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CONSULTING
GEOTECHNICAL ENVIRONMENTAL

ICON MANCHESTER DEVELOPMENTS LIMITED
AND
WINVIC CONSTRUCTION LIMITED

UNIT 2, ICON, MANCHESTER

GEOTECHNICAL ASSESSMENT REPORT

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1. INTRODUCTION

It is proposed to develop the Unit 2 site at ICON, Manchester for commercial purposes. The site forms part of a larger development area that has been split into a number of plots. The proposed development comprises a warehouse structure, together with associated service yard, car parking and limited landscaped areas. To enable construction, earthworks will be required at the site.

A ground investigation was undertaken across the larger development area in September and October 2016 by RoC Consulting and RoC produced a Phase 2 Site Investigation Report for the larger development area in November 2018. Relevant factual data from the RoC investigation is presented within this report.

The previous investigation has identified the ground conditions beneath the site to generally comprise a limited thickness of topsoil over Glacial Till (clays with lenses of silts and sands). Mercia Mudstone strata have been recorded at varying depths beneath the Glacial Till. Made Ground has been recorded locally.

Crossfield Consulting Limited was commissioned to undertake supplementary investigation works at the site to confirm the ground conditions and to provide updated geotechnical and geoenvironmental assessment for the proposed development. The geoenvironmental assessment is presented in the Crossfield Consulting Limited Supplementary Geonvironmental Report (CCL03330.CL58). This report comprises a Geotechnical Assessment Report and provides advice and recommendations on earthworks, foundations, slopes, retaining walls, road pavement design and general construction advice in the context of the above development proposals.

This report presents information obtained from the ground investigations. Sections 2 to 4 of the report, together with the associated Figures and Appendices, provides a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007. The report also provides the information required to produce a Geotechnical Design Report as defined in BS EN 1997-1:2004.

It is considered that the report is suitable to assist in an appraisal of development solutions and costs, together with the preparation of engineering designs for the development. The report also complies with the published guidance relating to the requirements of a Building Control authority.

2. THE SITE

2.1 Location

The site is located to the southwest of Manchester Airport terminal buildings and to the south of junction 6 of the M56, as shown on Figure 1. The National Grid Reference for the site is approximately SJ 8047 8443. Sunbank Lane forms the northeastern boundary, with commercial developments and a petrol station present to the north and northeast. The northwestern and southeastern boundaries are defined by Plots 1 and Plots 3 & 4 of the ICON development site and these plots are currently being developed for commercial purposes. Fields and areas of trees are present immediately to the southwest of the site.

2.2 Site Description

The following site description is based on observations made at the time of the ground investigations in June 2020 and a topographical survey provided by the Client, as presented on Figure 2. It should be noted that the topographical survey drawing is dated 2016 and does not show all current site features.

The site is generally rectangular in shape and is up to approximately 280 m wide and 295 m long. The site generally slopes down from the east to west with a change in elevation of approximately 4 m across the site.

Small depressions, understood to relate to former ponds, are present in the western and central-northern parts of the site with the depressions approximately 0.5 m to 1.3 m below surrounding ground levels.

The majority of the site comprises a grassed field. An area that has been stripped of vegetation is present in the western part of the site, this area is understood to be the surface of a backfilled borrow pit. Temporary site compounds, associated with the adjacent construction sites, are present within the northern and eastern parts of the site. Mounds of topsoil and type 1 stone are present along the southeastern boundary of the site and temporary stockpiles were also present in the northern part of the site. Mature trees and saplings are present along the northwestern and southwestern boundaries.

2.3 Site History

The following review of the site history is based on historical maps provided by the Client. In summary, it is indicated that the site has predominantly been used as farmland associated with Sunbank Farm. The farm buildings were located in the western part of the site and are understood to have been demolished in 2014. A road also passed through the northwestern section of the site. Ponds and ditches were present on site, although many of these features have been backfilled.

Significant historical development adjacent to the site includes the construction and operation of Manchester Airport to the southeast of the site, and more recently the construction of a DHL warehouse to the northeast and an Amazon warehouse to the north of the site. A Costa Coffee and a petrol station were constructed to the east of the site in 2018/2019. Since 2019, the adjacent plots to the northwest and southeast have been under construction and temporary compound areas have been formed on site.

2.4 Desk Study

Information available from on-line sources, including DEFRA's MAGIC interactive map and Groundsure's Enviro Data Viewer, have been reviewed as part of this report. A summary is presented below.

There are no active or historical landfills recorded within 250 m of the site.

The superficial strata beneath the site have been designated as Secondary Aquifers (undifferentiated). The solid strata beneath the site are designated as Secondary (B) Aquifers. The site does not lie within a groundwater Source Protection Zone.

The site does not lie within an area designated as a Zone 2 or Zone 3 Floodplain by the Environment Agency. The nearest water course is approximately 550 m to the southwest of the site.

BRE document *BRE211 – Radon: Guidance on Protective Measures for New Buildings* (2015) indicates that the site is not within an area where radon protective measures would be necessary.

3. PUBLISHED GEOLOGY

Geological map data published by the British Geological Survey (BGS) online and in print, on 1:50,000 scale Sheet No. 98 (Stockport) indicates that the site is underlain by Glacial Till. The Bollin Mudstone Member, part of the Mercia Mudstone Group, comprising mudstones and siltstones, is indicated to be present below the Glacial Till.

4. GROUND CONDITIONS AND GEOLOGICAL MODEL

4.1 Ground Investigation

A ground investigation was undertaken at the site by RoC consulting in 2016. Relevant factual records from the RoC Consulting ground investigation are included within Appendix I of this report. It should be noted that some of the soil descriptions have not been recorded to BS5930 standards.

Details of the rationale and scope of the Crossfield Consulting supplementary ground investigation and laboratory testing, together with exploratory hole logs, in situ and laboratory test results, are presented in Appendix II.

The investigations have identified the presence of the following, below the site.

4.2 Buried Foundations and Services

Buried structures/foundations and services were not encountered during the investigations but such features could still be present in areas of former structures and roads.

Services are present along Sunbank Lane and services associated with the recent commercial development may also be present on the northern side of Sunbank Lane. According to on-site personnel, a temporary sewer line is present in the northern part of the site. Land drains were encountered across the site during the intrusive investigation works.

4.3 Strata Encountered

Topsoil
Topsoil has been recorded across the majority of the site, generally to depths of between 0.2 m and 0.5 m. The topsoil typically comprises slightly gravelly silt with rootlets.

Made Ground
Made Ground has been recorded across parts of the site, notably in the area of the former farm buildings, roads and ponds. Outside of the former ponds, The Made Ground typically comprises reworked natural material with some man-made, and ashy inclusions and locally pockets of topsoil. The Made Ground has been recorded to depths of up to 1.5 m in these areas. However, within the northwestern part of the site organic Made Ground with an odour of manure has been recorded to approximately 3 m depth.

Excavations within the areas of former ponds encountered Made Ground to depths of between 1.1 m and 3.2 m and generally included reworked natural strata with some man-made inclusions. A backfilled pond in the centre of site (TPCCL3) contained organic clay Made Ground, similar to that encountered in the northwestern part of the site, to 1.3 m depth, overlying a reddish brown gravelly sandy clay Made Ground to 2.1 m depth.

Made Ground was also encountered by RoC Consulting in the eastern part of the site and was recorded as reworked natural clays to maximum depth of 1.3 m.

Pond Deposits
Pond deposits were encountered beneath the Made Ground within two of the backfilled ponds. These deposits generally comprised soft to firm consistency organic clays with decomposing plant material. The backfilled pond in the northeastern part of the site contained approximately 0.1 m thickness of these deposits, and the backfilled pond in the central northern part of the site contained approximately 1.3 m thickness of these

deposits. Pond deposits were not encountered within the western pond. The pond deposits, where encountered, were recorded to depths of between 1.9 m and 3.4 m below surrounding ground levels

Glacial Till
Glacial Till has been recorded below the topsoil, Made Ground and pond deposits (where recorded) during the Crossfield ground investigation. The shallow Glacial Till typically comprises stiff to very stiff consistency, medium to high strength, orangish brown and reddish brown gravelly clays. Locally, lenses of soft to firm consistency orangish brown clays and silts have been recorded and orangish brown sands and silty sands are also present. The deeper Glacial Till generally comprises very stiff consistency, reddish brown and grey, slightly gravelly, clay with rare sand lenses but locally, loose and/or soft strata have been recorded.

In-situ hand shear vane testing undertaken within the shallow Glacial Till clays recorded undrained shear strength values of between 20 kN/m^2 and in excess of 140 kN/m^2, with the lower values typically recorded within silty horizons.

The Glacial Till was also encountered during the ground investigation undertaken by RoC Consulting and was generally recorded as firm and stiff consistency, sandy clays with varying gravel and silt content, with sands also recorded locally. Standard Penetration Tests were undertaken in boreholes and usually recorded 'N' values of between 9 and 24, and locally soft strata was recorded with 'N' values of around 3. Triaxial tests were undertaken as part of the RoC investigation, and undrained shear strengths between 32 kN/m^{2}and 175 kN/m^2 were reported.

Cone penetration Tests (CPTs) were undertaken at the site as part of the Crossfield Consulting Limited investigation. In general, end cone resistance (q_c) values of between 0.5 MPa and 3.0 MPa were recorded within the Glacial Till. However, very loose and/or soft strata were recorded locally within the southern and central parts of the site, and at varying depths. It should be noted that the CPT contractor has reported "organic" material within its report but where trial pits were undertaken near these CPTs, "organic" materials were not recorded.

Mercia Mudstone Group
Mercia Mudstone Group strata are present below the Glacial Till. During the Crossfield investigation, Mercia Mudstone Group strata were encountered within trial pits excavated in the southern part of the site below depths of around 4 m. The strata encountered typically comprised extremely weak mudstones and siltstones with clay infill between discontinuities. The CPT data indicates that mudstone strata are generally present at depths of around 4 m beneath the southern part of the site and depths of around 7 m beneath the northern part.

During the ground investigation undertaken by RoC, the Mercia Mudstone Group strata were generally recorded as a weathered mudstones or siltstones, at depths ranging between 2.1 m in the southern part of the site and 7.6 m in the northern part. It should be noted that some descriptions from borehole data are recorded as drillers' (not engineers') descriptions. Standard Penetration Tests were undertaken in the boreholes and usually recorded SPT 'N' values of greater than 44.

4.4 Groundwater

During the Crossfield Consulting ground Investigation works, groundwater seepages were recorded locally within the Glacial Till at depths ranging from 1.8 m to 3.4 m. Groundwater was not encountered in trial pits undertaken by RoC Consulting but during boring operations groundwater was encountered at depths of between 2.1 m and 6.3 m. Groundwater monitoring undertaken by RoC recorded standing water between ground level and 3.3 m depth with water typically around 1 m to 1.5 m depth.

The groundwater conditions are based on observations made at the time of the fieldwork. It should be noted that groundwater levels may vary due to seasonal and other effects.

5. PROPOSED DEVELOPMENT

The proposed development is understood to comprise a warehouse structure, together with associated service yards, car parking and limited landscaped areas, as shown on Figure 3.

The site slopes down from the east of the west with a change in elevation of approximately 4 m across the site. Earthworks are required at the site to enable the construction of the proposed development. Areas of cut are proposed with up to 2.2 m thickness cut from the eastern parts, and up to 1.0 m of cut from the northwestern part of the site where docks are proposed. Up to approximately 1.4 m thickness of fill is proposed in the southwestern parts of the site. A cut/fill plan is presented on Figure 4. To provide a suitable development platform the earthworks are likely to require removal of any soft and/or organic materials from beneath the development platform.

6. ASSESSMENT OF MINING, QUARRYING AND OVERALL GROUND STABILITY

The site is not located within an area of recorded past mining or quarrying. Therefore, associated issues of ground stability are not applicable to the development.

With reference to published information provided by the British Geological Survey, and in the context of the low sensitivity of the proposed structure to very minor background seismic events recorded in the UK, it is considered that the foundation solution should not be constrained by potential ground vibrations from natural sources and that more detailed assessment is not necessary.

7. ASSESSMENT OF EARTHWORKS

7.1 Earthworks Operations

The site slopes from the east to the west with a change in elevation of approximately 4 m across the site. Earthworks are required at the site to create the required development levels with up to 2.2 m thickness of cut and up to approximately 1.4 m thickness of fill proposed.

The ground conditions beneath the site typically comprise topsoil over Glacial Till, with Mercia Mudstone strata present at depth. Made Ground has been recorded in areas of former buildings, roads and ponds and has been recorded beneath the northwestern part of the site. The Made Ground in areas of former buildings and roads and two of the former ponds generally comprises reworked natural strata with some man-made inclusions. In the northwestern part of the site and in the pond in the central-northern part of the site, the Made Ground includes topsoil/organic materials and has a strong manure odour.

In areas within the southern and central parts of the site, soft clays and silts have been recorded locally (and of varying thicknesses) at depths of between 3.5 m and 4.5 m. On the basis that the soft materials have been recorded at varying locations and depths, extensive investigation would be required to assess the full extent of these materials and whether digging out and replacing these materials would be feasible. If these are left in place, following the proposed earthworks, soft/compressible material may be within 3 m of the ground surface, and between 1 m and 2 m below the base of proposed foundations. On the basis that digging out and replacing materials may not be feasible and that the soft materials are unlikely to be suitable to support shallow pad

foundations and a ground bearing floor slab, it is recommended that vibro-replacement ground treatment (stone columns) be used to improve the ground beneath the entire building footprint. Ground treatment should not be required beneath external areas, provided that any unsuitable Made ground materials are dug-out and replaced.

As the recommended ground treatment will be undertaken following completion of the earthworks, the Engineered Fill will require to support the proposed working plant and to negate the potential for future adverse settlements within the new Engineered Fill. The performance requirements of the new Engineered Fill should be confirmed by the specialist ground treatment contractor. However, based on previous projects, placement and compaction of materials in accordance with an end-product specification is likely to be required.

Topsoil and/or organic material should not be used as fill materials and, where possible, should be re-used in landscaped areas. It is understood that the majority of the topsoil will be removed off site.

There is also potential for localised organic materials to be present in areas of backfilled ponds excavations, drainage ditches and tree-lines. Where present at the surface, such materials should be removed prior to fill placement.

It is recommended that the formation be proof-rolled and inspected prior to the placement of fill. If vibro-replacement ground treatment is undertaken then any inorganic Made Ground, soft/low strength strata and pond deposits should be suitable to remain in place where the ground treatment is being undertaken.

The organic Made Ground that was encountered within excavations in the northwestern part of the site and the pond in the central-northern part of the site will require to be fully excavated and replaced with Engineered Fill. The excavated organic materials should only be re-used in landscape areas.

Any Made Ground within external areas will require to be removed and replaced with Engineered Fill. It is considered that inorganic Made Ground should be suitable to be reused as Engineered Fill, following moisture conditioning. The Made Ground may require screening to remove any oversize and/or unsuitable materials prior to re-use.

Localised areas of sand and sand pockets have been recorded within the glacial soils. If these are found to be water-bearing, suitable drainage measures may be required to direct water flows from beneath the earthworks.

It should be noted that, due to the silty nature of the proposed fill materials, these materials will be susceptible to small changes in moisture content. The earthworks should be carried out during dry periods of weather if possible. Areas of completed earthworks will require protection and/or removal/replacement of any surface layers exposed to rainfall with associated softening/disturbance prior to placement of additional fill.

7.2 Earthworks Strategy

As detailed in Section 7.1, to enable the use of shallow pad foundations and a ground bearing floor slab floor slab, ground treatment is recommended.

7.2.1 Building Footprint

Within the proposed building footprint, materials should be placed in accordance with an end-product specification, as agreed with the ground treatment contractor. The following earthworks strategy is considered suitable:

- The formation should be proof rolled prior to placement of the first layer of Engineered Fill and any soft spots (or recently placed fill) identified during proof rolling should be treated and/or removed and replaced with Engineered Fill.

- The materials should be placed in layers in accordance with an end-product Specification with testing undertaken on a 50 m x 50 m test grid.

- In-situ moisture content/dry density tests should be undertaken on each grid square layer of fill and the results require to achieve greater than 90% of maximum dry density, as determined using the 4.5 kg rammer compaction test. Where clayey materials are used as Engineered Fill, consideration should also be given to achieving less than 5% air voids and an undrained shear strength greater than 75 kN/m^2. Where sand/silt materials are used as general fill, it is recommended that plate load tests be undertaken to assess performance. These materials could also be used in stabilised layers.

7.2.2 External Areas

Within external areas of the site, the materials could be placed in accordance with an end product specification, alternatively, a method-based specification could be used. The following earthworks strategy is considered suitable:

- The formation should be proof rolled prior to placement of the first layer of Engineered Fill and any soft spots/organic Made Ground identified during proof rolling should be removed and replaced with Engineered Fill.

- The materials should be placed in layers with testing undertaken on a 25 m x 25 m test grid.

- Where clay materials are used as Engineered Fill, the material should achieve an undrained shear strength greater than 50 kN/m^2. Where sand/silt materials are used as general fill, it is recommended that plate load tests be undertaken to assess performance.

7.3 Assessment of Fill Materials

The results of geotechnical laboratory testing are presented in Appendix II. The testing undertaken by Crossfield Consulting included moisture content, particle density, 4.5 kg rammer compaction tests, plasticity index testing and sulphate testing. A summary of the Crossfield Consulting compaction test results for 'as-dug' materials is presented on Figure 5 and 6. A summary of the compaction test results for materials modified with 2% lime is presented as Figure 7.

Below is a summary of the different earthwork materials.

7.3.1 Organic Made Ground

Due to the organic content of the organic Made Ground, these materials are considered only suitable for re-use beneath proposed landscaped areas.

7.3.2 Ponds Deposits

Due to the organic content of the Pond Deposits, these materials are considered only suitable for re-use beneath landscaped areas.

7.3.3 Inorganic Made Ground

It is considered that inorganic Made Ground materials should be suitable for reuse at the site as Engineered Fill, preferably within external areas. The recorded sulphate concentrations (Acid Soluble Sulphate concentrations of between 0.013% and 0.079% and Total Potential Sulphate (TPS) concentrations of between 0.042% and 0.234%), indicate that these materials should be suitable for modification and/or stabilisation with lime and/or cement.

7.3.4 Glacial Till

It is considered that the shallow Glacial Till should be suitable for reuse at the site as Engineered Fill.

A preliminary acceptability envelope has been produced for the 'as-dug' clayey Glacial Till as shown on Figure 5. As can be seen on Figure 5, lower and upper moisture contents of 12% and 20% are considered suitable for these materials.

Laboratory testing undertaken on the Glacial Till has recorded moisture content ranging from 16% and 24%. These results indicate that the Glacial Till may be suitable for use 'as-dug' beneath the building footprint, but some materials may require drying out, especially following periods of wet weather.

As shown on Figure 6, the silty/sandy Glacial Till strata encountered may be difficult to validate beneath the building using in-situ density tests. If this material is to be placed within the building footprint, it is recommended that plate load tests be undertaken to assess the performance of this material. The addition of cement may also aid placement and compaction of these materials. The silty/sandy Glacial Till materials could also be used within stabilised layers to form part of a working platform (in relation to ground treatment works) or within external areas.

The recorded sulphate concentrations (Acid Soluble Sulphate concentrations of between 0.005% and 0.06% and Total Potential Sulphate (TPS) concentrations of between 0.020% and 0.22%), indicate that the Glacial Till materials should be suitable for modification and/or stabilisation with lime and/or cement. Figure 7 presents a preliminary acceptability envelope for Glacial Till modified with 2% Lime.

8. ASSESSMENT OF SLOPES AND RETAINING STRUCTURES

It is understood that slopes and retaining structures are proposed as part of the development.

8.1 Slopes

Cut slopes, up to 2.2 m in height, and fill slopes, up to 1.4 m in height, are proposed. It is understood that slopes of up to 1:3 (vertical to horizontal) are currently indicated for the development.

Based on the ground conditions present in the areas of proposed cut slopes, it is expected that cut slopes will be mainly formed within intact Glacial Till strata but Made Ground strata may be present locally. Based on the expected ground conditions and proposed development levels, it is considered that, if required, cut slopes could be configured at gradients no steeper than 1:2.5 (vertical to horizontal). Subject to suitable fill placement, the same gradients should also be possible for slopes constructed using Engineered Fill.

It will be necessary for the excavated cut slopes to be inspected during, and on completion of, the excavation works to verify that intact/undisturbed Glacial Till strata are present. In the event that zones of granular and/or

water bearing strata are encountered, it may be necessary to re-assess the slope stability, to ensure that satisfactory stability is provided.

Cut-off drains should be provided along the full length of the slope crest and toe, to intercept surface water runoff. If groundwater is encountered in the excavated slope face, additional drainage measures will be necessary to take such water away from the slope and to mitigate risks of deterioration/softening, if soils were to be exposed to flowing water. Such drainage measures can be assessed, as required, by a qualified and experienced Geotechnical Engineer as the excavation works proceed.

To mitigate risks of potential surface erosion, it is recommended that the slopes be vegetated on completion. It is preferable that the vegetation includes both ground-cover and deeper-rooted plants/bushes, to aid the anchorage of surface topsoil and provide protection against surface erosion. The thickness of topsoil should reflect planting requirements.

8.2 Retaining Structures

Where space does not permit the recommended slope gradients to be constructed, retaining structures will be required.

Based on the expected ground conditions in areas where retaining structures are proposed, the following design parameters are considered for preliminary design:

	Total Stress			Effective Stress	
Imported Granular Backfill (6F2)	γ = 19 kN/m^3	C_u = 0 kN/m^2	ϕ_u = 40°	c′ = 0 kN/m^2	ϕ' = 40°
Engineered Fill (fine grained	γ = 20 kN/m^3	C_u = 75 kN/m^2	ϕ_u = 0°	c′ = 0 kN/m^2	ϕ' = 25°
Glacial Till (fine grained)	γ = 20 kN/m^3	C_u = 75 kN/m^2	ϕ_u = 0°	c′ = 0 kN/m^2	ϕ' = 25°

It should be noted that the actual coefficient of earth pressure used for design should reflect the form of construction employed and the temporary works required. For the in-situ natural materials present at the site, the coefficient of earth pressure at rest is probably in excess of 1 and the design of any retaining structures will need to take this into account.

It is considered that the use of reinforced concrete cantilever walls, crib walls or gabion walls should be suitable for this site. If space does not permit the required temporary works construction, embedded walls (sheet piles or soldier piles) may be required.

Suitable drainage measures will be required as part of any retaining structure design.

9. FOUNDATION RECOMMENDATIONS

9.1 Design Approach

In compliance with the requirements of the National Annex of BS EN 1997-1:2004 the geotechnical design assessment is based on Design Approach 1 (as defined in BS EN 1997-1:2004). As the structural loads for the

proposed building are well defined, uncertainty and risks of potential unfavourable conditions (or deviations from characteristic values) are primarily associated with the ground conditions.

Consideration is given to the assessment of ultimate limit state (ULS) conditions, where full collapse or failure conditions are considered. In addition, the assessment considers serviceability limit states (SLS), to ensure that the recommended design parameters are compatible with an acceptably low risk of serviceability criteria being exceeded during the standard design life of the structure. It is noted that the SLS has a greater influence on the design parameters in comparison to ULS conditions and this is considered in the following assessment.

9.2 Proposed Structural Loadings and Serviceability Criteria

Details of imposed foundation loads (i.e. actions imposed by the building structure) and serviceability limit values are not currently available for the proposed structures. The geotechnical assessment presented in the report has considered preliminary values for the proposed development type, which is considered appropriate for the appraisal of engineering solutions and preliminary design, and these are listed as follows:

Preliminary Values, for appraisal purposes:

Maximum Imposed Load on Foundations: column loads up to approximately 1800 kN

Imposed Load from Floor Slab: up to 50 kN/m² (time averaged load of 35 kN/m²)

Serviceability Limit Values (Columns)

Maximum Total Settlement:	25 mm
Maximum Differential Settlement:	15 mm
Angular Distortion:	1/500

If the structural loadings or serviceability criteria for the proposed structure are revised, such that they vary significantly from the values presented above, further assessment will be required.

9.3 Geotechnical Category of Proposed Structures

In view of the nature of the proposed structure and with reference to the indicated ground conditions, as outlined in Section 4, it is considered that the development is compatible with Geotechnical Category 2, as defined in BS EN 1997-1:2004, and the necessary information relating to the Ground Investigation and Geotechnical Design Reports has been obtained and assessed on this basis.

9.4 Assessment of Foundation Solutions

With reference to the recorded ground conditions and corresponding Geological Model presented in Section 4. Salient elements of the geotechnical model are outlined below.

The ground conditions beneath the site typically comprise topsoil over Glacial Till, with Mercia Mudstone strata present at depth. Made Ground has been recorded in areas of former buildings, roads and ponds and has been recorded beneath the northwestern part of the site. The Made Ground in areas of former buildings and roads and two of the former ponds generally comprises reworked natural strata with some man-made inclusions. In the northwestern part of the site and in the pond in the central-northern part of the site, the Made Ground includes topsoil/organic materials and has a strong manure odour.

Earthworks are required at the site to create the required development platform and it is recommended that the earthworks at the site be undertaken in accordance with a suitable end-product specification. Following the earthworks, the shallow strata beneath the building footprint should comprise high strength Engineered Fill and/or high strength Glacial Till. However, beneath the southern and central parts of the site, soft clays and silts have been recorded locally (and of varying thicknesses) at depths of between 3.5 m and 4.5 m.

On the basis that the soft materials have been recorded at varying locations and depths, extensive investigation would be required to assess the full extent of these materials and whether digging out and replacing these materials would be feasible. If these are left in place, following the proposed earthworks, soft/compressible material may be within 3 m of the ground surface, and between 1 m and 2 m below the base of proposed foundations. On this basis, that digging out and replacing materials may not be feasible and that the soft materials are unlikely to be suitable to support shallow pad foundations and a ground bearing floor slab, it is recommended that vibro-replacement ground treatment (stone columns) be used to improve the ground beneath the entire building footprint.

Consideration should be given to the use of 'bottom feed' vibro equipment. Following completion of the ground treatment, an allowable bearing pressure value of at least 125 KN/m^2 should be possible, subject to detailed design by a specialist contractor.

Laboratory testing results indicate the clayey horizons at the site comprise "medium volume change" potential soils, as defined in NHBC Standards (2020). Within the influence zones of existing or proposed trees, suitable foundation precautions should be adopted, as outlined in NHBC Standards (2020).

Based on guidance published within BRE Special Digest 1 (2005), the specified DC Class of concrete for buried structures and foundations should be suitable for an ACEC site classification of AC-1.

9.5 Floor Slab Recommendations

It is considered that, following vibro ground treatment, the use of a ground-bearing floor slab should be suitable.

9.6 General Construction Advice

All formations should be cleaned, and subsequently inspected by a suitably qualified engineer prior to placing concrete. Should any soft, compressible or otherwise unsuitable materials be encountered they should be removed and replaced by blinding concrete.

Foundation concrete, or alternatively, a blinding layer of concrete, should be placed immediately after excavation and inspection in order to protect the formation against softening and disturbance.

Generally, all formations should be placed wholly within the same material type, unless specific geotechnical inspection and assessment have been undertaken.

Care should be taken to ensure that any field drains encountered are carefully and satisfactorily blocked to prevent water seeping through the drains and into any excavations.

The locations of any trial pits undertaken as part of this investigation should be accurately surveyed in order that their precise locations are known and that appropriate precautions can be taken when building over or near to these locations.

10. TEMPORARY WORKS

Conventional plant is considered appropriate for shallow excavation works at the site.

Shallow excavations should remain stable in the short term. However, instability should be anticipated in excavations left open for extended periods of time. Support should be provided, or sides battered back, in any excavations requiring man entry. Excavations below water may become unstable and excavation support may be required.

Groundwater seepages, understood to be perched, were recorded during ground investigation works. Seepages were generally encountered within silty/sandy Glacial Till deposits and locally within the Made Ground. It is considered that perched water inflows should be controlled using conventional sump pumping techniques.

Where sandy layers are exposed in areas of cut the use of cement to create a stabilised upper layer may be required to aid trafficking around the site.

11. ASSESSMENT OF SOAKAWAY DRAINAGE

The presence of low permeability soils beneath the site is likely to preclude the use of soakaway drainage and an alternative method of site drainage should be sought.

12. ROAD PAVEMENTS

Road pavement design will depend on the materials present at subgrade following the earthworks. Based on the soils likely to be present at shallow depth following re-profiling of the site, and the guidance published in IAN73/06 and TRRL LR1132, it is considered that, provided that any localised soft spots are treated, an equilibrium design CBR value of 4% should be suitable for new pavements constructed on the clayey Glacial Till and/or Engineered Fill. Higher values may be used if stabilisation techniques are used.

Where sandy layers are exposed in areas of cut the use of cement to create a stabilised upper layer may be required to aid trafficking around these areas.

13. ASSESSMENT OF MATERIALS FOR WASTE DISPOSAL

An assessment of materials for waste disposal is presented within the Supplementary Geoenvironmental Report (CCL03330.CL58) and reference should be made to that report.

14. SUMMARY

It is proposed to develop the Unit 2 site at ICON, Manchester for commercial purposes. The site forms part of a larger development area that has been split into a number of plots. The proposed development comprises a warehouse structure, together with associated service yard, car parking and limited landscaped areas. To enable construction, earthworks will be required at the site.

Ground conditions at the site typically comprise a limited thickness of topsoil underlain by Glacial Till over Mercia Mudstone Group strata. Loose and/or soft Glacial Till strata has been recorded locally and at varying depths. Locally Made Ground has been recorded beneath the site, notably in the areas of former farm buildings

and roads, ponds and excavations. Perched groundwater has been encountered, typically within the Glacial Till. Groundwater monitoring undertaken by RoC has typically recorded standing water at depths of between 1 m and 1.5 m.

Earthworks are required at the site and the earthworks should be placed in accordance with a suitable end-product specification.

Due to the recorded ground conditions, the use of ground treatment using vibro-replacement techniques (stone columns) is recommended beneath the building footprint. Following ground treatment, shallow pad foundations and a ground-bearing floor slab should be suitable for the proposed development.

REFERENCES

Site Specific References

RoC Consulting (November 2016) *Airport City South Phase 2 SI Final* Report No 3532

Technical References

BRE (2005) *Special Digest 1 – Concrete in aggressive ground,* CRC Ltd

BRE (2015) *BRE FB 75 Building on Fill: Geotechnical Aspects* Building Research Establishment

BSI (2015) *BS 5930:2015 Code of Practice for Ground Investigations* British Standards Institution

BSI (2004) *BS EN1997-1:2004 Eurocode 7: Geotechnical Design – Part 1: General Rules* British Standards Institution

BSI (2007) *BS EN1997-2:2007 Eurocode 7: Geotechnical Design – Part 2: Ground Investigation and Testing* British Standards Institution

Department of Transport (2007) *Manual of Contract Documents For Highway Works (Volume 1) – Specification for Highway Works*, HMSO

Highways Agency (2009) *Interim Advice Note 73/06 Revision 1 – Design Guidance for Road Pavements (Draft HD25)* HA

NHBC (2020) *Standards* National House Building Council

TRRL (1989) *LR1132 – The Design of Bituminous Road Pavements* Transport and Road Research Laboratory

GENERAL NOTES

1. This report is provided in the context of the stated development proposals and should not be used in a different context.

2. The accuracy of map extracts cannot be guaranteed and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.

3. Any borehole data from the British Geological Survey sources are included on the following basis: "The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation.

4. Where any data supplied by the Client or by other external sources, including previous site investigation data, have been used it has been assumed that the information is correct unless otherwise stated. No responsibility can be accepted by Crossfield Consulting Limited for inaccuracies within the data supplied by others.

5. Exploratory hole locations provided in the report are generally established by tape measurement from existing features or boundaries. Hole locations are not accurately surveyed and ground levels at these locations are not obtained unless specifically requested.

6. Any assessments made in this report are based on the ground conditions indicated by the trial pits and/or boreholes, together with the results of any field or laboratory testing undertaken and, where appropriate, other relevant site data which may have been obtained for the site. Variations in ground conditions may occur between exploratory hole locations and there may be special conditions appertaining to the site which have not been revealed by the investigation and which have not been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available.

7. The report is provided for the sole use by the Client or its assignees and is confidential to the Client's professional advisers. No responsibility whatsoever for the contents of this report will be accepted to any person other than the Client or its assignees.

8. New information, improved practices and legislation may necessitate an alteration to the report in whole, or in part, after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Crossfield Consulting Limited for re-assessment and, if necessary, re-appraisal.

FIGURES

FIGURE 1

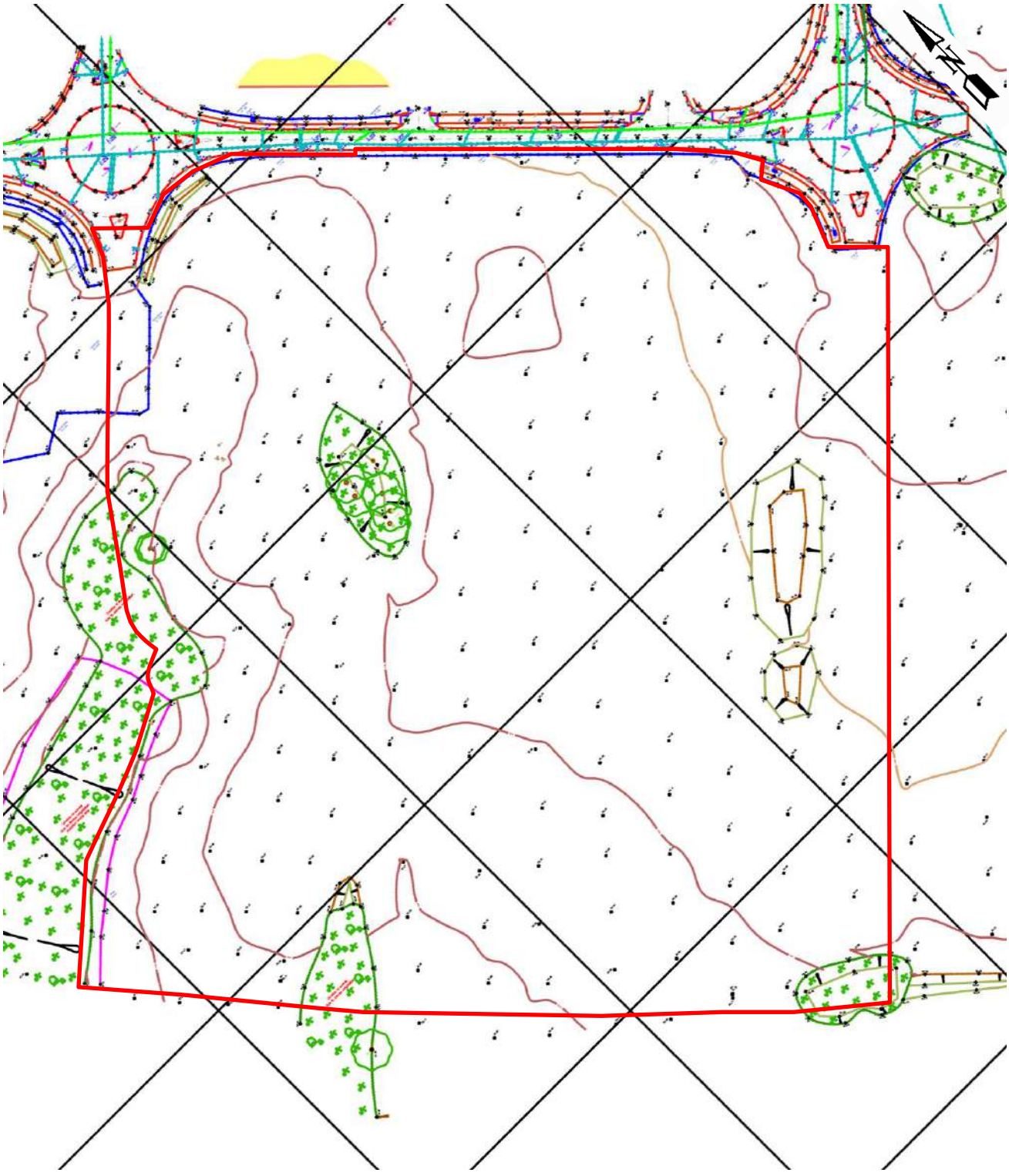


SITE LOCATION PLAN

Scale 1: 50,000

Reproduced from the 2013 1:50,000 Ordnance Survey map with the permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office, © Crown copyright. Licence No.100014660

FIGURE 2



TOPOGRAPHICAL SITE SURVEY PLAN

Scale 1:2000

Reproduced from the Topographical Survey by Greenhatch Group, dated November 2016. Drawing No. 24663_T_UG. Rev. 0

FIGURE 3

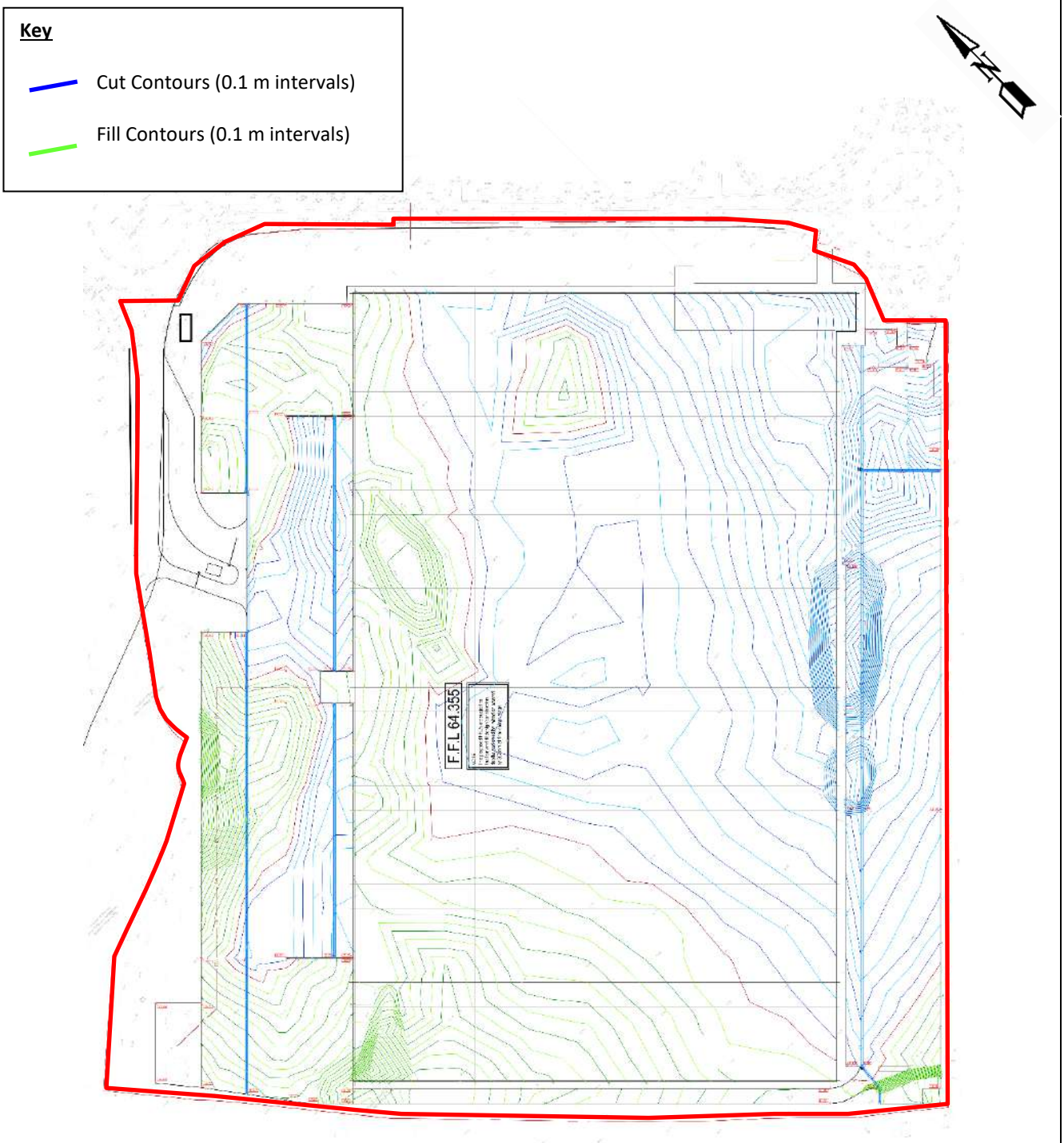


PROPOSED DEVELOPMENT PLAN

Scale 1:2000

Reproduced from the 'Site Layout Plan' by Webb Gray Limited dated June 2019. Drawing no. P-010

FIGURE 4

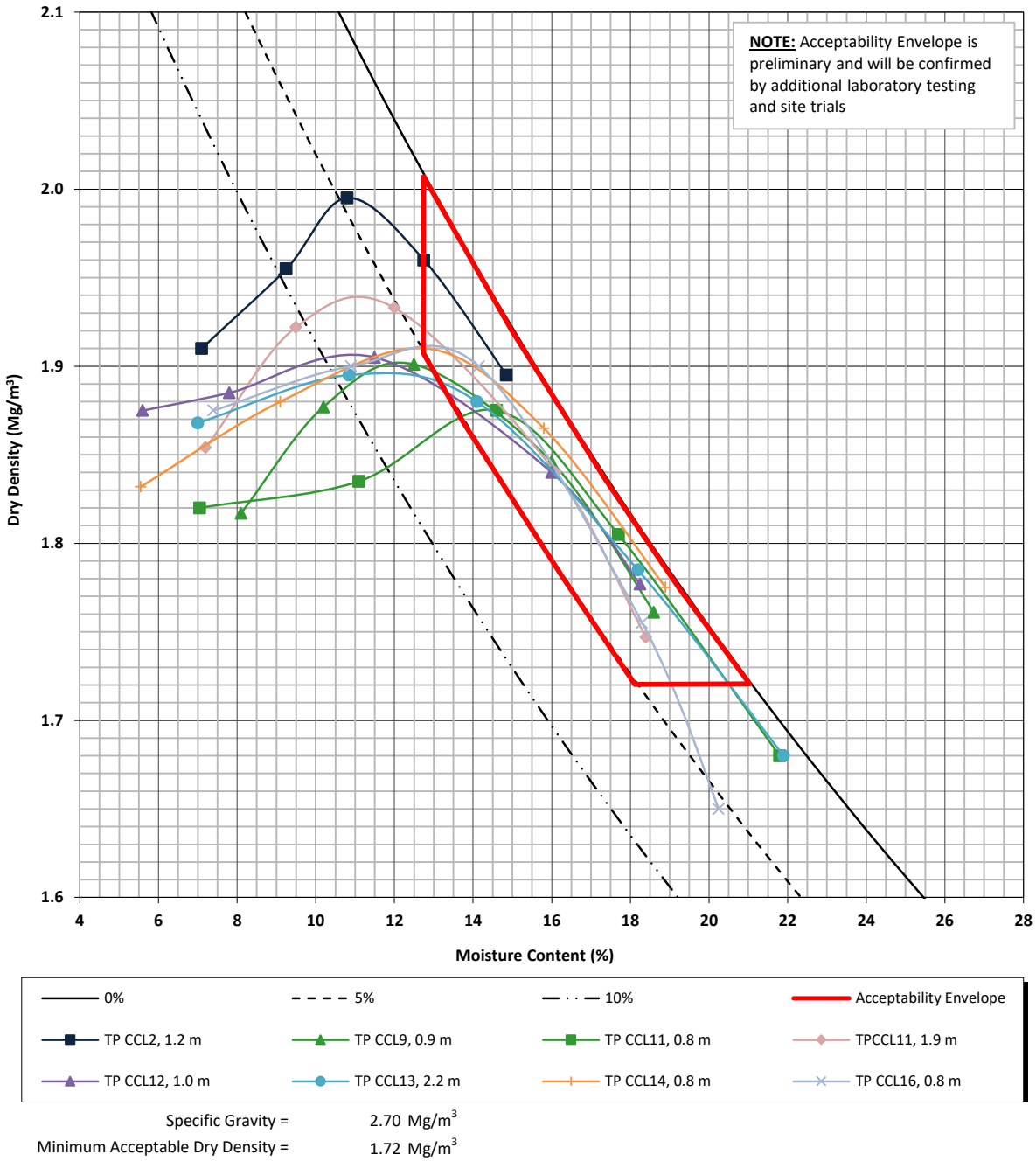


CUT/FILL PLAN WITH PROPOSED DEVELOPMENT OVERLAY

Scale 1:2000

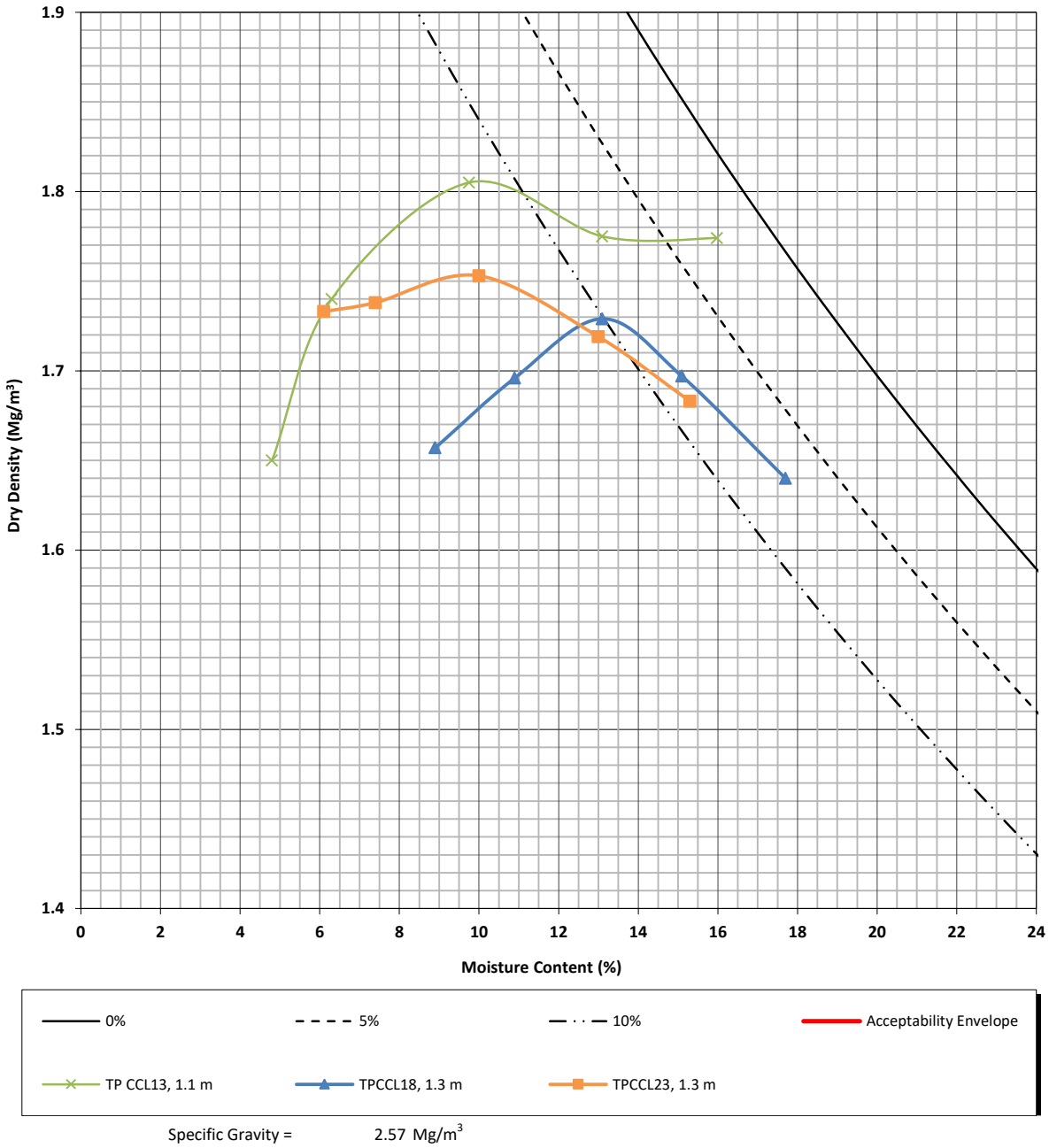
Reproduced from the Indicative Isopachytes provided by Winvic. Drawing No. 16-6878-SK2020-06-20

FIGURE 5



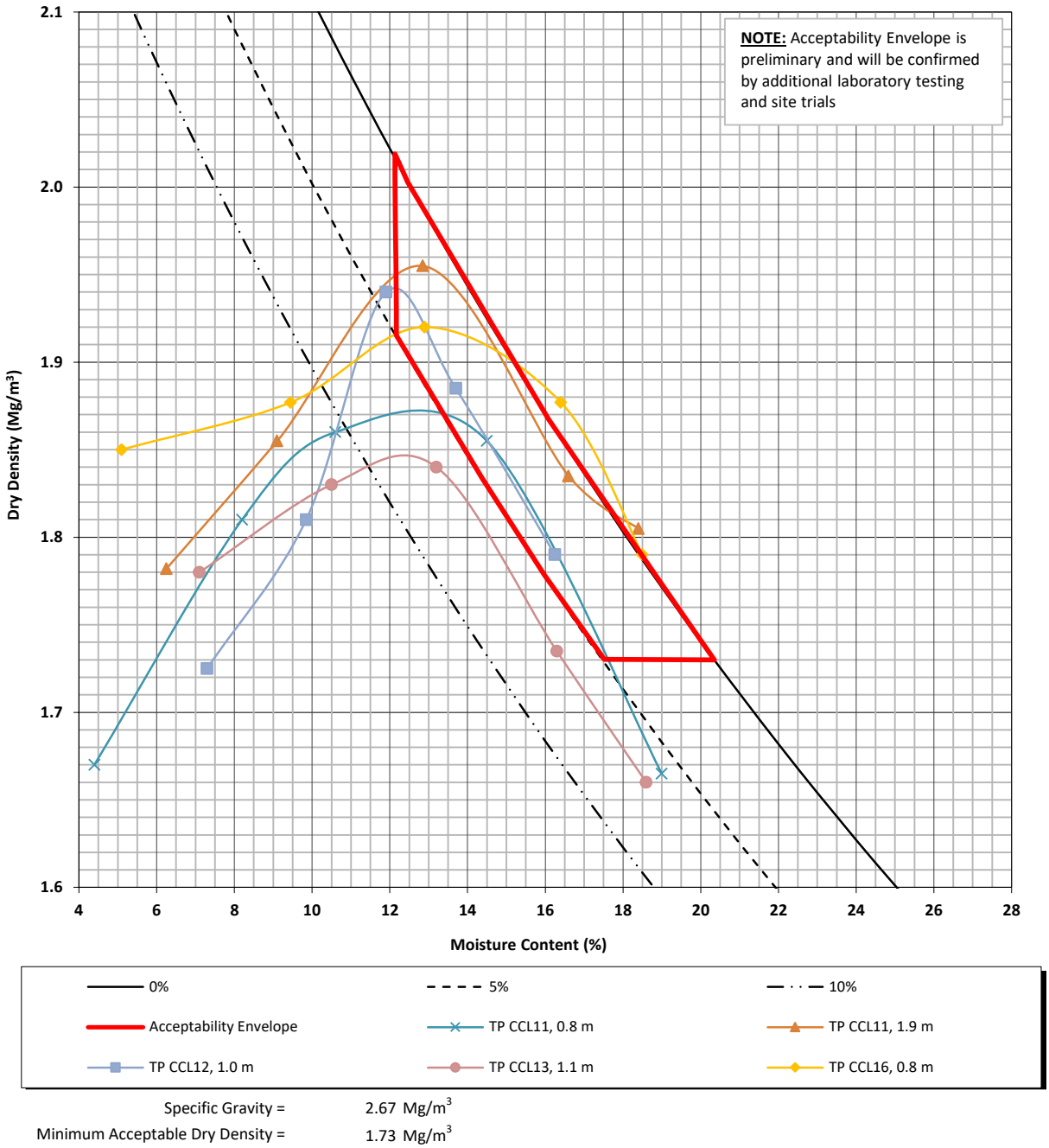
SUMMARY OF COMPACTION TEST RESULTS & PRELIMINARY ACCEPTABILITY ENVELOPE: CLAYEY GLACIAL TILL STRATA (AS-DUG)

FIGURE 6



SUMMARY OF COMPACTION TEST RESULTS: SILTY/SANDY GLACIAL TILL STRATA (AS-DUG)

FIGURE 7



Specific Gravity = 2.67 Mg/m^3

Minimum Acceptable Dry Density = 1.73 Mg/m^3

SUMMARY OF COMPACTION TEST RESULTS & PRELIMINARY ACCEPTABILITY ENVELOPE: GLACIAL TILL STRATA (2% LIME)

APPENDIX I

APPENDIX I – PREVIOUS GROUND INVESTIGATION BY ROC CONSULTING (2016)

Introduction

A ground investigation was undertaken at the site by RoC Consulting in September and October 2016 (reported November 2016). This Appendix presents the relevant factual records and includes the following:

- Exploratory Hole Location Plan
- Exploratory hole records (BH110 to BH118 and TP8, TP10 to TP18, TP20)
- Geotechnical Laboratory Testing
    - Moisture content
    - Atterberg limits
    - Compaction testing (2.5 kg rammer)
    - Oedometer testing
    - Triaxial tests

The investigation was undertaken over a larger development area and some of the laboratory test results presented do not relate to the Unit 2 plot.

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NOTES

HP01 ROC 2016 CABLE TOOL BOREHOLE LOCATION

TP01 ROC 2016 TRIAL PIT LOCATION

CBR01 ROC 2016 CBR TEST LOCATION

UNIT 1 [SEE DRAWING ES02B]

UNIT 2 [SEE DRAWING ES20C]

UNITS 3 & 4 [SEE DRAWING ES02D]

PLOT Q [SEE DRAWING ES02E]

DRAWING NOTES

1) ALL EXPLORATORY HOLE LOCATIONS ARE SHOWN AT COMPLETED LOCATIONS.

2) FOR A DETAILED OVERVIEW TO GROUND CONDITIONS AND QUALITY PLEASE REFER TO ROC CONSULTING ACCOMPANYING PHASE 2 SITE INVESTIGATION REPORT

3) JET FUEL LINE ALIGNMENT INFORMATION TAKEN FROM IAN FARMER 2013 SITE INVESTIGATION INFORMATION AND SHOULD BE CONSIDERED AS INDICATIVE.

4) PLEASE REFER TO ROC CONSULTING DRAWING ES01 FOR FURTHER INFORMATION ON CURRENT / RECENT SITE FEATURES AND LAYOUT.

REV.	DATE	DETAILS	DRN.	CHK.

DRAWING STATUS
INFORMATION

RoC CONSULTING
Civil & Structural Engineers
6 Commercial Street, Manchester,
M15 4PZ
Tel: 0161 214 5390

DRAWN JB	DATE 22/08/16	SCALES NTS
CHECKED AS	DATE 22/08/16	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE
APPRVD. AS	DATE 22/08/16	EMAIL FOR DRAWINGS drawings@rocconsulting.com

CLIENT
MANCHESTER AIRPORT GROUP LTD.

PROJECT TITLE
ACS GLOBAL LOGISTICS HUB

DRAWING TITLE
BOREHOLE LOCATION PLAN
UNIT 2

PROJECT No.	DRAWING No.	REV.
3532	ES02C	S1

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RoC Consulting

PLOT DATE: 22/08/16

ACADFILE

Borehole Log

Borehole No. **BH110**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380521.01 - 384558.66	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 63.76	Scale 1:50
Client: Airport City Partnerships		Dates: 29/09/2016 - 29/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30	63.46		Grass overlying dark brown sandy TOPSOIL
		0.80	D					Firm light brown mottled orange and grey CLAY (drillers description) (GLACIAL CLAY)
		1.20 1.20	D	N=18 (1,1/2,4,6,6)				*... contains orange sand lenses in the clay strata from 1m to 2.1m*
	▼	2.00 - 2.45	U	Ublow=48	2.10	61.66		
					2.50	61.26		Light brown SAND with fine gravel fragments (drillers description) (GLACIAL TILL)
		3.00 3.00	D	N=9 (3,2/2,2,2,3)				Soft-firm dark brown CLAY with fine gravel fragments and pockets of sand throughout (GLACIAL CLAY)
	▼							
		4.00 - 4.45 4.00 - 4.50	U B	Ublow=27				
		5.00 5.00	D	N=17 (1,1/3,4,5,5)				
		6.00 - 6.45	U	Ublow=42	6.00	57.76		Dark brown slightly sandy gravelly CLAY with occasional grey mudstone fragments (GLACIAL CLAY)
		7.00 7.00	D	50 (5,9/50 for 240mm)	7.32	56.44		End of borehole at 7.32 m

Remarks

1) Hand dug inspection pit completed to 1.2m
2) Slight groundwater seepage encountered at 1.2m
3) Groundwater encountered at 2.1m
4) Borehole terminated at 7.32m at request of engineer due to encountered bedrock.

Borehole Log

Borehole No. **BH111**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380566.68 - 384516.97	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 64.44	Scale 1:50
Client: Airport City Partnerships		Dates: 29/09/2016 - 30/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.25	64.19		Grass overlying dark brown sandy TOPSOIL
					0.90	63.54		Light brown mottled orange and grey slightly sandy CLAY with occasional rootlets (drillers description) (GLACIAL CLAY)
		1.20 - 1.65	U	Ublow=30				Light brown grey banded CLAY (drillers description) (GLACIAL CLAY)
		2.00 2.00	D	N=12 (2,2/3,2,4,3)	2.00	62.44		Firm dark brown slightly sandy gravelly CLAY with occasional orange sand lenses (drillers description) (GLACIAL CLAY)
		3.00 - 3.45	U	Ublow=26				
		4.00 4.00	D	N=16 (2,3/3,3,5,5)				
		5.00 - 5.45	U	Ublow=36				
		6.00 6.00	D	N=45 (3,7/10,13,10,12)				*... becoming very stiff at 6m*
					6.45	57.99		End of borehole at 6.45 m

Remarks

1) Hand dug inspection pit completed to 1.2m
2) No groundwater encountered
3) Borehole terminated at 6.45m at request of site engineer due to stiffness of clay

Borehole Log

Borehole No. **BH112**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380618.14 - 384442.06	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 65.09	Scale 1:50
Client: Airport City Partnerships		Dates: 15/09/2016 - 15/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	64.89		Grass overlying dark brown sandy TOPSOIL
								Light brown mottled grey very sandy CLAY with occasional subangular mudstone and siltstone fragments (GLACIAL CLAY)
								... suspected land drainage pipe encountered at 0.7m
		1.20 1.20 1.20 - 1.65	D B	N=15 (2,3/3,3,5,4)				*... becoming light orangish brown from 1.1m*
		2.00 2.00	D	N=24 (1,4/5,5,7,7)				
		3.00 3.00	D	N=3 (1,0/1,1,1,0)				*... becoming very soft at 3m*
					3.30	61.79		Firm brown slightly sandy CLAY (GLACIAL CLAY)
		4.00 - 4.45	U	Ublow=30				
		5.00 5.00	D	N=12 (1,2/2,4,4,4)				
		6.00 - 6.45	U	Ublow=26				
					7.00	58.09		Very stiff dark brown greyish CLAY (drillers description) (GLACIAL CLAY)
		7.30 7.30	D	50 (4,7/50 for 220mm)				
					7.60 7.67	57.49 57.42		Grey SILTSTONE (drillers description) End of borehole at 7.67 m

Remarks

1) Hand dug inspection pit completed to 1.2m
2) Slight groundwater seepage encountered at 2m
3) Borehole terminated at 7.67m at request of site engineer due to encountered bedrock

Borehole Log

Borehole No. **BH113**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380427.40 - 384474.75	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 63.40	Scale 1:50
Client: Airport City Partnerships		Dates: 30/09/2016 - 30/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	D		0.15	63.25		Coarse black ash with frequent large subangular grey and white gravel fragments, red brick fragments and grey cobbles (MADE GROUND)
		0.70	D		0.40	63.00		Grey slightly sandy CLAY (drillers description) (GLACIAL CLAY)
		1.20 - 1.65	U	Ublow=32	0.90	62.50		Light brown mottled grey very sandy CLAY (drillers description) (GLACIAL CLAY)
		2.00 2.00	D	N=9 (1,1/2,2,2,3)	1.70	61.70		Soft light brown grey banded CLAY (drillers description) (GLACIAL CLAY)
	▼	3.00 - 3.45	U	Ublow=41				Dark brown slightly sandy gravelly CLAY (drillers description) (GLACIAL CLAY)
		4.00		N=14 (2,2/3,2,4,5)	4.20	59.20		Medium dense light brown SAND (drillers description) (GLACIAL TILL)
		4.50 - 5.00	B					
		5.00 5.00	D	N=24 (4,3/3,5,7,9)				
		6.30 6.30	D	N=44 (3,5/5,9,13,17)	5.70	57.70		Very stiff dark brown slightly sandy gravelly CLAY (drillers description) (GLACIAL CLAY)
					6.60	56.80		Grey WEATHERED MUDSTONE
					6.75	56.65		End of borehole at 6.75 m

Remarks

1) Hand dug inspection pit completed to 1.2m
2) Groundwater encountered at 3.1m
3) Borehole terminated at 6.75m at request of site engineer due to encountered bedrock

Borehole Log

Borehole No. **BH114**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380474.28 - 384426.37	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 64.32	Scale 1:50
Client: Airport City Partnerships		Dates: 29/09/2016 - 29/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	64.22		Turf overlying dark greyish brown very fine sandy CLAY with occasional roots and organic matter (TOPSOIL)
								Light brown mottled orangish brown silty CLAY with occasional roots and organic matter (GLACIAL CLAY)
		1.20 1.20	D	N=20 (1,1/3,5,5,7)	1.00	63.32		Medium dense orangish brown very fine clayey SAND (GLACIAL TILL)
		2.00 2.00	D	N=17 (1,2/3,3,5,6)	1.80	62.52		Firm brown mottled orange CLAY with occasional fragments of subangular gravel (GLACIAL CLAY)
		3.00 3.00	D	N=11 (1,2/2,2,2,5)	2.80	61.52		Firm brown slightly sandy gravelly CLAY (GLACIAL CLAY)
		4.00 - 4.45	U	Ublow=18	4.00	60.32		Medium dense brown medium SAND (GLACIAL TILL)
	▼	5.00 5.00	D	N=27 (5,6/7,6,6,8)	5.30	59.02		Grey WEATHERED MUDSTONE
		6.00 6.00	D	50 (4,8/50 for 295mm)	6.00	58.32		End of borehole at 6.00 m

Remarks
1) Hand dug inspection pit completed to 1.2m
2) Groundwater encountered at 5.6m
3) Borehole terminated at 6m at request of site engineer due to encountered bedrock

Borehole Log

Borehole No. **BH115**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380516.95 - 384375.98	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 64.65	Scale 1:50
Client: Airport City Partnerships		Dates: 15/09/2016 - 15/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.40	64.25		Grass overlying brown clayey sandy TOPSOIL
		0.50 - 1.00	B					Soft light brown sandy CLAY with occasional rootlets (GLACIAL CLAY)
								... some orange mottling between 0.4m and 1.3m
		1.20 - 1.65	U	Ublow=19				
		2.00 2.00	D	N=5 (1,0/1,1,1,2)				*... thin laminae of grey clay noted from 2m*
		3.00 - 3.45	U	Ublow=23				
		4.00 4.00	D	N=7 (1,1/2,1,2,2)				
					4.30	60.35		Grey WEATHERED MUDSTONE (drillers description)
		5.00 5.00	D	N=45 (3,6/7,8,12,18)				
		5.50	D					
		6.00 6.00	D	80 (8,10/80 for 255mm)	6.00 6.26	58.65 58.40		Grey MUDSTONE (drillers description) End of borehole at 6.26 m

Remarks

1) Hand dug inspection pit completed to 1.2m
2) No groundwater encountered
3) Borehole terminated at 6.26m at request of site engineer due to encountered bedrock

Borehole Log

Borehole No. **BH116**

Sheet 1 of 1

Project Name:	ACS Global Logistics Hub	Project No. 3532	Co-ords: 380319.35 - 384387.65	Hole Type CP
Location:	Sunbank Lane, Manchester		Level: 62.76	Scale 1:50
Client:	Airport City Partnerships		Dates: 30/09/2016 - 30/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	62.66		Grass overlying clayey organic rich SAND (TOPSOIL) Brown medium SAND (drillers description) (GLACIAL TILL)
		1.20 1.20	D	N=15 (1,1/2,3,5,5)	1.10	61.66		*... becoming light brown at 1m* Firm brown mottled grey sandy silty CLAY (GLACIAL CLAY)
		2.00 2.00	D	N=12 (1,2/2,2,3,5)				
		3.00 - 3.45	U	Ublow=21	3.00	59.76		Reddish brown MUDSTONE (drillers description)
		4.00 4.00	D	50 (7,23/50 for 265mm)	4.00	58.76		End of borehole at 4.00 m

Remarks
1) Hand dug inspection pit completed to 1.2m
2) No groundwater encountered
3) Borehole terminated at 4m at request of site engineer due to encountered bedrock

Borehole Log

Borehole No. **BH117**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380377.29 - 384330.15	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 63.07	Scale 1:50
Client: Airport City Partnerships		Dates: 19/09/2016 - 19/09/2016	Logged By AN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.35	62.72		Grass overlying clayey organic rich SAND (TOPSOIL)
		0.50 - 1.00	B					Light brown mottled orange CLAY with occasional rootlets (drillers description) (GLACIAL CLAY)
		1.20 1.20	D	N=12 (1,1/2,2,3,5)	1.20	61.87		Firm dark brown slightly sandy gravelly CLAY with grey bands throughout (drillers description) (GLACIAL CLAY)
		2.00 - 2.45	U	Ublow=28				
		3.00 3.00	D	N=13 (1,2/3,3,3,4)				
		4.00 - 4.45	U	Ublow=26				
	▼				4.70	58.37		Reddish WEATHERED MUDSTONE (drillers description)
		5.00	D					
		5.30		50 (25 for 135mm/50 for 240mm)				
					5.60	57.47		End of borehole at 5.60 m

Remarks
1) Hand dug inspection pit completed to 1.2m
2) Groundwater encountered at 4.7m
3) Borehole terminated at 5.6m at request of site engineer due to encountered bedrock

Borehole Log

Borehole No. **BH118**

Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380428.38 - 384279.24	Hole Type CP
Location: Sunbank Lane, Manchester		Level: 63.71	Scale 1:50
Client: Airport City Partnerships		Dates: 19/09/2016 - 19/09/2016	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10 - 0.40	B		0.40	63.31		Grass overlying clayey organic rich SAND (TOPSOIL)
								Light brown mottled orange CLAY (drillers description) (GLACIAL CLAY)
		1.20 - 1.65	U	Ublow=26	1.10	62.61		Firm dark brown slightly sandy gravelly CLAY (drillers description) (GLACIAL CLAY)
		2.00 2.00	D	N=17 (1,2/3,4,5,5)				
		3.00 - 3.45	U	Ublow=21				
					3.50	60.21		Reddish brown WEATHERED MUDSTONE (drillers description)
		4.00 4.00	D	N=14 (1,2/2,3,5,4)				
		5.00 - 5.45	U	Ublow=50	5.10	58.61		Reddish brown MUDSTONE with white quartz pieces throughout (drillers description)
		6.00	D					
	▼	6.30 6.30	D	0 (75 for 100mm/,,,)	6.40	57.31		End of borehole at 6.40 m

Remarks

1) Hand dug inspection pit completed to 1.2m
2) Groundwater encountered at 6.3m
3) Borehole terminated at 6.4m at request of site engineer due to encountered bedrock

Trial Pit Log

TrialPit No: TP08
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380428.78 - 384494.48 Level: 63.20	Date 03/10/2016
Location: Sunbank Lane, Manchester		Dimensions (m): Depth 3.10, 0.70	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
	0.20	ES					Rough grass overlying dark brown mottled black ashy sand and gravel of brick, clay pot, cobble and paving slabs (MADE GROUND)
	0.55	ES					*... layer of dense brick fill comprising of intact brick sets at 0.45m*
				0.60	62.60		
	0.80	HVP	HVR=81kPa				Stiff initially light grey, becoming dark brown with depth, sandy silty CLAY (GLACIAL CLAY)
	1.00		HVR=>120kPa				
				3.10	60.10		End of Pit at 3.100m

1
2
3
4
5

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 3.1m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP10
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380435.97 - 384508.19 Level: 63.29	Date 03/10/2016
Location: Sunbank Lane, Manchester		Dimensions (m): Depth 2.90, 0.70	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
	0.20	ES					Rough grass overlying black ashy clayey gravelly SAND. Gravel is fine to coarse, subangular to angular of brick, slate and clay pot (MADE GROUND)
							... possible demolition fill
				0.50	62.79		Stiff initially light grey, becoming dark brown with depth, silty sandy friable CLAY (GLACIAL CLAY)
	0.80		HVR=>120kPa				
				2.90	60.39		End of Pit at 2.900m

1
2
3
4
5

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 2.9m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP11
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380385.99 - 384472.85 Level: 63.70	Date 03/10/2016
Location: Sunbank Lane, Manchester		Dimensions (m): Depth 4.00, 0.70	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.30	63.40		Turf overlying clayey organic rich SAND (TOPSOIL)
	0.50	HVP	HVR=58kPa	0.75	62.95		Soft to firm light brown silty sandy CLAY (GLACIAL CLAY)
							Light grey fine silty SAND (GLACIAL TILL)
							... sand noted to be damp indicating possible perched water table from 3.5m
				4.00	59.70		*... evidence of clay noted at pit base* End of Pit at 4.000m

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 4m at request of engineer due to failure of pit sides

Stability: Good becomes poor below 2.2m

Trial Pit Log

TrialPit No: TP12
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380327.92 - 384419.09 Level: 62.94	Date 03/10/2016
Location: Sunbank Lane, Manchester		Dimensions (m): Depth 2.80, 0.70	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.20	62.74		Turf overlying clayey organic rich SAND (TOPSOIL)
	0.30	ES					Firm light brown mottled grey sandy silty CLAY (GLACIAL CLAY)
	0.50	HVP	HVR=70kPa				
	0.80	HVP	HVR=82kPa				*... becoming stiff at 0.8m*
	1.10	HVP	HVR=90kPa				
	1.80		HVR=>120kPa				
				2.80	60.14		End of Pit at 2.800m

1
2
3
4
5

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 2.8m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP13
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380615.96 - 384468.58 Level: 65.47	Date 30/09/2016
Location: Sunbank Lane, Manchester		Dimensions (m): 2.80 × 0.70 Depth 3.70	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.00			Turf overlying light brown organic rich sand with many root fragments and organic material (TOPSOIL)
	0.45	HVP	HVR=53kPa	0.40	65.07		Firm light grey silty sandy CLAY (GLACIAL CLAY)
							... becoming reddish brown at 0.5m
	0.80	HVP	HVR=108kPa				*... becoming stiff at 0.8m*
							... becoming dark brown mottled grey and friable at 1m
				3.70	61.77		End of Pit at 3.700m

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 3.7m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP14
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380565.25 - 384382.16 Level: 67.09	Date 22/09/2016
Location: Sunbank Lane, Manchester		Dimensions (m): 2.50 × 0.80 Depth 2.80	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
	0.35	ES					Grass overlying Made Ground composed of reddish brown and brown sandy clayey matrix with sandstone cobbles fine-coarse angular gravel of brick and broken concrete. Some gravel of limestone (MADE GROUND-REWORKED CLAY)
				1.30	65.79		Dark brown and grey/brown clayey sand (POSSIBLE RELIC TOPSOIL LAYER)
				1.40	65.69		Stiff reddish brown mottled grey silty slightly gravelly CLAY. Sparse subrounded cobbles. Gravel is fine-coarse subrounded. Fissured (vertical and horizontal). (GLACIAL CLAY)
							... clay land drain noted at 1.8m
							... becoming very stiff at 2.5m
				2.80	64.29		End of Pit at 2.800m

Remarks:
1) Located on mound
2) CAT screened
3) No groundwater encountered
4) Clay land drain at 1.8m with some enclosed water
5) Trial pit terminated at 2.8m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP15
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380512.25 - 384331.42 Level: 64.98	Date 22/09/2016
Location: Sunbank Lane, Manchester		Dimensions (m): 2.10 × 0.70 Depth 2.90	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
	0.15	ES		0.20	64.78		Grass overlying brown clayey sandy TOPSOIL.
				0.50	64.48		Light grey brown silty sandy CLAY (GLACIAL CLAY)
				0.75	64.23		Firm-stiff brown mottled grey silty fine sandy CLAY (GLACIAL CLAY)
				1.20	63.78		Compact brown slightly clayey silty fine grained SAND (GLACIAL TILL)
	1.40	HVP	HVR=95kPa				Stiff reddish brown mottled grey silty CLAY, Sparse fine-coarse subrounded gravel, mixed lithologies. (GLACIAL CLAY) *... at the interface clay is softened*
				2.00	62.98		Very stiff reddish brown mottled grey, grey discolouration on the sub vertical fissures silty CLAY. Sparse fine-coarse subrounded gravel. Silt/fine Sand on partings. (GLACIAL CLAY) *... 150mm brown silty fine sand parting at 2.2m*
				2.90	62.08		End of Pit at 2.900m

1 2 3 4 5

Remarks: 1) CAT screened
2) No groundwater encountere
3) Trial pit terminated at 2.9m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP16
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380461.87 - 384265.22 Level: 64.10	Date 22/09/2016
Location: Sunbank Lane, Manchester		Dimensions (m): 2.30 × 0.70 Depth 2.20	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
	0.15	ES		0.20	63.90		Turf overlying dark brown and brown clayey very sandy TOPSOIL with numerous rootlets
							Firm-stiff brown mottled grey silty slightly fine sandy CLAY (GLACIAL CLAY)
				0.90	63.20		Stiff reddish brown mottled grey slightly silty CLAY (GLACIAL CLAY)
	1.30		HVR=>130kPa				*... becoming very stiff, layered grey and fissured (vertical and horizontal) with some white lime specks at 1.3m*
				2.20	61.90		End of Pit at 2.200m

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 2.2m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP17
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380631.44 - 384419.59 Level: 66.35	Date 22/09/2016
Location: Sunbank Lane, Manchester		Dimensions (m): 2.00 × 0.70 Depth 2.40	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.00	66.35		Made Ground composed of brown sandy clayey matrix with brick fragments some coal and macadam fragments (MADE GROUND)
	0.35	ES		0.35	66.00		Stiff light brown mottled grey silty CLAY (GLACIAL CLAY)
	1.00		HVR=>140kPa	1.00	65.35		Stiff and very stiff brown mottled grey silty CLAY. Sparse fine-coarse subrounded gravel, mixed lithologies. Rare subrounded cobbles. Some brown silty fine sand pockets (GLACIAL CLAY)
				1.70	64.65		Very stiff brown mottled grey silty CLAY. Sparse fine-coarse subrounded gravel, mixed lithologies. Rare subrounded cobbles. Some brown silty fine sand pockets. Fissured with grey silt/fine sand on partings. Some cobbles of grey siltstone. (GLACIAL CLAY).
				2.40	63.95		End of Pit at 2.400m

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 2.4m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP18
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380586.60 - 384365.31 Level: 65.85	Date 30/09/2016
Location: Sunbank Lane, Manchester		Dimensions (m): 2.60 x 0.70 Depth 3.30	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.35	65.50		Turf overlying light brown organic rich SAND with many root fragments and organic material (TOPSOIL)
	0.55	HVP	HVR=65kPa				Light brown mottled grey silty sandy CLAY (GLACIAL CLAY)
	1.60		HVR=>120kPa				*... becoming stiff to very stiff at 1.5m*
							... fine grey silty sand pockets noted from 3m
				3.30	62.55		End of Pit at 3.300m

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 3.3m at request of engineer due to stiffness of clay and excavation limits

Stability: Good

Trial Pit Log

TrialPit No: TP20
Sheet 1 of 1

Project Name: ACS Global Logistics Hub	Project No. 3532	Co-ords: 380496.86 - 384276.81 Level: 64.11	Date 30/09/2016
Location: Sunbank Lane, Manchester		Dimensions (m): 3.00 × 0.70 Depth 2.50	Scale 1:25
Client: Airport City Partnerships			Logged AN

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.25	63.86		Turf overlying clayey organic rich SAND (TOPSOIL)
				0.60	63.51		Light orangish brown very clayey SAND (GLACIAL TILL)
	0.90	HVP	HVR=118kPa				Stiff reddish brown mottled grey silty sandy CLAY (GLACIAL CLAY)
	1.45		HVR=>120kPa				
				2.10	62.01		Grey WEATHERED MUDSTONE
				2.50	61.61		End of Pit at 2.500m

Remarks: 1) CAT screened
2) No groundwater encountered
3) Trial pit terminated at 2.5m at request of site engineer due to encountered bedrock

Stability: Good

TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

4041

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client:	ROC Consulting Ltd	Client Reference:	3532
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	16-29244
		Date Sampled:	Not Given
		Date Received:	04/10/2016
Contact:	Jason Bradley	Date Tested:	13/10/2016
Site Name:	Airport City South GLH	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
638421	Not Given	BH104	8	Not Given	U	Brown slightly gravelly sandy CLAY	18
638423	Not Given	BH105	7	Not Given	U	Brown slightly gravelly sandy CLAY	17
638424	Not Given	BH107	1.2	Not Given	U	Brown slightly sandy CLAY with thin laminae of grey clay	19
638425	Not Given	BH107	3	Not Given	U	Brown slightly gravelly sandy CLAY	18
638427	Not Given	BH108a	2	Not Given	U	Brown slightly gravelly sandy CLAY	19
638430	Not Given	BH109	1.2	Not Given	U	Brown sandy CLAY. Sand is fine	21
638432	Not Given	BH117	2	Not Given	U	Brown slightly sandy CLAY with thin laminae of grey clay	19
638434	Not Given	BH118	1.2	Not Given	U	Brown slightly sandy CLAY with thin laminae of grey clay	18
638437	Not Given	BH124	1.2	Not Given	U	Brownish grey slightly gravelly slightly sandy CLAY with pocket of yellowish brown sand	14

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Date Reported: 17/10/2016

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Client:	ROC Consulting Ltd	Client Reference:	3532
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	16-29244
		Date Sampled:	Not Given
		Date Received:	04/10/2016
Contact:	Jason Bradley	Date Tested:	25/10/2016
Site Name:	Airport City South GLH	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
638420	Not Given	BH104	1.2	Not Given	U	Brown slightly gravelly sandy CLAY	21
638422	Not Given	BH105	2	Not Given	U	Brown very sandy CLAY	24
638426	Not Given	BH107	5	Not Given	U	Brown slightly gravelly very sandy CLAY	19
638428	Not Given	BH109	3	Not Given	U	Brown very sandy CLAY	16
638429	Not Given	BH109	5	Not Given	U	Brown slightly gravelly very sandy CLAY	19
638431	Not Given	BH117	4	Not Given	U	Brown slightly sandy CLAY with pockets of grey sand	23
638433	Not Given	BH118	3	Not Given	U	Orangish brown sandy CLAY	22
638435	Not Given	BH123	2	Not Given	U	Brown slightly gravelly sandy CLAY	17
638436	Not Given	BH123	4	Not Given	U	Orangish brown sandy CLAY	22

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 27/10/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client:	ROC Consulting Ltd	Client Reference:	3532
Client Address:	Commercial Wharf 6 Commercial Street Castlefield , Manchester M15 4PZ	Job Number:	16-30716
		Date Sampled:	Not Given
		Date Received:	21/10/2016
Contact:	Jason Bradley	Date Tested:	28/10/2016
Site Name:	Airport City South GLH	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
646849	Not Given	BH101	6	6.45	U	Reddish brown slightly gravelly clayey SAND	17
646850	Not Given	BH101	4	4.45	U	Brown slightyl gravelly very sandy CLAY	14
646851	Not Given	BH102	7	7.45	U	Brown slightly gravelly clayey SAND	14
646852	Not Given	BH102	3	3.45	U	Brown clayey SAND	14
646853	Not Given	BH102	5	5.45	U	Brown slightly gravelly very sandy CLAY	19
646854	Not Given	BH103	4	4.45	U	Reddish brown slightly gravelly very sandy CLAY	14
646855	Not Given	BH103	6	6.45	U	Brown slightly gravelly clayey SAND	13
646856	Not Given	BH106	5	5.45	U	Brown sandy CLAY	22
646857	Not Given	BH106	7	7.45	U	Reddish brown slightly gravelly very sandy CLAY	17
646858	Not Given	BH110	6	6.45	U	Reddish brown slightly gravelly very sandy CLAY	14

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Terry Stafford
Geotechnical Manager

Date Reported: 03/11/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client:	ROC Consulting Ltd	Client Reference:	3532
Client Address:	Commercial Wharf 6 Commercial Street Castlefield , Manchester M15 4PZ	Job Number:	16-30716
		Date Sampled:	Not Given
		Date Received:	21/10/2016
Contact:	Jason Bradley	Date Tested:	31/10/2016
Site Name:	Airport City South GLH	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
646859	Not Given	BH110	2	2.45	U	Orangish brown clayey SAND	18
646860	Not Given	BH111	3.3	3.45	U	Brown slightly gravelly sandy CLAY	27
646861	Not Given	BH111	5	5.45	U	Brown slightly gravelly very sandy CLAY	18
646862	Not Given	BH111	1.2	1.65	U	Brown slightly gravelly sandy CLAY	20
646863	Not Given	BH113	1.2	1.65	U	Brown slightly gravelly sandy CLAY	19
646864	Not Given	BH113	3	3.45	U	Brown slightly gravelly very sandy CLAY	17
646865	Not Given	BH114	4	4.45	U	Brown slightly gravelly very sandy CLAY	18
646866	Not Given	BH116	3	3.45	U	Brown slightly gravelly very sandy CLAY	18
646867	Not Given	BH119	3	3.45	U	Brown slightly gravelly sandy CLAY	21
646868	Not Given	BH119	1.2	1.65	U	Brown slightly gravelly slightly sandy CLAY	21

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Terry Stafford
Geotechnical Manager

Date Reported: 03/11/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: ROC Consulting Ltd
Client Address: Commercial Wharf
6 Commercial Street
Castlefield
Manchester
Contact: Jason Bradley
Site Name: Airport City South GLH
Site Address: Not Given

Client Reference: 3532
Job Number: 16-29244
Date Sampled: Not Given
Date Received: 04/10/2016
Date Tested: 13/10/2016
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Attenberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
638421	BH104	Not Given	8.00	Not Given	U	Brown slightly gravelly sandy CLAY	-	-	18	94	29	15	14	-
638423	BH105	Not Given	7.00	Not Given	U	Brown slightly gravelly sandy CLAY	-	-	17	97	26	15	11	-
638424	BH107	Not Given	1.20	Not Given	U	Brown slightly sandy CLAY with thin laminae of grey clay	-	-	19	100	42	21	21	-
638425	BH107	Not Given	3.00	Not Given	U	Brown slightly gravelly sandy CLAY	-	-	18	95	31	16	15	-
638427	BH108a	Not Given	2.00	Not Given	U	Brown slightly gravelly sandy CLAY	-	-	19	97	32	16	16	-
638430	BH109	Not Given	1.20	Not Given	U	Brown sandy CLAY. Sand is fine	-	-	21	100	37	20	17	-
638432	BH117	Not Given	2.00	Not Given	U	Brown slightly sandy CLAY with thin laminae of grey clay	-	-	19	100	40	19	21	-
638434	BH118	Not Given	1.20	Not Given	U	Brown slightly sandy CLAY with thin laminae of grey clay	-	-	18	100	38	19	19	-
638437	BH124	Not Given	1.20	Not Given	U	Brownish grey slightly gravelly slightly sandy CLAY with pocket of yellowish brown sand	-	-	14	98	32	18	14	-

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical Section

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

Date Reported: 17/10/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: ROC Consulting Ltd
Client Address: Commercial Wharf
6 Commercial Street
Castlefield
Manchester
M15 4PZ
Contact: Jason Bradley
Site Name: Airport City South GLH
Site Address: Not Given

Client Reference: 3532
Job Number: 16-29244
Date Sampled: Not Given
Date Received: 04/10/2016
Date Tested: 25/10/2016
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Attenberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
638420	BH104	Not Given	1.20	Not Given	U	Brown slightly gravelly sandy CLAY	-	-	21	98	40	20	20	-
638422	BH105	Not Given	2.00	Not Given	U	Brown very sandy CLAY	-	-	24	100	23	14	9	-
638426	BH107	Not Given	5.00	Not Given	U	Brown slightly gravelly very sandy CLAY	-	-	19	97	35	17	18	-
638428	BH109	Not Given	3.00	Not Given	U	Brown very sandy CLAY	-	-	16	100	27	16	11	-
638429	BH109	Not Given	5.00	Not Given	U	Brown slightly gravelly very sandy CLAY	-	-	19	97	35	18	17	-
638431	BH117	Not Given	4.00	Not Given	U	Brown slightly sandy CLAY with pockets of grey sand	-	-	23	100	42	22	20	-
638433	BH118	Not Given	3.00	Not Given	U	Orangish brown sandy CLAY	-	-	22	100	38	24	14	-
638435	BH123	Not Given	2.00	Not Given	U	Brown slightly gravelly sandy CLAY	-	-	17	96	38	19	19	-
638436	BH123	Not Given	4.00	Not Given	U	Orangish brown sandy CLAY	-	-	22	100	42	23	19	-

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical Section

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

Date Reported: 27/10/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: ROC Consulting Ltd
Client Address: Commercial Wharf
6 Commercial Street
Castlefield , Manchester
M15 4PZ
Contact: Jason Bradley
Site Name: Airport City South GLH
Site Address: Not Given

Client Reference: 3532
Job Number: 16-30716
Date Sampled: Not Given
Date Received: 21/10/2016
Date Tested: 28,31/10/2016
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Attenberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
646849	BH101	Not Given	6.00	6.45	U	Reddish brown slightly gravelly clayey SAND	-	-	17	84	22	13	9	-
646850	BH101	Not Given	4.00	4.45	U	Brown slightyl gravelly very sandy CLAY	-	-	14	94	27	12	15	-
646851	BH102	Not Given	7.00	7.45	U	Brown slightly gravelly clayey SAND	-	-	14	93	24	14	10	-
646852	BH102	Not Given	3.00	3.45	U	Brown clayey SAND	-	-	14	100	21	14	7	-
646853	BH102	Not Given	5.00	5.45	U	Brown slightly gravelly very sandy CLAY	-	-	19	96	29	17	12	-
646854	BH103	Not Given	4.00	4.45	U	Reddish brown slightly gravelly very sandy CLAY	-	-	14	88	25	13	12	-
646855	BH103	Not Given	6.00	6.45	U	Brown slightly gravelly clayey SAND	-	-	13	85	22	14	8	-
646856	BH106	Not Given	5.00	5.45	U	Brown sandy CLAY	-	-	22	100	36	21	15	-
646857	BH106	Not Given	7.00	7.45	U	Reddish brown slightly gravelly very sandy CLAY	-	-	17	98	33	18	15	-
646858	BH110	Not Given	6.00	6.45	U	Reddish brown slightly gravelly very sandy CLAY	-	-	14	86	26	13	13	-

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical Section

Signed:

Terry Stafford
Geotechnical Manager

Date Reported: 03/11/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: ROC Consulting Ltd
Client Address: Commercial Wharf
6 Commercial Street
Castlefield , Manchester
M15 4PZ
Contact: Jason Bradley
Site Name: Airport City South GLH
Site Address: Not Given

Client Reference: 3532
Job Number: 16-30716
Date Sampled: Not Given
Date Received: 21/10/2016
Date Tested: 28,31/10/2016
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Attenberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
646859	BH110	Not Given	2.00	2.45	U	Orangish brown clayey SAND	-	-	18	100	21	16	5	-
646860	BH111	Not Given	3.30	3.45	U	Brown slightly gravelly sandy CLAY	-	-	27	96	39	20	19	-
646861	BH111	Not Given	5.00	5.45	U	Brown slightly gravelly very sandy CLAY	-	-	18	96	35	18	17	-
646862	BH111	Not Given	1.20	1.65	U	Brown slightly gravelly sandy CLAY	-	-	20	100	40	19	21	-
646863	BH113	Not Given	1.20	1.65	U	Brown slightly gravelly sandy CLAY	-	-	19	94	39	20	19	-
646864	BH113	Not Given	3.00	3.45	U	Brown slightly gravelly very sandy CLAY	-	-	17	96	30	16	14	-
646865	BH114	Not Given	4.00	4.45	U	Brown slightly gravelly very sandy CLAY	-	-	18	97	34	17	17	-
646866	BH116	Not Given	3.00	3.45	U	Brown slightly gravelly very sandy CLAY	-	-	18	97	35	18	17	-
646867	BH119	Not Given	3.00	3.45	U	Brown slightly gravelly sandy CLAY	-	-	21	97	37	18	19	-
646868	BH119	Not Given	1.20	1.65	U	Brown slightly gravelly slightly sandy CLAY	-	-	21	99	45	22	23	-

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical Section

Signed:

Terry Stafford
Geotechnical Manager

Date Reported: 03/11/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Dry Density / Moisture Content Relationship
Light Compaction

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

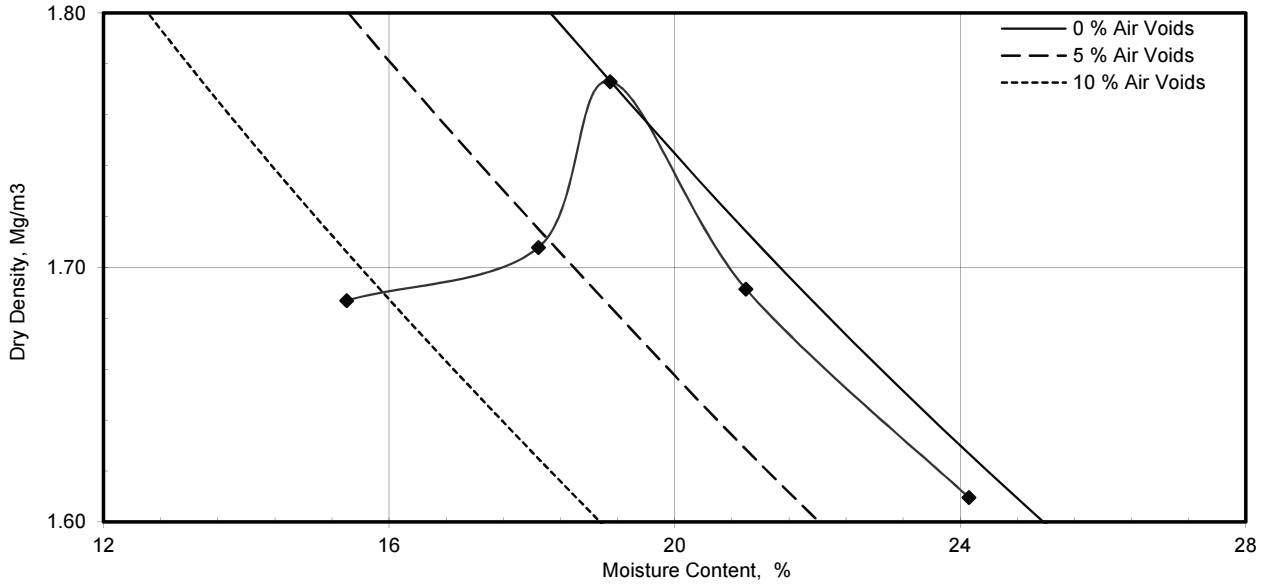
UKAS TESTING 4041

Tested in accordance with BS 1377-4:1990: Clause 3.3 using 2.5kg[light] Rammer

Client:	ROC Consulting Ltd	Client Reference:	3532
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	16-29244
		Date Sampled:	Not Given
		Date Received:	04/10/2016
		Date Tested:	10/12/2016
Contact:	Jason Bradley	Sampled By:	Not Given
Site Name:	Airport City South GLH		
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference:	638444		
Hole No.:	BH117	Depth Top [m]:	0.5
Sample Reference:	Not Given	Depth Base [m]:	Not Given
Sample Description:	Brown slightly gravelly slightly sandy CLAY with rootlets	Sample Type:	B



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	2.68

Maximum Dry Density	Mg/m³	**1.77**

Optimum Moisture Content	%	**19**

Remarks

Aproved:

Signed:

Mirosława Pytlik
PL Head of
Geotechnical Section

Date Reported: 17/10/2016

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Dry Density / Moisture Content Relationship
Light Compaction

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

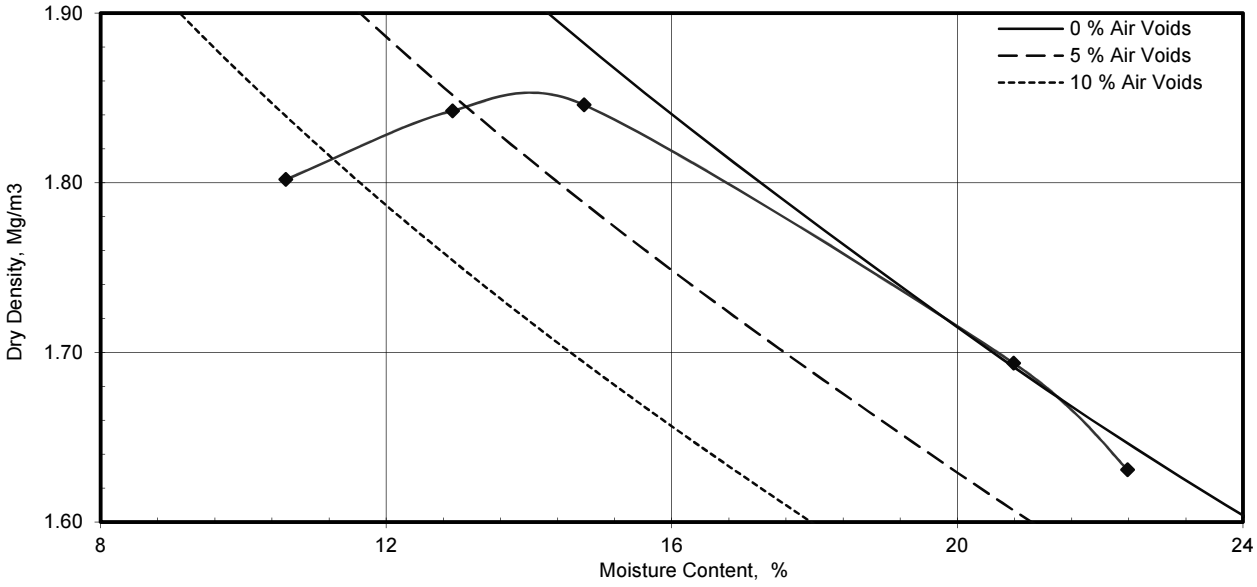
UKAS TESTING 4041

Tested in accordance with BS 1377-4:1990: Clause 3.3 using 2.5kg[light] Rammer

Client:	ROC Consulting Ltd	Client Reference:	3532
Client Address:	Commercial Wharf 6 Commercial Street Castlefield Manchester M15 4PZ	Job Number:	16-29244
		Date Sampled:	Not Given
		Date Received:	04/10/2016
		Date Tested:	12/10/2016
Contact:	Jason Bradley	Sampled By:	Not Given
Site Name:	Airport City South GLH		
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference:	638445		
Hole No.:	BH115	Depth Top [m]:	0.5
Sample Reference:	Not Given	Depth Base [m]:	Not Given
Sample Description:	Brown slightly gravelly slightly sandy CLAY with rootlets	Sample Type:	B



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	2.61

Maximum Dry Density	Mg/m³	**1.85**

Optimum Moisture Content	%	**15**

Remarks

Aproved: Signed:

Mirosława Pytlik
PL Head of
Geotechnical Section

Date Reported: 17/10/2016

for and on behalf of i2 Analytical Ltd

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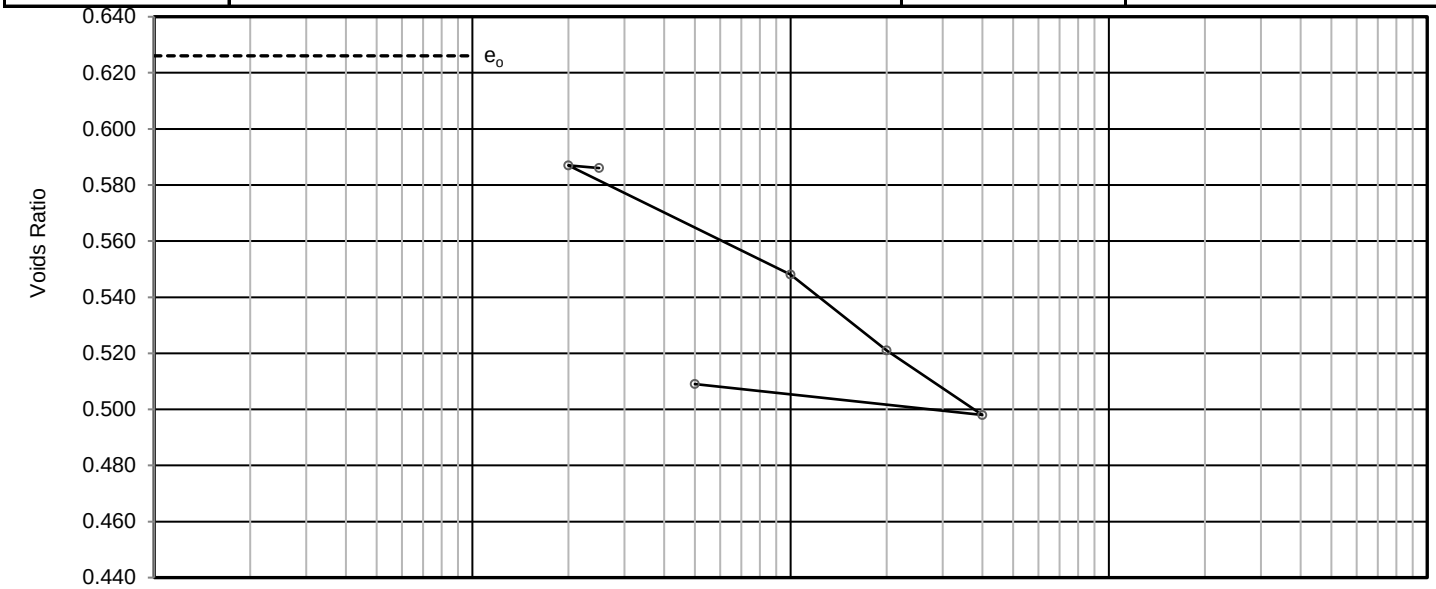
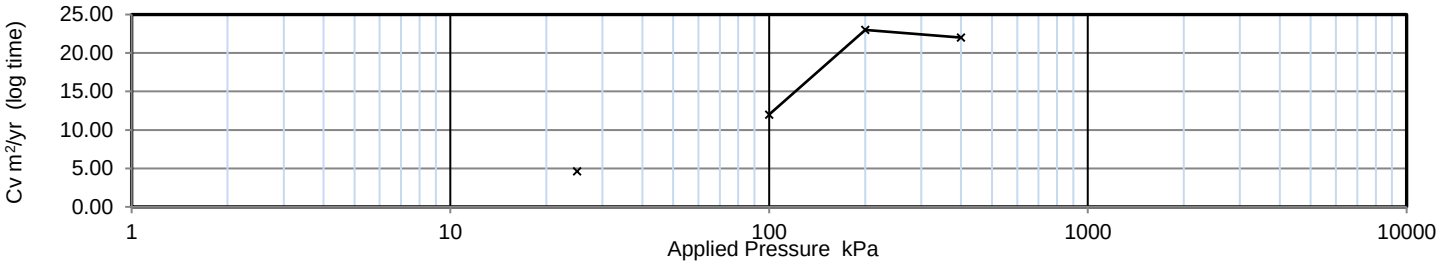
ONE DIMENSIONAL CONSOLIDATION TEST

				Job Ref	21638
				Borehole/Pit No.	BH115
Site Name	-			Sample No.	632744
Project ID	16-28278	Client	i2 Analytical	Depth	1.20
Soil Description	Brown mottled bluish grey slightly sandy clayey SILT			Sample Type	U
				Sample Received	23/09/2016
				Schedule received	23/09/2016
				Project Started	26/09/2016
Test Method	BS1377:Part 5:1990, clause 3			Date Test started	27/09/2016





Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
2.0	0.626	-	-	-	-
25	0.586	1.1	4.6	4.8	0.001
20	0.587	0.037			
100	0.548	0.3	12	15	0.00089
200	0.521	0.17	23	16	0.0017
400	0.498	0.076	22	22	0.0018
50	0.509	0.021			

Preparation

Orientation wthin sample: Vertical

Particle density: assumed 2.70 Mg/m3

Specimen details	Initial	Final	
Diameter	74.96	-	mm
Height	19.98	18.54	mm
Moisture Content	23.0	20.0	%
Bulk density	2.04	2.15	Mg/m3
Dry density	1.66	1.79	Mg/m3
Voids Ratio	0.626	0.509	
Saturation	99	106	%
Average temperature for test	22.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

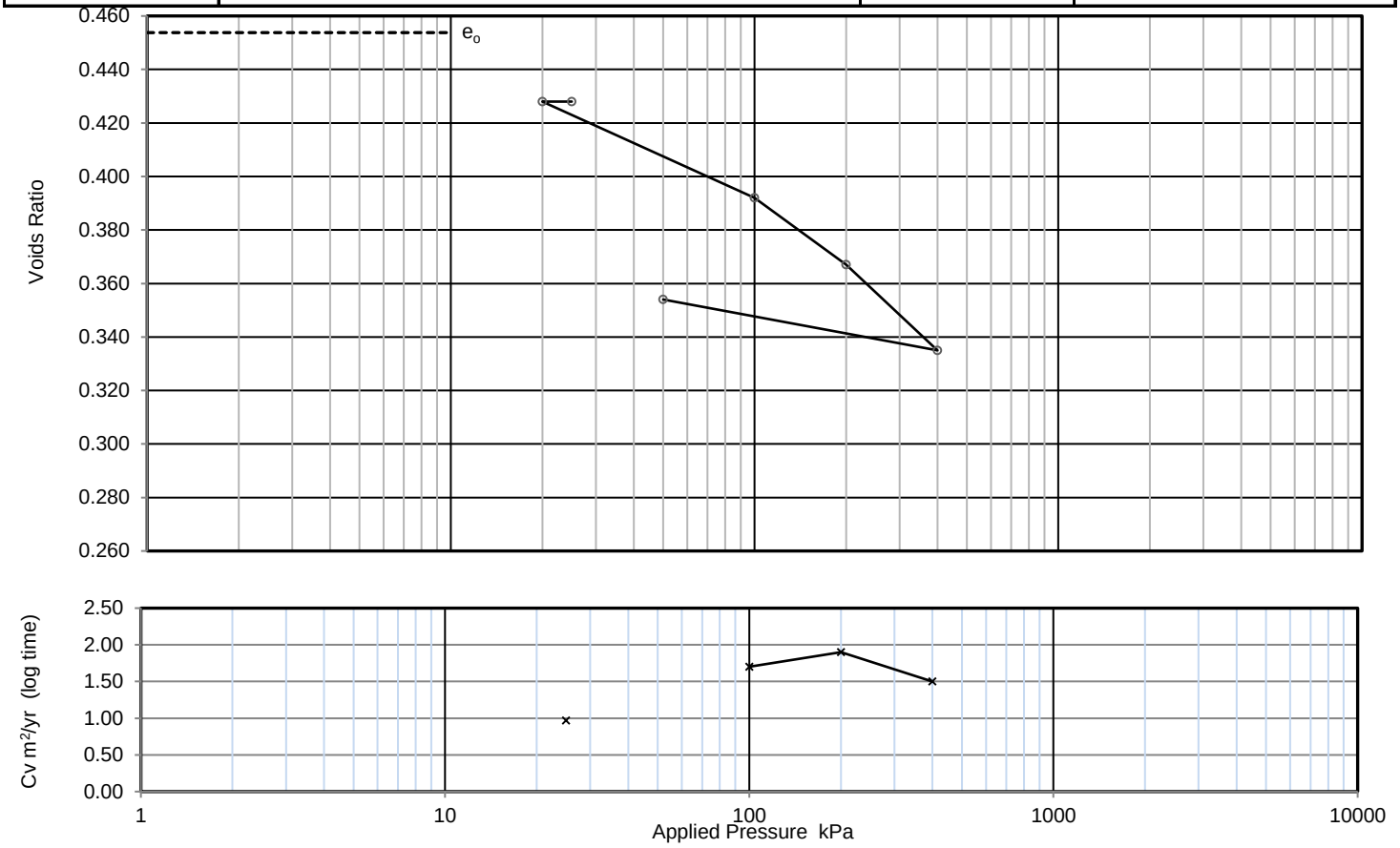
Checked and Approved

Initials K.P

Date: 06/10/2016

ONE DIMENSIONAL CONSOLIDATION TEST

				Job Ref	21638
				Borehole/Pit No.	BH115
Site Name	-			Sample No.	632741
Project ID	16-28278	Client	i2 Analytical	Depth	3.00
Soil Description	Brown slightly gravelly slightly sandy silty CLAY (gravel is fm and angular to sub-rounded)			Sample Type	U
				Sample Received	23/09/2016
				Schedule received	23/09/2016
				Project Started	26/09/2016
Test Method	BS1377:Part 5:1990, clause 3			Date Test started	27/09/2016



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
2.0	0.454	-	-	-	-
25	0.428	0.78	0.97	2.4	0.00049
20	0.428	0.039			
100	0.392	0.31	1.7	4.6	0.0011
200	0.367	0.18	1.9	2.3	0.0021
400	0.335	0.11	1.5	2.4	0.0017
50	0.354	0.04			

Preparation

Orientation wthin sample: Vertical

Particle density: assumed 2.70 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	18.78	17.49	mm
Moisture Content	17.4	15.0	%
Bulk density	2.18	2.29	Mg/m3
Dry density	1.86	1.99	Mg/m3
Voids Ratio	0.454	0.354	
Saturation	104	115	%
Average temperature for test	22.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

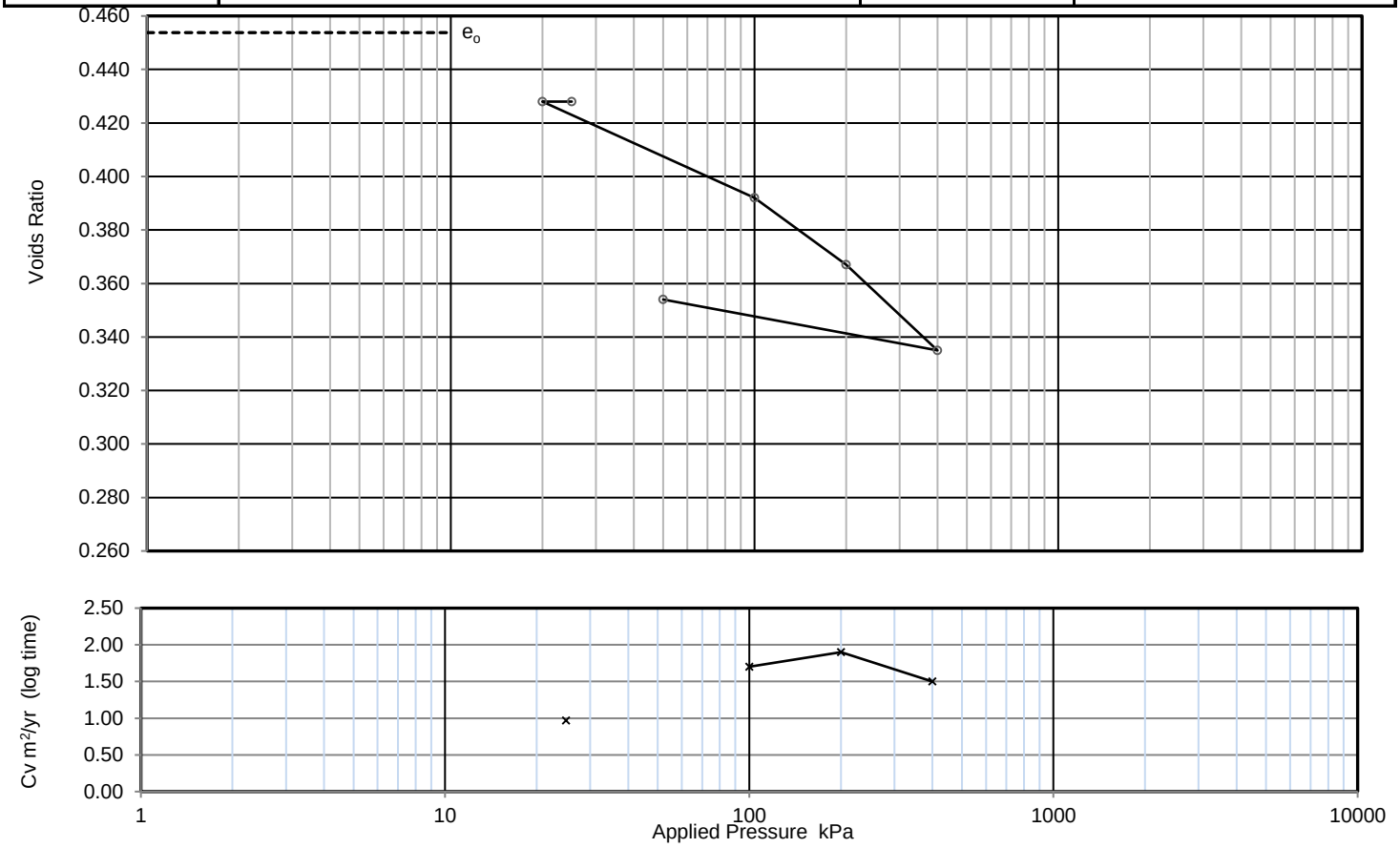
Checked and Approved

Initials K.P

Date: 06/10/2016

ONE DIMENSIONAL CONSOLIDATION TEST

				Job Ref	21638
				Borehole/Pit No.	BH115
Site Name	-			Sample No.	632741
Project ID	16-28278	Client	i2 Analytical	Depth	3.00
Soil Description	Brown slightly gravelly slightly sandy silty CLAY (gravel is fm and angular to sub-rounded)			Sample Type	U
				Sample Received	23/09/2016
				Schedule received	23/09/2016
				Project Started	26/09/2016
Test Method	BS1377:Part 5:1990, clause 3			Date Test started	27/09/2016



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
2.0	0.454	-	-	-	-
25	0.428	0.78	0.97	2.4	0.00049
20	0.428	0.039			
100	0.392	0.31	1.7	4.6	0.0011
200	0.367	0.18	1.9	2.3	0.0021
400	0.335	0.11	1.5	2.4	0.0017
50	0.354	0.04			

Preparation

Orientation wthin sample: Vertical

Particle density: assumed 2.70 Mg/m3

Specimen details	Initial	Final	
Diameter	75.00	-	mm
Height	18.78	17.49	mm
Moisture Content	17.4	15.0	%
Bulk density	2.18	2.29	Mg/m3
Dry density	1.86	1.99	Mg/m3
Voids Ratio	0.454	0.354	
Saturation	104	115	%
Average temperature for test	22.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

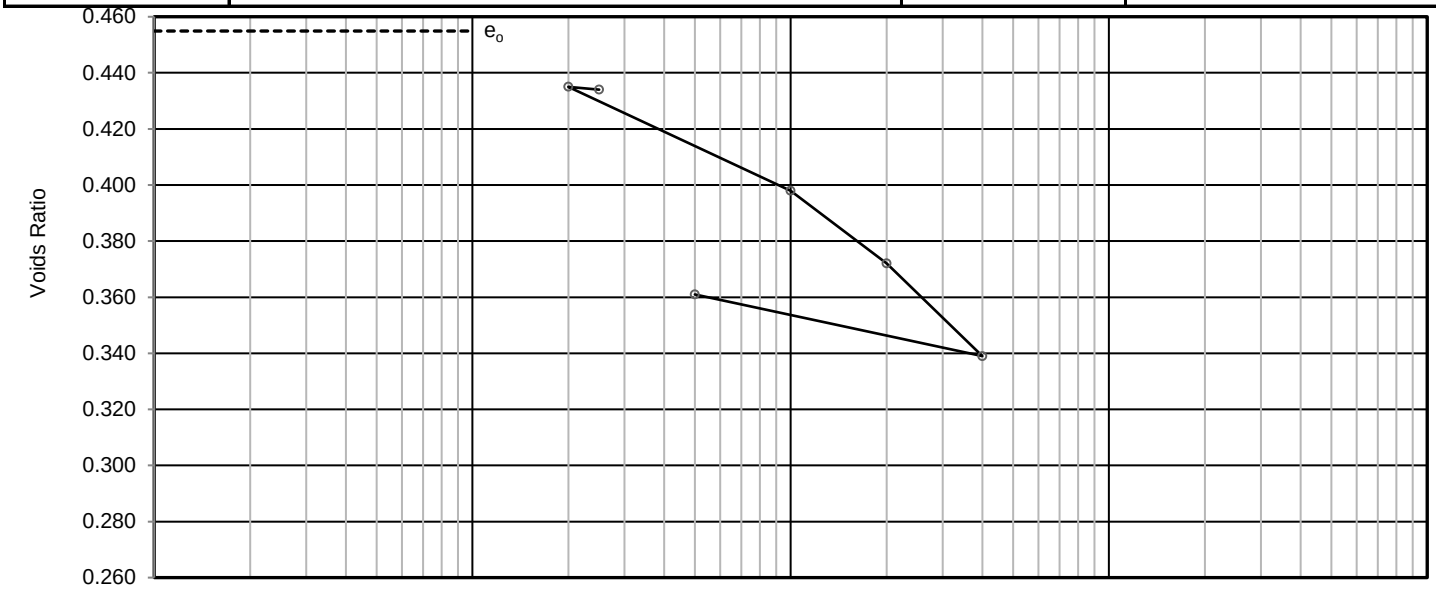
Checked and Approved

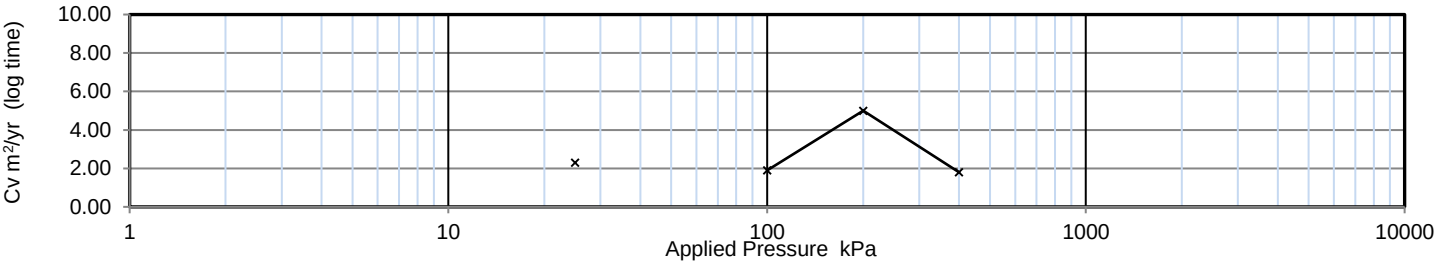
Initials K.P

Date: 06/10/2016

ONE DIMENSIONAL CONSOLIDATION TEST

				Job Ref	21638
				Borehole/Pit No.	BH112
Site Name	-			Sample No.	632745
Project ID	16-28278	Client	i2 Analytical	Depth	6.00
Soil Description	Brown slightly sandy silty CLAY with rare fine gravel			Sample Type	U
				Sample Received	23/09/2016
				Schedule received	23/09/2016
				Project Started	26/09/2016
Test Method	BS1377:Part 5:1990, clause 3			Date Test started	27/09/2016





Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
2.0	0.455	-	-	-	-
25	0.434	0.61	2.3	4.4	0.00075
20	0.435	0.075			
100	0.398	0.32	1.9	1.1	0.0011
200	0.372	0.19	5	5.6	0.0023
400	0.339	0.12	1.8	3.4	0.0019
50	0.361	0.047			

Preparation

Orientation wthin sample: Vertical

Particle density: assumed 2.70 Mg/m3

Specimen details	Initial	Final	
Diameter	75.05	-	mm
Height	18.90	17.68	mm
Moisture Content	17.6	16.2	%
Bulk density	2.18	2.30	Mg/m3
Dry density	1.86	1.98	Mg/m3
Voids Ratio	0.455	0.361	
Saturation	104	121	%
Average temperature for test	22.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

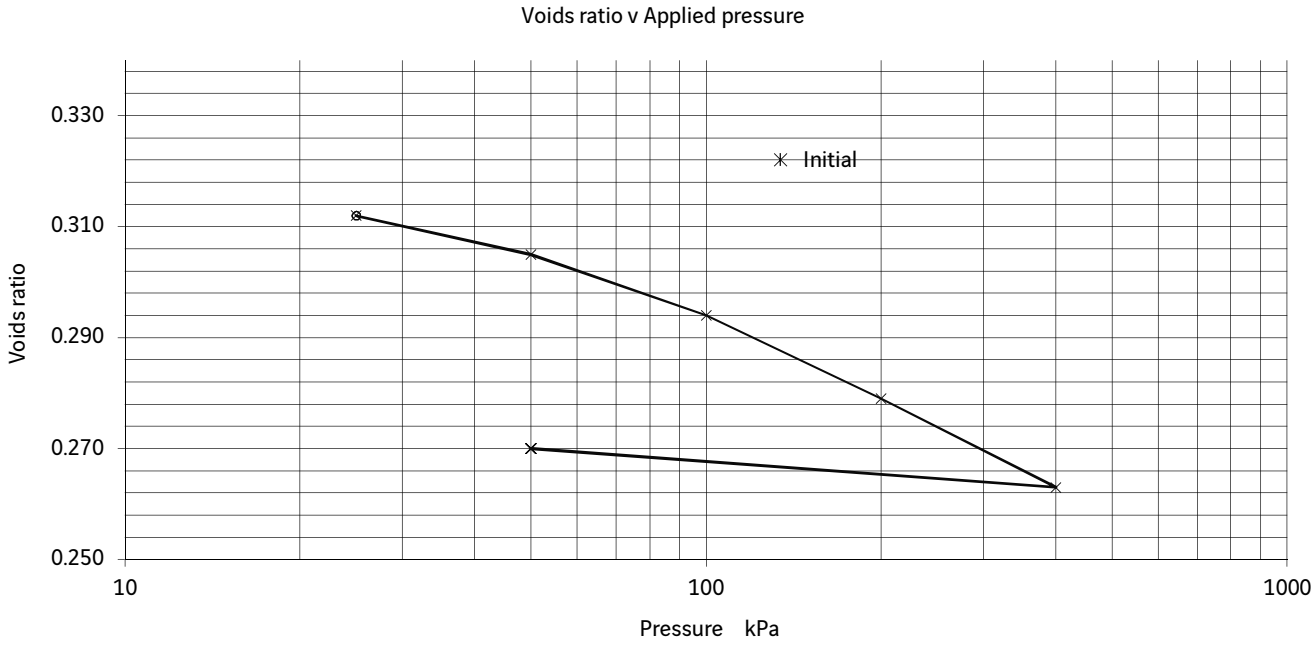
Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials K.P

Date: 06/10/2016

Project Name	16-29873	**Oedometer Consolidation**	Hole ID BH110
Project No.	LT1674		Sample Depth 6.00m
Engineer	i2 Analytical Ltd		Sample Number 642157
Client	i2 Analytical Ltd	BS1377: Part 5: 1990: 3.0	Sample Type U
Description	Brown gravelly sandy CLAY. Gravel is fine to medium subangular.		Specimen Depth 6.04m
			Specimen Number



Specimen details

Trimmings (initial) moisture content	13	%
Diameter	75.10	mm
Height	18.9	mm
Bulk density	2.27	Mg/m³
Dry density	2	Mg/m³
Moisture content of material in ring	13	%
Initial voids ratio	0.322	
Saturation	108	%
Particle density Assumed	2.65	Mg/m³
Final moisture content	11	%
Coefficient of volume compressibility for a pressure increment of 100kPa in excess of the present effective overburden pressure	0.10	m²/MN

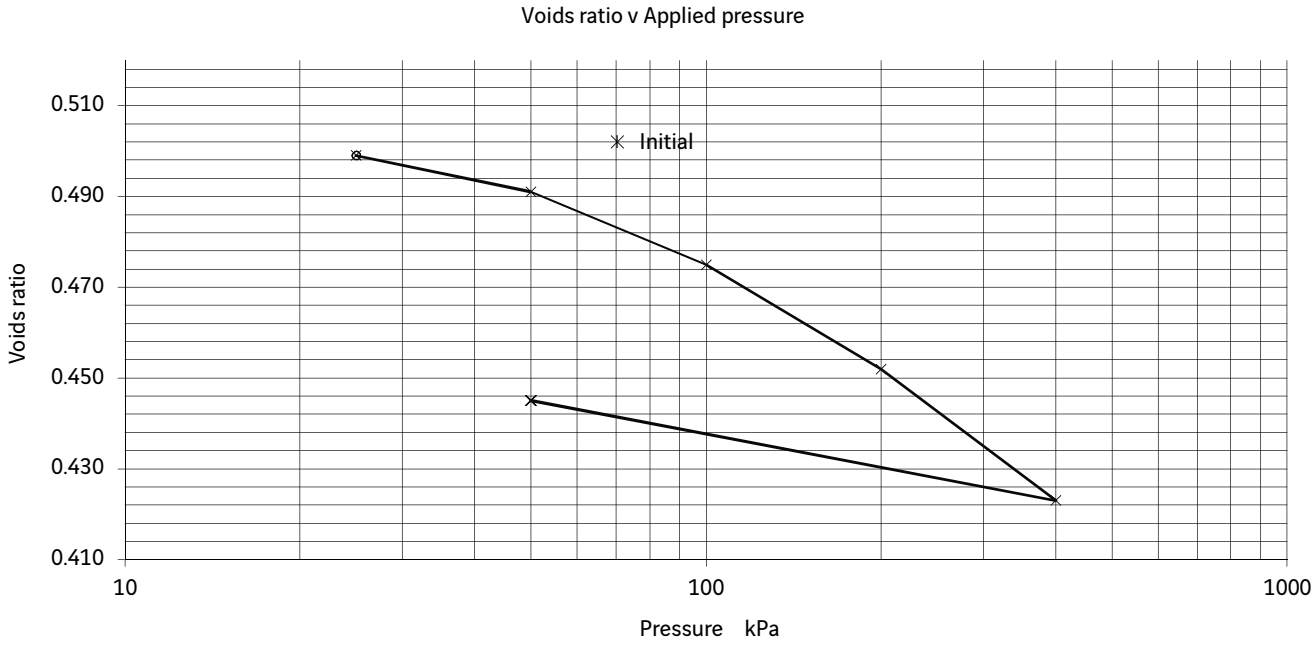
Laboratory coefficients

Pressure	Compressibility	Consolidation cv		Csec	Voids ratio
kPa	m²/MN	m²/year			
	m v	log time	root time		
25	0.300	1.000	0.470		0.312
50	0.240	0.910	0.710		0.305
100	0.170	1.700	0.950		0.294
200	0.110	2.300	1.500		0.279
400	0.064	2.900	1.500		0.263
50					0.270

Specimen prepared as per BS1377: Part 1: 1990: Clause 8.6. Test performed at an average temperature of 18.3°C (No correction required).
Specimen cut with longest axis in a vertical orientation.

Approved by:	Leeds Laboratory		SOIL ENGINEERING
Kevin Walker		Print date 04/11/2016	
	Revision No. 2.05	Issue Date 07/11/2012	Part of the Bachy Soletanche Group

Project Name	16-29873	**Oedometer Consolidation**	Hole ID BH111
Project No.	LT1674		Sample Depth 3.00m
Engineer	i2 Analytical Ltd		Sample Number 642158
Client	i2 Analytical Ltd	BS1377: Part 5: 1990: 3.0	Sample Type U
Description	Brown slightly gravelly CLAY. Gravel is fine to medium subangular.		Specimen Depth 3.40m
			Specimen Number



Specimen details

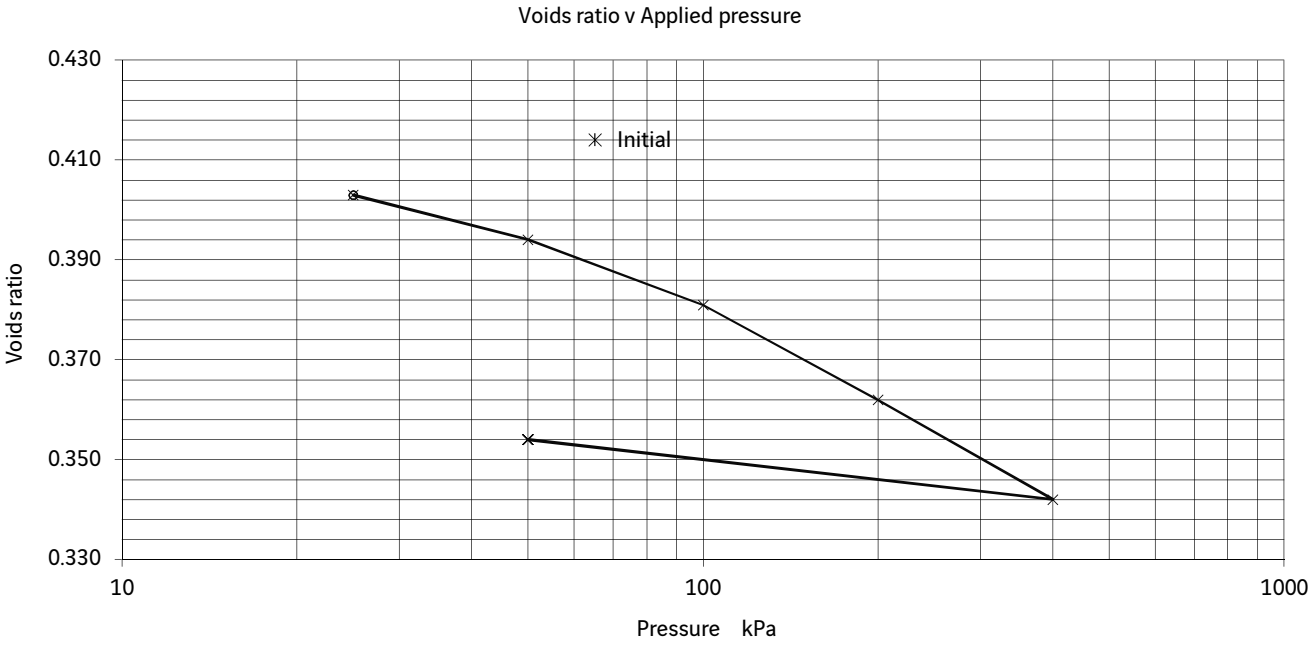
Trimmings (initial) moisture content	20	%
Diameter	75.10	mm
Height	18.85	mm
Bulk density	2.11	Mg/m³
Dry density	1.76	Mg/m³
Moisture content of material in ring	21	%
Initial voids ratio	0.502	
Saturation	104	%
Particle density Assumed	2.65	Mg/m³
Final moisture content	19	%
Coefficient of volume compressibility for a pressure increment of 100kPa in excess of the present effective overburden pressure	0.17	m²/MN

Laboratory coefficients

Pressure	Compressibility	Consolidation cv		Csec	Voids ratio
kPa	m²/MN	m²/year			
	m v	log time	root time		
25	0.100	N/D	200.000		0.499
50	0.210	2.000	1.400		0.491
100	0.210	1.100	1.200		0.475
200	0.160	1.400	0.760		0.452
400	0.099	1.400	1.300		0.423
50					0.445

Specimen prepared as per BS1377: Part 1: 1990: Clause 8.6. Test performed at an average temperature of 18.3°C (No correction required).
Specimen cut with longest axis in a vertical orientation. N/D is not determined, where it is not possible to identify end of primary.

Project Name	16-29873	**Oedometer Consolidation**	Hole ID BH113
Project No.	LT1674		Sample Depth 3.00m
Engineer	i2 Analytical Ltd		Sample Number 642159
Client	i2 Analytical Ltd	BS1377: Part 5: 1990: 3.0	Sample Type U
Description	Brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular.		Specimen Depth 3.02m
			Specimen Number



Specimen details

Trimmings (initial) moisture content	17	%
Diameter	75.00	mm
Height	18.9	mm
Bulk density	2.2	Mg/m³
Dry density	1.87	Mg/m³
Moisture content of material in ring	17	%
Initial voids ratio	0.414	
Saturation	110	%
Particle density Assumed	2.65	Mg/m³
Final moisture content	15	%
Coefficient of volume compressibility for a pressure increment of 100kPa in excess of the present effective overburden pressure	0.16	m²/MN

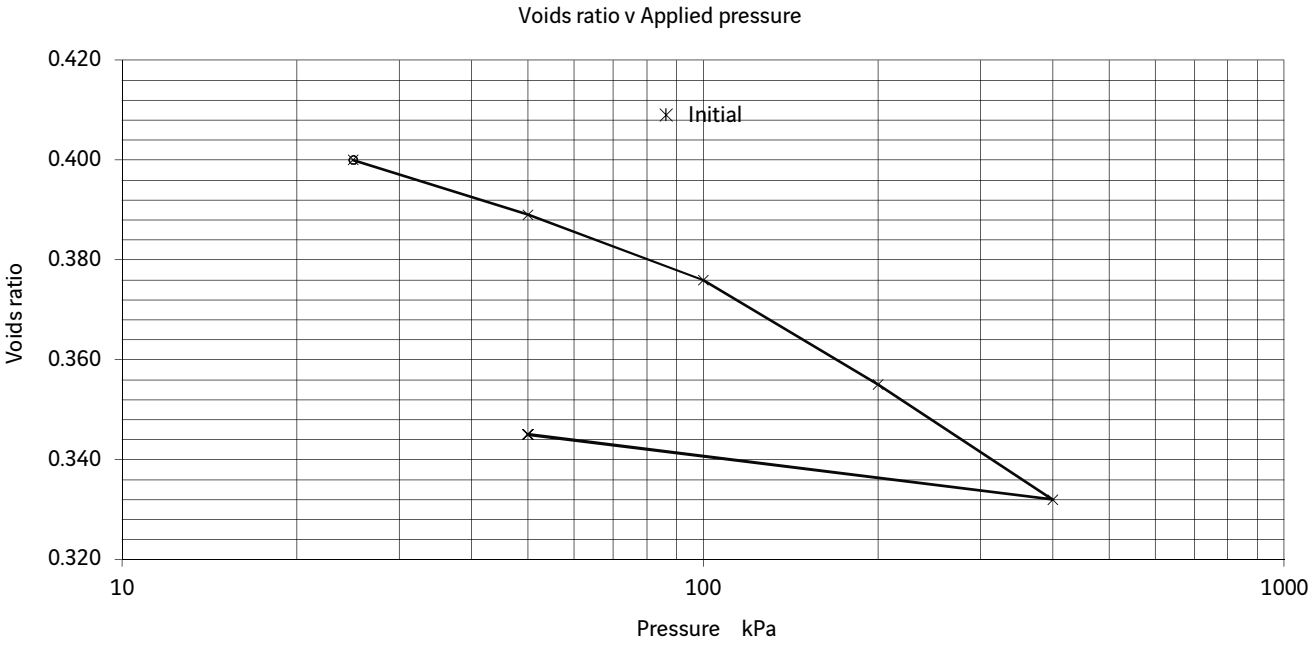
Laboratory coefficients

Pressure	Compressibility	Consolidation cv		Csec	Voids ratio
kPa	m²/MN	m²/year			
	m v	log time	root time		
25	0.310	1.400	0.560		0.403
50	0.270	0.990	1.100		0.394
100	0.190	1.200	0.940		0.381
200	0.130	1.700	0.710		0.362
400	0.073	2.100	1.600		0.342
50					0.354

Specimen prepared as per BS1377: Part 1: 1990: Clause 8.6. Test performed at an average temperature of 18.3°C (No correction required).
Specimen cut with longest axis in a vertical orientation.

Approved by:	Leeds Laboratory		SOIL ENGINEERING
Kevin Walker		Print date 04/11/2016	
	Revision No. 2.05	Issue Date 07/11/2012	Part of the Bachy Soletanche Group

Project Name	16-29873	**Oedometer Consolidation**	Hole ID BH114
Project No.	LT1674		Sample Depth 4.00m
Engineer	i2 Analytical Ltd		Sample Number 642160
Client	i2 Analytical Ltd	BS1377: Part 5: 1990: 3.0	Sample Type U
Description	Reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular.		Specimen Depth 4.02m
			Specimen Number



Specimen details

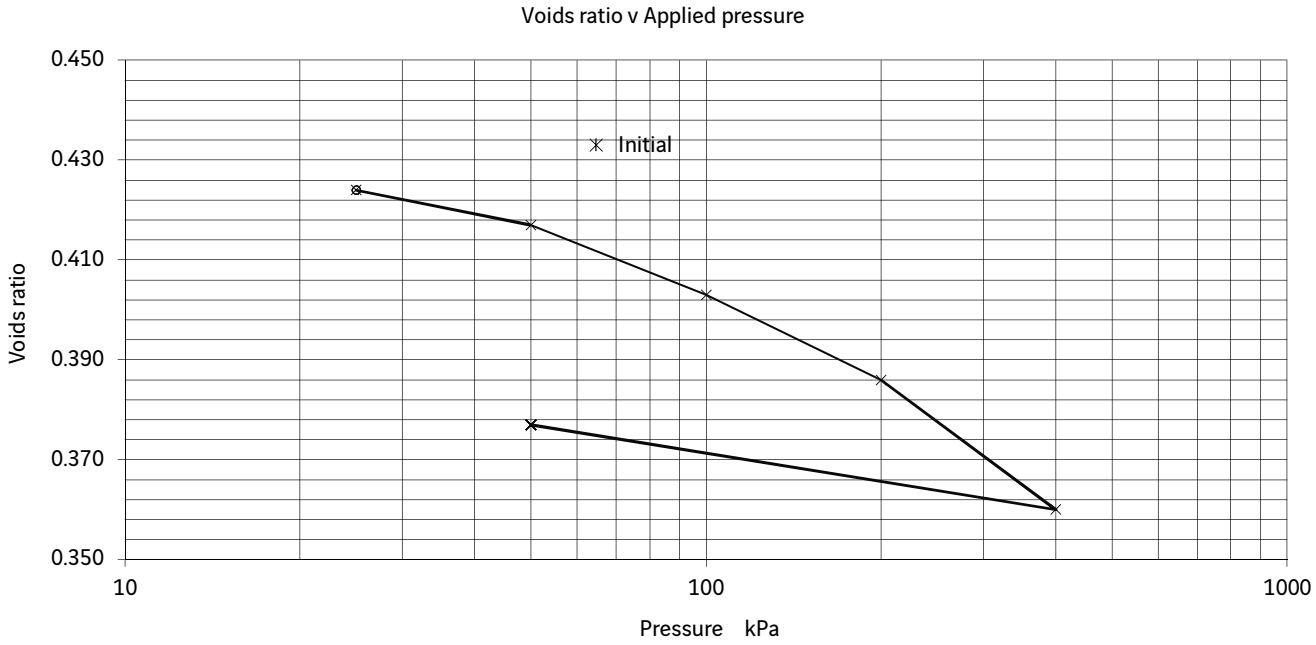
Trimmings (initial) moisture content	17	%
Diameter	75.10	mm
Height	18.75	mm
Bulk density	2.19	Mg/m³
Dry density	1.88	Mg/m³
Moisture content of material in ring	17	%
Initial voids ratio	0.409	
Saturation	108	%
Particle density Assumed	2.65	Mg/m³
Final moisture content	16	%
Coefficient of volume compressibility for a pressure increment of 100kPa in excess of the present effective overburden pressure	0.16	m²/MN

Laboratory coefficients

Pressure	Compressibility	Consolidation cv		Csec	Voids ratio
kPa	m²/MN	m²/year			
	m v	log time	root time		
25	0.270	3.500	0.800		0.400
50	0.310	1.600	0.600		0.389
100	0.190	1.800	0.910		0.376
200	0.150	1.900	1.000		0.355
400	0.087	2.400	1.100		0.332
50					0.345

Specimen prepared as per BS1377: Part 1: 1990: Clause 8.6. Test performed at an average temperature of 18.3°C (No correction required).
Specimen cut with longest axis in a vertical orientation.

Project Name	16-29873	**Oedometer Consolidation**	Hole ID BH116
Project No.	LT1674		Sample Depth 3.00m
Engineer	i2 Analytical Ltd		Sample Number 642161
Client	i2 Analytical Ltd	BS1377: Part 5: 1990: 3.0	Sample Type U
Description	Brown slightly gravelly CLAY. Gravel is fine to medium subangular.		Specimen Depth 3.04m
			Specimen Number



Specimen details

Trimmings (initial) moisture content	17	%
Diameter	75.00	mm
Height	20	mm
Bulk density	2.17	Mg/m³
Dry density	1.85	Mg/m³
Moisture content of material in ring	19	%
Initial voids ratio	0.433	
Saturation	107	%
Particle density Assumed	2.65	Mg/m³
Final moisture content	17	%

Coefficient of volume compressibility for a pressure increment of 100kPa in excess of the present effective overburden pressure: 0.15 m²/MN

Laboratory coefficients

Pressure	Compressibility	Consolidation cv		Csec	Voids ratio
kPa	m²/MN	m²/year			
	m v	log time	root time		
25	0.250	N/D	150.000		0.424
50	0.200	2.400	0.700		0.417
100	0.190	1.800	1.000		0.403
200	0.130	2.000	0.710		0.386
400	0.092	1.900	0.940		0.360
50					0.377

Specimen prepared as per BS1377: Part 1: 1990: Clause 8.6. Test performed at an average temperature of 18.3°C (No correction required).
Specimen cut with longest axis in a vertical orientation. N/D is not determined, where it is not possible to identify end of primary.

Approved by:	Leeds Laboratory		SOIL ENGINEERING
Kevin Walker		Print date 04/11/2016	
	Revision No. 2.05	Issue Date 07/11/2012	Part of the Bachy Soletanche Group

Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			4.00
Description			Brown slightly sandy CLAY
Type			U
Initial Sample Length	L_0	(mm)	197.0
Initial Sample Diameter	D_0	(mm)	98.9
Initial Sample Weight	W_0	(gr)	3312.4
Bulk Density	ρ_0	(Mg/m3)	2.19
Particle Density	ρ_s	(Mg/m3)	2.65

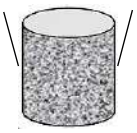
Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	80
Strain Rate	m_S	(mm/min)	3.93920
MembraneThickness	m_b	(mm)	0.21
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 4
Initial Moisture	$\omega_i\%$	(%)	17
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.87
Initial Voids Ratio	e_0	.	0.42
Initial Degree of Saturation	S_o	(%)	100

Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	207
MembraneCorrection	m_C	(kPa)	0.802
Strain At Max Stress	$\varepsilon_f\%$	(%)	20.00
Shear Strength	c_U	(kPa)	104
Final Moisture	$\omega_f\%$	(%)	17
Final Dry Density	ρ_{df}	(Mg/m3)	1.87
Final Voids Ratio	e_f	.	0.42
Final Degree of Saturation	S_f	(%)	100.0





Failure Sketch

(surface inclination)

Notes

Triaxial at over burden

Test Method	BS1377-7 : 1900 Clause 8			Test Name	632746
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	04/10/2016
Site Reference	Airport City South GLH			Borehole	BH112
Jobfile	16-28278			Sample	632746
Client	ROC Consulting Ltd.			Depth	4.00
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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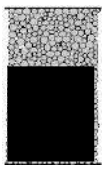
i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			3.00
Description			Brown slightly gravelly slightly sandy CLAY
Type			U
Initial Sample Length	L_0	(mm)	194.5
Initial Sample Diameter	D_0	(mm)	98.2
Initial Sample Weight	W_0	(gr)	3217.1
Bulk Density	ρ_0	(Mg/m3)	2.18
Particle Density	ρ_s	(Mg/m3)	2.65

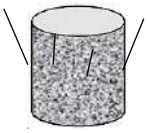
Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	60
Strain Rate	m_S	(mm/min)	3.89000
MembraneThickness	m_b	(mm)	0.31
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 4
Initial Moisture	$\omega_i\%$	(%)	19
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.84
Initial Voids Ratio	e_0	.	0.44
Initial Degree of Saturation	S_o	(%)	100

Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	135
MembraneCorrection	m_C	(kPa)	1.193
Strain At Max Stress	$\varepsilon_f\%$	(%)	20.00
Shear Strength	c_U	(kPa)	67
Final Moisture	$\omega_f\%$	(%)	19
Final Dry Density	ρ_{df}	(Mg/m3)	1.84
Final Voids Ratio	e_f	.	0.44
Final Degree of Saturation	S_f	(%)	100.0





Failure Sketch

(surface inclination)

Notes

Triaxial at over burden

Test Method	BS1377-7 : 1900 Clause 8			Test Name	632741
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	12/10/2016
Site Reference	Airport City South GLH			Borehole	BH115
Jobfile	16-28278			Sample	632741
Client	ROC Consulting Ltd.			Depth	3.00
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			1.20
Description			Light brown slightly sandy CLAY
Type			U
Initial Sample Length	L_0	(mm)	192.3
Initial Sample Diameter	D_0	(mm)	98.7
Initial Sample Weight	W_0	(gr)	2956.7
Bulk Density	ρ_0	(Mg/m3)	2.01
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	24
Strain Rate	m_S	(mm/min)	3.84680
MembraneThickness	m_b	(mm)	0.30
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 4
Initial Moisture	$\omega_i\%$	(%)	23
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.64
Initial Voids Ratio	e_0	.	0.62
Initial Degree of Saturation	S_o	(%)	98

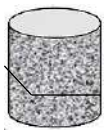
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	90
MembraneCorrection	m_C	(kPa)	1.004
Strain At Max Stress	$\varepsilon_f\%$	(%)	16.33
Shear Strength	c_U	(kPa)	45
Final Moisture	$\omega_f\%$	(%)	23
Final Dry Density	ρ_{df}	(Mg/m3)	1.64
Final Voids Ratio	e_f	.	0.62
Final Degree of Saturation	S_f	(%)	97.6



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1900 Clause 8			Test Name	632744
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	12/10/2016
Site Reference	Airport City South GLH			Borehole	BH115
Jobfile	16-28278			Sample	632744
Client	ROC Consulting Ltd.			Depth	1.20
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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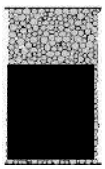
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth	6.00		
	Description	Brown slightly sandy CLAY		
	Type	U		
	Initial Sample Length	L_0	(mm)	196.2
	Initial Sample Diameter	D_0	(mm)	98.2
	Initial Sample Weight	W_0	(gr)	3303.0
	Bulk Density	ρ_0	(Mg/m3)	2.23
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	120
Strain Rate	m_S	(mm/min)	3.92320
MembraneThickness	m_b	(mm)	0.27
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 4
Initial Moisture	$\omega_i\%$	(%)	17
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.91
Initial Voids Ratio	e_0	.	0.39
Initial Degree of Saturation	S_o	(%)	100

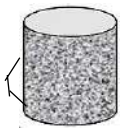
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	219
MembraneCorrection	m_C	(kPa)	1.039
Strain At Max Stress	$\varepsilon_f\%$	(%)	20.00
Shear Strength	c_U	(kPa)	110
Final Moisture	$\omega_f\%$	(%)	17
Final Dry Density	ρ_{df}	(Mg/m3)	1.91
Final Voids Ratio	e_f	.	0.39
Final Degree of Saturation	S_f	(%)	100.0



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1900 Clause 8			Test Name	632745
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	12/10/2016
Site Reference	Airport City South GLH			Borehole	BH112
Jobfile	16-28278			Sample	632745
Client	ROC Consulting Ltd.			Depth	6.00
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	**Depth**			**2.00**
	Description			**Brown slightly sandy CLAY with thin laminae of grey CLAY**
	Type			**U**
	Initial Sample Length	L_0	**(mm)**	**197.3**
	Initial Sample Diameter	D_0	**(mm)**	**98.9**
	Initial Sample Weight	W_0	**(gr)**	**3243.4**
	Bulk Density	ρ_0	**(Mg/m3)**	**2.14**
	Particle Density	ρ_s	**(Mg/m3)**	**2.65**

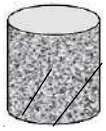
Initial Conditions			
Initial Cell Pressure	σ_3	**(kPa)**	**40**
Strain Rate	m_S	**(mm/min)**	**3.94540**
MembraneThickness	m_b	**(mm)**	**0.26**
Displacement Input	L_{IP}	**(mm)**	**CH 2**
Load Input	N_{IP}	**(N)**	**CH 4**
Initial Moisture	$\omega_i\%$	**(%)**	**19**
Initial Dry Density	ρ_{d0}	**(Mg/m3)**	**1.80**
Initial Voids Ratio	e_0	**.**	**0.48**
Initial Degree of Saturation	S_o	**(%)**	**100**

Final Conditions			
Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	**(kPa)**	**350**
MembraneCorrection	m_C	**(kPa)**	**0.811**
Strain At Max Stress	$\varepsilon_f\%$	**(%)**	**13.48**
Shear Strength	c_U	**(kPa)**	**175**
Final Moisture	$\omega_f\%$	**(%)**	**19**
Final Dry Density	ρ_{df}	**(Mg/m3)**	**1.80**
Final Voids Ratio	e_f	**.**	**0.48**
Final Degree of Saturation	S_f	**(%)**	**100.0**

Notes

Triaxial at over burden





Failure Sketch

(surface inclination)

Test Method	**BS1377-7 : 1900 Clause 8**			**Test Name**	**638432**
Database: .\SQLEXPRESS \ 6171-I2 Analytical				**Test Date**	**17/10/2016**
Site Reference	**Airport City South GLH**			**Borehole**	**BH117**
Jobfile	**16-29244**			**Sample**	**638432**
Client	**ROC Consulting Ltd.**			**Depth**	**2.00**
Operator	**palmowskia**	**Checked**	**pytlikm**	**Approved**	**pytlikm**

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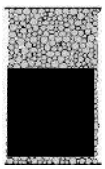
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	**Depth**			**1.20**
	Description			**Brown slightly sandy CLAY with thin laminae of grey CLAY**
	Type			**U**
	Initial Sample Length	L_0	**(mm)**	**195.5**
	Initial Sample Diameter	D_0	**(mm)**	**98.5**
	Initial Sample Weight	W_0	**(gr)**	**3190.9**
	Bulk Density	ρ_0	**(Mg/m3)**	**2.14**
	Particle Density	ρ_s	**(Mg/m3)**	**2.65**

Initial Conditions

Initial Cell Pressure	σ_3	**(kPa)**	**24**
Strain Rate	m_S	**(mm/min)**	**3.90940**
MembraneThickness	m_b	**(mm)**	**0.25**
Displacement Input	L_{IP}	**(mm)**	**CH 2**
Load Input	N_{IP}	**(N)**	**CH 4**
Initial Moisture	$\omega_i\%$	**(%)**	**18**
Initial Dry Density	ρ_{d0}	**(Mg/m3)**	**1.81**
Initial Voids Ratio	e_0	**.**	**0.46**
Initial Degree of Saturation	S_o	**(%)**	**100**

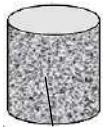
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	**(kPa)**	**256**
MembraneCorrection	m_C	**(kPa)**	**0.741**
Strain At Max Stress	$\varepsilon_f\%$	**(%)**	**13.21**
Shear Strength	c_U	**(kPa)**	**128**
Final Moisture	$\omega_f\%$	**(%)**	**18**
Final Dry Density	ρ_{df}	**(Mg/m3)**	**1.81**
Final Voids Ratio	e_f	**.**	**0.46**
Final Degree of Saturation	S_f	**(%)**	**100.0**



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	**BS1377-7 : 1900 Clause 8**			**Test Name**	**638434**
Database: .\SQLEXPRESS \ 6171-I2 Analytical				**Test Date**	**17/10/2016**
Site Reference	**Airport City South GLH**			**Borehole**	**BH118**
Jobfile	**16-29244**			**Sample**	**638434**
Client	**ROC Consulting Ltd.**			**Depth**	**1.20**
Operator	**palmowskia**	**Checked**	**pytlikm**	**Approved**	**pytlikm**

i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS
i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			4.00
Description			Brown slightly sandy CLAY with pockets of grey sand
Type			U
Initial Sample Length	L_0	(mm)	198.8
Initial Sample Diameter	D_0	(mm)	98.4
Initial Sample Weight	W_0	(gr)	3092.2
Bulk Density	ρ_0	(Mg/m3)	2.05
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	80
Strain Rate	m_S	(mm/min)	3.97560
MembraneThickness	m_b	(mm)	0.32
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 4
Initial Moisture	$\omega_i\%$	(%)	23
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.66
Initial Voids Ratio	e_0	.	0.59
Initial Degree of Saturation	S_o	(%)	100

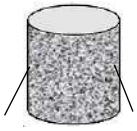
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	75
MembraneCorrection	m_C	(kPa)	1.229
Strain At Max Stress	$\varepsilon_f\%$	(%)	19.94
Shear Strength	c_U	(kPa)	38
Final Moisture	$\omega_f\%$	(%)	23
Final Dry Density	ρ_{df}	(Mg/m3)	1.66
Final Voids Ratio	e_f	.	0.59
Final Degree of Saturation	S_f	(%)	100.0



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1900 Clause 8			Test Name	638431
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	27/10/2016
Site Reference	Airport City South GLH			Borehole	BH117
Jobfile	16-29244			Sample	638431
Client	ROC Consulting Ltd.			Depth	4.00
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

i2 Analytical Limited, 7 Woodshots Meadow, Croxley Green Business Park, Herts WD18 8YS
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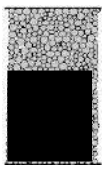
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth	3.00		
Description	Orangish brown sandy CLAY		
Type	U		
Initial Sample Length	L_0	(mm)	199.5
Initial Sample Diameter	D_0	(mm)	98.4
Initial Sample Weight	W_0	(gr)	3328.4
Bulk Density	ρ_0	(Mg/m3)	2.19
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	60
Strain Rate	m_S	(mm/min)	3.99080
MembraneThickness	m_b	(mm)	0.29
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 4
Initial Moisture	$\omega_i\%$	(%)	22
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.80
Initial Voids Ratio	e_0	.	0.47
Initial Degree of Saturation	S_o	(%)	100

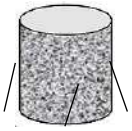
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	306
MembraneCorrection	m_C	(kPa)	1.113
Strain At Max Stress	$\varepsilon_f\%$	(%)	19.97
Shear Strength	c_U	(kPa)	153
Final Moisture	$\omega_f\%$	(%)	22
Final Dry Density	ρ_{df}	(Mg/m3)	1.80
Final Voids Ratio	e_f	.	0.47
Final Degree of Saturation	S_f	(%)	100.0



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1900 Clause 8			Test Name	638433
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	27/10/2016
Site Reference	Airport City South GLH			Borehole	BH118
Jobfile	16-29244			Sample	638433
Client	ROC Consulting Ltd.			Depth	3.00
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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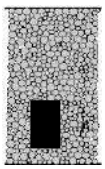
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	**Depth**			**2.00 - 2.45**
	Description			**Orangish brown clayey SAND**
	Type			**U**
	Initial Sample Length	L_0	**(mm)**	**96.6**
	Initial Sample Diameter	D_0	**(mm)**	**48.4**
	Initial Sample Weight	W_0	**(gr)**	**390.0**
	Bulk Density	ρ_0	**(Mg/m3)**	**2.19**
	Particle Density	ρ_s	**(Mg/m3)**	**2.65**

Initial Conditions

Initial Cell Pressure	σ_3	**(kPa)**	**40**
Strain Rate	m_S	**(mm/min)**	**1.93260**
MembraneThickness	m_b	**(mm)**	**0.28**
Displacement Input	L_{IP}	**(mm)**	**CH 2**
Load Input	N_{IP}	**(N)**	**CH 1**
Initial Moisture	$\omega_i\%$	**(%)**	**18**
Initial Dry Density	ρ_{d0}	**(Mg/m3)**	**1.87**
Initial Voids Ratio	e_0	**.**	**0.42**
Initial Degree of Saturation	S_o	**(%)**	**100**

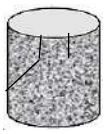
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	**(kPa)**	**65**
MembraneCorrection	m_C	**(kPa)**	**0.738**
Strain At Max Stress	$\varepsilon_f\%$	**(%)**	**4.03**
Shear Strength	c_U	**(kPa)**	**32**
Final Moisture	$\omega_f\%$	**(%)**	**18**
Final Dry Density	ρ_{df}	**(Mg/m3)**	**1.87**
Final Voids Ratio	e_f	**.**	**0.42**
Final Degree of Saturation	S_f	**(%)**	**100.0**

Notes

Triaxial at over burden





Failure Sketch

(surface inclination)

Test Method	**BS1377-7 : 1990 Clause 8**			**Test Name**	**646859**
Database: .\SQLEXPRESS \ 6171-I2 Analytical				**Test Date**	**31/10/2016**
Site Reference	**Airport City South GLH**			**Borehole**	**BH110**
Jobfile	**16-30716**			**Sample**	**646859**
Client	**ROC Consulting Ltd.**			**Depth**	**2.00 - 2.45**
Operator	**palmowskia**	**Checked**	**pytlikm**	**Approved**	**pytlikm**

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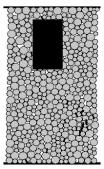
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth	5.00 - 5.45		
Description	Brown slightly gravelly very sandy CLAY		
Type	U		
Initial Sample Length	L_0	(mm)	143.6
Initial Sample Diameter	D_0	(mm)	69.6
Initial Sample Weight	W_0	(gr)	1131.3
Bulk Density	ρ_0	(Mg/m3)	2.07
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	100
Strain Rate	m_S	(mm/min)	2.87120
MembraneThickness	m_b	(mm)	0.26
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 1
Initial Moisture	$\omega_i\%$	(%)	18
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.76
Initial Voids Ratio	e_0	.	0.51
Initial Degree of Saturation	S_o	(%)	93

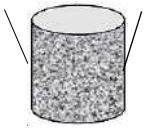
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	233
MembraneCorrection	m_C	(kPa)	1.411
Strain At Max Stress	$\varepsilon_f\%$	(%)	19.69
Shear Strength	c_U	(kPa)	116
Final Moisture	$\omega_f\%$	(%)	18
Final Dry Density	ρ_{df}	(Mg/m3)	1.76
Final Voids Ratio	e_f	.	0.51
Final Degree of Saturation	S_f	(%)	93.0



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1990 Clause 8	Test Name	646861
Database: .\SQLEXPRESS \ 6171-I2 Analytical		Test Date	31/10/2016
Site Reference	Airport City South GLH	Borehole	BH111
Jobfile	16-30716	Sample	646861
Client	ROC Consulting Ltd.	Depth	5.00 - 5.45
Operator	palmowskia	Checked	pytlikm
Approved	pytlikm		

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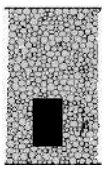
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			1.20 - 1.65
Description			Brown slightly gravelly sandy CLAY
Type			U
Initial Sample Length	L_0	(mm)	140.1
Initial Sample Diameter	D_0	(mm)	68.7
Initial Sample Weight	W_0	(gr)	1076.8
Bulk Density	ρ_0	(Mg/m3)	2.07
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	24
Strain Rate	m_S	(mm/min)	2.80280
MembraneThickness	m_b	(mm)	0.29
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 1
Initial Moisture	$\omega_i\%$	(%)	19
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.74
Initial Voids Ratio	e_0	.	0.52
Initial Degree of Saturation	S_o	(%)	96

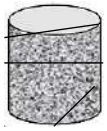
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	255
MembraneCorrection	m_C	(kPa)	1.175
Strain At Max Stress	$\varepsilon_f\%$	(%)	12.77
Shear Strength	c_U	(kPa)	128
Final Moisture	$\omega_f\%$	(%)	19
Final Dry Density	ρ_{df}	(Mg/m3)	1.74
Final Voids Ratio	e_f	.	0.52
Final Degree of Saturation	S_f	(%)	96.4



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1990 Clause 8			Test Name	646863
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	31/10/2016
Site Reference	Airport City South GLH			Borehole	BH113
Jobfile	16-30716			Sample	646863
Client	ROC Consulting Ltd.			Depth	1.20 - 1.65
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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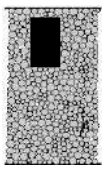
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details



sketch showing specimen location in original sample

Depth			4.00 - 4.45
Description			Brown slightly gravelly very sandy CLAY
Type			U
Initial Sample Length	L_0	(mm)	140.5
Initial Sample Diameter	D_0	(mm)	68.3
Initial Sample Weight	W_0	(gr)	1088.7
Bulk Density	ρ_0	(Mg/m3)	2.11
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	80
Strain Rate	m_S	(mm/min)	2.81020
MembraneThickness	m_b	(mm)	0.26
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 1
Initial Moisture	$\omega_i\%$	(%)	18
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.79
Initial Voids Ratio	e_0	.	0.48
Initial Degree of Saturation	S_o	(%)	100

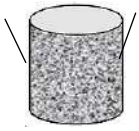
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	176
MembraneCorrection	m_C	(kPa)	1.439
Strain At Max Stress	$\varepsilon_f\%$	(%)	19.84
Shear Strength	c_U	(kPa)	88
Final Moisture	$\omega_f\%$	(%)	18
Final Dry Density	ρ_{df}	(Mg/m3)	1.79
Final Voids Ratio	e_f	.	0.48
Final Degree of Saturation	S_f	(%)	100.0



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1990 Clause 8			Test Name	646865
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	02/11/2016
Site Reference	Airport City South GLH			Borehole	BH114
Jobfile	16-30716			Sample	646865
Client	ROC Consulting Ltd.			Depth	4.00 - 4.45
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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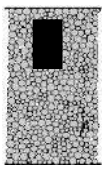
Total Stress Triaxial Compression

Unconsolidated Undrained (Single Stage)

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth	3.00 - 3.45		
	Description	Brown slightly gravelly very sandy CLAY		
	Type	U		
	Initial Sample Length	L_0	(mm)	140.6
	Initial Sample Diameter	D_0	(mm)	68.1
	Initial Sample Weight	W_0	(gr)	1117.4
	Bulk Density	ρ_0	(Mg/m3)	2.18
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	60
Strain Rate	m_S	(mm/min)	2.81100
MembraneThickness	m_b	(mm)	0.26
Displacement Input	L_{IP}	(mm)	CH 2
Load Input	N_{IP}	(N)	CH 1
Initial Moisture	$\omega_i\%$	(%)	18
Initial Dry Density	ρ_{d0}	(Mg/m3)	1.85
Initial Voids Ratio	e_0	.	0.43
Initial Degree of Saturation	S_o	(%)	100

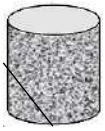
Final Conditions

Max Deviator Stress	$(\sigma_1-\sigma_3)_f$	(kPa)	134
MembraneCorrection	m_C	(kPa)	1.443
Strain At Max Stress	$\varepsilon_f\%$	(%)	19.20
Shear Strength	c_U	(kPa)	67
Final Moisture	$\omega_f\%$	(%)	18
Final Dry Density	ρ_{df}	(Mg/m3)	1.85
Final Voids Ratio	e_f	.	0.43
Final Degree of Saturation	S_f	(%)	100.0



Notes

Triaxial at over burden



Failure Sketch

(surface inclination)

Test Method	BS1377-7 : 1990 Clause 8			Test Name	646866
Database: .\SQLEXPRESS \ 6171-I2 Analytical				Test Date	02/11/2016
Site Reference	Airport City South GLH			Borehole	BH116
Jobfile	16-30716			Sample	646866
Client	ROC Consulting Ltd.			Depth	3.00 - 3.45
Operator	palmowskia	Checked	pytlikm	Approved	pytlikm

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APPENDIX II

APPENDIX II – SUPPLEMENTARY GROUND INVESTIGATION

Introduction

The site operations were carried out on 10th, 11th and 30th June 2020 under the supervision of a geotechnical/geoenvironmental engineer from Crossfield Consulting Limited. The scope and rationale for the design of the investigation is presented in Table II-1. The investigation was designed to provide geotechnical and geoenvironmental data. The geoenvironmental data and assessment have been reported under separate cover.

The ground investigation was designed and supervised by qualified and experienced geotechnical/geoenvironmental specialists from Crossfield Consulting Limited. Where appropriate, and as outlined below, specialist drilling/sampling equipment was procured together with trained and experienced operators. Unless otherwise indicated, sampling and logging remained the responsibility of trained staff from Crossfield Consulting Limited and field records were prepared on site, during or immediately following drilling/sampling or in situ measurements/tests. The results of in situ tests are presented on the relevant record sheets in this Appendix.

An exploratory hole location plan is presented as Figure II-1.

Trial Pits

23 trial pits, denoted as TPCCL1 to TPCCL23 were excavated by a Volvo EC220L excavator on 10th, 11th and 30th June. The trial pit records from the investigation are presented in this Appendix and these records include the descriptions and depths of the strata encountered, together with sample depths, groundwater observations and other pertinent comments.

In situ hand vane tests were carried out on fine-grained soils, where appropriate, to provide undrained shear strength data representative of the tested horizon. The tests were carried out using Pilcon-Edeco hand vane tester, with extension rods in accordance with the site health and safety method statement. With reference to the guidance published in Serota & Jangle (1972), it is noted that this instrument is calibrated and scaled to provide a direct reading of undrained shear strength, such that application of additional correction factors on the recorded measurements is not necessary. Published correlations with undrained shear strength, as measured by immediate undrained triaxial tests, indicate this hand vane tester provides measurements with a significantly lower scatter in comparison to triaxial tests, with fewer anomalous results. Specific test measurements are listed on the exploratory hole records.

Static Cone Penetration Testing

14 Static electric cone penetration tests, denoted as CPT1 to CPT14, were carried out, by Lankelma on 30th June to between 5.22 m and 9.38 m depth.

The CPTs generally terminated on encountering very dense strata that precluded penetration by the equipment (ballasted to approximately 15 tonnes). The CPTs included measurement of cone end-resistance and local side friction on a 10 cm^2 area electric cone.

The results from the testing are presented in this Appendix and the record sheets include a brief strata description, based on the soil type estimated from the in situ test data that has been assessed in conjunction with other available exploratory hole data for the site, as available at the time of the CPT site works.

Soil Samples

All samples for analytical testing were collected in appropriate containers, stored in cool boxes (where appropriate) and sent to the testing laboratory overnight. The sample containers, storage and handling

procedures were all compatible with the relevant recommendations of the UKAS accredited testing laboratory for the specific testing proposed.

Samples designated for geotechnical testing were collected, stored and transported in accordance with the published requirements for the specific tests scheduled, such that moisture content and soil structure integrity was maintained, as necessary for the test requirements.

Geotechnical Laboratory Testing
The rationale for the geotechnical laboratory testing is set out in the Table II-2.

Selected samples of the soils encountered were submitted for analysis for the following tests:

- Moisture content
- Atterberg Limits
- Particle size distribution
- Dry density/moisture content relationship (4.5 kg rammer) – 'as dug' and lime modified
- Particle density
- pH value
- Water soluble sulphate
- Total Sulphur
- Total Sulphate

The analyses were carried out by Construction Testing Solutions Ltd (CTS) and i2 Analytical, both UKAS accredited laboratories, and the results are presented in this Appendix.

RATIONALE FOR THE DESIGN OF THE GROUND INVESTIGATION

The scope of the ground investigation was designed with reference to the published geology and ground conditions indicated in the available desk study and ground investigation information. It is noted that the investigation works were constrained by on-site services and stockpiles/mounds.

In compliance with the guidance published in BS EN 1997-2:2007, the ground investigation was designed to verify the preliminary ground model, established from the available desk study and ground investigation information and to characterise the ground conditions within influencing distance of the proposed structures. In this regard, the exploratory holes were targeted within relevant areas of the site to provide information on the strata profile down to competent materials.

Exploratory Hole and Technique	Rationale for Hole Location	Depth (m)	Sampling/In Situ Testing and Monitoring
TPCCL1 to TPCCL23	Exploratory hole locations were chosen to provide general site coverage and supplement the existing ground investigation data. Following completion of CCLTP1 to CCLTP16, TPCCL17 to TPCCL23 were undertaken to provide additional information for the site Earthworks are proposed at the site and some of the exploratory holes were located in areas of proposed excavations to enable samples to be taken for earthworks classification and suitability testing. Exploratory holes were also located to confirm the nature of the strata beneath areas of proposed fill.	Up to 4.9 m	Selected samples were taken from Made Ground for analytical laboratory testing. Selected soil samples were recovered from the trial pits for geotechnical laboratory testing. In-situ hand vane tests were carried out on fine-grained soils (where possible and appropriate) to provide undrained shear strength data representative of the tested horizons.
TPCCL3 to TPCCL7 TPCCL10	Exploratory holes were located in areas of former farm buildings, access roads and ponds.	Up to 4.2 m	Selected samples were taken from Made Ground for analytical laboratory testing. Selected soil samples were recovered from the trial pits for geotechnical laboratory testing. In-situ hand vane tests were carried out on fine-grained soils (where possible and appropriate) to provide undrained shear strength data representative of the tested horizons.
TPCCL17 to TPCCL19 TPCCL23	Earthworks are proposed at the site and exploratory of the holes were located in areas of potential borrow pits to enable samples to be taken for earthworks classification and suitability testing.	Up to 3.7 m	Selected soil samples were recovered from the trial pits for geotechnical laboratory testing.

Exploratory Hole and Technique	Rationale for Hole Location	Depth (m)	Sampling/In Situ Testing and Monitoring
TPCCL20 to TPCCL22	Exploratory hole locations were located to investigate the area of the backfilled excavation recorded in TPCCL5.	Up to 3.9 m	In-situ hand vane tests were carried out on fine-grained soils (where possible and appropriate) to provide undrained shear strength data representative of the tested horizons.
CPT1 to CPT14	Exploratory holes located to provide information on the shallow and deep ground conditions across the site and to assess the in-situ density of the silty and sandy strata.	Up to 9.38 m	Measurements of end resistance and side friction recorded at regular intervals

Key
TPCCL *X* Machine dug trial pit
CP *X* Cone Penetration Test

RATIONALE FOR THE GEOTECHNICAL TESTING SUITE

Exploratory Hole and Samples	Selection Criteria	Analytical Tests
TPCCL2 1.2 m TPCCL4 0.9 m TPCCL5 3.8 m TPCCL8 0.6 m TPCCL9 0.9 m TPCCL9 1.7 m TPCCL10 1.15 m TPCCL11 0.8 m TPCCL11 1.9 m TPCCL12 1.0 m TPCCL13 1.1 m TPCCL13 2.2 m TPCCL14 0.8 m TPCCL15 1.0 m TPCCL16 0.8 m TPCCL18 1.3 m TPCCL23 1.3 m	Earthwork classification and suitability	Moisture Content
TPCCL4 0.9 m TPCCL5 3.8 m TPCCL8 0.6 m TPCCL9 1.7 m TPCCL11 0.8 m TPCCL12 1.0 m TPCCL13 2.2 m TPCCL16 0.8 m	Material classification and to assess materials volume change potential	Atterberg Limits
TPCCL12 1.0 m TPCCL16 0.8 m TPCCL18 1.3 m TPCCL23 1.3 m	Material Classification	Particle Size Distribution
TPCCL2 1.2 m TPCCL9 0.9 m TPCCL11 0.8 m TPCCL11 1.9 m TPCCL12 1.0 m TPCCL13 1.1 m TPCCL13 2.2 m TPCCL14 0.8 m TPCCL16 0.8 m TPCCL18 1.3 m TPCCL23 1.3 m	Earthwork classification and to determine acceptability criteria	Dry density/moisture content relationship (4.5 kg rammer) Undrained shear strength of remoulded materials Particle Density
TPCCL11 0.8 m TPCCL11 1.9 m TPCCL12 1.0 m TPCCL13 1.1 m TPCCL16 0.8 m	Earthwork classification and to determine acceptability criteria	Dry density/moisture content relationship (4.5 kg rammer) (2% Lime) Undrained shear strength of remoulded materials Particle Density

TABLE II-2
(Sheet 2 of 2)

Exploratory Hole and Samples	Selection Criteria	Analytical Tests
TPCCL1 1.2 m TPCCL3 0.9 m TPCCL3 2.0 m TPCCL4 0.4 m TPCCL5 1.5 m TPCCL7 1.2 m TPCCL9 0.7 m TPCCL10 0.8 m TPCCL1 1.6 m TPCCL2 1.2 m TPCCL4 0.9 m TPCCL5 3.0 m-3.5 m TPCCL5 3.8 m TPCCL6 0.8 m TPCCL7 2.3 m TPCCL8 0.6 m TPCCL11 0.8 m TPCCL11 1.9 m TPCCL12 1.0 m TPCCL13 1.1 m TPCCL13 2.2 m TPCCL14 0.8 m TPCCL15 1.0 m TPCCL16 0.8 m	Representative samples of natural material taken to assess the presence of substances hazardous to buried concrete.	pH Water soluble sulphates Total sulphate Total sulphur

TRIAL PIT RECORDS

KEY

	J	Disturbed Jar Sample	Category B Samples
	G	Soil Sample in Glass Container	
	g	Soil Sample in Glass Vial	
	B	Disturbed Bulk Sample	
	C	"Undisturbed" CBR Mould Sample (denoted Category A: OS-TK/W in BS EN 22475-1:2006)	
	W	Water Sample	
FVT	c_{fv}	Undrained Shear Strength (from hand vane shear vane test)	
	c_{rv}	Undrained Remoulded Shear Strength (from hand vane shear vane test)	
	c_{fv} *	Undrained Shear Strength from Hand Vane Shear Strength Test on block sample dug from pit by excavator	

Notes:

1. All measurement values on record sheets are uncorrected, unless otherwise indicated.
2. For corrected test values, refer to report.
3. Identification and classification of strata is based on the guidance published in the current edition of BS5930 together with BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004, BS EN ISO 14689-1:2003
4. Consistency (soft, firm, stiff etc.) relates to a manual test/inspection on site (in compliance with BS EN ISO 14688-1:2002 Section 5.14)
5. Undrained shear strength (low, medium, high etc.) relates to in situ or laboratory test data and the associated assessed strength of a stratum (in compliance with BS EN ISO 14688-2:2004 Section 5.3 and Table 5).
6. The density of coarse-grained soils is based on SPT N values (or equivalent Dynamic Probe test or CPT data) as outlined in BS5930 and BS EN ISO 14688-2:2004.
7. Rock strength (weak, strong etc.) is based on field identification (and/or strength test data), as outlined in BS EN ISO 14689-1:2003 Table 5.

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL1**
Date	10/06/2020	**Sheet**	1 of 2
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	63.40 m OD		
Plant	Volvo EC220EL	**Stability**	Slight spalling at 2.6 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	
	C	**Water**	Slow seepage at 2.6 m

Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
0.40		(1)		0.40
0.90		(2)		0.90
1.50		(3)		1.50
1.70		(4)		1.70
		(5)		
		(Continued on sheet 2 of 2)		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.40	Brown slightly gravelly silty clay with rootlets. Gravel is fine and rounded (TOPSOIL)
			2	0.40-0.90	Brown and light grey sandy clayey gravel. Gravel is fine to medium and rounded. Geotextile at 0.7 m (MADE GROUND)
1.20	JGg		3	0.90-1.50	Firm consistency brown gravelly clay with decomposing vegetation, ashy fragments and occasional asphalt cobbles (MADE GROUND)
1.60	c_{fv}	120, >140, >140	4	1.50-1.70	Stiff consistency reddish brown and orangish brown slightly sandy clay with brick and ashy fragments (MADE GROUND)
			5	1.70-3.80	Stiff consistency reddish brown mottled light grey slightly gravelly CLAY. Gravel is fine and rounded quartzite and rare fragments of coal (GLACIAL TILL) ...Pockets of orangish brown sand between 1.2 m and 2.4 m (Continued on sheet 2 of 2)

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL1**
Date	10/06/2020	**Sheet**	2 of 2
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	63.40 m OD		
Plant	Volvo EC220EL	**Stability**	Slight spalling at 2.6 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	Logged on site during excavation
	C	**Water**	Slow seepage at 2.6 m

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
3.80		(5)		3.80
		Base of pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			5	1.70-3.80	(continued from sheet 1 of 2) Stiff consistency reddish brown mottled light grey slightly gravelly CLAY. Gravel is fine and rounded quartzite and rare fragments of coal (GLACIAL TILL) ...Pockets of orangish brown sand between 1.2 m and 2.4 m

Remarks

Levels provided by Winvic

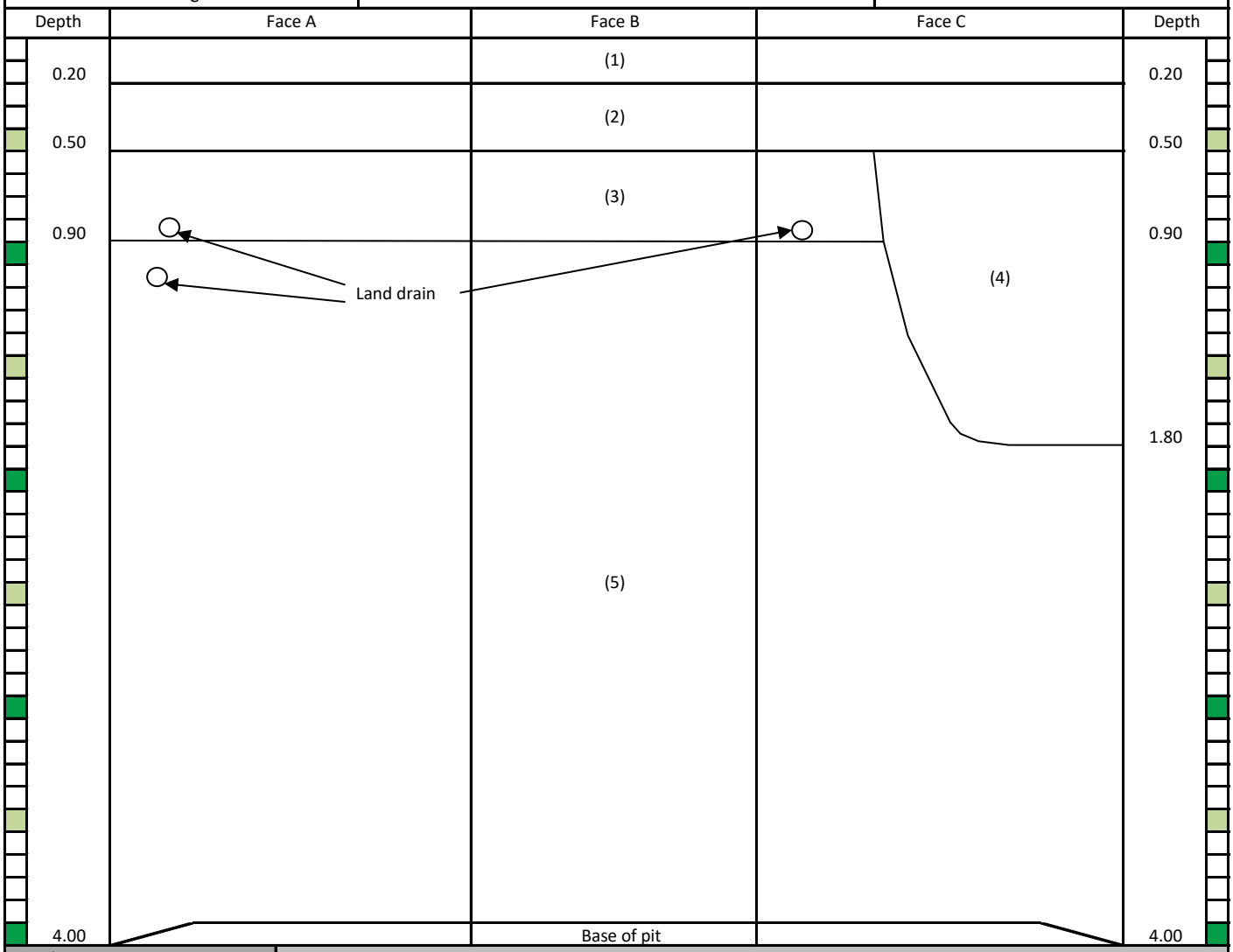
Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL2**
Date	10/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Northwest	**Shoring**	None used
Ground Level	63.60 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Water**	None encountered during excavation
	C	**Checked by**	Logged on site during excavation



Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.20	Vegetation over brown slightly gravelly clay with rootlets (TOPSOIL)
			2	0.20-0.50	Firm consistency dark brown and brown gravelly slightly sandy clay with brick and ashy fragments (MADE GROUND)
			3	0.50-0.90	Stiff consistency reddish brown and grey slightly gravelly clay with rare ash and coal fragments (MADE GROUND)
			4	0.50-1.80	Reddish brown SAND (GLACIAL TILL)
1.00 1.20	c_{fv} JB	95, 140, 140	5	0.90-4.00	Stiff consistency reddish brown and light grey slightly gravelly CLAY with occasional sand horizons (GLACIAL TILL)

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL3**
Date	11/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Northeast	**Shoring**	None used
Ground Level	63.75 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B, C	**Water**	None encountered during excavation
Checked by			Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
		(1)		
1.30				1.30
		(2)		
2.10				2.10
		(3)		
3.40				3.40
		(4)		
4.20		Base of pit		4.20

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
0.90	JGg		1	0.00-1.30	Dark brown gravelly clay with rootlets and tree branches. Manure odour (MADE GROUND)
2.00	JGg		2	1.30-2.10	Soft consistency reddish brown gravelly sandy clay with roots (MADE GROUND)
2.90	J		3	2.10-3.40	Soft to firm consistency dark brown organic CLAY with decomposing plant material (POND DEPOSITS)
4.00	c_{fv}*	90, 88, 88	4	3.40-4.20	Firm to stiff consistency brown gravelly CLAY with lenses of sand (GLACIAL TILL)

Remarks

Levels provided by Winvic

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL4**
Date	11/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
		Ground Level	63.60 m OD
Plant	Volvo EC220EL	**Stability**	Stable during excavation
		Co-ordinates	
Trial Pit	A		
Plan	→ B	**Logged by**	DB
	C	**Checked by**	Logged on site during excavation
		Water	None encountered during excavation

Depth	Face A	Face B	Face C	Depth
		(1)		
0.60				0.60
		(2)		
3.80		Base of pit		3.80

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
0.40	JGg		1	0.00-0.60	Dark brown gravelly clay with brick, wood, concrete and asphalt fragments (MADE GROUND)
0.90	J		2	0.60-3.80	Orangish brown and light grey SILT with lenses of stiff consistency reddish brown clay (GLACIAL TILL)
0.90	c_{fv}	40, 120, 44, 100, 100, 126, 50			…Becoming clay with silt horizons below 1.7 m

Remarks

Low values in hand shear vane at 0.9 m relate to silt horizons

Levels provided by Winvic

Notes

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2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL5**
Date	11/06/2020	**Sheet**	1 of 2
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	63.55 m OD		
Plant	Volvo EC220EL	**Stability**	Very unstable from ground level to 3.0 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	
	C	**Water**	Strata damp below 3.0 m

Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
0.30		(1)		0.30
3.00		(2)		3.00
		(3) (Continued on sheet 2 of 2)		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.30	Brown slightly gravelly clay with strands of hay. Gravel is fine to medium and rounded (TOPSOIL)
1.50	JGg		2	0.30-3.00	Soft consistency brown and dark brown slightly gravelly sandy clay with pockets of vegetation and rare ratchet ties. Odour of manure (MADE GROUND) …Land drain fragments at 3 m
3.00-3.50	J		3	3.00-4.50	Reddish brown clayey SILT with lenses of soft to firm consistency gravelly clay. Gravel is fine and rounded (GLACIAL TILL)
3.00-3.50	c_{fv}*	48, 44, 40, 70, 46			
3.80	J				
4.30	c_{fv}*	86, 60, 68			

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL5**
Date	11/06/2020	**Sheet**	2 of 2
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	63.55 m OD		
Plant	Volvo EC220EL	**Stability**	Very unstable from ground level to 3.0 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	
	C	**Water**	Strata is damp below 3.0 m

Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
		(3)		
4.50		Base of pit		4.50

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
3.00-3.50	J		3	3.00-4.50	Reddish brown clayey SILT with lenses of soft to firm consistency gravelly clay. Gravel is fine and rounded (GLACIAL TILL)
3.00-3.50	c_{fv}*	48, 44, 40, 70, 46			
3.80	J				
4.30	c_{fv}*	86, 60, 68			

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL6**
Date	11/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Northeast	**Shoring**	None used
Ground Level	63.70 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B, C	**Water**	None encountered during excavation
Checked by			Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
		(1)		
0.50				0.50
0.60		(2)		0.60
		(3)		
3.90				3.90
		Base of pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.50	Brown silty gravel with asphalt fragments. Gravel is fine to coarse and subangular (MADE GROUND)
0.60	c_{fv}	100, 105	2	0.50-0.60	Stiff consistency orangish brown and reddish brown slightly gravelly CLAY. Gravel is fine to coarse and rounded (GLACIAL TILL)
0.80	J		3	0.60-3.90	Stiff to very stiff consistency reddish brown mottled light grey CLAY
1.30	c_{fv}	>140			(GLACIAL TILL) …Horizons of silty clay below 1.3 m

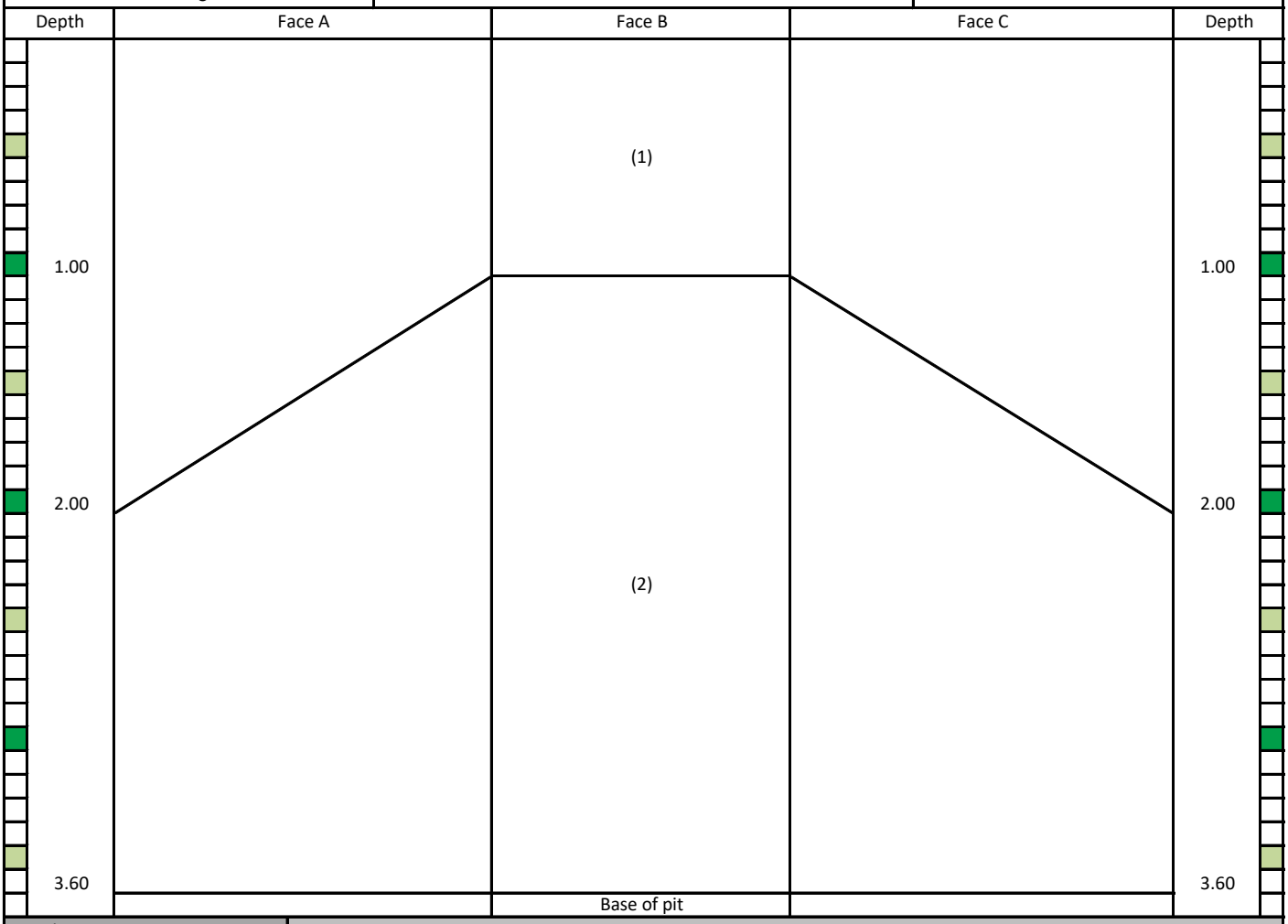
Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL7**
Date	11/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Northeast	**Shoring**	None used
Plant	Volvo EC220EL	**Stability**	Slight spalling between ground level and 2.0 m (strata (1))
Trial Pit	A	**Ground Level**	62.45 m OD
Plan	B / C	**Co-ordinates**	
		Logged by	DB
Water	None encountered during excavation	**Checked by**	Logged on site during excavation



Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
1.20	JGg		1	0.00-1.00/2.00	Brown gravelly clay with plastic bags, metal wire fence, tree branches, bricks, metal fragments and rootlets (MADE GROUND)
2.30 2.30	J c_{fv}*	48, 105, 80	2	1.00/2.00-3.60	Orangish brown clayey SILT with lenses of stiff consistency reddish brown and grey slightly gravelly clay (GLACIAL TILL) …Lense of sand at 2.9 m

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING GEOTECHNICAL ENVIRONMENTAL	Trial Pit Record Sheet		Hole Ref.	TPCCL8
	Project	Plot 2, ICON, Manchester	Sheet	1 of 1
	Date	11/06/2020	Job No.	CCL03330
Bearing: Northwest	Shoring	None used	Ground Level	62.45 m OD
Plant Volvo EC220EL	Stability	Stable during excavation	Co-ordinates	
Trial Pit A			Logged by	DB Logged on site during excavation
Plan → B C	Water	None encountered during excavation	Checked by	

Depth	Face A	Face B	Face C	Depth
0.30		(1)		0.30
		(2)		
4.10		Base of pit		4.10

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.30	Vegetation over brown slightly gravelly silt with rootlets (TOPSOIL)
0.60	J		2	0.30-4.10	Stiff to very stiff consistency orangish brown slightly gravelly CLAY (GLACIAL TILL)
0.70	c_{fv}	>140 *			...Rootlets to 1.0 m ...Becoming reddish brown mottled light grey below 0.5 m ...Rare coal fragments at 1.5 m

Remarks

* Strata was too hard to penetrate with shear vane

Levels provided by Winvic

Notes

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2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

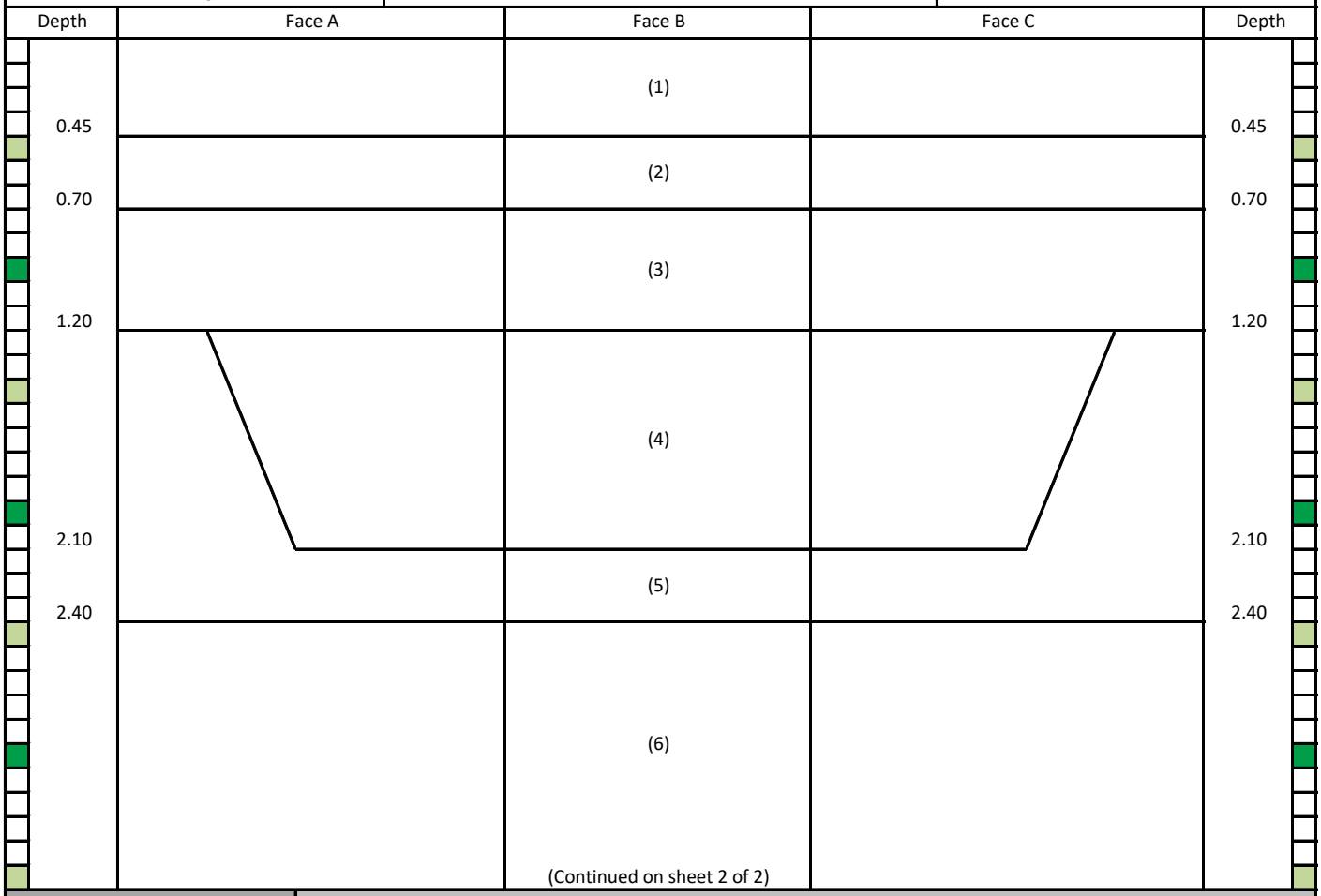
Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester
Date	10/06/2020
Shoring	None used
Stability	Stable during excavation
Water	Slow seepage at 3.0 m

Hole Ref.	**TPCCL9**
Sheet	1 of 2
Job No.	CCL03330
Ground Level	63.80 m OD
Co-ordinates	
Logged by	DB
Checked by	

Logged on site during excavation

Bearing:	Southeast
Plant	Volvo EC220EL
Trial Pit	A
Plan	B / C



Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.45	Brown clayey silt with rootlets (TOPSOIL)
0.70	JGg		2	0.45-0.70	Stiff consistency reddish brown and grey gravelly clay with rare pockets of ash (MADE GROUND)
0.90	JB		3	0.70-1.20	Stiff consistency reddish brown and grey slightly gravelly CLAY with rare pockets of sand (GLACIAL TILL)
0.90	c_{fv}	140, 124, 120			
1.70	J		4	1.20-2.10	Reddish brown clayey SILT (GLACIAL TILL)
			5	1.20-2.40	Stiff consistency reddish brown slightly gravelly silty CLAY (GLACIAL TILL)
			6	2.10-4.40	Stiff consistency reddish brown slightly gravelly CLAY with pockets of clayey silt (GLACIAL TILL)

Remarks

Levels provided by Winvic

Notes

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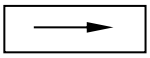
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester
Date	10/06/2020
Shoring	None used
Stability	Stable during excavation
Water	Slow seepage at 3.0 m

Hole Ref.	**TPCCL9**
Sheet	2 of 2
Job No.	CCL03330
Ground Level	63.80 m OD
Co-ordinates	
Logged by	DB
Checked by	

Bearing:	Southeast
Plant	Volvo EC220EL
Trial Pit	A
Plan	 B
	C

Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
		(6)		
4.40		Base of pit		4.40

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			6	2.10-4.40	Stiff consistency reddish brown slightly gravelly CLAY with pockets of clayey silt (GLACIAL TILL)

Remarks

Levels provided by Winvic

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL10**
Date	10/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	62.95 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Water**	Slow seepage at 1.8 m
	C	**Checked by**	Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
0.20		(1)		0.20
		(2)		
1.10				1.10
1.20		(3)		1.20
		(4)		
2.50		Base of pit		2.50

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.20	Vegetation over brown gravelly silty clay with rootlets (TOPSOIL)
0.80	JGg		2	0.20-1.10	Firm consistency orangish brown and brown slightly gravelly clay (MADE GROUND)
1.15	J		3	1.10-1.20	Soft to firm consistency dark brown organic clay with vegetation. Organic odour (POSSIBLE POND DEPOSITS)
1.20	c_{fv}	105, 118	4	1.20-2.50	Stiff consistency reddish brown and light grey gravelly CLAY. Gravel is fine to coarse and subrounded (GLACIAL TILL) …Lenses of silt at 1.8 m

Remarks

Land drain at 1.0 m

Levels provided by Winvic

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL11**
Date	10/06/2020	**Sheet**	1 of 2
		Job No.	CCL03330
Bearing:	Northeast	**Shoring**	None used
Ground Level	65.30 m OD		
Plant	Volvo EC220EL	**Stability**	Slight spalling below 2.0 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	
	C	**Water**	Moderate seepage at 2.9 m and 3.4 m

Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
0.35		(1)		0.35
1.00		(2)		1.00
		(3)		
		(Continued on sheet 2 of 2)		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.35	Brown slightly gravelly clayey silt. Gravel is fine to medium and rounded (TOPSOIL)
0.80	JB		2	0.35-1.00	Stiff consistency orangish brown and grey slightly gravelly CLAY with rootlets
0.80	c_{fv}	120, 126, 90, 100			(GLACIAL TILL)
1.90	JB		3	1.00-4.90	Stiff consistency reddish brown slightly gravelly CLAY with rare fragments of coal. Gravel is fine to coarse and rounded quartzite and extremely weak sandstone (GLACIAL TILL) …Pockets of silt and silty sand below 2.9 m …Slightly silty sand at 4.2 m …Pockets of sandy silt at 4.8 m

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL11**
Date	10/06/2020	**Sheet**	2 of 2
		Job No.	CCL03330
Bearing:	Northeast	**Shoring**	None used
Ground Level	65.30 m OD		
Plant	Volvo EC220EL	**Stability**	Slight spalling below 2.0 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	
	C	**Water**	Moderate seepage at 2.9 m and 3.4 m

Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
		(3)		
4.90				4.90
		Base of pit		

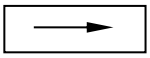
Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
1.90	JB		3	1.00-4.90	Stiff consistency reddish brown slightly gravelly CLAY with rare fragments of coal. Gravel is fine to coarse and rounded quartzite and extremely weak sandstone (GLACIAL TILL) ...Pockets of silt and silty sand below 2.9 m ...Slightly silty sand at 4.2 m ...Pockets of sandy silt at 4.8 m

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL12**
Date	10/06/2020	**Sheet**	1 of 2
		Job No.	CCL03330
Bearing:	Southwest	**Shoring**	None used
Ground Level	64.30 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	 B	**Checked by**	Logged on site during excavation
	C	**Water**	None encountered during excavation

Depth	Face A	Face B	Face C	Depth
0.30		(1)		0.30
2.50		(2)		2.50
		(3)		
		(Continued on sheet 2 of 2)		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.30	Vegetation over brown clayey silt with rootlets (TOPSOIL)
1.00	JB		2	0.30-2.50	Firm consistency reddish brown and orangish brown SILT with lenses of stiff consistency clay
1.50	c_{fv}	50, 60, 140, 40, 40, 50, 60, 98			(GLACIAL TILL)
3.70	c_{fv}*	90, 90, 72, 74, 80	3	2.50-4.40	Firm to stiff consistency brown mottled light grey slightly gravelly CLAY. Gravel is fine to medium and rounded quartzite (GLACIAL TILL)
4.40	c_{fv}*	94, 78, 86			

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL12**
Date	10/06/2020	**Sheet**	2 of 2
		Job No.	CCL03330
Bearing:	Southwest	**Shoring**	None used
Ground Level	64.30 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B, C	**Checked by**	Logged on site during excavation
		Water	None encountered during excavation

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
		(3)		
4.40				4.40
		Base of pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
3.70	c_{fv}*	90, 90, 72, 74, 80	3	2.50-4.40	Firm to stiff consistency brown mottled light grey slightly gravelly CLAY. Gravel is fine to medium and rounded quartzite (GLACIAL TILL)
4.40	c_{fv}*	94, 78, 86			

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL13**
Date	10/06/2020	**Sheet**	1 of 2
		Job No.	CCL03330
Bearing:	Northwest	**Shoring**	None used
Ground Level	65.25 m OD		
Plant	Volvo EC220EL	**Stability**	Slight spalling at 2.1 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	Logged on site during excavation
	C	**Water**	Slow seepage at 2.1 m

Depth	Face A	Face B	Face C	Depth
		(1)		
0.50				0.50
		(2)		
2.00				2.00
		(3)		
2.90				2.90
		(4)		
		(Continued on sheet 2 of 2)		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.50	Brown sandy clayey gravel with rootlets (TOPSOIL)
1.00 1.10	c_{fv} JB	>140, 20	2	0.50-2.00	Stiff consistency reddish brown and grey CLAY with abundant lenses of silt (GLACIAL TILL)
2.20	JB		3	2.00-2.90	Stiff consistency reddish brown and grey CLAY with occsasional lenses of silt and occasional coal fragments (GLACIAL TILL)
			4	2.90-4.00	Stiff consistency reddish brown and grey CLAY (GLACIAL TILL)
			5	4.00-4.20	Extremely weak light grey SILTSTONE (MERCIA MUDSTONE GROUP)

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL13**
Date	10/06/2020	**Sheet**	2 of 2
		Job No.	CCL03330
Bearing:	Northwest	**Shoring**	None used
Ground Level	65.25 m OD		
Plant	Volvo EC220EL	**Stability**	Slight spalling at 2.1 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	Logged on site during excavation
	C	**Water**	Slow seepage at 2.1 m

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
		(4)		
4.00				4.00
		(5)		
4.20				4.20
		Base of pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			4	2.90-4.00	Stiff consistency reddish brown and grey CLAY (GLACIAL TILL)
			5	4.00-4.20	Extremely weak light grey SILTSTONE (MERCIA MUDSTONE GROUP)

Remarks

Levels provided by Winvic

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

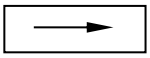
Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester
Date	10/06/2020
Shoring	None used
Stability	Stable during excavation
Water	None encountered during excavation

Hole Ref.	**TPCCL14**
Sheet	1 of 2
Job No.	CCL03330
Ground Level	64.15 m OD
Co-ordinates	
Logged by	DB
Checked by	

Logged on site during excavation

Bearing:	Northeast
Plant	Volvo EC220EL
Trial Pit	A
Plan	B / C



Depth	Face A	Face B	Face C	Depth
		(1)		
0.40				0.45
		(2)		
2.30				2.30
		(3)		
3.00				3.00
		(4)		
		(Continued on sheet 2 of 2)		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.40/0.45	Brown slightly gravelly clayey silt. Gravel is fine to medium and rounded (TOPSOIL)
0.80 0.80	JB c_{fv}	118, 140, 140	2	0.40/0.45-4.00	Stiff consistency reddish brown slightly gravelly slightly sandy CLAY. Gravel is fine and subangular sandstone (GLACIAL TILL) ...Silty clay at 0.5 m
			3	2.30-3.00	Reddish brown and brown clayey SILT (GLACIAL TILL)
			4	3.00-4.00	Stiff consistency reddish brown slightly gravelly slightly sandy CLAY. Gravel is fine and subangular sandstone (GLACIAL TILL)
			5	4.00-4.20	Soft to firm consistency light grey gravelly CLAY with rare boulders of sandstone. Gravel is fine to medium and subangular siltstone (GLACIAL TILL)

Remarks

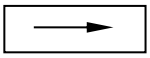
Levels provided by Winvic

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL14**
Date	10/06/2020	**Sheet**	2 of 2
		Job No.	CCL03330
Bearing:	Northeast	**Shoring**	None used
Ground Level	64.15 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	 B	**Checked by**	Logged on site during excavation
	C	**Water**	None encountered during excavation

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
		(4)		
4.00				4.00
		(5)		
4.20				4.20
4.30		(6)		4.30
		Base of pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
0.80	JB		4	3.00-4.00	Stiff consistency reddish brown slightly gravelly slightly sandy CLAY. Gravel is fine and subangular sandstone (GLACIAL TILL)
0.80	c_{fv}	118, 140, 140			
			5	4.00-4.20	Soft to firm consistency light grey gravelly CLAY with rare boulders of sandstone. Gravel is fine to medium and subangular siltstone (GLACIAL TILL)
			6	4.20-4.30	Stiff consistency reddish brown slightly gravelly CLAY. Gravel is fine and rounded (GLACIAL TILL)

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL15**
Date	11/06/2020	**Sheet**	1 of 2
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	63.10 m OD		
Plant	Volvo EC220EL	**Stability**	Spalling on Face C between 0.9 m and 2.3 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Checked by**	Logged on site during excavation
	C	**Water**	Slow seepage at 2.3 m

Depth	Face A	Face B	Face C	Depth
0.50		(1)		0.50
		(2)		
		(Continued on sheet 2 of 2)		

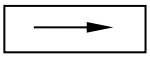
Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.50	Vegetation over brown slightly gravelly silty clay with rootlets (TOPSOIL)
0.60	c_{fv}	60, 130, 50, 140, 76	2	0.50-3.90	Stiff consistency reddish brown, orangish brown and light grey CLAY with lenses of silt (GLACIAL TILL)
1.00	J		3	3.90-4.50	Extremely weak light grey and orangish brown thinly laminated SILTSTONE and MUDSTONE with clayey infill between discontinuities and bands of selenite crystals (MERCIA MUDSTONE GROUP)
1.10	c_{fv}	60, 128, 50, 140, 140, 44			
4.30	J				

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL15**
Date	11/06/2020	**Sheet**	2 of 2
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	63.10 m OD		
Plant	Volvo EC220EL	**Stability**	Spalling on Face C between 0.9 m and 2.3 m
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	 B	**Checked by**	Logged on site during excavation
	C	**Water**	Slow seepage at 2.3 m

Depth	Face A	Face B	Face C	Depth
		(Continued from sheet 1 of 2)		
		(2)		
3.90				3.90
		(3)		
4.50				4.50
		Base of pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
0.60	c_{fv}	60, 130, 50, 140, 76	2	0.50-3.90	Stiff consistency reddish brown, orangish brown and light grey CLAY with lenses of silt (GLACIAL TILL)
1.00	J		3	3.90-4.50	Extremely weak light grey and orangish brown thinly laminated SILTSTONE and MUDSTONE with clayey infill between discontinuities and bands of selenite crystals (GLACIAL TILL)
1.10	c_{fv}	60, 128, 50, 140, 140, 44			
4.30	J				

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL16**
Date	11/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Northeast	**Shoring**	None used
Ground Level	64.10 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excvation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	B / C	**Checked by**	Logged on site during excavation
		Water	Slow seepage at 3.4 m

Depth	Face A	Face B	Face C	Depth
0.30		(1)		0.30
		(2)		
3.80		Base of pit		3.80

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.30	Vegetation over brown gravelly clayey silt (TOPSOIL)
0.80 0.80	JB c_{fv}	120, 140, 110	2	0.30-3.80	Stiff consistency reddish brown slightly gravelly slightly sandy CLAY with rare coal fragments (GLACIAL TILL) …Brown clayey sand between 2.4 m and 3.0 m …Cobble of grey siltstone at 3.8 m

Remarks

Refused at 3.8 m due to hard strata (possible siltstone)

Levels provided by Winvic

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

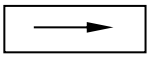
Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester
Date	30/06/2020
Shoring	None used
Stability	Stable during excavation
Water	None encountered during excavation

Hole Ref.	**TPCCL17**
Sheet	1 of 1
Job No.	CCL03330
Ground Level	65.65 m OD
Co-ordinates	
Logged by	DB
Checked by	

Logged on site during excavation

Bearing: Southeast
Plant Volvo EC220EL
Trial Pit A
Plan B C



Depth	Face A	Face B	Face C	Depth
		(1)		0.50
0.80		(2)		
1.20				1.20
		(3)		
3.10		Base of Pit		3.10

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.50/0.80	Brown gravelly clay with rootlets, land drain fragments and rare asphalt rubble. Gravel is fine to coarse subrounded (TOPSOIL/MADE GROUND)
0.90	JB		2	0.50/0.80-1.20	Stiff consistency orangish brown mottled grey slightly gravelly CLAY with occasional pockets of silty clay (GLACIAL TILL)
1.60	JB		3	1.20-3.10	Stiff consistency reddish brown mottled light bluish grey slightly gravelly CLAY. Gravel is rounded subangular of siltstone (GLACIAL TILL) …Occasional lenses of firm consistency silt below 1.8 m

Remarks
Rootlets to 1.0 m
Land drain at 1.1 m
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

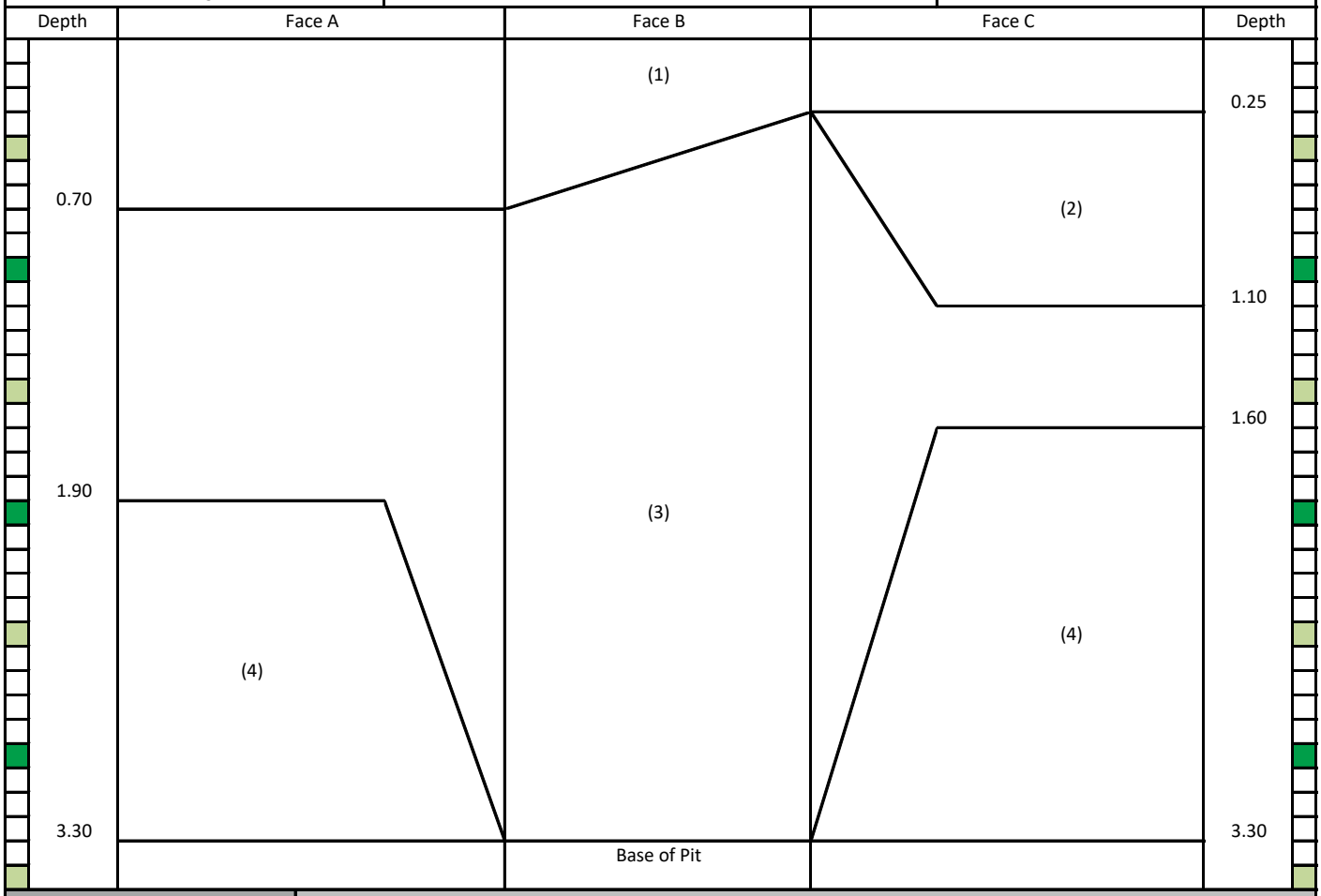
Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester
Date	30/06/2020
Shoring	None used
Stability	Stable during excavation
Water	None encountered during excavation

Hole Ref.	**TPCCL18**
Sheet	1 of 1
Job No.	CCL03330
Ground Level	64.70 m OD
Co-ordinates	
Logged by	DB
Checked by	

Logged on site during excavation

Bearing: Southeast
Plant Volvo EC220EL
Trial Pit A
Plan B C



Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.25/0.70	Brown slightly gravelly clay with rootlets and occasional brick fragments (TOPSOIL/MADE GROUND)
			2	0.25-1.10	Firm to stiff consistency brown silty CLAY (GLACIAL TILL)
1.30	JB		3	0.25/1.10-1.60/3.30	Light brown and bluish grey sandy SILT (GLACIAL TILL)
			4	1.60/1.90-3.30	Firm to stiff consistency brown slightly sandy CLAY (GLACIAL TILL)

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL19**
Date	30/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	Southeast	**Shoring**	None used
Ground Level	64.20 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	→ B	**Water**	None encountered during excavation
	C	**Checked by**	Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
0.40		(1)		0.40
0.90		(2)		0.90
3.50		(3)		3.50
		Base of Pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.40	Brown gravelly clay with rootlets. Gravel is fine to medium subangular (TOPSOIL)
			2	0.40-0.90	Stiff consistency orangish brown mottled light grey and light bluish grey CLAY (GLACIAL TILL)
1.20	JB		3	0.90-3.50	Stiff consistency reddish brown mottled light bluish grey slightly gravelly CLAY. Gravel is medium to coarse rounded (GLACIAL TILL)

Remarks

Land drain at 0.7 m
Roots to 0.9 m
Levels provided by Winvic

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING GEOTECHNICAL ENVIRONMENTAL	Trial Pit Record Sheet		Hole Ref.	TPCCL20
	Project	Plot 2, ICON, Manchester	Sheet	1 of 1
	Date	30/06/2020	Job No.	CCL03330
Bearing: Northeast	Shoring	None used	Ground Level	63.70 m OD
Plant Volvo EC220EL	Stability	Some spalling to 3.2 m	Co-ordinates	
Trial Pit A			Logged by	DB Logged on site during excavation
Plan → B C	Water	None encountered during excavation	Checked by	

Depth	Face A	Face B	Face C	Depth
		(1)		
3.20				3.20
		(2)		
3.90				3.90
		Base of Pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-3.20	Firm consistency light brown mottled brown gravelly clay with occasional cobbles and boulders of concrete and occasional fragments of asphalt. Rare metal wires and fabric. Manure odour (MADE GROUND)
3.80	c_{fv}*	112,90,90	2	3.20-3.90	Firm to stiff consistency reddish brown slightly gravelly CLAY with sand pockets (GLACIAL TILL)

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester
Date	30/06/2020
Hole Ref.	**TPCCL21**
Sheet	1 of 1
Job No.	CCL03330
Bearing:	Southwest
Shoring	None used
Ground Level	63.70 m OD
Plant	Volvo EC220EL
Stability	Unstable in Face A between ground level and 3.0 m. Spalling below 3.0 m
Co-ordinates	
Trial Pit	A
Plan	→ B, C
Logged by	DB
Checked by	
Water	Moderate inflow, becoming slow inflows below 3.3 m

Logged on site during excavation

Depth	Face A	Face B	Face C	Depth
		(1)		
0.30				0.30
		(2)		
3.00				3.00
		(3)		
3.50				3.50
		Base of Pit		

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.30	Firm consistency brown slightly gravelly organic clay with rootlets (TOPSOIL)
			2	0.30-3.00	Firm consistency light brown mottled dark brown gravelly silty clay with cobbles of concrete, rootlets and a manure odour. Gravel is fine to coarse subrounded (MADE GROUND)
			3	3.00-3.50	Brown mottled light brown SILT (GLACIAL TILL)

Remarks
Levels provided by Winvic

Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester
Date	30/06/2020
Shoring	None used
Stability	Stable during excavation
Water	None encountered during excavation

Hole Ref.	**TPCCL22**
Sheet	1 of 1
Job No.	CCL03330
Ground Level	62.05 m OD
Co-ordinates	
Logged by	DB
Checked by	

Logged on site during excavation

Bearing: Northeast
Plant Volvo EC220EL
Trial Pit A
Plan B C

Depth	Face A	Face B	Face C	Depth
		(1)		
0.40				0.40
		(2)		
0.90				0.90
1.10		(3)		1.10
		(4)		
1.80		Base of Pit		1.80

Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
			1	0.00-0.40	Brown clay with rootlets and a manure odour (TOPSOIL)
			2	0.40-0.90	Dark brown organic clay with rootlets and a manure odour (SUBSOIL)
			3	0.90-1.10	Firm to stiff consistency orangish brown mottled light brown CLAY (GLACIAL TILL)
			4	1.10-1.80	Stiff consistency reddish brown mottled light bluish grey CLAY with some lenses of SILT (GLACIAL TILL)

Remarks
Levels provided by Winvic

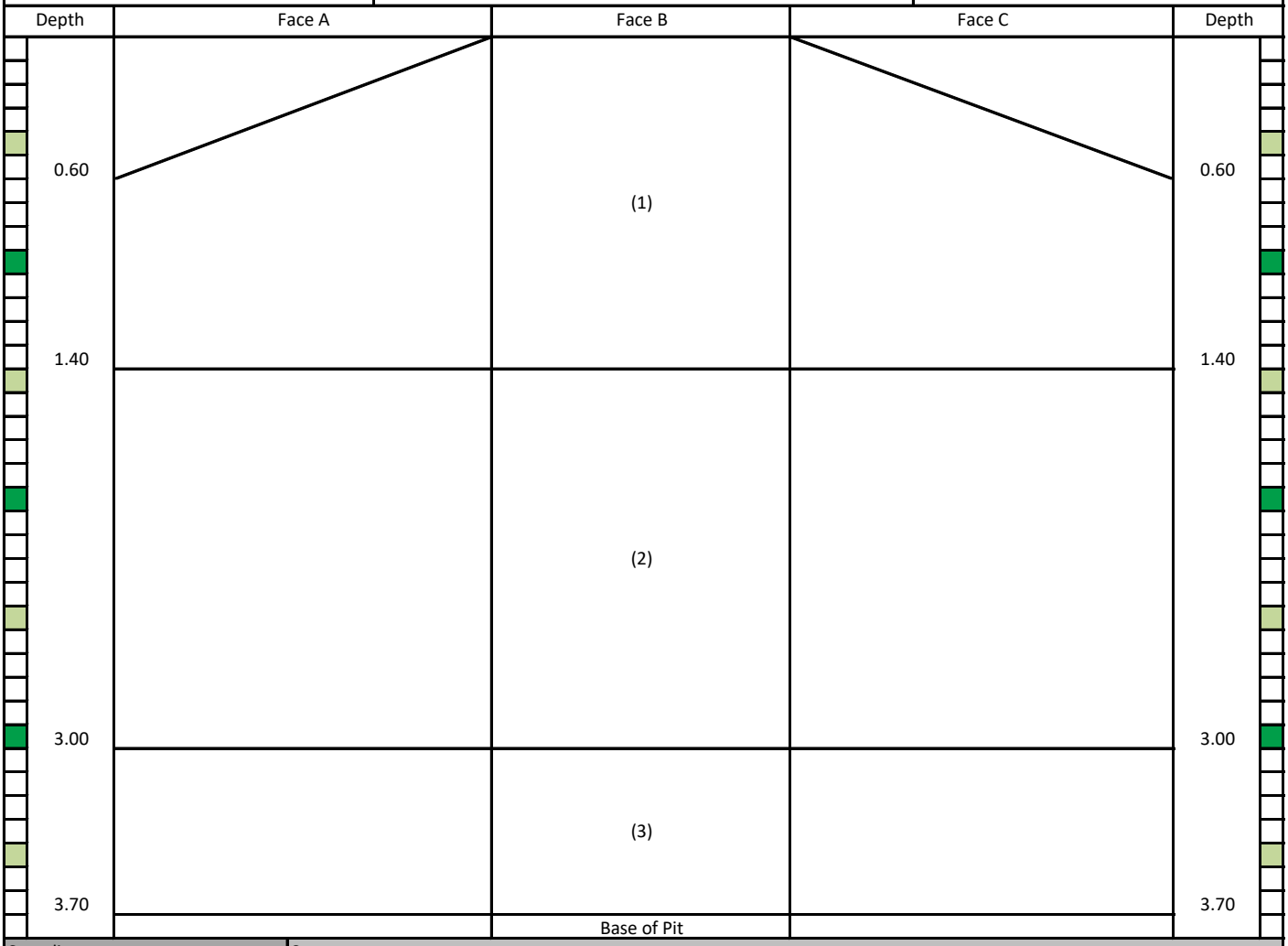
Notes
1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Trial Pit Record Sheet

Project	Plot 2, ICON, Manchester	**Hole Ref.**	**TPCCL23**
Date	30/06/2020	**Sheet**	1 of 1
		Job No.	CCL03330
Bearing:	North	**Shoring**	None used
Ground Level	63.90 m OD		
Plant	Volvo EC220EL	**Stability**	Stable during excavation
Co-ordinates			
Trial Pit	A	**Logged by**	DB
Plan	B	**Checked by**	
	C	**Water**	None encountered during excavation

Logged on site during excavation



Sampling			Strata		
Sample/Test Depth	Type	Strength (kN/m^2)	Ref. No.	Strata Depth	Description
1.30	JB		1	0.00-0.60/1.40	Brown mottled dark brown slightly gravelly slightly sandy clay with rootlets (MADE GROUND - MOUND)
			2	1.40-3.00	Light brown and light grey sandy SILT (GLACIAL TILL)
			3	3.00-3.70	Stiff consistency light bluish grey mottled light reddish brown slightly gravelly CLAY. Gravel is fine to coarse subangular of siltstone (GLACIAL TILL)

Remarks

Levels provided by Winvic

Hole excavated down through mound material

Notes

1. All logging and sampling in accordance with BS 5930:2015
2. Symbols and abbreviations are explained on the accompanying key
3. All linear dimensions are in metres unless otherwise stated

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MANCHESTER

SOIL INVESTIGATION

CPT REPORT

Cone penetration test
Geotechnical data interpretation

Project ref.: P-107495-1






PROJECT:	Manchester

CLIENT:	Crossfield Consulting

FIELDWORK

CPT rig(s)	18.0-tonne track-truck mounted CPT unit (UK22)
Date fieldwork started	30th June 2020
Date fieldwork completed	30th June 2020
Lankelma's representative	Emma Stickland
Client's representative	Daniel Bassingthwaighte

REPORT

Status	Revision	Action	Date	Name
Final	00	**Completed**	03/07/20	Chris Player
		Checked	03/07/20	Emma Stickland
		Approved	03/07/20	Joseph Hobbs

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APPENDIX E STANDARD INTERPRETATION RESULTS - SET 2

1 INTRODUCTION

At the request of Crossfield Consulting, a soils investigation was carried out on project *Manchester*

Site location:

(In the general region of)

Sunbank Lane
Altrinham
WA15 0AF

2 DISCLAIMER

The investigation information, raw data and interpretations provided in this report are for the sole benefit of the Client identified at the front of the report.

Lankelma has exercised reasonable skill, care and diligence in the fieldwork and preparation of this report. This report has been completed based on information available to Lankelma at the time of preparation. The measurement and interpreted data in this report do not constitute recommendations for design purposes. An appropriately qualified person must review and interpret the data given in this report, together with any assumptions we have made that affect the data, before using the data for design or recommendation.

Lankelma accepts no responsibility for the accuracy or suitability of any assumptions, derived soil parameters, soil descriptions or defined soil layer boundaries contained in this report.

3 COMPLETED WORKS

- 14 nr. cone penetration tests (CPTu) with piezo measurement
- Factual report including point data interpretation of selected parameters

Appendix A *Summary Tables* contains tabulated details of the works completed together with analysis results where applicable.

4 FIELDWORK GENERAL

Fieldwork was performed with an 18.0-tonne track-truck mounted CPT unit (UK22) equipped with a 17-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 10 m below ground level. Table 1 details the final test depths and reasons for test termination (r*efusal factor).* Where penetration refusal was encountered the termination depth was advised to, and agreed with, the Client's on-site representative.

5 CONE PENETRATION TESTS

Cone penetration testing was carried out in general accordance with BS ISO 22476-1:2012.

Penetrometer measurements included cone tip resistance, friction sleeve resistance and dynamic pore water pressure sampled at a 10 mm resolution.

Penetrometers without load cell temperature sensors were calibrated in accordance with BS8422:2003 and ASTM E74-13a, and penetrometers with down-hole digitisation and incorporating load cell temperature sensors were calibrated in accordance with ISO 376:2011. The BS8422:2003 calibration provides a single calibration uncertainty value as a percentage of full scale output (FSO), while ISO 376:2011 calibrations provide an uncertainty value for each calibration force or pressure and extends to the very low range (tip pressure >= 0.06 MPa) required to quantify uncertainty in low strength soils. The management of calibration records is in accordance with ISO 10012. Copies of all calibration certificates for the cones used are provided in Appendix B.

The piezometer filter element was in the u_2 position and was vacuum saturated. The pore pressure system was saturated with de-aired 10000 cSt silicone oil.

5.1 GLOSSARY OF CPT TERMS AND SYMBOLS

SYMBOLS & ABBREVIATIONS

q_c	**Cone resistance.** The total force acting on the cone Q_c, divided by the projected area of the cone, A_c: $q_c = Q_c/A_c$.
q_t	**Corrected tip resistance.** The cone tip resistance q_c corrected for pore water pressure effects on the cone shoulder.
f_s	**Friction sleeve resistance.** The total frictional force acting on the friction sleeve, F_s, divided by its surface area A_s: $f_s = F_s/A_s$.
u_2, u_1	**Pore pressure.** Dynamic water pressure measured at the shoulder position (u_2) or cone face (u_1) during penetration or pause in penetration for a dissipation test.
u_0	**Equilibrium pore pressure**
V_s, V_p	**Shear wave velocity, V_s, and pressure wave velocity, V_p.** Measured with use of a seismic receiver.
z	**Depth below ground level.** Depth below ground level as penetration length without correction for inclination or true depth after correction for inclination.

R_f	**Friction ratio** The ratio, expressed as a percentage, of the sleeve friction, f_s, to the cone resistance, q_c, both measured at the same depth: $R_f = (f_s/q_c) \cdot 100$
γ	**Unit weight of soil**
ρ	**Volumetric mass density (or specific mass) of soil**
γ_w	**Unit weight of water**
Gs	**Specific gravity of solids**
G	**Shear modulus**
G_0	**Small strain shear modulus**
g	**Gravitational constant:** $g = 9.81\ m/s^2$
σ_v	**Total overburden stress**
σ'_v	**Effective overburden stress**
σ_{atm}, **or,** P_a	**Reference atmospheric stress:** σ_{atm} = 100kPa
$q_{t\text{-}net}$	**Net cone resistance:** $q_{t\text{-}net} = q_t - \sigma_v$. Where q_t is unavailable q_c is applied.
Q_t	**Normalised cone resistance** (Method 1): $Q_t = (q_c - \sigma_v)/\sigma'v$
q_{t1}	**Normalised cone resistance** (Method 2): $q_{t1} = (q_t)/(\sigma'_v)^{0.5}$
F_r	**Normalised friction sleeve resistance:** $F_r = f_s/(q_c - \sigma_v)$
I_c	**Soil Behaviour Type Index**
SBT or SBTn	**Soil behaviour type classification**
B_q	**Pore pressure ratio.** The net pore pressure normalized with respect to the net cone resistance: $B_q = (u_2 - u_0)/(q_t - \sigma_v)$

TERMS

Cone or 'tip': The conical tip of the cone penetrometer.

Friction sleeve: The section of the cone penetrometer upon which the sleeve friction is measured, located behind the cone tip.

Piezocone: A cone penetrometer with a pore pressure sensor (u_2 / u_1)

Seismic cone: A cone penetrometer with a seismic receiver incorporated inside or behind.

Dynamic pore pressure: The pore pressure measured during penetration (u_2 / u_1).

Soil behaviour type: Soil classification scheme or classified soil type according to Robertson (1990, 2016) often abbreviated to SBT or SBTn.

5.2 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 BS ISO 22476-1:2012. CPT data and the associated derived geotechnical parameters are included in the AGS 3.1 and 4.0 data files provided.

The cone tip resistance and sleeve force measurements were converted to pressures using the nominal dimensions of the penetrometer.

For piezocone tests the corrected tip resistance was calculated according to the formula:

$$q_t = q_c + u_2 \times (1 - a)$$

Where a is the 'area ratio' and (1- a) is the proportion of cross-sectional area between the cone tip and cone 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 soils with large excess pore pressures. The percentage adjustment is described by the curves in the following chart for a = 0.8:

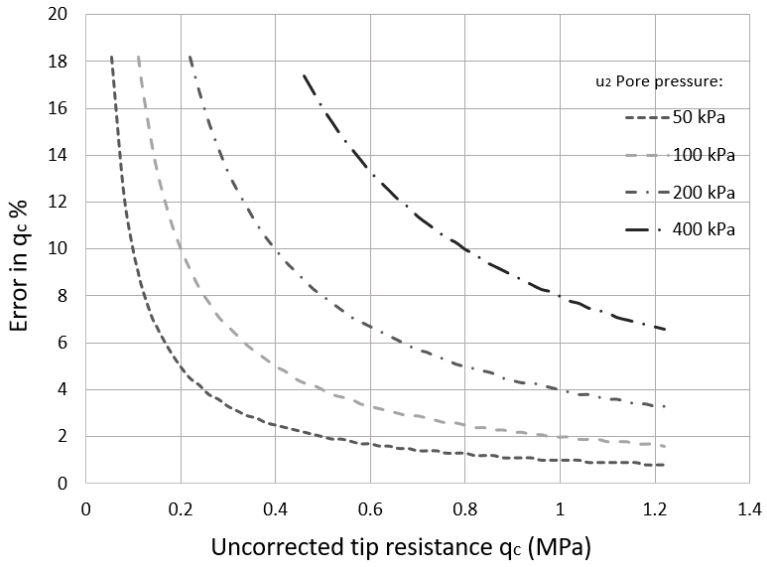

Figure 5-1 Uncorrected tip with measured tip resistance

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. 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 well within the intrinsic influence zone of the cone tip measurement and the loss of meaningful resolution is negligible.

The raw (or corrected) data are presented in Appendix C.

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 < *Ic* < 2.7 (see section 6.3).

In general, the engineering parameters derived for fine grain soils (undrained) are suitable for soils of both silicate and carbonate composition, whereas parameters derived for coarse soils are intended for non-cemented predominantly silicate composition.

5.3 IN-SITU STRESS CONDITIONS

An estimate of the equilibrium pore pressure and total and effective vertical stress states is required for many derived parameters obtained from the CPT and dissipation test.

The total vertical stress with depth was calculated as the sum of the calculated soil unit weight above a given depth. See section 5.4 for information on the empirical estimate of soil unit weight.

An arbitrary principal phreatic surface of 3.00 mBGL was applied in the calculation of effective stress.

Note: The term phreatic surface is used here, however when it is based on piezocone measurements it is assumed that the piezometric level (under hydrostatic conditions) and phreatic surface coincide. The phreatic or piezometric surface reported is intended to provide information about the assumed pore pressure distribution 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.

5.4 SOIL UNIT WEIGHT

The soil unit weight was estimated using the following method proposed by Robertson (2010).

$$\frac{y}{y_w} = 0.27\ Log(R_f) + 0.36\ (Log(q_t/R_f)) + 1.236$$

Throughout pre-drilled zones (inspection pits or drill-out) the soil unit weight was assumed as 17 kN/m^3.

For depths where the friction sleeve measurement falls below zero, the friction sleeve was substituted with an artificial 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 profile.

5.5 SOIL BEHAVIOUR TYPE

The soil behaviour type (SBT) was interpreted using the Robertson (1990) classification system based on the normalised cone resistance (Qt) and normalised friction sleeve resistance (Fr) for silicate soils.

While the classification based on normalised parameters is considered more accurate, particularly for NC soils exceeding 15 m, the classification is often significantly in error (artificially granular/drained) at very shallow depth (< 1-3 m). The error at shallow depth is associated with the potentially large difference between the estimated vertical effective stress (applied in normalisation) and the unknown horizontal stress influencing penetration resistance.

Robertson (2010) proposed a non-normalised version of the 1990 chart which uses dimensionless cone resistance (q_c/Pa) and friction ratio, Rf. The classification according to this chart can be

more reliable at shallow depth and has been plotted as an approximate SBT index (discussed below) for comparison to the normalised classification.

The SBT chart is provided in Appendix B – *General Information,* titled 'CPT Soil Behaviour Type Chart'.

It should be noted that the SBT classification provides the general soil 'type' which typically provides a similar CPT measurement range of q_c and f_s. Correspondingly, it will also show biased towards the soil fraction that dominates the mechanical behaviour. While the repeatability and behavioural bias of the SBT is usually beneficial, the classification is not always an appropriate substitute for classification based on grain-size distribution and plasticity.

The layer boundaries are manually interpreted based on broad changes in SBT classification or variance with depth. Once layer boundaries are defined, the SBT zones classified within each layer are listed together with the corresponding percentage of data points within the layer. The modal classification is reported in full, with abbreviated short descriptions for all secondary zones, for example - '*Clays – clay to silty clay [74%]; *Silt mixtures [20%]*', where the asterisk represents an abbreviation of the full description '*Silt mixtures – clayey silt to silty clay*'. It is important to consider that the classification zone boundaries do not exist in reality and small shifts in the cone response can lead multiple classifications within layers of relatively uniform behaviour; especially were the layer data plot close to a triple junction and/or has spurious spikes or very thin layers. Therefore, some system to limit the number of classified zones is usually necessary for clarity in the plot. The logic used by Lankelma for each layer is:

For LT >= 1, C = 85
For 0.5 <= LT < 1, C = 75
For 0 < LT < 0.5, C = 65

Where
C = Minimum % SBT zone classification coverage within the layer
LT = Layer thickness (m)

For layers having a thickness of less than 1 m then 10% of data at the top and bottom of the layer are excluded to limit the effect of transition zone data (mobilised resistance influenced by overlying or underlying strata) being included in the classification.

The continuous SBT index I_c should be used to assess the classification distribution and variation not accounted for by the layer description.

An alternative to this system is to classify each data point using coloured bars. However, the zones where the classification is known to be incorrect (very thin layers, transition zones etc) are left included and may be misinterpreted.

The results are presented in Appendix D.

5.6 SOIL BEHAVIOUR TYPE INDEX – I_c

The main trend in soil behaviour type (SBT) variation can be expressed by a continuous index, I_c, 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, as 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 Appendix B figure 'CPT Soil Behaviour Type Chart'. The method does not identify zones 1 (*sensitive fine grained)* and zones 8 & 9 (*overconsolidated or cemented*) which shall be reported in the layer analysis where they form a significant proportion of the layer.

Normalised SBT index I_c (Robertson and Wride, 1998)*:*

$$I_c = [(3.47 - \log Q_t)^2 + (logF_r + 1.22)^2]^{0.5}$$

Non-normalised SBT index I_c (Robertson, 2010)*:*

$$I_c = \left[\left(3.47 - \log\left(\frac{q_c}{\sigma_{atm}}\right)\right)^2 + (logR_f + 1.22)^2\right]^{0.5}$$

The normalised version if 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.

The results are presented in Appendix D.

5.7 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. The expected accuracy may be evaluated from the figures presented below.

$$D_r = 100\left[0.268 \cdot \ln\left(\frac{q_t/\sigma_{atm}}{\sqrt{\sigma_{vo}'/\sigma_{atm}}}\right) - k\right]$$

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.

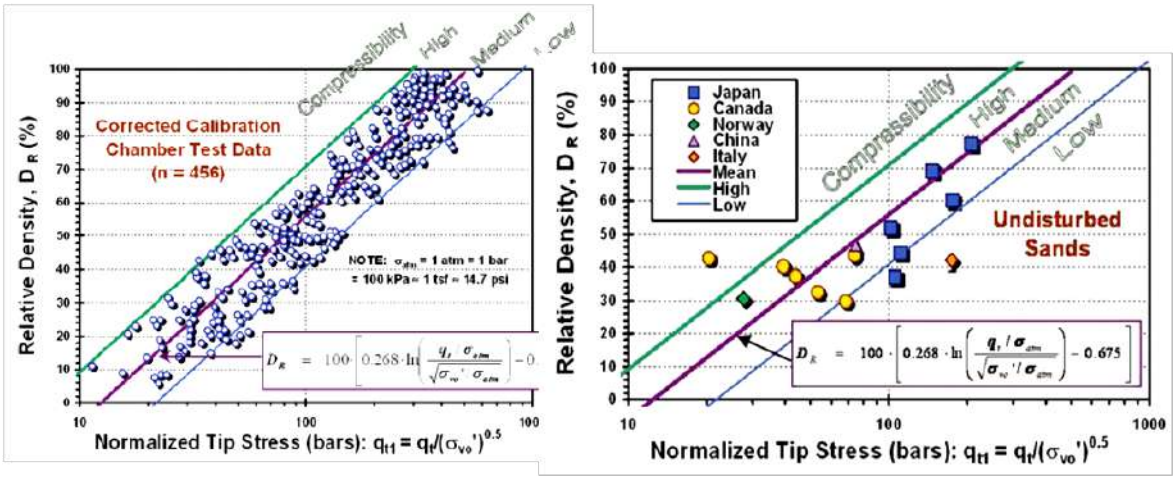

Figure 5-2 Relative density with normalised tip stress and sand compressibility from calibration chamber tests (left) and undisturbed frozen samples (right). Jamiolkowski *et al.* (2001). Reproduced from Mayne (2007).

The results are presented in Appendix E– *Standard interpretation results (set 2)*.

5.8 UNDRAINED SHEAR STRENGTH

The undrained shear strength s_u is usually estimated as a factor of net tip resistance (Lunne *et al*, 1981):

$$s_u = \frac{q_c - \sigma_{v0}}{N_k}$$

Where N_k is an empirical cone factor which varies with soil type, stress history, structure/fabric, plasticity, and the mode of shear.

Mayne and Peuchen (2018) performed and evaluation of 407 high-quality triaxial compression tests with net tip resistance to proposed N_{kt} factors with regression analysis details for five categories of clays shown in Table 1.

Table 1 Summary of CAUC s_u versus q_{net} for clays. Reproduced from Mayne and Peuchen (2018).

Clay Group	Number of sites	No. Data	Correlation Coefficient r_2	Factor N_{kt}	Mean Pore Pressure Parameter B_q
Offshore NC-LOC	17	115	0.98	12.32	0.51
Onshore NC-LOC	30	191	0.867	12	0.53
Sensitive NC-LOC	5	43	0.507	10.33	0.84
OC Intact	5	36	0.862	13.57	0.49
OC Fissured	5	22	0.393	22.47	-0.01
All clays	62	407	0.923	13.33	0.55

Alternatively, a variable N_{kt} factor can be estimated for the profile 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 N_{kt} estimate has a standard error of 2.4 N_k and correlation coefficient of 0.645.

The estimate based on B_q is presented as 's_u5' on the parameter plots and is only suitable for tests that have a high-quality pore pressure data, often indicated by a positive, repeatable, and dynamic response. For tests that have a reliable pore pressure response throughout, the evaluation on a point by point basis is warranted. For projects with variable response quality and with possible piezo desaturation (for example in the unsaturated zone or by dilation/cavitation) it is preferable to identify zones with reliable pore pressure response for representative soils and select a characteristic value of B_q for evaluation of N_{kt}. Lankelma are not always in view of the effort that has been made in preparation of the test location to maintain saturation of the piezo sensor.

Note: N_{kt} (with subscript 't') indicates a N_k factor that has been established using the corrected tip resistance q_t. N_{kt} can be applied to the uncorrected tip resistance q_c (non-piezocone tests) but results in a slightly lower estimate of s_u depending on the correction magnitude (q_c - q_t) in lower strength soils.

Undrained shear strengths corresponding to selected values of N_k are presented on the plots of Appendix D. *'s_u3'* on the logs (N_k = 15) has been included as a reference for comparison to traditional arbitrary N_k values of 15 and 20.

5.9 OVERCONSOLIDATION RATIO

The preconsolidation stress σ_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:

$$m' = 1 - \frac{0.28}{1 + \left(\frac{I_c}{2.65}\right)^{25}}$$

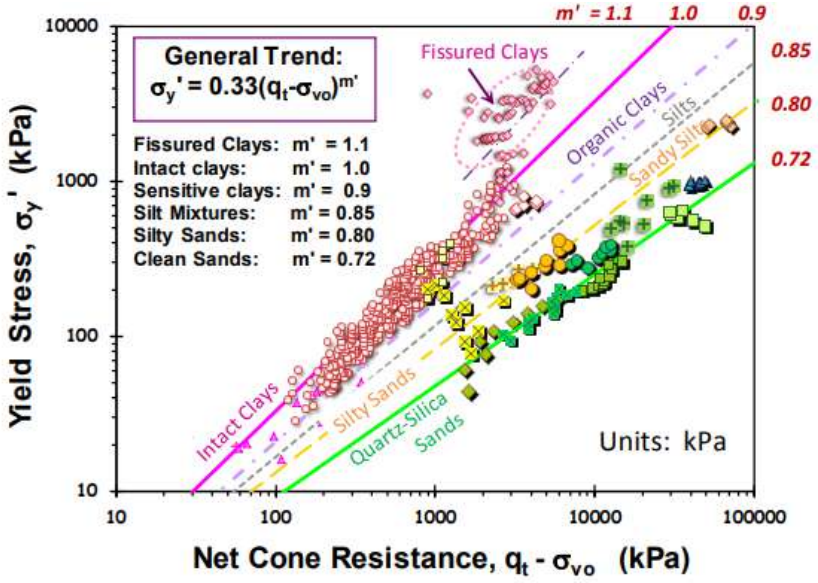

Figure 5-3 Preconsolidation stress with net cone resistance power law, reproduced from Mayne (2014).

An additional σ_p' and OCR was calculated for m' = 1.1 to reflect the upper trend for over consolidated fissured clays not captured by the soil behaviour type index I_c

5.10 SPT N60 VALUES

Equivalent SPT N60 values, defined as the non-normalised SPT blow count over a 30 cm interval, were derived for two correlations and are presented together in the results section for comparison.

Method 1 - Jefferies and Davies (1993) cited in Lunne *et al.* (1997)

$$N_{60} = \frac{q_t}{8.5 \cdot \sigma_{atm} \cdot \left(1 - \frac{I_c}{4.6}\right)}$$

Method 2 - Robertson (2012)

$$\frac{\left(\frac{q_t}{p_a}\right)}{N_{60}} = 10^{(1.268-0.2817I_c)}$$

The correlations are intended for clays, silts and sands and not for carbonates or cemented geo-materials.

The results are presented in Appendix D.

5.11 FRICTION ANGLE

Sands

The peak friction angle of granular materials was calculated using the Kulhawy and Mayne (1990) method and is an empirical relationship as a function of stress normalised cone tip resistance. The relationship is based on a calibration chamber database from 24 sands of varying mineralogy. The relationship has the form:

$$\phi' = 17.6 + 11.0 \cdot \log\left(q_{t1}\right)$$

Where:

ϕ' = Peak friction angle (degrees)

q_{t1} = stress normalised cone resistance =

$$\left(\frac{q_t}{\sigma_{atm}}\right) / \left(\frac{\sigma_{v0'}}{\sigma_{atm}}\right)^{0.5}$$

The presence of compressible minerals 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. High k_0 conditions also result in an overestimate of friction angle.

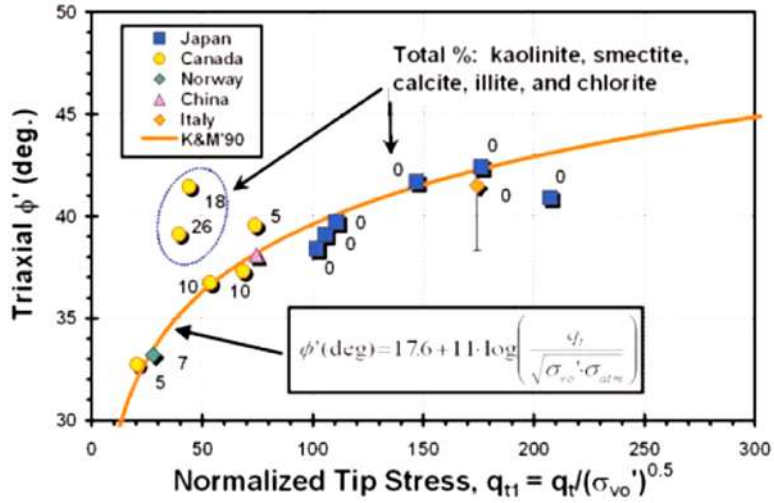

Figure 5-4 Peak triaxial friction angle from undisturbed sands with normalised cone resistance.

Fine grained soils

The effective friction angle for fine grained soils was calculated based on the Senneset *et al.* (1988, 1989) method by applying the approximate closed form solution by Mayne & Campanella (2005) as a direct function of the pore pressure parameter Bq and normalised tip resistance Q. The method is applicable where $0.1 < B_q < 1.0$ and $20° < \phi' < 45°$ and generally appropriate for non-cemented NC-LOC soils.

$$\phi' = 29.5° \, B_q^{0.121} [0.256 + 0.336 \, B_q + \log Q]$$

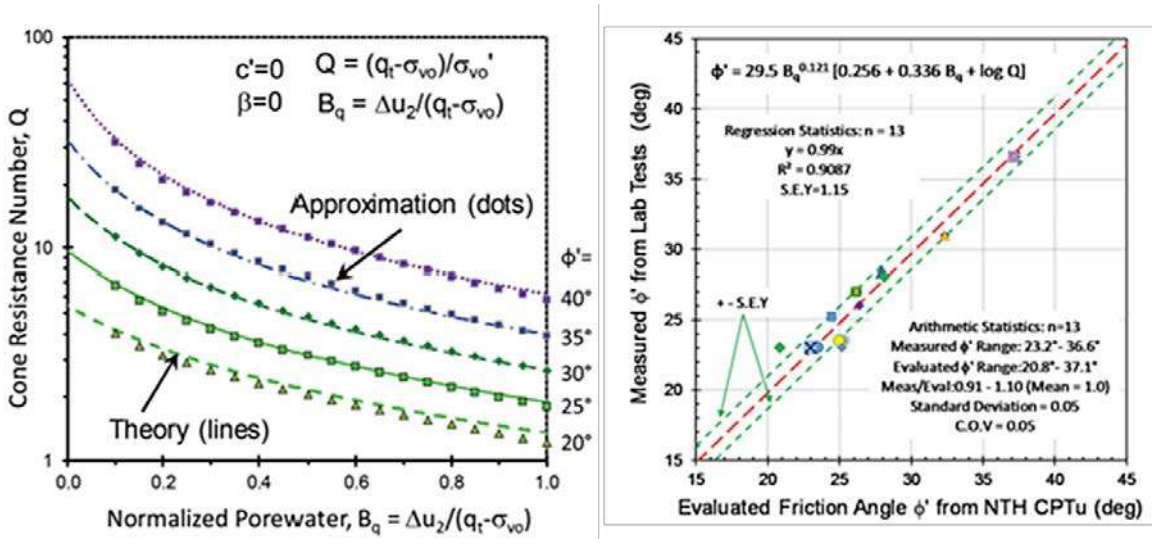

Figure 5-5 [Left] Theoretical curves with function approximation (dots) overlay [Right] calibration data from geotechnical centrifuge tests for a variety of soils. Redrawn from Ouyang & Mayne (2018).

The results are presented in Appendix E.

5.12 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) applicable to the present state of vertical effective stress up to the pre-consolidation stress.

$$m_v = \frac{1}{M}$$

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.

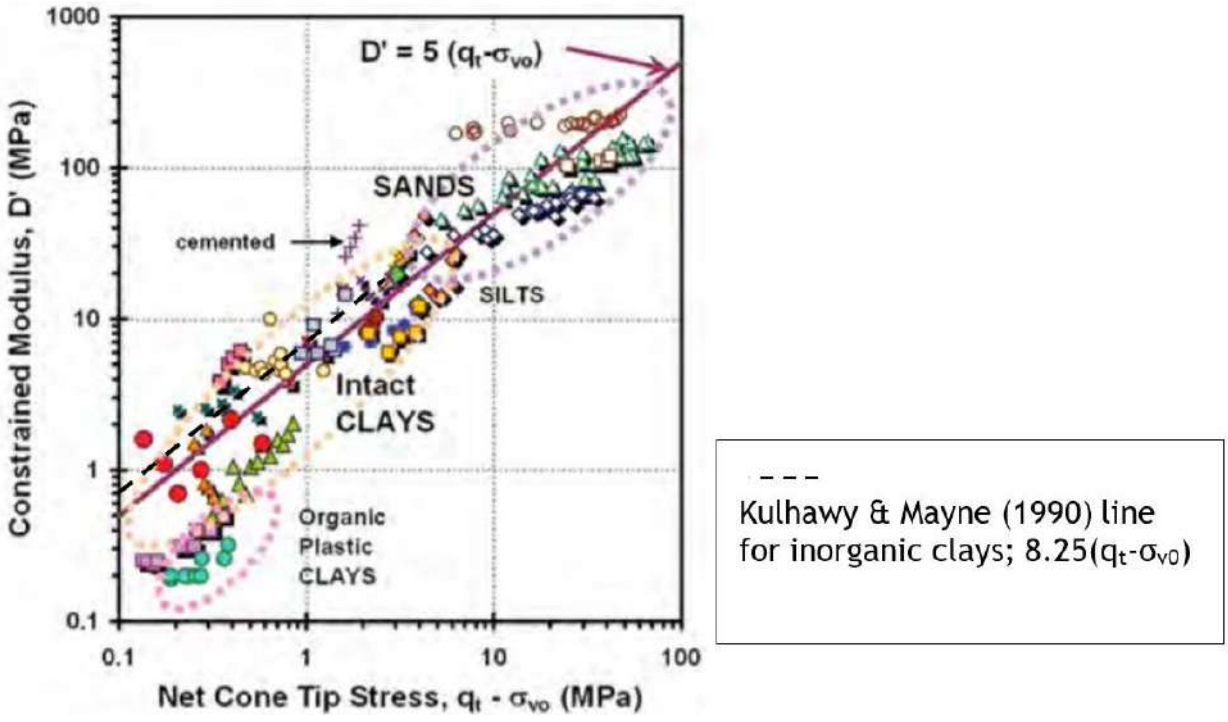

Figure 5-6 Constrained modulus of Mayne (2006). Annotated/redrawn from NCHRP Synthesis 368 (2007).

The results are presented in Appendix D.

5.13 YOUNG'S MODULUS

The Young's modulus at 25% mobilised shear strength (FOS = 4) was calculated according to the method proposed by Robertson (2009):

$E' = \alpha(q_t - \sigma_v)$
Where:

$\alpha = 0.015(10^{0.55Ic+1.68})$

The method described by Robertson may be adapted to estimate E' for loading at different percentages of yield stress.

The results are presented in Appendix E.

6 CPT 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 (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 during dilative shear at the cone shoulder. Dissipation tests that are undertaken following desaturation are likely to have a more pronounced initial rise and some degree of error will be present in the analysis.

If the system becomes desaturated it may or may not re-saturate at higher excess pressures later in the test. The pore pressure response in saturated contractive soils 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 than the equivalent corrected tip resistance depending on the magnitude of excess pore pressure generated during penetration.

CONE TIP AND SLEEVE OFFSET

The accuracy of the SBT over thin layers and at layer boundaries is sensitive to offset error in the friction ratio often resulting in sharp peaks or troughs at boundaries. The friction ratio is often inaccurate in heavily disturbed soils with a 'blocky' macro fabric. The last ~8 cm of data is also not included in the SBT material description as no friction sleeve measurements are recorded.

FRICTION SLEEVE DATA

There are two common causes of artificially low or negative friction sleeve measurement; 1) Sudden unequal pore pressure effects at strata boundaries often resulting in a negative spike and 2) very sensitive soils where the measured resistance falls to zero or lower due to instrument limitations or temperature effects. The latter can often be 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 the larger 15 cm^2 cone with 225 cm^2 friction sleeve area for improved sensitivity and penetration depth potential. Use of the 15 cm^2 cone will produce more pronounced transitions zones and thin layer effects (larger failure 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 (<~0.75 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).

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.

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APPENDICES

APPENDIX A SUMMARY TABLES

Table 1 CPT summary

Test ID	Final depth (mBGL)	**Cone ID {C=**Cone tip; **F=**Friction Sleeve**; I=** Inclination**; P =** Piezo**; S=**Subtraction cone**; 15/10 =** cone projected area (cm2))}	CPT rig	Pre-drilled / inspection pit (m)	Refusal factor	Dissipations	Seismic cone	Easting	Northing	Elevation (m)	Date of test	Remarks
CPT01	9.38	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT02	9.18	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT03	5.78	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT04	5.22	S15-CFIPT.1821	UK22		Sleeve load						30/06/2020	
CPT05	8.60	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT06	8.16	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT07	6.68	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT08	7.04	S15-CFIPT.1821	UK22		Sleeve load						30/06/2020	
CPT09	6.96	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT10	8.04	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT11	6.70	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	
CPT12	5.24	S15-CFIPT.1821	UK22		Sleeve load						30/06/2020	
CPT13	5.44	S15-CFIPT.1821	UK22		Sleeve load						30/06/2020	
CPT14	7.84	S15-CFIPT.1821	UK22		Lateral support						30/06/2020	

CPT test plots are presented in Appendix C.

APPENDIX B GENERAL INFORMATION

LIST OF FIGURES

Description	Pages included
Cone calibration certificate: S15-CFIP.1821	5
Data sheet: 18.0-tonne track-truck mounted CPT unit (UK22)	1
CPT soil behaviour type chart	1

CERTIFICATE OF CALIBRATION

Certificate Number: 1266

Cone Serial Number: DS15-CFIIPT.1821

Instrument:	**Digital-Geopoint-S15-150kN-5MPa**	**Location:**	**Lankelma Calibration Laboratory**
Serial number:	**DS15-CFIIPT.1821**	**Temperature (°C):**	**24.5**
Manufacturer:	**Geopoint**	**Temperature change (°C):**	**0.20**
Calibration standard:	**Conforms to ISO 376:2011 & ISO 22476-1:2012**	**Calibration engineer:**	**A Harman**
ISO 22476-1:2012 application class:	**Class 1**	**Calibration re-verification date:**	**01/08/2020 to 01/10/2020**
Date of calibration:	**01/06/2020**	**Calibration verification completed:**	**-**
Calibration expiry:	**01/10/2020**		

This calibration certificate is valid for 6 months, with a verification of the calibration being performed between 2 and 4 months from the date of calibration.

Calibration signed and dated by:	**Calibration checked and dated by:**	**Calibration verification signed and dated by:**
AN Harman	Ed Forder	

REFERENCE INSTRUMENTS	SERIAL NUMBER	UNCERTAINTY OF RECORDED VALUE	CALIBRATION DATE
AM DSCC-100kN Load Cell	51998	0.02%	12/07/2019
AM DSCCHA-5kN Load Cell	61065	0.05%	12/07/2019
Omega MMG750V	502273	0.01%	25/07/2019
Keithley 3706A Multimeter	4067652	24ppm	16/07/2019
STM Inclinometer	05-1810	0.05°	15/07/2019
Digitron 2024T Thermometer	5709263686	0.5°C	29/07/2019

The calibration tests were made in the Lankelma force standards machine. The applied forces of which are within an uncertainty of:
± 0.050 % of nominal value from 0.5kN up to 10kN, then 0.02% of nominal from 10kN up to 100kN.

MEASUREMENTS
1. The forces applied, and the resulting deflections are given in Tables 1. No corrections for temperature have been applied to these results.
2. The cone was loaded to full range 3 times for no less than 1 minute before calibration and after each rotation.
3. The cone was calibrated in low and high range using two reference load cells. The low range calibration consisted of a maximum load of 5kN with 4 sets of increasing forces and 2 sets of decreasing forces. The high range calibration consisted of a maximum load of 100kN with 3 sets of increasing forces and 2 sets of decreasing forces.
4. The difference in deflection for each applied force with rotation is the relative reproducibility error b, shown as a percentage of the recorded value and in units of pressure MPa. The uncertainty relating to the difference in deflection for increasing forces against degreasing forces is the reversibility uncertainty U_rev, shown as a percentage of the recorded value and in units of pressure MPa.
5. For each application of force, the coefficients of a linear and third order equation relating the estimate of the mean deflection as a function of the applied calibration force were calculated. Table 2.
6. The combined expanded uncertainty of deflection U for each force is shown as a percentage of the recorded value and in units of pressure MPa.
7. The coefficients of a third order equation relating a given applied force to the estimate of the mean deflection were also calculated. The coefficients are given in Table 3.
8. In use the forces acting on the sleeve load cell element are a combination of tip resistance and sleeve friction, with the tip resistance 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 4.
* The combined expanded uncertainties shown are to k=2 with a 95% coverage factor.

The calibration uncertainty is the uncertainty in the force value calculated from the interpolation equation at any deflection.

At each calibration point a combined standard uncertainty *uc* is calculated from the readings obtained during the calibration.

$$uc = \sqrt{\sum_{i=1}^{8} ui^2}$$

and

$$U = k \times uc$$

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 creep of the instrument.
u6 is the standard uncertainty associated with the drift in zero output.
u7 is the standard uncertainty associated with temperature of the instrument.
u8 is the standard uncertainty associated with interpolation best fit of the linear or 3rd order polynomial equation.

Symbols and their designations

Symbol	Designation
Ref LC	Reference load cell with calibration force in kN
cts	Counts. Base digital cone units.
0.1N	Interpolated digital cone units from counts
b	Relative reproducibility error
U_rev	Reversibility uncertainty
Uc	Combined standard uncertainty
Uc_sub	Combined standard uncertainty including sleeve subtraction
U	Combined expanded uncertainty
k=2	95% uncertainty coverage factor

LANKELMA

CERTIFICATE OF CALIBRATION

Certificate Number: 1266

Cone Serial Number: DS15-CFIIPT.1821

CONE END RESISTANCE CALIBRATION

Table 1-a.

Low range calibration									High range calibration							
	Tip change In output (cts)				Reproducibility error *b*		Reversibility error *U_rev*			Tip change in output (cts)			Reproducibility error *b*		Reversibility error *U_rev*	
Ref LC	1	2	3	4					Ref LC	1	2	3				
(kN)	0°	120°	240°	240°	MPa	%	MPa	%	(kN)	0°	120°	240°	MPa	%	MPa	%
0.100	1.124E+05	1.134E+05	1.139E+05	1.139E+05	0.001	1.32			5.000	5.833E+06	5.836E+06	5.835E+06	0.002	0.05		
0.500	5.790E+05	5.805E+05	5.795E+05	5.790E+05	0.001	0.26			10.000	1.167E+07	1.168E+07	1.168E+07	0.002	0.03		
1.000	1.165E+06	1.165E+06	1.165E+06	1.164E+06	0.000	0.04			15.000	1.752E+07	1.752E+07	1.752E+07	0.003	0.03		
1.500	1.749E+06	1.750E+06	1.749E+06	1.749E+06	0.001	0.06			20.000	2.336E+07	2.337E+07	2.336E+07	0.002	0.02		
2.000	2.334E+06	2.334E+06	2.334E+06	2.333E+06	0.000	0.03			30.000	3.506E+07	3.506E+07	3.506E+07	0.003	0.01		
2.500	2.918E+06	2.919E+06	2.919E+06	2.919E+06	0.001	0.04			40.000	4.674E+07	4.674E+07	4.674E+07	0.003	0.01		
3.000	3.503E+06	3.505E+06	3.504E+06	3.504E+06	0.001	0.04			50.000	5.841E+07	5.841E+07	5.842E+07	0.003	0.01		
3.500	4.089E+06	4.090E+06	4.090E+06	4.090E+06	0.001	0.03			60.000	7.007E+07	7.007E+07	7.007E+07	0.002	0.00		
4.000	4.675E+06	4.677E+06	4.677E+06	4.677E+06	0.001	0.05			80.000	9.334E+07	9.334E+07	9.334E+07	0.002	0.00		
5.000	5.845E+06	5.848E+06	5.847E+06	5.847E+06	0.002	0.05			100.000	1.165E+08	1.165E+08	1.165E+08	0.005	0.01		
4.000	4.676E+06	4.676E+06			0.000	0.01	0.000	0.00	80.000	9.340E+07	9.338E+07		0.010	0.02	-0.017	-0.03
3.500	4.089E+06	4.091E+06			0.001	0.06	0.000	-0.01	60.000	7.014E+07	7.013E+07		0.004	0.01	-0.021	-0.05
3.000	3.502E+06	3.505E+06			0.002	0.08	0.000	0.01	50.000	5.849E+07	5.849E+07		0.003	0.01	-0.026	-0.08
2.500	2.917E+06	2.919E+06			0.001	0.05	0.000	0.02	40.000	4.682E+07	4.683E+07		0.005	0.02	-0.028	-0.11
2.000	2.331E+06	2.333E+06			0.001	0.08	0.001	0.06	30.000	3.514E+07	3.514E+07		0.002	0.01	-0.027	-0.13
1.500	1.747E+06	1.747E+06			0.000	0.01	0.001	0.08	20.000	2.343E+07	2.343E+07		0.002	0.02	-0.023	-0.17
1.000	1.164E+06	1.164E+06			0.000	0.03	0.000	0.06	15.000	1.757E+07	1.758E+07		0.001	0.01	-0.018	-0.18
0.500	5.792E+05	5.790E+05			0.000	0.03	0.000	0.07	10.000	1.172E+07	1.172E+07		0.000	0.00	-0.014	-0.20
0.100	1.152E+05	1.149E+05			0.000	0.21	-0.001	-1.09	5.000	5.850E+06	5.849E+06		0.000	0.01	-0.005	-0.15

Table 2-a.

Low range calibration							
Reference output		Linear equation			3rd order equation		
Ref Load Cell Nom. (MPa)	Ref Load Cell (0.1N)	Cone output (0.1N)	Expanded uncertainty *U** MPa	%	Equation output (0.1N)	Expanded uncertainty *U** MPa	%
0.067	1000	970	0.004	6.02	1010	0.001	2.22
0.333	5000	4967	0.005	1.44	4995	0.001	0.31
0.667	10000	9981	0.003	0.49	9995	0.001	0.18
1.000	15000	14990	0.002	0.22	14991	0.002	0.20
1.333	20000	19998	0.002	0.16	19985	0.003	0.21
1.667	25000	25009	0.003	0.16	24982	0.003	0.20
2.000	30000	30023	0.004	0.20	29982	0.003	0.17
2.333	35000	35044	0.007	0.28	34990	0.003	0.15
2.667	40000	40066	0.010	0.38	39998	0.003	0.12
3.333	50000	50098	0.015	0.45	50003	0.007	0.21
2.667	40000	40065	0.009	0.34	39997	0.002	0.09
2.333	35000	35045	0.007	0.28	34991	0.003	0.11
2.000	30000	30019	0.003	0.16	29979	0.003	0.17
1.667	25000	25001	0.002	0.11	24974	0.004	0.23
1.333	20000	19978	0.003	0.25	19964	0.005	0.38
1.000	15000	14972	0.004	0.39	14973	0.004	0.37
0.667	10000	9972	0.004	0.59	9986	0.002	0.29
0.333	5000	4962	0.006	1.66	4990	0.002	0.46
0.067	1000	986	0.002	3.74	1025	0.003	5.09

High range calibration							
Reference output		Linear equation			3rd order equation		
Ref Load Cell Nom. (MPa)	Ref Load Cell (0.1N)	Cone output (0.1N)	Expanded uncertainty *U** MPa	%	Equation output (0.1N)	Expanded uncertainty *U** MPa	%
3.333	50000	49992	0.007	0.20	49897	0.015	0.45
6.667	100000	100036	0.011	0.16	99809	0.027	0.41
10.000	150000	150112	0.019	0.19	149760	0.034	0.34
13.333	200000	200190	0.029	0.22	199723	0.039	0.29
20.000	300000	300390	0.055	0.28	299736	0.039	0.19
26.667	400000	400502	0.071	0.27	399737	0.041	0.15
33.333	500000	500512	0.073	0.22	499735	0.044	0.13
40.000	600000	600418	0.064	0.16	599751	0.045	0.11
53.333	800000	799796	0.049	0.09	799803	0.048	0.09
66.667	1000000	998543	0.201	0.30	999977	0.050	0.07
53.333	800000	800219	0.049	0.09	800228	0.050	0.09
40.000	600000	600958	0.132	0.33	600292	0.049	0.12
33.333	500000	501182	0.159	0.48	500406	0.060	0.18
26.667	400000	401231	0.161	0.60	400466	0.066	0.25
20.000	300000	301086	0.145	0.73	300431	0.060	0.30
13.333	200000	200774	0.103	0.78	200306	0.043	0.32
10.000	150000	150581	0.077	0.77	150228	0.032	0.32
6.667	100000	100385	0.054	0.82	100157	0.022	0.34
3.333	50000	50122	0.018	0.55	50009	0.007	0.20

Table 3-a. Third order equation

For a given cone indicated output of D (0.1N units), the corrected applied force

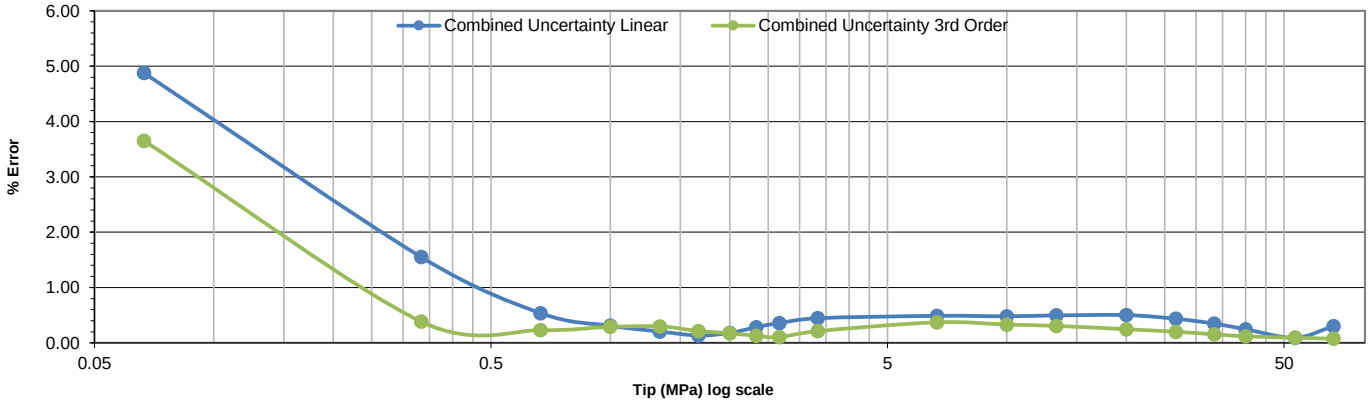
F (in 0.1N units) is calculated from :

$F = (a3 \times D^3) + (a2 \times D^2) + (a1 \times D) + a0$

a0	=	41.82403
a1	=	0.99724
a2	=	3.24754E-10
a3	=	3.84156E-15

Maximum tip zero drift during the calibration (MPa) =	0.000
Maximum load cell zero drift during the calibration (MPa) =	0.000
Factor used to convert from counts to 0.1N units =	0.0085684
Maximum tip full scale reading (MPa) =	100.00
Tip resolution (Pa) =	66.7
Tip area (cm²) =	15
Tip area ratio =	0.809

COMBINED EXPANDED UNCERTAINTY TIP



* The combined expanded uncertainties shown are to k=2 with a 95% coverage factor.

LANKELMA

CERTIFICATE OF CALIBRATION

Certificate Number: 1266

Cone Serial Number: DS15-CFIIPT.1821

SLEEVE FRICTION CALIBRATION

Table1-b.

Low range calibration									High range calibration							
	Sleeve change In output (cts)				Reproducibility error *b*		Reversibility error *U_rev*			Tip change in output (cts)			Reproducibility error *b*		Reversibility error *U_rev*	
Ref LC	1	2	3	4					Ref LC	1	2	3				
(kN)	0°	120°	240°	240°	kPa	%	kPa	%	(kN)	0°	120°	240°	kPa	%	kPa	%
0.100	1.204E+05	1.203E+05	1.201E+05	1.201E+05	0.010	0.23			5.000	6.027E+06	6.028E+06	6.027E+06	0.028	0.01		
0.500	6.034E+05	6.039E+05	6.036E+05	6.031E+05	0.017	0.08			10.000	1.205E+07	1.205E+07	1.205E+07	0.084	0.02		
1.000	1.208E+06	1.210E+06	1.208E+06	1.208E+06	0.054	0.12			15.000	1.808E+07	1.808E+07	1.808E+07	0.068	0.01		
1.500	1.813E+06	1.815E+06	1.814E+06	1.813E+06	0.051	0.08			20.000	2.411E+07	2.411E+07	2.410E+07	0.139	0.02		
2.000	2.418E+06	2.419E+06	2.418E+06	2.418E+06	0.029	0.03			30.000	3.616E+07	3.617E+07	3.616E+07	0.076	0.01		
2.500	3.022E+06	3.023E+06	3.023E+06	3.022E+06	0.017	0.02			40.000	4.821E+07	4.821E+07	4.821E+07	0.082	0.00		
3.000	3.626E+06	3.628E+06	3.627E+06	3.627E+06	0.048	0.04			50.000	6.025E+07	6.025E+07	6.025E+07	0.068	0.00		
3.500	4.232E+06	4.233E+06	4.232E+06	4.232E+06	0.040	0.03			60.000	7.228E+07	7.227E+07	7.227E+07	0.176	0.01		
4.000	4.836E+06	4.838E+06	4.837E+06	4.838E+06	0.054	0.03			80.000	9.628E+07	9.628E+07	9.628E+07	0.212	0.01		
5.000	6.044E+06	6.047E+06	6.046E+06	6.046E+06	0.080	0.04			100.000	1.202E+08	1.202E+08	1.202E+08	0.233	0.01		
4.000	4.835E+06	4.837E+06			0.058	0.03	0.022	0.01	80.000	9.634E+07	9.632E+07		0.828	0.02	-0.999	-0.03
3.500	4.229E+06	4.232E+06			0.094	0.06	0.041	0.03	60.000	7.234E+07	7.233E+07		0.378	0.01	-1.332	-0.05
3.000	3.623E+06	3.626E+06			0.125	0.09	0.052	0.04	50.000	6.033E+07	6.033E+07		0.344	0.02	-1.706	-0.08
2.500	3.018E+06	3.020E+06			0.093	0.08	0.071	0.06	40.000	4.830E+07	4.831E+07		0.310	0.02	-1.898	-0.11
2.000	2.412E+06	2.415E+06			0.097	0.11	0.098	0.11	30.000	3.625E+07	3.625E+07		0.057	0.00	-1.805	-0.14
1.500	1.809E+06	1.811E+06			0.057	0.09	0.093	0.14	20.000	2.418E+07	2.418E+07		0.046	0.01	-1.539	-0.17
1.000	1.206E+06	1.206E+06			0.005	0.01	0.069	0.15	15.000	1.814E+07	1.814E+07		0.002	0.00	-1.264	-0.19
0.500	6.014E+05	6.017E+05			0.012	0.06	0.045	0.20	10.000	1.209E+07	1.209E+07		0.016	0.00	-0.896	-0.20
0.100	1.208E+05	1.210E+05			0.008	0.18	-0.012	-0.27	5.000	6.044E+06	6.044E+06		0.017	0.01	-0.340	-0.15

Table 2-b.

Low range calibration							
Reference output		Linear factor output			3rd order equation		
Ref Load Cell Nom. (kPa)	Ref Load Cell (0.1N)	Cone output (0.1N)	Expanded uncertainty *U** kPa	%	Equation output (0.1N)	Expanded uncertainty *U** kPa	%
4	1000	999	0.016	0.36	997	0.028	0.62
22	5000	5015	0.142	0.64	4992	0.088	0.40
44	10000	10041	0.378	0.85	10003	0.088	0.20
67	15000	15070	0.631	0.95	15016	0.186	0.28
89	20000	20091	0.821	0.92	20022	0.242	0.27
111	25000	25112	1.004	0.90	25027	0.288	0.26
133	30000	30132	1.188	0.89	30033	0.338	0.25
156	35000	35163	1.466	0.94	35049	0.481	0.31
178	40000	40186	1.668	0.94	40057	0.546	0.31
222	50000	50226	2.058	0.93	50068	0.747	0.34
178	40000	40177	1.582	0.89	40048	0.453	0.25
156	35000	35148	1.325	0.85	35034	0.335	0.22
133	30000	30113	1.010	0.76	30013	0.182	0.14
111	25000	25083	0.750	0.67	24999	0.136	0.12
89	20000	20053	0.488	0.55	19983	0.205	0.23
67	15000	15035	0.324	0.49	14981	0.190	0.29
44	10000	10017	0.162	0.36	9978	0.200	0.45
22	5000	4998	0.062	0.28	4974	0.235	1.06
4	1000	1004	0.048	1.07	994	0.063	1.42

High range calibration							
Reference output		Linear factor output			3rd order equation		
Ref Load Cell Nom. (kPa)	Ref Load Cell (0.1N)	Cone output (0.1N)	Expanded uncertainty *U** kPa	%	Equation output (0.1N)	Expanded uncertainty *U** kPa	%
222	50000	50077	0.800	0.36	49919	0.835	0.38
444	100000	100127	1.283	0.29	99830	1.634	0.18
667	150000	150198	1.918	0.29	149776	2.133	0.16
889	200000	200271	2.558	0.29	199737	2.487	0.14
1333	300000	300445	4.106	0.31	299741	2.545	0.10
1778	400000	400536	4.966	0.28	399745	2.657	0.07
2222	500000	500537	5.072	0.23	499756	2.766	0.06
2667	600000	600442	4.431	0.17	599783	2.810	0.05
3556	800000	799876	2.931	0.08	799857	2.999	0.04
4444	1000000	998751	11.586	0.26	999994	3.307	0.04
3556	800000	800278	3.651	0.10	800260	3.548	0.05
2667	600000	600972	8.863	0.33	600314	3.426	0.06
2222	500000	501207	10.860	0.49	500426	4.145	0.09
1778	400000	401280	11.471	0.65	400489	4.574	0.13
1333	300000	301154	10.318	0.77	300449	4.143	0.16
889	200000	200880	7.860	0.88	200345	3.162	0.18
667	150000	150689	6.159	0.92	150265	2.443	0.18
444	100000	100476	4.259	0.96	100178	1.664	0.19
222	50000	50210	1.916	0.86	50052	0.623	0.14

Table 3-b. Third order equation

For a given cone indicated output of D (0.1N units), the corrected applied force

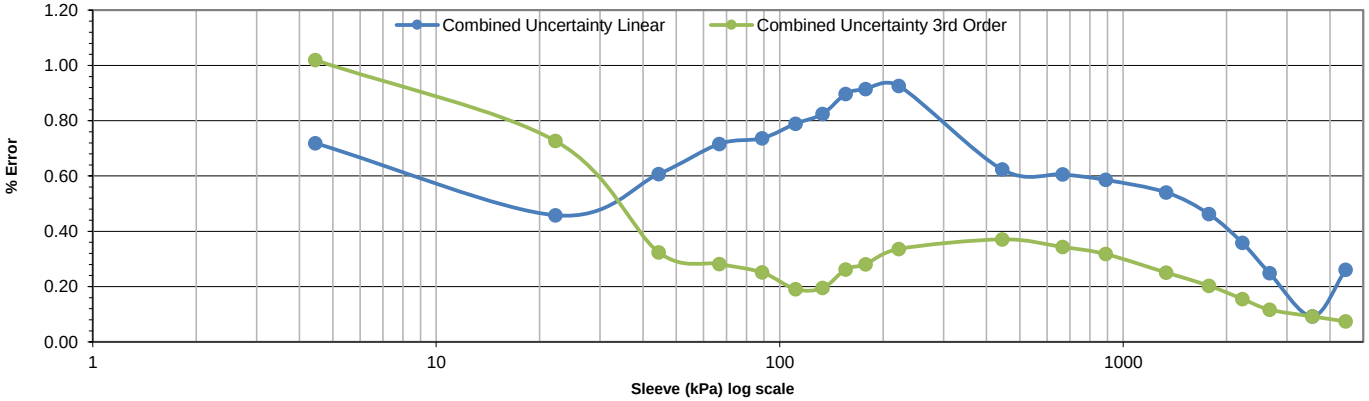
F (in 0.1N units) is calculated from :

$F = (a3 \times D^3) + (a2 \times D^2) + (a1 \times D) + a0$

a0	=	-7.74889
a1	=	0.99690
a2	=	1.83968E-09
a3	=	2.51838E-15

Maximum sleeve zero drift during the calibration (kPa) =	0.066
Maximum load cell zero drift during the calibration (kPa) =	0.006
Factor used to convert from counts to 0.1N units =	0.0083078
Physical strength limited maximum sleeve reading (MPa) =	1.333
Sleeve resolution (Pa) =	4.4
Sleeve area (cm²) =	225
Sleeve area ratio =	1.000

COMBINED EXPANDED UNCERTAINTY SLEEVE



* The combined expanded uncertainties shown are to k=2 with a 95% coverage factor.

Table 4-b Sleeve friction - tip subtraction combined standard uncertainty Uc_sub

Tip MPa	Sleeve linear equation subtraction error (%) Sleeve kPa → 4	22	44	67	111	156	222	667
0.07	3.2	0.8	0.6	0.5	0.5	0.5	0.5	0.3
0.33	5.4	1.2	0.8	0.7	0.6	0.6	0.6	0.3
0.67	6.1	1.4	0.9	0.7	0.6	0.6	0.6	0.3
1.00	8.0	1.8	1.1	0.9	0.7	0.7	0.6	0.3
1.67	11.9	2.5	1.5	1.1	0.9	0.8	0.7	0.4
2.33	21.0	4.4	2.4	1.7	1.2	1.0	0.9	0.4
3.33	34.6	7.1	3.7	2.6	1.8	1.4	1.1	0.5
10.00	81.8	16.5	8.4	5.8	3.7	2.8	2.1	0.7
13.33	108.6	21.9	11.1	10.8	4.7	3.5	3.6	1.1

Tip MPa	Sleeve 3rd order equation subtraction error (%) Sleeve kPa → 4	22	44	67	111	156	222	667
0.07	2.8	0.8	0.4	0.3	0.2	0.2	0.2	0.2
0.33	3.3	0.9	0.4	0.3	0.2	0.2	0.2	0.2
0.67	3.3	0.9	0.4	0.3	0.2	0.2	0.2	0.2
1.00	4.8	1.2	0.6	0.4	0.3	0.3	0.3	0.2
1.67	5.6	1.4	0.7	0.5	0.3	0.3	0.3	0.2
2.33	7.3	1.7	0.8	0.6	0.4	0.3	0.3	0.2
3.33	14.2	3.1	1.5	1.1	0.6	0.5	0.4	0.3
10.00	51.0	10.5	5.2	3.5	2.1	1.6	1.2	0.5
13.33	62.9	12.8	6.4	5.1	2.6	1.9	1.4	0.6

PORE PRESSURE CALIBRATION

Table1-c.

Ref PR (kPa)	PWP change in output (cts) 1 0°	2 120°	3 240°	Reproducibility error *b* kPa	%	Reversibility error *U_rev* kPa	%
100	4.450E+07	4.453E+07	4.469E+07	0.4	0.43		
200	8.919E+07	8.919E+07	8.923E+07	0.1	0.04		
400	1.781E+08	1.783E+08	1.783E+08	0.4	0.11		
600	2.671E+08	2.671E+08	2.671E+08	0.1	0.02		
800	3.557E+08	3.558E+08	3.559E+08	0.6	0.07		
1000	4.443E+08	4.443E+08	4.445E+08	0.5	0.05		
1500	6.649E+08	6.650E+08	6.651E+08	0.5	0.03		
2000	8.844E+08	8.844E+08	8.847E+08	0.7	0.03		
2500	1.102E+09	1.102E+09	1.102E+09	1.9	0.08		
3000	1.318E+09	1.319E+09	1.319E+09	0.6	0.02		
2500	1.103E+09	1.103E+09		1.8	0.07	-0.9	-0.04
2000	8.849E+08	8.852E+08		0.7	0.04	-0.9	-0.04
1500	6.651E+08	6.652E+08		0.3	0.02	-0.3	-0.02
1000	4.447E+08	4.445E+08		0.6	0.06	-0.4	-0.04
800	3.560E+08	3.560E+08		0.0	0.00	-0.4	-0.05
600	2.672E+08	2.671E+08		0.3	0.05	-0.1	-0.02
400	1.783E+08	1.783E+08		0.1	0.03	-0.1	-0.02
200	8.919E+07	8.930E+07		0.2	0.12	-0.1	-0.04
100	4.450E+07	4.465E+07		0.3	0.32	-0.1	-0.07

Table 2-c.

Reference output: Ref Pressure (kPa)	Ref Pressure (0.1Pa)	Linear factor output: Cone output (0.1Pa)	Expanded uncertainty *U** kPa	%	3rd order equation: Equation output (0.1N)	Expanded uncertainty *U** kPa	%
100	1000000	1013041	2.565	2.56	999526	0.315	0.31
200	2000000	2027225	5.538	2.77	2000463	0.205	0.10
400	4000000	4051437	10.342	2.59	4000716	0.408	0.10
600	6000000	6069836	14.120	2.35	5998686	0.462	0.08
800	8000000	8085815	17.377	2.17	7997917	0.762	0.10
1000	10000000	10099187	19.908	1.99	9998411	0.780	0.08
1500	15000000	15113052	22.582	1.51	14998258	0.988	0.07
2000	20000000	20100741	20.199	1.01	20000050	1.355	0.07
2500	25000000	25044605	9.378	0.38	24988553	2.999	0.12
3000	30000000	29967157	7.020	0.23	29988881	3.052	0.10
2500	25000000	25065005	12.769	0.51	25009205	2.734	0.11
2000	20000000	20113790	21.492	1.07	20013175	2.976	0.15
1500	15000000	15116868	23.719	1.58	15002074	0.992	0.07
1000	10000000	10103758	20.799	2.08	10002958	0.955	0.10
800	8000000	8090421	18.056	2.26	8002489	0.728	0.09
600	6000000	6071708	14.968	2.49	6000541	0.439	0.07
400	4000000	4052311	10.172	2.54	4001580	0.425	0.11
200	2000000	2028193	5.766	2.88	2001419	0.376	0.19
100	1000000	1013012	2.747	2.75	999985	0.264	0.26

Table 3-c. Third order equation

For a given cone indicated output of D (0.1N units), the corrected applied force

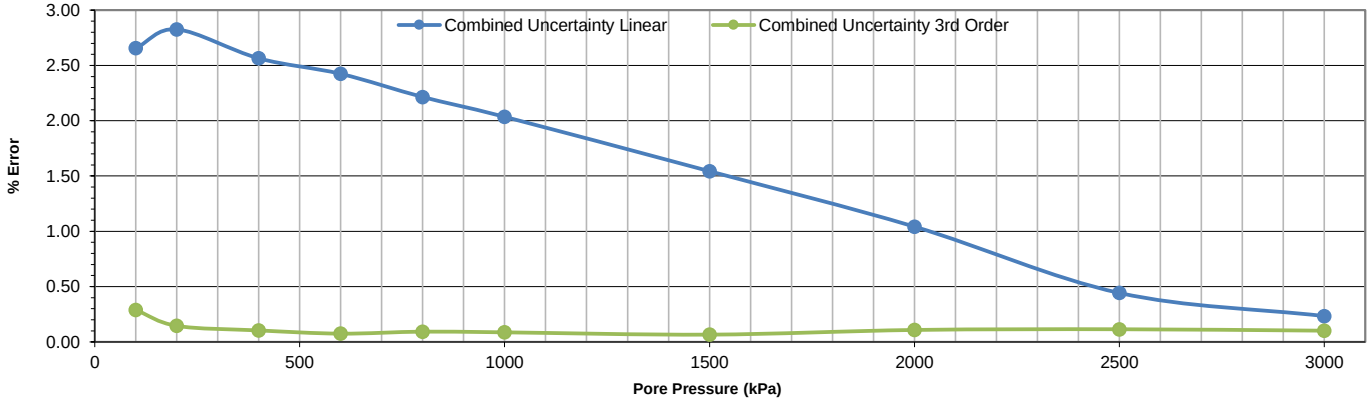
F (in 0.1N units) is calculated from :

$F = (a3 \times D^3) + (a2 \times D^2) + (a1 \times D) + a0$

a0	=	509.69670
a1	=	0.98577
a2	=	3.73690E-10
a3	=	4.16118E-18

Maximum PWP zero drift during the calibration (kPa) =	0.05
Maximum reference zero drift during the calibration (kPa) =	0.013
Factor used to convert from counts to 0.1Pa units =	0.0227264
Maximum PWP full scale reading (kPa) =	5000
PWP resolution (Pa) =	0.1

COMBINED EXPANDED UNCERTAINTY PORE PRESSURE



* The combined expanded uncertainties shown are to k=2 with a 95% coverage factor.

LANKELMA

CERTIFICATE OF CALIBRATION

Certificate Number: 1266

Cone Serial Number: DS15-CFIIPT.1821

INCLINATION CALIBRATION

Ref Inclination (°C)	Cone inclination output X Inc (cts)	Y Inc (cts)
-25	-26421	-24212
0	-1197	2167
25	23588	28283

Ref Inclination (°)	Cone inclination output X Inc (°)	Y Inc (°)
-25	-25.2	-25.1
0	0.0	0.0
25	24.8	24.9

	X inc	Y inc
Factor used to convert from counts to 0.1m° units =	9.99794351	9.52463695
Inclination error (°) =	0.2	0.1

TEMPERATURE CALIBRATION

Recorded temp (°C)	Cone output (cts)
6.77	-219638226
10.53	-172668181
17.38	-84898258
20.05	-50836859
24.83	10859085

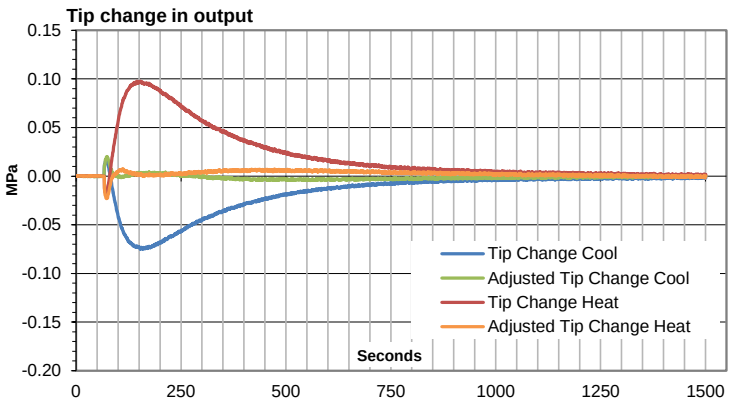
Recorded temp (°C)	Cone output (°C)
6.77	6.82
10.53	10.49
17.38	17.36
20.05	20.03
24.83	24.86

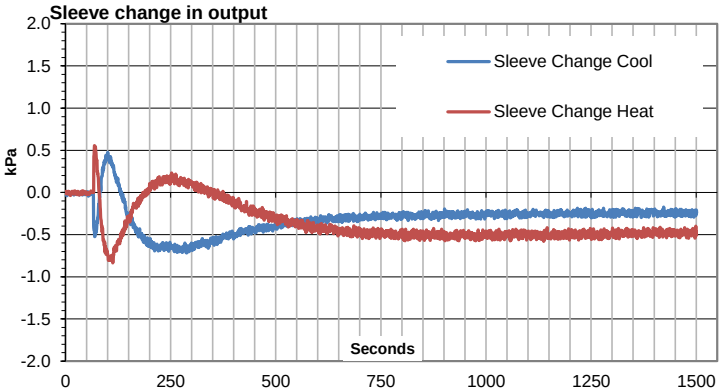
Factor used to convert from counts to 0.00001°C units =	0.00078272
Temperature error (°C) =	0.04

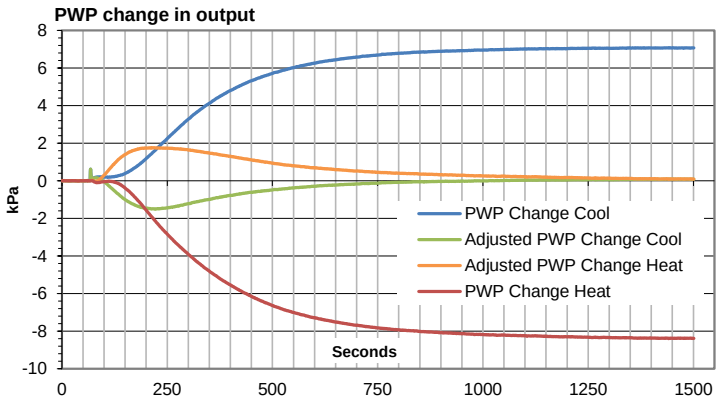
CONE TEMPERATURE EFFECT

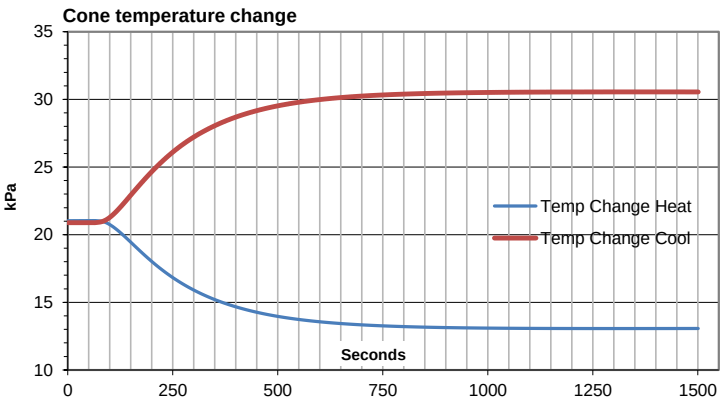
	Cooling	Heating
Start temperature =	21.04	20.89
End temperature =	13.06	30.55
Temperature change =	-7.98	9.67

	Cooling	Heating
Tip maximum rate of change (MPa/°C/min) =	0.042	0.045
Tip end change (MPa/°C) =	0.000	0.000
Adjusted tip end change (MPa/°C) =	0.000	0.000
Sleeve maximum rate of change (kPa/°C/min) =	3.04	2.84
Sleeve end change (kPa/°C) =	0.04	0.04
Adjusted sleeve end change (kPa/°C) =		
PWP end change (kPa/°C) =	0.89	0.87
Adjusted PWP end change (kPa/°C) =	0.00	0.00









UK22
Track-truck

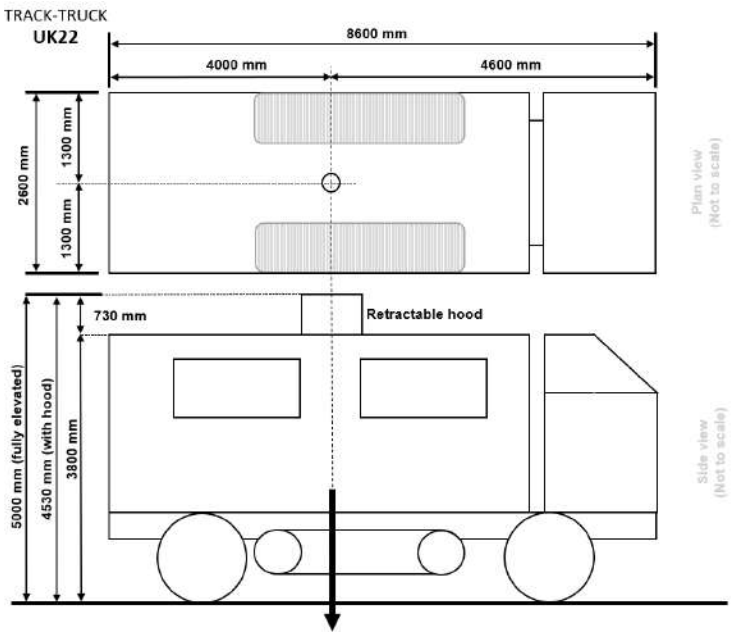


Rig weight	18 T
Max. operating ram capacity	200 kN
Max. travelling speed	4 km/h (tracking)
Track material	Composite
Track length	2800 mm
Track width	650 mm
Jack plate dimensions	Tracks act as jacks
Jack arrangements	1nr. on each side
Max. ground bearing pressure	76 kPa
Max. testing gradient	10 degrees
Max. traversing gradient	30 degrees (operator assessed)
Clamp arrangement	Automatic hydraulic
Ram stroke	1250 mm
Max. casing size	55 mm
Typical production	100 m+ of standard CPTu testing per day (depending on conditions and access)

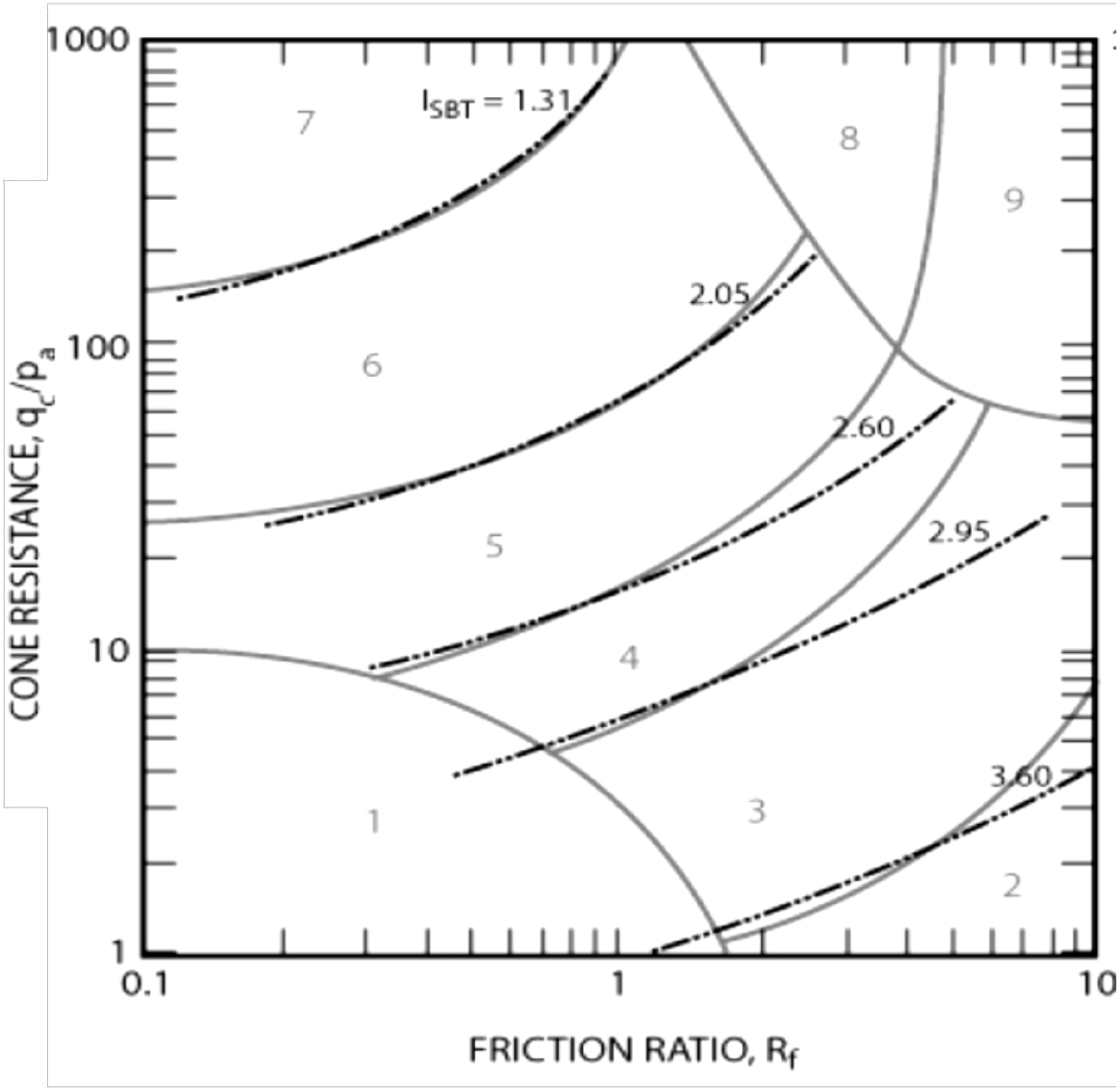
The versatile track-truck is suitable for most geotechnical sites. The rig is driven to site as a self-contained HGV with composite tracks that can be deployed to cope with soft or uneven terrain.

Remote-controlled tracking to assist with manoeuvring onto location.

Complies with Euro 6 emission standards for use in London's low emissions zones (LEZ).



CPT SOIL BEHAVIOUR TYPE CHART



Non-normalised SBT chart by Robertson *et al.* (2010) based on dimensionless cone resistance (qc/Pa) and friction ration, Rf, showing contours of *Ic* index. The chart is also applicable to normalised tip/sleeve values Q_t and F_r.

Zone	Soil Behaviour Type (SBT)		
1	Sensitive fine-grained	6	Sands: clean sand to sandy silt
2	Clay – organic soil	7	Dense sand to gravelly sand
3	Clays: Clay to silty clay	8	Stiff sand to clayey sand*
4	Silt mixtures: clayey silt to silty clay	9	Stiff fine grained*
5	Sand mixtures: Silty sand to sandy silt	*Heavily overconsolidated or cemented	

APPENDIX C CONE PENETRATION TEST RESULTS

RAW DATA PLOTS

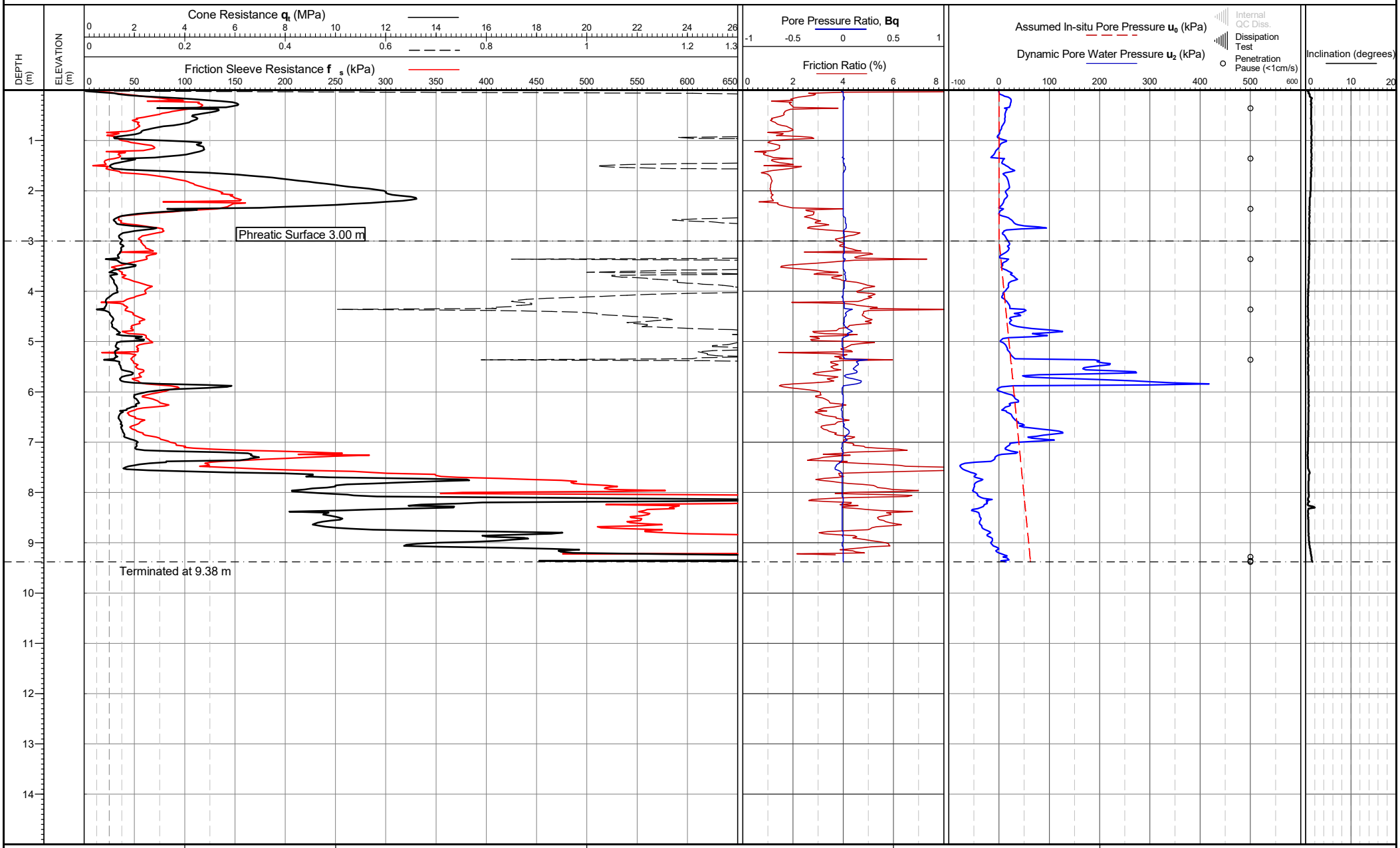
LIST OF FIGURES:

Location ID	Pages included
CPT01	1
CPT02	1
CPT03	1
CPT04	1
CPT05	1
CPT06	1
CPT07	1
CPT08	1
CPT09	1
CPT10	1
CPT11	1
CPT12	1
CPT13	1
CPT14	1

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



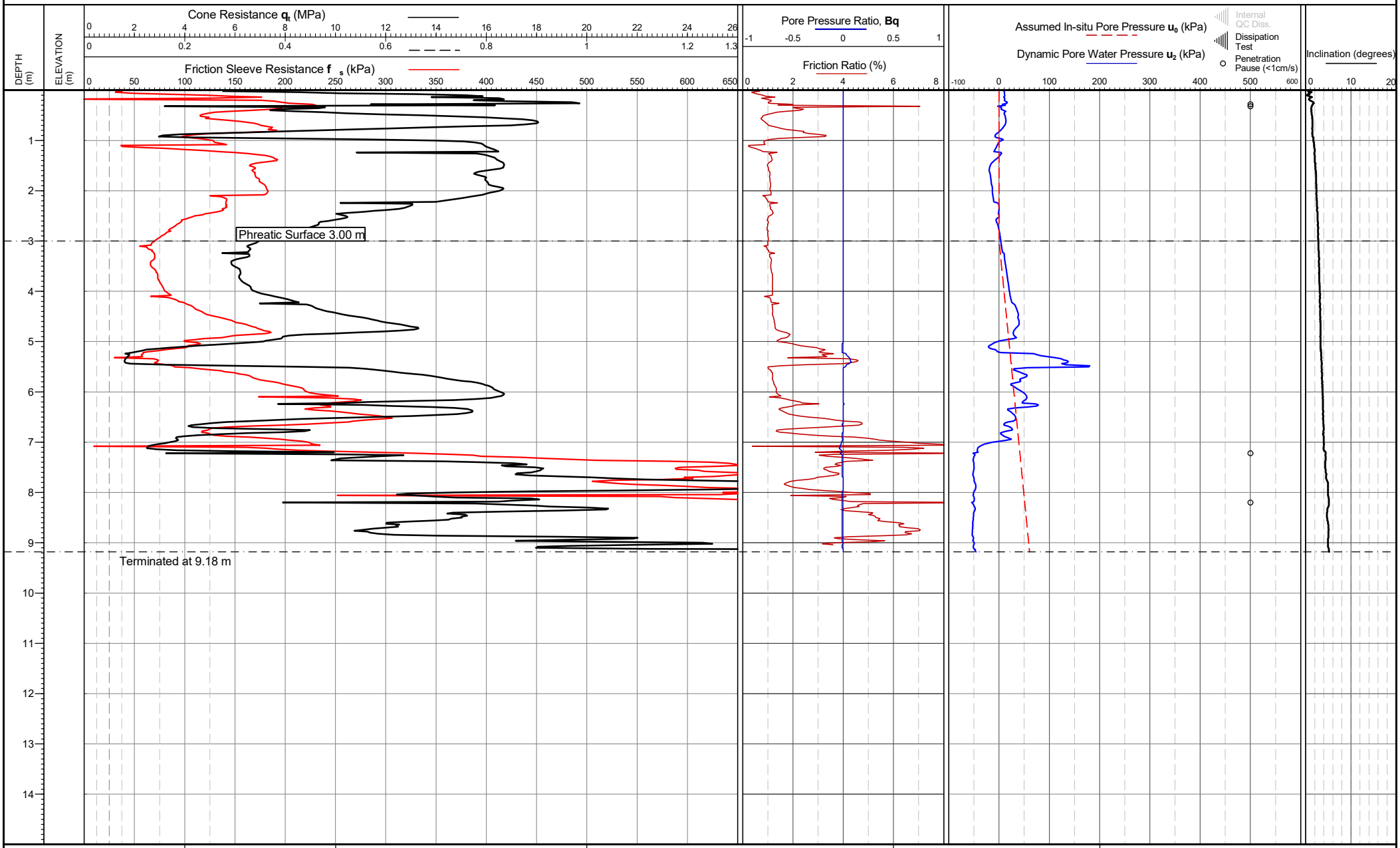
Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Phillip Case Rig Used: UK22 Date of test: 30/06/2020 08:28:00	Zero drift (Pre/post test) q_c (kPa): -12.6 f_s (kPa): -0.2 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): -5.3	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT01

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

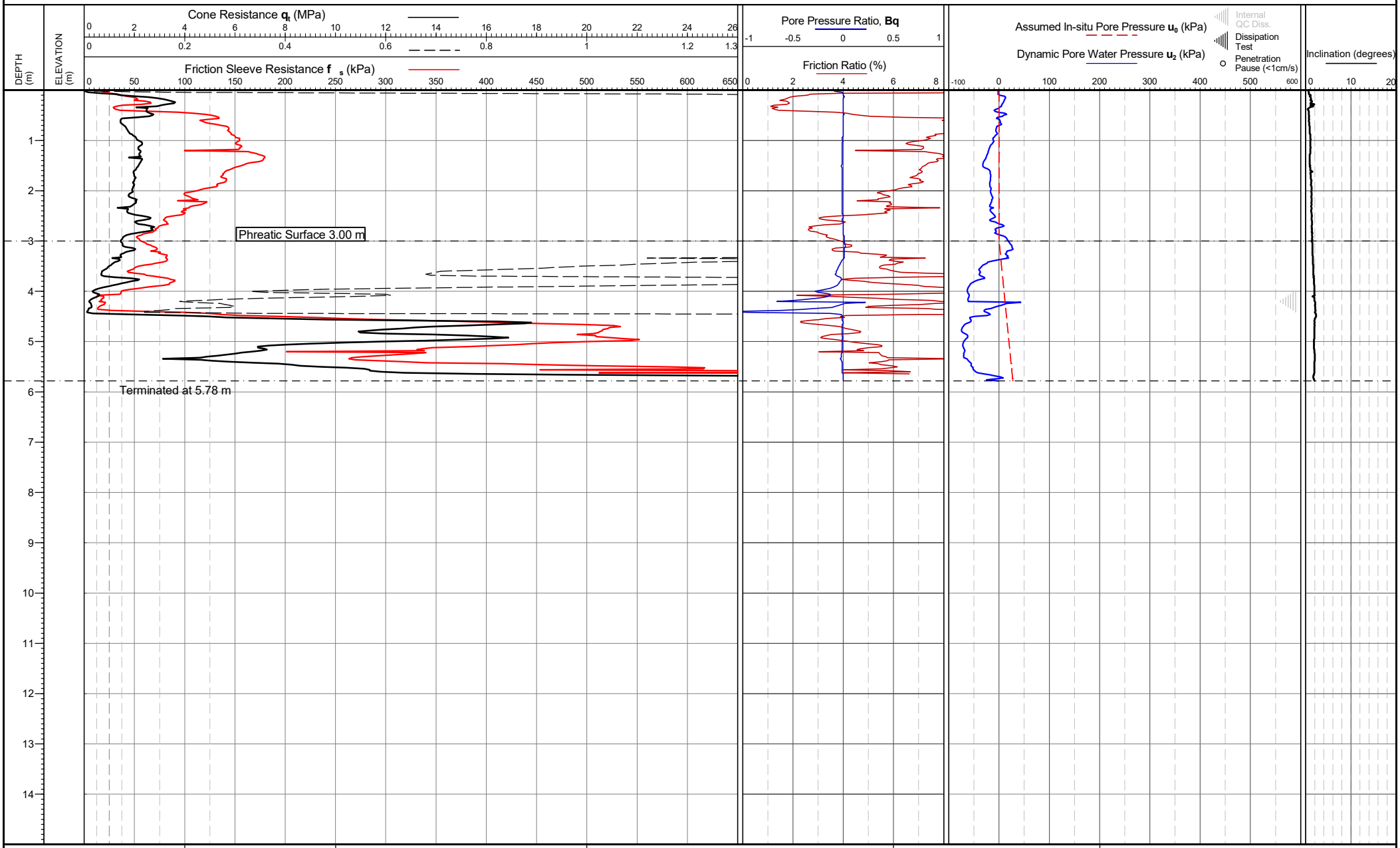


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 15:42:00	Zero drift (Pre/post test) q_c (kPa): -21.4 f_s (kPa): -2.2 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): 0.9	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT02

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



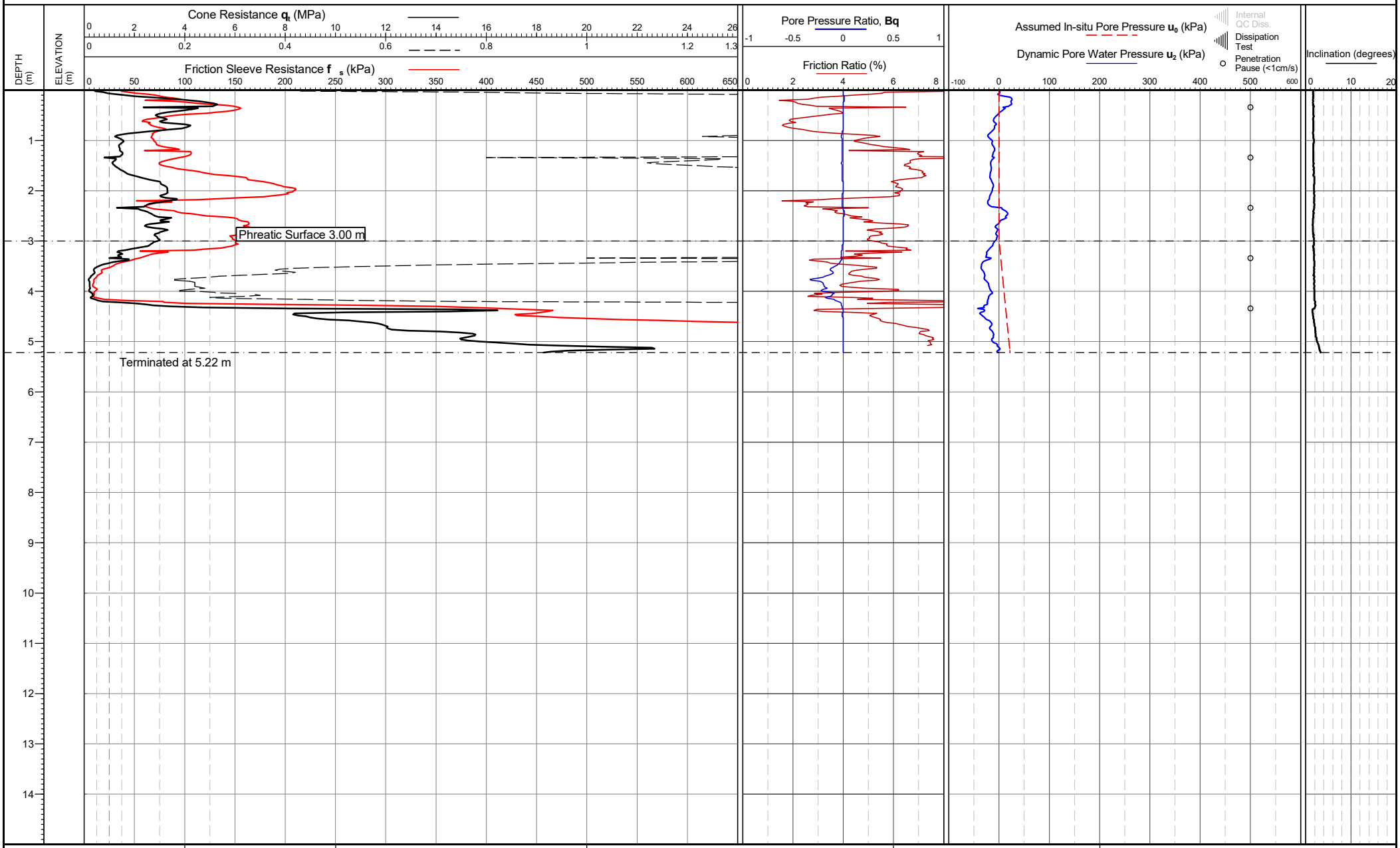
Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 12:58:00	Zero drift (Pre/post test) q_c (kPa): -2.4 f_s (kPa): 3.0 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): 1.7	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT03

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



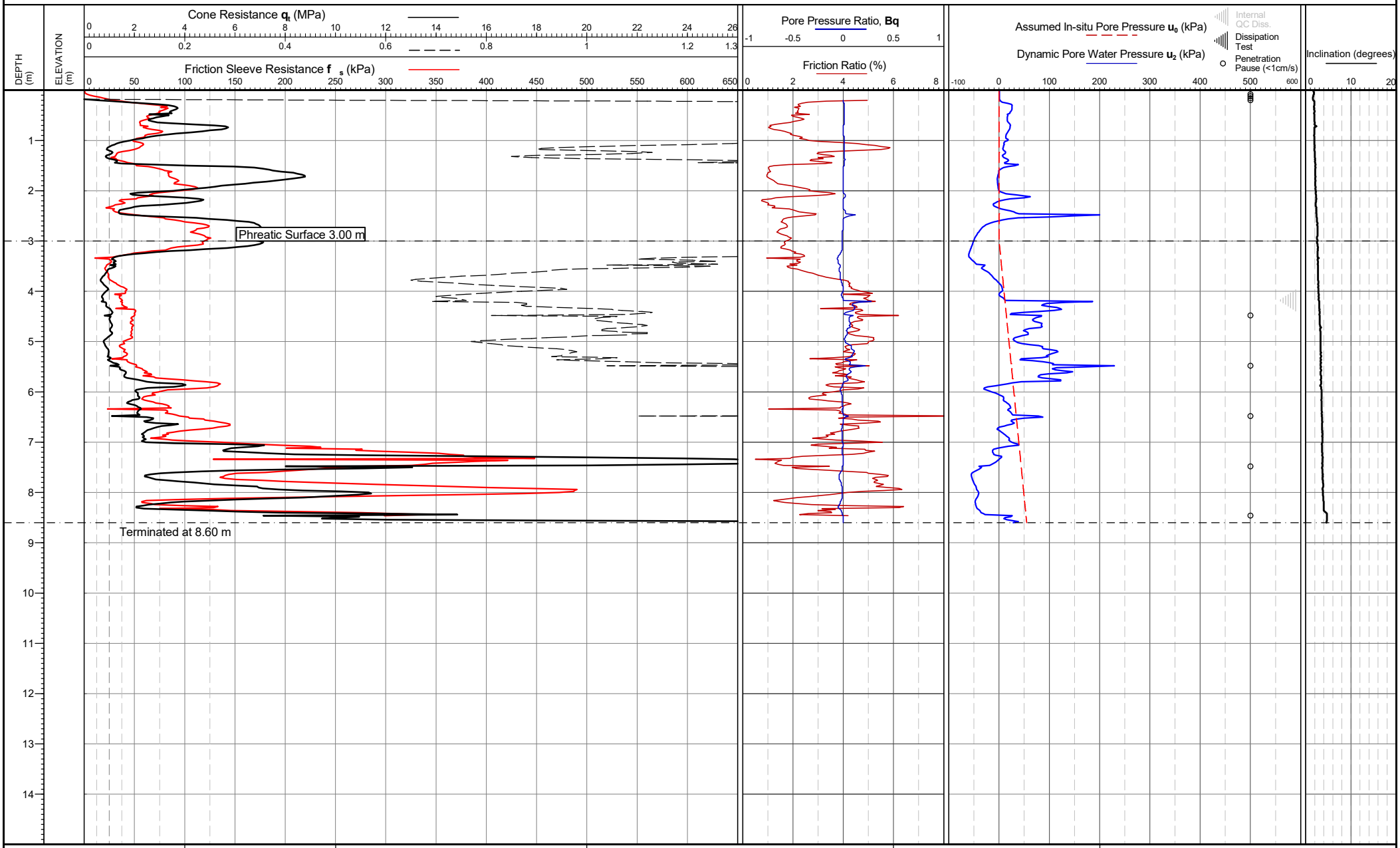
Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 12:35:00	Zero drift (Pre/post test) q_c (kPa): -12.4 f_s (kPa): 1.8 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): 4.5	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Sleeve load	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT04

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



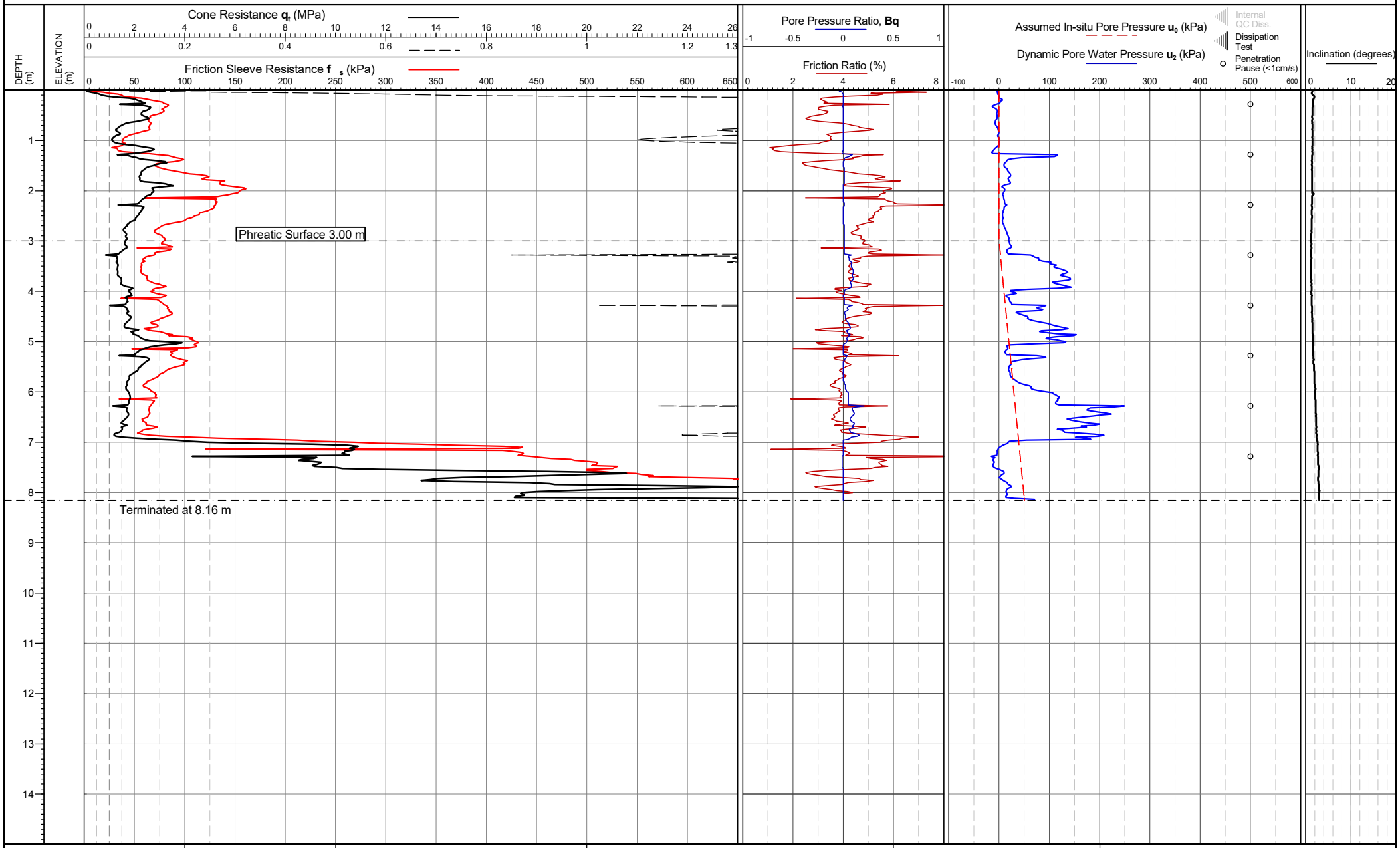
Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 10:03:00	Zero drift (Pre/post test) q_c (kPa): 29.0 f_s (kPa): 1.5 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): 5.0	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT05

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

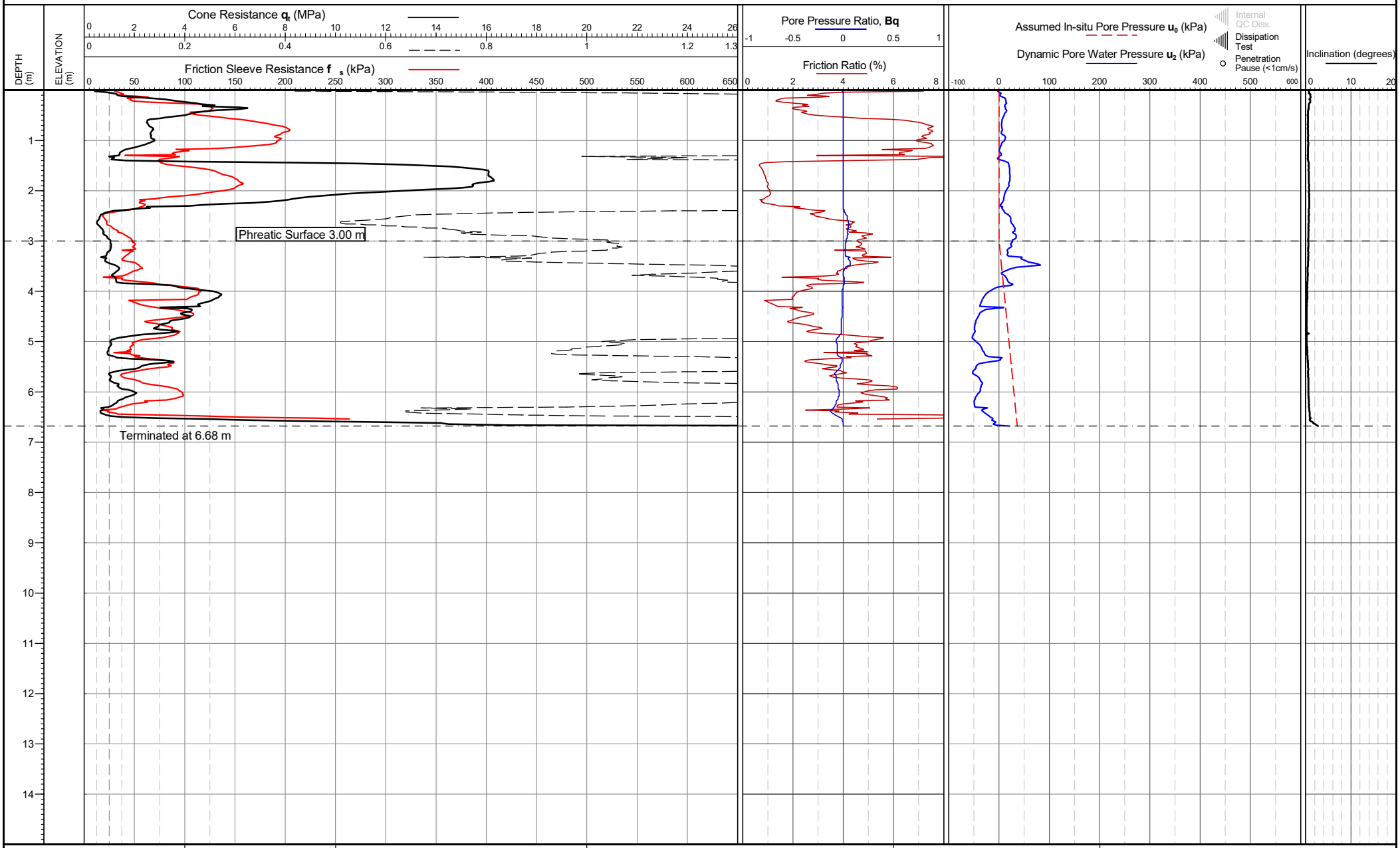


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 13:31:00	Zero drift (Pre/post test) q_c (kPa): 3.0 f_s (kPa): -3.9 ($f_{s\ drift}$ - $q_{c\ drift}$) U_2 (kPa): -2.7	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT06

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

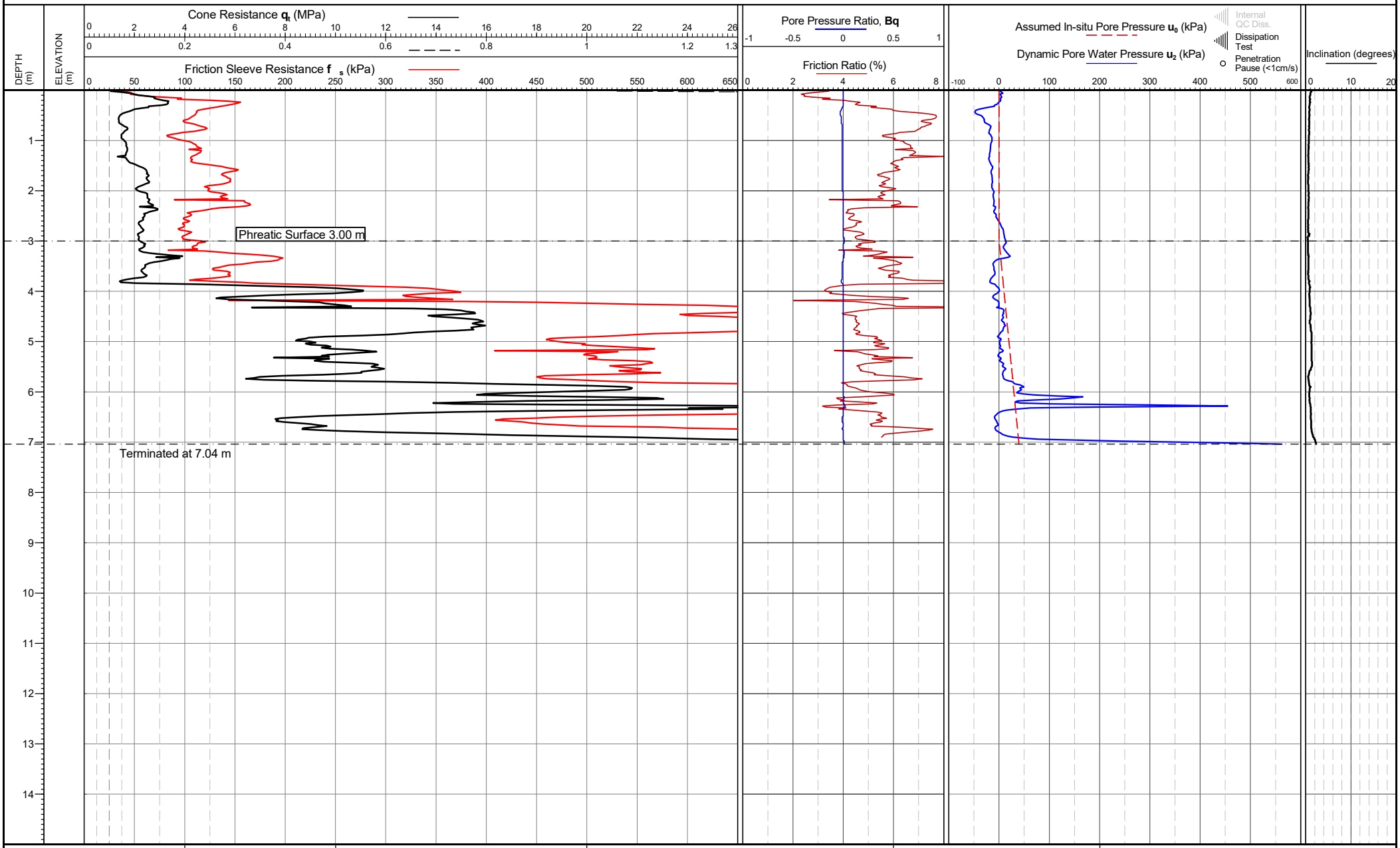


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 14:00:00	Zero drift (Pre/post test) q_c (kPa): 18.6 f_s (kPa): 3.9 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): 2.3	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT07

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

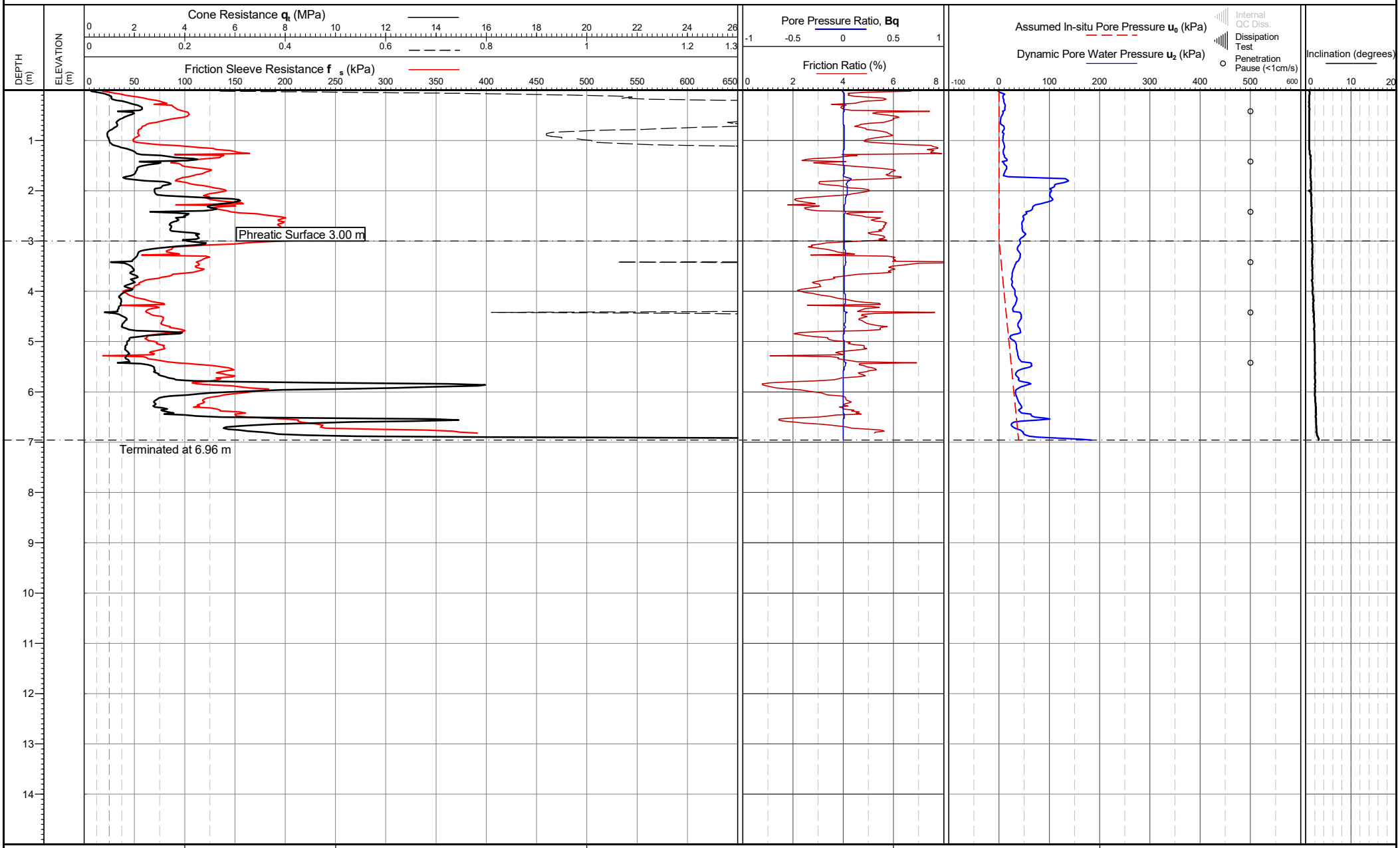


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 12:12:00	Zero drift (Pre/post test) q_c (kPa): -28.4 f_s (kPa): -3.2 ($f_{s\ drift}$ - $q_{c\ drift}$) U_2 (kPa): -6.1	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Sleeve load	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT08

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

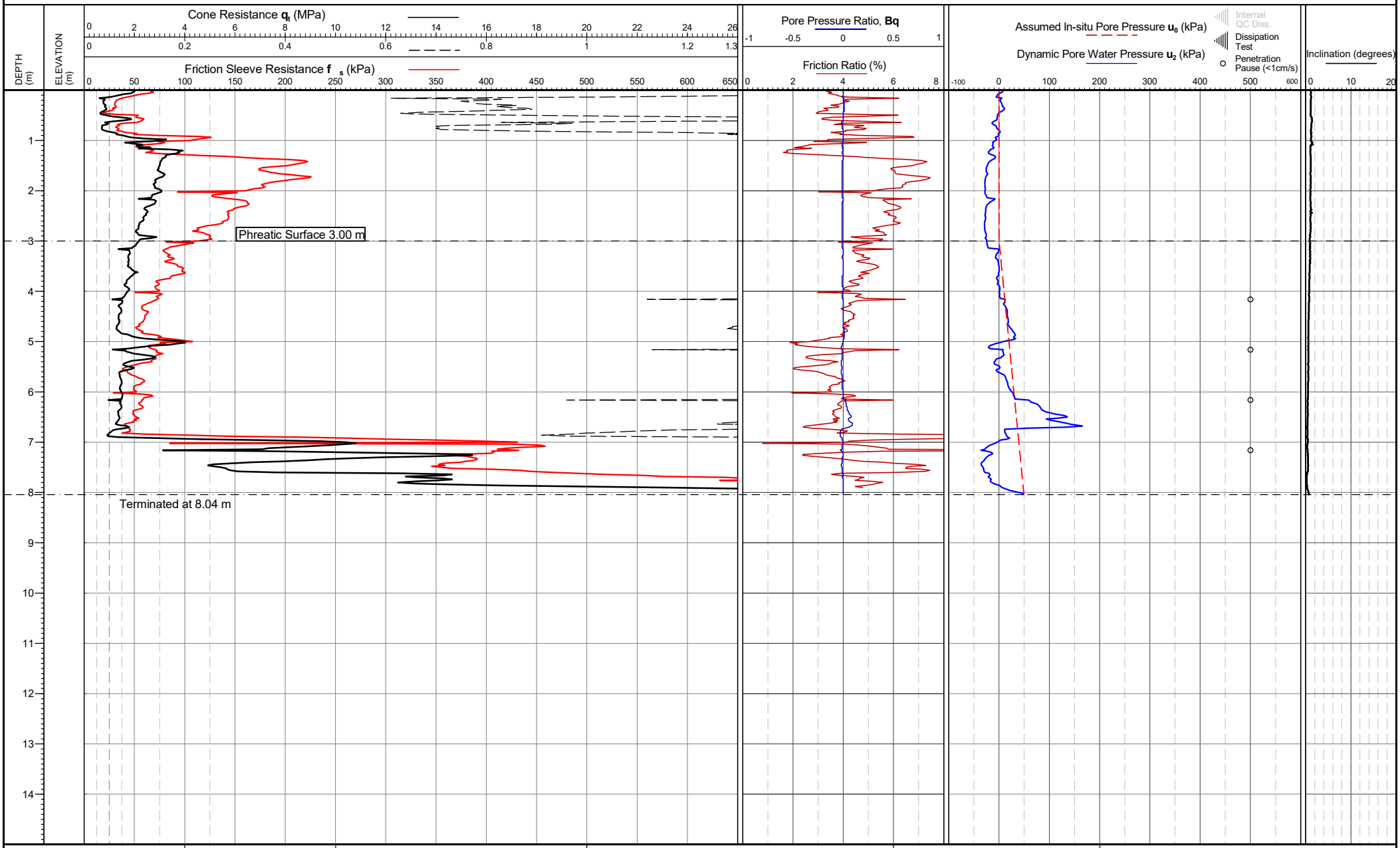


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 10:31:00	Zero drift (Pre/post test) q_c (kPa): -1.0 f_s (kPa): -0.6 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): -0.2	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT09

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

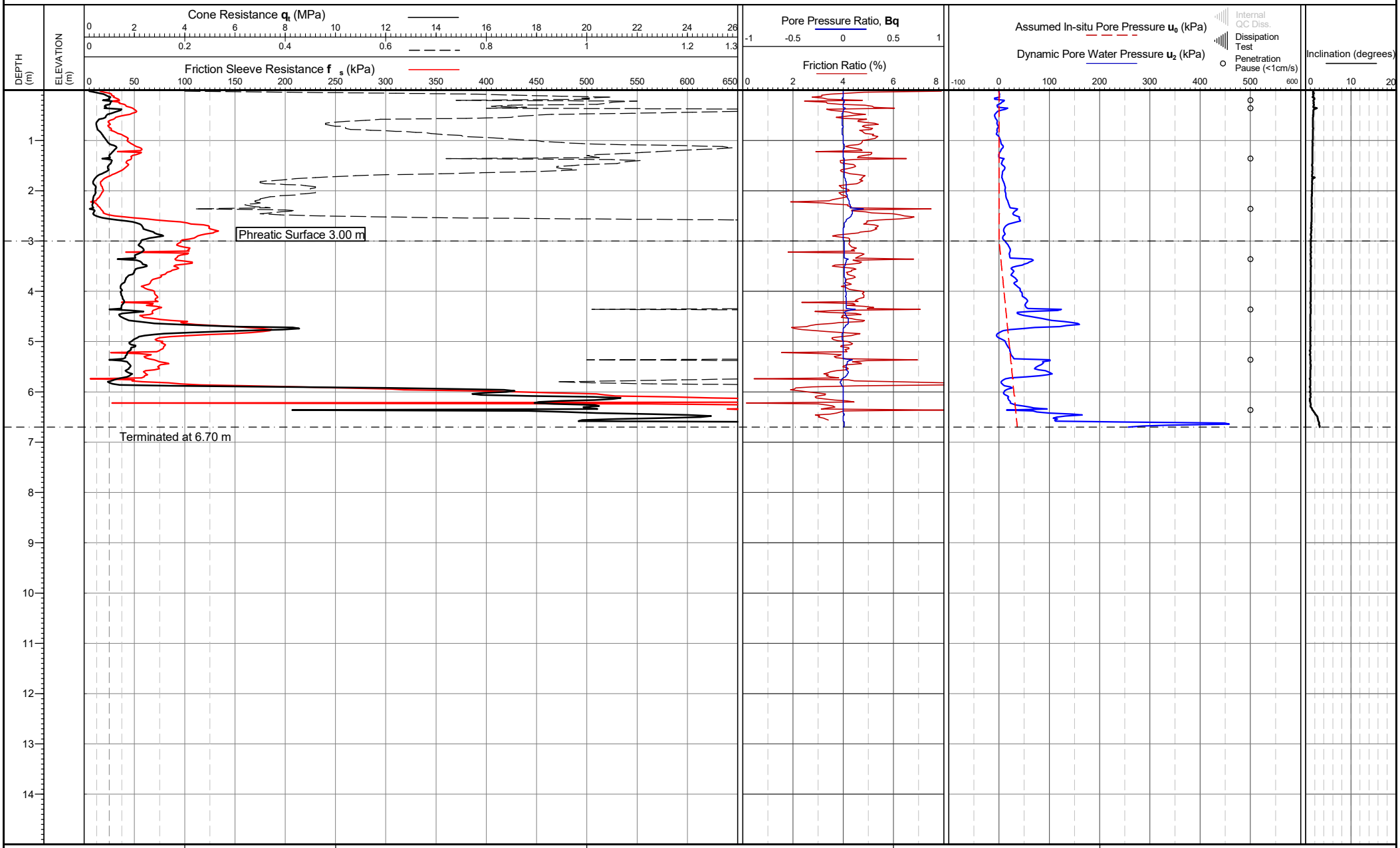


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 10:54:00	Zero drift (Pre/post test) q_c (kPa): -21.2 f_s (kPa): -4.1 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): -2.3	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT10

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

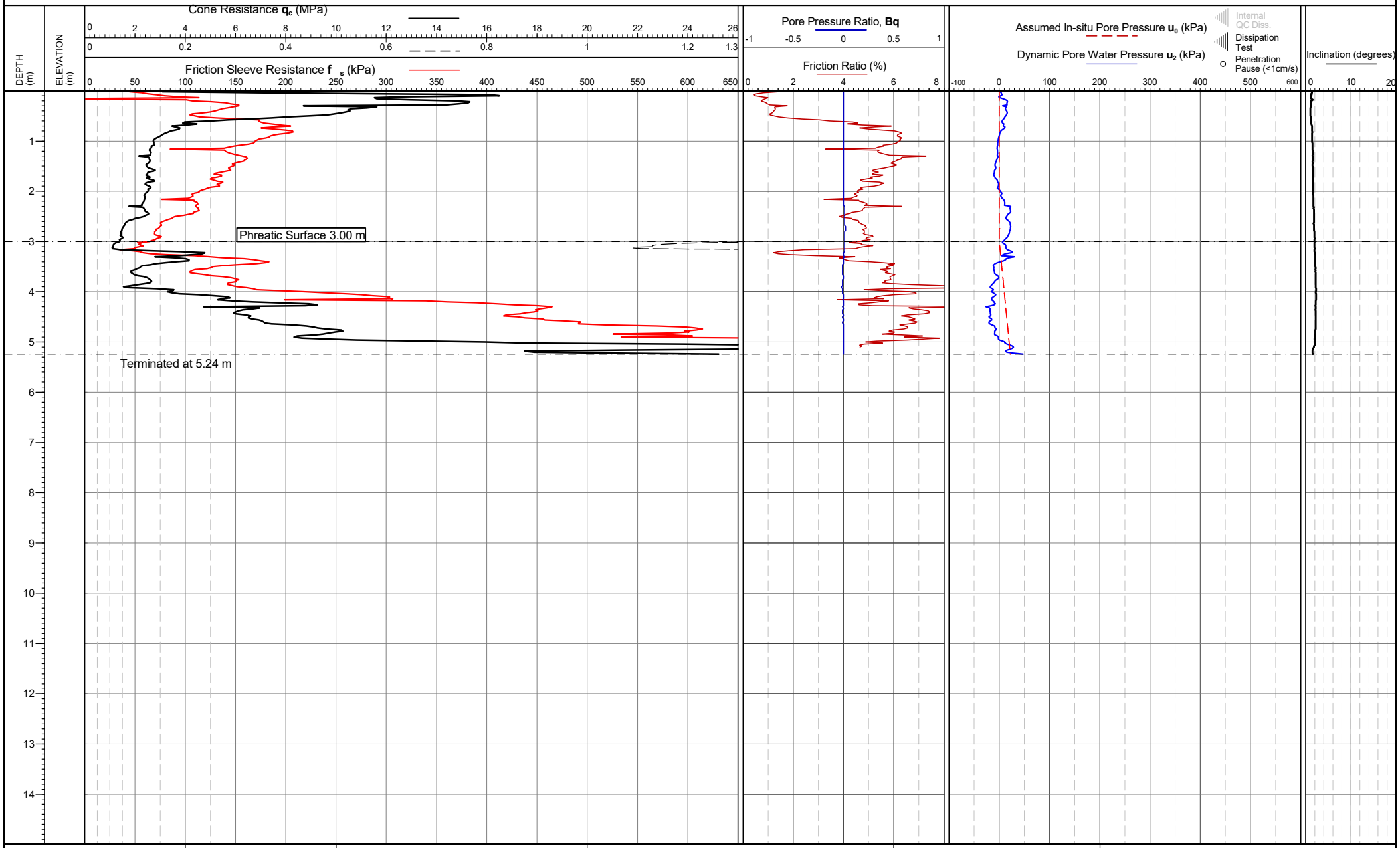


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 11:19:00	Zero drift (Pre/post test) q_c (kPa): 1.8 f_s (kPa): 1.3 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): -0.2	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT11

Project: MANCHESTER

Client: CROSSFIELD CONSULTING

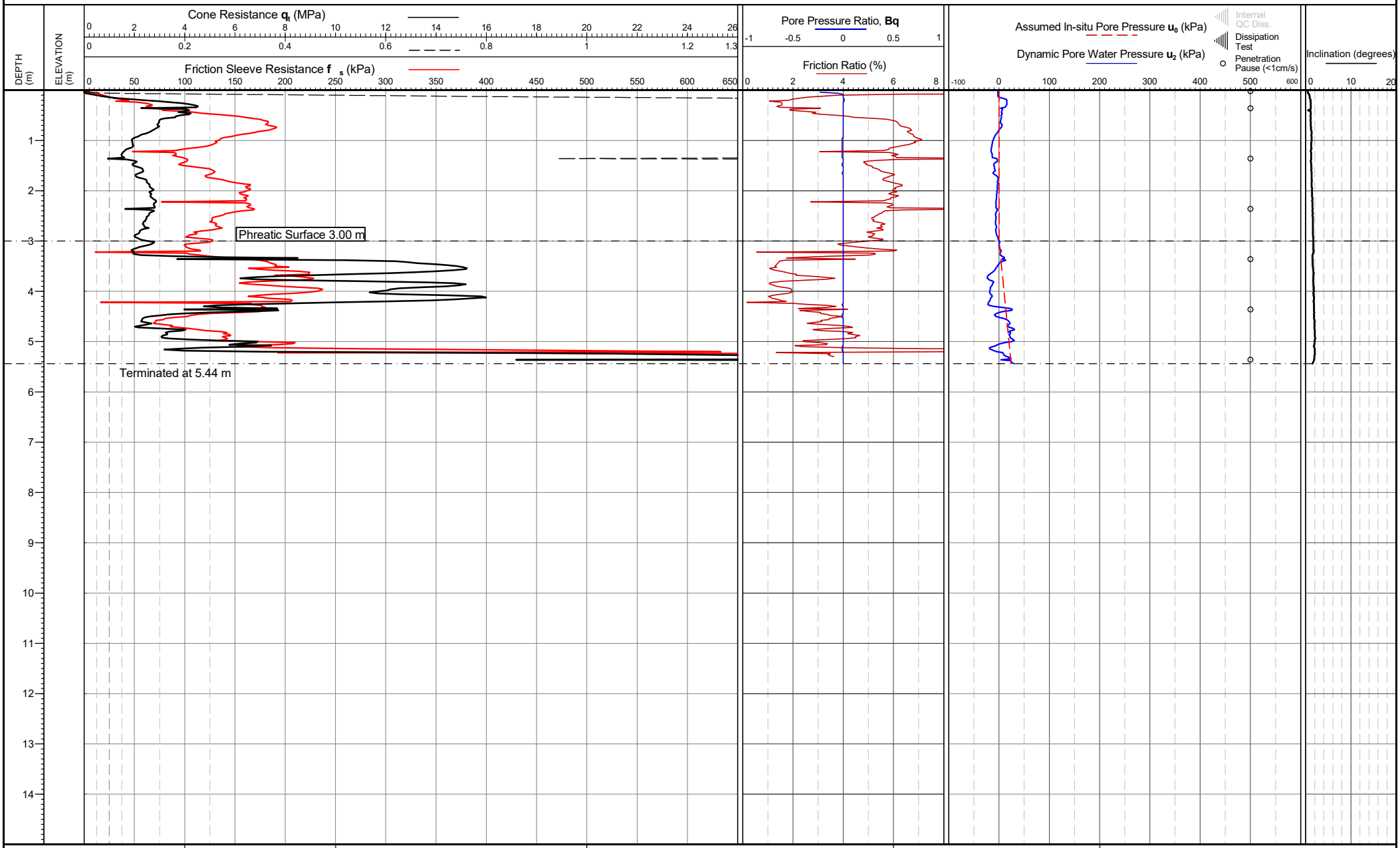


Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Phillip Case Rig Used: UK22 Date of test: 30/06/2020 11:42:00	Zero drift (Pre/post test) q_c (kPa): 0.0 f_s (kPa): -0.7 ($f_{s\,drift}$ - $q_{c\,drift}$)	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Sleeve load	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT12

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



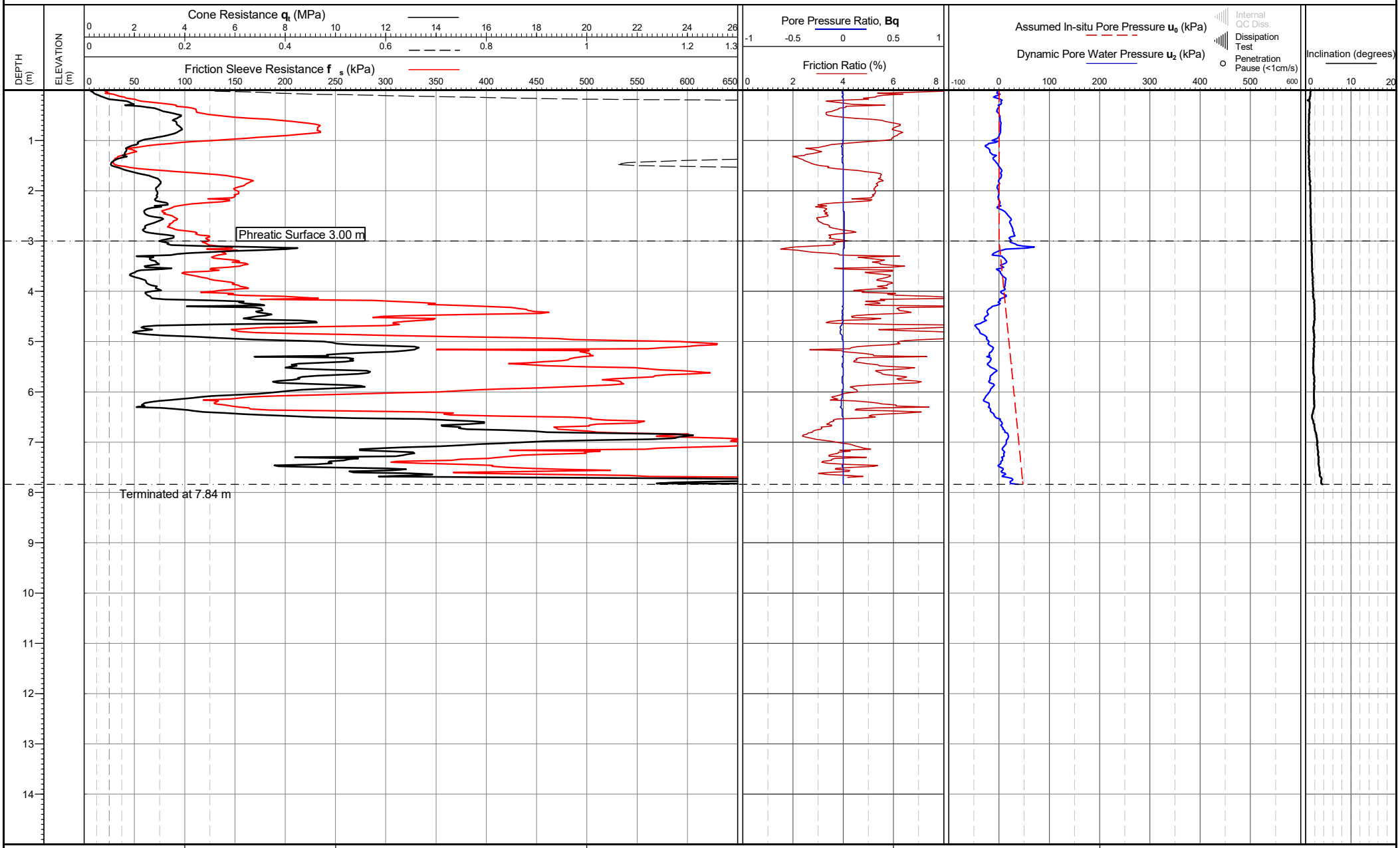
Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 15:05:00	Zero drift (Pre/post test) q_c (kPa): 8.4 f_s (kPa): -1.5 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): 1.9	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Sleeve load	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT13

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500 Cone ID: S15-CFIPT.1821 Operator: Rob Ashcroft Rig Used: UK22 Date of test: 30/06/2020 14:23:00	Zero drift (Pre/post test) q_c (kPa): -30.4 f_s (kPa): -3.5 ($f_{s\,drift}$ - $q_{c\,drift}$) U_2 (kPa): -1.7	Location: Manchester, UK Coordinates: , Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Lateral support	Date of plot: 30-06-20 Checked by: Chris Player	Lankelma Project Ref: P-107495-1

TEST ID: CPT14

APPENDIX D STANDARD INTERPRETATION RESULTS - SET 1

UNDRAINED SHEAR STRENGTH
COEFFICIENT OF VOLUME CHANGE
OVERCONSOLIDATION RATIO
SOIL BEHAVIOUR TYPE (SBT) DESCRIPTIONS

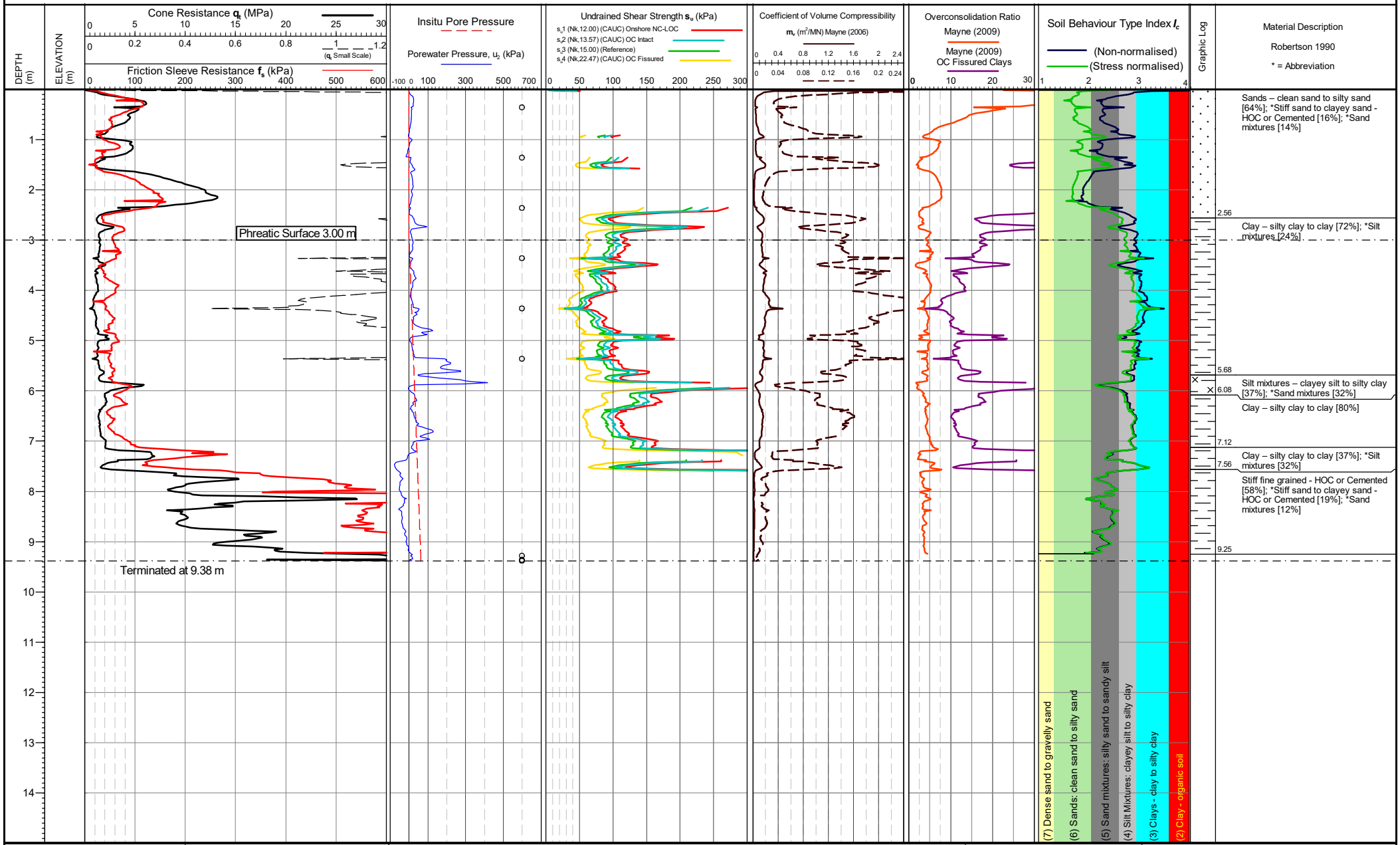
LIST OF FIGURES:

Location ID	Pages included
CPT01	1
CPT02	1
CPT03	1
CPT04	1
CPT05	1
CPT06	1
CPT07	1
CPT08	1
CPT09	1
CPT10	1
CPT11	1
CPT12	1
CPT13	1
CPT14	1

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Phillip Case
Rig Used: UK22
Date of test: 30/06/2020 08:28:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

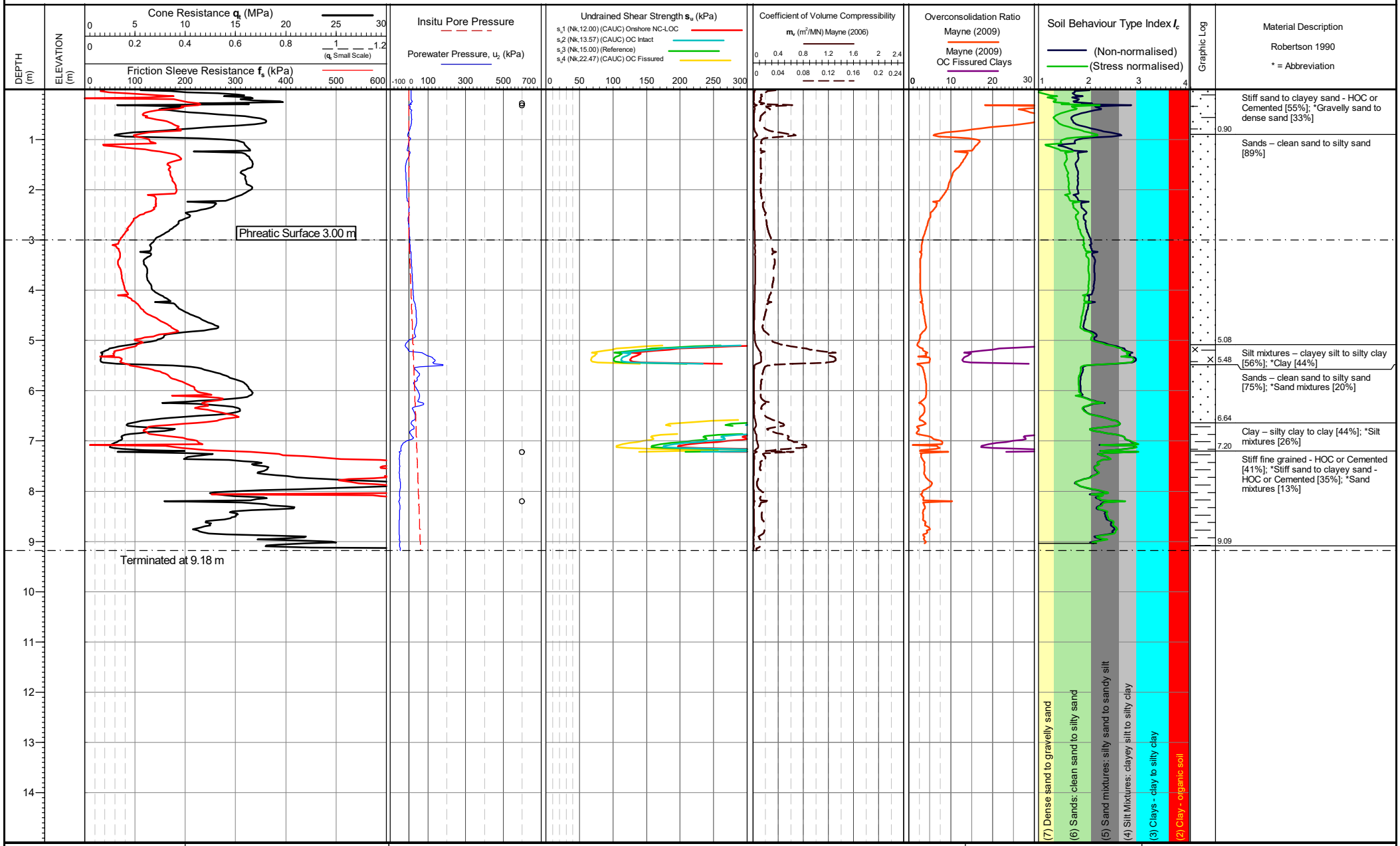
Lankelma Project Ref: P-107495-1

TEST ID: CPT01

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 15:42:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

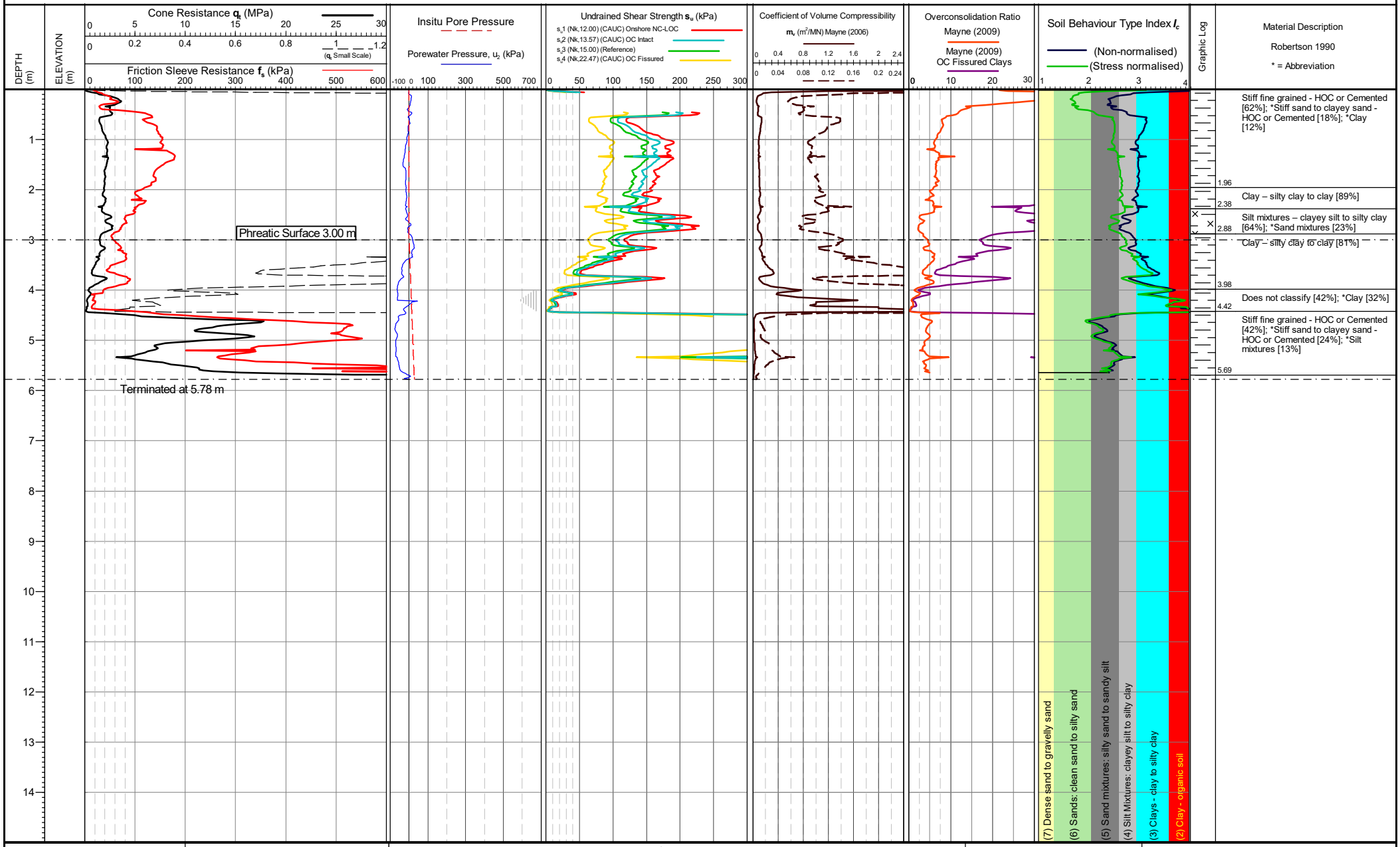
Checked by: Chris Player

Lankelma Project Ref: P-107495-1

TEST ID: CPT02

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 12:58:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

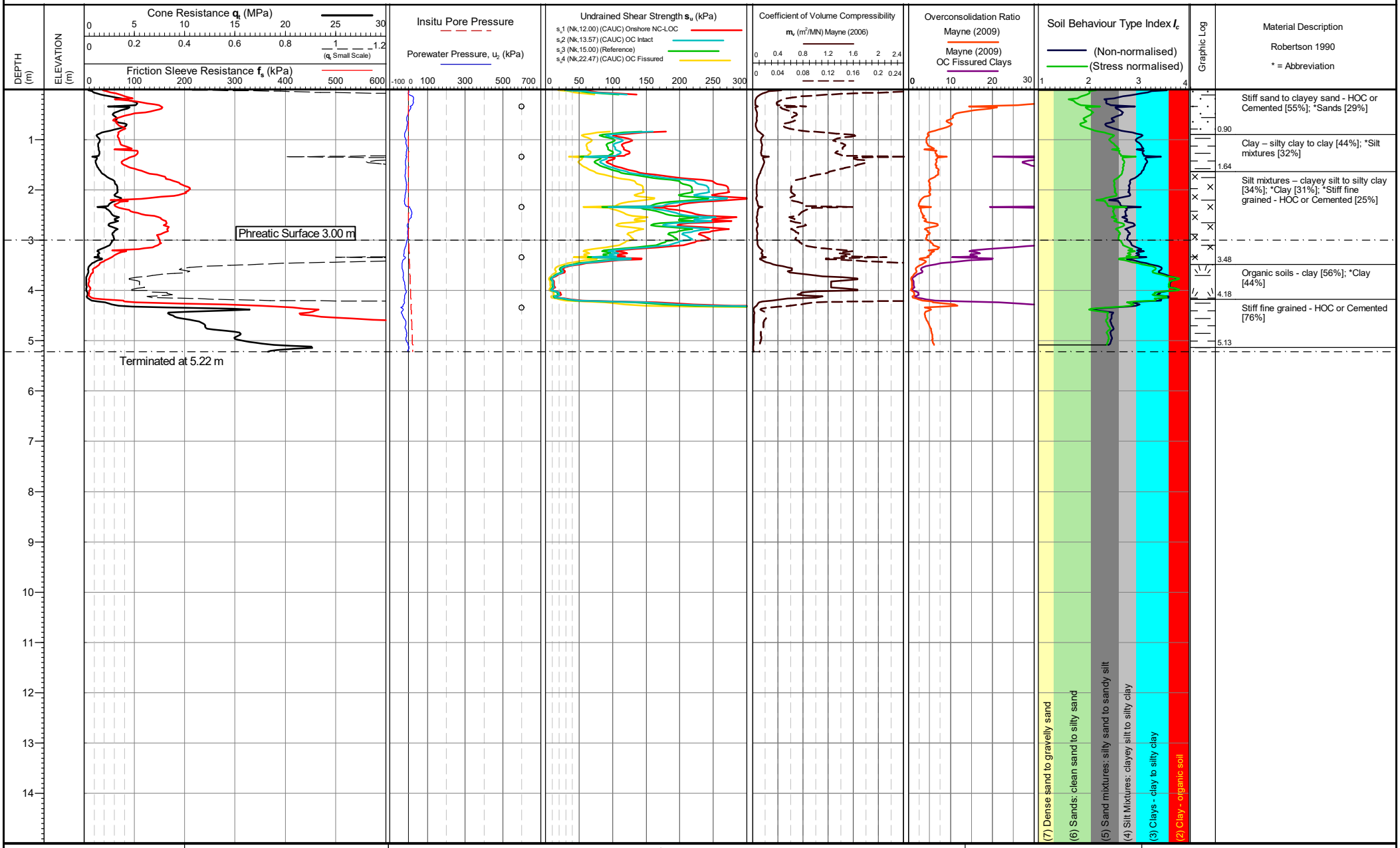
Lankelma Project Ref: P-107495-1

TEST ID: CPT03

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 12:35:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Sleeve load

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: 30-06-20

Checked by: Chris Player

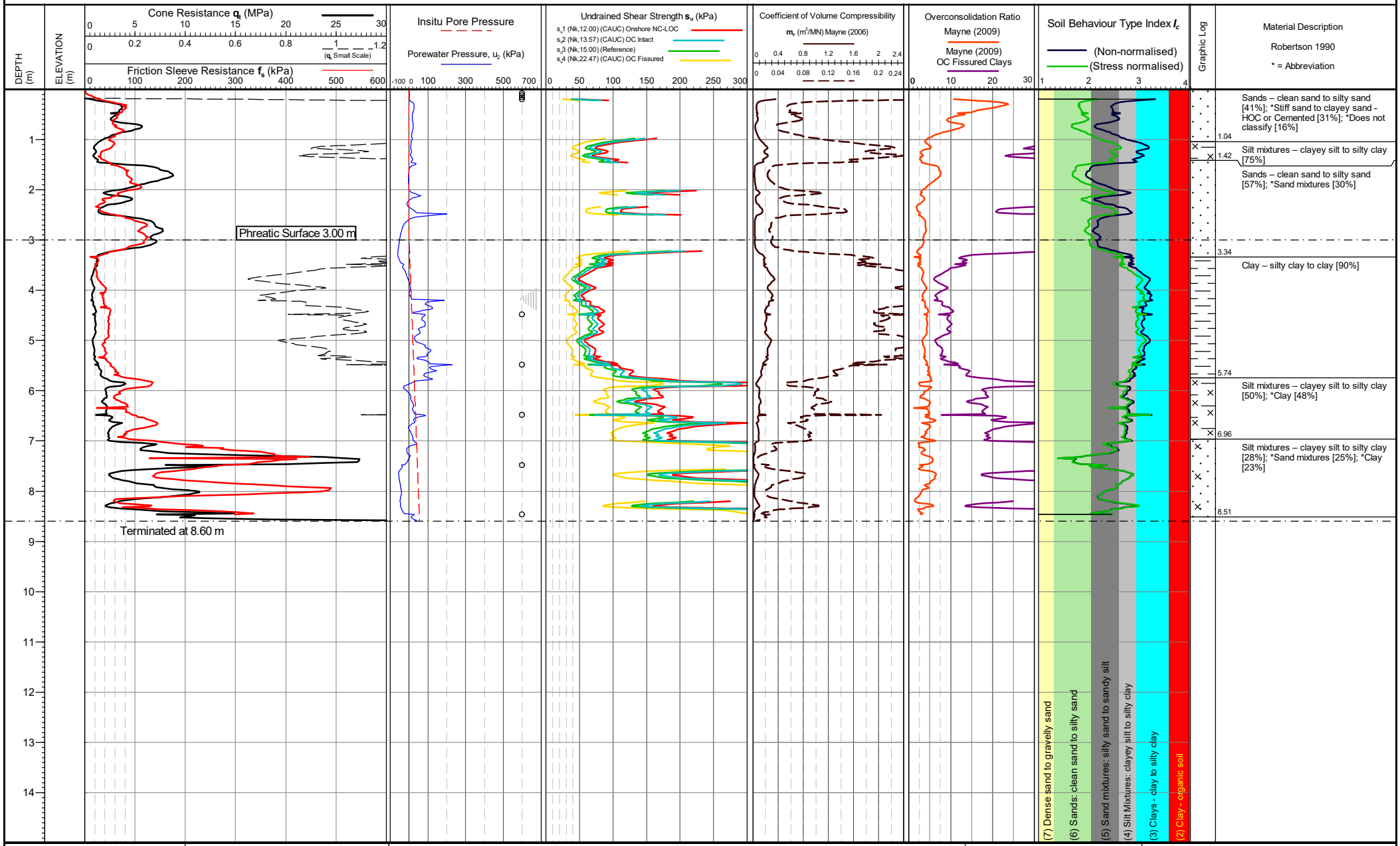
Lankelma Project Ref: P-107495-1

TEST ID: CPT04

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 10:03:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

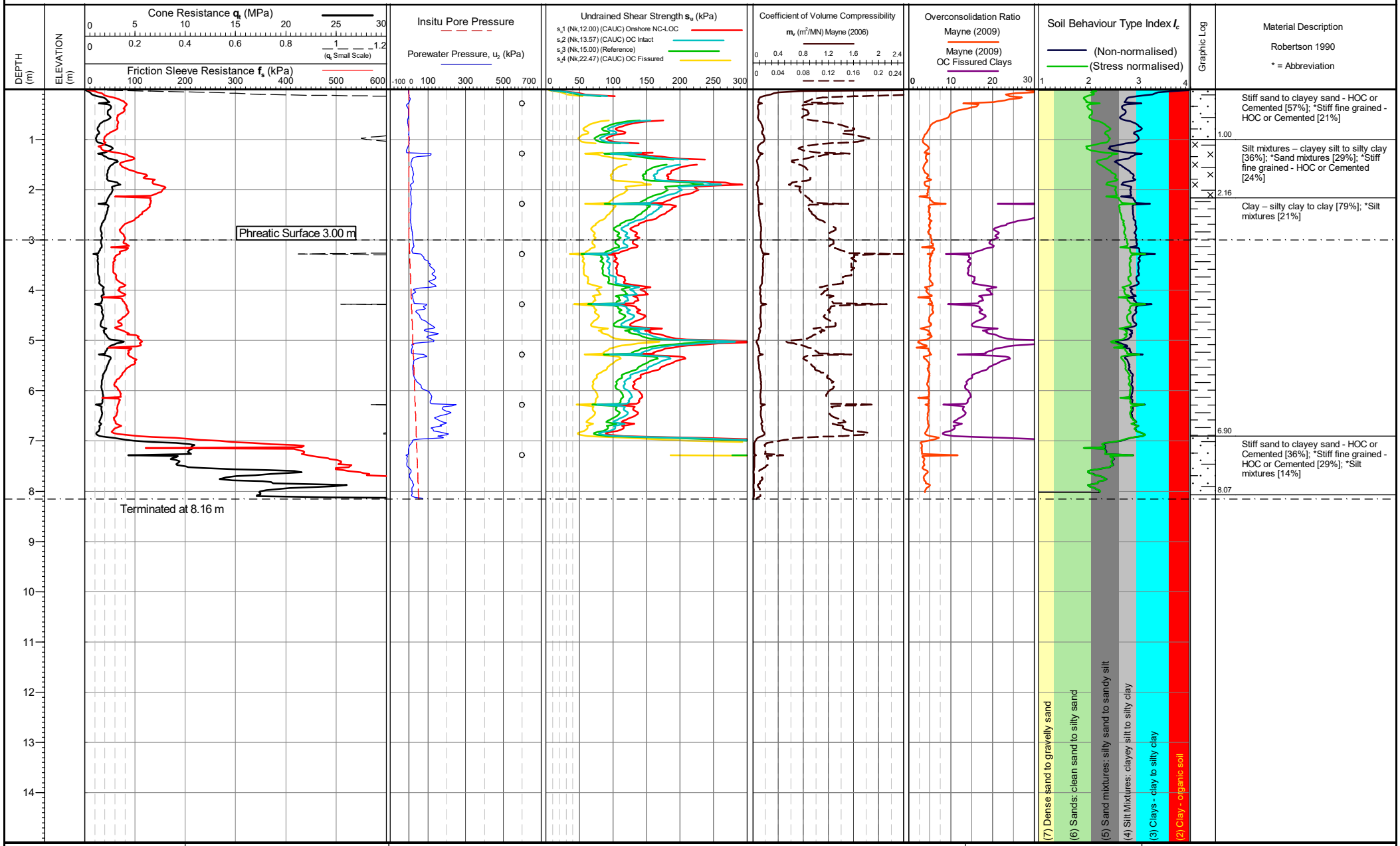
Lankelma Project Ref: P-107495-1

TEST ID: CPT05

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 13:31:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

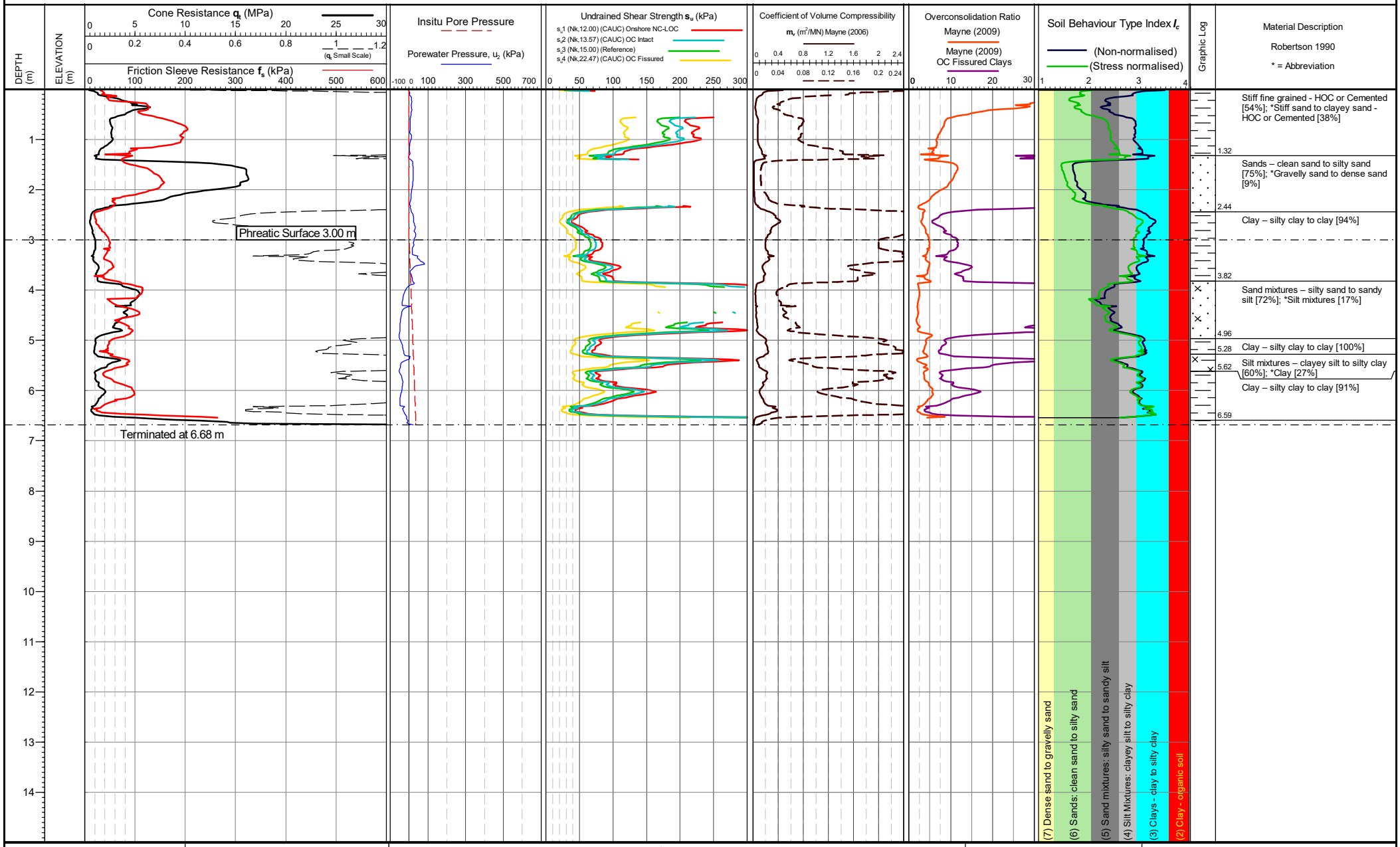
Lankelma Project Ref: P-107495-1

TEST ID: CPT06

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 14:00:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

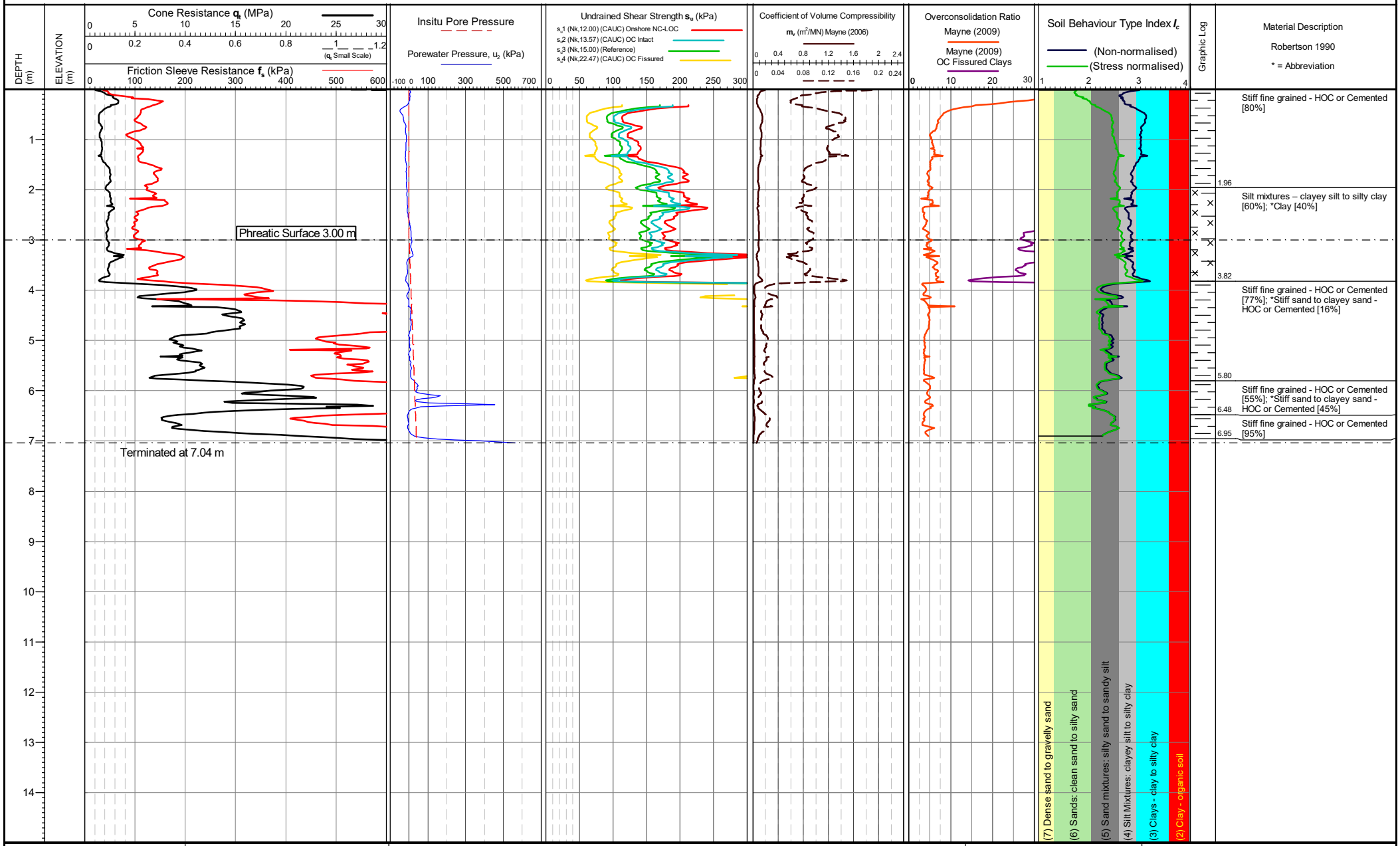
Lankelma Project Ref: P-107495-1

TEST ID: CPT07

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 12:12:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Sleeve load

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: 30-06-20

Checked by: Chris Player

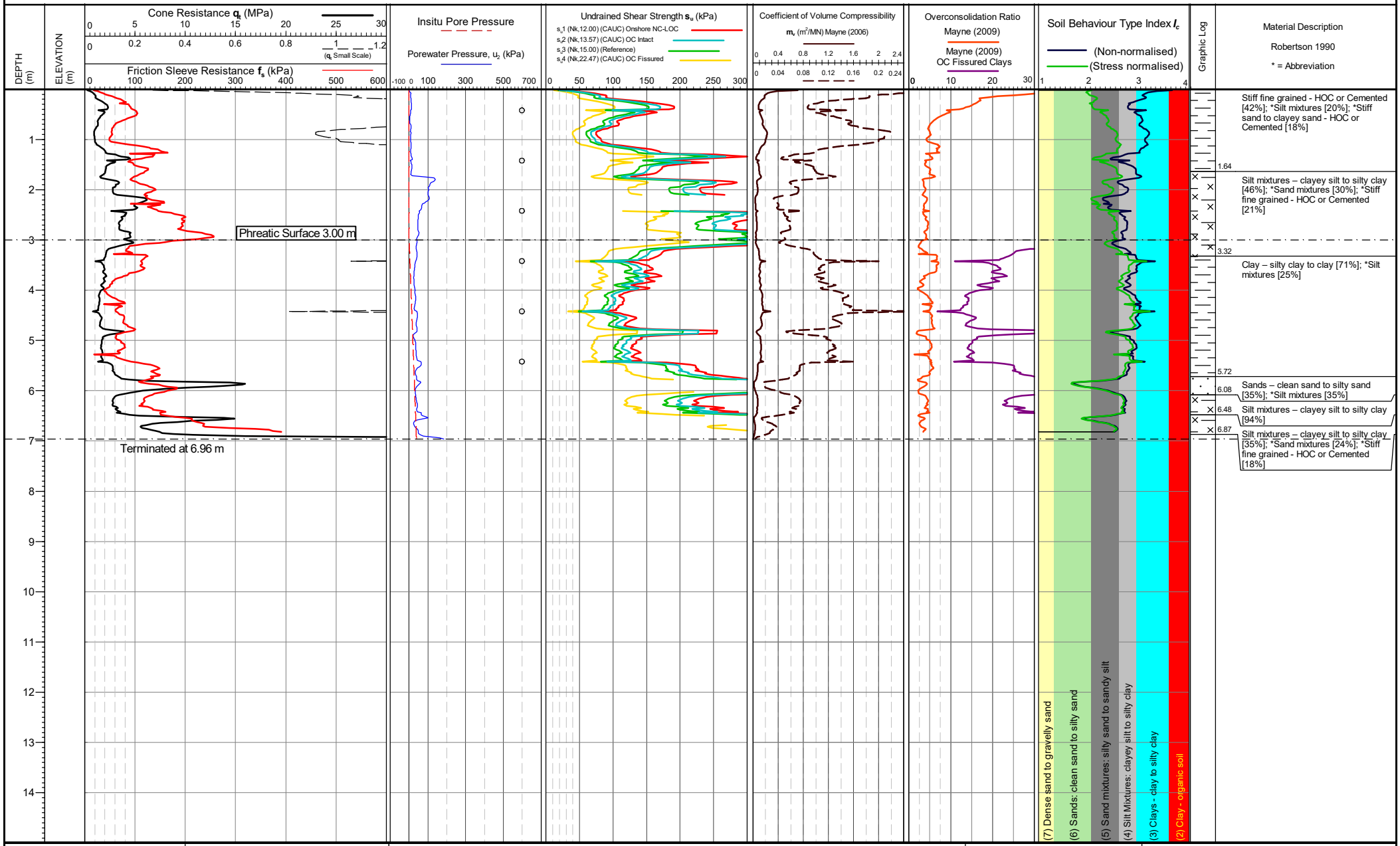
Lankelma Project Ref: P-107495-1

TEST ID: CPT08

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 10:31:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

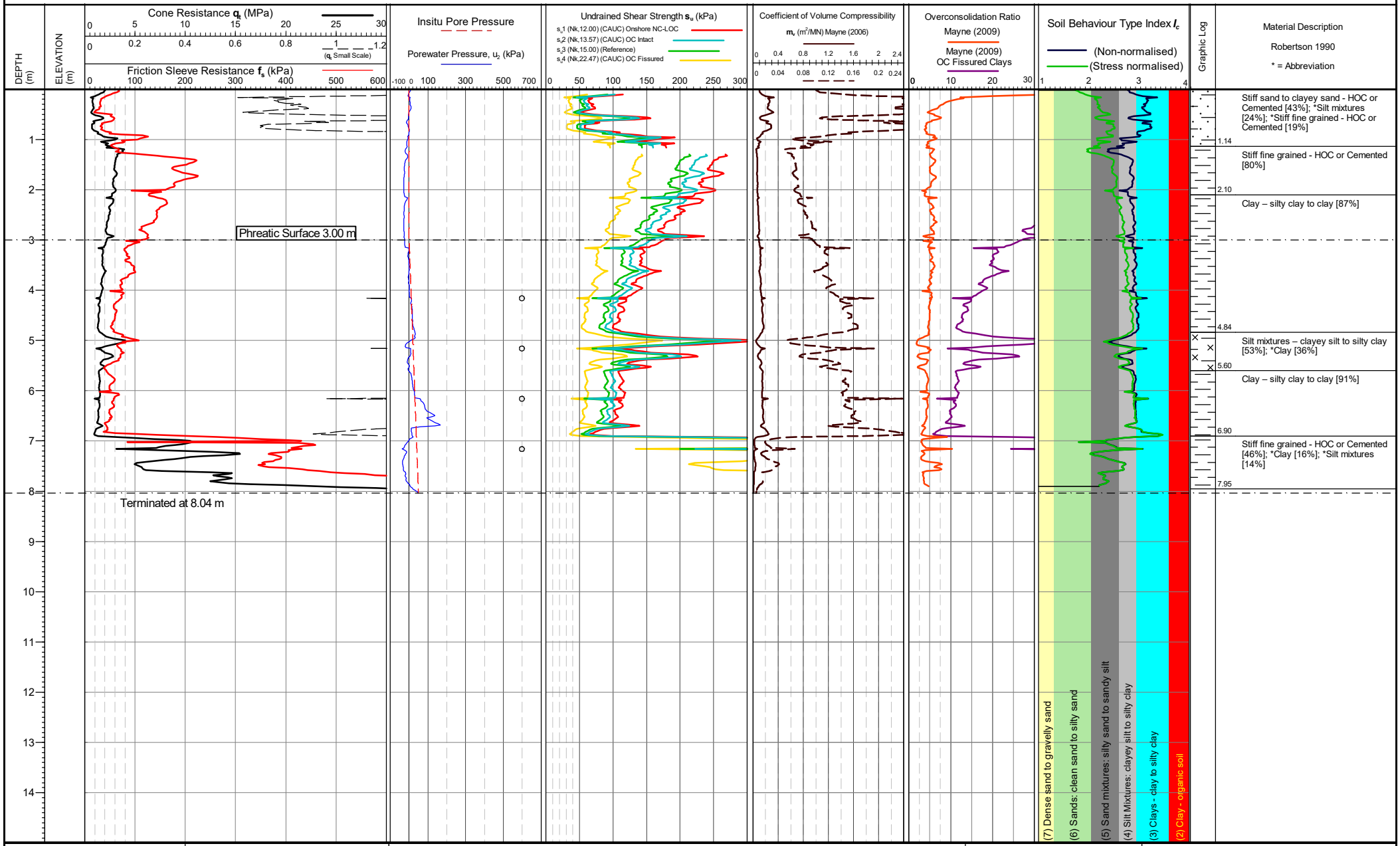
Lankelma Project Ref: P-107495-1

TEST ID: CPT09

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 10:54:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

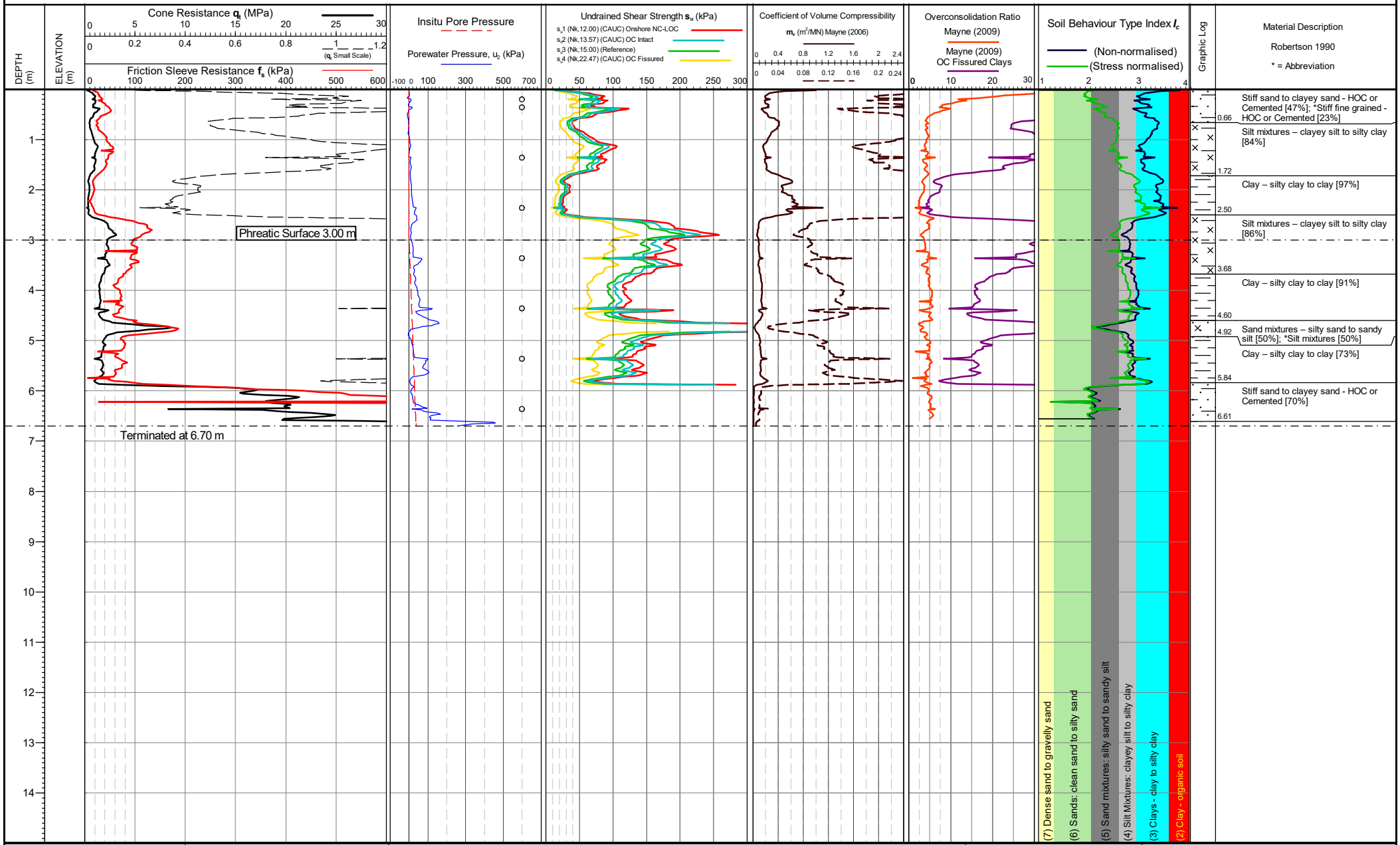
Lankelma Project Ref: P-107495-1

TEST ID: CPT10

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 11:19:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

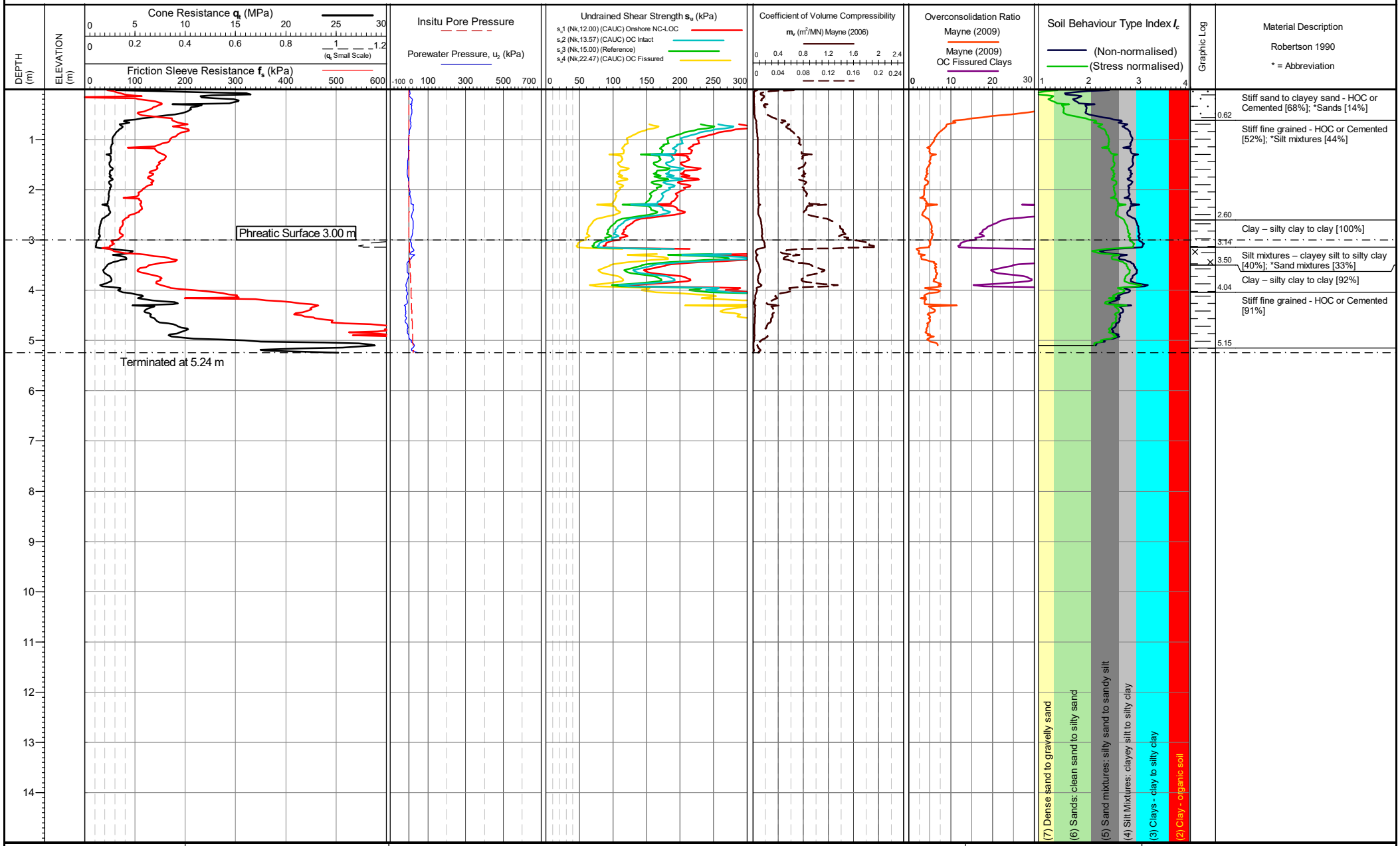
Lankelma Project Ref: P-107495-1

TEST ID: CPT11

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Phillip Case
Rig Used: UK22
Date of test: 30/06/2020 11:42:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Sleeve load

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: 30-06-20

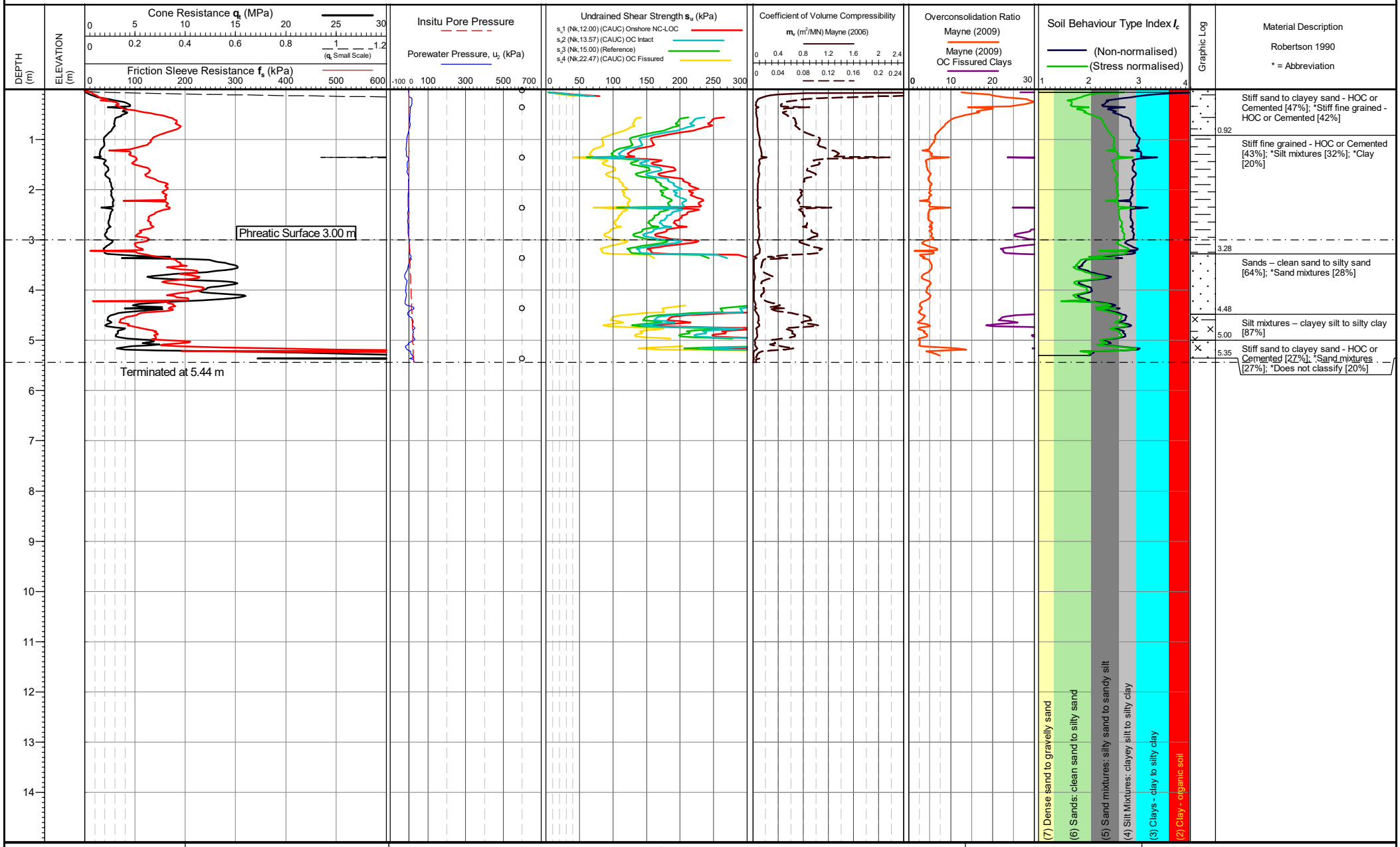
Checked by: Chris Player

Lankelma Project Ref: P-107495-1

TEST ID: CPT12

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 15:05:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Sleeve load

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: 30-06-20

Checked by: Chris Player

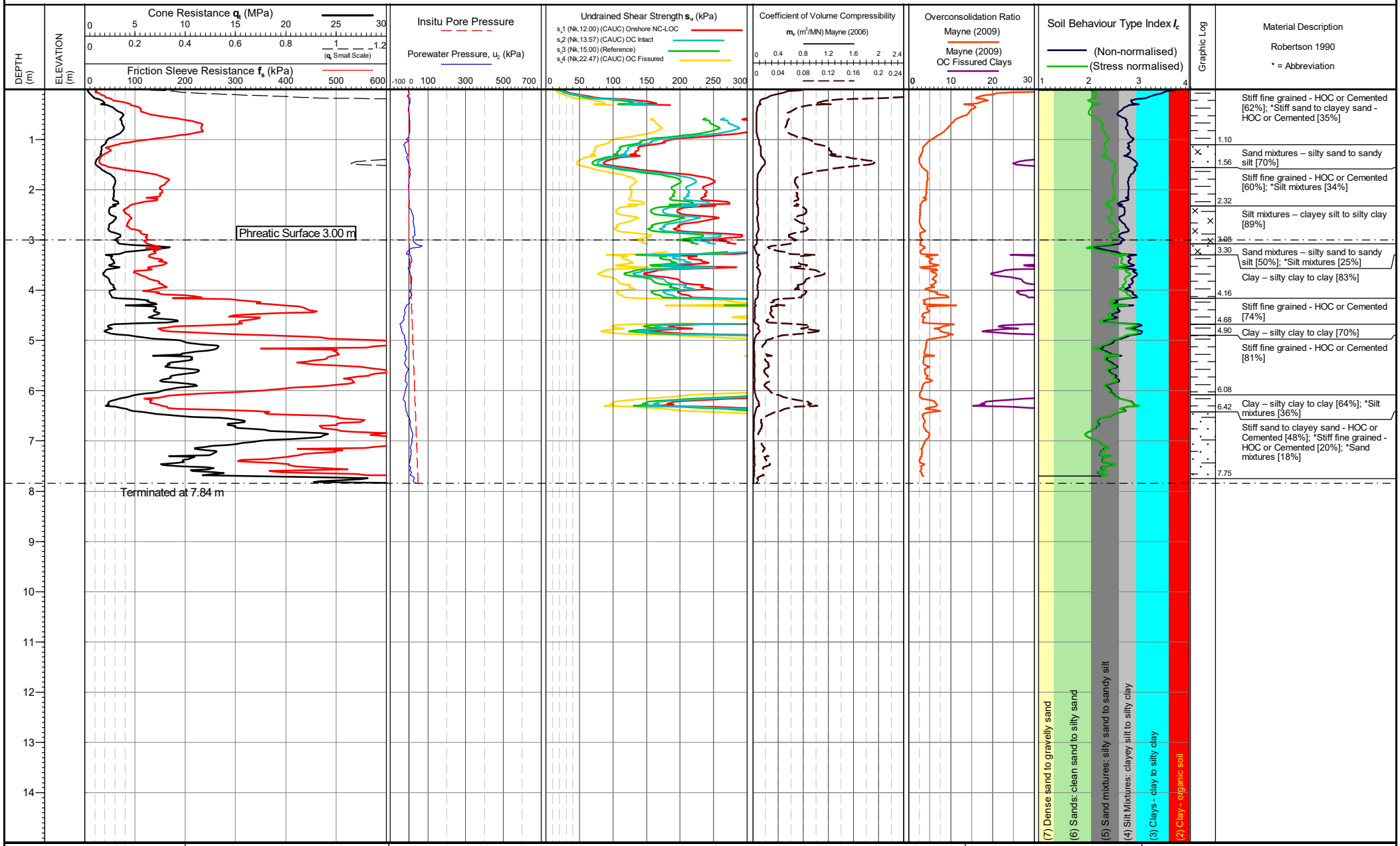
Lankelma Project Ref: P-107495-1

TEST ID: CPT13

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
ConeID: S15-CFIPT.1821
Operator: Rob Ashcroft
Rig Used: UK22
Date of test: 30/06/2020 14:23:00

Location: Manchester, UK
Coordinates: ,
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Lateral support

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: 30-06-20

Checked by: Chris Player

Lankelma Project Ref: P-107495-1

TEST ID: CPT14

APPENDIX E STANDARD INTERPRETATION RESULTS - SET 2

EQUIVALENT SPT N60
PEAK FRICTION ANGLE
RELATIVE DENSITY
YOUNG'S MODULUS

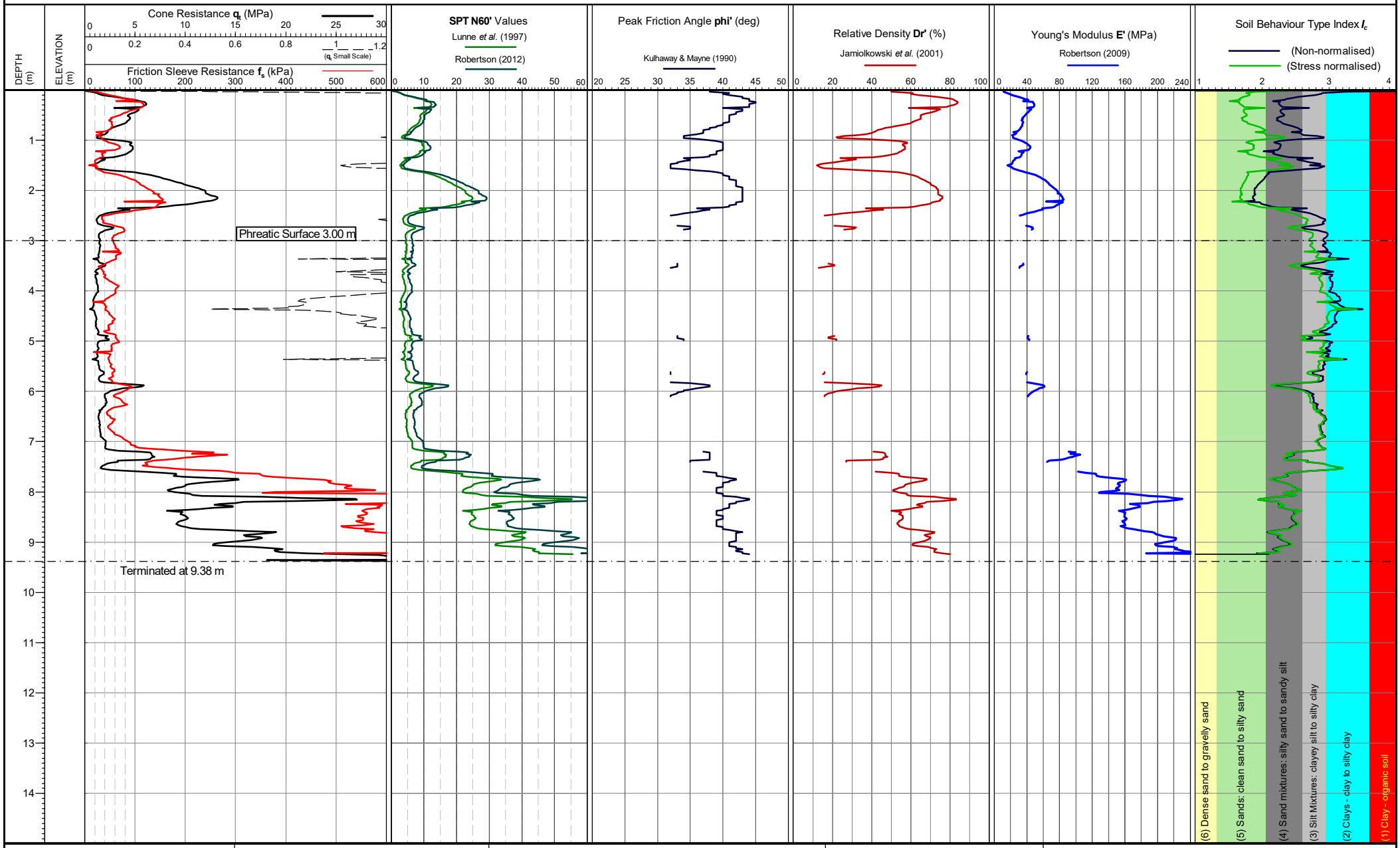
LIST OF FIGURES:

Location ID	Pages included
CPT01	1
CPT02	1
CPT03	1
CPT04	1
CPT05	1
CPT06	1
CPT07	1
CPT08	1
CPT09	1
CPT10	1
CPT11	1
CPT12	1
CPT13	1
CPT14	1

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Phillip Case
Date of test: 30/06/2020 08:28:00

Location: 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: 30-06-20

Checked by: Chris Player

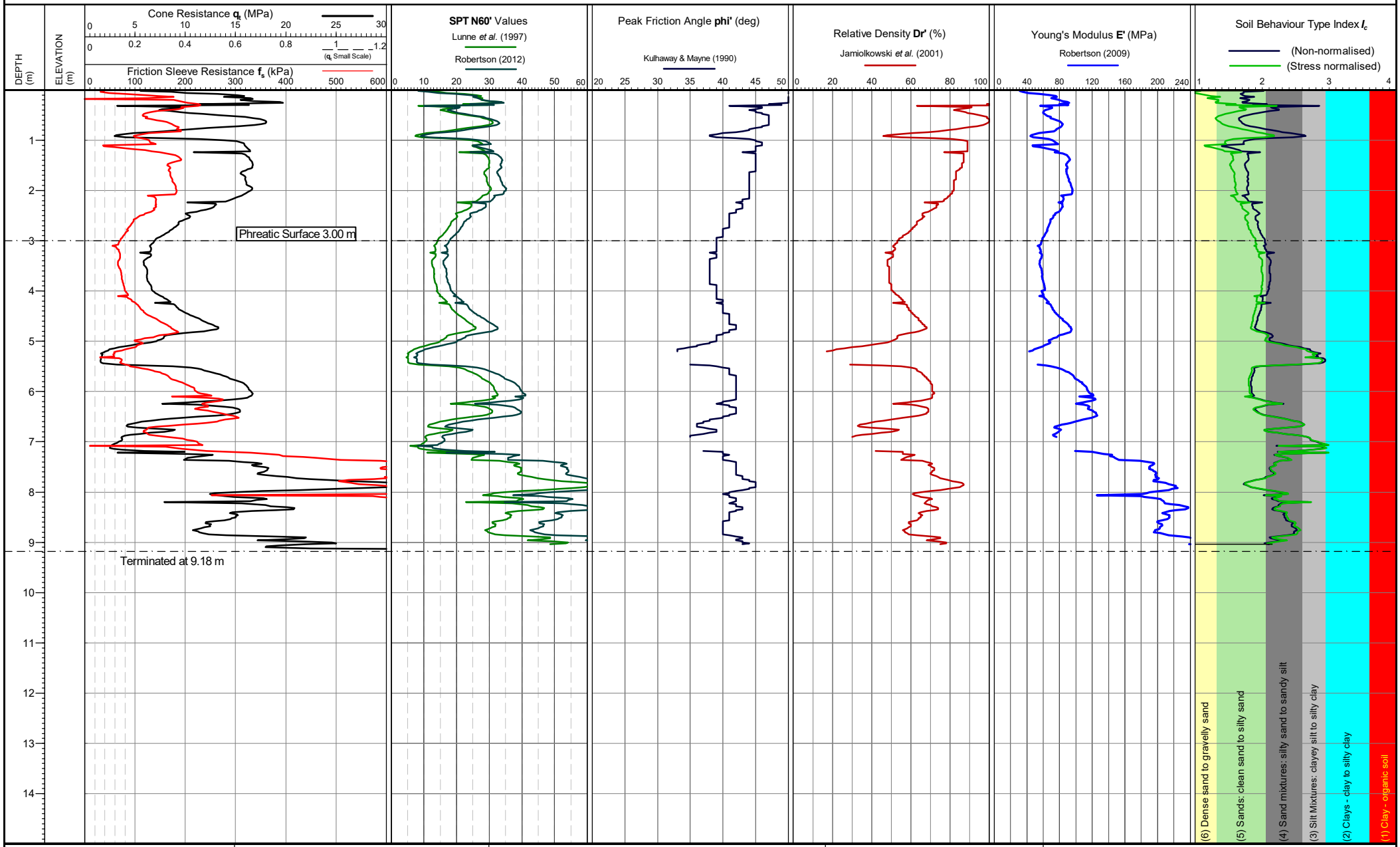
Lankelma Project Ref: P-107495-1

TEST ID: CPT01

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 15:42:00

Location: 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: 30-06-20
Checked by: Chris Player

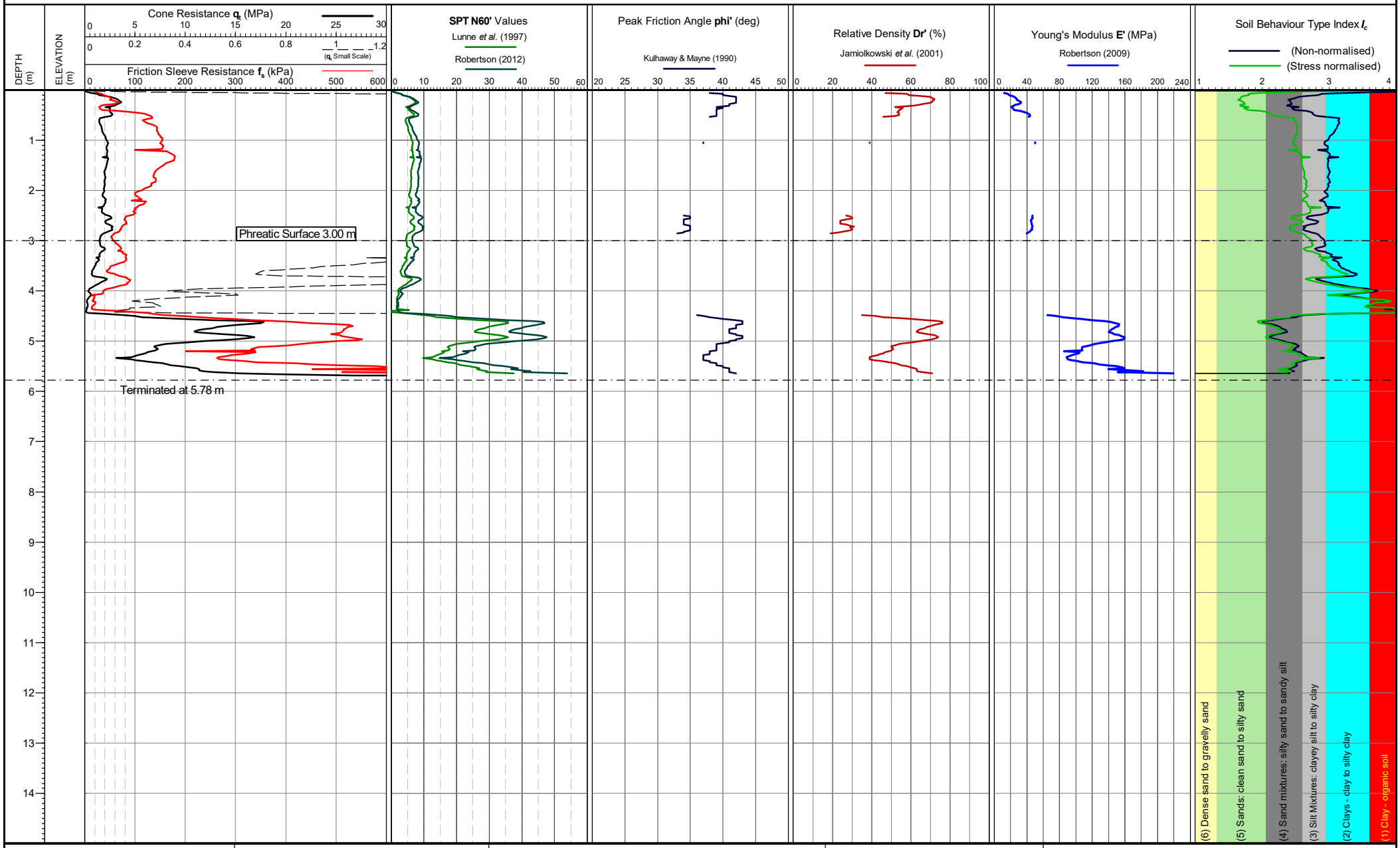
Lankelma Project Ref: P-107495-1

TEST ID: CPT02

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 12:58:00

Location: 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.

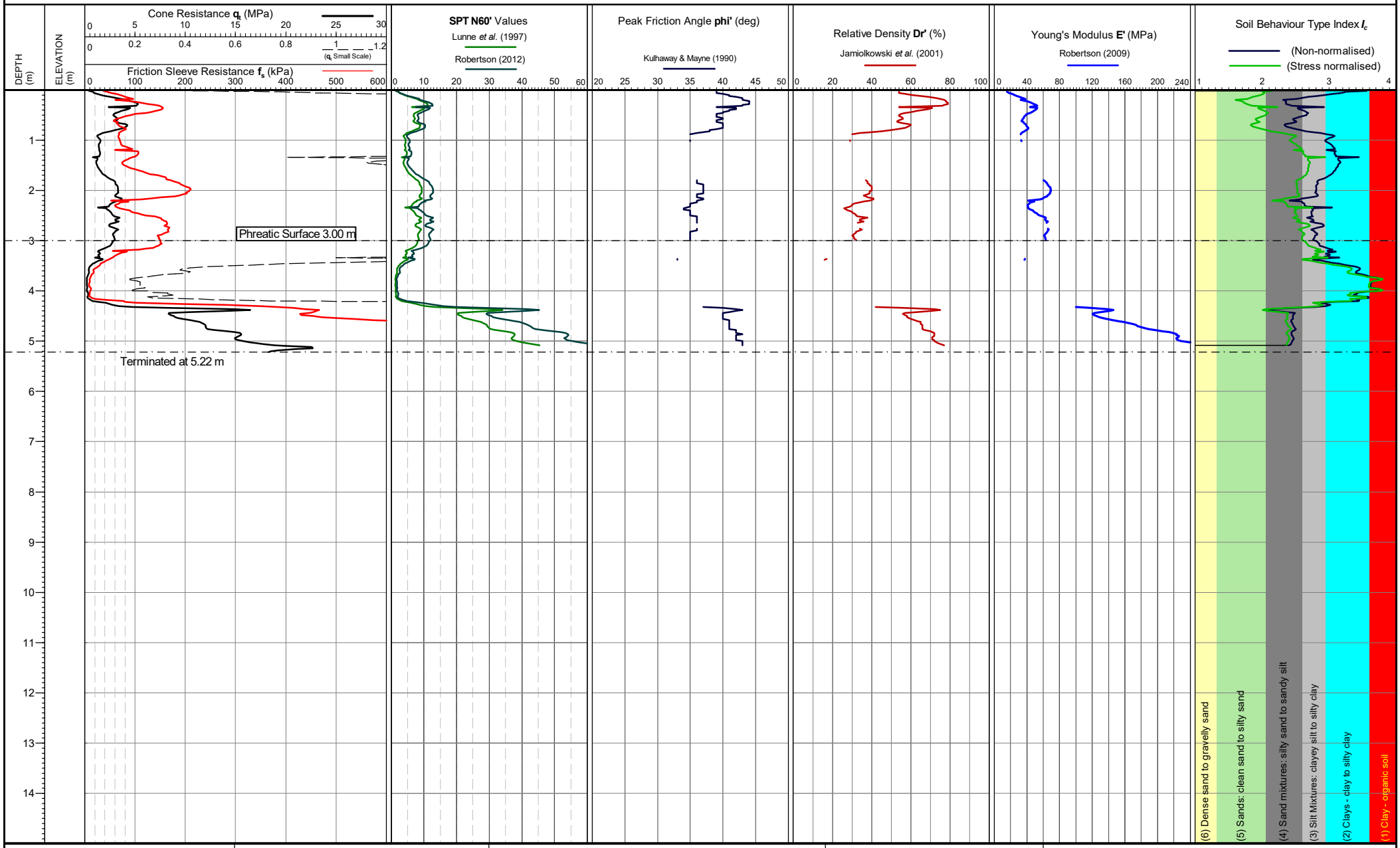
Date of plot: 30-06-20
Checked by: Chris Player

Lankelma Project Ref: P-107495-1

TEST ID: CPT03

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 12:35:00

Location: 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: 30-06-20
Checked by: Chris Player

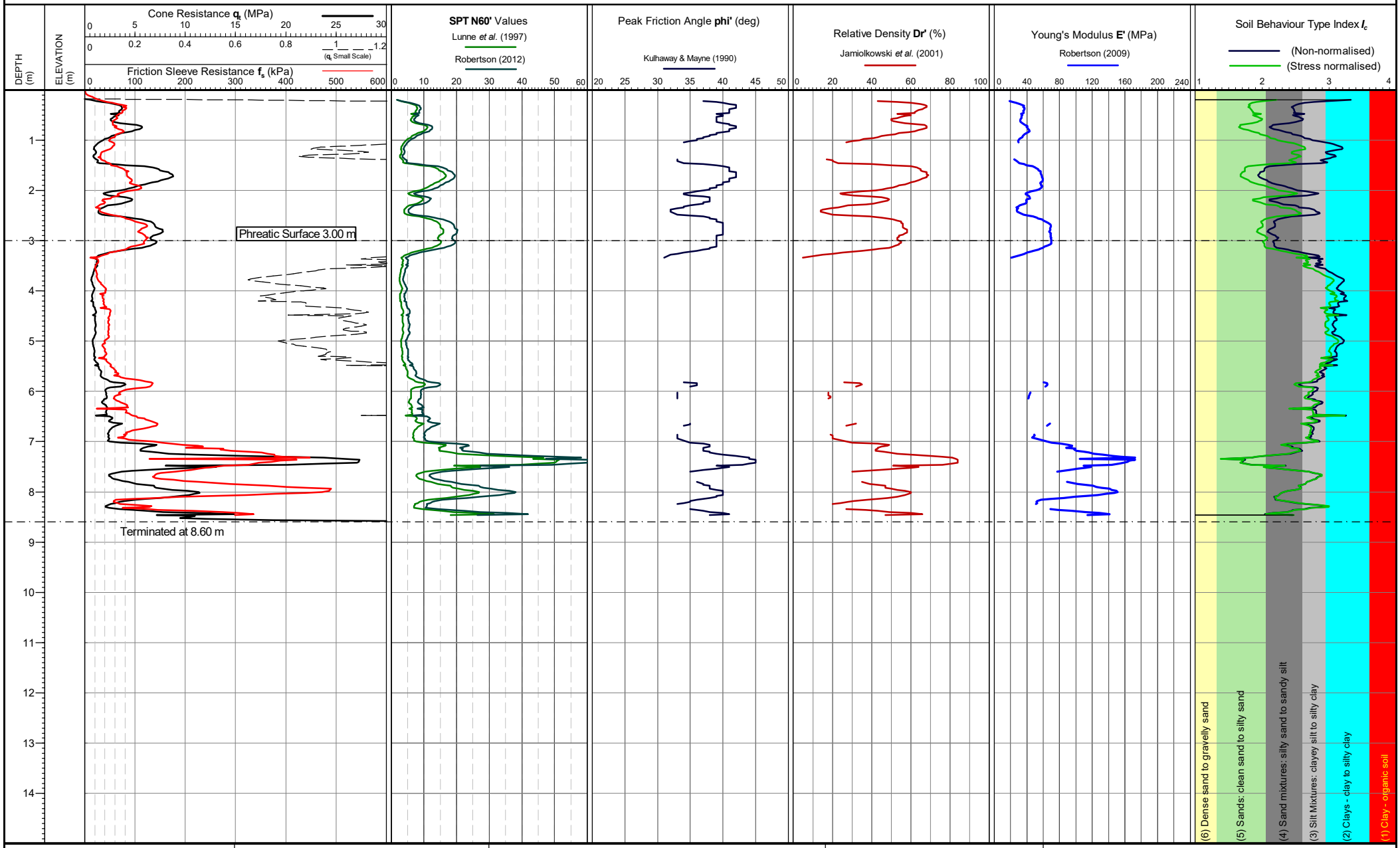
Lankelma Project Ref: P-107495-1

TEST ID: CPT04

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 10:03:00

Location: 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: 30-06-20
Checked by: Chris Player

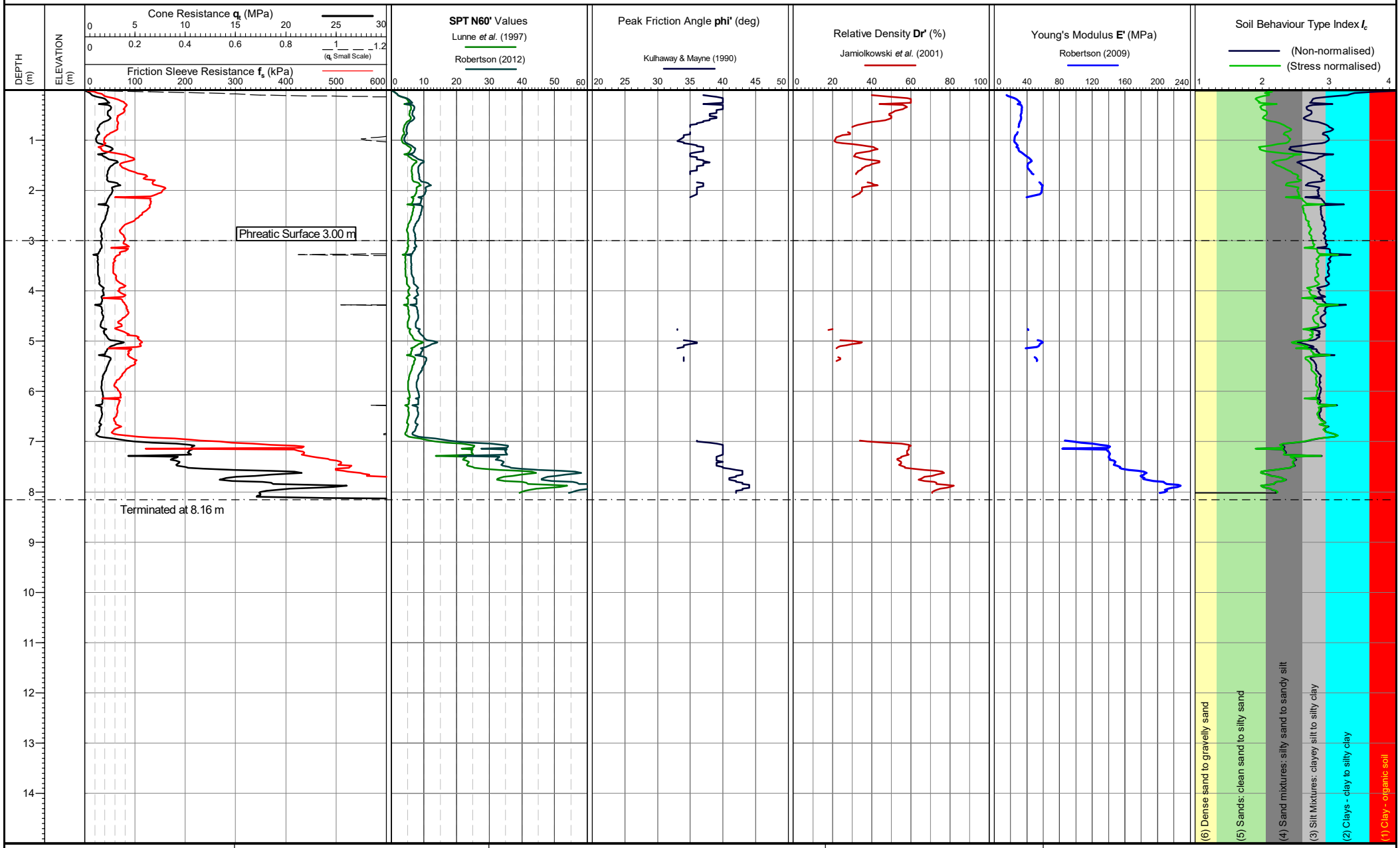
Lankelma Project Ref: P-107495-1

TEST ID: CPT05

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 13:31:00

Location: 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.

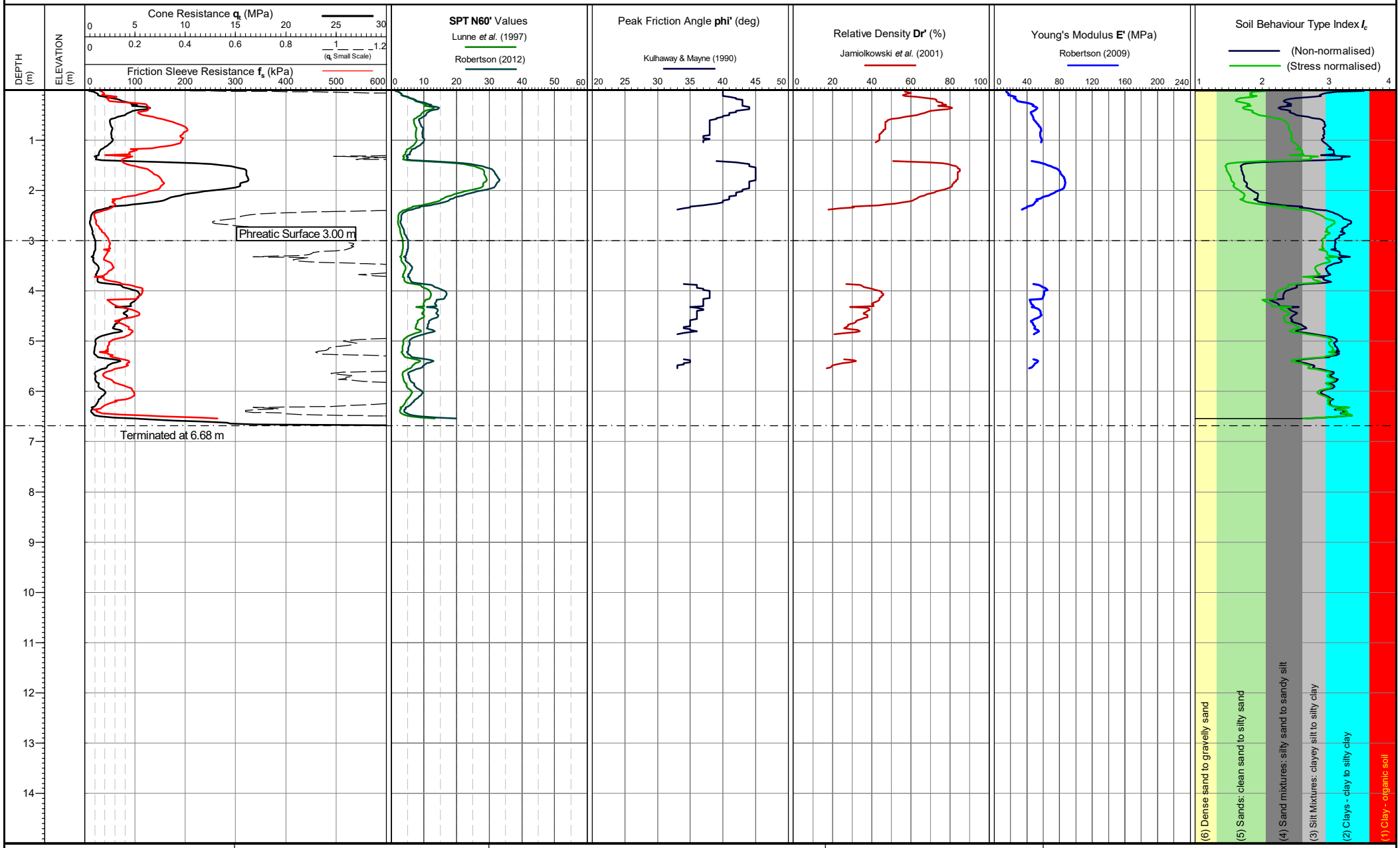
Date of plot: 30-06-20
Checked by: Chris Player

Lankelma Project Ref: P-107495-1

TEST ID: CPT06

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 14:00:00

Location: 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: 30-06-20

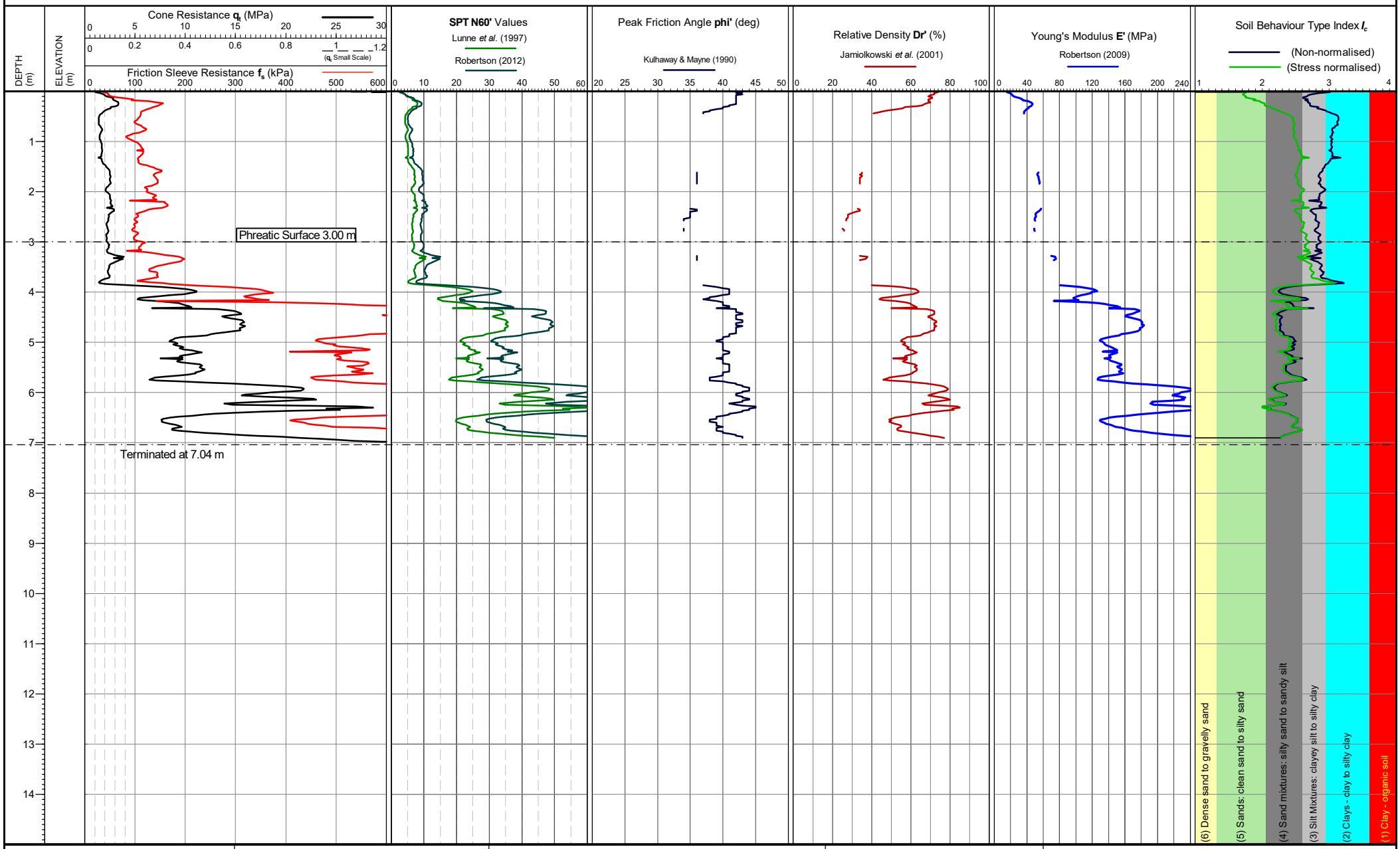
Checked by: Chris Player

Lankelma Project Ref: P-107495-1

TEST ID: CPT07

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 12:12:00

Location: 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: 30-06-20
Checked by: Chris Player

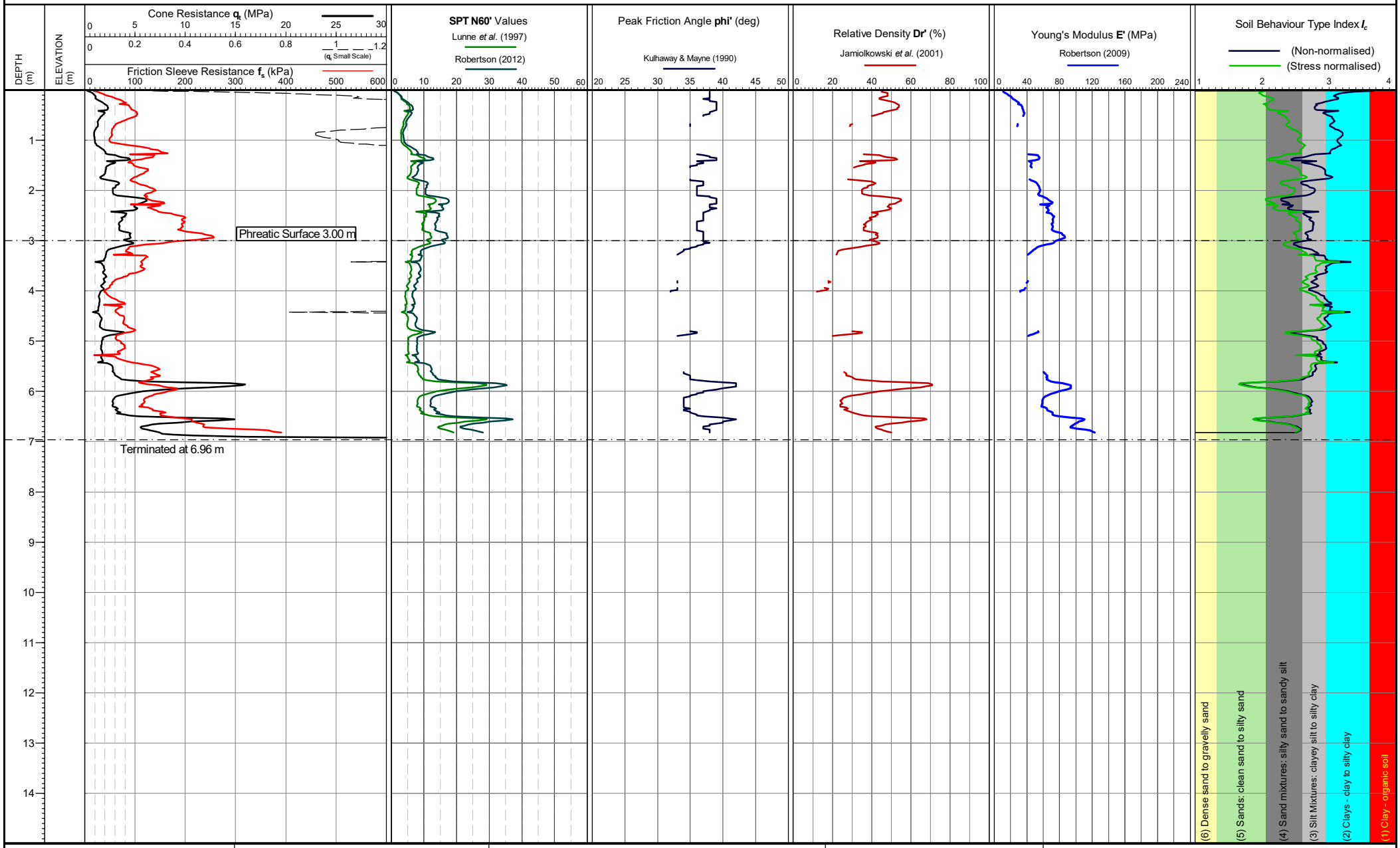
Lankelma Project Ref: P-107495-1

TEST ID: CPT08

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 10:31:00

Location: 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: 30-06-20
Checked by: Chris Player

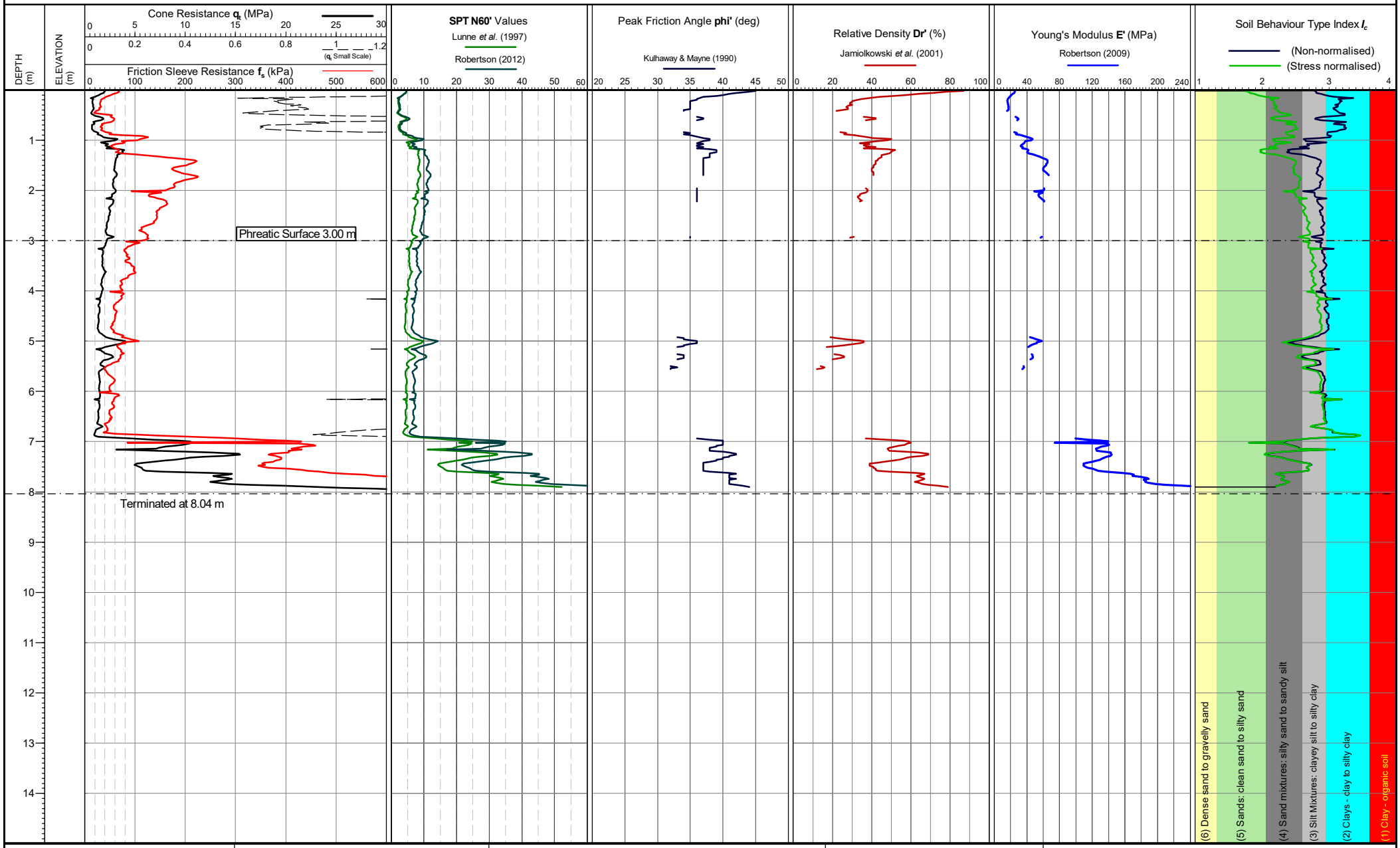
Lankelma Project Ref: P-107495-1

TEST ID: CPT09

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 10:54:00

Location: 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: 30-06-20
Checked by: Chris Player

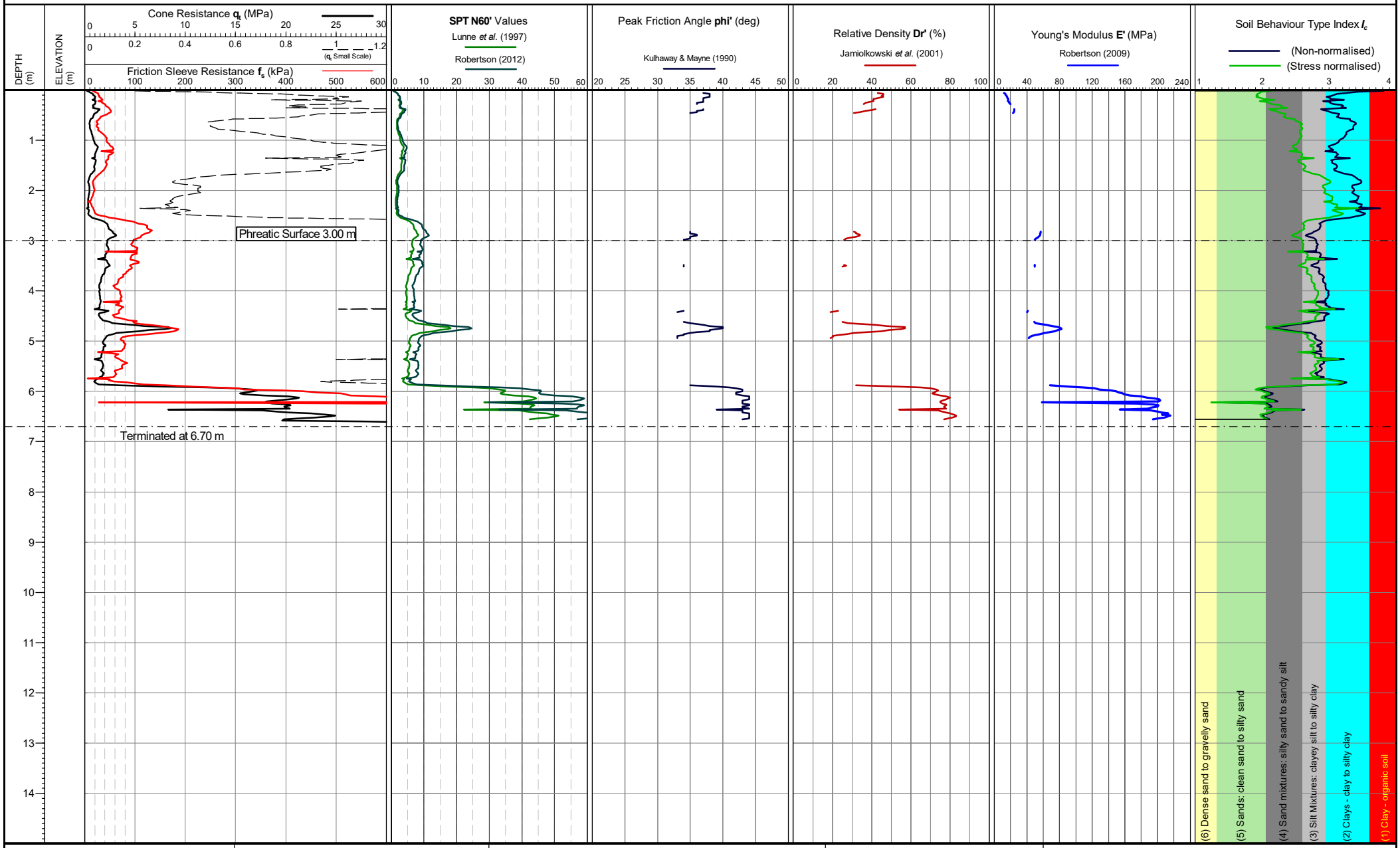
Lankelma Project Ref: P-107495-1

TEST ID: CPT10

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 11:19:00

Location: 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: 30-06-20

Checked by: Chris Player

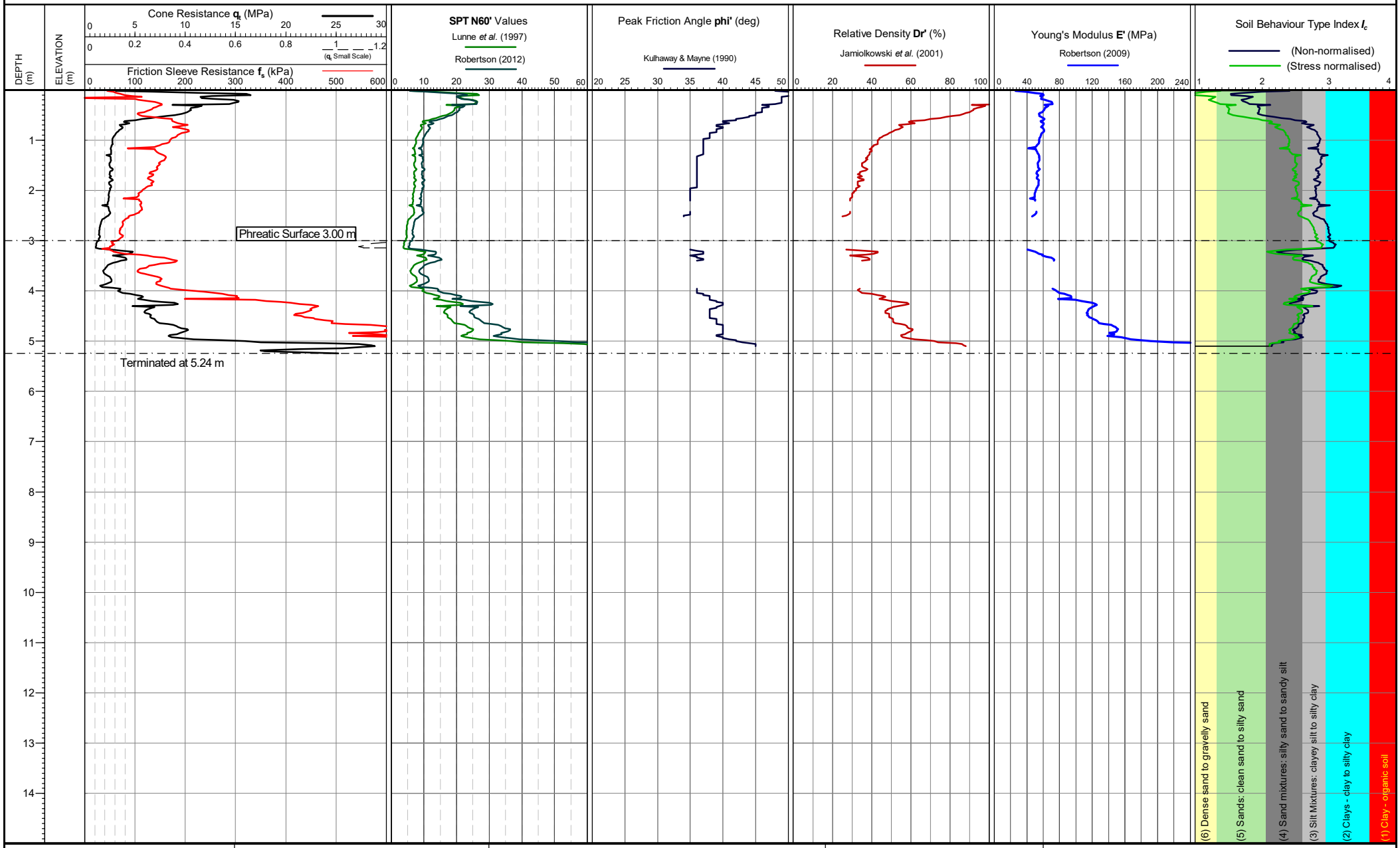
Lankelma Project Ref: P-107495-1

TEST ID: CPT11

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Phillip Case
Date of test: 30/06/2020 11:42:00

Location: 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: 30-06-20
Checked by: Chris Player

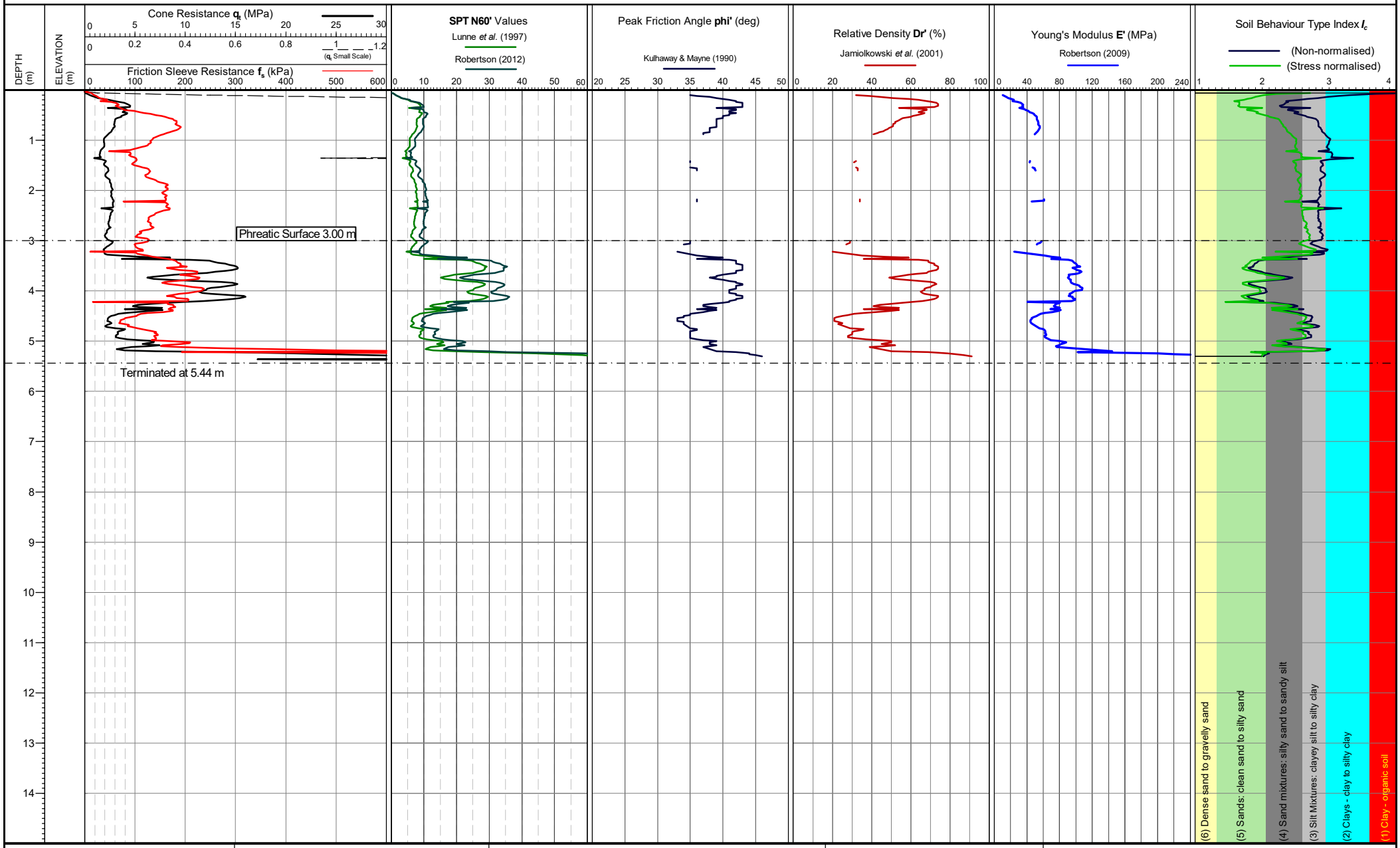
Lankelma Project Ref: P-107495-1

TEST ID: CPT12

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 15:05:00

Location: 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: 30-06-20
Checked by: Chris Player

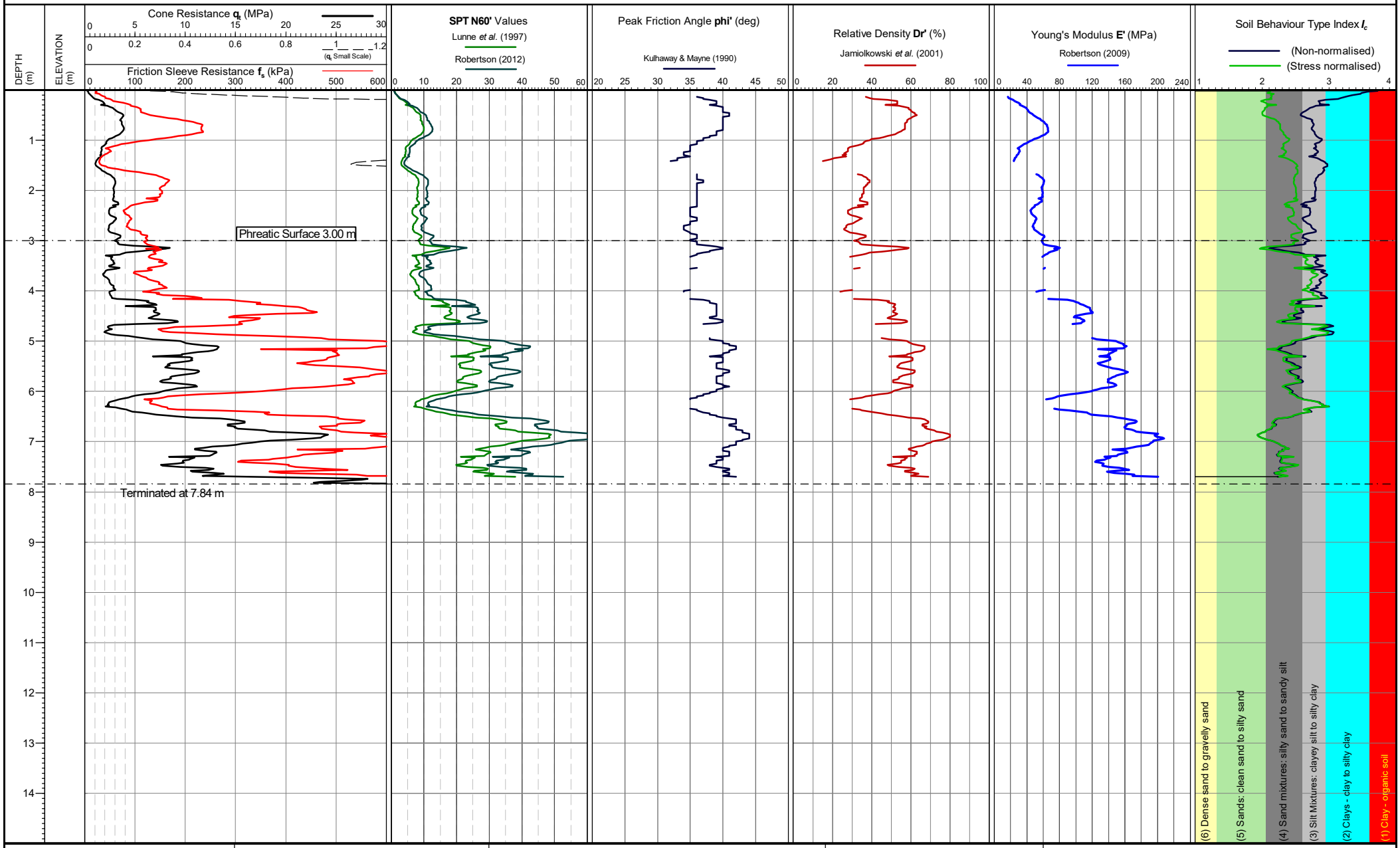
Lankelma Project Ref: P-107495-1

TEST ID: CPT13

LANKELMA

Project: MANCHESTER

Client: CROSSFIELD CONSULTING



Cone area (mm2):1500
Cone ID: S15-CFIPT.1821
Operator: Rob Ashcroft
Date of test: 30/06/2020 14:23:00

Location: 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: 30-06-20

Checked by: Chris Player

Lankelma Project Ref: P-107495-1

TEST ID: CPT14

Laboratory Report	DNR/34348-34362A	Contract Sample No	DN2055/1-15A
Report Date	24/06/2020	ETS Contract No	DN2055/1-15A

Construction Testing Solutions Ltd

Bootham Lane Industrial Estate
Bootham Lane
Dunscroft
Doncaster
DN7 4JU

Tel: 01302 352652
Fax: 01302 352700
Web: www.constructiontesting.co.uk
Email: enquiries@constructiontesting.co.uk

Crossfield Consulting Geotechnical Environmental
The Granary
White Hall Farm
Long Itchington
Warwickshire
CV47 9PU

Project:
ICON Plot 2, Manchester

Material Description	
Source	Not Stated
Supplier	Not Stated
Date Sampled	12/06/2020
Date Received	12/06/2020
Date Completed	24/06/2020
Sample Location	See OMC/MDD Reports
Client Reference	DN2055/1-15A

Determination of Equivalent Shear Strength

Based on BS1377, Part 9: 1990 & BS 5930: 1999

Calibration Constant:	1.432400	Equipment Ref.: HSV14	Operator SB

Sample Reference	Moisture Content (%)	Dry Density (Mg/m^3)	Shear Vane Readings (Divisions)				Average Vane Reading	Equivalent Shear Strength (kPa)
			Test 1	Test 2	Test 3	Test 4		
DN2055/1 - HOST	12.8	1.963	>140	>140	>140	>140	>140	**>201**
DN2055/1 - HOST	10.7	1.998	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/1 - HOST	9.2	1.954	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/1 - HOST	7.0	1.908	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/1 - HOST	14.9	1.898	94	98	100	106	100	**143**
DN2055/5 - HOST	18.6	1.761	82	76	80	84	81	**116**
DN2055/5 - HOST	16.0	1.846	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/5 - HOST	12.5	1.901	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/5 - HOST	10.2	1.877	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/5 - HOST	8.1	1.817	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/8 - HOST	21.7	1.684	130	98	100	98	107	**153**
DN2055/8 - HOST	17.7	1.802	>140	>140	>140	>140	>140	**>201**
DN2055/8 - HOST	14.6	1.871	>140	>140	>140	>140	>140	**>201**
DN2055/8 - HOST	11.1	1.833	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/8 - HOST	7.1	1.814	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/8 - 2% Lime	19.0	1.665	90	84	100	77	88	**126**
DN2055/8 - 2% Lime	14.5	1.855	84	100	77	77	85	**122**
DN2055/8 - 2% Lime	10.6	1.864	>140	>140	>140	>140	>140	**>201**
DN2055/8 - 2% Lime	8.2	1.809	>140	>140	>140	>140	>140	**>201**
DN2055/8 - 2% Lime	4.4	1.665	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/9 - HOST	16.1	1.840	130	110	115		118	**169**
DN2055/9 - HOST	12.0	1.933	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/9 - HOST	9.5	1.922	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/9 - HOST	7.2	1.854	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/9 - HOST	18.4	1.747	95	90	95	95	94	**135**
DN2055/9 - 2% Lime	16.6	1.835	110	110	110	110	110	**158**
DN2055/9 - 2% Lime	12.8	1.956	>140	>140	>140	>140	>140	**>201**
DN2055/9 - 2% Lime	9.2	1.855	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/9 - 2% Lime	6.3	1.786	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/9 - 2% Lime	18.4	1.802	90	75	90	75	83	**119**

Notes:

Authorised Signatory

C Langley - Laboratory Manager

Laboratory Report	DNR/34348-34362A	Contract Sample No	DN2055/1-15A
Report Date	24/06/2020	ETS Contract No	DN2055/1-15A

Construction Testing Solutions Ltd

Bootham Lane Industrial Estate
Bootham Lane
Dunscroft
Doncaster
DN7 4JU

Tel: 01302 352652
Fax: 01302 352700
Web: www.constructiontesting.co.uk
Email: enquiries@constructiontesting.co.uk

Crossfield Consulting Geotechnical Environmental
The Granary
White Hall Farm
Long Itchington
Warwickshire
CV47 9PU

Project:
ICON Plot 2, Manchester

Material Description	
Source	Not Stated
Supplier	Not Stated
Date Sampled	12/06/2020
Date Received	12/06/2020
Date Completed	24/06/2020
Sample Location	See OMC/MDD Reports
Client Reference	DN2055/1-15A

Determination of Equivalent Shear Strength

Based on BS1377, Part 9: 1990 & BS 5930: 1999

Calibration Constant:	1.432400	Equipment Ref.: HSV14	Operator SB

Sample Reference	Moisture Content (%)	Dry Density (Mg/m^3)	Shear Vane Readings (Divisions)				Average Vane Reading	Equivalent Shear Strength (kPa)
			Test 1	Test 2	Test 3	Test 4		
DN2055/10 - HOST	18.3	1.780	88	84	80	80	83	**119**
DN2055/10 - HOST	16.0	1.840	>140	>140	>140	>140	>140	**>201**
DN2055/10 - HOST	11.5	1.903	>140	>140	>140	>140	>140	**>201**
DN2055/10 - HOST	7.8	1.889	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/10 - HOST	5.6	1.875	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/10 - 2% Lime	16.3	1.793	80	80	80	80	80	**115**
DN2055/10 - 2% Lime	13.6	1.885	120	110	120	110	115	**165**
DN2055/10 - 2% Lime	11.9	1.940	>140	>140	>140	>140	>140	**>201**
DN2055/10 - 2% Lime	9.8	1.805	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/10 - 2% Lime	7.3	1.722	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/11 - HOST	16.0	1.770	75	80	75	80	78	**112**
DN2055/11 - HOST	13.1	1.773	100	90	100	90	95	**136**
DN2055/11 - HOST	9.7	1.804	>140	>140	>140	>140	>140	**>201**
DN2055/11 - HOST	6.3	1.743	>140	>140	>140	>140	>140	**>201**
DN2055/11 - HOST	4.8	1.650	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/11 - 2% Lime	16.4	1.739	>140	>140	>140	>140	>140	**>201**
DN2055/11 - 2% Lime	13.2	1.841	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/11 - 2% Lime	10.5	1.831	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/11 - 2% Lime	7.1	1.782	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/11 - 2% Lime	18.6	1.657	100	90	100	90	95	**136**
DN2055/12 - HOST	21.8	1.680	64	60	64	60	62	**89**
DN2055/12 - HOST	18.3	1.788	>140	>140	>140	>140	>140	**>201**
DN2055/12 - HOST	14.1	1.879	>140	>140	>140	>140	>140	**>201**
DN2055/12 - HOST	10.8	1.899	>140	>140	>140	>140	>140	**>201**
DN2055/12 - HOST	7.0	1.865	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/13 - HOST	18.8	1.774	108	120	130	130	122	**175**
DN2055/13 - HOST	15.8	1.863	>140	>140	>140	>140	>140	**>201**
DN2055/13 - HOST	12.7	1.906	>140	>140	>140	>140	>140	**>201**
DN2055/13 - HOST	9.1	1.879	>140	>140	>140	>140	>140	**>201**
DN2055/13 - HOST	5.6	1.834	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**

Notes:

Authorised Signatory

C Langley - Laboratory Manager

Laboratory Report	DNR/34348-34362B	Contract Sample No	DN2055/1-15B
Report Date	24/06/2020	ETS Contract No	DN2055/1-15B

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Crossfield Consulting Geotechnical Environmental
The Granary
White Hall Farm
Long Itchington
Warwickshire
CV47 9PU

Project:
ICON Plot 2, Manchester

Material Description	
Source	Not Stated
Supplier	Not Stated
Date Sampled	12/06/2020
Date Received	12/06/2020
Date Completed	24/06/2020
Sample Location	See OMC/MDD Reports
Client Reference	DN2055/1-15B

Determination of Equivalent Shear Strength

Based on BS1377, Part 9: 1990 & BS 5930: 1999

Calibration Constant:	1.432400	Equipment Ref.: HSV14	Operator SB

Sample Reference	Moisture Content (%)	Dry Density (Mg/m^3)	Shear Vane Readings (Divisions)				Average Vane Reading	Equivalent Shear Strength (kPa)
			Test 1	Test 2	Test 3	Test 4		
DN2055/15 - HOST	18.4	1.754	78	84	70	70	76	**109**
DN2055/15 - HOST	14.2	1.901	>140	>140	>140	>140	>140	**>201**
DN2055/15 - HOST	10.9	1.901	>140	>140	>140	>140	>140	**>201**
DN2055/15 - HOST	7.4	1.878	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/15 - HOST	21.3	1.650	38	40	38	38	39	**56**
DN2055/15 - 2% Lime	16.4	1.877	>140	>140	>140	>140	>140	**>201**
DN2055/15 - 2% Lime	12.9	1.918	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/15 - 2% Lime	9.4	1.875	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/15 - 2% Lime	5.1	1.850	Too Stiff	Too Stiff	Too Stiff	Too Stiff	N/A	**Too Stiff**
DN2055/15 - 2% Lime	18.5	1.795	85	70	85	70	78	**112**

Notes:

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C Langley - Laboratory Manager

Laboratory Report	DNR/36570-36571	Contract Sample No	DN2055/16-17
Report Date	17/07/2020	ETS Contract No	DN2055/16-17

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Crossfield Consulting Geotechnical Environmental
The Granary
White Hall Farm
Long Itchington
Warwickshire
CV47 9PU

Project:
ICON Plot 2, Manchester

Material Description	
Source	Not Stated
Supplier	Not Stated
Date Sampled	01/07/2020
Date Received	01/07/2020
Date Completed	17/07/2020
Sample Location	See OMC/MDD Reports
Client Reference	DN2055/16-17

Determination of Equivalent Shear Strength

Based on BS1377, Part 9: 1990 & BS 5930: 1999

Calibration Constant:	1.432400	Equipment Ref.: HSV14	Operator SB

Sample Reference	Moisture Content (%)	Dry Density (Mg/m^3)	Shear Vane Readings (Divisions)				Average Vane Reading	Equivalent Shear Strength (kPa)
			Test 1	Test 2	Test 3	Test 4		
DN2055/16	17.7	1.640	64	62	56	74	64	**92**
DN2055/16	15.1	1.697	96	82	84	98	90	**129**
DN2055/16	13.1	1.729	too stiff	too stiff	too stiff	too stiff	N/A	**Too Stiff**
DN2055/16	10.9	1.696	too stiff	too stiff	too stiff	too stiff	N/A	**Too Stiff**
DN2055/16	8.9	1.657	too stiff	too stiff	too stiff	too stiff	N/A	**Too Stiff**
DN2055/17	10.0	1.753	too stiff	too stiff	too stiff	too stiff	N/A	**Too Stiff**
DN2055/17	15.3	1.683	88	96	102	94	95	**136**
DN2055/17	13.0	1.719	too stiff	too stiff	too stiff	too stiff	N/A	**Too Stiff**
DN2055/17	7.4	1.738	too stiff	too stiff	too stiff	too stiff	N/A	**Too Stiff**
DN2055/17	6.1	1.733	too stiff	too stiff	too stiff	too stiff	N/A	**Too Stiff**

Notes:

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C Langley - Laboratory Manager

Laboratory Report	DNR/34348	Contract Sample No	DN2055/1
Report Date	24/06/2020	Clients Reference	DN2055/1
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL2 @ 1.2M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

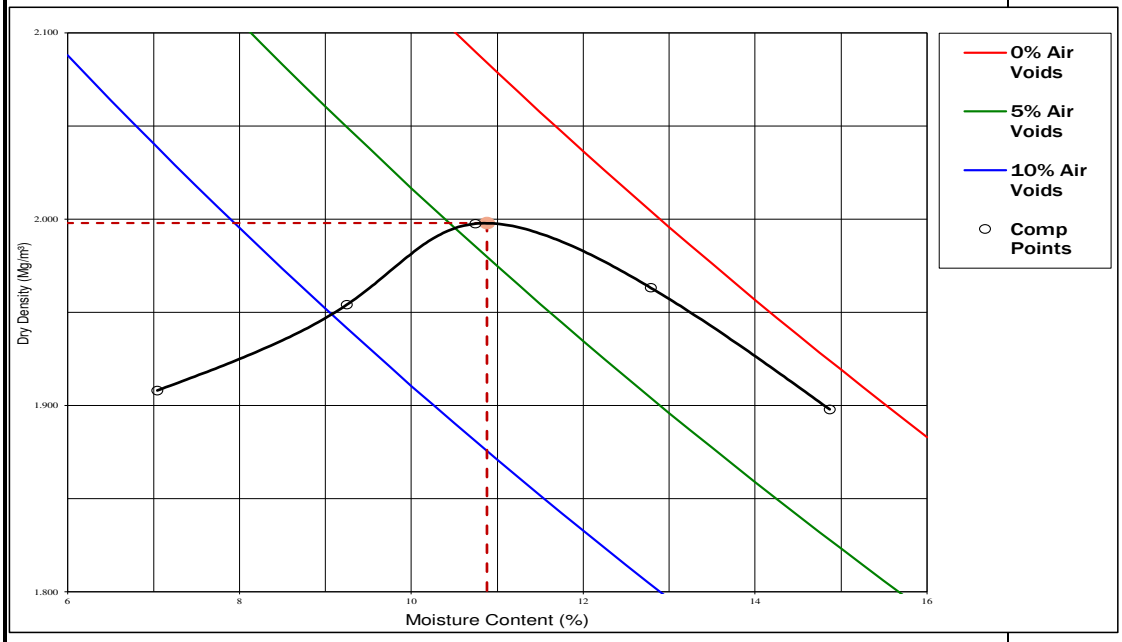
Moisture Content	16 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.70 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	11 %
Maximum Dry Density	2.00 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.70 Mg/m³

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Laboratory Report	DNR/34349	Contract Sample No	DN2055/2
Report Date	24/06/2020	Clients Reference	DN2055/2
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL4 @ 0.9M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	23.6 %

Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a natural soil specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	38 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	20 %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	18 %
Material Passing 425 µm test sieve	100 %

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Laboratory Report	DNR/34350	Contract Sample No	DN2055/3
Report Date	24/06/2020	Clients Reference	DN2055/3
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL5 @ 3.8M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	21.3 %

Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a natural soil specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	27 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	N/P %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	N/A %
Material Passing 425 µm test sieve	100 %

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Laboratory Report	DNR/34351	Contract Sample No	DN2055/4
Report Date	24/06/2020	Clients Reference	DN2055/4
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL8 @ 0.6M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	18.4 %

Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a natural soil specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	52 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	24 %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	28 %
Material Passing 425 µm test sieve	100 %

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Laboratory Report	DNR/34352	Contract Sample No	DN2055/5
Report Date	24/06/2020	Clients Reference	DN2055/5
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL9 @ 0.9M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

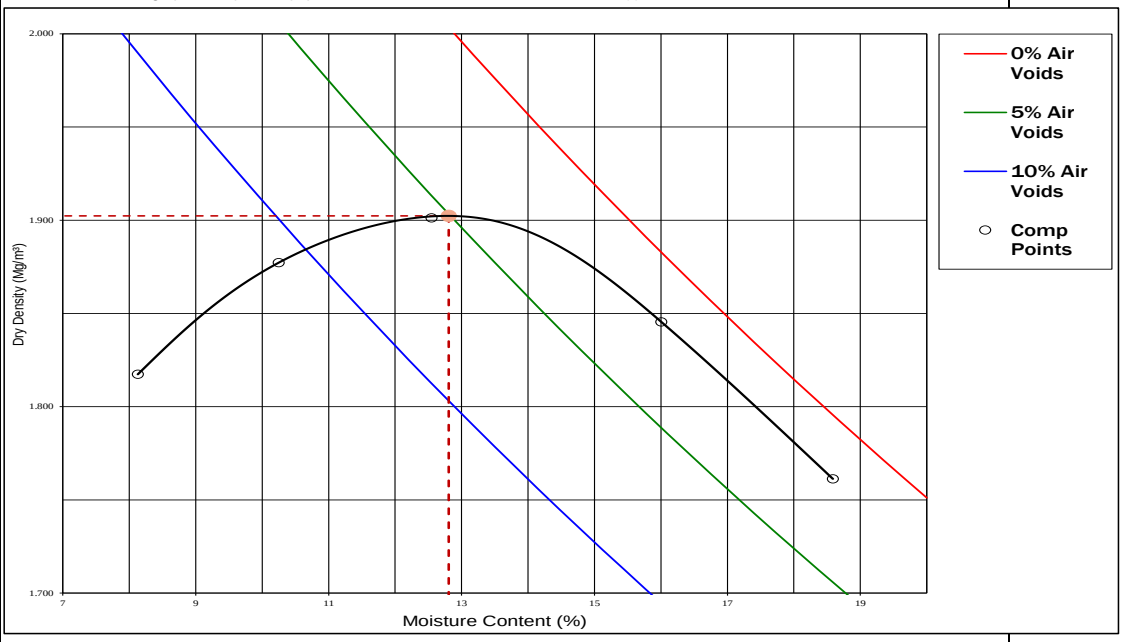
Moisture Content	23.2 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.70 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	13 %
Maximum Dry Density	1.90 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.70 Mg/m³

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Laboratory Report	DNR/34353	Contract Sample No	DN2055/6
Report Date	24/06/2020	Clients Reference	DN2055/6
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL9 @ 1.7M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	23.9 %

Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a natural soil specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	51 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	19 %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	32 %
Material Passing 425 µm test sieve	100 %

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Laboratory Report	DNR/34354	Contract Sample No	DN2055/7
Report Date	24/06/2020	Clients Reference	DN2055/7
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL10 @ 1.15M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	80.6 %

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Laboratory Report	DNR/34355A	Contract Sample No	DN2055/8A
Report Date	24/06/2020	Clients Reference	DN2055/8A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL11 @ 0.8M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	20.4 %

Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a natural soil specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	25 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	N/P %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	N/A %
Material Passing 425 µm test sieve	100 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.71 Mg/m^3

Laboratory Report	DNR/34355A	Contract Sample No	DN2055/8A
Report Date	24/06/2020	Clients Reference	DN2055/8A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL11 @ 0.8M

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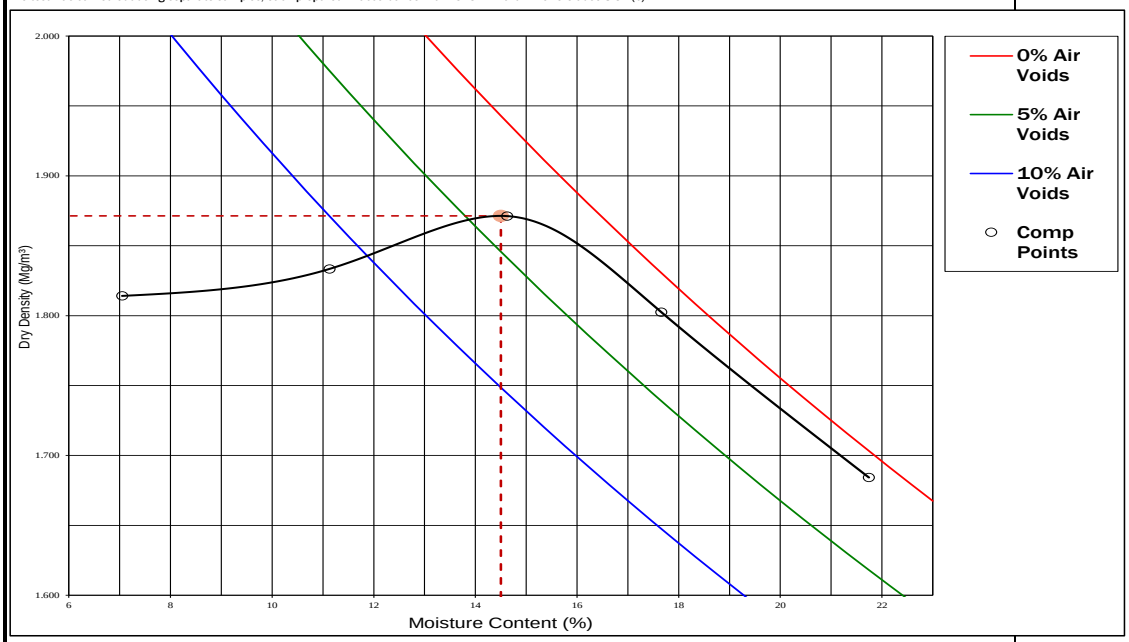
Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	15	%
Maximum Dry Density	1.87	Mg/m³
Material Retained on 37.5mm test sieve	0	%
Material Retained on 20.0mm test sieve	0	%
Particle Density (Measured)	2.71	Mg/m³

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Laboratory Report	DNR/34355B	Contract Sample No	DN2055/8B
Report Date	24/06/2020	Clients Reference	DN2055/8B
		Material Description	2% Lime
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL11 @ 0.8M

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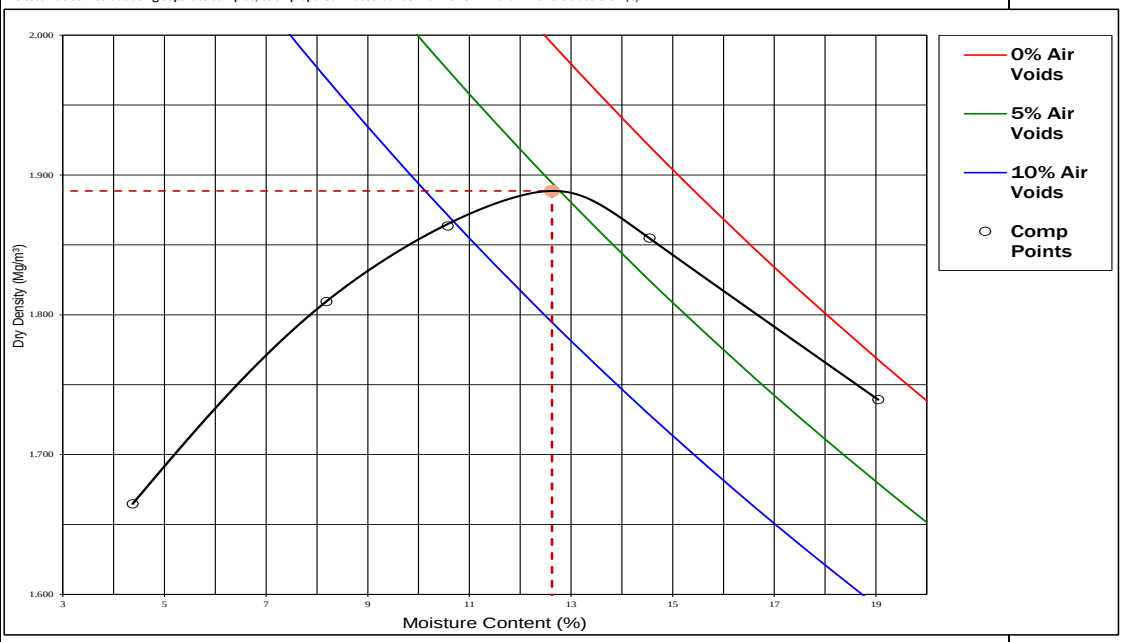
Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.67 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	13 %
Maximum Dry Density	1.89 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.67 Mg/m³

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Laboratory Report	DNR/34356A	Contract Sample No	DN2055/9A
Report Date	24/06/2020	Clients Reference	DN2055/9A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL11 @ 1.9M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

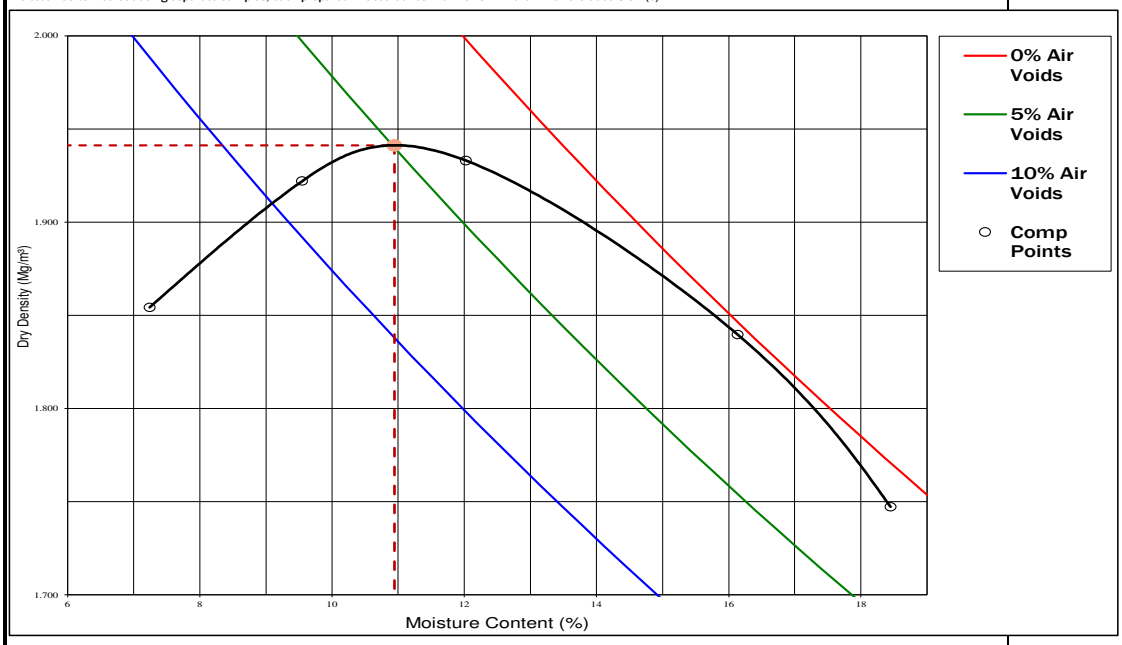
Moisture Content	17.3 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.63 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	11 %
Maximum Dry Density	1.94 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.63 Mg/m³

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Laboratory Report	DNR/34356B	Contract Sample No	DN2055/9B
Report Date	24/06/2020	Clients Reference	DN2055/9B
		Material Description	2% Lime
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL11 @ 1.9M

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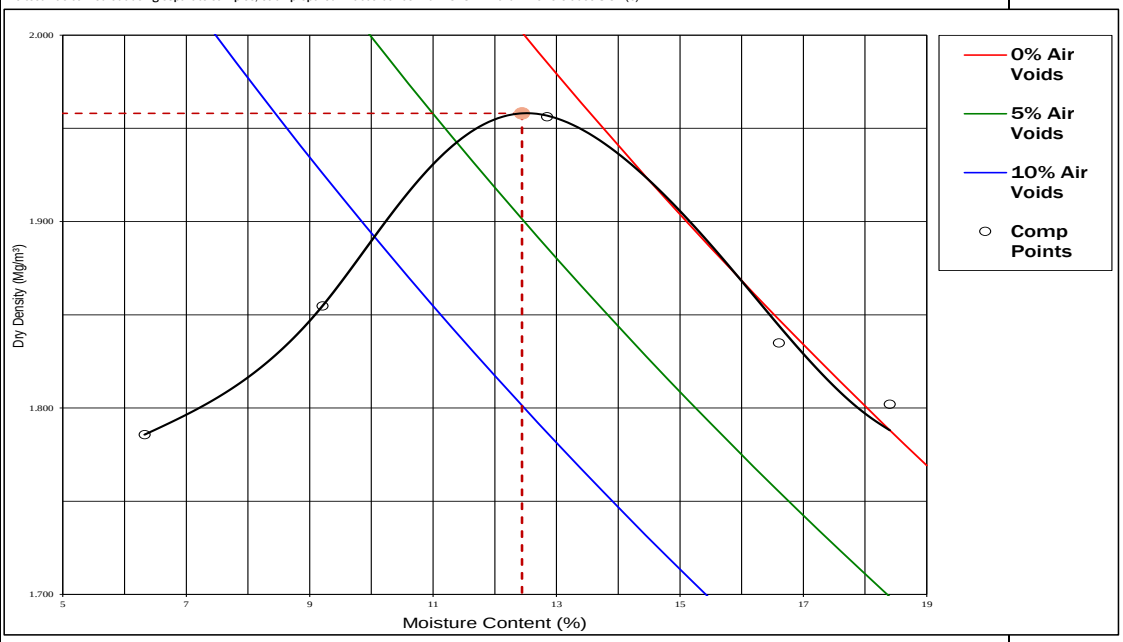
Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.67 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	12 %
Maximum Dry Density	1.96 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.67 Mg/m³

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Laboratory Report	DNR/34357A	Contract Sample No	DN2055/10A
Report Date	24/06/2020	Clients Reference	DN2055/10A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
0		Sample Location	TPCCL12 @ 1.0M

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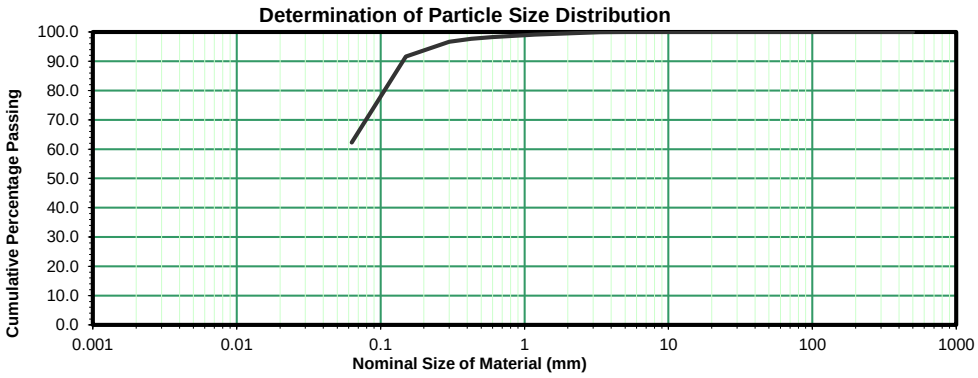
Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	20.2 %

Determination of particle size distribution (wet sieving method) - BS 1377: Part 2: 1990 Clause 9.2

Sample prepared in accordance with BS 1377: Part 1: 1990 clause 7.3.4(a)

BS Sieve Size	Passing BS Sieve	Specification MCHW SHW Vol 1 Series 600 Table 6/2 Class 2A
500 mm	100 %	
300 mm	100 %	
125 mm	100 %	100
100 mm	100 %	
90 mm	100 %	
75 mm	100 %	
63 mm	100 %	
50 mm	100 %	
37.5 mm	100 %	
28 mm	100 %	
20 mm	100 %	
14 mm	100 %	
10 mm	100 %	
6.3 mm	100 %	
5 mm	100 %	
3.35 mm	100 %	
2 mm	100 %	80 - 100
1.18 mm	99 %	
600 µm	98 %	
425 µm	98 %	
300 µm	97 %	
150 µm	92 %	
63 µm	62 %	15 - 100



Laboratory Report	DNR/34357A	Contract Sample No	DN2055/10A
Report Date	24/06/2020	Clients Reference	DN2055/10A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU 0		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
		Sample Location	TPCCL12 @ 1.0M

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Determination of particle size distribution (Hydrometer Method) - BS 1377: Part 2: 1990 Clause 9.5

Sample prepared in accordance with BS 1377: Part 1: 1990 clause 7.3.4(a)

Pretreatment for organic matter with hydrogen peroxide was not required.

20 µm	16 %
6 µm	12 %
2 µm	10 %

Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a wet sieved specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	41 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	18 %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	23 %
Material Passing 425 µm test sieve	98 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.67 Mg/m³

Laboratory Report	DNR/34357A	Contract Sample No	DN2055/10A
Report Date	24/06/2020	Clients Reference	DN2055/10A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
0		Sample Location	TPCCL12 @ 1.0M

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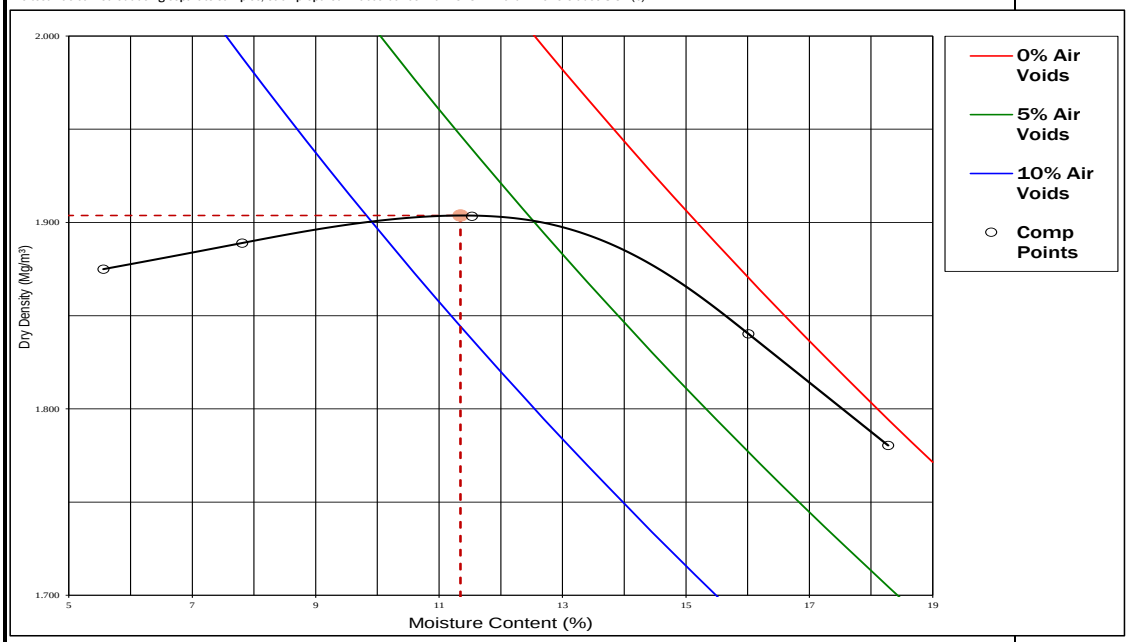
Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	11	%
Maximum Dry Density	1.90	Mg/m³
Material Retained on 37.5mm test sieve	0	%
Material Retained on 20.0mm test sieve	0	%
Particle Density (Measured)	2.67	Mg/m³

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Laboratory Report	DNR/34357B	Contract Sample No	DN2055/10B
Report Date	24/06/2020	Clients Reference	DN2055/10B
		Material Description	2% Lime
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL12 @ 1.0M

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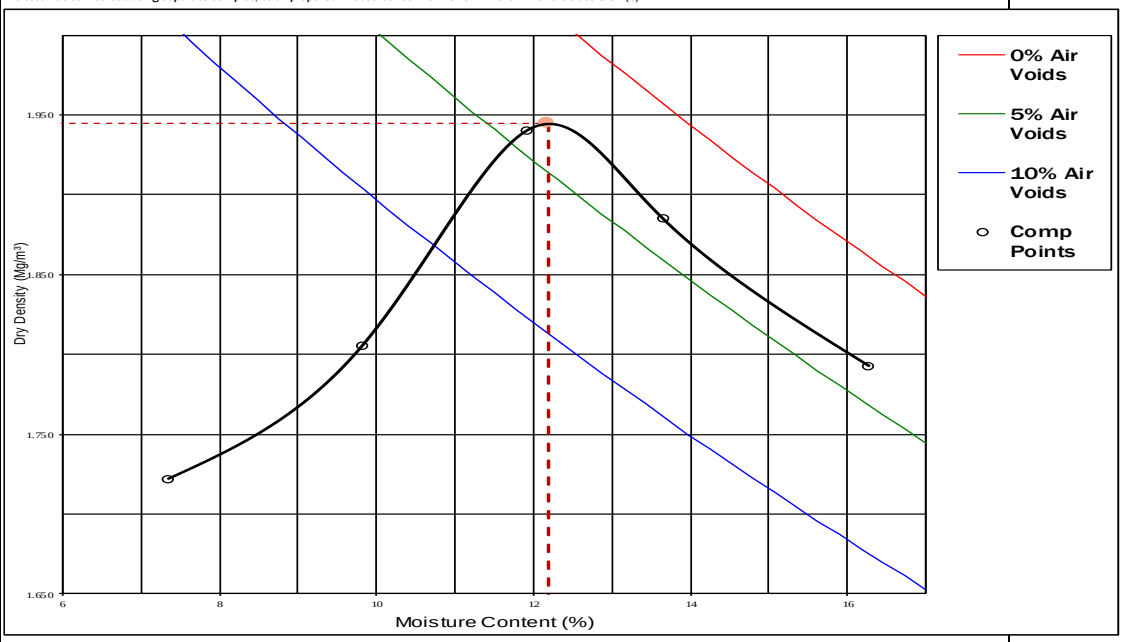
Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.67 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	12 %
Maximum Dry Density	1.95 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.67 Mg/m³

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Report Date	24/06/2020	Clients Reference	DN2055/11A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL13 @ 1.1M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

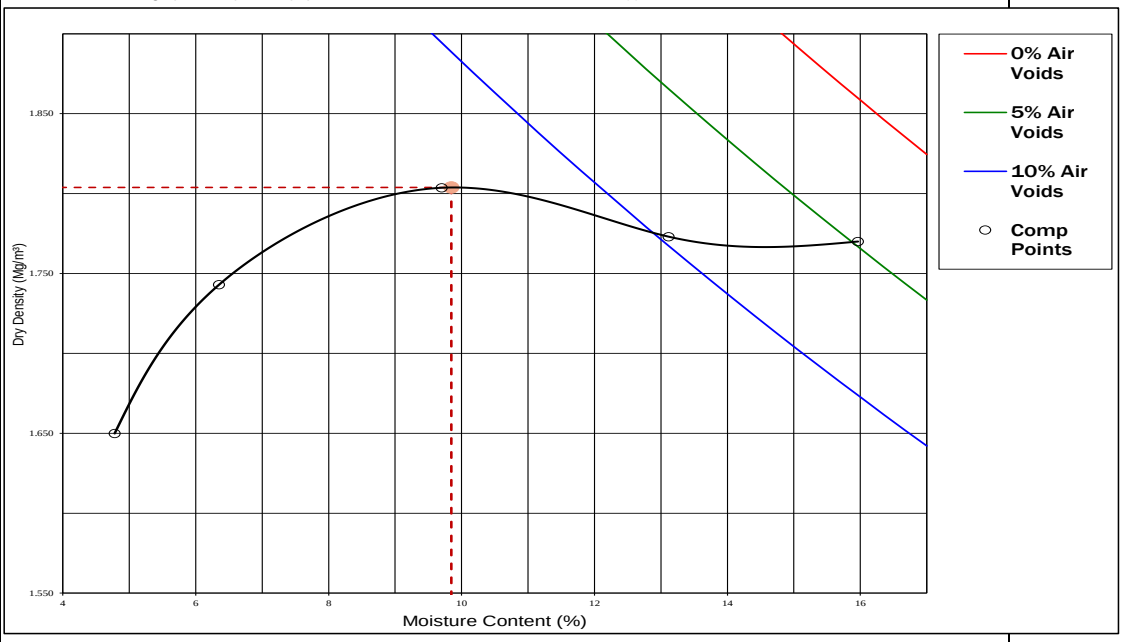
Moisture Content	20 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.65 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	10 %
Maximum Dry Density	1.80 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.65 Mg/m³

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Laboratory Report	DNR/34358B	Contract Sample No	DN2055/11B
Report Date	24/06/2020	Clients Reference	DN2055/11B
		Material Description	2% Lime
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL13 @ 1.1M

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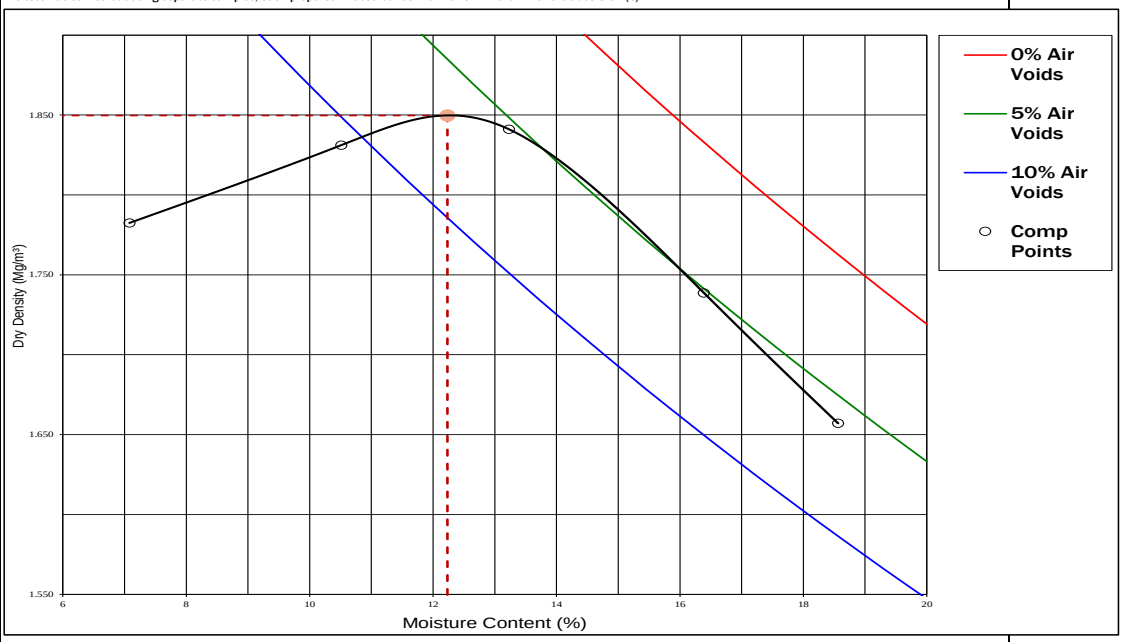
Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.62 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	12 %
Maximum Dry Density	1.85 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.62 Mg/m³

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Laboratory Report	DNR/34359	Contract Sample No	DN2055/12
Report Date	24/06/2020	Clients Reference	DN2055/12
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL13 @ 2.2M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	22 %

Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a natural soil specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	41 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	20 %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	21 %
Material Passing 425 µm test sieve	100 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.72 Mg/m^3

Laboratory Report	DNR/34359	Contract Sample No	DN2055/12
Report Date	24/06/2020	Clients Reference	DN2055/12
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL13 @ 2.2M

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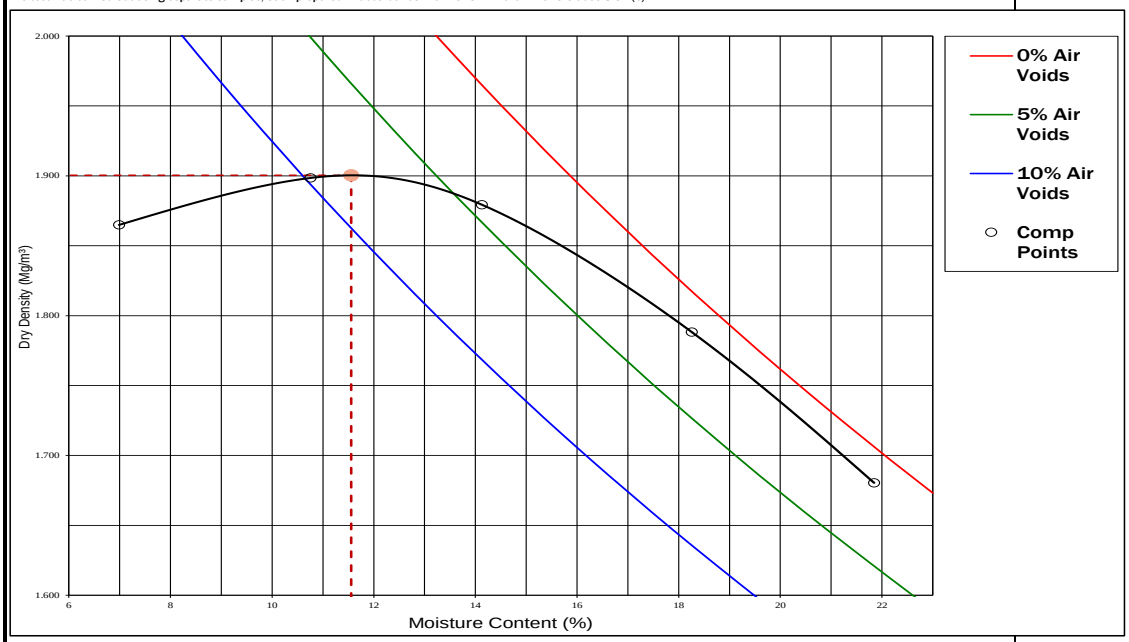
Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	12	%
Maximum Dry Density	1.90	Mg/m³
Material Retained on 37.5mm test sieve	0	%
Material Retained on 20.0mm test sieve	0	%
Particle Density (Measured)	2.72	Mg/m³

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Laboratory Report	DNR/34360	Contract Sample No	DN2055/13
Report Date	24/06/2020	Clients Reference	DN2055/13
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL14 @ 0.8M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

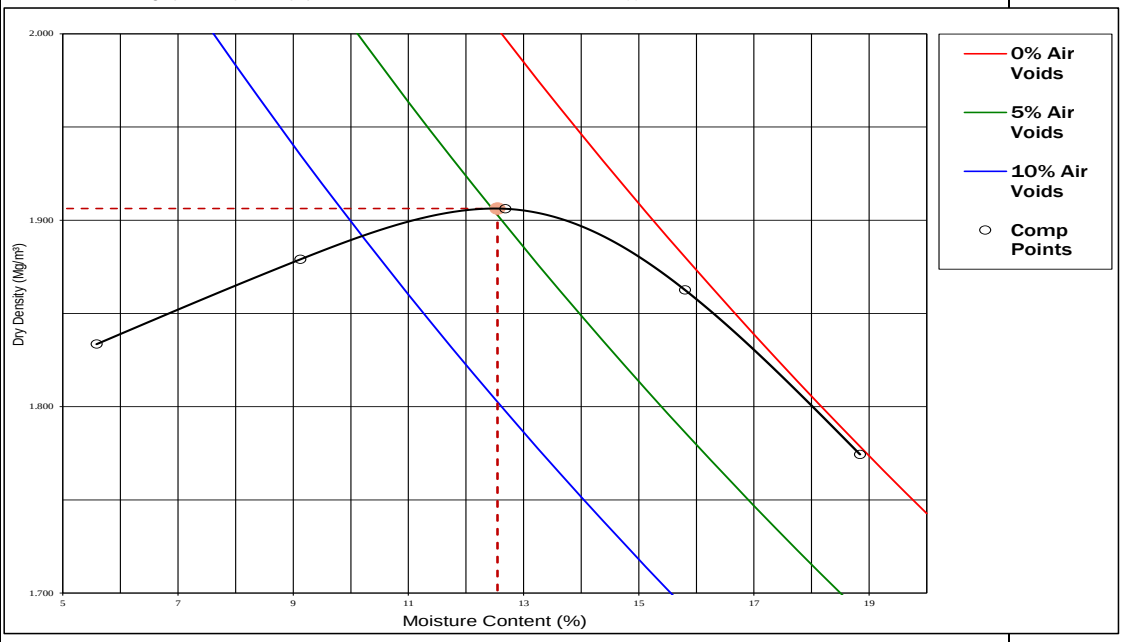
Moisture Content	21.8 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.68 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	13 %
Maximum Dry Density	1.91 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.68 Mg/m³

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Laboratory Report	DNR/34361	Contract Sample No	DN2055/14
Report Date	24/06/2020	Clients Reference	DN2055/14
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL15 @ 1.0M

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Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	19.4 %

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Laboratory Report	DNR/34362A	Contract Sample No	DN2055/15A
Report Date	24/06/2020	Clients Reference	DN2055/15A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL16 @ 0.8M

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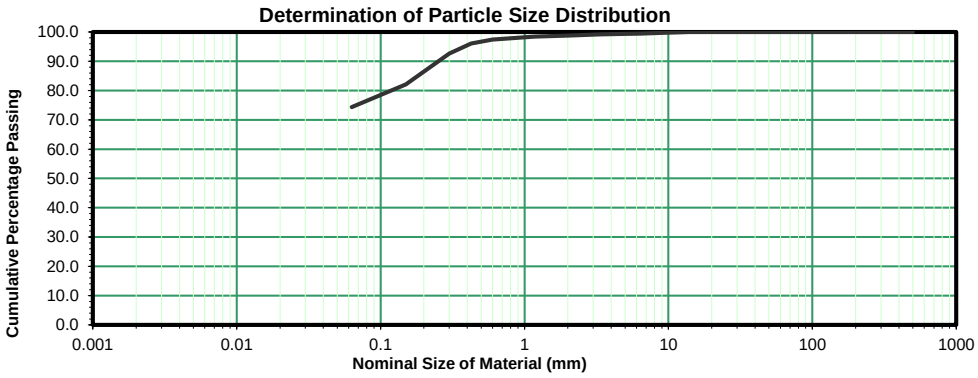
Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	19.4 %

Determination of particle size distribution (wet sieving method) - BS 1377: Part 2: 1990 Clause 9.2

Sample prepared in accordance with BS 1377: Part 1: 1990 clause 7.3.4(a)

BS Sieve Size	Passing BS Sieve	Specification MCHW SHW Vol 1 Series 600 Table 6/2 Class 2A
500 mm	100 %	
300 mm	100 %	
125 mm	100 %	100
100 mm	100 %	
90 mm	100 %	
75 mm	100 %	
63 mm	100 %	
50 mm	100 %	
37.5 mm	100 %	
28 mm	100 %	
20 mm	100 %	
14 mm	100 %	
10 mm	100 %	
6.3 mm	99 %	
5 mm	99 %	
3.35 mm	99 %	
2 mm	99 %	80 - 100
1.18 mm	98 %	
600 µm	97 %	
425 µm	96 %	
300 µm	93 %	
150 µm	82 %	
63 µm	74 %	15 - 100



Laboratory Report	DNR/34362A	Contract Sample No	DN2055/15A
Report Date	24/06/2020	Clients Reference	DN2055/15A
		Material Description	HOST
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL16 @ 0.8M

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Determination of Plastic Limit, Liquid Limit and Plasticity Index - BS1377: Part2: 1990

The sample was prepared from a wet sieved specimen and in accordance with BS1377: Part 1: 1990: Clause 7.3.4(b)

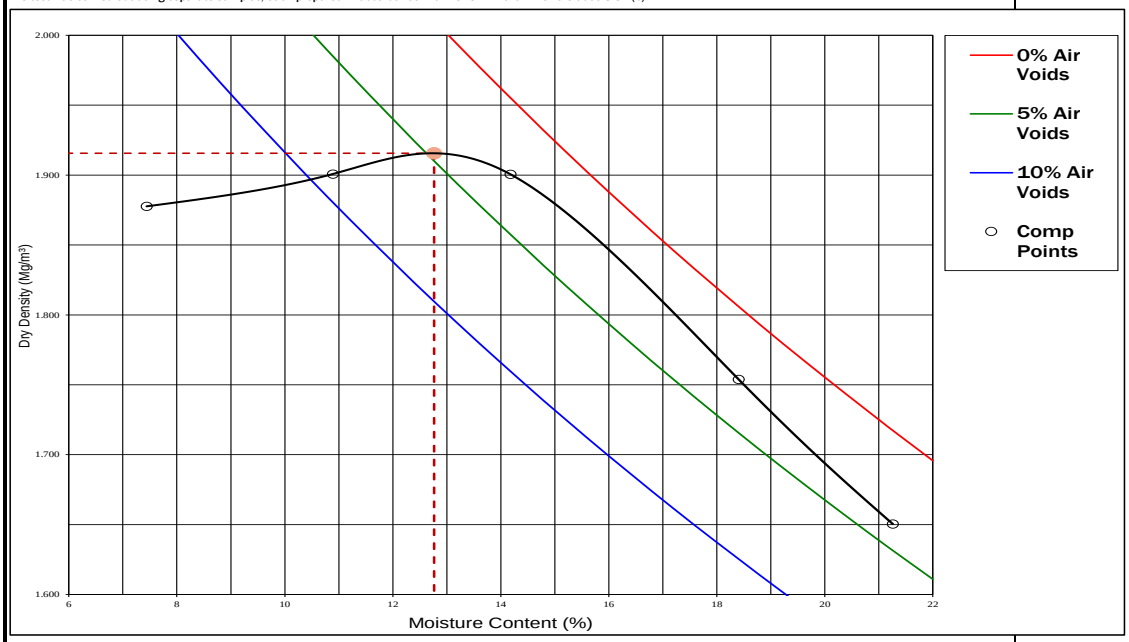
Liquid Limit (BS 1377: Part 2: 1990 Clause 4.3 - Definitive)	46 %
Plastic Limit (BS 1377: Part 2: 1990 Clause 5.3)	19 %
Plasticity Index (BS 1377: Part 2: 1990 Clause 5.4)	27 %
Material Passing 425 µm test sieve	96 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.71 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	13 %
Maximum Dry Density	1.92 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.71 Mg/m³

Template Version: 1.4

Authorised Signatory

M O'Hara - Deputy Laboratory Manager

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Laboratory Report	DNR/34362B	Contract Sample No	DN2055/15B
Report Date	24/06/2020	Clients Reference	DN2055/15B
		Material Description	2% Lime
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	12/06/2020
		Sampled By	Client
		Date Received	12/06/2020
		Date Completed	24/06/2020
ICON Plot 2, Manchester		Sample Location	TPCCL16 @ 0.8M

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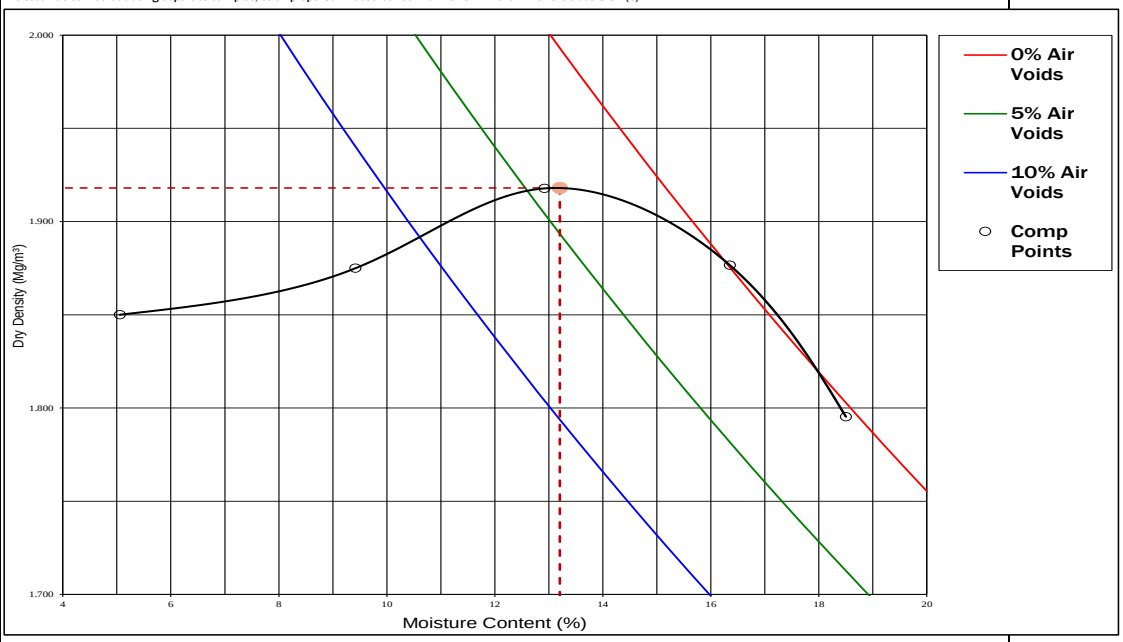
Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.71 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	13 %
Maximum Dry Density	1.92 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.71 Mg/m³

Template Version: 1.4

Authorised Signatory

M O'Hara - Deputy Laboratory Manager

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Laboratory Report	DNR/36570	Contract Sample No	DN2055/16
Report Date	17/07/2020	Clients Reference	DN2055/16
		Material Description	
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	01/07/2020
		Sampled By	Client
		Date Received	01/07/2020
		Date Completed	17/07/2020
ICON Plot 2, Manchester		Sample Location	TPCCL18 @ 1.3M

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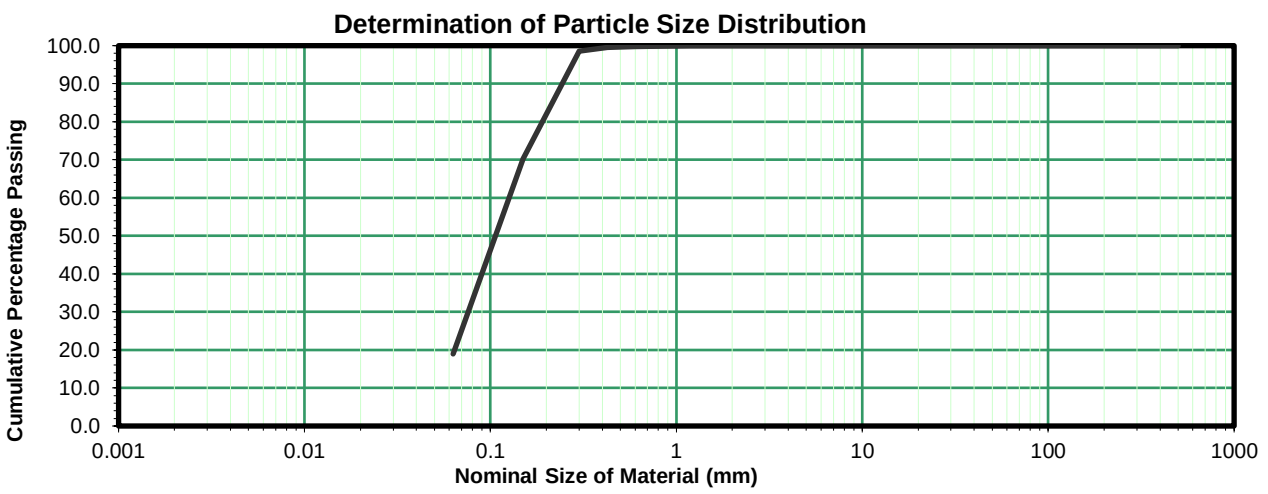
Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	18.6 %

Determination of particle size distribution (wet sieving method) - BS 1377: Part 2: 1990 Clause 9.2

Sample prepared in accordance with BS 1377: Part 1: 1990 clause 7.3.4(a)

BS Sieve Size	Passing BS Sieve	Specification MCHW SHW Vol 1 Series 600 Table 6/2 Class 2A/2B
500 mm	100 %	
300 mm	100 %	
125 mm	100 %	100
100 mm	100 %	
90 mm	100 %	
75 mm	100 %	
63 mm	100 %	
50 mm	100 %	
37.5 mm	100 %	
28 mm	100 %	
20 mm	100 %	
14 mm	100 %	
10 mm	100 %	
6.3 mm	100 %	
5 mm	100 %	
3.35 mm	100 %	
2 mm	100 %	80 - 100
1.18 mm	100 %	
600 µm	100 %	
425 µm	100 %	
300 µm	99 %	
150 µm	70 %	
63 µm	19 %	15 - 100



Material when tested complies with the material specification limits defined in the table above.

Laboratory Report	DNR/36570	Contract Sample No	DN2055/16
Report Date	17/07/2020	Clients Reference	DN2055/16
		Material Description	
Crossfield Consulting Geotechnical Environmental The Granary White Hall Farm Long Itchington Warwickshire CV47 9PU		Source	Not Stated
		Supplier	Not Stated
		Date Sampled	01/07/2020
		Sampled By	Client
		Date Received	01/07/2020
		Date Completed	17/07/2020
ICON Plot 2, Manchester		Sample Location	TPCCL18 @ 1.3M

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Determination of particle size distribution (Hydrometer Method) - BS 1377: Part 2: 1990 Clause 9.5

Sample prepared in accordance with BS 1377: Part 1: 1990 clause 7.3.4(a)

Pretreatment for organic matter with hydrogen peroxide was not required.

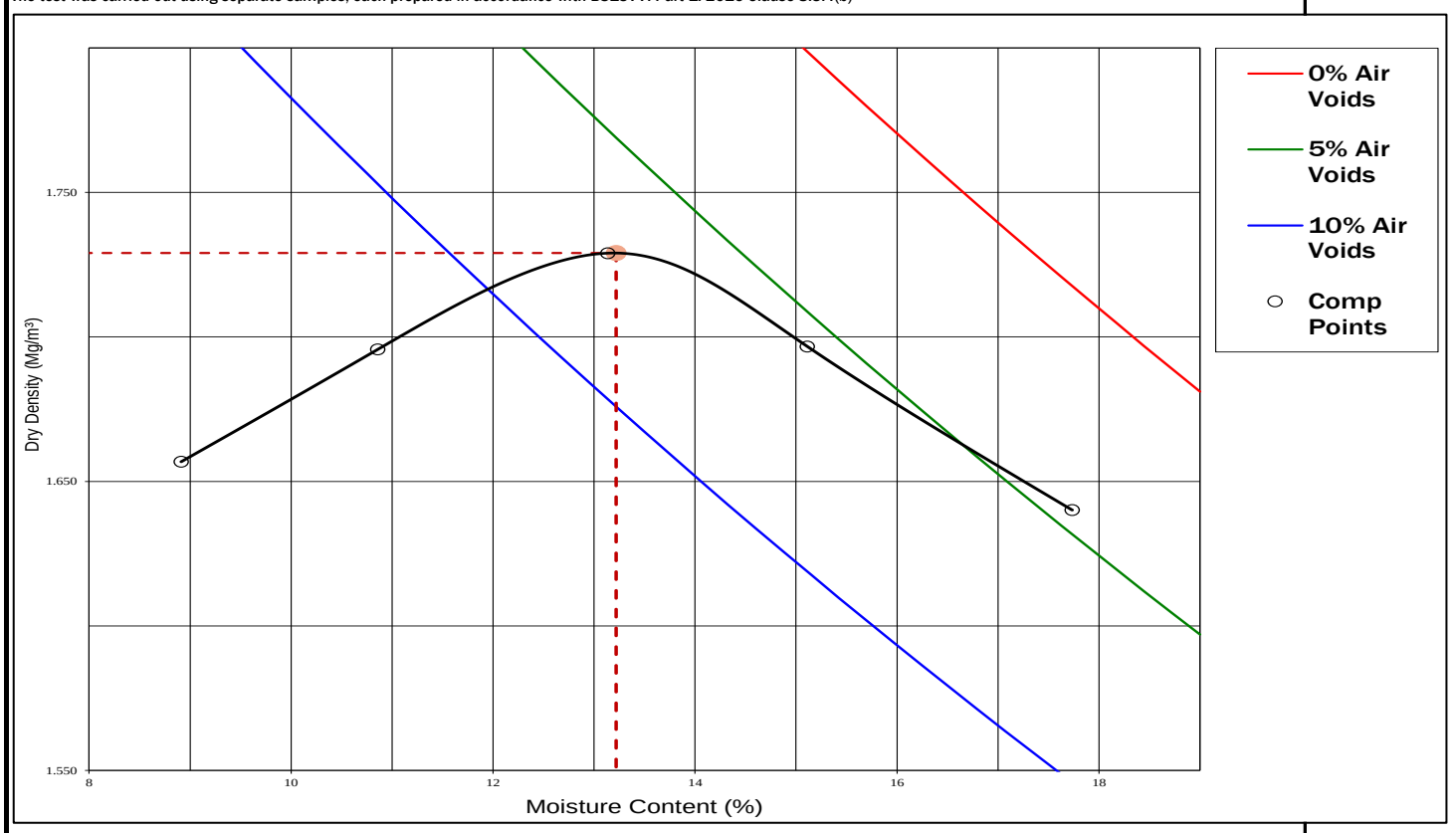
20 µm	6 %
6 µm	5 %
2 µm	5 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.47 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	13 %
Maximum Dry Density	1.73 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.47 Mg/m³

Template Version: 1.4

Authorised Signatory

A Fry - Section Manager

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Laboratory Report	DNR/36571	Contract Sample No	DN2055/17
Report Date	17/07/2020	Clients Reference	DN2055/17
		Material Description	

Crossfield Consulting Geotechnical Environmental
The Granary
White Hall Farm
Long Itchington
Warwickshire
CV47 9PU

ICON Plot 2, Manchester

Source	Not Stated
Supplier	Not Stated
Date Sampled	01/07/2020
Sampled By	Client
Date Received	01/07/2020
Date Completed	17/07/2020
Sample Location	TPCCL23 @ 1.3M

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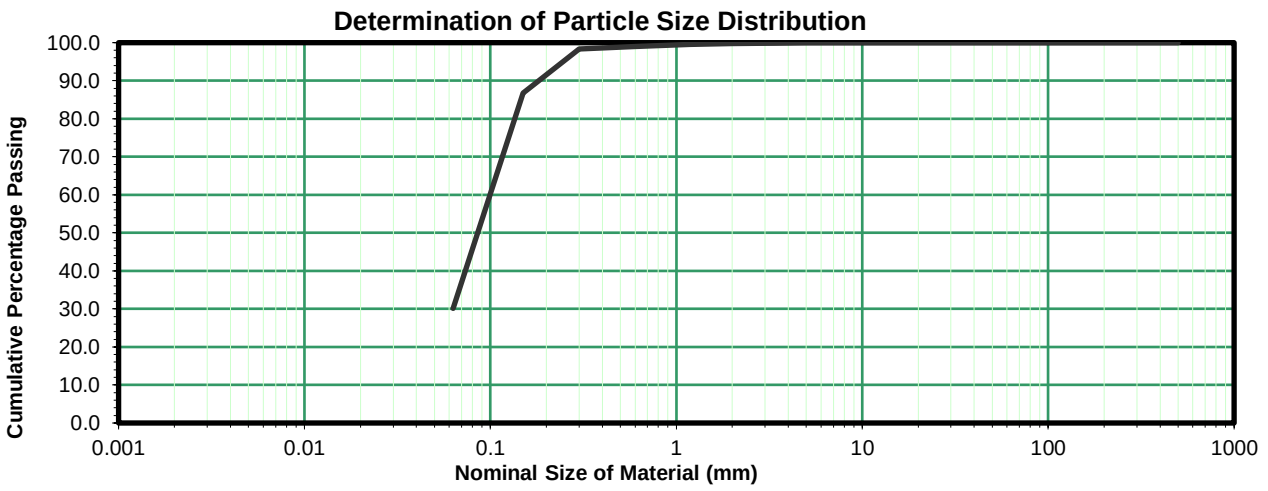
Determination of moisture content - BS 1377: Part 2: 1990 Clause 3

Moisture Content	22.7 %

Determination of particle size distribution (wet sieving method) - BS 1377: Part 2: 1990 Clause 9.2

Sample prepared in accordance with BS 1377: Part 1: 1990 clause 7.3.4(a)

BS Sieve Size	Passing BS Sieve	Specification MCHW SHW Vol 1 Series 600 Table 6/2 Class 2A/2B
500 mm	100 %	
300 mm	100 %	
125 mm	100 %	100
100 mm	100 %	
90 mm	100 %	
75 mm	100 %	
63 mm	100 %	
50 mm	100 %	
37.5 mm	100 %	
28 mm	100 %	
20 mm	100 %	
14 mm	100 %	
10 mm	100 %	
6.3 mm	100 %	
5 mm	100 %	
3.35 mm	100 %	
2 mm	100 %	80 - 100
1.18 mm	100 %	
600 µm	99 %	
425 µm	99 %	
300 µm	98 %	
150 µm	87 %	
63 µm	30 %	15 - 100



Material when tested complies with the material specification limits defined in the table above.

Laboratory Report	DNR/36571	Contract Sample No	DN2055/17
Report Date	17/07/2020	Clients Reference	DN2055/17
		Material Description	

Crossfield Consulting Geotechnical Environmental
The Granary
White Hall Farm
Long Itchington
Warwickshire
CV47 9PU

ICON Plot 2, Manchester

Source	Not Stated
Supplier	Not Stated
Date Sampled	01/07/2020
Sampled By	Client
Date Received	01/07/2020
Date Completed	17/07/2020
Sample Location	TPCCL23 @ 1.3M

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Determination of particle size distribution (Hydrometer Method) - BS 1377: Part 2: 1990 Clause 9.5

Sample prepared in accordance with BS 1377: Part 1: 1990 clause 7.3.4(a)

Pretreatment for organic matter with hydrogen peroxide was not required.

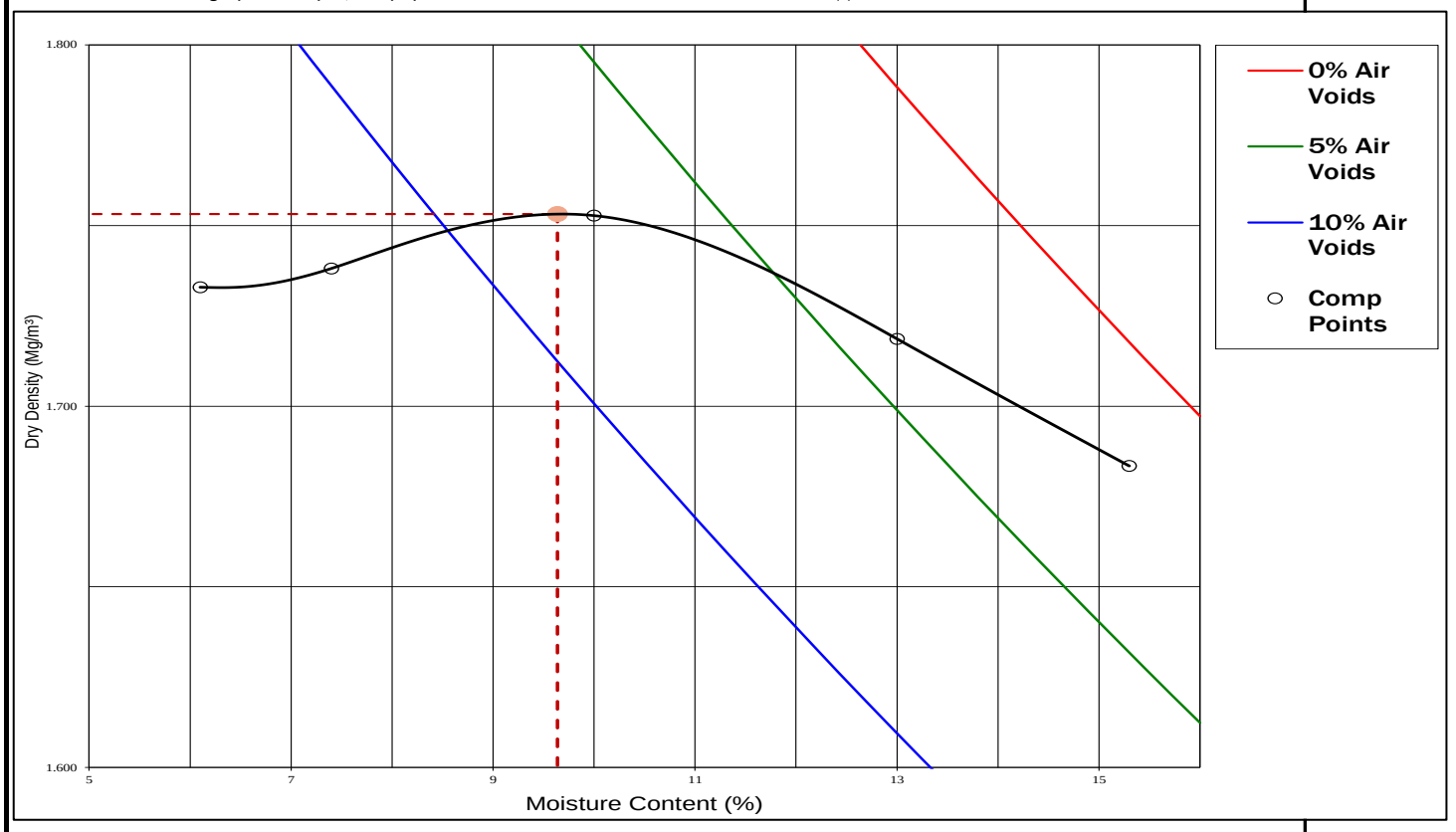
20 µm	9 %
6 µm	7 %
2 µm	6 %

Determination of particle density - BS 1377 Part 2 1990. Clause 8.2 (Gas Jar Method)

Average Particle Density	2.63 Mg/m³

Determination of dry density / moisture content relationship - BS 1377: Part 4: 1990 Clause 3.5.4.2 (4.5kg Rammer, 1 Litre mould)

The test was carried out using separate samples, each prepared in accordance with BS1377: Part 1: 2016 Clause 8.3.4(b)



Optimum Moisture Content (%)	10 %
Maximum Dry Density	1.75 Mg/m³
Material Retained on 37.5mm test sieve	0 %
Material Retained on 20.0mm test sieve	0 %
Particle Density (Measured)	2.33 Mg/m³

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Authorised Signatory

A Fry - Section Manager

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i2 Analytical Ltd.
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Analytical Report Number : 20-14388

Project / Site name:	Plot 2, ICON, Manchester	**Samples received on:**	12/06/2020
Your job number:	CCL03330	**Sample instructed/ Analysis started on:**	12/06/2020
Your order number:	PO11503	**Analysis completed by:**	23/06/2020
Report Issue Number:	1	**Report issued on:**	23/06/2020
Samples Analysed:	24 soil samples		

Signed: A. Czerwińska

Agnieszka Czerwińska

Technical Reviewer (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.

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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

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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.

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

Analytical Report Number: 20-14388

Project / Site name: Plot 2, ICON, Manchester
Your Order No: PO11503

Lab Sample Number				1535088	1535089	1535090	1535091	1535092
Sample Reference				TPCCL1	TPCCL3	TPCCL3	TPCCL4	TPCCL5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.90	2.00	0.40	1.50
Date Sampled				10/06/2020	11/06/2020	11/06/2020	11/06/2020	11/06/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	16	20	13	15	23
Total mass of sample received	kg	0.001	NONE	1.2	1.2	0.20	1.2	1.2
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.7	7.5	8.9	7.4	6.7
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	590	790	760	760	630
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.068	0.20	0.22	0.11	0.042
Sulphide	mg/kg	1	MCERTS	< 1.0	17	19	1.5	4.6
Total Sulphur	mg/kg	50	MCERTS	390	650	570	780	480
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.0	3.8	1.6	3.5	3.0
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.23	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.30	2.2	0.55	1.6	0.34
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.69	< 0.05	0.24	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.75	4.8	1.6	3.6	0.95
Pyrene	mg/kg	0.05	MCERTS	0.75	4.5	1.5	3.4	0.88
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.49	2.8	0.86	1.5	0.48
Chrysene	mg/kg	0.05	MCERTS	0.46	2.3	0.73	1.4	0.37
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.51	2.7	0.95	1.9	0.37
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.29	1.4	0.55	0.92	0.32
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.47	2.5	0.90	1.7	0.42
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	1.6	0.40	0.76	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.36	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	1.6	0.48	0.89	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	4.02	27.7	8.51	17.9	4.13
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	9.4	7.3	11	8.4
Boron (water soluble)	mg/kg	0.2	MCERTS	1.2	1.6	0.8	1.5	0.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	0.2	0.3	0.5	0.5
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	24	17	18	25
Copper (aqua regia extractable)	mg/kg	1	MCERTS	54	56	21	43	32
Lead (aqua regia extractable)	mg/kg	1	MCERTS	93	66	35	53	50
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.4	0.5	< 0.3	0.4	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	19	16	20	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	160	140	370	75

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Analytical Report Number: 20-14388

Project / Site name: Plot 2, ICON, Manchester
Your Order No: PO11503

Lab Sample Number				1535093	1535094	1535095	1535096	1535097
Sample Reference				TPCCL7	TPCCL9	TPCCL10	TPCCL1	TPCCL2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.70	0.80	1.60	1.20
Date Sampled				11/06/2020	10/06/2020	10/06/2020	10/06/2020	10/06/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	32	15	41	14	11
Total mass of sample received	kg	0.001	NONE	1.2	1.2	1.2	1.2	0.60
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.6	7.6	7.0	7.6	8.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	-	-
Total Sulphate as SO_4	mg/kg	50	MCERTS	790	130	680	340	270
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.11	0.013	0.058	0.10	0.033
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	2.9	-	-
Total Sulphur	mg/kg	50	MCERTS	700	140	580	160	140
Total Organic Carbon (TOC)	%	0.1	MCERTS	4.4	1.8	3.3	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Phenanthrene	mg/kg	0.05	MCERTS	0.57	< 0.05	< 0.05	-	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluoranthene	mg/kg	0.05	MCERTS	1.2	< 0.05	< 0.05	-	-
Pyrene	mg/kg	0.05	MCERTS	1.2	< 0.05	< 0.05	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.77	< 0.05	< 0.05	-	-
Chrysene	mg/kg	0.05	MCERTS	0.87	< 0.05	< 0.05	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.8	< 0.05	< 0.05	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.71	< 0.05	< 0.05	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.3	< 0.05	< 0.05	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.0	< 0.05	< 0.05	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.25	< 0.05	< 0.05	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.1	< 0.05	< 0.05	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	10.7	< 0.80	< 0.80	-	-
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	2.9	20	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	2.5	0.7	1.8	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	< 0.2	< 0.2	-	-
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	30	11	48	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	63	8.5	28	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	71	9.1	31	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.6	< 0.3	0.5	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	32	6.6	41	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	220	16	84	-	-

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Analytical Report Number: 20-14388

Project / Site name: Plot 2, ICON, Manchester
Your Order No: PO11503

Lab Sample Number				1535098	1535099	1535100	1535101	1535102
Sample Reference				TPCCL4	TPCCL5	TPCCL5	TPCCL6	TPCCL7
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.90	3.00-3.50	3.80	0.80	2.30
Date Sampled				11/06/2020	11/06/2020	11/06/2020	11/06/2020	11/06/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	12	11	12	12	16
Total mass of sample received	kg	0.001	NONE	0.60	0.60	0.60	0.60	0.60
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.4	9.8	8.6	7.9	8.3
Total Cyanide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphate as SO_4	mg/kg	50	MCERTS	600	330	250	120	400
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.30	0.098	0.036	0.045	0.12
Sulphide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	290	260	740	110	310
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	-
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Chromium (hexavalent)	mg/kg	4	MCERTS	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-

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Analytical Report Number: 20-14388

Project / Site name: Plot 2, ICON, Manchester
Your Order No: PO11503

Lab Sample Number				1535103	1535104	1535105	1535106	1535107
Sample Reference				TPCCL8	TPCCL11	TPCCL11	TPCCL12	TPCCL13
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	0.80	1.90	1.00	1.10
Date Sampled				11/06/2020	10/06/2020	10/06/2020	11/06/2020	10/06/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	14	14	12	14	13
Total mass of sample received	kg	0.001	NONE	0.60	0.60	0.60	0.60	0.60
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.2	7.7	8.5	7.9	8.5
Total Cyanide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphate as SO_4	mg/kg	50	MCERTS	110	51	150	52	< 50
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.016	0.020	0.027	0.019	0.019
Sulphide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	130	96	110	67	90
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	-
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Chromium (hexavalent)	mg/kg	4	MCERTS	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-

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Analytical Report Number: 20-14388

Project / Site name: Plot 2, ICON, Manchester
Your Order No: PO11503

Lab Sample Number				1535108	1535109	1535110	1535111	
Sample Reference				TPCCL13	TPCCL14	TPCCL15	TPCCL16	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				2.20	0.80	1.00	0.80	
Date Sampled				10/06/2020	10/06/2020	11/06/2020	11/06/2020	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	13	13	13	11	
Total mass of sample received	kg	0.001	NONE	0.60	0.60	0.60	0.60	
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.5	8.0	7.3	7.8	
Total Cyanide	mg/kg	1	MCERTS	-	-	-	-	
Total Sulphate as SO_4	mg/kg	50	MCERTS	150	76	75	65	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.045	0.018	0.015	0.030	
Sulphide	mg/kg	1	MCERTS	-	-	-	-	
Total Sulphur	mg/kg	50	MCERTS	160	120	140	120	
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	
Chromium (hexavalent)	mg/kg	4	MCERTS	-	-	-	-	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	

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Analytical Report Number : 20-14388

Project / Site name: Plot 2, ICON, Manchester

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1535088	TPCCL1	None Supplied	1.20	Brown clay and sand with gravel and vegetation.
1535089	TPCCL3	None Supplied	0.90	Brown loam and clay with vegetation and gravel
1535090	TPCCL3	None Supplied	2.00	Brown sand with gravel.
1535091	TPCCL4	None Supplied	0.40	Brown loam and sand with vegetation and gravel.
1535092	TPCCL5	None Supplied	1.50	Brown clay and loam with vegetation and gravel
1535093	TPCCL7	None Supplied	1.20	Brown clay and loam with vegetation and gravel
1535094	TPCCL9	None Supplied	0.70	Light grey clay and sand with vegetation and gravel.
1535095	TPCCL10	None Supplied	0.80	Brown clay and sand with gravel and vegetation.
1535096	TPCCL1	None Supplied	1.60	Brown clay and sand with gravel.
1535097	TPCCL2	None Supplied	1.20	Brown clay and sand with gravel.
1535098	TPCCL4	None Supplied	0.90	Light brown clay and sand with gravel.
1535099	TPCCL5	None Supplied	3.00-3.50	Brown clay and sand with gravel.
1535100	TPCCL5	None Supplied	3.80	Brown sandy clay.
1535101	TPCCL6	None Supplied	0.80	Brown clay and sand with gravel.
1535102	TPCCL7	None Supplied	2.30	Brown clay and sand.
1535103	TPCCL8	None Supplied	0.60	Light brown clay and sand with vegetation.
1535104	TPCCL11	None Supplied	0.80	Brown clay and sand with vegetation.
1535105	TPCCL11	None Supplied	1.90	Brown clay with gravel.
1535106	TPCCL12	None Supplied	1.00	Light brown sandy clay with gravel.
1535107	TPCCL13	None Supplied	1.10	Light brown sandy clay with gravel.
1535108	TPCCL13	None Supplied	2.20	Brown clay and sand with gravel.
1535109	TPCCL14	None Supplied	0.80	Brown clay and sand with gravel.
1535110	TPCCL15	None Supplied	1.00	Light brown clay and sand with gravel.
1535111	TPCCL16	None Supplied	0.80	Brown clay and sand with gravel.

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Analytical Report Number : 20-14388

Project / Site name: Plot 2, ICON, Manchester

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS

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Analytical Report Number : 20-14388

Project / Site name: Plot 2, ICON, Manchester

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' 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.

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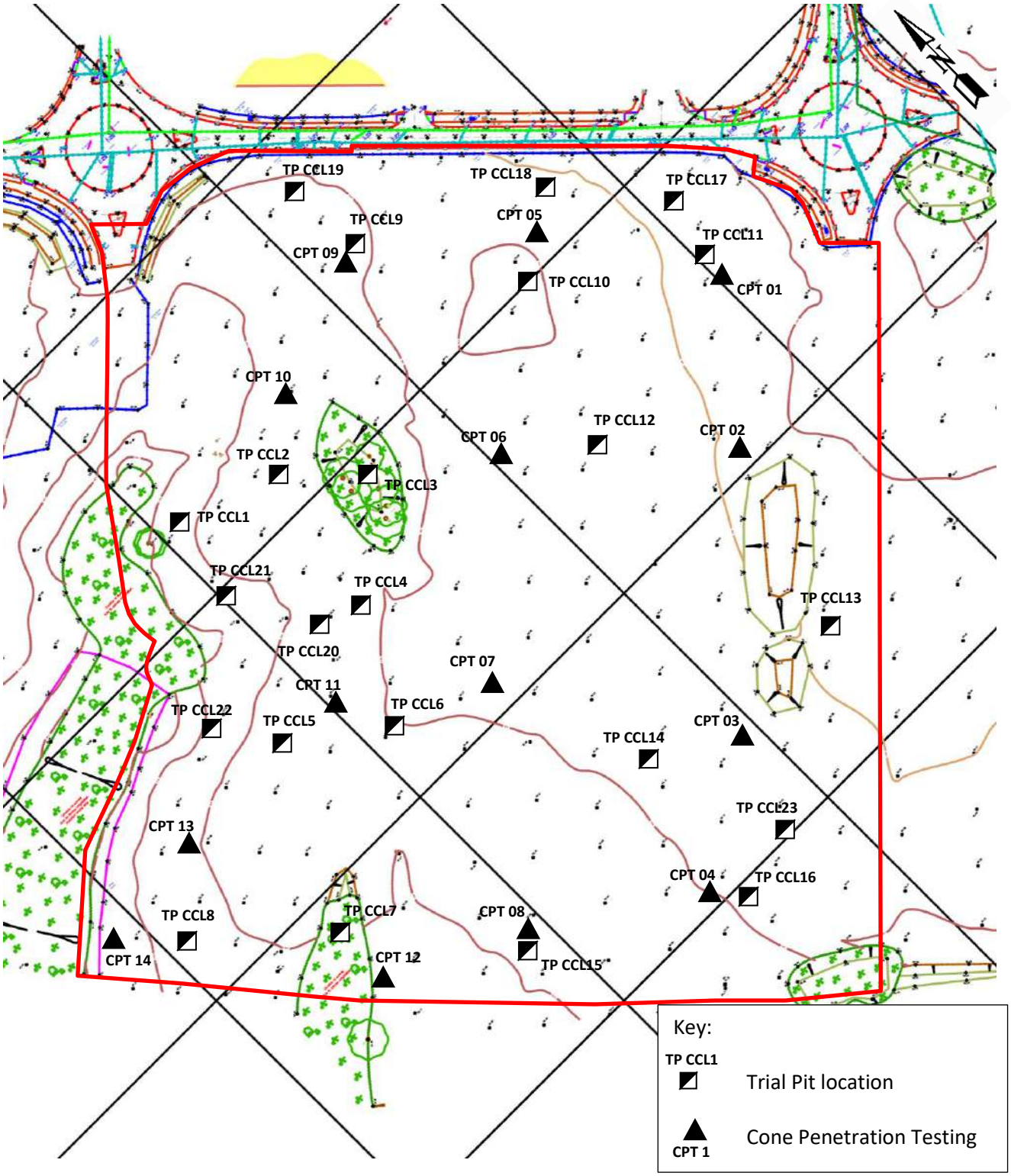
FIGURE II-1



EXPLORATORY HOLE LOCATION PLAN

Scale 1:2000

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