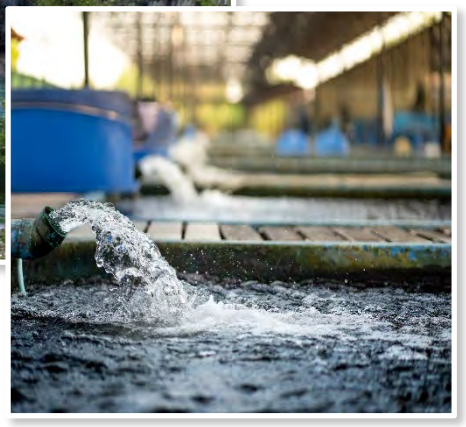
Fallowfield Campus

03847AB





Geotechnical Interpretative Report

Kennedy Redford

05/06/2025

Document prepared on behalf of Coffey Geotechnics Limited

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Table of contents

1.0 Introduction 6

1.1 General 6

1.2 Scope and Objectives of the Report 7

1.3 Site Location and Description 7

1.4 Information Received 9

1.5 Geotechnical Category 9

2.0 Review of Existing Information 10

2.1 Site History 10

2.2 Geology 10

2.3 Mineral Extraction 13

2.4 Hydrogeology and Hydrology 15

2.5 Flood Risk 16

2.6 Unexploded Ordnance Risk Assessment 17

2.7 Radon 19

2.8 Japanese Knotweed 20

3.0 Ground Investigation 21

3.1 Site Work 21

3.2 Laboratory testing 24

4.0 Description of Materials 26

4.1 General 26

4.2 Made Ground 27

4.3 Glacial Till 33

4.3 Weathered Sandstone 36

4.4 Sandstone (Extremely weak to weak Sandstone) 38
4.5 Groundwater 41
5.0 Geoenvironmental Assessment 43
5.1 Overview 43
5.2 Soil Generic Quantitative Risk Assessment (GQRA) 43
5.3 Made Ground 43
5.4 Natural Ground 48
5.5 Asbestos 48
5.6 Ground gas 49
5.7 Groundwater 49
6.0 Conceptual Site Model 50
7.0 Geo-environmental Risk Assessment 51
7.1 Summary of risk assessment 51
7.2 Risk Assessment 52
8.0 Geotechnical Risk 55
9.0 Geotechnical Considerations 58
9.1 Ground Model 58
9.2 Shallow Foundations 60
9.3 Piled Foundations 61
9.4 Hardstanding and Pavement Construction 62
9.5 Excavations 63
9.6 Re-use of materials 64
9.7 Aggressivity to Concrete 64
9.8 Soakaways 65

10.0 Conclusions 67

11.0 References.....68

Drawings

Drawing 001: Site Plan and Geological Sections

Drawing 002: Depth to Rockhead Plot and Made Ground Thickness Plot

Appendices

Appendix A: Draft Factual Report & Draft Borehole Logs

1.0 Introduction

1.1 General

Coffey Geotechnics Ltd (Coffey) has been instructed by Kennedy Redford (KR) to provide geotechnical services to assist Graham to deliver a DBFO project for a student housing redevelopment at the University of Manchester (UoM) Fallowfield Campus.

The redevelopment of the site includes several new buildings of varying height and arrangement as shown in Figure 1-1 below.



Figure 1-1: Proposed building layout (Sheppard Robbinson, 2025)

Coffey issued the following reports to Graham at the DBFO Tender Stage:

- Foundation Assessment (Coffey, 2023)
- Settlement Assessment (Coffey, 2024)
- Contamination Assessment (Coffey, 2024)

These reports were based on the results of a 2015 ground investigation carried out on the same site (noting different site boundaries), for which Coffey prepared the following Geoenvironmental and Geotechnical interpretative Reports, undertaken under a different contract but upon which UoM have confirmed Graham can place reliance:

- Project Oak, Stage 2a Geoenvironmental and Geotechnical interpretative Report (Coffey, 2015a)
- Project Oak, Stage 2b Geoenvironmental and Geotechnical interpretative Report (Coffey, 2015b)

1.2 Scope and Objectives of the Report

This report presents a summary of the ground conditions encountered during the 2015 ground investigation and provides initial geotechnical advice relating to foundations for the new development. It also provides guidance on possible environmental and human health risks based on the ground conditions observed in the exploratory holes, in relation to the existing site and proposed development.

1.3 Site Location and Description

The site is located within the Fallowfield Residential Campus, off Moseley Road in Fallowfield, Manchester (M14 6HD). The National Grid Reference of the site is 385790E, 394180N. The location of the site is shown on Figure 1-2.

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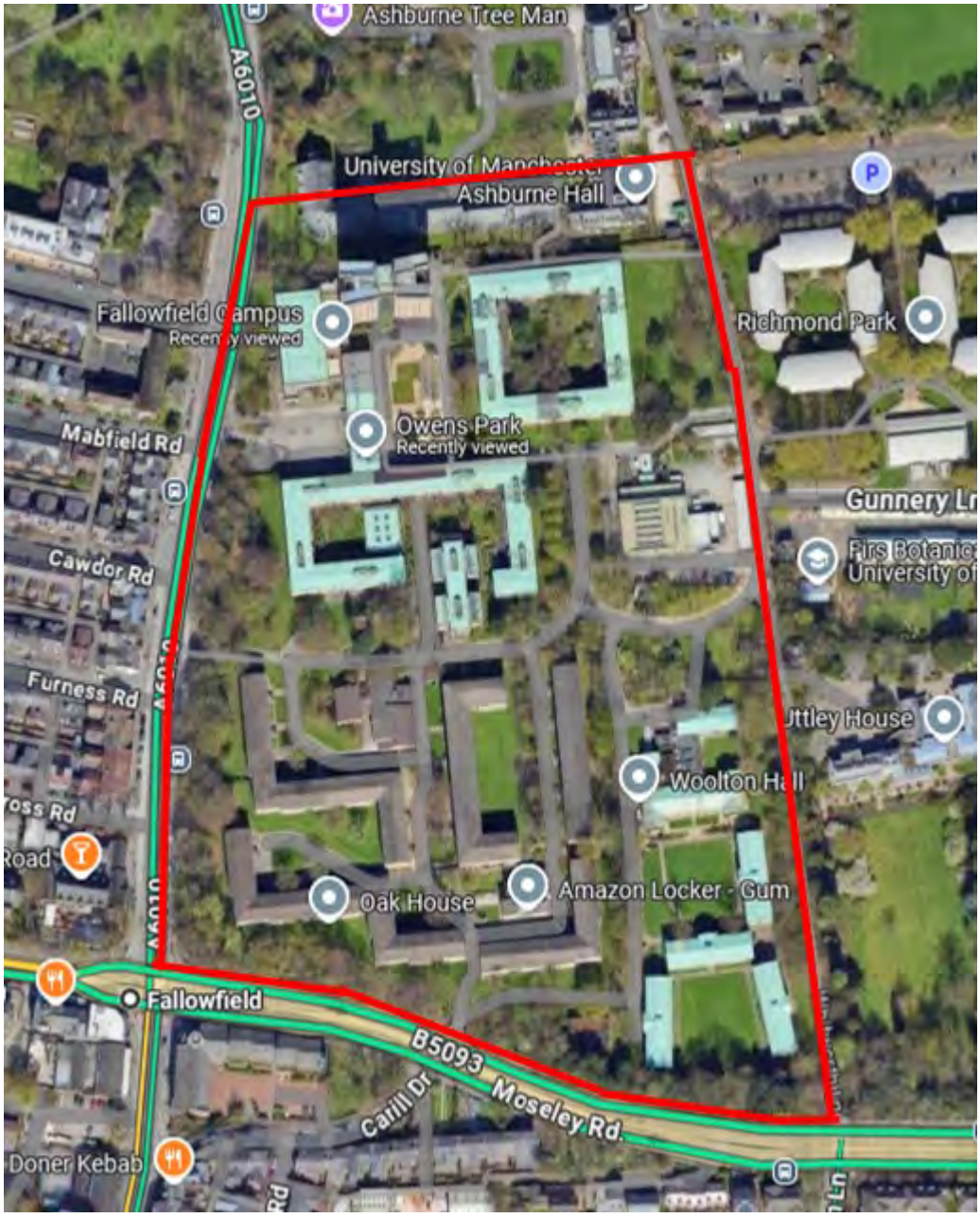


Figure 1-2: Site Location with red line showing the site boundary (Google Maps, 2025)

The site has a total area of approximately 8 ha. The Site is characterised as an urban setting and the topography is relatively flat with ground level sloping slightly from North to South with the north of the site at an elevation of 44m AOD and Moseley Road at the south at 39m AOD.

The West of the site is bounded by the A601 with residential properties beyond, the South of the site is bounded by the B5093, and the North and East of the site are bounded by further UoM buildings and significant green space including playing fields, rows of mature trees and parkland.

The existing site is used for student accommodation and other university-related land use and at the time of the additional ground investigation is split into two distinct areas: the north-west of the site is enclosed by PP. O'Connor as a demolition site; the rest of the site is an active student accommodation area.

1.4 Information Received

Coffey has received the following documents which have been used as sources of information to prepare this report:

1) Fallowfield Campus Factual Report (Tetra Tech, 2025)
2) Fallowfield Campus Phase 1 Desk Study Report (Buro Happold, 2023)
3) Sitewide Pile Cut Off Level Plan (KR, 2024a).
4) Typical Block 13/14 Foundation Option Layout Cast in Place Option (KR, 2024b).
5) Main Hub Foundation General Arrangement (KR, 2024c).
6) Preliminary Additional GI (KR, 2024d).

1.5 Geotechnical Category

The Geotechnical Risk Classification for the site is Geotechnical Category 2 as defined by BS EN 1997-1: 2004. This encompasses projects which include conventional types of geotechnical structures, earthworks, and activities, with no exceptional geotechnical risks, unusual or difficult ground conditions or loading conditions.

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2.0 Review of Existing Information

2.1 Site History

The site has been recorded as open fields in the mid-nineteenth century and shown as developed since 1890's, with various uses. A number of unnamed buildings are recorded across the site in 1890s, serviced by roads and a tramway is recorded from north to south in the western portion of the site. From mid 1950s the tramway is no longer recorded, and the site is recorded as Owen Park from 1970s.

Since then, the development is shown to have has expanded with more buildings added up to the present University of Manchester Fallowfield Campus.

The site history is outlined in more detail in Coffey, 2015a/2015b as well as in Buro Happold, 2023.

2.2 Geology

2.2.1 Published information

The following publications of the British Geological Survey (BGS) were examined with reference to the geology underlying the site:

- British Geological Survey 1:50,000 Scale Geological Sheet 85 – Manchester (solid)
- British Geological Survey 1:63,360 Scale Geological Sheet 85 – Manchester (drift)
- Memoir for the Geology of Manchester and the South-East Lancashire Coalfield

The geological data show site is underlain by Glacial Till (this is predominantly cohesive material but may include granular glacial materials) and solid geology beneath the site is shown to be the Chester Pebble Beds Formation. This formation is described on the BGS website as fine to coarse sandstone.

Figure 2-1 and Figure 2-2 below show the distribution of superficial deposits and bedrock at the site location.

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Figure 2-1: Superficial deposits (BGS onshore GeoIndex, 2025)

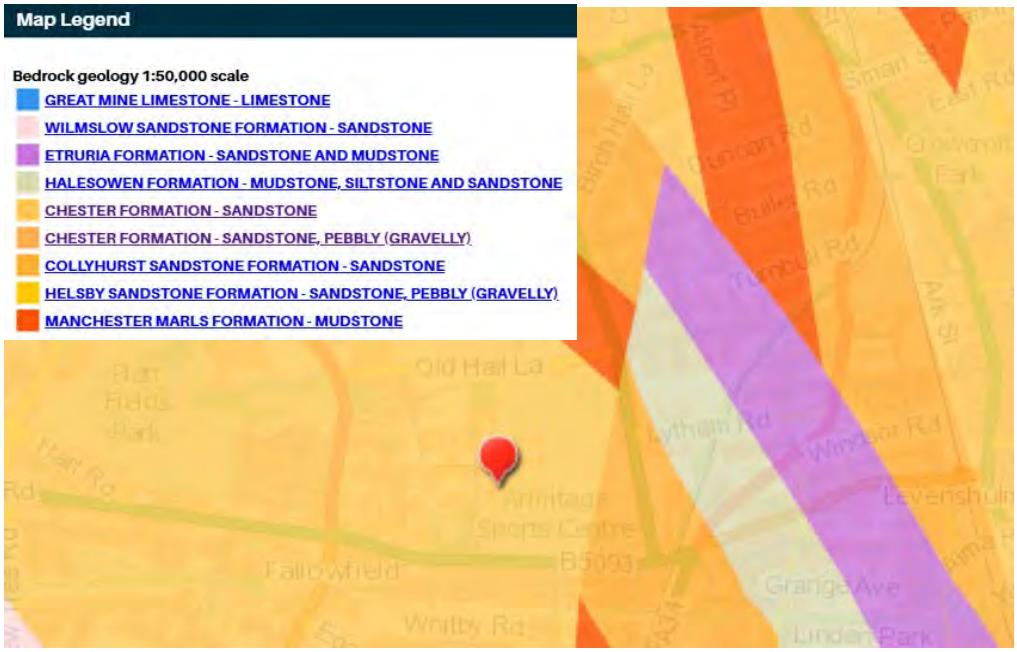


Figure 2-2: Bedrock deposits (BGS onshore GeoIndex, 2025)

There is a conjectured major northeast-southwest trending geological fault, with a down-throw to the northwest, which is indicated to be approximately 120m to the east of the site. To the west of this fault, strata of the older (Triassic) Collyhurst Sandstone Formation are depicted.

Figure 2-3 below is an extract from the BGS 1:10,000 scale geological map Sheet SJ 89 SE which also indicates that the superficial deposits are underlain by the Triassic Chester Formation (formerly known as Bunter Pebble Beds / Chester Pebble Beds Formation).

The regional dip for the Chester Formation is recorded to be 8° to the southwest.

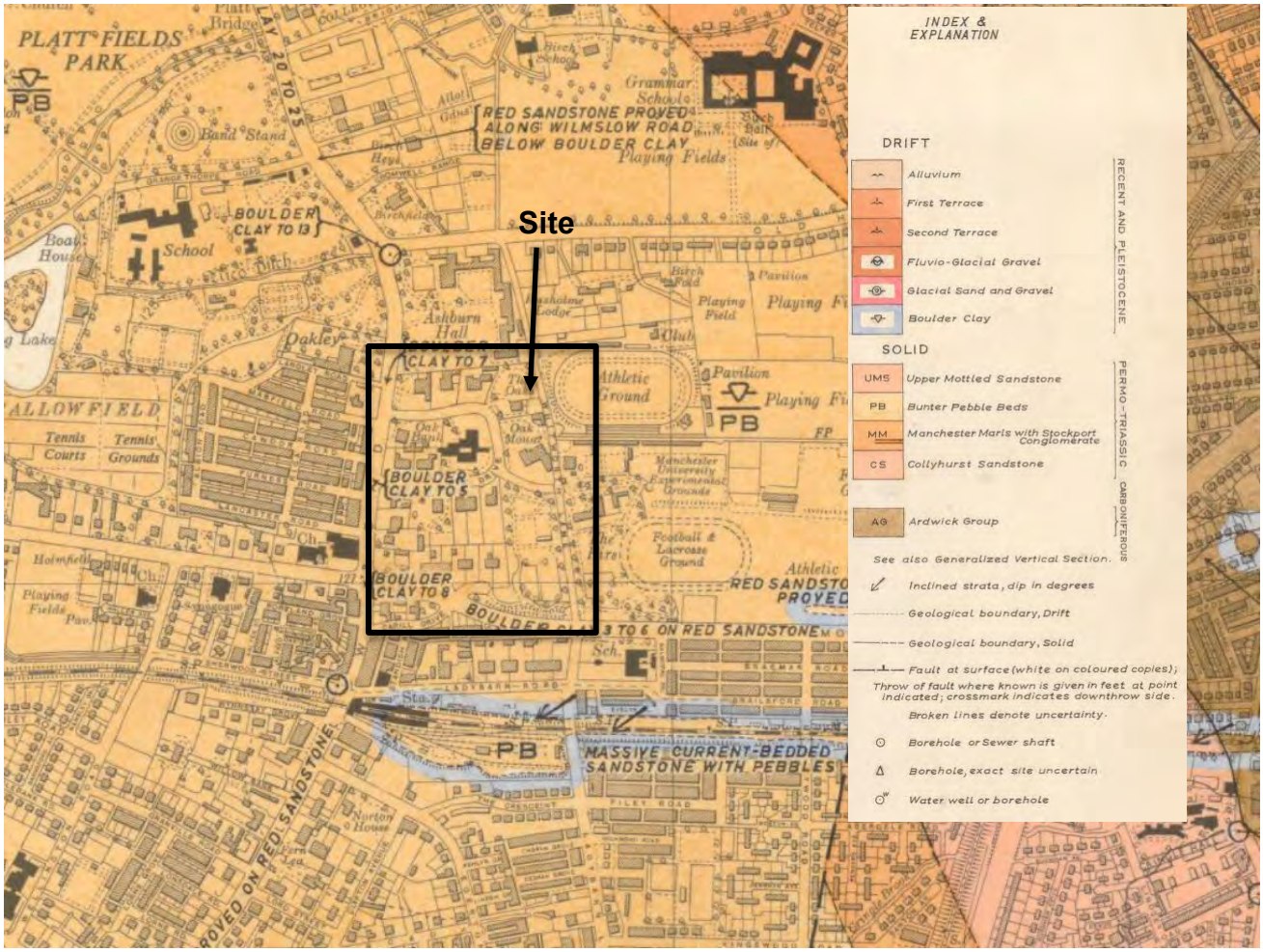


Figure 2-3: BGS 1:10,000 scale geological map Sheet SJ 89

2.2.2 Previous Investigations

Two previous investigations have been carried out at the site in 2015 by Geotechnics Ltd, managed by Coffey.

Stage 2a Ground Investigation

The preliminary ground investigation (Stage 2a) was undertaken between 1 and 23 April 2015 and comprised two windowless sample holes and 13no. cable percussive boreholes with in-situ standard penetration testing (SPTs), representative soil sampling, and relevant geotechnical/chemical laboratory testing.

This work is described in detail in Coffey, (2015a).

Stage 2b Ground Investigation

A principal ground investigation (Stage 2b) was undertaken between 27 May and 22 June 2015 which comprised:

- 34no. cable percussive boreholes.
- 12no. boreholes were extended by rotary technique through the base of cased cable percussion boreholes.
- 22no. trial pits.
- 10no. windowless sample holes.
- Laboratory tests for chemical and soils/rock.
- 17no. in-situ CBR (TRL Probe) tests.
- 4no. groundwater and gas monitoring installations were constructed in boreholes on their completion. A further two sets of ground gas and groundwater level monitoring was undertaken for Stage 2b: Monitoring rounds 5 (25 June 2015) & 6 (27 July 2015).

This work is described in detail in Coffey, (2015b).

2.3 Mineral Extraction

Coffey, (2015b) states that it does not identify any brine extraction areas, recorded mines or quarries within 500m of the site. The Mining and Remediation Authority interactive map was also referred and as shown in Figure 2-4 the site does not lies within a coal mining reporting area.

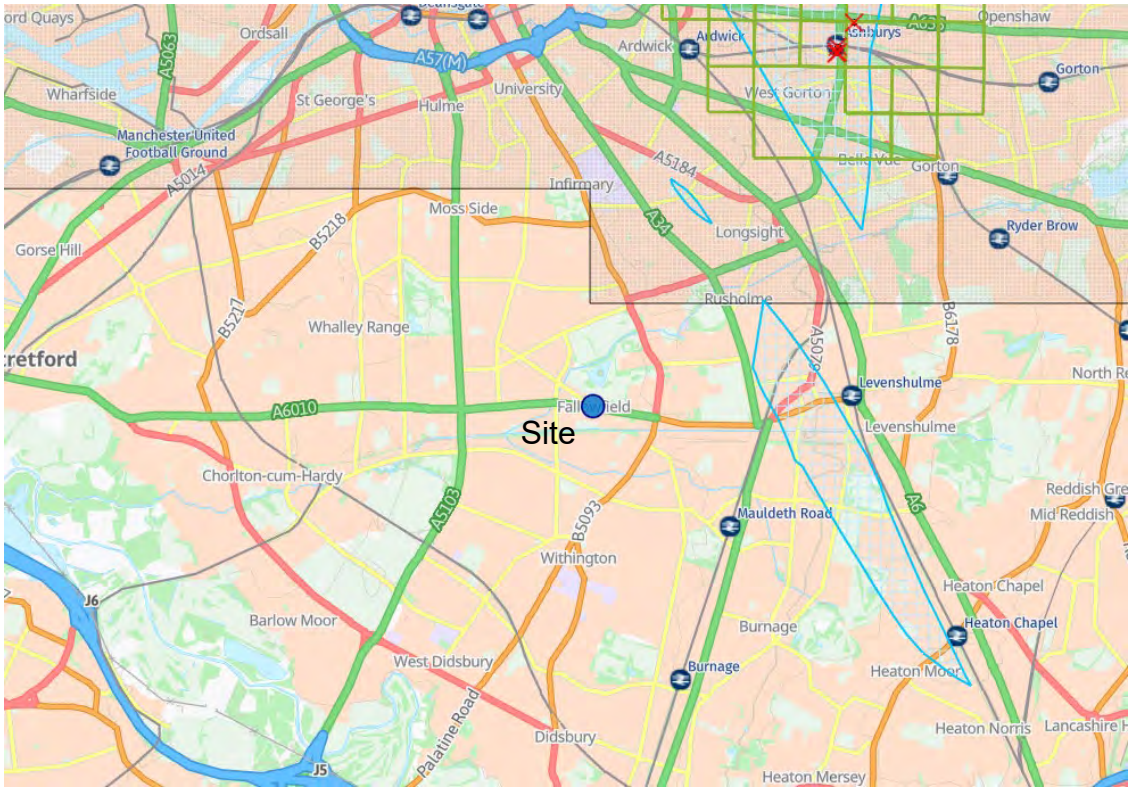


Figure 2-4: Extract from the Mining and Remediation Authority Interactive Map (Coal mining areas are shaded).

Figure 2-5 is an extract from the Groundsure report included in the previous desk study (Buro Happold, 2023).

The Desk Study (Buro Happold 2023) outlines that the site does not lie within an area affected by coal mining. The Groundsure report attached to the desk study identified 39 locations of surface ground workings within a 250m radius of site with most of them located in the south of the site as shown in Figure 2-5. These are historical land uses identified from Ordnance Survey mapping that involved ground excavation at the surface. These features may or may not have been subsequently backfilled. The feature identified at the southeaster boundary of the site is understood to be an infilled waterway.

The report does not identify any Brit Pits, natural cavities, underground workings, or Historical Mineral Planning Areas within 500m radius of site.

Two non-coal mining locations have been identified approximately 1km northeast of site; these are understood to be local and to not affect the site. It is concluded that no further assessment for coal mining is required.

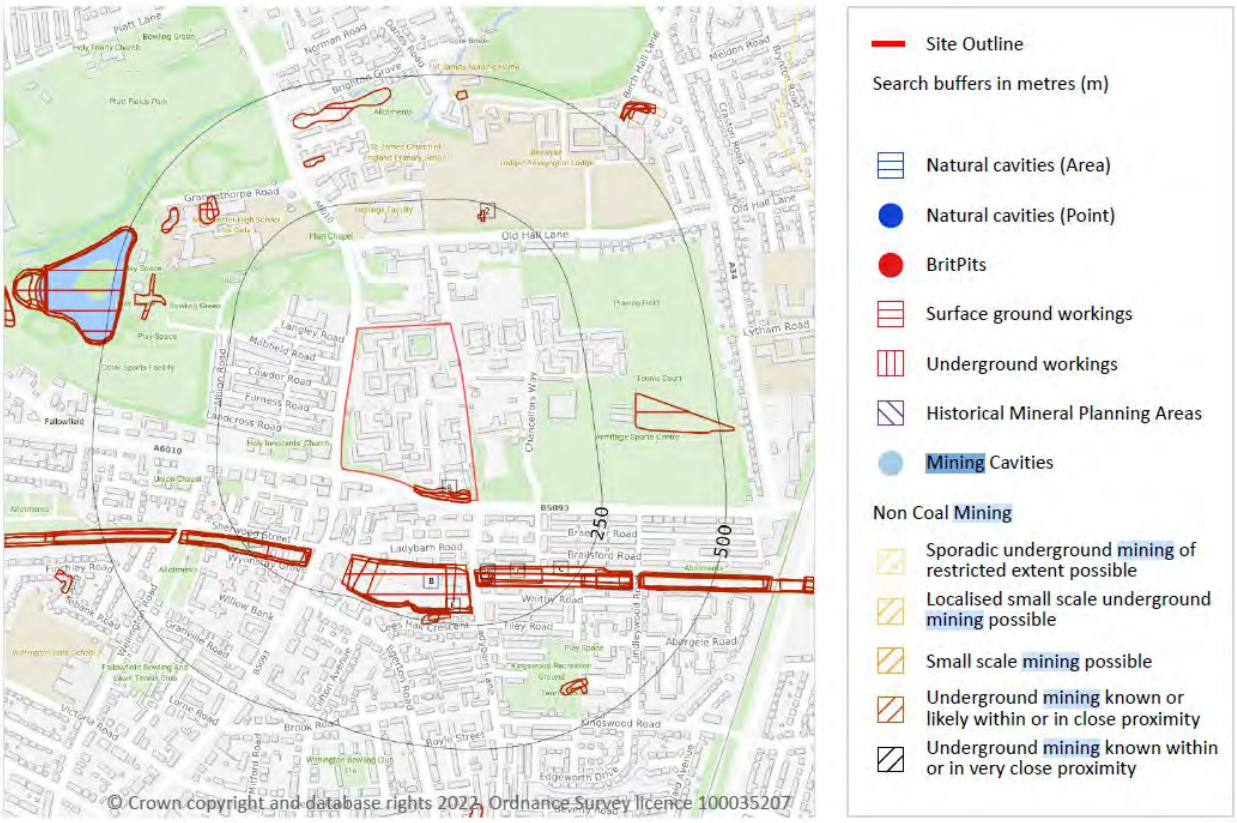


Figure 2-5: Mining activity(Desk Study Report Buro Happold, 2023)

2.4 Hydrogeology and Hydrology

The hydrogeology of the site is characterised by a principal aquifer within the Sandstone, overlain by unproductive strata of the glacial till unit.

- Principal Aquifer: Layers of rock or drift deposits that have high intergranular and/or fracture permeability (usually provide a high level of water storage). They may support water supply and/or river base flow on a strategic scale.
- Unproductive strata: Low permeability with negligible significance for water supply or river base flow.

The site is situated within an EA Source Protection Zone 3 or the “Total Catchment” which is defined as the area around the source within which all groundwater recharge is presumed to be discharged at the source. Three licensed groundwater abstractions have been identified within 2km of the site, none of which are public water supply boreholes.

The hydraulic gradient for the site is likely to be influenced by general site topography and any local watercourses near to the site. As such, any shallow groundwater in the site area is likely to flow towards the south or southwest.

The Buro Happold Desk Study Report identifies two surface water bodies recorded within 250m of the site, as follows:

- 62m south of the site, Fallowfield Brook which is classified as an “inland river not influenced by normal tidal action”; and
- 162m north of the site, Platt Brook which is classified as an “inland river not influenced by normal tidal action”.

There are no active surface water abstractions recorded within 2km of the site. Details of hydrogeological information are given in Coffey (2015b) and in Buro Happold (2023).

2.5 Flood Risk

A preliminary flood risk assessment was carried out and reported in the Buro Happold Desk Study Report. The indicative floodplain map for the area shows the site is located within Flood Zone 1 and therefore located outside of the 0.1% Annual Exceedance Probability (AEP) event, excluding Climate Change (CC) allowance.

Figure 2-6 is an extract of the surface water flood map and indicates that the southeast of the site has a risk of ponding water during extreme rainfall events.

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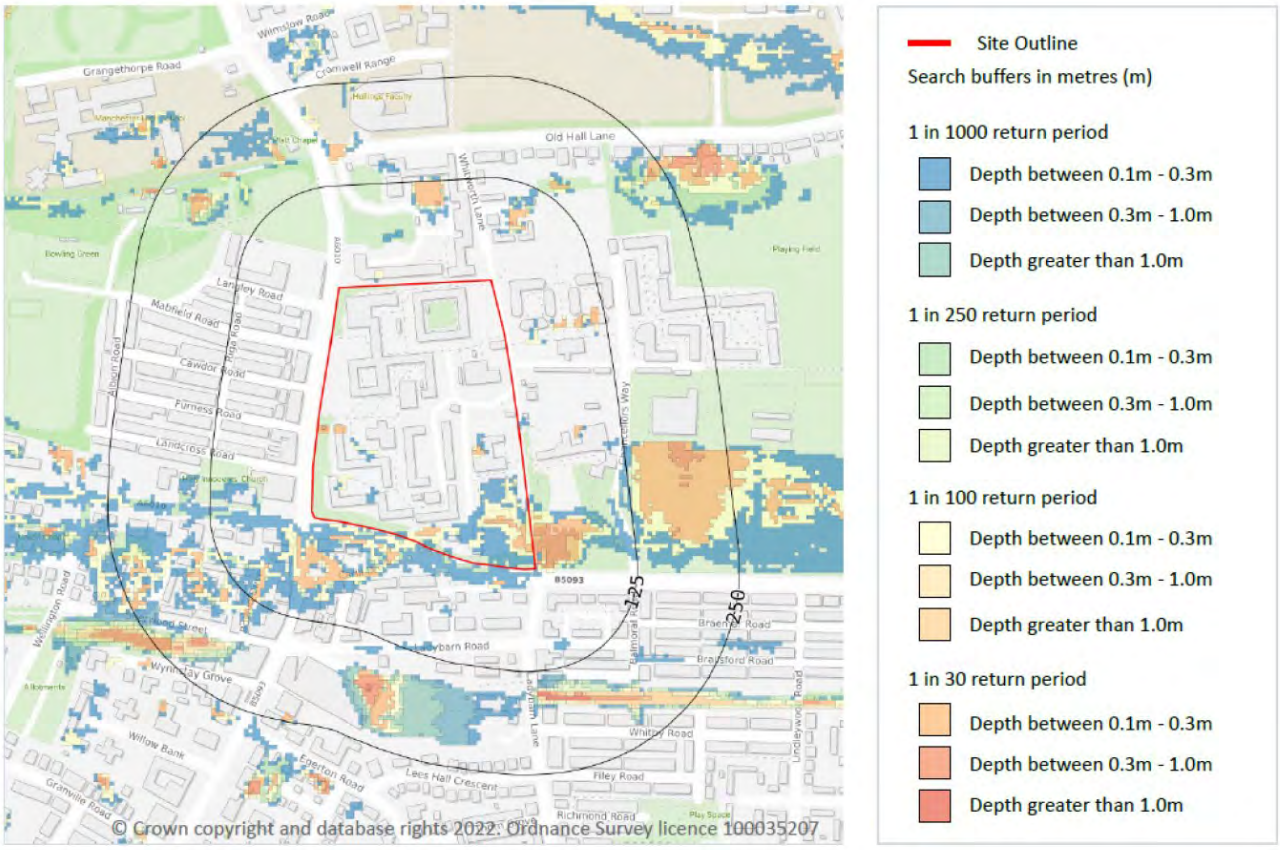


Figure 2-6: Surface Water Flood Map (extract from Buro Happold Desk Study, 2023)

2.6 Unexploded Ordnance Risk Assessment

The Buro Happold Desk Study, 2023 has categorised the site as at moderate risk for unexploded ordnance (UXO), as shown on Figure 2-7.

A Preliminary UXO Risk Assessment undertaken as part of the 2015 ground investigation concludes that the UXO probability assessment has a rating of 3, indicating a medium possibility of a UXO encounter. A summary of the risk assessment and conclusion of the desk study is reproduced below:

- During WWII, the site is situated with Manchester County Borough, which was subject of 26 high explosive (HE) bomb strikes per 1000 acres, a relatively low level of bombing density.

- A tramway depot, a goods yard and a railway station were located in the vicinity of the site and were likely to be considered secondary bombing targets.
- Air Raid Precaution (ARP) records show 2 HE bombs struck the site. Additional, 2 bombs were recorded within 20m of the site boundary.
- A heavy anti-aircraft (HAA) battery was located within the site's boundary, which may have been considered a bombing target and therefore may be a potential source for UXO contamination; and
- Given that the site was occupied by a HAA gun site (a potential source for UXO contamination) and 2 bomb strikes were recorded within the site, the report suggests that further action is warranted to address the potential for UXO encounter.

In accordance with CIRIA C681 Chapter 5 on managing UXO risks, it is recommended to conduct a detailed UXO Threat and Risk Assessment for the redevelopment of the site that involves undertaking a preliminary risk assessment by an UXO specialist to determine if any specific risk mitigation measures are required. Further details can be found in CIRIA C681.

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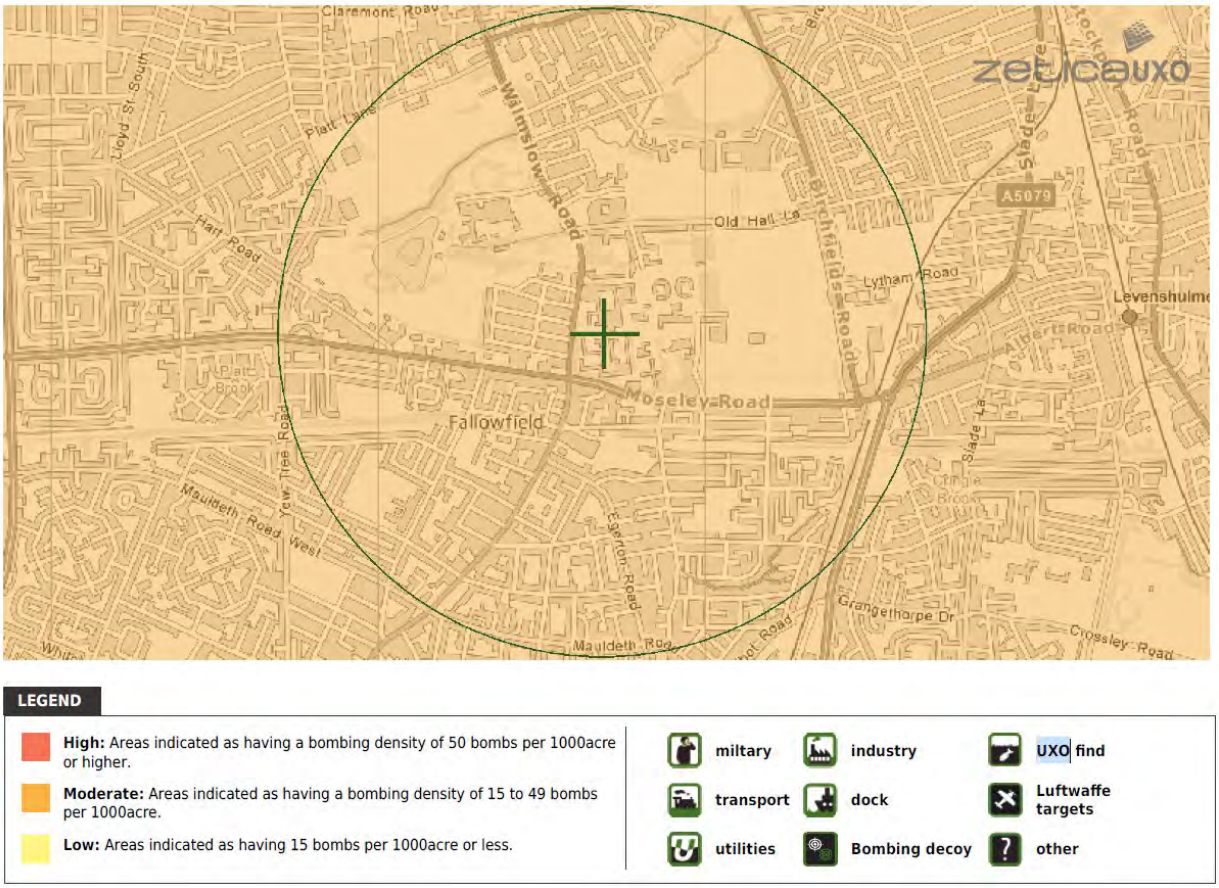


Figure 2-7: UXO risk map at the site location (https://zeticauxo.com)

2.7 Radon

The Buro Happold Desk Study 2023 indicates that the site is not in a Radon Affected Area, as less than 1% of properties are above the Action Level, as shown on Figure 2-8. The desk study report refers to the Indicative Atlas of Radon for England and Wales and the Groundsure reports.

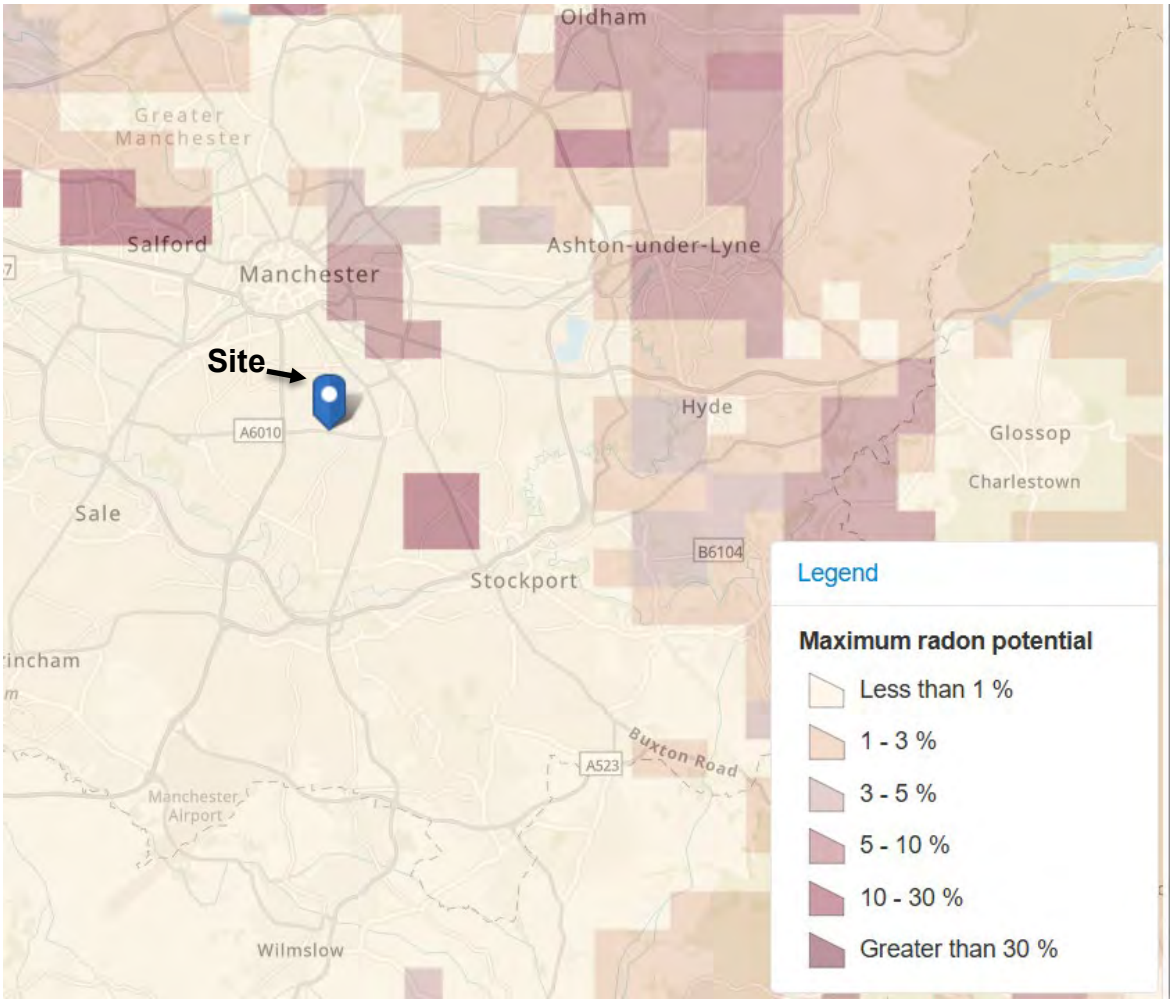


Figure 2-8: Radon Risk at the site (https://www.ukradon.org)

2.8 Japanese Knotweed

A visual inspection survey carried out by Japanese Knotweed Solution (JK Solutions (2015)) indicates areas of Japanese knotweed spread across north and central parts of the site at that time. There is no mention of Japanese Knotweed in the 2025 Factual reports by Tetra Tech or in the 2023 desk study report by Buro Happold.

There is a risk that areas of Japanese knotweed may have spread since it was last surveyed. Any Japanese Knotweed present will need to be professionally removed as part of site clearance works.

3.0 Ground Investigation

3.1 Site Work

The 2025 ground investigation was undertaken between 10 February 2025 and 28 February 2025 by Tetra Tech Limited.

The ground investigation comprised:

- 8no. cable percussive boreholes.
- 8no. CPTs
- 12no. Dynamic Cone Penetrometer Tests (labelled as TRL's)

An exploratory hole location plan is shown on Figure 3-1.

The purpose of the ground investigation was to:

- Provide a spread of boreholes across the site to validate the 2015 characterisation of ground conditions across the site, rather than at each building location. This approach is also to mitigate the risk that some locations of the site are not accessible during the ongoing demolition works and associated material stockpiles. Boreholes to extend to 15m depth to confirm the Sandstone profile to at least 5m below proposed pile lengths.
- Included in this spread of boreholes, boreholes to target areas where shallow foundations are proposed where our tender-stage assessments indicated uncertainty in suitable formation levels for shallow foundations.
- Boreholes to target the south-eastern corner of the proposed development which was not included in the 2015 ground investigation.
- All additional ground investigation locations to include for in situ testing (e.g. SPTs and hand shear vane) as well as ground and groundwater sampling for geotechnical and environmental laboratory testing to validate the findings of previous phases of GI.
- In-situ TRL Dynamic Cone Penetrometer tests to provide in-situ CBR values for pavement design in areas of proposed hardstanding. These would supplement the findings of previous CBR testing.

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- Investigation to delineate the potential infilled waterway indicated to be at the southern extent of the site, and to characterise the ground at the site boundaries.



Figure 3-1: Exploratory hole location plan (Tetra Tech, 2025)

Table 3-1 below provides a summary of the exploratory holes that were completed during the ground investigation.

Table 3-1: Summary of the exploratory holes undertaken during geotechnical investigation, 2025

BH ID	Exploratory Hole Type	Ground Level	Location		BH depth (mbgl)
			Easting	Northing	
BH101	CP	40.33	385828.9	394004.4	16.36
BH102	CP	40.38	385819.3	394056.7	15.00
BH103	CP	44.32	385819.5	394168.7	15.00
BH104	CP	-	-	-	16.00
BH105*	CP	-	-	-	0.60
BH105A*	CP	-	-	-	0.50
BH105B*	CP	-	-	-	0.40
BH106	CP	43.13	385726.9	394136.2	15.00
BH107	CP	43.16	385647.6	394179.3	16.45
BH108	CP	44.52	385720.2	394271.7	15.50
BH109	CP	44.41	385774.8	394204.3	10.00
CPT101	SCP	40.36	385819.3	393972.7	2.62
CPT102	SCP	40.28	385838	393976.3	2.44
CPT103	SCP	40.11	385861.7	393976.2	1.90
CPT104	SCP	40.36	385858.9	393991.6	2.08
CPT105	SCP	40.13	385807.3	393983.9	2.76
CPT106	SCP	42.94	385852.2	394023.8	2.16
CPT107	SCP	40.31	385797.6	394039.3	1.10
CPT108	SCP	43.38	385852.2	394049.6	1.84
TRL103	DCP	44.07	385756.3	394297.2	0.92
TRL107	DCP	44.21	385747.7	394179	0.37
TRL108	DCP	44.52	385792	394246.6	1.54
TRL109	DCP	43.41	385804.4	394143.9	1.55
TRL111	DCP	43.07	385701	394119.4	1.53

BH ID	Exploratory Hole Type	Ground Level	Location		BH depth (mbgl)
			Easting	Northing	
TRL112	DCP	41.44	385660.8	394103.1	1.56
TRL113	DCP	40.18	385645.3	394055.4	0.21
TRL114	DCP	40.28	385696.2	394037.9	1.50
TRL115	DCP	39.26	385733.7	394002.1	0.63
TRL116	DCP	40.4	385793.5	394026.6	1.50
TRL117	DCP	40.15	385788.8	394104.1	0.47
TRL118	DCP	41.48	385842.1	394078.9	0.20

Abbreviations: CP – Cable Percussion, SCP- Static Cone Penetration, DCP- Dynamic Conce Penetration. *BH105 could not be drilled as a concrete structure was identified during the excavation of its observation pit.

Representative soil sampling during bore hole formation and in-situ standard penetration testing (SPTs) were carried out in boreholes. In addition, 12no. in-situ CBR (TRL Probe) tests were undertaken to provide information for the pavement design on the site. The exploratory hole records, laboratory test results, and results from the gas and groundwater monitoring are presented in Factual Report (Tetra Tech, 2025).

3.2 Laboratory testing

3.2.1 Geotechnical testing

Geotechnical laboratory testing was scheduled on soil samples obtained and included:

- 8no. natural moisture content.
- 8no. liquid and plastic limits.
- 9no. particle density.
- 17no. particle size distribution.
- 5no. Sedimentation Analysis.
- 4no. 2.5kg Compaction.
- 4no. 2.5kg Compaction.

- 3no. Triaxial UU.
- 3no. Single stage quick undrained triaxial tests for undrained shear strength.
- 13no. UCS.
- 29no. Point load.

3.2.2 Chemical testing

Chemical laboratory testing was scheduled on 9no. soil samples and included:

- Metals suite (Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Selenium and Zinc).
- Inorganics (Boron, Cyanide, Phenol).
- Polycyclic Aromatic Hydrocarbons (PAH,16 speciated).
- Benzene, Toluene, Ethylbenzene, m/p-xylene, o-xylene (BTEX).
- Total Petroleum Hydrocarbons (TPHs).

3.2.3 Water testing

Chemical laboratory testing was scheduled for each borehole (eight). Tests included:

- Metals suite (Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Selenium and Zinc).
- Inorganics (Boron, Cyanide, Phenol).
- Polycyclic Aromatic Hydrocarbons (PAH,16 speciated).
- Benzene, Toluene, Ethylbenzene, m/p-xylene, o-xylene (BTEX).
- Total Petroleum Hydrocarbons (TPHs).

4.0 Description of Materials

4.1 General

Descriptions of the materials encountered during the 2025 Tetra Tech ground investigation are summarised in Table 4-1. The findings are generally in accordance with published geology and the findings of the 2015 investigations. Each material type encountered is discussed in detail below. A ground model is presented in Section 9.1.

An exploratory hole location plan is given in Figure 3-1 and Table 3-1 provides a summary of the exploratory holes (see Section 3.1). Drawing 001 also shows exploratory y hole locations and geological cross sections across the site. Drawing 002 shows contours of depth to material described as intact rock and thickness of Made Ground across the site.

Table 4-1: Summary of ground conditions

BH ID	Base of Made Ground (mbgl)	Base of Glacial Till (mbgl)	Base of Weathered Sandstone (mbgl)	Base of Sandstone (mbgl)	BH depth (mbgl)
BH101	1.15	2.00	2.9	Not proven	16.4
BH102	0.40	-	2.45	Not proven	15.0
BH103	1.40	-	3.94	Not proven	15.0
BH104	2.70	-	2.85	Not proven	16.0
BH105*	Not proven	-	-	-	0.6
BH105A*	Not proven	-	-	-	0.5
BH105B*	Not proven	-	-	-	0.4
BH106	2.00	-	3.70	Not proven	15.0
BH107	0.70	1.80	3.00	Not proven	16.5
BH108	0.90	2.50	6.90	Not proven	15.5
BH109	0.70	1.90	5.10	Not proven	10.0

*BH105 could not be drilled as a concrete structure was identified during the excavation of its observation pit

The sections below present review of geotechnical test results for each material. Where representative parameter values are presented, these are provisional only and characteristic and design parameters should be selected by the designer appropriate for the assessment being undertaken.

4.2 Made Ground

The fieldwork encountered Made Ground generally between 0.4m and 2.7m thick. The Made Ground generally comprised sand and gravel of siltstone, sandstone, quartz, and brick, within layers of clay.

Drawing 002 presents the variation in thickness of the Made Ground across the site based on exploratory hole data from 2015 and 2015 investigations.

Table 4-2 below presents a summary of the PSD testing undertaken on samples of Made Ground during 2025 Lab testing.

The majority of PSD testing carried out on samples taken from these layers identified them as granular material and this is consistent with what was found during the 2015 investigation.

Table 4-2: Summary of PSD testing

ID	Depth (mbgl)	Cobbles %	Gravel %	Sand%	Silt%	Clay%	Fines%
BH101	0	21	11	37	23	8	31
BH102	0	0	14	13			73
BH104	1.4	0	7	34			59
BH106	0.6	0	11	34	28	27	55
BH107	0	31	25	20			24
BH108	0	7	52	20			21
BH109	0.2	0	19	42	28	11	39

SPT ‘N’ values for the Made Ground are presented in Table 4-3 and graphically on Figure 4-1.

Table 4-3: SPT data for Made Ground

Test parameter	Unit	Range	Representative Value	Figure
SPT 'N' value	N/A	4 to >50 (refusal)	8	Fig 4-1

The limited number of SPT values recorded within Made Ground show large variability and the results are plotted in Figure 4-1 along with the SPT values from the 2015 investigation. The 2015 report stated and average SPT N value of 15 for Made Ground. The 2025 data is consistent with the 2015 data, and omitting N values greater than 50 which indicate refusal and may be associated with local inclusions or obstructions, SPT N value of 8 is considered representative for this material.

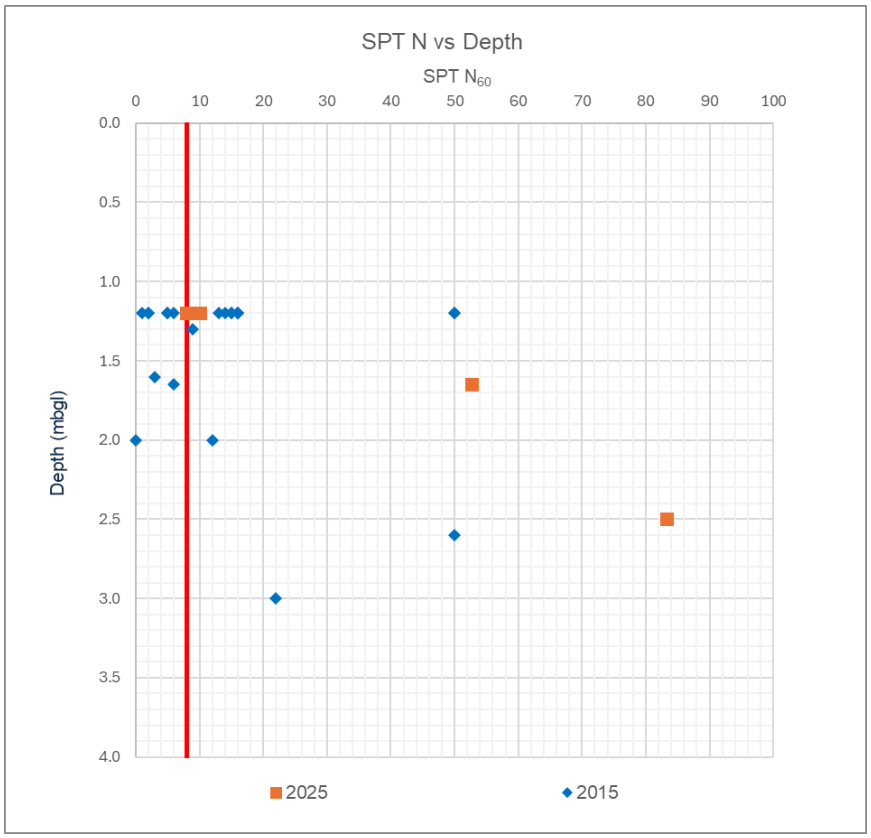


Figure 4-1: SPT N values of 2015 and 2025 investigations within Made Ground.

Parameters for Made Ground is derived for both its cohesive material and granular material. Four Plasticity Index (PI) tests were done on cohesive samples recovered from the Made Ground and they average 14.5. Based on a f1 of 5, and average SPT

N, using the Equation 1 given below, a representative Cu of 40 kPa is derived for cohesive Made Ground.

Equation 1:

$$Cu = f1\ x\ SPT\ N\ (Stroud\ and\ Butler, 1975)$$

Undrained stiffness parameters for the material have been derived based on the following equation:

Equation 2

$$Eu = 300 * Cu\ (Jamiolkowski, 1979)$$

This gives a value of 12MPa for undrained stiffness.

Drained friction angles can be derived from SPT N values as per Equation 3 below:

Equation 3

$$Friction\ angle\ (\phi') = 26.5 + 0.36 * N - 0.0014 * N^2\ (Ref: Peck\ et\ al, 1974)$$

The 2025 SPT data is consistent with the GI data within site boundary from the 2015 ground investigation. Based on the average SPT value of 8 considered for the Made Ground, the friction angle is 30° as per equation 3. However considering the clayey soils presents within the material, a lower bound drained friction angle of 28° is considered representative of the Made Ground across the site.

Figure 4-2 below presents friction angles derived from SPT N values and based on CPT reports provided by Tetra Tech (2025).

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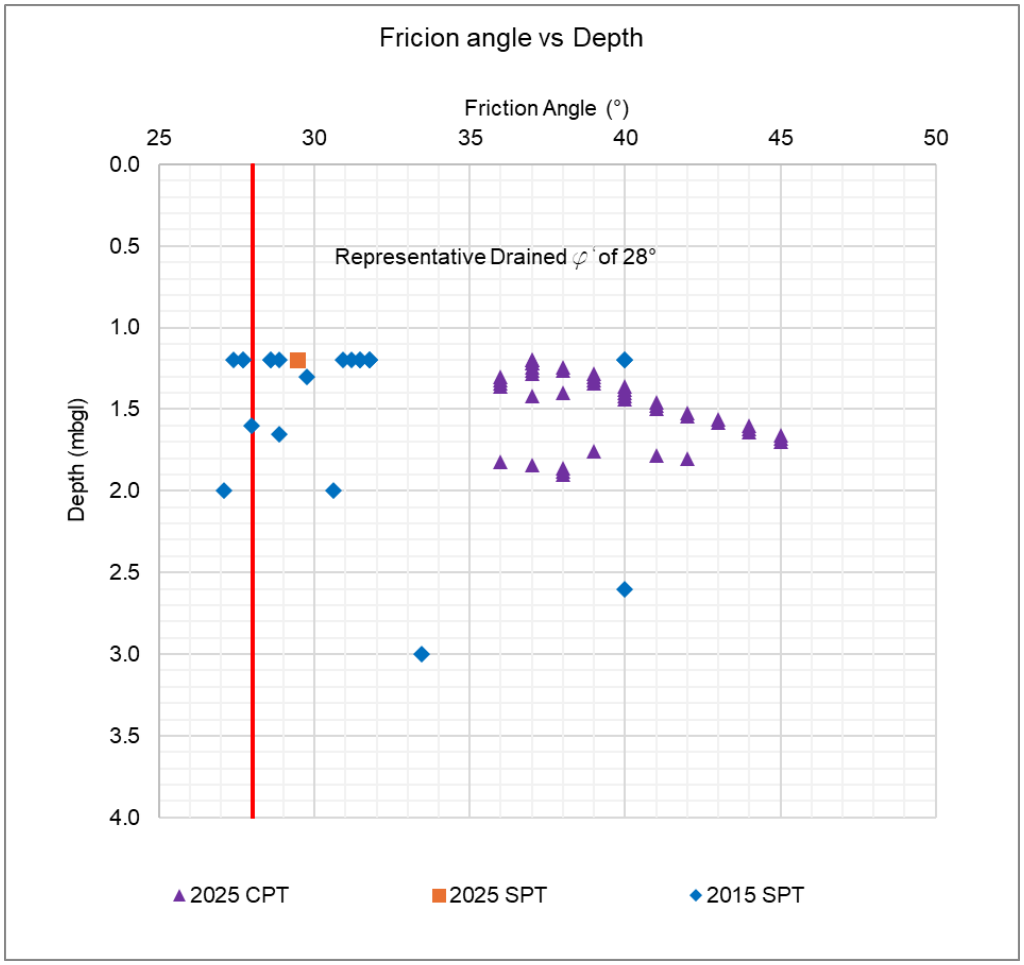


Figure 4-2: Friction angles derived for the Made Ground based on SPT and CPT

The 2025 CPT data shown on Figure 4-2 indicates higher drained friction angles than the SPT data. It notes that CPTs were only undertaken in the southeastern corner of the site and may not be representative of the material across the whole site.

The drained stiffness E` is calculated based on the relationship below:

Equation 4:

$$E' = 0.8\,Eu\ (CIRIA\ 143, 1995)$$

Which gives E` of 9.6MPa.

A unit weight of 18kN/m^3 for Made Ground is considered representative.

The Made Ground is very variable and is not considered a suitable founding material for foundations.
No allowable bearing capacity value is given for the Made Ground, as it is recommended that structural foundations do not bear onto this stratum directly.

Material Classification

Of the three-particle size distribution (PSD) tests undertaken on samples of Made Ground during the 2015 ground investigation only one was on a sample from within the current site boundary. The 2025 ground investigation included seven PSD tests on Made Ground, and the resulting grading plots are shown on Figure 4-3 below along with the 2015 result.

Figure 4-3 shows the upper and lower limits of Class 2A, 2B & 2C material in accordance with the Specification for Highways Works. The majority of classification curves from the site fit within the bounds of the following material classifications:

- Class 2A/2B material: Cohesive material suitable for general fill.
- Class 2C material: Stoney cohesive material suitable for general fill.

The grading curves with higher fines content may also be classed as Class 7E or Class 7I materials, suitable for stabilisation with lime or lime and cement for use as capping, subject to design and trials.

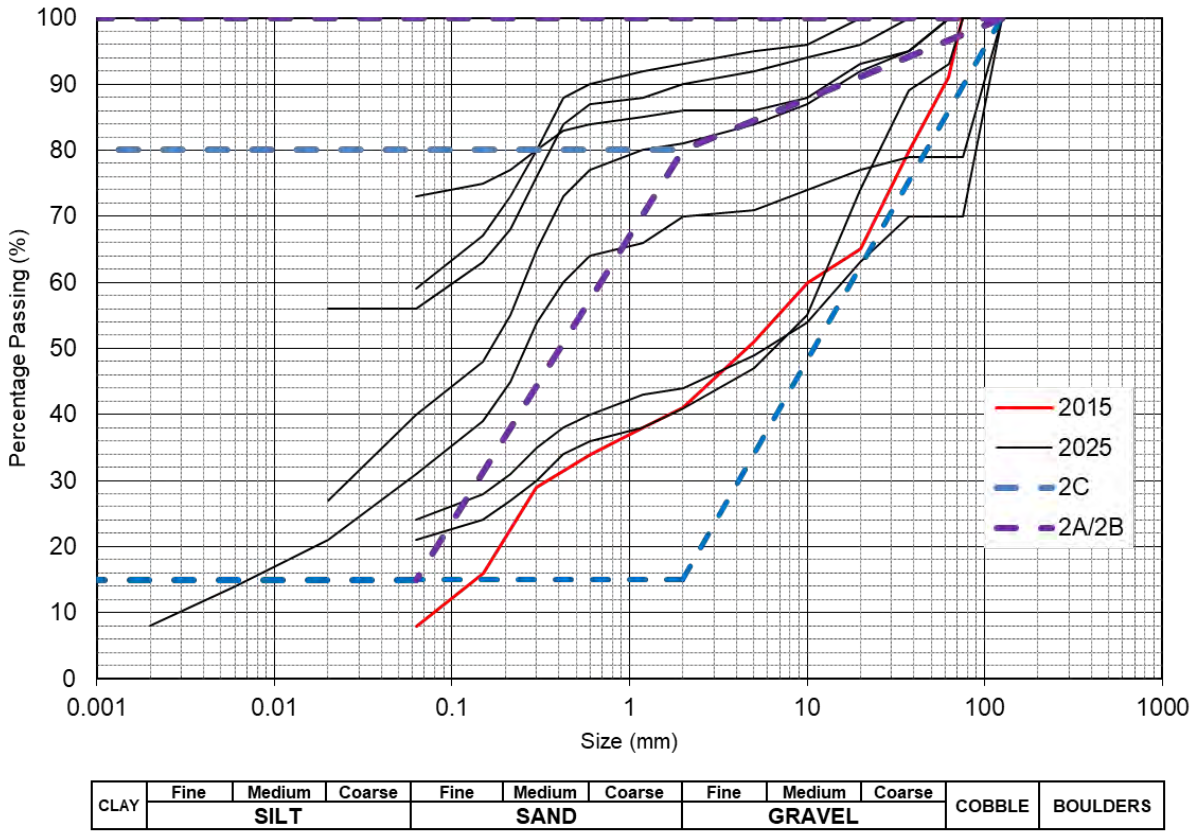


Figure 4-3: Grading Curves for Material Classification - Made Ground, showing bounds of Class 2 materials.

Figure 4-4 shows the same PSD curves with the upper and lower limits of Class 6F2. While the 2015 result indicates that the sample is broadly consistent with a Class 6F2 material, the 2025 results indicate a significantly higher clay fraction and that the Made Ground would not be classified as Class 6F2 material.

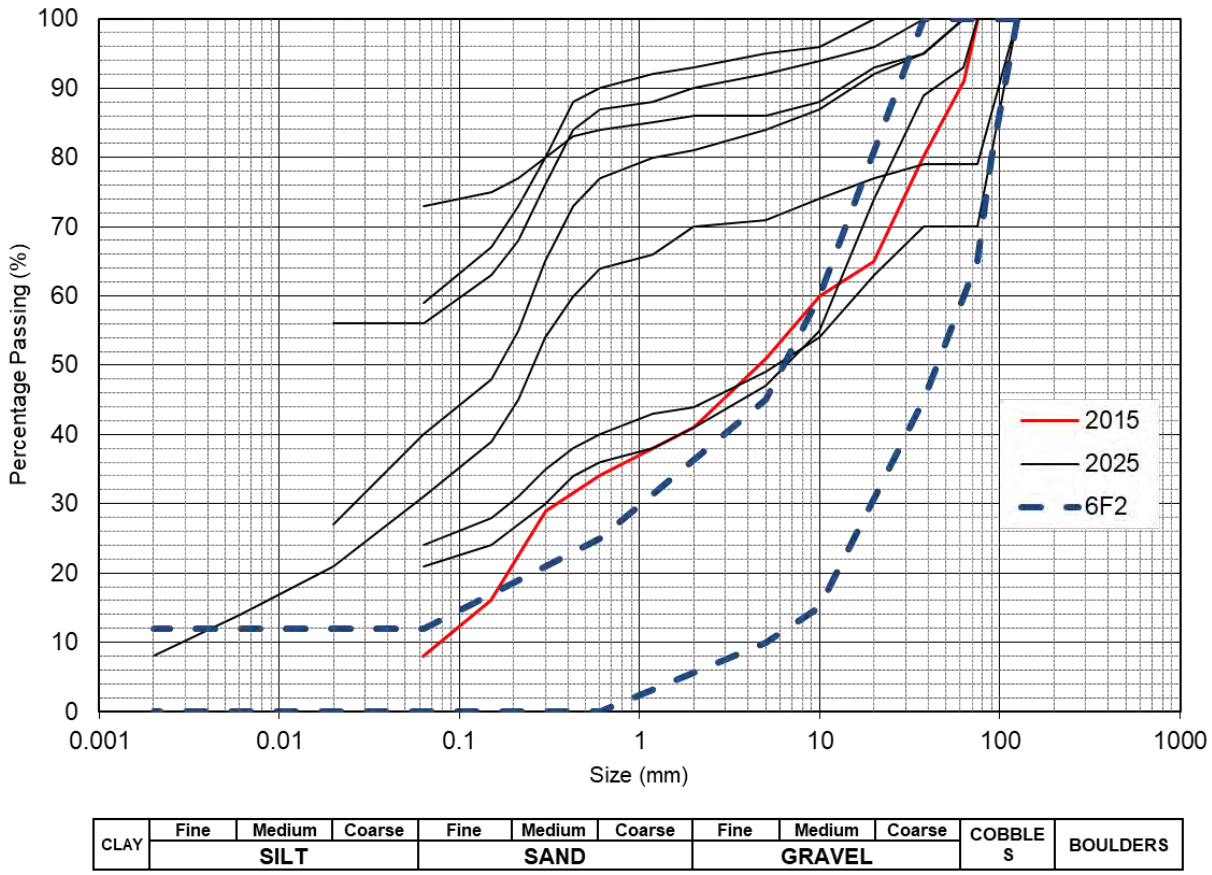


Figure 4-4: Grading Curves for Material Classification - Made Ground, showing bounds of Class 6F2 material.

4.3 Glacial Till

The 2025 site investigation encountered natural Glacial Till beneath the Made Ground at depths between 0.4m and 2.7m. The maximum thickness of Glacial Till is 1.55m at BH108. The material is absent in boreholes BH102, BH103, BH104 and BH106 where the Made Ground is directly underlain by Weathered Sandstone.

The Glacial Till is generally cohesive and soft becoming stiffer with depth. The 2015 investigation identified soft Glacial Till at shallow depths, becoming firm to stiff slightly sandy slightly gravelly clay with depth.

Table 4-4 below shows the SPT N value range recorded during 2025 investigation.

Table 4-4: SPT data for Glacial Till

Test parameter	Unit	Range	Figure
SPT 'N' value	N/A	8 to >50 (refusal)	Fig 4-4

Figure 4-4 below is a plot of the SPT N values within Glacial Till deposits from the 2015 and 2025 investigations.

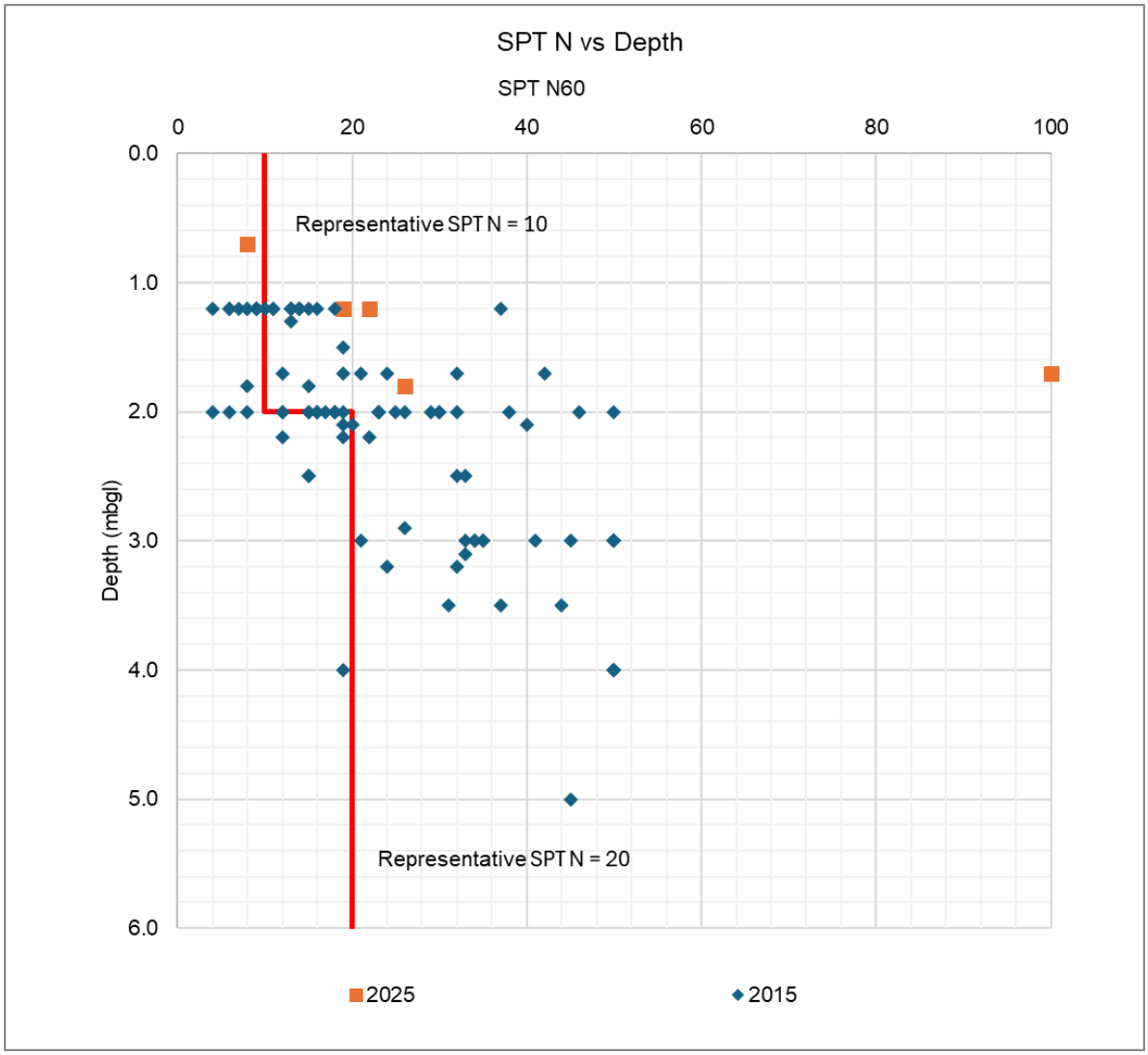


Figure 4-4: SPT N values within Glacial Till from 2015 and 2025 investigations.

CPTs which also penetrated into the Glacial Till, where undertaken at the southeastern corner of the site. The CPTs and SPTs have been used to derive the undrained shear strength of the Glacial Till.

Plasticity Index (PI) testing undertaken on samples of Glacial Till in 2025 indicates an average PI of 15%, therefore an f_1 value of 5.1 has been considered for correlation of SPT N value to undrained shear strength (c_u) (see Equation 1, consistent with the correlation used in 2015 GIR)

Figure 4-5 shows c_u for Glacial Till material based on in situ test results available for the site.

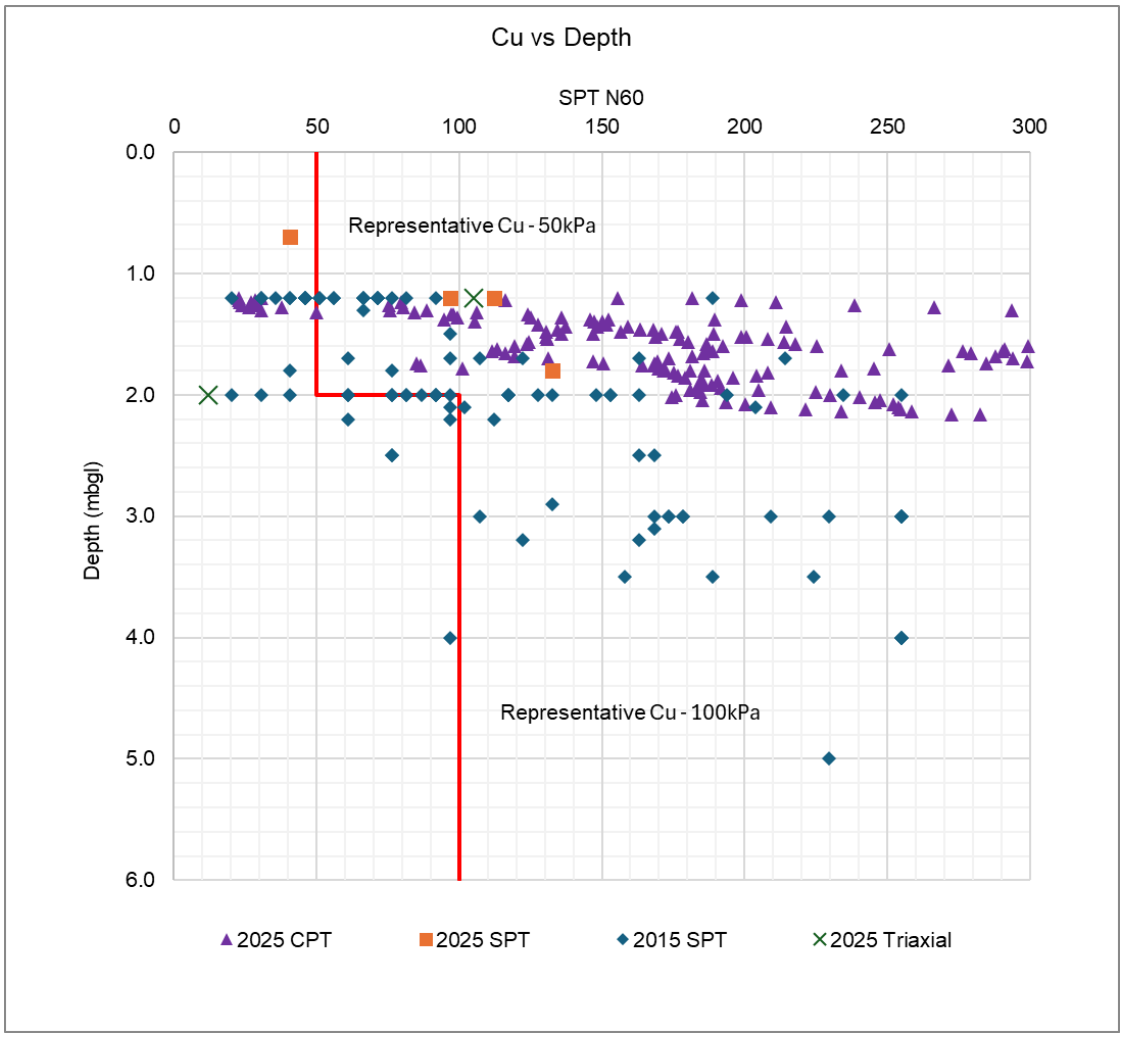


Figure 4-5: c_u derived for Glacial Till from SPT N, CPT, and Triaxial test data

The data in Figure 4-5 indicates the representative shear strength value suggested for Glacial Till in Coffey, (2015b) is consistent with the results from 2025 investigation as well. Therefore, the following is considered as representative Cu values:

- 0-2m depth = 50kPa
- >2m depth = 100kPa

Based on the same PI, a drained friction angle of 25° is derived based on the following correlation between friction angle and plasticity index in BS8002 for fine grained soils:

Equation 5

$\Phi' = 42 – 12.5 \times \log10 \times PI$

where PI is the soil's Plasticity Index (PI) entered as a %

Bulk density values taken during the triaxial testing for BH108 and BH109 has given values of 2.16 Mg/m^3 and 2.23 Mg/m^3. However, a unit weight of 21kN/m^3 for Glacial Till is considered representative.

Undrained and Drained stiffness for Glacial Till was derived based on equation 3 and 4 given in section 4.2 which gives the values of,

For Eu:

- 0-2m depth = 15MPa
- >2m depth = 30MPa

For E':

- 0-2m depth = 12MPa
- >2m depth = 24MPa

4.3 Weathered Sandstone

Weathered sandstone was encountered underlying the Glacial Till deposits to depths of between 2.45mbgl to 6.9mbgl. The deepest this layer was recorded was 6.9mbgl in BH108.

The weathered sandstone is described in the exploratory hole logs as dense reddish brown clayey sand with SPT N values generally over 50 (i.e. refusal in the sand). The

range for SPT N values are as presented in Table 4-5 below and graphically on Figure 4-6.

Table 4-5: SPT data for Weathered Sandstone

Test parameter	Unit	Range	Figure
SPT 'N' value	N/A	29 to >50 (refusal)	Fig 4-6

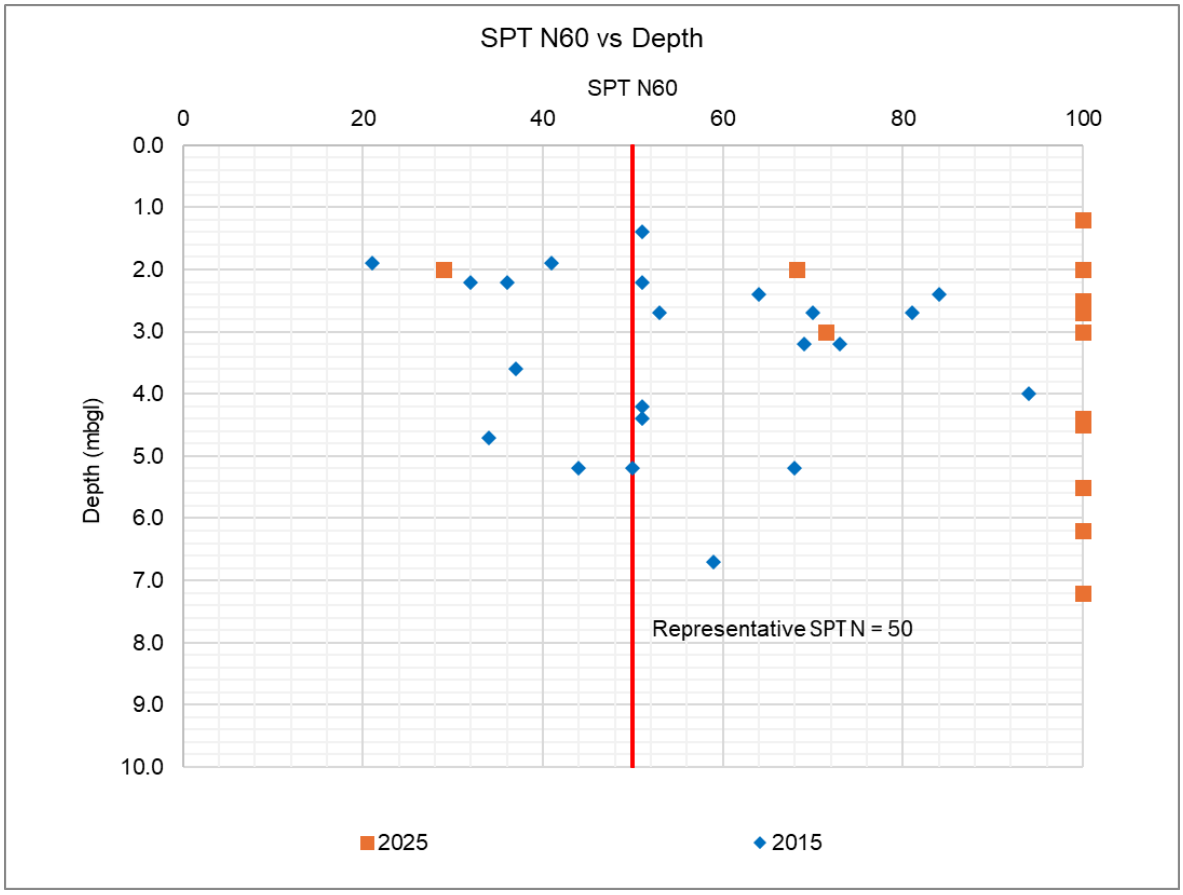


Figure 4-6: SPT N values from 2015 and 2025 investigations within Weathered Sandstone

Figure 4-6 above indicates extrapolated SPT N values greater than 100 for most of the 2025 SPTs. Based on 2015 values a n SPT N value of 50 is considered to be representative.

Drained friction angle for the granular soils was obtained by Equation 3. SPT N value of 50 indicates friction angle (ϕ') of >40° consistent with the findings of the 2015 GIR:

- Friction angle (ϕ') = 40°
- Allowable bearing value of 500kPa
- Unit weight of 20kN/m^3
- E` = 50MPa; Based on Equation below,

Equation 6

$E'/N60 = 1$

4.4 Sandstone (Extremely weak to weak Sandstone)

Sandstone was encountered at depths ranging between of 2.45mbgl and 6.9mbgl below the weathered sandstone. The base of the sandstone layer was not proven. Drawing 002 shows the variation in depth to material described in boreholes as intact rock from ground surface information provided to Coffey in 2015.

The sandstone is generally described in the exploratory logs as extremely weak to weak sandstone. While this is consistent with the findings of the 2015 investigation, the 2015 investigation also recorded the presence of layers of extremely weak mudstone within the sandstone closer to the southern boundary of the site. Such mudstone layers were not observed in any boreholes in the 2025 investigations.

Average SPT N values within Sandstone during the 2025 investigation were above 50 and 18 tests out of 20 tests carried out ended up as refusals (>50). This is shown the Table 4-6 below.

Table 4-6: SPT data for Sandstone

Test parameter	Unit	Range	Figure
SPT 'N' value	N/A	15 to >50 (refusal)	Fig 4-7

Figure 4-7 below shows SPT N values within Sandstone.

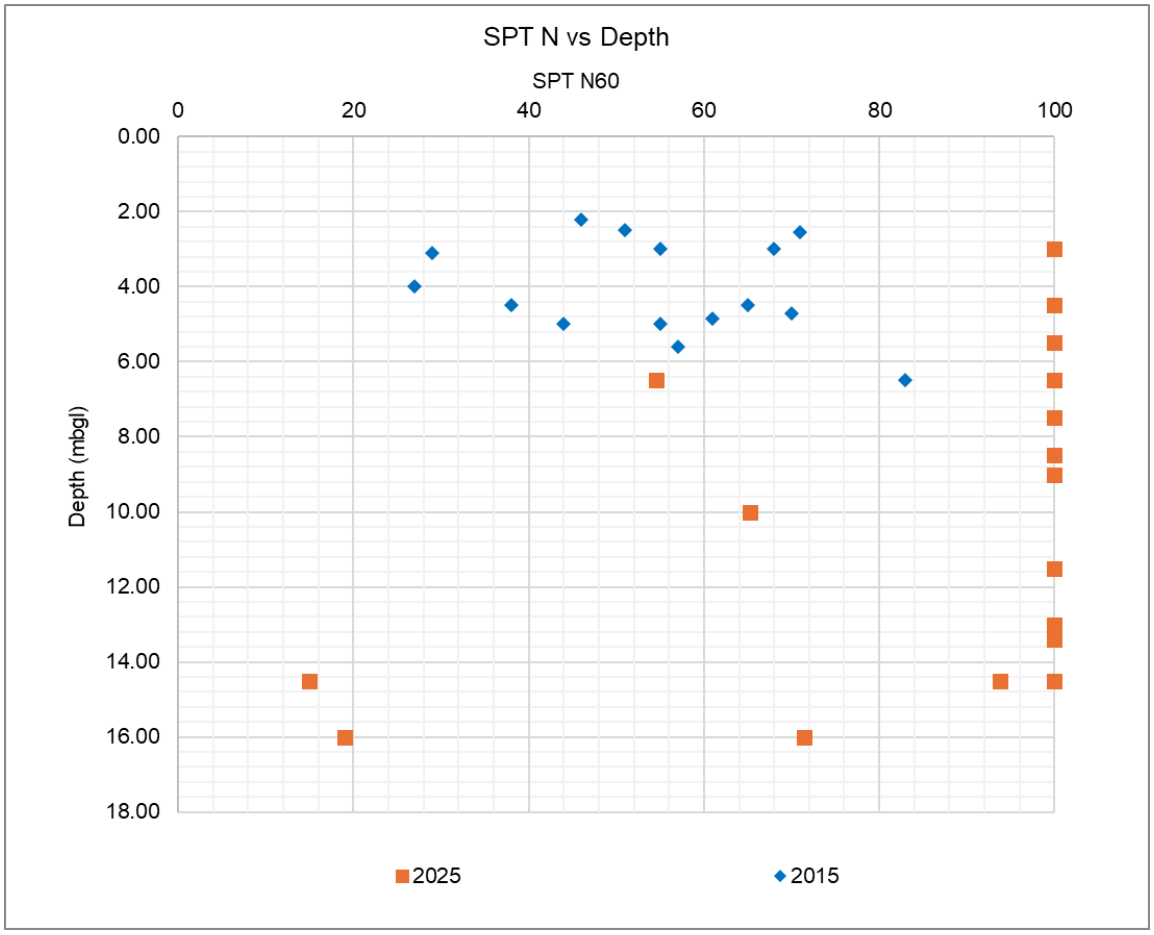


Figure 4-7: SPT N values within Sandstone from 2015 and 2025 investigations

Figure 4-8 below presents results from Point Load tests carried out on Sandstone samples. Point load results have been converted to UCS for comparison.

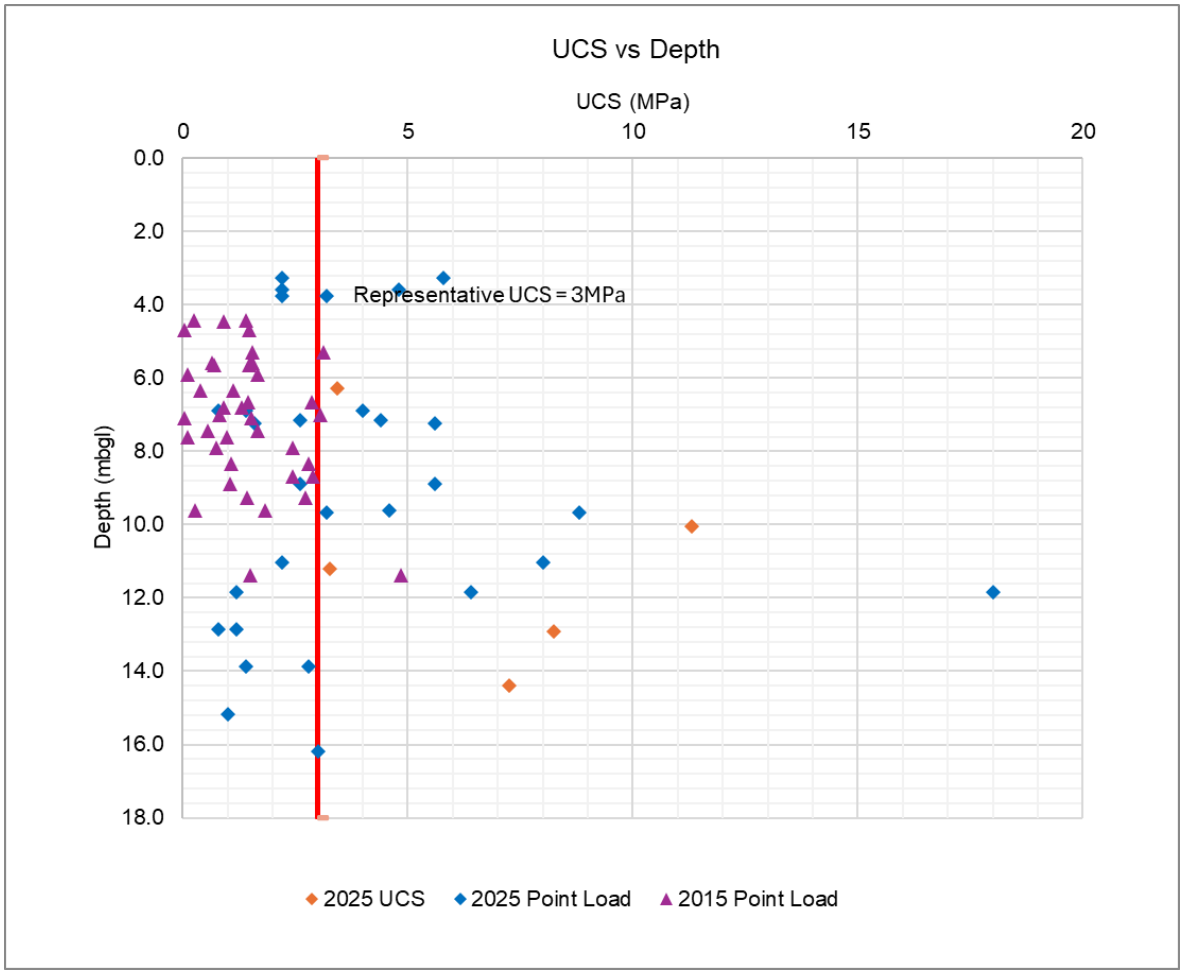


Figure 4-8: UCS results from 2015 and 2025 ground investigation

The 2015 GIR inferred the unconfined compressive strength (UCS) of the layer to be 3MPa and this is presented against all test results in Figure 4-8.

Based on rock description, unit weight of 22kN/m^3 for sandstone, is considered to be representative.

Stiffness of the rock is derived based on the Equation 7, below.

Equation 7

$$Em = J \; x \; Mr \; x \; Quc \; (Tomlinson, 2001)$$

Where:

J = Mass Factor

Q_{uc} = Unconfined compressive strength

M_r = Modulus ratio

Considering typical values for M_r and J (Tomlinson, 2001), for weathered weak sandstone, E_m is considered to be 900MPa.

4.5 Groundwater

Standpipes have been installed in the eight boreholes undertaken in 2025 with two 25mm standpipes per borehole targeting perched water levels in the Made Ground and deeper water levels in the Sandstone.

The first round of monitoring was undertaken in March 2025 and the results are summarised in Table 4-7 below.

Table 4-7: Groundwater levels after the first round of monitoring

BH ID	Point Reference	Date	Reading
BH101	MP1	14/03/2025	7.48
BH101	MP2	14/03/2025	6.00
BH101	MP1	14/03/2025	14.30
BH101	MP2	14/03/2025	6.00
BH102	MP2	14/03/2025	NA
BH102	MP1	14/03/2025	8.90
BH102	MP1	14/03/2025	15.00
BH102	MP2	14/03/2025	2.70
BH103	MP1	14/03/2025	NA
BH103	MP2	14/03/2025	NA
BH104	MP1	14/03/2025	2.68
BH104	MP2	14/03/2025	2.82
BH104	MP1	14/03/2025	14.80
BH104	MP2	14/03/2025	2.86
BH106	MP1	14/03/2025	12.96
BH106	MP2	14/03/2025	2.86
BH106	MP1	14/03/2025	13.75

BH ID	Point Reference	Date	Reading
BH106	MP2	14/03/2025	2.86
BH107	MP1	14/03/2025	13.17
BH107	MP1	14/03/2025	15.18
BH108	MP1	14/03/2025	4.80
BH108	MP1	14/03/2025	4.80
BH109	MP2	14/03/2025	2.80
BH109	MP1	14/03/2025	7.11
BH109	MP2	14/03/2025	2.80
BH109	MP1	14/03/2025	NA

Groundwater levels across the site are between 2.7m and 2.8m below ground level in the Made Ground / Glacial Till.

In the deeper installations with response zones in sandstone, groundwater levels were measured during monitoring at between 4.8m and 15.18m below ground level. However, higher groundwater levels were measured during the 2015 investigation including water seepage during drilling at 0.5 m depth. Therefore, it is considered that the perched groundwater level may rise to of 0.5m bgl.

The results based on the first round of groundwater monitoring indicate that groundwater is perched locally at shallow depths at the site within the Made Ground, overlying the more impermeable strata of the Glacial Till.

As the Sandstone (Chester Pebble Bed Formation) is a Principal Aquifer and it is anticipated to be water-bearing. The 2015 ground investigation indicated groundwater level at 8m bgl, but the 2025 ground investigation records shallowest groundwater level at 4.8m bgl.

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5.0 Geoenvironmental Assessment

5.1 Overview

Chemical analysis has been carried out on soil and water samples obtained during the site investigation works and post fieldwork groundwater monitoring.

5.2 Soil Generic Quantitative Risk Assessment (GQRA)

A comparison of soil chemical concentrations with published guidance levels has been undertaken to give an indication of the contamination potential of the Made Ground and natural soils encountered on the site. Details on laboratory testing suites are provided in Section 2.2.

The data have been compared against Generic Assessment Criteria (GAC) derived for a residential land use scenario to provide a conservative initial assessment of the data to establish what determinants exceed their respective GAC.

The chemical test results are presented in full in the factual report (Tetra Tech, 2025); the results are compared with their respective GAC concentrations in Table 5-1 below.

5.3 Made Ground

During the 2015 investigation the concentrations of potential contaminants were generally found to be below their respective detection limits and/or the GAC for residential end use in all samples of Made Ground tested except for following:

- Arsenic exceeded in one of twelve samples (up to 34.2mg/kg, GAC: 32mg/kg)
- Mercury exceeded in one of twelve samples (up to 6.8mg/kg, GAC: 1mg/kg)
- Naphthalene exceeded in two of twelve samples (up to 87.4mg/kg, GAC 1.5mg/kg)
- Phenanthrene exceeded in one of twelve samples (up to 87.37mg/kg, GAC 92mg/kg)
- Fluoranthene exceeded in one of twelve samples (492mg/kg, GAC 260mg/kg)
- Benzo[a]anthracene exceeded in six of twelve samples (up to 213.1mg/kg, GAC: 3.1mg/kg)

- Chrysene exceeded in five of twelve samples (up to 258.9mg/kg, 6mg/kg)
- Benzo[b]fluoranthene exceeded in four of twelve samples (up to 273mg/kg, GAC: 5.6mg/kg)
- Benzo[k]fluoranthene exceeded in four of twelve samples (up to 106.3mg/kg, GAC: 8.5mg/kg)
- Benzo[a]pyrene exceeded in six of twelve samples (up to 239.6mg/kg, GAC: 0.83mg/kg)
- Indeno[123-cd]pyrene exceeded in five of twelve samples (up to 150.9mg/kg; GAC:3.2mg/kg)
- Dibenzo[ah]anthracene exceeded in four of twelve samples (up to 17.9mg/kg; GAC:0.76mg/kg)
- Benzo[ghi]perylene exceeded in one of twelve samples (134.7mg/kg, GAC 44mg/kg)
- Aromatics EC >12-16 exceeded in two of ten samples (789mg/kg, GAC 140mg/kg)
- Aromatics EC >16-21 exceeded in four of ten samples (6795mg/kg, GAC 250mg/kg)
- Aromatics EC >21-35 exceeded in four of ten samples (7465mg/kg, GAC 890mg/kg)

The arsenic and mercury values are considered slight exceedances. Coffey (2015b) states that fragments of asphalt / tarmac are present within the Made Ground which have caused the TPHs and PAHs exceedances.

During the 2025 investigation, nine samples of Made Ground were tested for a general suite of specialist chemical testing and hydrocarbons. None of the tested samples exceeded the limits for GAC.

Table 5-1 below Provides Generic Quantitative Risk Assessment (GQRA) of inorganics and metals within the Made Ground based on 2025 investigation.

Table 5-2 below provides Generic Quantitative Risk Assessment (GQRA) os organics within the Made Ground based on 2025 investigation.

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Table 5-1: GQRA for inorganics and metals

Determinant	GAC Limit (mg/kg)	Samples above GAC limits	BH 101	BH 102	BH 103	BH 104	BH 104	BH 106	BH 107	BH 108	BH 109
			1.10	0.10	1.00	0.90	2.50	1.00	0.20	0.20	0.50
			MG	MG	MG	MG	MG	MG	MG	MG	MG
Arsenic	32	0	4.5	10.9	17.8	-	2	5.5	6	9.3	8.2
Cadmium	10	0	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium III	3000	0	34.3	38.5	29.6	-	33.3	37.2	19.1	20.3	31
Copper	2330	0	16	28	49	-	15	24	31	20	28
Lead	450	0	18	71	158	-	9	14	70	18	55
Mercury - Elemental	1	0	<0.1	0.3	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	130	0	16.4	15.4	15.1	-	13	26.7	10.9	11.6	14.4
Selenium	350	0	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	3750	0	44	58	41	-	46	52	74	76	59
Cyanide - Total	No Criteria	0	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	291	0	0.2	0.3	0.2	-	0.2	0.5	0.5	1.0	0.4

Table 5-2: GQRA for organics

Determinant	GAC Limit (mg/ kg)	Samples above GAC limits	BH 101	BH 102	BH 103	BH 104	BH 104	BH 106	BH 107	BH 108	BH 109
			1.10	0.10	1.00	0.90	2.50	1.00	0.20	0.20	0.50
			MG	MG	MG	MG	MG	MG	MG	MG	MG
Naphthalene	1.5	0	<0.04	0.50	0.19	-	<0.04	<0.04	0.04	0.04	0.04
Acenaphthylene	170	0	<0.03	0.42	0.04	-	<0.03	<0.03	0.03	0.04	0.03
Acenaphthene	210	0	<0.05	0.64	0.10	-	<0.05	<0.05	0.11	0.07	0.05
Fluorene	160	0	<0.04	0.75	0.05	-	<0.04	<0.04	0.07	<0.04	<0.04
Phenanthrene	92	0	<0.03	6.76	0.73	-	<0.03	<0.03	0.60	0.97	0.16
Anthracene	2300	0	<0.04	2.00	0.17	-	<0.04	<0.04	0.16	0.20	0.04
Fluoranthene	260	0	<0.03	8.58	1.05	-	<0.03	<0.03	0.66	1.76	0.27
Pyrene	560	0	<0.03	7.68	0.92	-	<0.03	<0.03	0.56	1.40	0.26
Benzo[a]anthracene	3.1	0	<0.06	3.36	0.55	-	<0.06	<0.06	0.33	0.75	0.17
Chrysene	6	0	<0.02	3.57	0.55	-	<0.02	<0.02	0.30	0.74	0.16
Benzo[b]fluoranthene	5.6	0	<0.02	1.50	0.24	-	<0.02	<0.02	0.13	0.33	0.08

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Benzo[k]fluoranthene	8.5	0	<0.05	3.84	0.63	-	<0.05	<0.05	0.35	0.84	0.19
Benzo[a]pyrene	0.83	0	<0.04	3.30	0.49	-	<0.04	<0.04	0.29	0.66	0.15
Indeno[123-cd]pyrene	3.2	0	<0.04	2.02	0.33	-	<0.04	<0.04	0.18	0.49	0.12
Dibenzo[ah]anthracene	0.76	0	<0.04	0.48	0.08	-	<0.04	<0.04	0.06	0.14	0.04
Benzo[ghi]perylene	44	0	<0.04	2.05	0.32	-	<0.04	<0.04	0.18	0.47	0.10
Naphthalene	1.5	0	<0.04	0.50	0.19	-	<0.04	<0.04	0.04	0.04	0.04

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5.4 Natural Ground

One sample of natural ground (from BH103) was tested for a general suite of specialist chemical testing and for hydrocarbons.

No Hydrocarbons or inorganic/metals were detected in this sample.

5.5 Asbestos

During the 2025 investigation, Asbestos was identified at the location of BH105A where the borehole was terminated due to the presence of asbestos.

During the 2015 investigation, 8 samples within the current site boundary were tested and these did not contain Asbestos. However, two trial pits (TP04/1B at 0.35m depth and TP06/1B at 0.6m depth) contained fragments identified as possible asbestos during the fieldworks.

It is recommended that the localised presence of asbestos within the Made Ground at the site should be documented within all required Health & Safety (CDM or Contractor's) risk assessments required for construction work including the pre-construction information pack for tenderers. The risk of chronic exposure to asbestos should be managed by the adoption of good general working practices (during all groundworks) such as dust suppression, use of standard PPE and good standards of hygiene, together with guidance and direction from a suitably qualified and experienced asbestos specialist. Any Made Ground containing asbestos which is to be taken off site may need to be treated and would require disposal at a suitable licenced landfill site. In terms of post-construction site use, near-surface soils in the landscaped/soft-standing parts of the site need to be devoid of asbestos. This can be addressed by ensuring that the upper 600mm of all such areas consist of cover soils that are uncontaminated, and in particular are devoid of asbestos.

5.6 Ground gas

A ground gas assessment was undertaken as part of the 2015 ground investigation (Coffey (2015b)) in accordance with BS 8485:2015.

The assessment indicated that the individual hazardous gas flow rate for the current site is category CS 1.

Category CS1 does not require gas protection measures according to BS 8485:2015, therefore no further assessment is necessary.

5.7 Groundwater

The list of testing Coffey have advised Tetra Tech to undertake on water samples from 2025 site investigation is given in Section 3.2.3.

It is proposed that any groundwater samples taken during groundwater monitoring rounds will be subject to this testing and that test results will be directly compared to the UK Drinking Water Standards (UK DWS) initially. Where UK DWS are not available, the groundwater determinand concentrations will be compared to the Environment Agency's Environmental Quality Standards (EQS), which are derived for the protection of aquatic life.

No groundwater testing was undertaken as part of the 2015 ground investigation on samples from within the current site boundary.

6.0 Conceptual Site Model

A Conceptual Site Model (CSM) was established based on the findings of the 2015 ground investigation and gas and groundwater monitoring results (Coffey (2015b)) and has been reviewed with consideration the results of the 2025 ground investigation.

In summary, sources comprise:

- Elevated arsenic, lead, mercury, TPHs and PAHs in the Made Ground.
- Asbestos in Made Ground.
- Japanese Knotweed on the site.
- Unexploded Ordnance (UXO) threat.
- There may be localised contamination in Made Ground at other locations.

The potential pathways at the site include:

- Dermal contact, ingestion and inhalation.
- Infiltration and runoff.
- Groundwater flow.
- Pathways via buried pipes such as redundant drainage.

Receptors considered include:

- Construction and maintenance workers.
- Current and future site users (university users and maintenance staff).
- Groundwater and surface water.

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7.0 Geo-environmental Risk Assessment

7.1 Summary of risk assessment

A geo-environmental risk assessment for the site is outlined below in the context of the findings of the investigations and the potential pollutant linkages identified in the CSM (see Section 6 above).

In brief, the geo-environmental risk assessment considers the various potential pollutant linkages identified in the CSM and qualitatively determines a level of risk (based on the classification of the magnitude of the potential consequence of the risk occurring and the magnitude of the probability of the risk occurring). The risk assessment highlights areas which warrant either further investigation to prove and validate the level of risk, or remedial action. Where information is of insufficient detail or incomplete, risks may be identified as moderate/high and then reduced as necessary after further information is gathered.

Table 7-1 below provides a description of the resultant risk levels, taken from NHBC & Environment Agency (2028) 'Guidance for the Safe Deployment of Housing on Land Affected by Contamination', R&D 66:2008 Vol. 1.

The outcome of the risk assessment below, considering the site in its present state and the proposed end use, to the environment and human health would be generally LOW with a MODERATE / HIGH risk to construction workers from asbestos in soils.

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Table 7-1: Risk Definitions (Ref: NHBC & Environment Agency, 2008)

Risk Term	Description
VERY HIGH	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
HIGH	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
MODERATE	It is possible that without appropriate remediation action harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
LOW	It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at worst if any harm was realised any effects would be mild.
VERY LOW	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor

7.2 Risk Assessment

The outcome of the risk assessment for the subject site in relation to the proposed development is summarised in Table 7-2.

Table 7-1: Summary of Risk Assessment (Risk Rating)

Receptor	Pathway	Source	
		Asbestos (primarily in Made Ground)	Metals, TPHs and PAH in soils
Human Health - construction and maintenance workers	Direct contact in open ground	N/A	LOW
	Ingestion in open ground	N/A	LOW
	Inhalation of gases/vapours/dust	HIGH / MODERATE	N/A
Human Health - development users	Direct contact in open ground	N/A	LOW
	Ingestion in open ground	N/A	LOW
	Inhalation of gases/vapours/dust	HIGH / MODERATE	N/A
	Explosion of gas	N/A	N/A
Groundwater	Leaching and/or percolation	N/A	LOW
	Off-site migration	N/A	LOW
Surface water	Off-site migration	N/A	LOW

The risks above are generally considered LOW, with a MODERATE to HIGH risk to human health based on asbestos encountered in soils.

Based on the limited amount of perched shallow groundwater above relatively impermeable clay layer of Glacial Till, risk to the local abstraction points from this site is considered to be low.

The presence of Japanese Knotweed on the site was noted in 2015. This should be reviewed, and if present should be treated and removed from site in accordance with statutory / Environment Agency guidelines.

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Any near-surface soils with asbestos containing material in landscaped/soft-standing should be addressed by ensuring that the upper 600mm of all such areas consist of cover soils that are uncontaminated, and devoid of asbestos.

8.0 Geotechnical Risk

A geotechnical risk register identifying the key geotechnical and geo-environmental risks considered pertinent to the site and the proposed development is given in Table 8-1.

The risks have been evaluated using the risk evaluation matrix suggested in CD 622 'Managing Geotechnical Risk (National Highways, 2020), reproduced as Table 8-2 below.

Table 8-1: Risk Evaluation Matrix

Risk Matrix						
Likelihood		Severity				
		1	2	3	4	5
		Minor	Moderate	Serious	Major	Catastrophic
1	Extremely unlikely	1	2	3	4	5
2	Unlikely	2	4	6	8	10
3	Likely	3	6	9	12	15
4	Extremely likely	4	8	12	16	20
5	Almost certain	5	10	15	20	25

Risk Classification	
Low (1-8)	Ensure assumed control measures are maintained and reviewed as necessary.
Medium (9-19)	Additional control measures needed to reduce risk rating to a level that is equivalent to a test of "reasonably required" for.
High (20-25)	Activity not permitted. Hazard to be avoided or risk to be reduced to tolerable level.

Table 8-2: Geotechnical Risk Register

Risk ID	Hazard	Consequence	Likelihood	Severity	Risk	Mitigation	Likelihood	Severity	Residual Risk
1	Low strength Made Ground and / or Glacial Till.	- Failure of earthworks and/or structures due to excessive progressive movement or collapse upon adding extra loading. - Variation of level to suitable founding stratum. - Excessive/differential settlements	4	4	16	Mitigation Undertaken: Ground Investigation has been undertaken at the site. GI identified soft Made Ground. Future Mitigation Recommended: Design of foundations to account for Made Ground. Recommended to avoid shallow foundations sitting on these deposits and to omit consideration of positive skin friction contribution from these layers for pile foundations.	2	4	8
2	Variability of rock head and weathering at top of rock	- Conditions differ from design assumptions - Excessive total / differential settlement - Damage to structures / inoperable machinery - Bearing capacity failure	5	3	15	Mitigation Undertaken: Ground Investigation has been undertaken at the site. Variable rockhead level identified. Future Mitigation: Foundation and earthworks design should consider the potential for a variable rockhead profile.	1	3	3
3	Soil aggressivity to concrete	- Degradation of buried concrete structure	3	3	9	Mitigation Undertaken: Ground Investigation has been undertaken at the site. Geochemical testing of samples of soil and groundwater undertaken indicate Design Sulphate Class DS-2 and ACEC Class AC-2. Future Mitigation: Design concrete in accordance with Design Sulphate Class.	2	3	6
4	Ground Contamination	- Risk to human health of construction and maintenance workers. - Risk to human health of development users. - Risk to groundwater. - Risk to surface waters.	2	3	6	Mitigation Undertaken: Ground Investigation and Geo-environmental Risk Assessment have been undertaken and conclude Low Risk.	1	3	3

Risk ID	Hazard	Consequence	Likelihood	Severity	Risk	Mitigation	Likelihood	Severity	Residual Risk
5	Higher groundwater levels than anticipated	- Instability of soils leading to damage to structures.	3	2	6	Mitigation Undertaken: Ground Investigation and groundwater monitoring have been undertaken at the site to assess the groundwater regime. The groundwater table has been shown to be present at Sandstone formation as well as perched within the Made Ground above the Glacial Till boundary. Future Mitigation Recommended: Design to consider potential groundwater levels. Design and implementation of appropriate dewatering techniques and excavation protection measures during construction.	3	1	3
6	Buried/Overhead Services	- Death/injury to construction workers. - Loss of service to customers.	3	5	15	Future Mitigation Recommended: Service plans to be obtained and reviewed as part of detailed design and prior to mobilisation to site. All services to be positively identified on site prior to breaking ground. Safe digging practices to be implemented during all excavation work.	1	5	5
7	Asbestos	- Longterm health issues for construction workers or development users from inhalation of asbestos.	4	5	20	Future Mitigation: Any near-surface soils with asbestos containing material in landscaped/soft-standing should be addressed by ensuring that the upper 600mm of all such areas consist of cover soils that are uncontaminated, and devoid of asbestos Taking appropriate precautions such as damping down ground to reduce air-borne fibres, wearing appropriate breathing apparatus and provision of appropriate training/guidance, PPE and welfare facilities during the works	1	5	5
8	Japanese knotweed	- Legal obligation to prevent spread. - Damage to structures.	4	3	12	Future Mitigation: Japanese knotweed was identified on the site in 2015. This should be reviewed and, if present, it should be treated and removed from site in accordance with statutory / Environment Agency guidelines.	1	3	3

9.0 Geotechnical Considerations

9.1 Ground Model

Table 9-1 below presents a generalised ground model with representative geotechnical parameters based on the 2025 borehole data and in situ testing and data from previous investigations in 2015. Design parameters for detailed design should be selected appropriate to the design assessments undertaken.

Drawing 001 gives geological cross sections through the site which show the variability of ground conditions which should be considered in design.

Drawing 002 shows contours of the thickness of Made Ground and the depth to top of materials described in the borehole logs as intact rock.

Made Ground thickness varies between 0.0m and 2.5m, typically less than 2m. The maximum thicknesses are recorded towards southwest corner of the site and towards the northwest boundary of the site. There are other localised areas of thicker Made Ground across the site.

Depth to the rock typically ranges between 2m and 4m mbgl. There are three localised areas where rock is shown to be deeper on Drawing 002 (up to 7m depth), and these contours are influenced by very local triangulation between apparent structural features in the topographical survey which are not representative of the overall ground surface, and locally thicker strata recorded as completely weathered sandstone. Reference should be made to cross sections shown on Drawing 001, the topographical survey, and borehole logs for full details.

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Table 9-1: Ground Model

Geology	Layer base	Thickness	Unit Weight	c_u	c`	Phi	Eu	E`
	mbgl	m	kN/m3	kPa	kPa	°	MPa	MPa
Made Ground	1	1	18	40	0	28	12	9.6
Glacial Till (Soft to firm)	2	1	21	50	0	25	15	12
Glacial Till (Firm to stiff)	3	1	21	100	0	25	30	24
Weathered Sandstone	6.9	3.9	20	NA	0	40	NA	50
Sandstone	Not Proven	Not Proven	22	UCS = 3 MPa			Em = 900 MPa	

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9.2 Shallow Foundations

The feasibility of different foundation types will ultimately depend on the building loadings and specific ground conditions at the building location. Made Ground is unsuitable for the support of any major structure owing to the risk of excessive total and/or differential settlements resulting from the loading of such strata.

However, shallow spread or trench-fill foundations may be viable for redevelopment, provided they extend beyond the Made Ground and weaker clay layers to reach the more competent stiff glacial clays or weathered sandstone. Foundations placed at approximately 2m depth within these suitable layers can achieve an allowable bearing capacity of 200kPa. In cases where foundations span across different soil strata, reinforcement should be incorporated to mitigate differential settlement risks.

For foundations that rest directly on dense sand or weathered sandstone, an allowable bearing capacity of at least 500kPa is expected. However, a conservative estimate of 300kPa is recommended to account for any undetected weaker materials.

To mitigate soil shrinkage or swelling, particularly for cohesive formations, the minimum foundation depth should be 0.75m below ground level, in accordance with local building regulations. The glacial clay and most Made Ground formations are classified as having low volume change potential, but the influence of nearby trees must be considered. Some trees on-site and in adjacent areas may need removal, and their potential impact on foundation depths, heave precautions, and floor slab designs must be assessed.

Any new tree planting should be positioned at least half the mature tree height away from buildings to prevent future interference. Alternatively, a properly designed root barrier system can be installed to protect structures from root encroachment.

Exploratory investigations confirm that a suitable stratum for shallow foundations is generally located around 2m below ground level, consisting of stiff clay, dense sand, and sandstone. These findings indicate that shallow foundations can be successfully integrated into the redevelopment plan, depending on loading and settlement criteria, and provided all necessary precautions are taken to account for soil variability and structural integrity.

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9.3 Piled Foundations

Piled foundations into bedrock are feasible for the proposed buildings and may be required depending on the structural loads to be accommodated. Piles should have a rock socket of at least 2m into the extremely weak sandstone, total rock socket length depending on loads.

Small displacement piles, such as circular steel tubes, are ideally suited to piling in the weak rock with its design and installation advantages. However, load carrying capacity would be limited by the driveability and thereby diameter of the piles. Limitations of driven piles would include noise and vibration effects, together with possible heave effects.

It is possible to install significant rock sockets with replacement techniques (Bored or Continuous Flight Auger (CFA)), particular when using modern high torque piling rigs. The feasible construction depth of the CFA piles into bedrock will depend on the rock strength and piling equipment used. Discussion with specialist piling contractors is required to ensure the piling type and rig are suitable for the ground conditions. Note that whilst the rock is generally described as extremely weak to weak sandstone and mudstone, some layers of medium strong to strong sandstone were encountered during the investigation.

Preliminary calculations for allowable capacities of single CFA piles (or conventional bored piles) are presented in Table 9-2 below.

Table 9-2: Summary of preliminary allowable pile capacities for a single CFA pile

Rock Socket Length (m)	Pile diameter (mm)		
	300	450	600
2	500	900	1350
4	700	1450	2100

The capacities given in the table are for single piles and for a detailed pile design group effects should be considered.

For design of piles socketed in sandstone, as well as pile load testing, adequate construction quality control is required, i.e. an observational approach of an experienced geotechnical engineer examining pile arising together with monitoring of CFA pile torques,

to confirm that the pile is socketed into an adequate depth of competent sandstone to achieve the required load capacities.

The methodology for the preliminary pile assessment used to determine the capacities given in Table 9-2 is presented below.

For the assessment of CFA piles in cohesive materials, an adhesion factor (α) is considered to vary according to the undrained shear strength for bored piles in Glacial Till. For pile capacity calculations for concrete CFA piles Ks tan δ = 0.72 was used for Weathered Sandstone. The average unit shaft friction and base resistance were limited to values of 100kN/m^2 and 10,000kN/m^2.

Positive skin friction from Made Ground / soft Glacial Till (up to 2.0m depth) was ignored in this design.

A factor of safety of 2.5 was applied to pile end bearing to limit total settlement to within 10mm, subject to more detailed settlement calculations which would be required at detailed design stage.

The site area is underlain by bedrock designated as a Principal Aquifer and the groundwater protection zone map identifies that the site is located in a Source Protection Zone III area. Piling may provide a more direct route for potentially contaminated groundwater entering the aquifer. However, on the basis of the site history, current features and observations made during the site inspection, gross/site-wide mobile ground contamination sources are considered unlikely to exist.

9.4 Hardstanding and Pavement Construction

As part of the 2025 investigation, twelve TRL Probe Tests have been undertaken in trial pits at depths between 0.21m and 1.56m across the site to assess appropriate CBR values for pavement design.

A summary of correlated CBR values determined from the TRL Probe Test results is presented in Table 9-3 below.

Table 9-3: Summary of CBR Results

Stratum Type	Test Locations	Minimum CBR Value (%)	Maximum CBR Value (%)	Median
Made Ground	2	1	372	12
Glacial Till - Clays	9	8	62	22

Previous investigations (Coffey (2015b)) gave a lower bound CBR value of 4%.

Given the high variability that is observed in TRL probe results, it can be considered a CBR value of 4% may be taken as representative.

When the location of proposed access roads and formation levels are known, further in-situ CBR testing should be undertaken to validate CBR values for the pavement design.

9.5 Excavations

Excavation work is required both for removing the existing foundations and for constructing the new building's footings. It is anticipated that the Made Ground layer at the site will not remain stable during excavation and will require temporary support or the formation of battered slopes. Accordingly, the Principal Contractor must conduct a comprehensive risk assessment to determine safe working methods.

Excavations deeper than roughly 0.5m may necessitate groundwater control measures. A perched water table is expected across the Made Ground, located just above the glacial clays, with monitoring indicating water levels as shallow as 0.5m below ground level. While full-scale dewatering is not planned, localized sump drainage could be necessary based on the final foundation scheme. It is critical that any excavation design incorporating groundwater control is robustly engineered to avoid piping or failure at the base due to water pressure.

Removal and disposal of contaminated Made Ground material should also be considered. Waste Acceptance Criteria (WAC) testing will likely be required by any proposed landfill and should be undertaken at the time of construction works.

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9.6 Re-use of materials

The suitability of excavated materials for re-use should consider the material classifications discussed in Section 4.2 above. It is anticipated that Made Ground will be classified as Class 2 material suitable for general fill.

Made Ground with higher fines content may also be classed as Class 7E or Class 7I materials, suitable for stabilisation with lime or lime and cement for use as capping, subject to design and trials.

9.7 Aggressivity to Concrete

Testing to determine the aggressivity of the ground towards concrete was undertaken on soil and groundwater samples in accordance with the BRE SD1:2005.

A total of 16 samples were tested in 2015 within the current site boundary and three further tests were undertaken during the 2025 investigation. As reported in Coffey (2015b), the results from 2015 investigation correspond with a Design Sulphate Class and ACEC Class of DS-2 and AC-2 respectively.

Table 9-4 below presents the summary of 2025 test results.

The maximum concentrations of sulphates are slightly lower than the recorded values of 2015 investigation and they also correspond with a Design Sulphate Class and ACEC Class of DS-2 and AC-2 respectively

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Table 9-4: Summary of concentrations measured in soils for materials assessment

BH ID	GL	Test depth	Elevation	Water soluble sulphate (as SO4)	Acid Soluble Sulphate	Total Sulphur	pH Value
	(mAOD)	(mbgl)	(mAOD)	(mg/l)	(%)	(%)	pH Units
BH103	44.32	1	43.32	0.025	0.05	0.08	8.7
BH107	43.16	1.7	41.46	0.023	< 0.01	< 0.01	8.6
BH108	44.52	2	42.52	0.97	0.29	0.1	8.2
BH108	44.52	4.5	40.02	0.034	< 0.01	< 0.01	8.8
BH109	44.41	0.5	43.91	0.11	0.05	0.03	8.2
BH109	44.41	1.2	43.21	0.12	0.04	0.03	8.7
BH109	44.41	5.5	38.91	<0.01	< 0.01	< 0.01	8.8
Min				**<0.01**	**< 0.01**	**< 0.01**	**8.2**
Max				**0.97**	**0.29**	**0.1**	**8.8**

9.8 Soakaways

Falling head permeability tests were carried during 2015 ground investigation out to evaluate the potential for soakaways. No permeability testing has been carried out in 2025 investigation. As per Coffey (2015b) of soakaways on the site has been considered and it is concluded that the site is not suitable for soakaways. The results from 2015 investigation are summarised in the Table 9-5 below.

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Table 9-5: Summary of soakaway analysis from Coffey (2015b).

Geological Stratum	Infiltration Rate ($m^3/m^2/s$)	Description	Suitability for Soakaway
Made Ground	Not specified	Contains a perched water table and has limited volume capacity, which may lead to site flooding.	No
Glacial Till (predominantly clay)	3.6×10^{-7} to 4.4×10^{-7}	Consists mainly of clay with extremely low infiltration rates; this stratum does not allow sufficient water infiltration for effective soakaway function.	No
Upper Weathered Sandstone (fine to coarse sand)	1.44×10^{-6} to 1.2×10^{-5}	This layer is composed of fine to coarse sand with variable thickness; the infiltration rates are considered poor to moderately poor, making it less effective as a soakaway medium.	No
Weathered Sandstone	2×10^{-5} to 7×10^{-5}	Although slightly higher infiltration rates are observed, they are still considered moderately poor; additionally, any soakaway system would require excavation below the perched water table and through the glacial till, which creates construction challenges, compounded by the fact that the sandstone is a Principal Aquifer.	No

The table above provides an overview of the geological conditions, estimated infiltration rates based on falling head tests, how these characteristics impact the suitability for soakaways, and ultimately shows that none of the strata are considered appropriate for soakaway installation.

10.0 Conclusions

The following are key conclusions from the ground investigation:

1. The site consists of Made Ground and glacial clay superficial deposits, underlain by weathered sandstone and sandstone.
2. The rock is highly weathered and described as weak to extremely weak with closely spaced discontinuities.
3. The ground conditions encountered during the 2025 investigation are consistent with those identified by the previous investigations and described in published geology.
4. The Made Ground is not considered suitable as a founding stratum. Shallow foundation may be acceptable on still Glacial Till and Sandstone, subject to loadings and settlement criteria. Piled foundations into the Sandstone would be suitable for higher loads.
5. The Tetra Tech 2025 ground investigation includes for groundwater monitoring over a six-month period following completion of the intrusive investigation. Groundwater monitoring results will be included in the Final Factual Report after the final round of monitoring. No groundwater samples were obtained during the intrusive ground investigation works. Any groundwater samples obtained during groundwater monitoring rounds will be subject to geoenvironmental testing and the results reviewed in an addendum to this GIR.
6. The main risk to site / construction workers is from disturbed Made Ground containing asbestos. This can be addressed by taking appropriate precautions such as damping down ground to reduce air-borne fibres, wearing appropriate breathing apparatus and provision of appropriate training/guidance, PPE and welfare facilities during the works. This residual risk should be considered in the Contractor's Method Statement
7. There is a risk that contamination of groundwater may occur locally to the piles as a result of the pile concrete or grout entering groundwater. It is considered that this additional risk may be mitigated by the contractor following good working practices. This residual risk should be considered in the Contractor’s Methos Statement.

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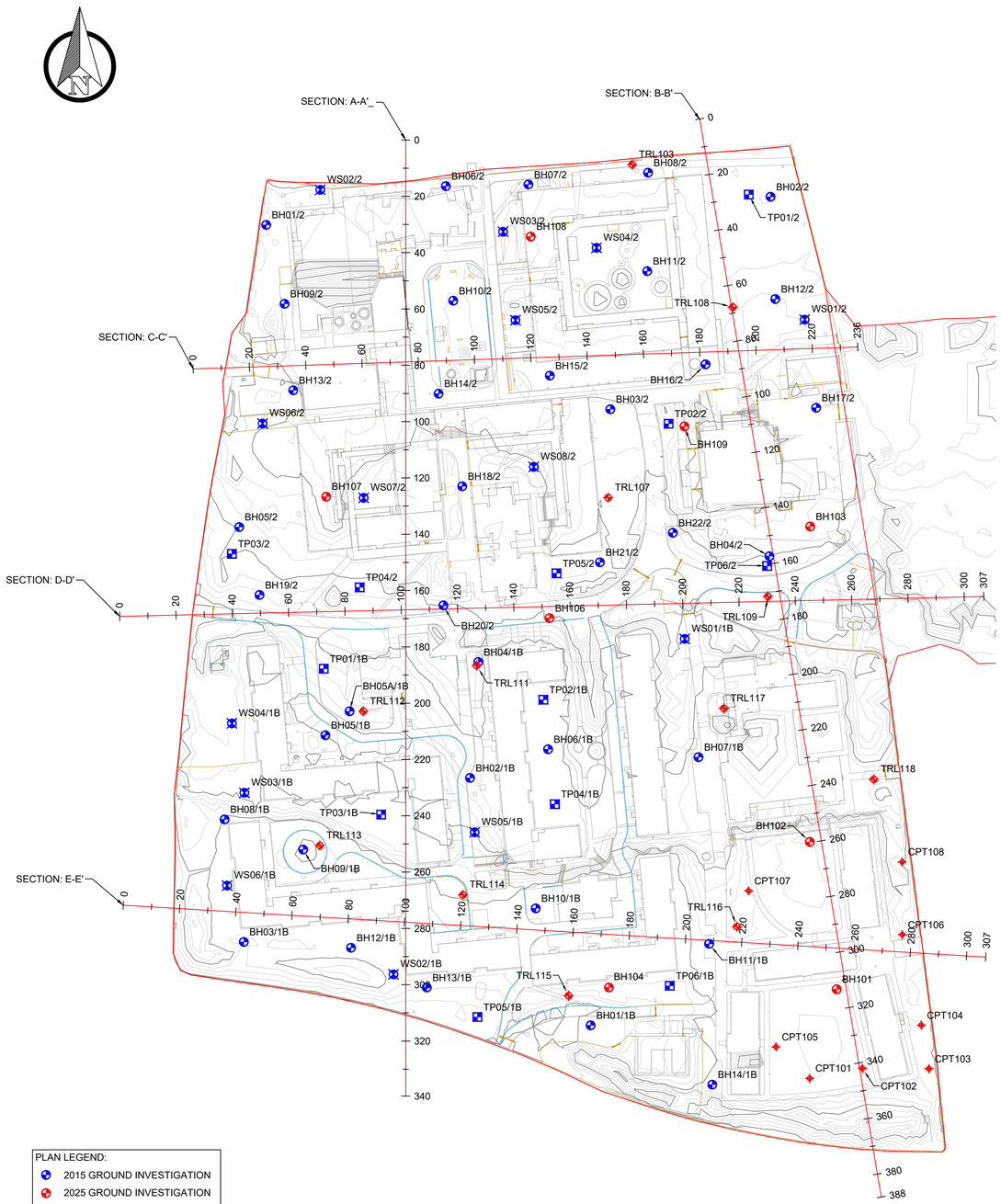
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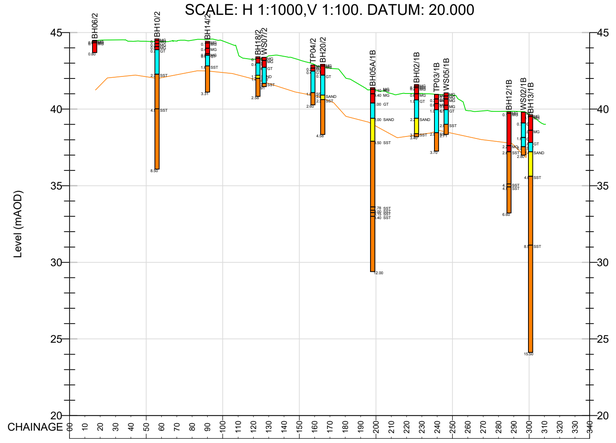
DRAWINGS

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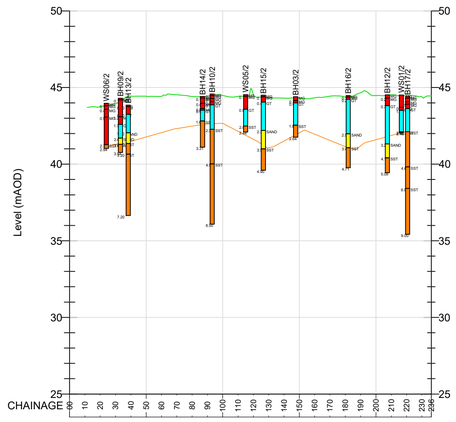


SITE PLAN
SCALE 1:1,000

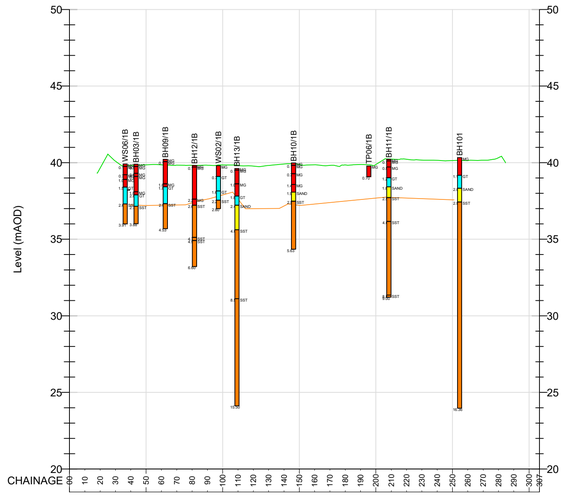
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SCALE: H 1:1000,V 1:100. DATUM: 20.000



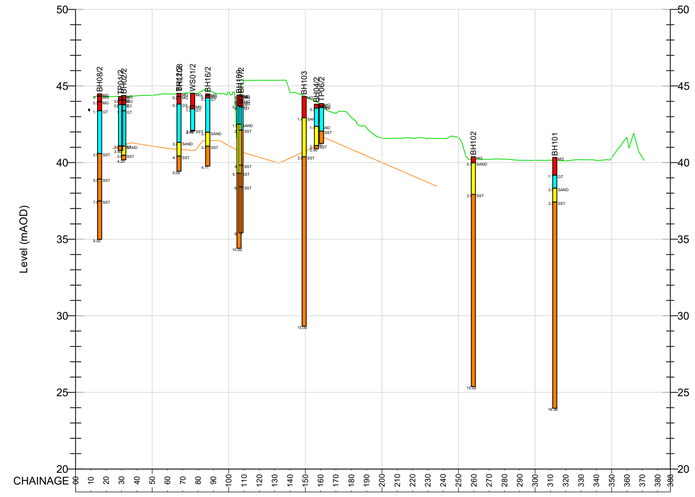
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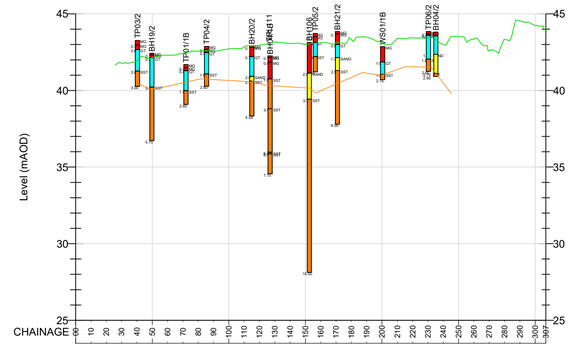
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SCALE: H 1:1000,V 1:100. DATUM: 20.000



GEOL SECTION B-B' - X10 VERTICAL EXAGGERATION
SCALE: H 1:1000,V 1:100. DATUM: 20.000



GEOL SECTION D-D' - X10 VERTICAL EXAGGERATION
SCALE: H 1:1000,V 1:100. DATUM: 25.000



GEOLOGICAL LEGEND:
MADE GROUND
GLACIAL TILL
COMPLETELY WEATHERED SANDSTONE
INTACT SANDSTONE
EXISTING GROUND SURFACE
TOP OF INTACT SANDSTONE

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. TOPOGRAPHICAL SURFACE "EG" CREATED FROM PROVIDED CSV DATA FILE: Project Oak Redline_SpotLevel_Meter.csv
3. SITE LAYOUT REPRODUCED FROM DATA CONTAINED WITHIN DRAWING FILE: Project Oak Redline_2010version_Millimeter.dwg

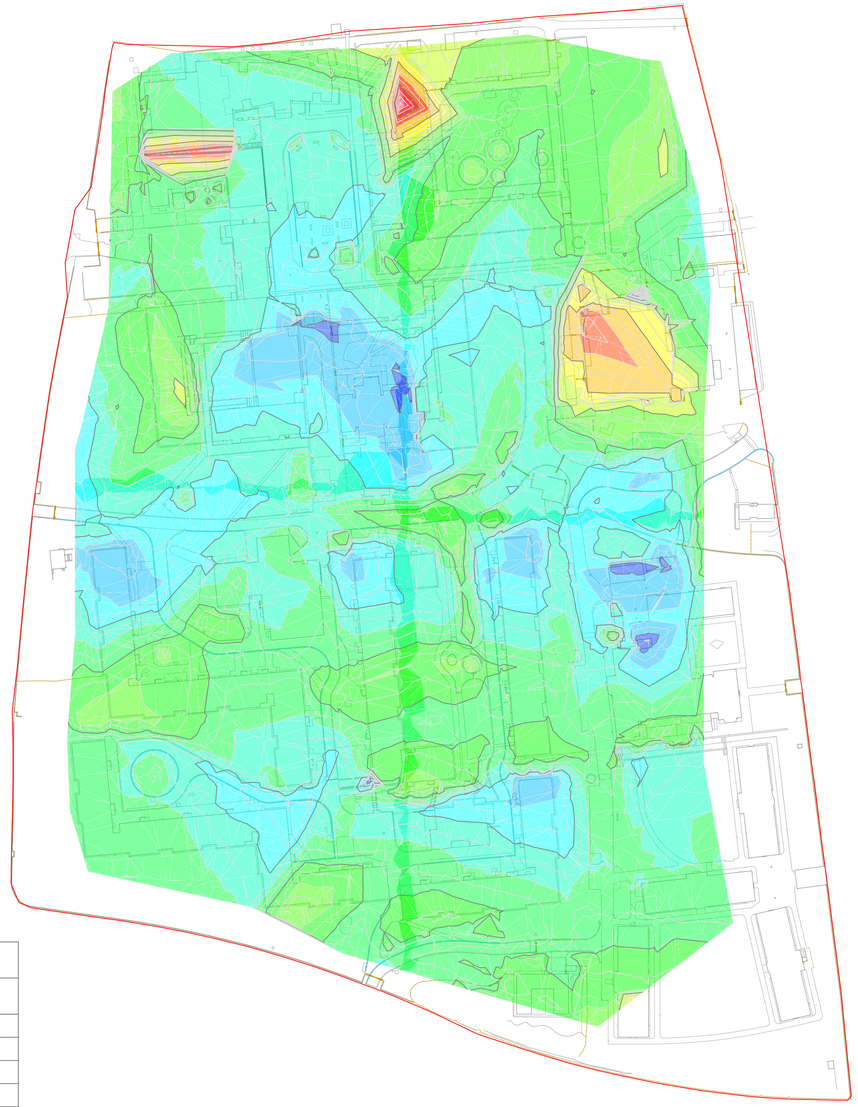
rev no	revision note	date	checked	approved

drawn	JDP
checked	RP
approved	JMB
date	08/05/25
scale	AS SHOWN
original size	A1

coffey
A TETRA TECH COMPANY
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Website: www.coffeygeotechnics.co.uk
Coffey Geotechnics Limited
Registered Office: 1 Northfield Road, Reading, Berkshire, RG1 8AH, United Kingdom
Registered in England No 06328315.

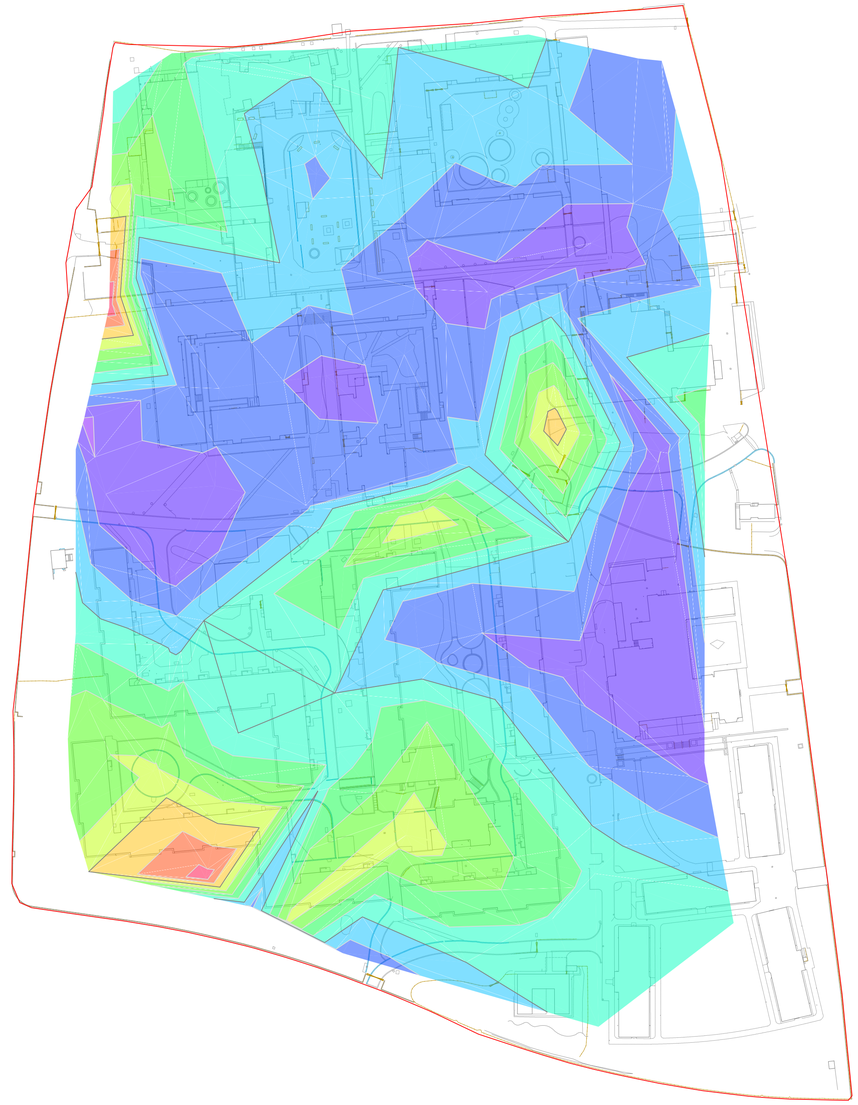
client:	KENNEDY REDFORD
project:	FALLOWFIELD CAMPUS
title:	SITE PLAN AND GEOLOGICAL SECTIONS
cof proj no: 03847AB	dwg no: 001 rev: 0

File Path: \\Bdc04\03 E:\local\Manchester GG\03800 Series\03847AB - Fallowfield Campus\Drawings\1 CIVIL\1.1 MODELS\03847AB_M3_01-21_GEOL_reconver.dwg



DEPTH TO ROCKHEAD BENEATH GROUND LEVEL		
COL	FROM mBGL	TO mBGL
	-7.0	-6.5
	-6.5	-6.0
	-6.0	-5.5
	-5.5	-5.0
	-5.0	-4.5
	-4.5	-4.0
	-4.0	-3.5
	-3.5	-3.0
	-3.0	-2.5
	-2.5	-2.0
	-2.0	-1.5
	-1.5	-1.0
	-1.0	-0.5
	-0.5	0.0
	0.0	0.5
	0.5	1.0

SITE PLAN SHOWING
DEPTH TO ROCKHEAD
SCALE 1:1,000



MADE GROUND THICKNESS		
COL	FROM m	TO m
	0.00	0.25
	0.25	0.50
	0.50	0.75
	0.75	1.00
	1.00	1.25
	1.25	1.50
	1.50	1.75
	1.75	2.00
	2.00	2.25
	2.25	2.50
	2.50	2.75

SITE PLAN SHOWING
MADE GROUND THICKNESS
SCALE 1:1,000

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. TOPOGRAPHICAL SURFACE "EG" CREATED FROM PROVIDED CSV DATA FILE: Project Oak Redline_SpotLevel_Meter.csv
3. SITE LAYOUT REPRODUCED FROM DATA CONTAINED WITHIN DRAWING FILE: Project Oak Redline_2010version_Millimeter.dwg

rev no	revision note	date	checked	approved

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original size	A1

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Registered in England No 06328315

client:	KENNEDY REDFORD
project:	FALLOWFIELD CAMPUS
title:	DEPTH TO ROCKHEAD PLOT AND MADE GROUND THICKNESS PLOT
cof proj no: 03847AB	dwg no: 002 rev: 0

File Path: \\ttsl24nt3.ttsl.local\Manchester GG\B\3800 Series\03847AB - Fallowfield Campus\Drawings\1 CWD\1.1 MODELS\03847AB_M3_01-01_GEOL_recover.dwg

Appendix A – Draft Factual Report & Draft Borehole Logs

784-B069852 Fallowfield Campus- Ground Investigation

Factual Ground Investigation Report



TETRA TECH

Version 2

June 2025



Tetra Tech Limited
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Sovereign Street
Leeds
LS1 4ER

tetratech.com

Fallowfield Campus
Factual Ground Investigation Report

June 2025

PRESENTED TO

Kennedy Redford Limited

PRESENTED BY

Tetra Tech Ltd tetratech.com
3 Sovereign Square,
Sovereign Street, Leeds,
LS1 4ER

Rev 0

Prepared by:

Ed Martindale **April 2025**

Geo-Environmental Consultant

Reviewed and authorised by:

Stephen Marwood **April 2025**

Principal Geo-Environmental Consultant

Rev 1

Reason for revision:
Addition of chemical analysis

Prepared by:

Ed Martindale **April 2025**

Geo-Environmental Consultant

Reviewed and authorised by:

Stephen Marwood **April 2025**

Rev 2

Reason for revision:
Addition of monitoring rounds and updated laboratory data.

Prepared by:

Stephen Marwood **June 2025**

Principal Geo-Environmental Consultant

Reviewed and authorised by:

Stephen Marwood **June 2025**

Principal Geo-Environmental Consultant

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Instruction 1
1.2 Brief 1
1.3 Limitations 1
2.0 SITE DETAILS 2
2.1 Location 2
2.2 Site Description 2
2.3 Geology 2
3.0 GROUND INVESTIGATION 3
3.1 Site Activities 3
3.2 Scope 3
3.3 General 3
3.4 Limitations 4
4.0 LABORATORY ANALYSIS 5
4.1 Laboratory Analysis 5
4.2 Chemical Laboratory Analysis 5
4.3 Geotechnical Laboratory Analysis 5
APPENDICES 6

APPENDICES

APPENDIX A – REPORT CONDITIONS .....
APPENDIX B – DRAWINGS .....
APPENDIX C – EXPLORATORY HOLE RECORDS .....
APPENDIX D – PHOTOGRAPHS .....
APPENDIX E - GEOCHEMICAL TEST RESULTS .....
APPENDIX F – GEOTECHNICAL TEST RESULTS .....
APPENDIX G – DYNAMIC CONE PENETROMETER RESULTS .....
APPENDIX H – CONE PENETRATION TESTING REPORT .....
APPENDIX I – GROUNDWATER AND GROUNDGAS MONITORING RECORDS .....

DRAWINGS IN APPENDIX B

784-B069852-TTE-WIR-0059-DR-U-0001-01 (Site Boundary

784-B069852-TTE-WIR-0059-DR-U-0002-01 (Exploratory Hole Location Plan)

1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech Ltd (Tetra Tech) was commissioned by Kennedy Redford (the Client) to undertake a ground investigation for a proposed development at Manchester University Fallowfield Campus, Wilmslow Road Fallowfield, M14 6HD (known hereafter as 'the site) and to produce a factual ground investigation report.

The location of the site is shown on Drawing No. B069852-TTE-00-XX-DR-U-0001-01 (Site Location Plan).

1.2 BRIEF

This report includes the following key elements:

- Full factual records of the ground investigation site works carried out.
- Summary of the ground conditions encountered.
- Drawings and factual data are presented as Appendices B to I.

1.3 LIMITATIONS

The information contained in this report is intended for the use of the Kennady Redford and Tetra Tech can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

This report is subject to the conditions presented in Appendix A.

2.0 SITE DETAILS

2.1 LOCATION

The site is located off Wilmslow Road, Fallowfield, Manchester, M14 6HD.

A site location plan is presented in Appendix B as Drawing No. B069852-TTE-00-XX-DR-U-0001-01.

2.2 SITE DESCRIPTION

The Site, covering an area of approximately 7 hectares, is almost square in shape. The site is currently split into 2 No. distinct areas. The first lies to the north-west and is enclosed by PP O'Connor enclosed demolition site. The other side is an active student accommodation area. The Site topography is relatively flat and is characterised as an urban setting.

2.3 GEOLOGY

Details of the geology underlying the site have been obtained from the following sources:

- Geological Survey of England and Wales, New Series 1:63 360/1:50 000 geological map series-sheet 85 (2011)
- Geological Survey of England and Wales, New Series 1:63 360/1:50 000 geological map series- sheet 85 (2010).
- BGS Online Geoindex: Onshore.

The British Geological Survey Online Geoindex and BGS paper maps includes Triassic rock formations with overlying Devensian Superficial deposits. The region is characterized by a mix of superficial deposits, including glacial till and tidal flat deposits with underlying sandstone bedrock from the Triassic period

The superficial deposits mainly consist of glacial till and tidal flat deposits a mixture of clays, sands, gravels and silts.

The solid geology underlying the site is indicated to comprise the Chester Pebble Beds Formation of Triassic Age. This group primarily consists of red-brown fine to medium grained sandstones with rounded quartzite gravels.

3.0 GROUND INVESTIGATION

3.1 SITE ACTIVITIES

The ground investigation was undertaken between the 10th February and 28th February 2025.

The exploratory hole location plan is presented as B069852-TTE-00-XX-DR-U-0002-01 (Ground Investigation Location Plan) in Appendix B.

The site works are summarised below.

3.2 SCOPE

The works were undertaken in general accordance with BS 10175: Code of Practice for Site Investigations of Potentially Contaminative Sites, BS 5930, BS EN1997-2, BS EN ISO 14688/9 and BS 8576.

The site investigation work comprised of the following elements:

- 8 No. Dynamic sampling with Rotary Follow-on boreholes to depths between 10.00m and 15.00m bgl to confirm the sequence of geology beneath the site and to obtain soil samples for chemical and geotechnical testing.
- 8 No. Cone Penetration Tests (CPT) with pore pressure measurement to depths between 1.10m and 2.76m bgl.
- 12 No. Dynamic Cone Penetrometer Tests (labelled as TRL's) to 0.20m to 1.56m bgl.
- PAS/GPR clearance of all locations prior to drilling by a qualified and fully competent surveyor.
- 1.20m bgl hand dug inspection pits prior to drilling for service avoidance.
- Installation of 8 No. boreholes with 50mm standpipe to a maximum of 15.00m bgl and a minimum of 1.00m bgl.
- Return visits at monthly intervals to monitor standpipes for groundwater levels, at the time of writing the report 1 No. visit has been completed.
- Full time supervision by an experienced Tetra Tech Engineer to log strata and collect soil samples.
- Soil geo-chemical and geotechnical testing from samples recovered on site.
- Preparation of a factual Ground Investigation report.

3.3 GENERAL

- Full details of the geology encountered within each exploratory hole are provided on the respective logs within Appendix C.
- The exploratory holes were surveyed to UK OS National Grid co-ordinates, and the level to Ordnance Datum; the details of which are provided on the individual exploratory hole logs within Appendix C.
- Photographs are included within Appendix D.
- DCP is presented in Appendix G.
- CPT testing report is presented in Appendix H.
- Groundwater monitoring data is contained within Appendix I.

3.4 LIMITATIONS

- BH05 was terminated due to below ground obstructions, BH05A was terminated due to encountering asbestos and BH05B was terminated due to a below ground obstruction. Coffey (designer) confirmed further attempts to undertake the hole were not required.
- 2 No. CPT (CPT109 and CPT110) unable to be completed due to access restrictions.
- 6 No. DCP (TRL1,2,4,5,6 and10) unable to be completed due to access restrictions.
- At the time of writing the report 3 No. groundwater monitoring rounds have been completed out of a total of 6 No. scheduled rounds.
- This report is subject to the conditions presented in Appendix A.

4.0 LABORATORY ANALYSIS

4.1 LABORATORY ANALYSIS

4.2 CHEMICAL LABORATORY ANALYSIS

Chemical analysis was scheduled by Tetra Tech on soil and water samples obtained during the site investigation works and post fieldwork groundwater monitoring. Chemical testing was carried out by Element at their laboratory in Deeside, Cheshire in accordance with their UKAS / MCERTS Accreditation.

Chemical analysis results are presented as Appendix E.

4.3 GEOTECHNICAL LABORATORY ANALYSIS

Geotechnical analysis was scheduled by Tetra Tech on soil samples obtained during the site investigation works. Geotechnical testing was carried out by The Testing Lab at their laboratory in Doncaster, in accordance with their UKAS Accreditation, Geotechnical analysis results are presented as Appendix F.

APPENDICES

APPENDIX A – REPORT CONDITIONS

APPENDIX A - REPORT CONDITIONS

GROUND INVESTIGATION

This report is produced solely for the benefit of Kennedy Redford Limited and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

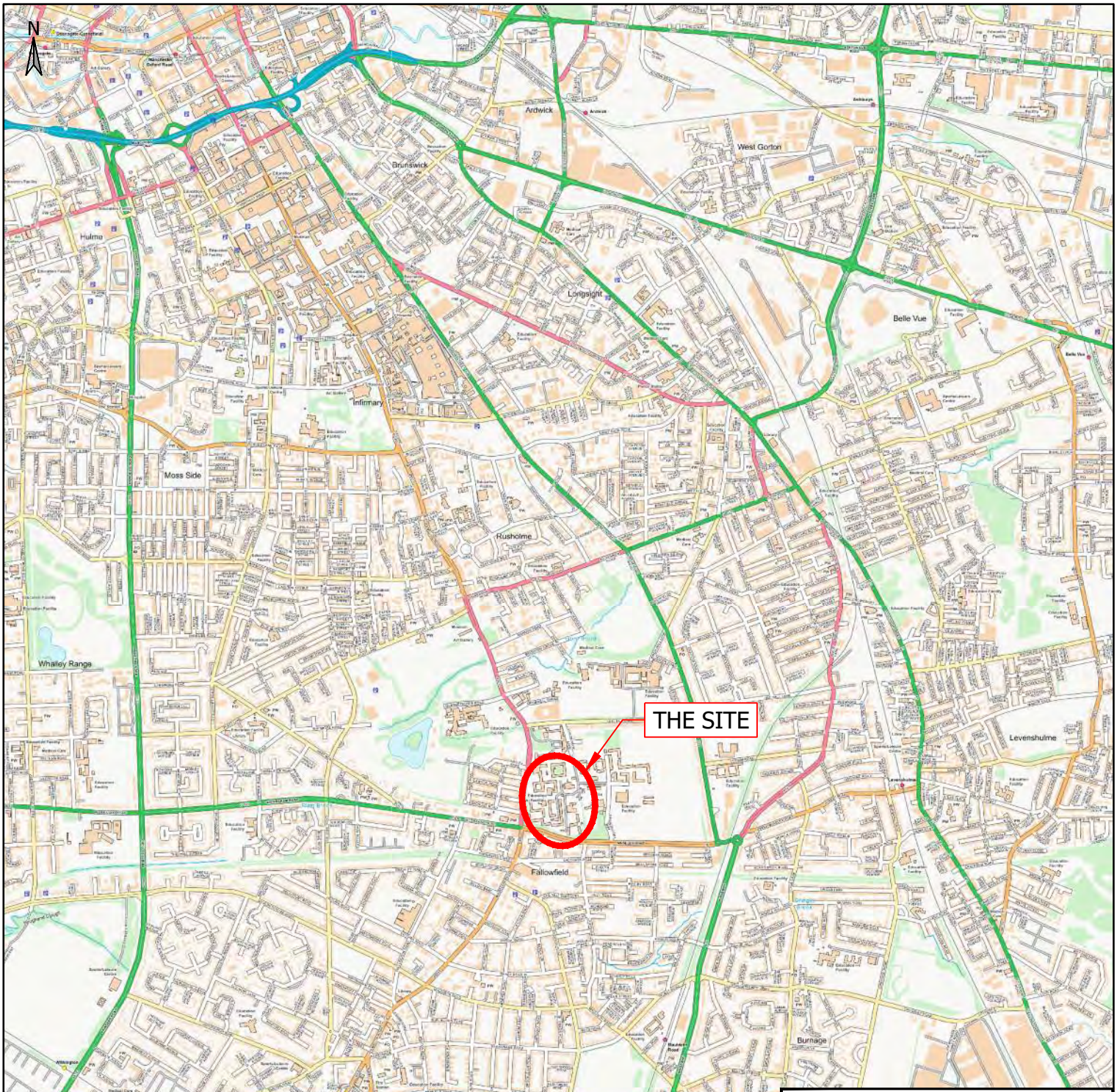
This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Tetra Tech. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

APPENDIX B – DRAWINGS



Contains Ordnance Survey data ©
Crown copyright and database right 2025

FOR INFORMATION ONLY

Rev	Description	Date	Drn	Chk	App
01	FIRST ISSUE	02.04.25	CM	EM	SCM

Document Control

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TETRA TECH

Client

KENNEDY REDFORD LIMITED

Project Name

FALLOWFIELD CAMPUS
GROUND INVESTIGATION

Sheet Title

SITE LOCATION PLAN

Model Reference

N/A

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale @ A4	Status
B069852	CM	02.04.25	EM	02.04.25	SCM	02.04.25	1:25,000	S2

Client Project Number	Originator	Function	Spatial	Form	Role	Number	Revision
B069852	- TTE -	00 -	XX -	DR -	U -	0001	01

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TTE_MT_v4



KEY

- WINDOWLESS SAMPLE TO ROTARY CORE
- STATIC CONE PENETROMETER
- DYNAMIC CONE PENETROMETER
- INSPECTION PIT

FOR INFORMATION ONLY

Rev	Description	Date	Drn	Chk	App
01	FIRST ISSUE	02.06.25	CM	SCM	SCM

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TETRA TECH

Client

KENNEDY REDFORD LIMITED

Project Name

FALLOWFIELD CAMPUS
GROUND INVESTIGATION

Sheet Title

GROUND INVESTIGATION PLAN

Model Reference

N/A

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale @ A3	Status
B069852	CM	02.06.25	SCM	02.06.25	SCM	02.06.25	1:2,000	S2

Client Project Number	Originator	Function	Spatial	Form	Role	Number	Revision
B069852	- TTE -	00	- XX -	DR	- U -	0002	01

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TTE_MT_v2

APPENDIX C – EXPLORATORY HOLE RECORDS

Log Legend Sheet

TETRA TECH

Sample Code	Sample Description
AMAL	Amalgamated Sample
B	Bulk Disturbed Sample
BLK	Block Sample
C	Core Sample
CBR	CBR Mould Sample
D	Small Disturbed Sample
ES	Environmental Sample for Geochemical Testing
EW	Water Sample for Environmental Testing
U	Undisturbed Sample - Open drive
UT	Thin Wall Open Drive Tube Sampler
D-NR	Disturbed Sample (No Recovery)
G	Gas Sample
LB	Large Bulk Disturbed Sample
P	Piston Sample
SPTLS	Standard Penetration Test Liner Sample
U-NR	Undisturbed Sample - Open drive (No Recovery)
UT-NR	Undisturbed Thin Wall Sample (No Recovery)

Tests Code	Test Description	Test Result Example
SPT	Standard Penetration Test	N=13 (2,2/3,3,3,4)
HV	Hand Shear Vane	(p)=188 kPa (r)=42 kPa
PID	Photo Ioninisation Detector	2.0 ppm
U Blows	Blows and Recovery on U Sample	Ublows=84 Recovery=100%
PP	Hand Penetrometer Tests	192 kPa

Tap Legend	Tap Description	Cover Legend	Cover Description
■	Pipe Plug	▭	Box Cover
||	Pipe Cover Connector	⏢	Concrete Cover
⊓	Pipe Cover	⊓	Steel Cover
▭	Pipe Cap	▬	Flush Cover

Activity Code	Activity Description
ABS	Automatic Ballast Sampler
CC	Concrete Core
CP	Cable Percussion
DCP	Dynamic Cone Penetrometer
HA	Hand Auger
IP	Inspection Pit
OP	Observation Pit
RC	Rotary Core
RO	Rotary Open Hole
SCP	Static Cone Penetrometer/CPT
SNC	Sonic Core Drilling
TP	Trial Pit/Trench
WLS	Windowless Sampler
WS	Window Sample

Strata Legend	Strata Description
	TOPSOIL
	MADE GROUND
	CLAY
	SILT
	SAND
	GRAVEL
	PEAT/ORGANIC
	COBBLES
	BOULDERS
	MUDSTONE
	SILTSTONE
	SANDSTONE
	LIMESTONE
	CHALK
	COAL
	BRECCIA
	CONGLOMERATE
	IGNEOUS
	METAMORPHIC
	SHALE

Backfill Legend	Backfill Description
	Gravel backfill
	Bentonite
	Grout
	Arisings
	Concrete
	Asphalt
	Sand backfill

Water Strike Legend	Water Strike Description
▽	Standing Water Level
▽	Water Strike Level

Install Legend	Install Description
	Standpipe + Piezometer
	Plain Pipe
	Slotted Pipe

Instrument Legend	Instrument Description
Ⓦ	Groundwater Monitoring Point
Ⓖ	Gas Monitoring Point
	Extensometer
	Inclinometer
○	Interface Pressure Cell
Ⓢ	Strain Gauge
□	Slip Indicator
Ⓣ	Temperature Monitoring Point
●	Embedment Pressure Cell

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385828.88	Northing:	394004.37
Level:	40.33mAOD	Depth:	16.36m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH101**

Sheet 1 of 2

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 20/02/2025
Finish Date: 20/02/2025

Method, Plant and Crew					Diameter	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK	1.20	300
1.20	2.70	Dynamic Windowless Sampling	Comacchio 205	Geotron UK	2.70	117
2.70	16.36	Rotary Core	Comacchio 205	Geotron UK	16.36	92

Casing		Drilling Progress by Time				
Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
4.00	146	20/02	17:00	16.36	4.00	

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Soft dark grey slightly gravelly slightly sandy silty CLAY. Gravel is angular to subangular fine to coarse sandstone. Sand is fine to coarse.						0.00 - 0.50 0.10 0.10	B1 D3 ES2						
Light brown gravelly silty clayey fine to coarse SAND. Gravel is angular to subrounded fine to coarse of sandstone.		0.50	39.83			0.50 - 1.20	B4						
Firm brown slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to medium of sandstone and coal. Sand is fine to coarse.		1.15	39.18			1.00 1.10 1.20 - 1.65 1.50	D6 ES5 D7 D8						SPT(S) 1.20m, N=19 (1,2/2,3,3,11)
Very dense reddish brown slightly gravelly silty clayey fine to coarse SAND. Gravel is subangular to subrounded fine of sandstone.		2.00	38.33			2.00 2.30	D9 D10						SPT(S) 2.00m, 50 (1,7/50 for 220mm)
Assumed zone of core loss. *From 2.70m to 2.80m bgl assumed zone of core loss.*		2.70 2.80	37.63 37.53			2.70 - 3.15	D11		AZCL NI				SPT(S) 2.70m, 50 (25 for 85mm/50 for 90mm)
Non intact extremely weak reddish brown fine to medium grained SANDSTONE. Recovered as fine to medium sand.		2.90	37.43						8				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 10 to 0 degrees, very closely spaced, planar and undulating, rough with sand on surfaces. *From 3.14m to 3.44m bgl non intact and extremely weak. Recovered as fine to medium sand.*								2.70 4.00	NI	92	61	27	
from 4.00m to 4.10m bgl assumed zone of core loss.						3.75 - 3.89	C12		6				
From 5.38m to 5.50m bgl discontinuity set 2 is 80 to 90 degrees, very closely spaced, planar, rough with sand on surfaces. *From 5.50m to 5.61m bgl assumed zone of core loss.*						5.12 - 5.30	C13	4.00 5.50	AZCL 13	93	80	20	
From 6.06m to 6.23m bgl non intact and extremely weak. Recovered as fine to medium sand. *From 6.23m to 9.16m bgl weak.*								5.50 7.00	AZCL 15 NI 7	93	81	46	
From 7.00m to 7.08m bgl assumed zone of core loss.						6.88 - 7.00	C14	7.00 8.50	AZCL 11	95	93	50	
Assumed zone of core loss.		8.50	31.83						AZCL				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very close spaced, planar and undulating, rough with sand on surfaces. *From 9.16m to 9.30m bgl non intact and extremely weak. Recovered as sandy subangular fine to medium gravel. Sand is fine to coarse.* *From 9.30m to 10.00m bgl weak.*		8.86	31.47			9.44 - 9.58	C15	8.50 10.00	18 NI 11	76	67	25	
		10.00	30.33										

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 6.00m and 15.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
1.20	2.00	102	100
2.00	2.70	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
2.70	16.36	40		Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR932	78

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385828.88	Northing:	394004.37
Level:	40.33mAOD	Depth:	16.36m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH101**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK	1.20	300	4.00	146	20/02	17:00	16.36	4.00	
1.20	2.70	Dynamic Windowless Sampling	Comacchio 205	Geotron UK	2.70	117							
2.70	16.36	Rotary Core	Comacchio 205	Geotron UK	16.36	92							

Scale:	1:50
Checked By:	SCM
Approved By:	SCM
Start Date:	20/02/2025
Finish Date:	20/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Assumed zone of core loss.									AZCL				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very close to medium spaced planar and undulating, rough with sand on surfaces.		10.40	29.93					10.00 11.50	12	73	66	33	
From 10.90m to 11.20m bgl discontinuity set 2 is 80 to 90 degrees, very closely spaced, planar, rough with sand on surfaces.						11.20 - 11.40	C16						
From 11.50m to 11.60m bgl assumed zone of core loss.									AZCL				
From 12.18m to 12.39m bgl non intact and extremely weak. Recovered as sandy subangular fine to medium gravel. Sand is fine to coarse.								11.50 13.00	15	93	79	33	
						12.44 - 12.58	C17		NI				
									9				
Assumed zone of core loss.		13.00	27.33						AZCL				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely to closely spaced, planar and undulating, rough with sand on surfaces.		13.95	26.38					13.00 14.50		37	29	17	
						14.12 - 14.24	C18		14				
Assumed zone of core loss.		14.50	25.83										SPT(C) 14.50m, 50 (3,7/50 for 160mm)
								14.50 16.00	AZCL	27	9	0	
Non intact extremely weak reddish brown fine to medium grained SANDSTONE. Recovered as fine to medium sand.		15.60	24.73						NI				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely spaced, planar and undulating, rough with sand on surfaces.		15.78	24.55						12				SPT(C) 16.00m, 55 (2,5/55 for 210mm)
EOH at 16.36m - Achieved target depth		16.36	23.97										

Observations / Remarks
1. Groundwater not observed. 2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 6.00m and 15.00m bgl.

Sampling Runs			
From (m)	To (m)	Diameter (mm)	Recovery %

Drilling Fluid				
From (m)	To (m)	Return Min %	Colour	Type
2.70	16.36	40		Water

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information	
Serial No.	Energy Ratio %
AR932	78

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385819.34	Northing:	394056.71
Level:	40.38mAOD	Depth:	15.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH102**

Sheet 1 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	3.00	145	20/02	17:00	15.00	3.00	
1.20	1.30	Dynamic Windowless Sampling	Comacchio 205	Geotron UK Ltd	1.30	102							
1.30	15.00	Rotary Core	Comacchio 205	Geotron UK Ltd	15.00	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 20/02/2025
Finish Date: 20/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Dark greyish brown slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of sandstone, mudstone, brick and concrete.						0.00 - 0.40 0.10 0.10	B1 D3 ES2						
Reddish brown slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of quartzite and sandstone.		0.40	39.98			0.40 - 1.20	B4						
						1.00 1.00 1.20 1.25 1.30	D6 ES5 D7 ES8 D9						SPT(S) 1.20m, 50 (5,14/50 for 90mm)
Assumed zone of core loss.		1.35	39.03					1.30 2.80	AZCL	23	20	9	
Very weak grey mottled reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very close to closely spaced, planar, rough with sand on surfaces.		2.45	37.93						24				
Assumed zone of core loss.		2.80	37.58						AZCL				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, closely spaced, planar, rough and clean.		3.25	37.13			3.28 - 3.38	C10		8				
Very weak grey mottled reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very close to closely spaced, planar, rough with sand on surfaces.		3.51	36.87					2.80 4.30	30	70	36	7	
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, closely to medium spaced, planar, rough and clean.		4.30	36.08			4.73 - 4.88	C11	4.30 5.90	11	88	85	28	
Assumed zone of core loss		5.90	34.48						AZCL				
Very weak grey mottled reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very close to closely spaced, planar, rough with sand on surfaces.		6.34	34.04					5.90 7.40	14	71	63	18	
Weak reddish brown fine to medium grained SANDSTONE with fine rounded gravel of quartzite. Discontinuities are 0 to 10 degrees, closely to medium spaced, planar, rough and clean.		7.13	33.25			7.14 - 7.40	C12		4				
								7.40 8.90	10	94	88	52	
						8.78 - 8.90	C13						
								8.90 10.40	9	89	86	55	

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 3.00m and 15.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
1.20	1.30	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
1.35	15.00	20	Red	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR2462	68

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385819.34	Northing:	394056.71
Level:	40.38mAOD	Depth:	15.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH102**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	3.00	145	20/02	17:00	15.00	3.00	
1.20	1.30	Dynamic Windowless Sampling	Comacchio 205	Geotron UK Ltd	1.30	102							
1.30	15.00	Rotary Core	Comacchio 205	Geotron UK Ltd	15.00	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 20/02/2025
Finish Date: 20/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Weak reddish brown fine to medium grained SANDSTONE with fine rounded gravel of quartzite. Discontinuities are 0 to 10 degrees, closely to medium spaced, planar, rough and clean. *From 10.40 to 10.58m bgl assumed zone of core loss*						10.04 - 10.25	C14						
									AZCL				
						11.09 - 11.25	C15	10.40 11.90	6	88	86	72	
Assumed zone of core loss.		11.90	28.48						AZCL				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, closely spaced, planar, rough and clean.		12.62	27.76					11.90 13.40	15	52	21	10	
Non intact extremely weak reddish brown SANDSTONE with occasional bands of subrounded to rounded fine to coarse quartzite.. Recovered as gravelly fine to medium sand. Gravel is subrounded to rounded fine to coarse.		13.06	27.32						NI				
		13.24	27.14			13.23 - 13.37	C16		18				SPT(C) 13.40m, 50 (25 for 5mm/50 for 10mm)
Very weak grey mottled reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely to closely spaced, planar, rough with sand on surfaces. *From 13.40 to 13.65m bgl assumed zone of core loss.*		13.65	26.73						AZCL				
Weak reddish brown fine to medium grained SANDSTONE with occasional thin bands of fine rounded gravel of quartzite. Discontinuities are 0 to 10 degrees, closely to medium spaced, planar, rough and clean.						14.38 - 14.66	C17	13.40 15.00	9	83	78	54	
EOH at 15.00m - Achieved target depth		15.00	25.38										

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 3.00m and 15.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
1.35	15.00	20	Red	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR2462	68

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385819.50	Northing:	394168.72
Level:	44.32mAOD	Depth:	15.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH103**

Sheet 1 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	7.50	146	14/02	15:30	5.40	2.60	
1.20	2.60	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	2.60	102			17/02	17:00	15.00	7.50	
2.60	15.00	Rotary Core	Comacchio 305	Geotron UK Ltd	15.00	92							

Scale:	1:50
Checked By:	SCM
Approved By:	SCM
Start Date:	14/02/2025
Finish Date:	17/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Strong dark grey MACADAM.		0.15	44.17										
MADE GROUND: Grey sandy angular to subangular fine to coarse GRAVEL of concrete and brick with rare roots and rootlets. Sand is fine to coarse.		0.30	44.02			0.30 - 1.20	B1						
MADE GROUND: Reddish brown mottled reddish grey sandy subangular fine to coarse GRAVEL of quartzite, sandstone, concrete and brick. Sand is fine to coarse.						0.50	D3						
						0.50	ES2						
						1.00	D6						
						1.00	ES5						
						1.20	D7						SPT(S) 1.20m, N=8 (2,4/2,3,1,2)
Loose reddish brown silty clayey fine to medium SAND with occasional bands of subrounded to rounded fine to coarse quartzite.		1.40	42.92			1.40 - 2.40	B4						
						1.50	ES8						
From 2.00m bgl medium dense.						2.00	D9						SPT(S) 2.00m, N=29 (4,2/6,8,7,8)
No recovery		2.60	41.72			2.60	D10	2.60 2.90	AZCL	0	0	0	SPT(S) 2.60m, 50 (25 for 95mm/50 for 85mm)
Assumed zone of core loss		2.90	41.42					2.90 4.40	AZCL	31	15	0	
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely close to closely spaced, planar and undulating, rough with sand on surfaces.		3.94	40.38						30				
From 4.31m to 4.36m bgl discontinuity set 2 is 80 to 90 degrees, planar, rough with sand on surfaces.		4.40	39.92										SPT(S) 4.40m, 50 (1,5/50 for 60mm)
Assumed zone of core loss.								4.40 5.40	AZCL	44	13	13	
Non intact very weak reddish brown fine to medium grained SANDSTONE. Recovered as sandy subangular fine to coarse gravel.		4.96	39.36			5.20	D11		NI				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely to medium spaced, planar, rough with sand on surfaces.		5.29	39.03						10				
Assumed zone of core loss.		5.40	38.92					5.40 6.40	AZCL	0	0	0	
						6.20	D12						SPT(S) 6.20m, 50 (25 for 95mm/50 for 30mm)
								6.40 7.50	AZCL	0	0	0	
													SPT(S) 7.20m, 50 (25 for 30mm/50 for 30mm)
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely to medium spaced, planar, rough with sand on surfaces.		7.90	36.42						AZCL				
								7.50 9.00		73	73	49	
						8.80 - 9.00	C13		11				
Assumed zone of core loss.		9.00	35.32						AZCL				
Non intact very weak reddish brown fine to medium grained SANDSTONE. Recovered as sandy subangular fine to coarse gravel.		9.35	34.97						NI				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely to medium spaced, planar, rough with sand on surfaces.		9.48	34.84					9.00 10.50	8	77	60	47	

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 2.50m and 15.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
1.20	2.00	102	100
2.00	2.60	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
2.60	15.00	80	Reddish Brown	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR2135 AR2135	69

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385819.50	Northing:	394168.72
Level:	44.32mAOD	Depth:	15.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH103**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	7.50	146	14/02	15:30	5.40	2.60	
1.20	2.60	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	2.60	102			17/02	17:00	15.00	7.50	
2.60	15.00	Rotary Core	Comacchio 305	Geotron UK Ltd	15.00	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 14/02/2025
Finish Date: 17/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring							
						Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely to medium spaced, planar, rough with sand on surfaces.						10.19 - 10.31	C14						
From 10.50 to 10.61m bgl assumed zone of core loss.								10.50 12.00	AZCL 12	93	89	53	
						11.85 - 12.00	C15						
From 12.00 to 12.20m bgl assumed zone of core loss.								12.00 13.50	AZCL 10	87	83	51	
						12.67 - 12.89	C16						
FRom 13.50 to 13.60m bgl assumed zone of core loss.								13.50 15.00	AZCL 8	93	89	79	
						14.86 - 15.00	C17						
EOH at 15.00m - Achieved target depth		15.00	29.32										

11 12 13 14 15 16 17 18 19 20

Observations / Remarks
1. Groundwater not observed. 2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 2.50m and 15.00m bgl.

Sampling Runs			
From (m)	To (m)	Diameter (mm)	Recovery %

Drilling Fluid				
From (m)	To (m)	Return Min %	Colour	Type
2.60	15.00	80	Reddish Brown	Water

Groundwater					
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information	
Serial No.	Energy Ratio %
AR2135 AR2135	69

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385748.19	Northing:	394005.31
Level:	39.72mAOD	Depth:	16.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH104**

Sheet 1 of 2

Method, Plant and Crew					Diameter	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300
1.20	2.80	Dynamic Windowless Sampling	Comacchio 205	Geotron UK Ltd	2.80	102
2.80	16.00	Rotary Core	Comacchio 205	Geotron UK Ltd	16.00	92

Casing		Drilling Progress by Time				
Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
2.80	145	25/02	17:00	16.00	2.80	

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 25/02/2025
Finish Date: 26/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Dark grey mottled reddish brown gravelly silty slightly clayey fine to coarse SAND with medium cobble content, frequent roots and rootlets. Gravel is angular to subrounded fine to coarse of brick, concrete, sandstone and mudstone. Cobbles are angular to subangular of brick and concrete.						0.00 - 0.70 0.20 0.20	B1 D3 ES2						
MADE GROUND: Soft greyish brown slightly sandy gravelly silty CLAY with low cobble content, rare roots and rootlets. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of brick, concrete, sandstone and mudstone. Cobbles are angular to subangular of brick and concrete.		0.70	39.02			0.70 - 1.20 0.90 0.90 1.20 - 1.65 1.40 - 2.40 1.50 1.50 2.30 2.50	B4 D6 ES5 D10 B7 D9 ES8 D11 ES12						SPT(S) 1.20m, N=10 (1,0/2,2,3,3) SPT(S) 2.50m, 50 (8,7/50 for 180mm)
Reddish brown fine to medium SAND with occasional bands of subrounded to rounded fine to coarse quartzite. *From 2.80 to 2.85m bgl assumed zone of core loss.*		2.70 2.85	37.02 36.87						AZCL				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 20 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.						3.58 - 3.68	C13	2.80 4.00	11	96	96	37	
Assumed zone of core loss.		4.00	35.72						AZCL				
Extremely weak reddish brown fine to medium grained SANDSTONE with occasional bands of subrounded to rounded fine gravel of quartzite. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces. *From 5.50 to 5.66m bgl assumed zone of core loss.*		4.30	35.42			5.10 - 5.25	C14	4.00 5.50	7	80	73	46	
Assumed zone of core loss.		7.00	32.72			6.29 - 6.56	C15	5.50 7.00	AZCL 30 12	89	63	19	
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		7.47	32.25						AZCL				
Non intact extremely weak reddish brown SANDSTONE. Recovered as soft slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to coarse sandstone. Sand is fine to coarse.		8.14 8.27	31.58 31.45			7.99 - 8.11	C16	7.00 8.50	30 NI 8	69	43	8	
Extremely weak reddish brown fine to medium grained SANDSTONE with subrounded to rounded fine gravel of quartzite. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		8.50	31.22										SPT(C) 8.50m, 50 (25 for 60mm/50 for 20mm)
Assumed zone of core loss.									AZCL				
Extremely weak reddish brown fine to medium grained SANDSTONE with occasional bands of subrounded to rounded fine gravel of quartzite. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces. *From 9.74m to 9.89m bgl discontinuity set 2 is 30 degrees, stepped, rough with sand on surfaces.*		9.30	30.42			9.60 - 9.69	C17	8.50 10.00	NI 30	40	36	0	
		10.00	29.72										

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 3.00m and 15.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
1.20	2.50	102	100
2.50	2.80	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
2.80	16.00	100	Red	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR2462	68

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385748.19	Northing:	394005.31
Level:	39.72mAOD	Depth:	16.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH104**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	2.80	145	25/02	17:00	16.00	2.80	
1.20	2.80	Dynamic Windowless Sampling	Comacchio 205	Geotron UK Ltd	2.80	102							
2.80	16.00	Rotary Core	Comacchio 205	Geotron UK Ltd	16.00	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 25/02/2025
Finish Date: 26/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Assumed zone of core loss.									AZCL				
Extremely weak reddish brown fine to medium grained SANDSTONE with occasional bands of subrounded to rounded fine gravel of quartzite. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		10.30	29.42						30				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 20 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		10.72	29.00			11.06 - 11.29	C18	10.00 11.50	8	80	69	45	
Assumed zone of core loss. *From 11.50 to 12.20m bgl assumed zone of core loss.*		11.50	28.22						AZCL				
Extremely weak reddish brown fine to medium grained SANDSTONE with occasional bands of subrounded to rounded fine gravel of quartzite. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		12.20	27.52			12.85 - 13.00	C19	11.50 13.00	16	53	51	10	
Assumed zone of core loss.		13.00	26.72						AZCL				SPT(C) 13.00m, 50 (25 for 40mm/50 for 20mm)
Extremely weak reddish brown fine to medium grained SANDSTONE with occasional bands of subrounded to rounded fine gravel of quartzite. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		13.63	26.09			14.42 - 14.50	C20	13.00 14.50	17	58	43	0	
Assumed zone of core loss.		14.50	25.22						AZCL				SPT(C) 14.50m, 50 (25 for 40mm/50 for 30mm)
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 20 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		15.03	24.69			15.25 - 15.43	C21	14.50 16.00	18	65	61	27	
						15.85 - 16.00	C22						
EOH at 16.00m - Achieved target depth		16.00	23.72										

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipes installed to 3.00m and 15.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
2.80	16.00	100	Red	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR2462	68

Project Number: **784-B069852**

TETRA TECH

Project:	**Fallowfield Campus GI**	Location Details	Status
Location:	**Manchester**	Easting: 385633.10 Northing: 394021.70	FINAL
Client:	**Kennedy Redford**	Level: 39.82mAOD Depth: 0.60m	Pit Number **BH105**
		Logger: EM Type: IP	Sheet 1 of 1

Hole Information

Pit Dimensions		
0.30m	Orientation:	0°
0.30m	Shoring:	None
	Stability:	Stable
	Plant:	Hand Excavation

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale:	1:10
Checked By:	SCM
Approved By:	SCM
Start Date:	25/02/2025
Finish Date:	25/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Dark grey gravelly clayey fine to coarse SAND with medium cobble content, frequent roots and rootlets. Gravel is angular to subangular fine to coarse of brick, concrete, mudstone and sandstone. Cobbles are angular of brick and concrete.								
EOH at 0.60m - Terminated due to obstruction		0.60	39.22					

1

2

Observations / Remarks

1. Groundwater not observed.
2. Upon completion exploratory hole backfilled with arisings.

3 Sovereign Square,
Sovereign Street,
Leeds,
LS1 4ER
0113 278 7111

Project Number

784-B069852

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details

Easting: 385645.36 Northing: 394055.46

Level: 40.02mAOD Depth: 0.50m

Logger: EM Type: IP

Status: FINAL

Pit Number: **BH105A**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: 0°

Shoring: None

Stability: Stable

Plant: Hand Excavation Tools

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:10

Checked By: SCM

Approved By: SCM

Start Date: 26/02/2025

Finish Date: 26/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft dark brownish grey slightly gravelly slightly sandy silty CLAY with medium cobble content, frequent roots and rootlets. Gravel is angular to subangular fine to coarse of brick, concrete, mudstone and sandstone. Sand is fine to coarse. Cobbles are angular of brick and concrete.								
EOH at 0.50m - Terminated due to obstruction		0.50	39.52					

1

2

Observations / Remarks

1. Groundwater not observed.
2. Upon completion exploratory hole backfilled with arisings.

3 Sovereign Square,
Sovereign Street,
Leeds,
LS1 4ER
0113 278 7111

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**	Location Details	Status	Pit Number
Location: **Manchester**	Easting: 385633.58 Northing: 394053.15	FINAL	**BH105B**
Client: **Kennedy Redford**	Level: 39.85mAOD Depth: 0.40m		Sheet 1 of 1
	Logger: EM Type: IP		

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions	Orientation: 0°	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: SCM
0.30m x 0.30m	Shoring: None					Approved By: SCM
	Stability: Stable					Start Date: 26/02/2025
	Plant: Hand Excavation Tools					Finish Date: 26/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Dark grey gravelly silty clayey fine to coarse SAND with medium cobble content, frequent roots and rootlets. Gravel is angular to subangular fine to coarse of brick, concrete, mudstone and sandstone. Cobbles are angular of brick and concrete.								
MADE GROUND: Very strong grey CONCRETE.		0.35	39.51					
EOH at 0.40m - Terminated due to obstruction		0.40	39.46					

Observations / Remarks

1. Groundwater not observed.
2. Upon completion exploratory hole backfilled with arisings.

3 Sovereign Square,
Sovereign Street,
Leeds,
LS1 4ER
0113 278 7111

Project Number

784-B069852

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385726.88	Northing:	394136.18
Level:	43.13mAOD	Depth:	15.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH106**

Sheet 1 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	9.00	145	19/02	16:30	15.00	9.00	
1.20	2.00	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	2.00	102							
2.00	15.00	Rotary Core	Comacchio 305	Geotron UK Ltd	15.00	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 18/02/2025
Finish Date: 19/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Very strong dark grey MACADAM.		0.12	43.01			0.20	D2						
MADE GROUND: Dark grey sandy angular to rounded fine to coarse GRAVEL of macadam, brick and quartzite. Sand is fine to coarse.						0.20	ES1						
MADE GROUND: Firm light brownish grey mottled light brown silty CLAY.		0.60	42.53			0.60 - 1.20	B3						
						1.00	D5						
						1.00	ES4						
						1.20 - 1.65	UT6						
						1.50	ES8						
						1.50 - 2.00	B7						
						1.65 - 2.10	D9						SPT(S) 1.65m, N=50 (6,7/50 for 285mm)
Assumed zone of core loss.		2.00	41.13						AZCL				
Stiff brown sandy silty CLAY. Sand is fine to medium.		2.46	40.67					2.00 3.00	NI	54	27	0	
Extremely weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely close to very closely spaced, planar and undulating, rough with sand on surfaces.		2.68	40.45						30				
Assumed zone of core loss.		3.00	40.13						AZCL				SPT(S) 3.00m, 50 (10,10/50 for 210mm)
Non intact reddish brown SANDSTONE with occasional bands of subrounded to rounded fine to coarse gravel of quartzite. Recovered as gravelly fine to medium sand. Gravel is subrounded to rounded fine to coarse.		3.63	39.50					3.00 4.50	NI	58	13	0	
		3.73	39.40						30				
Extremely weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely closely to very closely spaced, planar and undulating, rough with sand on surfaces.		3.91	39.22						26				
Non intact extremely weak reddish brown SANDSTONE. Recovered as slightly gravelly fine to coarse sand. Gravel is subangular fine to coarse.		4.54	38.59										SPT(S) 4.50m, 50 (25 for 50mm/50 for 40mm)
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, very closely to medium spaced, planar, rough with sand on surfaces.								4.50 6.00	9	100	95	43	
						5.55 - 5.72	C10						
Non intact extremely weak reddish brown SANDSTONE. Recovered as slightly gravelly fine to coarse sand. Gravel is subangular fine to coarse.		6.00	37.13						NI				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuity set 1 is 0 to 10 degrees, very closely to closely spaced, planar, rough with sand on surfaces. Discontinuity set 2 is 80 to 90 degrees, planar, rough and clean.		6.66	36.47					6.00 7.50	10	100	33	17	
								7.50 9.00	11	100	85	27	
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, close to medium spaced, planar, rough with sand on surfaces.		8.59	34.54						NI				
						8.86 - 8.96	C11		10				
From 9.47m to 9.63m bgl non intact and extremely weak.. Recovered as slightly gravelly fine to coarse sand. Gravel is subangular fine to coarse.									6				
								9.00 10.50	NI	100	87	41	
						9.67 - 9.78	C12						

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2no. 33mm diameter gas/groundwater monitoring standpipe installed to 2.00m and 15.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
1.20	2.00	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
2.00	15.00	53	Red	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR2135	69

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385726.88	Northing:	394136.18
Level:	43.13mAOD	Depth:	15.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH106**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	9.00	145	19/02	16:30	15.00	9.00	
1.20	2.00	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	2.00	102							
2.00	15.00	Rotary Core	Comacchio 305	Geotron UK Ltd	15.00	92							

Scale:	1:50
Checked By:	SCM
Approved By:	SCM
Start Date:	18/02/2025
Finish Date:	19/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring							
						Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, close to medium spaced, planar, rough with sand on surfaces.									23				
						10.68 - 10.78	C13						
								10.50 12.00	18	100	83	55	
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		12.05	31.08										
								12.00 13.50	9	100	93	67	
						12.92 - 13.24	C14						
Assumed zone of core loss		13.50	29.63						AZCL				
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely closely to closely spaced, planar, rough with sand on surfaces.		13.84	29.29			13.87	C15						
								13.50 15.00	4	77	63	61	
EOH at 15.00m - Achieved target depth		15.00	28.13										

Observations / Remarks	Sampling Runs				Drilling Fluid					Hammer Information	
	From (m)	To (m)	Diameter (mm)	Recovery %	From (m)	To (m)	Return Min %	Colour	Type	Serial No.	Energy Ratio %
1. Groundwater not observed. 2. Upon completion 2no. 33mm diameter gas/groundwater monitoring standpipe installed to 2.00m and 15.00m bgl.					2.00	15.00	53	Red	Water	AR2135	69

Groundwater						
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385647.60	Northing:	394179.34
Level:	43.16mAOD	Depth:	16.45m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH107**

Sheet 1 of 2

Method, Plant and Crew					Diameter	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)
0.00	0.70	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	0.70	300
0.70	3.00	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	3.00	102
2.00	16.45	Rotary Core	Comacchio 305	Geotron UK Ltd	16.45	92

Casing	
Depth(m)	Diam (mm)
2.50	146

Drilling Progress by Time				
Date	Time	Depth (m)	Casing (m)	Water (m)
11/02	17:00	11.50	2.50	
12/02	17:00	16.45	2.50	

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 11/02/2025
Finish Date: 12/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Reddish brown mottled grey sandy silty slightly clayey angular to subrounded fine to coarse GRAVEL of brick, concrete and sandstone with low cobble content and rare plastic and metal reinforcement bars. Sand is fine to coarse. Cobbles are angular to subangular of concrete and brick.						0.00 - 0.70 0.20 0.20	B1 D3 ES2						
Firm reddish brown slightly gravelly sandy silty CLAY. Gravel is subangular fine to medium of quartzite. Sand is fine to coarse.		0.70	42.46			0.70 - 1.10 1.20	D4 ES5						SPT(S) 0.70m, N=8 (1,1/1,2,3,2)
Very dense reddish brown fine to medium SAND with occasional bands subrounded to rounded fine to coarse gravel of quartzite.		1.80	41.36			1.70 - 2.15 2.00 2.00 2.00 - 2.50	D6 D9 ES8 B7						SPT(S) 1.70m, 50 (25 for 80mm/50 for 25mm) SPT(S) 2.00m, 50 (25 for 15mm/50 for 30mm)
Assumed zone of core loss		3.00	40.16						AZCL				SPT(C) 3.00m, 50 (3,7/50 for 95mm)
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuity set 1 is 0 to 10 degrees, closely spaced, planar, rough with sand on surfaces. Discontinuity set 2 is 80 to 90 degrees, planar and undulating, rough with sand on surfaces.		3.10	40.06			3.75 - 3.93	C10	3.00 4.00	10	90	86	49	
Assumed zone of core loss		4.00	39.16						AZCL				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuity set 1 is 0 to 10 degrees, closely spaced, planar, rough with sand on surfaces. Discontinuity set 2 is 80 to 90 degrees planar and undulating, rough with sand on surfaces.		4.80	38.36			4.98 - 5.15 5.00 - 5.45	C11 D12	4.00 5.50	14	47	43	13	
Assumed zone core loss.		5.50	37.66						AZCL				SPT(S) 5.50m, 50 (25 for 15mm/50 for 10mm)
Non intact reddish brown SANDSTONE. Recovered as fine to medium sand.		6.20	36.96					5.50 6.50	NI	30	0	0	
Assumed zone of core loss.		6.50	36.66			6.50 - 6.77	D13		AZCL				SPT(S) 6.50m, 50 (25 for 95mm/50 for 45mm)
Non intact reddish brown SANDSTONE. Recovered as fine to medium sand.		6.98	36.18					6.50 7.50	NI	52	39	27	
Weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 20 degrees, very close to closely spaced, planar, rough with sand on surfaces.		7.11	36.05			7.24 - 7.38	C14		9				
Assumed zone of core loss.		7.50	35.66			7.50 - 7.57	D15		AZCL				SPT(S) 7.50m, 50 (25 for 25mm/50 for 50mm)
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuity set 1 is 0 to 10 degrees, extremely closely to closely spaced, planar and undulating, rough with sand on surfaces. Discontinuity set 2 is 80 to 90 degrees planar, rough with sand on surfaces.		7.83	35.33					7.50 8.50	30	67	65	0	
Assumed zone core loss.		8.50	34.66			8.50 - 8.95	D16		AZCL				SPT(S) 8.50m, 50 (25 for 65mm/50 for 40mm)
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuity set 1 is 0 to 10 degrees, extremely closely to closely spaced, planar and undulating, rough with sand on surfaces. Discontinuity set 2 is 80 to 90 degrees very closely to closely spaced, planar, rough with sand on surfaces.		9.09	34.07					8.50 10.00	16	73	73	13	
		10.00	33.16			9.91 - 10.00 10.00 - 10.45	C17 D18						SPT(S) 10.00m, N=55 (1,3/55 for 230mm)

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 50mm diameter gas/groundwater monitoring standpipe installed to 16.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
0.70	1.70	102	100
1.70	2.00	102	100
2.00	3.00	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
3.00	16.45	30	Red	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR932	78

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385647.60	Northing:	394179.34
Level:	43.16mAOD	Depth:	16.45m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH107**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	0.70	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	0.70	300	2.50	146	11/02	17:00	11.50	2.50	
0.70	3.00	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	3.00	102			12/02	17:00	16.45	2.50	
2.00	16.45	Rotary Core	Comacchio 305	Geotron UK Ltd	16.45	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 11/02/2025
Finish Date: 12/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Assumed zone of core loss									AZCL				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuity set 1 is 0 to 10 degrees, extremely closely to closely spaced, planar and undulating, rough with sand on surfaces. Discontinuity set 2 is 80 to 90 degrees very closely to closely spaced, planar, rough with sand on surfaces.		10.65	32.51					10.00 11.50		57	57	21	
						11.02 - 11.22	C19		9				
From 11.50m to 12.04m Assumed Zone of Core loss						11.50 - 11.95	D20						SPT(S) 11.50m, 50 (2,9/50 for 100mm)
									AZCL				
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuity set 1 is 0 to 10 degrees, very closely to closely spaced, planar and undulating, rough with sand on surfaces. Discontinuity set 2 is 80 to 90 degrees, planar, rough with sand on surfaces.		12.04	31.12					11.50 13.00		64	64	27	
						12.60 - 12.69	C21		9				
Assumed zone of core loss		13.00	30.16						AZCL				
								13.00 14.50		31	17	7	
Very weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 20 degrees, very closely to closely spaced, planar, rough with sand on surfaces. *From 14.23m to 14.34m bgl discontinuity set 2 is 50 degrees, planar, rough with sand on surface.*		14.04	29.12						26				
						14.50 - 14.95	D22						SPT(S) 14.50m, N=15 (1,3/5,4,2,4)
Assumed zone of core loss		14.63	28.53										
								14.50 16.00	AZCL	18	9	0	
Non intact extremely weak reddish brown SANDSTONE. Recovered as medium dense fine to medium sand.		15.86	27.30						NI				
						16.00 - 16.45	D23						SPT(S) 16.00m, N=19 (1,3/2,4,6,7)
EOH at 16.45m - Achieved target depth		16.45	26.71										

Observations / Remarks	Sampling Runs				Drilling Fluid					Hammer Information	
	From (m)	To (m)	Diameter (mm)	Recovery %	From (m)	To (m)	Return Min %	Colour	Type	Serial No.	Energy Ratio %
1. Groundwater not observed. 2. Upon completion 50mm diameter gas/groundwater monitoring standpipe installed to 16.00m bgl.					3.00	16.45	30	Red	Water	AR932	78

Groundwater						
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385720.21	Northing:	394271.69
Level:	44.52mAOD	Depth:	15.50m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH108**

Sheet 1 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	8.50	146	11/02	17:00	11.00	8.50	
1.20	2.50	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	2.50	102			12/02	17:00	15.50	8.50	
2.50	15.50	Rotary Core	Comacchio 305	Geotron UK Ltd	15.50	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 11/02/2025
Finish Date: 12/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Reddish brown mottled grey sandy silty slightly clayey angular to subrounded fine to coarse GRAVEL of brick, concrete and sandstone with low cobble content and rare plastic and metal reinforcing bars. Sand is fine to coarse. Cobbles are angular to subangular of concrete and brick.						0.00 - 0.90 0.20 0.20	B1 D3 ES2						
Firm reddish brown slightly gravelly sandy silty CLAY. Gravel is subangular fine to medium of quartzite. Sand is fine to coarse.		0.90	43.62			0.90 - 1.90 1.20 1.20	B4 D6 ES5						SPT(S) 1.20m, N=22 (3,5/5,6,5,6)
						2.00 - 2.45 2.20 2.40 2.50	UT7 ES8 D9 D10						Ublows=50 Recovery=100%
Assumed zone of core loss.		2.50	42.02					2.50 3.00		0	0	0	SPT(S) 2.50m, 50 (25 for 95mm/50 for 60mm)
								3.00 4.50		0	0	0	SPT(S) 3.00m, 50 (25 for 40mm/50 for 35mm)
						4.50	D11	4.50 5.00	NR	0	0	0	SPT(S) 4.50m, 50 (25 for 40mm/50 for 60mm)
								5.00 5.50		0	0	0	
						5.50	D12	5.50 6.50		0	0	0	SPT(S) 5.50m, 50 (25 for 60mm/50 for 45mm)
Extremely weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely closely to very closely spaced, planar and undulating, rough with sand infill on surfaces.		6.90	37.62					6.50 7.50	AZCL 30	60	52	0	
Assumed zone of core loss.		7.50	37.02					7.50 8.50	AZCL 17	30	20	0	
Extremely weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 10 degrees, extremely closely to very closely spaced, planar and undulating, rough with sand infill on surfaces.		8.20	36.32			8.71 - 8.79	C13	8.50 9.50	4	100	95	50	
Assumed zone of core loss. Non intact extremely weak reddish brown SANDSTONE. Recovered as slightly gravelly fine to coarse sand. Gravel is subangular fine to coarse.		9.50	35.02						AZCL 20				
Extremely weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 20 degrees, extremely closely to very closely spaced, planar, rough with sand infill on surfaces.		9.84 9.98	34.68 34.54						NI				

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 50mm diameter gas/groundwater monitoring standpipe installed to 4.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
1.20	2.00	102	100
2.00	2.50	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
2.50	15.50	70	Red	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR2135	69

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385720.21	Northing:	394271.69
Level:	44.52mAOD	Depth:	15.50m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH108**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	8.50	146	11/02	17:00	11.00	8.50	
1.20	2.50	Dynamic Windowless Sampling	Comacchio 305	Geotron UK Ltd	2.50	102			12/02	17:00	15.50	8.50	
2.50	15.50	Rotary Core	Comacchio 305	Geotron UK Ltd	15.50	92							

Scale:	1:50
Checked By:	SCM
Approved By:	SCM
Start Date:	11/02/2025
Finish Date:	12/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring							
						Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
Extremely weak reddish brown fine to medium grained SANDSTONE. Discontinuities are 0 to 20 degrees, extremely closely to very closely spaced, planar, rough with sand infill on surfaces.								9.50 11.00	30	80	58	0	
From 11.80 to 11.89m bgl assumed zone of core loss.						11.83 - 11.90	C14	11.00 12.50	AZCL 16	94	77	29	
						13.60 - 13.70	C15	12.50 14.00	4	100	81	47	
From 14.27m to 14.38m bgl yellowish orange.								14.00 15.50	3	100	100	90	
						15.18 - 15.40	C16						
						15.40 - 15.50	C17						
EOH at 15.50m - Achieved target depth		15.50	29.02										

Observations / Remarks	Sampling Runs				Drilling Fluid					Hammer Information	
	From (m)	To (m)	Diameter (mm)	Recovery %	From (m)	To (m)	Return Min %	Colour	Type	Serial No.	Energy Ratio %
1. Groundwater not observed. 2. Upon completion 50mm diameter gas/groundwater monitoring standpipe installed to 4.00m bgl.					2.50	15.50	70	Red	Water	AR2135	69

Groundwater						
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	

Project Number: **784-B069852**

TETRA TECH

Project: **Fallowfield Campus GI**

Location: **Manchester**

Client: **Kennedy Redford**

Location Details			
Easting:	385774.79	Northing:	394204.30
Level:	44.41mAOD	Depth:	10.00m
Logger:	EM	Type:	WLS+RC
		Inclination:	90°

Status: FINAL

Borehole Number: **BH109**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	1.20	Inspection Pit	Hand Excavation Tools	Geotron UK Ltd	1.20	300	7.50	146	14/02	17:00	7.50	3.50	
1.20	3.00	Dynamic Windowless Sampling	Comacchio 205	Geotron UK Ltd	3.00	102			17/02	17:00	10.00	7.50	
3.00	10.00	Rotary Core	Comacchio 205	Geotron UK Ltd	10.00	92							

Scale: 1:50
Checked By: SCM
Approved By: SCM
Start Date: 14/02/2025
Finish Date: 17/02/2025

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
MADE GROUND: Grey sandy angular to subangular fine to coarse of GRAVEL of concrete and brick with rare roots and rootlets. Sand is fine to coarse.		0.09	44.32			0.20 - 0.70	B1						
MADE GROUND: Soft to firm dark grey slightly gravelly sandy silty CLAY. Gravel is angular to subangular fine to coarse of sandstone, brick and concrete. Sand is fine to coarse.						0.50	D3						
						0.50	ES2						
Soft grey mottled light reddish brown sandy silty CLAY. Sand is fine to coarse.		0.70	43.71			0.70 - 1.20	B4						
						1.00	D6						
						1.00	ES5						
						1.20 - 1.65	UT7						
						1.20 - 2.15	B8						
						1.40 - 1.80	D9						
						1.50	ES10						
						1.80 - 2.25	D11						SPT(S) 1.80m, N=26 (2,3/3,7,7,9)
Medium dense reddish brown fine to medium SAND.		1.90	42.51										
						2.15 - 2.30	B12						
						2.20	D13						
Non intact very weak reddish brown SANDSTONE. Recovered as fine to coarse sand.		2.30	42.11										
		3.00	41.41			3.00	D14						SPT(S) 3.00m, 50 (25 for 115mm/50 for 50mm)
Assumed zone of core loss.								3.00 4.00	AZCL	0	0	0	
									AZCL				
Non intact reddish brown SANDSTONE with occasional bands of subrounded to rounded fine to coarse gravel of quartzite. Recovered as gravelly fine to medium sand. Gravel is subrounded to rounded fine to coarse.		4.70	39.71					4.00 5.50	NI	52	26	0	
Extremely weak reddish brown fine to medium SANDSTONE. Discontinuities are 0 to 10 degrees, closely spaced, planar and undulating, rough with sand on surfaces.		5.10	39.31						8				
Assumed zone of core loss.		5.50	38.91			5.50	D15						SPT(S) 5.50m, 50 (25 for 95mm/50 for 50mm)
								5.50 6.50	AZCL	0	0	0	
						6.50 - 6.90	D16						SPT(S) 6.50m, N=50 (3,4/50 for 275mm)
								6.50 7.50	AZCL	28	24	0	
Very weak reddish brown fine to medium grained SANDSTONE with occasional bands of subrounded to rounded fine to coarse quartzite. Discontinues are 0 to 10 degrees, very close to closely spaced, planar and undulating, rough with sand.		7.22	37.19						28				
		7.50	36.91			7.50	D17						SPT(S) 7.50m, 50 (25 for 40mm/50 for 55mm)
Assumed zone of core loss.								7.50 9.00	AZCL	23	21	7	
Weak reddish brown fine to medium grained SANDSTONE. Discontinues are 0 to 10 degrees, very closely to closely spaced, planar and undulating, rough with sand on surfaces.		8.65	35.76						23				
Assumed zone of core loss.						8.89 - 9.00	C18						
Non intact reddish brown SANDSTONE with occasional bands of subrounded to rounded fine to coarse gravel of quartzite. Recovered as gravelly fine to medium sand. Gravel is subrounded to rounded fine to coarse.		9.00	35.41			9.00	D19						SPT(S) 9.00m, 50 (25 for 30mm/50 for 30mm)
		9.22	35.19						AZCL				
Extremely weak reddish brown fine to medium SANDSTONE. Discontinuities are 0 to 10 degrees, extremely closely to very closely spaced, planar and undulating, rough with sand on surfaces.		9.41	35.00						NI				
								9.00 10.00	30	78	21	0	
Weak reddish brown fine to medium SANDSTONE. Discontinuities are 0 to 10 degrees, very close to closely spaced, planar and undulating, rough with sand on surfaces.		9.83	34.58						9				
EOH at 10.00m - Achieved target depth		10.00	34.41										

Observations / Remarks

1. Groundwater not observed.
2. Upon completion 2No. 33mm diameter gas/groundwater monitoring standpipe installed to 3.00m and 9.00m bgl.

Sampling Runs

From (m)	To (m)	Diameter (mm)	Recovery %
1.20	2.00	102	100
2.00	3.00	102	100

Drilling Fluid

From (m)	To (m)	Return Min %	Colour	Type
3.00	10.00	20	Red/Brown	Water

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Hammer Information

Serial No.	Energy Ratio %
AR932	78

Project Number: **784-B069852**

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref:	AR932
Test Date:	27/09/2024
Report Date:	27/09/2024
File Name:	AR932.spt
Test Operator:	TW

Instrumented Rod Data

Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.4
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	72572
Accelerometer No.2:	72572

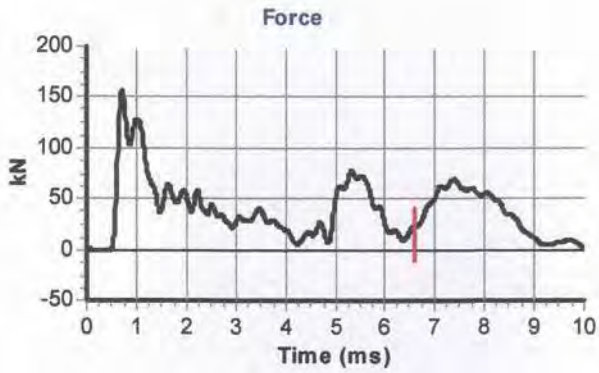
SPT Hammer Information

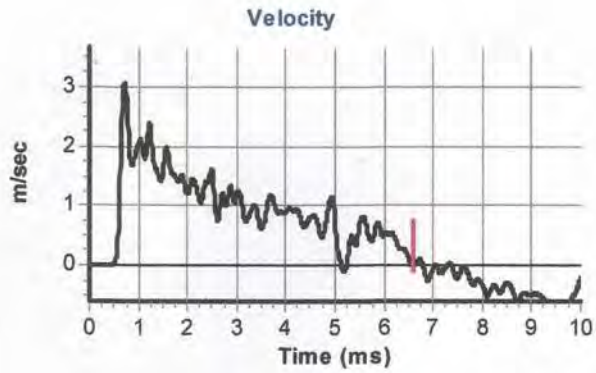
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

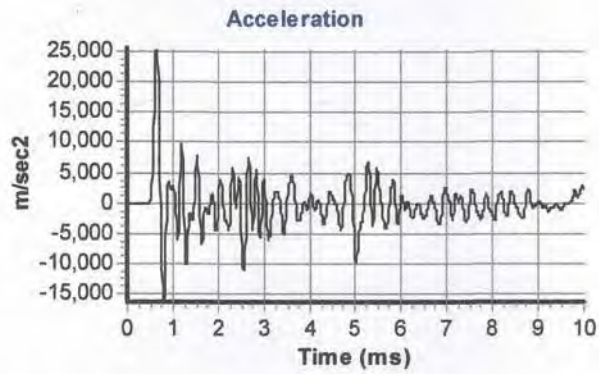
Comments / Location

GEOTRON LTD

91166









Calculations

Area of Rod A (mm2):	957
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	371

Energy Ratio E_r (%): 78

Signed: T WILKINSON

Title: FITTER

The recommended calibration interval is 12 months

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref:	AR2135
Test Date:	20/06/2024
Report Date:	20/06/2024
File Name:	AR2135.spt
Test Operator:	JL

Instrumented Rod Data

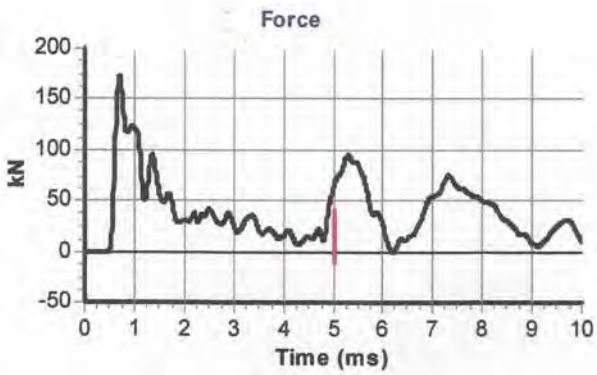
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.4
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	72572
Accelerometer No.2:	72572

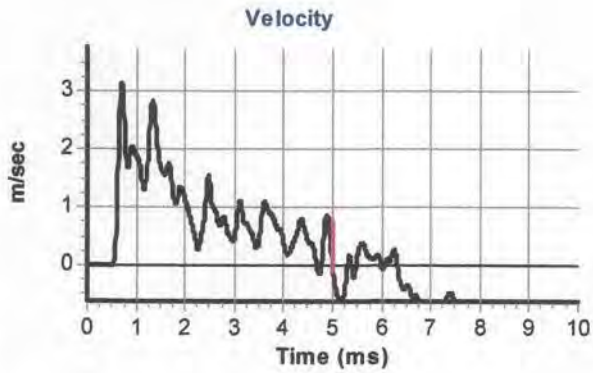
SPT Hammer Information

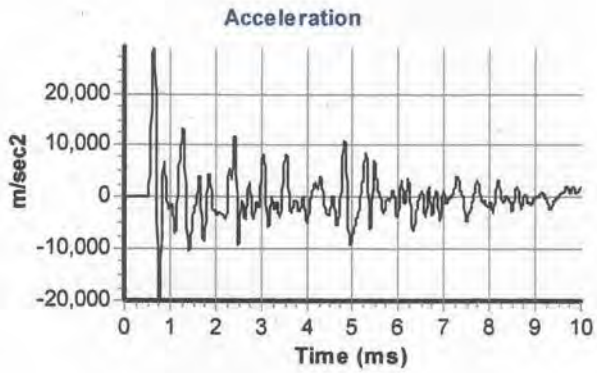
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location

GEOTRON UK LIMITED - 89743









Calculations

Area of Rod A (mm2):	957
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	324

Energy Ratio E_r (%): **69**

Signed: J LOCK

Title: FITTER

The recommended calibration interval is 12 months

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref:	AR.2462
Test Date:	06/02/2025
Report Date:	06/02/2025
File Name:	AR.2462.spt
Test Operator:	TW

Instrumented Rod Data

Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.4
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	72572
Accelerometer No.2:	72572

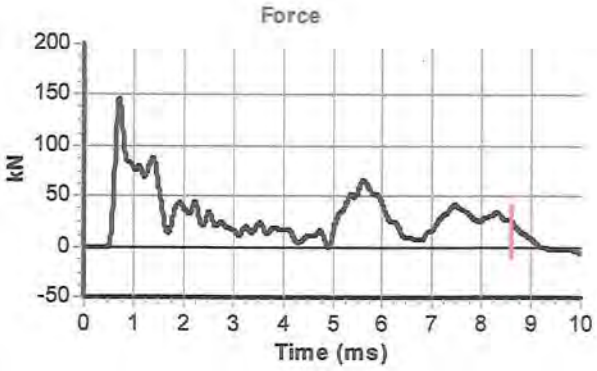
SPT Hammer Information

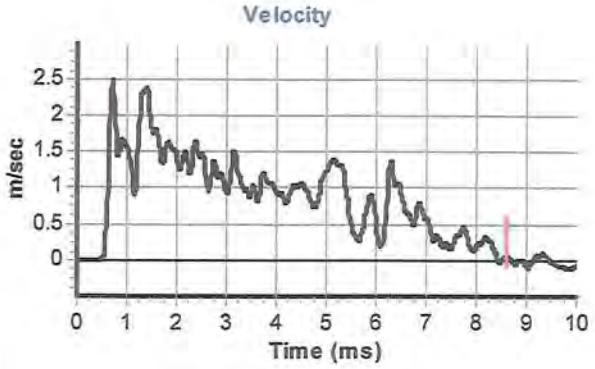
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

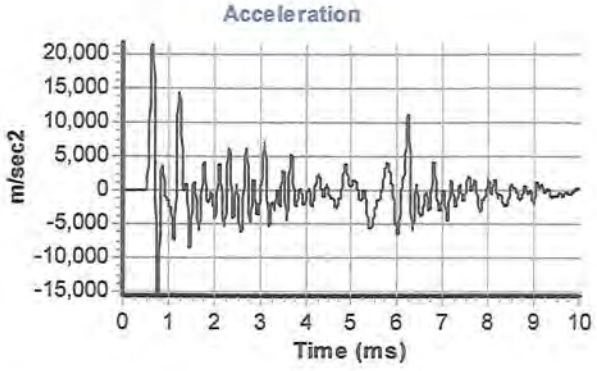
Comments / Location

GEOTRON UK LTD

91939









Calculations

Area of Rod A (mm2):	957
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	321

Energy Ratio E_r (%): **68**

Signed: T.WILKINSON

Title: FITTER

The recommended calibration interval is 12 months

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SPT Hammer Ene. gy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref:	AR4358
Test Date:	20/06/2024
Report Date:	20/06/2024
File Name:	AR4358.spt
Test Operator:	JL

Instrumented Rod Data

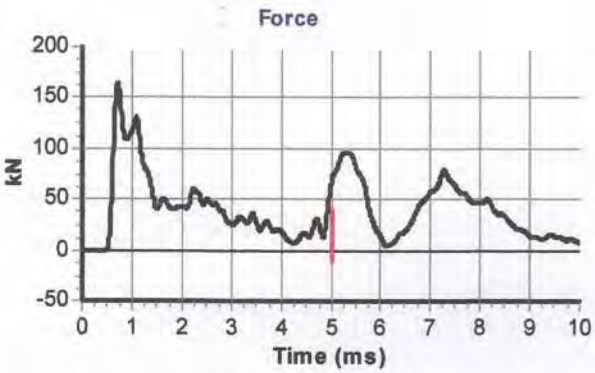
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.4
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	72572
Accelerometer No.2:	72572

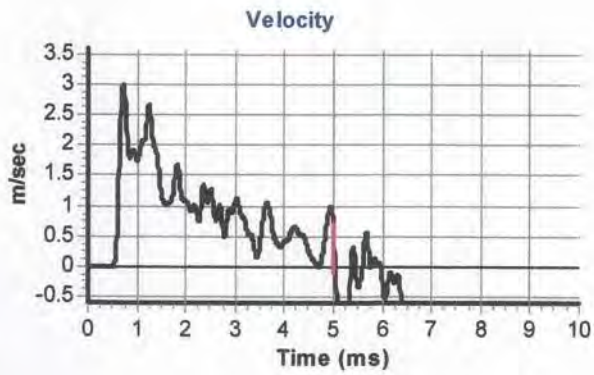
SPT Hammer Information

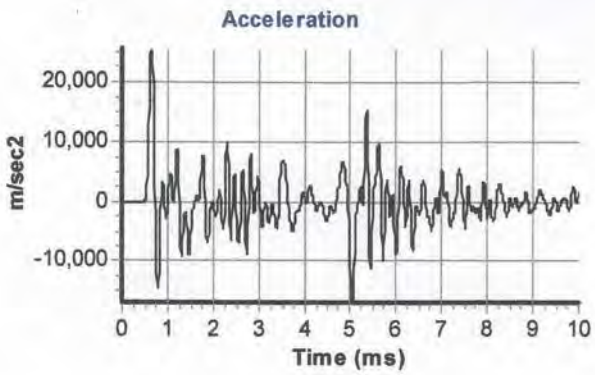
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location

GEOTRON UK LIMITED - 89743









Calculations

Area of Rod A (mm2):	957
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	326

Energy Ratio E_r (%): **69**

Signed: J LOCK

Title: FITTER

The recommended calibration interval is 12 months

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APPENDIX D – PHOTOGRAPHS



Photograph No.1: BH101 – 2.70m to 5.50m bgl



Photograph No.2: BH101 – 5.50m to 8.50m bgl

3 Sovereign Square
Sovereign Street
Leeds
LS1 4ER

Tel: 0113 278 7111
Fax: 0113 275 0623
E-mail enviro.leeds@tetratech.com

Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.3: BH101 – 8.50m to 11.50m bgl



Photograph No.4: BH101 – 11.50m to 14.50m bgl

3 Sovereign Square
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Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.5: BH101 – 14.50m to 16.00m bgl



Photograph No.6: BH102 – 1.35m to 4.30m bgl

3 Sovereign Square
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Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.7: BH102 – 4.30m to 7.40m bgl



Photograph No.8: BH102 – 7.40m to 10.40m bgl

3 Sovereign Square
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Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.9: BH102 – 10.40m to 13.40m bgl



Photograph No.10: BH102 – 13.40m to 14.90m bgl

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Sovereign Street
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Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.11: BH103 – 2.60m to 5.40m bgl



Photograph No.12: BH103 – 5.40m to 10.50m bgl

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LS1 4ER

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Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.13: BH103 – 10.50m to 13.50m bgl



Photograph No.14: BH103 – 13.50m to 15.00m bgl

3 Sovereign Square
Sovereign Street
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LS1 4ER

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E-mail enviro.leeds@tetratech.com

Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.15: BH104 – 2.80m to 5.50m bgl



Photograph No.16: BH104 – 5.50m to 8.50m bgl

3 Sovereign Square
Sovereign Street
Leeds
LS1 4ER

Tel: 0113 278 7111
Fax: 0113 275 0623
E-mail enviro.leeds@tetratech.com

Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.17: BH104 – 8.50m to 11.50m bgl



Photograph No.18: BH104 – 11.50m to 14.50m bgl

3 Sovereign Square
Sovereign Street
Leeds
LS1 4ER

Tel: 0113 278 7111
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Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project : Fallowfield Campus GI
Rotary Core Photographs

Client: Kennedy Redford

Project No: 784-B069852

Date: April 2025



Photograph No.19: BH104 – 14.50m to 16.00m bgl



Photograph No.20: BH106 – 2.50m to 4.50m bgl

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Photograph No.21: BH106 – 4.50m to 7.50m bgl



Photograph No.22: BH106 – 7.50m to 10.50m bgl

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Photograph No.23: BH106 – 10.50m to 13.50m bgl



Photograph No.24: BH106 – 13.50m to 15.00m bgl

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Photograph No.25: BH107 – 3.00m to 5.50m bgl



Photograph No.26: BH107 – 5.50m to 8.70m bgl

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Client: Kennedy Redford

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Photograph No.27: BH107 – 8.70m to 11.50m bgl



Photograph No.28: BH107 – 11.50m to 16.00m bgl

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Photograph No.29: BH108 – 6.50m to 8.50m bgl



Photograph No.30: BH108 – 8.50m to 10.50m bgl

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Photograph No.31: BH108 – 10.50m to 12.50m bgl



Photograph No.32: BH108 – 12.50m to 15.50m bgl

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Photograph No.33: BH109 – 4.00m to 7.50m bgl



Photograph No.34: BH109 – 7.50m to 10.00m bgl

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Date: April 2025

APPENDIX E - GEOCHEMICAL TEST RESULTS

Element Materials Technology
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Tetra Tech
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United Kingdom
LS1 4ER

Attention :	Stephen Marwood
Date :	24th March, 2025
Your reference :	784-B069852
Our reference :	Test Report 25/2236 Batch 1
Location :	Fallowfield Campus GI
Date samples received :	14th February, 2025
Status :	Final Report
Issue :	202503240920

Six samples were received for analysis on 14th February, 2025 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 7.095 kg of CO2

Scope 1&2&3 emissions - 16.768 kg of CO2

Authorised By:



Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/2236

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	10-12									LOD/LOR	Units	Method No.
Sample ID	BH107	BH108											
Depth	0.20	0.20											
COC No / misc													
Containers	V J T	V J T											
Sample Date	11/02/2025	11/02/2025											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	14/02/2025	14/02/2025											
Arsenic #	6.0	9.3									<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1									<0.1	mg/kg	TM30/PM15
Chromium #	19.1	20.3									<0.5	mg/kg	TM30/PM15
Copper #	31	20									<1	mg/kg	TM30/PM15
Lead #	70	18									<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1									<0.1	mg/kg	TM30/PM15
Nickel #	10.9	11.6									<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1									<1	mg/kg	TM30/PM15
Sulphur as S	0.12	0.27									<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	0.26	0.57									<0.01	%	TM50/PM29
Water Soluble Boron #	0.5	1.0									<0.1	mg/kg	TM74/PM32
Zinc #	74	76									<5	mg/kg	TM30/PM15
Magnesium	0.0001	0.0013									<0.0001	g/l	TM30/PM20
PAH MS													
Naphthalene #	<0.04	0.04									<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.04									<0.03	mg/kg	TM4/PM8
Acenaphthene #	0.11	0.07									<0.05	mg/kg	TM4/PM8
Fluorene #	0.07	<0.04									<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.60	0.97									<0.03	mg/kg	TM4/PM8
Anthracene #	0.16	0.20									<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.66	1.76									<0.03	mg/kg	TM4/PM8
Pyrene #	0.56	1.40									<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.33	0.75									<0.06	mg/kg	TM4/PM8
Chrysene #	0.30	0.74									<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.48	1.17									<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.29	0.66									<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.18	0.49									<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	0.06	0.14									<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.18	0.47									<0.04	mg/kg	TM4/PM8
PAH 16 Total	4.0	8.9									<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.35	0.84									<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.13	0.33									<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	91	88									<0	%	TM4/PM8
EPH >C8-C10 (EH_1D_Total) #	<5	<5									<5	mg/kg	TM5/PM8
EPH >C10-C12 (EH_1D_Total) #	<10	<10									<10	mg/kg	TM5/PM8
EPH >C12-C16 (EH_1D_Total) #	<10	<10									<10	mg/kg	TM5/PM8
EPH >C16-C21 (EH_1D_Total) #	42	27									<10	mg/kg	TM5/PM8
EPH >C21-C40 (EH_1D_Total)	176	349									<10	mg/kg	TM5/PM8
EPH >C8-C40 (EH_1D_Total)	218	376									<30	mg/kg	TM5/PM8
Total Phenols HPLC	<0.15	<0.15									<0.15	mg/kg	TM26/PM21B

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/2236

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	10-12										
Sample ID	BH107	BH108										
Depth	0.20	0.20										
COC No / misc												
Containers	V J T	V J T										
Sample Date	11/02/2025	11/02/2025										
Sample Type	Soil	Soil										
Batch Number	1	1										
Date of Receipt	14/02/2025	14/02/2025										

Please see attached notes for all abbreviations and acronyms

			LOD/LOR	Units	Method No.
Natural Moisture Content	19.4	9.4	<0.1	%	PM4/PM0
Chloride (2:1 Ext BRE) #	0.008	0.010	<0.002	g/l	TM38/PM20
Hexavalent Chromium #	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Nitrate as NO3 (2:1 Ext BRE)	<0.0025	<0.0025	<0.0025	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.3450	0.8979	<0.0015	g/l	TM38/PM20
Free Cyanide	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
pH #	11.17	11.42	<0.01	pH units	TM73/PM11

Client Name: Tetra Tech

Matrix : Solid

Reference: 784-B069852

Location: Fallowfield Campus GI

Contact: Stephen Marwood

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
25/2236	1	BH107	0.20	1-3	Chloride, Cr VI, EPH, Metals, PAH, pH, Sulphate	Sample holding time exceeded
25/2236	1	BH108	0.20	10-12	Chloride, Cr VI, EPH, Metals, PAH, pH, Sulphate	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 25/2236

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 degrees Celsius or 105 degrees Celsius. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes

EMT Job No: 25/2236

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes

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Attention :	Stephen Marwood
Date :	4th April, 2025
Your reference :	784-B069852
Our reference :	Test Report 25/2455 Batch 1
Location :	Fallowfield Campus GI
Date samples received :	19th February, 2025
Status :	Final Report
Issue :	202504041547

Six samples were received for analysis on 19th February, 2025 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 7.457 kg of CO2

Scope 1&2&3 emissions - 17.623 kg of CO2

Authorised By:

[redacted]

Bruce Leslie
Project Manager

Element Materials Technology Environmental UK Limited
Registered in England and Wales
Registered Office: 3rd Floor Davidson Building, 5 Southampton Street, London WC2E 7HA
Company Registration No: 11371415

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/2455

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	4-6	10-12									LOD/LOR	Units	Method No.
Sample ID	BH103	BH109											
Depth	1.00	0.50											
COC No / misc													
Containers	V J T	V J T											
Sample Date	14/02/2025	14/02/2025											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	19/02/2025	19/02/2025											
Arsenic #	17.8	8.2									<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1									<0.1	mg/kg	TM30/PM15
Chromium #	29.6	31.0									<0.5	mg/kg	TM30/PM15
Copper #	49	28									<1	mg/kg	TM30/PM15
Lead #	158	55									<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1									<0.1	mg/kg	TM30/PM15
Nickel #	15.1	14.4									<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1									<1	mg/kg	TM30/PM15
Sulphur as S	0.04	0.02									<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	0.04	0.02									<0.01	%	TM50/PM29
Water Soluble Boron #	0.2	0.4									<0.1	mg/kg	TM74/PM32
Zinc #	41	59									<5	mg/kg	TM30/PM15
Magnesium	0.0019	0.0006									<0.0001	g/l	TM30/PM20
PAH MS													
Naphthalene #	0.19	<0.04									<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.04	<0.03									<0.03	mg/kg	TM4/PM8
Acenaphthene #	0.10	<0.05									<0.05	mg/kg	TM4/PM8
Fluorene #	0.05	<0.04									<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.73	0.16									<0.03	mg/kg	TM4/PM8
Anthracene #	0.17	<0.04									<0.04	mg/kg	TM4/PM8
Fluoranthene #	1.05	0.27									<0.03	mg/kg	TM4/PM8
Pyrene #	0.92	0.26									<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.55	0.17									<0.06	mg/kg	TM4/PM8
Chrysene #	0.55	0.16									<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.87	0.27									<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.49	0.15									<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.33	0.12									<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	0.08	<0.04									<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.32	0.10									<0.04	mg/kg	TM4/PM8
PAH 16 Total	6.4	1.7									<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.63	0.19									<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.24	0.08									<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	98	93									<0	%	TM4/PM8
EPH >C8-C10 (EH_1D_Total) #	<5	<5									<5	mg/kg	TM5/PM8
EPH >C10-C12 (EH_1D_Total) #	<10	<10									<10	mg/kg	TM5/PM8
EPH >C12-C16 (EH_1D_Total) #	<10	<10									<10	mg/kg	TM5/PM8
EPH >C16-C21 (EH_1D_Total) #	15	<10									<10	mg/kg	TM5/PM8
EPH >C21-C40 (EH_1D_Total)	62	38									<10	mg/kg	TM5/PM8
EPH >C8-C40 (EH_1D_Total)	77	38									<30	mg/kg	TM5/PM8
Total Phenols HPLC	<0.15	<0.15									<0.15	mg/kg	TM26/PM21B

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/2455

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	4-6	10-12											
Sample ID	BH103	BH109											
Depth	1.00	0.50									Please see attached notes for all abbreviations and acronyms		
COC No / misc													
Containers	V J T	V J T											
Sample Date	14/02/2025	14/02/2025											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	19/02/2025	19/02/2025									LOD/LOR	Units	Method No.
Natural Moisture Content	19.2	21.5									<0.1	%	PM4/PM0
Chloride (2:1 Ext BRE) #	0.029	0.009									<0.002	g/l	TM38/PM20
Hexavalent Chromium #	<0.3	<0.3									<0.3	mg/kg	TM38/PM20
Nitrate as NO3 (2:1 Ext BRE)	<0.0025	<0.0025									<0.0025	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0168	0.0331									<0.0015	g/l	TM38/PM20
Free Cyanide	<0.5	<0.5									<0.5	mg/kg	TM89/PM45
pH #	8.87	7.57									<0.01	pH units	TM73/PM11

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Tetra Tech

Matrix : Solid

Reference: 784-B069852

Location: Fallowfield Campus GI

Contact: Stephen Marwood

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
25/2455	1	BH103	1.00	4-6	Chloride, EPH, Metals, PAH, pH, Sulphate	Sample holding time exceeded
25/2455	1	BH109	0.50	10-12	Chloride, Cr VI, EPH, Metals, PAH, pH, Sulphate	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 25/2455

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 25/2455

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 degrees Celsius or 105 degrees Celsius. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes

EMT Job No: 25/2455

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes

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Leeds
West Yorkshire
United Kingdom
LS1 4ER

Attention :	Stephen Marwood
Date :	4th April, 2025
Your reference :	784-B069852
Our reference :	Test Report 25/2798 Batch 1
Location :	Fallowfield Campus GI
Date samples received :	22nd February, 2025
Status :	Final Report
Issue :	202504041549

Six samples were received for analysis on 22nd February, 2025 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 14.19 kg of CO2

Scope 1&2&3 emissions - 33.536 kg of CO2

Authorised By:

[redacted]

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/2798

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	4-6	7-9	10-12	16-18							LOD/LOR	Units	Method No.
Sample ID	BH101	BH102	BH102	BH106									
Depth	1.10	0.10	1.00	1.00									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	20/12/2024	20/12/2024	20/12/2024	19/12/2024									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	22/02/2025	22/02/2025	22/02/2025	22/02/2025									
Arsenic #	4.5	10.9	-	5.5							<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1	-	<0.1							<0.1	mg/kg	TM30/PM15
Chromium #	34.3	38.5	-	37.2							<0.5	mg/kg	TM30/PM15
Copper #	16	28	-	24							<1	mg/kg	TM30/PM15
Lead #	18	71	-	14							<5	mg/kg	TM30/PM15
Mercury #	<0.1	0.3	-	<0.1							<0.1	mg/kg	TM30/PM15
Nickel #	16.4	15.4	-	26.7							<0.7	mg/kg	TM30/PM15
Selenium #	1	1	-	<1							<1	mg/kg	TM30/PM15
Sulphur as S	<0.01	-	<0.01	0.01							<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	<0.01	-	<0.01	0.01							<0.01	%	TM50/PM29
Water Soluble Boron #	0.2	0.3	-	0.5							<0.1	mg/kg	TM74/PM32
Zinc #	44	58	-	52							<5	mg/kg	TM30/PM15
Magnesium	0.0005	-	0.0002	0.0032							<0.0001	g/l	TM30/PM20
PAH MS													
Naphthalene #	<0.04	0.50	-	<0.04							<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.42	-	<0.03							<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	0.64	-	<0.05							<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	0.75	-	<0.04							<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	6.76	-	<0.03							<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	2.00	-	<0.04							<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	8.58	-	<0.03							<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	7.68	-	<0.03							<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	3.36	-	<0.06							<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	3.57	-	<0.02							<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	5.34	-	<0.07							<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	3.30	-	<0.04							<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	2.02	-	<0.04							<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	0.48	-	<0.04							<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	2.05	-	<0.04							<0.04	mg/kg	TM4/PM8
PAH 16 Total	<0.6	47.5	-	<0.6							<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	3.84	-	<0.05							<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	1.50	-	<0.02							<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	104	99	-	110							<0	%	TM4/PM8
EPH >C8-C10 (EH_1D_Total) #	<5	<5	-	<5							<5	mg/kg	TM5/PM8
EPH >C10-C12 (EH_1D_Total) #	<10	<10	-	<10							<10	mg/kg	TM5/PM8
EPH >C12-C16 (EH_1D_Total) #	<10	<10	-	<10							<10	mg/kg	TM5/PM8
EPH >C16-C21 (EH_1D_Total) #	<10	27	-	<10							<10	mg/kg	TM5/PM8
EPH >C21-C40 (EH_1D_Total)	<10	60	-	<10							<10	mg/kg	TM5/PM8
EPH >C8-C40 (EH_1D_Total)	<30	87	-	<30							<30	mg/kg	TM5/PM8
Total Phenols HPLC	<0.15	<0.15	-	<0.15							<0.15	mg/kg	TM26/PM21B

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/2798

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	4-6	7-9	10-12	16-18							LOD/LOR	Units	Method No.
Sample ID	BH101	BH102	BH102	BH106									
Depth	1.10	0.10	1.00	1.00									
COC No / misc													
Containers	V J T	V J T	V J T	V J T									
Sample Date	20/12/2024	20/12/2024	20/12/2024	19/12/2024									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1									
Date of Receipt	22/02/2025	22/02/2025	22/02/2025	22/02/2025									
Natural Moisture Content	16.5	17.0	-	17.8							<0.1	%	PM4/PM0
Ammoniacal Nitrogen as NH4	<0.6	-	-	<0.6							<0.6	mg/kg	TM38/PM20
Chloride (2:1 Ext BRE) #	0.004	-	0.005	0.014							<0.002	g/l	TM38/PM20
Hexavalent Chromium #	<0.3	<0.3	-	<0.3							<0.3	mg/kg	TM38/PM20
Nitrate as NO3 (2:1 Ext BRE)	<0.0025	-	<0.0025	<0.0025							<0.0025	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0064	0.0046	0.0039	0.0292							<0.0015	g/l	TM38/PM20
Free Cyanide	<0.5	<0.5	-	<0.5							<0.5	mg/kg	TM89/PM45
pH #	7.53	6.56	7.06	6.92							<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Tetra Tech

Matrix : Solid

Reference: 784-B069852

Location: Fallowfield Campus GI

Contact: Stephen Marwood

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
25/2798	1	BH101	1.10	4-6	Chloride, Cr VI, EPH, Metals, PAH, pH, Sulphate	Sample holding time exceeded prior to receipt
25/2798	1	BH102	0.10	7-9	Cr VI, EPH, Metals, PAH, pH, Sulphate	Sample holding time exceeded prior to receipt
25/2798	1	BH102	1.00	10-12	Chloride, pH, Sulphate	Sample holding time exceeded prior to receipt
25/2798	1	BH106	1.00	16-18	Chloride, Cr VI, EPH, Metals, PAH, pH, Sulphate	Sample holding time exceeded prior to receipt

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 25/2798

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 25/2798

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 degrees Celsius or 105 degrees Celsius. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes

EMT Job No: 25/2798

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes

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Tetra Tech
3 Sovereign Street
Leeds
West Yorkshire
United Kingdom
LS1 4ER

Attention :	Stephen Marwood
Date :	24th March, 2025
Your reference :	784-B069852
Our reference :	Test Report 25/3110 Batch 1
Location :	Fallowfield Campus GI
Date samples received :	28th February, 2025
Status :	Final Report
Issue :	202503240939

Four samples were received for analysis on 28th February, 2025 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 4.923 kg of CO2

Scope 1&2&3 emissions - 11.635 kg of CO2

Authorised By:



Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/3110

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	4-6	10-12									LOD/LOR	Units	Method No.
Sample ID	BH104	BH104											
Depth	0.90	2.50											
COC No / misc													
Containers	V J T	V J T											
Sample Date	25/02/2025	25/02/2025											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	28/02/2025	28/02/2025											
Arsenic #	-	2.0									<0.5	mg/kg	TM30/PM15
Cadmium #	-	<0.1									<0.1	mg/kg	TM30/PM15
Chromium #	-	33.3									<0.5	mg/kg	TM30/PM15
Copper #	-	15									<1	mg/kg	TM30/PM15
Lead #	-	9									<5	mg/kg	TM30/PM15
Mercury #	-	<0.1									<0.1	mg/kg	TM30/PM15
Nickel #	-	13.0									<0.7	mg/kg	TM30/PM15
Selenium #	-	<1									<1	mg/kg	TM30/PM15
Sulphur as S	0.03	-									<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	0.04	-									<0.01	%	TM50/PM29
Water Soluble Boron #	-	0.2									<0.1	mg/kg	TM74/PM32
Zinc #	-	46									<5	mg/kg	TM30/PM15
Magnesium	0.0012	-									<0.0001	g/l	TM30/PM20
PAH MS													
Naphthalene #	-	<0.04									<0.04	mg/kg	TM4/PM8
Acenaphthylene	-	<0.03									<0.03	mg/kg	TM4/PM8
Acenaphthene #	-	<0.05									<0.05	mg/kg	TM4/PM8
Fluorene #	-	<0.04									<0.04	mg/kg	TM4/PM8
Phenanthrene #	-	<0.03									<0.03	mg/kg	TM4/PM8
Anthracene #	-	<0.04									<0.04	mg/kg	TM4/PM8
Fluoranthene #	-	<0.03									<0.03	mg/kg	TM4/PM8
Pyrene #	-	<0.03									<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	-	<0.06									<0.06	mg/kg	TM4/PM8
Chrysene #	-	<0.02									<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	-	<0.07									<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	-	<0.04									<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	-	<0.04									<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	-	<0.04									<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	-	<0.04									<0.04	mg/kg	TM4/PM8
PAH 16 Total	-	<0.6									<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	-	<0.05									<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	-	<0.02									<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	-	91									<0	%	TM4/PM8
EPH >C8-C10 (EH_1D_Total) #	-	<5									<5	mg/kg	TM5/PM8
EPH >C10-C12 (EH_1D_Total) #	-	<10									<10	mg/kg	TM5/PM8
EPH >C12-C16 (EH_1D_Total) #	-	<10									<10	mg/kg	TM5/PM8
EPH >C16-C21 (EH_1D_Total) #	-	<10									<10	mg/kg	TM5/PM8
EPH >C21-C40 (EH_1D_Total)	-	<10									<10	mg/kg	TM5/PM8
EPH >C8-C40 (EH_1D_Total)	-	<30									<30	mg/kg	TM5/PM8
Total Phenols HPLC	-	<0.15									<0.15	mg/kg	TM26/PM21B

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B069852
Location: Fallowfield Campus GI
Contact: Stephen Marwood
EMT Job No: 25/3110

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	4-6	10-12									LOD/LOR	Units	Method No.
Sample ID	BH104	BH104											
Depth	0.90	2.50											
COC No / misc													
Containers	V J T	V J T											
Sample Date	25/02/2025	25/02/2025											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	28/02/2025	28/02/2025											
Natural Moisture Content	-	14.8									<0.1	%	PM4/PM0
Chloride (2:1 Ext BRE) #	0.004	-									<0.002	g/l	TM38/PM20
Hexavalent Chromium #	-	<0.3									<0.3	mg/kg	TM38/PM20
Nitrate as NO3 (2:1 Ext BRE)	<0.0025	-									<0.0025	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0114	0.0043									<0.0015	g/l	TM38/PM20
Free Cyanide	-	<0.5									<0.5	mg/kg	TM89/PM45
pH #	8.39	8.10									<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Notification of Deviating Samples

Client Name: Tetra Tech

Matrix : Solid

Reference: 784-B069852

Location: Fallowfield Campus GI

Contact: Stephen Marwood

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
25/3110	1	BH104	2.50	10-12	EPH, PAH	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

Please include all sections of this report if it is reproduced

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 25/3110

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 25/3110

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 degrees Celsius or 105 degrees Celsius. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.			AD	Yes

EMT Job No: 25/3110

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes

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Analytical Report Number : 25-026716

Project / Site name:	Fallowfield	**Samples received on:**	23/05/2025
Your job number:	784-B069851	**Samples instructed on/ Analysis started on:**	23/05/2025
Your order number:	7019987	**Analysis completed by:**	30/05/2025
Report Issue Number:	1	**Report issued on:**	30/05/2025
Samples Analysed:	4 water samples		

Signed: [redacted]

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 25-026716
Project / Site name: Fallowfield

Lab Sample Number				555614	555615	555616	555617
Sample Reference				BH101	BH104	BH103	BH106
Sample Number				1	1	1	1
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				8.5	8.5	13.6	13
Date Sampled				21/05/2025	21/05/2025	21/05/2025	21/05/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
General Inorganics							
pH (L099)	pH Units	N/A	ISO 17025	6.9	7.2	7.1	7.1
Total Cyanide (Low Level 1 µg/l)	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Sulphate as SO_4	mg/l	0.045	ISO 17025	29.7	33.7	32.8	46.8
Total Sulphur	mg/l	0.015	NONE	9.893	11.24	10.92	15.6
Chloride	mg/l	0.15	ISO 17025	32	110	31	43
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	22	23	660	< 15
Ammoniacal Nitrogen as NH_4^+	mg/l	0.015	ISO 17025	0.028	0.03	0.85	< 0.015
Nitrate as N	mg/l	0.01	ISO 17025	5.9	< 0.01	< 0.01	0.77
Nitrate as NO_3	mg/l	0.05	ISO 17025	26.1	< 0.05	< 0.05	3.41
Alkalinity as $CaCO_3$	mgCaCO3/l	3	ISO 17025	240	310	360	160
Total Phenols							
Total Phenols (Monohydric) Low Level	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs							
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.32	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.48	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.26	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	0.04	0.15	0.07
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.03
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	0.06	0.04	0.12
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.09
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.07
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.05
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.05
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	0.02
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH							
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	1.25	0.51
Heavy Metals / Metalloids							
Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.62	0.46	12.9	1.32
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.59	0.44	< 0.02	0.28
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2
Copper (dissolved)	µg/l	0.5	ISO 17025	2.1	3.7	3.4	4.1
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	NONE	< 0.05	0.13	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	35	16	3.3	14
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.2	1.9	< 0.6	1.9
Zinc (dissolved)	µg/l	0.5	ISO 17025	9.8	2.4	3.3	6.8
Boron (dissolved)	µg/l	10	ISO 17025	49	54	96	51
Magnesium (dissolved)	mg/l	0.005	ISO 17025	17	23	28	14

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 25-026716
Project / Site name: Fallowfield

Lab Sample Number				555614	555615	555616	555617
Sample Reference				BH101	BH104	BH103	BH106
Sample Number				1	1	1	1
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				8.5	8.5	13.6	13
Date Sampled				21/05/2025	21/05/2025	21/05/2025	21/05/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**				
Petroleum Hydrocarbons							
TPH (>EC10 - EC12) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH (>EC12 - EC16) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH (>EC28 - EC35) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH (>EC35 - EC40) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH (EC10 - EC40) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 25-026716
Project / Site name: Fallowfield

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW,GW, Hg - SW,PW, Al - SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total Petroleum Hydrocarbons in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS. Accredited matrices (TPH C12 - C35): SW, PW, GW	In-house method	L070B	W	NONE
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08	L078-PL	W	ISO 17025
Nitrate in water	Determination of nitrate by reaction with sodium salicylate followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08	L078-PL	W	ISO 17025
Monohydric phenols (low level) in water	Determination of phenols in water by continuous flow analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	NONE
Total cyanide (low level) in water	Determination of total cyanide in water by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	NONE
Alkalinity of water (discrete analyser)	Determination of alkalinity of water by colorimetry using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on MEWAM & USEPA Method 310.2	L082B	W	ISO 17025
Chloride in water	Determination of chloride in water by colorimetry using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house based on MEWAM Method ISBN 0117516260	L082B	W	ISO 17025
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
Ammoniacal Nitrogen as N in water	Determination of ammonium/ammonia/ammoniacal nitrogen by the colorimetric salicylate/nitroprusside method using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	ISO 17025
Ammonium as NH4 in water	Determination of ammonium/ammonia/ammoniacal nitrogen by the colorimetric salicylate/nitroprusside method using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025

Analytical Report Number : 25-026716
Project / Site name: Fallowfield

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total Sulphur in water	Determination of total sulphur in water by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

APPENDIX F – GEOTECHNICAL TEST RESULTS

Document Transmittal Sheet

The Testing Lab PLC
Unit 2 James Road
Adwick-le-Street
Doncaster
DN6 7HH

To
Tetra Tech
3 Sovereign Road
Sovereign Street
Leeds
LS1 4ER

Report Remarks

Despatch Date	22/04/2025
Issue Number	1
Issuer Name	M Athorne
Issuer Signatory	[redacted]
Date of Sample Receipt:	26/03/2025
Start Date of Test:	26/03/2025
Date of Issue of report:	22/04/2025

Note: Test carried out at TTL laboratory facility as detaied in contact information

Project Name:
Fallowfield Campus

Project No:
J306095

Details of Report Contents

*Tests in the following list marked * are not UKAS accredited*

ITEM	Sheet Nos	Comments
Document Transmittal sheet / Contents	page(s) 1 to 1	

TESTS	Sheet Nos	Authoriser Signatory
ISO - Summary of Classification tests	ISOSUM 1 to 1	[redacted]
Particle Size Distribution Analysis - Summary of Results	PSD SUM 1 to 14	
UU triaxial compression test - Summary of Results	UUSUM 1 to 1	
Compaction test, 2.5kg, light	COMPL 1 to 4	
Compaction test, 4.5kg, heavy	COMPH 1 to 4	
ISRM - Unconfined Compressive Strength of Rock - Summary of results	ISRMUCS 1 to 1	
Point Load test - Summary of results	PLT 1 to 1	
End of Report		

Total number of pages in this report: 27

The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated.Opinions and interpretations expressed in this report are outside the scope of accreditation.
Reports referenced by this document shall not be reproduced except in full without prior approval from the issuing laboratory.

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GFQ-008-74
Issue 02 - Nov 23

Summary of Classification Test Results

Project No.
J306095

Project Name
Fallowfield Campus GI Manchester

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	If 1 Point Test			PL	PI	Particle density	Remarks
	Ref	Top	Base	Type		bulk	dry				Pen 1	Pen 2	CF				
						Mg/m^3		%	%	%				%	%	Mg/m^3	
BH101	3	0.10		D	Dark brown slightly sandy slightly gravelly CLAY			22.7	79S	34-4pt-i				21	13		
BH101	8	1.50		D	Brown slightly sandy slightly gravelly CLAY			15.8	76S	29-4pt-i				15	14		
BH102	4	0.40	1.20	B	Brown slightly gravelly SAND with pockets of CLAY											2.64-sp	
BH103	4	1.40	2.40	B	Brown silty SAND											2.63-sp	
BH104	7	1.40	2.40	B	Brown slightly sandy slightly gravelly CLAY											2.71-sp	
BH104		1.50		D	Brown slightly sandy slightly gravelly CLAY			14.8	95-hp	27-4pt-i				16	11		
BH106	6	1.20	1.65	UT	Stiff brown mottled grey slightly sandy slightly gravelly CLAY			16.4	93S	38-4pt-i				18	20		
BH107	4	0.70	1.10	D	Brown slightly sandy slightly gravelly CLAY			18.1	76S	38-4pt-i				18	20		
BH108	7	2.00	2.45	UT	Soft brown slightly sandy slightly gravelly CLAY becoming stiff brown			17.5	95S	37-4pt-i				18	19		
BH109	3	0.50		D	Dark brown slightly sandy slightly gravelly CLAY with rare roots			23.1	85S	34-4pt-i				20	14	2.64-sp	
BH109	7	1.20	1.65	UT	Stiff brown slightly gravelly sandy CLAY			14.6	96S	33-4pt-i				17	16		

Key

Density tests:
Linear measurement unless :
wd - water displacement
wi - immersion in water

w - water content

Atterberg:
4pt cone unless :
cas - Casagrande method
1pt - single point test
CF - Correlation Factor
Liquid limit test: i - increasing moisture content, d - decreasing moisture content
Atterberg sample prep: n - Natural, HP - Hand Picked, w - Washed

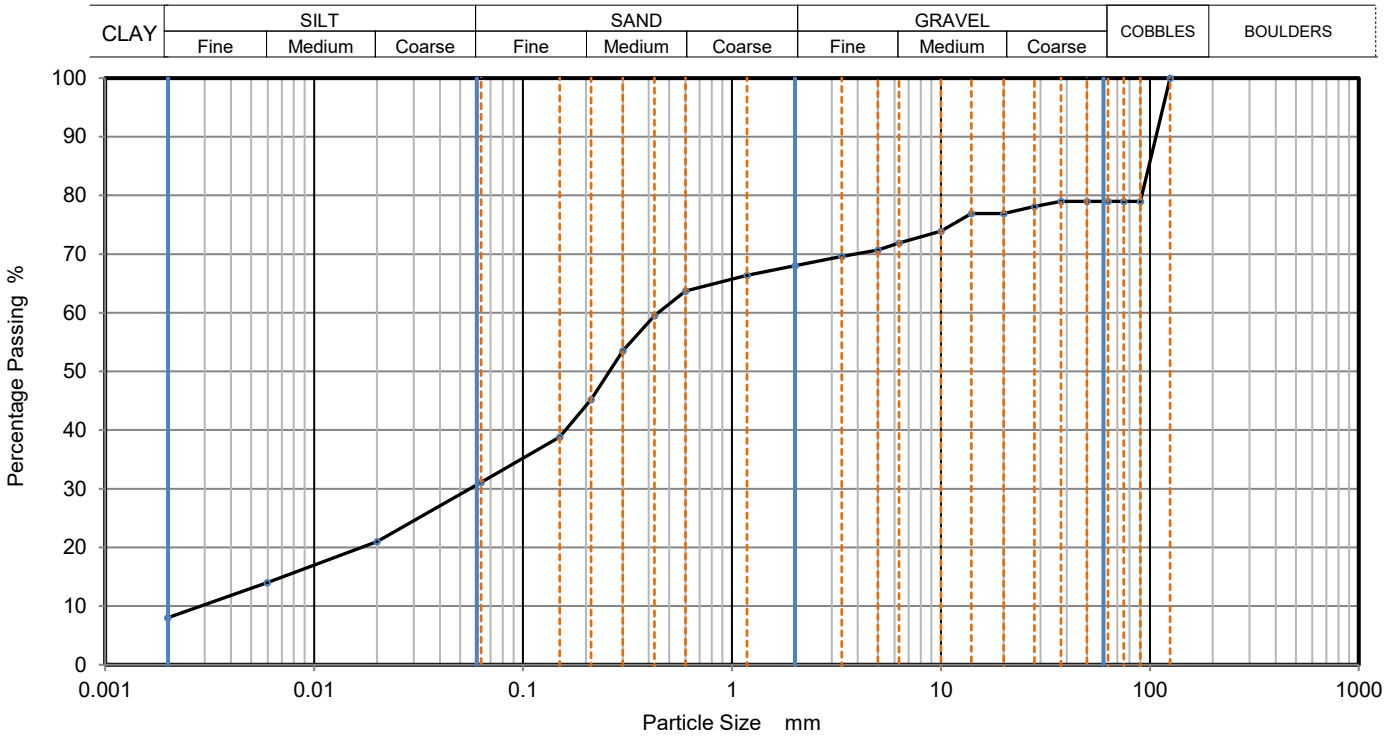
Particle density:
sp - fluid pycnometer

Test Standards:
Bulk Density Tests - BS EN ISO 17892-2:2014
Water Content - BS EN ISO 17892-1:2014+A1:2022
Liquid & Plastic Limits - BS EN ISO 17892-12:2018+A2:2022
Particle Density - BS EN ISO 17892-3:2015

Date Printed:
17/04/2025

ISO INDX

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH101
Project Name	Fallowfield Campus GI Manchester			Sample No.	1
Soil Description	Dark brown slightly gravelly sandy silty CLAY with some cobbles			Depth, m	0.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving and pipette sedimentation			KeyLAB ID	TTLP202503280



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	21
90	79	0.0060	14
75	79	0.0020	8
63	79		
50	79		
37.5	79		
28	78		
20	77		
14	77		
10	74		
6.3	72		
5	71		
3.35	70		
2	68		
1.18	66		
0.6	64	Particle density (assumed)	
0.425	60	2.65	Mg/m3
0.3	54		
0.212	45		
0.15	39		
0.063	31		

Dry Mass of sample, g: 5067

Sample Proportions	% dry mass
Very coarse	21
Gravel	11
Sand	37
Silt	23
Clay	8

Grading Analysis		
D100	mm	125
D60	mm	0.444
D30	mm	0.0558
D10	mm	0.00287
Uniformity Coefficient		150
Curvature Coefficient		2.4
Pretreatment Method (If Applicable)		

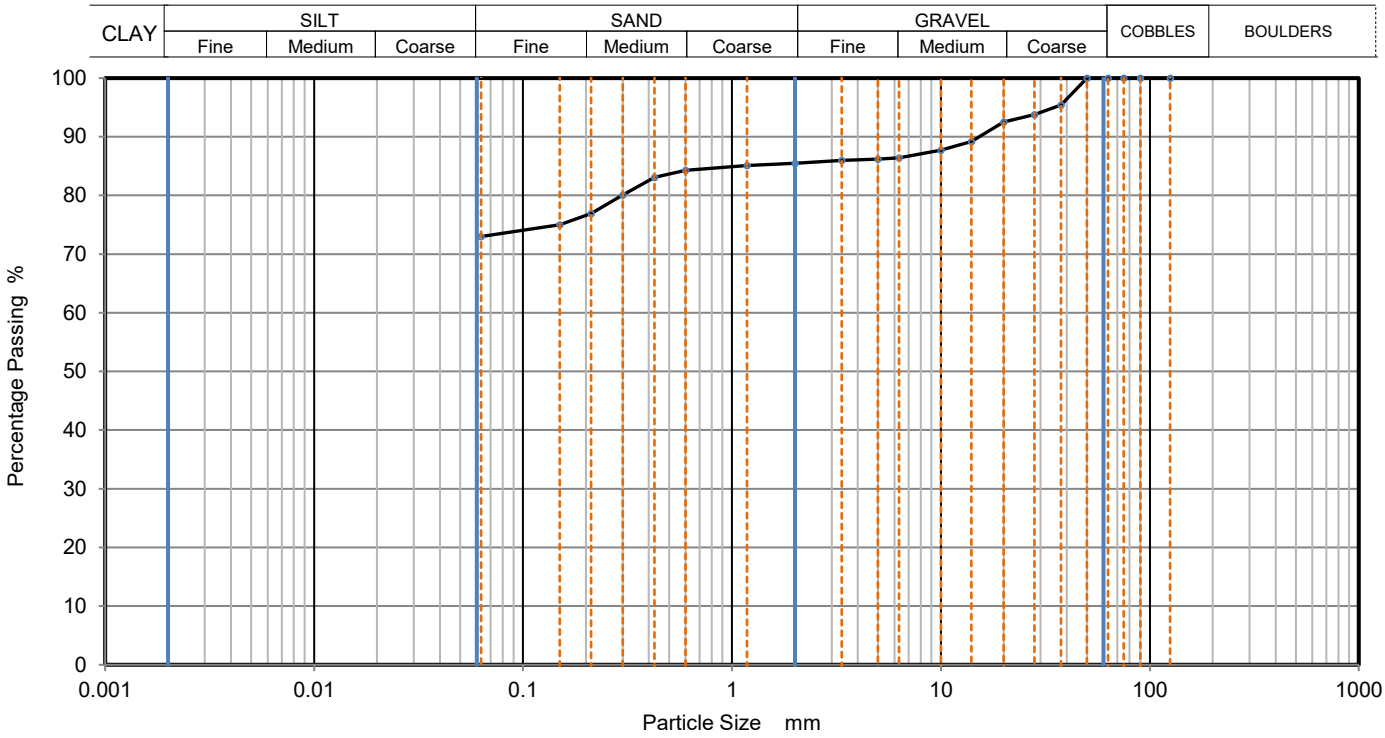
Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH102
Project Name	Fallowfield Campus GI Manchester			Sample No.	1
Soil Description	Dark brown slightly sandy slightly gravelly CLAY			Depth, m	0.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample			KeyLAB ID	TTLP202503287



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	94		
20	93		
14	89		
10	88		
6.3	86		
5	86		
3.35	86		
2	86		
1.18	85		
0.6	84		
0.425	83		
0.3	80		
0.212	77		
0.15	75		
0.063	73		

Dry Mass of sample, g: 2066

Sample Proportions	% dry mass
Very coarse	0
Gravel	14
Sand	13
Fines <0.063mm	73

Grading Analysis		
D100	mm	50
D60	mm	
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

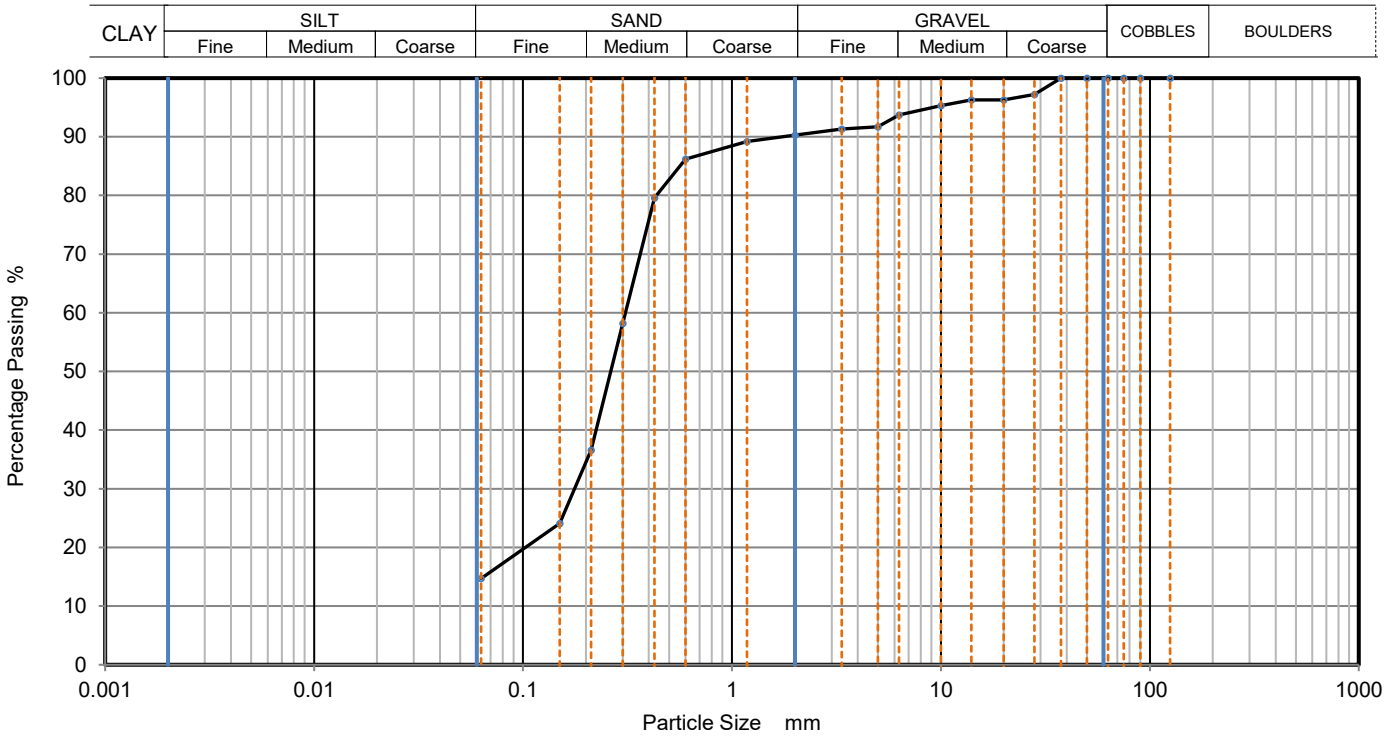
Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH102
Project Name	Fallowfield Campus GI Manchester			Sample No.	4
Soil Description	Brown slightly gravelly SAND with pockets of CLAY			Depth, m	0.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample			KeyLAB ID	TTLP202503288



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	96		
14	96		
10	95		
6.3	94		
5	92		
3.35	91		
2	90		
1.18	89		
0.6	86		
0.425	80		
0.3	58		
0.212	37		
0.15	24		
0.063	15		

Dry Mass of sample, g: 3310

Sample Proportions	% dry mass
Very coarse	0
Gravel	10
Sand	75
Fines <0.063mm	15

Grading Analysis		
D100	mm	37.5
D60	mm	0.309
D30	mm	0.177
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

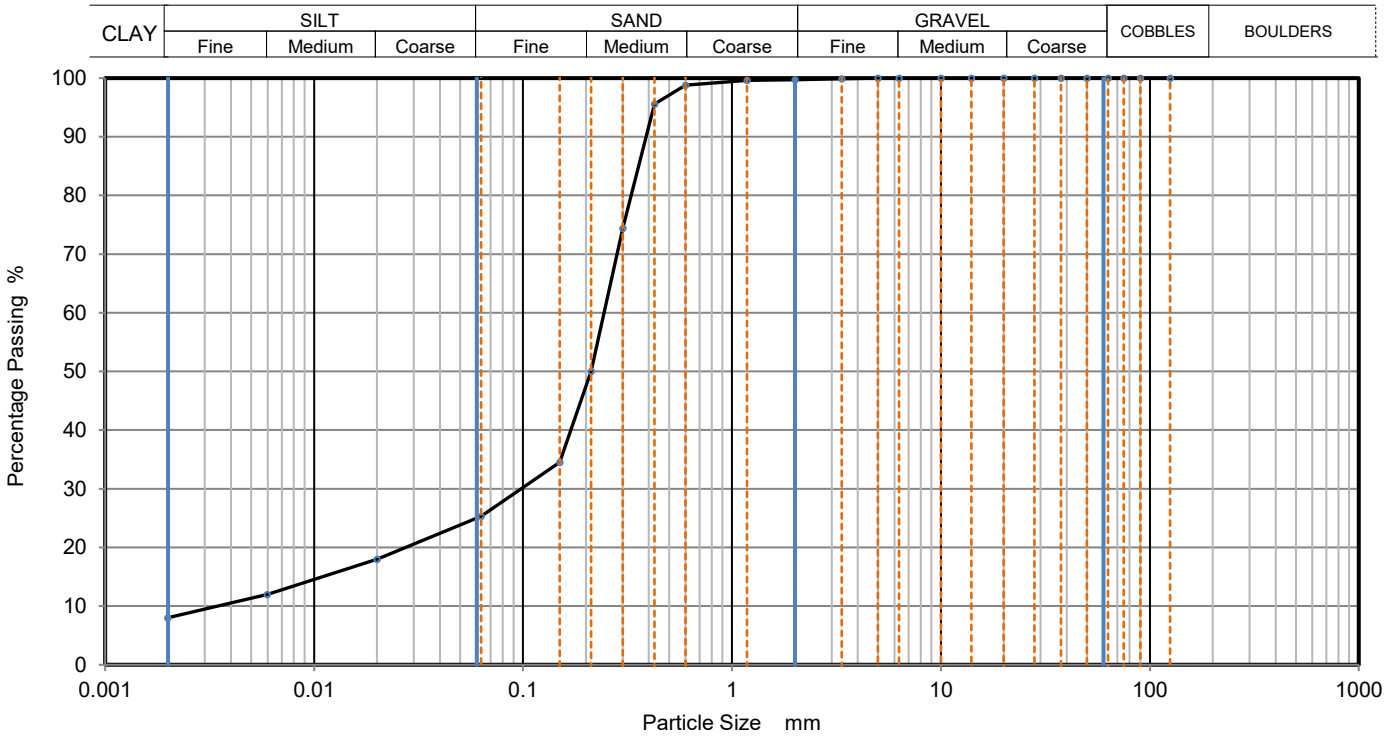
Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH103
Project Name	Fallowfield Campus GI Manchester			Sample No.	4
Soil Description	Brown silty SAND			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving and pipette sedimentation			KeyLAB ID	TTLP2025032814



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	18
90	100	0.0060	12
75	100	0.0020	8
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99	Particle density (assumed)	
0.425	96	2.65	Mg/m3
0.3	74		
0.212	50		
0.15	35		
0.063	25		

Dry Mass of sample, g: 1040

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	75
Silt	17
Clay	8

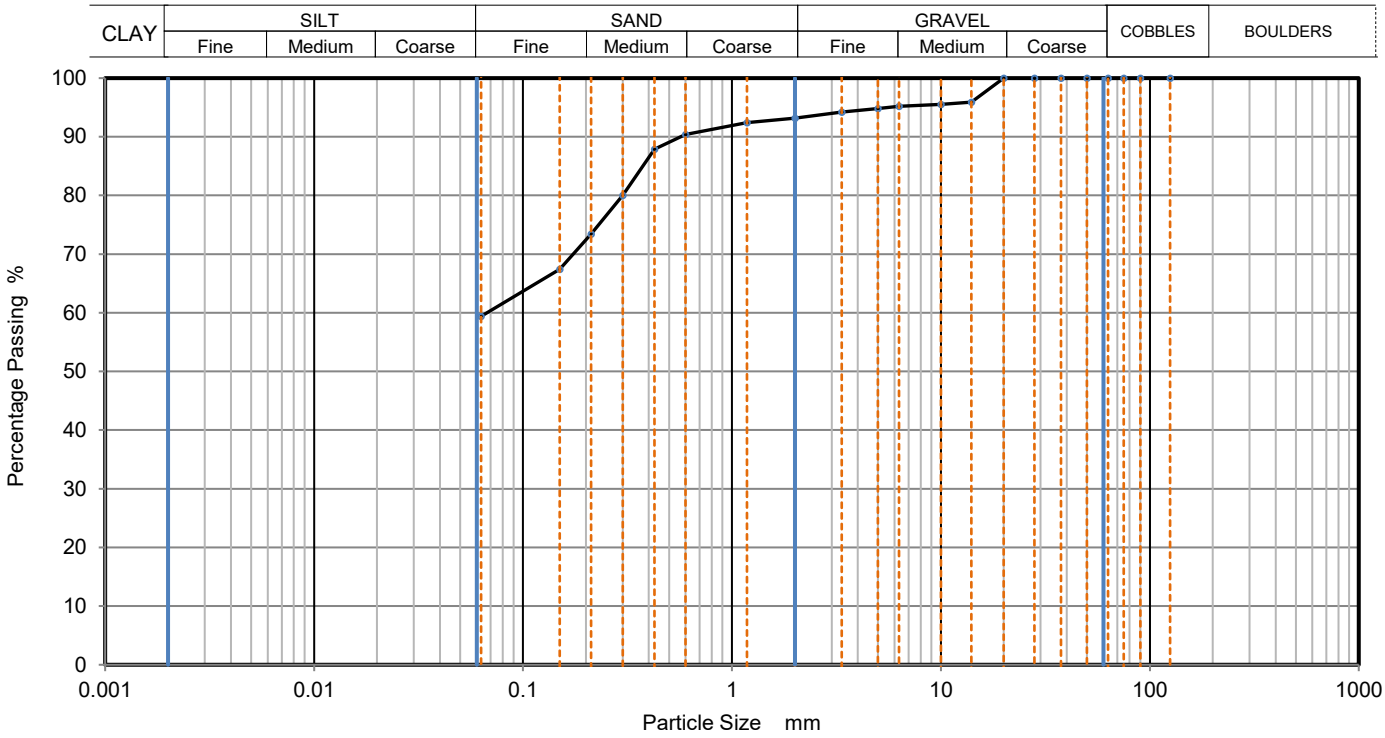
Grading Analysis		
D100	mm	5
D60	mm	0.244
D30	mm	0.0982
D10	mm	0.00335
Uniformity Coefficient		73
Curvature Coefficient		12
Pretreatment Method (If Applicable)		

Remarks

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Date Printed:		**ISO PSD**
22/04/2025		

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH104
Project Name	Fallowfield Campus GI Manchester			Sample No.	7
Soil Description	Brown slightly sandy slightly gravelly CLAY			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on as received or wet sample			KeyLAB ID	TTLP2025032821



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	96		
10	96		
6.3	95		
5	95		
3.35	94		
2	93		
1.18	92		
0.6	90		
0.425	88		
0.3	80		
0.212	73		
0.15	67		
0.063	59		

Dry Mass of sample, g: 1181

Sample Proportions	% dry mass
Very coarse	0
Gravel	7
Sand	34
Fines <0.063mm	59

Grading Analysis		
D100	mm	20
D60	mm	0.0672
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

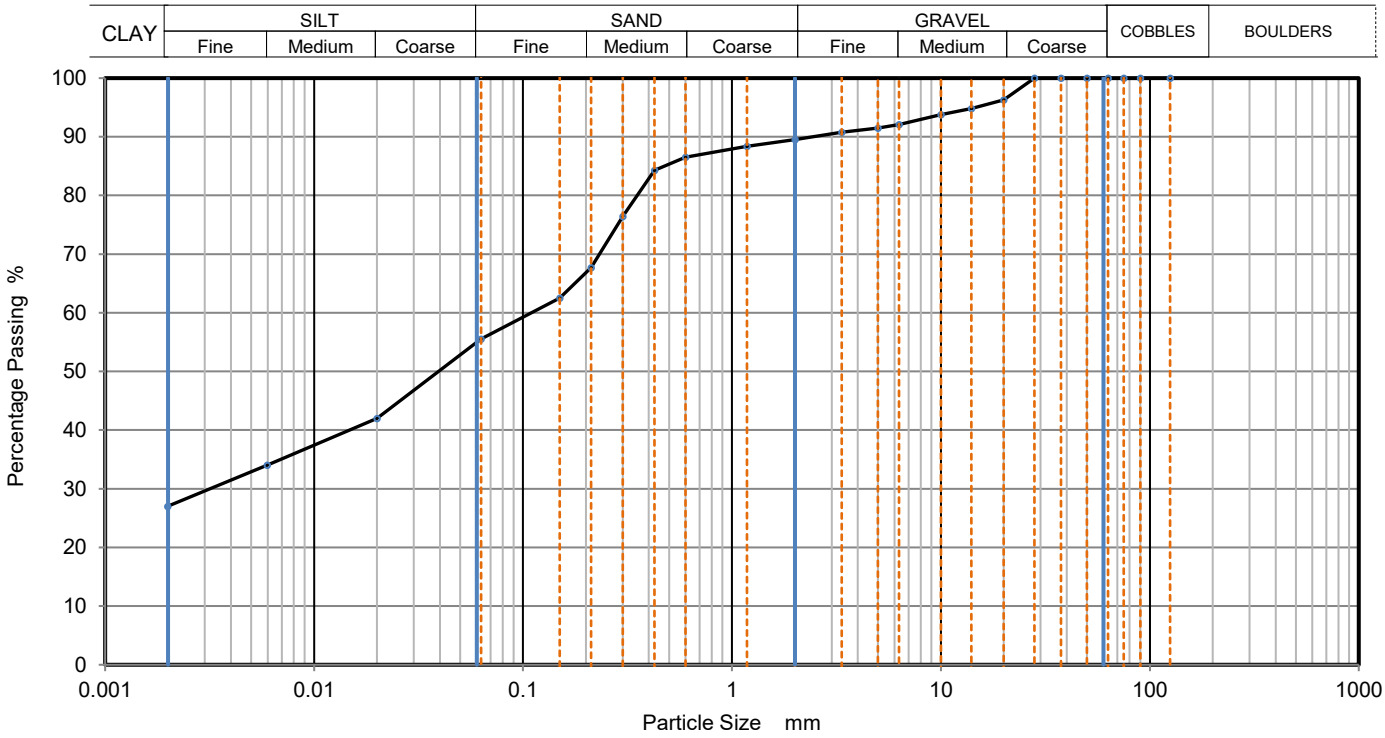
Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH106
Project Name	Fallowfield Campus GI Manchester			Sample No.	3
Soil Description	Brown mottled grey slightly sandy slightly gravelly CLAY			Depth, m	0.60
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving and pipette sedimentation			KeyLAB ID	TTLP2025032827



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	42
90	100	0.0060	34
75	100	0.0020	27
63	100		
50	100		
37.5	100		
28	100		
20	96		
14	95		
10	94		
6.3	92		
5	92		
3.35	91		
2	90		
1.18	88		
0.6	87	Particle density (assumed)	
0.425	84	2.65	Mg/m3
0.3	76		
0.212	68		
0.15	63		
0.063	56		

Dry Mass of sample, g: 2025

Sample Proportions	% dry mass
Very coarse	0
Gravel	11
Sand	34
Silt	28
Clay	27

Grading Analysis		
D100	mm	28
D60	mm	0.11
D30	mm	0.00307
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

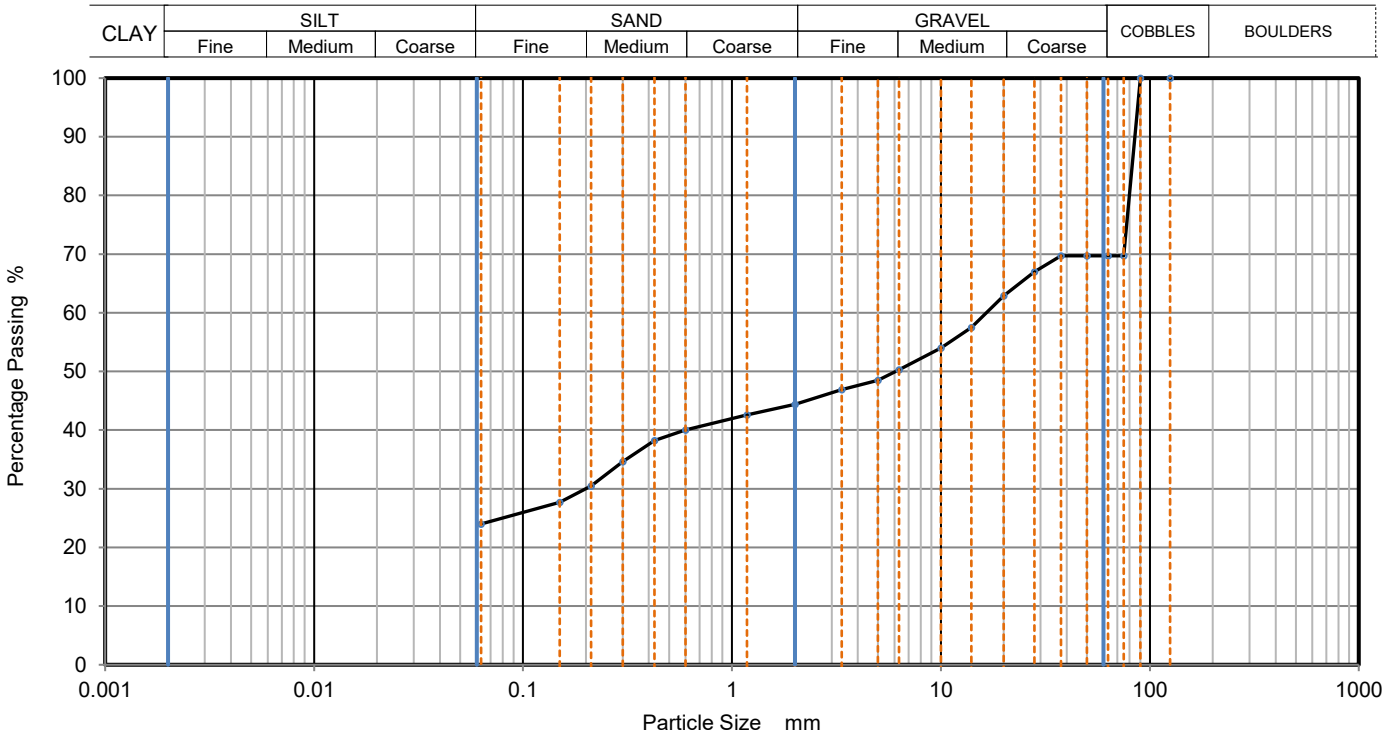
Remarks

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Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH107
Project Name	Fallowfield Campus GI Manchester			Sample No.	1
Soil Description	Brown slightly sandy slightly gravelly CLAY with some cobbles			Depth, m	0.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample			KeyLAB ID	TTLP2025032834



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	70		
63	70		
50	70		
37.5	70		
28	67		
20	63		
14	58		
10	54		
6.3	50		
5	49		
3.35	47		
2	44		
1.18	43		
0.6	40		
0.425	38		
0.3	35		
0.212	31		
0.15	28		
0.063	24		

Dry Mass of sample, g	3062

Sample Proportions	% dry mass
Very coarse	31
Gravel	25
Sand	20
Fines <0.063mm	24

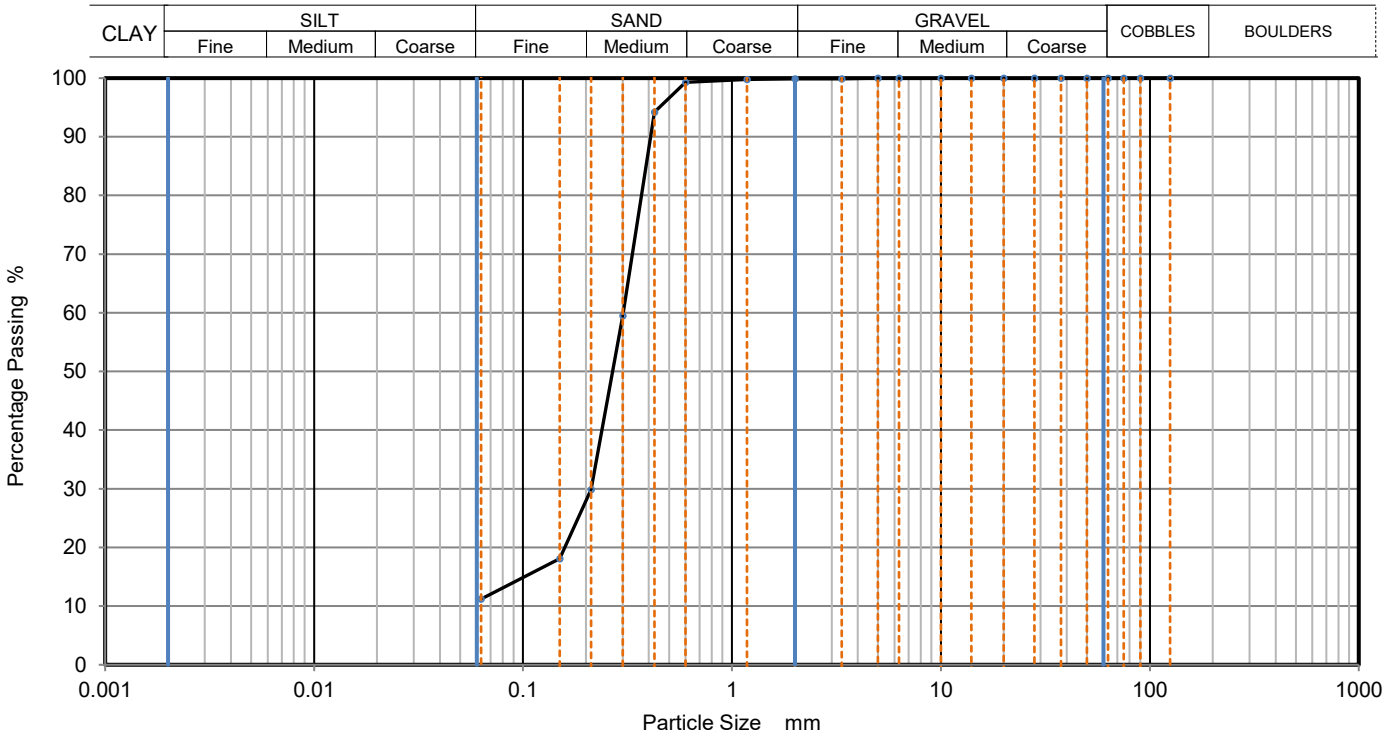
Grading Analysis		
D100	mm	90
D60	mm	16.5
D30	mm	0.199
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025		**ISO PSD**

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH107
Project Name	Fallowfield Campus GI Manchester			Sample No.	7
Soil Description	Reddish brown clayey SAND			Depth, m	2.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample			KeyLAB ID	TTLP202504142



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	94		
0.3	60		
0.212	30		
0.15	18		
0.063	11		

Dry Mass of sample, g	2316

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	89
Fines <0.063mm	11

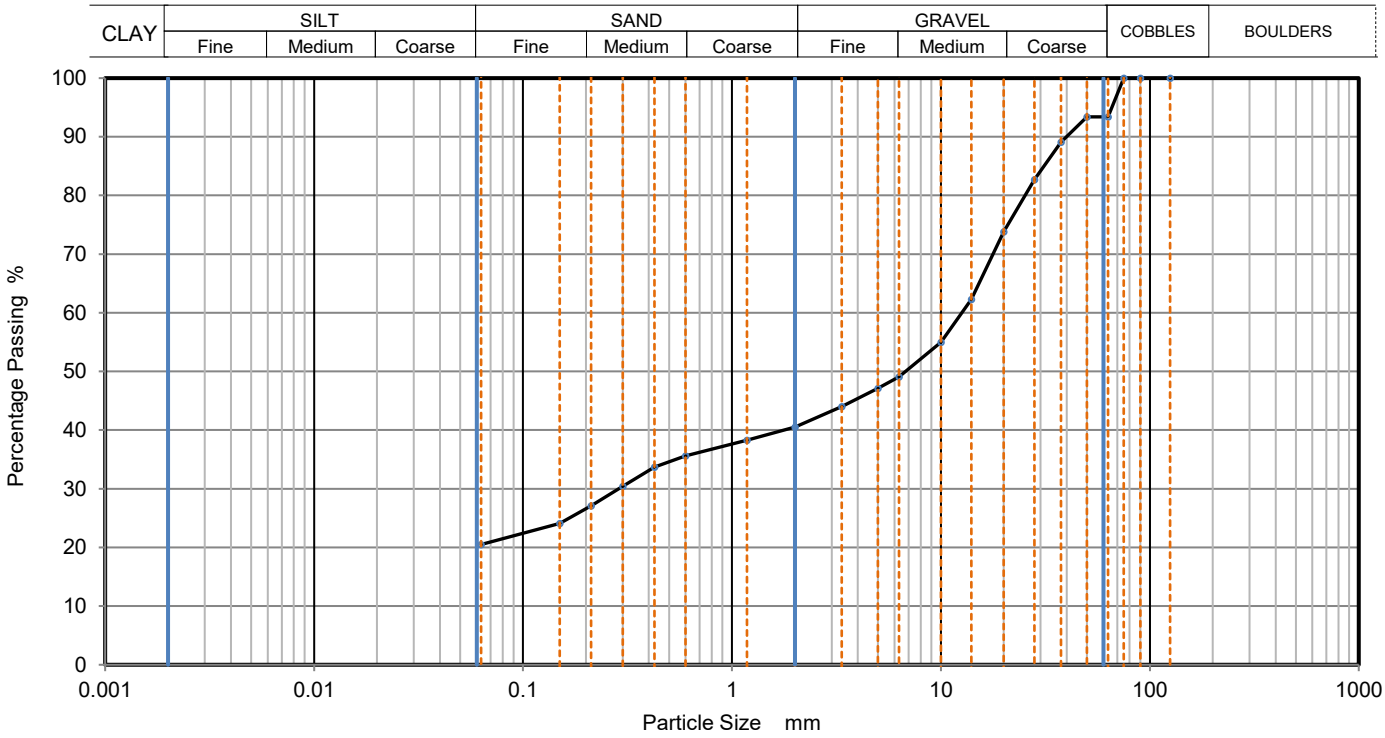
Grading Analysis		
D100	mm	5
D60	mm	0.301
D30	mm	0.212
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed:		**ISO PSD**
22/04/2025		

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH108
Project Name	Fallowfield Campus GI Manchester			Sample No.	1
Soil Description	Multicoloured slightly sandy clayey GRAVEL with occasional cobbles			Depth, m	0.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample			KeyLAB ID	TTLP2025032842



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	93		
50	93		
37.5	89		
28	83		
20	74		
14	62		
10	55		
6.3	49		
5	47		
3.35	44		
2	41		
1.18	38		
0.6	36		
0.425	34		
0.3	30		
0.212	27		
0.15	24		
0.063	21		

Dry Mass of sample, g	5132

Sample Proportions	% dry mass
Very coarse	7
Gravel	52
Sand	20
Fines <0.063mm	21

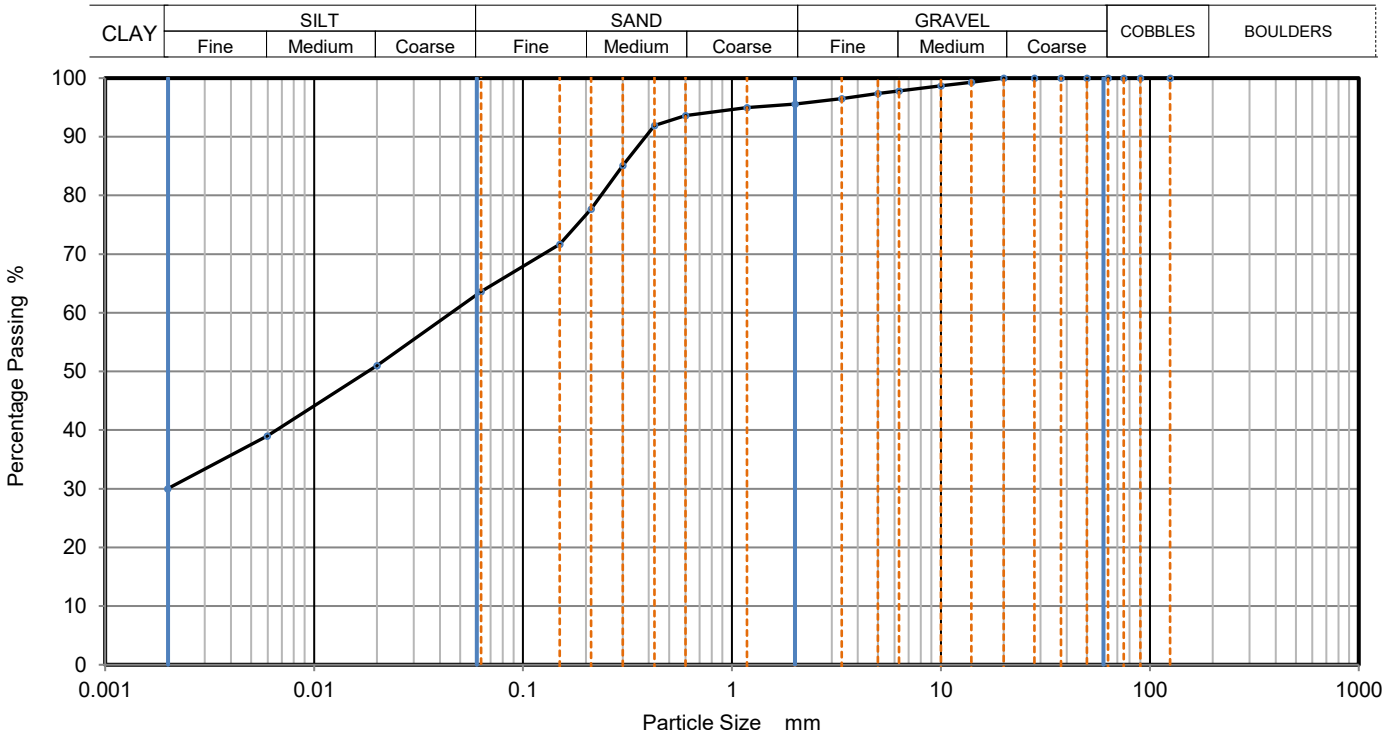
Grading Analysis		
D100	mm	75
D60	mm	12.6
D30	mm	0.288
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025		**ISO PSD**

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH108
Project Name	Fallowfield Campus GI Manchester			Sample No.	4
Soil Description	Brown slightly sandy slightly gravelly CLAY			Depth, m	0.90
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving and pipette sedimentation			KeyLAB ID	TTLP2025032843



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	51
90	100	0.0060	39
75	100	0.0020	30
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	99		
6.3	98		
5	97		
3.35	97		
2	96		
1.18	95		
0.6	94	Particle density (assumed)	
0.425	92	2.65	Mg/m3
0.3	85		
0.212	78		
0.15	72		
0.063	64		

Dry Mass of sample, g: 1380

Sample Proportions	% dry mass
Very coarse	0
Gravel	4
Sand	32
Silt	34
Clay	30

Grading Analysis		
D100	mm	20
D60	mm	0.0452
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

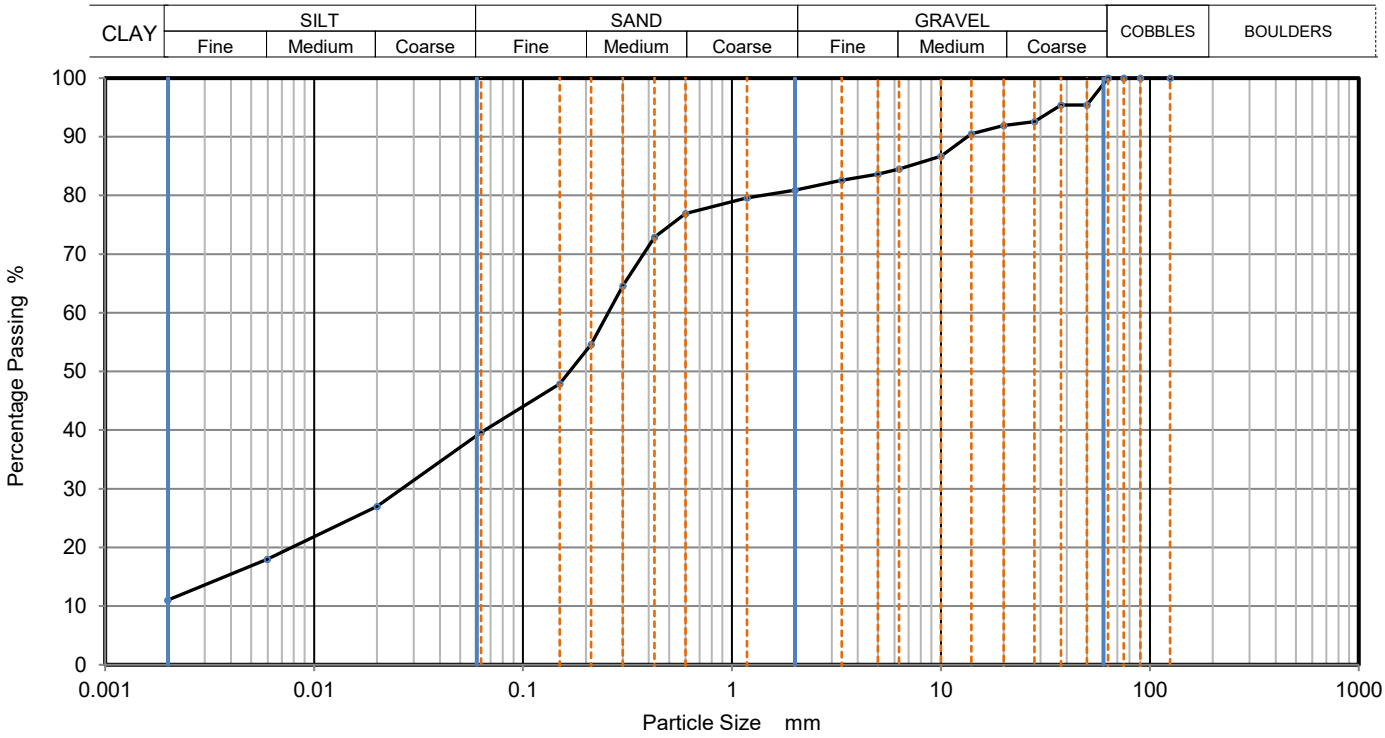
Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH109
Project Name	Fallowfield Campus GI Manchester			Sample No.	1
Soil Description	Dark brown slightly gravelly sandy CLAY with roots			Depth, m	0.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving and pipette sedimentation			KeyLAB ID	TTLP2025032850



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	27
90	100	0.0060	18
75	100	0.0020	11
63	100		
50	95		
37.5	95		
28	93		
20	92		
14	91		
10	87		
6.3	85		
5	84		
3.35	83		
2	81		
1.18	80		
0.6	77	Particle density (assumed)	
0.425	73	2.65	Mg/m3
0.3	65		
0.212	55		
0.15	48		
0.063	40		

Dry Mass of sample, g: 3833

Sample Proportions	% dry mass
Very coarse	0
Gravel	19
Sand	42
Silt	28
Clay	11

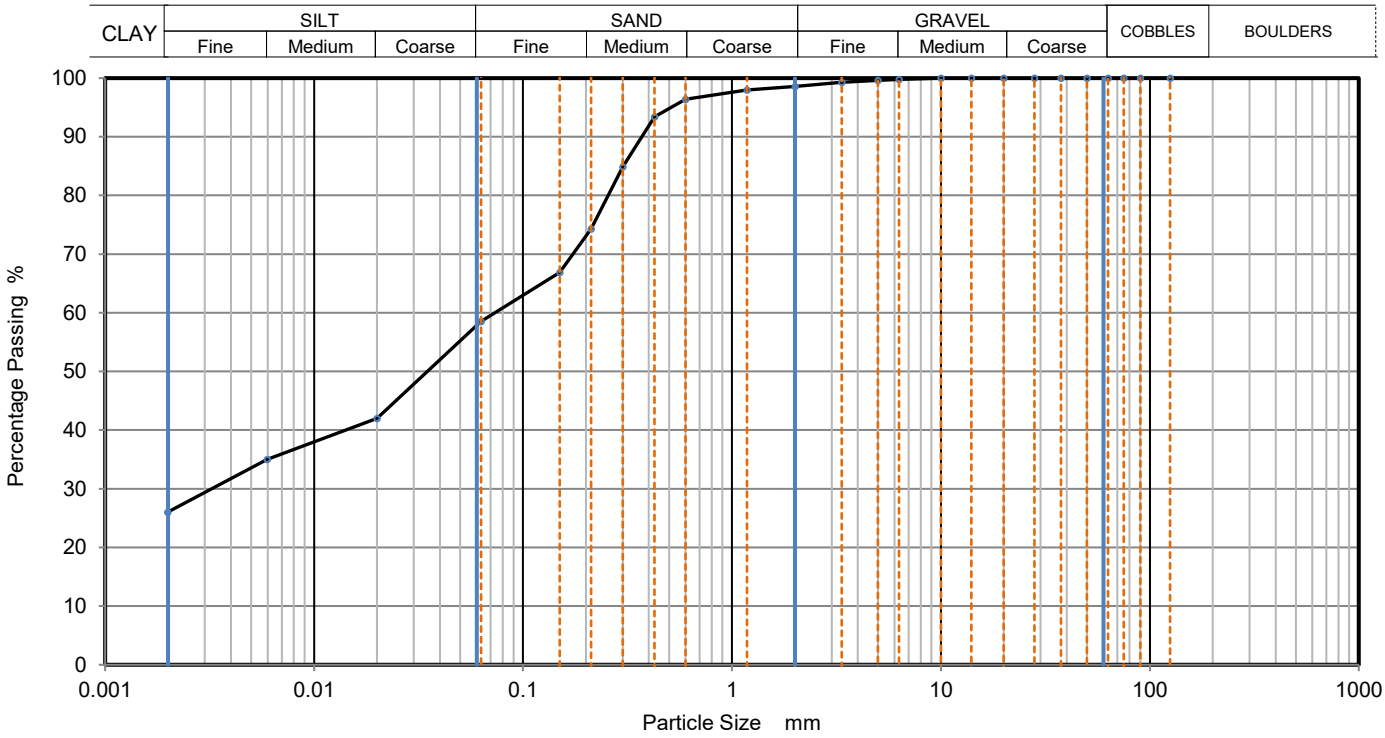
Grading Analysis		
D100	mm	63
D60	mm	0.255
D30	mm	0.0261
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed:		**ISO PSD**
22/04/2025		

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH109
Project Name	Fallowfield Campus GI Manchester			Sample No.	4
Soil Description	Brown slightly sandy silty CLAY			Depth, m	0.70
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving and pipette sedimentation			KeyLAB ID	TTLP2025032852



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	42
90	100	0.0060	35
75	100	0.0020	26
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	98		
0.6	96	Particle density (assumed)	
0.425	93	2.65	Mg/m3
0.3	85		
0.212	74		
0.15	67		
0.063	59		

Dry Mass of sample, g: 1052

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	41
Silt	32
Clay	26

Grading Analysis		
D100	mm	10
D60	mm	0.0734
D30	mm	0.00318
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

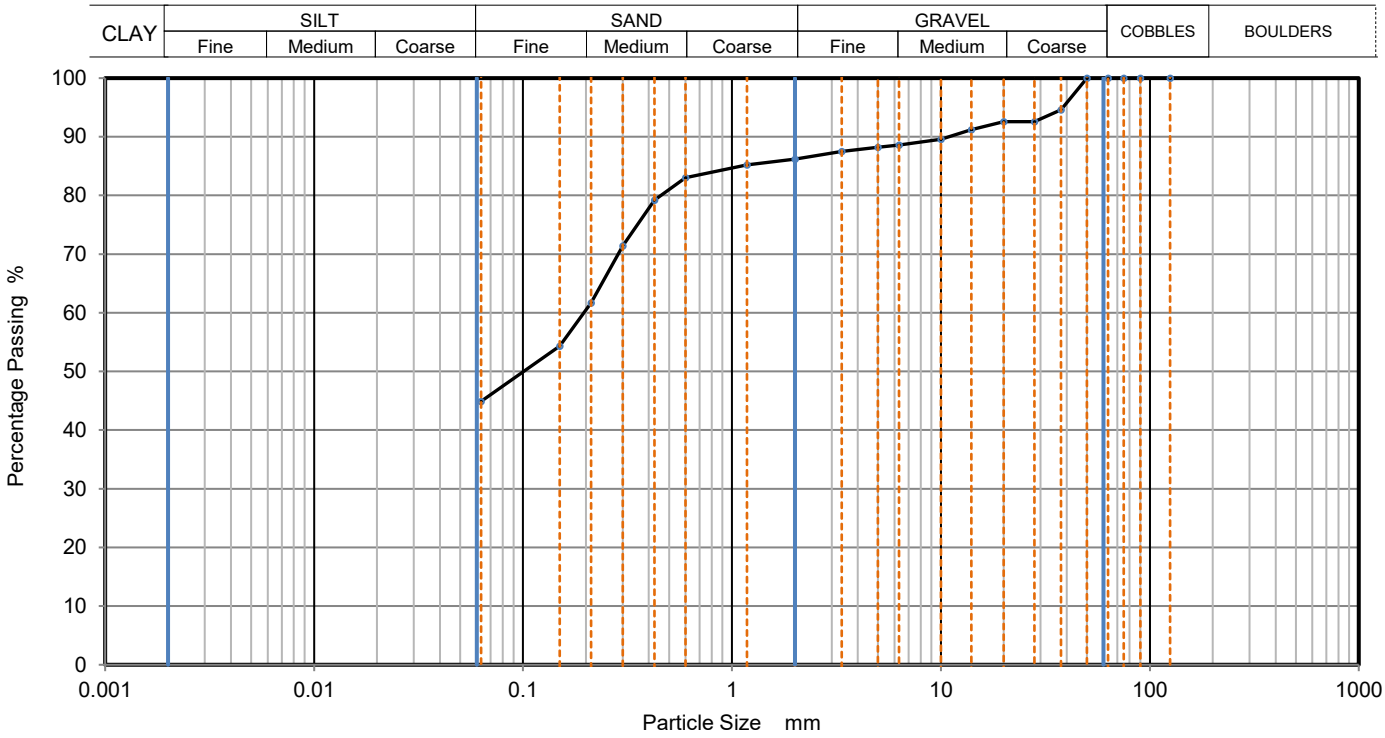
Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH109
Project Name	Fallowfield Campus GI Manchester			Sample No.	8
Soil Description	Reddish brown slightly sandy slightly gravelly CLAY			Depth, m	1.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample			KeyLAB ID	TTLP2025032854



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	95		
28	93		
20	93		
14	91		
10	90		
6.3	89		
5	88		
3.35	88		
2	86		
1.18	85		
0.6	83		
0.425	79		
0.3	71		
0.212	62		
0.15	54		
0.063	45		

Dry Mass of sample, g: 1853

Sample Proportions	% dry mass
Very coarse	0
Gravel	14
Sand	41
Fines <0.063mm	45

Grading Analysis		
D100	mm	50
D60	mm	0.196
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

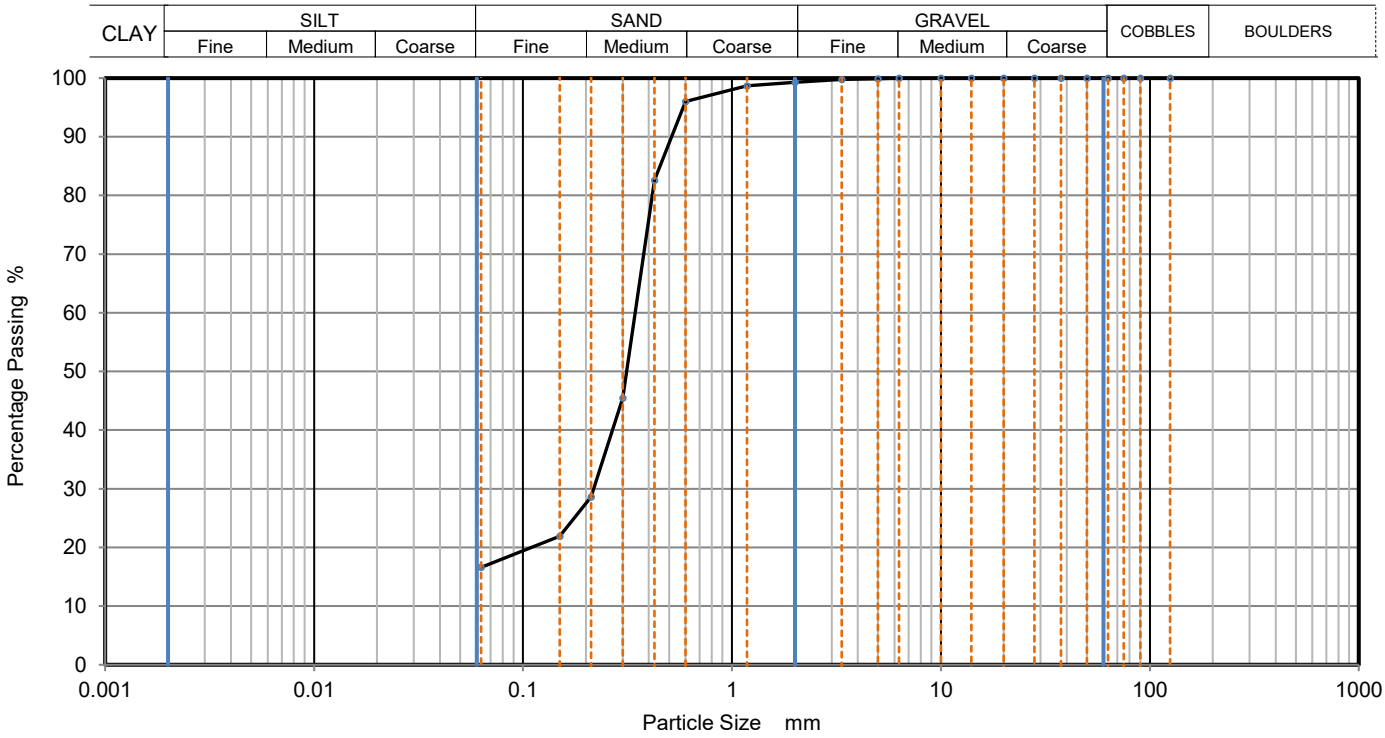
Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025

ISO PSD

GFQ-008-77 Issue 02 - Nov 23	**Determination of Particle Size Distribution (ISO 17892-4:2016)**			Job Ref	**J306095**
				Borehole/Pit No.	BH109
Project Name	Fallowfield Campus GI Manchester			Sample No.	12
Soil Description	Reddish brown silty SAND			Depth, m	2.15
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	ISO 17892 -4, by sieving on pre-dried or dry sample			KeyLAB ID	TTLP2025032855



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	96		
0.425	83		
0.3	46		
0.212	29		
0.15	22		
0.063	17		

Dry Mass of sample, g	2551

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	82
Fines <0.063mm	17

Grading Analysis		
D100	mm	6.3
D60	mm	0.344
D30	mm	0.218
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		
Pretreatment Method (If Applicable)		

Remarks

Preparation and testing performed to BS EN ISO 17892-4 unless noted below

Date Printed: 22/04/2025		**ISO PSD**

Particle Density by Gas Jar Tests - Summary of Results

Project No.
J306095

Project Name
Fallowfield Campus GI Manchester

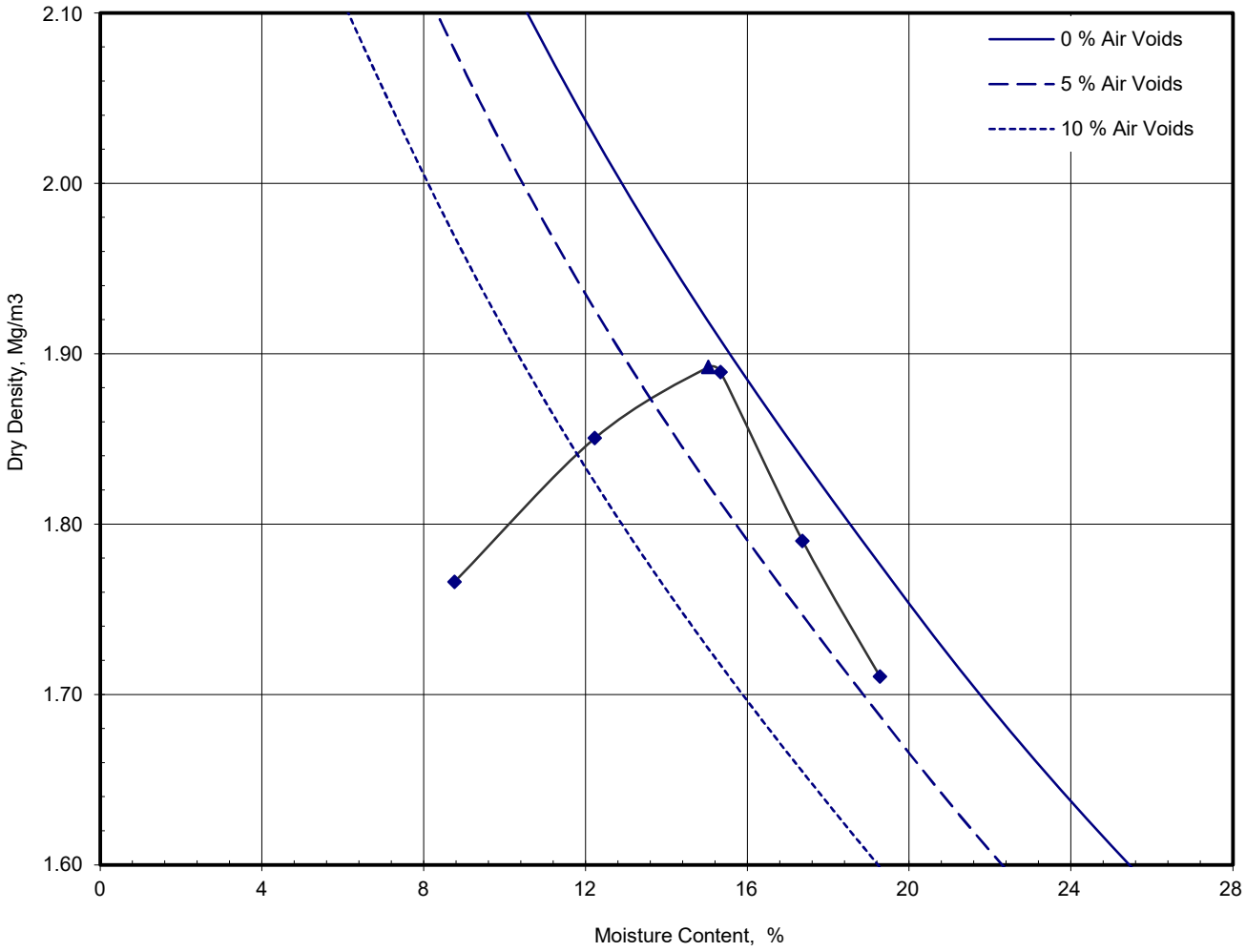
Hole No.	Sample				Soil Description at test horizon	Particle Density Mg/m^3	Remarks
	Ref	Top	Base	Type			
BH106	3	0.60	1.20	B	Brown mottled grey slightly sandy slightly gravelly CLAY	2.77	
BH107	1	0.00	0.70	B	Brown slightly sandy slightly gravelly CLAY with some cobbles	2.61	
BH108	1	0.00	0.90	B	Multicoloured slightly sandy clayey GARVEL with occasional cobbles	2.61	
BH108	6	1.20		D	Brown slightly sandy slightly gravelly CLAY	2.68	

Notes
Tests performed in accordance with BS 1377 unless annotated otherwise
Gas Jar tests to BS1377: Part 2 : 2022, clause 9.2

Date Printed
17/04/2025

Table
sheet

GQF-008-50 Issue 02 - June 24	**Dry Density / Moisture Content Relationship Light Compaction**			Job Ref	**J306095**
				Borehole / Pit No	BH104
Project Name	**Fallowfield Campus GI Manchester**			Sample No	7
Soil Description	Brown slightly sandy slightly gravelly CLAY			Depth	1.40 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377-2:2022			Keylab ID	TTLP2025032821

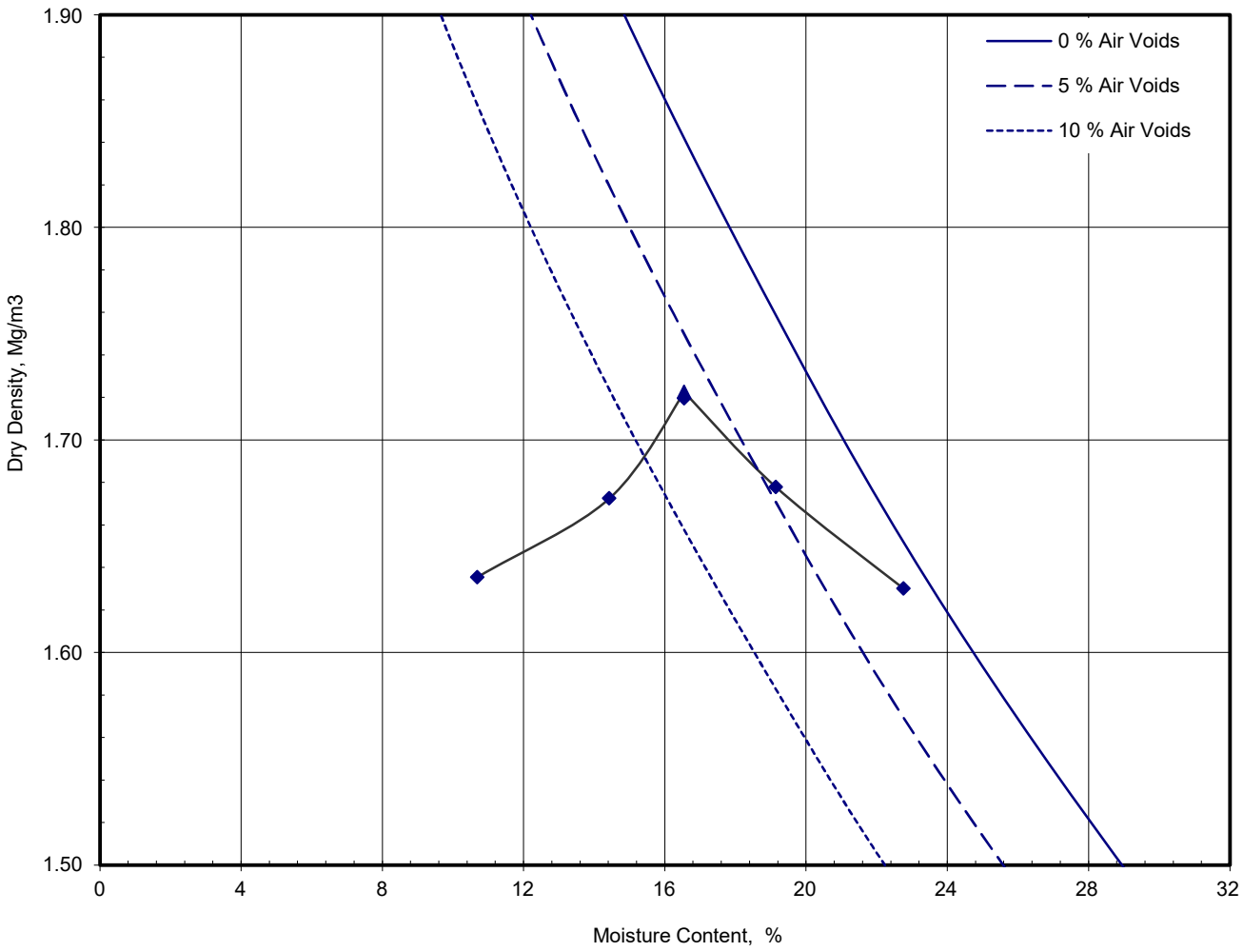


Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.70

Maximum Dry Density	Mg/m³	**1.89**
Optimum Moisture Content	%	**15**

		Remarks		**COMPL**
	7758	Date Printed	17/04/2025	

GQF-008-50 Issue 02 - June 24	**Dry Density / Moisture Content Relationship Light Compaction**			Job Ref	**J306095**
				Borehole / Pit No	BH106
Project Name	**Fallowfield Campus GI Manchester**			Sample No	3
Soil Description	Brown mottled grey slightly sandy slightly gravelly CLAY			Depth	0.60 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377-2:2022			Keylab ID	TTLP2025032827



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	1
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.72**
Optimum Moisture Content	%	**17**

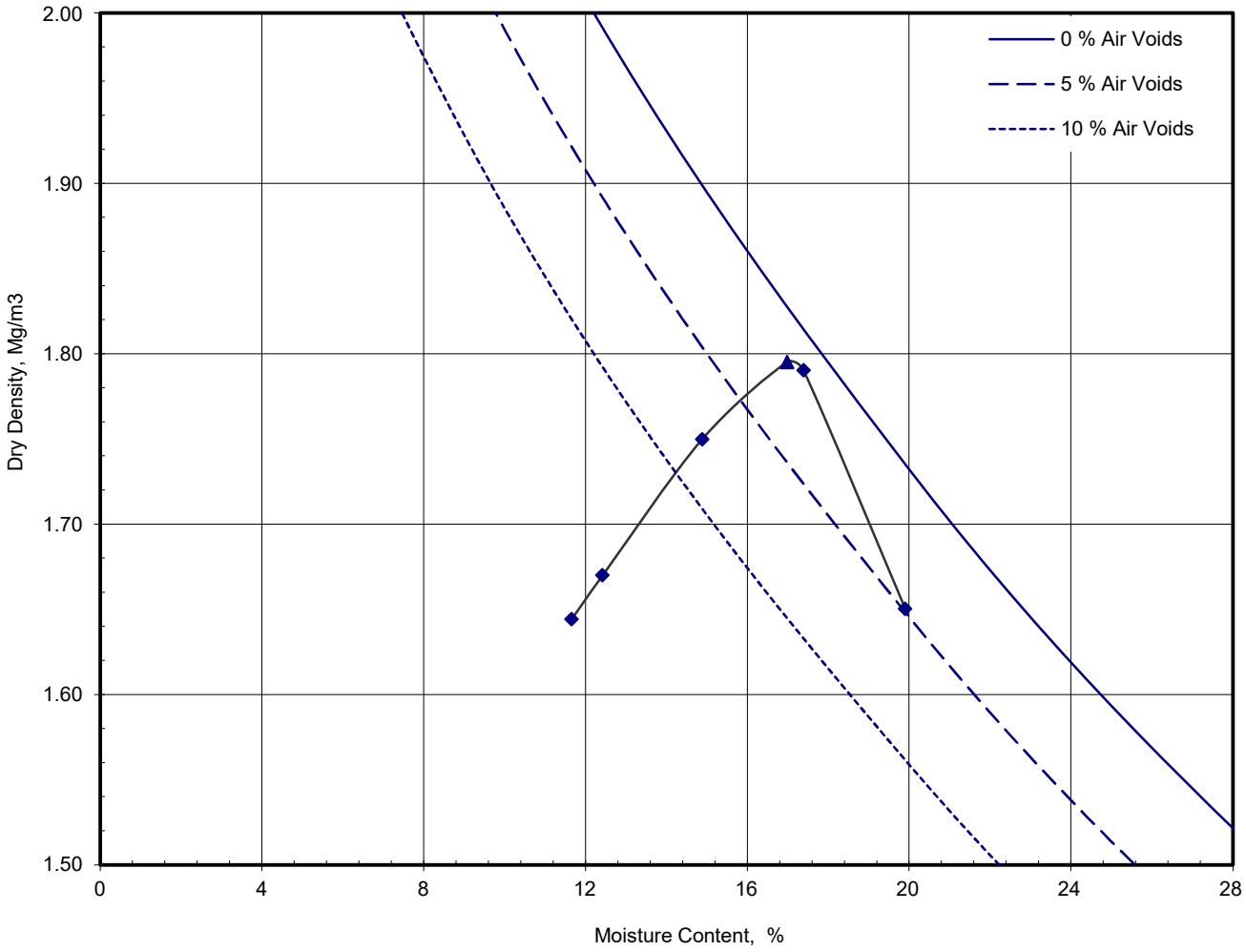
7758

Remarks

COMPL

Date Printed 17/04/2025

GQF-008-50 Issue 02 - June 24	**Dry Density / Moisture Content Relationship Light Compaction**			Job Ref	**J306095**
				Borehole / Pit No	BH108
Project Name	**Fallowfield Campus GI Manchester**			Sample No	4
Soil Description	Brown slightly sandy slightly gravelly CLAY			Depth	0.90 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377-2:2022			Keylab ID	TTLP2025032843



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.80**
Optimum Moisture Content	%	**17**

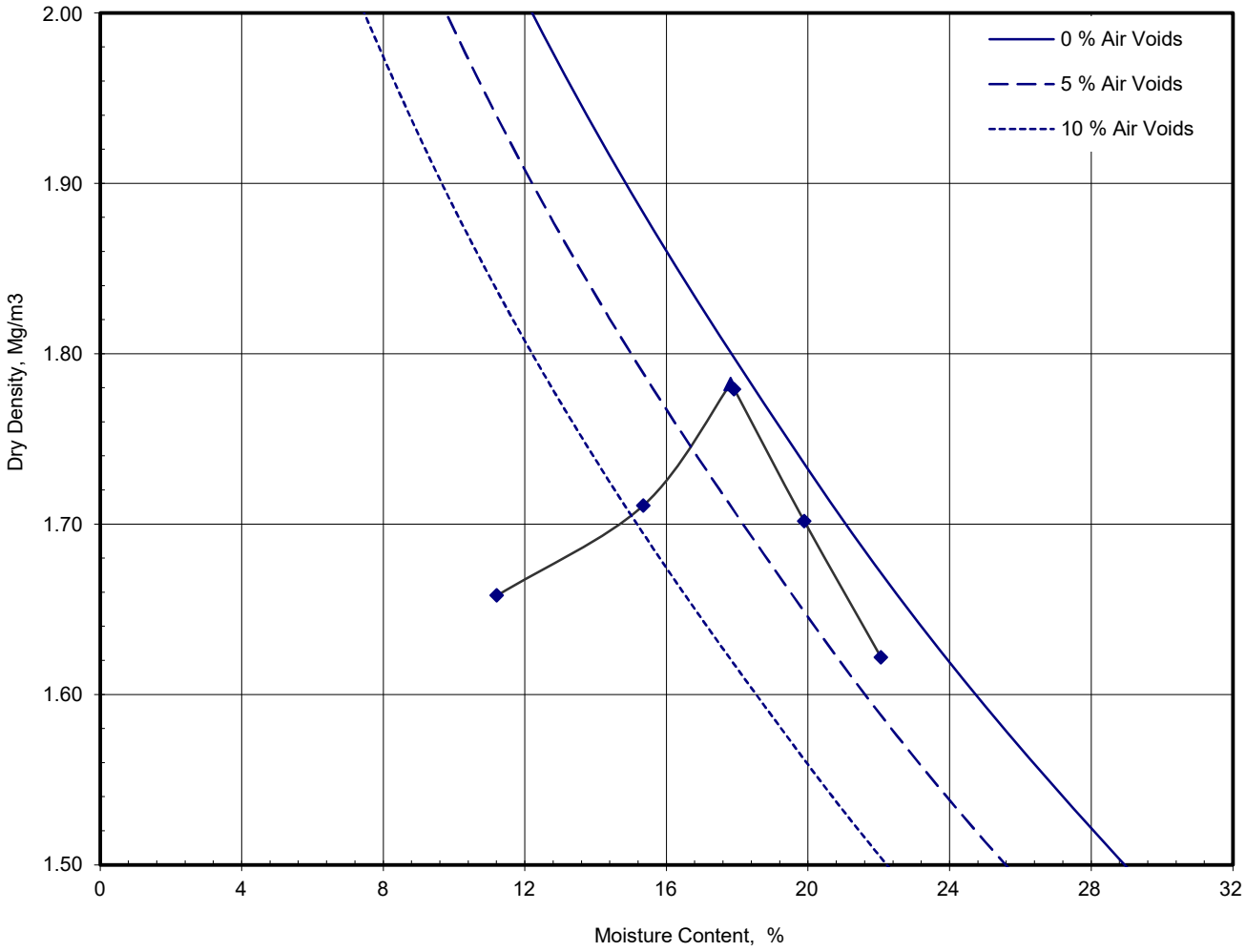
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Remarks

Date Printed 17/04/2025

COMPL

GQF-008-50 Issue 02 - June 24	**Dry Density / Moisture Content Relationship Light Compaction**			Job Ref	**J306095**
				Borehole / Pit No	BH109
Project Name	**Fallowfield Campus GI Manchester**			Sample No	4
Soil Description	Brown slightly sandy silty CLAY			Depth	0.70 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377-2:2022			Keylab ID	TTLP2025032852



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Separate specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.78**
Optimum Moisture Content	%	**18**

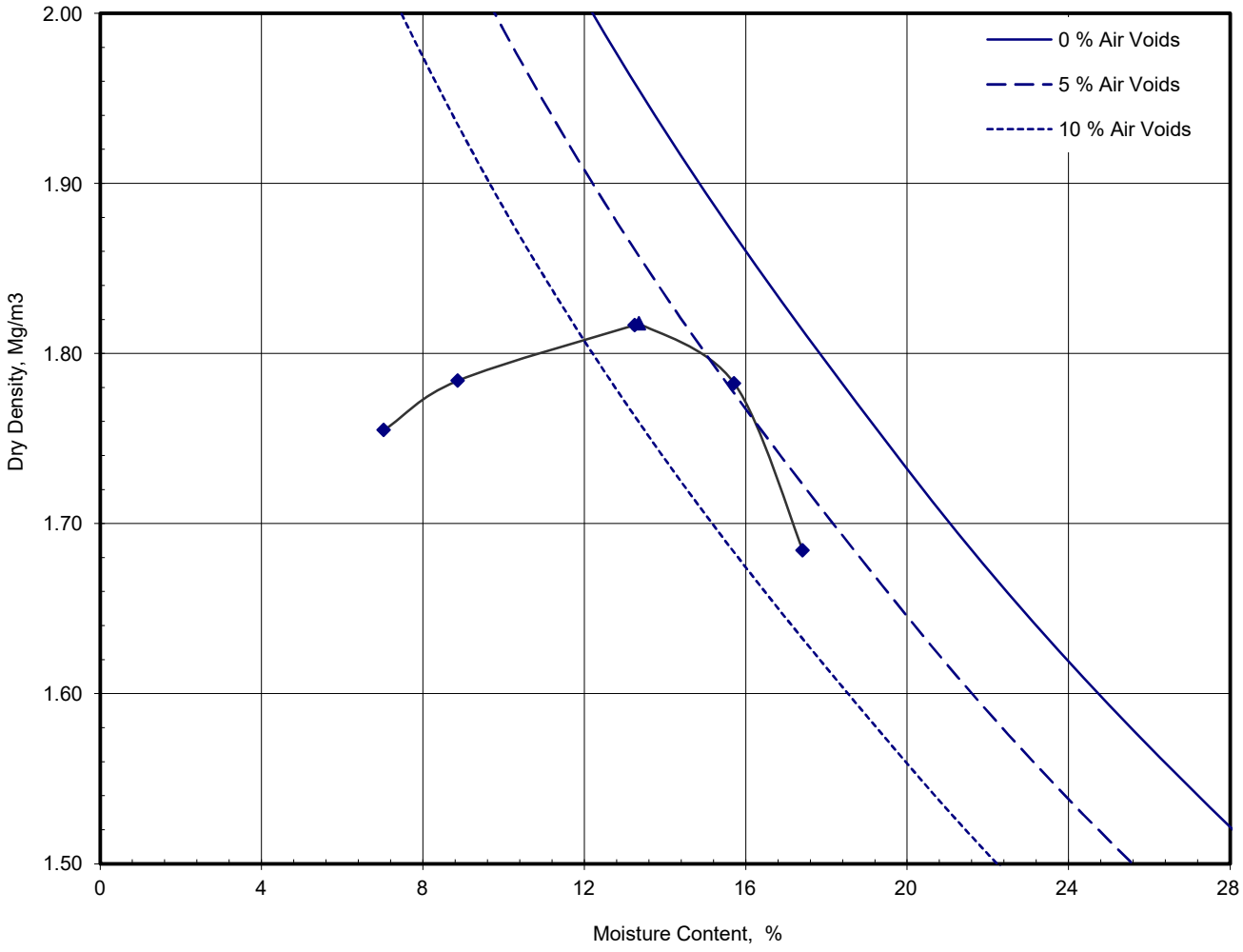
7758

Remarks

Date Printed 17/04/2025

COMPL

GQF-008-46 Issue 02 - June 24	**Dry Density / Moisture Content Relationship Heavy Compaction**			Job Ref	**J306095**
				Borehole / Pit No	BH102
Project Name	**Fallowfield Campus GI Manchester**			Sample No	4
Soil Description	Brown slightly gravelly SAND with pockets of CLAY			Depth	0.40 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.5, 4.5kg rammer			Keylab ID	TTLP202503288
				Compaction Test Reference/No.	



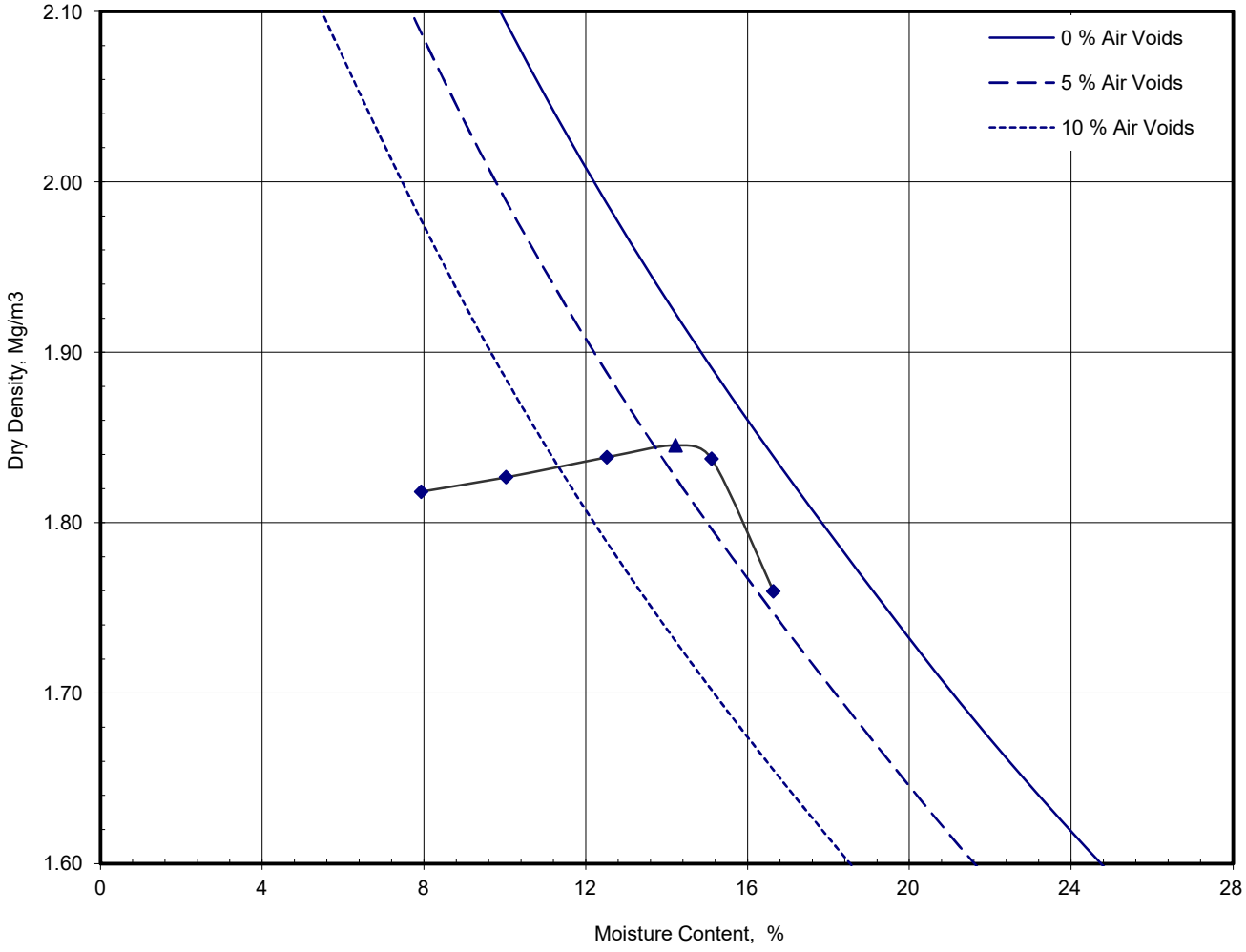
Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Separate specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	1
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.82**

Optimum Moisture Content	%	**13**

		Remarks		**COMPH**
	7758	Date Printed	17/04/2025	

GQF-008-46 Issue 02 - June 24	**Dry Density / Moisture Content Relationship Heavy Compaction**			Job Ref	**J306095**
				Borehole / Pit No	BH103
Project Name	**Fallowfield Campus GI Manchester**			Sample No	4
Soil Description	Brown silty SAND			Depth	1.40 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.5, 4.5kg rammer			Keylab ID	TTLP2025032814
				Compaction Test Reference/No.	



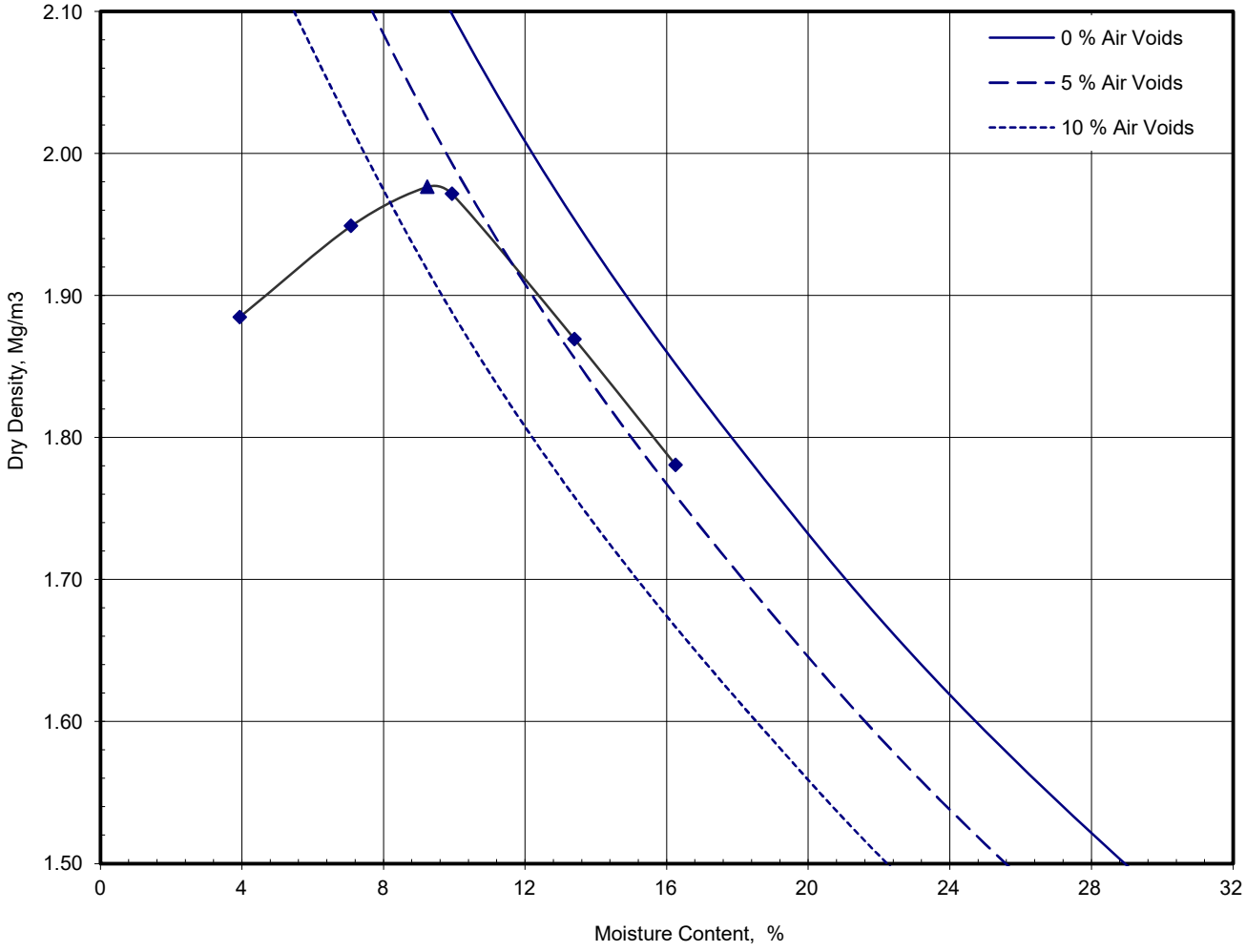
Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.85**

Optimum Moisture Content	%	**14**

		Remarks		**COMPH**
	7758	Date Printed	17/04/2025	

GQF-008-46 Issue 02 - June 24	**Dry Density / Moisture Content Relationship Heavy Compaction**			Job Ref	**J306095**
				Borehole / Pit No	BH107
Project Name	**Fallowfield Campus GI Manchester**			Sample No	1
Soil Description	Brown slightly sandy slightly gravelly CLAY with some cobbles			Depth	0.00 m
Specimen Ref.		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.6, 4.5kg rammer			Keylab ID	TTLP2025032834
				Compaction Test Reference/No.	



Preparation		Material used was natural
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	26
Material Retained on 20.0 mm Sieve	%	11
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.98**

Optimum Moisture Content	%	**9.2**

7758

Remarks

Date Printed	17/04/2025	

COMPH

GQF-008-58
Issue 01 - Oct 22

Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure
Summary of Results

Project No.: J306095

Project Name: Fallowfield Campus GI Manchester

Hole No.	Sample Ref	Top	Base	Type	Soil Description	Test Type	Density bulk Mg/m³	Density dry Mg/m³	w %	Length mm	Diameter mm	σ_3 kPa	At failure: Axial strain %	At failure: $\sigma_1 - \sigma_3$ kPa	At failure: c_u kPa	At failure: Mode	Remarks
BH106	6	1.20	1.65	UT	Stiff brown mottled grey slightly sandy slightly gravelly CLAY	UUM	2.18	1.87	16.4	201.0	103.2	30 60 120	3.2 5.2 14.7	195 247 359	97 124 180	P	
BH108	7	2.00	2.45	UT	Soft brown slightly sandy slightly gravelly CLAY becoming stiff brown slightly sandy slightly gravelly CLAY	UUM	2.16	1.84	17.5	200.9	102.9	50 100 150	2.0 4.0 14.9	23 28 84	12 14 42	C	
BH109	7	1.20	1.65	UT	Stiff brown slightly gravelly sandy CLAY	UUM	2.23	1.94	14.7	200.7	103.5	30 60 120	4.0 5.5 15.0	209 251 385	105 125 193	P	

Legend

UU - single stage test (single and multiple specimens)
UUM - Multistage test on a single specimen
suffix R - remoulded or recompacted

σ_3 Cell pressure
$\sigma_1 - \sigma_3$ Maximum corrected deviator stress
c_u Undrained shear strength, ½ ($\sigma_1 - \sigma_3$)

Mode of failure ; B - Brittle; P - Plastic; C - Compound

Notes

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test type. Tests performed at a nominal rate of strain of 2%/min unless annotated otherwise. See individual test reports for further details.

UKAS TESTING 7758

UU SUM

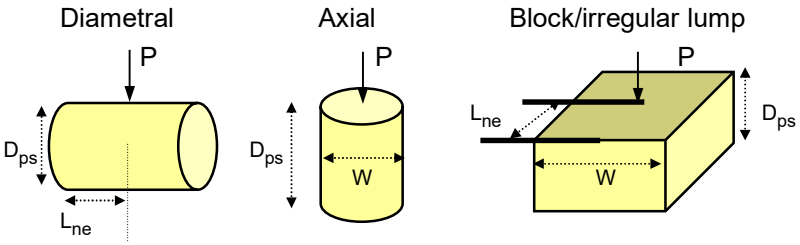
Date Printed: 22/04/2025

Point Load Index Test
ISRM:2007

Project No	Project Name
J306095	Fallowfield Campus

All specimens tested at **as received water content** unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction (U = unknown or random)
L - parallel to planes of weakness
P - perpendicular to planes of weakness
Dimensions
D_{ps} - Distance between platens (platen separation)
D_{ps}' - at failure (see ISRM note 6)
L_{ne} - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



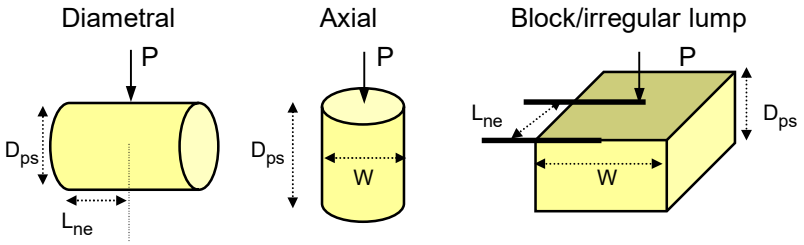
Borehole	Depth, m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions				LOAD P	De equivalent diameter, mm	Point Load Index MPa $F = (De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN		I_s	$I_{s(50)}$	
BH101	3.75-3.89	C		12		SANDSTONE	D	L	Y	52.0	85.9	53.0	49.0	0.60	64.87	0.14	0.16	
BH101	3.75-3.89	C		12		SANDSTONE	A	P	Y		84.1	84.0	79.0	0.70	92.00	0.08	0.11	
BH101	6.88 - 7.00	C		14		SANDSTONE	D	L	Y	49.0	85.9	85.0	81.0	0.40	83.40	0.06	0.07	
BH101	6.88 - 7.00	C		14		SANDSTONE	A	P	Y		85.9	49.0	42.0	0.80	67.76	0.17	0.20	
BH102	3.28-3.38	C		10		SANDSTONE	D	L	Y	52.0	84.1	59.0	50.0	1.10	64.86	0.26	0.29	
BH102	3.28-3.38	C		10		SANDSTONE	A	P	Y		86.2	86.0	80.0	0.70	93.72	0.08	0.11	
BH102	7.14-7.40	C		12		SANDSTONE	D	L	Y	51.0	85.9	85.0	80.0	0.70	82.91	0.10	0.13	
BH102	7.14-7.40	C		12		SANDSTONE	A	P	Y		85.9	55.0	50.0	1.00	73.96	0.18	0.22	
BH103	11.85-12.00	C		15		SANDSTONE	D	L	Y	55.0	86.2	60.0	54.0	1.30	68.24	0.28	0.32	
BH103	11.85-12.00	C		15		SANDSTONE	A	P	Y		85.9	85.0	80.0	0.40	93.51	0.05	0.06	
BH104	3.58-3.68	C		13		SANDSTONE	D	L	Y	48.0	85.9	49.0	42.0	0.80	60.05	0.22	0.24	
BH104	3.58-3.68	C		13		SANDSTONE	A	P	Y		84.3	84.0	80.0	0.70	92.66	0.08	0.11	
BH104	9.60-9.69	C		17		SANDSTONE	A	P	Y		84.3	52.0	47.0	1.00	71.03	0.20	0.23	
BH104	12.85-13.00	C		19		SANDSTONE	D	L	Y	47.0	84.1	84.0	80.0	0.30	82.03	0.04	0.06	
BH104	12.85-13.00	C		19		SANDSTONE	A	P	Y		84.1	55.0	50.0	0.20	73.18	0.04	0.04	
BH106	9.67-9.78	C		12		SANDSTONE	D	L	Y	44.0	85.5	85.0	68.0	2.10	76.26	0.36	0.44	
BH106	9.67-9.78	C		12		SANDSTONE	A	P	Y		85.5	65.0	55.0	0.80	77.39	0.13	0.16	
BH106	13.87-13.99	C		15		SANDSTONE	D	L	Y	58.0	86.3	86.0	81.0	0.40	83.60	0.06	0.07	
BH106	13.87-13.99	C		15		SANDSTONE	A	P	Y		86.3	49.0	44.0	0.60	69.52	0.12	0.14	

Point Load Index Test

Project No	Project Name
J306095	Fallowfield Campus

All specimens tested at **as received water content** unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction (U = unknown or random)
L - parallel to planes of weakness
P - perpendicular to planes of weakness
Dimensions
D_{ps} - Distance between platens (platen separation)
D_{ps}' - at failure (see ISRM note 6)
L_{ne} - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Borehole	Depth, m	Sample Ref	Sample Type	Specimen Ref	Specimen Depth	Rock type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions				LOAD P	De equivalent diameter, mm	Point Load Index MPa $F = (De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	W mm	Dps mm	Dps' mm	kN		I_s	$I_{s(50)}$	
BH107	3.75-3.93	C		10		SANDSTONE	D	L	Y	55.0	85.7	85.0	81.0	0.20	83.33	0.03	0.04	
BH107	3.75-3.93	C		10		SANDSTONE	A	P	Y		85.7	55.0	47.0	0.60	71.63	0.12	0.14	
BH107	6.88-7.00	C		14		SANDSTONE	A	P	Y		85.7	62.0	59.0	0.20	80.23	0.03	0.04	
BH107	7.24-7.38	C		14		SANDSTONE	D	L	Y	47.0	83.8	83.0	79.0	0.40	81.35	0.06	0.08	
BH107	7.24-7.38	C		14		SANDSTONE	A	P	Y		83.8	54.0	48.0	1.20	71.55	0.23	0.28	
BH107	11.02-11.22	C		19		SANDSTONE	D	L	Y	52.0	85.5	85.0	79.0	0.60	82.19	0.09	0.11	
BH107	11.02-11.22	C		19		SANDSTONE	A	P	Y		85.5	47.0	36.0	1.40	62.60	0.36	0.40	
BH108	11.83-11.90	C		14		SANDSTONE	A	P	Y		83.3	52.0	50.0	0.40	72.80	0.08	0.09	
BH108	15.18-15.40	C		16		SANDSTONE	D	L	Y	57.0	86.0	86.0	80.0	0.30	82.95	0.04	0.05	
BH108	15.18-15.40	C		16		SANDSTONE	A	P	Y		86.0	59.0	51.0	0.70	74.73	0.13	0.15	
BH109	8.89-9.00	C		18		SANDSTONE	D	L	Y	50.0	86.3	86.0	81.0	0.70	83.62	0.10	0.13	
BH109	8.89-9.00	C		18		SANDSTONE	A	P	Y		86.3	54.0	45.0	1.20	70.33	0.24	0.28	

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK - SUMMARY OF RESULTS

Project No	Project Name
J306095	Fallowfield Campus

Hole No.	Sample				Rock Type	Specimen Dimensions[2]			Bulk Density[2]	Water Content[1]	Uniaxial Compression[3]				Remarks
	No.	Depth (m)		type		Dia.	Height	H/D			Load Rate	Time to failure	Mode of failure	UCS	
		from	to			mm	mm		Mg/m^3	%	kN/min	secs		MPa	
BH101	16	11.20	11.40	C	Sandstone	85.29	142.11	1.7	2.09	15.1	4.5	119	Axial Cleavage	3.26	
BH102	14	10.04	10.25	C	Sandstone	84.88	171.47	2.0	2.22	11.7	4.5	410	Axial Cleavage	11.30	
BH102	17	14.38	14.66	C	Sandstone	86.2	220.2	2.6	2.15	14.4	4.5	313	Axial Cleavage	7.26	
BH104	15	6.29	6.56	C	Sandstone	85.5	148.3	1.7	2.02	12.6	4.5	131	Axial Cleavage	3.43	
BH106	14	12.92	13.24	C	Sandstone	85.3	171.5	2.0	2.28	10.7	4.5	264	Axial Cleavage	8.25	

Notes :

Test Specification : International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

1 ISRM p87 test 1, water content at 105 ± 3 °C, specimen as received at the laboratory

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

thetestinglab

Printed:01/04/2025 08:37

Table

RUCS

The Testing Lab
Unit 2 & 4, James Road
Adwick le Street,
DN6 7HH

7 - 11 Harding Street
Leicester
LE1 4DH

Analytical Test Report: P25/00241/TTL - 25-61650

Your Project Reference:	**J306095 Tetra Tech**		
Your Order Number:	1947	Samples Received / Instructed:	04/04/2025 / 04/04/2025
Report Issue Number:	1	Sample Tested:	04/04 to 14/04/2025
Samples Analysed:	7 sample(s)	Report issued:	14/04/2025

Signed

James Gane
Analytical Services Manager
CTS

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

This report shall not be reproduce except in full

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

UKAS accreditation on waters only covers the Ground water and Surface water matrices

Date of Issue: 12.03.25

Issued by: J. Gane

Issue No: 4

Rev No: 26

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Leicester
LE1 4DH

P25/00241/TTL - 25-61650

Project Reference - J306095 Tetra Tech

Analytical Test Results - Chemical Analysis

Lab Reference			482244	482245	482246	482247	482248	482249
Client Sample ID			-	-	-	-	-	-
Client Sample Location			BH103	BH107	BH108	BH108	BH109	BH109
Client Sample Type			-	-	-	-	-	-
Client Sample Number			6	6	7	11	3	7
Depth - Top (m)			1.00	1.70	2.00	4.50	0.50	1.20
Depth - Bottom (m)			1.00	2.15	2.45	4.50	0.50	1.65
Date of Sampling			-	-	-	-	-	-
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Sand	Sand	Clay	Sand	Clay	Clay
Determinant	**Units**	**Accreditation**						
Water soluble sulphate (as SO_4)	(mg/l)	u	25	23	970	34	110	120
Acid Soluble Sulphate	(%)	u	0.05	< 0.01	0.29	< 0.01	0.05	0.04
Total Sulphur	(%)	UKAS	0.08	< 0.01	0.10	< 0.01	0.03	0.03
pH Value	pH Units	MCERTS	8.7	8.6	8.2	8.8	8.2	8.7
Water Soluble Chloride	(mg/l)	u	37	5.0	20	3.8	12	33
Water Soluble Nitrate (As NO_3)	(mg/l)	u	< 1.0	< 1.0	1.1	< 1.0	5.8	< 1.0
Water Soluble Magnesium	(mg/l)	u	1.5	2.3	8.3	4.4	< 1.5	3.4
Water Soluble Ammonium Ion	(mg/l)	u	1.3	1.3	1.3	1.3	2.3	1.3

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Leicester
LE1 4DH

P25/00241/TTL - 25-61650

Project Reference - J306095 Tetra Tech

Analytical Test Results - Chemical Analysis

Lab Reference			**482250**
Client Sample ID			-
Client Sample Location			BH109
Client Sample Type			-
Client Sample Number			15
Depth - Top (m)			5.50
Depth - Bottom (m)			5.50
Date of Sampling			-
Time of Sampling			-
Sample Matrix			Sand
Determinant	**Units**	**Accreditation**	
Water soluble sulphate (as SO_4)	(mg/l)	u	< 10
Acid Soluble Sulphate	(%)	u	< 0.01
Total Sulphur	(%)	UKAS	< 0.01
pH Value	pH Units	MCERTS	8.8
Water Soluble Chloride	(mg/l)	u	2.0
Water Soluble Nitrate (As NO_3)	(mg/l)	u	< 1.0
Water Soluble Magnesium	(mg/l)	u	3.7
Water Soluble Ammonium Ion	(mg/l)	u	1.3

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P25/00241/TTL - 25-61650

Project Reference - J306095 Tetra Tech

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
482244	-	BH103	-	6	Made Ground- dark brown slightly gravelly silty sand with frequent brick fragments	-	-	46
482245	-	BH107	-	6	Reddish brown silty sand	-	-	100
482246	-	BH108	-	7	Brown slightly gravelly silty clay with rare brick fragments	-	-	77
482247	-	BH108	-	11	Reddish brown slightly gravelly silty sand	-	-	68
482248	-	BH109	-	3	Dark brown slightly gravelly silty clay with rare brick fragments organic matter	-	-	59
482249	-	BH109	-	7	Brown very silty clay	-	-	77
482250	-	BH109	-	15	Reddish brown silty sand	-	-	100

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P25/00241/TTL - 25-61650

Project Reference - J306095 Tetra Tech

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
482244	-	BH103	-	6	
482245	-	BH107	-	6	
482246	-	BH108	-	7	
482247	-	BH108	-	11	
482248	-	BH109	-	3	
482249	-	BH109	-	7	
482250	-	BH109	-	15	

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P25/00241/TTL - 25-61650

Project Reference - J306095 Tetra Tech

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preperation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
ASSO4S	MS - CL - Acid Soluble Sulphate	Oven Dried	Passing 2mm test sieve	Determination of total sulphate in soils by acid extraction followed by ICP analysis
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis
1377TS-ELT	BS1377 Total Sulphur Content by HTC	Oven dried	BS1377 : Part 1 : 2016	Total Sulphur Content testing of Soil in accordance with BS 1377 : Part 3 : 2018 + A1 : 2021 Clause 7.10 (using Eltra CS-800 Analyser)
1377MGICP	BS1377 WS Magnesium (ICP)	Oven dried	Passing 2mm test sieve	Water Soluble Magnesium testing of Soil in accordance with BS 1377 : Part 3 : 2018 + A1 : 2021 Clause 10.

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P25/00241/TTL - 25-61650

Project Reference - J306095 Tetra Tech

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided
W - No time of sampling provided for water sample
C - Received in inappropriate container
H - Contains headspace
T - Temperature on receipt exceeds storage temperature
R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
482244	-	BH103	-	6		A
482245	-	BH107	-	6		A
482246	-	BH108	-	7		A
482247	-	BH108	-	11		A
482248	-	BH109	-	3		A
482249	-	BH109	-	7		A
482250	-	BH109	-	15		A

APPENDIX G – DYNAMIC CONE PENETROMETER RESULTS

DCP w. In Situ CBR v1.1 (03/09/2018)

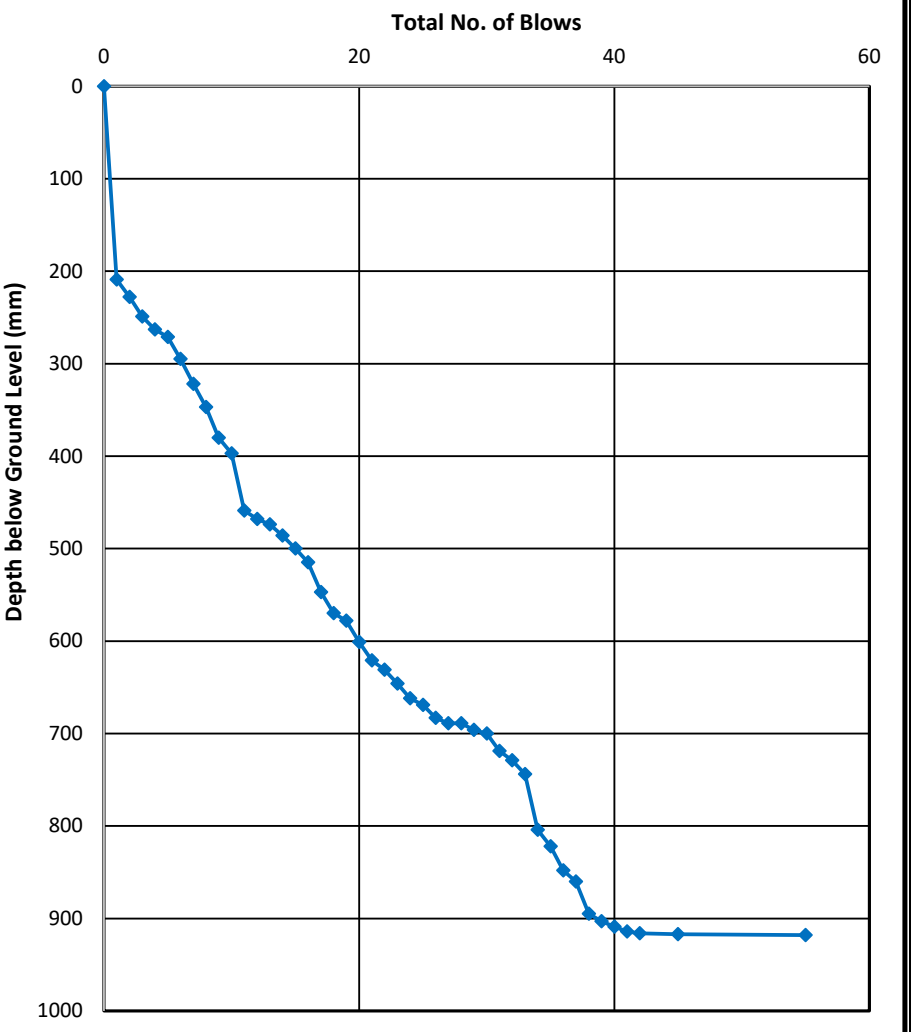
Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL103
Final Depth (m):	0.92
Easting (x):	385746.275
Northing (y):	394297.23
Elevation (m AOD):	44.07
Weather:	Temperate

Tetra Tech

2nd Floor,
11 York Street,
Manchester
M2 2AW
Tel: 0161 872 3223

TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	123	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	209	209.00	1.066
209	459	25.00	10.055
459	515	11.20	23.495
515	621	21.20	11.969
621	700	8.78	30.398
700	903	22.56	11.210
903	918	2.69	106.248

Checked by : Stephen Marwood — Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	123	0
1	1	332	209
1	2	351	19
1	3	372	21
1	4	386	14
1	5	394	8
1	6	418	24
1	7	445	27
1	8	470	25
1	9	503	33
1	10	520	17
1	11	582	62
1	12	591	9
1	13	597	6
1	14	609	12
1	15	623	14
1	16	638	15
1	17	670	32
1	18	693	23
1	19	701	8
1	20	724	23
1	21	744	20
1	22	754	10
1	23	769	15
1	24	785	16
1	25	792	7
1	26	806	14
1	27	812	6
1	28	812	0
1	29	819	7
1	30	823	4
1	31	842	19
1	32	852	10
1	33	867	15
1	34	927	60
1	35	945	18
1	36	971	26
1	37	983	12
1	38	1018	35
1	39	1026	8
1	40	1032	6
1	41	1037	5
1	42	1039	2
3	45	1040	1
10	55	1041	1

DCP w. In Situ CBR v1.1 (03/09/2018)

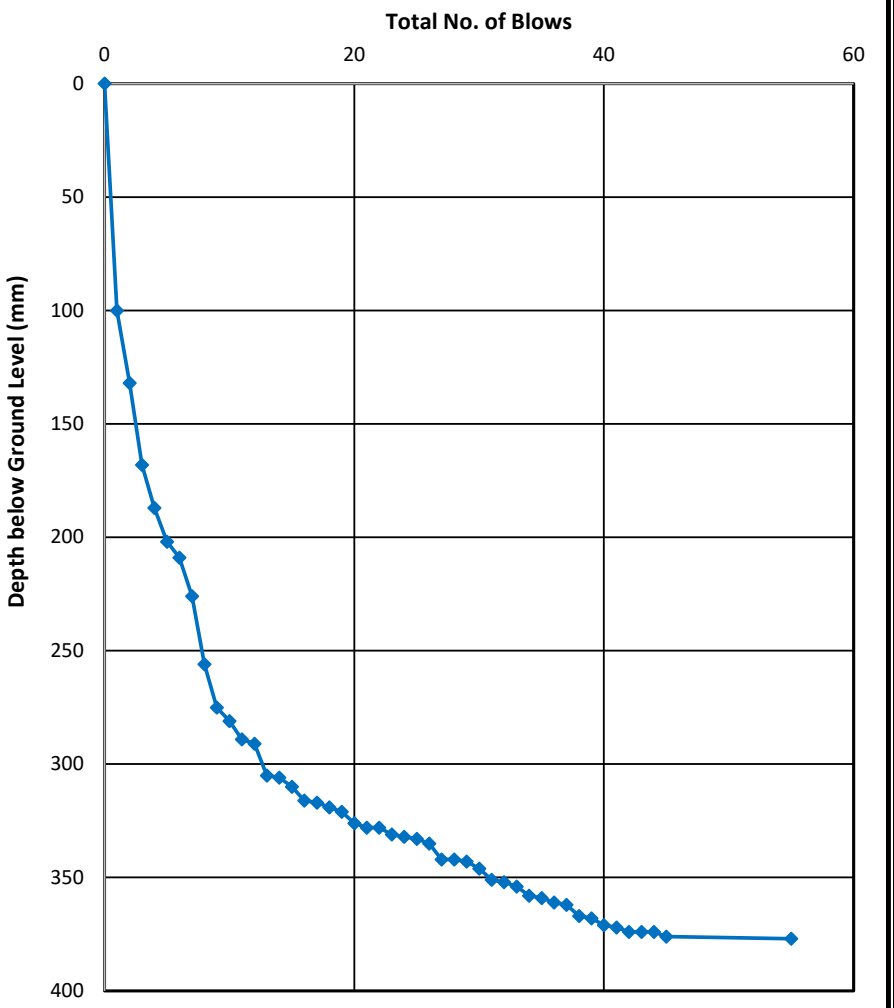
Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL107
Final Depth (m):	0.37
Easting (x):	385747.719
Northing (y):	394178.96
Elevation (m AOD):	44.21
Weather:	Temperate

Tetra Tech

2nd Floor,
11 York Street,
Manchester
M2 2AW
Tel: 0161 872 3223

TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	120	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	202	40.40	6.054
202	281	15.80	16.331
281	306	6.25	43.527
306	335	2.42	118.834
335	372	2.47	116.289
372	377	0.82	372.476

Checked by : Stephen Marwood Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	120	0
1	1	220	100
1	2	252	32
1	3	288	36
1	4	307	19
1	5	322	15
1	6	329	7
1	7	346	17
1	8	376	30
1	9	395	19
1	10	401	6
1	11	409	8
1	12	411	2
1	13	425	14
1	14	426	1
1	15	430	4
1	16	436	6
1	17	437	1
1	18	439	2
1	19	441	2
1	20	446	5
1	21	448	2
1	22	448	0
1	23	451	3
1	24	452	1
1	25	453	1
1	26	455	2
1	27	462	7
1	28	462	0
1	29	463	1
1	30	466	3
1	31	471	5
1	32	472	1
1	33	474	2
1	34	478	4
1	35	479	1
1	36	481	2
1	37	482	1
1	38	487	5
1	39	488	1
1	40	491	3
1	41	492	1
1	42	494	2
1	43	494	0
1	44	494	0
1	45	496	2
10	55	497	1

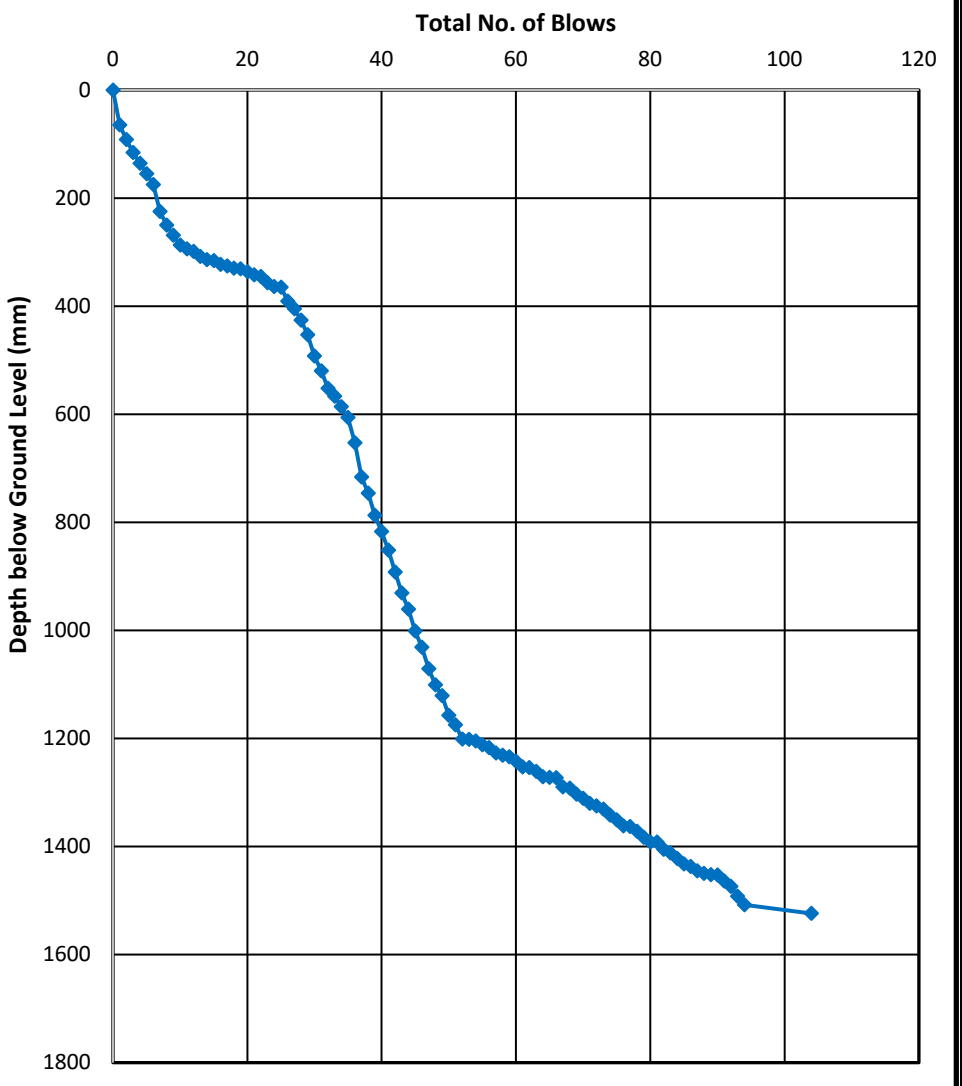
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL108
Final Depth (m):	1.54
Easting (x):	385792.011
Northing (y):	394246.62
Elevation (m AOD):	44.52
Weather:	Temperate

Tetra Tech
2nd Floor,
11 York Street,
Manchester
M2 2AW
Tel: 0161 872 3223

TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	115	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	65	65.00	3.662
65	294	22.90	11.032
294	391	6.47	41.987
391	567	25.14	9.995
567	716	37.25	6.597
716	1202	30.38	8.184
1202	1392	7.04	38.398
1392	1464	6.55	41.453
Checked by :		Stephen Marwood	Final

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	115	0
1	1	180	65
1	2	207	27
1	3	231	24
1	4	251	20
1	5	270	19
1	6	290	20
1	7	340	50
1	8	365	25
1	9	384	19
1	10	402	18
1	11	409	7
1	12	414	5
1	13	423	9
1	14	429	6
1	15	431	2
1	16	438	7
1	17	441	3
1	18	445	4
1	19	446	1
1	20	451	5
1	21	457	6
1	22	460	3
1	23	472	12
1	24	479	7
1	25	480	1
1	26	506	26
1	27	520	14
1	28	541	21
1	29	568	27
1	30	607	39
1	31	635	28
1	32	667	32
1	33	682	15
1	34	701	19
1	35	721	20
1	36	768	47
1	37	831	63
1	38	861	30
1	39	902	41
1	40	932	30
1	41	967	35
1	42	1007	40

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

1	43	1046	39
1	44	1076	30
1	45	1116	40
1	46	1146	30
1	47	1186	40
1	48	1216	30
1	49	1236	20
1	50	1272	36
1	51	1290	18
1	52	1316	26
1	53	1317	1
1	54	1320	3
1	55	1327	7
1	56	1332	5
1	57	1342	10
1	58	1346	4
1	59	1349	3
1	60	1357	8
1	61	1368	11
1	62	1369	1
1	63	1376	7
1	64	1386	10
1	65	1387	1
1	66	1388	1
1	67	1405	17
1	68	1407	2
1	69	1418	11
1	70	1426	8
1	71	1435	9
1	72	1440	5
1	73	1446	6
1	74	1457	11
1	75	1466	9
1	76	1477	11
1	77	1478	1
1	78	1487	9
1	79	1498	11
1	80	1507	9
1	81	1507	0
1	82	1520	13
1	83	1527	7
1	84	1537	10
1	85	1547	10
1	86	1552	5
1	87	1560	8
1	88	1565	5
1	89	1567	2
1	90	1568	1
1	91	1579	11
1	92	1589	10
1	93	1607	18
1	94	1623	16
10	104	1639	16

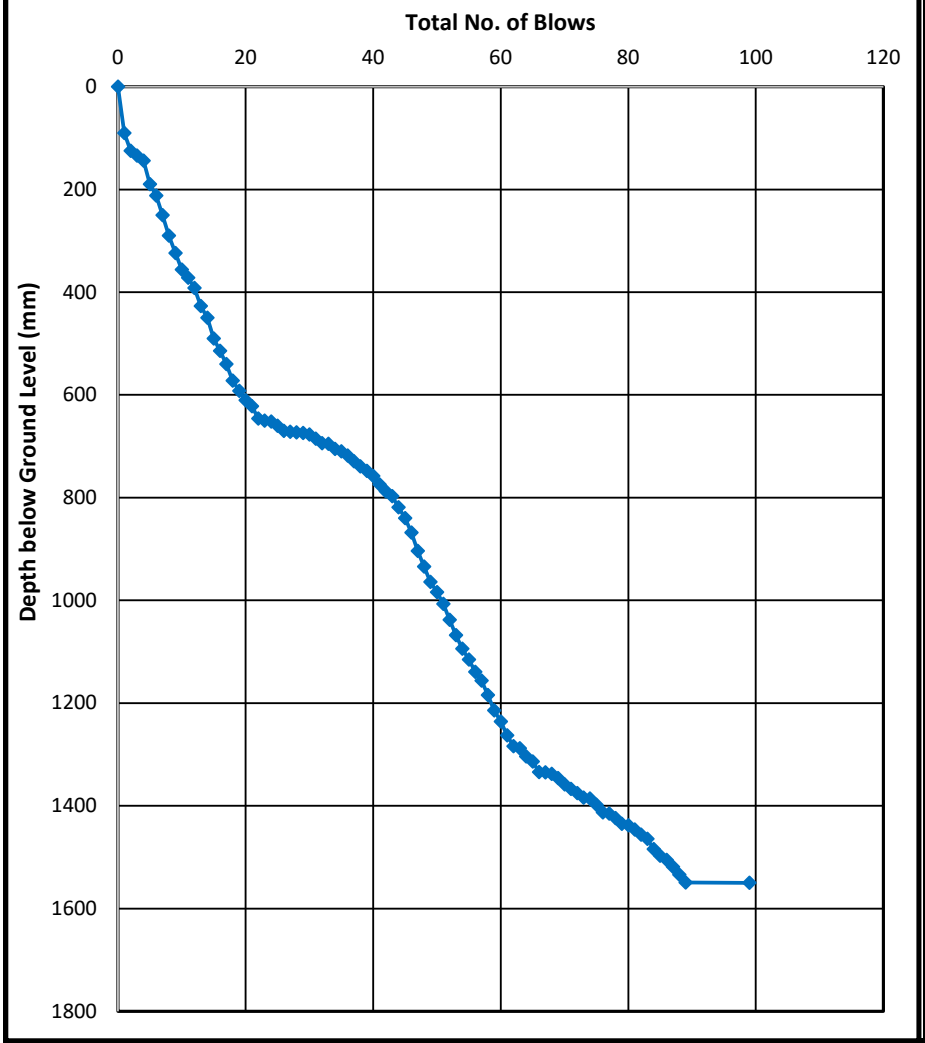
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL109
Final Depth (m):	1.55
Easting (x):	385804.437
Northing (y):	394143.87
Elevation (m AOD):	43.41
Weather:	Temperate

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TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	120	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	125	62.50	3.817
125	650	25.00	10.055
650	718	5.23	52.538
718	819	12.63	20.701
819	1288	24.68	10.191
1288	1335	11.75	22.334
1335	1435	8.33	32.114
1435	1519	10.50	25.154

Checked by : Stephen Marwood — Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	120	0
1	1	210	90
1	2	245	35
1	3	254	9
1	4	264	10
1	5	310	46
1	6	332	22
1	7	370	38
1	8	410	40
1	9	444	34
1	10	476	32
1	11	492	16
1	12	512	20
1	13	547	35
1	14	570	23
1	15	610	40
1	16	634	24
1	17	660	26
1	18	692	32
1	19	712	20
1	20	730	18
1	21	742	12
1	22	766	24
1	23	770	4
1	24	772	2
1	25	780	8
1	26	790	10
1	27	792	2
1	28	793	1
1	29	794	1
1	30	797	3
1	31	805	8
1	32	814	9
1	33	815	1
1	34	825	10
1	35	830	5
1	36	838	8
1	37	849	11
1	38	859	10
1	39	868	9
1	40	878	10
1	41	894	16
1	42	908	14
1	43	917	9
1	44	939	22
1	45	960	21

1	46	988	28
1	47	1024	36
1	48	1054	30
1	49	1084	30
1	50	1104	20
1	51	1127	23
1	52	1158	31
1	53	1188	30
1	54	1214	26
1	55	1235	21
1	56	1259	24
1	57	1276	17
1	58	1304	28
1	59	1334	30
1	60	1356	22
1	61	1383	27
1	62	1404	21
1	63	1408	4
1	64	1424	16
1	65	1434	10
1	66	1454	20
1	67	1455	1
1	68	1458	3
1	69	1466	8
1	70	1478	12
1	71	1487	9
1	72	1495	8
1	73	1504	9
1	74	1506	2
1	75	1518	12
1	76	1533	15
1	77	1535	2
1	78	1544	9
1	79	1555	11
1	80	1558	3
1	81	1566	8
1	82	1576	10
1	83	1584	8
1	84	1604	20
1	85	1617	13
1	86	1625	8
1	87	1639	14
1	88	1654	15
1	89	1669	15
10	99	1670	1

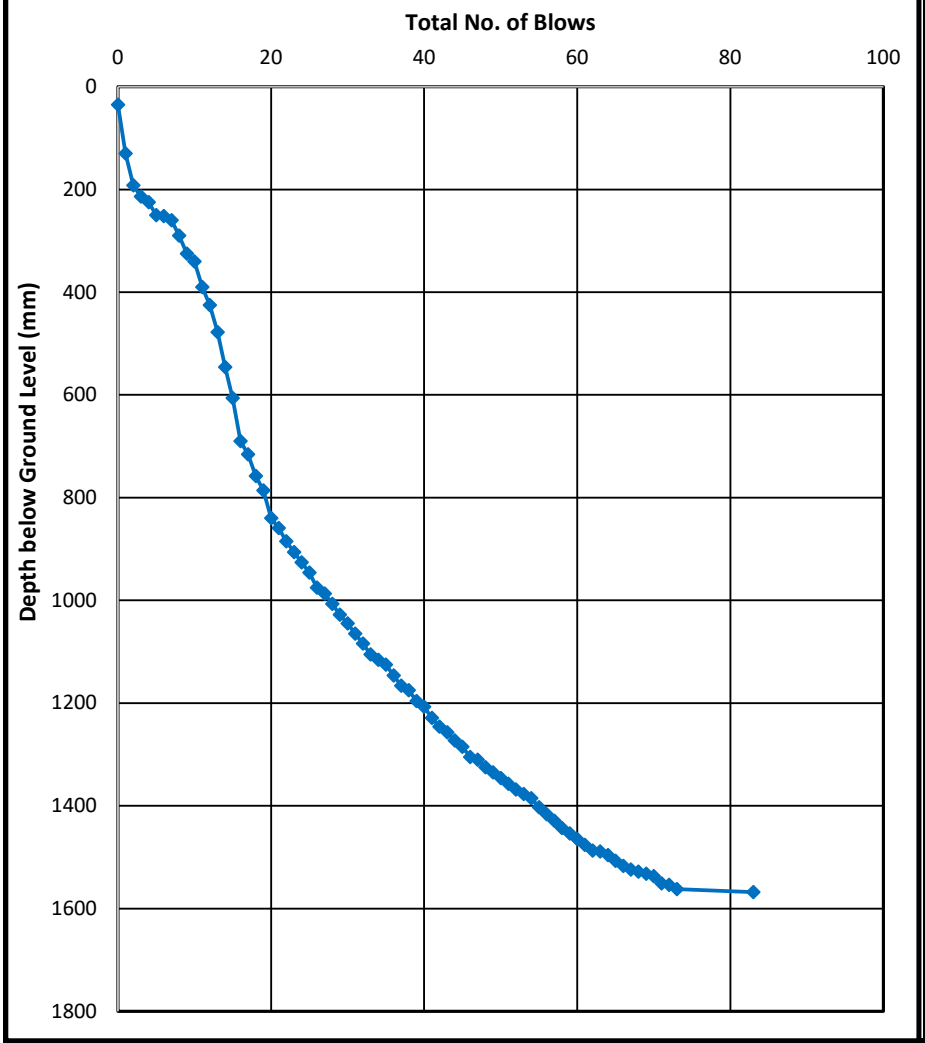
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL111
Final Depth (m):	1.53
Easting (x):	385701.029
Northing (y):	394119.37
Elevation (m AOD):	43.07
Weather:	Temperate

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TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	120	Test Number	1
Logged by:	Stephen Marwood				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
35	130	95.00	2.452
130	252	24.40	10.316
252	840	42.00	5.811
840	987	21.00	12.090
987	1146	17.67	14.513
1146	1310	14.91	17.364
1310	1403	11.63	22.588
1403	1551	9.25	28.760

Checked by :	Stephen Marwood	Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	155	35
1	1	250	95
1	2	312	62
1	3	334	22
1	4	345	11
1	5	370	25
1	6	372	2
1	7	380	8
1	8	410	30
1	9	445	35
1	10	460	15
1	11	510	50
1	12	545	35
1	13	598	53
1	14	666	68
1	15	726	60
1	16	810	84
1	17	836	26
1	18	878	42
1	19	906	28
1	20	960	54
1	21	979	19
1	22	1005	26
1	23	1026	21
1	24	1046	20
1	25	1066	20
1	26	1095	29
1	27	1107	12
1	28	1127	20
1	29	1148	21
1	30	1165	17
1	31	1185	20
1	32	1204	19
1	33	1225	21
1	34	1236	11
1	35	1245	9
1	36	1266	21
1	37	1286	20
1	38	1295	9
1	39	1316	21
1	40	1327	11
1	41	1349	22
1	42	1366	17
1	43	1377	11
1	44	1393	16
1	45	1405	12

1	46	1425	20
1	47	1430	5
1	48	1445	15
1	49	1455	10
1	50	1466	11
1	51	1477	11
1	52	1488	11
1	53	1497	9
1	54	1505	8
1	55	1523	18
1	56	1536	13
1	57	1549	13
1	58	1563	14
1	59	1574	11
1	60	1585	11
1	61	1596	11
1	62	1607	11
1	63	1609	2
1	64	1616	7
1	65	1627	11
1	66	1637	10
1	67	1644	7
1	68	1648	4
1	69	1652	4
1	70	1657	5
1	71	1671	14
1	72	1674	3
1	73	1682	8
10	83	1688	6

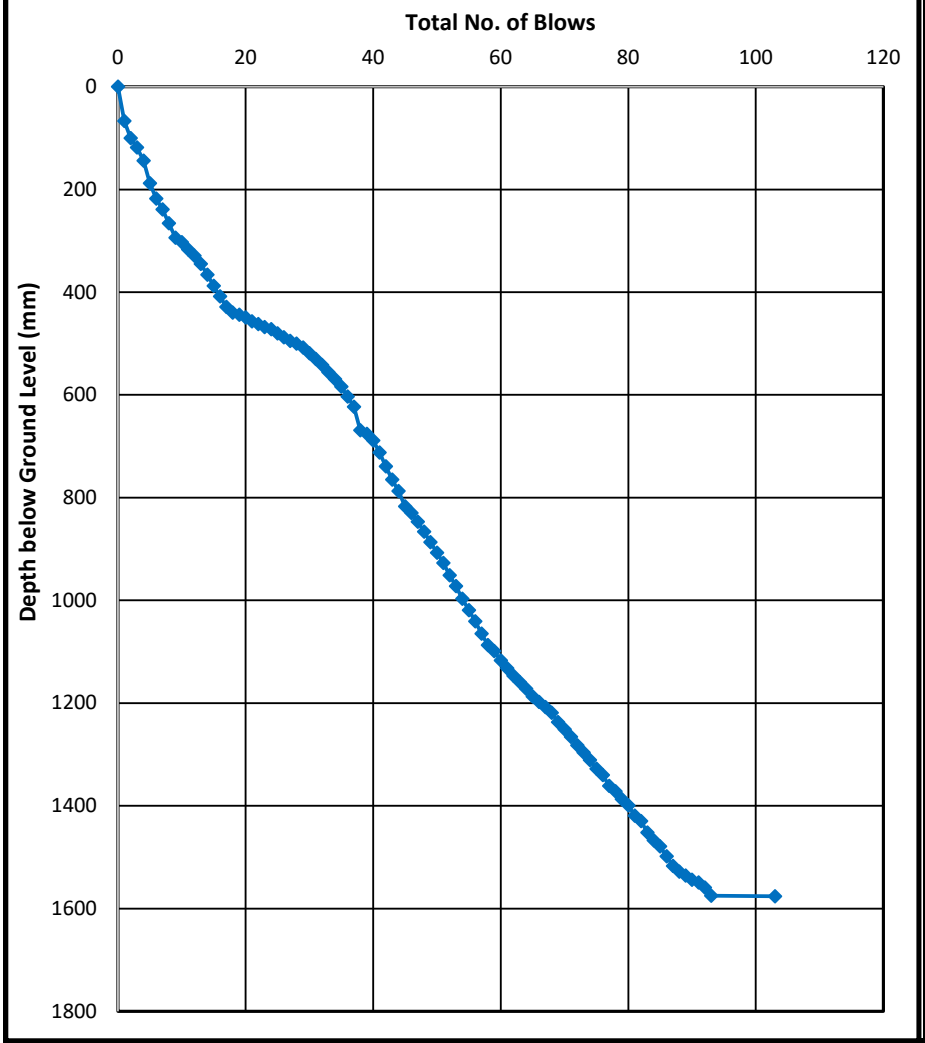
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL112
Final Depth (m):	1.56
Easting (x):	385660.758
Northing (y):	394103.10
Elevation (m AOD):	41.44
Weather:	Temperate

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TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	112	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	294	32.67	7.579
294	440	16.22	15.882
440	519	6.58	41.201
519	669	18.75	13.628
669	1099	20.48	12.417
1099	1452	14.71	17.615
1452	1536	14.00	18.558
1536	1575	9.75	27.203

Checked by : Stephen Marwood — Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	112	0
1	1	179	67
1	2	212	33
1	3	230	18
1	4	256	26
1	5	300	44
1	6	330	30
1	7	351	21
1	8	378	27
1	9	406	28
1	10	415	9
1	11	429	14
1	12	441	12
1	13	457	16
1	14	478	21
1	15	500	22
1	16	520	20
1	17	541	21
1	18	552	11
1	19	556	4
1	20	561	5
1	21	569	8
1	22	574	5
1	23	580	6
1	24	584	4
1	25	592	8
1	26	600	8
1	27	607	7
1	28	612	5
1	29	620	8
1	30	631	11
1	31	642	11
1	32	654	12
1	33	668	14
1	34	681	13
1	35	696	15
1	36	715	19
1	37	735	20
1	38	781	46
1	39	788	7
1	40	801	13
1	41	824	23
1	42	851	27
1	43	877	26
1	44	899	22
1	45	929	30

1	46	942	13
1	47	959	17
1	48	978	19
1	49	999	21
1	50	1019	20
1	51	1039	20
1	52	1063	24
1	53	1084	21
1	54	1109	25
1	55	1131	22
1	56	1153	22
1	57	1177	24
1	58	1199	22
1	59	1211	12
1	60	1229	18
1	61	1244	15
1	62	1259	15
1	63	1271	12
1	64	1284	13
1	65	1299	15
1	66	1310	11
1	67	1320	10
1	68	1331	11
1	69	1349	18
1	70	1363	14
1	71	1378	15
1	72	1394	16
1	73	1408	14
1	74	1423	15
1	75	1440	17
1	76	1452	12
1	77	1473	21
1	78	1484	11
1	79	1499	15
1	80	1511	12
1	81	1531	20
1	82	1542	11
1	83	1564	22
1	84	1579	15
1	85	1591	12
1	86	1610	19
1	87	1629	19
1	88	1640	11
1	89	1648	8
1	90	1656	8
1	91	1661	5
1	92	1671	10
1	93	1687	16
10	103	1688	1

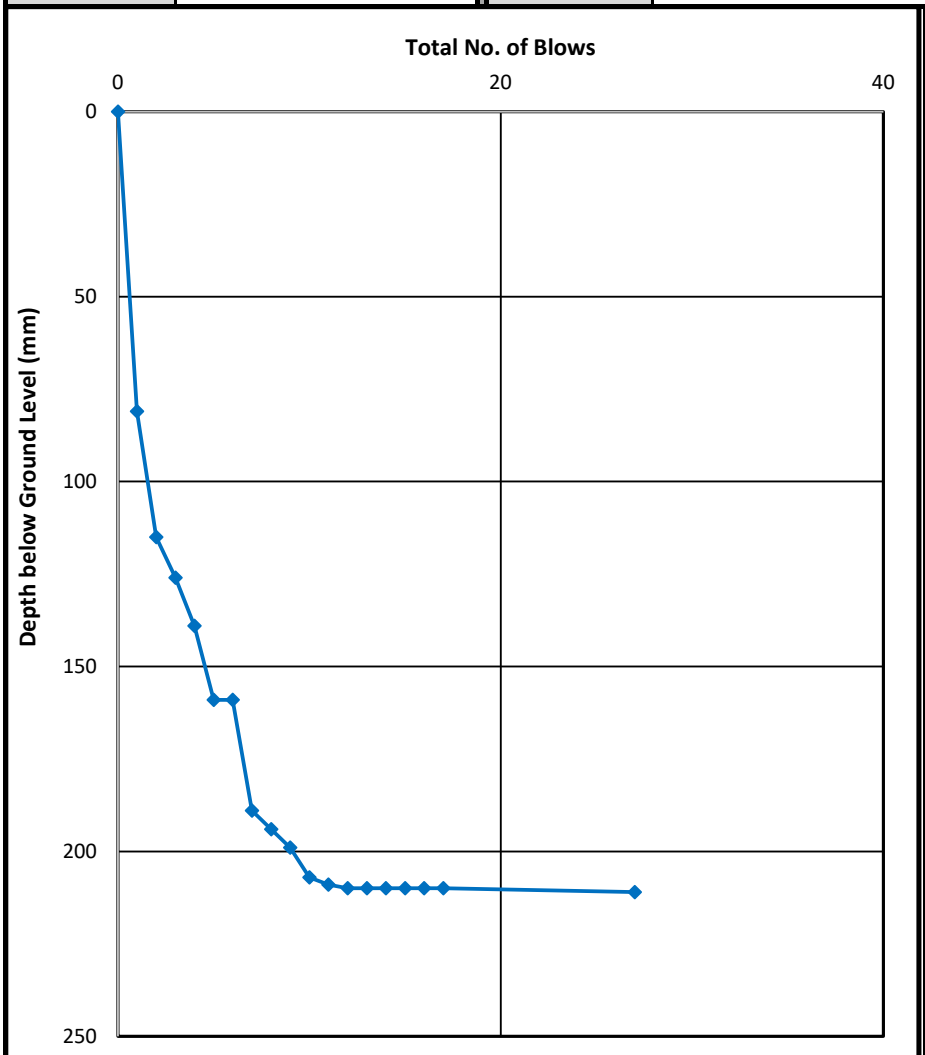
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL113
Final Depth (m):	0.21
Easting (x):	385645.385
Northing (y):	394055.44
Elevation (m AOD):	39.95
Weather:	Temperate

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TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	141	Test Number	1
Logged by:	Stephen Marwood				
Logged Date:	27/02/2025				



Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	141	0
1	1	222	81
1	2	256	34
1	3	267	11
1	4	280	13
1	5	300	20
1	6	300	0
1	7	330	30
1	8	335	5
1	9	340	5
1	10	348	8
1	11	350	2
1	12	351	1
1	13	351	0
1	14	351	0
1	15	351	0
1	16	351	0
1	17	351	0
10	27	352	1

Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	81	81.00	2.902
81	126	22.50	11.239
126	159	16.50	15.600
159	194	11.67	22.503
194	207	6.50	41.759
207	210	1.50	196.730

Checked by : Stephen Marwood Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

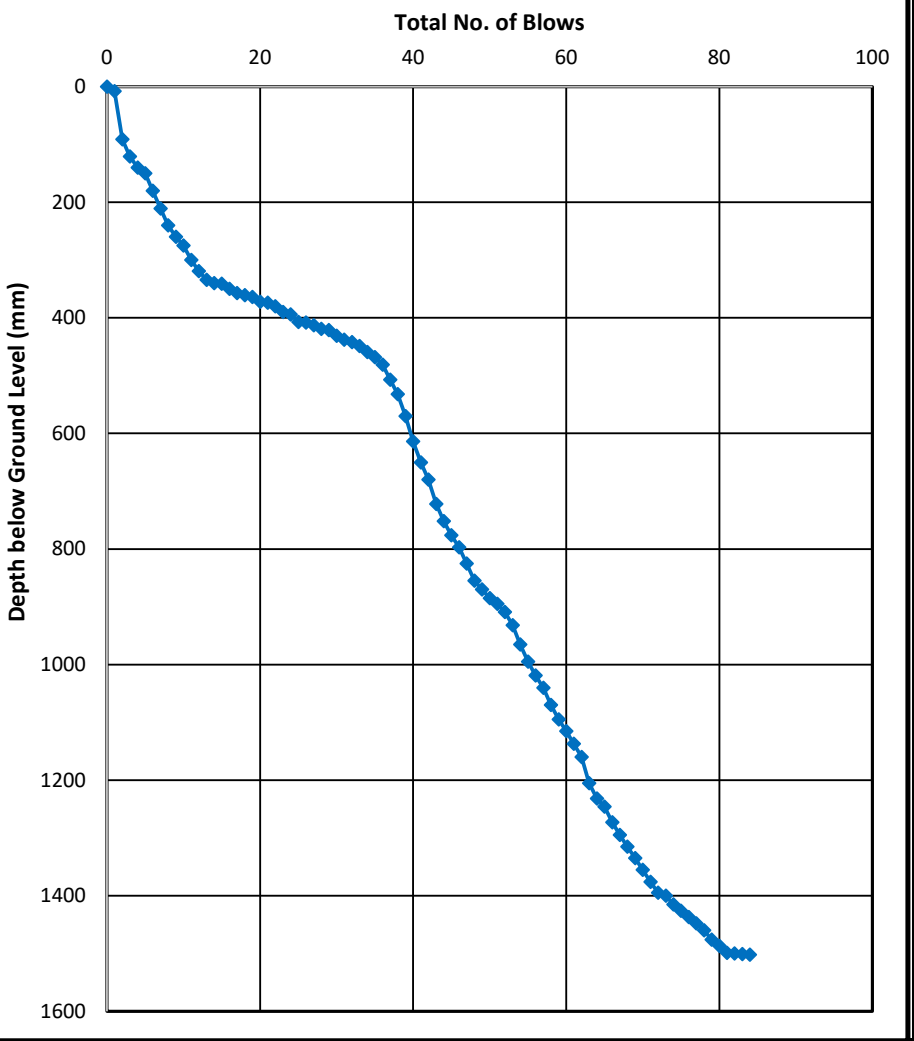
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL114
Final Depth (m):	1.50
Easting (x):	385696.155
Northing (y):	394037.89
Elevation (m AOD):	40.28
Weather:	Temperate

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TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	200	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	91	45.50	5.339
91	340	20.75	12.244
340	407	6.09	44.729
407	507	8.33	32.114
507	895	27.71	9.017
895	1335	24.44	10.297
1335	1499	13.67	19.037

Checked by : Stephen Marwood — Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	200	0
1	1	208	8
1	2	291	83
1	3	321	30
1	4	340	19
1	5	350	10
1	6	380	30
1	7	411	31
1	8	440	29
1	9	460	20
1	10	475	15
1	11	500	25
1	12	519	19
1	13	534	15
1	14	540	6
1	15	541	1
1	16	550	9
1	17	557	7
1	18	561	4
1	19	564	3
1	20	572	8
1	21	574	2
1	22	580	6
1	23	590	10
1	24	594	4
1	25	607	13
1	26	608	1
1	27	613	5
1	28	619	6
1	29	621	2
1	30	631	10
1	31	638	7
1	32	642	4
1	33	649	7
1	34	659	10
1	35	668	9
1	36	681	13
1	37	707	26
1	38	732	25
1	39	770	38
1	40	814	44
1	41	850	36
1	42	880	30
1	43	922	42
1	44	952	30
1	45	976	24

1	46	997	21
1	47	1025	28
1	48	1055	30
1	49	1070	15
1	50	1085	15
1	51	1095	10
1	52	1109	14
1	53	1132	23
1	54	1165	33
1	55	1195	30
1	56	1219	24
1	57	1240	21
1	58	1270	30
1	59	1295	25
1	60	1315	20
1	61	1337	22
1	62	1360	23
1	63	1405	45
1	64	1432	27
1	65	1446	14
1	66	1473	27
1	67	1495	22
1	68	1515	20
1	69	1535	20
1	70	1555	20
1	71	1576	21
1	72	1595	19
1	73	1600	5
1	74	1615	15
1	75	1626	11
1	76	1637	11
1	77	1648	11
1	78	1660	12
1	79	1676	16
1	80	1687	11
1	81	1699	12
1	82	1700	1
1	83	1701	1
1	84	1702	1

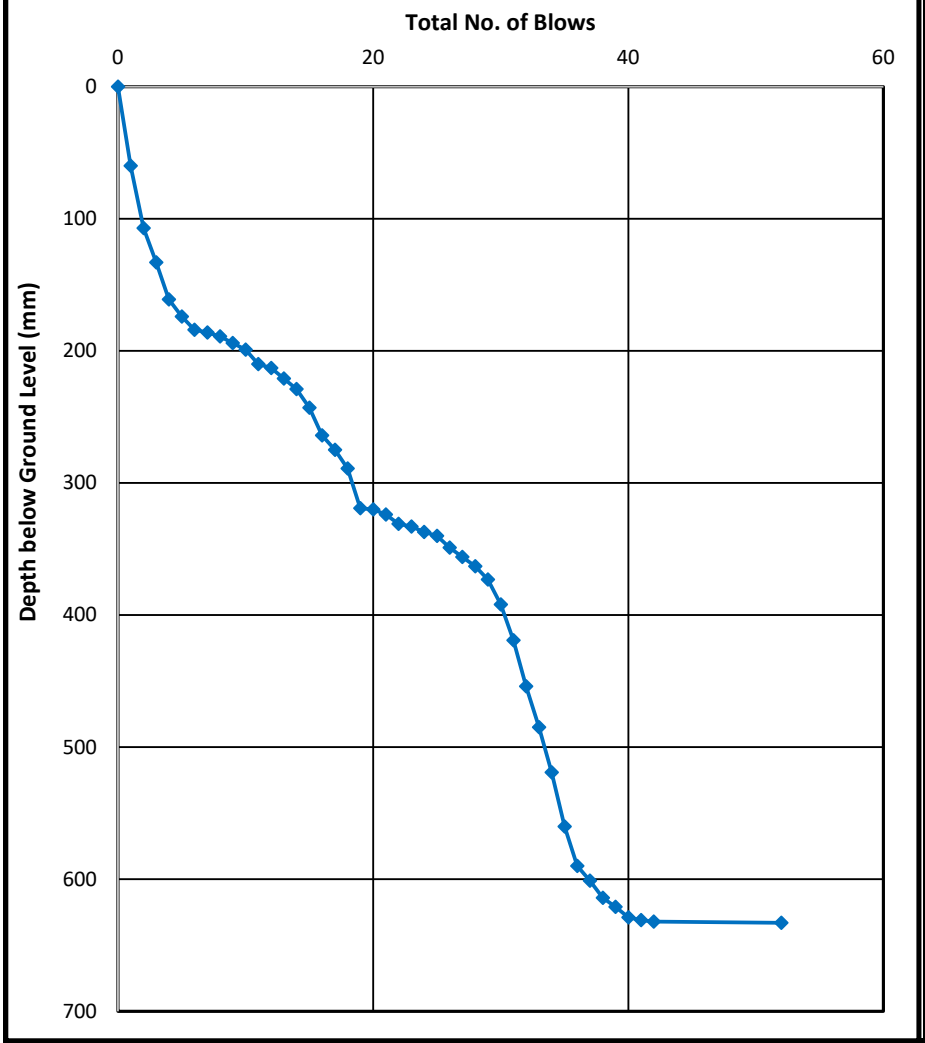
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL115
Final Depth (m):	0.63
Easting (x):	385733.694
Northing (y):	394002.08
Elevation (m AOD):	39.26
Weather:	Temperate

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TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	151	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	174	34.80	7.088
174	243	6.90	39.205
243	320	15.40	16.780
320	363	5.38	51.049
363	614	25.10	10.013
614	633	3.62	77.526
Checked by :	Stephen Marwood	Final	

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	151	0
1	1	211	60
1	2	258	47
1	3	284	26
1	4	312	28
1	5	325	13
1	6	335	10
1	7	337	2
1	8	340	3
1	9	345	5
1	10	350	5
1	11	361	11
1	12	364	3
1	13	372	8
1	14	380	8
1	15	394	14
1	16	415	21
1	17	426	11
1	18	440	14
1	19	470	30
1	20	471	1
1	21	475	4
1	22	482	7
1	23	484	2
1	24	488	4
1	25	491	3
1	26	500	9
1	27	507	7
1	28	514	7
1	29	524	10
1	30	543	19
1	31	570	27
1	32	605	35
1	33	636	31
1	34	670	34
1	35	711	41
1	36	741	30
1	37	752	11
1	38	765	13
1	39	772	7
1	40	780	8
1	41	782	2
1	42	783	1
10	52	784	1

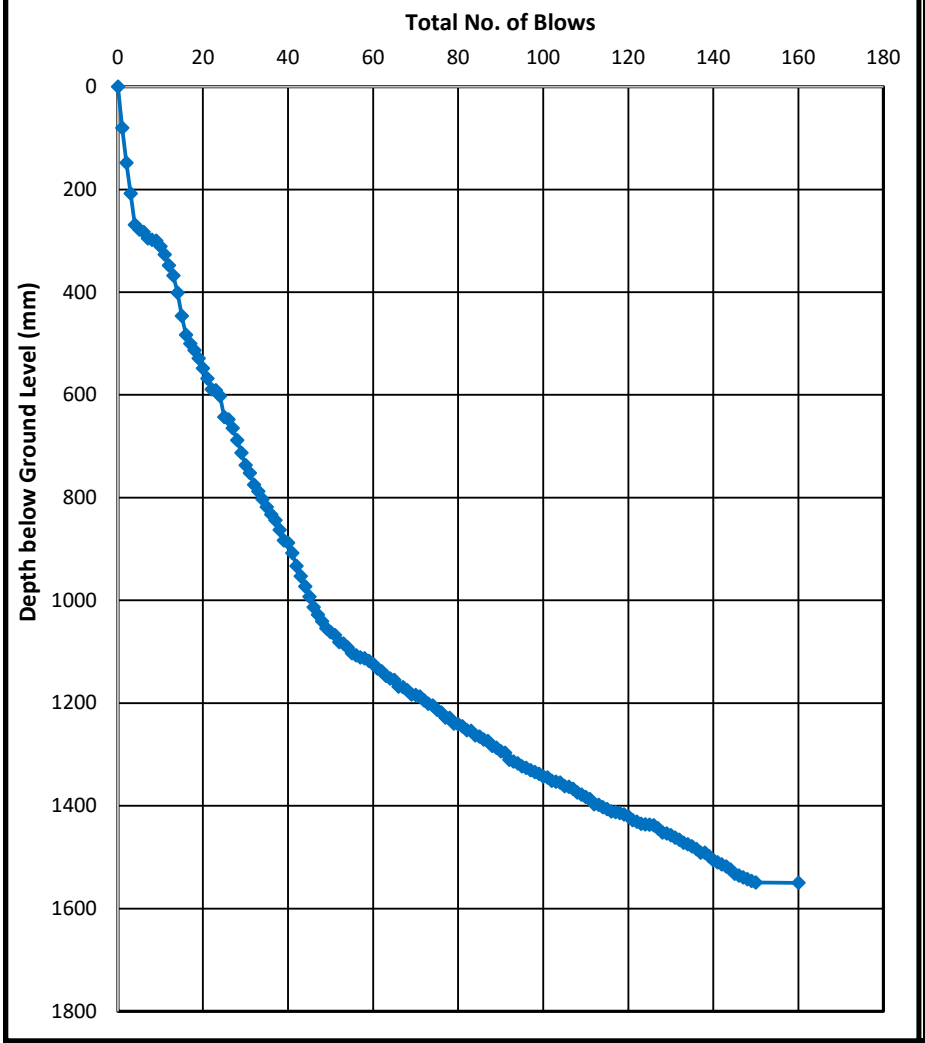
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL116
Final Depth (m):	1.50
Easting (x):	385793.482
Northing (y):	394026.61
Elevation (m AOD):	40.40
Weather:	Temperate

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TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	112	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	269	67.25	3.533
269	648	17.23	14.905
648	1062	17.25	14.884
1062	1187	5.95	45.830
1187	1254	5.58	49.038
1254	1532	4.48	61.830

Checked by :	Stephen Marwood	Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	112	0
1	1	192	80
1	2	260	68
1	3	320	60
1	4	381	61
1	5	390	9
1	6	395	5
1	7	407	12
1	8	410	3
1	9	412	2
1	10	423	11
1	11	439	16
1	12	460	21
1	13	480	20
1	14	513	33
1	15	558	45
1	16	595	37
1	17	612	17
1	18	625	13
1	19	641	16
1	20	660	19
1	21	680	20
1	22	701	21
1	23	703	2
1	24	714	11
1	25	755	41
1	26	760	5
1	27	777	17
1	28	800	23
1	29	825	25
1	30	849	24
1	31	864	15
1	32	887	23
1	33	900	13
1	34	915	15
1	35	930	15
1	36	945	15
1	37	956	11
1	38	975	19
1	39	995	20
1	40	1000	5
1	41	1020	20
1	42	1045	25
1	43	1065	20
1	44	1085	20
1	45	1105	20

1	46	1125	20
1	47	1140	15
1	48	1153	13
1	49	1166	13
1	50	1174	8
1	51	1180	6
1	52	1193	13
1	53	1196	3
1	54	1204	8
1	55	1215	11
1	56	1219	4
1	57	1223	4
1	58	1225	2
1	59	1230	5
1	60	1236	6
1	61	1245	9
1	62	1250	5
1	63	1259	9
1	64	1264	5
1	65	1267	3
1	66	1280	13
1	67	1281	1
1	68	1287	6
1	69	1295	8
1	70	1296	1
1	71	1299	3
1	72	1307	8
1	73	1313	6
1	74	1317	4
1	75	1325	8
1	76	1330	5
1	77	1340	10
1	78	1341	1
1	79	1352	11
1	80	1353	1
1	81	1357	4
1	82	1365	8
1	83	1366	1
1	84	1375	9
1	85	1377	2
1	86	1383	6
1	87	1386	3
1	88	1395	9
1	89	1399	4
1	90	1406	7
1	91	1409	3
1	92	1422	13
1	93	1426	4
1	94	1429	3
1	95	1435	6
1	96	1438	3
1	97	1443	5
1	98	1446	3
1	99	1450	4
1	100	1455	5
1	101	1457	2
1	102	1463	6
1	103	1465	2
1	104	1467	2
1	105	1474	7
1	106	1475	1
1	107	1479	4
1	108	1486	7
1	109	1490	4
1	110	1495	5
1	111	1499	4
1	112	1509	10
1	113	1510	1
1	114	1515	5
1	115	1518	3

1	116	1523	5
1	117	1524	1
1	118	1526	2
1	119	1529	3
1	120	1533	4
1	121	1540	7
1	122	1543	3
1	123	1547	4
1	124	1548	1
1	125	1549	1
1	126	1550	1
1	127	1556	6
1	128	1564	8
1	129	1566	2
1	130	1569	3
1	131	1574	5
1	132	1578	4
1	133	1584	6
1	134	1587	3
1	135	1591	4
1	136	1596	5
1	137	1603	7
1	138	1603	0
1	139	1610	7
1	140	1618	8
1	141	1622	4
1	142	1626	4
1	143	1630	4
1	144	1636	6
1	145	1644	8
1	146	1648	4
1	147	1651	3
1	148	1655	4
1	149	1658	3
1	150	1661	3
10	160	1662	1

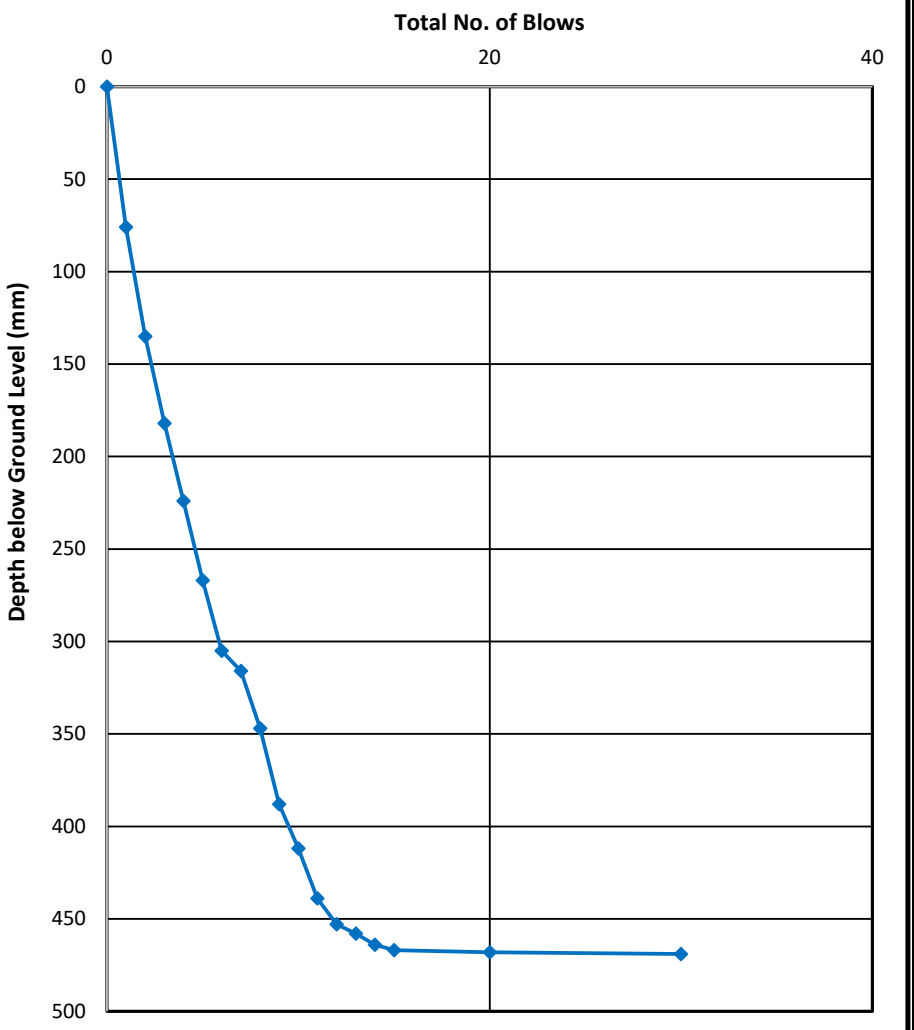
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL117
Final Depth (m):	0.47
Easting (x):	385788.8
Northing (y):	394104.11
Elevation (m AOD):	40.15
Weather:	Temperate

Tetra Tech
2nd Floor,
11 York Street,
Manchester
M2 2AW
Tel: 0161 872 3223

TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	125	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
0	76	76.00	3.104
76	316	40.00	6.118
316	388	36.00	6.839
388	453	21.67	11.697
453	464	5.50	49.824

Checked by : Stephen Marwood Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	125	0
1	1	201	76
1	2	260	59
1	3	307	47
1	4	349	42
1	5	392	43
1	6	430	38
1	7	441	11
1	8	472	31
1	9	513	41
1	10	537	24
1	11	564	27
1	12	578	14
1	13	583	5
1	14	589	6
1	15	592	3
5	20	593	1
10	30	594	1

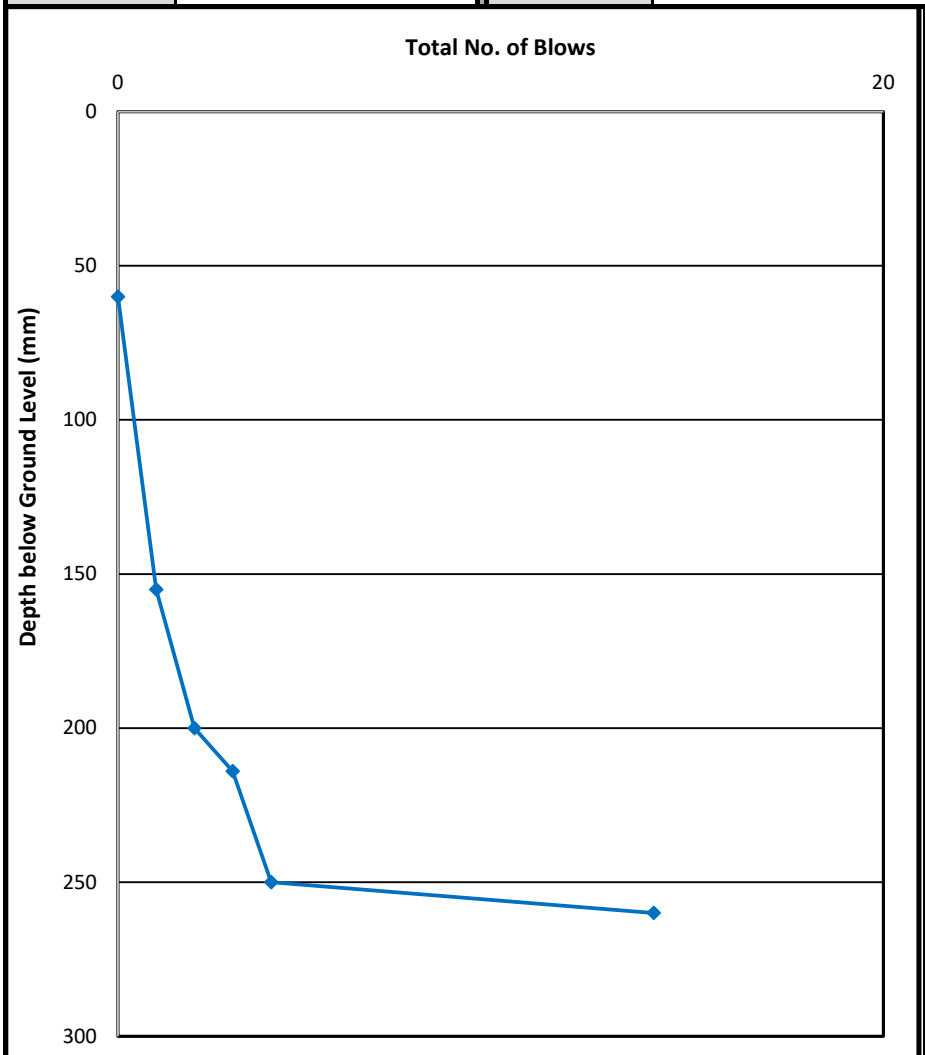
DCP w. In Situ CBR v1.1 (03/09/2018)

Client	United Utilities Ltd
Project No:	784-B069852
Hole Number:	TRL118
Final Depth (m):	0.20
Easting (x):	385842.072
Northing (y):	394078.90
Elevation (m AOD):	41.48
Weather:	Temperate

Tetra Tech
2nd Floor,
11 York Street,
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Tel: 0161 872 3223

TETRA TECH

Start Depth (mm)	0	Zero Reading (mm)	10	Test Number	1
Logged by:	Ed Martindale				
Logged Date:	27/02/2025				



Depth Range Start (mm BGL)	Depth Range End (mm BGL)	Average penetration / blow (mm)	Average CBR value (%)
60	155	95.00	2.452
155	200	45.00	5.402
200	214	14.00	18.558
214	250	36.00	6.839
250	260	1.00	301.995

Checked by :	Stephen Marwood	Final

CBR values derived from DCP by Highways specification: Log10 (CBR) = 2.48 - 1.057 (Log10 (mm/blow))

Data

No Blows	Total Blows	Reading (mm)	Penetration (mm)
0	0	70	60
1	1	165	95
1	2	210	45
1	3	224	14
1	4	260	36
10	14	270	10

APPENDIX H – CONE PENETRATION TESTING REPORT

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MANCHESTER

SOIL INVESTIGATION

CPT REPORT

Cone penetration testing
Magnetometer testing
Parameter derivation

Project Reference.: 25-32-29098-7

Report Issue No.: 01 29098_01

PROJECT:	Manchester

CLIENT:	Tetra Tech

FIELDWORK

CPT rig(s)	1.0-tonne mini-crawler CPT unit (UK27)
Date fieldwork started	12th February 2025
Date fieldwork completed	14th February 2025
Lankelma's representative	Paul Dimelow
Client's representative	Stephen Marwood

DOCUMENT CHECKING

Action	Date	Name
Completed	21/02/2025	Christopher Player
Checked	24/02/2025	Joseph Hobbs
Approved	24/02/2025	Joseph Hobbs

Issue	Date	Status
01_01	24/02/2025	Final

CONTENTS

1	INTRODUCTION	1
2	DISCLAIMER	1
3	GLOSSARY OF SYMBOLS, TERMS AND ABBREIATIONS	1
4	COMPLETED WORKS	3
5	FIELDWORK GENERAL	3
6	CONE PENETRATION TESTS	3
6.1	*CPT Data Reduction and Presentation*	*4*
6.2	*In-situ Stress Conditions*	*5*
6.3	*Soil Unit Weight*	*6*
6.4	*Soil Behaviour Type*	*6*
6.5	*Soil Behaviour Type (SBT)*	*6*
6.6	*Soil Behaviour Type Index – I_c*	*11*
6.7	*Relative Density*	*11*
6.8	*Undrained Shear Strength*	*12*
6.9	*Overconsolidation Ratio*	*13*
6.10	*SPT N60 Values*	*14*
6.11	*Friction Angle*	*15*
6.12	*Coefficient of Volume Change*	*16*
6.13	*Young's Modulus*	*17*
7	GENERAL INTERPRETATION NOTES	18
8	MAGNETOMETER TESTING	19
9	REFERENCES	21

Appendix A	SUMMARY TABLES
Appendix B	GENERAL INFORMATION
Appendix C	CONE PENETRATION TEST RESULTS
Appendix D	SOIL BEHAVIOUR TYPE RESULTS
Appendix E	PARAMETER RESULTS 1 – s_u, m_v, OCR, SBT, I_c
Appendix F	PARAMETER RESULTS 2 – SPT N60, Phi, D_r, E, I_c

1 INTRODUCTION

At the request of Tetra Tech, a soils investigation was carried out on project *Manchester*.

Site location:

(In the general region of)

Fallowfield
Manchester
M14 6YY

2 DISCLAIMER

The information contained in this report and all other associated reporting deliverables supplied in digital data files and AGS format data files referenced within this report (collectively "Report") are for the sole benefit of Lankelma's client ("Client") identified at the front of this report.

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3 GLOSSARY OF SYMBOLS, TERMS AND ABBREIATIONS

SYMBOLS (excluding base units)

B_q	Pore pressure ratio. The net pore pressure normalized with respect to the net cone resistance: $B_q = (u_2 - u_0)/(q_t - \sigma_v)$
c_{vh}	Coefficient of consolidation. Subscript vh indicates some combination of horizontal and vertical flow when assessed from CPTu dissipation tests.
E	Young's modulus (generic, E' and E_u apply to drained and undrained deformation conditions respectively)
F_r	Normalised friction sleeve resistance: $F_r = f_s / (q_c - \sigma_v)$
f_s	Friction sleeve resistance: The total frictional force acting on the friction sleeve, F_s, divided by its surface area A_s: $f_s = F_s / A_s$
g	Gravitational field strength: g = 9.81 N kg^{-1}
G	Shear modulus (generic, G_0 applies to small strain conditions, G_u applies to undrained shear (G at existing effective stress) and $G_{\%}$ applies to stress at variable % mobilised yield stress (e.g. G_{50}))

s	Specific gravity of solids
I_c & I_{SBT}	Soil Behaviour Type Index: Continuous numerical representations of Robertson soil behaviour type classification charts. I_c and I_{SBT} apply to the Robertson (1990) and Robertson and Cabal (2010) classification charts respectively.
	Soil Behaviour Type Index: Continuous numerical representation of Robertson & Cabal (2010) soil behaviour type classification chart based on dimensionless parameters.
I_R	Rigidity Index: Ratio of shear modulus to undrained shear strength, $I_R = G_u/s_u$
k	Coefficient of permeability with units of velocity
m_v	Coefficient of compressibility: $m_v = 1/M'$
m'	Pre-consolidation (yield) stress exponent (section 0).
M'	Constrained modulus
q_c	Cone resistance: The total force, Q_c, acting on the cone, divided by the projected area of the cone, A_c: $q_c = Q_c/A_c$
Q_t	Normalised cone resistance (method 1): $Q_t = (q_c - \sigma_v)/\sigma'v$
Q_{tn}	Normalised cone resistance where normalisation varies with soil type. See section 6.5.
q_t	Corrected tip resistance: The cone tip resistance q_c corrected for pore water pressure effects on the cone shoulder
$q_{t\text{-}net}$	Net cone resistance: $q_{t\text{-}net} = q_t - \sigma_v$. Where q_t is unavailable q_c is applied
q_{t1}	Normalised cone resistance (method 2): $q_{t1} = (q_t)/(\sigma'_v)^{0.5}$
Dr	Relative density (percentage)
R_f	Friction ratio: The ratio, expressed as a percentage, of the sleeve friction, f_s, to the cone resistance, q_c: $R_f = (f_s/q_c) \cdot 100$
s_u	Undrained shear strength (generic)
u_0	Equilibrium pore pressure
u_2	Measured pore pressure: Dynamic pore pressure measured at the shoulder position (u_2) during penetration and dissipation tests. $u_2 = \Delta u_2 + u_0$
Δu_2	Excess (or differential) pore pressure: $\Delta u_2 = u_2 - u_0$
V_s, V_p	Shear wave velocity, V_s, and pressure wave velocity, V_p. Measured with use of a seismic receiver

Greek

γ	Unit weight of soil
γ_w	Unit weight of water
ρ	Volumetric mass density (or specific mass) of soil: $\rho = \gamma/g$
σ_v	Total overburden stress
σ'_v	Effective overburden stress
σ_{atm}, P_a	Reference atmospheric stress: σ_{atm} = 101.3 kPa

TERMS AND ABBREVIATIONS

Cone or 'tip': The conical tip of the cone penetrometer. This is sometimes referred to as the 'point' in other literature

CPT: Cone penetration test

CPTu: Cone penetration test using a penetrometer with pore pressure measurement (piezocone).

Friction sleeve: The section of the cone penetrometer upon which the sleeve friction is measured, located behind the conical tip.

HOC: Heavily overconsolidated

LOC: Lightly overconsolidated

mBGL: Meters below ground level

NC: Normally consolidated

OC: Overconsolidated

Penetration length: CPT test length without correction for inclination

Piezocone: A cone penetrometer with a pore pressure sensor (u_2 or u_1 position).

Seismic cone: A cone penetrometer with a seismic receiver incorporated.

Dynamic pore pressure: The pore pressure measured during penetration (u_2 or u_1)

Soil behaviour type, or 'SBT': A classified soil type according to a classification system based on CPT or CPTu measurements.

Rod string: The series of hollow tube push rods that transmit thrust force to the penetrometer.

Zero value(s) or baseline value(s): The analog or digital output of a sensor (or set of sensors) with no load applied.

4 COMPLETED WORKS

- 8 nr. combined magnetometer-cone penetration tests with pore pressure measurement (CPTu)
- Factual report including point data interpretation of selected parameters

Appendix A contains tabulated details of the works completed together with analysis results where applicable.

5 FIELDWORK GENERAL

Fieldwork was performed with a 1.0-tonne mini-crawler CPT unit (UK27) equipped with a 15.0-tonne capacity hydraulic ram set.

The Client was responsible for the positioning and re-survey of all investigative locations.

The target depth for the investigation was 6 m below ground level. Table 3 details the final test depths and reasons for test termination (*refusal factor).* Where required, each penetration refusal decision was verbally confirmed with the Client's on-site representative.

6 CONE PENETRATION TESTS

Cone penetration testing was carried out in general accordance with BS ISO 22476-1:2022.

Penetrometer measurements included cone tip resistance, friction sleeve resistance and dynamic pore water pressure sampled at a 10 mm resolution.

Penetrometers were calibrated in accordance with BS ISO 22476-1:2022 and ISO 376:2011 within 6 months of the fieldwork completion. Copies of all calibration certificates for the cones used are provided in Appendix B.

The piezometer filter element was HDPE plastic with a nominal filtration of 40 to 60 microns. The filter was vacuum saturated in a > 99.9% vacuum under 1.5 Pa.s vegetable glycerine oil for > 7 days prior to mobilisation. The pore pressure system was vacuum saturated in the disassembled state under 0.042 Pa.s monopropylene glycol and assembled under oil prior to each test. The u_2 filter position was used for all piezocone tests.

At intervals during the fieldwork, the penetrometer was temperature stabilised in a water bath to obtain stabilised zero load baseline values (after extraction from the water). This was done prior to each test, or approximately every 30 m of testing where the final depths were relatively shallow, when larger zero drifts were observed, or when changing penetrometer. The purpose of this procedure is to prevent transient temperature effects from influencing the strain gauge sensors, so that representative baseline values may be subtracted from the data collected during penetration - where temperature is controlled, and temperature effects are corrected for based on the magnitude and rate of change in temperature. Additionally, it enables more reliable assessment of long-term shift in the baseline output of the sensors.

Penetrometer dimensional measurements and tolerance checks were obtained prior to each test, or following each 20-60 m of testing, depending on aggressiveness of ground conditions and closeness of prior measurements to tolerance limits. The tip measurement was based on the largest diameter portion of the tip (comprising the conical part, u_2 pore pressure filter and 'equal end area piece' adjacent to the friction sleeve), while the sleeve measurement was obtained at both ends of the sleeve and averaged for the purpose of determining the surface area.

6.1 CPT DATA REDUCTION AND PRESENTATION

The CPT results are presented in Appendix C. The corrected cone resistance (q_t), local side friction (f_s), dynamic pore water pressure (u_2), friction ratio (R_f) and inclination are all presented against depth and elevation in accordance with BS ISO 22476-1:2012. CPT data and the associated derived geotechnical parameters are included in the 4.0 data file provided.

The cone tip and sleeve force measurements were converted to pressure using the measured tip and sleeve diameters.

Cone tip and sleeve force measurements were converted to pressure using the field measured dimensions of the penetrometer.

For piezocone tests the total cone resistance (or 'corrected cone resistance'), q_t, was calculated according to the formula

$$q_t = q_c + u_2 (1 - a)$$

Where a is the 'net area ratio' of projected shaft area divided by projected face area, and 1- a is the proportion of cross-sectional area between the cone tip and penetrometer body where pore pressures (positive or negative) can act to add or subtract from the total external axial force on the tip. The difference between measured and corrected values is largest in low strength collapsible soils with large excess pore pressures. The percentage adjustment is described by the curves on the chart below for a = 0.8:

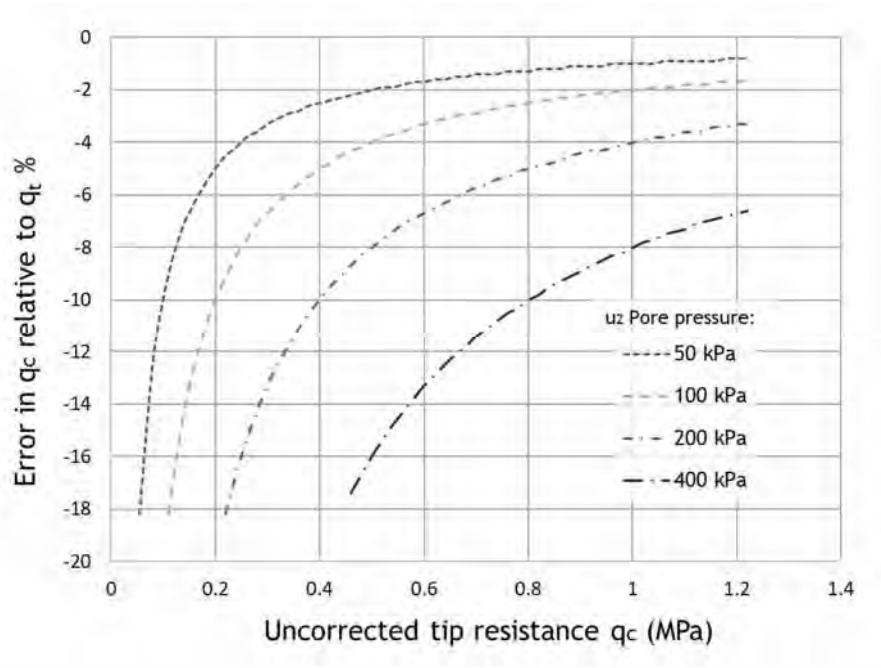


Figure 6-1 Uncorrected tip with % error for various pore pressure values

All penetrometers had equal sleeve end areas and no correction for pore pressure effects were applied to the sleeve readings.

Penetration length readings were corrected for inclination and sleeve readings were depth corrected for the dimensional offset between cone tip and sleeve during post processing.

Rod spikes (artefacts of the pause for push rod addition) were filtered from the cone tip and sleeve data and replaced with an interpolated value.

The data was re-sampled from 10 mm resolution to 20 mm to reduce the size of the data set to a more manageable size for end users. A 20 mm resolution is within the intrinsic influence zone of the cone tip measurement and the loss of meaningful resolution is negligible.

Raw data plots are presented in Appendix C and include the intermediate interpretation parameters friction ratio, R_f, and pore pressure ratio B_q. For piezocone tests q_t is reported on all logs, and q_c only appears in the digital AGS data.

Geotechnical parameters appropriate for drained and undrained cone penetration conditions were derived for corresponding drained and undrained derived soil behaviour types (SBTs) respectively, however, to account for uncertainty in the SBT correlation with drainage behaviour, all parameters were derived over a range of transitional soils within the range $2.4 < I_c < 2.7$ (see section 6.6). Geotechnical parameter plots are presented in Appendix D onwards.

6.2 IN-SITU STRESS CONDITIONS

An estimate of the equilibrium pore pressure and total and effective vertical stress states is required for derivation of net and normalised readings required for interpretation of most soil parameters obtained from the CPT and dissipation test.

The total vertical stress with depth was calculated as the sum of the derived soil unit weight above a given depth:

$$\sigma_{v0} = \sum_{i=1}^{n} \gamma_i \, h_i$$

Where γ_i is the soil unit weight (kN/m^3) assigned to the depth increment i, h_i is the depth increment (m) and n is the total number of increments above the considered depth.

See section 6.3 for information on the applied empirical estimate of soil unit weight.

An arbitrary phreatic surface of 3.00 mBGL was applied in the calculation of effective stress.

Note: The term phreatic surface is used here and it is assumed that that the piezometric level measured by the piezometer, under hydrostatic conditions, coincides with the phreatic surface. The phreatic surface reported is intended to provide information about pore pressure distribution assumed for calculation purposes and may not represent the true position of the groundwater table or perched water bodies. Complex groundwater pressure distributions will be applied if they are observed from the measurements and are sufficiently well defined.

6.3 SOIL UNIT WEIGHT

The soil unit weight was estimated using the following method proposed by Robertson (2010b).

$$\frac{y}{y_w} = 0.27\,Log(R_f) + 0.36\,(Log(q_t/R_f)) + 1.236$$

Throughout pre-drilled zones (inspection pits or drill-out) the soil was assigned a nominal unit weight of 17 kN/m^3.

For depths where the friction sleeve resistance measurement was less than zero due to measurement limitations, the friction sleeve resistance input parameter was substituted with a nominal 1.0 kPa resistance for the purpose of obtaining an approximate soil unit weight necessary for estimation of total vertical stress over the entire test profile.

6.4 SOIL BEHAVIOUR TYPE

6.5 SOIL BEHAVIOUR TYPE (SBT)

The data have been interpreted using 4 soil behaviour type schemes: Robertson (1990, 2010, 2016) and Schneider et al, 2008. The Robertson (1990) scheme is very widely used and forms the bases of the layer analysis whereby the profile is split into approximate zones of common classification or classification variance. The Robertson (2010 & 2016) and Schneider at al methods are less widely used in general practice but can provide classification that is more relevant to the design problem in many instances and the reader is directed to the relevant references for additional information.

For all SBT classification systems discussed in this report, it should be noted that:

- The systems provide a general soil type that tends to show biased towards the soil fraction that dominates the mechanical behaviour in relation to the CPT parameters on which the system is based.

- Significant bonding/microstructure will influence derived soil type (Robertson 2022).

- If cohesive soils are dry and/or heavily overconsolidated, the classification tends to shift towards a coarser soil type (or lower I_c index).

- Strictly, all SBT systems are applicable to saturated or near saturated soils. If applicable, performance of SBT systems in dryer soils should receive due scrutiny.

- While the repeatability and behavioural bias of the SBT is often of practical benefit, the classification may not be an appropriate substitute for classification based on particle size grading and/or consistency (Atterberg indices).

A dedicated SBT comparison log is provided in Appendix D.

Robertson (1990, 2010)

The Robertson 1990 and 2010 SBT classification systems, based on the same chart shown in Figure 6-3, provides 9 classification zones as a function of q_t (or q_c) and f_s.

The 1990 system is based on dimensionless stress normalised parameters of cone resistance (Q_t) and friction ratio (F_r). Where:

$$Q_t = \left(\frac{q_t - \sigma_{v0}}{\sigma'_{v0}}\right)$$

$$F_r = \left(\frac{f_s}{q_t - \sigma_{v0}}\right)$$

Robertson (2009) recommended use of an improved stress normalisation method for tip resistance (Q_{tn}) that uses a stress exponent n that varies with the derived soil type and is found iteratively (starting with Q_t) from:

$$Q_{tn} = \left(\frac{q_t - \sigma_{v0}}{p_a}\right) \cdot \left(\frac{p_a}{\sigma'_{v0}}\right)^n$$

and

$$n = 0.318(I_c) + 0.05\left(\frac{\sigma'_{v0}}{p_a}\right) - 0.15$$

where I_c is the SBT index discussed in section 6.6, and is continuous function of Q_{tn} and F_r.

Three iterations of Q_{tn} were performed during data processing, with the initial calculation based on an average of the non-normalised and normalised values of I_c for the upper 6 m to limit the effects of overconsolidation at shallow depth.

While the classification based on normalised parameters is more accurate, particularly for NC soils exceeding ~15 m depth, the classification is often significantly in error (artificially granular/drained) at shallow depth (< ~1-3 m). The error at shallow depth is largely associated with the potentially large difference between the estimated vertical effective stress (applied in normalisation of q_t and f_s) and the unknown horizontal stress influencing penetration resistance, especially at high OCR state.

Robertson (2010) proposed a non-normalised version of the 1990 chart which uses dimensionless cone resistance (q_c/Pa) and friction ratio (Rf). SBT classification according to this chart is generally more reliable at shallow depth in Lankelma's experience.

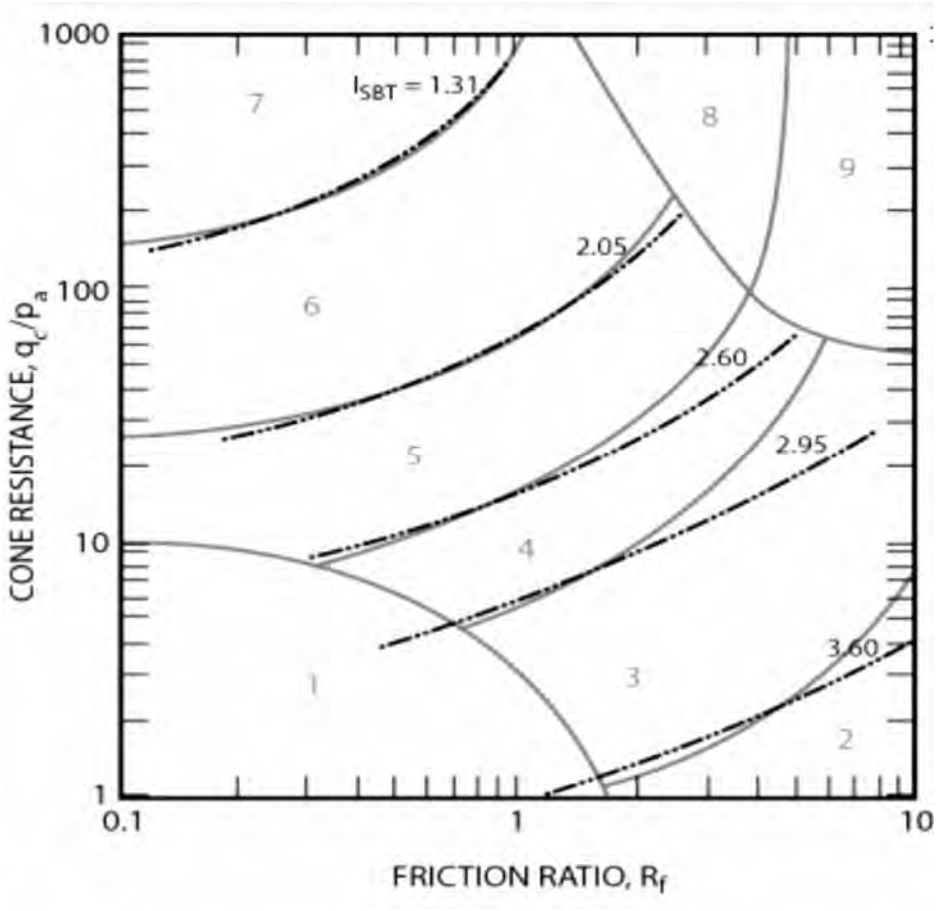


Figure 6-2 Non-normalised SBT chart by Robertson et al. (2010) based on dimensionless cone resistance (qc/Pa) and friction ration, Rf, showing contours of SBT index I_{SBT} (denoted I_c on the test plots). The chart is equally applicable to normalised tip resistance (Q_t, Q_{tn}) and normalised friction ratio (F_r) values using the same dimensionless scales.

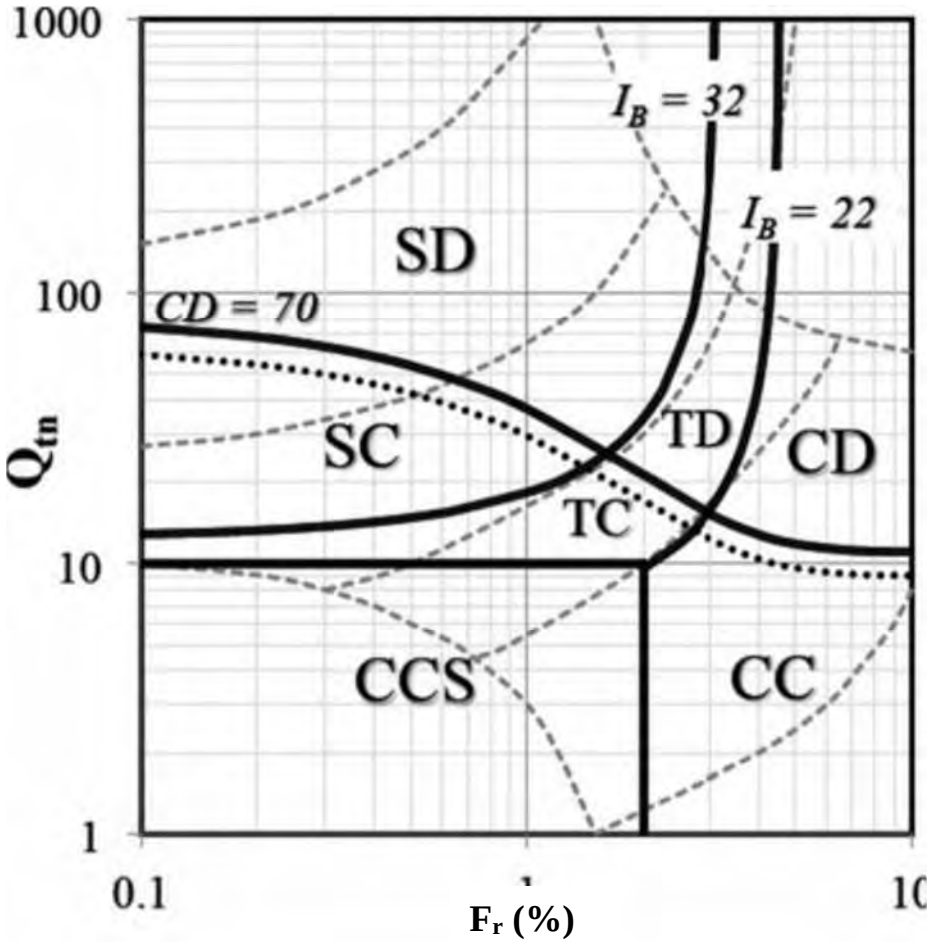
Table 1 Robertson (1990, 2010) soil behaviour type zone descriptions

Zone	**Soil Behaviour Type (SBT)**		
1	Sensitive fine-grained	6	Sands - clean sand to silty sand
2	Organic soils	7	Gravelly sand to sand
3	Clays – clay to silty clay	8*	Very stiff/dense sand to clayey sand[1]
4	Silt mixtures - clayey silt to silty clay	9*	Very stiff fine grained[1]
5	Sand mixtures – silty sand to sandy silt	*Heavily overconsolidated or cemented*	

[1]Note zones 8 and 9 appear as *'Very stiff/dense sand to clayey sand – HOC or cemented'* and *'Very stiff fine grained – HOC or cemented'* within the soil unit descriptions of plots in Appendix D.

Robertson 2016

Using the same Q_{tn} - F_r space as the 1990 and 2010 charts, Robertson (2016) proposed an alternative purely behavioural classification system that places less emphasis on classification according to composition/textural properties and more emphasis on mechanical behaviour – namely the tendency of the soil to dilate or collapse during large strain shear, and sensitivity.



Zone	**Soil Behaviour Type (SBT)**
CCS	Clay-like – contractive - sensitive
CC	Clay-like – Contractive
CD	Clay-like – Dilative
TC	Transitional - Contractive
TD	Transitional - Dilative
SC	Sand-like - Contractive
SD	Sand-like - Dilative

Figure 6-3 Robertson 2016 soil behaviour type classification chart and zone descriptions

Schneider *et al.* (2008)

Schneider *et al.* (2008) proposed a classification system based on the normalised pore pressure B_q and normalised tip resistance Q_t. This system is particularly useful for fully saturated soils with a repeatable and dynamic pore pressure response.

A set of logs showing both the Robertson and Schneider et al. classification results are provided for comparison in Appendix D.

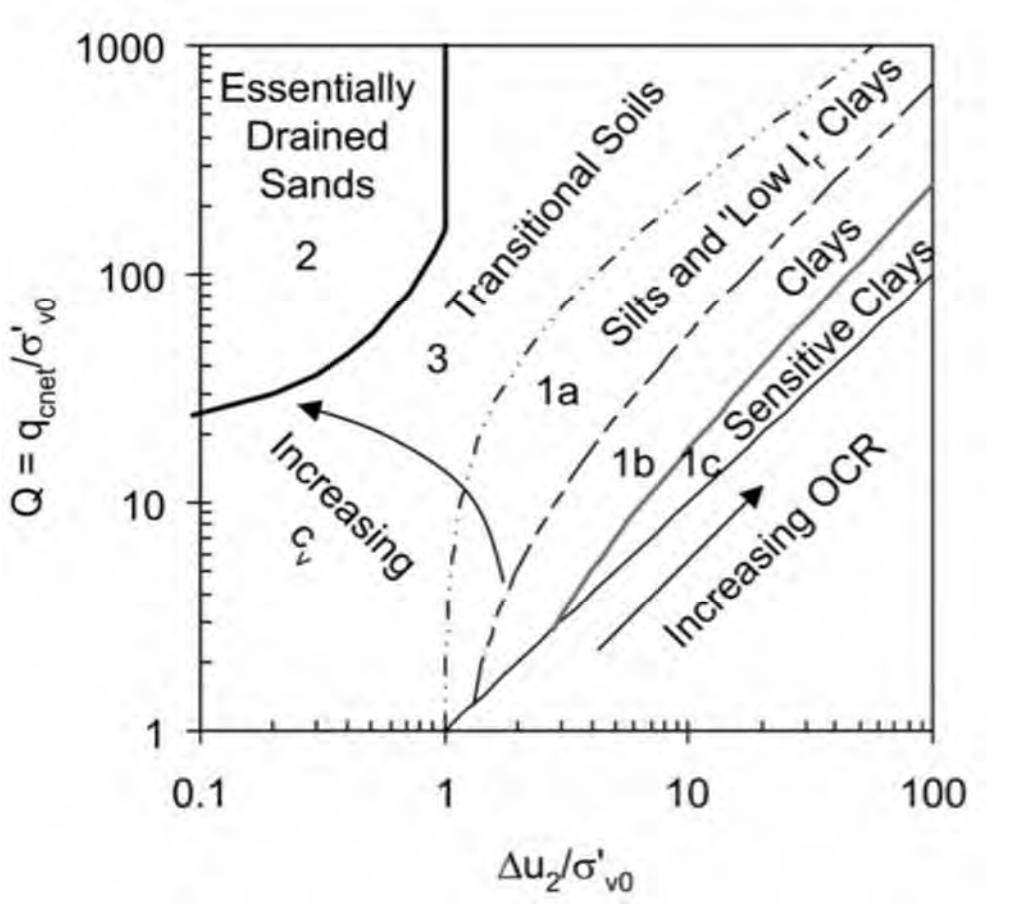


Figure 6-4 Schneider 2008 soil behaviour type classification chart

Layer Analysis

The layer boundaries are manually interpreted based on broad changes in Robertson's (1990) SBT classification or variance with depth. Once the layer boundaries are defined, the SBT zones within each layer are listed along with the corresponding percentage of data points, excluding null/filtered data. The modal classification is reported in full, while secondary zones are provided with abbreviated descriptions. For example: *'Clays – clay to silty clay [74%];* Silt mixtures [20%]', where the asterisk indicates an abbreviation of the full description 'Silt mixtures – clayey silt to silty clay'.

It is important to note that classification zone boundaries do not exist naturally, and minor variations in cone response can result in multiple classifications within layers of relatively uniform behavior. This is particularly true when the data plot is near a zone boundary, contains spurious spikes, or includes very thin layers. Therefore, a system is necessary to limit the number of classified zones within each layer description. The following logic has been applied to retain only the most significant classifications:

For LT >= 1, C = 85
For 0.5 <= LT < 1, C = 75
For LT < 0.5, C = 65

Where
C = Minimum % SBT zone classification coverage within the layer description text
LT = Layer thickness (m)

For layers having a thickness of less than 1 m, 8% of data at the top and bottom of the layer (16% total) are excluded to limit the effect of transition zone data (measured resistance influenced by overlying or underlying strata of different stiffness) being included in the classification.

The continuous SBT index I_c can be used to assess the classification distribution and variation not accounted for by the layer description.

6.6 SOIL BEHAVIOUR TYPE INDEX – I_C

The principal trend in soil behaviour type (SBT) variation can be expressed by a continuous index, I_C, as proposed by Robertson and Wride (1998) based on a similar index proposed by Jefferies and Davies (1993). The index provides a continuous profile of SBT variation with depth for end-user analysis of soil units and variation within units. The equivalent non-normalised version proposed by Robertson (2010) is provided for comparison.

The basis of I_c and its approximation of the original chart classification zones may be seen from Figure 6-2. The method does not identify zones 1 (*sensitive fine grained)* or zones 8 & 9 (*heavily overconsolidated or cemented*).

Normalised SBT index I_C (Robertson and Wride, 1998), as updated by Robertson (2009) to use Q_{tn}:

$$I_c = [(3.47 - \log Q_{tn})^2 + (\log F_r + 1.22)^2]^{0.5}$$

Non-normalised SBT index I_C (Robertson, 2010):

$$I_c = \left[\left(3.47 - \log\left(\frac{q_c}{\sigma_{atm}}\right)\right)^2 + (\log R_f + 1.22)^2\right]^{0.5}$$

The normalised version of I_c is generally more accurate, while the non-normalised version is intended for compatibility with the non-normalised Robertson's (2010) SBT chart and may be more accurate at shallow depths in overconsolidated soils.

I_c results are presented in Appendix D and are repeated alongside derived parameters on all plot sheets to provide SBT context.

6.7 RELATIVE DENSITY

The relative density of sands was calculated based on an empirical relationship proposed by Jamiolkowski *et al.* (2001) based on a large database of undisturbed frozen samples and calibration chamber tests on clean sands.

$$D_r = 100\left[0.268 \cdot \ln\left(\frac{q_t/\sigma_{atm}}{\sqrt{\sigma_{vo}'/\sigma_{atm}}}\right) - k\right]$$

k = Compressibility dependant constant can be taken as -0.675 for medium compressibility (applied value in our interpretation), <= 1 for high compressibility and >= 2 for compressible sands.

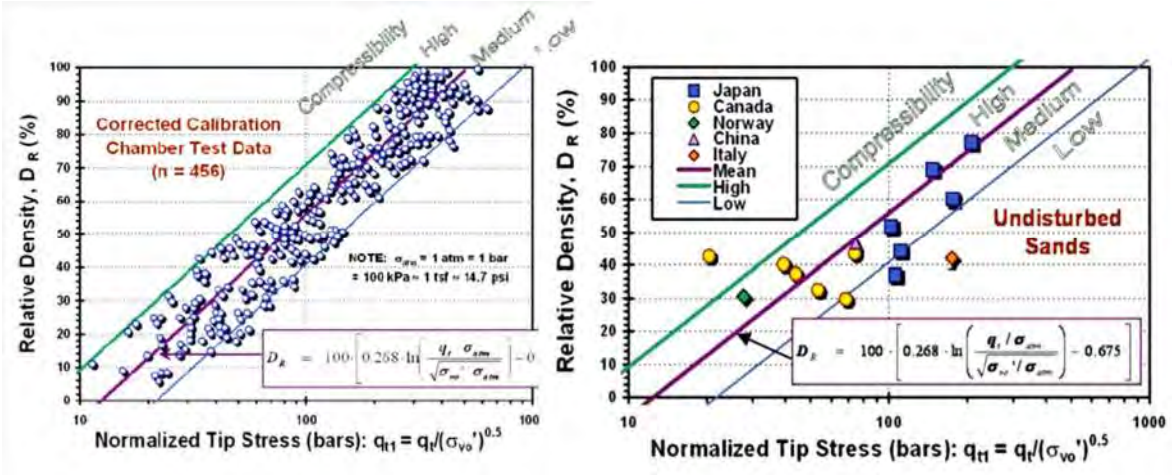


Figure 6-5 Relative density with normalised tip stress and sand compressibility from calibration chamber tests (left) and undisturbed frozen samples (right). Jamiolkowski *et al.* (2001). Reproduced from Mayne (2007).

The results are presented in Appendix F.

6.8 UNDRAINED SHEAR STRENGTH

The undrained shear strength s_u is usually estimated by dividing the net tip resistance by an empirical cone factor N_k (Lunne *et al*, 1997):

$$s_u = \frac{q_c - \sigma_{v0}}{N_k}$$

Mayne and Peuchen (2018) performed an evaluation of 407 high-quality undrained anisotropically consolidated triaxial compression tests (CAUC) with net tip resistance data pairs, resulting in N_{kt} factors with regression analysis details for five categories of clays shown in Table 2.

Table 2 Summary of CAUC s_u versus q_{net} for various clays. Reproduced from Mayne and Peuchen (2018).

Clay Group	Number of sites	Nr Data	Correlation Coefficient r^2	Factor N_{kt}	Mean Pore Pressure Parameter B_q
1) Offshore NC-LOC	17	115	0.98	12.32	0.51
2) Onshore NC-LOC	30	191	0.867	12.00	0.53
3) Sensitive NC-LOC	5	43	0.507	10.33	0.84
4) OC Intact	5	36	0.862	13.57	0.49
5) OC Fissured	5	22	0.393	22.47	-0.01
All clays	62	407	0.923	13.33	0.55

The test plots of Appendix E provide profiles of s_u corresponding to the N_{kt} factors of groups 2, 4 and 5, with the applicable N_{kt} value and soil group name indicated in the header legend. *'s_u3…reference'* on the logs corresponding to N_{kt} = 15 and has been included for comparison to data interpreted using the commonly adopted N_{kt} value of 15 for 'normal' clays.

A variable N_{kt} factor can be estimated with depth as a function of the pore pressure parameter B_q, applicable for B_q values of > -0.01. The following equation proposed by Mayne and Peuchen is based on the same database evaluation:

$$N_{kt} = 10.5 - 4.6 \cdot \ln(B_q + 0.1)$$

Where the pore pressure parameter B_q is the ratio of excess pore pressure to net tip resistance:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{v0}}$$

The estimate of N_{kt} has a standard error of 2.4 and correlation coefficient of 0.645.

When calculated, the s_u estimate based on B_q is presented as 's_u5 – Dynamic N_{kt} from Bq (CAUC)' on the plots and is only suitable for tests that have a high-quality pore pressure data, often indicated by a positive, repeatable, and dynamic response.

Note: N_{kt} (with subscript 'kt') indicates a N_k factor that has been established using the corrected (total) tip resistance q_t. N_{kt} can be applied to the uncorrected tip resistance q_c but results in a slightly lower estimate of s_u depending on the correction magnitude (q_c - q_t) in lower strength soils.

s_u results are presented in Appendix E.

6.9 OVERCONSOLIDATION RATIO

The preconsolidation stress $\sigma_p^{'}$ was calculated based on the method proposed by Mayne et al (2009):

$$\sigma_p^{'} = k \cdot (q_t - \sigma_{vo})^{m\prime}$$

$$OCR = \sigma_p{}'/\sigma'_{v0}{}'$$

Mayne *et al* found that the trend with mean grain size followed a power law through the addition of exponent m' and that its value can be estimated by relation to soil behaviour type index I_c:

$$m^{'} = 1 - \frac{0.28}{1 + (I_c/2.65)^{25}}$$

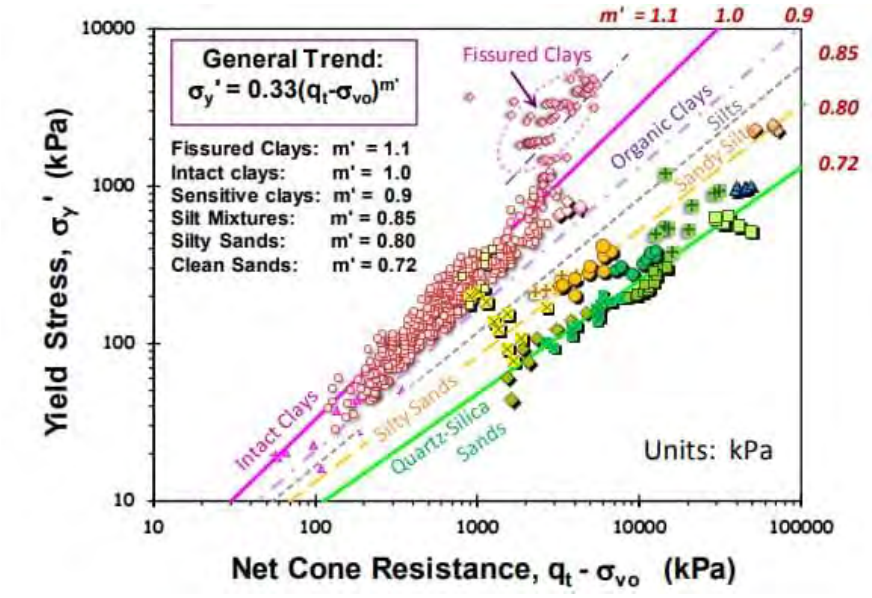


Figure 6-6 Preconsolidation stress with net cone resistance power law, reproduced from Mayne (2014).

An additional set of $\sigma_p^{'}$ and OCR values were calculated for $m^{'}$ = 1.1 to reflect the upper trend for over consolidated fissured clays not captured by the correlation with Ic.

The results are presented in Appendix E.

6.10 SPT N60 VALUES

Equivalent SPT N_{60} values, defined as the non-normalised SPT blow count over a 30 cm interval, with a reference hammer efficiency (energy transfer ratio, 'ETR' or 'ER') of 60%, were derived for two correlations.

Method 1 - Jefferies and Davies (1993) cited in, and modified by, Lunne *et al.* (1997) to use I_c according to normalised Robertson 1990 SBT chart:

$$N_{60} = \frac{q_t}{8.5 \cdot \sigma_{atm} \cdot (1 - I_c/4.6)}$$

Method 2 - Robertson (2012):

$$\frac{\left(\frac{q_t}{p_a}\right)}{N_{60}} = 10^{(1.268 - 0.2817 I_c)}$$

The correlations are intended for clays, silts and sands and not for carbonates or cemented geo-materials.

Conversion of N_{60} values for comparison to other hammer efficiency values, or vice-versa, can be performed using the relationship:

$$N_{60} \cdot \frac{60}{ETR} = N_{ETR}$$

Where ETR is entered as a percentage.

The results are presented in Appendix F.

6.11 FRICTION ANGLE

Sands

The peak friction angle of granular materials was calculated using the Kulhawy and Mayne (1990) method. The relationship is based on a calibration chamber database from 24 sands (mainly sampled by freezing) of varying mineralogy and is found from:

$$\phi' = 17.6 + 11.0 \cdot \log (q_{t1})$$

Where:

ϕ' = Peak friction angle (degrees)

q_{t1} = stress normalised cone resistance:

$$q_{t1} = \left(\frac{q_t}{\sigma_{atm}}\right) / \left(\frac{\sigma_{v0'}}{\sigma_{atm}}\right)^{0.5}$$

The presence of compressible minerals or fines tends to reduce tip resistance resulting in lower estimate of friction angle, while very coarse (sand) or larger grain size tends to increase tip resistance resulting in higher estimate. Increased penetration resistance due to high k_0 conditions also results in an overestimate of friction angle.

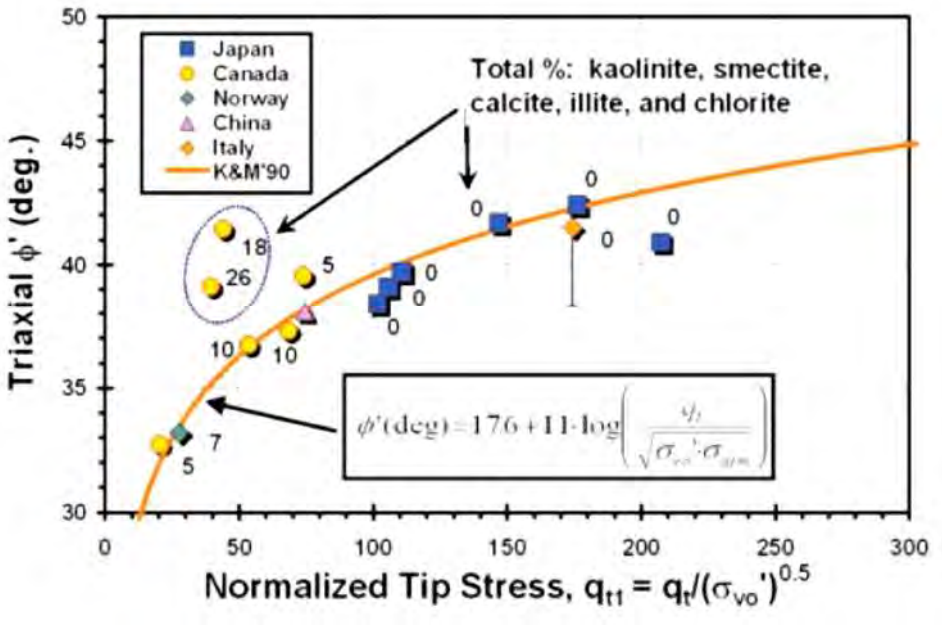


Figure 6-7 Peak triaxial friction angle from undisturbed sands with normalised cone resistance.

Fine grained soils

The effective friction angle for fine grained soils was calculated based on the Senneset *et al.* (1988, 1989) method, referred to as 'NTH' (Norwegian Institute of Technology) solution, using the modified and approximate closed form solution by Mayne & Campanella (2005) as a direct function of the pore pressure parameter Bq and normalised tip resistance Q_{tn} (referred to as Q in figure Figure 6-8 Triaxial ϕ' versus CPTu-evaluated value (NTH method) for 105 soft-firm clays with OCRs < 2.5 (Ouyang and Mayne 2018, cited in Mayne *et al* 2022). The method is generally applicable where $0.1 < B_q < 1.0$ and $20° < \phi' < 45°$and is appropriate for non-cemented normally consolidated to lightly overconsolidated soils.

$$\phi' = 29.5° \, B_q^{0.121} [0.256 + 0.336 \, B_q + \log Q]$$

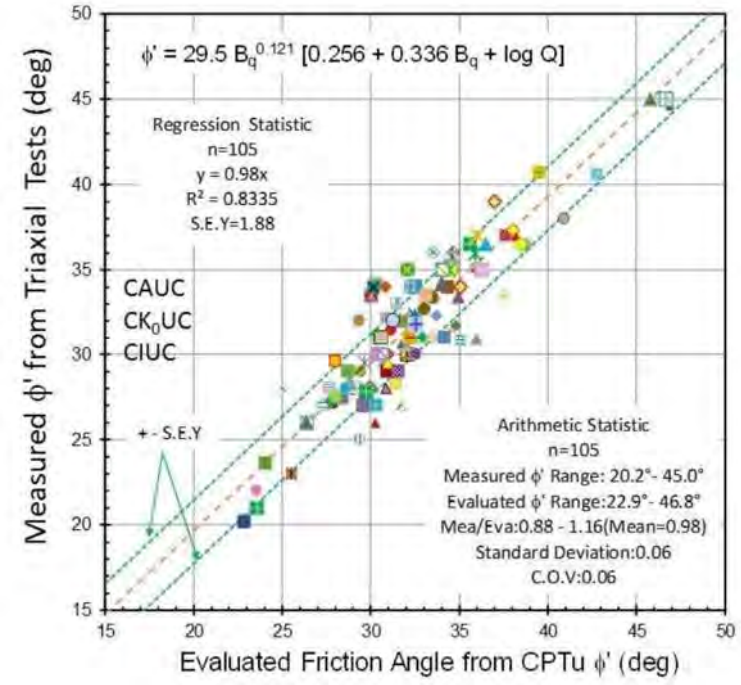


Figure 6-8 Triaxial ϕ' versus CPTu-evaluated value (NTH method) for 105 soft-firm clays with OCRs < 2.5 (Ouyang and Mayne 2018, cited in Mayne *et al* 2022).

The results are presented in Appendix F.

6.12 COEFFICIENT OF VOLUME CHANGE

Coefficient of volume change m_v defined as the inverse of the constrained modulus M, is evaluated for all soil types using the constrained modulus method proposed by Mayne (2006) cited in Mayne (2007). The value may be used to predict settlement at the end of primary consolidation and is applicable to the present state of vertical effective stress up to the pre-consolidation stress for overconsolidated soils.

$$m_v = 1/M'$$

Where:

$$M' = \alpha \cdot (q_t - \sigma_v)$$

$\alpha = 5$

An alpha factor of 8.25 reported by Kulhawy & Mayne (1990) for fine grained soils appears to provide a better fit through the data for intact non-organic clays, reducing to around 1 to 2 for organic plastic clays.

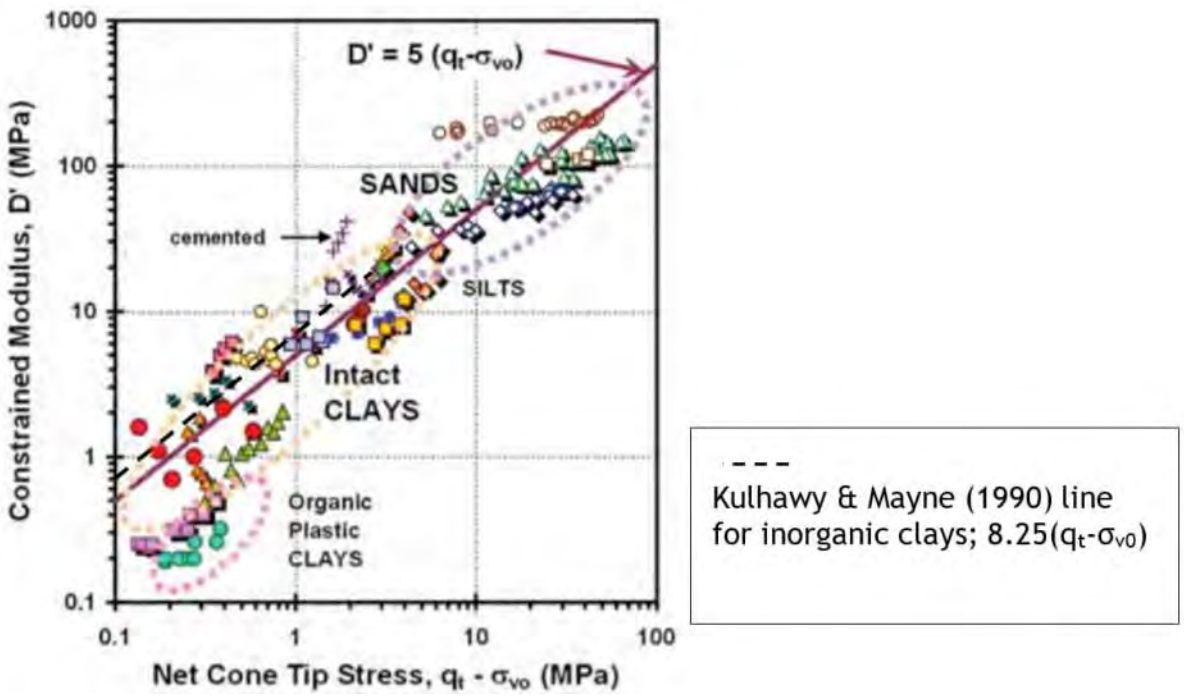


Figure 6-9 Constrained modulus of Mayne (2006). Annotated/redrawn from NCHRP Synthesis 368 (2007).

The results are presented in Appendix E.

6.13 YOUNG'S MODULUS

The secant Young's modulus E' at 25% mobilised shear strength (FOS = 4) was calculated according to the method proposed by Robertson (2009):

$E' = \alpha(q_t - \sigma_v)$
Where:

$\alpha = 0.015(10^{0.55\boldsymbol{Ic}+1.68})$

The method described by Robertson may be adapted to estimate E' for loading at different percentages of mobilised shear strength.

The results are presented in Appendix F.

7 GENERAL INTERPRETATION NOTES

Provided below is a non-exhaustive set of notes on interpretation of the acquired CPT data with reference to examples within the dataset where appropriate.

DRAINED AND UNDRAINED SOIL BEHAVIOUR

Geotechnical parameters appropriate for drained and undrained cone penetration conditions are derived for drained and undrained soil behaviour types (SBTs) respectively, however, to help mitigate the uncertainty in the SBT correlation with drainage behaviour, all parameters are derived over the Soil Behaviour Type range $2.4 < I_c < 2.7$. For partially drained conditions, error will be introduced within derived parameters.

Piezocone dynamic pore pressure and dissipation tests may be used to identify drainage conditions. Dissipation t_{50} values exceeding 50 seconds indicate undrained penetration behaviour based on the findings of Kim *et al.* (2008).

In partially drained materials the friction sleeve resistance may rise significantly immediately following a pause in penetration due to consolidation and increased effective stress on the friction sleeve.

DYNAMIC PORE PRESSURE u_2 (CPTu)

While the piezo system is saturated before use, testing through unsaturated soils may result in some degree of desaturation leading to a less accurate and more 'sluggish' pore pressure response. Desaturation can also occur during penetration due to suction pressure causing cavitation during dilative shear at the cone shoulder. Dissipation tests that are undertaken following desaturation are likely to have a more pronounced initial rise and the results of analysis may have some degree of error.

If the piezometer system becomes desaturated it may re-saturate at higher excess pressures later in the test as gas dissolves under pressure. The pore pressure response in saturated contractive soils should normally have a dynamic 'peaky' appearance.

The tip resistance in lower strength contractive soils without pore pressure measurement in the u_2 position is likely to be significantly lower (up to 20%, typically ~10%) than the equivalent corrected tip resistance depending on the magnitude of excess pore pressure generated during penetration.

CONICAL TIP AND FRICTION SLEEVE OFFSET

The accuracy of the friction ratio (and derived SBT) over thin layers and at layer boundaries is sensitive to the offset between the focal point of shear in front of the conical tip and the centre of the friction sleeve, and the difference in the vertical extent of soil influencing the sensors. This often results in sharp peaks or troughs at boundaries when the sleeve rises or falls out of unison with tip resistance. More broadly, this error will be seen in any circumstances where the spacing between inclusions or discontinuities causes the cone tip and sleeve to experience heterogeneity, for example in disturbed fill or landslip material with a 'blocky' macro fabric or large inclusions. The figure below provides an example of the tip-sleeve offset and resulting (erroneous) friction ratio spike.

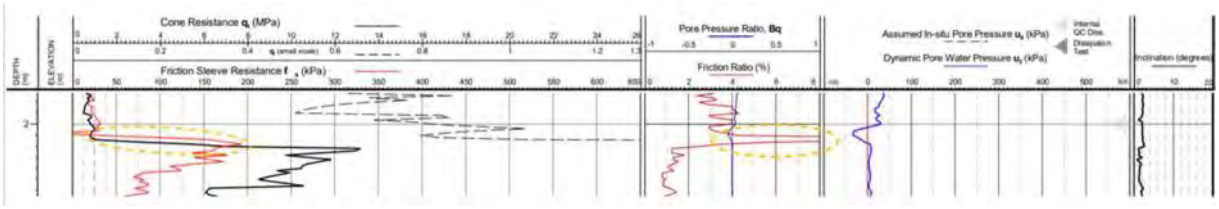


Figure 7-1 example of offset in tip and sleeve response at a strata boundary.

Note that the cone-sleeve offset results in the absence of friction ratio over the last ~14 cm of each test location, and therefore the SBT material description does not extend over this range.

FRICTION SLEEVE DATA

There are three common causes of friction sleeve measurement error; 1) unequal pore pressure acting on the sleeve end areas as the sleeve passes though materials of different permeability and hence excess pore pressure Δu_2, often resulting in a negative/positive spike, 2) Accuracy limitations and temperature effects in very low strength or sensitive soils, and 3) error associated with bending strain that occurs while the cone inclination deviates rapidly. Temperature effects are generally mitigated by temperature stabilisation during the test and at the time of zero output measurement.

CONE TYPE

The reference cone type has a 10 cm^2 projected cone tip area and 150 cm^2 friction sleeve area, however it is common to use a larger 15 cm^2 cone with a 225 cm^2 friction sleeve area for improved sensitivity, temperature stability, damage prevention and penetration depth potential due to the higher bending strength. Use of a 15 cm^2 cone does however require higher penetration force (reaction force) for a given penetration pressure and produces more pronounced transitions zones and thin layer effects due to the larger influence zone.

TRANSITION ZONES AND THIN LAYER EFFECTS

During penetration at the boundary between soils of contrasting stiffness, a transition zone is often evident prior to mobilisation of the true soil stiffness. These should be cautiously ignored in assessment of soil behaviour type and parameter evaluation. Where the stiff layer is thin (<~1 m) mobilised resistance may be significantly less than that of an equivalent thick layer. The effect for thin low stiffness layers is less significant. Procedures for thin-layer effect correction are provided by Robertson and Wride (1998) and Boulanger & DeJong (2018).

GRAVELS

The presence of gravel or larger clasts in a soil is often characterised by short peaks in the CPT tip and sleeve readings, possibly with associate inclinometer ‘shake’ and/or short sharp reductions in pore water readings due to dilation effects. Frequent gravels in soft or loose soils may generate localised erroneous friction ratio values.

8 MAGNETOMETER TESTING

A combined CPT/magnetometer was used at prescribed locations to provide the data for on-site mitigation of UXO risk.

The magnetometer used in the Lankelma magcone system comprises a Bartington Instruments 3-axis flux gate magnetometer that is capable of measuring disturbances in the Earth's field of less than 1 part in a million. Buried ferrous items, such as UXO, result in localized distortions of the magnetic field. The detection radius of the works undertaken was dependent upon the level of magnetic field distortion noise and the size of the ferrous object(s) of interest. The magnetometer data was reviewed in real-time. As such no data had been processed or provided in this report.

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APPENDICES

Appendix A SUMMARY TABLES

Appendix B GENERAL INFORMATION

Appendix C CONE PENETRATION TEST RESULTS

Appendix D SOIL BEHAVIOUR TYPE RESULTS

Appendix E PARAMETER RESULTS 1 – s_u, m_v, OCR, SBT, I_c

Appendix F PARAMETER RESULTS 2 – SPT N60, Phi, D_r, E, I_c

APPENDIX A SUMMARY TABLES

Table 3 CPT summary

Location ID	Stroke number	Final depth (m)	Cone ID	Piezocone test	Pre-drilled (m)	Pre-drilling details	Rig	Primary refusal factor	Applied zero values	Tip zero drift (kPa)	Sleeve zero drift (subtraction) (kPa)	Piezo. zero drift (kPa)	Nr dissipation tests	Raw file name	X Coordinate	Y Coordinate	Z Coordinate	Date	Remarks
CPT101	1	2.62	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	-30.00	1.80	-6.80		29098-V1-120225-UK27-LP79.L01				13/02/2025	
CPT102	1	2.44	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	-33.60	-0.70	-4.80		29098-V1-120225-UK27-LP79.L03				13/02/2025	
CPT103	1	1.90	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	28.80	-1.70	-2.60		29098-V1-120225-UK27-LP79.L04				14/02/2025	
CPT104	1	1.74	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Acquisition error	pre	10.20	2.30	-15.80		29098-V1-120225-UK27-LP79.L05				14/02/2025	
CPT104	2	2.08	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	6.40	-0.70	-4.70		29098-V1-120225-UK27-LP79.L06				14/02/2025	
CPT105	1	2.76	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	-65.20	2.90	0.10		29098-V1-120225-UK27-LP79.L02				13/02/2025	
CPT106	1	2.16	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	11.40	-0.30	-2.20		29098-V1-120225-UK27-LP79.L07				14/02/2025	
CPT107	1	1.10	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	-55.60	3.70	-1.00		29098-V1-120225-UK27-LP79.L10				14/02/2025	
CPT108	1	1.52	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	40.40	-1.90	-1.00		29098-V1-120225-UK27-LP79.L08				14/02/2025	
CPT108	2	1.84	S15-CFIPTTM250.2488	YES	1.20	IP-BF	UK27	Total reaction force	pre	24.60	-1.40	-3.70		29098-V1-120225-UK27-LP79.L09				14/02/2025	

CPT test plots are presented in Appendix C.

APPENDIX B GENERAL INFORMATION

LIST OF FIGURES

Cone calibration certificate: S15-CFIIP.2488

Data sheet: 1.3-tonne mini-crawler CPT unit (UK27)

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Test Setup

Calibrated Instrument

Instrument type:	**Subtraction**	**Number of sensors:**	**6**
Serial number:	**DS15-CFIIPTTM.2488**	**Manufacturer:**	**Eijkelkamp Geopoint**
Nominal cone area:	**15 cm²**	**Nominal sleeve area:**	**227 cm²**
Calibration standard:	**BS EN ISO 22476-1:2023**	**Location:**	**Lankelma Calibration Laboratory**
Calibration date:	**08 January 2025**	**Calibration expiry:**	**08 July 2025**

Sensor measurand	Calibration range	Maximum rating	Momentary overload	Sensor stability (60 sec)	Max drift before re-calibration
Cone resistance (qc)	66.67 MPa	100 MPa	100 MPa	± 0.46 kPa	4 bar
Sleeve friction (fs)	4.41 MPa	1.00 MPa*	1.00 MPa	± 0.05 kPa	0.04 bar
Pore pressure (u)	4 MPa	5 MPa	6.75 MPa	± 0.02 kPa	0.14 bar
Inclination (i)	20 °	90 °		± 0.04 °	
Temperature (t)	30 °C	90 °C		± 0.005 °C	
Magnetic field (m)	200 uT	200 uT			

** The maximum usable sleeve friction stress is limited by the physical strength of the sleeve.*

ISO 22476-22 Cone Penetrometer Classification

Sensor measurand	Measurement uncertainty $U_{qc:class}$, $U_{fs:class}$, $U_{u:class}$	Ambient temperature stability		Transient temperature stability		Bending influence Δb_{qc}, Δb_{fs}, Δb_u	Overall classification *(highest number represents penetrometer class)*
		Uncorrected Δa_{qc}, Δa_{fs}, Δa_u	Corrected Δa_{qcc}, Δa_{fsc}, Δa_{uc}	Uncorrected Δt_{qc}, Δt_{fs}, Δt_u	Corrected Δt_{qcc}, Δt_{fsc}, Δt_{uc}		
Cone resistance	0	2	0	2	1	0	1
Sleeve friction	0	0	0	0	0	0	0
Pore pressure	0	N/A	0	2	0	0	0

Calibration signed by:

Paul Metcalf

Digitally signed by Paul Metcalf
DN: cn=Paul Metcalf, c=GB, o=Lankelma Ltd, email=paulmetcalf@lankelma.co.uk
Date: 2025.01.14 15:13:09

P Metcalf

Calibration checked by:

Alastair Harman

Digitally signed by Alastair Harman
DN: cn=Alastair Harman, c=GB, o=Lankelma Ltd, email=alastairharman@lankelma.co.uk
Date: 2025.01.14 15:13:21

A Harman

Cone penetrometer, serial number: DS15-CFIIPTTM.2488 was found to comply with the requirements of BS EN ISO 22476-1:2023 for the following classifications:
Cone Resistance - Class 1 Sleeve Friction - Class 0 Pore Pressure - Class 0

Reference Instruments

Device	Serial number	Uncertainty of recorded value	Calibration date
AM DSCCHA-100 kN	66914	0.02 ±%	19/06/2023
AM DSCCHA-5 kN	61065	0.05 ±%	19/06/2023
Keithley 7.5 Digit DMM	4496826	12.00 PPM	02/07/2024
MMG750V1P1MC0T3A6CE	502273	0.02 ±%	15/03/2024
ETI Ref Thermometer	D24276054	0.04 °C	17/09/2024
Lankelma HV6 Rotary Table	INC-JIG 01	0.10 °	17/07/2023
10 kg Calibration Weight	H1-S1 10kg	0.001 %	02/08/2024
Mitutoyo 200mm Caliper	A23044194	0.02 ±mm	20/06/2024

Calibration Standard

The calibration was performed according to BS EN ISO 22476-1:2023 & BS EN ISO 17025:2017 for the calibration of cone penetrometers.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation for each of the calibrated sensors has been carried out in accordance with BS EN ISO 22476-1:2023 requirements.

The report provides traceability of measurement to national standards and the SI system of units.

Clause 5.1.2 of BS EN ISO 22476-1:2023, states that the maximum period of validity of the calibration of the cone penetrometer shall not exceed 12 months. The cone penetrometer shall be recalibrated if the readings before a test show a zero baseline drift of over 2% of full scale output compared to the calibration zero load readings.

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Cone Dimension Verification

Cone Tip

Cone shoulder diameter

Rotational position	d_c
0 °	43.90 mm
120 °	43.92 mm
240 °	43.89 mm

Height of the cylindrical extension of the cone

Rotational position	h_e
0 °	11.67 mm
120 °	11.67 mm
240 °	11.67 mm

Height of the conical section of the cone

Rotational position	h_c
0 °	36.85 mm
120 °	36.85 mm
240 °	36.88 mm

Filter element diameter

Rotational position	d_{fil}
0 °	4.61 mm
120 °	4.61 mm
240 °	4.61 mm

Friction Sleeve

Friction sleeve diameter

Rotational position	Upper section d_{2u}	Middle section d_{2m}	Lower section d_{2l}
0 °	43.98 mm	44.00 mm	44.00 mm
120 °	44.00 mm	44.02 mm	44.00 mm
240 °	44.00 mm	43.99 mm	44.00 mm

Friction sleeve length

Rotational position	l_s
0 °	165.13 mm
120 °	165.13 mm
240 °	165.13 mm

Gap between the cone and the lower end of the friction sleeve

Rotational position	l_{gl}
0 °	2.07 mm
120 °	2.07 mm
240 °	2.07 mm

Gap above the upper end of the friction sleeve

Rotational position	l_{gu}
0 °	2.63 mm
120 °	2.59 mm
240 °	2.59 mm

Cone Tip Dimension Uncertainty

Reference device uncertainty u_r	0.015 mm
Average diameter d_c	43.903 mm
Relative error b_c	0.038 %
Area A_c	1513.857 mm²
Dimension uncertainty U_{dc}	0.018 mm
Area uncertainty u_{AC}	1.229 mm²
Expanded area uncertainty U_{AC}	2.458 mm²

Friction Sleeve Dimension Uncertainty

Reference device uncertainty u_r	0.015 mm
Average diameter d_2	43.999 mm
Relative error b_{c2}	0.048 %
Average length l_s	165.130 mm
Relative error b_{ls}	0.000 %
Area A_s	22825.356 mm²
Dimension uncertainty diameter u_{d2}	0.019 mm
Dimension uncertainty length u_{ls}	0.015 mm
Area uncertainty u_{as}	10.239 mm²
Expanded area uncertainty U_{as}	20.478 mm²
Sleeve length to diameter ratio	3.753
Diameter difference, sleeve - tip	0.096 mm

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Cone Resistance Calibration

Calibration method

1. The cone was loaded to full range 3 times for no less than 1 minute before calibration.
2. The cone was calibrated with 4 sets of increasing forces and 2 sets of decreasing forces, with rotation before set 3 and 5.
3. The coefficients of a linear and third order equation relating the the estimate of applied force as a function of the deflection were calculated and are shown in Table 1.
4. The forces applied, and the resulting deflections are given in Tables 2. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Ucqc and Uqc_class for each force is shown as a percentage of the recorded value and in units of pressure (kPa) as shown in Table 3.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

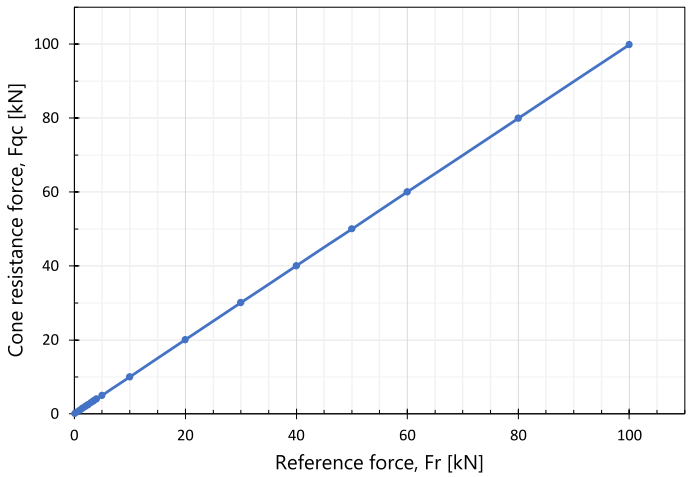
Cone Penetrometer	
Cone penetrometer type	Subtraction
Cone resistance capacity	150 kN
Calibration range	100 kN
Cone resistance effective resolution	0.0005 kN
Cone area	1,514 mm^2
Measured alpha factor cone area ratio	0.81
Historic drift between cone calibrations (u_{drift})	0 %
Apparent pore pressure (u_a) at full range	-0.22 kPa
Cone resistance max zero drift	1.40 kPa
Reference load cell max zero drift	3.49 kPa

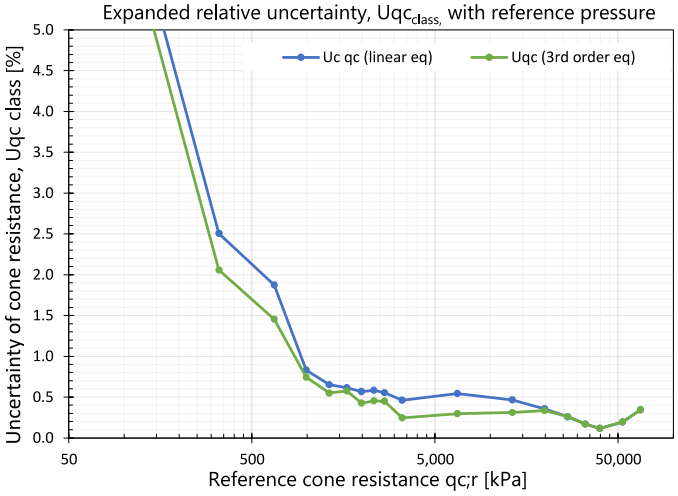
Calibration Conditions	
Ambient temperature	22.6 °C
Ambient temperature variation	0.10 °C
Instrument temperature variation	0.12 °C

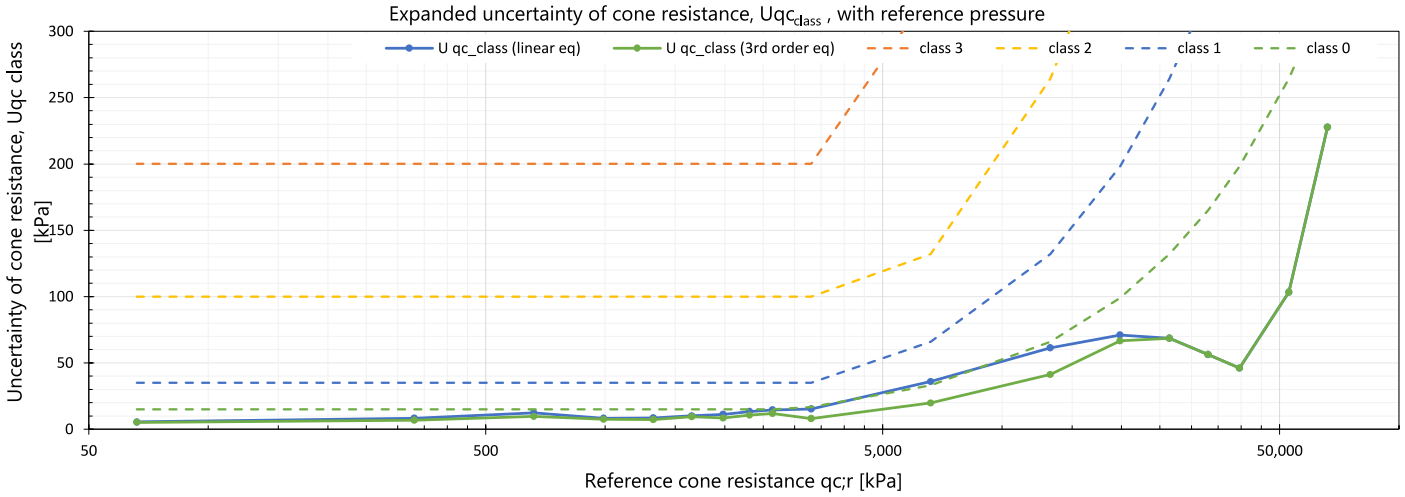
Reference Load Cell Uncertainty	
AM DSCCHA-100 kN	0.02 ±%
AM DSCCHA-5 kN	0.05 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Cone Resistance Calibration - Graphical Results







Interpolation

Table - 1

Linear Equation	*The cone output in force units of D (0.1 N) is derived using a linear factor from the raw cone output. D = Factor x RAW_Output*	0.1 N Factor = 0.009058
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (in 0.1 N units), the corrected applied force, F (in 0.1 N units) is calculated from :*	a0 = 0 a1 = 0.99760034 a2 = -2.41899E-09 a3 = 1.74362E-14 *Polynomial calc. is only to be used when the cone load is under 30 kN*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Cone Resistance Calibration - Tabular Results

Table - 2a **Low range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
0	0.0011	0.0021	0.0014		0.0009	
0.1	0.1057	0.1068	0.1018		0.1033	
0.5	0.5054	0.5078	0.5045		0.5045	
1	1.0060	1.0098	1.0065		1.0069	
1.5	1.5011	1.5031	1.4987		1.4979	
2	2.0003	2.0033	1.9993		1.9977	
2.5	2.4998	2.5046	2.4964		2.4971	
3	3.0006	3.0021	3.0000		2.9962	
3.5	3.5013	3.5044	3.4979		3.4961	
4	4.0015	4.0021	3.9963		3.9949	
5	5.0014	5.0029	4.9977		4.9964	
4				4.0064		4.0037
3.5				3.5087		3.5021
3				3.0068		3.0020
2.5				2.5056		2.5031
2				2.0056		2.0003
1.5				1.5042		1.5006
1				1.0050		1.0013
0.5				0.5044		0.5024
0.1				0.1015		0.1000

Table -2b **High range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
10	10.0026	10.0027	9.9993		9.9992	
20	19.9918	19.9980	19.9910		19.9945	
30	29.9712	29.9769	29.9728		29.9743	
40	40.0343	40.0429	40.0408		40.0420	
50	50.0230	50.0301	50.0250		50.0281	
60	59.9972	60.0059	59.9976		60.0036	
80	79.9231	79.9256	79.9307		79.9277	
100	99.8274	99.8423	99.8398		99.8414	
80				79.9542		79.9534
60				60.0509		60.0521
50				50.0780		50.0797
40				40.0948		40.0955
30				30.0214		30.0208
20				20.0337		20.0251
10				10.0171		10.0194

Table - 3 **Uncertainty assessment**

Reference force	Reference tip resistance	Standard uncertainty u1 - u8								Combined standard calibration uncertainty		Expanded calibration uncertainty [k=2]				BS EN ISO 22476:2023 class	Tip calibration drift
kN	kPa	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kPa	%	kPa	%		kPa
Fr	qc;r	u1*	u2	u3	u4	u5	u6	u7	u8	uc	uc;dim	Uc qc		Uqc class		Cone Class **	u_{drift}***
0	0	0.0000	0.0002	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.3		0.3		0	0.0
0.1	66	0.0007	0.0011	0.0006	0.0002	0.0000	0.0035	0.0010	0.0000	0.0039	0.0039	5.2	7.85	5.2	7.84	0	0.0
0.5	330	0.0011	0.0003	0.0014	0.0002	0.0000	0.0048	0.0006	0.0000	0.0051	0.0052	6.8	2.06	6.8	2.06	0	0.0
1	661	0.0012	0.0012	0.0022	0.0002	0.0000	0.0064	0.0020	0.0000	0.0073	0.0073	9.7	1.46	9.6	1.45	0	0.0
1.5	991	0.0048	0.0009	0.0011	0.0002	0.0000	0.0007	0.0024	0.0000	0.0056	0.0057	7.5	0.76	7.4	0.74	0	0.0
2	1,321	0.0041	0.0016	0.0017	0.0002	0.0000	0.0009	0.0026	0.0000	0.0055	0.0057	7.6	0.57	7.3	0.55	0	0.0
2.5	1,651	0.0041	0.0017	0.0027	0.0002	0.0001	0.0022	0.0044	0.0000	0.0072	0.0075	9.8	0.60	9.5	0.57	0	0.0
3	1,982	0.0044	0.0026	0.0009	0.0002	0.0001	0.0011	0.0036	0.0000	0.0064	0.0068	9.0	0.46	8.5	0.43	0	0.0
3.5	2,312	0.0053	0.0025	0.0018	0.0002	0.0001	0.0015	0.0049	0.0000	0.0080	0.0084	11.2	0.48	10.5	0.45	0	0.0
4	2,642	0.0061	0.0026	0.0004	0.0002	0.0001	0.0024	0.0055	0.0000	0.0090	0.0096	12.6	0.48	11.9	0.45	0	0.0
5	3,303	0.0020	0.0038	0.0009	0.0002	0.0001	0.0015	0.0040	0.0000	0.0062	0.0074	9.7	0.29	8.1	0.25	0	0.0
10	6,606	0.0048	0.0089	0.0001	0.0002	0.0002	0.0004	0.0110	0.0000	0.0149	0.0170	22.4	0.34	19.7	0.30	0	0.0
20	13,211	0.0074	0.0200	0.0036	0.0002	0.0004	0.0075	0.0211	0.0000	0.0311	0.0351	46.4	0.35	41.1	0.31	0	0.0
30	19,817	0.0107	0.0301	0.0033	0.0002	0.0006	0.0273	0.0275	0.0000	0.0503	0.0559	73.8	0.37	66.5	0.34	0	0.0
40	26,423	0.0135	0.0024	0.0049	0.0002	0.0008	0.0390	0.0310	0.0000	0.0519	0.0612	80.9	0.31	68.6	0.26	0	0.0
50	33,028	0.0153	0.0015	0.0041	0.0002	0.0011	0.0254	0.0302	0.0000	0.0425	0.0588	77.7	0.24	56.2	0.17	0	0.0
60	39,634	0.0179	0.0021	0.0050	0.0002	0.0013	0.0005	0.0294	0.0000	0.0348	0.0599	79.1	0.20	46.0	0.12	0	0.0
80	52,845	0.0244	0.0022	0.0015	0.0002	0.0017	0.0729	0.0142	0.0000	0.0783	0.1017	134.4	0.25	103.4	0.20	0	0.0
100	66,056	0.0521	0.0044	0.0086	0.0002	0.0021	0.1641	0.0000	0.0000	0.1724	0.1906	251.8	0.38	227.8	0.34	0	0.0

The class of the penetrometer is determined from the measurement uncertainty at any deflection
At each given deflection the expanded measurement uncertainty Uqc_class is calculated from the readings obtained during calibration.

$$Uqc_{class} = \frac{2}{S} \times \sqrt{\sum_{i=1}^{8} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration force.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the repeatability of the calibration results.
u4 is the standard uncertainty associated with the resolution and noise of the system.
u5 is the standard uncertainty associated with the drift in zero output.
u6 is the standard uncertainty associated with interpolation.
u7 is the standard uncertainty associated with reversibility.
u8 is the standard uncertainty associated with apparent load transfer from other sensor.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Uqc_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Sleeve Friction Calibration

Calibration method

1. The sleeve was loaded to full range 3 times for no less than 1 minute before calibration.
2. The sleeve was calibrated with 4 sets of increasing forces and 2 sets of decreasing forces, with rotation before set 3 and 5.
3. The coefficients of a linear and third order equation relating the estimate of applied force as a function of the deflection were calculated and are shown in Table 4.
4. The forces applied, and the resulting deflections are given in Tables 5. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Ucfs and Ufs_class for each force is shown as a percentage of the recorded value and in units of pressure (kPa) as shown in Table 6.

*The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

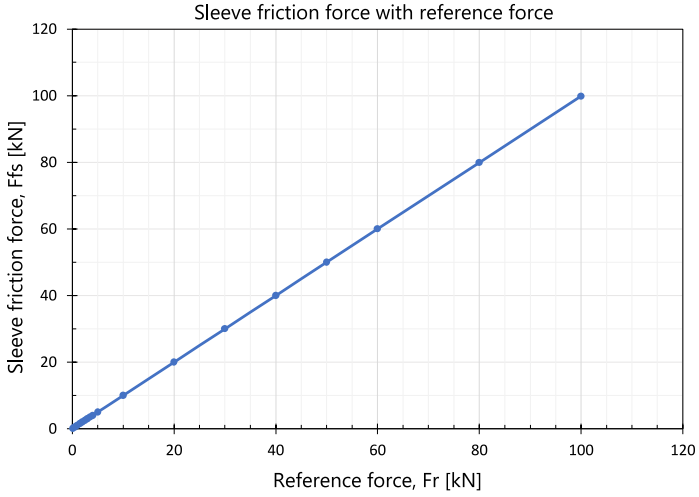
Cone Penetrometer	
Cone penetrometer type	Subtraction
Sleeve friction capacity	150 kN
Calibration range	100 kN
Sleeve friction effective resolution	0.005 kN
Sleeve area	22,825 mm^2
Measured beta factor sleeve area ratio	0.000
Historic drift between sleeve calibrations (u_{drift})	0 %
Apparent pore pressure (u_a) at full range	-0.22 kPa
Sleeve friction max zero drift	0.09 kPa
Reference load cell max zero drift	0.23 kPa

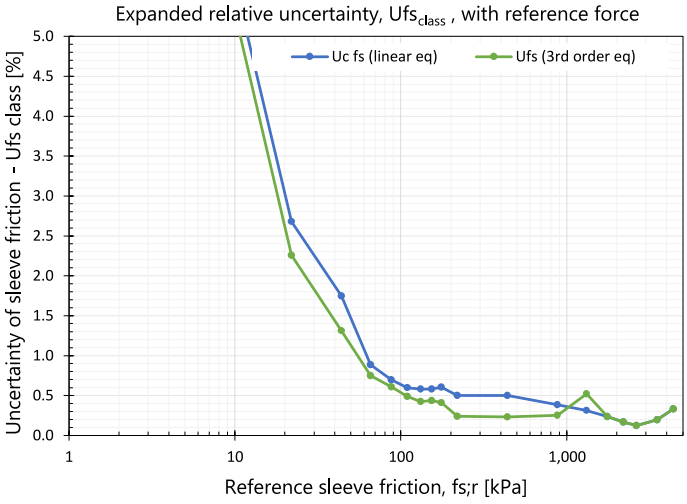
Calibration Conditions	
Ambient temperature	22.6 °C
Ambient temperature variation	0.10 °C
Instrument temperature variation	0.12 °C

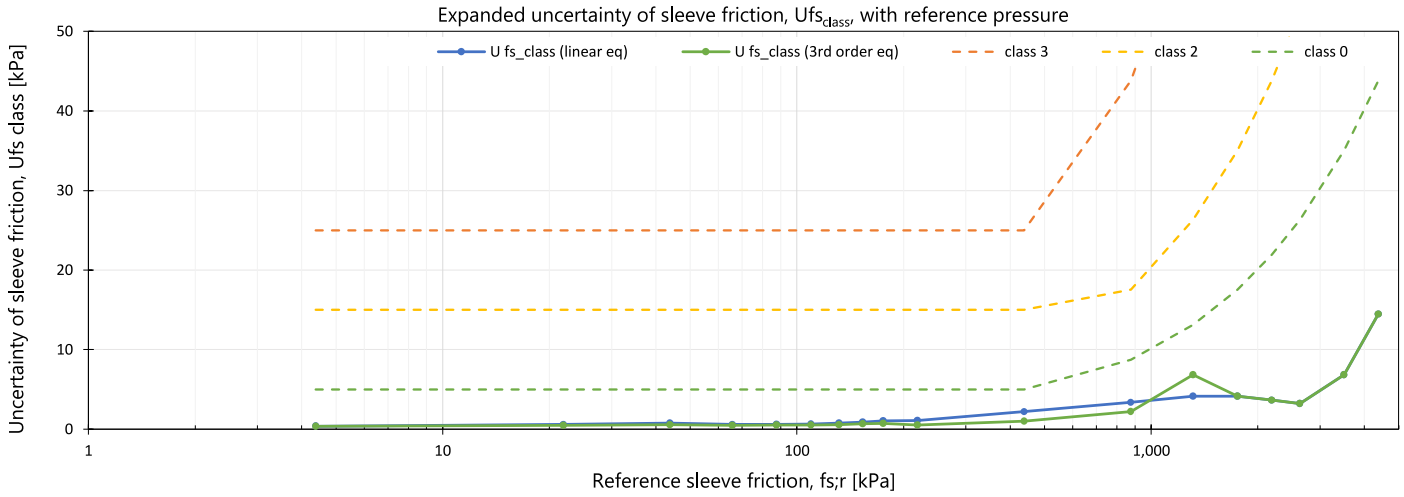
Reference Load Cell Uncertainty	
AM DSCCHA-100 kN	0.02 ±%
AM DSCCHA-5 kN	0.05 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Sleeve Friction Calibration - Graphical Results







Interpolation

Table - 4

Linear Equation	*The sleeve output in force units D (0.1 N) is derived using a linear factor from the raw sleeve output. D = Factor x RAW_Output*	0.1 N Factor = 0.008795
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (0.1 N units), the corrected applied force, F (in 0.1 N units) is calculated from :*	a0 = 0 a1 = 0.997575902 a2 = 5.87711E-09 a3 = -8.60854E-16 *Polynomial calc. is only to be used when the sleeve load is under 30 kN*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Sleeve Friction Calibration - Tabular Results

Table - 6a **Low range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
0	0.0008	0.0020	0.0013		0.0014	
0.1	0.1045	0.1072	0.1025		0.1021	
0.5	0.5074	0.5080	0.5043		0.5031	
1	1.0088	1.0098	1.0046		1.0044	
1.5	1.5026	1.5018	1.4989		1.4988	
2	2.0007	2.0048	1.9996		1.9964	
2.5	2.4999	2.5037	2.4982		2.4984	
3	3.0012	3.0031	3.0006		2.9960	
3.5	3.5007	3.5040	3.4985		3.4980	
4	4.0030	4.0046	3.9996		3.9985	
5	5.0032	5.0048	4.9997		4.9986	
4				4.0056		4.0057
3.5				3.5073		3.5049
3				3.0049		3.0040
2.5				2.5033		2.5034
2				2.0044		2.0009
1.5				1.5034		1.4993
1				1.0044		1.0036
0.5				0.5031		0.5015
0.1				0.1013		0.0991

Table - 6b **High range calibration results**

	0°	0°	120°	120°	240°	240°
kN	kN	kN	kN	kN	kN	kN
Fr	X1	X2	X3	X4'	X5	X6'
10	10.0064	10.0096	10.0036		10.0035	
20	20.0025	20.0099	20.0021		20.0053	
30	30.0337	30.0381	30.0365		30.0364	
40	40.0251	40.0333	40.0327		40.0334	
50	50.0148	50.0233	50.0192		50.0201	
60	59.9915	60.0000	59.9926		60.0000	
80	79.9212	79.9258	79.9313		79.9306	
100	99.8342	99.8507	99.8490		99.8487	
80				79.9564		79.9598
60				60.0500		60.0497
50				50.0744		50.0792
40				40.0866		40.0907
30				30.0831		30.0851
20				20.0427		20.0372
10				10.0160		10.0194

Table - 6 **Uncertainty assessment**

Reference force	**Reference sleeve friction**	**Standard uncertainty u1 - u8**								**Combined standard calibration uncertainty**		**Expanded calibration uncertainty [k=2]**				**BS EN ISO 22476:2023 Class**	**Sleeve calibration drift**
kN	kPa	kN	kN	kN	kN	kN	kN	kN	kN	kN	kN	kPa	%	kPa	%		kPa
Fr	fs;r	u1*	u2	u3	u4	u5	u6	u7	u8	uc	uc;dim	Uc_{fs}		Ufs_{class}		Cone Class **	u_{drift}***
0	0	0.0000	0.0002	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000	0.0020	0.0020	0.18		0.18		0	0.00
0.1	4	0.0007	0.0007	0.0015	0.0020	0.0000	0.0030	0.0012	-0.0006	0.0042	0.0042	0.37	8.48	0.37	8.48	0	0.00
0.5	22	0.0011	0.0013	0.0004	0.0020	0.0000	0.0049	0.0008	0.0001	0.0056	0.0056	0.49	2.26	0.49	2.26	0	0.00
1	44	0.0012	0.0014	0.0005	0.0020	0.0000	0.0059	0.0003	-0.0005	0.0066	0.0066	0.58	1.32	0.57	1.32	0	0.00
1.5	66	0.0048	0.0012	0.0004	0.0020	0.0000	0.0001	0.0014	0.0008	0.0056	0.0056	0.49	0.75	0.49	0.75	0	0.00
2	88	0.0041	0.0013	0.0024	0.0020	0.0000	0.0011	0.0027	-0.0002	0.0061	0.0062	0.54	0.62	0.53	0.62	0	0.00
2.5	110	0.0041	0.0006	0.0022	0.0020	0.0001	0.0012	0.0029	0.0011	0.0061	0.0062	0.54	0.50	0.53	0.50	0	0.00
3	131	0.0044	0.0017	0.0011	0.0020	0.0001	0.0007	0.0035	0.0004	0.0064	0.0065	0.57	0.43	0.56	0.43	0	0.00
3.5	153	0.0053	0.0008	0.0019	0.0020	0.0001	0.0009	0.0045	0.0006	0.0076	0.0078	0.68	0.45	0.67	0.45	0	0.00
4	175	0.0061	0.0013	0.0009	0.0020	0.0001	0.0004	0.0038	0.0028	0.0082	0.0084	0.74	0.42	0.72	0.42	0	0.00
5	219	0.0020	0.0014	0.0009	0.0020	0.0001	0.0005	0.0046	0.0020	0.0060	0.0064	0.56	0.26	0.53	0.26	0	0.00
10	438	0.0048	0.0009	0.0019	0.0020	0.0002	0.0045	0.0082	0.0041	0.0116	0.0124	1.09	0.25	1.02	0.25	0	0.00
20	876	0.0074	0.0010	0.0043	0.0020	0.0004	0.0033	0.0209	0.0108	0.0254	0.0270	2.36	0.27	2.23	0.27	0	0.00
30	1,314	0.0107	0.0009	0.0025	0.0020	0.0006	0.0355	0.0275	0.0628	0.0780	0.0791	6.94	0.53	6.83	0.53	0	0.00
40	1,752	0.0135	0.0027	0.0047	0.0020	0.0008	0.0304	0.0321	-0.0087	0.0473	0.0506	4.44	0.25	4.15	0.25	0	0.00
50	2,191	0.0153	0.0016	0.0049	0.0020	0.0010	0.0180	0.0330	-0.0073	0.0416	0.0473	4.14	0.19	3.65	0.19	0	0.00
60	2,629	0.0179	0.0027	0.0049	0.0020	0.0012	0.0053	0.0309	-0.0048	0.0369	0.0457	4.00	0.15	3.24	0.15	0	0.00
80	3,505	0.0244	0.0032	0.0027	0.0020	0.0016	0.0724	0.0157	0.0005	0.0781	0.0860	7.53	0.21	6.85	0.21	0	0.00
100	4,381	0.0521	0.0049	0.0096	0.0020	0.0020	0.1563	0.0000	0.0077	0.1653	0.1713	15.01	0.34	14.48	0.34	0	0.00

The class of the penetrometer is determined from the measurement uncertainty at any deflection.
At each given deflection the expanded measurement uncertainty Ufs_class is calculated from the readings obtained during calibration.

$$Ufs_{class} = \frac{2}{S} \times \sqrt{\sum_{i=1}^{8} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration force.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the repeatability of the calibration results.
u4 is the standard uncertainty associated with the resolution and noise of the system.
u5 is the standard uncertainty associated with the drift in zero output.
u6 is the standard uncertainty associated with interpolation.
u7 is the standard uncertainty associated with reversibility.
u8 is the standard uncertainty associated with apparent load transfer from other sensor. Includes subtraction error where: Fr;qc = Fr;fs.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Ufs_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

Sleeve Friction Calibration - Subtraction Error

In use, the forces acting on the sleeve load cell element are a combination of tip resistance and sleeve friction, with the tip resistance force value from the tip load cell element being subtracted to give the sleeve friction value. The resultant error values for differing tip and sleeve values are shown in Table 7.

The highlighted cell results in Table 7, show a direct reading of the subtraction error from the calibration results.

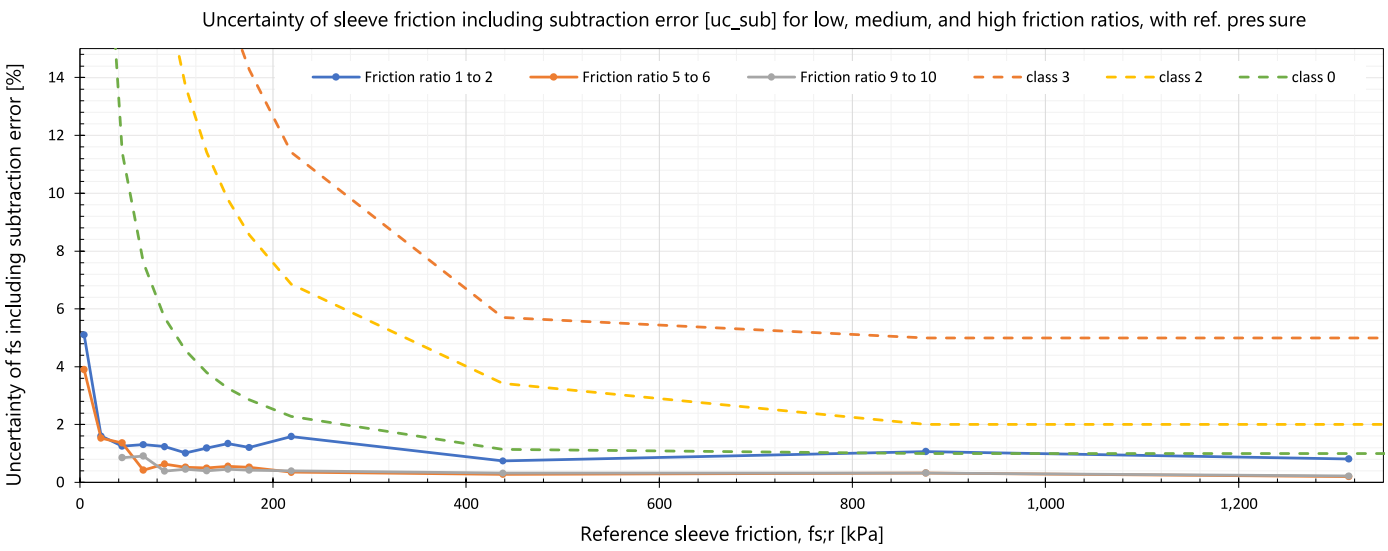
The non-highlighted cells in Table 7, show an interpolated subtraction error from the calibration results.

Sleeve friction - tip subtraction combined standard uncertainty uc_sub, where friction ratio is between 0.1% and 10%.

Table - 7

	Sleeve friction combined standard uncertainty including subtraction error (%)												
Tip resistance kPa ↓ / Sleeve friction kPa →	4	22	44	66	88	110	131	153	175	219	438	876	1,314
66	3.90	-	-	-	-	-	-	-	-	-	-	-	-
330	5.10	***1.53***	-	-	-	-	-	-	-	-	-	-	-
661	5.06	***2.39***	***1.37***	***0.91***	-	-	-	-	-	-	-	-	-
991	7.01	***1.29***	***0.65***	***0.43***	***0.39***	-	-	-	-	-	-	-	-
1,321	6.59	***1.27***	***0.65***	***0.51***	***0.47***	0.45	0.41	-	-	-	-	-	-
1,651	8.46	***1.57***	***0.89***	0.77	0.63	0.53	0.47	0.46	-	-	-	-	-
1,982	8.36	***1.56***	***0.97***	0.76	***0.38***	0.52	0.47	0.45	0.43	-	-	-	-
2,312	9.23	***2.03***	1.26	0.82	0.67	0.56	0.50	0.48	0.45	0.34	-	-	-
2,642	12.05	2.79	***0.90***	1.01	0.81	0.67	0.59	0.56	0.52	0.40	-	-	-
3,303	12.44	2.86	1.58	1.03	0.83	0.69	0.60	0.57	0.53	***0.35***	-	-	-
6,606	-	4.50	2.40	1.58	1.24	1.01	0.87	0.80	0.73	0.57	***0.28***	-	-
13,211	-	8.27	4.29	2.84	2.18	1.77	1.50	1.34	1.20	0.94	***1.21***	***0.57***	0.22
19,817	-	21.09	10.70	7.11	5.39	4.33	3.64	3.17	2.81	2.23	***1.05***	***0.43***	***0.20***
26,423	-	-	4.77	3.16	2.42	1.96	1.66	1.48	1.32	1.04	***0.63***	***0.43***	0.51
33,028	-	-	6.12	4.05	3.10	2.50	2.11	1.87	1.66	1.31	***0.68***	0.52	***0.59***
39,634	-	-	7.59	5.03	3.83	3.09	2.60	2.28	2.03	1.60	0.92	***0.75***	0.61
52,845	-	-	-	7.01	5.31	4.27	3.59	3.13	2.77	2.19	1.21	***1.24***	0.71
66,056	-	-	-	-	6.88	5.53	4.64	4.03	3.56	2.82	1.53	0.89	0.81
Friction ratio (for a given row) →													

Friction ratio (for a given column) ↑



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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Pore Pressure Calibration

Calibration method

1. The cone penetrometer was placed in a pressure vessel and was pressurised to full range 3 times for no less than 1 minute before calibration.
2. The pore pressure was calibrated with 2 sets of increasing pressures and 2 sets of decreasing pressures.
3. The coefficients of a linear and third order equation relating the estimate of applied pressure as a function of deflection were calculated and are shown in Table 8.
4. The pressures applied, and the resulting deflections are given in Tables 9. No corrections for temperature have been applied to these results.
5. The combined expanded uncertainty* of deflection Uu and Uu_class for each force is shown as a percentage of the recorded value and in units of pressure kPa as shown in Table 10.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

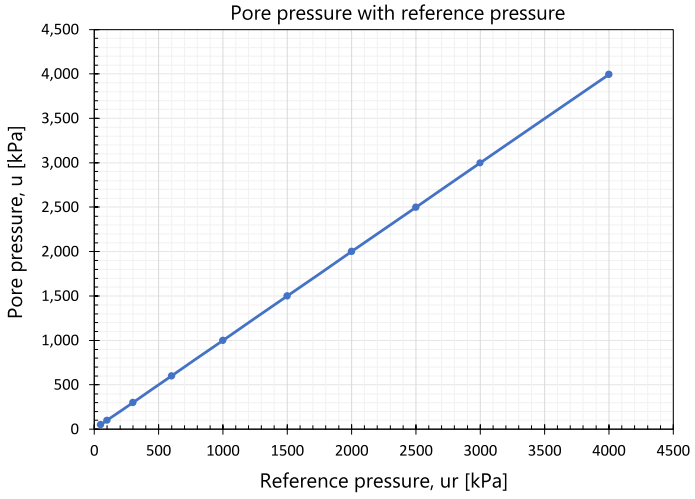
Cone Penetrometer	
Pore pressure sensor capacity	5 MPa
Calibration range	4 MPa
Pore pressure resolution	0.005 kPa
Historic drift between pore calibrations (u_{drift})	0 %
Pore pressure sensor max zero drift	0.07 kPa
Reference pressure sensor max zero drift	0.05 kPa

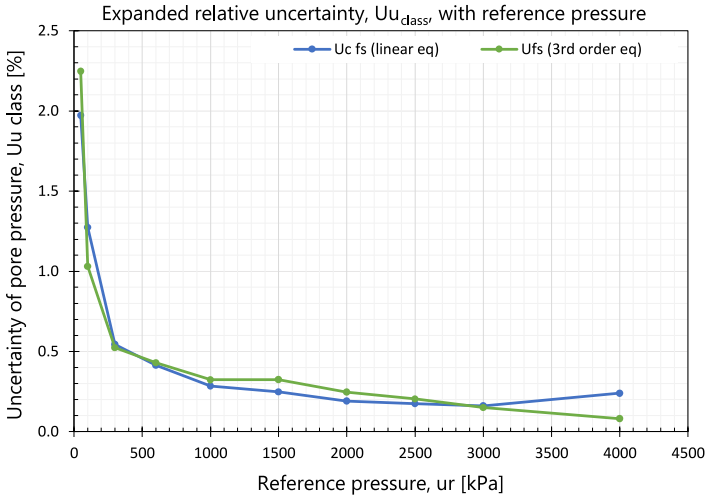
Calibration Conditions	
Ambient temperature	20.7 °C
Pressure chamber temperature variation	0.22 °C
Instrument temperature variation	0.01 °C

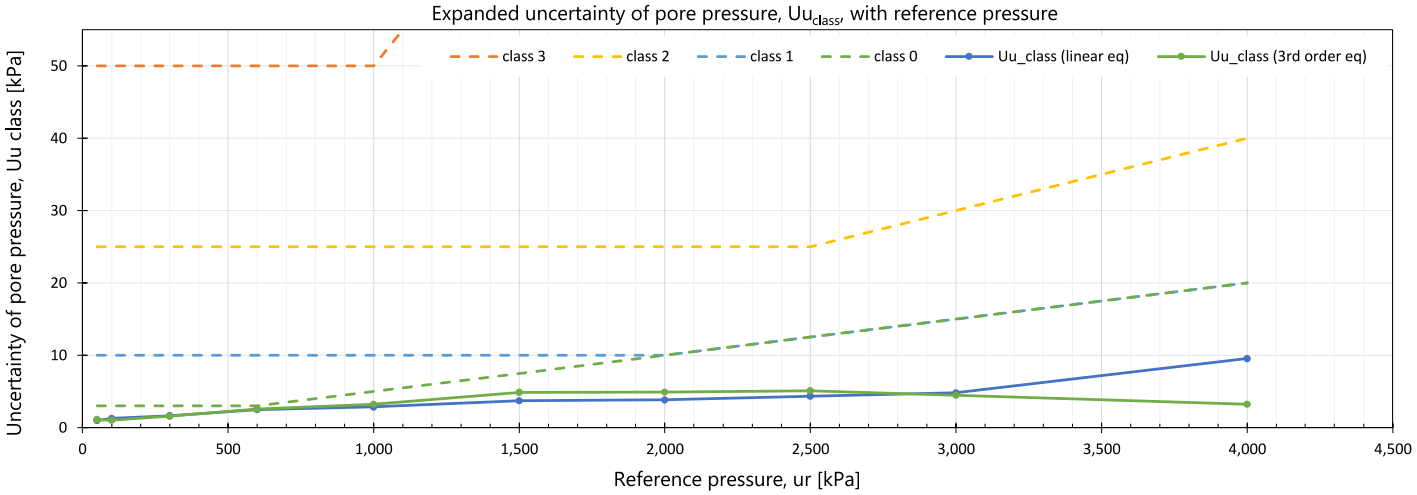
Reference Pressure Sensor Uncertainty	
MMG750V1P1MC0T3A6CE	0.02 ±%

Reference Indicator Uncertainty	
Keithley 7.5 Digit DMM	12 PPM

Pore Pressure Calibration - Graphical Results







Interpolation

Table - 8

Linear Equation	*The pore pressure output in pressure units D (0.1 Pa) is derived using a linear factor from the raw pore pressure output. D = Factor x RAW_Output*	0.1 Pa Factor = 0.048553
Polynomial Equation	*3rd order polynomial equation. For a given cone indicated output of D (0.1 Pa units), the corrected applied pressure, P (in 0.1 Pa units) is calculated from :* $P = (a3 \times D^3) + (a2 \times D^2) + (a1 \times D) + a0$	a0 = -4102.336419 a1 = 0.998534142 a2 = 2.85156E-11 a3 = 9.46788E-19

Pore Pressure Calibration - Tabular Results

Table - 9 **Calibration results**

kPa ur	kPa X1	kPa X2'	kPa X3	kPa X4'
0	-0.07		0.07	
50	49.85		49.52	
100	99.93		99.78	
300	299.67		299.58	
600	599.38		599.36	
1000	999.06		999.05	
1500	1498.68		1498.19	
2000	1998.34		1998.57	
2500	2498.90		2498.15	
3000	2998.91		2998.83	
4000	3999.92		3999.73	
3000		3001.47		3001.23
2500		2501.47		2501.38
2000		2001.38		2001.15
1500		1501.35		1501.16
1000		1000.97		1001.00
600		601.13		600.95
300		300.34		300.58
100		100.36		100.17
50		49.96		49.82

Table - 10 **Uncertainty assessment**

Reference pressure	**Standard uncertainty u1 to u6**						**Combined standard calibration uncertainty**		**Expanded calibration uncertainty [k=2]**				**BS EN ISO 22476:2023 class**	**Pore calibration drift**
kPa ur	kPa u1*	kPa u2	kPa u3	kPa u4	kPa u5	kPa u6	kPa u_i	%	kPa U_u	%	kPa Uu_{class}	%	Cone Class **	kPa u_{drift}***
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0	0.00
50	0.41	0.19	0.00	0.00	0.32	0.12	0.56	1.12	1.12	2.25	1.12	2.25	0	0.00
100	0.42	0.09	0.00	0.00	0.15	0.24	0.52	0.52	1.03	1.03	1.03	1.03	0	0.00
300	0.48	0.05	0.00	0.01	0.38	0.48	0.78	0.26	1.57	0.52	1.57	0.52	0	0.00
600	0.57	0.02	0.00	0.01	0.63	0.97	1.29	0.21	2.58	0.43	2.58	0.43	0	0.00
1000	0.70	0.01	0.00	0.02	0.94	1.11	1.62	0.16	3.23	0.32	3.23	0.32	0	0.00
1500	0.85	0.28	0.00	0.03	1.57	1.63	2.43	0.16	4.87	0.32	4.87	0.32	0	0.00
2000	1.00	0.13	0.00	0.04	1.55	1.63	2.46	0.12	4.92	0.25	4.92	0.25	0	0.00
2500	1.15	0.43	0.00	0.05	1.48	1.68	2.55	0.10	5.10	0.20	5.10	0.20	0	0.00
3000	1.30	0.05	0.00	0.06	1.13	1.43	2.24	0.07	4.48	0.15	4.48	0.15	0	0.00
4000	1.60	0.11	0.00	0.07	0.17	0.00	1.62	0.04	3.24	0.08	3.24	0.08	0	0.00

The class of the penetrometer is determined from the measurement uncertainty at any deflection

At each given deflection the expanded measurement uncertainty Uu_class is calculated from the readings obtained during calibration.

$$Uu_{class} = 2 \times \sqrt{\sum_{i=1}^{6} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration pressure.
u2 is the standard uncertainty associated with the repeatability of the calibration results.
u3 is the standard uncertainty associated with the resolution and noise of the system.
u4 is the standard uncertainty associated with the drift in zero output.
u5 is the standard uncertainty associated with interpolation.
u6 is the standard uncertainty associated with reversibility.

** u1 is not a requirement for BS EN ISO 22476-1:2023 class uncertainty Uu_class. We have included u1 for clarity and confidence in the result.*
*** If the classification is altered with the inclusion u1, then the lower classification will be given alongside a # symbol as identification.*
**** udrift is the standard uncertainty associated with the drift in sensitivity between calibrations. This is an uncertainty associated with subsequent use and not a calibration uncertainty.*

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Pore Pressure Calibration - Measured Area Ratios

Calibration method

1. The apparent cone resistance qc;a and apparent sleeve friction fs;a are recorded for all pore pressure calibration intervals, and shown in Table 11a and 11b.
2. The resulting net area ratios of the cone *a* and net area ratios of the sleeve *b* are computed and shown in Table 11a and 11b.
3. The final recorded cone net area ratio *a* and sleeve net area ration *b* are shown in Table 12, where reference pressure ur = 2000kPa

Table - 11a **Cone net area ratio assessment**

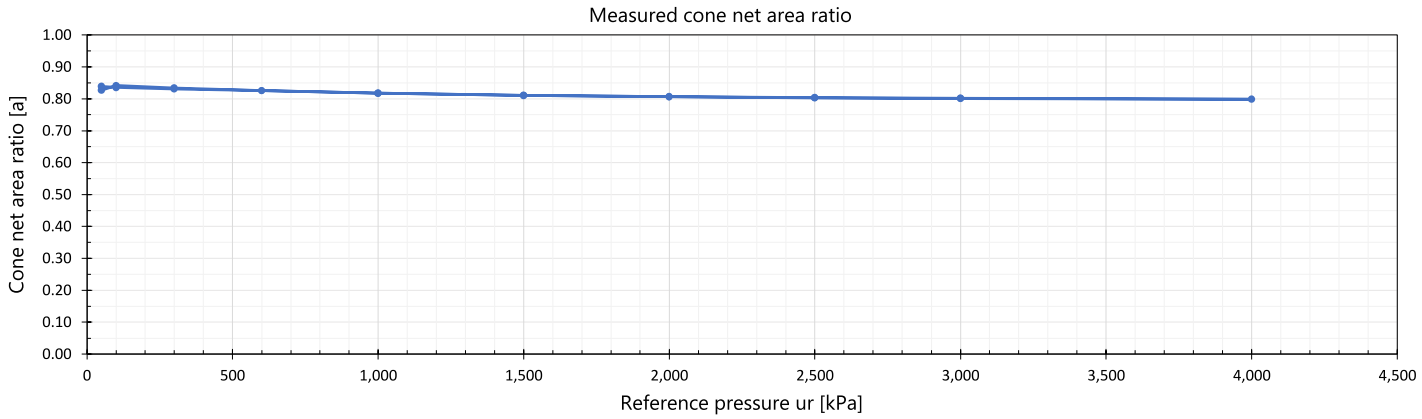
	Apparent cone resistance [qc;a]					
kPa	kPa	kPa	kPa	kPa	kPa	Alpha
ur	X1	X2'	X3	X4'	Mean	factor
50	41.8		40.9		41.3	0.83
100	84.5		83.9		84.2	0.84
300	250.7		249.7		250.2	0.83
600	496.7		494.5		495.6	0.83
1000	818.2		817.1		817.6	0.82
1500	1216.1		1214.9		1215.5	0.81
2000	1612.2		1612.6		1612.4	0.81
2500	2008.6		2006.7		2007.6	0.80
3000	2404.9		2402.1		2403.5	0.80
4000	3195.7		3194.3		3195.0	0.80
3000		2407.0		2405.4	2406.2	0.80
2500		2011.3		2010.23	2010.8	0.80
2000		1614.38		1613.9	1614.1	0.81
1500		1216.88		1216.92	1216.9	0.81
1000		818.482		818.046	818.3	0.82
600		495.813		495.434	495.6	0.83
300		249.274		249.642	249.5	0.83
100		84.0348		83.1019	83.6	0.84
50		41.7742		42.1435	42.0	0.84

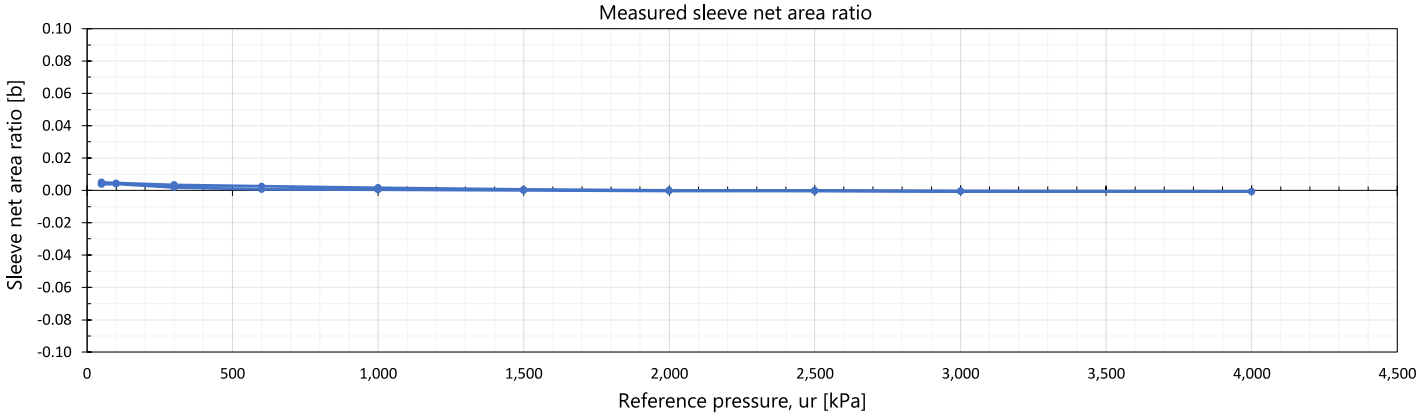
Table - 11b **Sleeve friction net area ratio assessment**

	Apparent sleeve friction [fs;a]					
kPa	kPa	kPa	kPa	kPa	kPa	Beta
ur	X1	X2'	X3	X4'	Mean	factor
50	0.20		0.30		0.25	0.005
100	0.48		0.43		0.45	0.005
300	0.96		1.07		1.02	0.003
600	1.45		1.63		1.54	0.003
1000	1.53		1.62		1.58	0.002
1500	0.81		0.86		0.84	0.001
2000	0.11		0.12		0.11	0.000
2500	-0.59		-0.47		-0.53	0.000
3000	-1.34		-1.07		-1.21	0.000
4000	-2.69		-2.57		-2.63	-0.001
3000		-1.69		-1.59	-1.64	-0.001
2500		-1.10		-1.01	-1.06	0.000
2000		-0.54		-0.44	-0.49	0.000
1500		0.07		0.05	0.06	0.000
1000		0.30		0.47	0.39	0.000
600		0.41		0.45	0.43	0.001
300		0.60		0.56	0.58	0.002
100		0.39		0.43	0.41	0.004
50		0.22		0.16	0.19	0.004

Table - 12

Cone net area ratio [a]	0.81
Sleeve friction net area ratio [b]	0.000





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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Inclination Calibration

Calibration method

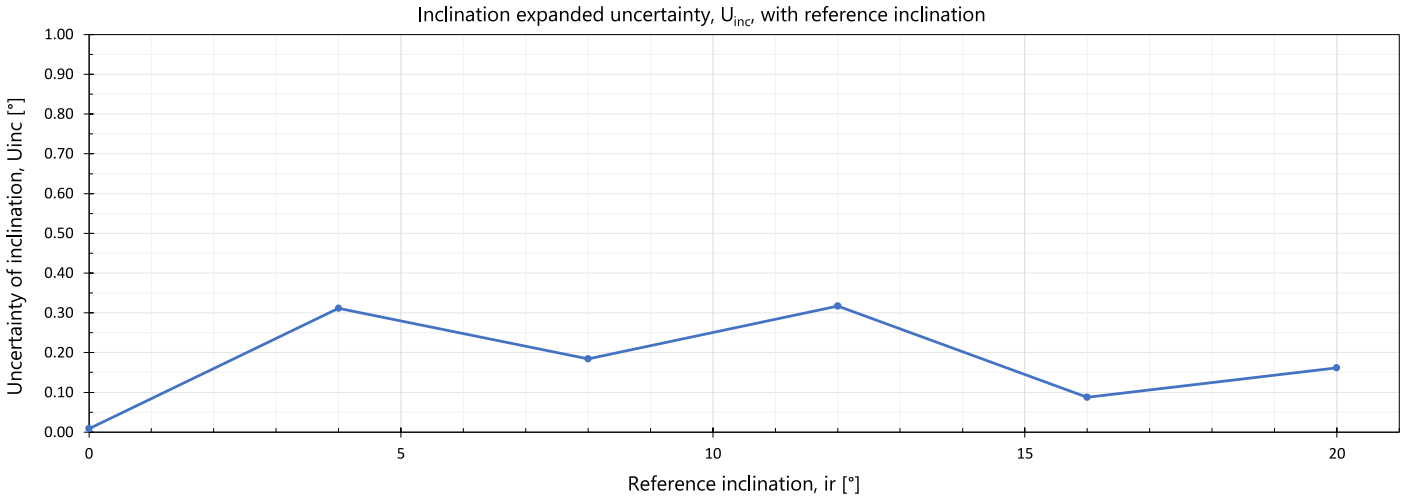
1. The cone penetrometer was placed in the inclination calibration frame and set to a vertical reference inclination of ir = 0°.
2. The inclination was calibrated from ir = 0° to ir = 20°. This was conducted twice, once with the cone at 0° rotation and once with the cone at 90° rotation.
3. The coefficients of a linear equation relating the estimate of the inclination as a function of raw sensor deflection were calculated and are shown in Table 13.
4. The inclination angle applied, and the resulting measurements are given in Table 14.
5. The combined expanded uncertainty* of measurement Uinc for each inclination angle is shown as a percentage of the recorded value and in units of arc degrees °, as shown in Table 15.

* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Cone Penetrometer	
Inclination sensor range	90 °
Calibration range	20 °
Inclination resolution	0.005 °
Inclinometer number of axis	2

Reference Inclination Rotary Table Uncertainty	
Lankelma HV6 Rotary Table	0.10 °

Inclination - Graphical Results



Interpolation

Table - 13

Linear Equation	*The Inclination output in angular units ($0.1° \times 10^{-3}$) is derived using a linear factor from the raw inclination output.*	X axis Factor =	9.927223
		Y axis Factor =	9.955083

Inclination Calibration - Tabular Results

Table - 14

Inclination calibration

° ir	° θ0	° θ90
0	0.00	0.00
4	3.78	3.94
8	7.90	7.92
12	12.21	12.09
16	15.97	15.95
20	20.03	20.12

Table - 15 **Uncertainty assessment**

Reference Inclination	Standard calibration uncertainty u1 to u4				Combined standard calibration uncertainty ui		Expanded calibration uncertainty Uinc [k=2]	
° ir	° u1	° u2	° u3	° u4	° u_i	%	° U_{inc}	%
0	0.00	0.00	0.00	0.00	0.00		0.01	
4	0.01	0.06	0.00	-0.14	0.16	3.90	0.31	7.80
8	0.02	0.01	0.00	-0.09	0.09	1.15	0.18	2.31
12	0.02	0.04	0.00	0.15	0.16	1.32	0.32	2.64
16	0.02	0.01	0.00	-0.04	0.04	0.28	0.09	0.55
20	0.02	0.03	0.00	0.07	0.08	0.40	0.16	0.81

At each given deflection the expanded measurement uncertainty Uinc is calculated from the readings obtained during calibration.

$$U_{inc} = 2 \times \sqrt{\sum_{i=1}^{4} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration inclination.
u2 is the standard uncertainty associated with the reproducibility of the calibration results.
u3 is the standard uncertainty associated with the resolution and noise of the system.
u4 is the standard uncertainty associated with interpolation.

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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Temperature Calibration

Calibration method

1. The cone penetrometer was placed in the thermostatic temperature calibration bath with the temperature set to 0°C.
2. The temperature was calibrated from Tr = 0°C to Tr = 30°C.
3. The coefficients of a linear equation relating the estimate of temperature as a function of raw temperature sensor deflection were calculated and are shown in Table 16.
4. The applied temperature, and the resulting measurements are given in Table 17.
5. The combined expanded uncertainty* of measurement Utemp for each temperature is shown as a percentage of the recorded value and in units of Celsius °C, as shown in Table 18.

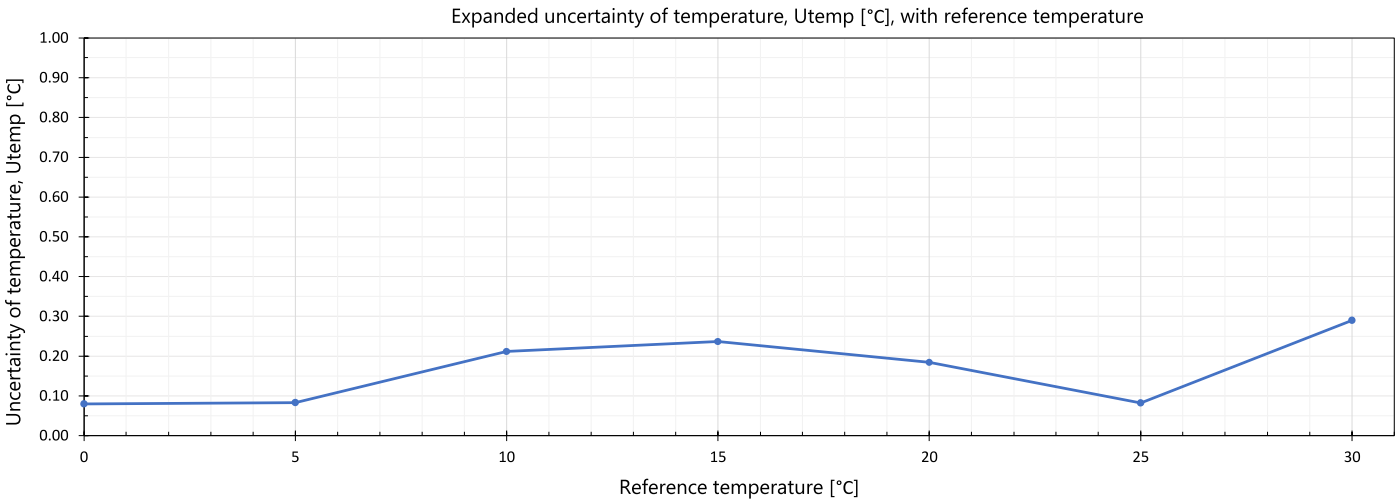
* The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Cone Penetrometer	
Temperature sensor range	90 °
Calibration range	30 °
Temperature resolution	0.005 °
Temperature number of axis	2

Reference Thermometer Uncertainty	
ETI Ref Thermometer	0.04 °

Temperature Datalogger Uncertainty	
ETI ThermaData	0.4 °

Temperature Calibration - Graphical Results



Interpolation

Table - 16

Linear Equation	*The temperature sensor output in temperature units (0.1°C x 10^{-3}) is derived using a linear factor from the raw temperature output.*	Temperature sensor [qc] factor =	0.569322
		Temperature sensor [fs] factor =	0.570665

Temperature Calibration - Tabular Results

Table - 17
Temperature calibration

°C T_r	°C T_a
0	0.00
5	5.01
10	9.90
15	14.89
20	19.92
25	24.99
30	30.14

Table - 18 **Uncertainty assessment**

Reference temp	Standard calibration uncertainty u1 to u3			Combined standard calibration uncertainty u_t		Expanded calibration uncertainty U_{temp} [k=2]	
°C T_r	°C u1	°C u2	°C u3	°C u_t	%	°C U_{temp}	%
0	0.04	0.00	0.00	0.04		0.08	
5	0.04	0.00	0.01	0.04	0.84	0.08	1.67
10	0.04	0.00	-0.10	0.11	1.06	0.21	2.12
15	0.04	0.00	-0.11	0.12	0.79	0.24	1.58
20	0.04	0.00	-0.08	0.09	0.46	0.18	0.92
25	0.04	0.00	-0.01	0.04	0.16	0.08	0.33
30	0.04	0.00	0.14	0.14	0.48	0.29	0.97

At each given deflection the expanded measurement uncertainty Utemp is calculated from the readings obtained during calibration.

$$U_{temp} = 2 \times \sqrt{\sum_{i=1}^{3} u_i^2}$$

where,
u1 is the standard uncertainty associated with the applied calibration temperature.
u2 is the standard uncertainty associated with the resolution and noise of the system.
u3 is the standard uncertainty associated with interpolation.

Temperature Influence Verification

Verification method

1. The cone penetrometer was placed in the thermostatic temperature calibration bath with the temperature set to 30°C, the second bath temperature was set to 0°C.
2. The test method for verification of a cone penetrometer for temperature influence was followed as set out in BS EN ISO 22476-1:2023, clause B.2.7.2.
3. The bath temperatures, apparent cone resistance, apparent sleeve friction, apparent pore pressure, and apparent cone temperature were recorded for the duration of the test.
4. The correction factors for; corrected apparent cone resistance, corrected sleeve friction, and corrected pore pressure were applied in post processing.
5. The start and end apparent readings are shown in Table 19. The maximum and minimum apparent readings are shown in Table 20.
6. The ambient stability, transient stability, and resulting penetrometer class were calculated and are shown in Table 21.

Table - 19 **Start and end apparent readings**

	°C	°C	kPa	kPa	kPa	kPa	kPa	kPa
	Ta_{qc}	Ta_{fs}	qc;a	qc;ac	fs;a	fs;ac	u;a	u;ac
T30	30.2	29.9	-0.4	-0.7	-0.1	-0.1	-0.1	-0.1
T0	0.3	0.3	-133.6	12.1	0.8	-1.3	40.2	-8.2

Table - 20 **Maximum / minimum apparent readings**

	kPa	kPa	kPa	kPa	kPa	kPa
	qc;a	qc;ac	fs;a	fs;ac	u;a	u;ac
max	295.4	114.4	6.2	6.2	40.2	0.5
min	-415.0	-96.6	-6.1	-6.1	-2.9	-12.1

Maximum rate of change

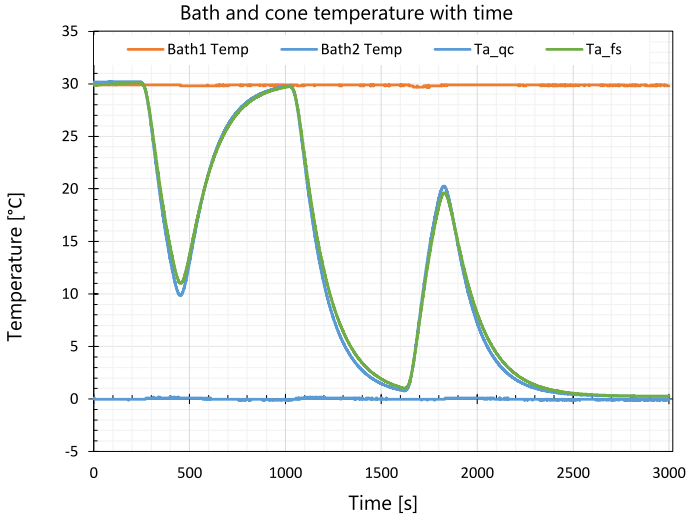
kPa/s	kPa/s	kPa/s	kPa/s	kPa/s	kPa/s
Δfgqc	Δfgqcc	Δfgfs	Δfgfsc	Δfgu	Δfguc
13.75	5.66	0.36	0.36	0.28	0.41

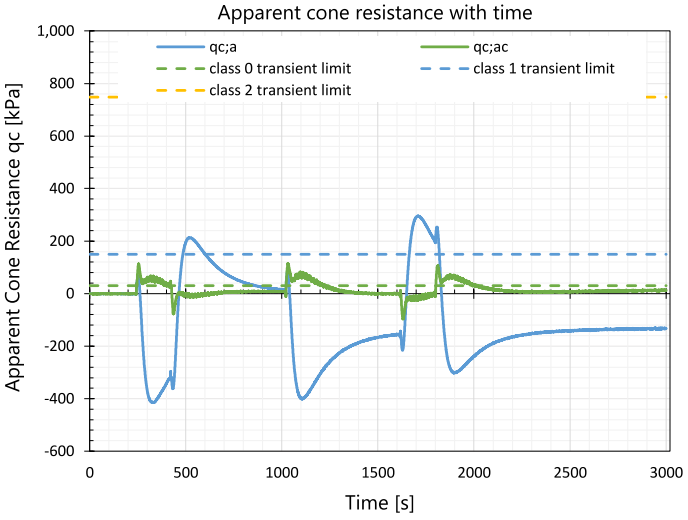
Table - 21a **Ambient temperature stability and classification**

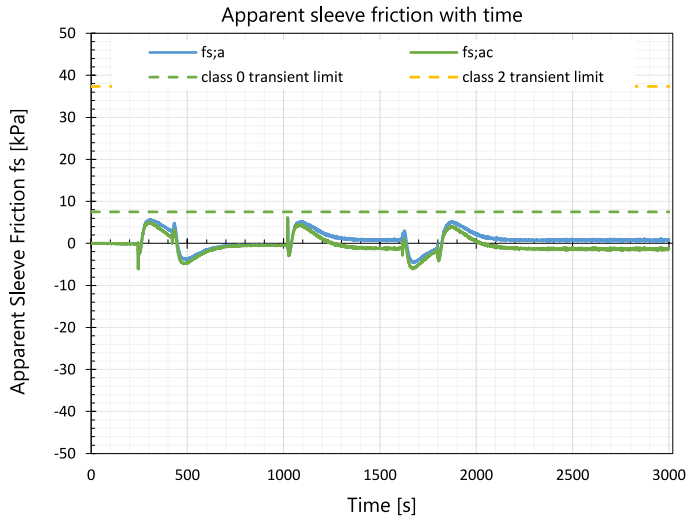
Ambient temperature stability		kPa/°C	Class
Uncorrected	Δaqc	4.45	2
	Δafs	-0.03	0
	Δau	-1.35	N/A
Corrected	Δaqcc	-0.43	0
	Δafsc	0.04	0
	Δauc	0.27	0

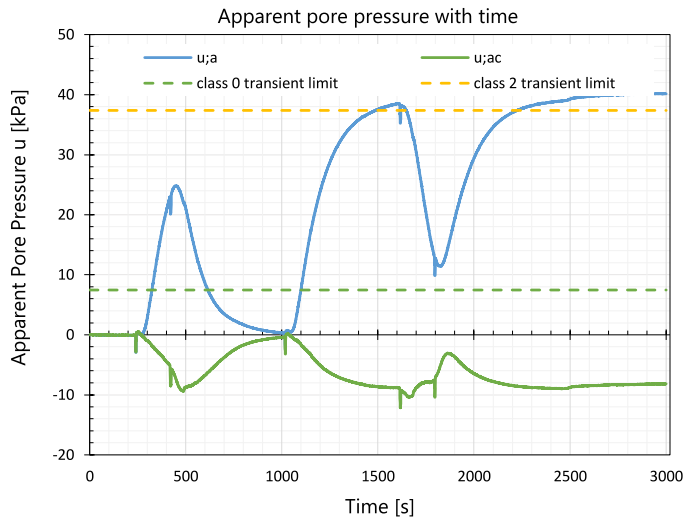
Table - 21b **Transient temperature stability and classification**

Transient temperature stability		kPa/°C	Class
Uncorrected	Δtqc	23.74	2
	Δtfs	0.41	0
	Δtu	1.44	2
Corrected	Δtqcc	7.05	1
	Δtfsc	0.41	0
	Δtuc	0.42	0









Bending Influence Verification

Verification Method

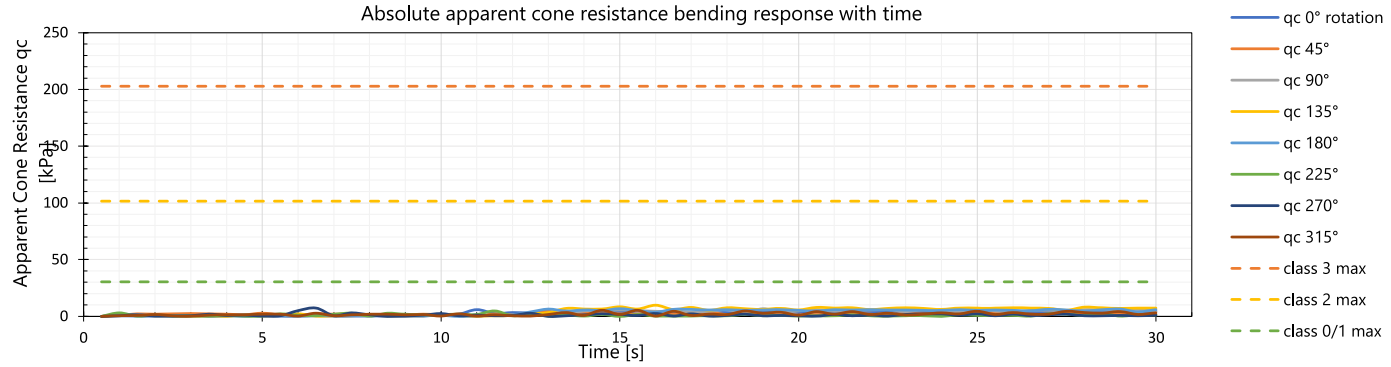
1. The cone penetrometer was placed in the bending influence frame, clamping the cone horizontally.
2. The test method for verification of a cone penetrometer for bending influence was followed as set out in BS EN ISO 22476-1:2023, clause B.2.8.2.
3. The air temperature, apparent cone resistance, apparent sleeve friction, and apparent pore pressure were recorded for the duration of each test. In total 8 tests were performed from 0° rotation to 315° rotation, evenly spaced with 45° rotation between tests.
4. The bending influence results and resulting cone penetrometer classification was calculated and are shown in Table 22.

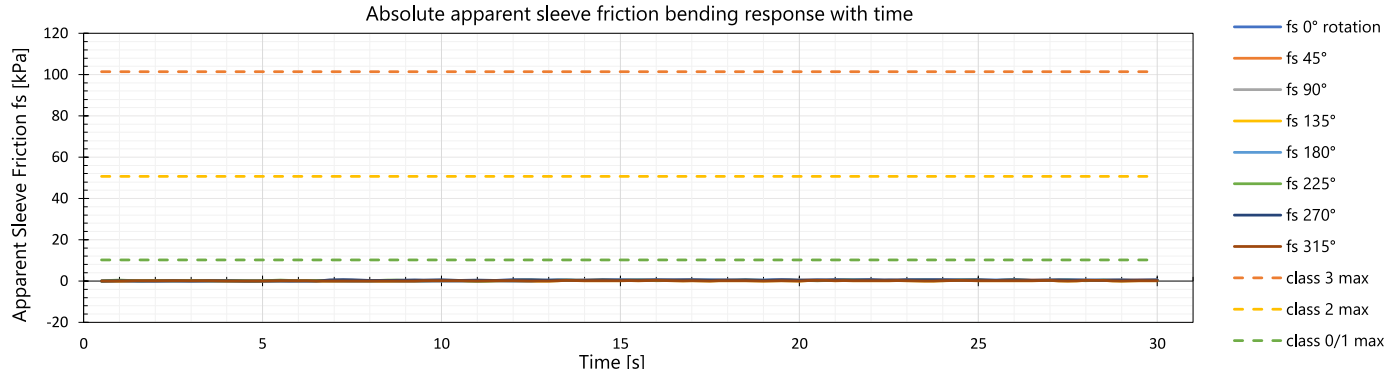
Table - 22 **Bending Influence results**

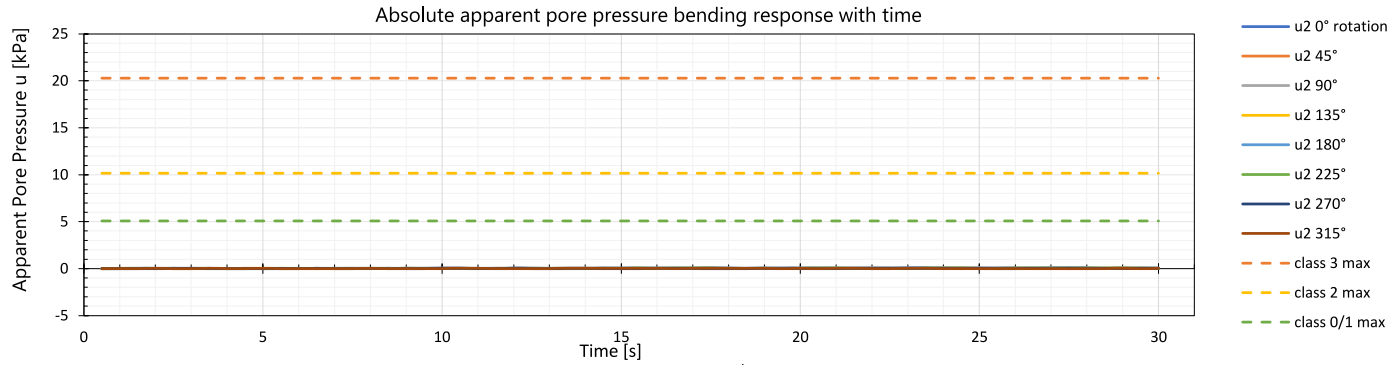
	qc;a [kPa/N]	fs;a [kPa/N]	u2;a [kPa/N]	Ambient Temp [°C]
max	0.022	0.005	0.001	23.8
min	-0.097	-0.004	0.000	23.5
max test Δb, Δt	0.119	0.009	0.001	0.3
class	0	0	0	

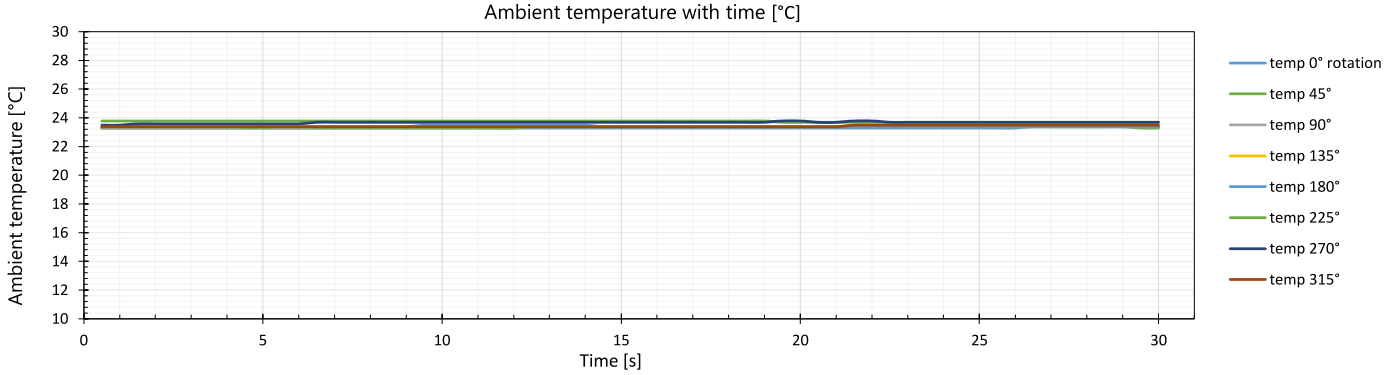
10 kg Calibration Weight Uncertainty	
10 kg Calibration Weight	0.001 %

10 kg Calibration Weight	
Reference weight	10.341 kg
Reference force	101.411 N









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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Sensor Stability Verification

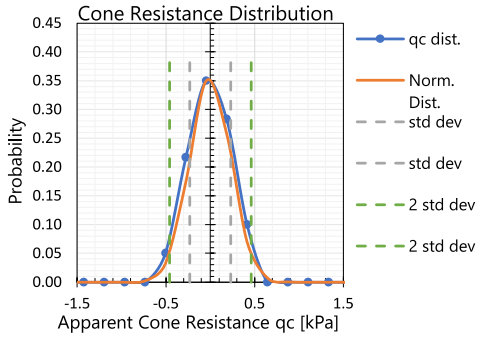
The purpose of this section is to quantify the stability of the geotechnical sensors (qc, fs, u) and demonstrate validity of applying a normal distribution, described by standard deviation and mean, when assessing probability of noise magnitude. The sampling duration has been limited to 60 seconds to allow direct comparison to the field verification data required under BS EN ISO 22476-1: 2023.

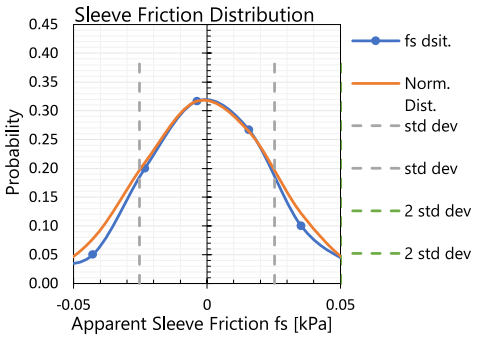
Verification method

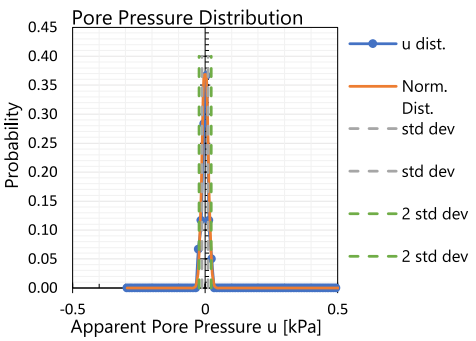
1. The cone penetrometer was placed in the thermostatic temperature calibration bath at ambient temperature.
2. The cone penetrometer was left for no less than 30 minuets or until the output was stable.
3. The output was recorded for 60 seconds at a frequency of 1Hz. The maximum change and standard deviation are shown in Table 23.

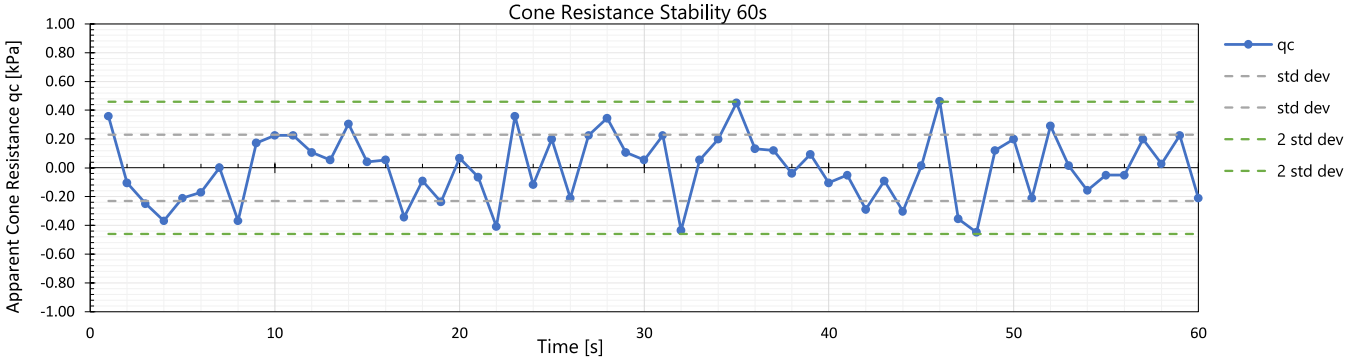
Table - 23 **Sensor stability results**

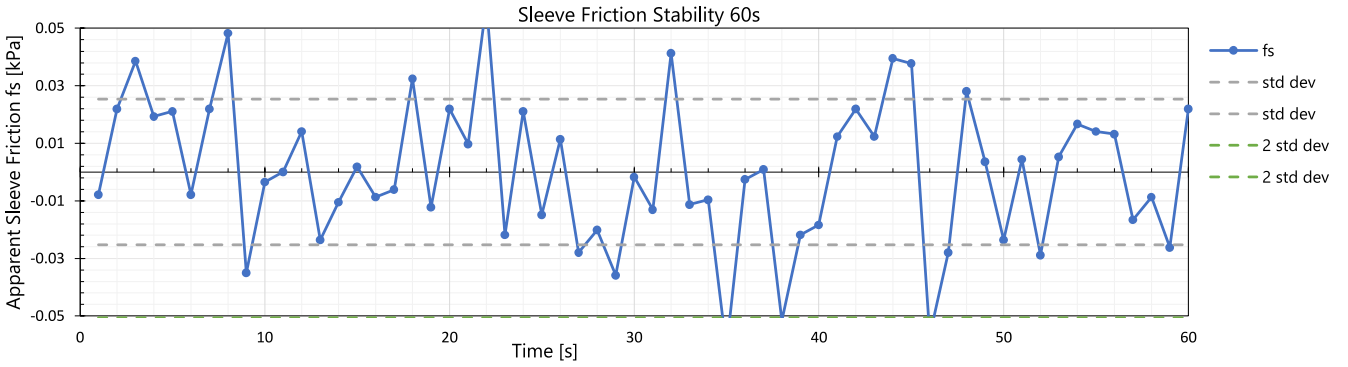
	qc (kPa)	fs (kPa)	u (kPa)	Inc (°)	Temp (°C)
Max	0.464	0.059	0.022	0.050	0.006
Min	-0.448	-0.061	-0.027	-0.054	-0.004
Δ (Max - Min)	0.912	0.120	0.049	0.108	0.018
Standard deviation (68% coverage)	± 0.230	± 0.025	± 0.011	± 0.019	± 0.003
2 standard deviations (95% coverage)	± 0.460	± 0.051	± 0.023	± 0.038	± 0.005

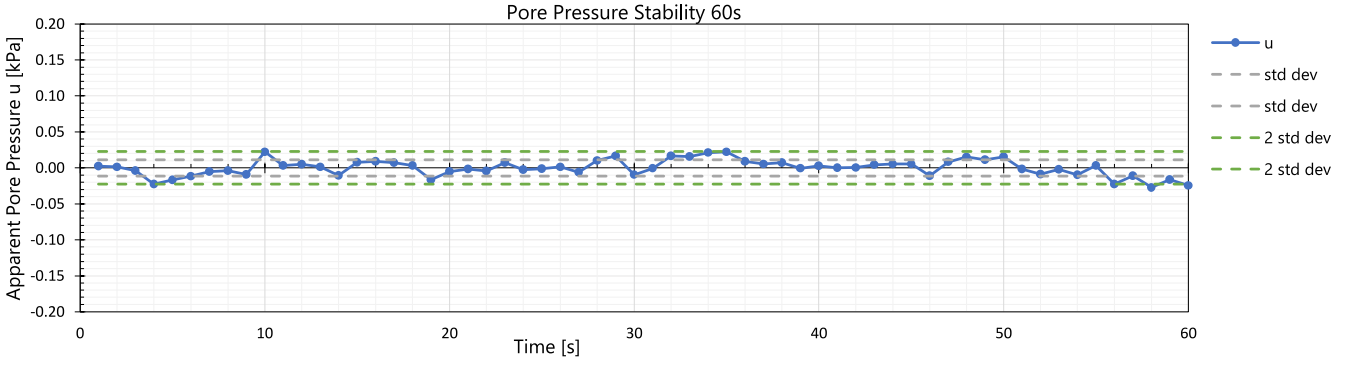












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CERTIFICATE OF CALIBRATION

Certificate Number: 1692

Cone Penetrometer Serial No.
DS15-CFIIPTTM.2488

Magnetometer Calibration

Calibration Method

1. The cone penetrometer was connected to a steel crossover rod.
2. The cone penetrometer was moved through the earths magnetic field for at least 5 minuets, at varying inclination and rotation angles.
3. The sensor was calibrated against the NOAA World Magnetic Model field estimate, using the coordinates of the calibration laboratory.
4. The resulting sensor bias, and sensor calibration factors for the calibration of soft iron effects are shown in Table 24.
5. The calibrated mean total field, total field mean error, and standard deviation of total field are shown in Table 25.

Cone Penetrometer Magnetometer	
Sensor range	200 uT
Resolution	10 nT

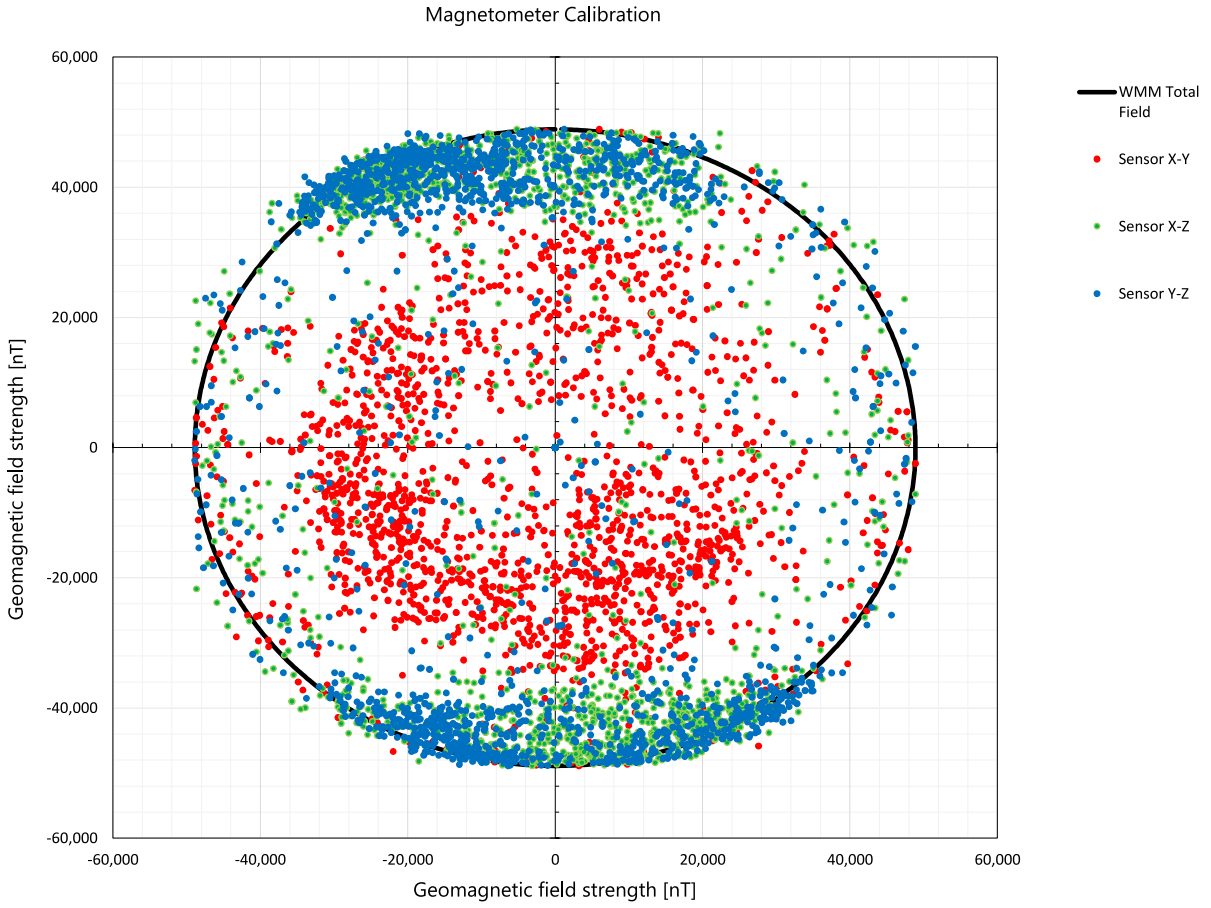
World Magnetic Model Total Field Calculations		
NOAA WMM total field estimate	48,892.3	nT
WMM field estimate uncertainty	145	nT
Latitude	50.975	N
Longitude	0.711	E
Elevation	0.031	km

Table - 24 ***Calibration factors***

X bias	-825	nT
Y bias	-1150	nT
Z bias	3475	nT
X factor	1.09154	factor
Y factor	1.15358	factor
Z factor	0.63366	factor

Table - 25 ***Calibration for soft iron effects, including cone and crossover rod***

Calibrated average total field	49,478	nT
Calibrated total field std deviation	1,598	nT
Total field mean error	1.20	%



UK27
Mini crawler



Rig weight	1.0 T (1.2 T with accessories)
Travel height	1.531 m
Working height [1]	3.724 m
Width	1.11 m
Max. operating ram capacity [2]	15 to 20 T
Max. travelling speed	2 km/h
Track material	Rubber
Track length	1.15 m
Track width	0.18 m
Footprint of tracks	1.15 m x 0.75 m
Max. ground bearing pressure	Tracking/testing: 26.9 kPa
Max. testing/travelling gradient	14 degrees
Noise output at 2 m	Testing – 76 dBA
Clamp arrangement	Push socket and pull pin
Ram stroke	1.3 m
Typical production	Up to 50 m of standard CPTu testing per day (depending on site conditions and access)

Ideal for sites with challenging access: along rivers, canals, flood and sea defenses/embankments and other sites where access is difficult for conventional rigs. The rig is also well suited to testing in beach or tidal environments due to the its ease of recovery combined with the speed of the CPT.

Options for the set-up: 2 ground anchors screwed into natural material, concrete bolt into competent concrete or ballasted (weights to be provided and moved by others).

Rubber tracks allow minimal tracking damage.

The rig is transported on a flat bed van or trailer.

[1] The working height can be reduced by 0.25 or 0.5 m with notice and discussion of project requirements for restricted access locations.

[2] Hydraulic rams capacity can be increased to 20 T where required for penetration of difficult strata. In practice this is usually limited to testing with mechanical fixing to concrete. When using auger anchors the available reaction force is dominated by the performance of the anchors, which perform best in firm to stiff clay or loose to medium dense sand.

APPENDIX C CONE PENETRATION TEST RESULTS

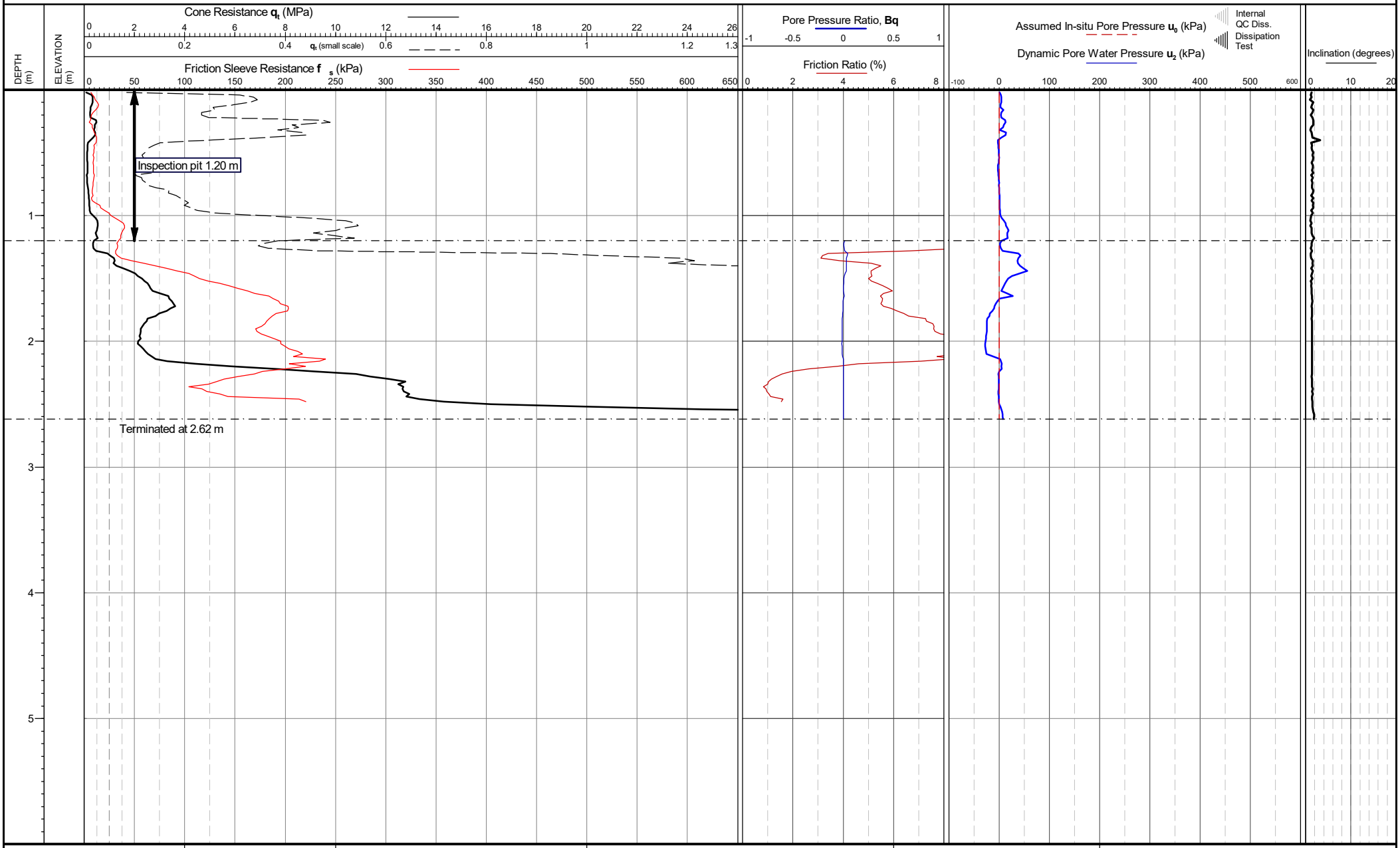
Measured CPT parameters

intermediate parameters R_f and B_q

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

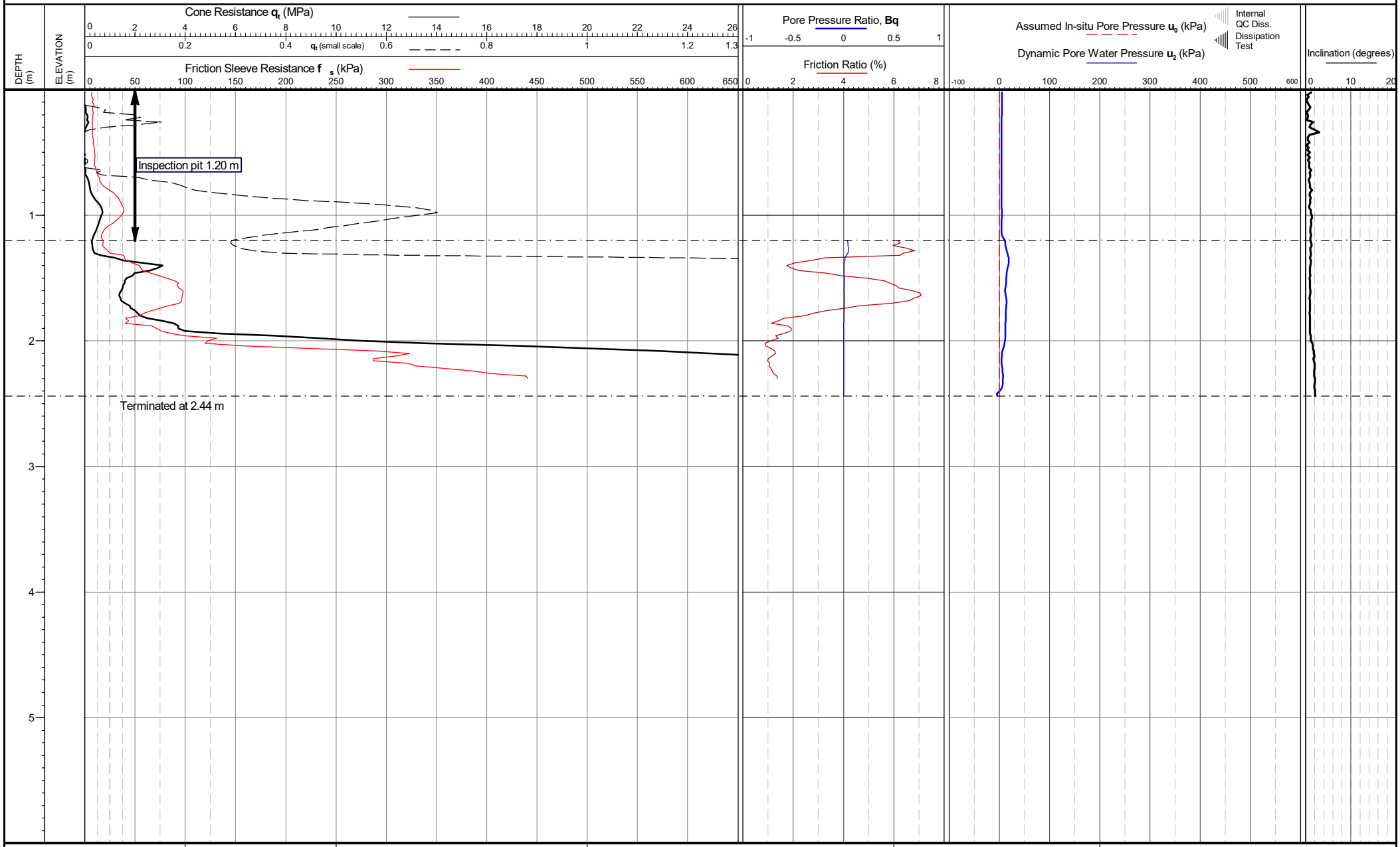


Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 13/02/2025 12:49:58	Zero drift (Pre/post test) q_c (kPa): -30.0 f_s (kPa): 1.8 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -6.8	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT101

Project: MANCHESTER

Client: TETRA TECH

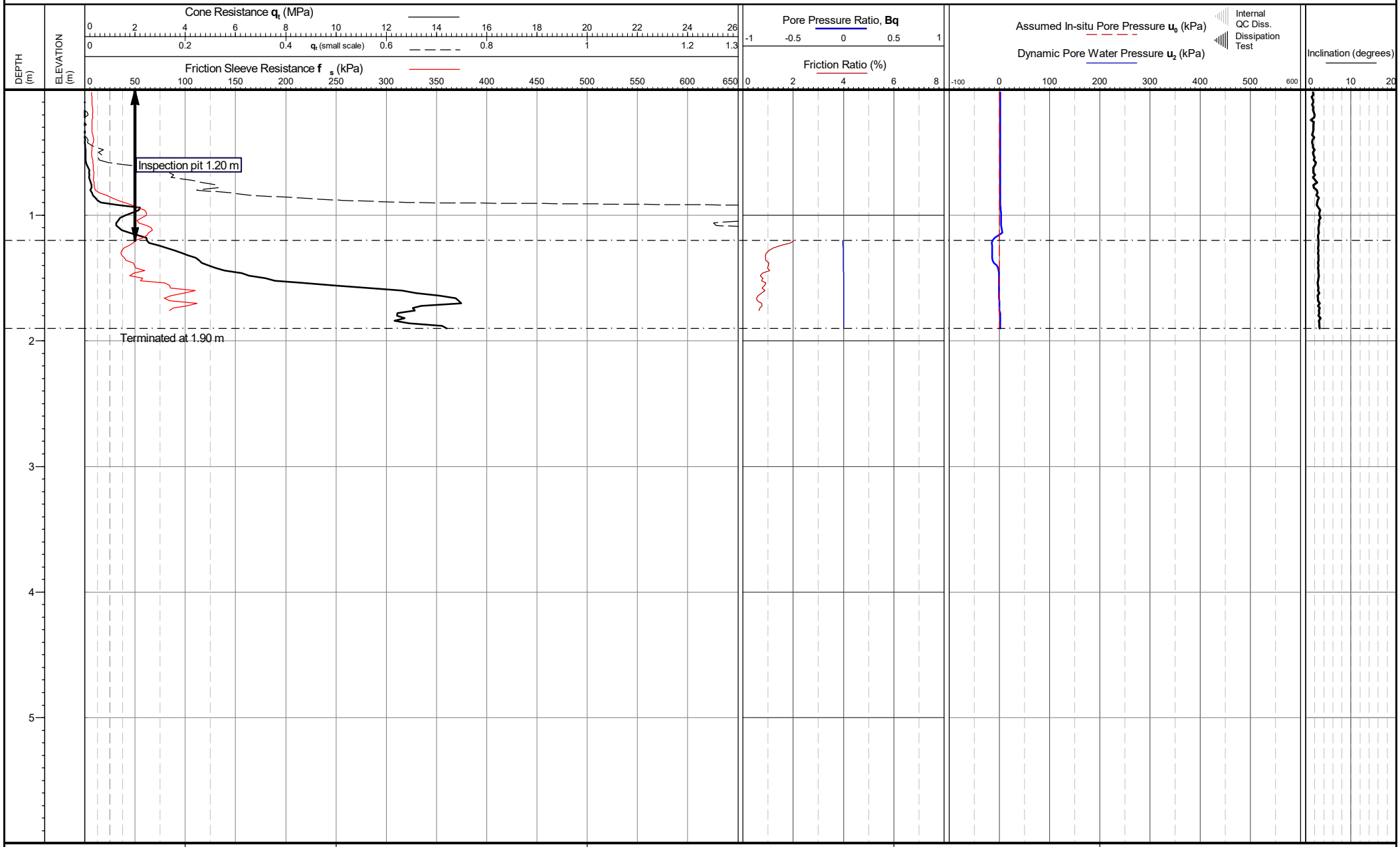


Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 13/02/2025 16:00:11	Zero drift (Pre/post test) q_c (kPa): -33.6 f_s (kPa): -0.7 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -4.8	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT102

Project: MANCHESTER

Client: TETRA TECH



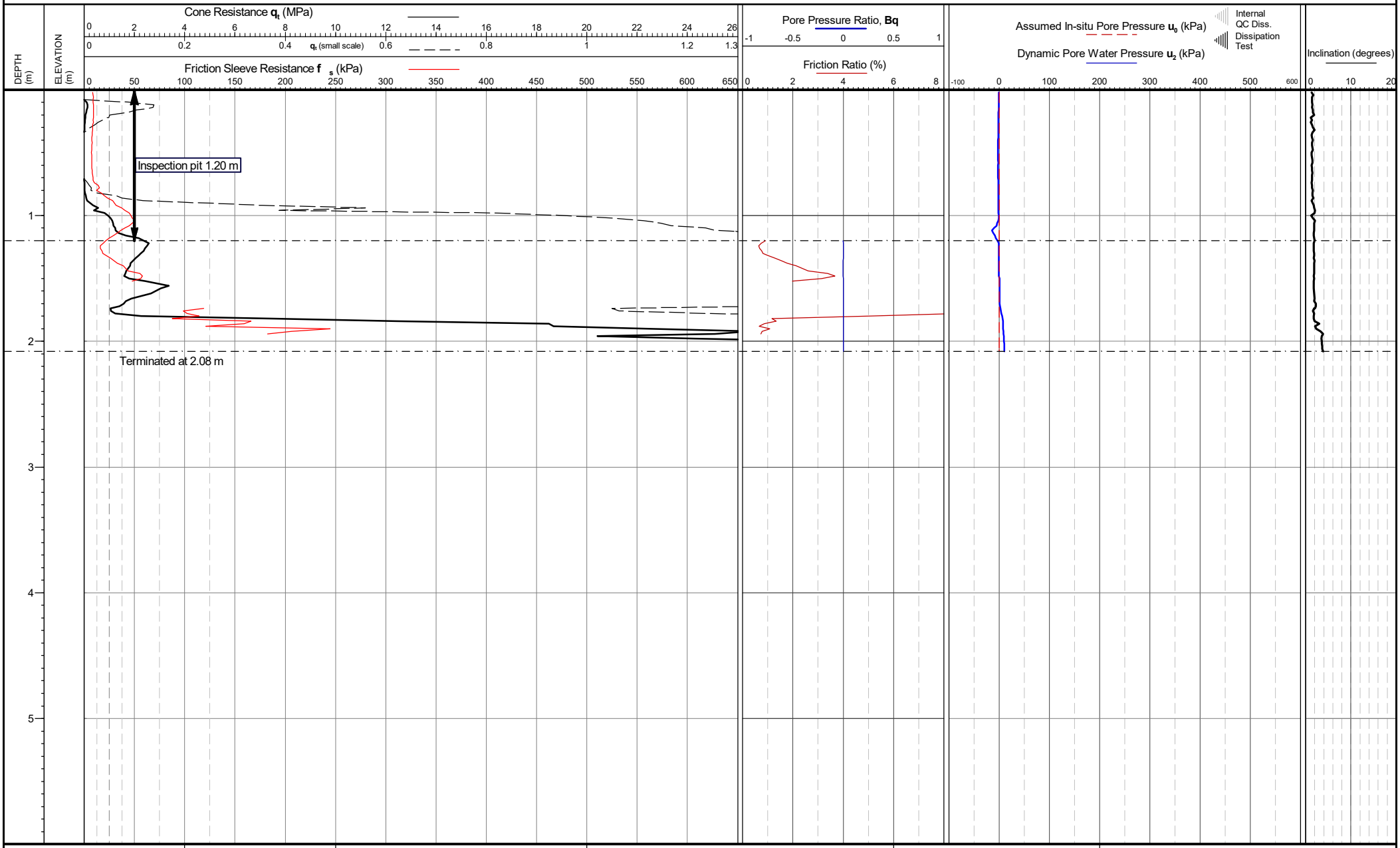
Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 14/02/2025 09:59:55	Zero drift (Pre/post test) q_c (kPa): 28.8 f_s (kPa): -1.7 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -2.6	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT103

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

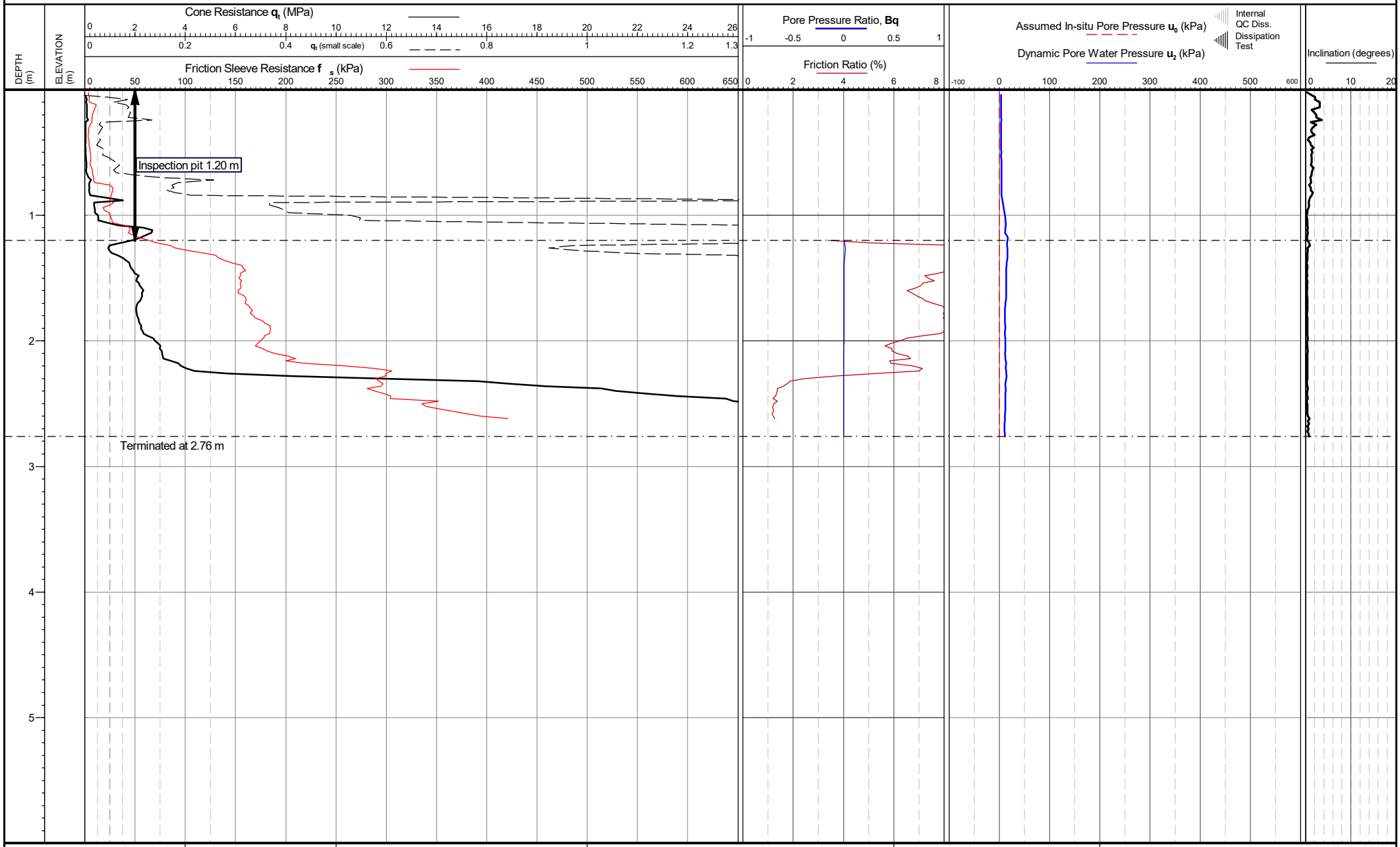


Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 14/02/2025 11:02:54	Zero drift (Pre/post test) q_c (kPa): 10.2 f_s (kPa): 2.3 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -15.8	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT104

Project: MANCHESTER

Client: TETRA TECH

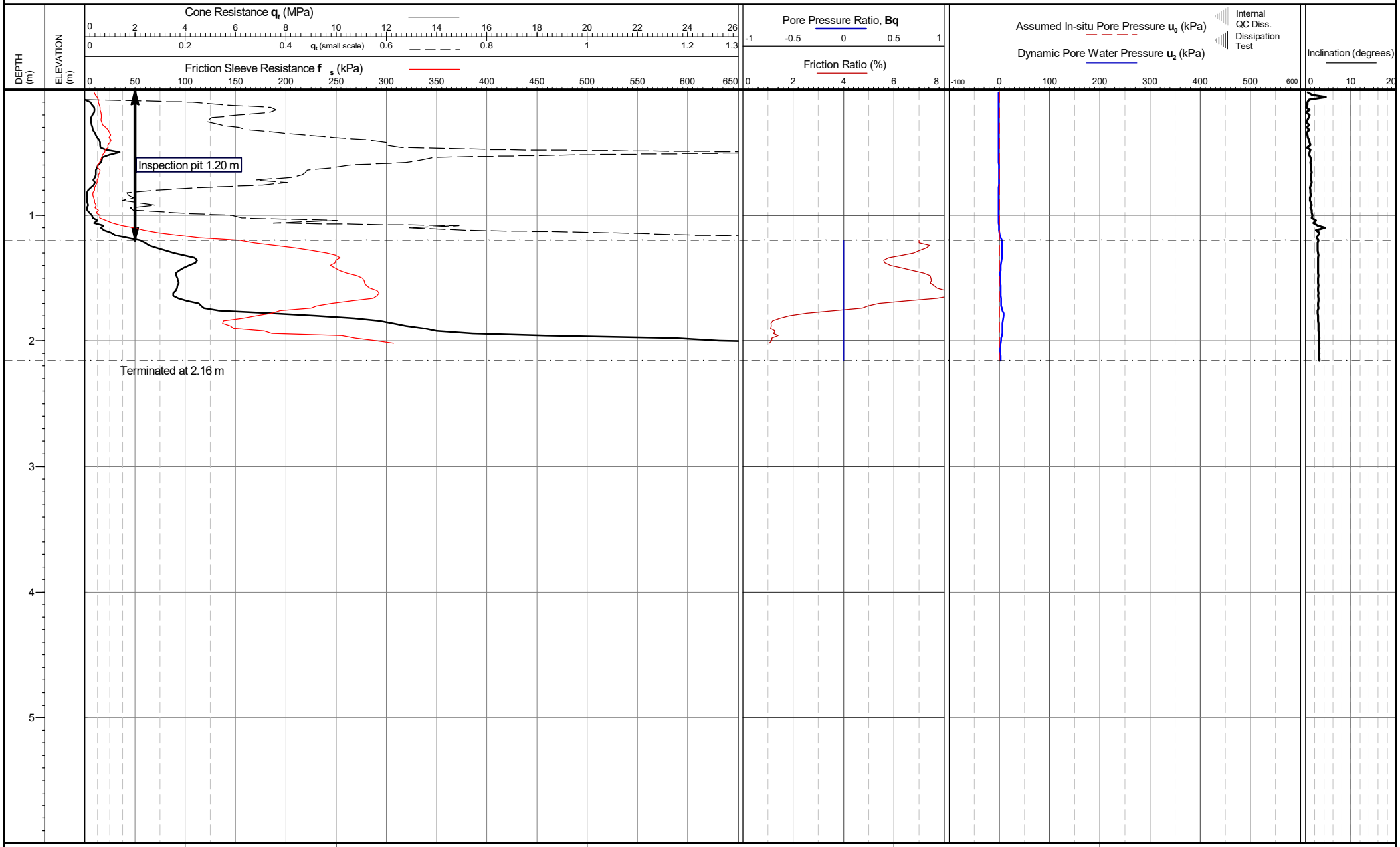


Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 13/02/2025 14:16:11	Zero drift (Pre/post test) q_c (kPa): -65.2 f_s (kPa): 2.9 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): 0.1	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT105

Project: MANCHESTER

Client: TETRA TECH

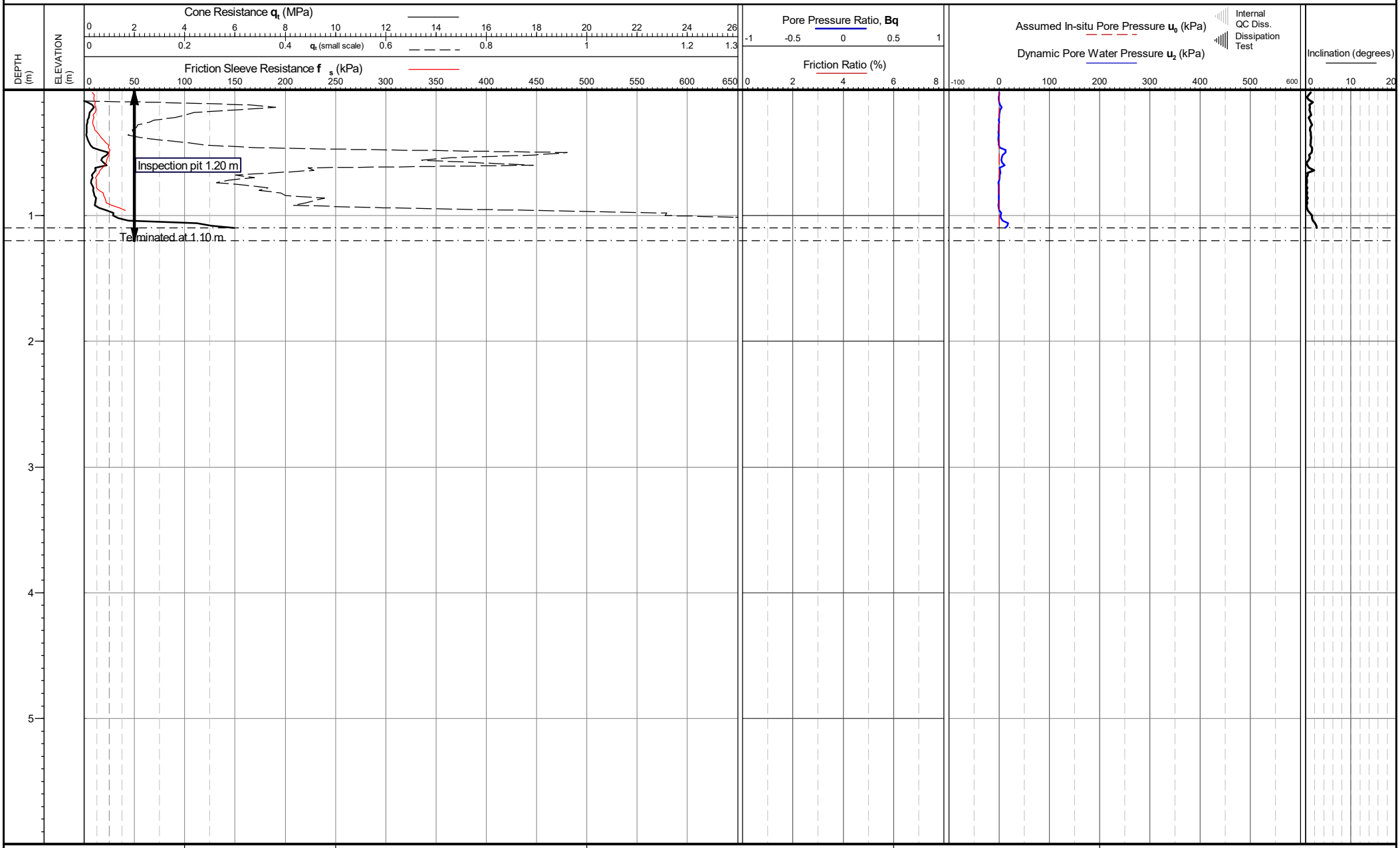


Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 14/02/2025 12:25:08	Zero drift (Pre/post test) q_c (kPa): 11.4 f_s (kPa): -0.3 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -2.2	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT106

Project: MANCHESTER

Client: TETRA TECH

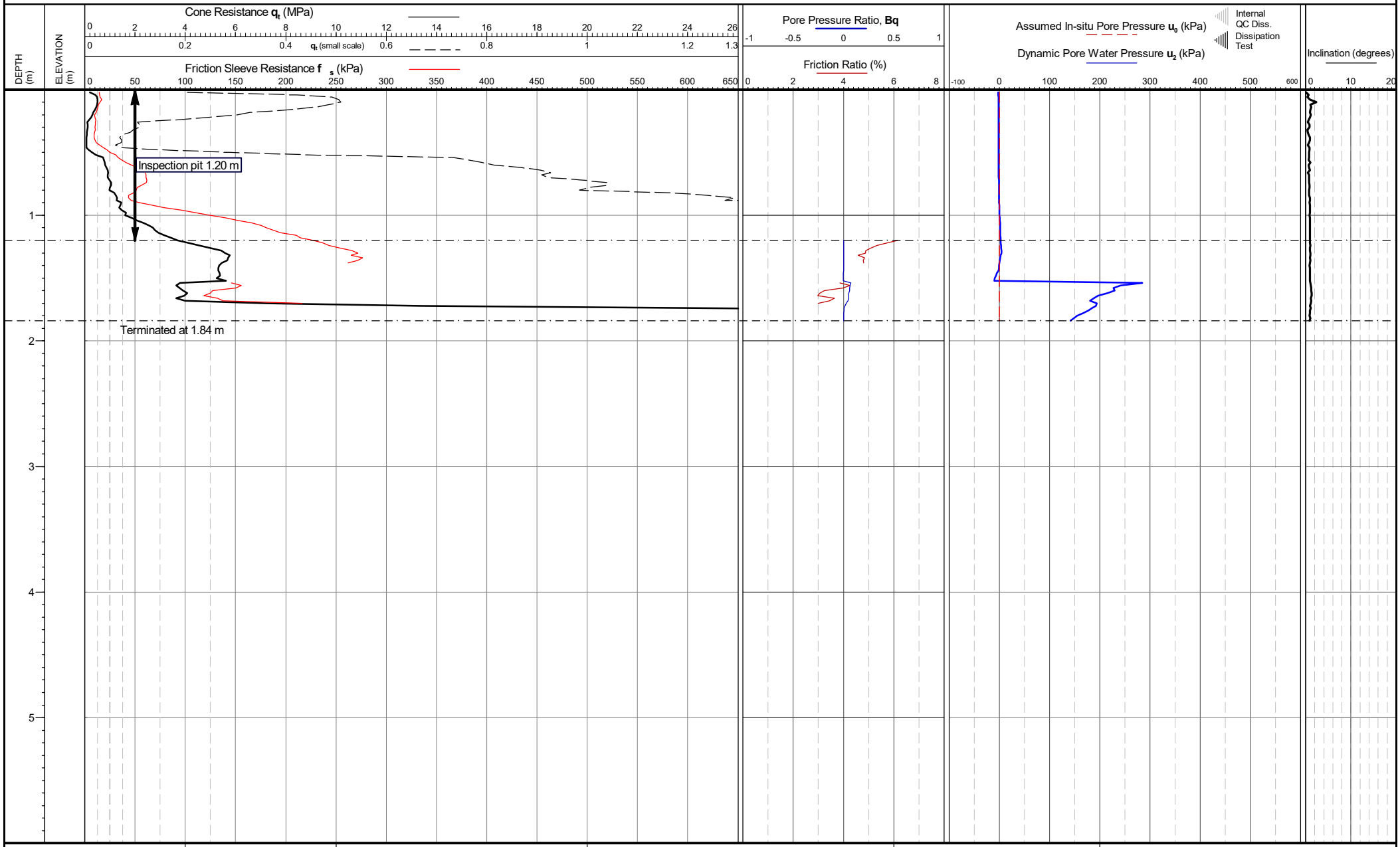


Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 14/02/2025 15:35:44	Zero drift (Pre/post test) q_c (kPa): -55.6 f_s (kPa): 3.7 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -1.0	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT107

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2): Cone ID: S15-CFIPTTM250.2488 Operator: Jamie Butterworth Rig Used: UK27 Date of test: 14/02/2025 13:42:42	Zero drift (Pre/post test) q_c (kPa): 40.4 f_s (kPa): -1.9 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -1.0	Location: Greater Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total reaction force	Date of plot: 14-02-25 Checked by: Chris Player	Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT108

APPENDIX D SOIL BEHAVIOUR TYPE RESULTS

Soil behaviour type (SBT) point data evaluation according to:

Schneider et al (2008)

Robertson (2016)

Robertson (2010) with aggregate layer descriptions

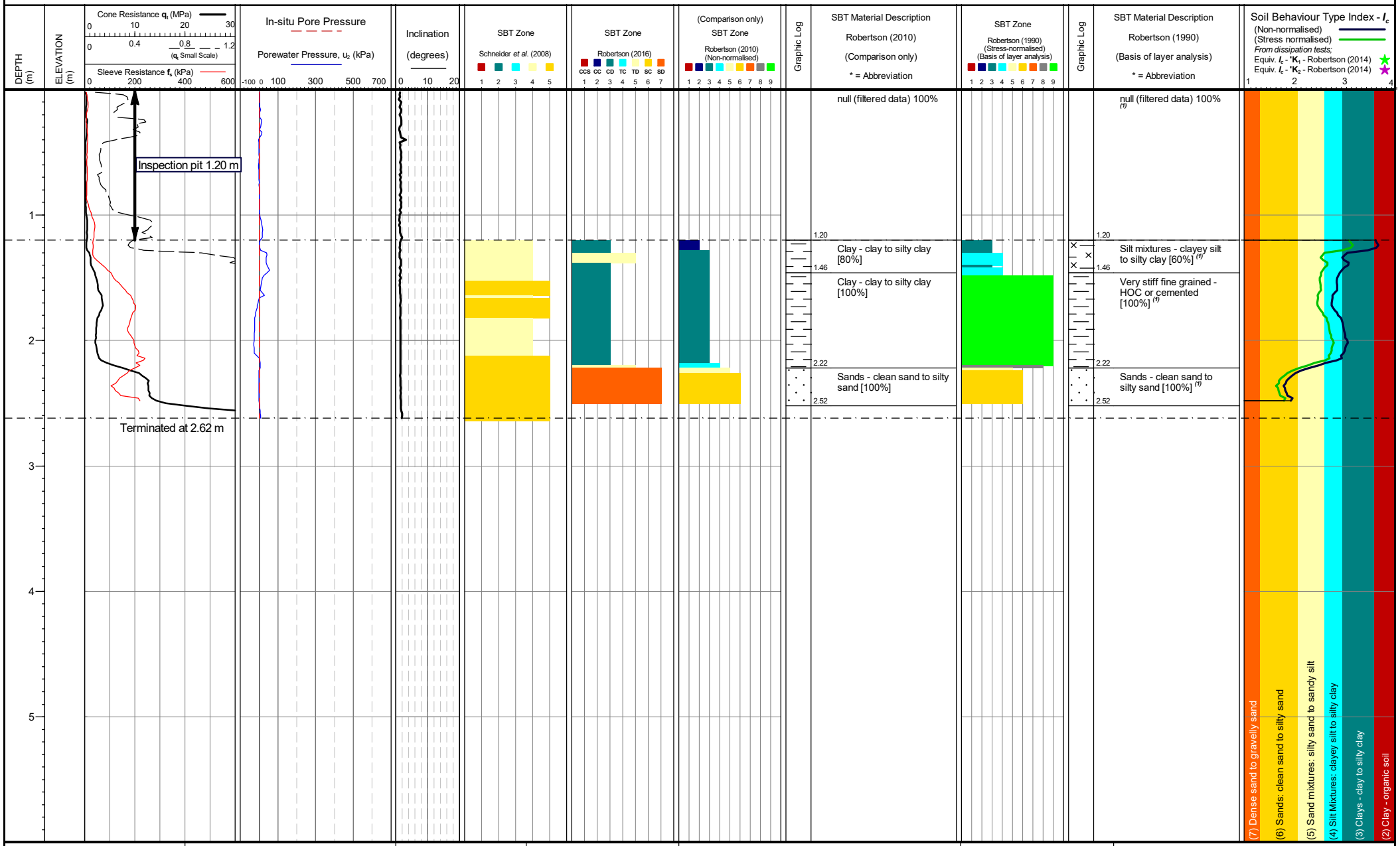
Robertson (1990) with aggregate layer descriptions

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 13/02/2025 12:49:58

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

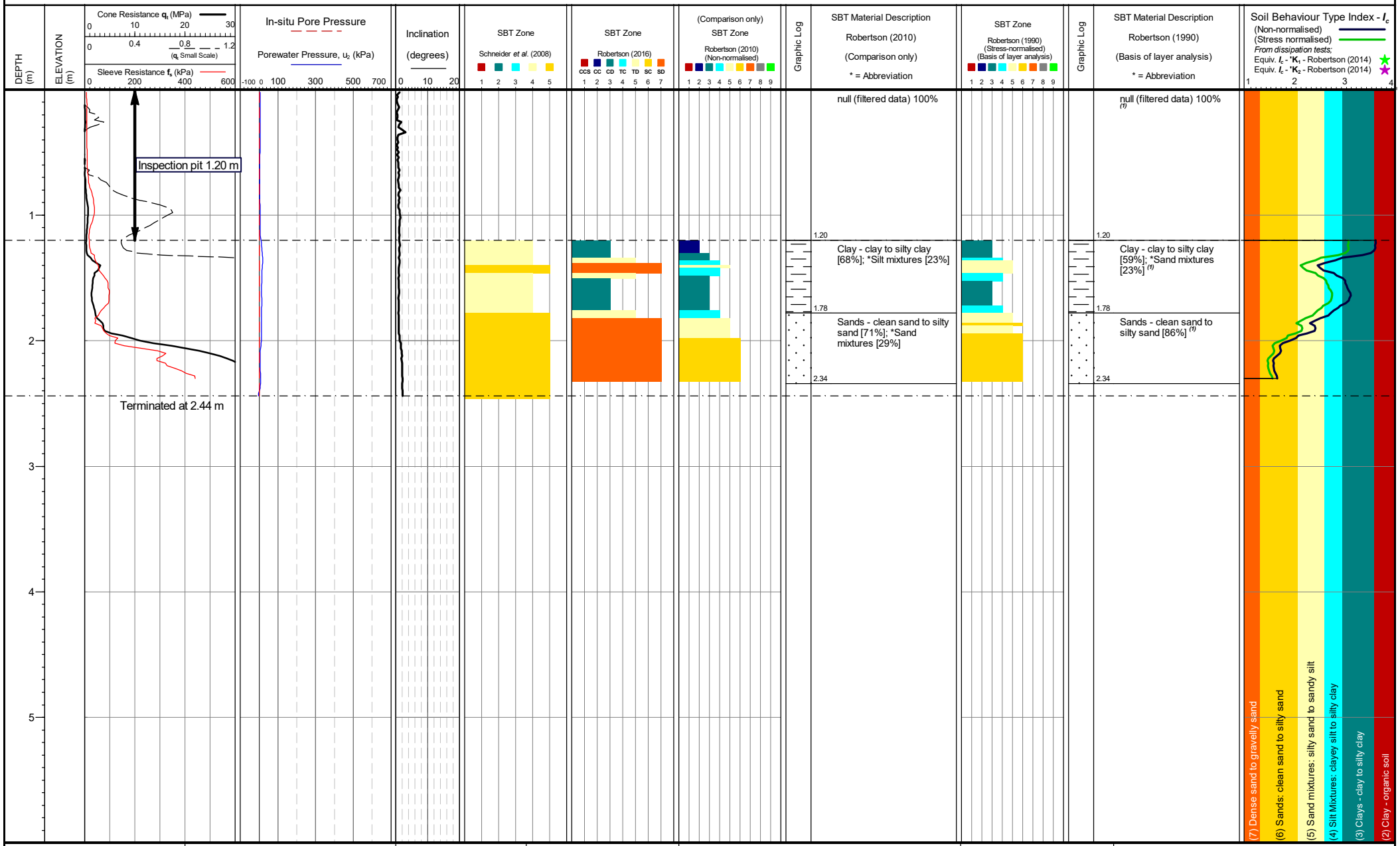
Internal QA Diss. Dissipation Test

TEST ID: CPT101

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 13/02/2025 16:00:11

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

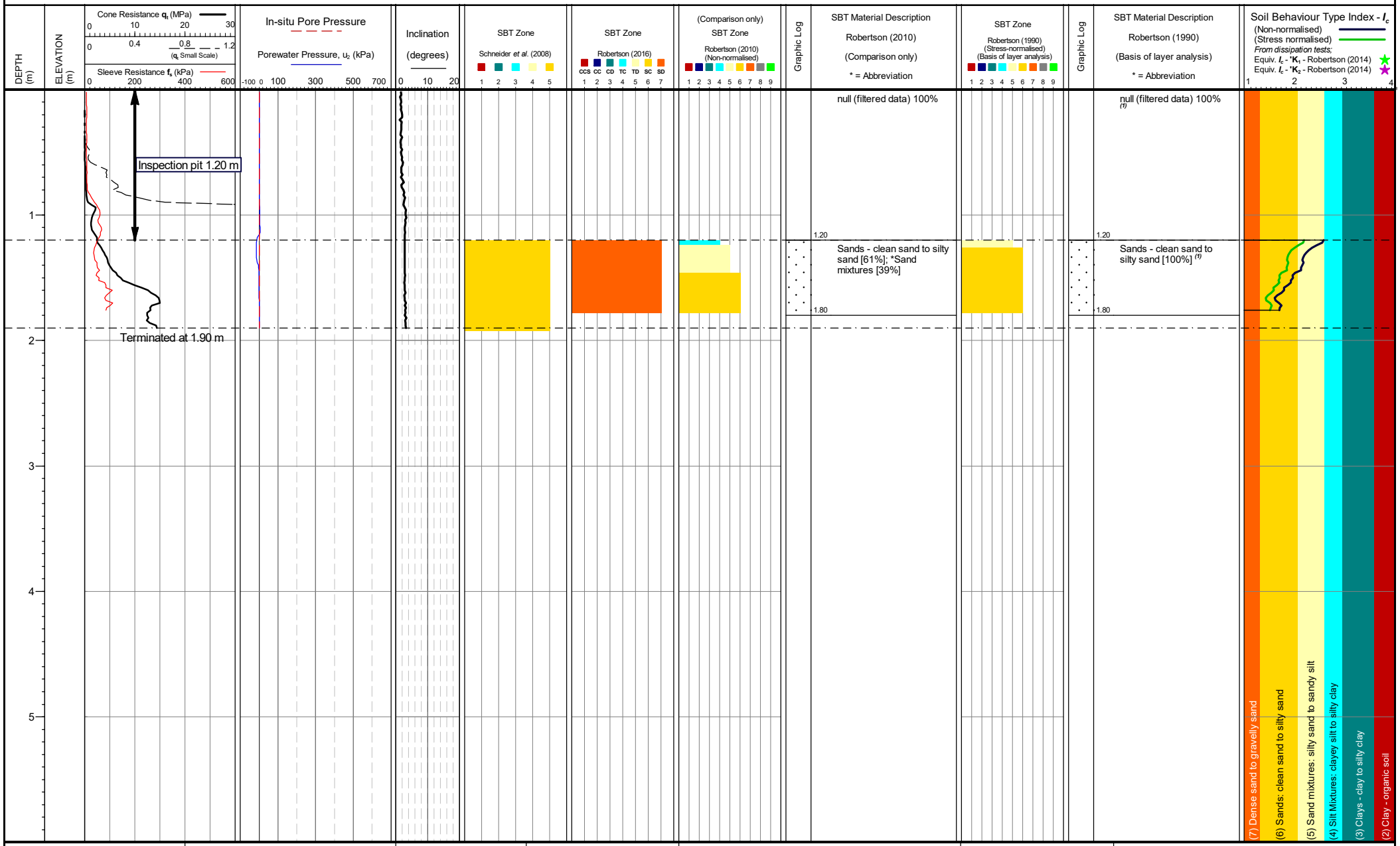
TEST ID: CPT102

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 14/02/2025 09:59:55

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(†) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

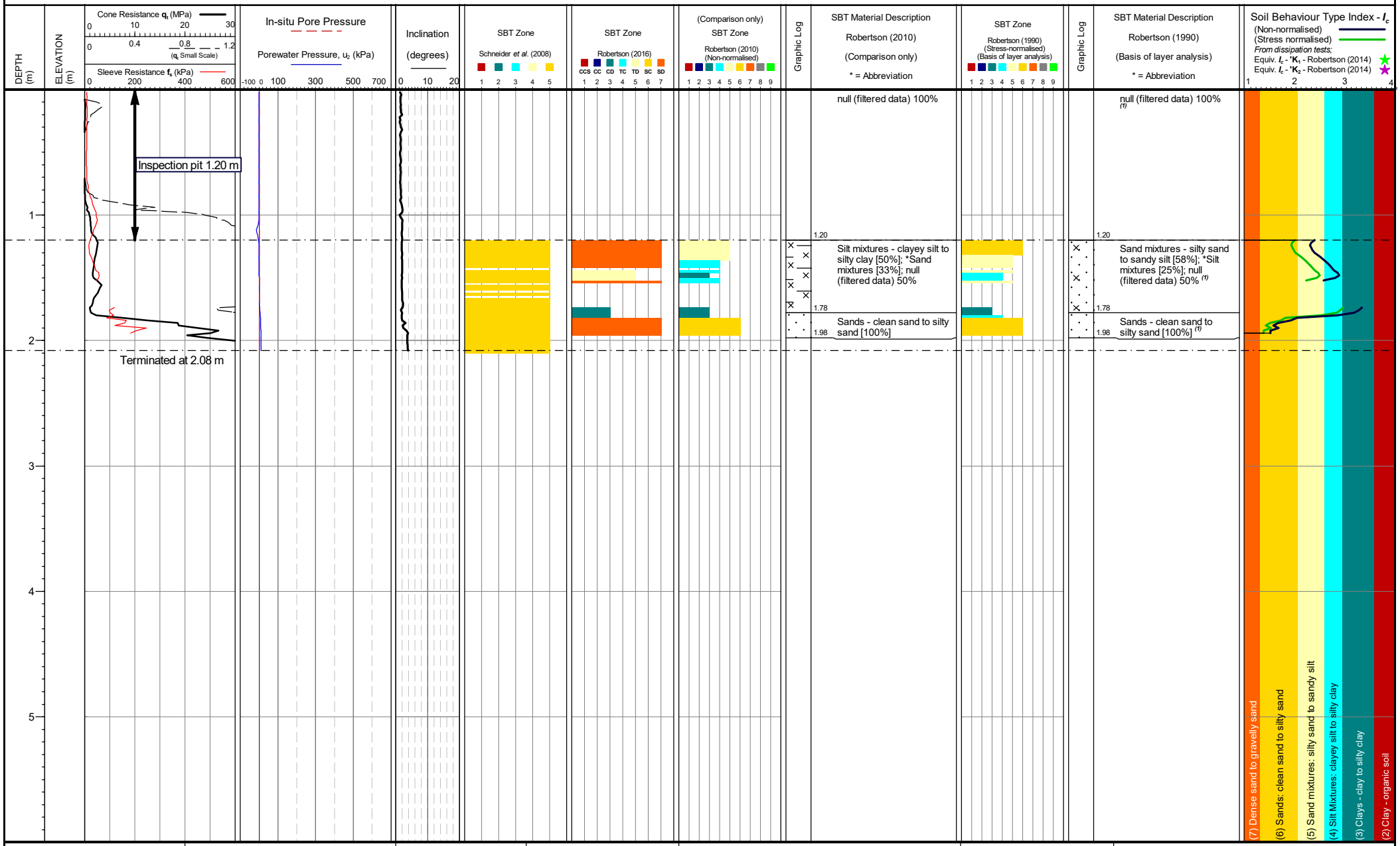
TEST ID: CPT103

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 14/02/2025 11:02:54

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

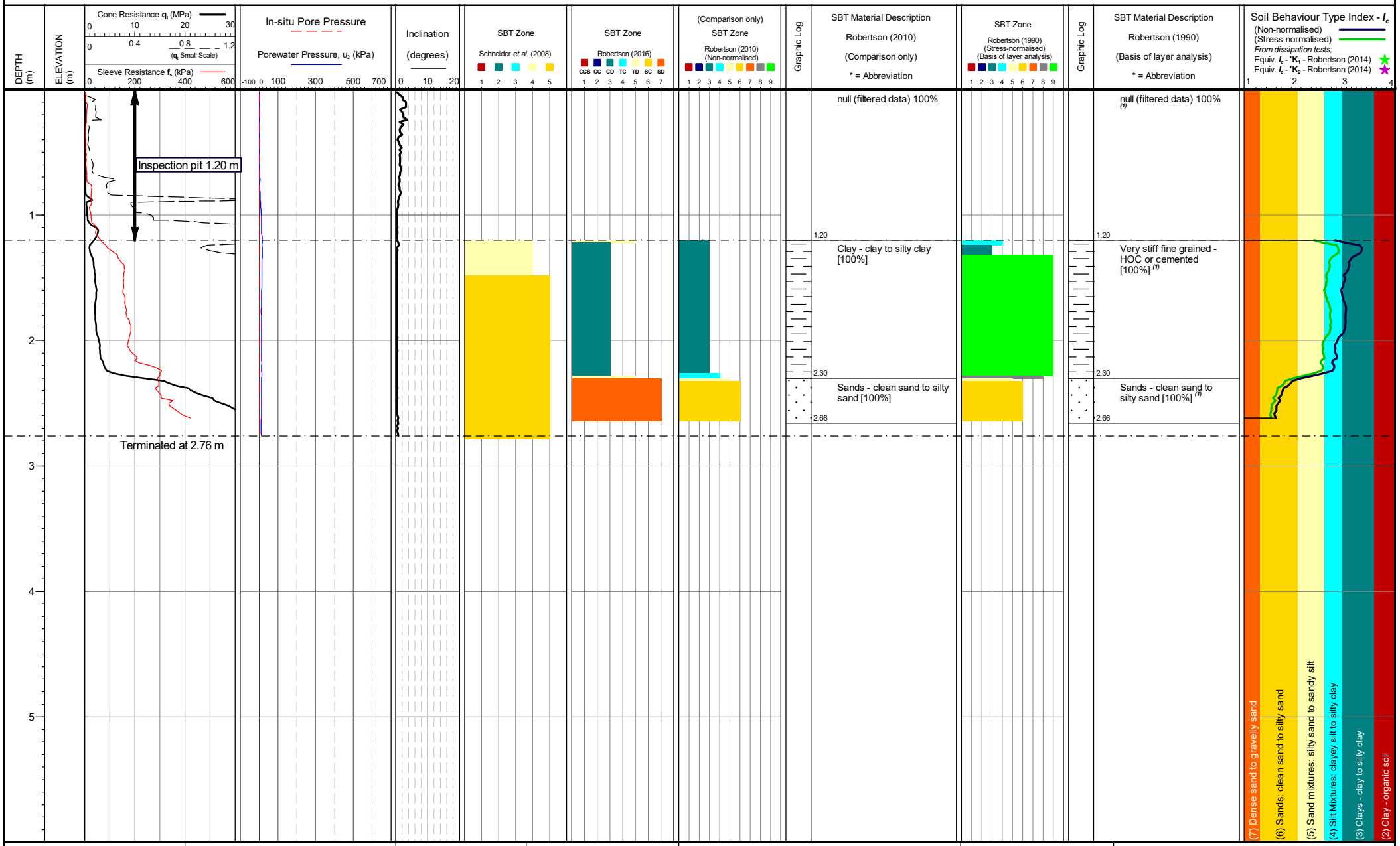
TEST ID: CPT104

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 13/02/2025 14:16:11

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

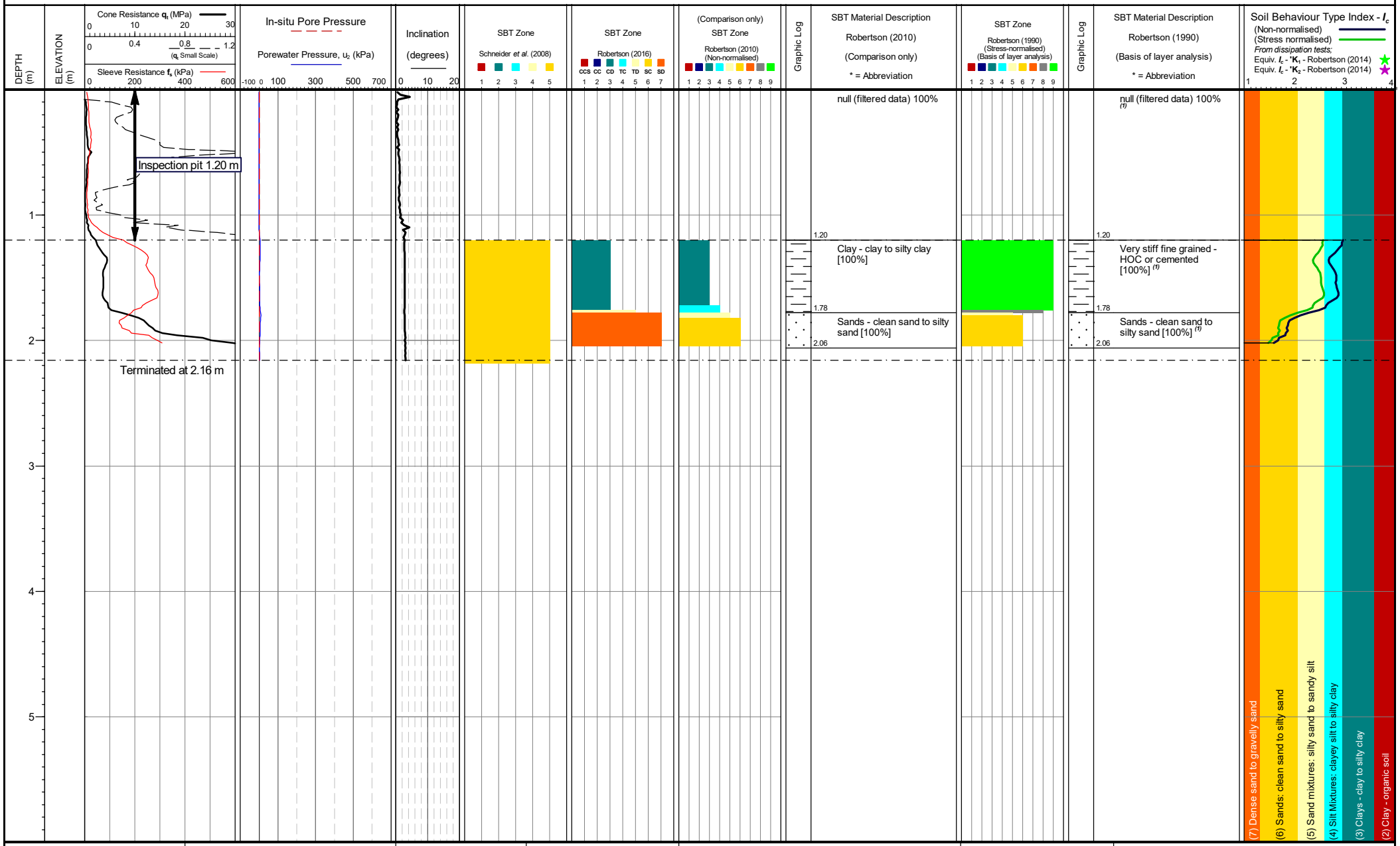
TEST ID: CPT105

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 14/02/2025 12:25:08

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

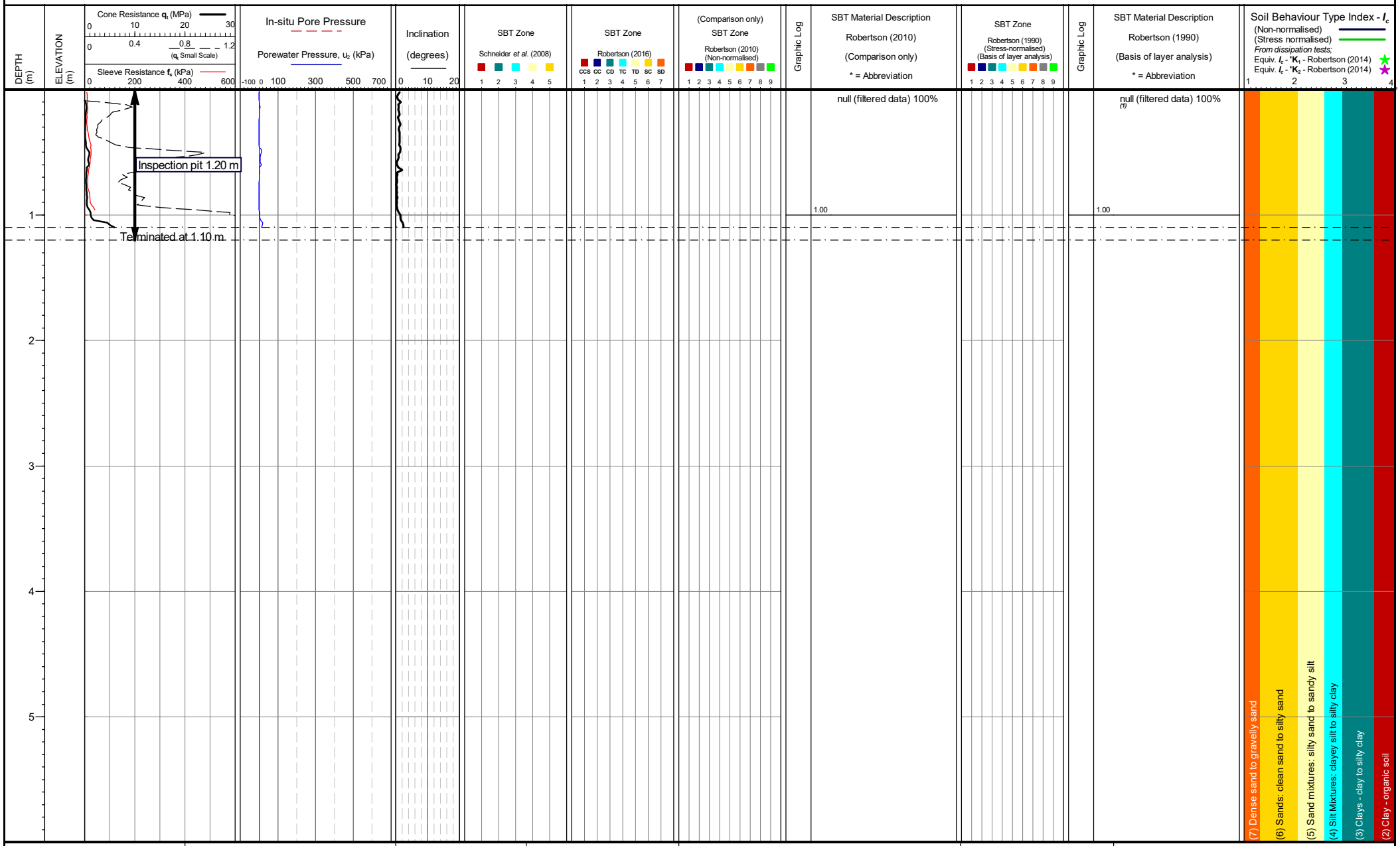
TEST ID: CPT106

LANKELMA

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 14/02/2025 15:35:44

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

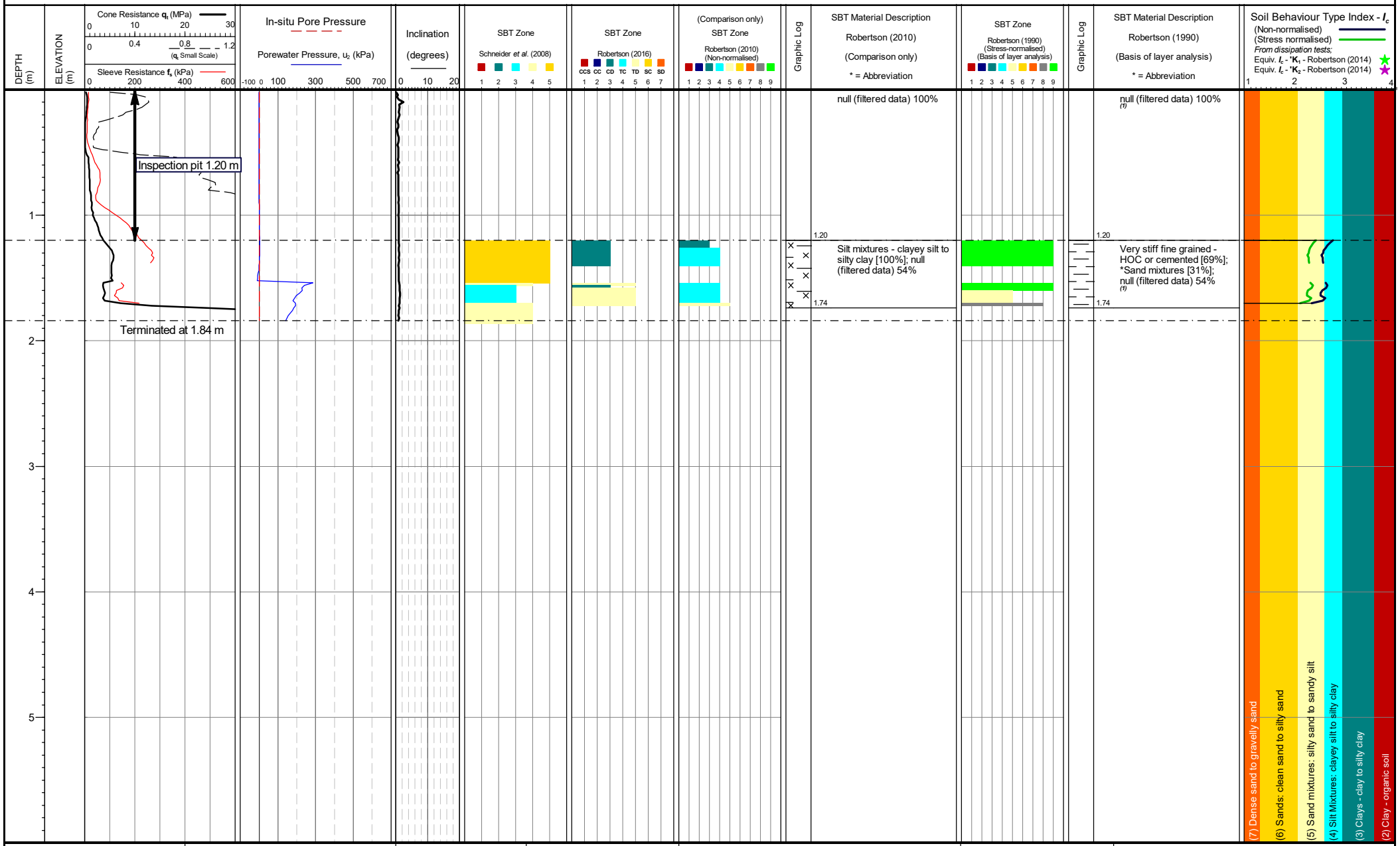
Internal QA Diss.
Dissipation Test

TEST ID: CPT107

Project: MANCHESTER

Client: TETRA TECH

Lankelma Project Ref: 25-32-29098-7



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Location: Greater Manchester, UK
Rig Used: UK27
Date of test: 14/02/2025 13:42:42

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: ,
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I_c clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

TEST ID: CPT108

APPENDIX E PARAMETER RESULTS 1 – S_U, M_V, OCR, SBT, I_C

Undrained shear strength

Coefficient of volume change

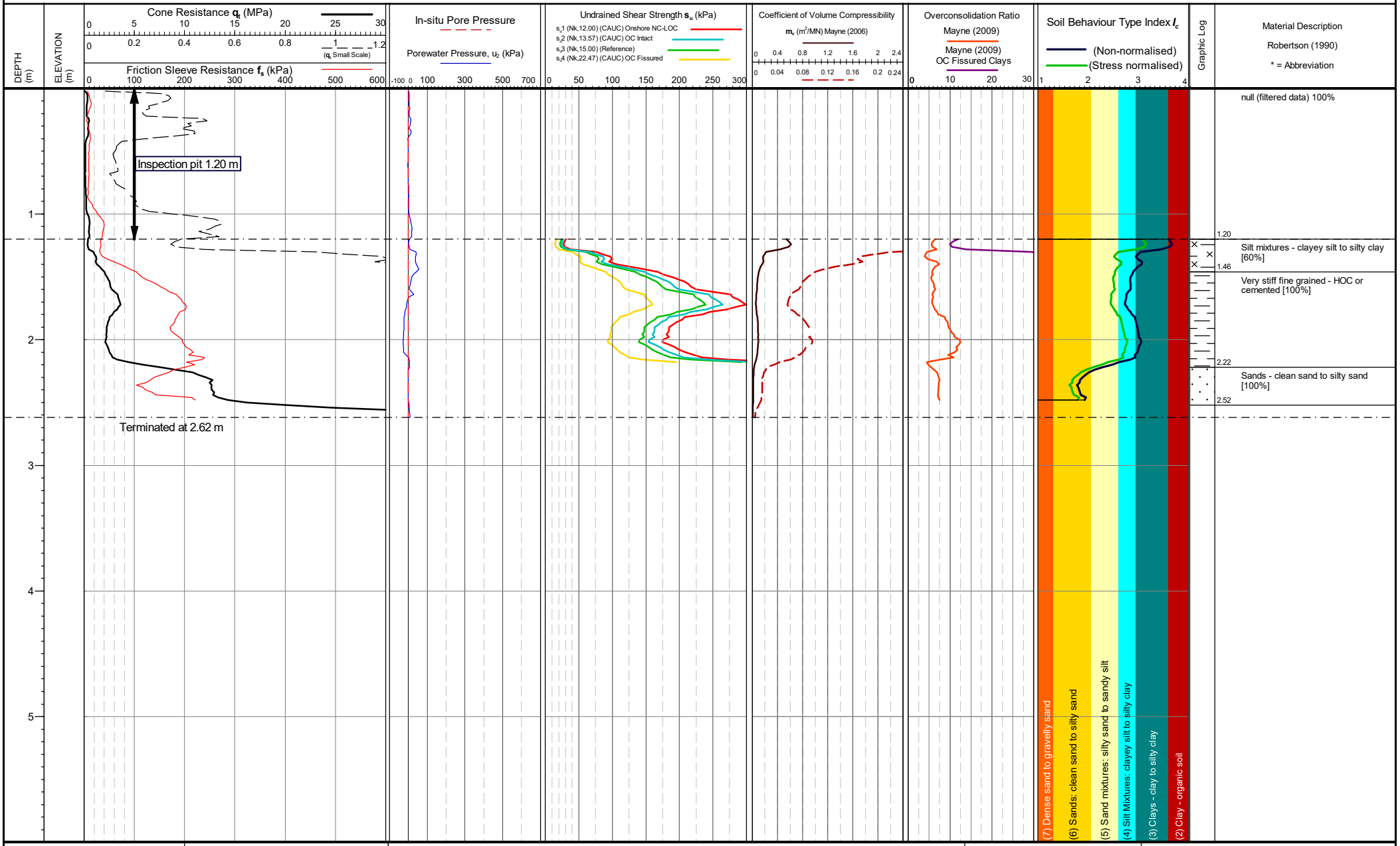
Overconsolidation ratio

Robertson 1990 SBT descriptions & SBT index I_c

LANKELMA

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 13/02/2025 12:49:58

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

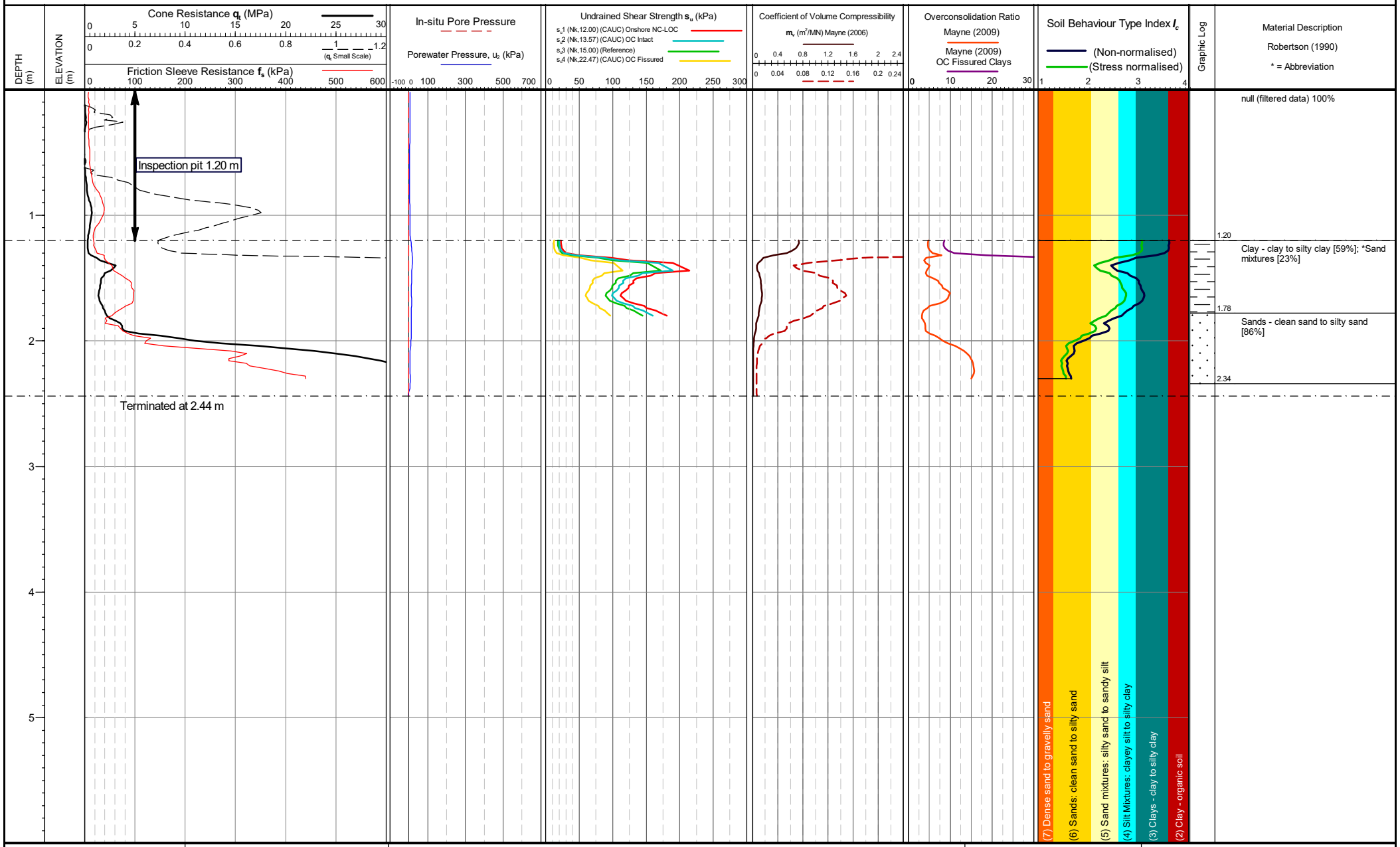
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT101

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 13/02/2025 16:00:11

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

Checked by: Chris Player

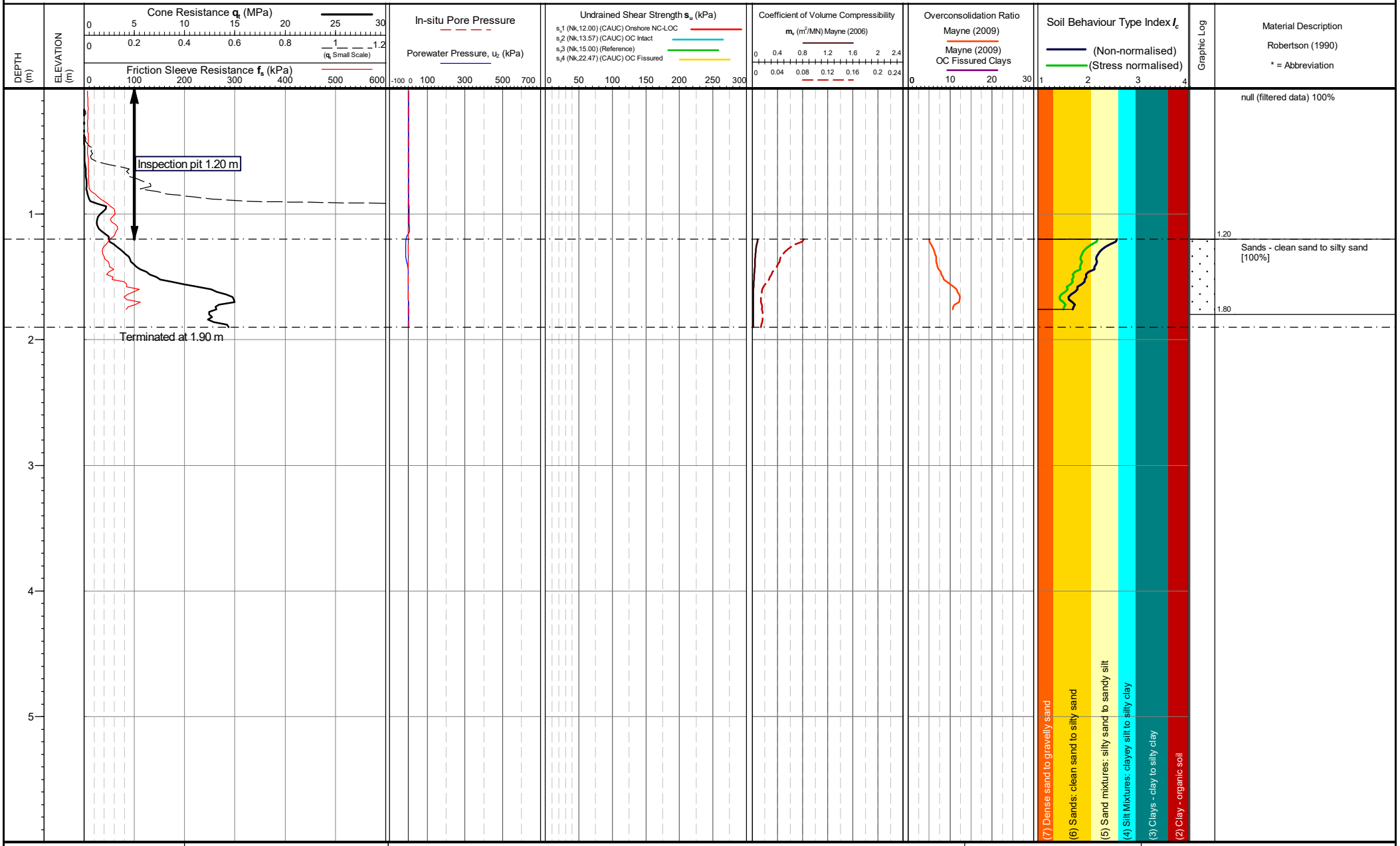
Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT102

LANKELMA

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 14/02/2025 09:59:55

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

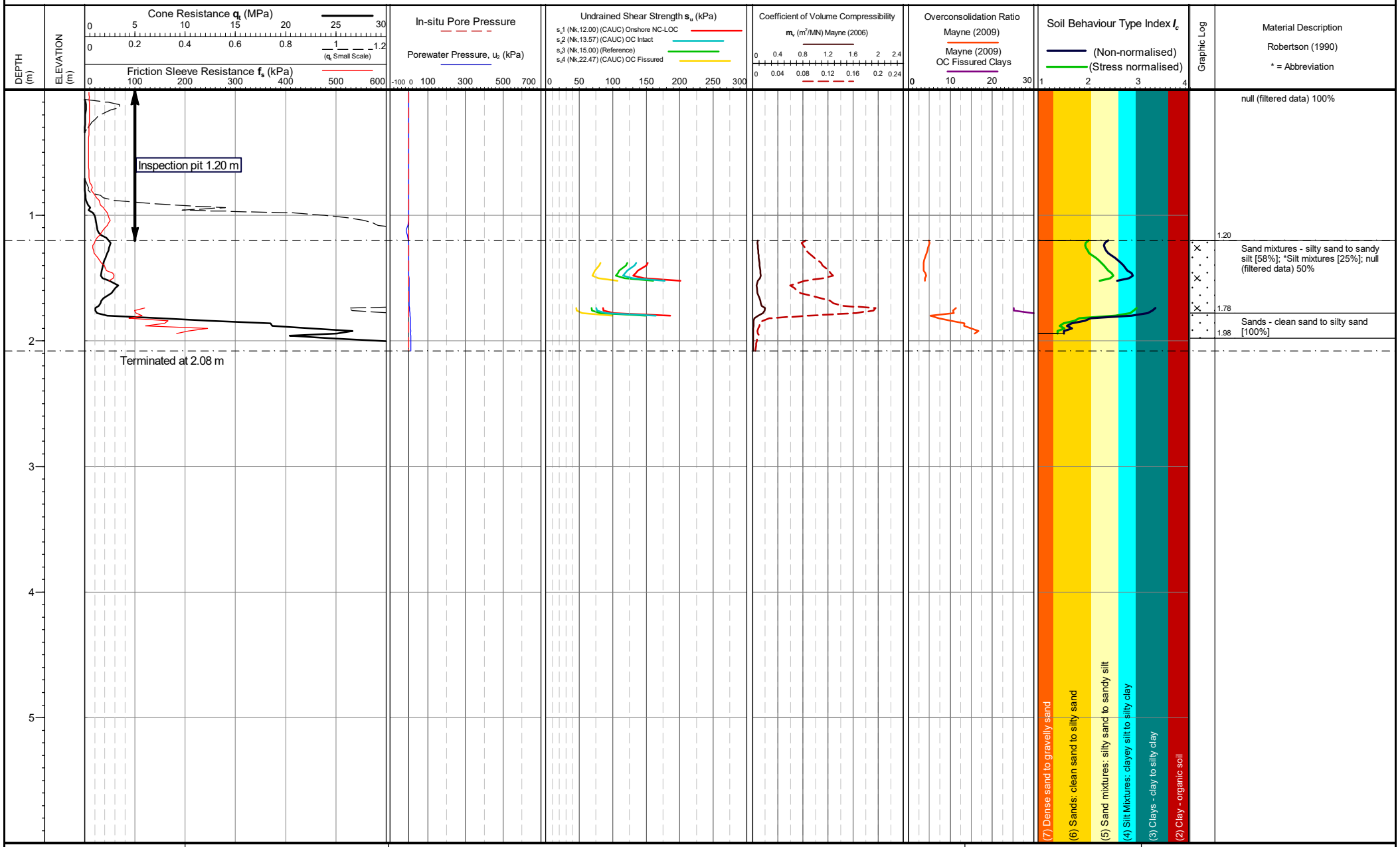
Lankelma Project Ref: 25-32-29098-7

Checked by: Chris Player

TEST ID: CPT103

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 14/02/2025 11:02:54

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

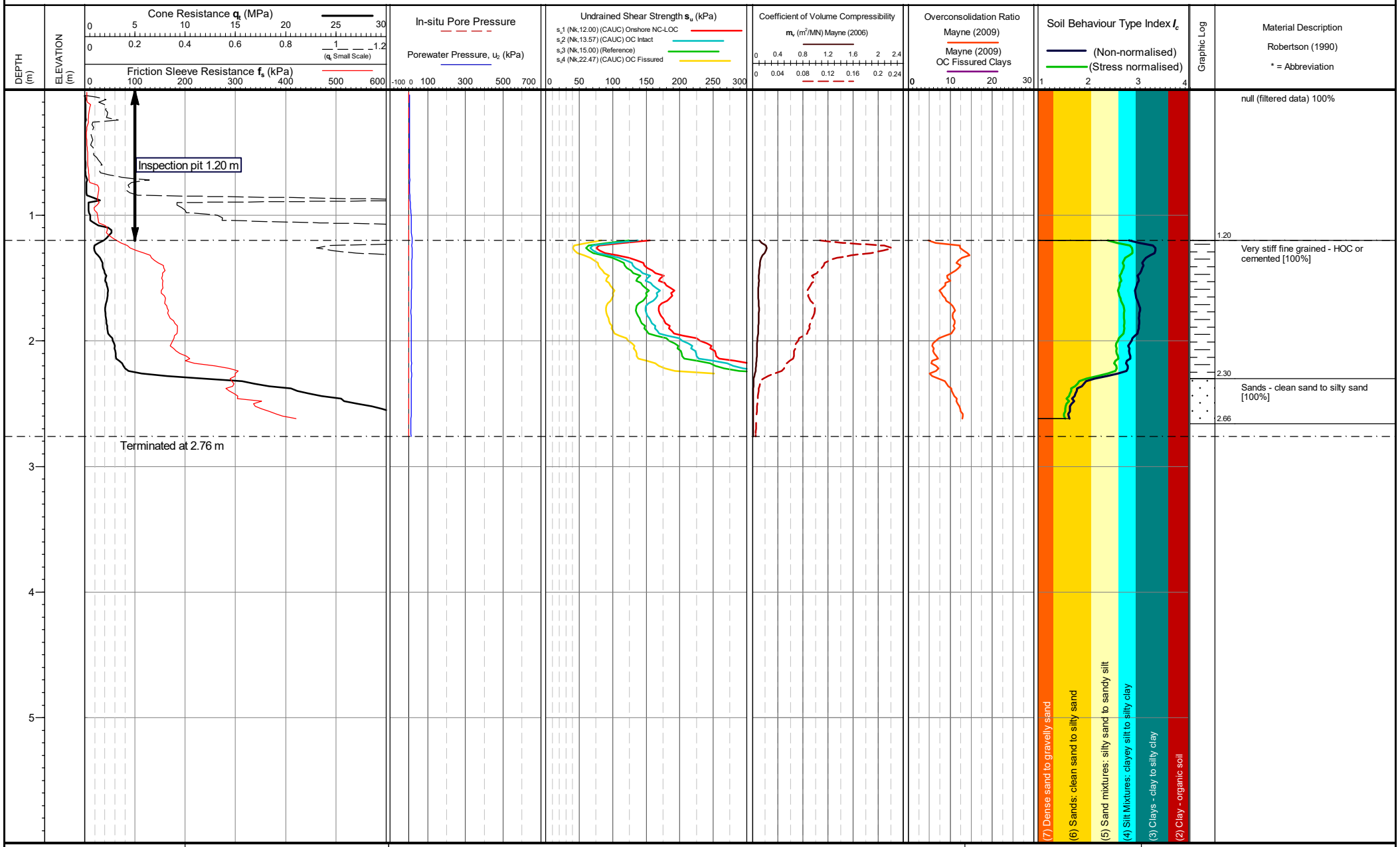
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT104

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 13/02/2025 14:16:11

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

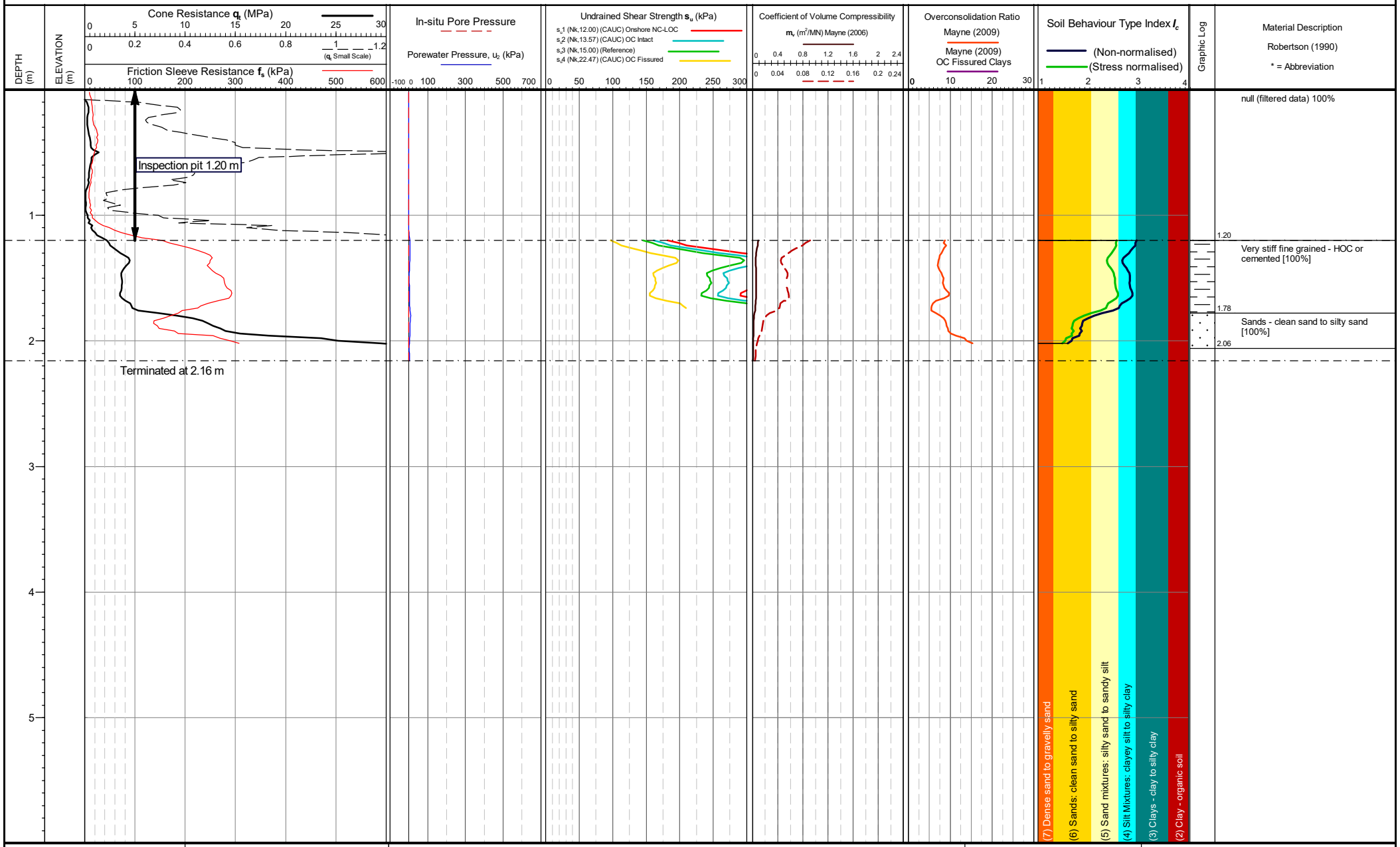
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT105

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 14/02/2025 12:25:08

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

Lankelma Project Ref: 25-32-29098-7

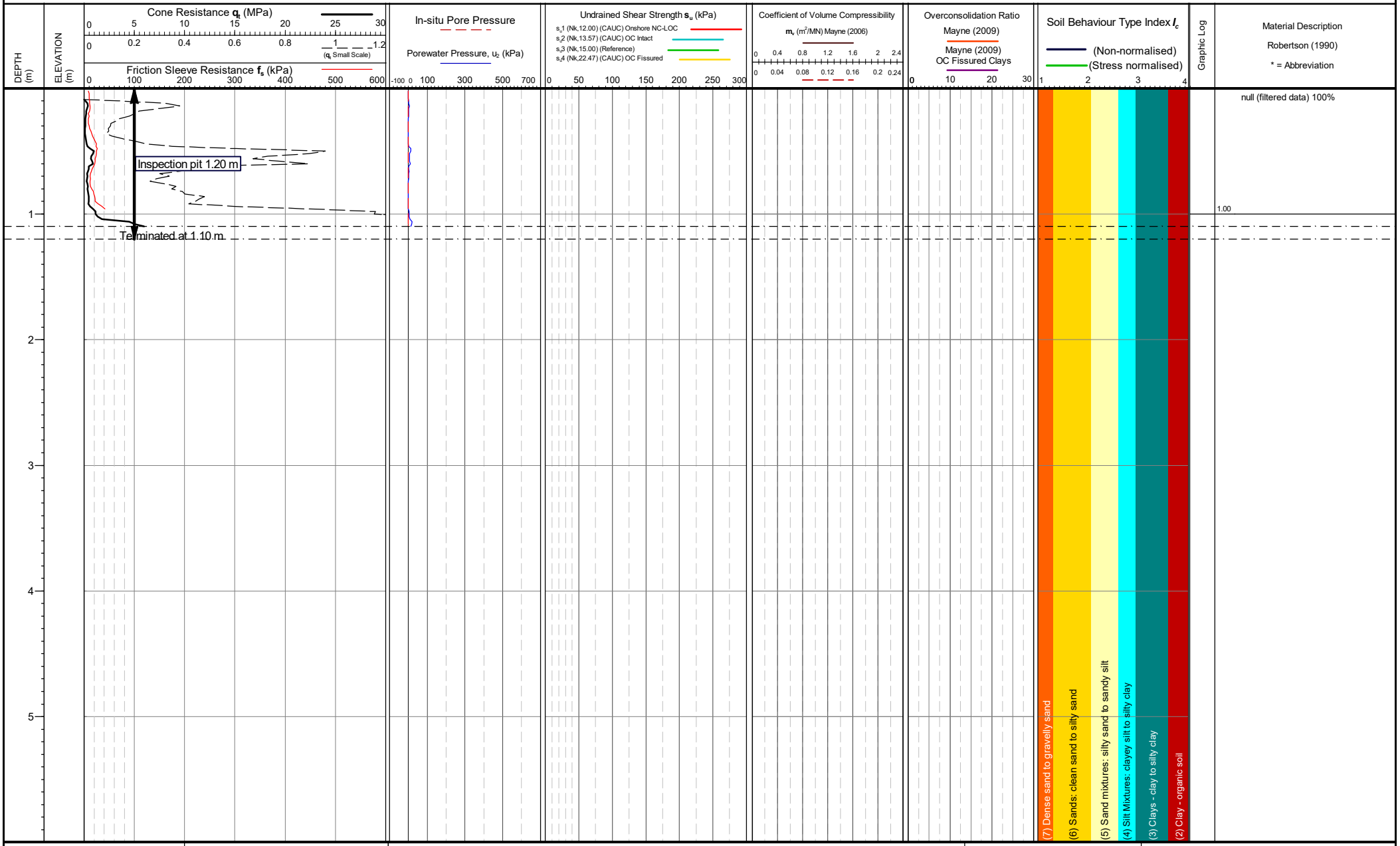
Checked by: Chris Player

TEST ID: CPT106

LANKELMA

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 14/02/2025 15:35:44

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

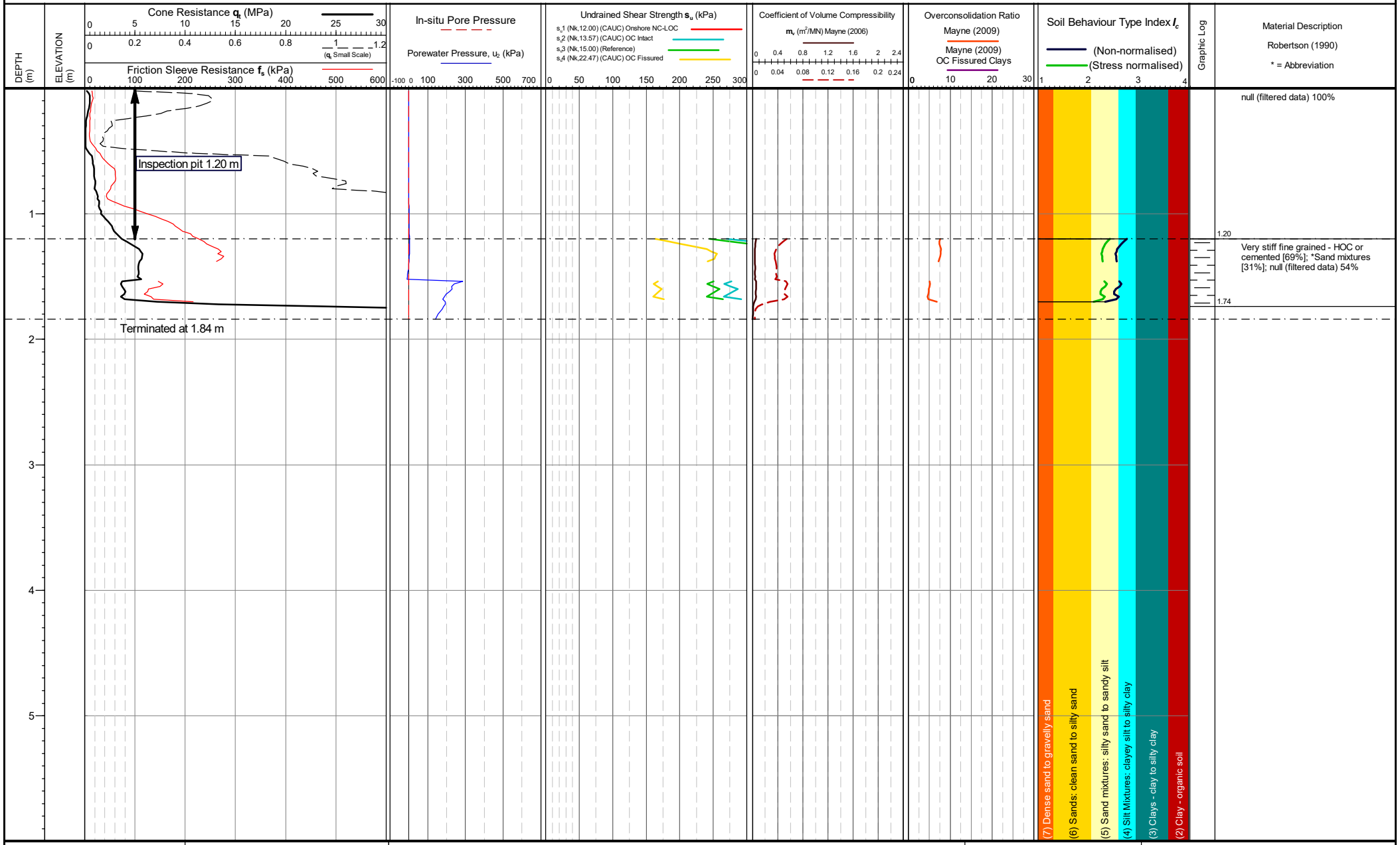
Lankelma Project Ref: 25-32-29098-7

Checked by: Chris Player

TEST ID: CPT107

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
ConeID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Rig Used: UK27
Date of test: 14/02/2025 13:42:42

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total reaction force

Internal QA Diss.
Dissipation Test
Penetration Pause (<1cm/s)

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25

Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT108

APPENDIX F PARAMETER RESULTS 2 – SPT N60, PHI, D_R, E, I_C

Equivalent SPT N60

Peak friction angle

Relative density

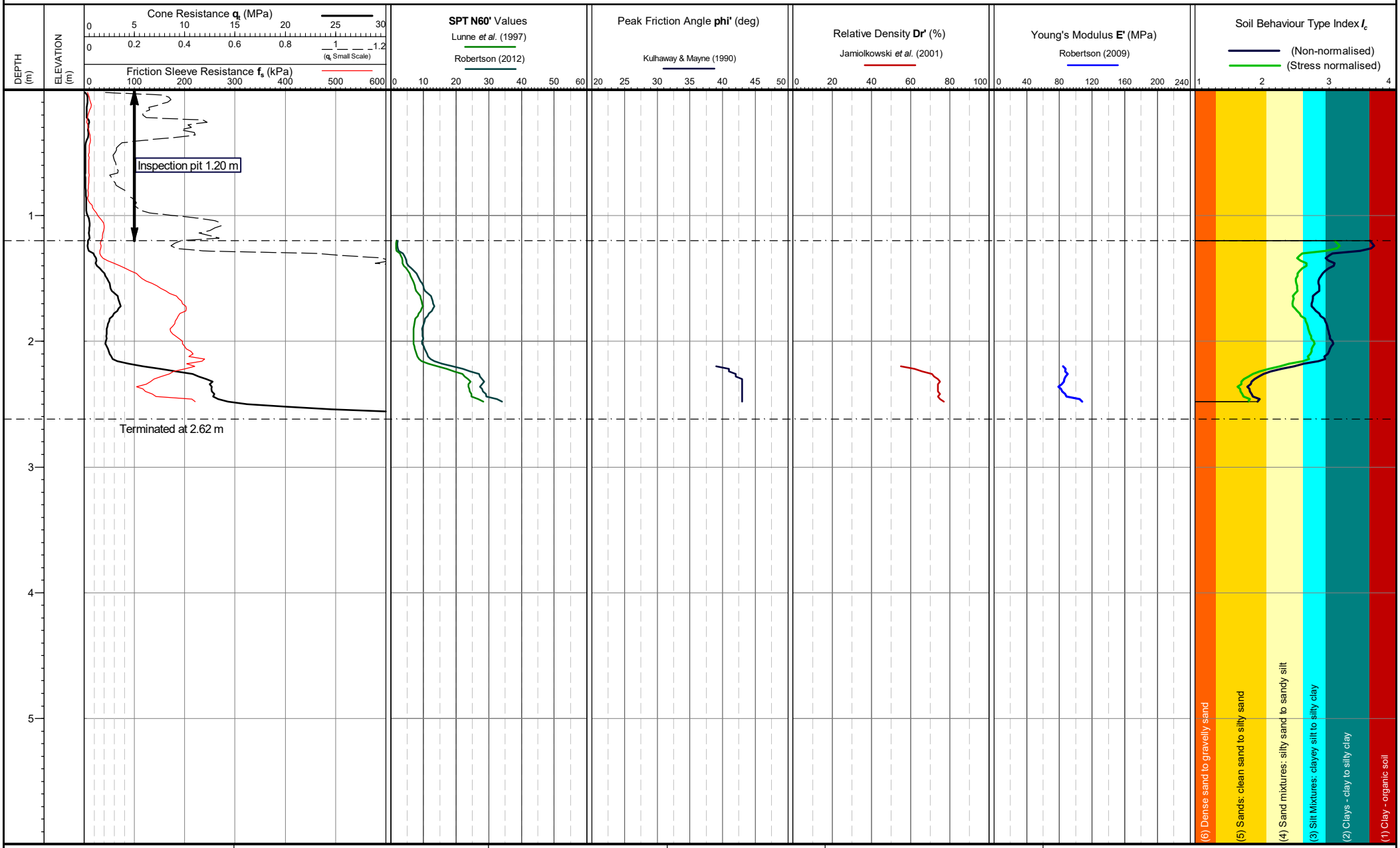
Young's modulus

SBT index I_c

LANKELMA

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 13/02/2025 12:49:58

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25
Checked by: Chris Player

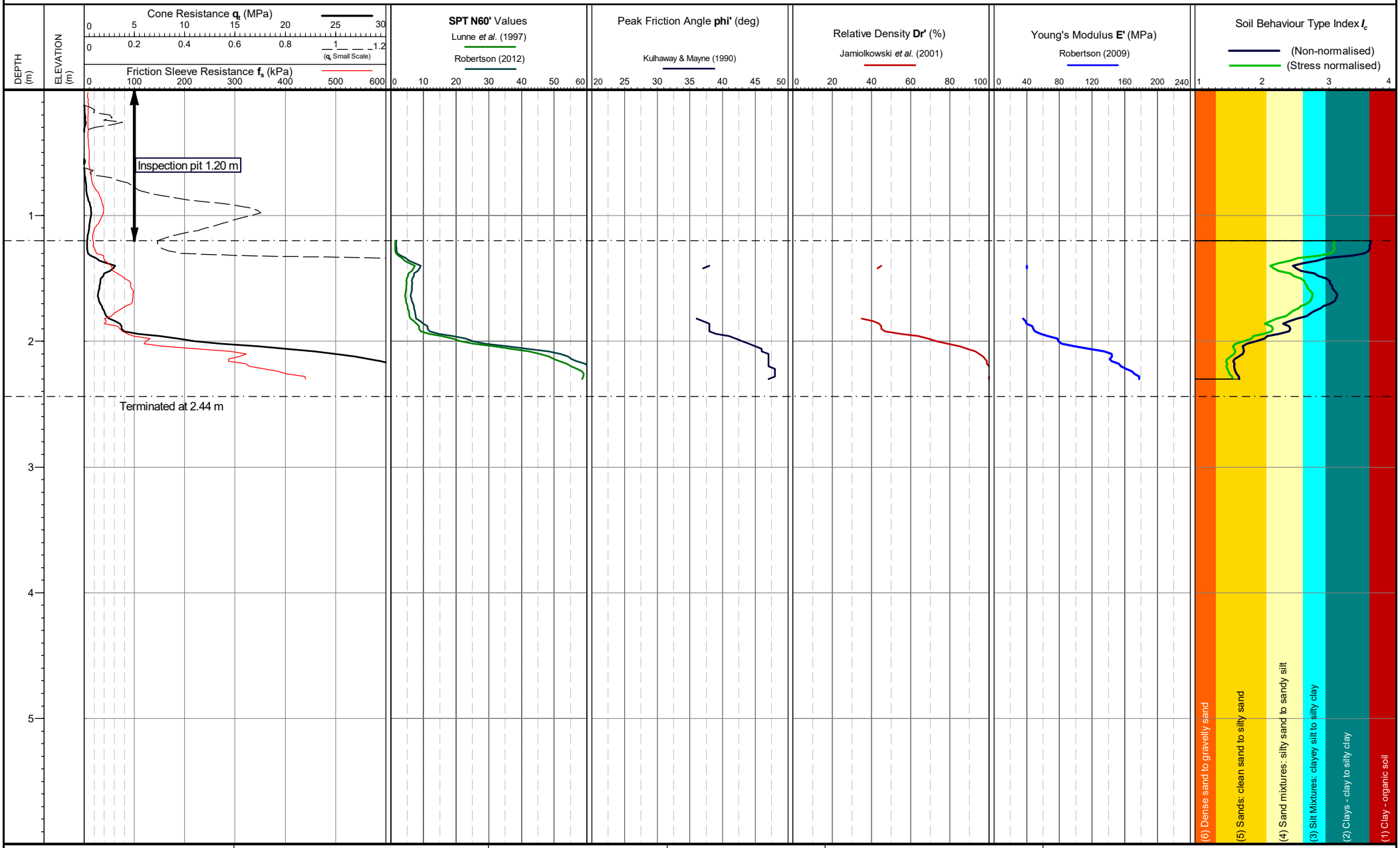
Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT101

LANKELMA

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 13/02/2025 16:00:11

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

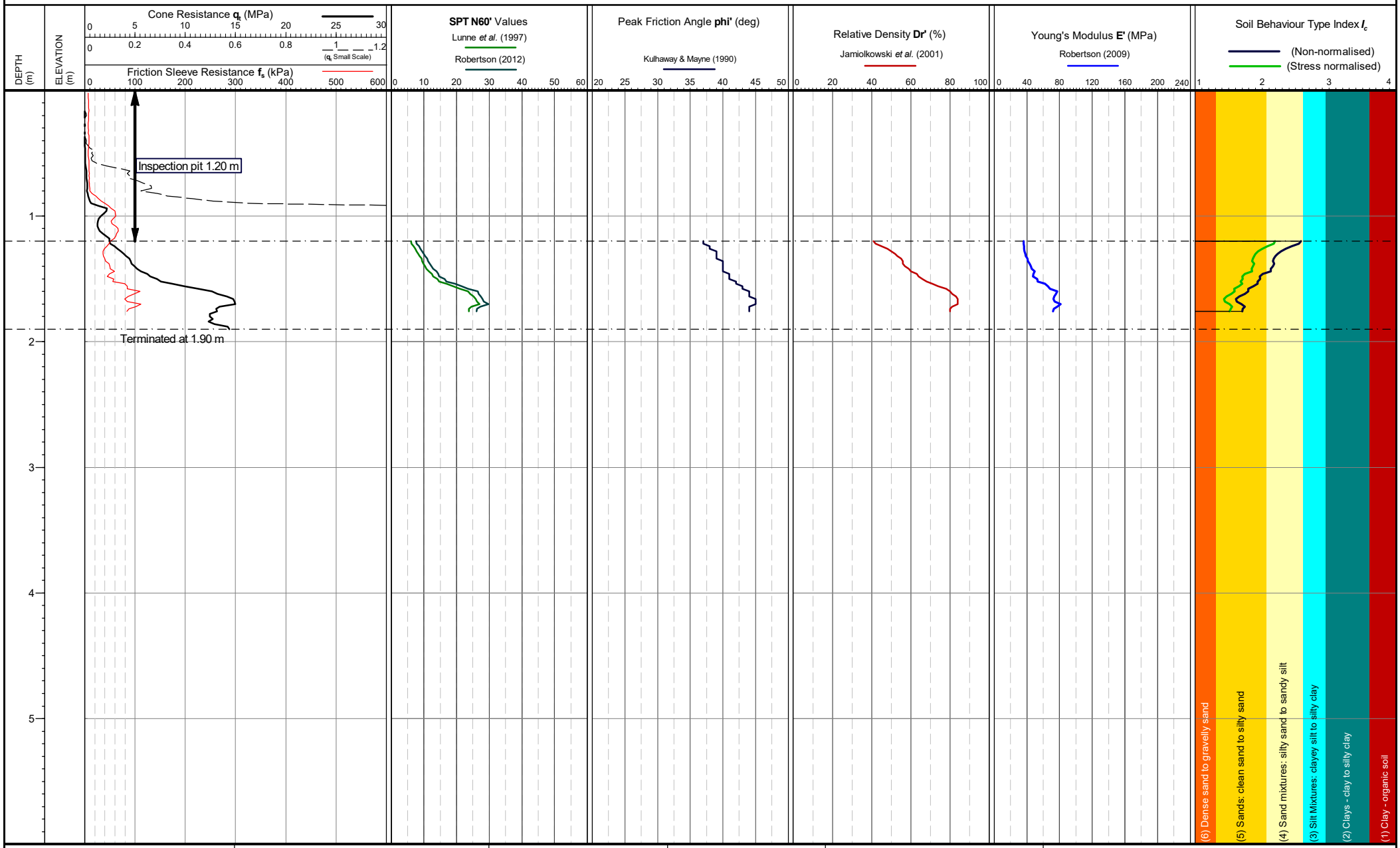
Date of plot: 14-02-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT102

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 14/02/2025 09:59:55

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25
Checked by: Chris Player

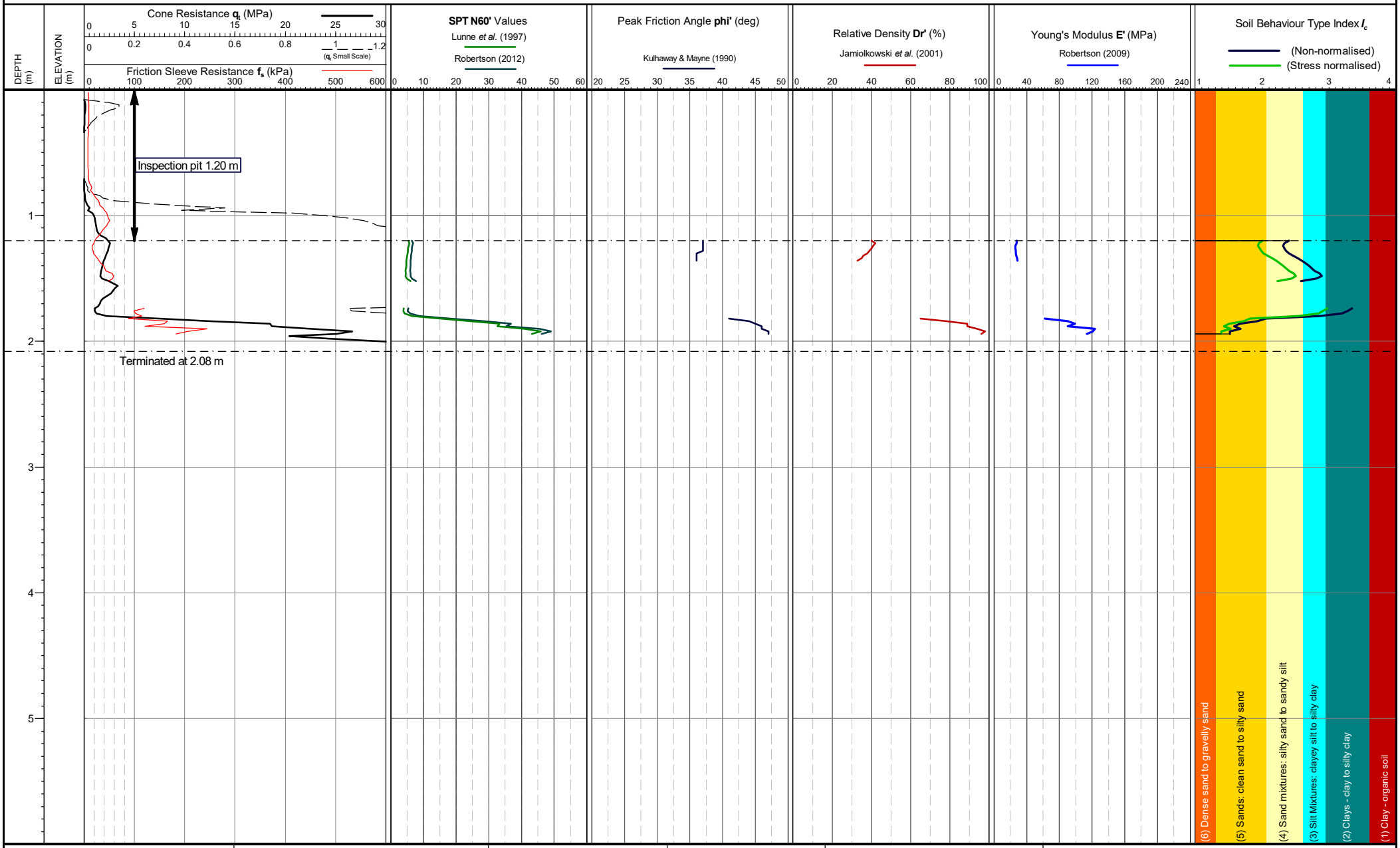
Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT103

LANKELMA

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 14/02/2025 11:02:54

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

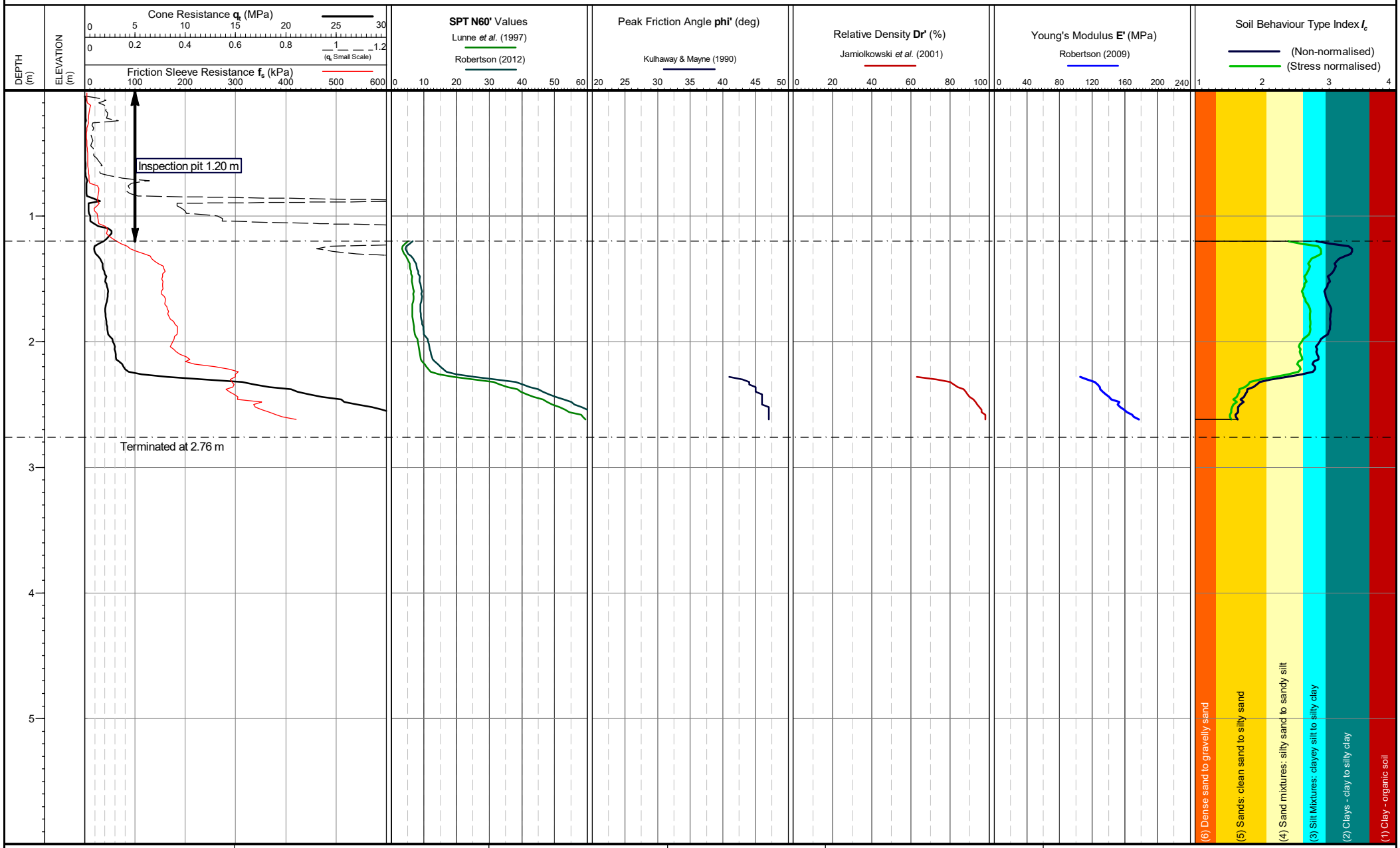
Date of plot: 14-02-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT104

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 13/02/2025 14:16:11

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25
Checked by: Chris Player

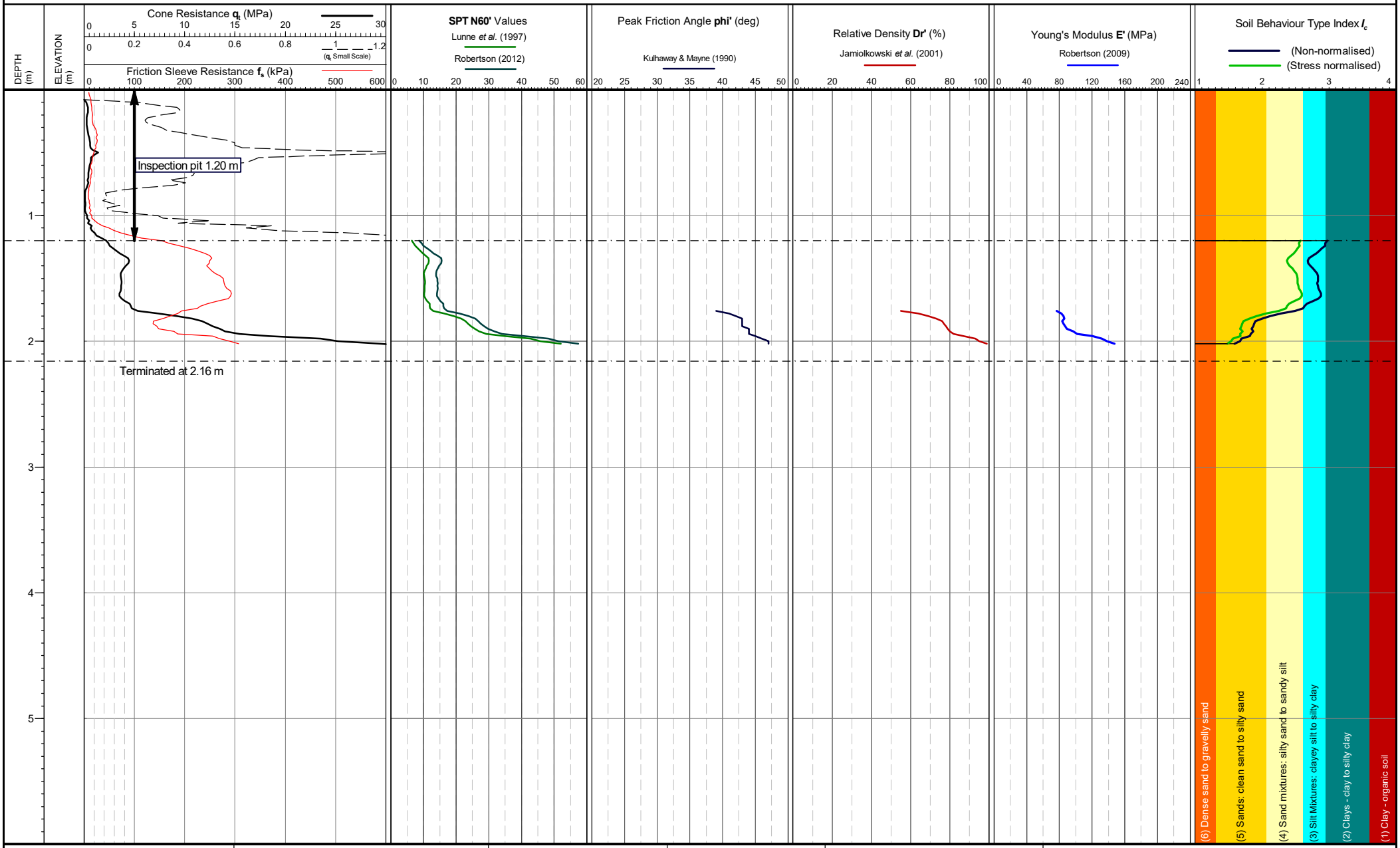
Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT105

LANKELMA

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 14/02/2025 12:25:08

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

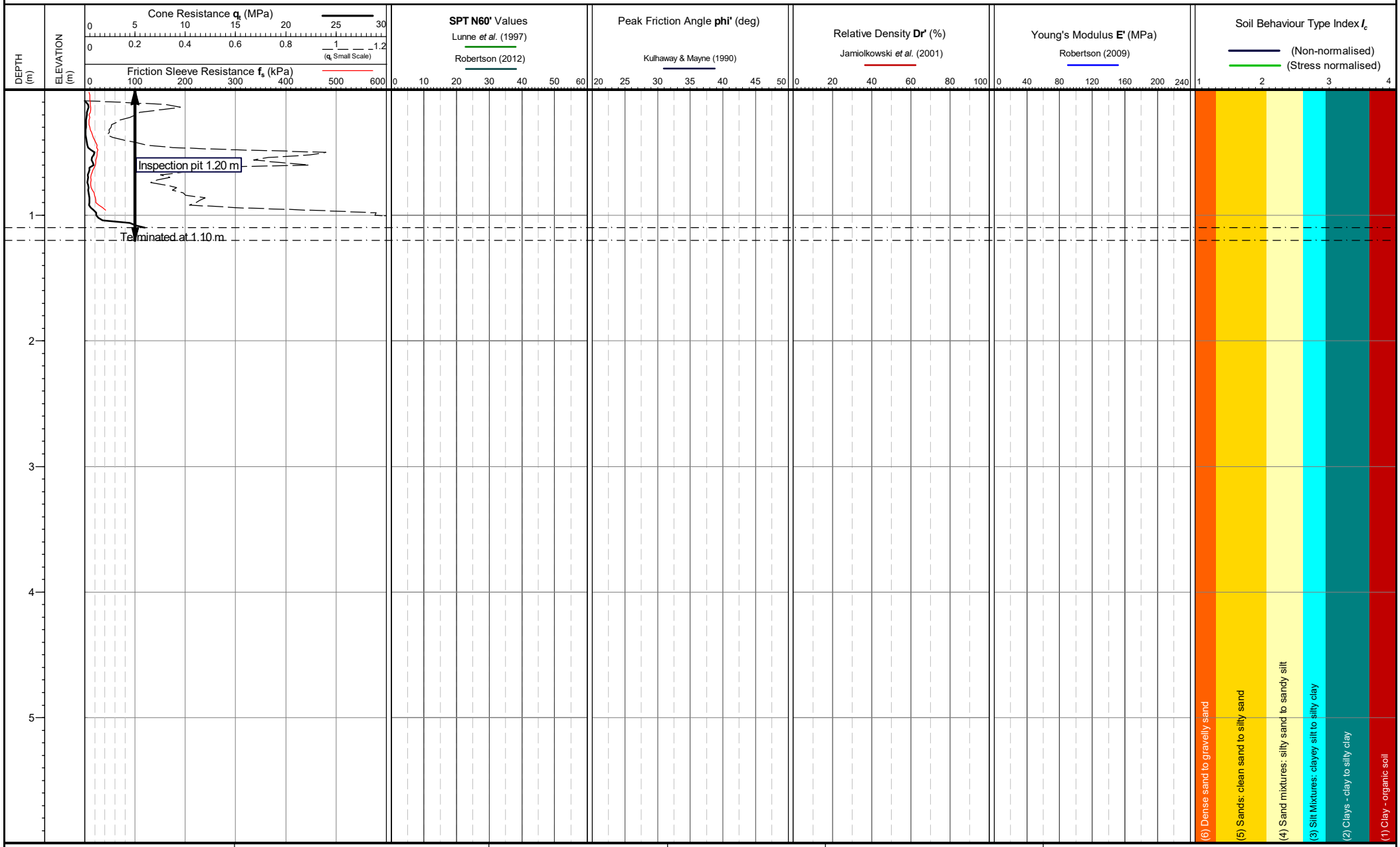
Date of plot: 14-02-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT106

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 14/02/2025 15:35:44

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

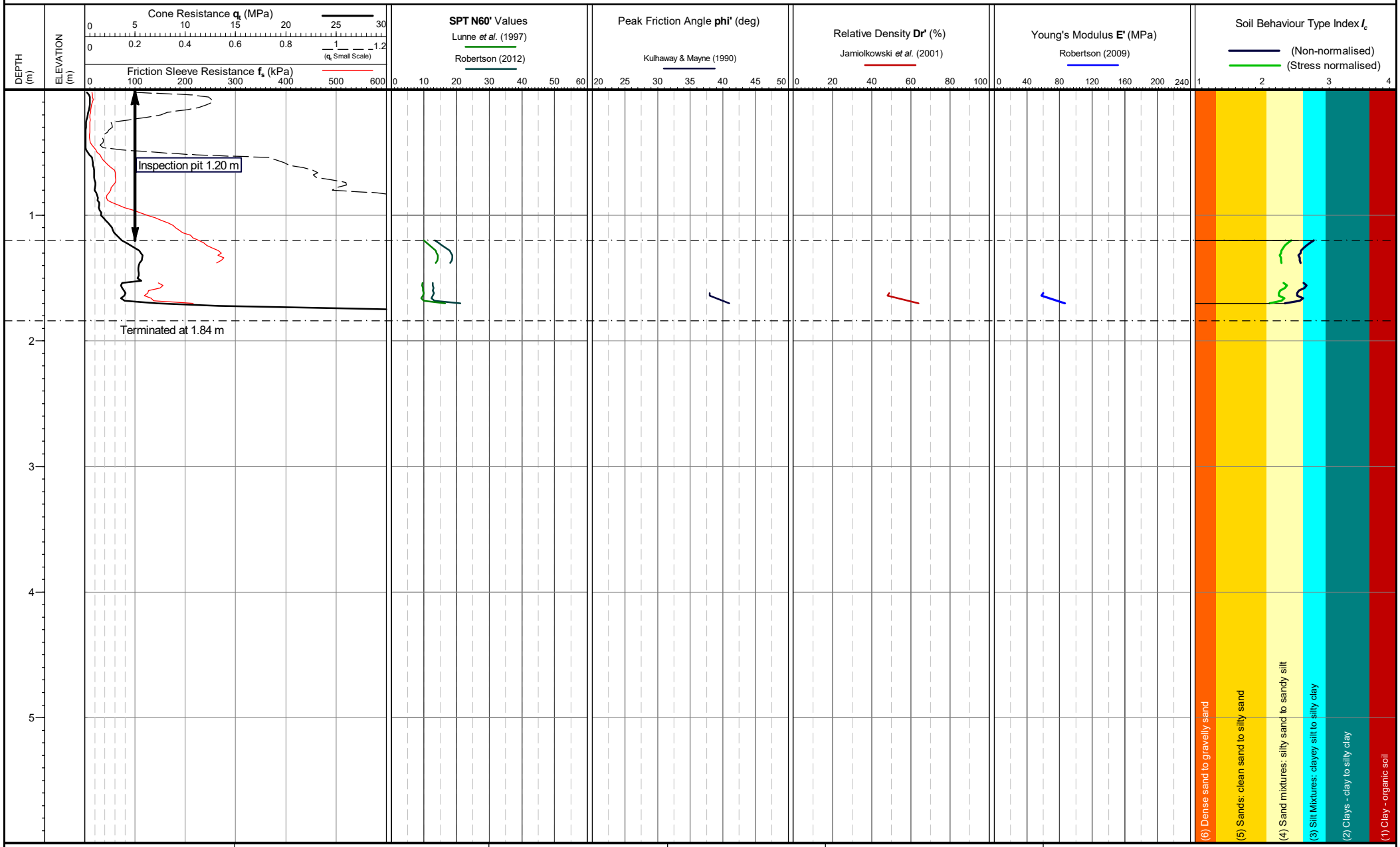
Date of plot: 14-02-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT107

Project: MANCHESTER

Client: TETRA TECH



Cone area (mm2):
Cone ID: S15-CFIPTTM250.2488
Operator: Jamie Butterworth
Date of test: 14/02/2025 13:42:42

Location: Greater Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.40-2.70. See report text for methods and discussion of parameter evaluation.

Date of plot: 14-02-25
Checked by: Chris Player

Lankelma Project Ref: 25-32-29098-7

TEST ID: CPT108

APPENDIX I – GROUNDWATER AND GROUNDGAS MONITORING RECORDS

Tetra Tech

3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
Tel: 0113 278 7111

Exploratory holes dipped from ground level.

GROUND GAS MONITORING RECORD SHEET

Client:	Kennedy Redford	**Job No:**	784-B069852
Project Name:	Fallowfield Campus G	**Instruments Used:**	Dip Meter
Weather:	Overcast, breezy	**Date:**	14/03/2025
Monitored By:	EM		

Exploratory Hole No.	Elevation (m AOD)	Water Depth (m bgl)	Water Level (m AOD)	Comments
BH101 - Deep	40.33	7.48	32.85	
BH101 - Shallow	40.33	6.00	34.33	
BH102 - Deep	40.38	8.90	31.48	
BH102 - Shallow	40.38	Dry		
BH103	44.32			Car parked over borehole, unable to monitor
BH104 - Deep	39.72	2.82	36.90	
BH104 - Shallow	39.72	2.68	37.04	
BH106 - Deep	43.13	12.96	30.17	
BH106 - Shallow	43.13	2.86	40.27	
BH107	43.16	13.17	29.99	
BH108	44.52	4.80	39.72	
BH109 - Deep	44.41	7.11	37.30	
BH109 - Shallow	44.41	2.80	41.61	

Tetra Tech

3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
Tel: 0113 278 7111

Exploratory holes dipped from ground level.

GROUND GAS MONITORING RECORD SHEET

Client:	Kennedy Redford	**Job No:**	784-B069852
Project Name:	Fallowfield Campus G	**Instruments Used:**	Dip Meter
Weather:	Overcast	**Date:**	25/04/2025
Monitored By:	EM		

Exploratory Hole No.	Elevation (m AOD)	Water Depth (m bgl)	Water Level (m AOD)	Comments
BH101 - Deep	40.33	8.00	32.33	
BH101 - Shallow	40.33	6.50	33.83	
BH102 - Deep	40.38	9.05	31.33	
BH102 - Shallow	40.38	2.80	37.58	
BH103	44.32			Car parked over borehole, unable to monitor
BH104 - Deep	39.72	9.40	30.32	
BH104 - Shallow	39.72	2.80	36.92	
BH106 - Deep	43.13	6.10	37.03	
BH106 - Shallow	43.13	2.88	40.25	
BH107	Destroyed			
BH108	Bung pushed into hole between monitoring rounds			
BH109 - Deep	44.41	6.10	38.31	
BH109 - Shallow	44.41	2.88	41.53	

Tetra Tech

3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
Tel: 0113 278 7111

Exploratory holes dipped from ground level.

GROUND GAS MONITORING RECORD SHEET

Client:	Kennedy Redford	**Job No:**	784-B069852
Project Name:	Fallowfield Campus G	**Instruments Used:**	Dip Meter
Weather:	Sunny	**Date:**	21/05/2025
Monitored By:	Samuel Noakes		

Exploratory Hole No.	Elevation (m AOD)	Water Depth (m bgl)	Water Level (m AOD)	Comments
BH101 - Deep	40.33	8.15	32.18	
BH101 - Shallow	40.33	Dry		
BH102 - Deep	40.38	6.69	33.69	
BH102 - Shallow	40.38	Dry		
BH103 - Deep	44.32	13.50	30.82	
BH103 - Shallow	44.32	Dry		
BH104 - Deep	39.72	8.63	31.09	
BH104 - Shallow	39.72	Dry		
BH106 - Deep	43.13	12.93	30.20	
BH106 - Shallow	43.13	Dry		
BH107	Destroyed			
BH108	Bung pushed into hole between monitoring rounds			
BH109 - Deep	44.41	Dry		
BH109 - Shallow	44.41	Dry		