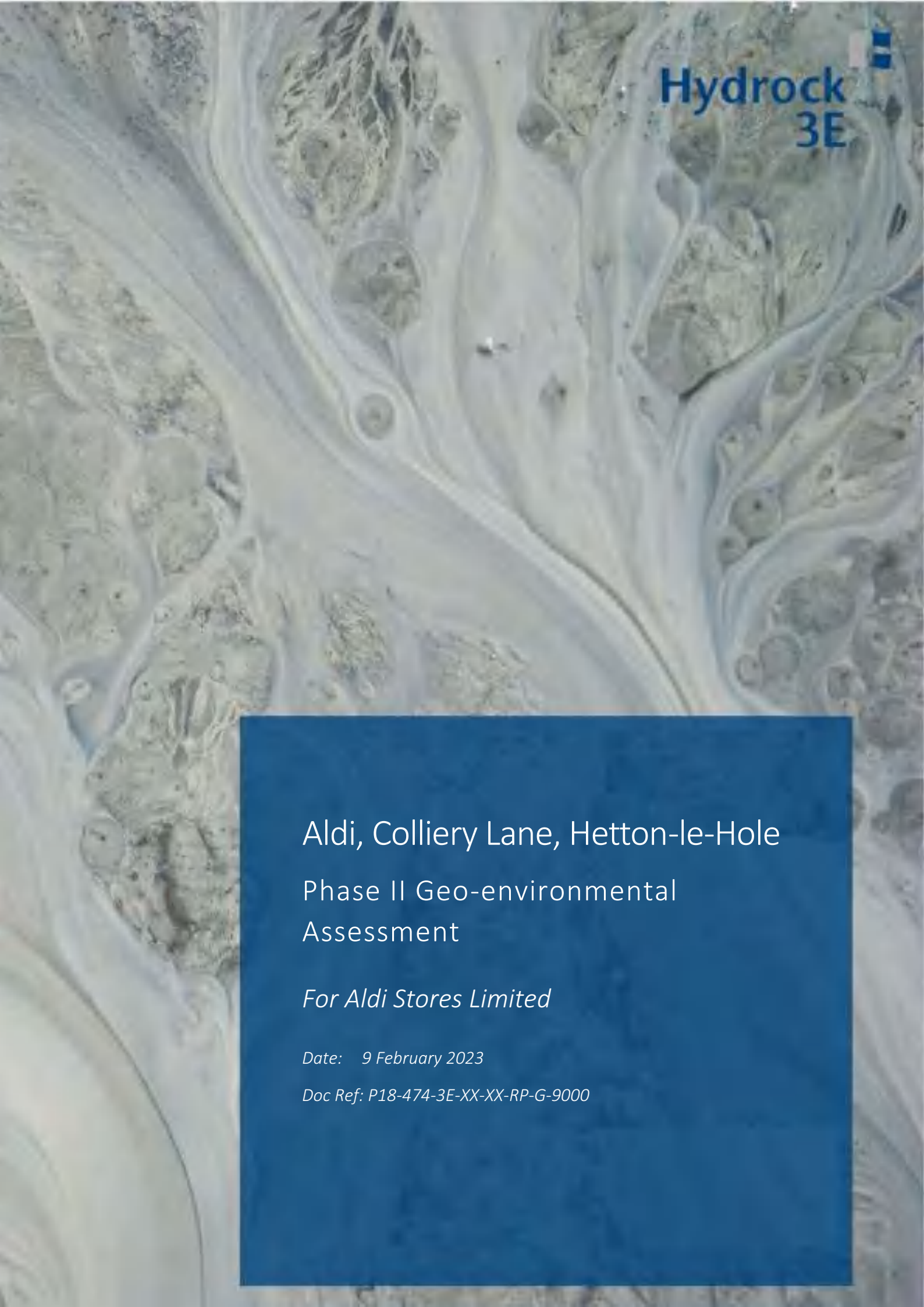

Hydrock 3E

Aldi, Colliery Lane, Hetton-le-Hole

Phase II Geo-environmental Assessment

For Aldi Stores Limited

Date: 9 February 2023

Doc Ref: P18-474-3E-XX-XX-RP-G-9000

DOCUMENT CONTROL SHEET

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Executive Summary

SITE INFORMATION AND SETTING	
Report title	Phase II Geo-environmental Assessment
Client	Aldi Stores Limited
Site name	Aldi, Colliery Lane, Hetton-le-Hole
Location	Colliery Lane, Hetton-le-Hole, Tyne & Wear
Proposed Development	Construction of a new Aldi store, car parking facilities and associated soft landscaping.
PHASE II GEO-ENVIRONMENTAL ASSESSMENT	
Ground Conditions	*Made Ground* Made ground was identified within all of the exploratory hole locations to depths of between 0.10m and 1.70m below ground level. These materials typically comprised an initial surfacing of grass over dark brown sandy soil recorded to depths of between 0.10m and 0.50m. Across the central and western site area, the initial surfacing was generally recorded to be underlain by disturbed brown clayey sand and gravel of sandstone and mudstone with occasional brick to depths of between 0.90m and 1.50m which were in turn generally underlain by a thin band of organic sand (possible relic topsoil layer) to a maximum recorded depth of 1.70m. The eastern site area was noted to record a limited thickness of made ground (i.e. initial topsoil surfacing and occasionally a possible relic topsoil layer). Made ground across the site was noted to typically locally deepen from east to west, which concurs with the initial assessment undertaken as part of the Phase I assessment indicating that there was historical evidence of potential site reprofiling, raising the western extent of the site in order to create a level platform for former site usages (i.e. football field). *Natural (Superficial) Deposits* Variable superficial deposits were encountered across the site as a whole. Natural deposits encountered formed mixed clay, sand, gravel and silt deposits with the site showing no indication of uniformity, particularly within the initial 5.00m. In addition, at the location of WS07, a significant reduction in resistance of the sampling equipment along with no recovery was noted at a depth of between 3.00m and 4.00m. In order to further investigate this, a trial pit was excavated within the location of WS07, with running sand deposits encountered from the approximate depth (3.20m) to the termination depth of the pit at 3.65m. *Bedrock Deposits* From the CPT's which targeted the proposed building footprint, refusal of testing equipment occurred at depths of between 10.46m and 14.92m which is considered to be potentially associated with the underlying bedrock deposits (i.e. Limestone), which is recorded at a similar depth within nearby historical BGS borehole records. In addition, cone resistance was recorded to decrease at the majority of the CPT locations at an average depth of c.3.00m where water was typically encountered (Phreatic Groundwater Surface). As previously noted, during completion of the CPT's, refusal of testing equipment occurred within the area of the proposed building at depths of between 10.46m and 14.92m which is considered to be potentially associated with the presence of Limestone bedrock deposits.
Groundwater	During the investigation works, groundwater strikes were noted within the majority of the mini percussive borehole positions at depths of between 1.00m and 2.40m. In addition, at the location of TP07, groundwater was recorded at a depth of 3.20m, upon encountering running sand deposits, with slight water seepages noted within TP01 and TP02 at a depth of 0.50m. From the findings of the CPT's, cone resistance was also indicated to decrease at the majority of the CPT locations at a depth of approximately of 3.00m where water was typically encountered (Phreatic Groundwater Surface). The results of the groundwater monitoring undertaken to date recorded standing water levels ranging between 1.60m and 2.40m below ground level within WS01, WS02 and WS03, with only minor fluctuations noted during the initial monitoring period.

Contamination	Based the findings of the contamination risk assessment no concentrations of contaminants have been identified, which exceed current assessment criteria, based upon a commercial end use. Therefore, these materials are considered suitable for continued use within a commercial setting without representing a potential risk to human health (i.e. future end users). In addition, when considering the very low levels of potential contaminants recorded below the site, there is no significant risk considered to controlled waters
Foundations	From the findings of the intrusive investigations, the use of conventional shallow foundation options and trench fill is considered unviable due to the variability of the natural deposits beneath the site. In view of this, the use of Controlled Modulus Columns CMC's may represent a potential viable option for the site, subject to confirmation from a specialist ground improvement contractor. Alternatively, a piled foundation solution presents a viable foundation solution for the site, with foundations taken down through the made ground and natural deposits, and based on limestone bedrock deposits. If this foundation option is to be adopted, the contents of this report should be made available to the appropriate design specialist. Taking into account the variable ground conditions beneath the site, a ground bearing floor slab will likely be unsuitable, therefore it is considered a suspended floor slab will likely be required for the proposed development
External Works	It is recommended that a CBR value of 2% be adopted for the design of any new hardstanding which would result in a preliminary requirement for the inclusion of 400mm sub-base within external hard-standing areas. This should be reviewed following the completion of in-situ plate load (CBR) tests during the initial stages of the development works when the final formation level has been confirmed.
Soakaways	From the results of the Soakaway test results, it is considered the natural shallow deposits below the site are not suitable for the use with soakaways.
Disposal of Materials	Following a review of the soil and WAC screening results increased levels of TOC were typically noted for the made ground materials which exceed acceptance criteria for disposal at an Inert landfill (3%), indicating that the majority of these materials will likely be characterised as Non-Hazardous for disposal. Natural soils below the site will likely be suitable for disposal to an Inert landfill site. Where offsite disposal of waste soils is required, the results of the investigation should be made available to the waste carrier/receiver in order to determine the waste classification, costs for disposal and the requirement for further testing. Sufficient time should be allowed in the site programme to effectively segregate soils based on material type, including the time allowed for any further laboratory classification analysis as required.
Sulphate Attack on Buried Concrete	The results of the chemical analyses indicate a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC classification AC-1.
Excavations	If man entry is proposed into excavations the use of support to excavation sides is recommended, in line with health and safety guidelines.
Dewatering	Significant groundwater ingress into shallow excavations is possible due to the presence of perched groundwater. As such appropriate groundwater control measures should be implemented for excavations and carefully monitored in order to prevent loss of fine/ground.

This Executive Summary forms part of Hydrock 3E report number P18-474-3E-XX-XX-RP-G-9000 and should not be used as a separate document.

1. INTRODUCTION

1.1 Commission

Hydrock 3E was commissioned by Aldi Stores Limited to carry out a Phase II Geo-Environmental Assessment for land located adjacent to Colliery Lane, Hetton Le Hole, Tyne & Wear.

This report highlights potential ground related environmental and geotechnical considerations in relation to the proposed development which it is understood to include the construction of a new Aldi Store with associated car parking and soft landscaping, as shown on the proposed site plan included in Appendix A.

1.2 Objectives

This assessment has been produced to provide an assessment of ground conditions along with potential geotechnical and environmental conditions and constraints at the site.

The primary objectives of this assessment were:

- To investigate near surface soil and groundwater conditions.
- To determine the potential risks posed by any ground or groundwater contamination and provide recommendations on remedial measures to manage such risks (if required).
- To assess the risk posed by hazardous ground gases.
- To provide advice relating to geotechnical issues associated with the site.
- To provide foundation recommendations.

1.3 Scope

The initial phase of fieldworks were undertaken on the 12th and 13th January 2023 and comprised of ten mini-percussive boreholes (referenced as WS01 to WS10) and three soakaway trial pits (referenced as TP01 to TP03).

Following the completion of the initial fieldworks, supplementary ground investigation works were undertaken on the site to further assess potential geotechnical constraints identified during the initial phase of works and to aid in future foundation design. The supplementary investigation works were undertaken on 27th January 2023 which comprised 4 no. trial pits (referenced as TP04 to TP07) and nine cone penetrometer tests (referenced as CPT01 to CPT09).

This report presents the factual information available during this appraisal, interpretation of the data obtained and recommendations relevant to the scope of works outlined above. For the purpose of this report a commercial end use has been adopted for this assessment.

The comments and opinions presented in this report are based on the findings of the Intrusive investigation carried out by Hydrock 3E. Responsibility cannot be accepted for any conditions not revealed by these reports and which have not been taken into account by this report.

1.4 Previous Reports

To aid in this assessment, where applicable reference has been made to a previous Phase I Geo-environmental Assessment (Desk Study Report) produced for the site by 3e Consulting Engineers Limited. A summary of the Phase I report, referenced below is included in Section 3 of this assessment.

- 3e Consulting Engineers Limited (December 2018). Phase I Geo-Environmental Assessment for Aldi Stores Limited – Colliery Lane, Hetton-le-Hole, Tyne & Wear. Report Reference P18-474-3E-XX-XX-RP-G-9000, Issue 1.

It is recommended that the following report be read in conjunction with this report.

1.5 Uncertainties and Limitations

The report has been prepared by Hydrock 3E (which is a trading style of 3e Consulting Engineers Ltd) for the use of Aldi Stores Limited. Any third parties who use the information contained herein do so at their own risk. Hydrock 3E shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Hydrock 3E's appointment. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and Hydrock 3E do not owe them any Duty of Care or Skill.

This report presents the factual information available during this appraisal, interpretation of the data obtained and recommendations relevant to the outlined scope of works. It has been assumed in the production of this report that the site is to be developed for a commercial end use.

This report provides the findings of the assessment carried out in February 2023. The report has been prepared by Hydrock 3E on the basis of available information obtained during the investigation period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed. Responsibility cannot be accepted for any conditions not revealed and which have not been taken into account by this report.

Any diagram or opinion relating to site geology, contamination or other spatially variable features between or beyond investigation positions is conjectural and provided for guidance only. Confirmation of ground conditions between exploratory holes should be undertaken if deemed necessary. Evaluation of groundwater is based on observations made at the time of the investigation, and it should be noted that levels may vary due to seasonal effects.

References to possible asbestos containing material made within this report do not constitute an asbestos survey. Hydrock 3E are not asbestos specialists and cannot provide specific asbestos risk assessment advice, it is recommended that the Client appoints an asbestos consultant to advise on any matters relating to asbestos.

This assessment has been carried out in general accordance with recognised best practice. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Hydrock 3E.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials, ecology or invasive weeds, this report does not constitute a formal survey of these potential constraints and specialist advice should be sought.

Information provided by third parties has been used in good faith and is taken at face value; however, Hydrock 3E cannot guarantee its accuracy or completeness. Where the existing report(s) prepared by others have been provided by the Client, it is assumed that these have been either commissioned by the Client, or can be assigned to the Client, and can be relied upon by Hydrock 3E. Should this not be the case Hydrock 3E should be informed immediately as additional work may be required. Hydrock 3E is not responsible for any factual errors or omissions in the supplied data, or for the opinions and recommendations of others. It is possible that the conditions described may have since changed through natural processes or later activities.

Any site boundary line depicted on plans does not imply legal ownership of land.

2. THE SITE

2.1 Location and Description

The site, centred on National Grid Reference 435780, 546820 is located approximately 800m to the south east of Hetton-le-Hole town centre. A site location plan is included as Drawing G0001.

The site is approximately 0.81 Hectares (Ha) in size and generally rectangular in shape. The site is an area of public open space, absent of structural development. The northern boundary of the site is lined by a concrete post and metal pole permanent fence, with a double vehicular gate in a state of disrepair at the north western corner of the site. To the west and east, residential fences bound the site, with residential properties beyond. A wooden fence line is also shown along the southern boundary of the site with the Hetton Lyons Cricket and Football Club on the opposing side.

A topographical survey undertaken for the site by Castle Keep Surveys on the 23rd November 2022 (Drawing ref: CKS-1309-001, Rev. A) indicates a site level of approximately 97m AOD (above ordinance datum) at the north eastern corner of the site, reducing towards the west of the site where a level of 94.50m AOD is recorded. Along the western boundary, a sharp reduction of site level to approximately 93.50m AOD is recorded, indicating some extent of site reprofiling has likely occurred to accommodate a relatively level surface level across the majority of the site.

The adjacent land use is generally as follows:

- North: Colliery Lane with Hetton Lyons Industrial Estate beyond.
- South: Hetton Lyons Cricket and Football Club.
- West: Residential properties.
- East: Residential properties.

3. SUMMARY OF PHASE I GEO-ENVIRONMENTAL ASSESSMENT

3.1 Phase I Geo-environmental Assessment (3e Consulting Engineers Limited)

The following provides a summary of the Phase I report produced by for the site by 3e Consulting Engineers Limited as referenced in paragraph 1.4.

3.1.1 Site History

From the earliest OS plans, dated 1856 the site is recorded as absent of development. By 1974, a lined feature is shown across the western extent of the site, potentially indicating some level of site reprofiling. By 1980 the site is shown as a football field however by 2009 the site is no longer used as a football field and has allowed to become overgrown grassland.

The surrounding area has included collieries, quarries, sand pits, gas works and lime kilns form pre 1859's to the 1950's. By the 1960's, previous industrial land use has been replaced with factories, allotments and housing.

3.1.2 Environmental Setting

- From BGS data significant thicknesses of made ground are not recorded beneath the site, however nearby BGS borehole data record the presence of ash and brick fill to depths of between 0.75m and 1.70m within close proximity to the north western and north eastern boundary of the site.
- BGS plans record the site as being underlain by Glaciofluvial deposits (sand and gravel) and alluvial deposits (clay, silt, sand and gravel). Nearby BGS data identify medium dense gravelly sand to depths of between 3.80m and in excess of 6.00m.
- The bedrock beneath the site is indicated to be the Raisby Formation (dolomitic limestone).
- The superficial deposits are classified as a Secondary A Aquifer with the underlying bedrock deposits classified as a Principal Aquifer.
- The nearest surface water feature is an un-named feature located 300m east of the site.
- The site is recorded by the EA to lie within a Flood Zone I setting with regards to flooding from rivers or the sea.
- The site is located within a Source Protection Zone III (total catchment).
- There are no discharge consents recorded within 250m.
- There are no pollution incidents recorded within 250m.
- There are no groundwater abstractions recorded within 1km.
- There are no local authority landfill sites recorded within 250m of the site.
- There is 1 no. waste transfer site within 250 of the site.
- There are no IPC's or IPPC's within 250m.
- There area 3 no LAPPC's within 250m of the site.

3.1.3 Unexploded Ordnance

The regional unexploded bomb risk map obtained from Zetica UXO records the site as being located within a low risk area from possible unexploded ordnance (UXO) resulting from WWII bombing, indicating that works can progress without the requirement for special precautions in this regard.

3.1.4 Radon

From information obtained as part of the Phase I report the site is located within an intermediate probability radon area (between 1% to 3% of homes are estimated to be at or above the action level) indicating no Radon protection measures are required.

3.1.5 Coal Mining

From the findings of the Phase I assessment, the site is not considered to be at significant risk from historical shallow coal mining activities and therefore no further work was considered necessary in this regard.

3.1.6 Preliminary Ground Gas Risk Assessment

The preliminary ground gas risk assessment completed as part of the Phase I report identified a low to medium risk to the development from ground gas, with the primary sources considered to be made ground associated with possible former activities on the site (i.e. re-profiling activities) and the potential for organic Alluvium superficial deposits below the site.

3.1.7 Conceptual Site Model

Based on the information reviewed as part of the Phase I report potential sources of contamination identified for this site included the following:

Sources

Table 3.1: Sources of Contamination and Potential Contaminants of Concern (PCOC)

Potential Source	Potential Contaminative Processes	Potential Contaminants of Concern (PCOC)
On-site: Made Ground.	• Made ground associated with former site activities and potential site reprofiling.	• Metals • Metalloids • PAH's • TPH's • Asbestos
Off-site: Made Ground (former nearby land usages such as colliery and industrial land)	• Made ground/fill associated with former colliery site and industrial land to the north.	• Metals • Metalloids • PAH's • TPH's • Asbestos
Ground gas migration and/or production	• Made ground associated with site reprofiling. • Potential for ground gases associated with the underlying Alluvium (i.e. possible degradation of organic matter).	• Carbon Dioxide (CO_2) • Methane (CH_4) • Depleted Oxygen (O_2)

When considering the environmental site setting and nature of the proposed development the following potential pollution pathways and receptors were identified for this site:

3.1.8 Potential Pollution Pathways

- Human Health – direct contact, soil ingestion, dust and vapour inhalation.
- Surface Water Feature - Lateral migration into surface water features (considered low risk at this stage due to distance to the nearest surface water feature).
- Principal and Secondary A Aquifers – leaching and vertical migration of contamination.

- Human Health - Vertical and lateral migration, ingress and accumulation of ground gases and vapours into buildings and service entries (manholes).
- Direct contact of aggressive soils with building foundations and floor slabs.

3.1.9 Receptors

- Human Health - site end users.
- Human Health - construction workers.
- Surface water features.
- Underlying Principal and Secondary A Aquifers.
- Buildings, foundations and floor slabs.

3.1.10 Pollutant Linkage Assessment

From information gathered during the Phase I desk study a qualitative risk assessment was made of the likelihood of any pollutant linkages operating and their potential significance, as summarised in the table on the following page:

Table 3.2: Preliminary Conceptual Site Model (CSM)

Contamination Source	Pathway	Potential Receptors	Potential Severity	Potential Probability of Occurring	Risk Level	Comments
On-site: Made Ground	Direct contact, ingestion, dust and vapour inhalation	Human Health Risk - Construction workers	Medium	Likely / Low Likelihood	Low Risk	Contaminants may be present associated with likely historic site reprofiling which could represent a potential risk to construction workers. However, the risk could be mitigated by adopting appropriate measures, i.e. PPE, exposure times etc.
	Direct contact, ingestion and dust/vapour inhalation	Human Health Risk – End users	Medium	Likely / Low Likelihood	Low Risk	Contaminants may be present associated with the likely historic reprofiling works, which could represent a potential risk.
	Lateral and vertical migration	Pollution of Controlled Waters – surface water	Medium	Low Likelihood	Low Risk	Yes, potentially but would be largely mitigated by use of hard cover in development
	Lateral and vertical migration	Pollution of Controlled Waters – Principal and Secondary A Aquifer	Medium	Low Likelihood	Low Risk	Potentially, given the potential presence of ashy made ground soils. The proposed extensive hardcover will also reduce the presence of mobile groundwater.

Contaminants associated with off-site sources	Lateral migration	Human Health Risk - Site end users	Medium	Low Likelihood	Low Risk	Possible migration of contamination associated with nearby land uses (i.e. former colliery and industrial land).
Ground gas migration and/or production	Vertical migration into buildings or confined spaces	Site end users, construction workers and property	Medium	Low Likelihood	Low Risk	The potential sources identified for this site include made ground and Alluvium.

4. METHOD OF INVESTIGATION

4.1 General

An initial phase of fieldworks were undertaken on the 12th and 13th January 2023 and comprised of ten mini-percussive boreholes (referenced as WS01 to WS10) and three soakaway trial pits (referenced as TP01 to TP03).

Following the finding as the initial phase of works, Hydrock 3E attended site on the 27th January 2023 to undertaken a supplementary phase of works to further inform potential geotechnical constraints identified as part of the initial phase of works along with ground investigation works to aid in future foundation design. The supplementary investigation works comprised 4 no. trial pits (referenced as TP04 to TP07) and nine cone penetrometer tests (CPT) (referenced as CPT01 to CPT09).

The locations of the exploratory holes can be seen on Drawing G0002 with copies of the borehole and trial pit record sheets included in Appendix B and results of the CPT attached in Appendix C.

All depths recorded are taken from below existing ground level, with the exploratory holes positioned to provide a general coverage across the site, whilst also taking into account existing access constraints and making allowance for buried utilities. Fieldwork and soil descriptions were carried out in general accordance with BS5930:2015+A1:2020 'Code of Practice for Ground Investigations', BS EN ISO 14688-1, BS EN ISO 14689-1 and BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'.

4.2 Investigation Rationale

The mini-percussive boreholes were positioned in order to determine the soil profile and target potential areas of contaminative concern. Disturbed samples were recovered as appropriate for soil descriptions and laboratory testing. In situ standard penetration tests (SPT's) were carried out to provide an assessment of the in-situ density of the made ground and natural deposits present at the exploratory hole locations.

The initial phase of trial pits were positioned in order to facilitate the completion of soakaway tests (BRE 365). However, supplementary trial pits were undertaken across the site to investigate a potential anomalous ground conditions recorded at WS07 and to allow for the recovery of samples from proposed road infrastructure routes for appropriate geotechnical laboratory testing.

In addition, from the findings of the initial phase of ground investigation works undertaken on the site. cone Penetration Tests (CPT) with pore water measurement were undertaken across the proposed store location in order to further aid in determining potential foundation options and foundation design for the site.

4.3 Laboratory Chemical Testing

The results of the chemical analysis are included as Appendix D. The analyses were carried out at an MCERTS registered and UKAS accredited laboratory.

4.3.1 Soils

In order to provide an assessment of potential contamination representative samples of made ground and natural soil recovered from across the site as part of the combined investigation works, were screened for the following range of determinands:

- 12 no. samples screened for Metals: Arsenic, Boron, Copper, Cadmium, Chromium (total), Lead, Mercury, Nickel, Selenium, Zinc and TOC.
- 8 no. samples screened for Cyanide (total) and Chromium (VI).
- 4 no. samples screened for Metals: Antimony, Barium and Molybdenum.
- 8 no. samples screened for Polycyclic Aromatic Hydrocarbons (USEPA 16 PAH's).

- 4 no. samples screened for Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG).
- 8 no. samples screened for the presence of Asbestos.

In addition to the above, 3 no. samples of the made ground and 1 no. sample of the natural soil were screened for Waste Acceptance Criteria (WAC) analysis, including WAC metals.

4.4 Laboratory Geotechnical Testing

Geotechnical testing was carried out on selected samples in accordance with techniques outlined in BS 1377:1990, comprising the following:

- 4 no. Particle Size Distributions tests to aid in classifying the superficial soils.
- 6 no. Atterberg limit determination tests.
- 3 no. Remoulded California Bearing Ratio (CBR) tests.

In addition, 8 no. samples of the made ground and 3 no. samples of the natural soil were scheduled for water soluble sulphate and pH determinations to assess the potential for sulphate attack on buried concrete.

The results of the geotechnical testing are presented in Appendix E with the results of the water soluble sulphate and pH analysis contained within the chemical test certificates included in Appendix D.

5. RESULTS OF THE INVESTIGATION

5.1 Ground Conditions

Detailed descriptions of the materials encountered together with observations of groundwater, the results of in situ testing and sampling information are given on the exploratory hole record sheets included in Appendix B with locations shown on Drawing G0002. A generalised succession of the ground profile encountered during the investigation works is summarised below. However, it should be noted that there is a potential for some local variation across the site and reference should be made to individual exploratory hole records.

5.1.1 Made Ground

Made ground was identified within all of the exploratory hole locations to depths of between 0.10m and 1.70m below ground level. These materials typically comprised an initial surfacing of grass over dark brown sandy soil recorded to depths of between 0.10m and 0.50m. Across the central and western site area, the initial surfacing was generally recorded to be underlain by disturbed brown clayey sand and gravel of sandstone and mudstone with occasional brick to depths of between 0.90m and 1.50m which were in turn generally underlain by a thin band of organic sand (possible relic topsoil layer) to a maximum recorded depth of 1.70m. The eastern site area was noted to record a limited thickness of made ground (i.e. initial topsoil surfacing and occasionally a possible relic topsoil layer).

Made ground across the site was noted to typically locally deepen from east to west, which concurs with the initial assessment undertaken as part of the Phase I assessment indicating that there was historical evidence of potential site reprofiling, raising the western extent of the site in order to create a level platform for former site usages (i.e. football field).

5.1.2 Superficial (Drift) Deposits

Variable superficial deposits were encountered across the site as a whole. Natural deposits encountered formed mixed clay, sand, gravel and silt deposits with the site showing no indication of uniformity, particularly within the initial 5.00m. In addition, at the location of WS07, a significant reduction in resistance of the sampling equipment along with no recovery was noted at a depth of between 3.00m and 4.00m. In order to further investigate this, a trial pit was excavated within the location of WS07, with running sand deposits encountered from the approximate depth (3.20m) to the termination depth of the pit at 3.65m.

From the CPT's which targeted the proposed building footprint, refusal of testing equipment occurred at depths of between 10.46m and 14.92m which is considered to be potentially associated with the underlying bedrock deposits (i.e. Limestone), which is recorded at a similar depth within nearby historical BGS borehole records. In addition, cone resistance was recorded to decrease at the majority of the CPT locations at an average depth of c.3.00m where water was typically encountered (Phreatic Groundwater Surface).

5.1.3 Bedrock Deposits

As previously noted, during completion of the CPT's, refusal of testing equipment occurred within the area of the proposed building at depths of between 10.46m and 14.92m which is considered to be potentially associated with the presence of Limestone bedrock deposits.

5.2 Visual and / or Olfactory Evidence of Potential Contamination

During the investigation works, there was no significant visual and / or olfactory evidence of contamination encountered.

5.3 Groundwater

During the investigation works, groundwater strikes were noted within the majority of the mini percussive borehole positions at depths of between 1.00m and 2.40m. In addition, at the location of TP07, groundwater was recorded at a depth of 3.20m, upon encountering running sand deposits, with slight water seepages noted within TP01 and TP02 at a depth of 0.50m.

From the findings of the CPT's, cone resistance was also indicated to decrease at the majority of the CPT locations at a depth of approximately of 3.00m where water was typically encountered (Phreatic Groundwater Surface).

The results of the groundwater monitoring undertaken to date recorded standing water levels ranging between 1.60m and 2.40m below ground level within WS01, WS02 and WS03, with only minor fluctuations noted during the initial monitoring period. The results of the initial groundwater monitoring are presented in **Appendix F**. It should be noted that groundwater levels vary seasonally and that a higher water table than recorded could occur.

5.4 In situ Test Results

5.4.1 Standard Penetration Tests (SPT's)

SPT's undertaken within the natural clay and silt deposits recorded 'N' values of between 0 and 49, with these deposits typically noted to be soft or firm in consistency.

SPT's undertaken within the natural sand and gravel deposits recorded 'N' values of between 0 and 19, indicative of very loose to medium dense deposits.

5.4.2 Hand Shear Vane Test Results

Hand shear vane (HSV) readings carried out on undisturbed samples of the natural clay deposits varied between 2kPa and 89kPa. These results are indicative of extremely low to high strength cohesive deposits. However the majority of the tests undertaken on the natural cohesive deposits were noted to be typically very low to low strength.

5.4.3 Soakaway Tests (BRE 365)

In-situ soakaway test were completed at selected trial pit locations (TP01 to TP03) in accordance with BRE 365: Soakaway Design, to assess the suitability of the upper natural deposits for use with soakaways. The trial pits were excavated in order to target the potential locations of future soakaways, with copies of the trial pit records included in **Appendix B** and soakaway calculation sheets included as **Appendix G**. A summary of the findings are presented in the table below.

Table 5.1: Summary of BRE 365 Soakaway Results.

Location	Depth and Range of Test (m)	Principal Strata Type	Soil Infiltration Rate (m/s)	Drainage Characteristics
TP01	1.20m to 2.20m	Clayey gravelly SAND	Unable to Calculate (1)	N/A
TP02	1.70m to 2.30m	Clayey gravelly SAND	Unable to Calculate (1)	N/A
TP03	1.30m to 2.20m	Clayey gravelly SAND	Unable to Calculate (1)	N/A

Notes:
1. Unable to calculate due to insignificant or no change in water level during monitoring period.

From the results of the soakaway tests, no significant change in groundwater level occurred during the monitoring period, indicating the presence of practically impermeable deposits below the site. Therefore it is considered the natural shallow deposits below the site are not considered suitable for the use with soakaways.

5.5 Geotechnical Related Testing

5.5.1 Classification Tests

The results of the geotechnical testing are presented in Appendix E.

Atterberg limit determination analysis was undertaken on 4 no. representative samples of the underlying cohesive deposits below the site ranging from depths of between 1.00m and 2.50m. The results of the analysis recorded modified plasticity indices of between 4.4% and 14.56%, which is indicative of cohesive soils with a low volume change potential.

In addition to the above, 2 no. samples of the underlying possible relic topsoil materials were also subjected to Atterberg limit determination analysis in order to confirm the nature of these materials, with the testing confirming the materials as non-plastic.

5.5.2 Particle Size Distribution (PSD) Tests

Particle size distribution analysis was carried on 4 no. representative samples of the coarse superficial deposits recovered from WS03, WS05, WS06 and WS09 at depths of between 1.50m to 2.00m, to confirm field descriptions and classify these materials. From the results the deposits tested generally comprise well graded sand and gravel. These results generally concur with the field descriptions.

5.5.3 Remoulded California Bearing Ratio (CBR) Tests

Remoulded CBR tests were undertaken on 3 no. representative samples of materials taken form the locations of proposed road and car park infrastructure at depths of between 0.40m and 0.75m. The CBR results indicate average CBR values of between 2.15 and 18.5, indicative of highly variable deposits beneath the site. Taking this into consideration, it is recommended that a CBR value of 2% be adopted for the design of any new hardstanding which would result in a preliminary requirement for the inclusion of 400mm sub-base within external hard-standing areas.

This should be reviewed following the completion of in-situ plate load (CBR) tests during the initial stages of the development works when the final formation level has been confirmed.

5.5.4 Sulphate and pH Determinations

The results of the chemical testing are presented in Appendix D.

Within the made ground, water soluble sulphate concentrations were recorded between <10mg/l and 53mg/l with pH values between 6.9 and 8.0. This indicates a BRE Design Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-1.

Within the natural ground, water soluble sulphate concentrations were recorded as between <10mg/l and 12mg/l with pH values between 6.7 and 7.4. This indicates a BRE Design Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-1.

6. CONTAMINATION RISK ASSESSMENT

6.1 Methodology

The results of the contamination related testing undertaken on samples of made ground and natural strata are included as **Appendix D**. In relation to human health risk the results have been assessed using the LQM/CIEH Suitable for Use Levels (S4UL's) for Human Health Risk Assessment (Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3170; All rights reserved), which have been derived in accordance with current UK legislation, and national policy using the most recent version of the CLEA software (v1.06).

The derived S4UL's are based on the concept of minimal tolerable risk as described in SR2 (Environment Agency 2009a) which underpins all previous Environment Agency (EA) SGV's and other GAC's. As part of this assessment, it is noted that S4UL's do not incorporate any toxicological parameter changes to the CLEA base model, however recent toxicological data has been incorporated into the contaminant databases.

Furthermore, S4UL GAC's are considered to be equivalent to the previously published Environment agency SGV's, and previous iterations of LQM/CIEH GAC's and as such are suitable for use in generic quantitative risk assessments under both planning and Part IIa regimes. Taking this into account, it is considered that the modified exposure assumptions adopted in S4UL's are sufficiently conservative in relation to assessing the level of potential risk to human health for the development and future end users.

Where no S4UL is available, reference has been made to appropriate Category 4 Screening Levels (C4SL's), EIC/AGS:CL:AIRE GAC's, SoBRA AGAC for standard land uses, which are similarly considered to be sufficiently conservative in relation to assessing the level of potential risk to human health. For the purpose of this report, all S4UL's, C4SL's, EIC/AGS:CL:AIRE GAC's and SoBRA AGAC's have been referred to as Generic Assessment Criteria (GAC).

With respect to the assessment of the site proposals include the construction of a new Aldi store with car parking facilities and areas of soft landscaping. When considering the potential receptors, an assessment has been undertaken utilising GAC for a commercial end use. To provide a conservative assessment, a value of an SOM of 1.0% has been used in the assessment.

6.2 Human Health Risk Assessment

A summary of the human health contamination related testing is presented in the following table.

Table 6.1: Soil Analysis

Determinand	Maximum Concentration (mg/kg)	No. of Samples Tested	Generic Assessment Criteria (GAC)[1] mg/kg	No. of Samples Exceeding GAC
Metals and Metalloids				
Antimony	1.3	4	7500[4]	0
Arsenic	14	12	640	0
Barium	185	4	22000[4]	0
Boron	2.6	12	240000	0
Cadmium	0.4	12	190	0
Chromium (III)	36	12	86000	0
Chromium (VI)	<1	8	33	0
Cyanide	<1	8	24[2]	
Lead	266	12	2330[3]	0
Mercury	1.1	12	1100	0
Molybdenum	2.3	4	1700[4]	0
Selenium	1.1	12	12000	0
Copper	77	12	68000	0
Nickel	36	12	980	0
Zinc	182	12	730000	0

Table 6.1: Soil Analysis

Determinand	Maximum Concentration (mg/kg)	No. of Samples Tested	Generic Assessment Criteria (GAC)[1] mg/kg	No. of Samples Exceeding GAC
Polycyclic Aromatic Hydrocarbons (USEPA 16)				
Naphthalene	0.33	8	190	0
Acenaphthylene	0.07	8	83000	0
Acenaphthene	0.05	8	84000	0
Fluorene	0.08	8	63000	0
Phenanthrene	1.42	8	22000	0
Anthracene	0.28	8	520000	0
Fluoranthene	3.13	8	23000	0
Pyrene	2.47	8	54000	0
Benzo(a)anthracene	1.68	8	170	0
Chrysene	1.79	8	350	0
Benzo(b)fluoranthene	2.08	8	44	0
Benzo(k)fluoranthene	0.73	8	1200	0
Benzo(a)pyrene	1.39	8	35	0
Indeno(1,2,3-cd)pyrene	1.29	8	500	0
Dibenz(a,h)anthracene	0.25	8	3.5	0
Benzo(g,h,i)perylene	1.05	8	3900	0
Total Petroleum Hydrocarbons (TPH CWG)				
Aliphatic TPH C5-C6	<0.1	4	3200	0
Aliphatic TPH C6-C8	<0.1	4	7800	0
Aliphatic TPH C8-C10	<0.1	4	2000	0
Aliphatic TPH C10-C12	<6	4	9700	0
Aliphatic TPH C12-C16	<6	4	59000	0
Aliphatic TPH C16-C35	16	4	1600000	0
Aliphatic TPH C35-C44	12	4	1600000	0
Aromatic TPH C5-C7	<0.01	4	26000	0
Aromatic TPH C7-C8	<0.01	4	56000	0
Aromatic TPH C8-C10	<0.01	4	3500	0
Aromatic TPH C10-C12	<10	4	16000	0
Aromatic TPH C12-C16	<10	4	36000	0
Aromatic TPH C16-C21	11	4	28000	0
Aromatic TPH C21-C35	132	4	28000	0
Aromatic TPH C35-C44	122	4	28000	0
Total Petroleum Hydrocarbons (TPH C6-C40)				
TPH C10-C40	150	4	2000[5]	0

Notes:
1. LQM/CIEH S4UL for Commercial end use.
2. SOBRA AGAC
3. Category 4 Screening Level (C4SL) for Commercial end use.
4. EIC/AGS/CL:AIRE GAC for Commercial end use.
5. Category 4 Screening Level (C4SL) for most conservative Aliphatic/Aromatic hydrocarbon banding.

From the results of the laboratory chemical analysis, none of the determinands tested were elevated above the generic assessment criteria for a commercial end use.

In addition, when considering the very low levels of potential contaminants recorded below the site, there is no significant risk considered to controlled waters.

6.2.1 Asbestos

A total of 8 no. samples of made ground recovered were screened for asbestos fibres; none were detected.

7. GROUND GAS RISK ASSESSMENT

This ground gas risk assessment has been undertaken in general accordance with CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings', BS8485:2015+A1:2019 'Code of practice for the design of protective measures for methane and carbon dioxide for ground gases in new buildings' and BS8576:2013 'Guidance on investigation for ground gas – permanent gases and Volatile Organic Compounds (VOC's)'.

7.1 Ground Gas

From the Phase I Geo-environmental assessment, it was considered a low to medium risk was present on the site due to the potential presence of made ground and alluvial soils. Therefore, in consideration of the proposed commercial end use, in accordance with CIRIA C665 an appropriate monitoring frequency and period of six readings over a minimum three month period is considered appropriate for this site, with monitoring also undertaken over periods of rising and falling atmospheric pressure, as recommended within BS8485:2015+A1:2019.

To aid in assessing the gas regime below the site, a total of 3 no. gas monitoring wells, comprising slotted 50mm diameter HDPE pipe set within a granular filter, were installed across the site at the locations of WS01, WS02 & WS03, to depths of between 4.00m and 5.00m below current ground levels. The locations of the monitoring wells are shown on **Drawing G0002** whilst further details relating to well construction at each borehole location can be seen on the exploratory hole record sheets included in **Appendix B**.

In total the wells have been monitored on two occasions on the 27th January and 1st February 2023, with the results of the monitoring presented in **Appendix F** along with copies of the gas analyser calibration certificates. The results of the monitoring are summarised in the following table:

Table 7.1: Gas Monitoring Results

Location	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	Maximum Flow (l/hr)	Barometric Pressure (mb)	Maximum GSV* (l/hr)	
						CO2	CH4
WS01	0.0	1.00	20.40-20.70	<0.1	1007-1025	<0.07	<0.07
WS02	0.0	1.50-2.60	19.20-20.10	<0.1			
WS03	0.0	5.10-6.00	12.30-15.80	<0.1			

** CIRIA 665 Gas Screening Value*

During the initial monitoring visits, no Methane (CH_4) was detected whilst Carbon Dioxide (CO_2) was recorded up to a maximum concentration of 6.00% v/v. Negligible flow rates were also recorded during the monitoring period (i.e. <0.1l/hr), whilst occasional slightly depleted Oxygen levels were also recorded to a minimum concentration of 12.30% v/v.

When considering the above, for the purposes of this preliminary assessment the risk to the site from ground gases has been evaluated by converting the results in the table above to a gas screening value (GSV), which is calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive steady flow rate. As negligible concentrations of Methane were recorded during the monitoring period, only the preliminary GSV for Carbon Dioxide has been calculated, using the maximum recorded value of 6.00% v/v with a flow rate taken as 0.1l/hr.

The preliminary GSV has be calculated as follows:

- Carbon Dioxide GSV = 0.060 (6.00%) x 0.1 = 0.006l/hr

From the results of the ground gas monitoring carried out to date, the preliminary GSV for Carbon Dioxide does not exceed the GSV minimum assessment values for a Characteristic Situation 1 (CS1), as outlined in BS8485:2015+A1:2019 and CIRIA C665. However as concentrations of Carbon Dioxide are recorded above the 5% threshold, an initial assessment indicates the site to lie within a Characteristic Situation 2 (CS2) setting, indicating ground gas protection measures will be required for the site.

It should be noted a further 4 no. gas monitoring visits are planned and any conclusions may be subject to change until completion of the monitoring programme.

7.2 Radon

From the 1st December 2022, the UK Health Agency (UKHSA) and British Geological Survey published updated information pertaining to levels of risk posed by Radon. As such, the radon assessment for this site has been updated in accordance with the ukradon.org online interactive map.

In view of the above information, the site is recorded within an area where between 1%-3% of homes are at or above the action level. As such, in order to determine the potential risk, an updated envirocheck data sheet which includes a site specific radon risk assessment report was obtained and is attached in Appendix H. The results confirm the absence of risk and therefore no radon protection measures are required for this site.

8. MODIFIED CONCEPTUAL SITE MODEL

8.1 Sources of Contamination

From the findings of the contamination risk assessment, no concentrations of potential contaminants have been recorded which are considered to represent a potential risk to human health (i.e. future end users or construction workers). In addition, given the low levels of potential contaminants identified, the risk to controlled waters is also considered to be negligible.

From the results of the initial gas monitoring, increased levels of CO_2 have been recorded, with a preliminary assessment indicating this site could potentially fall within a CIRIA C665 and BS8485:2015+A1:2019 **Characteristic Situation 2 (CS2)** setting.

As gas monitoring is still ongoing for this site (a further 4 no visits still to be undertaken), the potential ground gas risk is subject to change following the completion of the programmed 6 visits.

When considering the above the following pathways and receptors are still considered applicable for this site:

8.2 Pathways

- Vertical and lateral migration, possible ingress and accumulation of ground gases into buildings and service entries (manholes).

8.3 Receptors

- Human Health – Site end Users

8.4 Pollutant Linkage Assessment

A qualitative risk assessment has been made of the likelihood of any pollutant linkage operating and its potential significance as summarised in the table below:

Table 8.1: Pollutant Linkage Model

Contamination Source	Pathway	Hazard	Potential Receptors	Linkage Complete
Ground Gas	Vertical Migration into buildings and confined spaces	Human Health Risk, Fire Risk	Human Health and Properties	Elevated levels of Carbon Dioxide have been recorded above the 5% threshold during the initial ground gas monitoring visits undertaken on the site, indicating the site potentially falls within a **Characteristic Situation 2 (CS2)**. It should be noted a further 4 no. gas monitoring visits are planned and any conclusions may be subject to change until completion of the monitoring programme.

9. DISCUSSION

Development proposals include the construction of a new Aldi store with associated car park facilities and soft landscaping. This investigation was carried out to provide contamination related testing to outline potential environmental constraints.

9.1 Contamination Assessment

Based the findings of the contamination risk assessment no concentrations of potential contaminants have been identified, which exceed current assessment criteria, based upon a commercial end use. Therefore, these materials are considered suitable for continued use within a commercial setting without representing a potential risk to human health (i.e. future end users).

In addition, when considering the very low levels of potential contaminants recorded below the site, there is no significant risk considered to controlled waters (i.e. underlying aquifers and surface water features).

9.2 Disposal of Materials

As part of the investigation, Waste Acceptance Criteria (WAC) testing was undertaken on representative samples of made ground, the results of which are included in Appendix D. In addition, the results of the chemical analyses has been reviewed to allow an initial assessment to be made in relation to potential off-site disposal characterisation of soils recovered during the investigation works.

Following a review of the soil and WAC screening results increased levels of TOC were typically noted for the made ground materials which exceed acceptance criteria for disposal at an Inert landfill (3%), indicating that the majority of these materials will likely be characterised as Non-Hazardous for disposal.

Natural soils below the site will likely be suitable for disposal to an Inert landfill site.

Where offsite disposal of waste soils is required, the results of the investigation should be made available to the waste carrier/receiver in order to determine the waste classification, costs for disposal and the requirement for further testing. Sufficient time should be allowed in the site programme to effectively segregate soils based on material type, including the time allowed for any further laboratory classification analysis as required.

9.3 Foundations and Floor Slabs

From the findings of the intrusive investigations, the use of conventional shallow foundation options and trench fill is considered unviable due to the variability of the natural deposits beneath the site.

In view of this, the use of Controlled Modulus Columns CMC's may represent a potential viable option for the site, subject to confirmation from a specialist ground improvement contractor.

Alternatively, a piled foundation solution presents a viable foundation solution for the site, with foundations taken down through the made ground and natural deposits, and based on limestone bedrock deposits. If this foundation option is to be adopted, the contents of this report should be made available to the appropriate design specialist.

Taking into account the variable ground conditions beneath the site, a ground bearing floor slab will likely be unsuitable, therefore it is considered a suspended floor slab will likely be required for the proposed development.

9.4 External Works

Remoulded CBR tests were undertaken on 3 no. samples of materials at depth of between 0.40m and 0.75m within areas of proposed road and car parking infrastructure. The CBR results indicate highly variable deposits beneath the site, and as such, it is recommended that a CBR value of 2% be adopted for the design of any new hardstanding which would result in a preliminary requirement for the inclusion of 400mm sub-base within external hard-standing areas.

This should be reviewed following the completion of in-situ plate load (CBR) tests during the initial stages of the development works when the final formation level has been confirmed.

9.5 Gas Protection Measures

Radon protection measures are not required for the proposed development.

From the results of the initial gas monitoring elevated levels of CO_2 have been recorded indicating the site falling within a CIRIA C665 and BS8485:2015+A1:2019 Characteristic Situation 2 (CS2) setting. As a result gas protection measures are considered necessary for this site.

A further 4 no. gas monitoring visits are planned and any conclusions may be subject to change until completion of the monitoring programme.

9.6 Excavations and Dewatering

During the investigation works, natural ground beneath the site was recorded as variable, with materials ranging from clay, sand and silt, the stability of which was variable. Therefore, it is recommended that an allowance be included for appropriate trench support during future investigations, in line with health and safety guidelines.

From the findings of the investigation works, a continuous groundwater surface was noted as locally absent beneath the site, with perched groundwater recorded at depths of between 1.00m and 2.40m. In addition, at the location of TP07, groundwater was recorded at a depth of 3.20m, upon encountering running sand deposits.

During completion of the CPT's cone resistance was also indicated to decrease at the majority of the CPT locations at an average depth of 3m where water was typically encountered (Phreatic Groundwater Surface).

The results of the groundwater monitoring also recorded relatively consistent standing water levels ranging between 1.60m and 2.40m below ground level within WS01, WS02 and WS03, with only minor fluctuations noted during the monitoring period.

Taking the above into consideration, it is recommended that an allowance be included for groundwater control measures (i.e. localised pumping through sumps) should groundwater ingresses occur into future excavations.

9.7 Sulphate Attack on Buried Concrete

The results of the chemical analyses indicate a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC classification AC-1.

9.8 Soakaways

From the results of the Soakaway test results, it is considered the natural shallow deposits below the site are not suitable for the use with soakaways.

Drawings

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SITE NORTH

Date	Revision	Checked	Rev.

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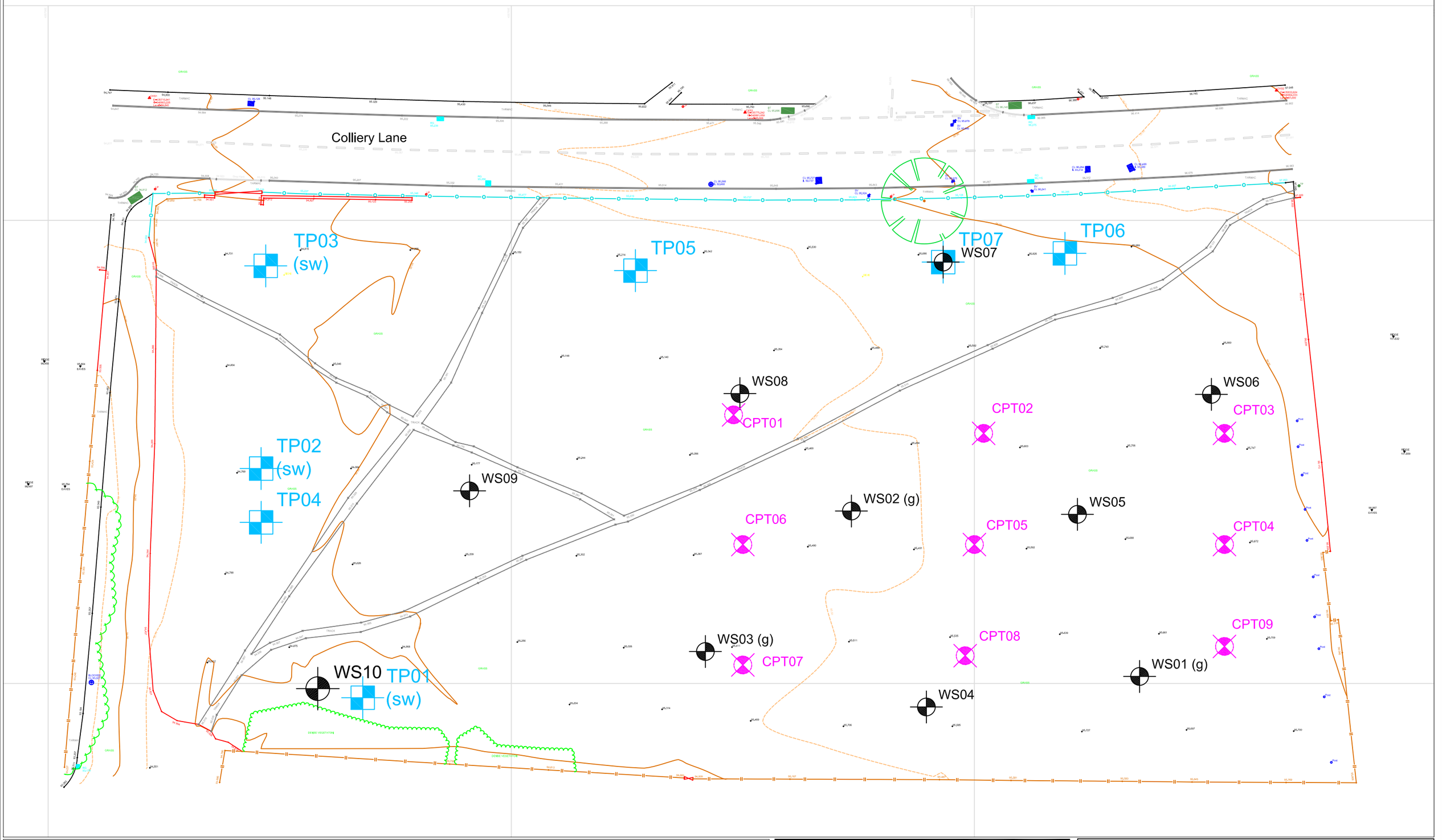
Project	Colliery Lane, Hetton-le-Hole for Aldi Stores Limited		
Title	Site Location Plan		
Scale 1:25,000 at A4	Drawn AM	Checked NW	Date Jan 2023
Job No P18-474	Drawing No. G0001		Rev 0



Key:

- WS — Mini Percussive Borehole Location, (g) Denotes Location of Combined Ground Gas and Groundwater Monitroing Well
- TP — Trial Pit Locations, (sw) denotes Location of Soakaway Test
- CPT — Location of Cone Pentrometer Test

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Project	Colliery Lane, Hetton-le-Hole for Aldi Stores Limited			
Title	Exploratory Hole Location Plan			
Scale	NTS	Drawn AM	Checked NW	Date Jan 2023
Job No. P18-474	Drawing No. G0002			Rev 2

Appendix A

Proposed Site Plan

REV	DATE	DESCRIPTION	DRW	CHK
P01	2022-08-26	Initial Issue	LAV	JWC

Tree Tops

1

22

Low level timber knee rail

Proposed ornamental shrub planting

Low-level timber knee rail

Proposed ornamental shrub planting

POST SIGN

Low-level timber knee rail

Proposed ornamental shrub planting

Low-level timber knee rail

Existing boundary fence

Pedestrian entrance

Proposed native buffer mix planting

Proposed native buffer mix planting

6000

6500

Bollards

Potential future informal public site access

Proposed native buffer mix planting

Low-level timber knee rail

6000

7000

8000

Bollards

Sheffield cycle stands

Bollards

Weld-mesh fence

Existing boundary fence

Acoustic timber fence

Proposed Wildflower Meadow

Proposed native buffer mix planting

Existing boundary fence

Electric Vehicle charging points

Proposed native buffer mix planting

Existing boundary fence

Proposed Wildflower Meadow

Acoustic timber fence

Weld-mesh fence

Proposed Wildflower Meadow

Acoustic timber fence

Low-level timber knee rail

55000

SALES AREA

23900

36487

PLANT

LOBBY

58247

WAREHOUSE

7000

7000

Planting layout to be confirmed by landscape designers

Client
Aldi Stores Ltd.

Project Title
Aldi - Hetton le Hole

Project Address
Colliery Lane
Hetton le Hole

Drawing Title
Proposed Site Plan
Slim Plant

Job No.	Originator	Zone	Level	Type	Role
0440	PA	XX	00	DR	A

System Classification	Drawing No.	Suitability	Revision
PM_00_10_00-0002		S4	P01

Drawn	Checked	Date	Scale	Size
JWC		2022-04-04	1:250	A1

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0 5m 10m 15m 20m 25m

N

Appendix B

Exploratory Hole Records

Borehole Log

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Borehole No. **WS01**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 12/01/2023 - 12/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.25			MADE GROUND: Grass over dark brown sandy clay with sandstone gravel and rootlets.
		0.50	D					Firm brown and grey friable sandy CLAY with occasional gravel and sand lens.
		1.00	D					
		1.00		N=9 (1,1/1,2,2,4)				
		1.60	D		1.50			Soft brown very sandy clayey SILT.
	▼	2.00	D					
		2.00		N=7 (1,1/1,2,2,2)				
		3.00	D					
		3.00		N=3 (1,1/0,1,1,1)				
		4.00	D		3.80			Soft grey silty sandy CLAY.
		4.00		N=4 (1,0/0,1,1,2) HVP=20	4.00			Solid drilling, no recovery.
		5.00		N=7 (1,1/1,1,2,3)				
					5.45			End of borehole at 5.45 m

Remarks

1. Borehole terminated at a depth of 5.45m upon completion.
2. Solid drilling with no recovery between 5.00m to 5.45.
3. Groundwater encountered at a depth of 2.00m.

AGS

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Borehole Log

Borehole No. **WS02**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 12/01/2023 - 12/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30			MADE GROUND: Grass over dark brown sandy clay with sandstone gravel and rootlets.
		0.50	ES					Firm brown and grey friable sandy CLAY with occasional gravel and sand lens.
		1.00	D					
		1.00		N=7 (1,2/1,1,2,3) HVP=31	1.50			Soft grey clayey SILT/ silty CLAY with occasional gravel and sand lens.
		1.60	D					
		2.00	D					
	▼	2.00		N=5 (1,2/1,1,1,2) HVP=17				
		3.00	D					
		3.00		N=3 (0,0/0,0,1,2) HVP=14				
		4.00		N=6 (3,3/2,1,1,2)				
		5.00	D					
		5.00		N=0 (0,0/0,0,0,0) HVP=21	5.45			End of borehole at 5.45 m

Remarks

1. Borehole terminated at a depth of 5.45m upon completion.
2. Groundwater encountered at a depth of 2.40m.

AGS

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Borehole Log

Borehole No. **WS03**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 12/01/2023 - 12/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30			MADE GROUND: Grass over dark brown sandy clay with sandstone gravel and rootlets.
		0.50	ES					MADE GROUND: Brown sand and gravel of sandstone and mudstone with occasional brick.
		1.00		N=10 (1,2/1,3,2,4)	1.00			
		1.10	ES		1.20			MADE GROUND: Black clayey sand with occasional rootlets (relic topsoil).
	▼	1.50	D					Loose to medium dense brown slightly silty slightly clayey SAND with occasional clay bands.
		2.00	D					
		2.00		N=8 (1,1/1,1,2,4)				
		3.00	D					
		3.00		N=15 (1,1/2,3,5,5)				
		4.00	D					
		4.00		N=13 (1,2/2,3,4,4)				
					4.45			Soft grey clayey SILT.
		5.00	D					
		5.00		N=12 (1,1/2,3,3,4) HVP=11				
					5.45			End of borehole at 5.45 m

Remarks

1. Borehole terminated at a depth of 5.45m upon completion.
2. Groundwater encountered at a depth of 1.70m.

AGS

Hydrock 3E

Borehole Log

Borehole No. **WS04**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 12/01/2023 - 12/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D		0.35			MADE GROUND: Grass over dark brown sandy clay with sandstone gravel and rootlets.
		0.50	ES		0.60			MADE GROUND: Black clayey sand with occasional rootlets (relic topsoil).
	▼	1.00	D					Soft brown very sandy very gravelly CLAY. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		1.00		N=4 (1,0/1,1,1,1)				
		2.00		N=10 (1,2/2,1,3,4)	2.00			Loose grey slightly gravelly SAND. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		2.10	D		2.50			Loose brown SAND.
		2.70	D					
		3.00		N=0 (1,0/0,0,0,0)	3.00			Loose grey slightly gravelly SAND. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		3.10	D		3.20			Very loose brown silty sandy fine to coarse, subrounded to subangular GRAVEL of mudstone, sandstone and limestone.
		3.50	D		3.90			Soft grey clayey SILT.
		4.00	D		4.00			Solid drilling, no recovery.
		4.00		N=1 (1,1/1,0,0,0)				
		5.00		N=2 (1,1/1,0,0,1)				
					5.45			End of borehole at 5.45 m

Remarks
1. Borehole terminated at a depth of 5.45m upon completion.
2. Groundwater encountered at a depth of 1.00m.

AGS

Hydrock 3E

Borehole Log

Borehole No. **WS05**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 12/01/2023 - 12/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D					MADE GROUND: Grass over dark brown sandy clay with sandstone gravel and rootlets.
		0.50	ES		0.40			
					0.65			MADE GROUND: Black clayey sand with occasional rootlets (relic topsoil).
		1.00	D					Medium dense brown sandy clayey fine to coarse subrounded to subangular GRAVEL of mudstone, sandstone and limestone.
		1.00		N=11 (1,2/3,3,2,3)				
		1.50	D					
	▼	2.00		N=4 (0,0/1,1,1,1)	2.00			Loose brown sandy fine to coarse, subrounded to subangular GRAVEL of sandstone, mudstone and limestone.
		2.20	D					
					2.40			Soft grey and brown sandy SILT.
		3.00	D					
		3.00		N=4 (1,2/1,1,1,1)	3.10			Loose brown SAND.
		3.20	D		3.30			Soft grey and brown sandy SILT.
		4.00	D					
		4.00		N=10 (2,1/3,3,2,2)				
					4.60			Stiff grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		5.00	D					
		5.00		N=8 (2,2/3,2,1,2) HVP=89				
					5.45			End of borehole at 5.45 m

Remarks

1. Borehole terminated at a depth of 5.45m upon completion.
2. Groundwater encountered at a depth of 2.00m.

AGS

Hydrock 3E

Borehole Log

Borehole No. **WS06**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 13/01/2023 - 13/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES					MADE GROUND: Dark brown clayey sand with with rootlets and wood.
					0.50			Medium dense brown slightly clayey slightly gravelly SAND. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		1.00	D					
	▼	1.00		N=19 (3,3/3,8,4,4)				
		1.50	D					
		2.00		N=4 (1,1/1,1,1,1)	2.00			Brown sandy fine to coarse, subrounded to subangular GRAVEL of sandstone, mudstone and limestone.
		2.10	D		2.20			Soft brown very sandy CLAY.
		3.00	D					
		3.00		N=2 (3,0/0,0,1,1) HVP=41				
				HVP=27				
		4.00	D		4.00			Loose brown SAND.
		4.00		N=6 (2,2/2,1,2,1)				
					4.60			Soft grey sandy silty CLAY.
		5.00	D					
		5.00		N=7 (3,3/3,2,1,1)				
					5.45			End of borehole at 5.45 m

Remarks
1. Borehole terminated at a depth of 5.45m upon completion.
2. Groundwater encountered at a depth of 1.40m.

AGS

Hydrock 3E

Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 13/01/2023 - 13/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.40			MADE GROUND: Dark brown clayey sand with with rootlets and wood.
		0.50	D					Brown slightly clayey slightly gravelly SAND. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		1.00		N=15 (3,4/4,4,3,4)	1.10			Firm brown friable sandy gravelly CLAY. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		1.50	D					
	▼	2.00	D					
		2.00		N=5 (2,2/2,1,1,1)	2.20			Firm becoming soft brown and grey silty sandy CLAY.
		2.50	D	HVP=30				
		3.00		HVP=9 N=0 (1,0/0,0,0,0)	3.00			Running SAND. (Confirmed via TP07)
		4.00		N=13 (2,3/3,3,4,3)	4.00			Stiff grey silty sandy CLAY.
		4.50	D	HVP=70				
		5.00		N=7 (1,1/1,2,1,3) HVP=72	5.45			End of borehole at 5.45 m

Remarks

1. Borehole terminated at a depth of 5.45m upon completion.
2. Possible void noted between depths of 3.00m and 4.00m.
3. Groundwater encountered at a depth of 2.00m.

AGS

Hydrock 3E

Borehole Log

Borehole No. **WS08**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 13/01/2023 - 13/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.90			MADE GROUND: Dark brown and black clayey sand with brick, glass, metal and coal.
		1.00 1.00	D	N=15 (4,4/4,3,4,4)				Firm brown friable sandy gravelly CLAY. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		1.90 2.00	D	N=8 (1,3/2,2,2,2)	2.00			Soft and firm brown very sandy CLAY.
		2.50	D	HVP=13	2.80			Soft and firm grey silty sandy CLAY.
		3.00 3.00	D	N=12 (3,2/3,3,2,4) HVP=40				
		3.50	D	HVP=6				
		4.00		N=8 (0,0/0,2,3,3) HVP=50				
		4.50	D	HVP=2				
		5.00 5.00	D	N=17 (2,3/4,4,5,4) HVP=47				
					5.45			End of borehole at 5.45 m

Remarks
1. Borehole terminated at a depth of 5.45m upon completion.
2. No groundwater encountered.

AGS

Hydrock 3E

Borehole Log

Borehole No. **WS09**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 13/01/2023 - 13/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	ES					MADE GROUND: Dark brown and black clayey sand with brick, glass, metal and coal.
		1.00		N=8 (2,2/3,2,2,1)	1.00			
		1.20	ES					MADE GROUND: Black clayey sand with occasional rootlets (relic topsoil).
		1.50	D		1.35			Brown gravelly SAND. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		2.00		N=10 (3,3/3,3,2,2)	2.00			
		2.50	D					Soft and firm grey and brown sandy gravelly CLAY. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone, limestone and coal.
		3.00	D					
		3.00		N=9 (1,1/2,3,2,2)	3.10			Soft brown sandy SILT with occasional sand partings
		3.50	D					
		4.00		N=17 (4,4/4,4,5,4)	4.00			Medium dense brown SAND.
		4.50	D					
		5.00	D		4.90			Stiff grey silty sandy CLAY.
		5.00		N=6 (1,1/1,0,1,4)				
					5.45			End of borehole at 5.45 m

Remarks
1. Borehole terminated at a depth of 5.45m upon completion.
2. No groundwater encountered.

AGS

Borehole Log

Hydrock 3E

Borehole No. **WS10**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: -	Hole Type WLS
Location: Hetton Le Hole		Level:	Scale 1:50
Client: Aldi Stores Limited		Dates: 13/01/2023 - 13/01/2023	Logged By AM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.35			MADE GROUND: Dark brown and black clayey sand with brick, glass, metal and coal.
								MADE GROUND: Brown and black sand with sandstone, mudstone, brick and coal.
		1.00	ES					
		1.00		N=13 (3,3/2,4,4,3)	1.10			Medium dense brown SAND.
		1.50	D					
		1.90	D		1.80			Black silty organic SAND.
		2.00		N=9 (6,1/2,2,2,3)	2.00			Loose to medium dense brown and grey clayey gravelly SAND. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and limestone.
		2.50	D					
		3.00		N=15 (3,3/3,4,4,4)				
					3.50			Firm grey sandy silty CLAY.
		4.00	D					
		4.00		N=49 (7,8/8,14,12,15) HVP=30	4.45			End of borehole at 4.45 m

Remarks

1. Borehole terminated at a depth of 4.45m upon refusal of sampling equipment.
2. No groundwater encountered.

AGS

Trial Pit Log

Hydrock 3E

Trialpit No **TP01**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: - Level:	Date 12/01/2023
Location: Hetton Le Hole		Dimensions (m): 1.3 × 0.4, Depth 2.20	Scale 1:25
Client: Aldi Stores Limited			Logged KRC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							MADE GROUND: Grass over topsoil.
				0.30			
	0.50	ES					MADE GROUND: Brown gravelly clayey fine to coarse sand. Gravel is fine to coarse subangular of mudstone, concrete, brick and sandstone,
				0.90			
	1.00	ES					MADE GROUND: Yellow brown slightly gravelly clayey fine to coarse sand. Gravel is fine to coarse subangular of sandstone, mudstone and quartz.
				1.30			MADE GROUND: Black slightly silty fine to coarse sand with occasional rootlets. (Possible relic topsoil) (Organic odour noted).
				1.50			Yellow brown clayey gravelly fine to coarse SAND. Gravel is fine to coarse subangular of sandstone, mudstone and quartz.
				2.20			End of pit at 2.20 m

1 2 3 4 5

Remarks:
1. Trial pit complete at 2.20mbgl.
2. Soakaway test completed at depth of 1.20m to 2.20m.
3. Dry.

Stability: All faces stable.

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Hydrock 3E

Trial Pit Log

Trialpit No **TP02**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: - Level:	Date 12/01/2023
Location: Hetton Le Hole		Dimensions (m): 1.4 × 0.4, Depth 2.30	Scale 1:25
Client: Aldi Stores Limited			Logged KRC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			MADE GROUND: Grass over topsoil.
	0.80	ES					MADE GROUND: Yellow brown gravelly clayey fine to coarse sand. Gravel is fine to coarse subangular of sandstone, mudstone and quartz.
	1.60	ES		1.50			MADE GROUND: Black slightly silty fine to coarse sand with occasional rootlets. (Possible relic topsoil) (Organic odour noted).
				1.70			Yellow brown clayey gravelly fine to coarse SAND. Gravel is fine to coarse subangular of sandstone, mudstone and quartz.
				2.30			End of pit at 2.30 m

1 2 3 4 5

Remarks:
1. Trial pit complete at 2.30mbgl.
2. Soakaway test completed at depth of 1.70m to 2.30m.
3. Water seepage at 0.50mbgl.

Stability: Face A unstable between 0.50m and 1.50m.

AGS

Trial Pit Log

Hydrock 3E

Trialpit No **TP03**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: - Level:	Date 12/01/2023
Location: Hetton Le Hole		Dimensions (m): 1.5 × 0.4, Depth 2.20	Scale 1:25
Client: Aldi Stores Limited			Logged KRC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			MADE GROUND: Grass over topsoil.
	0.50	ES					MADE GROUND: Yellow brown gravelly clayey fine to coarse sand. Gravel is fine to coarse subangular of sandstone, mudstone and quartz.
	1.00	ES		0.90			MADE GROUND: Black slightly silty fine to coarse sand with occasional rootlets. (Possible relic topsoil).
	2.00	ES		1.30			Yellow brown clayey gravelly fine to coarse SAND. Gravel is fine to coarse subangular of sandstone, mudstone and quartz.
				2.20			End of pit at 2.20 m

1 2 3 4 5

Remarks:
1. Trial pit complete at 2.20mbgl.
2. Soakaway test completed at depth of 1.30m to 2.20m.
3. Water seepage at 0.50mbgl.

Stability: All faces stable.

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Hydrock 3E

Trial Pit Log

Trialpit No **TP04**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: - Level:	Date 27/01/2023
Location: Hetton Le Hole		Dimensions (m): 1 × 0.4, Depth 0.65	Scale 1:25
Client: Aldi Stores Limited			Logged AM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			MADE GROUND: Grass over sandy soil.
	0.60	B		0.65			MADE GROUND: Yellow brown gravelly clayey fine to coarse sand. Gravel is fine to coarse subangular of sandstone, mudstone and quartz. End of pit at 0.65 m

Remarks: 1. Trial pit terminated at a depth of 0.65m upon encountering target depth for sample recovery.
2. No groundwater encountered.

Stability: All faces stable.

AGS

Hydrock 3E

Trial Pit Log

Trialpit No **TP05**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: - Level:	Date 27/01/2023
Location: Hetton Le Hole		Dimensions (m): 1 × 0.4, Depth 0.55	Scale 1:25
Client: Aldi Stores Limited			Logged AM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							MADE GROUND: Grass over sandy soil.
	0.40	B		0.35			Brown slightly clayey gravelly SAND. Gravel is fine to coarse, subrounded to subangular of sandstone and mudstone.
				0.55			End of pit at 0.55 m

Remarks: 1. Trial pit terminated at a depth of 0.55m upon encountering target depth for sample recovery.
2. No groundwater encountered.

Stability: All faces stable.

AGS

Trial Pit Log

Hydrock 3E

Trialpit No **TP06**

Sheet 1 of 1

Project Name: Aldi Hetton Le Hole	Project No. P18-474	Co-ords: - Level:	Date 27/01/2023
Location: Hetton Le Hole		Dimensions (m): Depth 0.80 (1 × 0.4)	Scale 1:25
Client: Aldi Stores Limited			Logged AM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.10			MADE GROUND: Grass over sandy soil.
	0.75	B					Orange brown SAND.
				0.80			End of pit at 0.80 m

Remarks: 1. Trial pit terminated at a depth of 0.80m upon encountering target depth for sample recovery.
2. No groundwater encountered.

Stability: All faces stable.

AGS

Trial Pit Log

Hydrock 3E

Trialpit No **TP07**

Sheet 1 of 1

Project Name:	Aldi Hetton Le Hole	Project No. P18-474	Co-ords: - Level:	Date 27/01/2023
Location:	Hetton Le Hole	Dimensions (m): Depth 3.65	2 / 0.6	Scale 1:25
Client:	Aldi Stores Limited			Logged AM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			MADE GROUND: Grass over sandy soil.
							Orange brown SAND.
				2.60			Grey silty sandy CLAY.
▼				3.20			Brown RUNNING SAND.
				3.65			End of pit at 3.65 m

1 2 3 4 5

Remarks: 1. Trial pit terminated at a depth of 3.65m upon completion.
2. Groundwater encountered at a depth of 3.20m.

Stability: All faces become unstable from 3.20m upon encountering running sand.

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Appendix C

Cone Penetrometer Test Result Data Sheets

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COLLIERY LANE, HETTON-LE-HOLE

SOIL INVESTIGATION

CPT REPORT

Cone penetration testing
Parameter interpretation

Project Reference.: P-108244-1

Report Issue No.: 01 P-108244_01

PROJECT:	Colliery Lane, Hetton-le-Hole

CLIENT:	Hydrock

FIELDWORK

CPT rig(s)	20.5-tonne track-truck mounted CPT unit (UK3)
Date fieldwork started	27th January 2023
Date fieldwork completed	27th January 2023
Lankelma's representative	Emma Stickland
Client's representative	Nicola Watson

DOCUMENT CHECKING

Action	Date	Name
Completed	01/02/2023	Christopher Player
Checked	01/02/2023	Joseph Hobbs
Approved	01/02/2023	Joseph Hobbs

Issue	Date	Status
01_01	01/02/2023	Final

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1 INTRODUCTION

At the request of Hydrock, a soils investigation was carried out on project *Colliery Lane, Hetton-le-Hole.*

Site location:

(In the general region of)

Colliery Lane
Hetton-le-Hole
Durham
DH5 0JA

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 and care 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 classification descriptions or soil layer boundaries contained in this report.

3 COMPLETED WORKS

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

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

4 FIELDWORK GENERAL

Fieldwork was performed with a 20.5-tonne track-truck mounted CPT unit (UK3) equipped with a 17.0-tonne capacity hydraulic ram set.

The Client was responsible for the positioning and re-survey of all investigative locations.

The target depth for the investigation was until cone refusal was reached. Table 3 details the final test depths and reasons for test termination (*refusal factor).* Where required, each penetration refusal decision was verbally confirmed with the Client's on-site representative.

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 were calibrated in accordance with ISO 376:2011. 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 penetrometer used was a digital model (down-hole digitisation) with internal measurement of load cell temperature. The temperature data was used for QA during the test and QC during processing. The test operative aimed to keep the rate of temperature change to less than 0.5°/min in low strength soils to maintain acceptable measurement error. The temperature data can be used to assess ground temperature at depths where the cone has paused for more than 10 minutes with an accuracy of ~+- 0.5°.

The piezometer filter element was in the u_2 position and was vacuum saturated in a > 99.9% vacuum under 1000 cSt silicone oil for > 7 days prior to mobilisation. The pore pressure system was vacuum saturated in the disassembled state under 500 cSt glycerine oil (dipropylene glycol or propylene glycol) and assembled under oil prior to each test.

5.1 GLOSSARY OF CPT TERMS AND SYMBOLS

SYMBOLS & ABBREVIATIONS

B_q	**Pore pressure ratio.** The net pore pressure normalized with respect to the net cone resistance: $B_q = (u_2 - u_0)/(q_t - \sigma_v)$
F_r	**Normalised friction sleeve resistance:** $F_r = f_s / (q_c - \sigma_v)$
f_s	**Friction sleeve resistance:** The total frictional force acting on the friction sleeve, F_s, divided by its surface area A_s: $f_s = F_s/A_s$.
G	**Shear modulus**
g	**Gravitational constant:** g = 9.81 m/s^2
G_0	**Small strain shear modulus**
Gs	**Specific gravity of solids**
HOC	**Heavily overconsolidated**
I_c	**Soil Behaviour Type Index:** Continuous numerical representation of Robertson (1990) soil behaviour type classification chart.
LOC	**Lightly overconsolidated**
NC	**Normally consolidated**
OC	**Overconsolidated**
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	**Normalised cone resistance** (Method 1): $Q_t = (q_c - \sigma_v)/\sigma'v$

q_t	**Corrected tip resistance:** The cone tip resistance q_c corrected for pore water pressure effects on the cone shoulder.
$q_{t\text{-}net}$	**Net cone resistance:** $q_{t\text{-}net} = q_t - \sigma_v$. Where q_t is unavailable q_c is applied.
q_{t1}	**Normalised cone resistance** (Method 2): $q_{t1} = (q_t)/(\sigma'_v)^{0.5}(\frac{q_t}{\sigma_{atm}})/(\frac{\sigma_{v0}'}{\sigma_{atm}})^{0.5}$
R_f	**Friction ratio:** The ratio, expressed as a percentage, of the sleeve friction, f_s, to the cone resistance, q_c, at a given depth: $R_f = (f_s/q_c) \cdot 100$
SBT or SBTn	**Soil behaviour type classification**
SPT	**Standard Penetration Test**
u_0	**Equilibrium pore pressure**
u_2	**Pore pressure:** Dynamic pore pressure measured at the shoulder position (u_2) during penetration and during dissipation tests. $u_2 = \Delta u_2 + u_0$
Δu_2	**Excess pore pressure:** $\Delta u_2 = u_2 - u_0$
V_s, V_p	**Shear wave velocity, V_s, and pressure wave velocity, V_p.** Measured with use of a seismic receiver.
z	**Depth below ground level:** Depth as penetration length without correction for inclination, or true depth after correction for inclination.
<u>Greek</u>	
γ	**Unit weight of soil**
γ_w	**Unit weight of water**
ρ	**Volumetric mass density (or specific mass) of soil:** $\rho = \gamma/g$
σ_v	**Total overburden stress**
σ'_v	**Effective overburden stress**
σ_{atm}, **or,** P_a	**Reference atmospheric stress:** σ_{atm} = 101.3 kPa

<u>TERMS</u>

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 or 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 or u_1) .

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

Rod string: The series of hollow tube push rods that transmit force to the penetrometer.

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 4.0 data file provided.

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

Zero load output values were recorded before and after each test. The set of zero values applied to the measurements (subtracted from the raw output measurement) were those deemed to be obtained at a temperature closest to ground temperature, or the average of the two sets where appropriate.

For tests performed with digital cones, the tip sleeve and pore pressure measurements were corrected for static and transient temperature effects using parameters obtained from the *TEMPERATURE EFFECTS* section of the calibration certificate. For each CPT, the dataset was first grouped into penetration strokes (max 1.2 m) and then locally sub-grouped by tip resistance above and below 2 MPa. For each sub-group of qc < 2 MPa, the slope of the temperature (T) profile with time (t) was determined by regression to obtain the rate of temperature change $\Delta T/\Delta t$. For each recorded value, the static and transient temperature error component (apparent sensor output due to change in temperature) was subtracted from the reading.

For subtraction type cones incorporating traditional temperature compensation wiring in the strain gauge circuit, the residual apparent cone tip resistance ($q_{c:a}$) and sleeve resistance ($f_{s:a}$) due to static and transient temperature effects can be approximated by

$$q_{c:a} = a(\Delta T/\Delta t) + b(\Delta T),$$

$$f_{s:a} = a(\Delta T/\Delta t) + b(\Delta T) - q_{c:a}$$

and

$$u_a = b(\Delta T)$$

Where $q_{c:a}$ is the apparent tip resistance, $f_{s:a}$ is the apparent sleeve resistance, a is the apparent resistance due to unit transient temperature change $\Delta T/\Delta t$, and b is the change in apparent resistance per unit static temperature change relative to the temperature of the penetrometer at the time of zero load output measurement. Note that for the piezometer sensor only the static temperature component is considered and is only applied to piezometer sensors without temperature compensation circuitry.

Parameter a is established by subjecting the cone to a positive and negative nominal temperature change (ΔT ~ +- 9°) in water and measuring the apparent output corresponding to the maximum rate of temperature change at the load cells. Parameter b is established by measuring the apparent output after the cone has temperature stabilised.

The temperature corrected tip ($q_{c:c}$), sleeve resistance ($f_{s:c}$) and pore pressure ($u_{:c}$) are then found from

$q_{c:c} = q_{c:m} - q_{c:a,}$

$f_{s:c} = f_{s:m} - f_{s:a}$

$u_{:c} = u_{:m} - u_{:a}$

Where subscript '$_{:m}$', denotes the field measured resistance/pressure as recorded in the raw data files.

Notes:

1. Depending on the temperature performance of the individual cone, temperature correction of the sleeve is often not warranted as it does not substantially improve accuracy. This is because for subtraction type cones the errors in the sleeve force largely cancel with errors in the tip force when they have the same sign.

2. There is currently no recognised nomenclature for CPT parameters with temperature correction applied during post processing. To avoid confusion the nomenclature is kept unchanged in the logs and AGS data (q_c/q_t, f_s, and u_2) and unless stated otherwise, temperature correction has been applied using the parameters reported in the calibration certificate.

For piezocone tests the total cone resistance (or 'corrected cone 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 penetrometer body where pore pressures (positive or negative) can act to add or subtract from the total external axial force on the tip. The difference between measured and corrected values is largest in low strength collapsible soils with large excess pore pressures. The percentage adjustment is described by the curves on the chart below for a = 0.8:

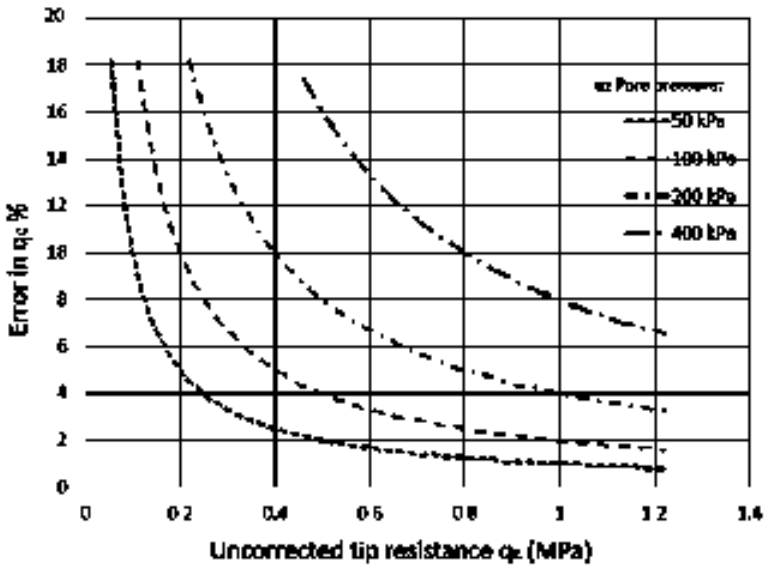


Figure 5-1 Uncorrected tip with measured tip resistance

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 and replaced with an interpolated value. The data was re-sampled from 10 mm resolution to 20 mm to reduce the size of the data set to a more manageable size for end users. A 20 mm resolution is well within the intrinsic influence zone of the cone tip measurement and the loss of meaningful resolution is negligible.

The raw data is presented in Appendix C. For piezocone tests q_t is reported on all logs, and q_c only appears in the digital AGS data.

Geotechnical parameters appropriate for drained and undrained cone penetration conditions were derived for corresponding drained and undrained derived soil behaviour types (SBTs) respectively, however, to account for uncertainty in the SBT correlation with drainage behaviour, all parameters were derived over a range of transitional soils within the range $2.4 < Ic < 2.7$ (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 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 derivation of most soil parameters obtained from the CPT and dissipation test.

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

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

Note: The term phreatic surface is used here, however when it is based on piezometer measurements (piezocone) it is assumed that the piezometric level (under hydrostatic conditions) and phreatic surface coincide. The phreatic or piezometric level reported is intended to provide information about pore pressure distribution assumed for calculation purposes and may not represent the true position of the groundwater table or perched water bodies. Complex groundwater pressure distributions will be applied if they are observed from the measurements and are sufficiently well defined.

5.4 SOIL UNIT WEIGHT

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

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

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

For depths where the friction sleeve resistance measurement was less than zero due to measurement limitations, the friction sleeve resistance input parameter was substituted with a nominal 1.0 kPa resistance for the purpose of obtaining an approximate soil unit weight necessary for estimation of total vertical stress over the entire profile.

5.5 SOIL BEHAVIOUR TYPE

The data have been interpreted using 4 soil behaviour type schemes: Robertson (1990, 2010, 2016) and Schneider et al, 2008. The Robertson (1990) scheme is widely used and forms the bases of the layer analysis whereby the profile is split into zones of common classification. The Robertson (2010 & 2016) and Schneider at al methods are less widely used but can provide better or more relevant classification in many instances. Differences in classification between the Robertson 1990, 2016 and Schneider et al schemes can also help to identify significant structure/cementation (Robertson 2016).

A dedicated soil behaviour type comparison log is provided in Appendix D.

Robertson (1990, 2010)

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 and organic soils.

While the classification based on normalised parameters is more accurate, particularly for NC soils exceeding 15 m depth, the classification is often significantly in error (artificially granular/drained) at shallow depth (< 1-3 m). The error at shallow depth is 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.

It should be noted that:

- The SBT classification provides a general soil type and tends to show biased towards the soil fraction that dominates the mechanical behaviour.
- If fine cohesive soils are dry and overconsolidated, the classification tends to shift towards a coarser soil type (or lower I_c index)

While the repeatability and behavioural bias of the SBT is usually beneficial, the classification is not always an appropriate substitute for classification based on particle size and plasticity index tests.

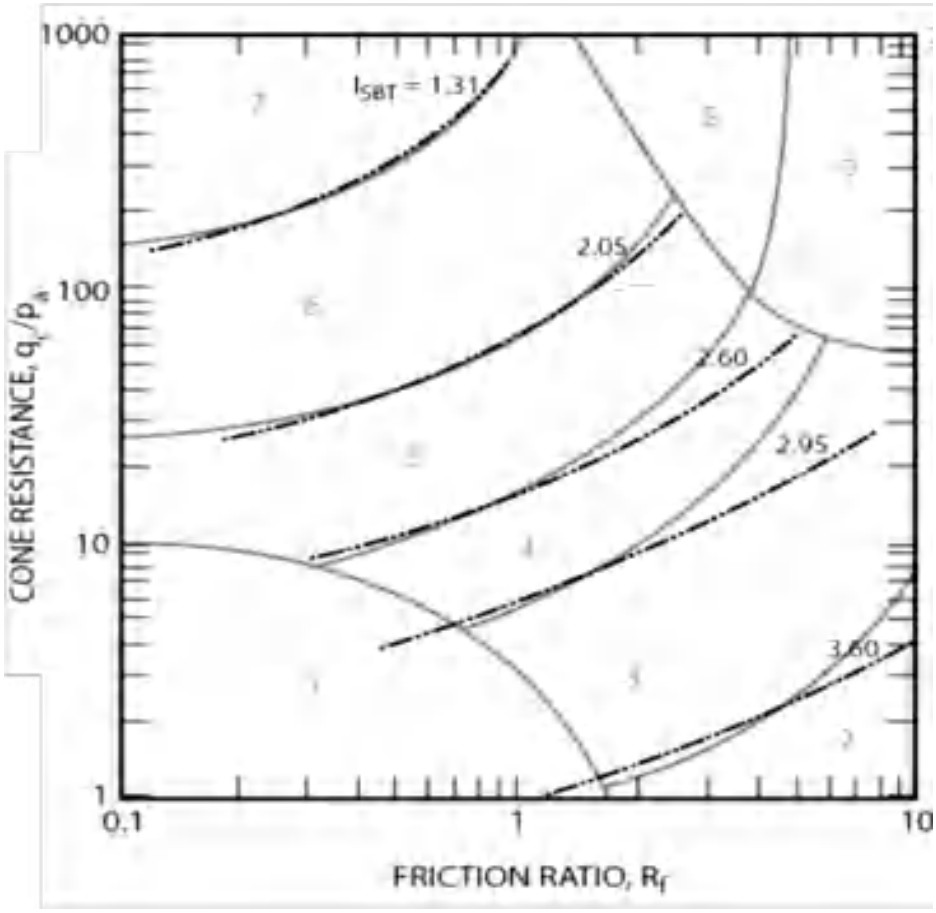


Figure 5-2 Non-normalised SBT chart by Robertson et al. (2010) based on dimensionless cone resistance (qc/Pa) and friction ration, Rf, showing contours of SBT index ISBT (denoted Ic on the test plots). The chart is also applicable to normalised tip (Q_t) and sleeve (F_r) values.

Table 1 Robertson (1990, 2010) soil behaviour type zone descriptions

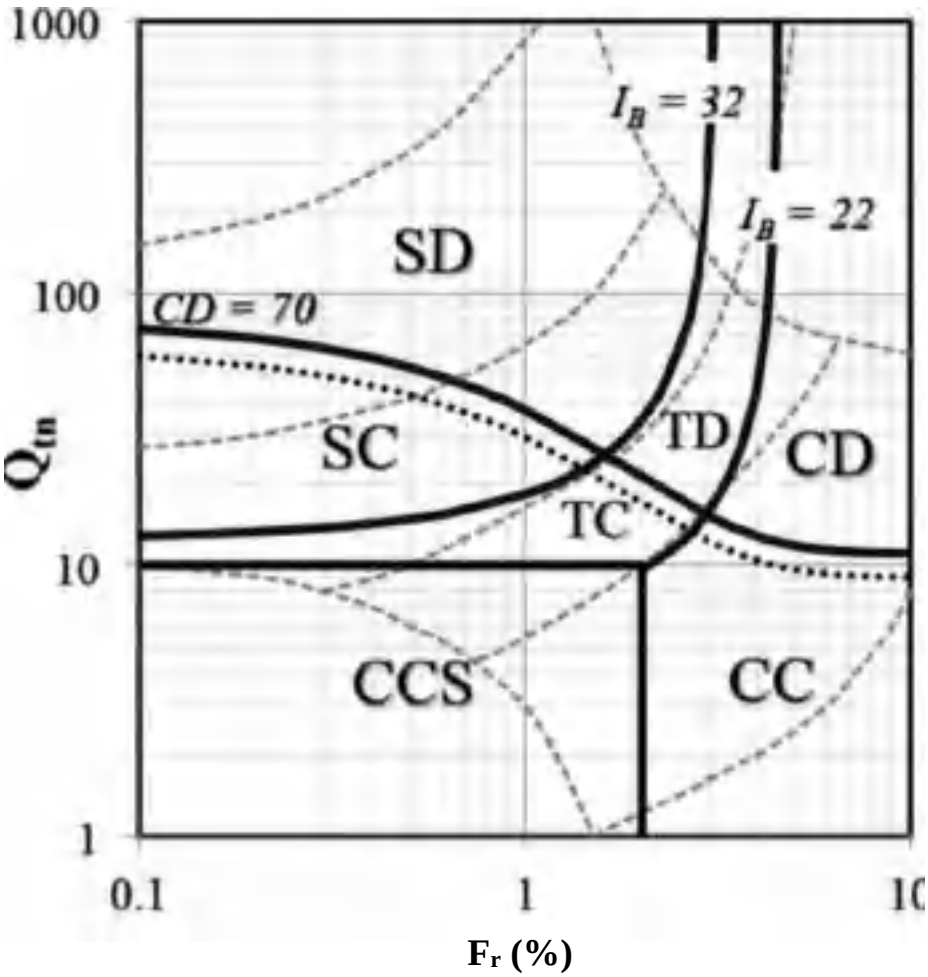
Zone	Soil Behaviour Type (SBT)		
1	Sensitive fine-grained	6	Sands - clean sand to silty sand
2	Organic soils	7	Gravelly sand to sand
3	Clays – clay to silty clay	8*	Very stiff/dense sand to clayey sand[1]
4	Silt mixtures - clayey silt to silty clay	9*	Very stiff fine grained[1]
5	Sand mixtures – silty sand to sandy silt	*Heavily overconsolidated or cemented	

[1]Note zones 8 and 9 appear as *'Very stiff/dense sand to clayey sand – HOC or cemented'* and *'Very stiff fine grained – HOC or cemented'* within the soil unit descriptions of plots in Appendix D.

Results are presented in Appendix D.

Robertson 2016

Using the same Q_t - F_r space as above, Robertson (2016) proposed an alternative purely behavioural classification system that places less emphasis on classification according to composition/textural properties and more emphasis on mechanical behaviour – namely the tendency of the soil to dilate or collapse during large strain shear, and sensitivity.



Zone	Soil Behaviour Type (SBT)
CCS	Clay-like – contractive - sensitive
CC	Clay-like – Contractive
CD	Clay-like – Dilative
TC	Transitional - Contractive
TD	Transitional - Dilative
SC	Sand-like - Contractive
SD	Sand-like - Dilative

Figure 5-3 Robertson 2016 soil behaviour type classification chart and zone descriptions

Schneider *et al.* (2008)

Schneider *et al.* (2008) proposed a classification system based on the normalised pore pressure B_q and tip resistance Q_t. This system is particularly useful for soils of very low strength or that exhibit drainage behaviour or u_2 response inconsistent with the SBT derived from tip and sleeve measurements. However, when using this method for onshore CPT data, the u_2 piezometer response should be assessed for possible desaturation. Generally, it is safest to only use this method when the piezometer response is 'spikey' and responding dynamically to changes in tip resistance.

A set of logs showing both the Robertson and Schneider et al. classification results are provided for comparison in Appendix D.

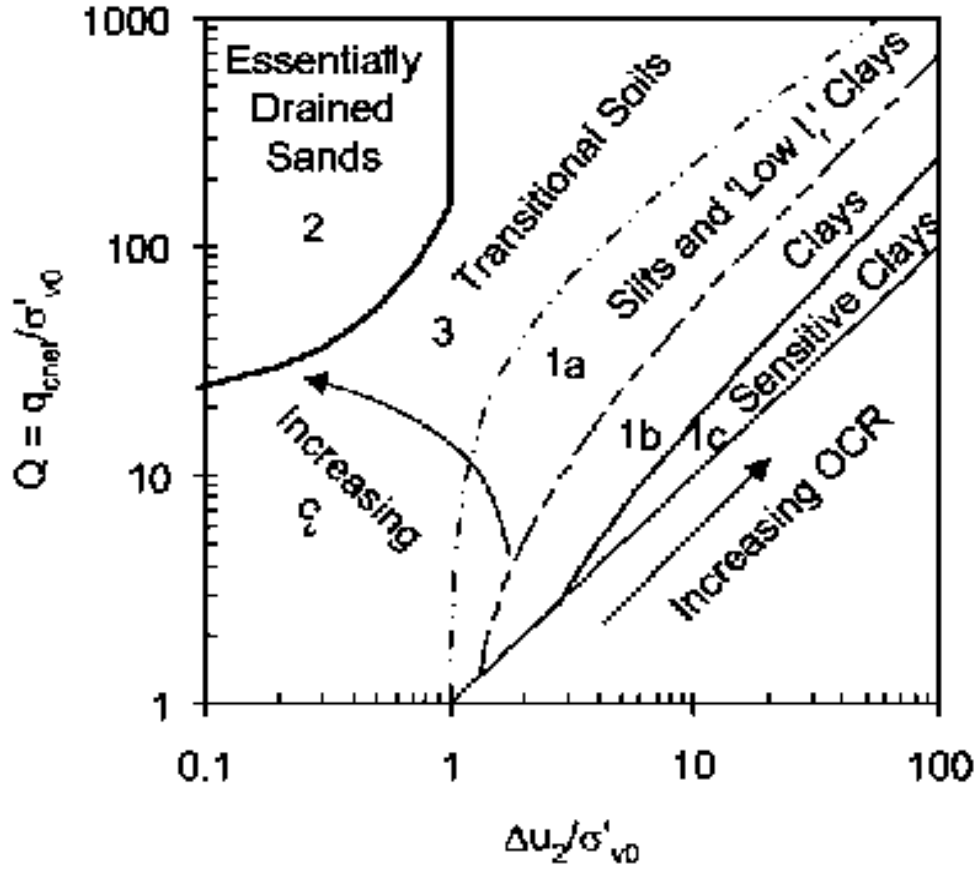


Figure 5-4 Schneider 2008 soil behaviour type classification chart and zone descriptions

Layer Analysis

The layer boundaries are manually interpreted based on broad changes in Robertson 1990 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 (excluding null/filtered data). 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 nature and small shifts in the cone response can lead to multiple classifications within layers of relatively uniform behaviour; especially were the layer data plot close to a zone junction and/or has spurious spikes or very thin layers. Therefore, some system is required to limit the number of classified zones that appear within each layer description. The following logic has been used to only retain high % constituent classification values:

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 description text
LT = Layer thickness (m)

For layers having a thickness of less than 1 m, 10% of data at the top and bottom of the layer are excluded to limit the effect of transition zone data (measured 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.

5.6 SOIL BEHAVIOUR TYPE INDEX - I_c

The principal trend in soil behaviour type (SBT) variation can be expressed by a continuous index, I_c, proposed by Robertson and Wride (1998) based on a similar index proposed by Jefferies and Davies (1993). The index provides a continuous profile of SBT variation with depth for end-user analysis of soil units and variation within units. The equivalent non-normalised version proposed by Robertson (2010) is provided for comparison.

The basis of I_c and its approximation of the original chart classification zones may be seen from Figure 5-2. The method does not identify zones 1 (*sensitive fine grained)* or zones 8 & 9 (*heavily overconsolidated or cemented*).

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

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

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 of I_c is generally more accurate, while the non-normalised version is intended for compatibility with the non-normalised Robertson's (2010) SBT chart and may be more accurate at shallow depths in overconsolidated soils.

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.

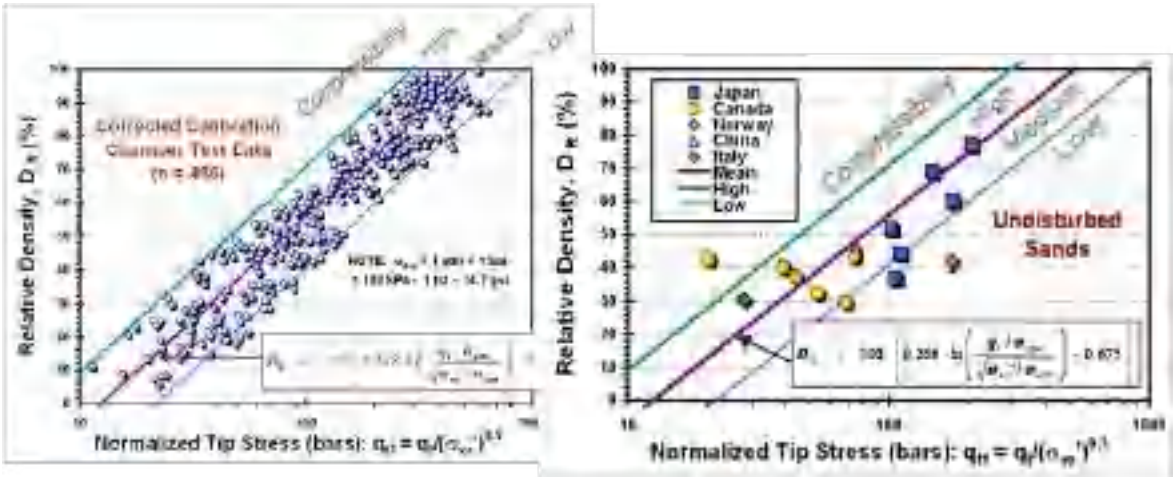


Figure 5-5 Relative density with normalised tip stress and sand compressibility from calibration chamber tests (left) and undisturbed frozen samples (right). Jamiolkowski *et al.* (2001). Reproduced from Mayne (2007).

The results are presented in Appendix F.

5.8 UNDRAINED SHEAR STRENGTH

The undrained shear strength s_u is usually estimated by the bearing capacity method, whereby the net tip resistance is divided by a factor N_k (Lunne *et al*, 1981):

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

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

Mayne and Peuchen (2018) performed an evaluation of 407 high-quality undrained anisotropically consolidated triaxial compression tests (CAUC) with net tip resistance data pairs, resulting in N_{kt} factors with regression analysis details for five categories of clays shown in Table 2.

Table 2 Summary of CAUC s_u versus q_{net} for clays. Reproduced from Mayne and Peuchen (2018).

Clay Group	Number of sites	Nr Data	Correlation Coefficient r^2	Factor N_{kt}	Mean Pore Pressure Parameter B_q
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.

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 traditionally applied N_k values of 15 and 20.

The results are presented in Appendix E.

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:

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

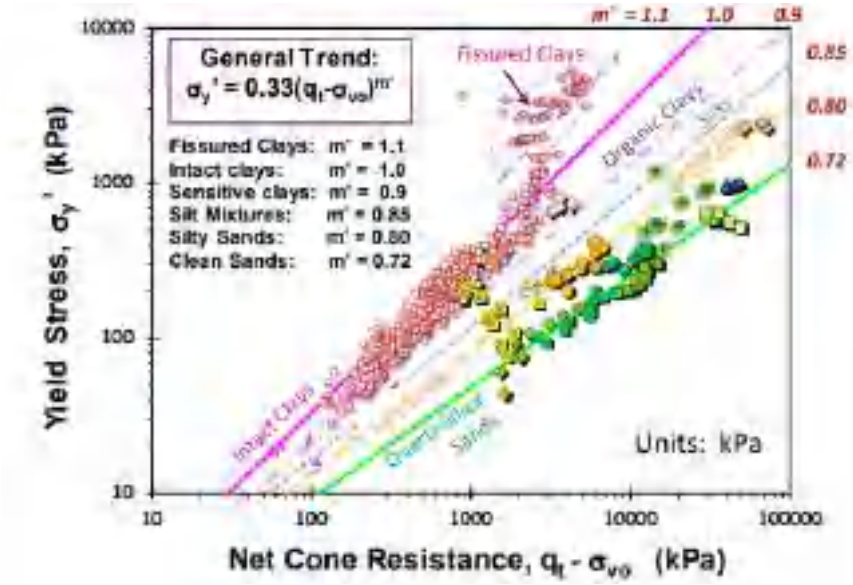


Figure 5-6 Preconsolidation stress with net cone resistance power law, reproduced from Mayne (2014).

An additional set of σ_p' and OCR values were calculated for m' = 1.1 to reflect the upper trend for over consolidated fissured clays not captured by the correlation with I_c.

The results are presented in Appendix E.

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.

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):

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

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

The results are presented in Appendix F.

5.11 FRICTION ANGLE

Sands

The peak friction angle of granular materials was calculated using the Kulhawy and Mayne (1990) method. The relationship is based on a calibration chamber database from 24 sands of varying mineralogy and is found from:

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

Where:

ϕ' = Peak friction angle (degrees)

q_{t1} = stress normalised cone resistance:

$$q_{t1} = \left(\frac{q_t}{\sigma_{atm}}\right) / \left(\frac{\sigma_{v0'}}{\sigma_{atm}}\right)^{0.5}$$

The presence of compressible minerals tends to reduce tip resistance resulting in lower estimate of friction angle, while very coarse (sand) or larger grain size tends to increase tip resistance resulting in higher estimate. Increased penetration resistance due to high k_0 conditions also results in an overestimate of friction angle.

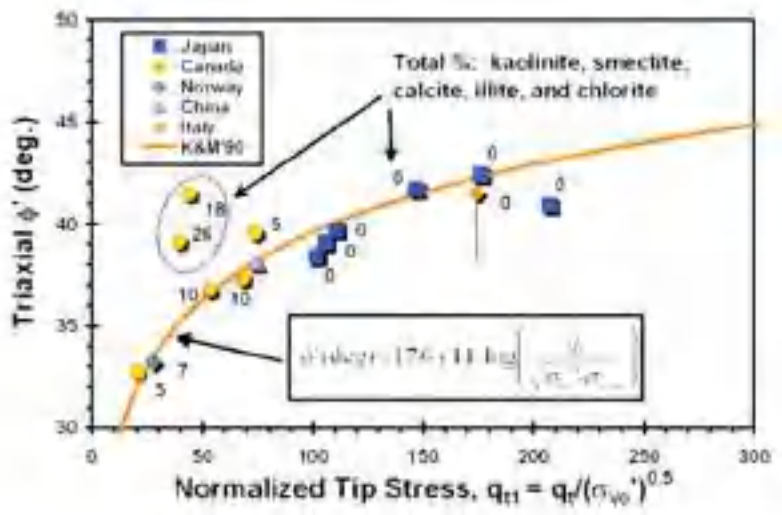


Figure 5-7 Peak triaxial friction angle from undisturbed sands with normalised cone resistance.

Fine grained soils

The effective friction angle for fine grained soils was calculated based on the Senneset *et al.* (1988, 1989) method 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 normally consolidated to lightly overconsolidated soils.

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

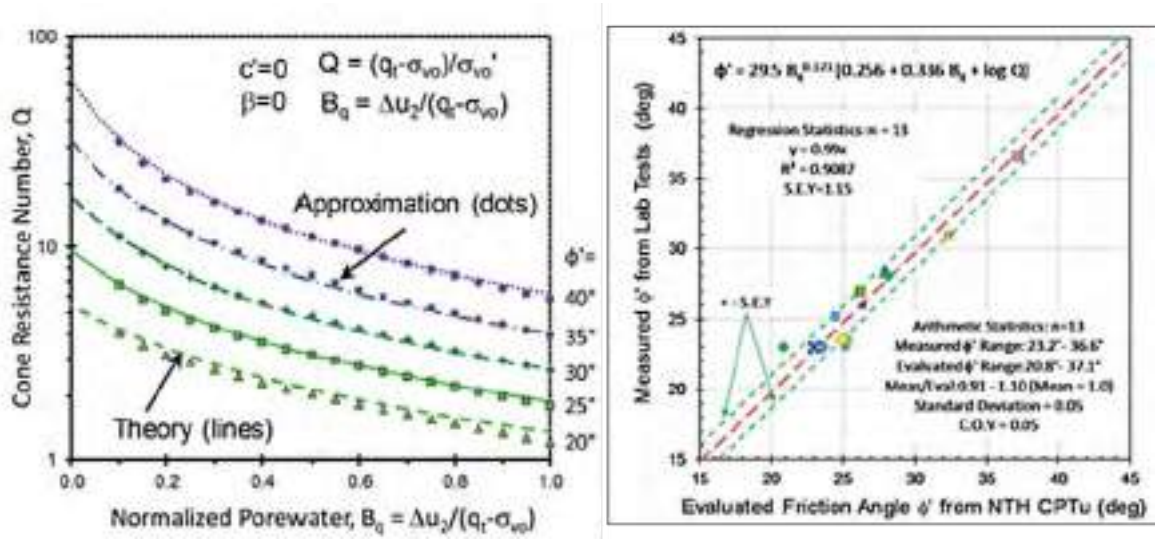


Figure 5-8 [Left] Theoretical curves with function approximation (dots) overlay [Right] calibration data from geotechnical centrifuge tests for a variety of soils. Redrawn from Ouyang & Mayne (2018).

The results are presented in Appendix F.

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). The value may be used to predict settlement at the end of primary consolidation and is applicable to the present state of vertical effective stress up to the pre-consolidation stress for overconsolidated soils.

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

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.

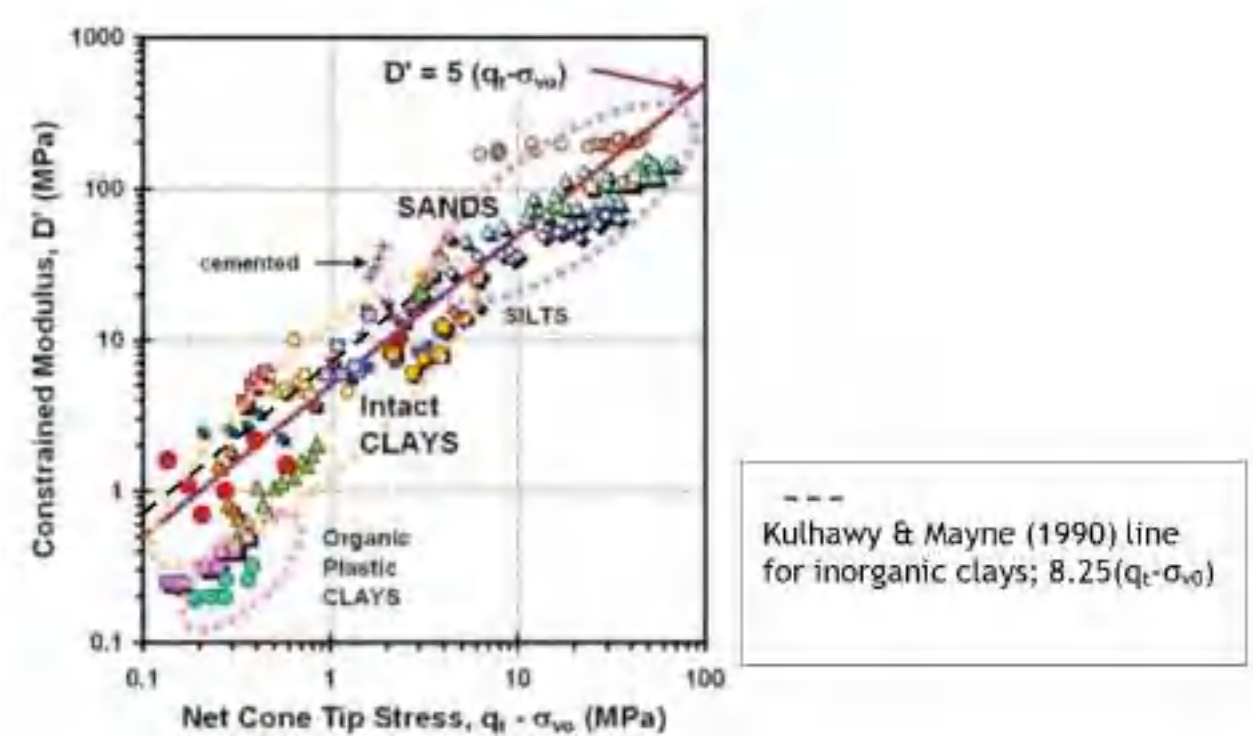


Figure 5-9 Constrained modulus of Mayne (2006). Annotated/redrawn from NCHRP Synthesis 368 (2007).

The results are presented in Appendix E.

5.13 YOUNG'S MODULUS

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

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

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

The method described by Robertson may be adapted to estimate E' for loading at different percentages of mobilised shear strength.

The results are presented in Appendix F.

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 u_2 (CPTu)

While the piezo system is saturated before use, testing through unsaturated soils may result in some degree of desaturation leading to a less accurate and more 'sluggish' pore pressure response. Desaturation can also occur during penetration due to suction pressure causing cavitation during dilative shear at the cone shoulder. Dissipation tests that are undertaken following desaturation are likely to have a more pronounced initial rise and the results of analysis may have some degree of error.

If the piezometer system becomes desaturated it may re-saturate at higher excess pressures later in the test as gas dissolves under pressure. The pore pressure response in saturated contractive soils should normally have a dynamic 'peaky' appearance.

The tip resistance in lower strength contractive soils without pore pressure measurement in the u_2 position is likely to be significantly lower (up to 20%, typically ~10%) than the equivalent corrected tip resistance depending on the magnitude of excess pore pressure generated during penetration.

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 three common causes of friction sleeve measurement error; 1) unequal pore pressure acting on the sleeve end areas as the sleeve passes though materials of different permeability and hence excess pore pressure Δu_2, often resulting in a negative/positive spike, 2) Accuracy limitations and temperature effects in very low strength or sensitive soils, and 3) error associated with bending strain that occurs while the cone inclination deviates rapidly. Temperature effects

are generally mitigated by temperature stabilisation during the test and at the time of zero output measurement.

CONE TYPE

The reference cone type has a 10 cm^2 projected cone tip area and 150 cm^2 friction sleeve area, however it is common to use a larger 15 cm^2 cone with a 225 cm^2 friction sleeve area for improved sensitivity, temperature stability, damage prevention and penetration depth potential due to the higher bending strength. Use of a 15 cm^2 cone does however require higher penetration force (reaction force) for a given penetration pressure and produces more pronounced transitions zones and thin layer effects due to the larger influence zone.

TRANSITION ZONES AND THIN LAYER EFFECTS

During penetration at the boundary between soils of contrasting stiffness, a transition zone is often evident prior to mobilisation of the true soil stiffness. These should be cautiously ignored in assessment of soil behaviour type and parameter evaluation. Where the stiff layer is thin (<~1 m) mobilised resistance may be significantly less than that of an equivalent thick layer. The effect for thin low stiffness layers is less significant. Procedures for thin-layer effect correction are provided by Robertson and Wride (1998) and Boulanger & DeJong (2018).

GRAVELS

The presence of gravel or larger clasts in a soil is often characterised by short peaks in the CPT tip and sleeve readings, possibly with associate inclinometer 'shake' and/or short sharp reductions in pore water readings due to dilation effects. Frequent gravels in soft or loose soils may generate localised erroneous friction ratio values.

7 REFERENCES

ASTM E74-13a (2013), Standard Practice of Calibration of Force-Measuring Instruments for Verifying the Force Indication of Testing Machines, ASTM International, West Conshohocken, PA.

Boulanger, R.W. and DeJong J.T. (2018) "Inverse filtering procedure to correct cone penetration data for thin-layer effects" Proceedings, 4th International Symposium on Cone Penetration Testing (CPT'18), 21-22 June 2018, Delft, The Netherlands. CRC Press. pp. 25-44.

British Standards Institution (2003) BS 8422:2003, Force measurement – Strain gauge load cell systems – Calibration method. London: British Standards Institution.

Houlsby, G.T. and Teh, C.I. (1988). Analysis of the Piezocone in Clay. Proceedings of the International Symposium on Penetration Testing (ISOPT-1), Orlando, Vol. 2, pp. 777-783. Balkema Pub., Rotterdam.

ISO 376:201. Metallic materials — Calibration of force-proving instruments used for the verification of uniaxial testing machines (2011).

ISO 10012:2003 Measurement management systems - Requirements for measurement processes and measuring equipment. New Delhi: Bureau of Indian Standards (2003).

ISO 22476-1:2012 Geotechnical investigation and testing - Field testing - Part 1: Electrical cone and piezocone penetration test. New Delhi: Bureau of Indian Standards (2012).

ISSMGE, 1999. International reference test procedure for the cone penetrometer test CPT and the cone penetration test CPTU, Report of ISSMGE TC16 on Ground Property Characterisation for in situ Testing, In Proceedings of the 12th European conference on Soil Mechanics and Geotechnical Engineering 3:2195-222 (1999).

Idriss, I. M., and Boulanger, R. W. (2008) "Soil liquefaction during earthquakes". Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, pp. 261.

Jamiolkowski, M., LoPresti, D.C.F., and Manassero, M. (2001) "Evaluation of Relative Density and Shear Strength of Sands from Cone Penetration Test and Flat Dilatometer Test". Soil Behaviour and Soft Ground Construction (GSP119), American Society of Civil Engineers, pp. 201-238. Reston, Va. 2001

Jefferies, M.G. and Davies M.P. (1993), "Use of CPTu to estimate equivalent SPT N60", Geotechnical Testing Journal, 16(4), pp. 458-467.

Kim, K., Prezzi, M., Salgado, R., and Lee, W. (2008) "Effect of Penetration Rate on Cone Penetration Resistance in Saturated Clayey Soils", Journal of Geotech. Geoenviron. Eng., Vol. 134(8), pp. 1142-1153.

Kulhawy, F.H. and Mayne, P.W. (1990) "Manual on Estimating Soil Properties for Foundation Design". Report EPRI EL-6800 Research Project 1493-6, Electric Power Research Institute, Palo Alto, CA, pp. 306.

Ladd, C.C. and DeGroot, D.J. (2003) "Recommended Practice for Soft Ground Site Characterization: Arthur Casagrande Lecture". Soil & Rock America 2003 (Proceedings. 12th Pan American Conference on Soil Mechanics and Geotechnical Engineering, Boston, MA). Verlag Glückauf, Essen, Germany. pp. 3-57.

Lunne, T., Robertson, P.K. and Powell, J.J.M. (1997) "Cone Penetration Testing in Geotechnical Practice" Blackie Academic, New York 1997. (Robertson, 2009)

Lunne, T. and Kleven, A. (1981) "Role of CPT in North Sea Foundation Engineering". Session at the ASCE National Convention: Cone Penetration Testing and Materials. pp. 76-107. American Society of Engineers (ASCE).

Mayne, P.W. and Campanella, R.G. (2005) "Versatile Site Characterisation by Seismic Piezocone". Proceedings, 16th International Conference on Soil Mechanics and Geotechnical Engineering, Vol. 2. Millpress, Rotterdam, The Netherlands 2005. pp 721-724.

Mayne, P.W. and Peuchen J. (2018), "Evaluation of CPTU Nkt cone factor for undrained strength of clays". Proceedings, 4th International Symposium on Cone Penetration Testing (CPT'18), 21-22 June 2018, Delft, The Netherlands. CRC Press. pp. 423-429.

Mayne, P.W. (2007) "Cone Penetration Testing – A Synthesis of Highway Practice". NCHRP Synthesis 368, Transportation Research Board, Washington, D.C.

Mayne, P.W. (2014). KN2: "Interpretation of geotechnical parameters from seismic piezocone tests". Proceedings, 3rd International Symposium on Cone Penetration Testing (CPT'14), June 2014, ISSMGE Technical Committee TC 102, Edited by P.K. Robertson and K.I. Cabal: pp. 47-73.

Parez, L. and Fauriel, R. (1988). "Le piézocône. Améliorations apportées à la reconnaissance de sols". Revue Française de Géotech, Vol. 33, pp. 13-27.

Robertson, P.K. (2009). Cited in "Guide to Cone Penetration Testing - 6th edition (2015)", pp. 36, pp. 58, Gregg Drilling & Testing, Inc.

Robertson, P.K. (2009). Interpretation of cone penetration tests – a unified approach. Canadian Geotechnical Journal, 46, pp. 1337–1355.

Robertson, P.K. (2010a) "Soil Behaviour Type from the CPT: an update". Proceedings, 2nd International Symposium on Cone Penetration Testing. Huntingdon Beach, CA, USA.

Robertson, P.K. (2010b) "Estimating soil unit weight from CPT". Proceedings, 2nd International Symposium on Cone Penetration Testing. Huntingdon Beach, CA, USA.

Robertson, P.K. (2012). "Interpretation of in-situ tests – some insights", Proceedings, 4th Int. Conf. on Geotechnical & Geophysical Site Characterization, ISC'4, Brazil, 1.

Robertson, P.K (2014) "Estimating in-situ soil permeability from CPT & CPTu". Proceedings, 3rd International Symposium on Cone Penetration Testing (CPT'14), June, 2014, ISSMGE Technical Committee TC 102.

Senneset, K., R. Sandven, and N. Janbu (1989), "Evaluation of Soil Parameters from Piezocone Tests," Transportation Research Record 1235, Transportation Research Board, National Research Council, Washington D.C, pp. 24-37.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J. (1999) "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils". Canadian Geotechnical Journal. Vol. 36, pp. 369-381.

APPENDICES

Appendix A	**SUMMARY TABLES**
Appendix B	**GENERAL INFORMATION**
Appendix C	**CONE PENETRATION TEST RESULTS**
Appendix D	**SOIL BEHAVIOUR TYPE RESULTS**
Appendix E	**PARAMETER RESULTS 1 – s_u, m_v, OCR, SBT, I_c**
Appendix F	**PARAMETER RESULTS 2 – SPT N60, Phi, D_r, E, I_c**
Appendix G	**PENETROMETER TEMPERATURE RESULTS**

APPENDIX A SUMMARY TABLES

Table 3 CPT summary

Location ID	Stroke number	Final depth (m)	Cone ID	Piezocone test	Pre-drilled (m)	Pre-drilling details	Rig	Primary refusal factor	Applied zero values: qc, fs, u2	Tip zero drift (kPa)	Sleeve zero drift (subtraction) (kPa)	Piezo zero drift (kPa)	Nr dissipation tests	Raw File Name	Easting (m)	Northing (m)	Elevation (m)	Date	Remarks
CPT01	1	12.60	S15-CFIPTT.2117	YES			UK3	Total cone load	pre, pre, pre	-82.40	0.30	-7.50		108244-V1-270123-UK03-LP62.L01	435774	546829		27/01/2023	
CPT02	1	12.46	S15-CFIPTT.2117	YES			UK3	Total cone load	pre, pre, pre	-29.80	1.60	-9.00		108244-V1-270123-UK03-LP62.L02	435801	546827		27/01/2023	
CPT03	1	10.46	S15-CFIPTT.2117	YES			UK3	Total cone load	pre, pre, pre	-86.00	1.40	-4.50		108244-V1-270123-UK03-LP62.L03	435827	546827		27/01/2023	
CPT04	1	11.44	S15-CFIPTT.2117	YES			UK3	Inclination	pre, pre, pre	-57.40	12.70	-7.70		108244-V1-270123-UK03-LP62.L04	435827	546815		27/01/2023	
CPT05	1	13.28	S15-CFIPTT.2117	YES			UK3	Total cone load	pre, pre, pre	-57.80	0.80	-1.90		108244-V1-270123-UK03-LP62.L05	435800	546815		27/01/2023	
CPT06	1	14.84	S15-CFIPTT.2117	YES			UK3	Inclination	pre, pre, pre	-85.00	1.30	-5.20		108244-V1-270123-UK03-LP62.L06	435775	546815		27/01/2023	
CPT07	1	14.92	S15-CFIPTT.2117	YES			UK3	Total cone load	pre, pre, pre	-6.00	-0.40	-5.70		108244-V1-270123-UK03-LP62.L07	435775	546802		27/01/2023	
CPT08	1	13.52	S15-CFIPTT.2117	YES			UK3	Total cone load	pre, pre, pre	-65.00	0.90	-8.40		108244-V1-270123-UK03-LP62.L08	435799	546803		27/01/2023	
CPT09	1	12.36	S15-CFIPTT.2117	YES			UK3	Total cone load	pre, pre, pre	-59.00	1.00	-6.80		108244-V1-270123-UK03-LP62.L09	435827	546804		27/01/2023	

Note: Coordinates and levels have been provided by the Client for inclusion in this report.

CPT test plots are presented in Appendix C.

APPENDIX B GENERAL INFORMATION

LIST OF FIGURES

Cone calibration certificate: S15-CFIIP.2117

Data sheet: 20.5-tonne track-truck mounted CPT unit (UK3)

CERTIFICATE OF CALIBRATION

Certificate Number: 1471

Cone Serial Number: S15-CFIIPTT.2117

Instrument:	**Digital-Geopoint-S15-150kN-5MPa**	**Location:**	**Lankelma Calibration Laboratory**
Serial number:	**S15-CFIIPTT.2117**	**Temperature (°C):**	**18.5**
Manufacturer:	**Geopoint**	**Temperature change (°C):**	**0.02**
Calibration standard:	**Conforms to ISO 376:2011 & ISO 22476-1:2012**	**Calibration engineer:**	**P Metcalf**
ISO 22476-1:2012 application class:	**Class 1**	**Date of calibration:**	**22/12/2022**
		Calibration expiry:	**22/06/2023**

This calibration certificate is valid for 6 months.

Calibration signed and dated by:	**Calibration checked and dated by:**	**Calibration verification signed and dated by:**
P Metcalf	A Harman	

REFERENCE INSTRUMENTS	SERIAL NUMBER	UNCERTAINTY OF RECORDED VALUE	CALIBRATION DATE
AM DSCCHA-100kN Load Cell	66914	0.02%	29/04/2021
AM DSCCHA-5kN Load Cell	61065	0.05%	29/04/2021
Omega MMG750V	502273	0.01%	01/09/2022
Keithley 3706A Multimeter	4067652	10ppm	11/08/2022
LD Solar2-45	168558	0.04°	01/08/2022
ETI Ref Thermometer	D20345255	0.01°C	08/09/2022

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

Cone tempreture effect profile:

This section deals with the apparent pressure readings obtained from sensors due to static and transient temperature change. The parameters for post-processing temperature correction are established and the apparent pressures after correction are presented. Depending on the design or temperature performance, correction of the friction sleeve and/or piezometer readings may not be warranted

LANKELMA

CERTIFICATE OF CALIBRATION

Certificate Number: 1471

Cone Serial Number: S15-CFIIPTT.2117

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	1.082E+05	1.104E+05	1.112E+05	1.112E+05	0.001	0.83			5.000	5.499E+06	5.495E+06	5.497E+06	0.001	0.02		
0.500	5.498E+05	5.500E+05	5.539E+05	5.523E+05	0.001	0.24			10.000	1.100E+07	1.099E+07	1.099E+07	0.001	0.01		
1.000	1.102E+06	1.101E+06	1.107E+06	1.105E+06	0.001	0.18			15.000	1.649E+07	1.649E+07	1.649E+07	0.001	0.01		
1.500	1.655E+06	1.652E+06	1.659E+06	1.657E+06	0.001	0.11			20.000	2.198E+07	2.198E+07	2.198E+07	0.001	0.01		
2.000	2.204E+06	2.200E+06	2.210E+06	2.210E+06	0.002	0.14			30.000	3.296E+07	3.296E+07	3.296E+07	0.001	0.00		
2.500	2.756E+06	2.752E+06	2.761E+06	2.760E+06	0.002	0.09			40.000	4.393E+07	4.393E+07	4.393E+07	0.001	0.00		
3.000	3.307E+06	3.302E+06	3.313E+06	3.311E+06	0.002	0.10			50.000	5.489E+07	5.489E+07	5.489E+07	0.001	0.00		
3.500	3.860E+06	3.853E+06	3.863E+06	3.864E+06	0.002	0.08			60.000	6.585E+07	6.584E+07	6.584E+07	0.001	0.00		
4.000	4.410E+06	4.401E+06	4.415E+06	4.414E+06	0.002	0.09			80.000	8.772E+07	8.771E+07	8.771E+07	0.001	0.00		
5.000	5.512E+06	5.505E+06	5.519E+06	5.517E+06	0.003	0.08			100.000	1.096E+08	1.095E+08	1.095E+08	0.002	0.00		
4.000	4.407E+06	4.398E+06			0.002	0.07	0.001	0.04	80.000	8.771E+07	8.771E+07		0.001	0.00	0.002	0.00
3.500	3.855E+06	3.853E+06			0.000	0.02	0.001	0.03	60.000	6.582E+07	6.582E+07		0.000	0.00	0.007	0.02
3.000	3.306E+06	3.300E+06			0.001	0.07	0.001	0.03	50.000	5.487E+07	5.486E+07		0.001	0.00	0.009	0.03
2.500	2.755E+06	2.748E+06			0.001	0.09	0.001	0.05	40.000	4.390E+07	4.390E+07		0.000	0.00	0.010	0.04
2.000	2.202E+06	2.200E+06			0.000	0.03	0.000	0.03	30.000	3.293E+07	3.293E+07		0.000	0.00	0.009	0.04
1.500	1.654E+06	1.648E+06			0.001	0.13	0.001	0.09	20.000	2.196E+07	2.196E+07		0.001	0.00	0.007	0.06
1.000	1.103E+06	1.100E+06			0.001	0.11	0.000	-0.01	15.000	1.647E+07	1.647E+07		0.000	0.00	0.006	0.06
0.500	5.508E+05	5.495E+05			0.000	0.09	0.000	-0.03	10.000	1.098E+07	1.098E+07		0.000	0.00	0.004	0.07
0.100	1.074E+05	1.105E+05			0.001	0.98	0.000	0.18	5.000	5.490E+06	5.489E+06		0.000	0.01	0.003	0.08

Table 2-a.

Low range calibration								High range calibration							
Reference output		Linear equation			3rd order equation			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	%	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	1003	0.001	1.78	1005	0.001	1.91	3.333	50000	50142	0.020	0.59	50005	0.006	0.18
0.333	5000	5028	0.005	1.36	5018	0.003	0.92	6.667	100000	100280	0.039	0.58	100018	0.011	0.16
0.667	10000	10061	0.009	1.39	10036	0.006	0.83	10.000	150000	150385	0.053	0.53	150017	0.016	0.16
1.000	15000	15098	0.014	1.40	15058	0.008	0.83	13.333	200000	200497	0.069	0.52	200042	0.021	0.16
1.333	20000	20110	0.017	1.25	20055	0.008	0.64	20.000	300000	300629	0.089	0.44	300054	0.031	0.16
1.667	25000	25141	0.020	1.22	25072	0.010	0.62	26.667	400000	400711	0.102	0.38	400092	0.041	0.15
2.000	30000	30168	0.024	1.21	30085	0.012	0.62	33.333	500000	500686	0.103	0.31	500098	0.050	0.15
2.333	35000	35197	0.028	1.21	35100	0.014	0.61	40.000	600000	600579	0.097	0.24	600100	0.060	0.15
2.667	40000	40215	0.031	1.16	40104	0.015	0.57	53.333	800000	800068	0.078	0.15	800043	0.078	0.15
3.333	50000	50281	0.040	1.19	50143	0.021	0.62	66.667	1000000	999240	0.140	0.21	999990	0.097	0.15
2.667	40000	40160	0.022	0.83	40049	0.009	0.32	53.333	800000	800041	0.077	0.14	800016	0.077	0.14
2.333	35000	35157	0.021	0.91	35060	0.009	0.38	40.000	600000	600408	0.079	0.20	599929	0.058	0.15
2.000	30000	30128	0.018	0.88	30045	0.007	0.36	33.333	500000	500452	0.077	0.23	499865	0.051	0.15
1.667	25000	25099	0.014	0.83	25030	0.006	0.33	26.667	400000	400444	0.070	0.26	399824	0.045	0.17
1.333	20000	20074	0.010	0.76	20019	0.003	0.25	20.000	300000	300406	0.061	0.31	299831	0.037	0.18
1.000	15000	15059	0.008	0.84	15019	0.004	0.39	13.333	200000	200314	0.046	0.35	199859	0.027	0.20
0.667	10000	10047	0.006	0.97	10021	0.003	0.50	10.000	150000	150240	0.035	0.35	149873	0.022	0.22
0.333	5000	5018	0.003	0.79	5008	0.001	0.40	6.667	100000	100171	0.025	0.37	99909	0.016	0.23
0.067	1000	994	0.002	2.62	995	0.001	2.17	3.333	50000	50071	0.011	0.33	49933	0.010	0.31

Table 3-a. Third order equation

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

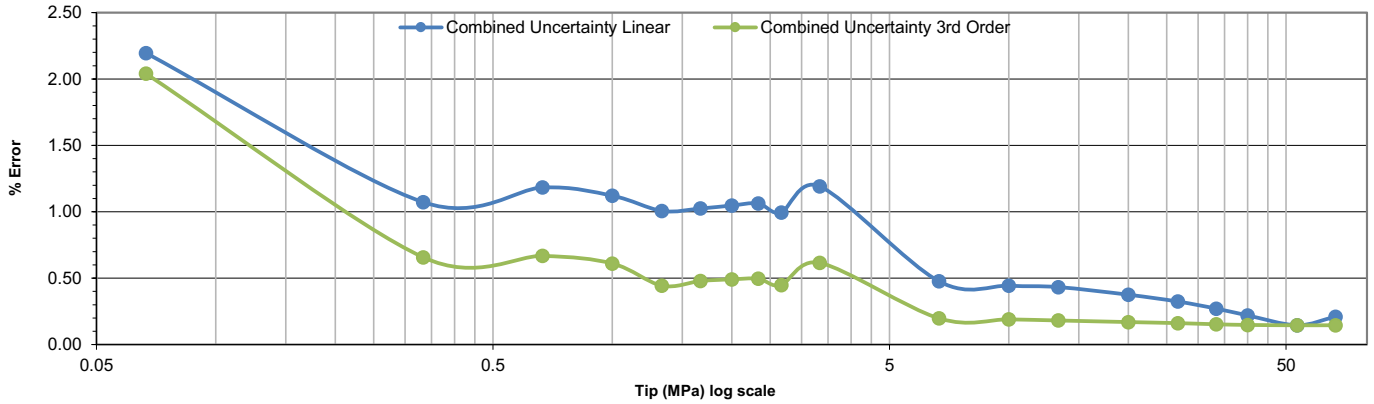
F (in 0.1N units) is calculated from :

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

a0	=	4.69892
a1	=	0.99698
a2	=	3.55987E-09
a3	=	2.05163E-16

Maximum tip zero drift during the calibration (MPa) =	0.002
Maximum load cell zero drift during the calibration (MPa) =	0.000
Factor used to convert from counts to 0.1N units =	0.0091216
Maximum tip full scale reading (MPa) =	100.00
Tip resolution (Pa) =	66.7
Tip area (cm²) =	15
Tip area ratio factor =	0.795

COMBINED EXPANDED UNCERTAINTY TIP



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

LANKELMA

CERTIFICATE OF CALIBRATION

Certificate Number: 1471

Cone Serial Number: S15-CFIIPTT.2117

SLEEVE FRICTION CALIBRATION

Table1-b.

Low range calibration									High range calibration							
	Sleeve change In output (cts)				Reproducibility error *b*		Reversibility error *U_rev*			Sleeve 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	1.144E+05	1.173E+05	1.140E+05	1.140E+05	0.039	0.89			5.000	5.700E+06	5.701E+06	5.700E+06	0.018	0.01		
0.500	5.718E+05	5.714E+05	5.732E+05	5.714E+05	0.020	0.09			10.000	1.140E+07	1.140E+07	1.140E+07	0.009	0.00		
1.000	1.142E+06	1.140E+06	1.143E+06	1.141E+06	0.042	0.10			15.000	1.709E+07	1.708E+07	1.708E+07	0.029	0.00		
1.500	1.711E+06	1.707E+06	1.710E+06	1.710E+06	0.043	0.07			20.000	2.278E+07	2.277E+07	2.277E+07	0.023	0.00		
2.000	2.282E+06	2.276E+06	2.283E+06	2.283E+06	0.083	0.09			30.000	3.415E+07	3.414E+07	3.414E+07	0.034	0.00		
2.500	2.851E+06	2.846E+06	2.850E+06	2.850E+06	0.059	0.05			40.000	4.551E+07	4.551E+07	4.551E+07	0.002	0.00		
3.000	3.419E+06	3.415E+06	3.421E+06	3.420E+06	0.068	0.05			50.000	5.686E+07	5.686E+07	5.686E+07	0.033	0.00		
3.500	3.988E+06	3.983E+06	3.990E+06	3.990E+06	0.082	0.05			60.000	6.820E+07	6.820E+07	6.820E+07	0.055	0.00		
4.000	4.558E+06	4.550E+06	4.559E+06	4.559E+06	0.114	0.06			80.000	9.086E+07	9.085E+07	9.085E+07	0.057	0.00		
5.000	5.693E+06	5.684E+06	5.698E+06	5.699E+06	0.163	0.07			100.000	1.135E+08	1.135E+08	1.135E+08	0.086	0.00		
4.000	4.557E+06	4.544E+06			0.172	0.10	0.078	0.04	80.000	9.088E+07	9.087E+07		0.064	0.00	-0.442	-0.01
3.500	3.987E+06	3.978E+06			0.121	0.08	0.057	0.04	60.000	6.823E+07	6.823E+07		0.011	0.00	-0.654	-0.02
3.000	3.419E+06	3.411E+06			0.103	0.08	0.046	0.03	50.000	5.689E+07	5.689E+07		0.009	0.00	-0.727	-0.03
2.500	2.850E+06	2.845E+06			0.066	0.06	0.022	0.02	40.000	4.554E+07	4.554E+07		0.025	0.00	-0.742	-0.04
2.000	2.281E+06	2.275E+06			0.082	0.09	0.011	0.01	30.000	3.417E+07	3.417E+07		0.006	0.00	-0.660	-0.05
1.500	1.712E+06	1.706E+06			0.087	0.13	0.001	0.00	20.000	2.279E+07	2.279E+07		0.023	0.00	-0.422	-0.05
1.000	1.142E+06	1.138E+06			0.050	0.11	0.026	0.06	15.000	1.710E+07	1.710E+07		0.062	0.01	-0.351	-0.05
0.500	5.715E+05	5.698E+05			0.023	0.10	0.022	0.10	10.000	1.140E+07	1.141E+07		0.053	0.01	-0.164	-0.04
0.100	1.137E+05	1.143E+05			0.009	0.20	0.041	0.93	5.000	5.701E+06	5.703E+06		0.023	0.01	-0.028	-0.01

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	1015	0.154	3.50	1006	0.097	2.21
22	5000	5037	0.339	1.54	5013	0.147	0.67
44	10000	10052	0.473	1.07	10009	0.153	0.35
66	15000	15051	0.471	0.71	14991	0.155	0.23
88	20000	20073	0.679	0.77	19995	0.217	0.25
110	25000	25080	0.733	0.67	24984	0.249	0.23
132	30000	30093	0.857	0.65	29980	0.299	0.23
154	35000	35100	0.926	0.60	34969	0.390	0.25
176	40000	40108	1.011	0.57	39960	0.497	0.28
220	50000	50109	1.081	0.49	49928	0.803	0.36
176	40000	40063	0.703	0.40	39915	0.861	0.49
154	35000	35063	0.647	0.42	34932	0.681	0.44
132	30000	30064	0.632	0.48	29951	0.518	0.39
110	25000	25067	0.623	0.57	24970	0.331	0.30
88	20000	20058	0.550	0.62	19979	0.277	0.31
66	15000	15047	0.462	0.70	14987	0.229	0.35
44	10000	10034	0.327	0.74	9992	0.140	0.32
22	5000	5024	0.220	1.00	5000	0.058	0.26
4	1000	1003	0.046	1.05	994	0.060	1.36

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	%
220	50000	50187	1.694	0.77	50006	0.383	0.17
441	100000	100333	3.004	0.68	99999	0.662	0.08
661	150000	150414	3.784	0.57	149952	1.079	0.08
881	200000	200504	4.633	0.53	199936	1.448	0.08
1322	300000	300606	5.690	0.43	299901	2.145	0.08
1762	400000	400629	6.095	0.35	399881	2.744	0.08
2203	500000	500573	5.948	0.27	499878	3.328	0.08
2643	600000	600436	5.386	0.20	599891	3.896	0.07
3524	800000	799878	5.147	0.15	799923	5.079	0.07
4405	1000000	998984	10.925	0.25	1000008	6.268	0.07
3524	800000	800063	4.988	0.14	800109	5.048	0.07
2643	600000	600701	7.211	0.27	600157	3.964	0.07
2203	500000	500855	8.150	0.37	500161	3.414	0.08
1762	400000	400921	8.485	0.48	400173	2.911	0.08
1322	300000	300864	7.840	0.59	300158	2.330	0.09
881	200000	200673	6.059	0.69	200105	1.555	0.09
661	150000	150556	4.991	0.76	150093	1.256	0.10
441	100000	100399	3.574	0.81	100065	0.864	0.10
220	50000	50198	1.785	0.81	50017	0.386	0.09

Table 3-b. Third order equation

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

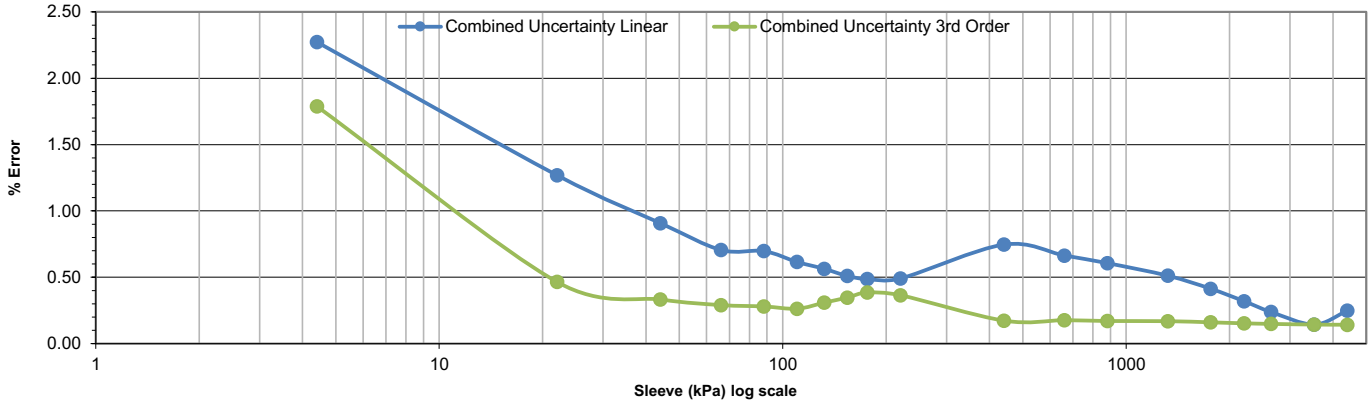
F (in 0.1N units) is calculated from :

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

a0	=	-5.27699
a1	=	0.99625
a2	=	4.68849E-09
a3	=	9.52751E-17

Maximum sleeve zero drift during the calibration (kPa) =	0.085
Maximum load cell zero drift during the calibration (kPa) =	0.003
Factor used to convert from counts to 0.1N units =	0.0088040
Physical strength limited maximum sleeve reading (MPa) =	1.333
Sleeve resolution (Pa) =	4.4
Sleeve area (cm²) =	227
Sleeve area ratio factor =	-0.001

COMBINED EXPANDED UNCERTAINTY SLEEVE



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

LANKELMA

CERTIFICATE OF CALIBRATION

Certificate Number: 1471

Cone Serial Number: S15-CFIIPTT.2117

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

Tip MPa	Sleeve linear equation subtraction error (%) Sleeve kPa → 4	22	44	66	110	154	220	661
0.07	3.4	1.1	0.7	0.5	0.4	0.3	0.3	0.3
0.33	7.0	1.8	1.0	0.7	0.5	0.4	0.4	0.4
0.67	11.6	2.7	1.5	1.1	0.7	0.6	0.5	0.4
1.00	14.8	3.4	1.8	1.3	0.9	0.6	0.5	0.4
1.67	21.6	4.7	2.5	1.7	1.1	0.8	0.7	0.4
2.33	28.7	6.1	3.2	2.2	1.4	1.0	0.8	0.4
3.33	43.2	9.0	4.7	3.2	2.0	1.5	1.1	0.5
10.00	84.2	17.2	8.8	5.9	3.6	2.6	1.9	0.7
13.33	105.1	21.4	10.8	9.2	4.5	3.2	2.9	1.0

Tip MPa	Sleeve 3rd order equation subtraction error (%) Sleeve kPa → 4	22	44	66	110	154	220	661
0.07	2.8	0.6	0.4	0.3	0.2	0.2	0.2	0.1
0.33	3.7	0.8	0.4	0.3	0.2	0.3	0.2	0.1
0.67	5.9	1.2	0.7	0.5	0.3	0.3	0.3	0.1
1.00	7.7	1.6	0.8	0.6	0.4	0.4	0.3	0.1
1.67	10.2	2.1	1.1	0.8	0.5	0.4	0.4	0.2
2.33	15.6	3.2	1.6	1.1	0.7	0.6	0.5	0.2
3.33	25.4	5.1	2.6	1.8	1.1	0.9	0.7	0.3
10.00	28.4	5.7	2.9	2.0	1.2	1.0	0.7	0.3
13.33	36.1	7.3	3.7	3.5	1.5	1.2	0.9	0.3

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	2.085E+07	2.083E+07	2.084E+07	0.0	0.03		
200	4.165E+07	4.162E+07	4.161E+07	0.1	0.03		
400	8.322E+07	8.322E+07	8.322E+07	0.0	0.00		
600	1.249E+08	1.249E+08	1.248E+08	0.0	0.01		
800	1.665E+08	1.665E+08	1.665E+08	0.0	0.00		
1000	2.082E+08	2.081E+08	2.082E+08	0.1	0.01		
1500	3.123E+08	3.123E+08	3.122E+08	0.1	0.01		
2000	4.165E+08	4.165E+08	4.164E+08	0.2	0.01		
2500	5.206E+08	5.206E+08	5.206E+08	0.1	0.00		
3000	6.248E+08	6.248E+08	6.247E+08	0.2	0.01		
2500	5.205E+08	5.206E+08		0.2	0.01	0.2	0.01
2000	4.162E+08	4.163E+08		0.1	0.00	0.7	0.04
1500	3.119E+08	3.119E+08		0.0	0.00	1.0	0.07
1000	2.078E+08	2.078E+08		0.0	0.00	1.0	0.10
800	1.662E+08	1.662E+08		0.1	0.01	0.9	0.11
600	1.246E+08	1.246E+08		0.0	0.00	0.8	0.13
400	8.301E+07	8.302E+07		0.0	0.00	0.6	0.14
200	4.149E+07	4.149E+07		0.0	0.00	0.4	0.20
100	2.075E+07	2.076E+07		0.0	0.03	0.2	0.23

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	1000506	0.221	0.22	1001986	0.442	0.44
200	2000000	1998744	0.431	0.22	2002385	0.591	0.30
400	4000000	3995788	0.991	0.25	4002907	0.775	0.19
600	6000000	5995002	1.252	0.21	6004567	1.181	0.20
800	8000000	7994335	1.450	0.18	8005433	1.411	0.18
1000	10000000	9994000	1.654	0.17	10005838	1.626	0.16
1500	15000000	14993260	1.991	0.13	15004263	1.691	0.11
2000	20000000	19996924	1.915	0.10	20004761	2.048	0.10
2500	25000000	24995599	2.335	0.09	24999828	2.161	0.09
3000	30000000	29996766	2.698	0.09	29998822	2.629	0.09
2500	25000000	24993394	2.552	0.10	24997624	2.231	0.09
2000	20000000	19986463	3.256	0.16	19994308	2.118	0.11
1500	15000000	14976486	4.945	0.33	14987497	2.892	0.19
1000	10000000	9976001	4.949	0.49	9987835	2.669	0.27
800	8000000	7979479	4.232	0.53	7990569	2.093	0.26
600	6000000	5981427	3.821	0.64	5990978	1.952	0.33
400	4000000	3986024	2.876	0.72	3993128	1.467	0.37
200	2000000	1992230	1.613	0.81	1995859	0.890	0.44
100	1000000	996544	0.738	0.74	998014	0.444	0.44

Table 3-c. Third order equation

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

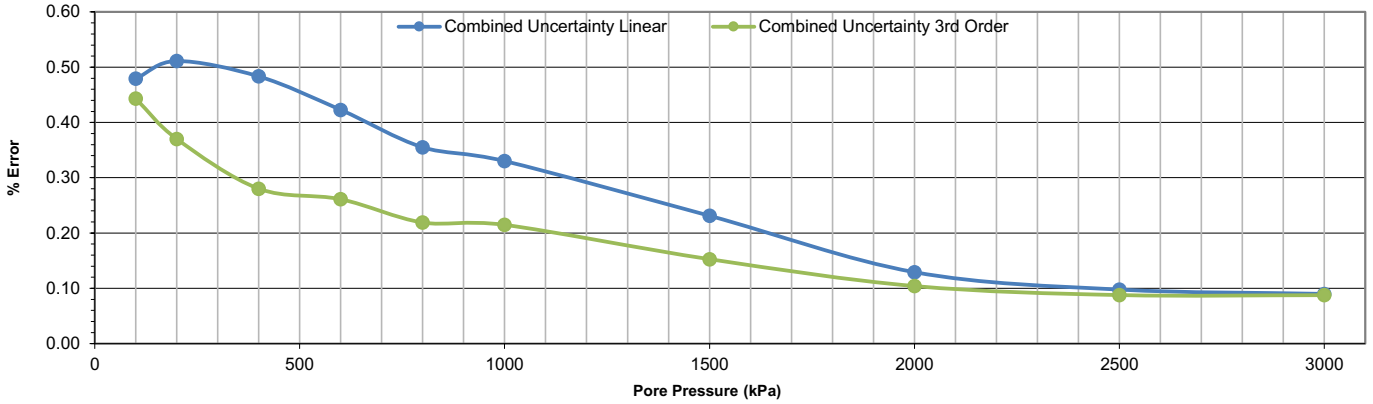
F (in 0.1N units) is calculated from :

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

a0	=	-991.64742
a1	=	1.00263
a2	=	-1.59473E-10
a3	=	2.50999E-18

Maximum PWP zero drift during the calibration (kPa) =	0.05
Maximum reference zero drift during the calibration (kPa) =	0.05
Factor used to convert from counts to 0.1Pa units =	0.0480138
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: 1471

Cone Serial Number: S15-CFIIPTT.2117

INCLINATION CALIBRATION

Ref Inclination (°C)	Cone inclination output X Inc (cts)	Y Inc (cts)
-25	-29973	25988
0	-3656	121
25	22357	-25537

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

	X inc	Y inc
Factor used to convert from counts to 0.1m° units =	9.55464123	-9.703974
Inclination error (°) =	0.1	0.1

TEMPERATURE CALIBRATION

Recorded temp (°C)	Cone output 1 FS (cts)	Cone output 2 QC (cts)
7.15	3068458	3058595
10.35	3121384	3113492
15.27	3208108	3198934
20.28	3293912	3286642
25.16	3382194	3373567

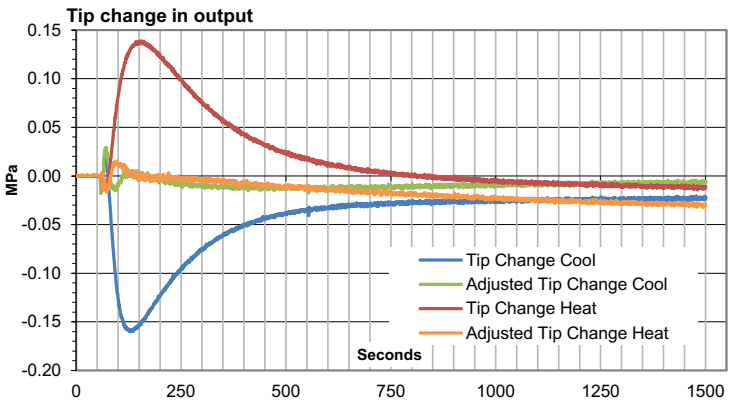
Recorded temp (°C)	Cone output 1 FS (°C)	Cone output 2 QC (°C)
7.15	7.24	7.19
10.35	10.28	10.33
15.27	15.26	15.22
20.28	20.18	20.24
25.16	25.25	25.21

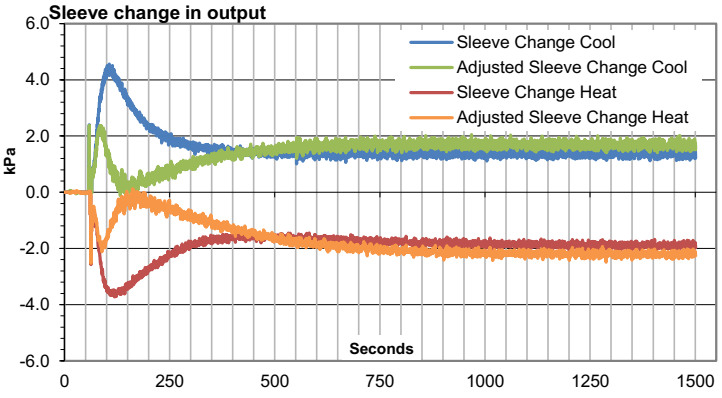
Factor used to convert from counts to 0.00001°C units =	0.574113529	0.572087411
Temperature error (°C) =	0.10	0.05

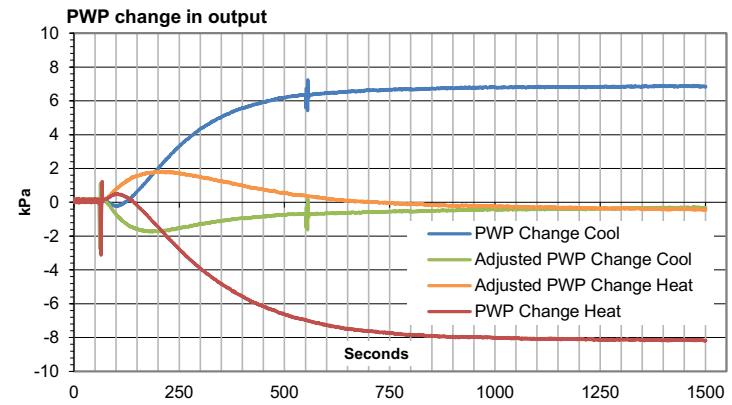
CONE TEMPERATURE EFFECT

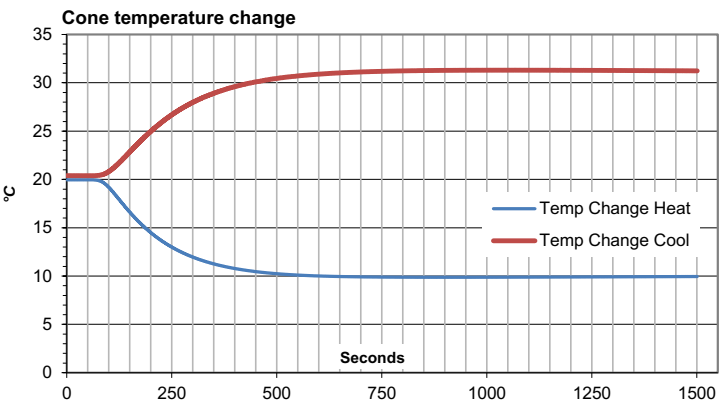
	Cooling	Heating
Start temperature =	19.96	20.38
End temperature =	9.87	31.31
Temperature change =	-10.09	10.92

	Cooling	Heating
Tip maximum rate of change (MPa/°C/min) =	0.050	0.050
Tip end change (MPa/°C) =	-0.002	-0.001
Adjusted tip end change (MPa/°C) =	0.001	0.003
Sleeve maximum rate of change (kPa/°C/min) =	2.32	2.31
Sleeve end change (kPa/°C) =	0.12	-0.18
Adjusted sleeve end change (kPa/°C) =	0.15	-0.21
PWP end change (kPa/°C) =	0.68	-0.75
Adjusted PWP end change (kPa/°C) =	0.03	-0.04









UK3
Track-truck

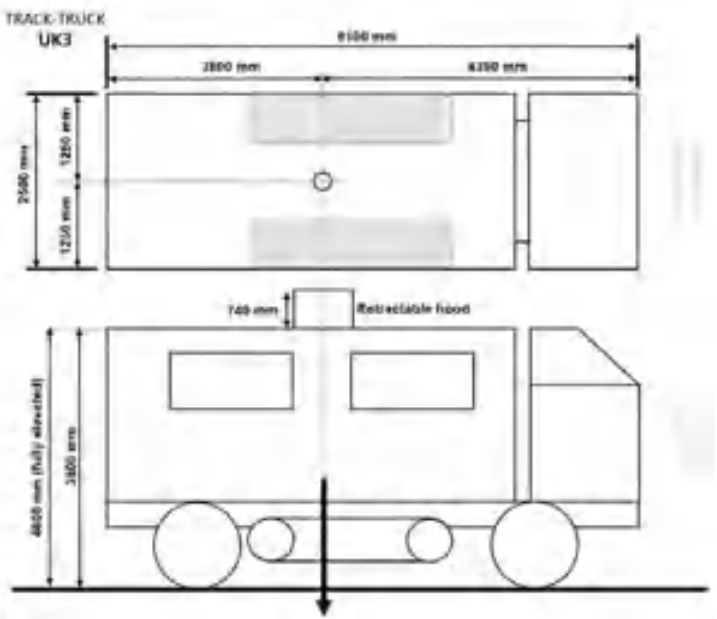
LANKELMA
01791 280050 – www.lankelma.com

Rig weight	20.5 T
Max. operating ram capacity	17 T
Max. travelling speed	86 km/h
Track material	Steel
Track length	3300 mm
Track width	650 mm
Jack plate dimensions	Tracks act as jacks
Jack arrangements	1nr. on each side
Max. ground clearance on jacks	210 mm
Max. ground bearing pressure	Tracking/pushing – 47 kPa Pulling – 88 kPa
Max. testing gradient	10 degrees
Max. traversing gradient	20 degrees (operator assessed)
Noise output at 2 m	Testing - 74 dBA Driving – 87 dBA
Clamp arrangement	36/55 push-pull clamp
Ram stroke	1.2 m
Max. casing size	55 mm

Lankelma's versatile track-truck is suitable for most geotechnical sites. The rig is driven to site as a self-contained HGV with tracks that can be deployed to cope with soft or uneven terrain. Fitted with a chalwyn valve and spark arrestor.

Typical production
An expected 100m+ of standard CPTu testing can be executed in a day (depending on conditions and access).

Specialist testing	**Installations**	**Sampling**
Seismic	VWP	MOSTAP
Pressuremeter	Piezometer	Shelby
Magnetometer	Inclinometer	
Video cone		
Wing cone		
Push-in shear vane		



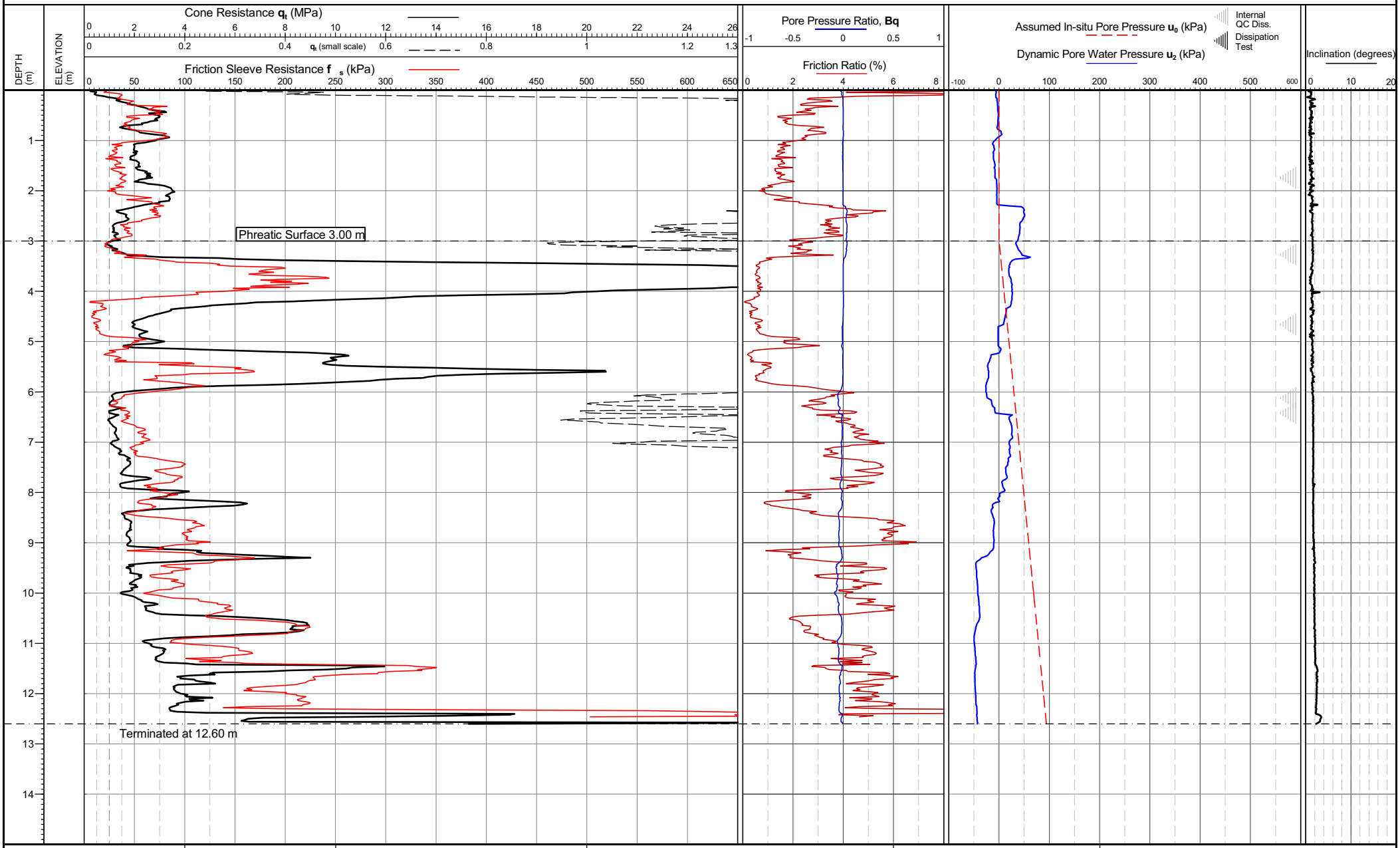
APPENDIX C CONE PENETRATION TEST RESULTS

Measured CPT parameters

intermediate parameters R_f and B_q

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

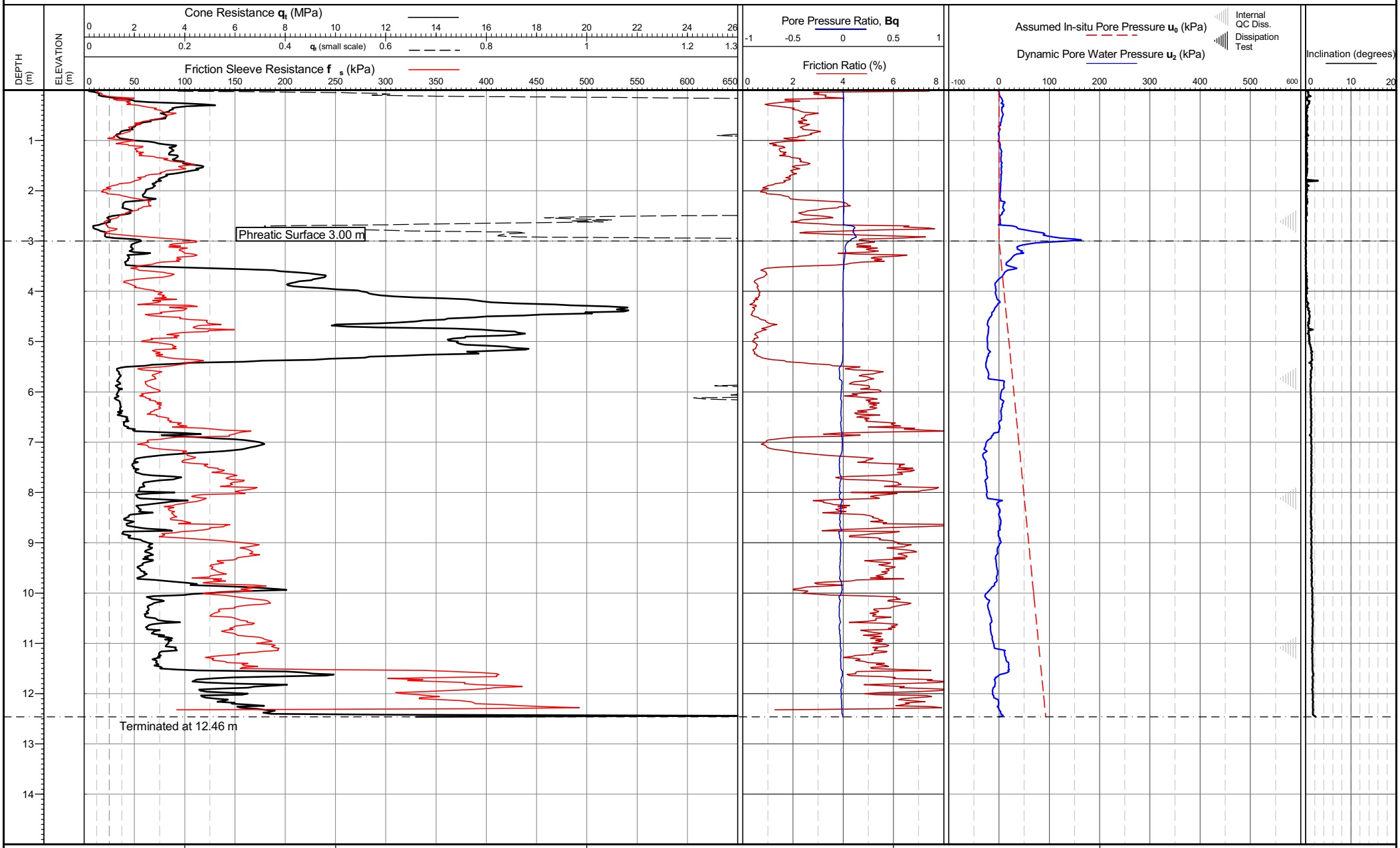


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 08:08:43	Zero drift (Pre/post test) q_c (kPa): -82.4 f_s (kPa): 0.3 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -7.5	Location: Tyne & Wear, UK Coordinates: 435774, 546829 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT01

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

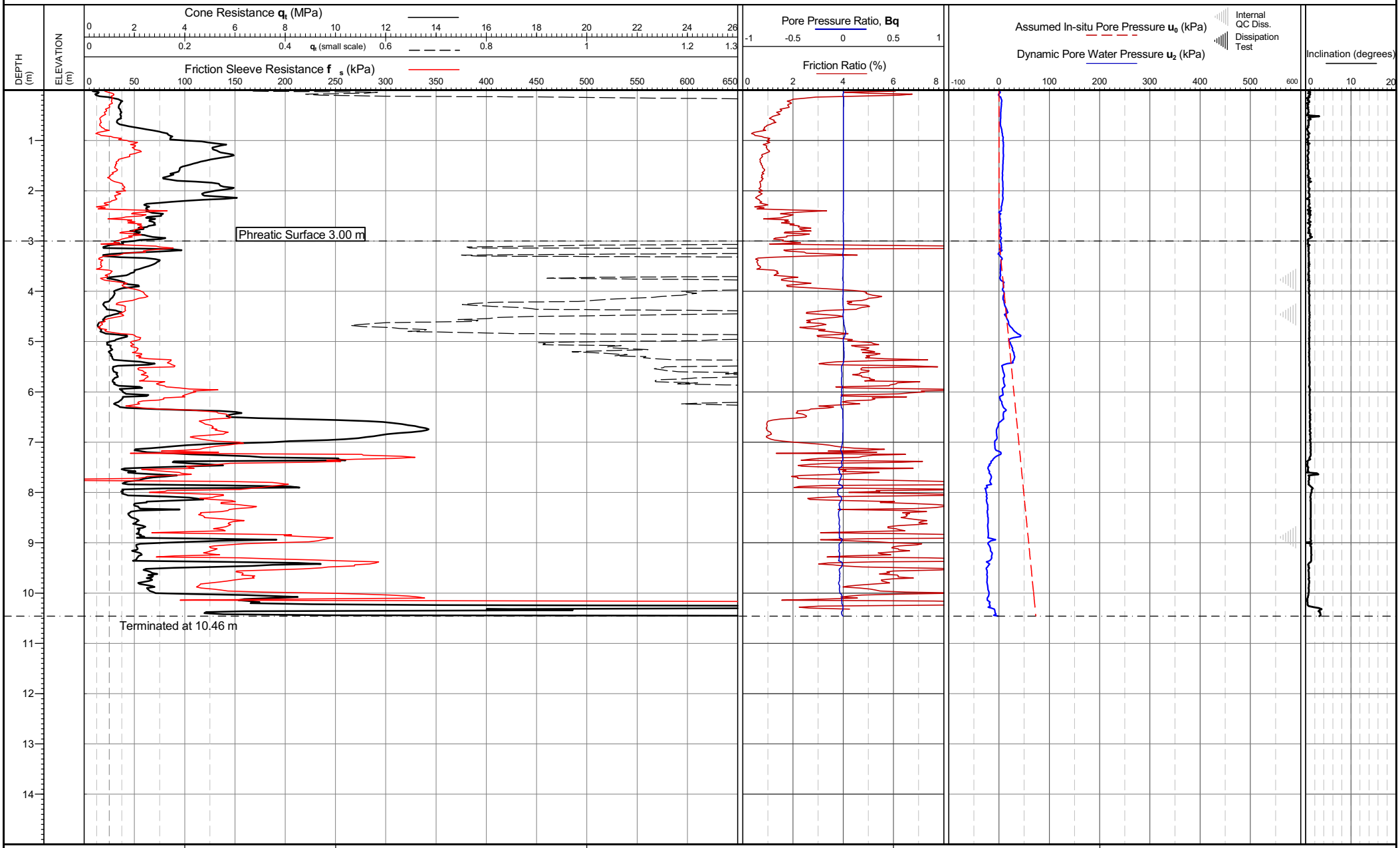


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 09:02:03	Zero drift (Pre/post test) q_c (kPa): -29.8 f_s (kPa): 1.6 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -9.1	Location: Tyne & Wear, UK Coordinates: 435801, 546827 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT02

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

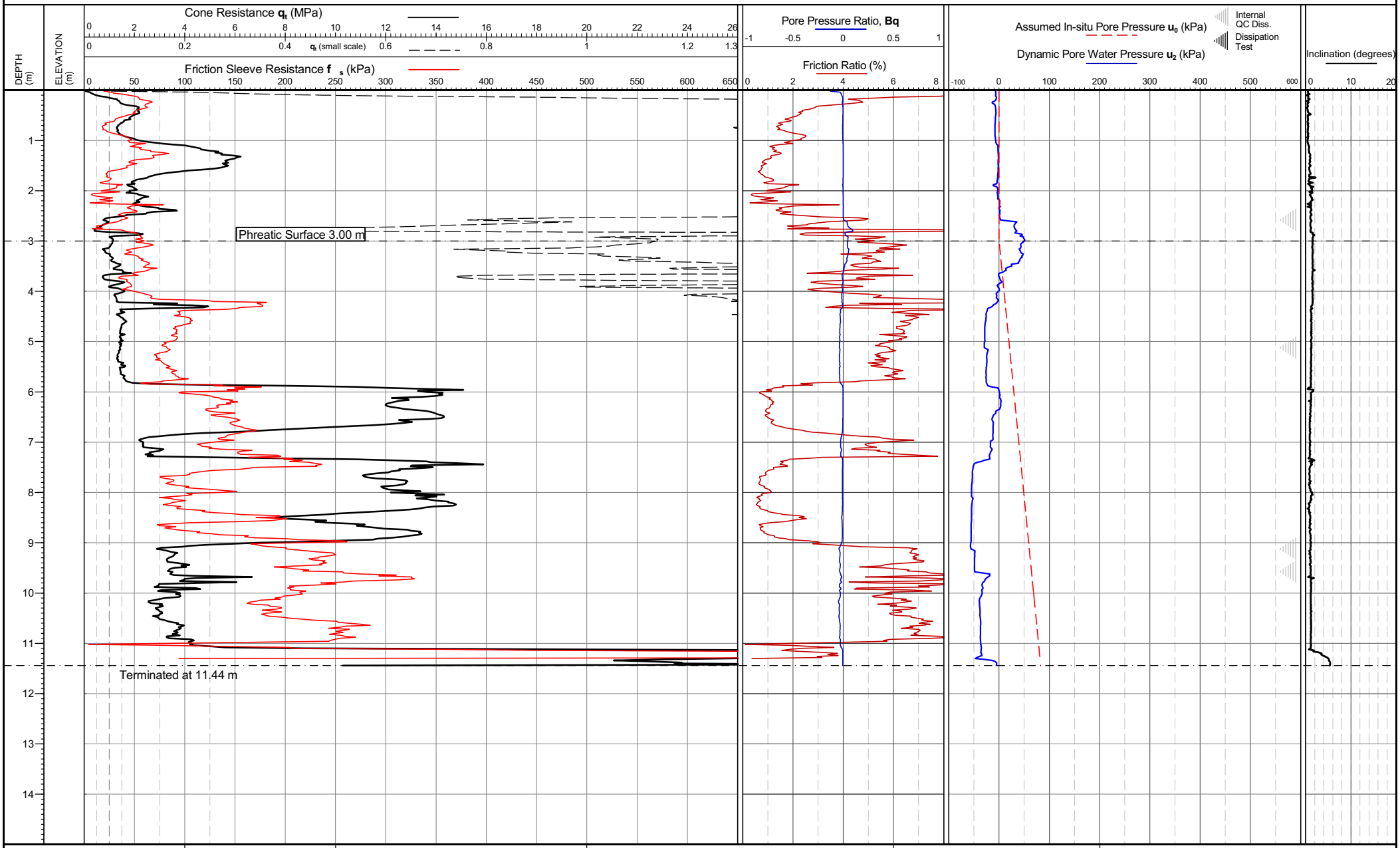


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 09:52:17	Zero drift (Pre/post test) q_c (kPa): -86.0 f_s (kPa): 1.4 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -4.5	Location: Tyne & Wear, UK Coordinates: 435827, 546827 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT03

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

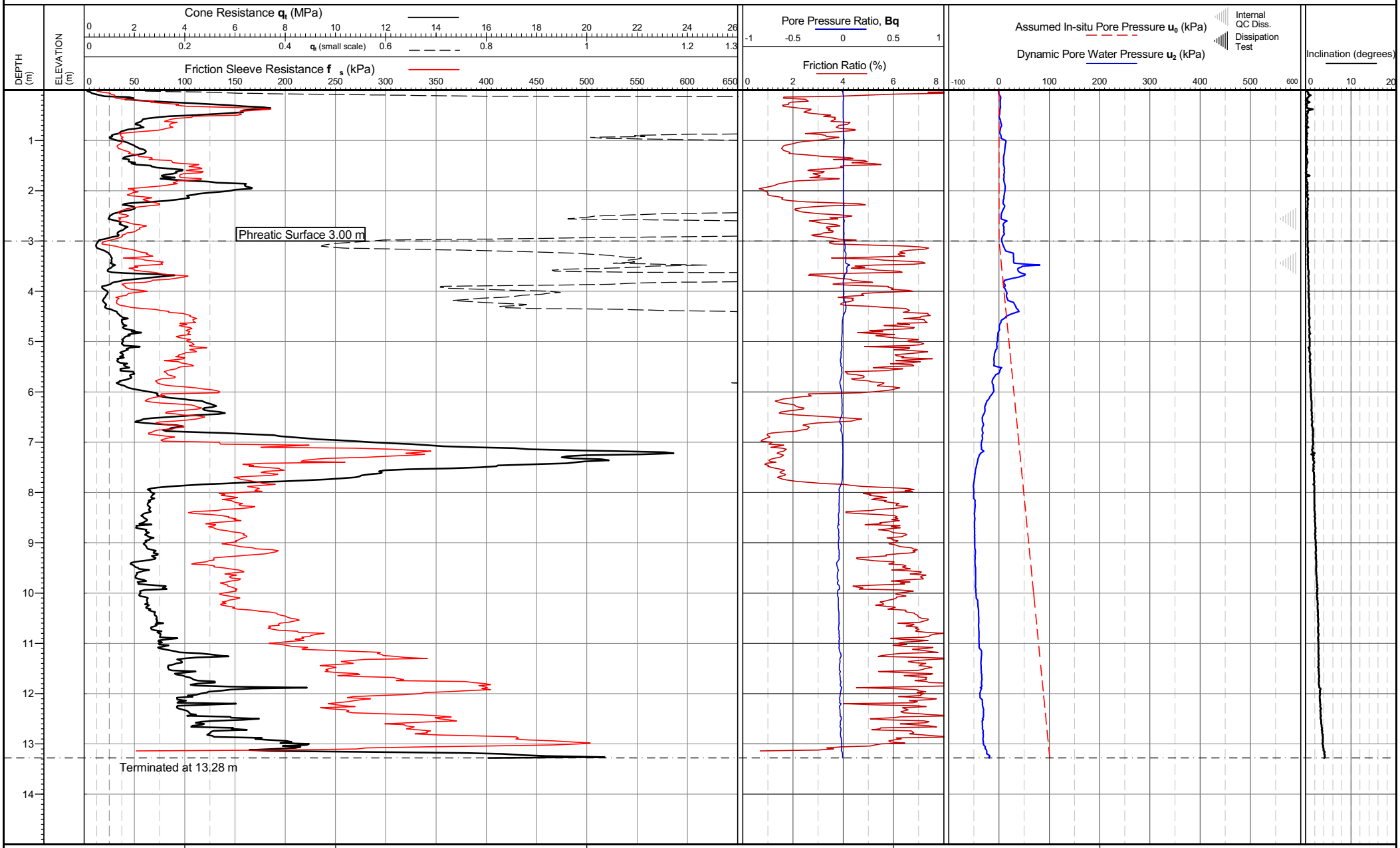


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 10:36:13	Zero drift (Pre/post test) q_c (kPa): -57.4 f_s (kPa): 12.7 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -7.7	Location: Tyne & Wear, UK Coordinates: 435827, 546815 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Inclination	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT04

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

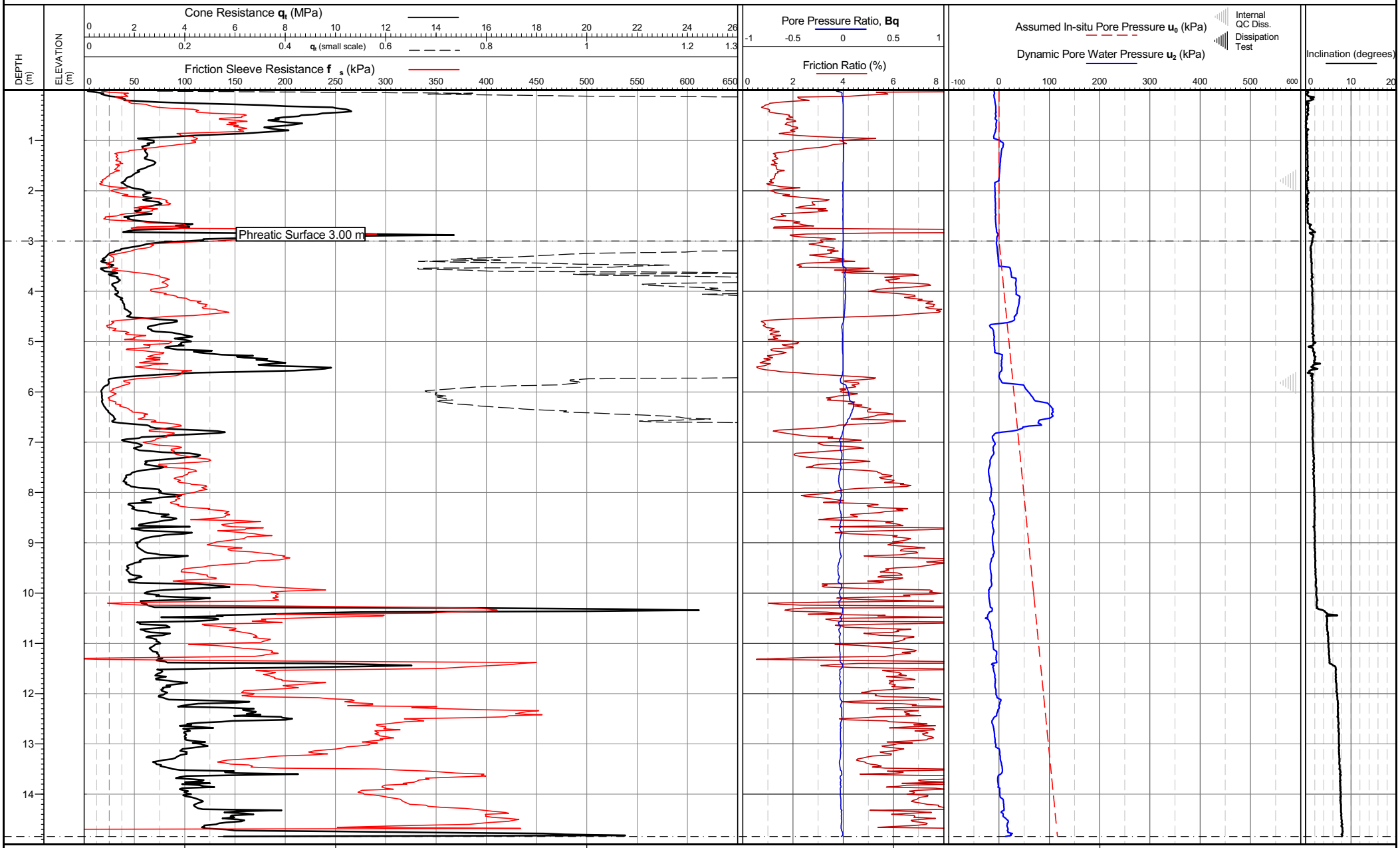


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 11:17:54	Zero drift (Pre/post test) q_c (kPa): -57.8 f_s (kPa): 0.8 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -1.9	Location: Tyne & Wear, UK Coordinates: 435800, 546815 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT05

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

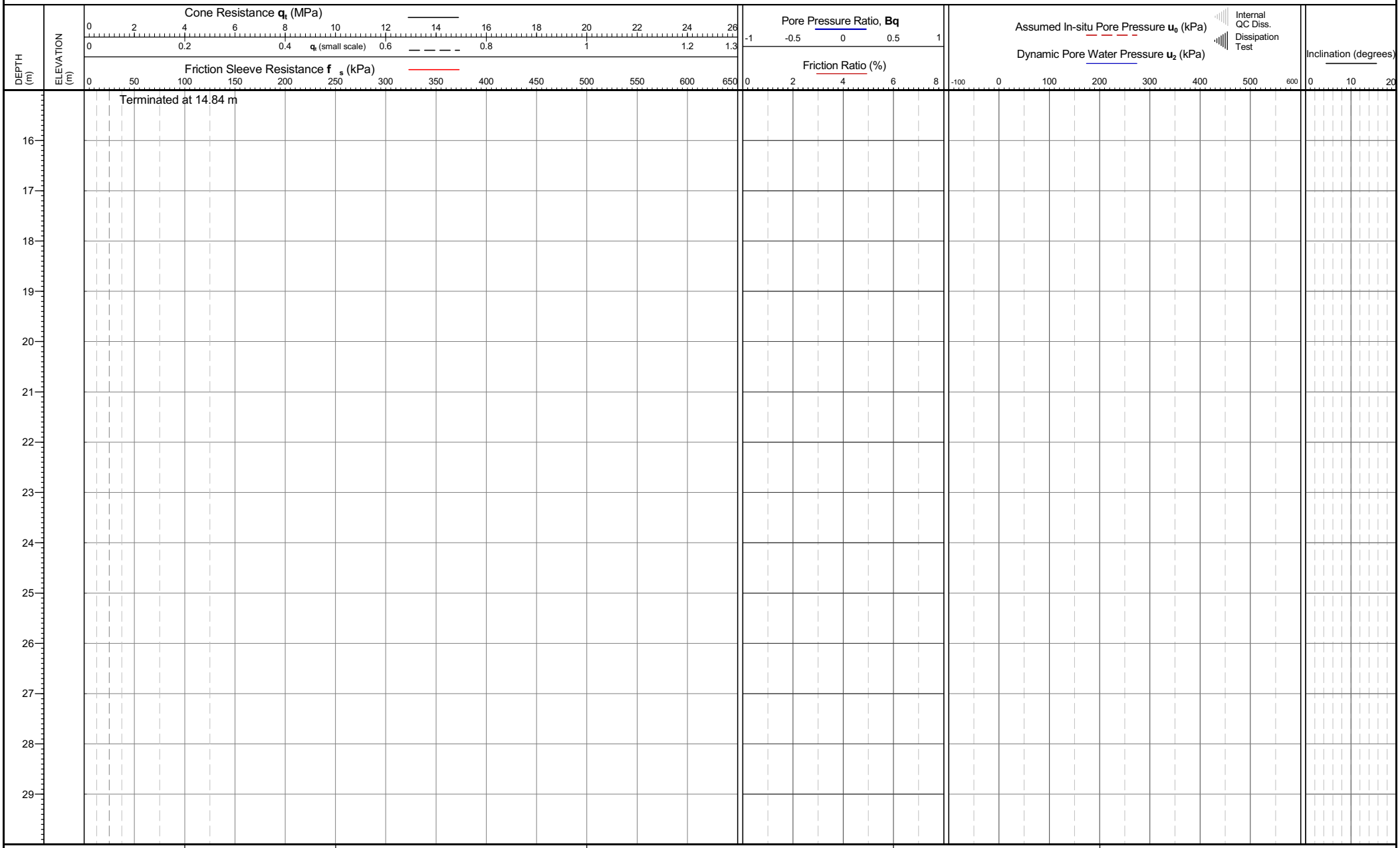


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 12:10:26	Zero drift (Pre/post test) q_c (kPa): -85.0 f_s (kPa): 1.3 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -5.2	Location: Tyne & Wear, UK Coordinates: 435775, 546815 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Inclination	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

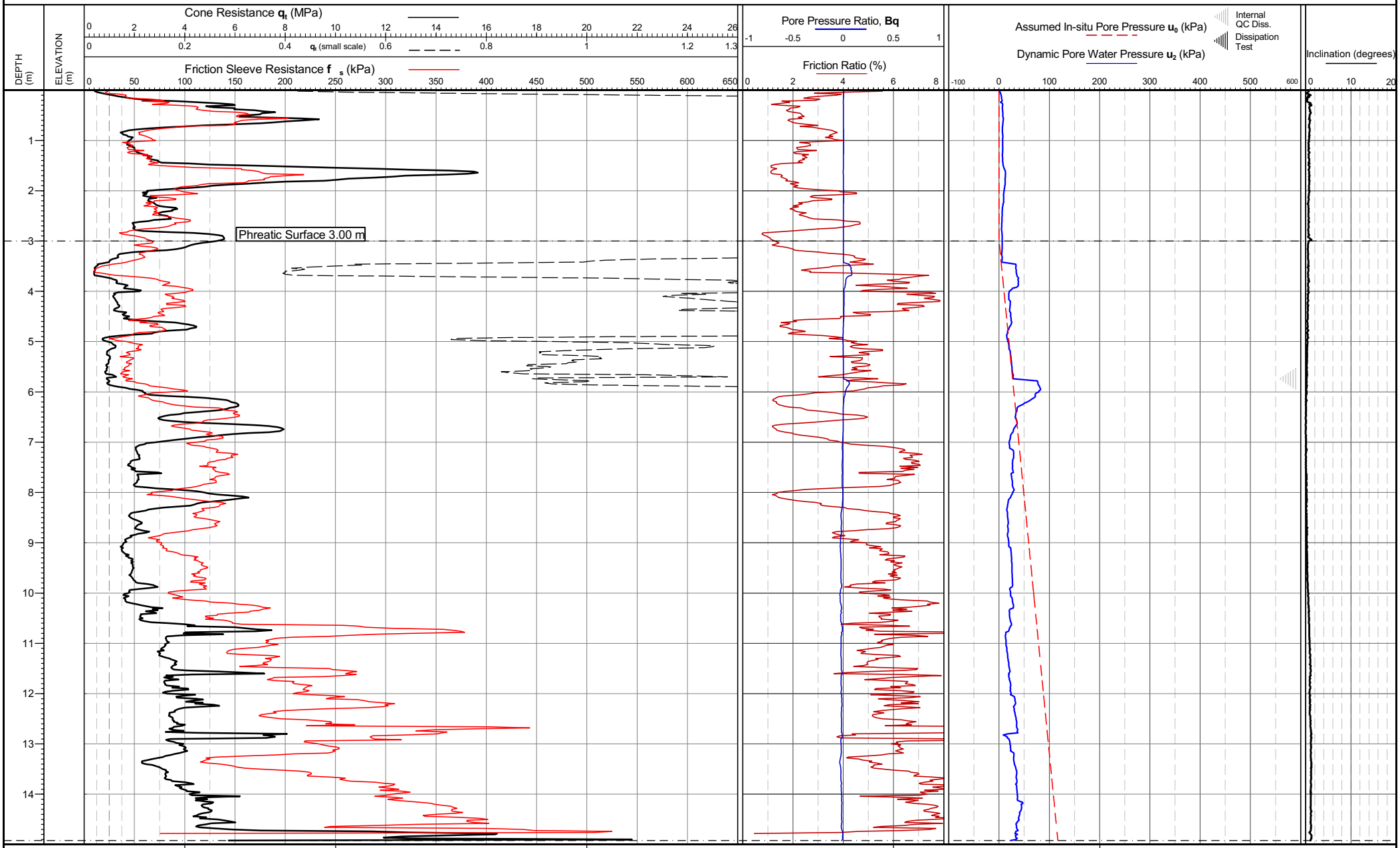


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 12:10:26	Zero drift (Pre/post test) q_c (kPa): -85.0 f_s (kPa): 1.3 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -5.2	Location: Tyne & Wear, UK Coordinates: 435775, 546815 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Inclination	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

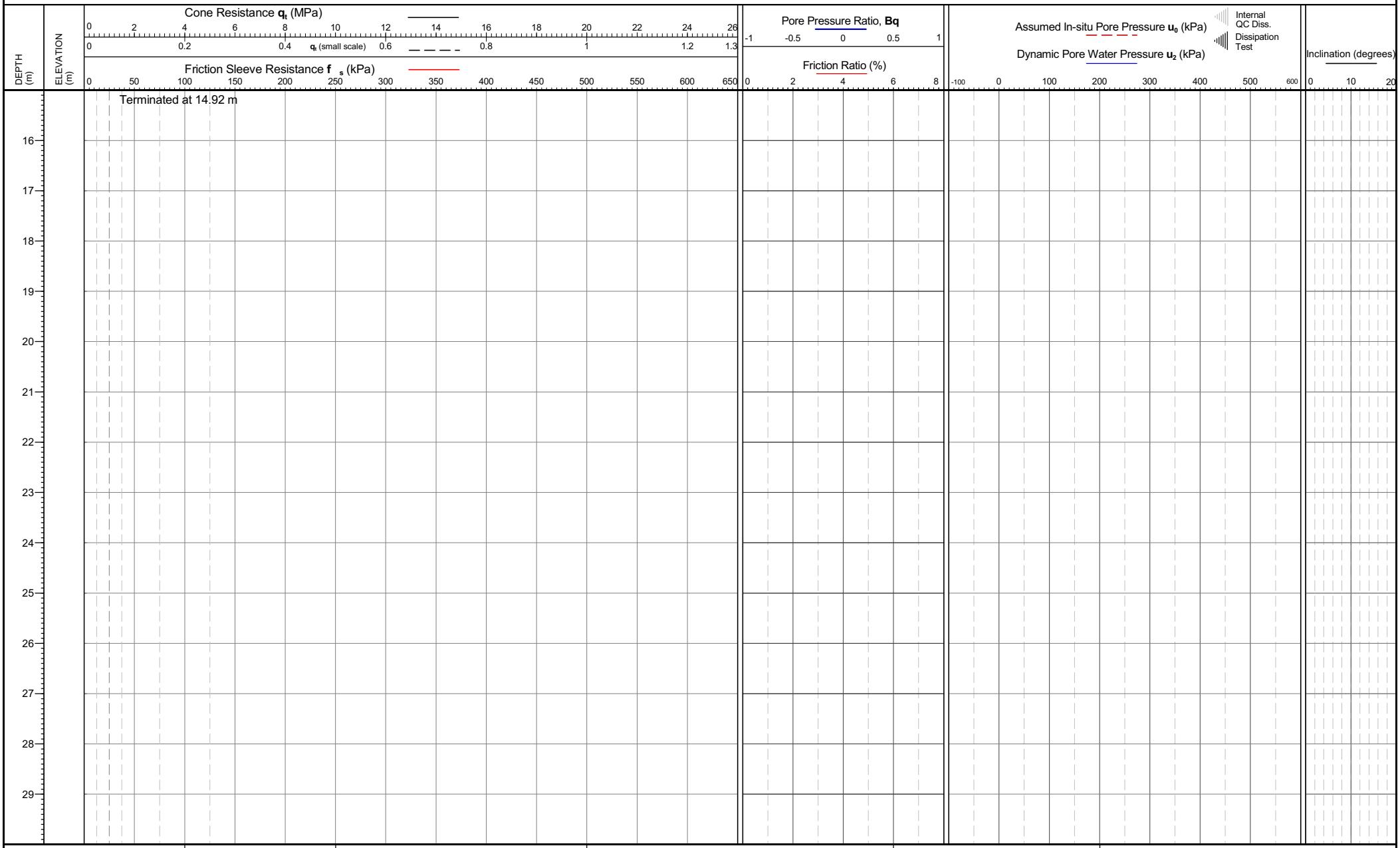


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 12:55:23	Zero drift (Pre/post test) q_c (kPa): -6.0 f_s (kPa): -0.4 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -5.7	Location: Tyne & Wear, UK Coordinates: 435775, 546802 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

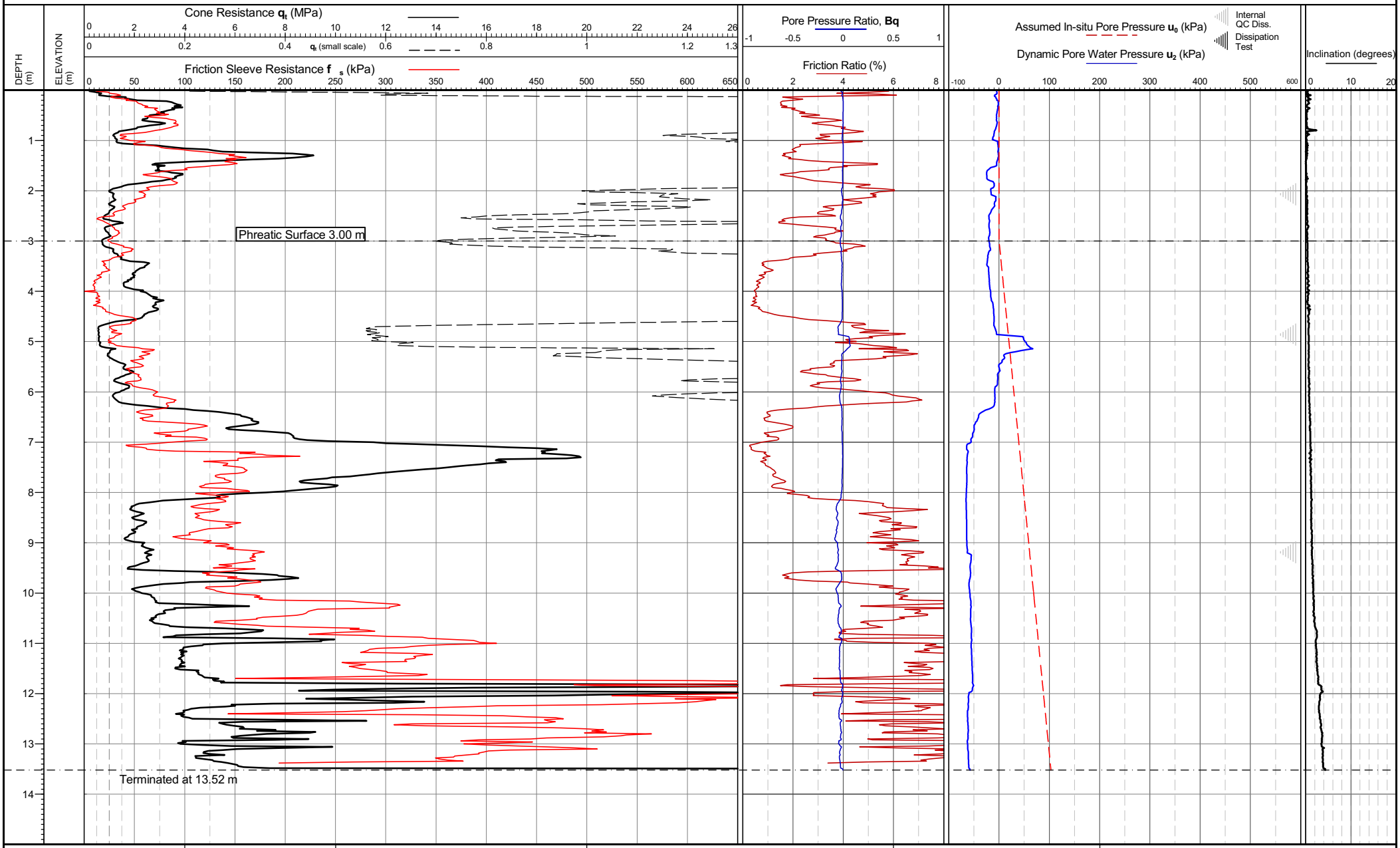


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 12:55:23	Zero drift (Pre/post test) q_c (kPa): -6.0 f_s (kPa): -0.4 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -5.7	Location: Tyne & Wear, UK Coordinates: 435775, 546802 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

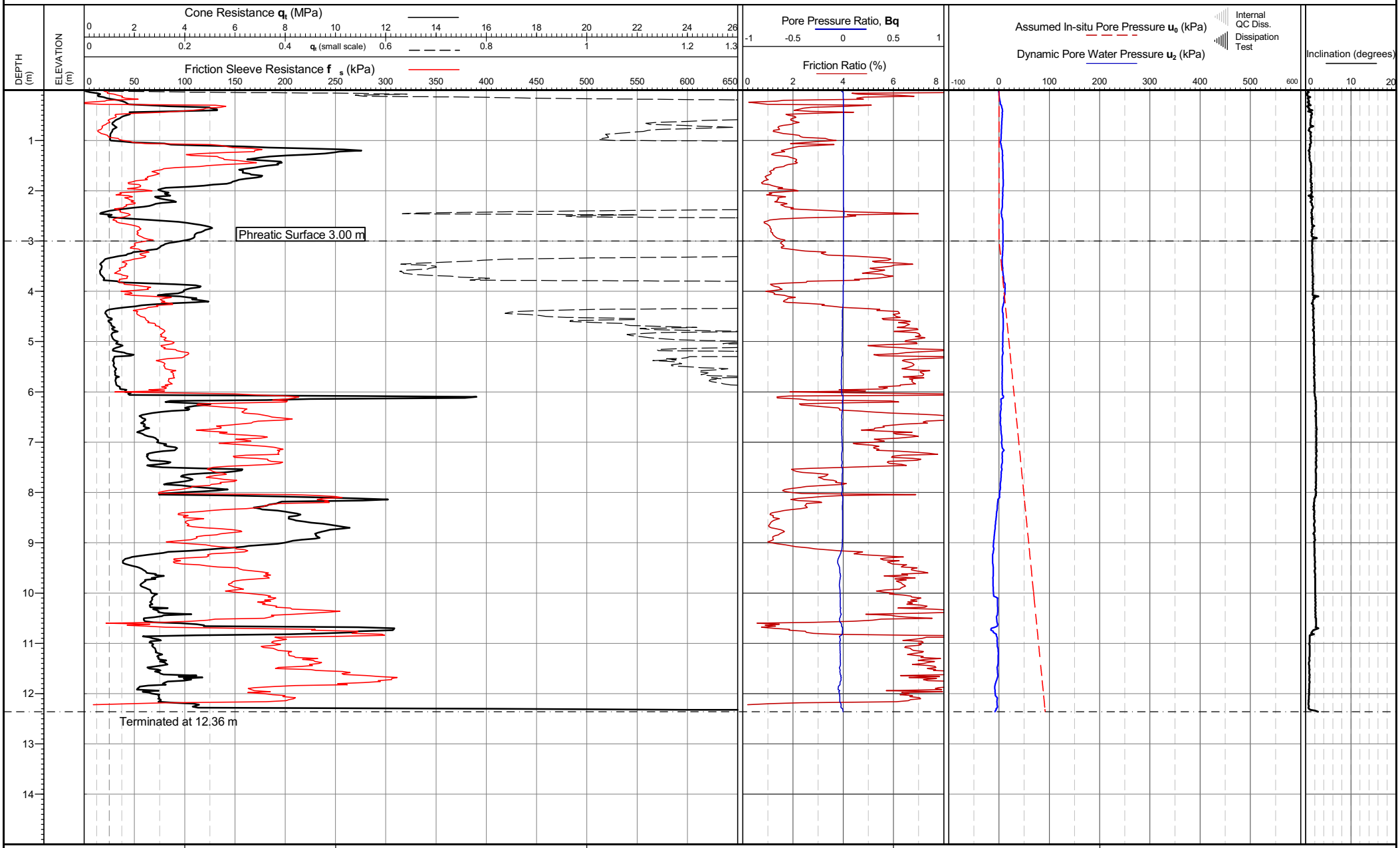


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 13:37:03	Zero drift (Pre/post test) q_c (kPa): -65.0 f_s (kPa): 0.9 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -8.4	Location: Tyne & Wear, UK Coordinates: 435799, 546803 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT08

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 14:24:05	Zero drift (Pre/post test) q_c (kPa): -59.0 f_s (kPa): 1.0 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -6.8	Location: Tyne & Wear, UK Coordinates: 435827, 546804 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT09

APPENDIX D SOIL BEHAVIOUR TYPE RESULTS

Soil behaviour type (SBT) point data evaluation according to:

Schneider et al (2008)

Robertson (2016)

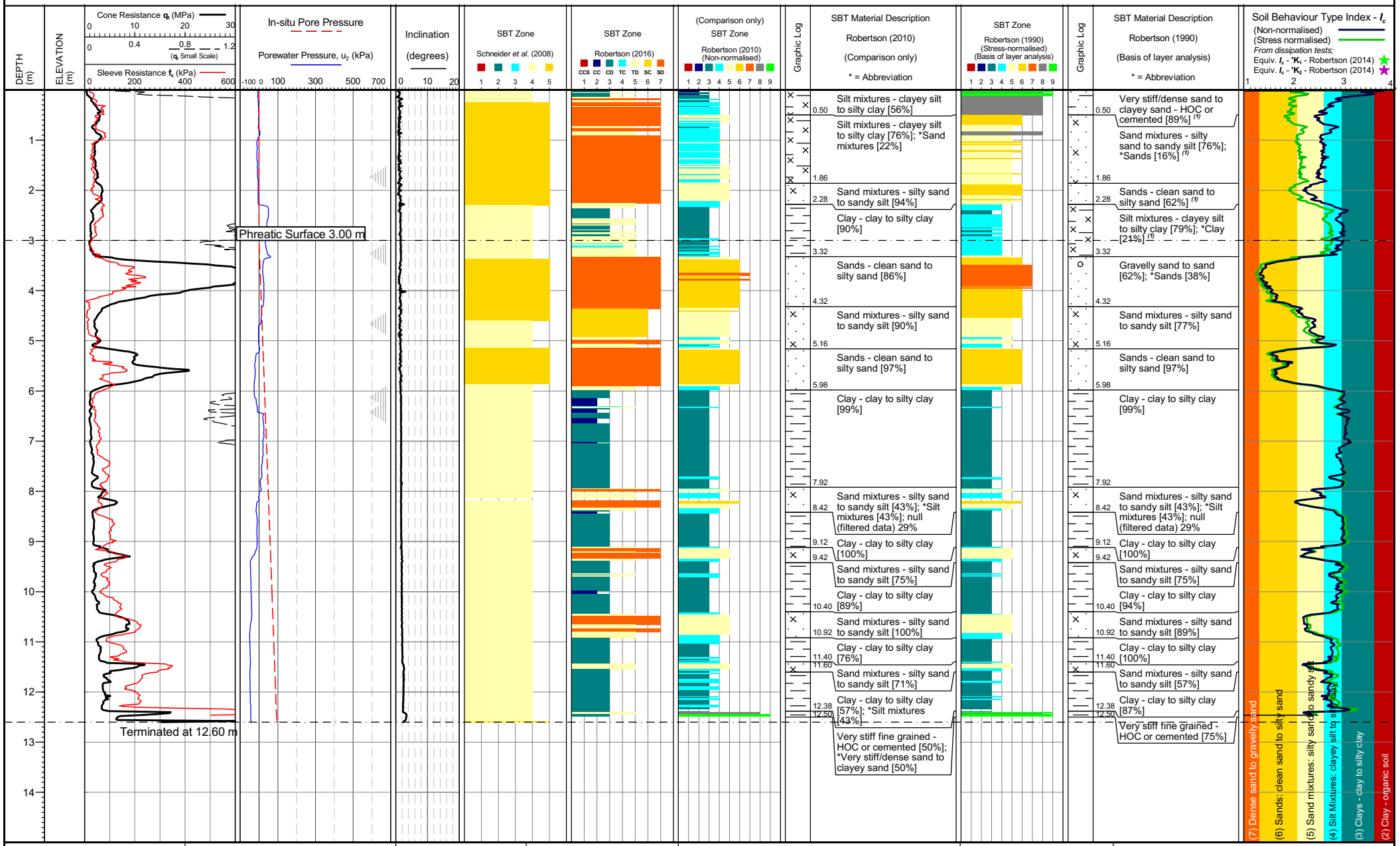
Robertson (2010) with aggregate layer descriptions

Robertson (1990) with aggregate layer descriptions

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 08:08:43

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435774, 546829
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

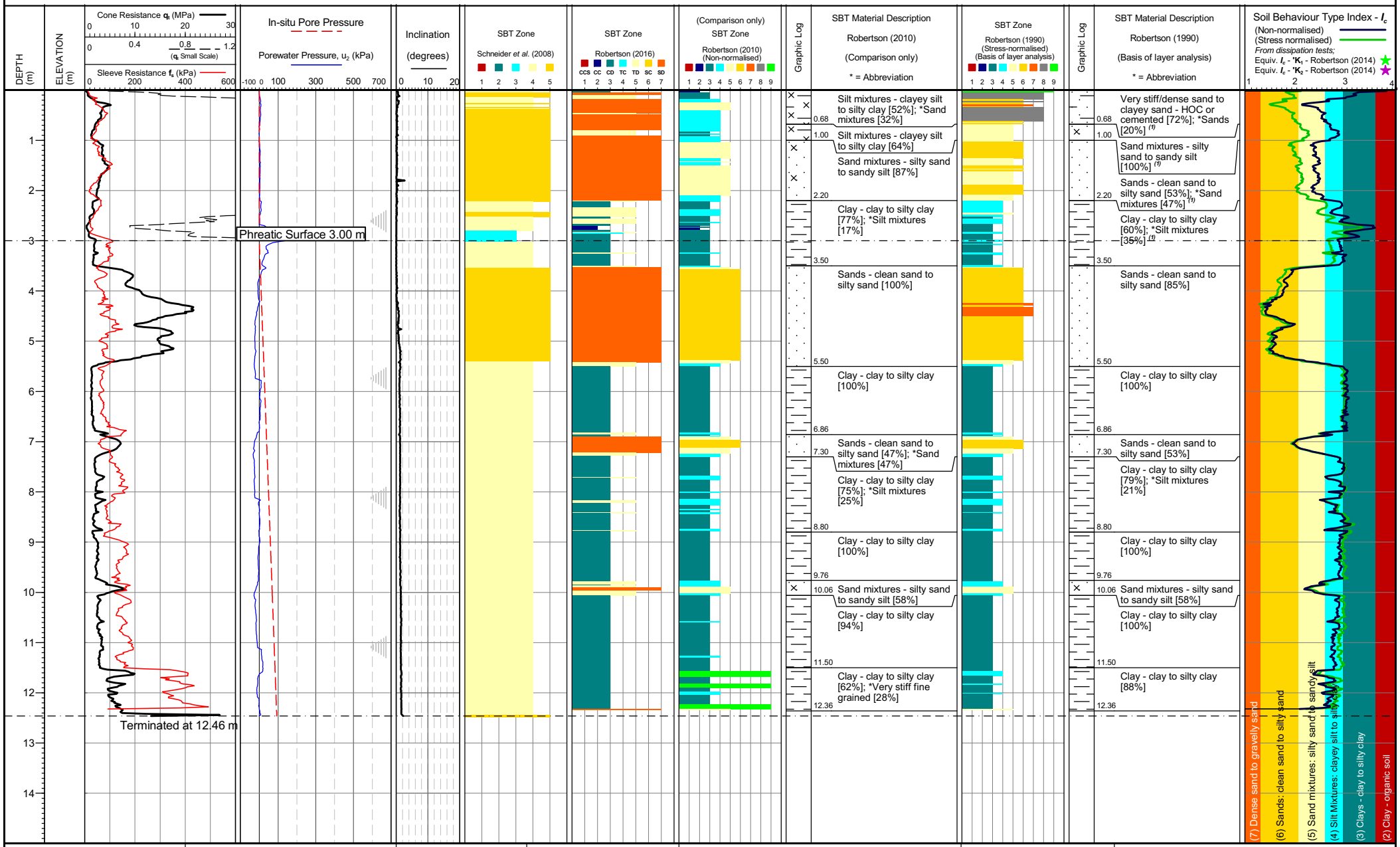
Internal QA Diss.
Dissipation Test

TEST ID: CPT01

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 09:02:03

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435801, 546827
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

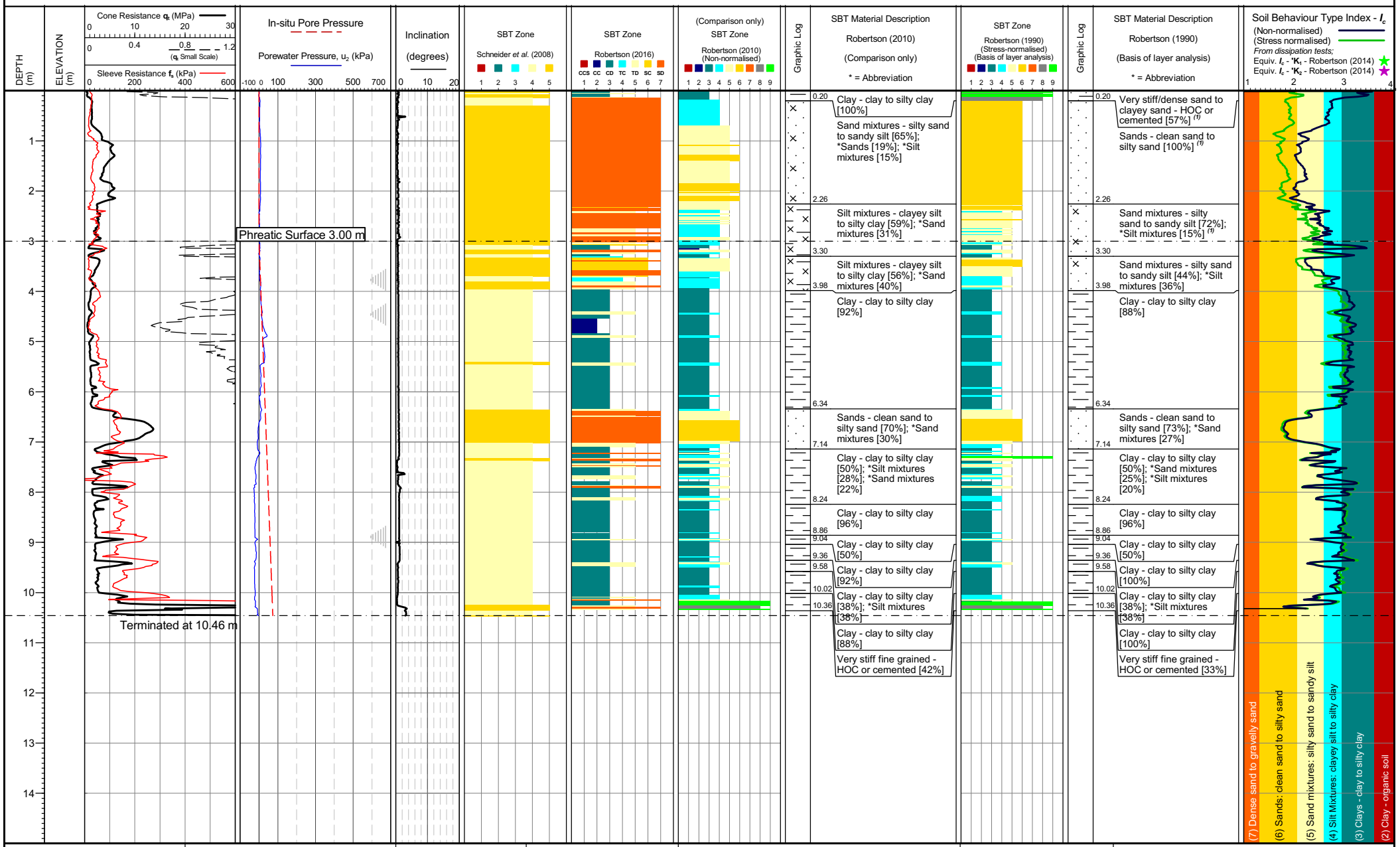
Internal QA Diss.
Dissipation Test

TEST ID: CPT02

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 09:52:17

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435827, 546827
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

TEST ID: CPT03

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1

Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 10:36:13

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435827, 546815
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

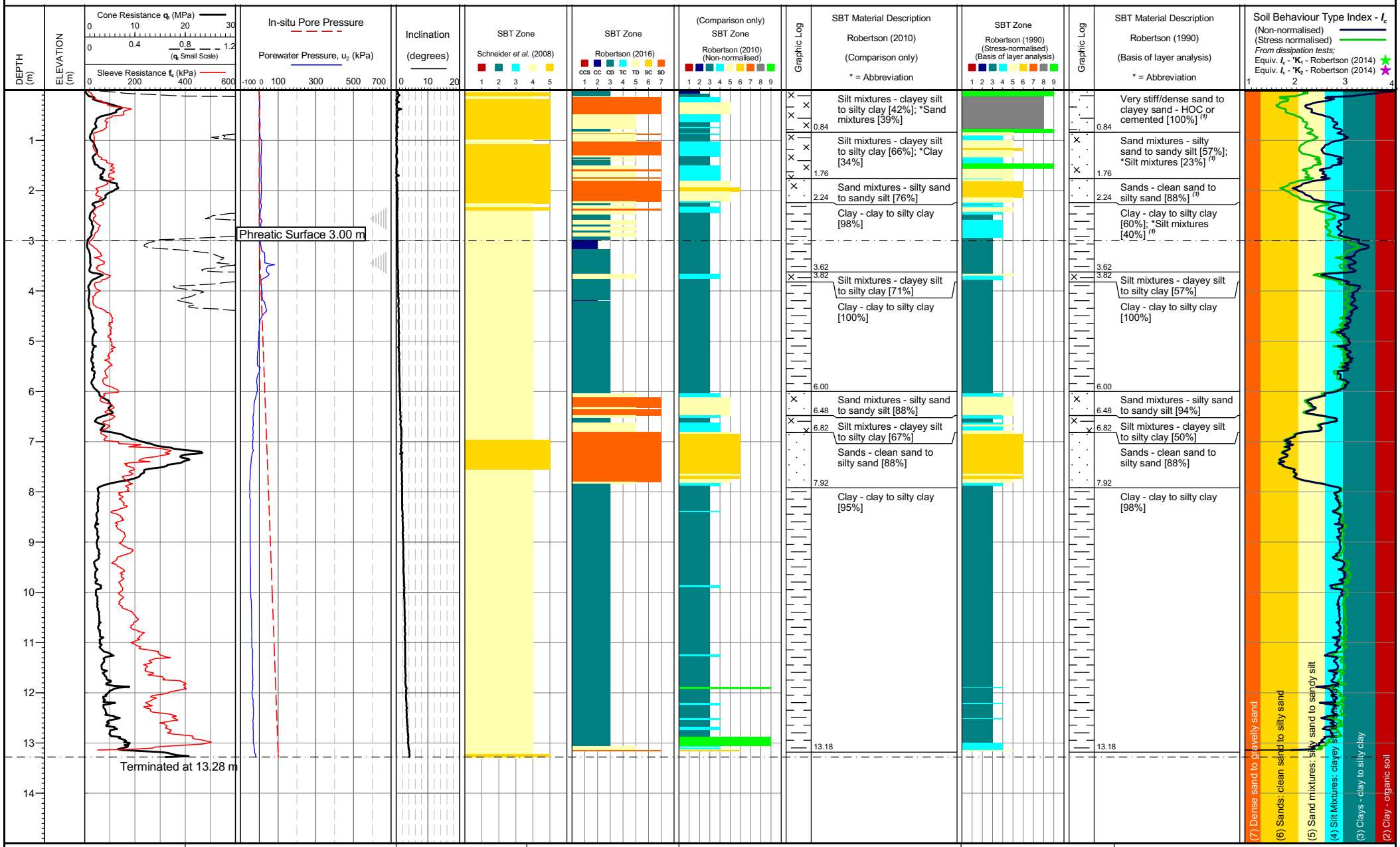
Internal QA Diss.
Dissipation Test

TEST ID: CPT04

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 11:17:54

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435800, 546815
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

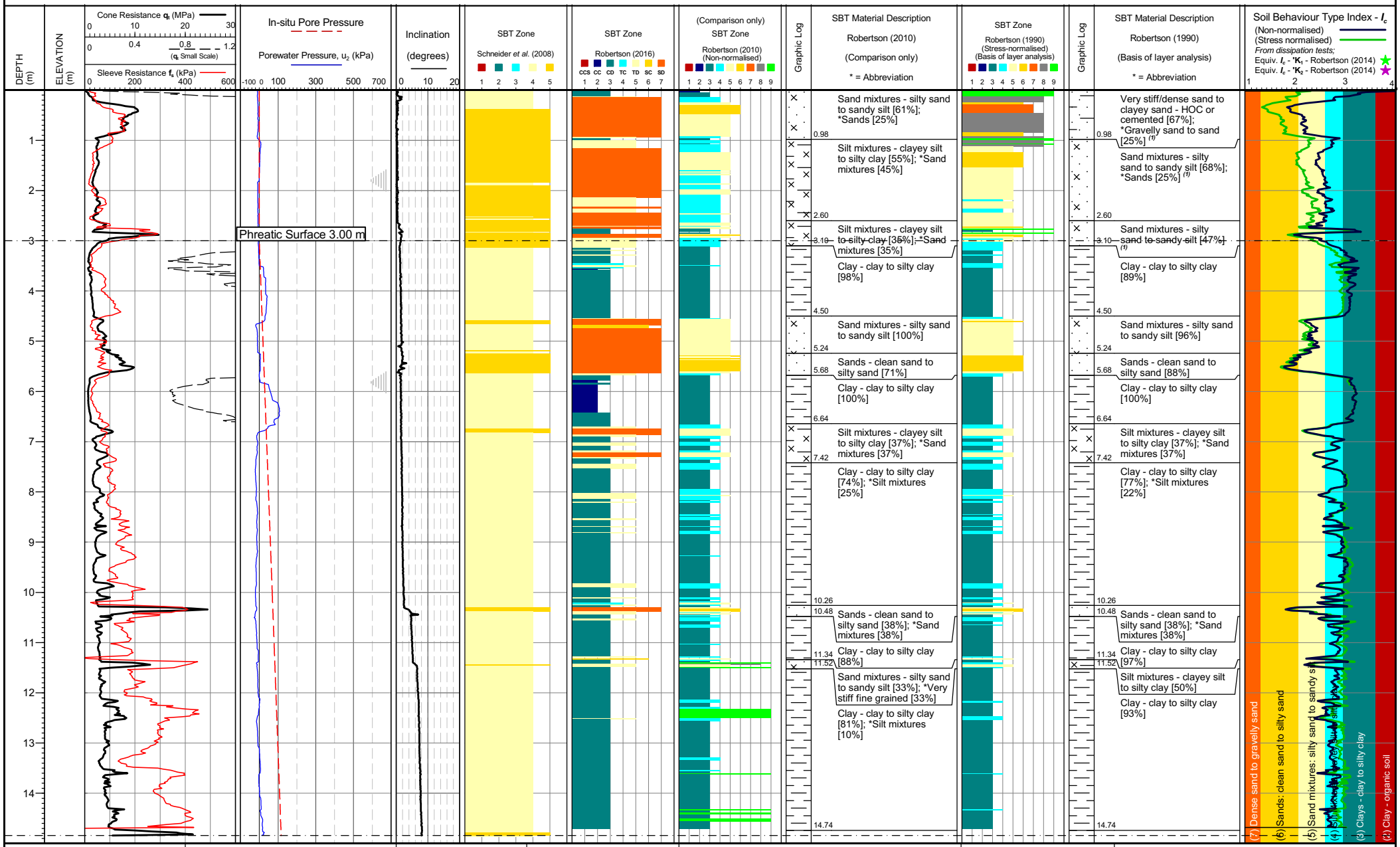
Internal QA Diss.
Dissipation Test

TEST ID: CPT05

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 12:10:26

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435775, 546815
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

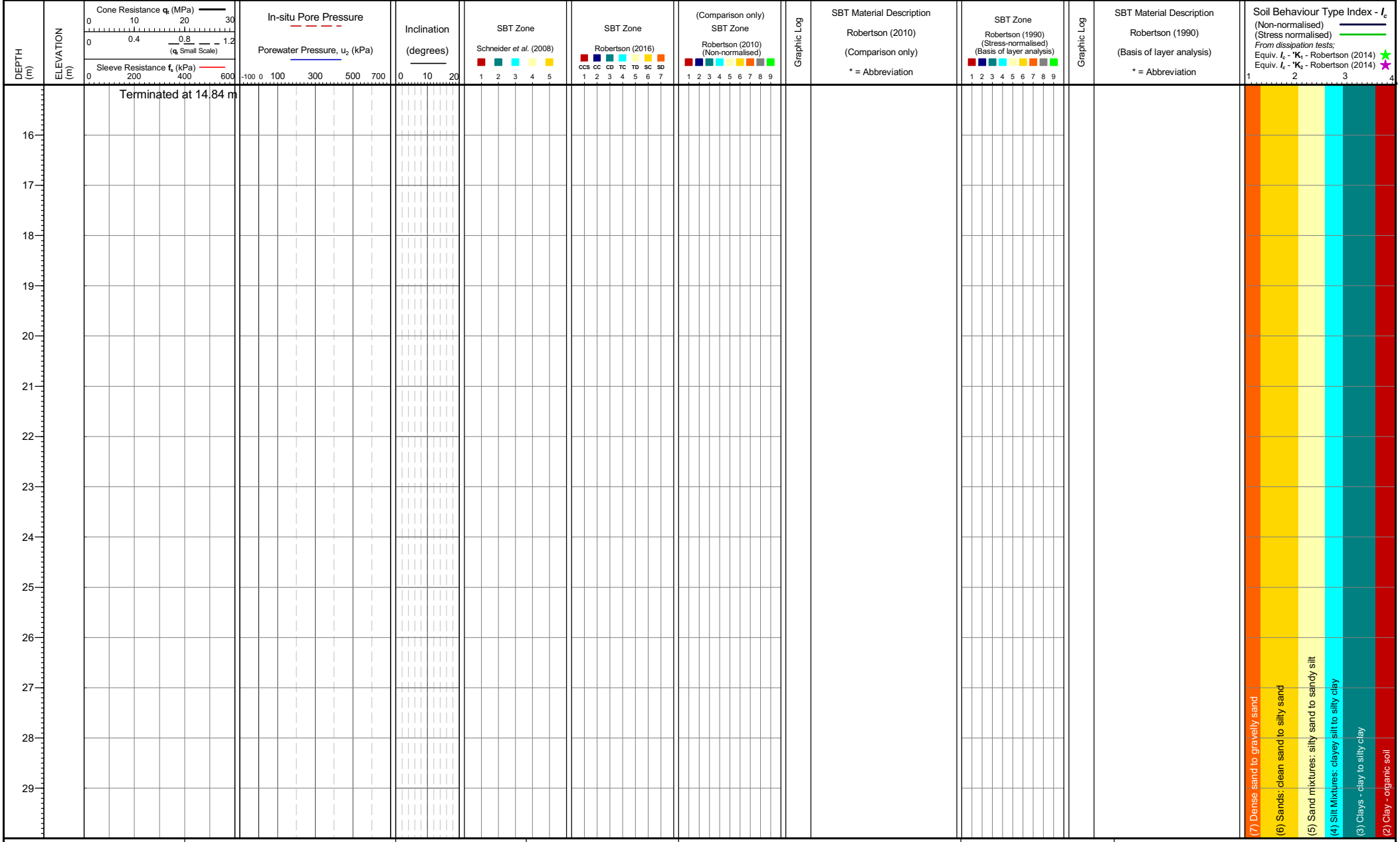
Internal QA Diss.
Dissipation Test

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 12:10:26

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435775, 546815
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

[1] 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

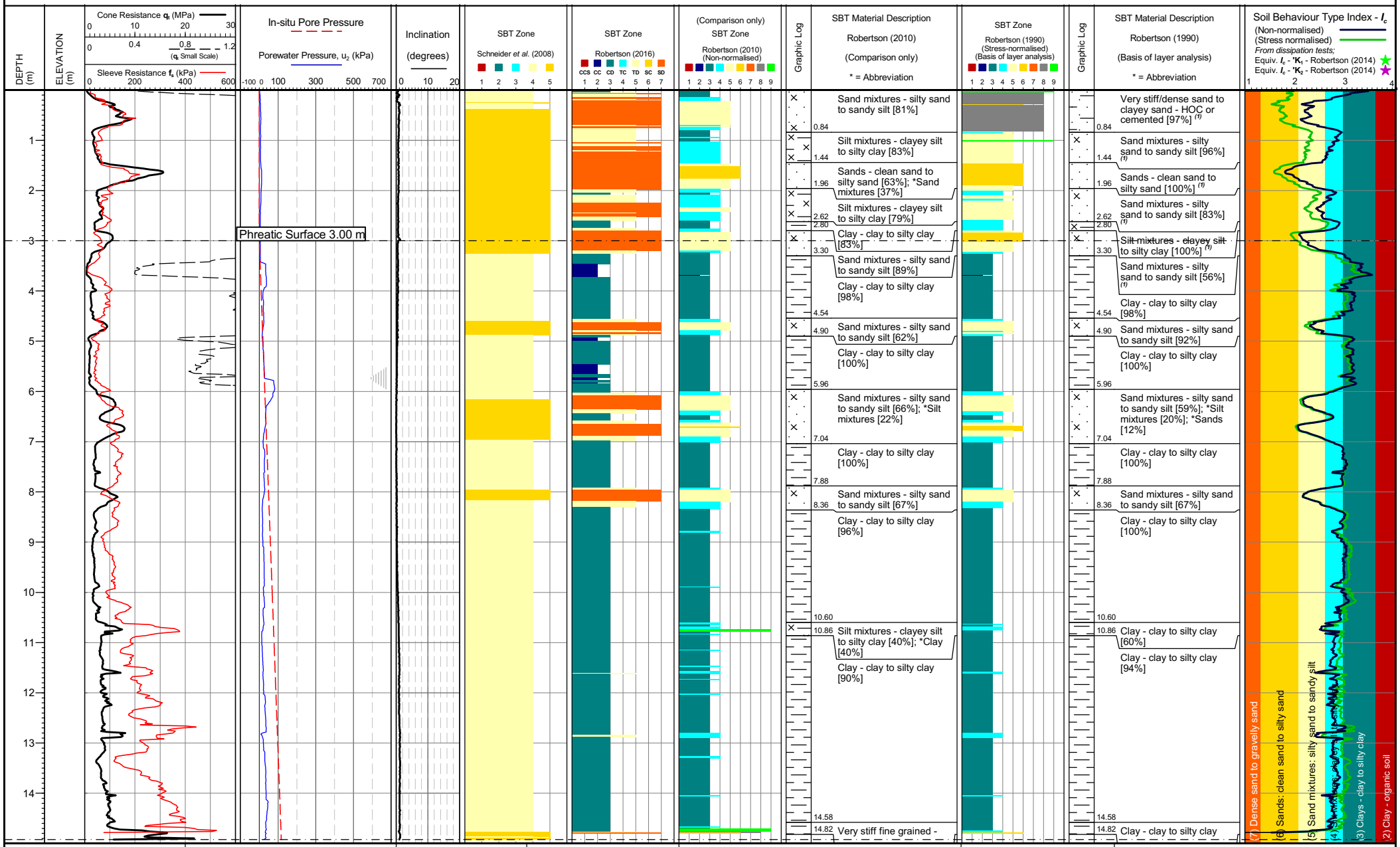
Internal QA Diss.
Dissipation Test

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 12:55:23

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435775, 546802
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

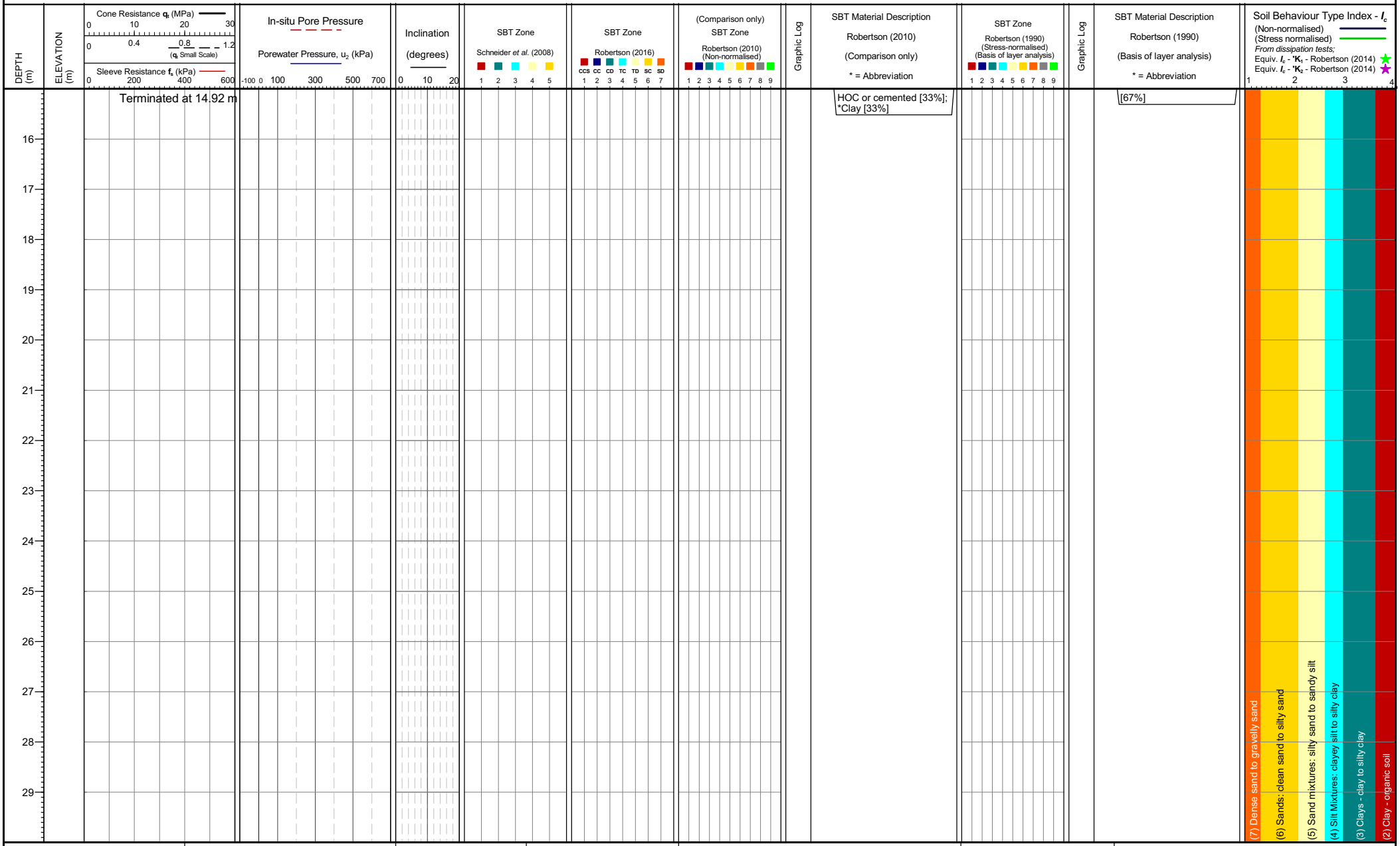
Internal QA Diss.
Dissipation Test

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 12:55:23

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435775, 546802
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

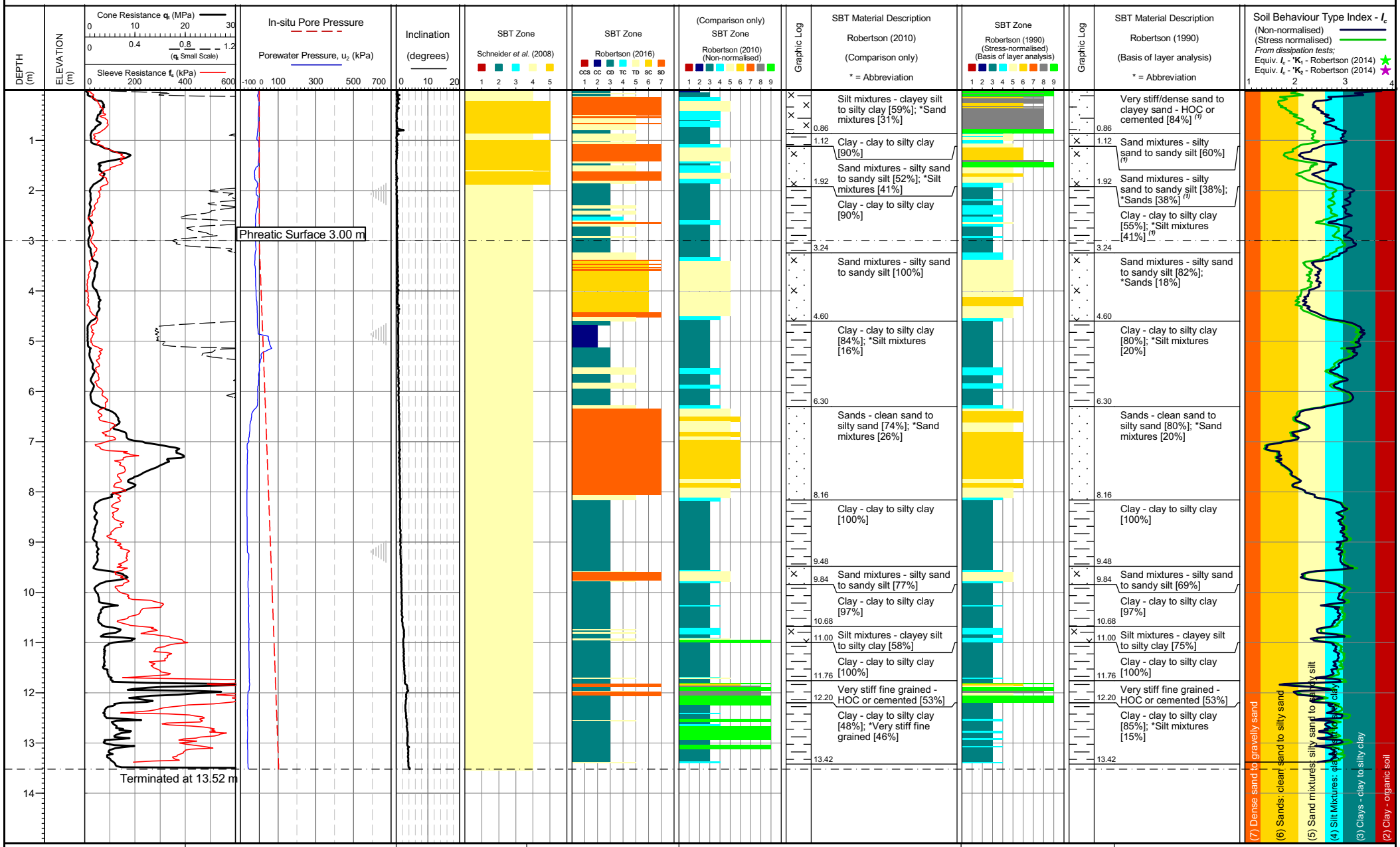
Internal QA Diss.
Dissipation Test

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 13:37:03

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435799, 546803
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

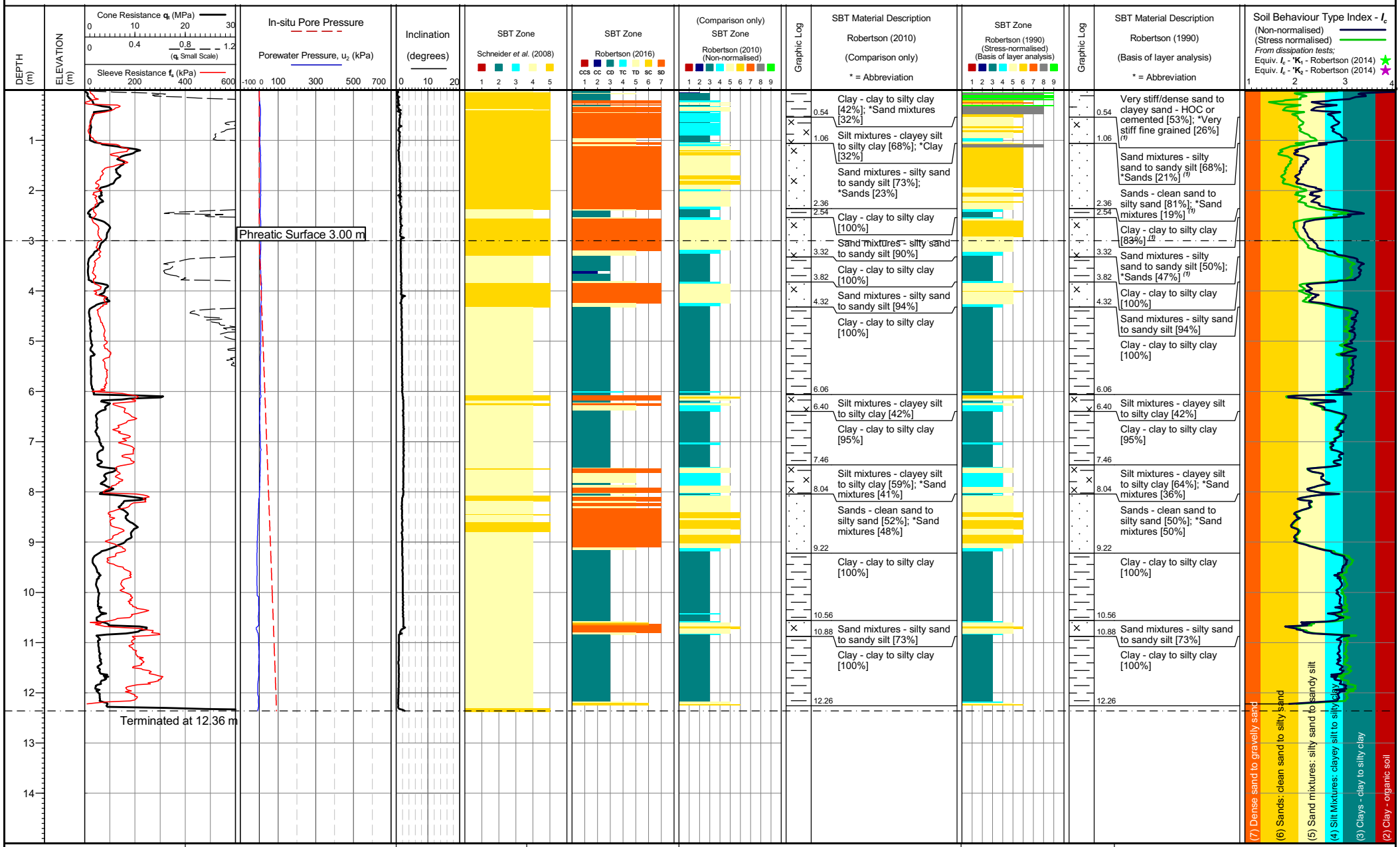
Internal QA Diss.
Dissipation Test

TEST ID: CPT08

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

Lankelma Project Ref: P-108244-1



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Location: Tyne & Wear, UK
Rig Used: UK3
Date of test: 27/01/2023 14:24:05

Remarks: *Phreatic surface origin: Arbitrary value

Coordinates: 435827, 546804
Elevation:

Schneider *et al.* (2008) Material Type
1 - (1c) Sensitive clays
2 - (1b) Clays
3 - (1a) Silts & low I, clays
4 - (3) Transitional soils
5 - (2) Essentially drained sands

Robertson (2016) Material Type
1 - **CCS** - Clay-like - Contractive - Sensitive
2 - **CC** - Clay-like - Contractive
3 - **CD** - Clay-like - Dilative
4 - **TC** - Transitional - Contractive
5 - **TD** - Transitional - Dilative
6 - **SC** - Sand-like - Contractive
7 - **SD** - Sand-like - Dilative

Robertson (1990 & 2010) Material Type
1 - Sensitive fine-grained
2 - Organic soils
3 - Clays - clay to silty clay
4 - Silt mixtures - clayey silt to silty clay
5 - Sand mixtures - silty sand to sandy silt
6 - Sands - clean sand to silty sand
7 - Gravelly sand to sand
8 - Very stiff/dense sand to clayey sand
9 - Very stiff fine grained

(1) 0-3 m: Normalised SBT often artificially coarse/stiff at very low in-situ stresses

Internal QA Diss.
Dissipation Test

TEST ID: CPT09

APPENDIX E PARAMETER RESULTS 1 – S_U, M_V, OCR, SBT, I_C

Undrained shear strength

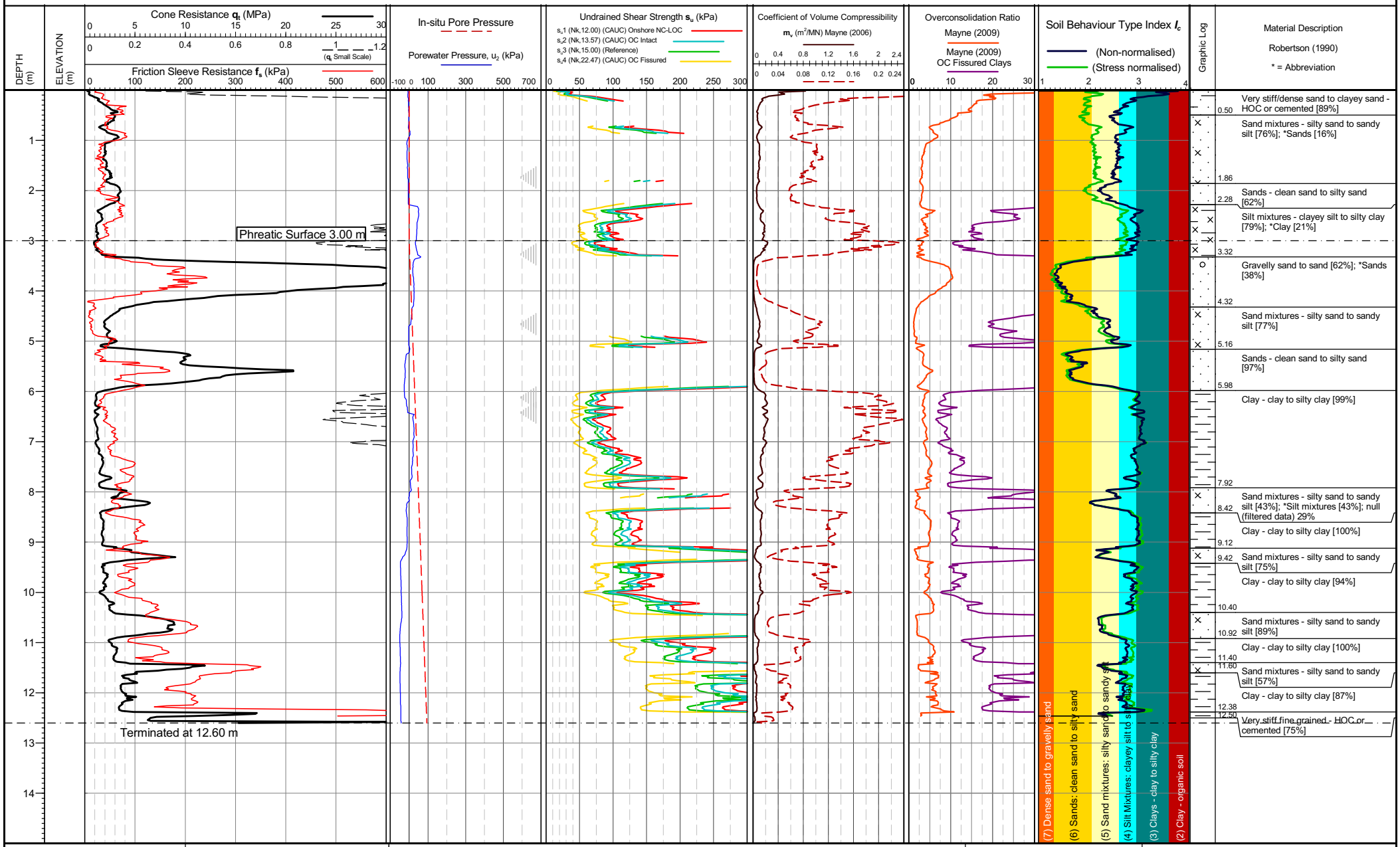
Coefficient of volume change

Overconsolidation ratio

Robertson 1990 SBT descriptions & SBT index I_c

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 08:08:43

Location: Tyne & Wear, UK
Coordinates: 435774, 546829
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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.

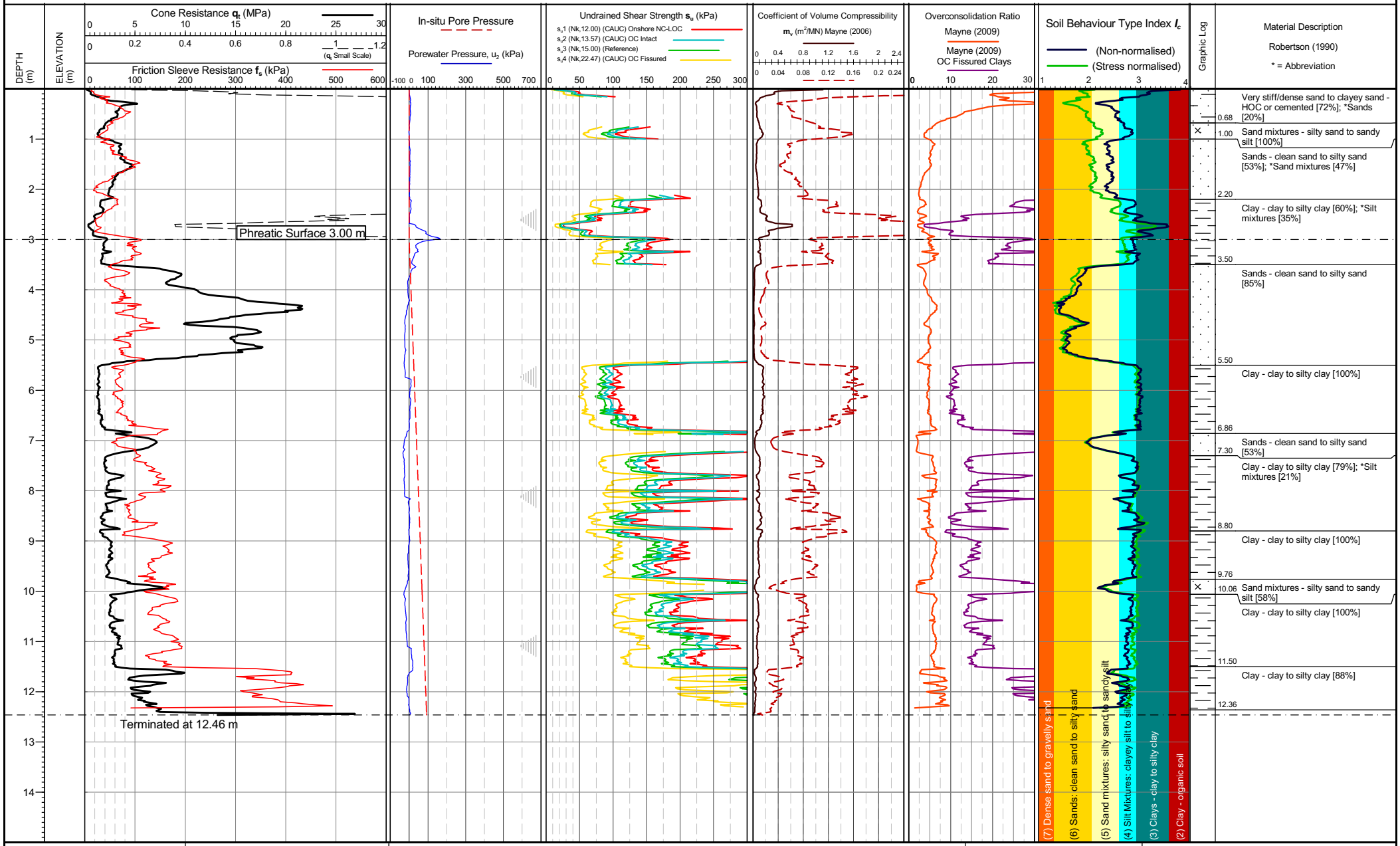
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT01

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 09:02:03

Location: Tyne & Wear, UK
Coordinates: 435801, 546827
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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.

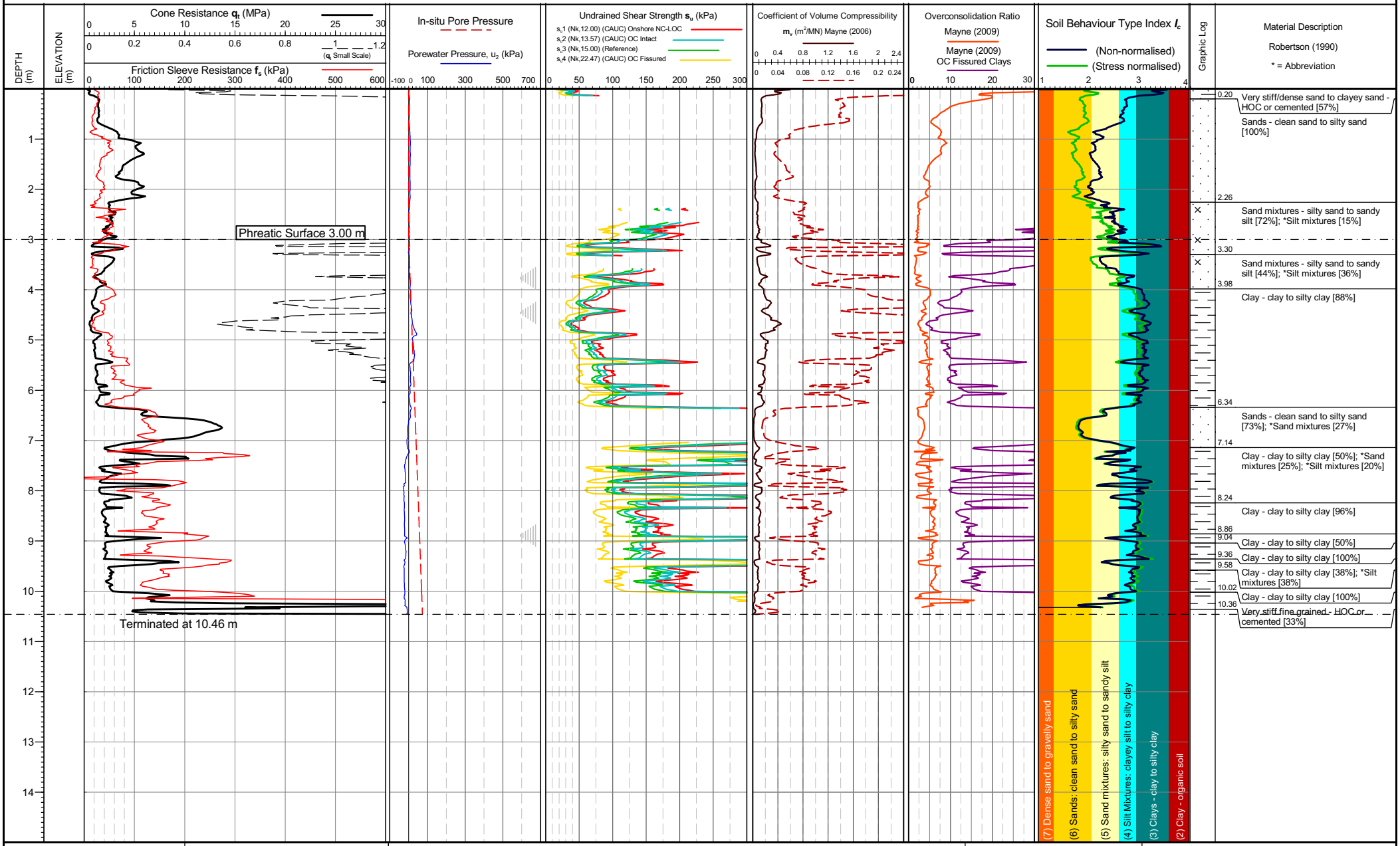
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT02

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 09:52:17

Location: Tyne & Wear, UK
Coordinates: 435827, 546827
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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: 31-01-23

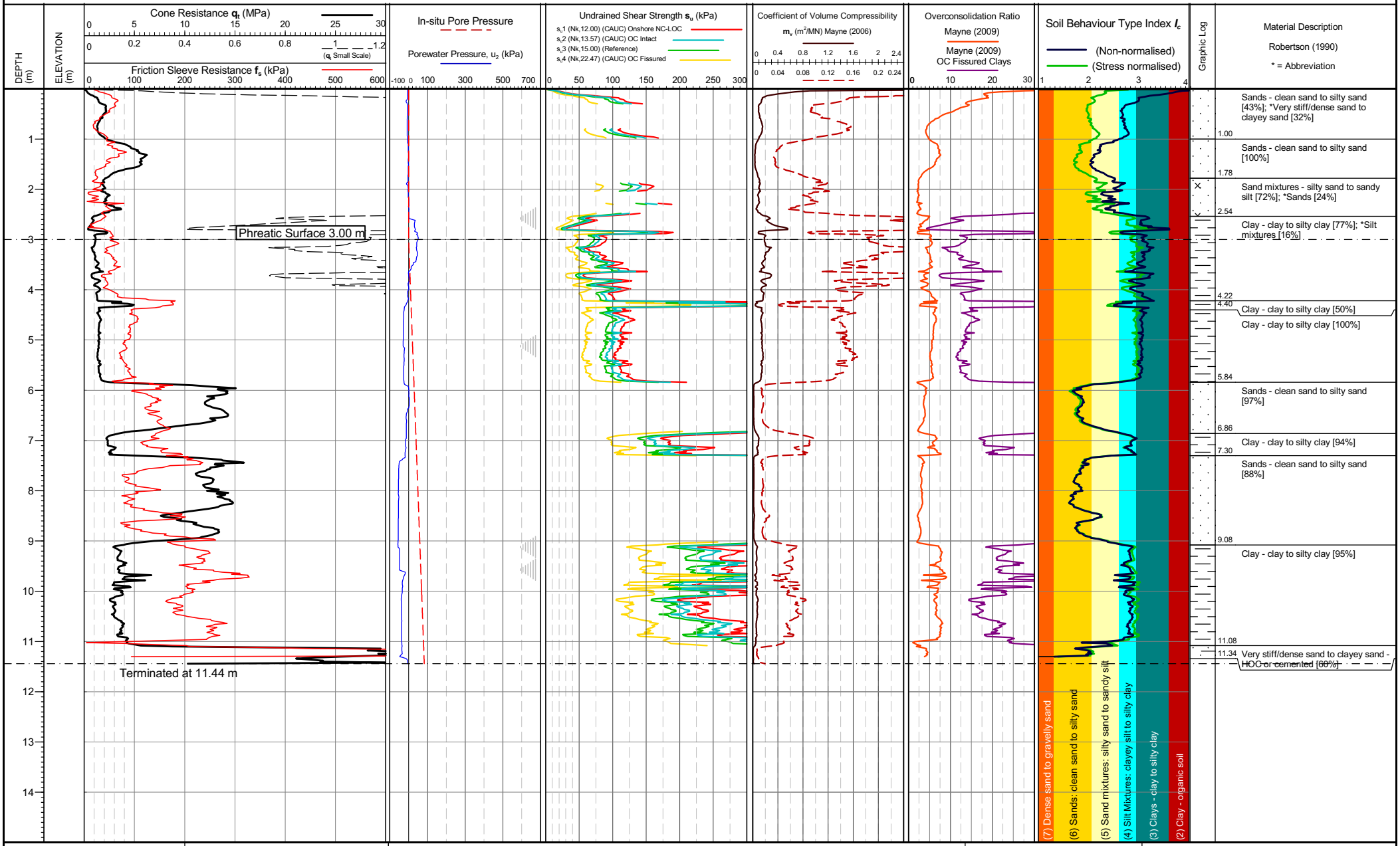
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT03

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 10:36:13

Location: Tyne & Wear, UK
Coordinates: 435827, 546815
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Inclination

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: 31-01-23

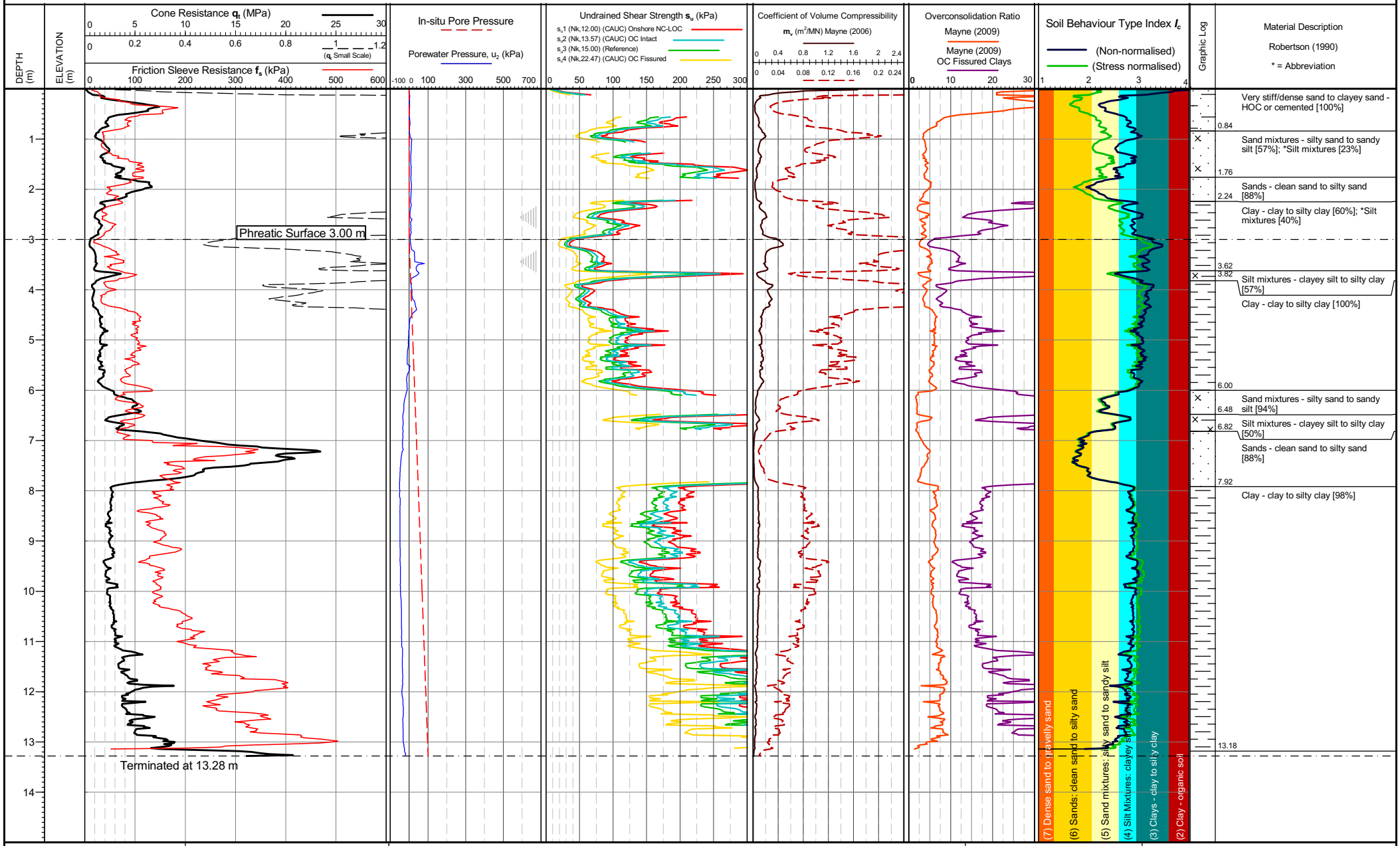
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT04

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 11:17:54

Location: Tyne & Wear, UK
Coordinates: 435800, 546815
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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.

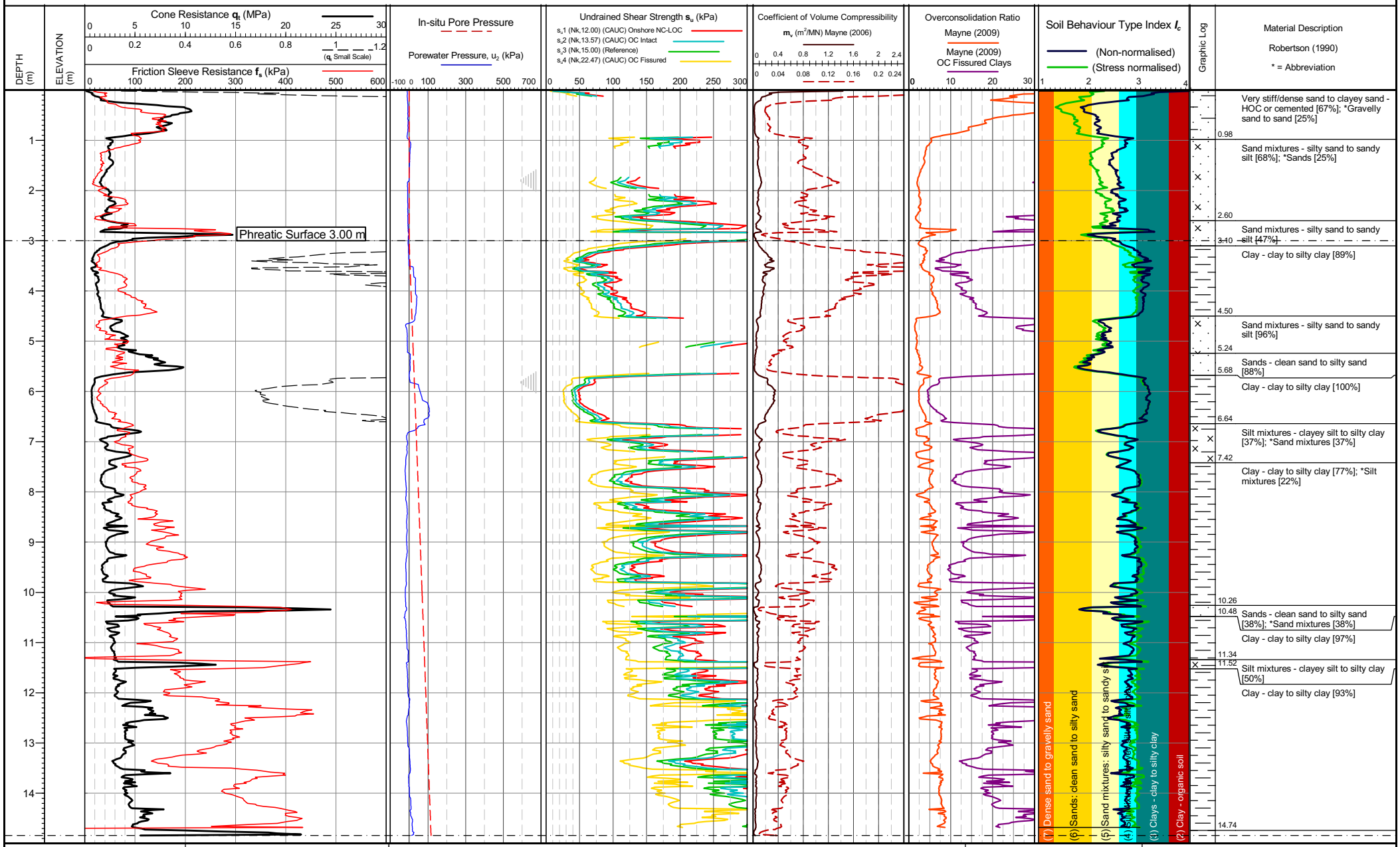
Date of plot: 31-01-23
Lankelma Project Ref: P-108244-1

Checked by:
Chris Player

TEST ID: CPT05

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 12:10:26

Location: Tyne & Wear, UK
Coordinates: 435775, 546815
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Inclination

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.

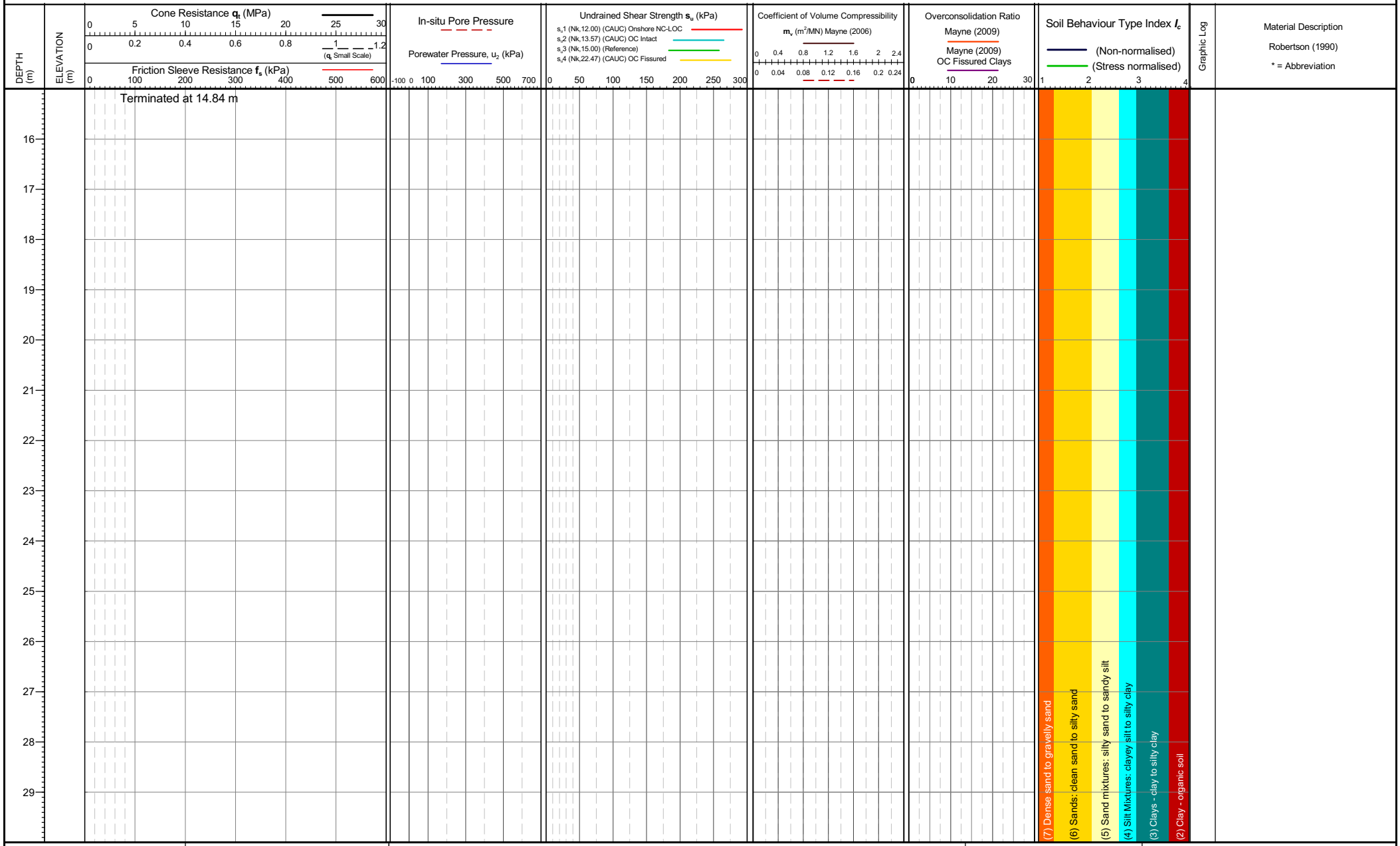
Date of plot: 31-01-23
Lankelma Project Ref: P-108244-1

Checked by:
Chris Player

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 12:10:26

Location: Tyne & Wear, UK
Coordinates: 435775, 546815
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Inclination

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.

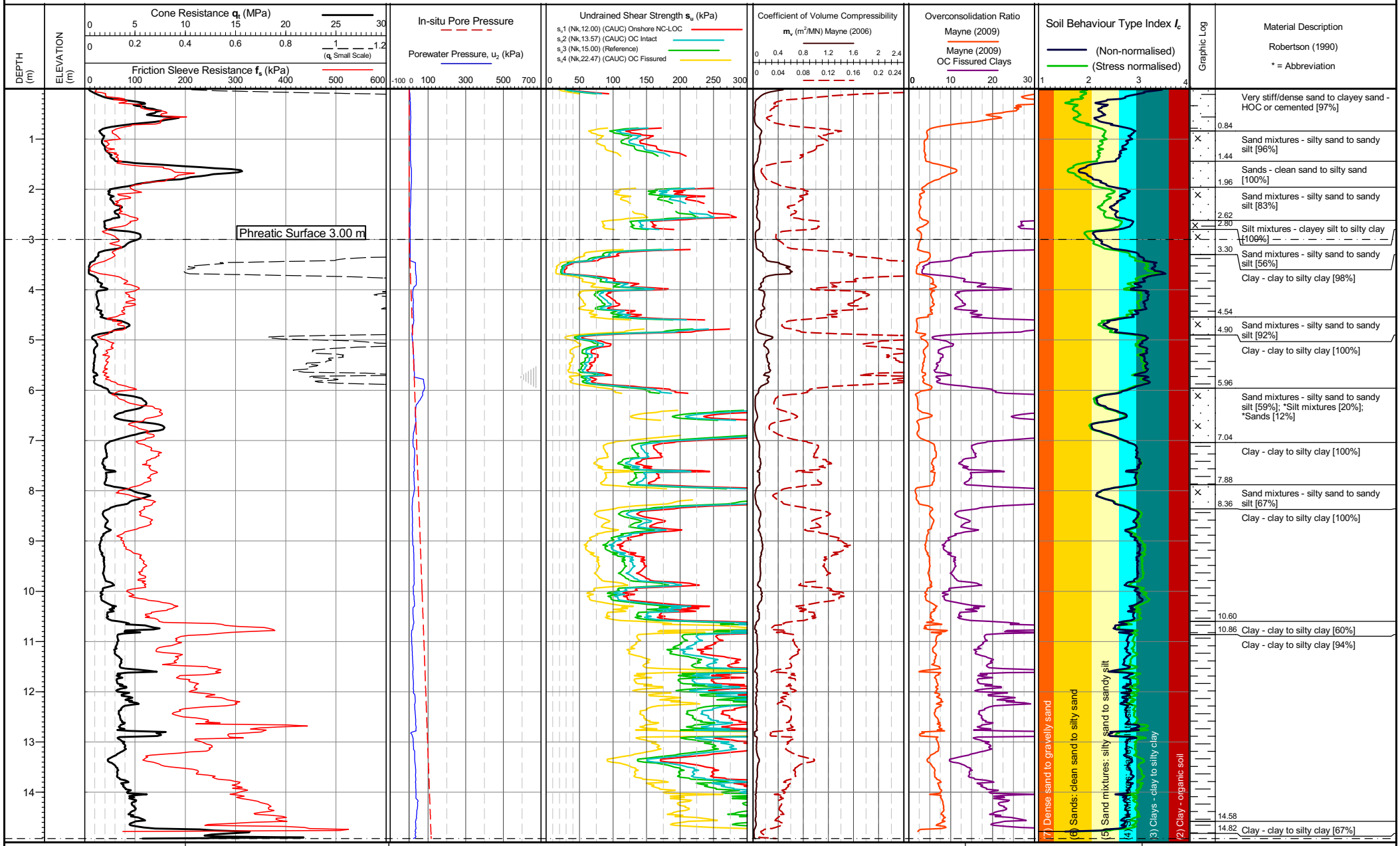
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 12:55:23

Location: Tyne & Wear, UK
Coordinates: 435775, 546802
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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.

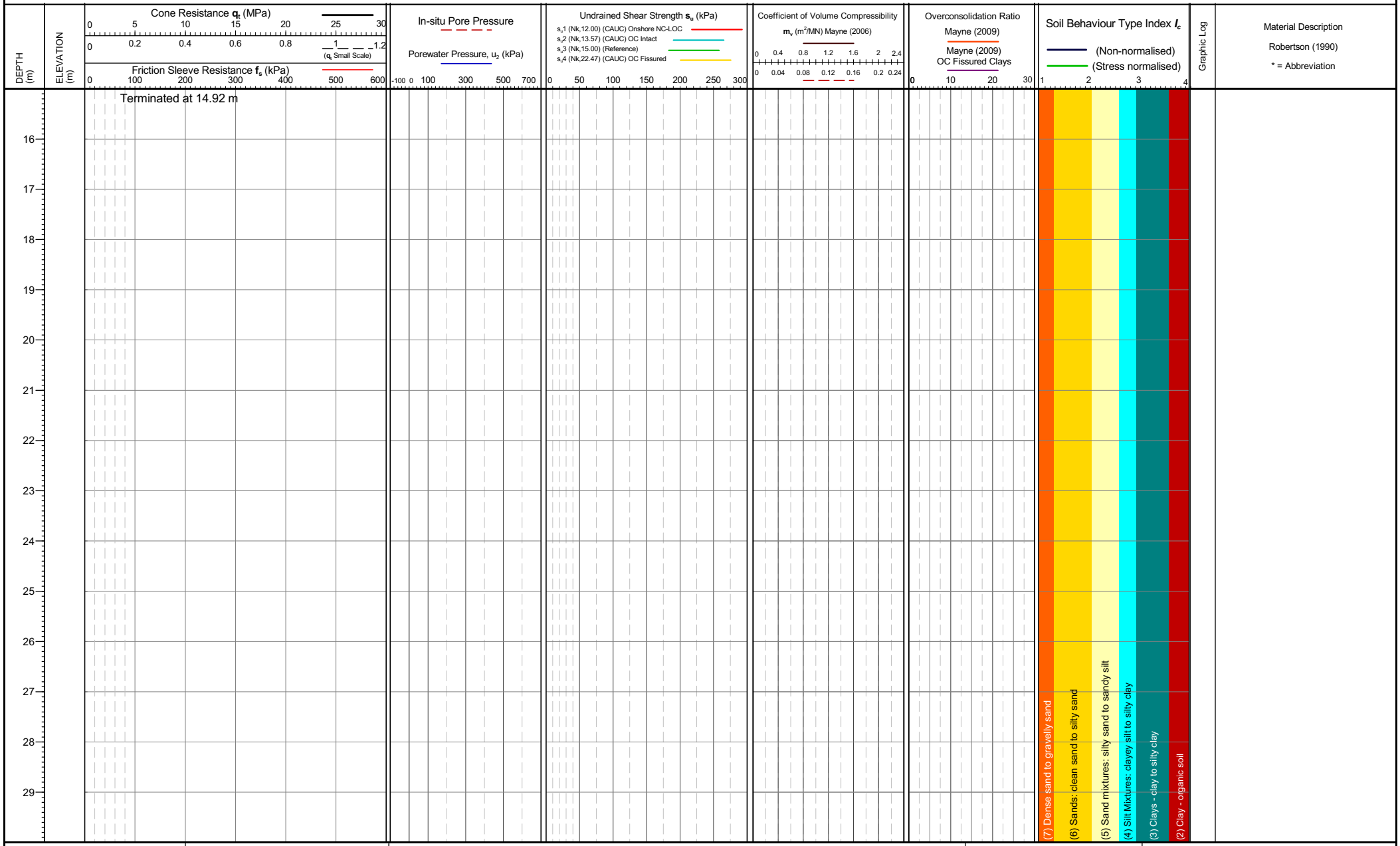
Date of plot: 31-01-23
Lankelma Project Ref: P-108244-1

Checked by:
Chris Player

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 12:55:23

Location: Tyne & Wear, UK
Coordinates: 435775, 546802
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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.

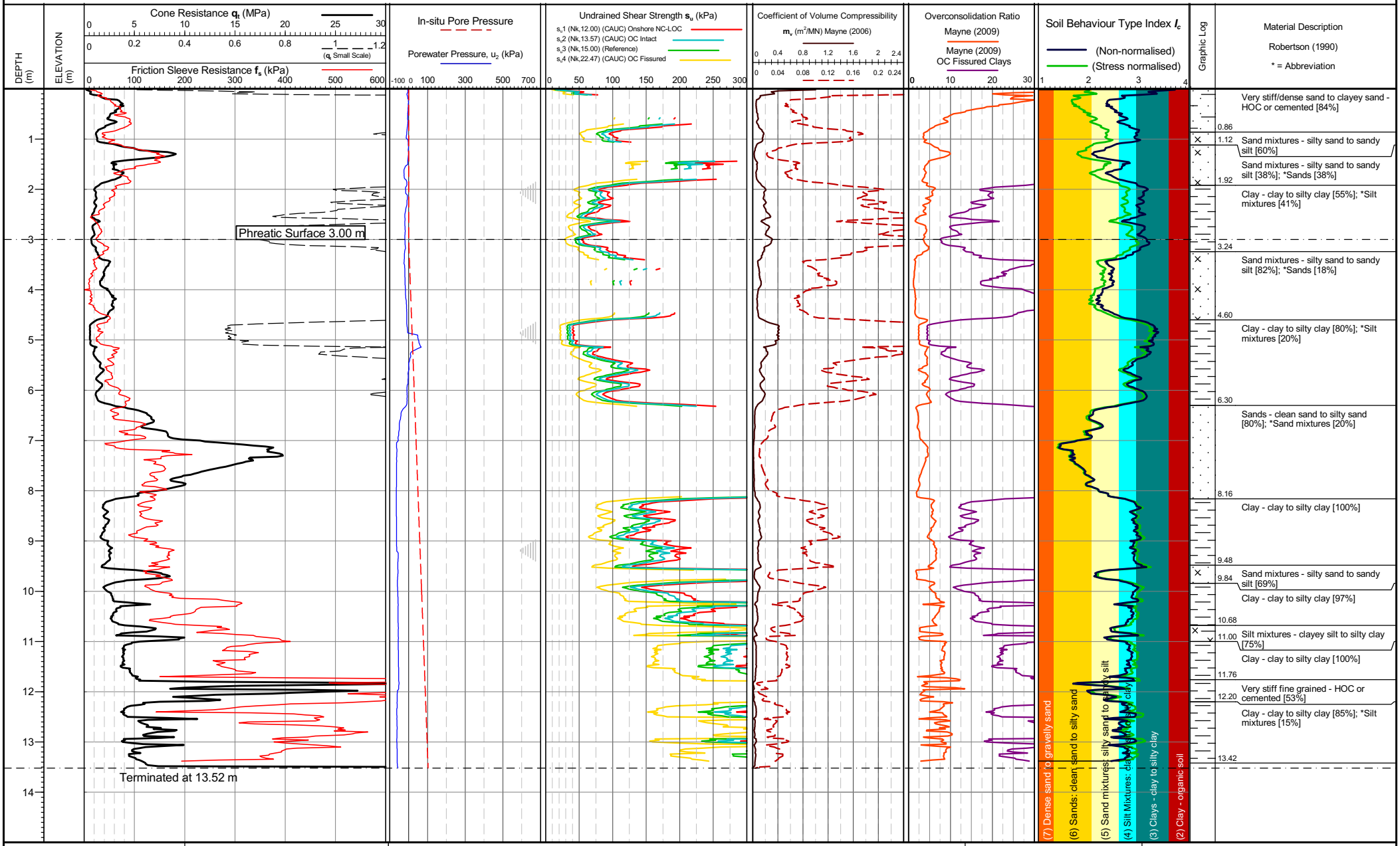
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 13:37:03

Location: Tyne & Wear, UK
Coordinates: 435799, 546803
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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: 31-01-23

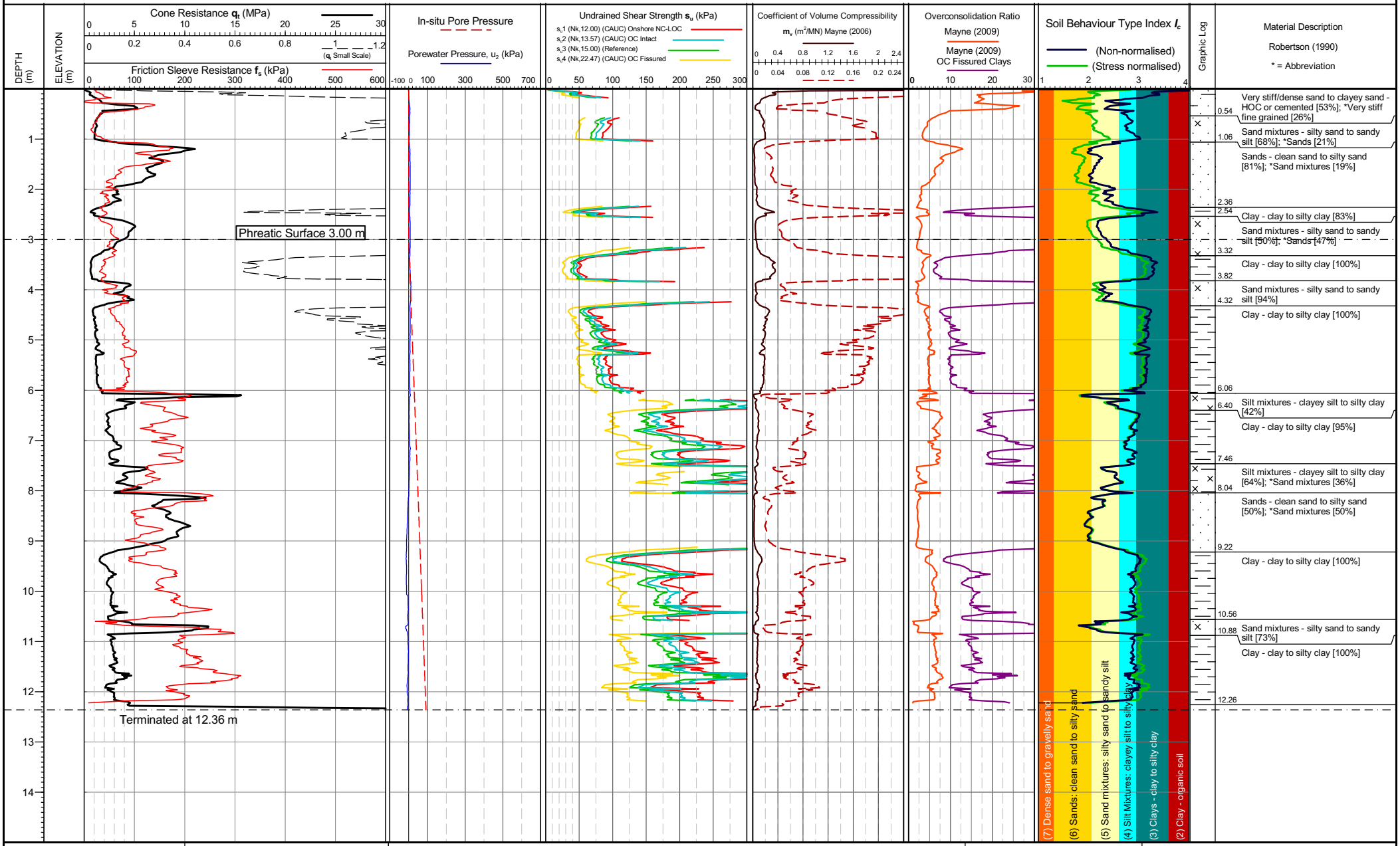
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT08

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
ConeID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 14:24:05

Location: Tyne & Wear, UK
Coordinates: 435827, 546804
Elevation:
Coordinate system:

Remarks: *Phreatic surface origin: Arbitrary value

Termination Remark:
Total cone 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: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT09

APPENDIX F PARAMETER RESULTS 2 – SPT N60, PHI, D_R, E, I_C

Equivalent SPT N60

Peak friction angle

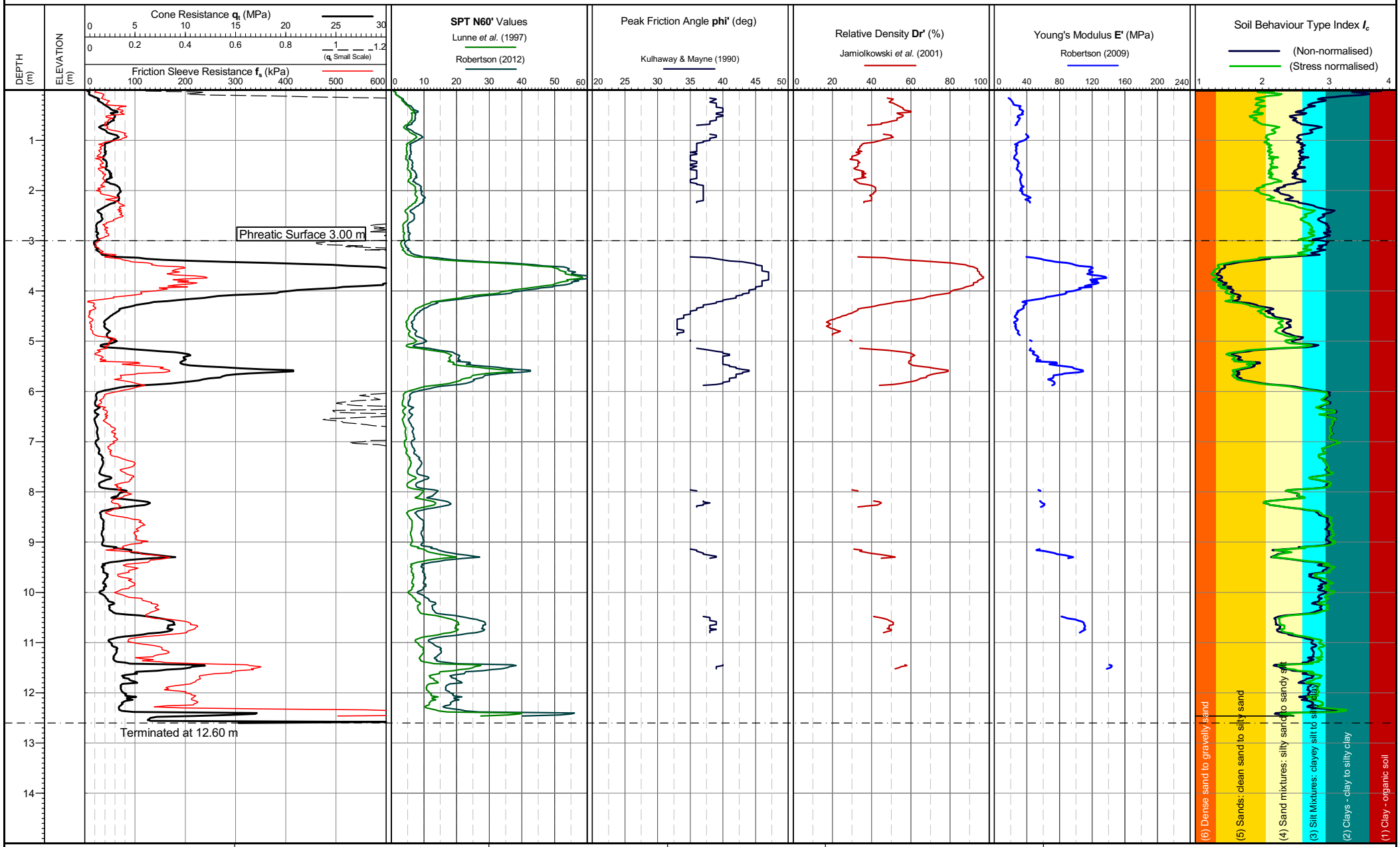
Relative density

Young's modulus

SBT index I_c

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 08:08:43

Location: Tyne & Wear, UK
Coordinates: 435774, 546829
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.

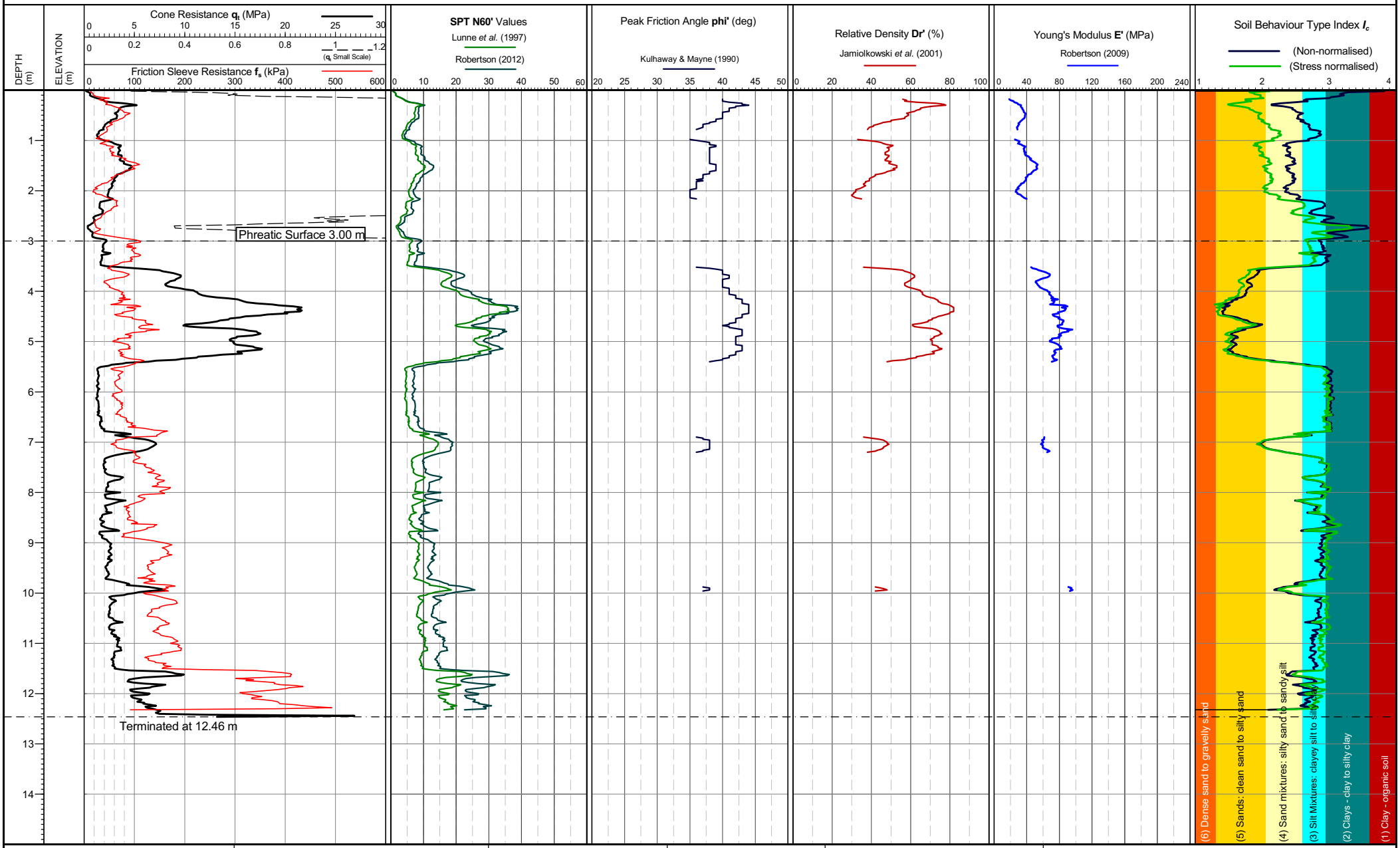
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT01

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 09:02:03

Location: Tyne & Wear, UK
Coordinates: 435801, 546827
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.

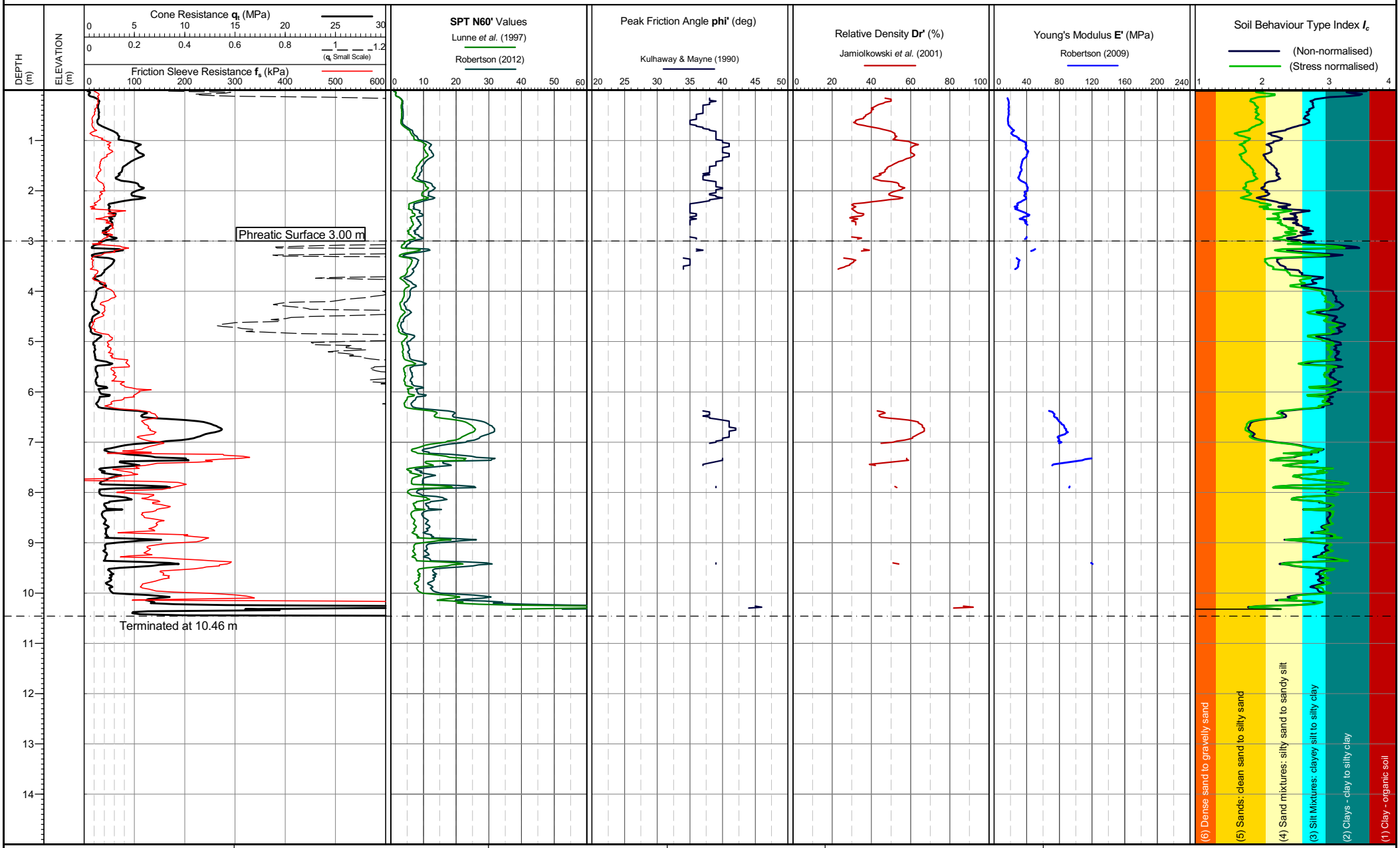
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT02

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 09:52:17

Location: Tyne & Wear, UK
Coordinates: 435827, 546827
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.

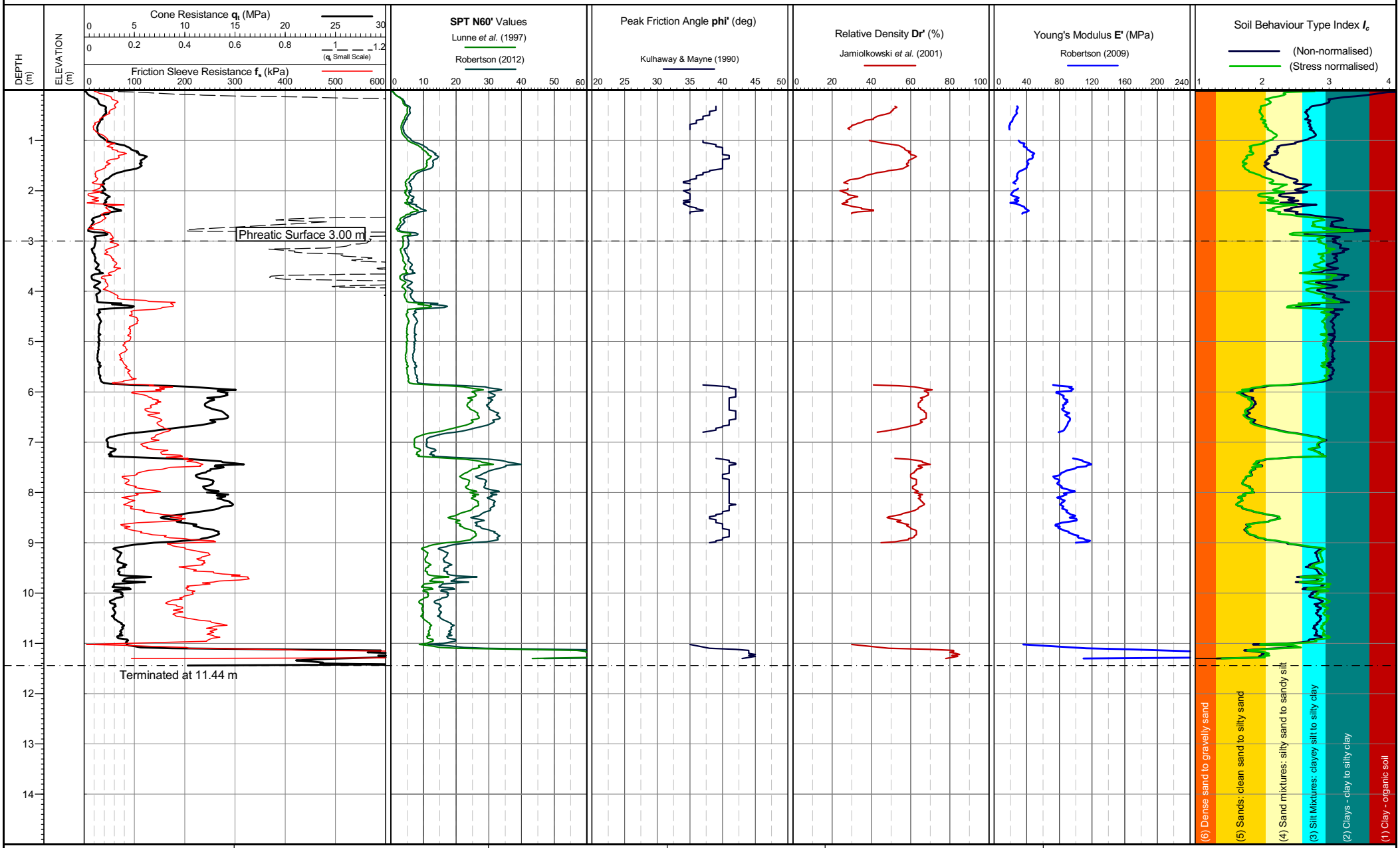
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT03

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 10:36:13

Location: Tyne & Wear, UK
Coordinates: 435827, 546815
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.

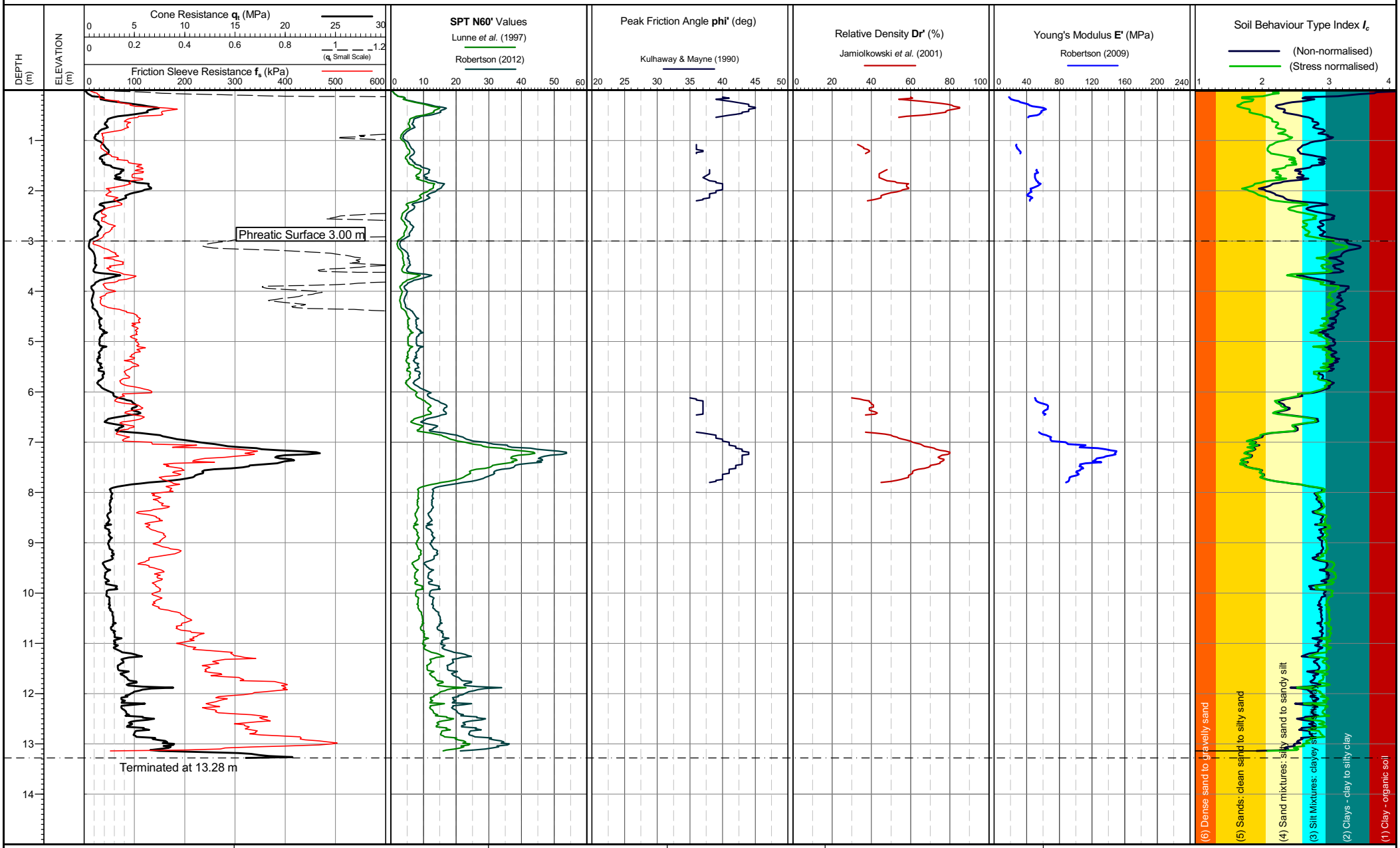
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT04

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 11:17:54

Location: Tyne & Wear, UK
Coordinates: 435800, 546815
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.

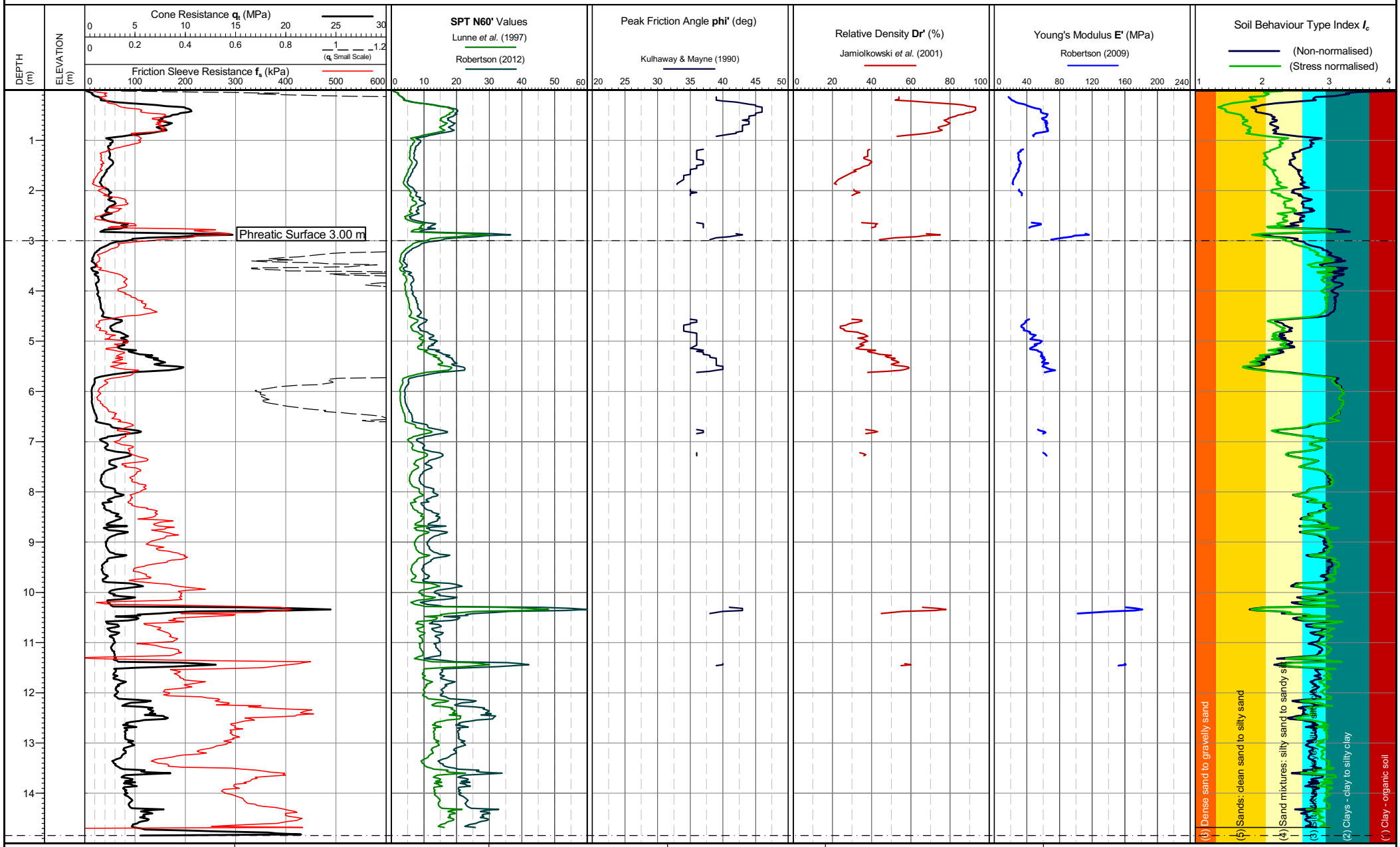
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT05

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 12:10:26

Location: Tyne & Wear, UK
Coordinates: 435775, 546815
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.

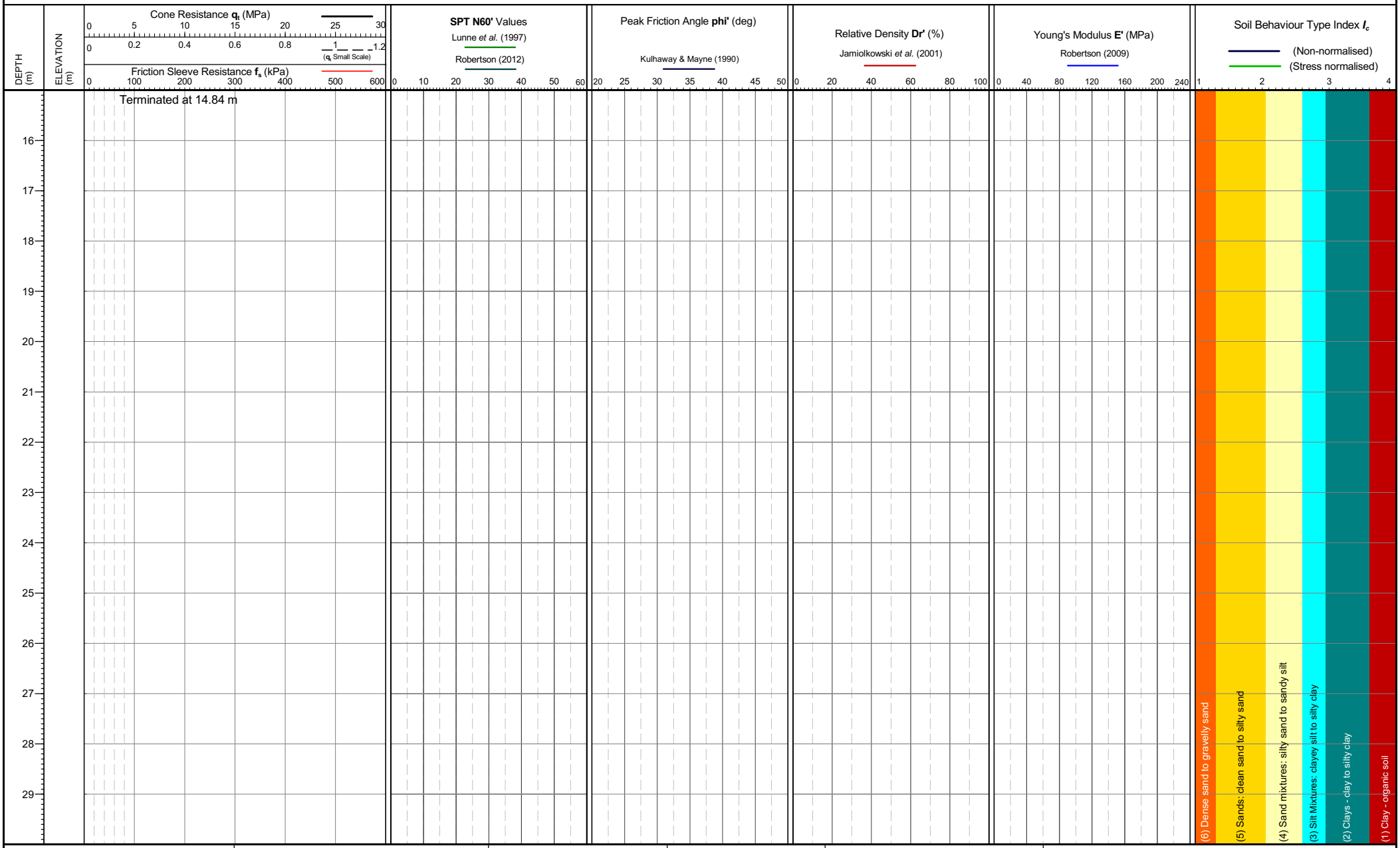
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 12:10:26

Location: Tyne & Wear, UK
Coordinates: 435775, 546815
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.

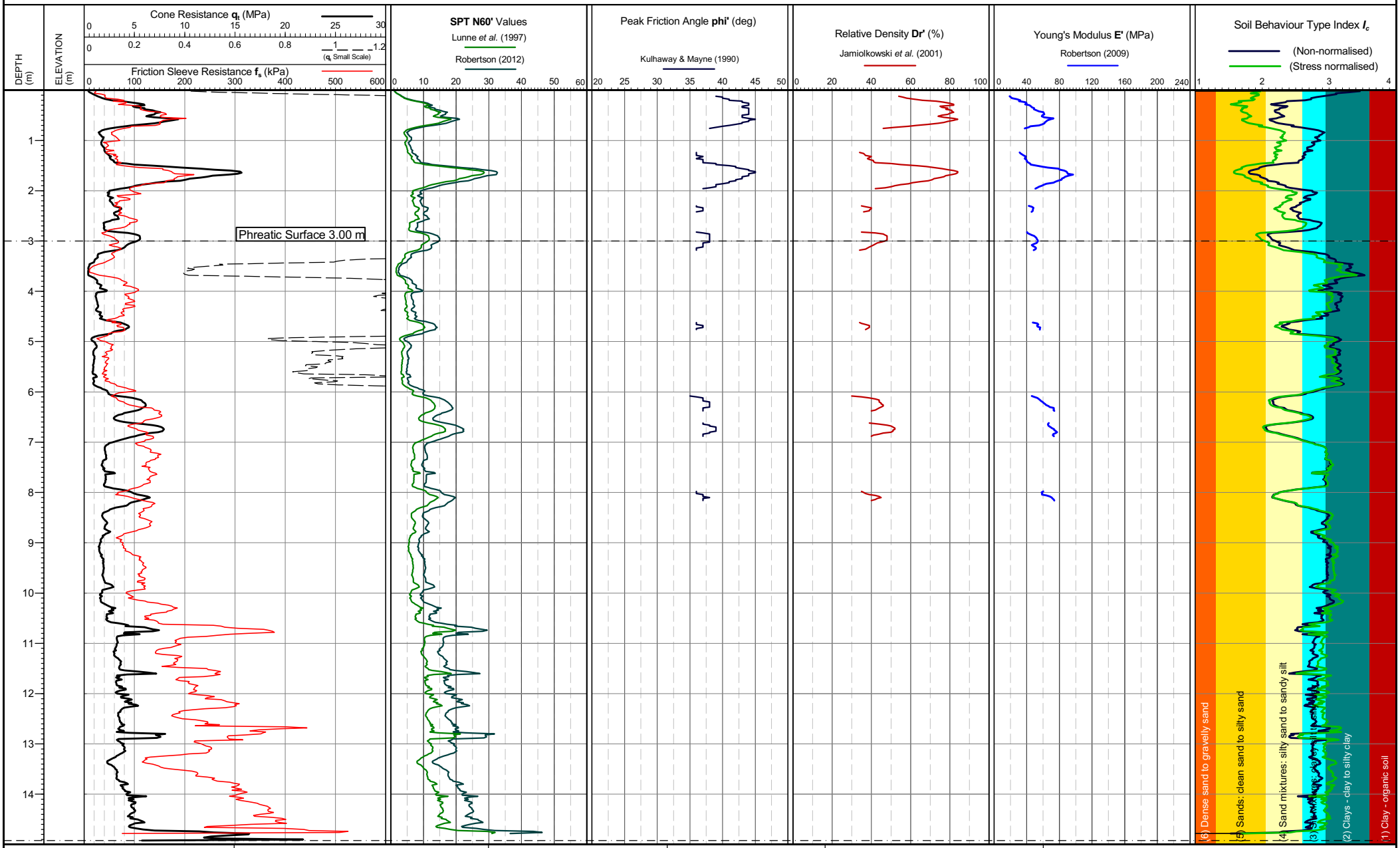
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 12:55:23

Location: Tyne & Wear, UK
Coordinates: 435775, 546802
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.

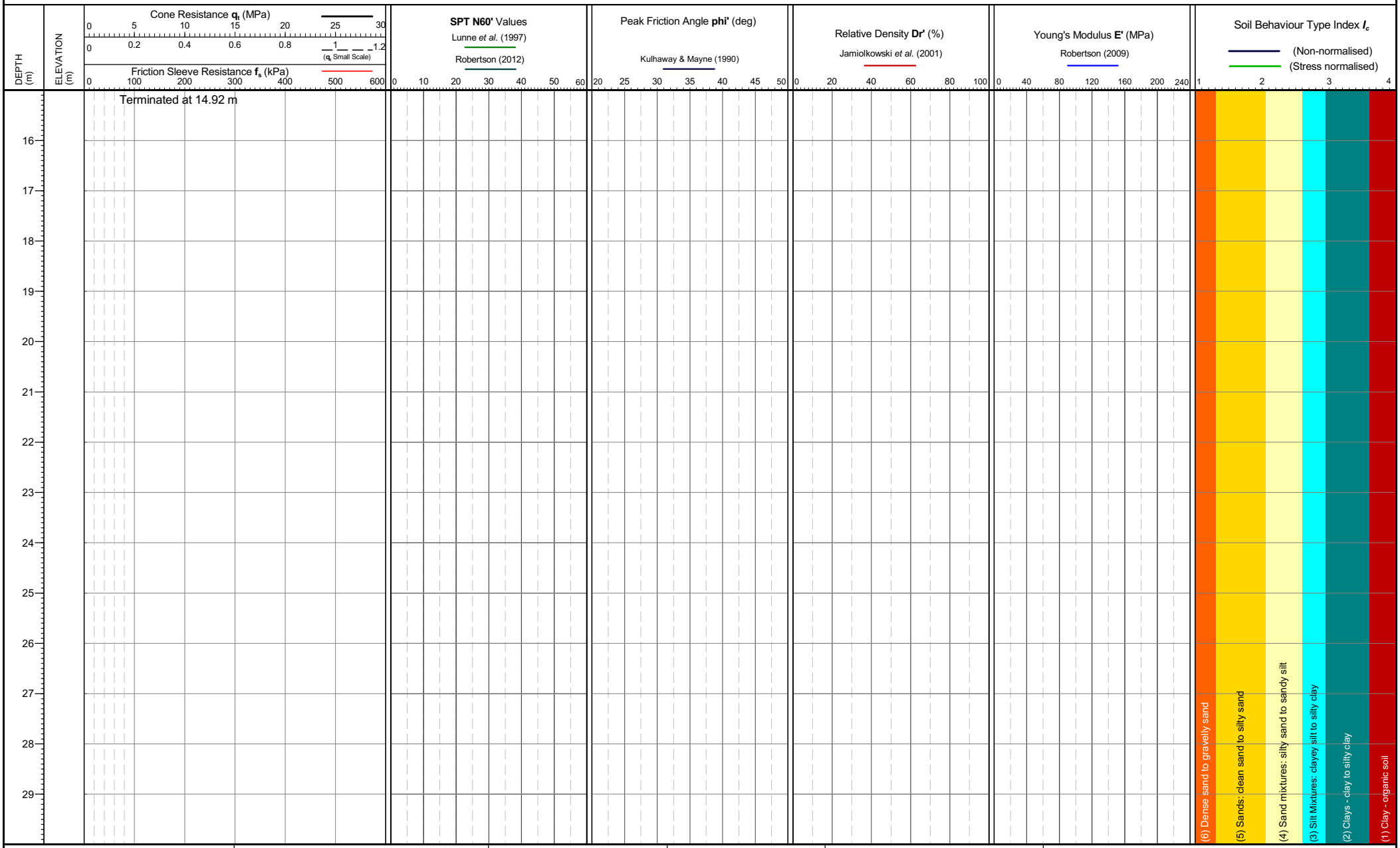
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 12:55:23

Location: Tyne & Wear, UK
Coordinates: 435775, 546802
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.

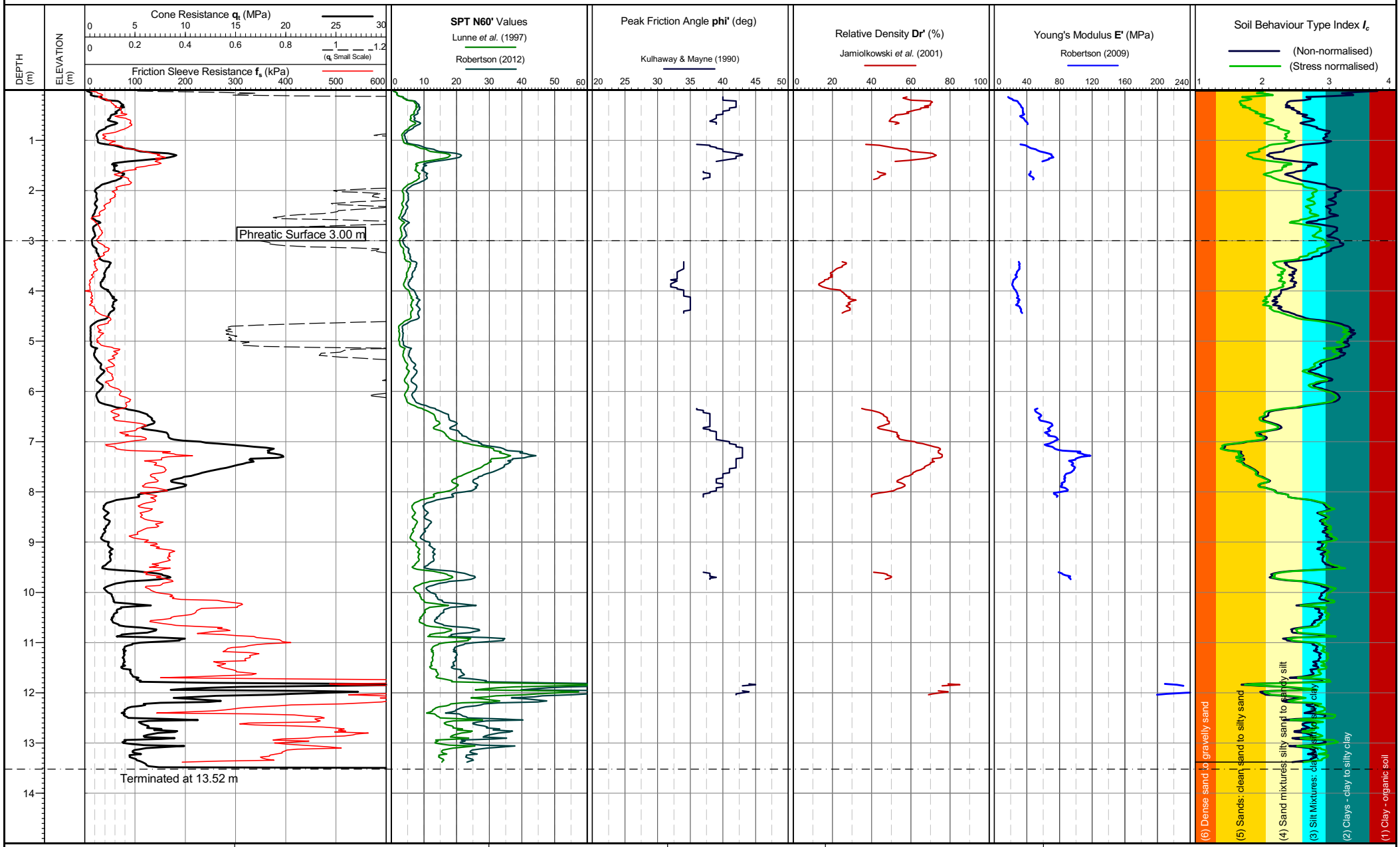
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 13:37:03

Location: Tyne & Wear, UK
Coordinates: 435799, 546803
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.

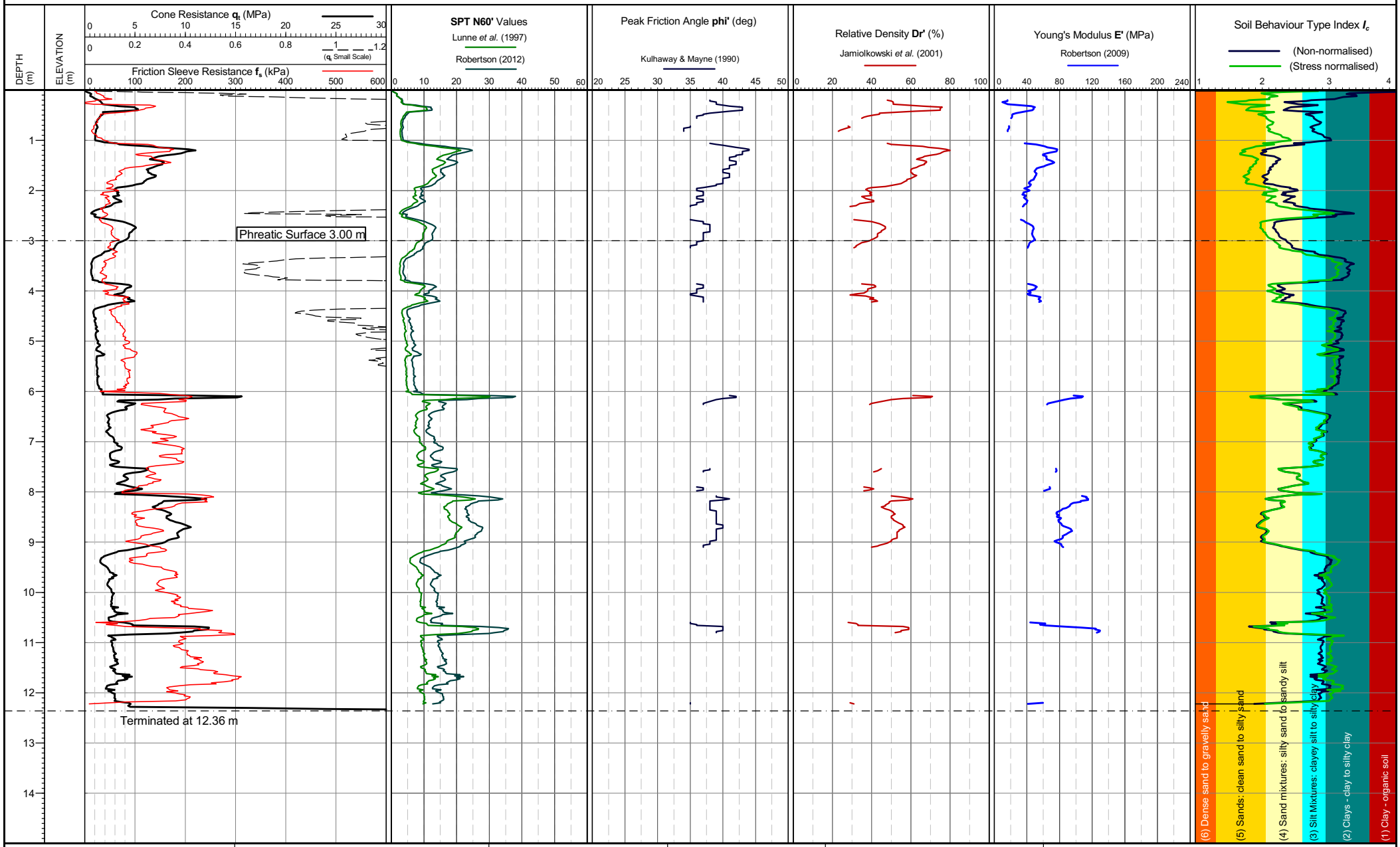
Date of plot: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT08

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Date of test: 27/01/2023 14:24:05

Location: Tyne & Wear, UK
Coordinates: 435827, 546804
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: 31-01-23
Checked by: Chris Player

Lankelma Project Ref: P-108244-1

TEST ID: CPT09

APPENDIX G PENETROMETER TEMPERATURE RESULTS

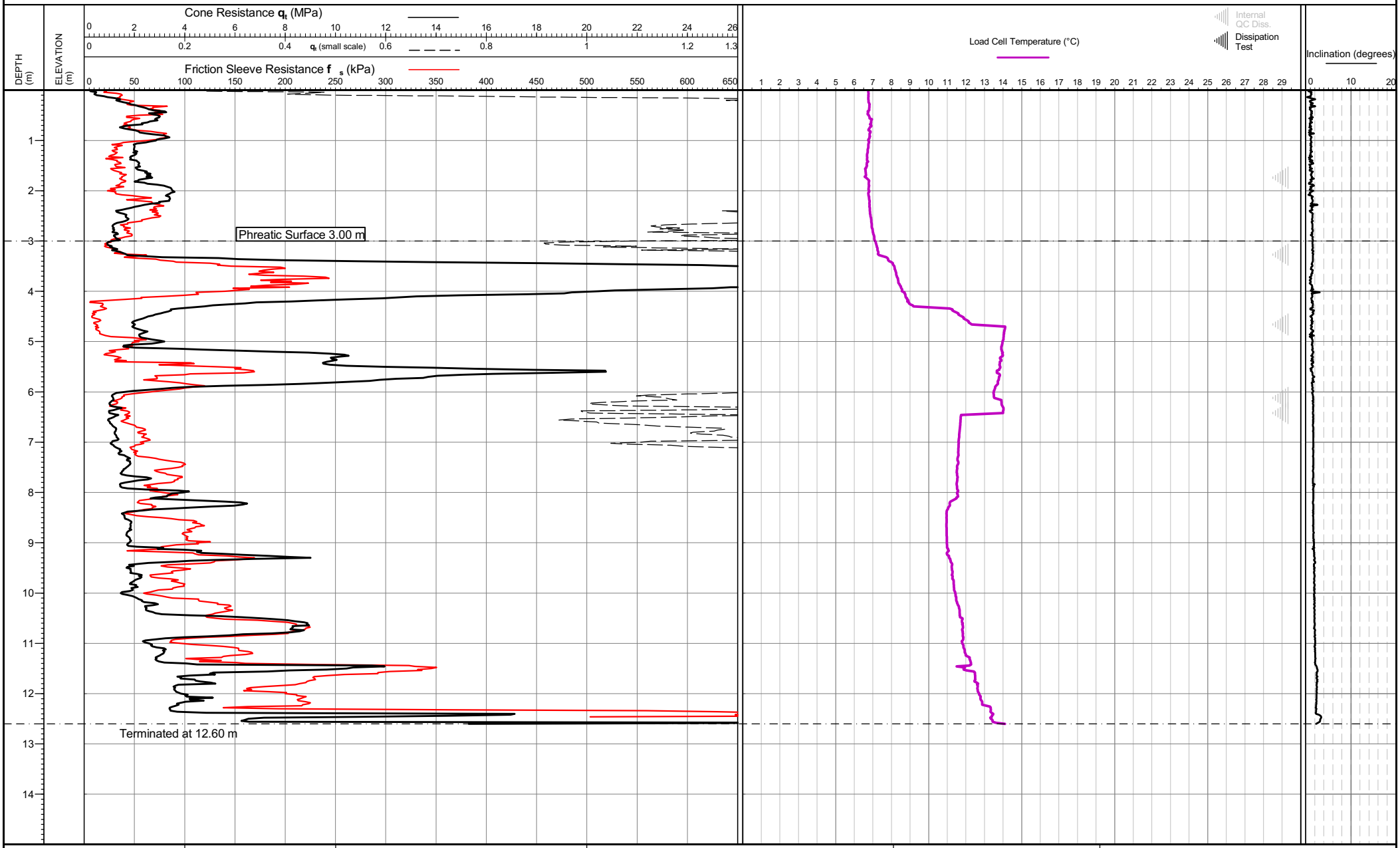
The temperature values in these logs represent the internal load cell temperature of the penetrometer and are used for QC purposes by comparison to the measured temperature response indicated on the calibration certificate. The CPT results have been corrected for transient and static temperature effects during post processing.

Ground temperature is only represented following a penetration pause of > 11 minutes.

Plots are provided for locations performed with a digital penetrometer measuring internal load cell temperature.

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

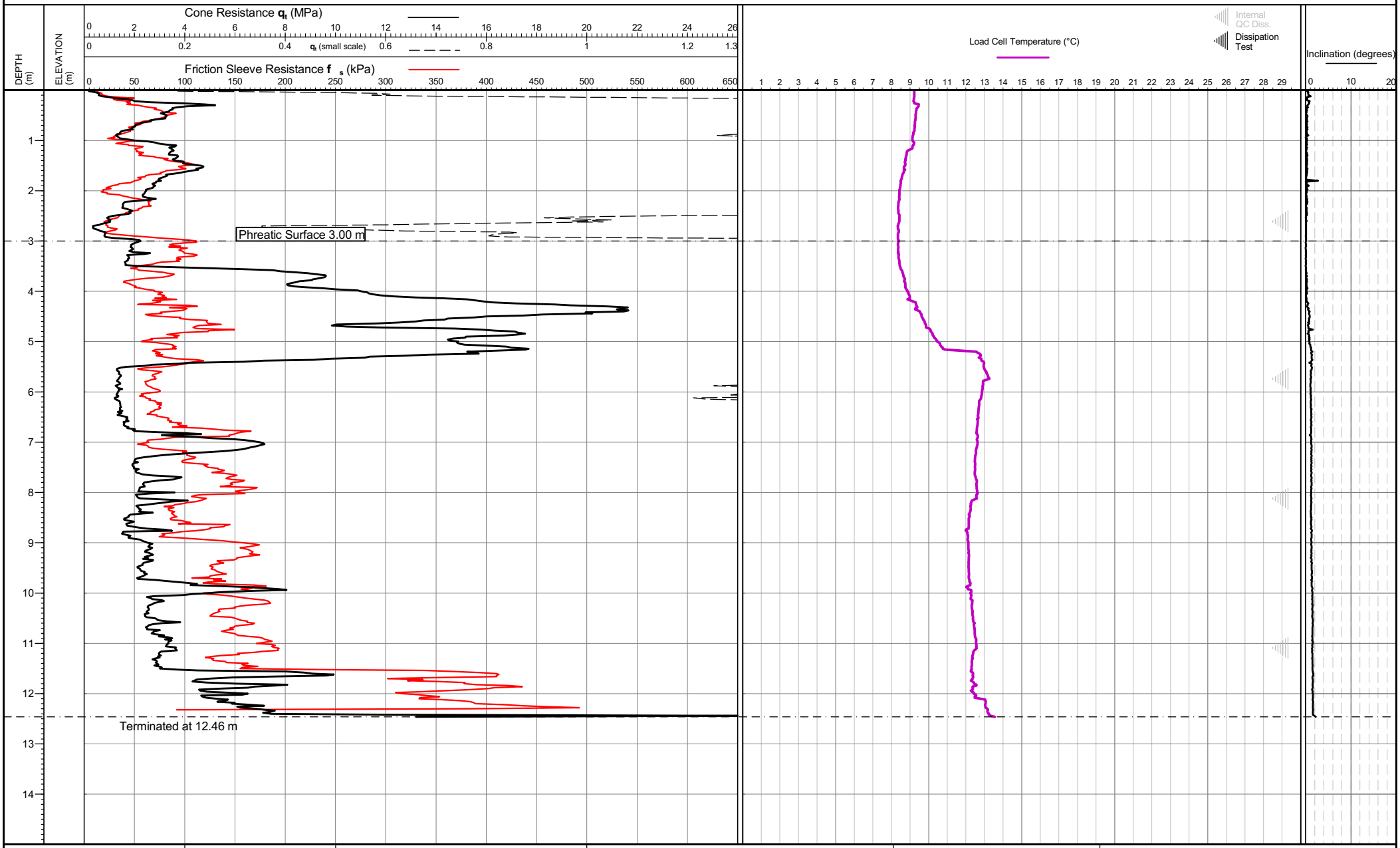


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 08:08:43	Zero drift (Pre/post test) q_c (kPa): -82.4 f_s (kPa): 0.3 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -7.5	Location: Tyne & Wear, UK Coordinates: 435774, 546829 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT01

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

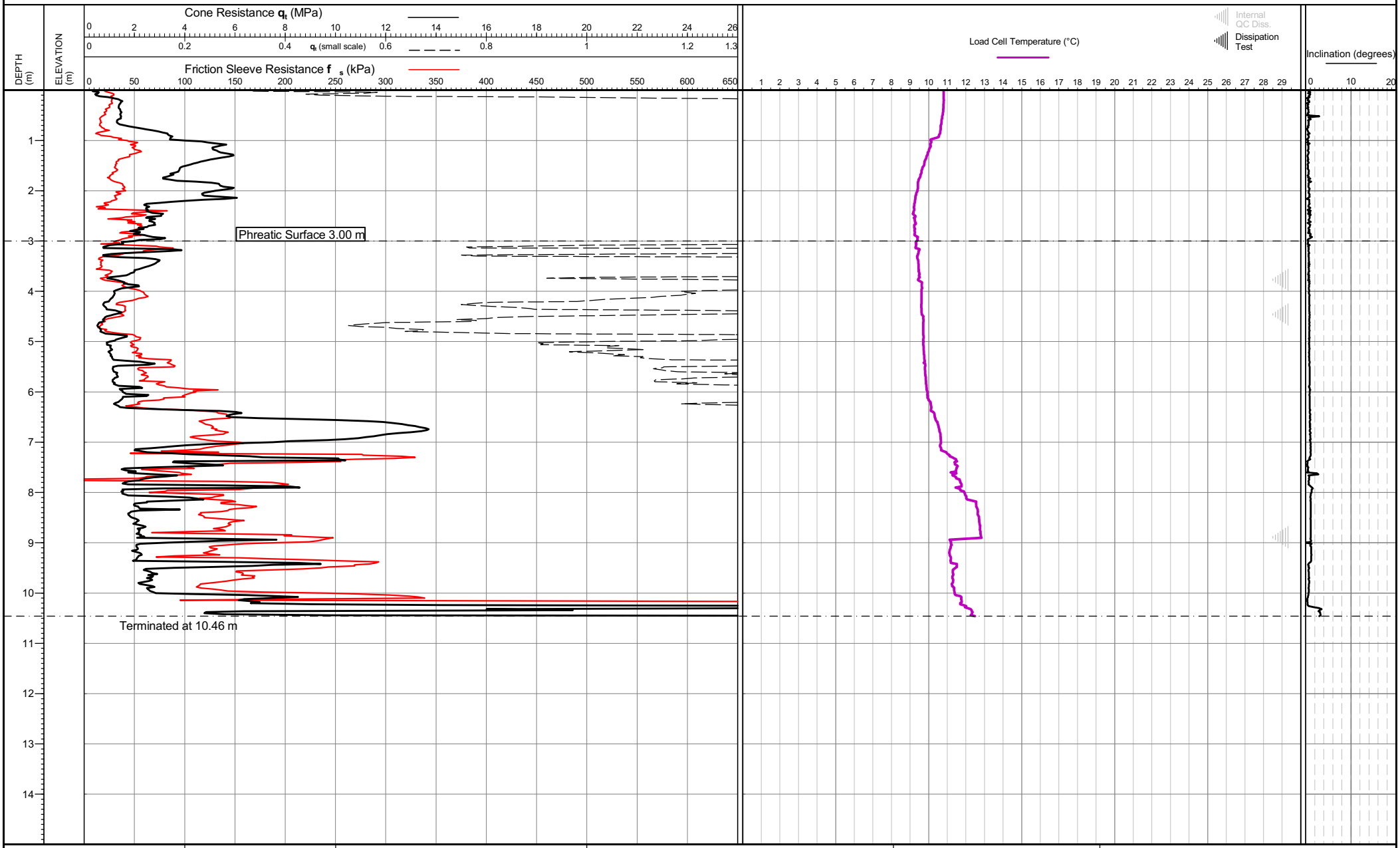


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 09:02:03	Zero drift (Pre/post test) q_c (kPa): -29.8 f_s (kPa): 1.6 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -9.1	Location: Tyne & Wear, UK Coordinates: 435801, 546827 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT02

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

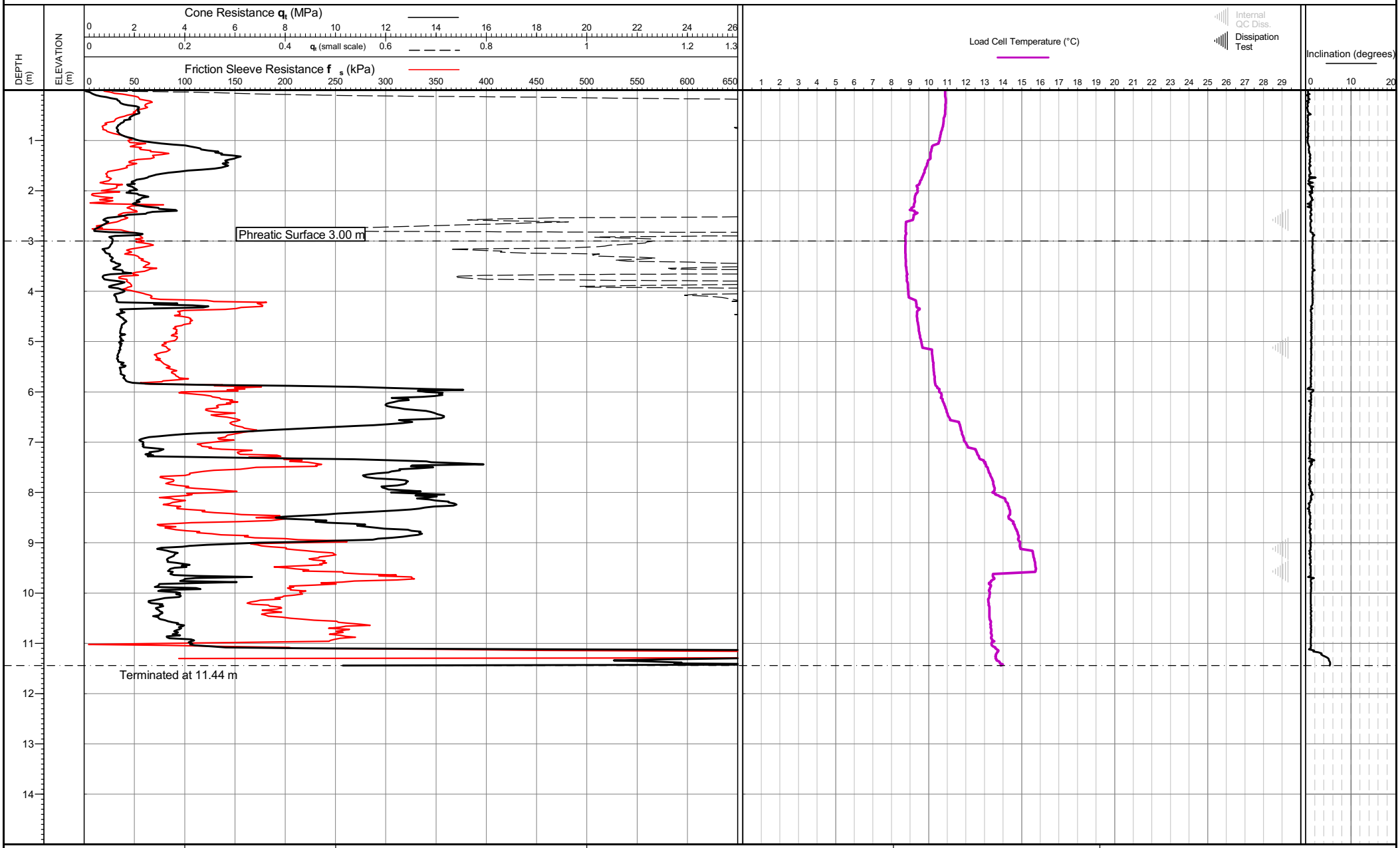


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 09:52:17	Zero drift (Pre/post test) q_c (kPa): -86.0 f_s (kPa): 1.4 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -4.5	Location: Tyne & Wear, UK Coordinates: 435827, 546827 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT03

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

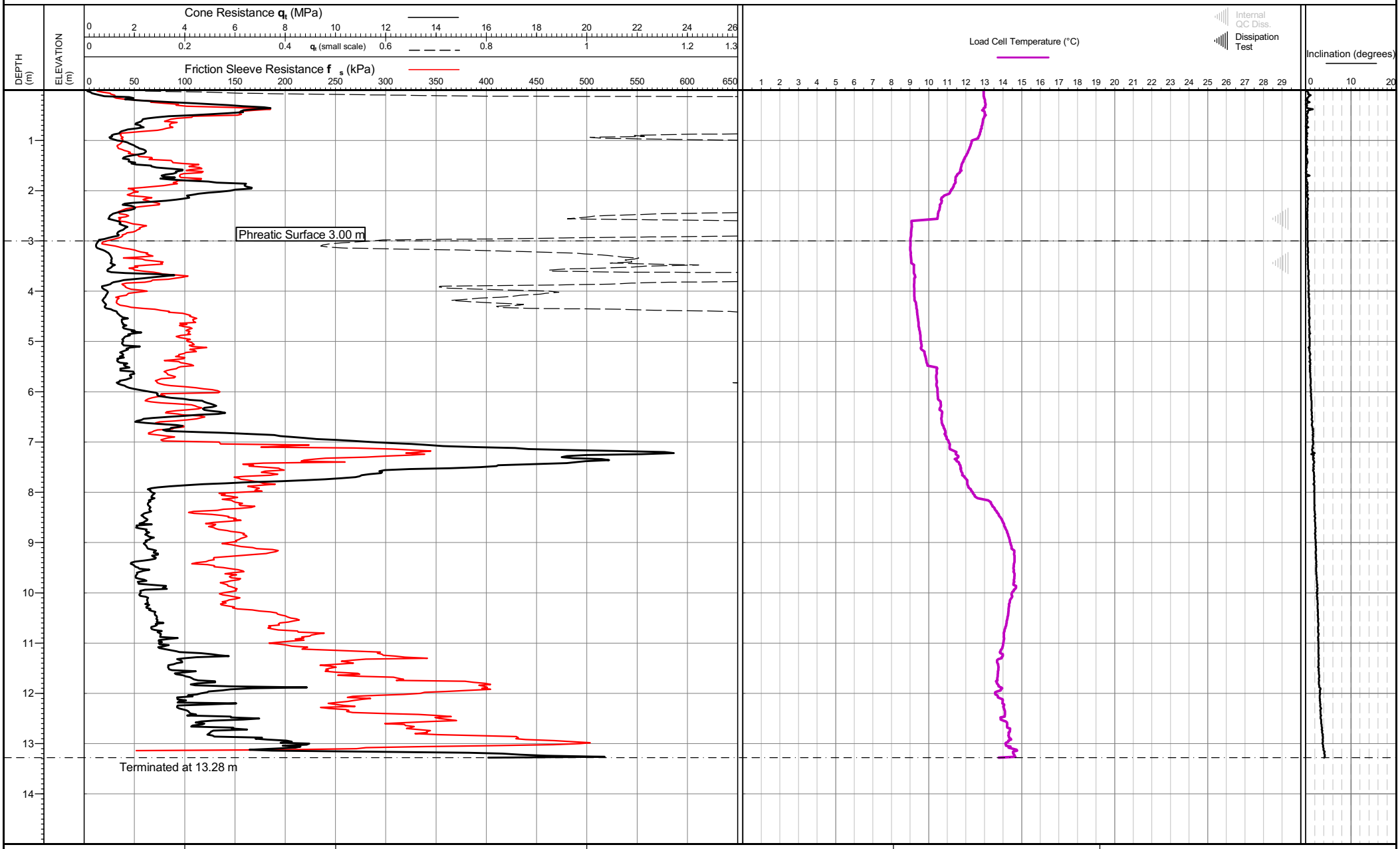


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 10:36:13	Zero drift (Pre/post test) q_c (kPa): -57.4 f_s (kPa): 12.7 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -7.7	Location: Tyne & Wear, UK Coordinates: 435827, 546815 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Inclination	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT04

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

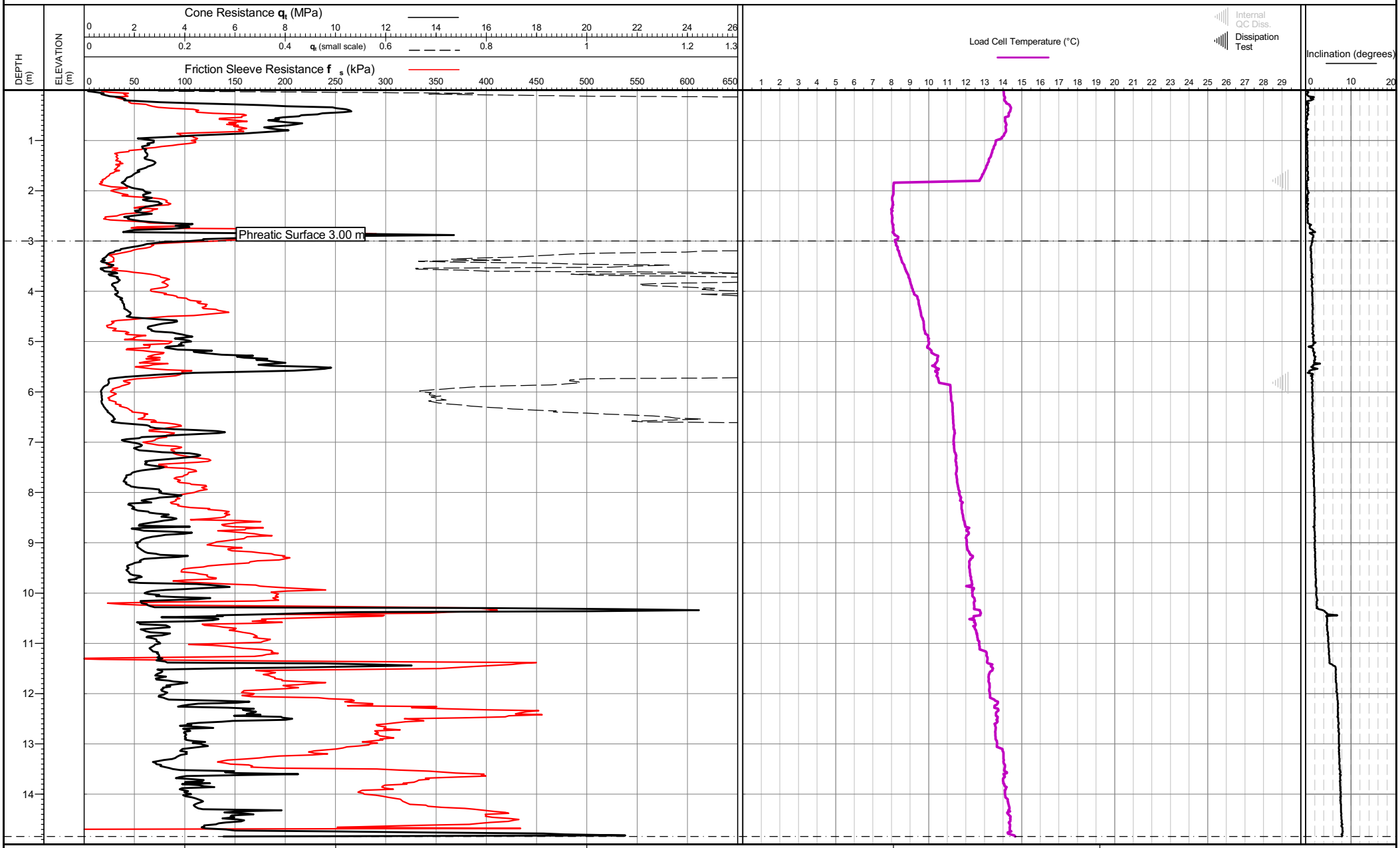


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 11:17:54	Zero drift (Pre/post test) q_c (kPa): -57.8 f_s (kPa): 0.8 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -1.9	Location: Tyne & Wear, UK Coordinates: 435800, 546815 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT05

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

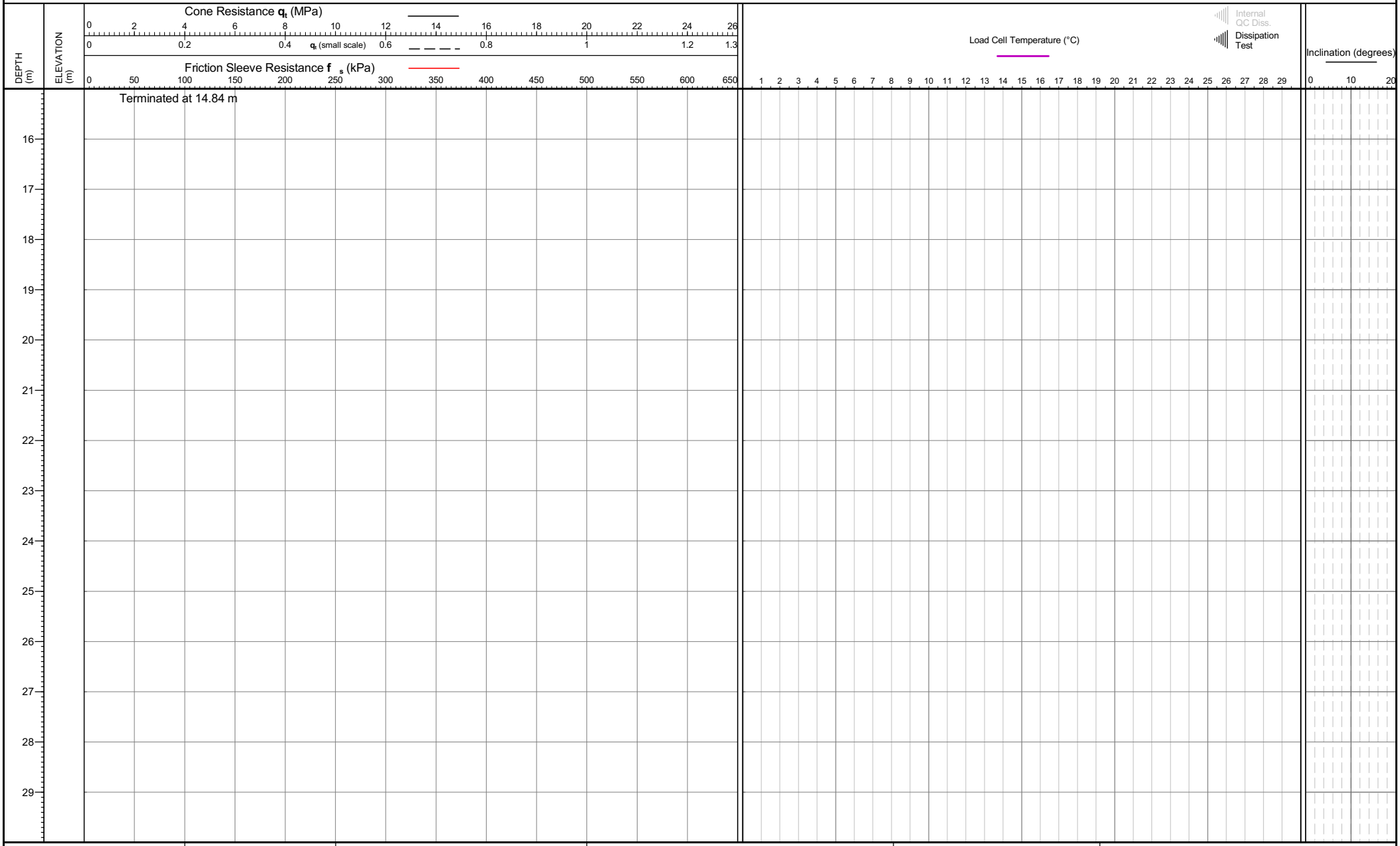


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 12:10:26	Zero drift (Pre/post test) q_c (kPa): -85.0 f_s (kPa): 1.3 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -5.2	Location: Tyne & Wear, UK Coordinates: 435775, 546815 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Inclination	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2):
Cone ID: S15-CFIPTT.2117
Operator: Walter Geddes
Rig Used: UK3
Date of test: 27/01/2023 12:10:26

Zero drift (Pre/post test)
q_c (kPa): -85.0
f_s (kPa): 1.3 ($f_{s\,drift}$ - $q_{c\,drift}$)
u_2 (kPa): -5.2

Location: Tyne & Wear, UK
Coordinates: 435775, 546815
Elevation:
Coordinate system:

Remarks:
*Phreatic surface origin: Arbitrary value

Termination Remark: Inclination

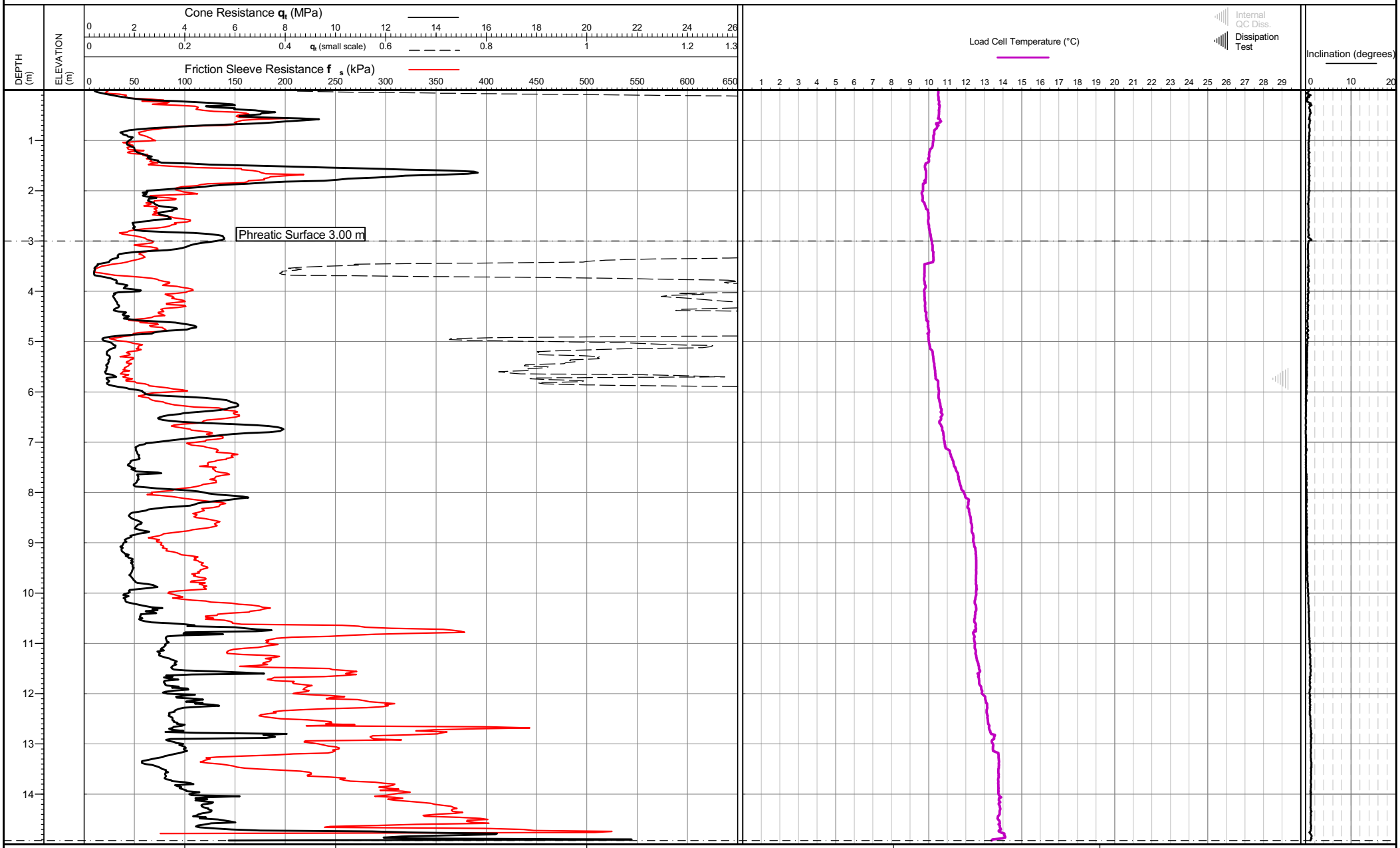
Date of plot: 31-01-23
Lankelma Project Ref: P-108244-1

Checked by: Chris Player

TEST ID: CPT06

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

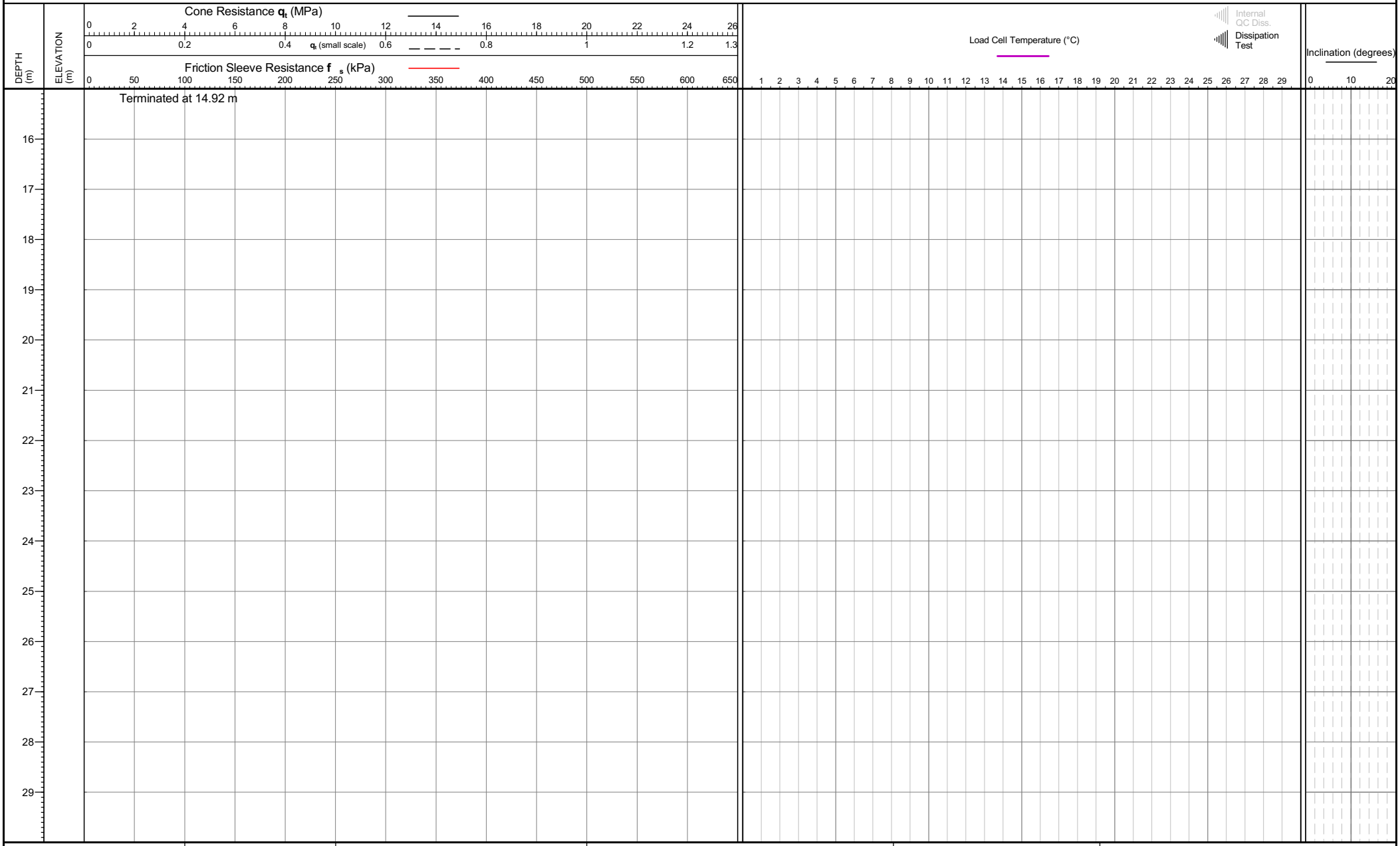


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 12:55:23	Zero drift (Pre/post test) q_c (kPa): -6.0 f_s (kPa): -0.4 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -5.7	Location: Tyne & Wear, UK Coordinates: 435775, 546802 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

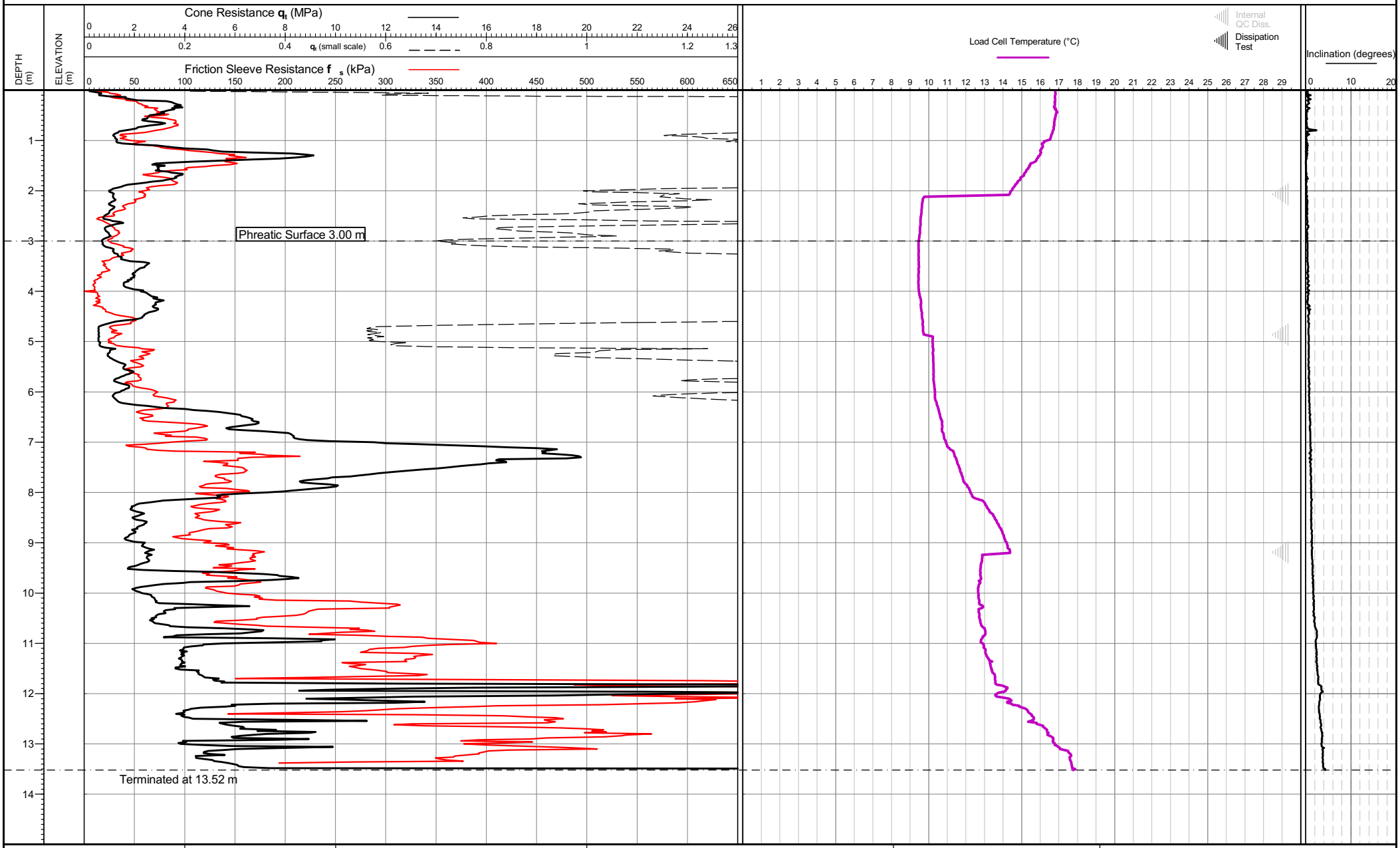


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 12:55:23	Zero drift (Pre/post test) q_c (kPa): -6.0 f_s (kPa): -0.4 ($f_{s\ drift}$ - $q_{c\ drift}$) u_2 (kPa): -5.7	Location: Tyne & Wear, UK Coordinates: 435775, 546802 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT07

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK

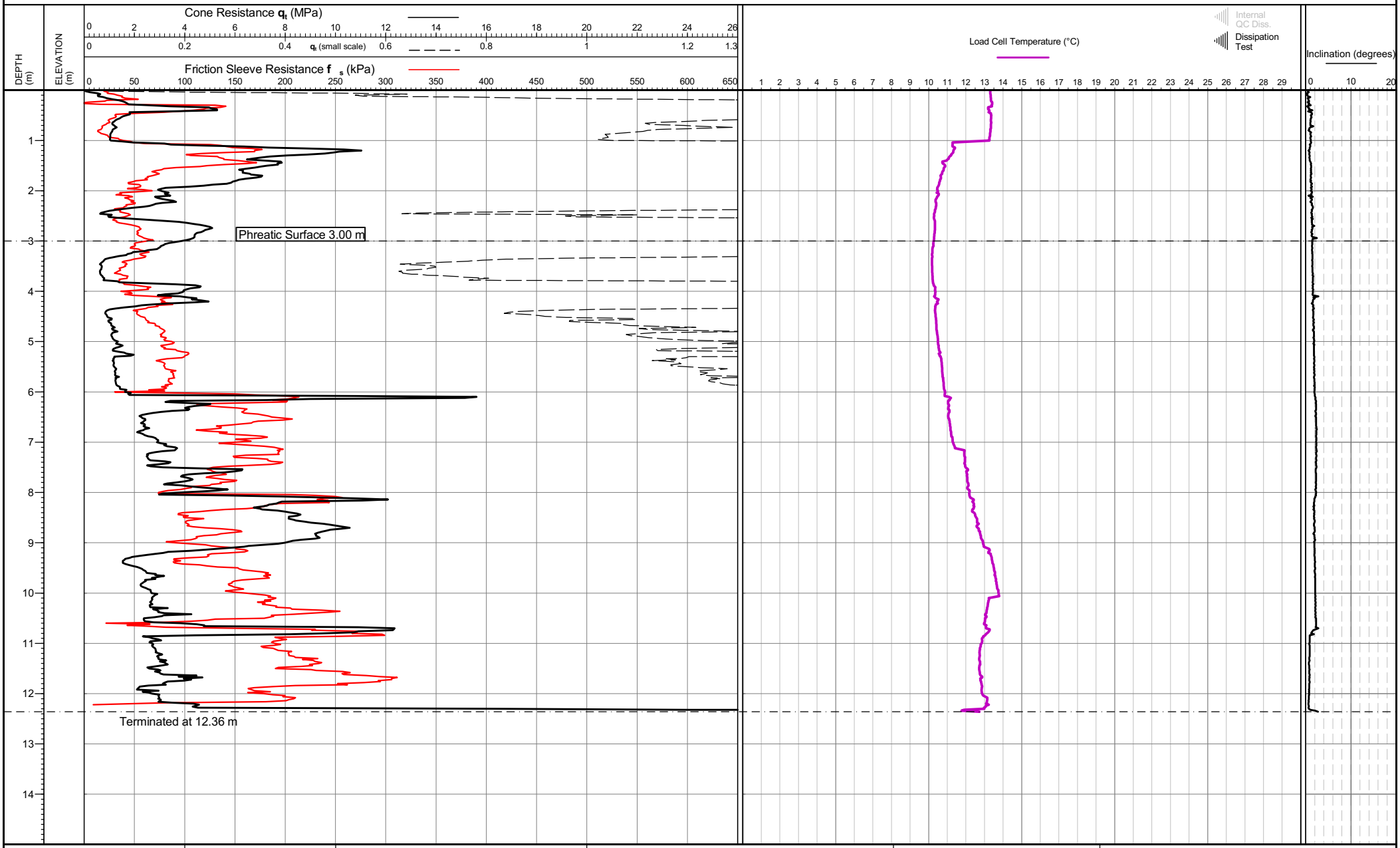


Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 13:37:03	Zero drift (Pre/post test) q_c (kPa): -65.0 f_s (kPa): 0.9 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -8.4	Location: Tyne & Wear, UK Coordinates: 435799, 546803 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT08

Project: COLLIERY LANE, HETTON-LE-HOLE

Client: HYDROCK



Cone area (mm2): Cone ID: S15-CFIPTT.2117 Operator: Walter Geddes Rig Used: UK3 Date of test: 27/01/2023 14:24:05	Zero drift (Pre/post test) q_c (kPa): -59.0 f_s (kPa): 1.0 ($f_{s\,drift}$ - $q_{c\,drift}$) u_2 (kPa): -6.8	Location: Tyne & Wear, UK Coordinates: 435827, 546804 Elevation: Coordinate system:	Remarks: *Phreatic surface origin: Arbitrary value Termination Remark: Total cone load	Date of plot: 31-01-23 Checked by: Chris Player	Lankelma Project Ref: P-108244-1

TEST ID: CPT09

Appendix D

Ground Gas and Groundwater Monitoring Record Sheets

Ground Gas and Water Monitoring Certificate

Site: Aldi, Hetton Le Hole
Project No. P18-474
Date: 27.01.2023

Borehole	Gas Flow (l/hr)		Time	Atmospheric Pressure (mB)	Methane (%v/v)		Methane (% LEL*)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Other Gases (ppm)			Depth to Water (mBGL)
	Initial	Steady			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
WS01	<0.1	<0.1	-	1025	0.0	0.0	000	000	1.00	1.00	20.70	20.70	-	0.0	0.0	1.60
WS02	<0.1	<0.1	-	1025	0.0	0.0	000	000	2.60	2.60	19.20	19.20	-	0.0	0.0	2.00
WS03	<0.1	<0.1	-	1025	0.0	0.0	000	000	5.10	5.10	15.80	15.80	-	0.0	0.0	2.40

Notes:
Monitoring should be for **not less** than 3 minutes. However, if high concentrations of gases initially recorded, monitoring should be for up to 10 minutes
* LEL = Lower Explosive Limit = 5%v/v. mBGL = metres Below Ground Level.

Relevant Information At Time Of Monitoring				
Monitored by:	AM			
Atmospheric Pressure (mB):	1025			
Weather:	Dry and Sunny			
Atmospheric Pressure Trend:				
Equipment Used:	Infra-red Gas Analyser	Yes	**Last calibrated:**	23.06.2022
	Mass Balance Transducer	~	**Last calibrated:**	~
	Tiger PID	~	**Last calibrated:**	~
Visible Signs of Vegetation Stress:	None of significance noted			
Other Comments / Observations:	~			
Boreholes Sampled For Laboratory Analysis:	~			

Ground Gas and Water Monitoring Certificate

Site: Aldi, Hetton Le Hole
Project No. P18-474
Date: 01.02.2023

Borehole	Gas Flow (l/hr)		Time	Atmospheric Pressure (mB)	Methane (%v/v)		Methane (% LEL*)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Other Gases (ppm)			Depth to Water (mBGL)
	Initial	Steady			Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	PID	H_2S	CO	
WS01	<0.1	<0.1	-	1007	0.0	0.0	000	000	0.1	1.0	20.4	20.4	-	0.0	0.0	1.67
WS02	<0.1	<0.1	-	1007	0.0	0.0	000	000	0.0	1.50	20.1	20.1	-	0.0	0.0	2.12
WS03	<0.1	<0.1	-	1007	0.0	0.0	000	000	0.1	6.0	12.3	12.3	-	0.0	0.0	2.40

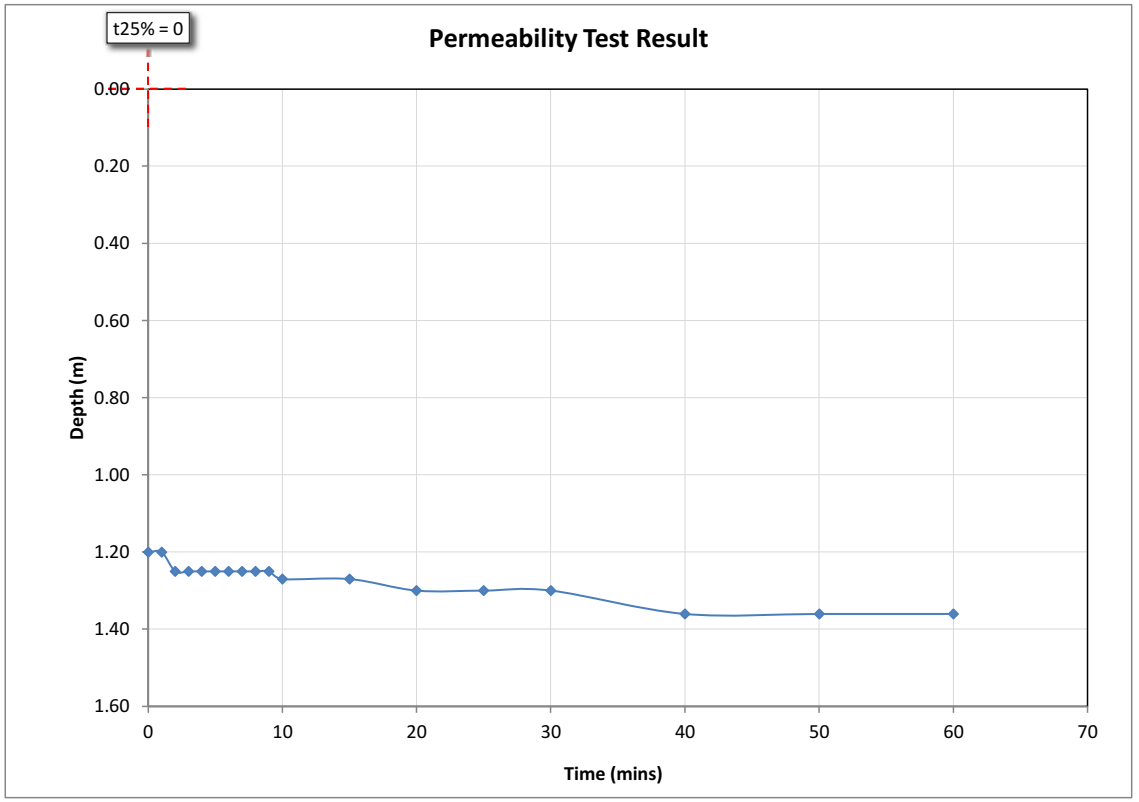
Notes:
Monitoring should be for **not less** than 3 minutes. However, if high concentrations of gases initially recorded, monitoring should be for up to 10 minutes
* LEL = Lower Explosive Limit = 5%v/v. mBGL = metres Below Ground Level.

Relevant Information At Time Of Monitoring				
Monitored by:	KRC			
Atmospheric Pressure (mB):	1007			
Weather:	Dry and Sunny			
Atmospheric Pressure Trend:				
Equipment Used:	Infra-red Gas Analyser	Yes	**Last calibrated:**	23.06.2022
	Mass Balance Transducer	~	**Last calibrated:**	~
	Tiger PID	~	**Last calibrated:**	~
Visible Signs of Vegetation Stress:	None of significance noted			
Other Comments / Observations:	~			
Boreholes Sampled For Laboratory Analysis:	~			

Appendix E

Soakaway Record Sheets

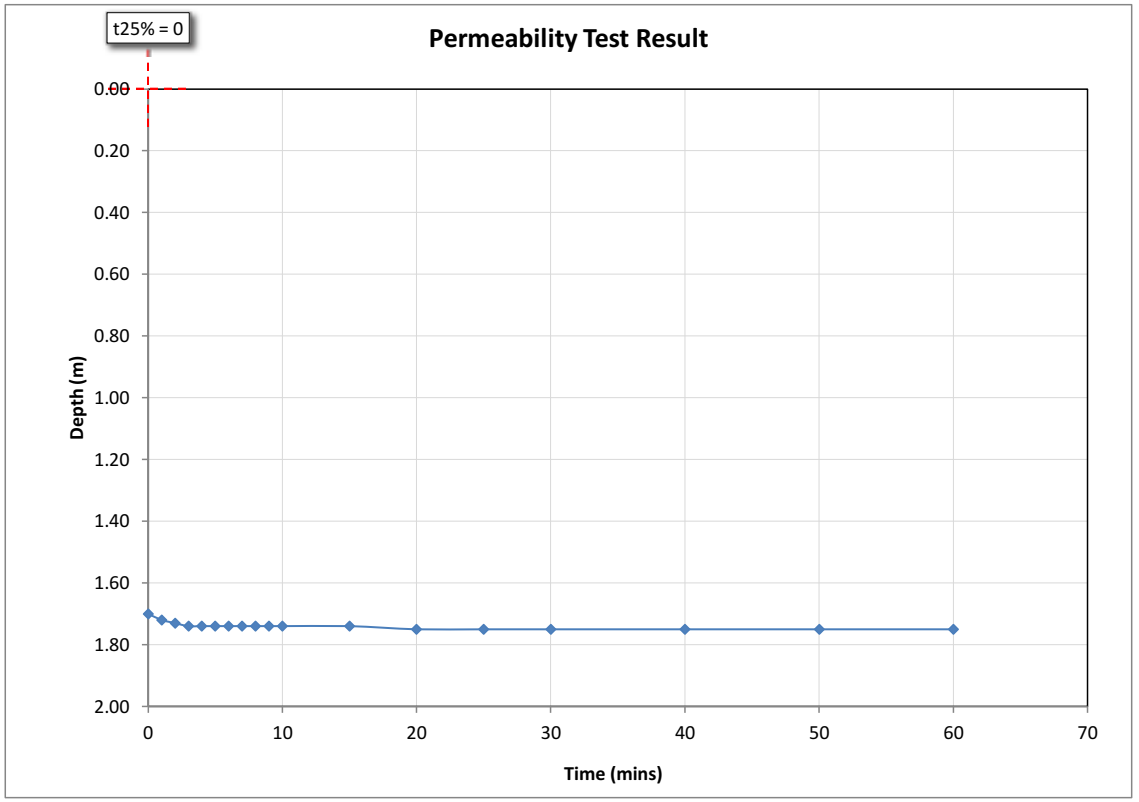
Trial Pit:	TP01
Time (mins)	**Water Depth (bgl)**
0	1.20
1	1.20
2	1.25
3	1.25
4	1.25
5	1.25
6	1.25
7	1.25
8	1.25
9	1.25
10	1.27
15	1.27
20	1.30
25	1.30
30	1.30
40	1.36
50	1.36
60	1.36



Trial Pit Depth	2.20
Total Fall (m):	1.00
75% Depth (m) [from ground level]	1.45
50% Depth (m) [from ground level]	1.70
25% Depth (m) [from ground level]	1.95
Effective Range 75% - 25% (m)	0.50

Time to fall to 75% Depth (mins)	0
Time to fall to 25% Depth (mins)	0
Time from 75% to 25% Depth (mins)	0

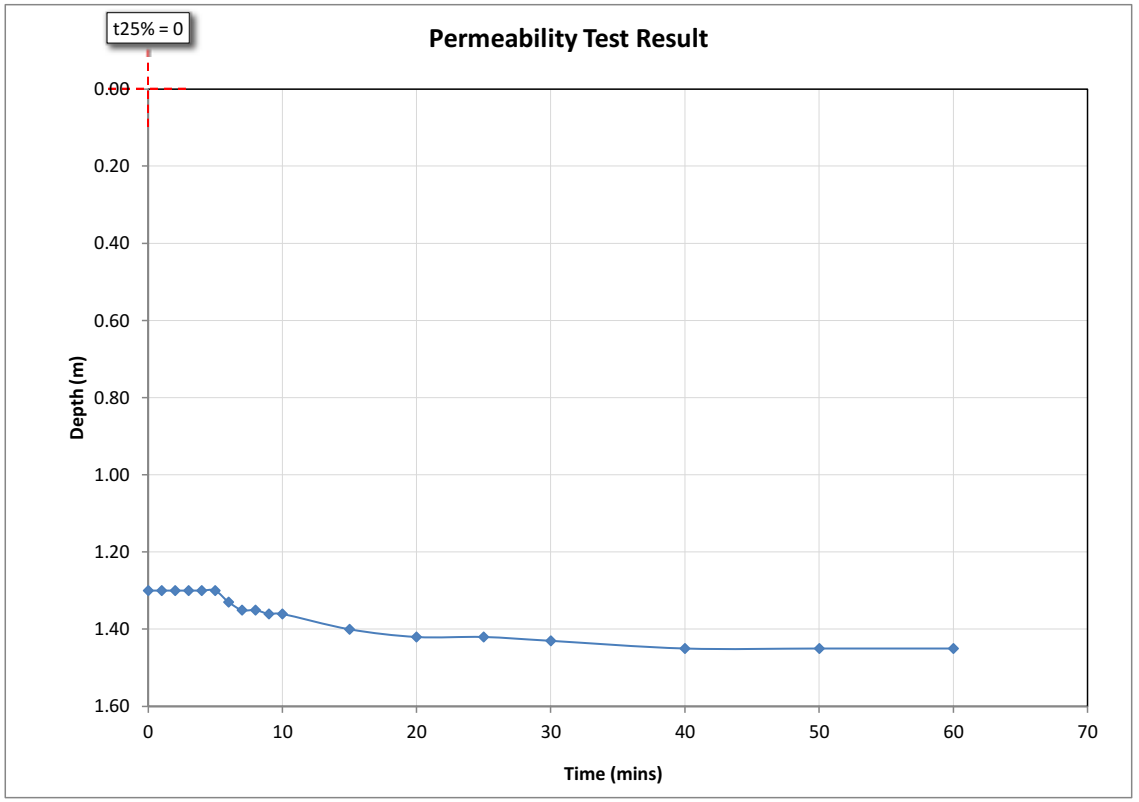
Trial Pit:	TP02
Time (mins)	**Water Depth (bgl)**
0	1.70
1	1.72
2	1.73
3	1.74
4	1.74
5	1.74
6	1.74
7	1.74
8	1.74
9	1.74
10	1.74
15	1.74
20	1.75
25	1.75
30	1.75
40	1.75
50	1.75
60	1.75



Trial Pit Depth	2.30
Total Fall (m):	0.60
75% Depth (m) [from ground level]	1.85
50% Depth (m) [from ground level]	2.00
25% Depth (m) [from ground level]	2.15
Effective Range 75% - 25% (m)	0.30

Time to fall to 75% Depth (mins)	0
Time to fall to 25% Depth (mins)	0
Time from 75% to 25% Depth (mins)	0

Trial Pit:	TP03
Time (mins)	**Water Depth (bgl)**
0	1.30
1	1.30
2	1.30
3	1.30
4	1.30
5	1.30
6	1.33
7	1.35
8	1.35
9	1.36
10	1.36
15	1.40
20	1.42
25	1.42
30	1.43
40	1.45
50	1.45
60	1.45



Trial Pit Depth	2.20
Total Fall (m):	0.90
75% Depth (m) [from ground level]	1.53
50% Depth (m) [from ground level]	1.75
25% Depth (m) [from ground level]	1.98
Effective Range 75% - 25% (m)	0.45

Time to fall to 75% Depth (mins)	0
Time to fall to 25% Depth (mins)	0
Time from 75% to 25% Depth (mins)	0

Appendix F

Chemical Laboratory Result Sheets

2531

ANALYTICAL TEST REPORT

Contract no:	118334
Contract name:	Hetton-le-Hole
Client reference:	P18-474
Clients name:	Hydrock 3E
Clients address:	2 Esh Plaza Sir Bobby Robson Way Great Park, Newcastle NE13 9BA
Samples received:	27 January 2023
Analysis started:	27 January 2023
Analysis completed:	14 February 2023
Report issued:	14 February 2023

Key		
	U	UKAS accredited test
	M	MCERTS & UKAS accredited test
	$	Test carried out by an approved subcontractor
	I/S	Insufficient sample to carry out test
	N/S	Sample not suitable for testing
	NAD	No Asbestos Detected

Approved by:

Will Fardon

Technical Director

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
118334-1	WS01	0.20	Loam with Gravel	-	-	15.8
118334-2	WS01	0.50	Loam with Gravel	-	-	12.0
118334-3	WS02	0.30	Sandy Loam	-	-	12.7
118334-4	WS03	0.50	Sandy Loam with Gravel	-	-	15.3
118334-5	WS03	1.50	Sand with Gravel	-	-	12.6
118334-6	WS04	0.50	Loam with Gravel	-	-	24.8
118334-7	WS05	0.50	Sandy Loam with Gravel	-	-	17.2
118334-8	WS05	1.50	Loamy Sand	-	-	14.2
118334-9	WS06	0.20	Loam with Roots	-	-	21.0
118334-10	WS06	1.00	Sand with Gravel	-	-	11.7
118334-11	WS07	0.30	Loam	-	-	22.5
118334-12	WS08	0.50	Sandy Loam with Gravel	-	-	9.2
118334-13	WS09	0.50	Loamy Sand with Gravel	-	-	12.6
118334-14	WS09	1.20	Loam with Gravel	-	-	20.7
118334-15	WS10	0.20	Loamy Sand	-	-	16.4
118334-16	WS10	1.00	Loamy Clay with Gravel & Roots	-	-	17.9

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SOILS

Lab number			118334-1	118334-2	118334-3	118334-4	118334-5	118334-6
Sample id			WS01	WS01	WS02	WS03	WS03	WS04
Depth (m)			0.20	0.50	0.30	0.50	1.50	0.50
Date sampled			13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023
Test	Method	Units						
Antimony (total)	CE127 U	mg/kg Sb	-	-	0.4	1.1	-	1.3
Arsenic (total)	CE127 M	mg/kg As	12	-	5.1	11	-	14
Barium (total)	CE127 M	mg/kg Ba	-	-	92	88	-	185
Boron (water soluble)	CE063 U	mg/kg B	0.8	-	-	-	-	-
Cadmium (total)	CE127 M	mg/kg Cd	0.4	-	0.2	0.3	-	0.4
Chromium (total)	CE127 M	mg/kg Cr	33	-	30	27	-	34
Chromium (VI)	CE146	mg/kg CrVI	<1	-	-	-	-	-
Copper (total)	CE127 M	mg/kg Cu	42	-	16	39	-	77
Lead (total)	CE127 M	mg/kg Pb	94	-	24	61	-	266
Mercury (total)	CE127 M	mg/kg Hg	<0.5	-	<0.5	<0.5	-	1.1
Molybdenum (total)	CE127 M	mg/kg Mo	-	-	<1	2.0	-	2.3
Nickel (total)	CE127 M	mg/kg Ni	29	-	23	24	-	36
Selenium (total)	CE127 M	mg/kg Se	1.1	-	1.0	0.9	-	1.1
Zinc (total)	CE127 M	mg/kg Zn	154	-	65	123	-	182
pH	CE004 M	units	6.9	6.7	-	-	7.0	-
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	53	<10	-	-	12	-
Cyanide (total)	CE077	mg/kg CN	<1	-	-	-	-	-
Total Organic Carbon (TOC)	CE197	% w/w C	5.1	-	0.9	-	-	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	8.8	-	-	-	-	-
PAH								
Naphthalene	CE087 M	mg/kg	0.12	-	-	-	-	-
Acenaphthylene	CE087 M	mg/kg	0.07	-	-	-	-	-
Acenaphthene	CE087 M	mg/kg	0.05	-	-	-	-	-
Fluorene	CE087 U	mg/kg	0.08	-	-	-	-	-
Phenanthrene	CE087 M	mg/kg	1.39	-	-	-	-	-
Anthracene	CE087 U	mg/kg	0.28	-	-	-	-	-
Fluoranthene	CE087 M	mg/kg	3.13	-	-	-	-	-
Pyrene	CE087 M	mg/kg	2.47	-	-	-	-	-
Benzo(a)anthracene	CE087 U	mg/kg	1.68	-	-	-	-	-
Chrysene	CE087 M	mg/kg	1.79	-	-	-	-	-
Benzo(b)fluoranthene	CE087 M	mg/kg	2.08	-	-	-	-	-
Benzo(k)fluoranthene	CE087 M	mg/kg	0.73	-	-	-	-	-
Benzo(a)pyrene	CE087 U	mg/kg	1.39	-	-	-	-	-
Indeno(123cd)pyrene	CE087 M	mg/kg	1.29	-	-	-	-	-
Dibenz(ah)anthracene	CE087 M	mg/kg	0.25	-	-	-	-	-
Benzo(ghi)perylene	CE087 M	mg/kg	1.05	-	-	-	-	-
PAH (total of USEPA 16)	CE087	mg/kg	17.83	-	-	-	-	-
TPH								
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	-	-	-	-	-
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	-	-	-	-	-
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	-	-	-	-	-

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SOILS

Lab number			118334-1	118334-2	118334-3	118334-4	118334-5	118334-6
Sample id			WS01	WS01	WS02	WS03	WS03	WS04
Depth (m)			0.20	0.50	0.30	0.50	1.50	0.50
Date sampled			13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023
Test	Method	Units						
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	-	-	-	-	-
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	-	-	-	-	-
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	11	-	-	-	-	-
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	132	-	-	-	-	-
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	122	-	-	-	-	-
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	-	-	-	-	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	-	-	-	-	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	-	-	-	-	-
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	-	-	-	-	-
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	-	-	-	-	-
EPH Aliphatic (>C16-C35)	CE250	mg/kg	16	-	-	-	-	-
EPH Aliphatic (>C35-C44)	CE250	mg/kg	12	-	-	-	-	-
Subcontracted analysis								
Asbestos (qualitative)	$	-	NAD	-	-	-	-	-

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SOILS

Lab number			118334-7	118334-8	118334-9	118334-10	118334-11	118334-12
Sample id			WS05	WS05	WS06	WS06	WS07	WS08
Depth (m)			0.50	1.50	0.20	1.00	0.30	0.50
Date sampled			13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023
Test	Method	Units						
Antimony (total)	CE127 U	mg/kg Sb	-	-	-	-	-	0.4
Arsenic (total)	CE127 M	mg/kg As	12	-	12	-	11	4.5
Barium (total)	CE127 M	mg/kg Ba	-	-	-	-	-	177
Boron (water soluble)	CE063 U	mg/kg B	0.8	-	1.1	-	-	<0.5
Cadmium (total)	CE127 M	mg/kg Cd	0.3	-	0.3	-	0.4	0.2
Chromium (total)	CE127 M	mg/kg Cr	31	-	29	-	34	28
Chromium (VI)	CE146	mg/kg CrVI	<1	-	<1	-	<1	-
Copper (total)	CE127 M	mg/kg Cu	34	-	36	-	37	12
Lead (total)	CE127 M	mg/kg Pb	66	-	104	-	71	19
Mercury (total)	CE127 M	mg/kg Hg	<0.5	-	<0.5	-	<0.5	<0.5
Molybdenum (total)	CE127 M	mg/kg Mo	-	-	-	-	-	1.1
Nickel (total)	CE127 M	mg/kg Ni	23	-	23	-	23	22
Selenium (total)	CE127 M	mg/kg Se	1.1	-	1.0	-	1.1	0.5
Zinc (total)	CE127 M	mg/kg Zn	103	-	104	-	106	56
pH	CE004 M	units	8.0		7.2	7.4	7.2	-
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	<10	<10	15	<10	33	-
Cyanide (total)	CE077	mg/kg CN	<1	-	<1	-	<1	-
Total Organic Carbon (TOC)	CE197	% w/w C	5.8	-	7.2	-	9.8	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	10.1	-	12.4	-	16.8	-
PAH								
Naphthalene	CE087 M	mg/kg	0.19	-	0.28	-	0.33	-
Acenaphthylene	CE087 M	mg/kg	<0.02	-	<0.02	-	<0.02	-
Acenaphthene	CE087 M	mg/kg	0.02	-	0.03	-	0.04	-
Fluorene	CE087 U	mg/kg	0.03	-	0.04	-	0.07	-
Phenanthrene	CE087 M	mg/kg	0.71	-	0.95	-	1.42	-
Anthracene	CE087 U	mg/kg	0.09	-	0.13	-	0.18	-
Fluoranthene	CE087 M	mg/kg	0.46	-	0.60	-	1.74	-
Pyrene	CE087 M	mg/kg	0.38	-	0.49	-	1.31	-
Benzo(a)anthracene	CE087 U	mg/kg	0.36	-	0.37	-	0.93	-
Chrysene	CE087 M	mg/kg	0.43	-	0.48	-	1.14	-
Benzo(b)fluoranthene	CE087 M	mg/kg	0.44	-	0.49	-	1.27	-
Benzo(k)fluoranthene	CE087 M	mg/kg	0.14	-	0.17	-	0.41	-
Benzo(a)pyrene	CE087 U	mg/kg	0.28	-	0.36	-	0.95	-
Indeno(123cd)pyrene	CE087 M	mg/kg	0.19	-	0.23	-	0.72	-
Dibenz(ah)anthracene	CE087 M	mg/kg	0.03	-	0.04	-	0.13	-
Benzo(ghi)perylene	CE087 M	mg/kg	0.15	-	0.22	-	0.57	-
PAH (total of USEPA 16)	CE087	mg/kg	3.91	-	4.88	-	11.20	-
TPH								
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	-	-	-	-	-
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	-	-	-	-	-
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	-	-	-	-	-

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SOILS

Lab number			118334-7	118334-8	118334-9	118334-10	118334-11	118334-12
Sample id			WS05	WS05	WS06	WS06	WS07	WS08
Depth (m)			0.50	1.50	0.20	1.00	0.30	0.50
Date sampled			13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023	13/01/2023
Test	Method	Units						
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	-	-	-	-	-
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	-	-	-	-	-
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	<1	-	-	-	-	-
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	<1	-	-	-	-	-
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	12	-	-	-	-	-
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	-	-	-	-	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	-	-	-	-	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	-	-	-	-	-
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	-	-	-	-	-
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	-	-	-	-	-
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	-	-	-	-	-
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	-	-	-	-	-
Subcontracted analysis								
Asbestos (qualitative)	$	-	NAD	-	NAD	-	-	-

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SOILS

Lab number			118334-13	118334-14	118334-15	118334-16
Sample id			WS09	WS09	WS10	WS10
Depth (m)			0.50	1.20	0.20	1.00
Date sampled			13/01/2023	13/01/2023	13/01/2023	13/01/2023
Test	Method	Units				
Antimony (total)	CE127 U	mg/kg Sb	-	-	-	-
Arsenic (total)	CE127 M	mg/kg As	6.6	11	9.5	11
Barium (total)	CE127 M	mg/kg Ba	-	-	-	-
Boron (water soluble)	CE063 U	mg/kg B	0.6	2.6	0.7	0.8
Cadmium (total)	CE127 M	mg/kg Cd	0.2	0.4	0.3	0.3
Chromium (total)	CE127 M	mg/kg Cr	31	29	33	36
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1
Copper (total)	CE127 M	mg/kg Cu	20	33	36	31
Lead (total)	CE127 M	mg/kg Pb	33	68	47	45
Mercury (total)	CE127 M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5
Molybdenum (total)	CE127 M	mg/kg Mo	-	-	-	-
Nickel (total)	CE127 M	mg/kg Ni	25	22	28	30
Selenium (total)	CE127 M	mg/kg Se	0.7	1.0	1.0	0.9
Zinc (total)	CE127 M	mg/kg Zn	74	111	101	105
pH	CE004 M	units	7.9	7.0	7.8	7.8
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	11	36	11	<10
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1
Total Organic Carbon (TOC)	CE197	% w/w C	2.8	8.8	4.2	3.4
Estimate of OMC (calculated from TOC)	CE197	% w/w	4.8	15.2	7.3	5.9
PAH						
Naphthalene	CE087 M	mg/kg	<0.02	0.26	0.08	0.05
Acenaphthylene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 M	mg/kg	<0.02	0.02	<0.02	<0.02
Fluorene	CE087 U	mg/kg	<0.02	0.05	<0.02	<0.02
Phenanthrene	CE087 M	mg/kg	0.12	0.90	0.24	0.22
Anthracene	CE087 U	mg/kg	<0.02	0.14	0.02	0.04
Fluoranthene	CE087 M	mg/kg	0.10	0.75	0.21	0.28
Pyrene	CE087 M	mg/kg	0.08	0.61	0.18	0.26
Benzo(a)anthracene	CE087 U	mg/kg	0.05	0.40	0.13	0.18
Chrysene	CE087 M	mg/kg	0.05	0.43	0.15	0.21
Benzo(b)fluoranthene	CE087 M	mg/kg	0.06	0.56	0.15	0.25
Benzo(k)fluoranthene	CE087 M	mg/kg	<0.03	0.16	0.05	0.09
Benzo(a)pyrene	CE087 U	mg/kg	0.04	0.38	0.10	0.22
Indeno(123cd)pyrene	CE087 M	mg/kg	<0.02	0.25	0.06	0.13
Dibenz(ah)anthracene	CE087 M	mg/kg	<0.02	0.04	<0.02	<0.02
Benzo(ghi)perylene	CE087 M	mg/kg	<0.02	0.21	0.05	0.12
PAH (total of USEPA 16)	CE087	mg/kg	0.50	5.17	1.42	2.04
TPH						
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	-	<0.01	-
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	-	<0.01	-
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	-	<0.01	-

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SOILS

Lab number			118334-13	118334-14	118334-15	118334-16
Sample id			WS09	WS09	WS10	WS10
Depth (m)			0.50	1.20	0.20	1.00
Date sampled			13/01/2023	13/01/2023	13/01/2023	13/01/2023
Test	Method	Units				
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	-	<10	-
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	-	<10	-
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	<1	-	<1	-
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	<1	-	<1	-
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	<1	-	<1	-
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	-	<0.1	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	-	<0.1	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	-	<0.1	-
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	-	<6	-
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	-	<6	-
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	-	<15	-
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	-	<10	-
Subcontracted analysis						
Asbestos (qualitative)	$	-	NAD	NAD	NAD	NAD

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Antimony (total)	Aqua regia digest, ICP-MS	Dry	U	0.2	mg/kg Sb
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE127	Barium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ba
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	U	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Molybdenum (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Mo
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO_4
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	As received		0.01	mg/kg
CE250	EPH Aromatic (>EC10-EC12)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC12-EC16)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC16-EC21)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC21-EC35)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC35-EC44)	Solvent extraction, GCxGC-FID	As received		1	mg/kg

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE067	VPH Aliphatic (>C5-C6)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C6-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE250	EPH Aliphatic (>C10-C12)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C12-C16)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C16-C35)	Solvent extraction, GCxGC-FID	As received		15	mg/kg
CE250	EPH Aliphatic (>C35-C44)	Solvent extraction, GCxGC-FID	As received		10	mg/kg
$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
118334-1	WS01	0.20	N	
118334-2	WS01	0.50	N	
118334-3	WS02	0.30	N	
118334-4	WS03	0.50	N	
118334-5	WS03	1.50	N	
118334-6	WS04	0.50	N	
118334-7	WS05	0.50	N	
118334-8	WS05	1.50	N	
118334-9	WS06	0.20	N	
118334-10	WS06	1.00	N	
118334-11	WS07	0.30	N	
118334-12	WS08	0.50	N	
118334-13	WS09	0.50	N	
118334-14	WS09	1.20	N	
118334-15	WS10	0.20	N	
118334-16	WS10	1.00	N	

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.

Waste Acceptance Criteria Testing
BS EN 12457-Part 3, 2 Stage Process

Sample Details		Test Values	
Contract Name	Hetton-le-Hole	Mass of Raw Test Portion (MW) kg	0.200
Lab Number	118334-3	Mass of Dried Test Portion (MD) kg	0.175
Sample ID	WS02 0.30m	Moisture Content Ratio (MC) %	14.54
Date Sampled	13 January 2023	Dry Matter Content Ratio (DR) %	87.30
Date Received	27 January 2023	Leachant Volume (1) (L2) Litre	0.325
Particle Size (<4mm)	-	Leachant Volume (2) (L8) Litre	1.400
Method of size reduction	N/A	Eluate Volume (1) (VE1) Litre	0.100
Non-crushable matter	N/A	Eluate Volume (2) (VE2) Litre	1.080

Eluate Analysis	Conc in Eluate		Amount Leached		Council Decision 2003/33/EC Limit Values mg/kg at L:S 10:1		
Liquid : Waste Ratio	2:1	8:1					
pH (units)	6.4	6.8			Inert	Non-reactive	Hazardous
Temperature (°C)	20	20	2:1	10:1	Waste	Hazardous	Waste
Conductivity (µS/cm)	74	24	mg/kg	mg/kg		Waste	
Antimony (µg/l Sb)	0.86	0.22	0.002	0.003	*0.06*	*0.7*	*5*
Arsenic (µg/l As)	0.75	0.37	0.002	0.004	*0.5*	*2*	*25*
Barium (µg/l Ba)	4.2	1.0	0.008	0.012	*20*	*100*	*300*
Cadmium (µg/l Cd)	<0.07	<0.07	<0.0002	<0.0007	*0.04*	*1*	*5*
Chromium (µg/l Cr)	0.3	0.5	0.001	0.005	*0.5*	*10*	*70*
Copper (µg/l Cu)	1.5	1.3	0.003	0.014	*2*	*50*	*100*
Lead (µg/l Pb)	<0.2	0.6	<0.0004	<0.006	*0.5*	*10*	*50*
Mercury (µg/l Hg)	<0.008	<0.008	<0.00002	<0.00008	*0.01*	*0.2*	*2*
Molybdenum (µg/l Mo)	1.0	0.5	0.002	0.006	*0.5*	*10*	*30*
Nickel (µg/l Ni)	<0.5	<0.5	<0.001	<0.005	*0.4*	*10*	*40*
Selenium (µg/l Se)	0.33	<0.07	0.001	<0.0009	*0.1*	*0.5*	*7*
Zinc (µg/l Zn)	<1	2	<0.002	<0.021	*4*	*50*	*200*
Chloride (mg/l Cl)	4.1	0.9	8.2	11	*800*	*15000*	*25000*
Fluoride (mg/l F)	0.1	<0.1	0.3	<1.0	*10*	*150*	*500*
Sulphate (mg/l SO_4)	3.1	<1.7	6	<18	*1000*	*20000*	*50000*
Total Dissolved Solids (mg/l TDS)	55	20	110	220	*4000*	*60000*	*100000*
Phenol Index (µg/l PhOH)	<10	<10	<0.02	<0.1	*1*		
Dissolved Organic Carbon (mg/l C)	6.8	<5	14	<51	*500*	*800*	*1000*

Waste Analysis	Units	Result			
Total Organic Carbon	% w/w	0.9	3%	5%	6%
Loss on Ignition	% w/w	3.0			10%
BTEX	mg/kg	<0.06	6		
PCBs (7 congeners)	mg/kg	<0.045	1		
Mineral Oil (C10 - C40)	mg/kg	<10	500		
PAH (total)	mg/kg	<0.36	100		
pH	pH units	7.0		>6	
Acid Neutralisation Capacity (pH4)	mol/kg	0.02		To be evaluated	
Acid Neutralisation Capacity (pH7)	mol/kg	0.02		To be evaluated	

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Waste Acceptance Criteria assessment is outside the scope of the laboratory's UKAS accreditation.

Comments

Authorised by: Name: Will Fardon

Report date: 14 February 2023 Position: Technical Director

Unit 6 Parkhead, Greencroft Industrial Park, Stanley, County Durham, DH9 7YB
Tel 01207 528578 Email customerservices@chemtech-env.co.uk
Vat Reg No. 772 5703 18 Registered in England number 4284013

Waste Acceptance Criteria Testing
BS EN 12457-Part 3, 2 Stage Process

Sample Details		Test Values	
Contract Name	Hetton-le-Hole	Mass of Raw Test Portion (MW) kg	0.207
Lab Number	118334-4	Mass of Dried Test Portion (MD) kg	0.175
Sample ID	WS03 0.50m	Moisture Content Ratio (MC) %	18.13
Date Sampled	13 January 2023	Dry Matter Content Ratio (DR) %	84.65
Date Received	27 January 2023	Leachant Volume (1) (L2) Litre	0.318
Particle Size (<4mm)	-	Leachant Volume (2) (L8) Litre	1.400
Method of size reduction	N/A	Eluate Volume (1) (VE1) Litre	0.205
Non-crushable matter	N/A	Eluate Volume (2) (VE2) Litre	1.140

Eluate Analysis	Conc in Eluate		Amount Leached		Council Decision 2003/33/EC Limit Values mg/kg at L:S 10:1		
Liquid : Waste Ratio	2:1	8:1					
pH (units)	6.6	7.1			Inert	Non-reactive	Hazardous
Temperature (°C)	20	20	2:1	10:1	Waste	Hazardous	Waste
Conductivity (µS/cm)	117	59	mg/kg	mg/kg		Waste	
Antimony (µg/l Sb)	0.87	0.35	0.002	0.004	*0.06*	*0.7*	*5*
Arsenic (µg/l As)	1.32	1.07	0.003	0.011	*0.5*	*2*	*25*
Barium (µg/l Ba)	7.8	3.6	0.016	0.041	*20*	*100*	*300*
Cadmium (µg/l Cd)	<0.07	<0.07	<0.0002	<0.0007	*0.04*	*1*	*5*
Chromium (µg/l Cr)	0.5	0.6	0.001	0.006	*0.5*	*10*	*70*
Copper (µg/l Cu)	5.1	3.5	0.010	0.037	*2*	*50*	*100*
Lead (µg/l Pb)	4.5	4.7	0.009	0.046	*0.5*	*10*	*50*
Mercury (µg/l Hg)	0.026	0.010	0.00005	0.00012	*0.01*	*0.2*	*2*
Molybdenum (µg/l Mo)	2.5	1.5	0.005	0.016	*0.5*	*10*	*30*
Nickel (µg/l Ni)	0.8	0.6	0.002	0.007	*0.4*	*10*	*40*
Selenium (µg/l Se)	0.53	0.24	0.001	0.003	*0.1*	*0.5*	*7*
Zinc (µg/l Zn)	4	4	0.007	0.043	*4*	*50*	*200*
Chloride (mg/l Cl)	2.0	0.9	3.9	10	*800*	*15000*	*25000*
Fluoride (mg/l F)	0.5	0.3	1.0	3.1	*10*	*150*	*500*
Sulphate (mg/l SO_4)	3.2	<1.7	6	<19	*1000*	*20000*	*50000*
Total Dissolved Solids (mg/l TDS)	90	45	180	503	*4000*	*60000*	*100000*
Phenol Index (µg/l PhOH)	<10	<10	<0.02	<0.1	*1*		
Dissolved Organic Carbon (mg/l C)	11	6.7	22	72	*500*	*800*	*1000*

Waste Analysis	Units	Result			
Total Organic Carbon	% w/w	4.5	3%	5%	6%
Loss on Ignition	% w/w	6.4			10%
BTEX	mg/kg	<0.06	6		
PCBs (7 congeners)	mg/kg	<0.045	1		
Mineral Oil (C10 - C40)	mg/kg	33	500		
PAH (total)	mg/kg	1.61	100		
pH	pH units	7.2		>6	
Acid Neutralisation Capacity (pH4)	mol/kg	0.04		To be evaluated	
Acid Neutralisation Capacity (pH7)	mol/kg	0.02		To be evaluated	

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Waste Acceptance Criteria assessment is outside the scope of the laboratory's UKAS accreditation.

Comments

Authorised by: Name: Will Fardon

Report date: 14 February 2023 Position: Technical Director

Unit 6 Parkhead, Greencroft Industrial Park, Stanley, County Durham, DH9 7YB
Tel 01207 528578 Email customerservices@chemtech-env.co.uk
Vat Reg No. 772 5703 18 Registered in England number 4284013

Waste Acceptance Criteria Testing
BS EN 12457-Part 3, 2 Stage Process

Sample Details		Test Values	
Contract Name	Hetton-le-Hole	Mass of Raw Test Portion (MW) kg	0.233
Lab Number	118334-6	Mass of Dried Test Portion (MD) kg	0.175
Sample ID	WS04 0.50m	Moisture Content Ratio (MC) %	32.92
Date Sampled	13 January 2023	Dry Matter Content Ratio (DR) %	75.23
Date Received	27 January 2023	Leachant Volume (1) (L2) Litre	0.292
Particle Size (<4mm)	-	Leachant Volume (2) (L8) Litre	1.400
Method of size reduction	N/A	Eluate Volume (1) (VE1) Litre	0.150
Non-crushable matter	N/A	Eluate Volume (2) (VE2) Litre	1.100

Eluate Analysis	Conc in Eluate		Amount Leached		Council Decision 2003/33/EC Limit Values mg/kg at L:S 10:1		
Liquid : Waste Ratio	2:1	8:1					
pH (units)	7.2	7.4			Inert	Non-reactive	Hazardous
Temperature (°C)	20	20	2:1	10:1	Waste	Hazardous	Waste
Conductivity (µS/cm)	199	99	mg/kg	mg/kg		Waste	
Antimony (µg/l Sb)	1.00	0.57	0.002	0.006	*0.06*	*0.7*	*5*
Arsenic (µg/l As)	0.83	0.66	0.002	0.007	*0.5*	*2*	*25*
Barium (µg/l Ba)	10.1	6.9	0.020	0.072	*20*	*100*	*300*
Cadmium (µg/l Cd)	<0.07	<0.07	<0.0002	<0.0007	*0.04*	*1*	*5*
Chromium (µg/l Cr)	0.3	0.4	0.001	0.004	*0.5*	*10*	*70*
Copper (µg/l Cu)	7.2	4.3	0.014	0.046	*2*	*50*	*100*
Lead (µg/l Pb)	3.7	4.9	0.007	0.048	*0.5*	*10*	*50*
Mercury (µg/l Hg)	0.087	0.053	0.00017	0.00056	*0.01*	*0.2*	*2*
Molybdenum (µg/l Mo)	4.3	2.6	0.009	0.028	*0.5*	*10*	*30*
Nickel (µg/l Ni)	1.0	0.6	0.002	0.007	*0.4*	*10*	*40*
Selenium (µg/l Se)	1.05	0.50	0.002	0.005	*0.1*	*0.5*	*7*
Zinc (µg/l Zn)	2	3	0.005	0.029	*4*	*50*	*200*
Chloride (mg/l Cl)	3.1	1.0	6.1	12	*800*	*15000*	*25000*
Fluoride (mg/l F)	0.8	0.4	1.7	4.4	*10*	*150*	*500*
Sulphate (mg/l SO_4)	5.0	<1.7	10	<20	*1000*	*20000*	*50000*
Total Dissolved Solids (mg/l TDS)	150	75	300	814	*4000*	*60000*	*100000*
Phenol Index (µg/l PhOH)	<10	<10	<0.02	<0.1	*1*		
Dissolved Organic Carbon (mg/l C)	22	12	43	125	*500*	*800*	*1000*

Waste Analysis	Units	Result			
Total Organic Carbon	% w/w	6.8	3%	5%	6%
Loss on Ignition	% w/w	9.8			10%
BTEX	mg/kg	<0.06	6		
PCBs (7 congeners)	mg/kg	<0.045	1		
Mineral Oil (C10 - C40)	mg/kg	150	500		
PAH (total)	mg/kg	6.55	100		
pH	pH units	7.7		>6	
Acid Neutralisation Capacity (pH4)	mol/kg	0.16		To be evaluated	
Acid Neutralisation Capacity (pH7)	mol/kg	0.02		To be evaluated	

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Comments

Authorised by: Name: Will Fardon

Report date: 14 February 2023 Position: Technical Director

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Vat Reg No. 772 5703 18 Registered in England number 4284013

Waste Acceptance Criteria Testing
BS EN 12457-Part 3, 2 Stage Process

Sample Details		Test Values	
Contract Name	Hetton-le-Hole	Mass of Raw Test Portion (MW) kg	0.226
Lab Number	118334-12	Mass of Dried Test Portion (MD) kg	0.175
Sample ID	WS08 0.50m	Moisture Content Ratio (MC) %	29.11
Date Sampled	13 January 2023	Dry Matter Content Ratio (DR) %	77.45
Date Received	27 January 2023	Leachant Volume (1) (L2) Litre	0.299
Particle Size (<4mm)	-	Leachant Volume (2) (L8) Litre	1.400
Method of size reduction	N/A	Eluate Volume (1) (VE1) Litre	0.265
Non-crushable matter	N/A	Eluate Volume (2) (VE2) Litre	1.300

Eluate Analysis	Conc in Eluate		Amount Leached		Council Decision 2003/33/EC Limit Values mg/kg at L:S 10:1		
Liquid : Waste Ratio	2:1	8:1					
pH (units)	7.7	8.3			Inert	Non-reactive	Hazardous
Temperature (°C)	20	20	2:1	10:1	Waste	Hazardous	Waste
Conductivity (µS/cm)	144	70	mg/kg	mg/kg		Waste	
Antimony (µg/l Sb)	0.28	0.11	0.001	0.001	*0.06*	*0.7*	*5*
Arsenic (µg/l As)	0.46	0.33	0.001	0.003	*0.5*	*2*	*25*
Barium (µg/l Ba)	26.0	7.2	0.052	0.101	*20*	*100*	*300*
Cadmium (µg/l Cd)	<0.07	<0.07	<0.0002	<0.0007	*0.04*	*1*	*5*
Chromium (µg/l Cr)	0.3	<0.2	0.001	<0.002	*0.5*	*10*	*70*
Copper (µg/l Cu)	3.3	0.9	0.007	0.013	*2*	*50*	*100*
Lead (µg/l Pb)	0.5	<0.2	0.001	<0.002	*0.5*	*10*	*50*
Mercury (µg/l Hg)	<0.008	<0.008	<0.00002	<0.00008	*0.01*	*0.2*	*2*
Molybdenum (µg/l Mo)	2.6	1.4	0.005	0.016	*0.5*	*10*	*30*
Nickel (µg/l Ni)	1.1	<0.5	0.002	<0.006	*0.4*	*10*	*40*
Selenium (µg/l Se)	0.78	0.44	0.002	0.005	*0.1*	*0.5*	*7*
Zinc (µg/l Zn)	1	<1	0.003	<0.011	*4*	*50*	*200*
Chloride (mg/l Cl)	2.8	1.2	5.7	15	*800*	*15000*	*25000*
Fluoride (mg/l F)	0.2	<0.1	0.4	<1.2	*10*	*150*	*500*
Sulphate (mg/l SO_4)	2.5	<1.7	5	<18	*1000*	*20000*	*50000*
Total Dissolved Solids (mg/l TDS)	110	55	220	633	*4000*	*60000*	*100000*
Phenol Index (µg/l PhOH)	<10	<10	<0.02	<0.1	*1*		
Dissolved Organic Carbon (mg/l C)	14	6.1	29	74	*500*	*800*	*1000*

Waste Analysis	Units	Result			
Total Organic Carbon	% w/w	1.2	3%	5%	6%
Loss on Ignition	% w/w	2.6			10%
BTEX	mg/kg	<0.06	6		
PCBs (7 congeners)	mg/kg	<0.045	1		
Mineral Oil (C10 - C40)	mg/kg	28	500		
PAH (total)	mg/kg	<0.36	100		
pH	pH units	8.2		>6	
Acid Neutralisation Capacity (pH4)	mol/kg	1.10		To be evaluated	
Acid Neutralisation Capacity (pH7)	mol/kg	0.06		To be evaluated	

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Waste Acceptance Criteria assessment is outside the scope of the laboratory's UKAS accreditation.

Comments

Authorised by: Name: Will Fardon

Report date: 14 February 2023 Position: Technical Director

Unit 6 Parkhead, Greencroft Industrial Park, Stanley, County Durham, DH9 7YB
Tel 01207 528578 Email customerservices@chemtech-env.co.uk
Vat Reg No. 772 5703 18 Registered in England number 4284013

Statement of Conformity
Where Chemtech reports a statement of conformity to a specification, the decision rules applied are derived from the Ilac document ILAC G8:09/2019.
Acceptance limits (AL), applied are derived from the tolerance limits (TL) by you the client or applicable standard (e.g. 2003.33.EC Council Decision, BS3882, BS8601)

Agreed and reported Decision Rule:
"PASS" if the result < TL, and the bias / precision values for the process meet the targets defined within the methodology and/or applied accreditation.

Reported Decisions:
Result < TL for determinands: PASS
Result > TL for determinands: FAIL

Definitions Used:
Acceptance limit (AL) Specified upper or lower bounds of permissible measured quantity values.
Tolerance limit (TL) Specified upper or lower bound of permissible values of a property.

Appendix G

Geotechnical Laboratory Result Sheets

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531**

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

TEST REPORT

Client:	**3E Consulting Engineers Ltd, 2 Esh Plaza, Great Park, Newcastle, NE13 9**
Engineer:	**Alex Middleton**
Project:	**P18-474 - Hetton-le-Hole**
Supplier/Source:	**Site**
Date Sampled:	**12/01/2023**
Date Received:	**25/01/2023**
Sampled By:	**Clients Staff**
SampleSpec:	**Sampled by Site Staff/Client**
Remarks:	**None**

Signed: _____ [✓] M. Newton, Laboratory Manager
[ ] P. Fletcher. Senior Technician

ADDITIONAL INFORMATION

Notes:
Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
If Northumberland County Council carried out the sampling then all sampling was carried out at the named project above. All testing is carried out at Northumberland County Council Laboratory, except for subcontracted testing.
Uncertainty of measurement available on request..
Results reported herein relate only to the material supplied to the laboratory.
No decision rule will be given
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/01-CLS**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

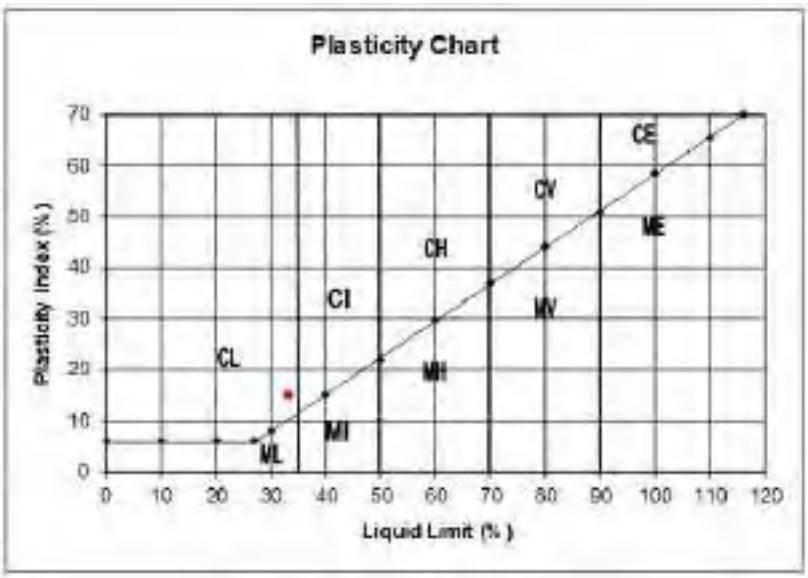
CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Location: **WS01 at 1.00m**

Material Type: **Grey, brown very sandy CLAY with very occasional gravel.**

	Test Results	Specification
Water Content (%)	**22.0**	BS EN ISO 17892-1;2014
Liquid Limit (%):	**33**	Part 2 Clause 4.4 (One point method)
Plastic Limit (%):	**18**	Part 2 Clause 5.3
Plasticity Index (%):	**15**	Part 2 Clause 5.4
Passing 425mic (%):	**76**	
Soil Classification:	**CL**	



Remarks: **None**

Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/02-CLS**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

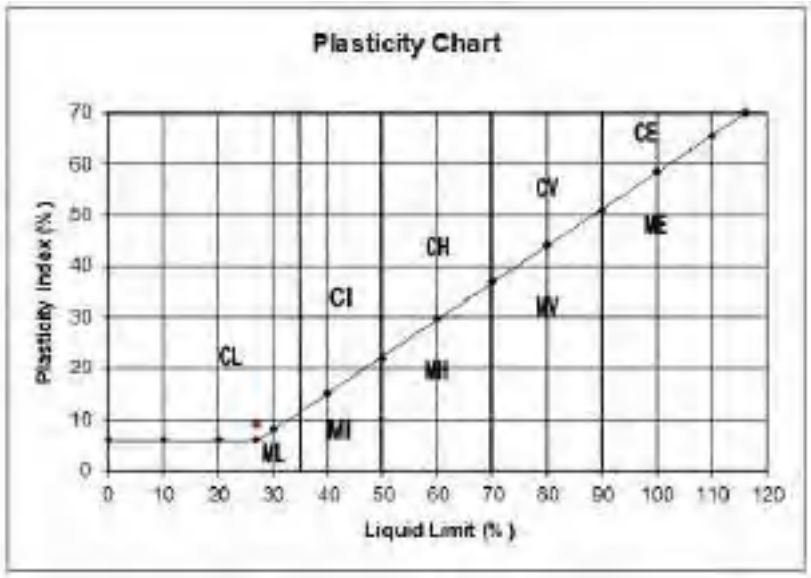
Location: **WS02 at 1.60m**

Material Type: **Grey CLAY with sand inclusions.**

	Test Results	Specification
Water Content (%)	**28.3**	BS EN ISO 17892-1;2014

Liquid and Plastic Limit Tests Carried out in Accordance with BS 1377-Part 2:1990

	Test Results	Specification
Liquid Limit (%):	**27**	Part 2 Clause 4.4 (One point method)
Plastic Limit (%):	**18**	Part 2 Clause 5.3
Plasticity Index (%):	**9**	Part 2 Clause 5.4
Passing 425mic (%):	**95**	
Soil Classification:	**CL**	



Remarks: **None**

Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/03 -PSD**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Particle Size Distribution carried out in accordance with B.S. 1377 : Part 2 Clause 9.2 :1990
Sedimentation Hydrometer carried out in accordance with B.S. 1377 : Part 2 Clause 9.5 :1990

Location: **WS03 at 2.00m**

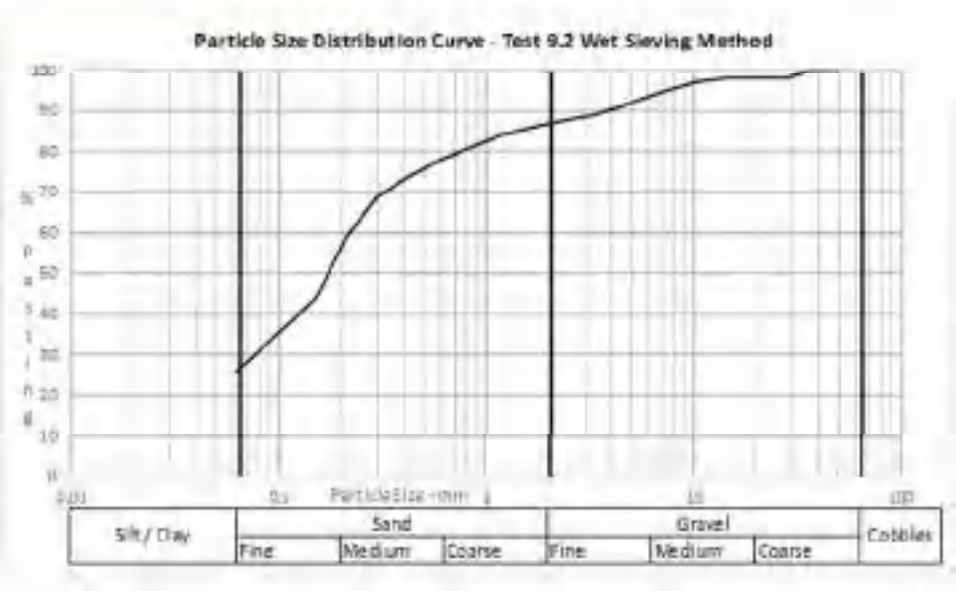
Material Type: **Brown clayey SAND and GRAVEL**

Date Sampled: **12/01/2023** Date Received: **25/01/2023**

Natural Water Content (%): **15.9** Part 2 Clause 3.2

PSD Sieving		PSD Sedimentation	
Size (mm)	% Passing	Size (mm)	% Passing
75	100	No sedimentation test	
63	100		
50	100		
37.5	100		
28	98		
20	98		
14	98		
10	97		
6.3	94		
5	92		
3.35	89		
2	87		
1.18	84		
0.6	78		
0.425	74		
0.300	69		
0.212	59		
0.150	44		
0.063	26		

Gravel %	13
Sand %	61
Silt/Clay %	26



Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/04-CLS**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

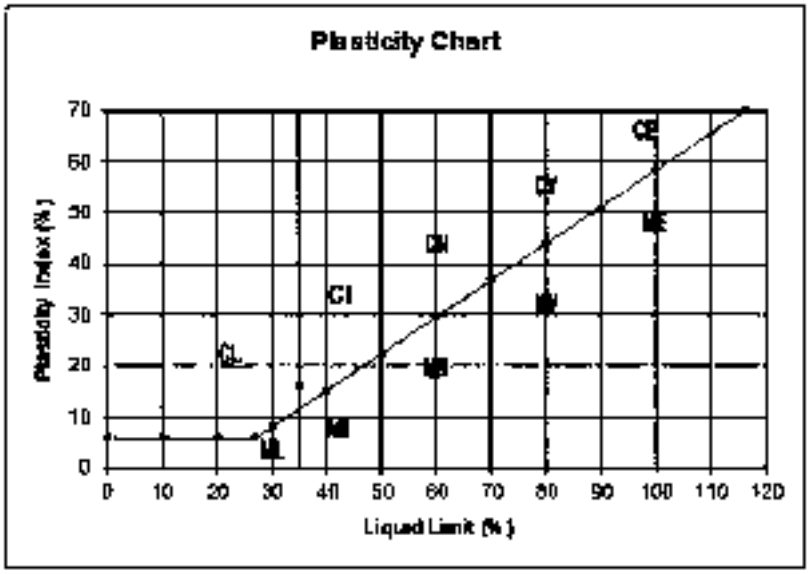
Location: **WS04 at 1.00m**

Material Type: **Brown, very sandy CLAY with very occasional gravel.**

	Test Results	Specification
Water Content (%)	**19.0**	BS EN ISO 17892-1;2014

Liquid and Plastic Limit Tests Carried out in Accordance with BS 1377-Part 2:1990

	Test Results	Specification
Liquid Limit (%):	**28**	Part 2 Clause 4.4 (One point method)
Plastic Limit (%):	**20**	Part 2 Clause 5.3
Plasticity Index (%):	**8**	Part 2 Clause 5.4
Passing 425mic (%):	**55**	
Soil Classification:	**CL**	



Remarks: **None**

Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/05 -PSD**

Northumberland County Council

Highways Laboratory
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CLASSIFICATION OF SOILS

Particle Size Distribution carried out in accordance with B.S. 1377 : Part 2 Clause 9.2 :1990
Sedimentation Hydrometer carried out in accordance with B.S. 1377 : Part 2 Clause 9.5 :1990

Location: **WS05 at 1.50m**

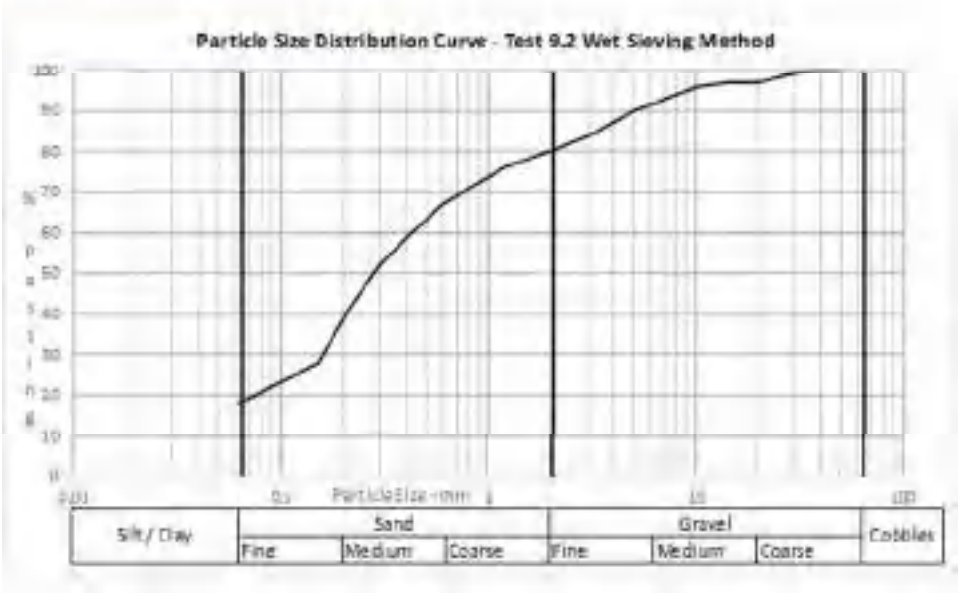
Material Type: **Brown clayey SAND with occasional gravel**

Date Sampled: **12/01/2023** Date Received: **25/01/2023**

Natural Water Content (%): **17.8** Part 2 Clause 3.2

PSD Sieving		PSD Sedimentation	
Size (mm)	% Passing	Size (mm)	% Passing
75	100	No sedimentation test	
63	100		
50	100		
37.5	100		
28	99		
20	97		
14	97		
10	96		
6.3	92		
5	90		
3.35	85		
2	80		
1.18	76		
0.6	67		
0.425	60		
0.300	52		
0.212	41		
0.150	28		
0.063	18		

Gravel %	20
Sand %	62
Silt/Clay %	18



Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/06 -PSD**

Northumberland County Council

Highways Laboratory
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Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Particle Size Distribution carried out in accordance with B.S. 1377 : Part 2 Clause 9.2 :1990
Sedimentation Hydrometer carried out in accordance with B.S. 1377 : Part 2 Clause 9.5 :1990

Location: **WS06 at 1.50m**

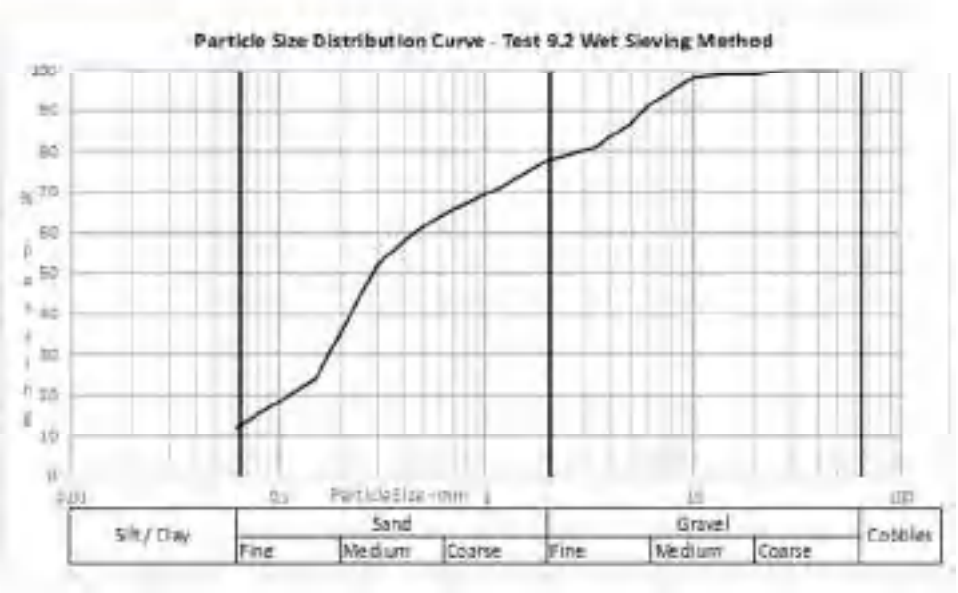
Material Type: **Brown, orange SAND with occasional gravel**

Date Sampled: **13/01/2023** Date Received: **25/01/2023**

Natural Water Content (%): **14.2** Part 2 Clause 3.2

PSD Sieving		PSD Sedimentation	
Size (mm)	% Passing	Size (mm)	% Passing
75	100	No sedimentation test	
63	100		
50	100		
37.5	100		
28	100		
20	99		
14	99		
10	98		
6.3	92		
5	87		
3.35	81		
2	78		
1.18	71		
0.6	64		
0.425	59		
0.300	52		
0.212	38		
0.150	24		
0.063	12		

Gravel %	22
Sand %	66
Silt/Clay %	12



Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/07-CLS**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

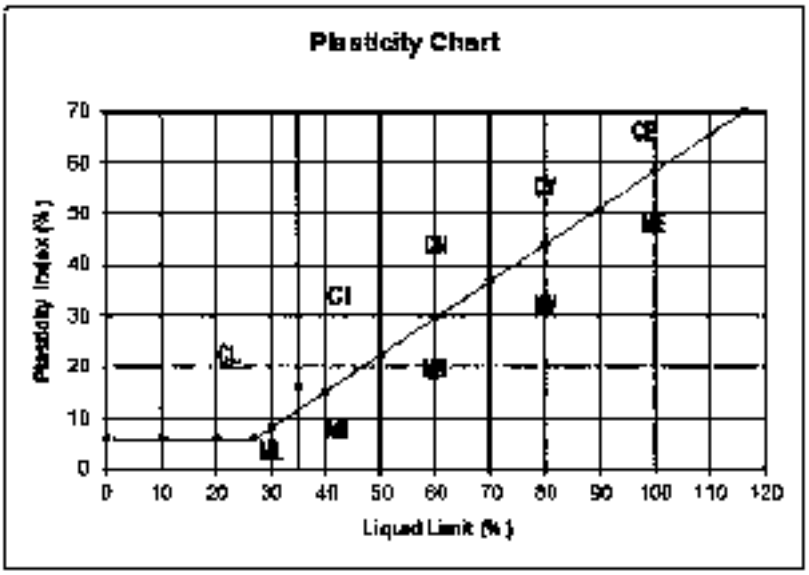
Location: **WS08 at 2.50m**

Material Type: **Brown sandy CLAY with very occasional gravel.**

	Test Results	Specification
Water Content (%)	**26.7**	BS EN ISO 17892-1;2014

Liquid and Plastic Limit Tests Carried out in Accordance with BS 1377-Part 2:1990

	Test Results	Specification
Liquid Limit (%):	**35**	Part 2 Clause 4.4 (One point method)
Plastic Limit (%):	**19**	Part 2 Clause 5.3
Plasticity Index (%):	**16**	Part 2 Clause 5.4
Passing 425mic (%):	**91**	
Soil Classification:	**CL/CI**	



Remarks: **None**

Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/08 -PSD**

Northumberland County Council

Highways Laboratory
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CLASSIFICATION OF SOILS

Particle Size Distribution carried out in accordance with B.S. 1377 : Part 2 Clause 9.2 :1990
Sedimentation Hydrometer carried out in accordance with B.S. 1377 : Part 2 Clause 9.5 :1990

Location: **WS09 at 1.50m**

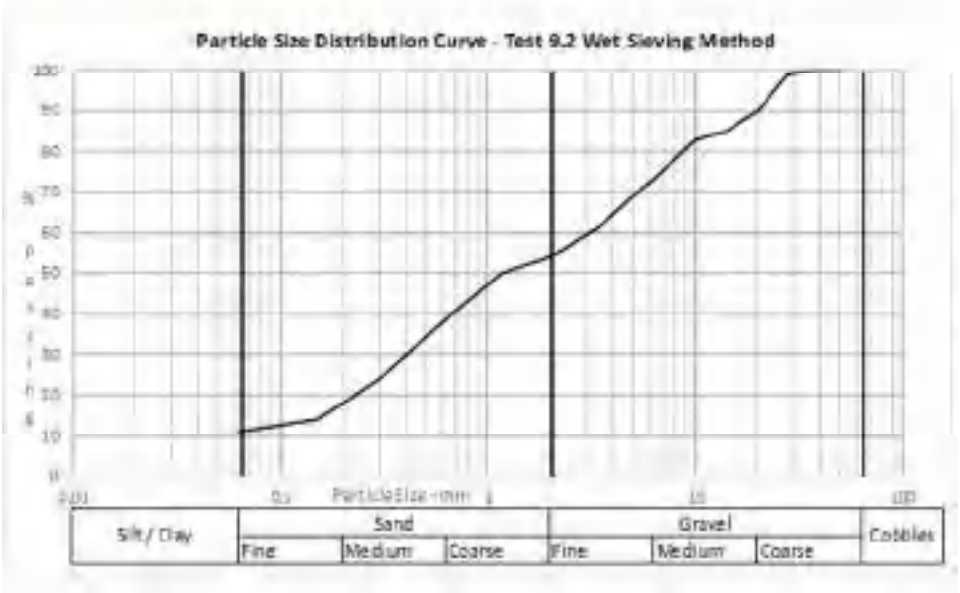
Material Type: **Brown SAND and GRAVEL**

Date Sampled: **13/01/2023** Date Received: **26/01/2023**

Natural Water Content (%): **12.7** Part 2 Clause 3.2

PSD Sieving		PSD Sedimentation	
Size (mm)	% Passing	Size (mm)	% Passing
75	100	No sedimentation test	
63	100		
50	100		
37.5	100		
28	99		
20	90		
14	85		
10	83		
6.3	73		
5	69		
3.35	61		
2	54		
1.18	50		
0.6	38		
0.425	31		
0.300	24		
0.212	19		
0.150	14		
0.063	11		

Gravel %	46
Sand %	43
Silt/Clay %	11



Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/09-CLS**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
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CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Location: **TP02 at 1.60m**

Material Type: **Dark brown loamy PEAT.**

	Test Results	Specification
Water Content (%)	**52.7**	BS EN ISO 17892-1;2014

Liquid and Plastic Limit Tests Carried out in Accordance with BS 1377-Part 2:1990

	Test Results	Specification
Passing 425mic (%):	**50**	

Remarks: **Material found to be Non-Plastic**

Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531/10-CLS**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

CLASSIFICATION OF SOILS

Tests according to B.S. 1377 : 1990

Location: **TP03 at 1.00m**

Material Type: **Dark brown loamy PEAT.**

	Test Results	Specification
Water Content (%)	**38.5**	BS EN ISO 17892-1;2014

Liquid and Plastic Limit Tests Carried out in Accordance with BS 1377-Part 2:1990

	Test Results	Specification
Passing 425mic (%):	**40**	

Remarks: **Material found to be Non-Plastic**

Start of Test Date: **26/01/2023** End of Test Date: **01/02/2023** Report Date: **01/02/2023**

UKAS accredited testing laboratory No. 0744 Report/Sample ID No: **S1531**

Northumberland County Council

Highways Laboratory
Bassington Drive • Cramlington • Northumberland • NE23 8AJ
Tel (01670) 737575 • Email highwayslaboratory@northumberland.gov.uk

DEVIATING SAMPLE INFORMATION

Comments:
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards. For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling. If Northumberland County Council Laboratory did not undertake the sampling. Such samples may be deviating.

Lab ID	Client ID	Deviating	Tests (Reason for deviation)
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	
		N	

Appendix H

Site Specific Radon Assessment Sheet (Envirocheck)

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
307849427_1_1

Customer Reference:
P18-474

National Grid Reference:
435770, 546820

Slice:
A

Site Area (Ha):
0.83

Search Buffer (m):
1000

Site Details:

land adjacent to Colliery Lane
Hetton-le-Hole
Houghton le Spring
DH5 0AD

Client Details:

Mrs N Watson
Hydrock 3E
2 Esh Plaza
Sir Bobby Robson Way
Great Park
Newcastle upon Tyne
NE13 9BA

Hydrock 3E

Contents

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	16
Hazardous Substances	-
Geological	18
Industrial Land Use	20
Sensitive Land Use	26
Data Currency	27
Data Suppliers	32
Useful Contacts	33

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.
In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Report Version v53.0

Hydrock 3E

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 2			6	9
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 5		6	1	
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 6			Yes	
Pollution Incidents to Controlled Waters	pg 6			2	4
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances					
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 7				1
Water Abstractions					
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 8	Yes	n/a	n/a	n/a
Groundwater Vulnerability - Soluble Rock Risk	pg 8	1	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 8	Yes	n/a	n/a	n/a
Superficial Aquifer Designations	pg 8	Yes	n/a	n/a	n/a
Source Protection Zones	pg 8	1			
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 8			14	46

Hydrock 3E

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites	pg 16			2	1
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)	pg 16		1	1	
Local Authority Landfill Coverage	pg 17	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites	pg 17			1	1
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					
Geological					
BGS 1:625,000 Solid Geology	pg 18	Yes	n/a	n/a	n/a
BGS Recorded Mineral Sites	pg 18		2	1	
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas	pg 18	Yes	n/a	n/a	n/a
Mining Instability	pg 18	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 18	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 18	Yes	Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards	pg 19	Yes		n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 19	Yes		n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 19	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 19	Yes	Yes	n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a

Hydrock 3E

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Industrial Land Use					
Contemporary Trade Directory Entries	pg 20		19	14	22
Fuel Station Entries	pg 25			1	1
Gas Pipelines					
Underground Electrical Cables					
Sensitive Land Use					
Ancient Woodland					
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves	pg 26				1
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 26	2			
Ramsar Sites					
Sites of Special Scientific Interest	pg 26				1
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (W)	0	1	435750 546818
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (E)	0	1	435771 546818
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NE (E)	16	1	435850 546850
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (W)	53	1	435650 546818
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (W)	154	1	435550 546818
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SW (W)	253	1	435450 546800
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13NW (W)	258	1	435450 546850
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12NE (W)	304	1	435400 546818
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A14NW (E)	312	1	436150 546818
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (NW)	325	1	435500 547100
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	360	1	435450 547100
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13NW (NW)	365	1	435500 547150
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14NW (E)	378	1	436200 546950
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14NW (NE)	400	1	436150 547100
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14SW (E)	414	1	436250 546750
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A18SE (NE)	430	1	436000 547250
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SW (N)	452	1	435650 547300
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SE (NE)	476	1	436000 547300
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14SW (E)	482	1	436300 546650

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Northumbrian Water Limited Property Type: WASTE COLLECTION/TREATMENT/DISPOSAL/MATERIALS RECOVERY Location: Hetton Lyons Stw, Hetton-Le-Hole Authority: Environment Agency, North East Region Catchment Area: Wear (Lower) Reference: 245/0931 Permit Version: 1 Effective Date: 28th September 1989 Issued Date: 28th September 1989 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn, Tributary Of **Status: Transferred from Water Act 1989** Positional Accuracy: Located by supplier to within 100m	A13NE (E)	270	2	436100 546900
2	**Discharge Consents** Operator: Mr R Scott Property Type: Undefined Or Other Location: Claude Street, A New Dwelling, HETTON-LE-HOLE Authority: Environment Agency, North East Region Catchment Area: Not Given Reference: 245/0090 Permit Version: Not Supplied Effective Date: Not Supplied Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Surface Water Discharge Environment: Onto Land Receiving Water: Land **Status: Not Supplied** Positional Accuracy: Located by supplier to within 100m	A13NW (NW)	322	2	435500 547095
2	**Discharge Consents** Operator: Unknown, Property Type: DOMESTIC PROPERTY (SINGLE) (INCL FARM HOUSE) Location: Claude Street, A New Dwelling, Hetton-Le-Hole, Tyne And Wear Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/0090 Permit Version: 1 Effective Date: 3rd July 1985 Issued Date: 3rd July 1985 Revocation Date: 28th October 1993 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Land **Status: Authorisation revoked** Positional Accuracy: Located by supplier to within 100m	A13NW (NW)	325	2	435500 547100
2	**Discharge Consents** Operator: Unknown, Property Type: DOMESTIC PROPERTY (SINGLE) (INCL FARM HOUSE) Location: Claude Street, A New Dwelling, Hetton-Le-Hole, Tyne And Wear Authority: Environment Agency, North East Region Catchment Area: Not Given Reference: 245/0090 Permit Version: 1 Effective Date: 3rd July 1985 Issued Date: 3rd July 1985 Revocation Date: 28th October 1993 Discharge Type: Trade Discharges - Site Drainage Discharge Environment: Freshwater Stream/River Receiving Water: Land **Status: Authorisation revoked** Positional Accuracy: Located by supplier to within 100m	A13NW (NW)	325	2	435500 547100

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
3	**Discharge Consents** Operator: Redundant - Northumbrian Water Ltd Property Type: PUMPING STATION ON SEWERAGE NETWORK (WATER COMPANY) Location: Hetton Lyons Pumping Station, Hetton Le Hole, County Durham Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/A/0585 Permit Version: 1 Effective Date: 26th February 1980 Issued Date: 26th February 1980 Revocation Date: 2nd September 1991 Discharge Type: Unspecified Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn **Status: Authorisation revoked** Positional Accuracy: Located by supplier to within 10m	A14SW (E)	362	2	436200 546800
4	**Discharge Consents** Operator: Redundant - Northumbrian Water Ltd Property Type: STORM TANK/CSO ON SEWERAGE NETWORK (WATER COMPANY) Location: Four Lane Ends Sso, Hetton-Le-Hole Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/C/0296 Permit Version: 1 Effective Date: 22nd February 1974 Issued Date: 22nd February 1974 Revocation Date: 28th February 1991 Discharge Type: Unspecified Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn, Tributary Of **Status: Authorisation revoked** Positional Accuracy: Located by supplier to within 10m	A12SE (W)	404	2	435300 546800
5	**Discharge Consents** Operator: City Of Sunderland Property Type: PUMPING STATION ON SEWERAGE NETWORK (WATER COMPANY) Location: Hetton Lyons Indust Est Ps Hetton Lyons Industrial Estate, Hetton Lyons, Hetton Le Hole, Tyne And Wear Authority: Environment Agency, North East Region Catchment Area: Wear (Lower) Reference: 245/1072 Permit Version: 1 Effective Date: 25th November 1993 Issued Date: 25th November 1993 Revocation Date: 5th March 2012 Discharge Type: Sewage Discharges - Pumping Station - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn **Status: Surrendered under EPR 2010** Positional Accuracy: Located by supplier to within 10m	A19SW (NE)	514	2	436150 547260
6	**Discharge Consents** Operator: Unknown, Property Type: WWTW (NOT WATER CO) (NOT STP AT A PRIVATE PREMISES) Location: Urwin Street, 2 Properties S.W. Of, Hetton-Le-Hole Authority: Environment Agency, North East Region Catchment Area: Wear (Lower) Reference: 245/0691 Permit Version: 1 Effective Date: 7th October 1988 Issued Date: 7th October 1988 Revocation Date: 30th September 1996 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Onto Land Receiving Water: Land **Status: Lapsed (under Environment Act 1995, Schedule 23)** Positional Accuracy: Located by supplier to within 100m	A18SW (NW)	536	2	435540 547360

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
7	**Discharge Consents** Operator: Redundant - Northumbrian Water Ltd Property Type: STORM TANK/CSO ON SEWERAGE NETWORK (WATER COMPANY) Location: Frederick Terrace Sso, Hetton-Le-Hole Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/C/0297 Permit Version: 1 Effective Date: 22nd February 1974 Issued Date: 22nd February 1974 Revocation Date: 31st May 1994 Discharge Type: Unspecified Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn, Tributary Of **Status: Authorisation revoked** Positional Accuracy: Located by supplier to within 10m	A8NE (SE)	645	2	436100 546200
8	**Discharge Consents** Operator: Unknown, Property Type: CONSTRUCTION OF BUILDINGS Location: Station Road, A Housing Development, Hetton-Le-Hole, Tyne And Wear Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/0732 Permit Version: 1 Effective Date: 7th November 1988 Issued Date: 7th November 1988 Revocation Date: 25th November 1991 Discharge Type: Trade Discharges - Site Drainage Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn **Status: Transferred from COPA 1974** Positional Accuracy: Located by supplier to within 10m	A17SE (NW)	654	2	435170 547220
9	**Discharge Consents** Operator: Northumbrian Water Limited Property Type: PUMPING STATION ON SEWERAGE NETWORK (WATER COMPANY) Location: Hartside Gardens Ps, Easington Lane, Sunderland Authority: Environment Agency, North East Region Catchment Area: Wear (Lower) Reference: 245/0967 Permit Version: 1 Effective Date: 3rd March 1992 Issued Date: 3rd March 1992 Revocation Date: 29th December 2017 Discharge Type: Sewage Discharges - Pumping Station - Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Rainton Burn Tributary (Wear) **Status: Surrendered under EPR 2010** Positional Accuracy: Located by supplier to within 10m	A9NW (SE)	688	2	436290 546270
10	**Discharge Consents** Operator: Northumbrian Water Limited Property Type: STORM TANK/CSO ON SEWERAGE NETWORK (WATER COMPANY) Location: Hetton-Le-Hole Sso No. 1, Hetton-Le-Hole, Co. Durham Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/1365 Permit Version: 1 Effective Date: 31st March 2005 Issued Date: 28th February 2005 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn **Status: Consent without application (Water Resources Act 1991, Schedule 10)** Positional Accuracy: Located by supplier to within 10m	A17SW (NW)	726	2	435090 547230

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
10	**Discharge Consents** Operator: Northumbrian Water Limited Property Type: STORM TANK/CSO ON SEWERAGE NETWORK (WATER COMPANY) Location: Hetton-Le-Hole Sso No. 1, Hetton-Le-Hole, Co. Durham Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/1365 Permit Version: 1 Effective Date: 31st March 2005 Issued Date: 28th February 2005 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn **Status: Consent without application (Water Resources Act 1991, Schedule 10)** Positional Accuracy: Located by supplier to within 10m	A17SW (NW)	752	2	435060 547230
11	**Discharge Consents** Operator: Redundant - Northumbrian Water Ltd Property Type: STORM TANK/CSO ON SEWERAGE NETWORK (WATER COMPANY) Location: Murton Lane Sso, Hetton-Le-Hole Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/C/0298 Permit Version: 1 Effective Date: 22nd February 1974 Issued Date: 22nd February 1974 Revocation Date: 28th February 1991 Discharge Type: Unspecified Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn, Tributary Of **Status: Authorisation revoked** Positional Accuracy: Located by supplier to within 10m	A9NW (SE)	749	2	436300 546200
12	**Discharge Consents** Operator: Redundant - Northumbrian Water Ltd Property Type: STORM TANK/CSO ON SEWERAGE NETWORK (WATER COMPANY) Location: Brickgarth Sso, West End, Hetton-Le-Hole Authority: Environment Agency, North East Region Catchment Area: Not Supplied Reference: 245/C/0299 Permit Version: 1 Effective Date: 22nd February 1974 Issued Date: 22nd February 1974 Revocation Date: 28th February 1991 Discharge Type: Unspecified Discharge Environment: Freshwater Stream/River Receiving Water: Hetton Burn, Tributary Of **Status: Authorisation revoked** Positional Accuracy: Located by supplier to within 10m	A8SW (S)	790	2	435600 546000
13	**Local Authority Pollution Prevention and Controls** Name: Friskies Pet Care Location: Hetton Lyons Industrial Estate, Hetton le Hole, HOUGHTON LE SPRING, Tyne and Wear, DH5 0RH Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department Permit Reference: 0058 Dated: Not Supplied Process Type: Local Authority Air Pollution Control Description: PG6/24 Pet food manufacturing **Status: Authorisation has varied** Positional Accuracy: Manually positioned within the geographical locality	A13NE (NE)	11	3	435791 546863
14	**Local Authority Pollution Prevention and Controls** Name: Alltrac Waste Recycling (Mobile Crusher) Location: Unit 6 Hetton Lyons Industrial Estate, Hetton, DH5 0RH Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department Permit Reference: 1034/1 Dated: Not Supplied Process Type: Local Authority Pollution Prevention and Control Description: PG3/16 Mobile screening and crushing processes **Status: Permitted** Positional Accuracy: Manually positioned to the address or location	A13NE (N)	157	3	435778 547009

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
14	**Local Authority Pollution Prevention and Controls** Name: Coleman Cabinets Ltd Location: 6 Hetton Lyons Industrial Estate, Hetton Le Hole, SUNDERLAND, Tyne and Wear, DH5 ORH Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department Permit Reference: 0069 Dated: Not Supplied Process Type: Local Authority Air Pollution Control Description: PG6/2 Manufacture of timber and wood-based products **Status: Authorisation revoked** Positional Accuracy: Manually positioned within the geographical locality	A13NW (N)	169	3	435742 547021
14	**Local Authority Pollution Prevention and Controls** Name: Coleman Cabinets Ltd Location: 6 Hetton Lyons Industrial Estate, Hetton Le Hole, SUNDERLAND, Tyne and Wear, DH5 ORH Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department Permit Reference: 0069 Dated: Not Supplied Process Type: Local Authority Air Pollution Control Description: PG6/33 Wood coating **Status: Authorisation revoked** Positional Accuracy: Manually positioned within the geographical locality	A13NW (N)	169	3	435742 547021
15	**Local Authority Pollution Prevention and Controls** Name: Rose Cabinets Location: 6 Hetton Lyons Industrial Estate, Hetton le Hole, HOUGHTON LE SPRING, Tyne and Wear, DH5 0RH Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department Permit Reference: Not Given Dated: Not Supplied Process Type: Local Authority Air Pollution Control Description: PG6/2 Manufacture of timber and wood-based products **Status: Authorisation revoked** Positional Accuracy: Manually positioned within the geographical locality	A13NE (N)	233	3	435812 547086
16	**Local Authority Pollution Prevention and Controls** Name: Reg Vardy Location: Vehicle Preparation Centre, Hetton Lyons Industrial Estate, Hetton Le Hole, DH5 0RN Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department Permit Reference: 0147 Dated: Not Supplied Process Type: Local Authority Pollution Prevention and Control Description: PG6/34 Respraying of road vehicles **Status: Permitted** Positional Accuracy: Manually positioned within the geographical locality	A13NE (NE)	237	3	435935 547068
16	**Local Authority Pollution Prevention and Controls** Name: Reg Vardy Vehicel Preparation Centre Location: Hetton Lyons Industrial Estate, Hetton Le Hole, Dh5 0rn Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department Permit Reference: 0147 Dated: Not Supplied Process Type: Local Authority Pollution Prevention and Control Description: PG6/34 Respraying of road vehicles **Status: Permitted** Positional Accuracy: Manually positioned within the geographical locality	A13NE (NE)	262	3	435940 547094
	Nearest Surface Water Feature	A12NE (W)	297	-	435411 546848
17	**Pollution Incidents to Controlled Waters** Property Type: Cattle (Dairy) Farming: Other Location: Hetton Lyons Authority: Environment Agency, North East Region Pollutant: Organic Wastes: Other slurry Note: Biology Affected; Fisheries Affected; 201 - 500 Fish Killed Incident Date: 10th September 1995 Incident Reference: NW950099 Catchment Area: Lower Wear Receiving Water: Pond/Lake Cause of Incident: Not Given Incident Severity: Category 1 - Major Incident Positional Accuracy: Located by supplier to within 100m	A14NW (NE)	441	2	436200 547100

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
18	**Pollution Incidents to Controlled Waters** Property Type: Contaminated Land Location: Hetton Lyons Authority: Environment Agency, North East Region Pollutant: Not Given Note: Pollution Found; Biology Affected; No Fish Killed Incident Date: 6th January 1996 Incident Reference: NW960004 Catchment Area: Lower Wear Receiving Water: Pond/Lake Cause of Incident: Unknown Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A19SW (NE)	500	2	436200 547195
18	**Pollution Incidents to Controlled Waters** Property Type: Contaminated Land Location: Hetton Lyons Authority: Environment Agency, North East Region Pollutant: Unknown Note: Biology Affected; No Fish Killed Incident Date: 6th January 1996 Incident Reference: NW960004 Catchment Area: Lower Wear Receiving Water: Pond/Lake Cause of Incident: Not Given Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A19SW (NE)	504	2	436200 547200
19	**Pollution Incidents to Controlled Waters** Property Type: Industrial: Other Location: Hetton Le Hole Authority: Environment Agency, North East Region Pollutant: Oils - Diesel (Including Agricultural) Note: Biology Affected; Geology Affected; No Fish Killed Incident Date: 20th March 1995 Incident Reference: NW950187 Catchment Area: Lower Wear Receiving Water: Freshwater Stream/River Cause of Incident: Not Given Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 100m	A17SE (NW)	545	2	435400 547300
20	**Pollution Incidents to Controlled Waters** Property Type: Other General Premises Location: HETTON-LE-HOLE Authority: Environment Agency, North East Region Pollutant: Not Given Note: Hetton Lyons Pond Incident Date: 23rd April 1994 Incident Reference: 245/004188 Catchment Area: Not Given Receiving Water: Pond/Lake Cause of Incident: Other Cause Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A19SW (NE)	577	2	436200 547300
21	**Pollution Incidents to Controlled Waters** Property Type: Highway/Car Park Location: HETTON-LE-HOLE Authority: Environment Agency, North East Region Pollutant: Not Given Note: Wear Incident Date: 21st April 1992 Incident Reference: 245/002425 Catchment Area: Not Given Receiving Water: No Pollution Cause of Incident: Other Oil Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A12SE (W)	631	2	435100 546600
22	**Substantiated Pollution Incident Register** Authority: Environment Agency - North East Region, North East Area Incident Date: 15th January 2015 Incident Reference: 1306785 Water Impact: Category 1 - Major Incident Air Impact: Category 4 - No Impact Land Impact: Category 4 - No Impact Positional Accuracy: Located by supplier to within 10m Pollutant: Oils - Diesel (Including Agricultural)	A18SW (N)	511	2	435557 547340

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Groundwater Vulnerability Map Combined Classification: Secondary Superficial Aquifer - Medium Vulnerability Combined Vulnerability: Medium Combined Aquifer: Productive Bedrock Aquifer, Productive Superficial Aquifer Pollutant Speed: Intermediate Bedrock Flow: Well Connected Fractures Dilution: 300-550 mm/year Baseflow Index: <40% Superficial Patchiness: >90% Superficial Thickness: 3-10m Superficial Recharge: Low	A13NW (E)	0	4	435771 546818
	Groundwater Vulnerability - Soluble Rock Risk Classification: Significant Risk - Problems Unlikely	A13NW (E)	0	4	435771 546818
	Bedrock Aquifer Designations Aquifer Designation: Principal Aquifer	A13NW (E)	0	4	435771 546818
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - A	A13NW (E)	0	4	435771 546818
23	**Source Protection Zones** Name: Not Supplied Source: Environment Agency, Head Office Reference: Not Supplied Type: Zone III (Total Catchment): The total area needed to support the discharge from the protected groundwater source.	A13NW (E)	0	2	435771 546818
	Extreme Flooding from Rivers or Sea without Defences None				
	Flooding from Rivers or Sea without Defences None				
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
24	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 247.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14NW (E)	339	5	436177 546837
25	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 140.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14NW (E)	342	5	436179 546848
26	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 71.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14NW (E)	342	5	436179 546848

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
27	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 25.4 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14NW (E)	358	5	436186 546919
28	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 190.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14NW (E)	366	5	436189 546945
29	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 41.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14NW (NE)	453	5	436207 547111
30	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 121.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14SW (SE)	462	5	436240 546561
31	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 25.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Stephenson Lake Catchment Name: Wear Primacy: 1	A14NW (NE)	465	5	436201 547140
32	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 91.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Stephenson Lake Catchment Name: Wear Primacy: 1	A14NW (NE)	465	5	436201 547140
33	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 15.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Stephenson Lake Catchment Name: Wear Primacy: 1	A19SW (NE)	485	5	436154 547218
34	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 162.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14NW (NE)	487	5	436226 547144
35	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 363.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14SW (E)	493	5	436312 546653

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
36	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 3.2 Watercourse Level: Underground Permanent: True Watercourse Name: Stephenson Lake Catchment Name: Wear Primacy: 1	A19SW (NE)	496	5	436153 547234
37	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 8.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Stephenson Lake Catchment Name: Wear Primacy: 1	A19SW (NE)	499	5	436153 547237
38	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 111.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Stephenson Lake Catchment Name: Wear Primacy: 1	A19SW (NE)	505	5	436153 547246
39	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 485.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Hetton Burn Catchment Name: Wear Primacy: 1	A18SW (N)	510	5	435556 547338
40	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 344.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Hetton Burn Catchment Name: Wear Primacy: 1	A18SW (N)	510	5	435556 547338
41	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 167.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Blossom Pond Catchment Name: Wear Primacy: 1	A18SE (NE)	512	5	436024 547329
42	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 443.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A8NW (S)	546	5	435580 546250
43	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 351.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A8NW (S)	560	5	435667 546224
44	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 12.0 Watercourse Level: Underground Permanent: True Watercourse Name: Blossom Pond Catchment Name: Wear Primacy: 1	A18SE (N)	571	5	435965 547409

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
45	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 231.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Lyons Lake Catchment Name: Wear Primacy: 1	A18SE (N)	581	5	435960 547420
46	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 21.6 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A19SW (NE)	626	5	436339 547225
47	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 115.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	628	5	435234 546366
48	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 56.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	628	5	435234 546366
49	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 142.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A19SW (NE)	638	5	436337 547246
50	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 856.0 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	649	5	435185 546394
51	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 8.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A17SE (NW)	668	5	435140 547202
52	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 37.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Hetton Burn Catchment Name: Wear Primacy: 1	A17SE (NW)	674	5	435138 547209
53	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 19.1 Watercourse Level: Underground Permanent: True Watercourse Name: Hetton Burn Catchment Name: Wear Primacy: 1	A17SE (NW)	711	5	435109 547232

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
54	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 362.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Hetton Burn Catchment Name: Wear Primacy: 1	A17SW (NW)	730	5	435091 547239
55	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 11.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	732	5	435178 546274
56	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 1.7 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	743	5	435168 546269
57	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 15.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	745	5	435166 546268
58	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 8.6 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	760	5	435152 546261
59	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 769.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A19SE (NE)	761	5	436473 547268
60	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 230.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A19SE (NE)	761	5	436473 547268
61	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	768	5	435144 546258
62	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 33.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	773	5	435138 546256

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
63	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 52.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	773	5	435138 546256
64	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 460.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	781	5	435182 546202
65	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 56.7 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	781	5	435182 546202
66	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 46.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NE (SW)	824	5	435099 546225
67	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 19.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14SE (E)	834	5	436639 546553
68	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 28.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A14SE (E)	834	5	436639 546553
69	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 8.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A8SW (S)	845	5	435685 545937
70	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 1.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A8SW (S)	845	5	435685 545937
71	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 154.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A8SW (S)	850	5	435679 545932

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
72	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 43.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A8SW (S)	850	5	435679 545932
73	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 2.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NW (SW)	869	5	435069 546189
74	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 63.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NW (SW)	872	5	435068 546188
75	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 16.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7NW (SW)	872	5	435068 546188
76	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 90.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7SW (SW)	909	5	435076 546126
77	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 18.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A7SW (SW)	909	5	435076 546126
78	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 5.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A18NW (N)	920	5	435740 547773
79	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 25.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A18NW (N)	921	5	435746 547773
80	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 94.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Hetton Burn Catchment Name: Wear Primacy: 1	A17NW (NW)	977	5	435013 547535

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
81	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 346.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A19SE (NE)	985	5	436629 547434
82	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 55.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A19SE (NE)	985	5	436629 547434
83	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 227.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Wear Primacy: 1	A3NW (S)	986	5	435632 545799

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
84	**Historical Landfill Sites** Licence Holder: Not Supplied Location: Hetton-le-Hole, Sunderland Name: Hetton Lyons Operator Location: Not Supplied Boundary Accuracy: As Supplied Provider Reference: EAHLD06724 First Input Date: Not Supplied Last Input Date: Not Supplied Specified Waste Type: Not Supplied EA Waste Ref: 0 Regis Ref: Not Supplied WRC Ref: 4500/0252 BGS Ref: Not Supplied Other Ref: SL 014	A14NW (E)	345	2	436182 546834
85	**Historical Landfill Sites** Licence Holder: Not Supplied Location: Hetton-le-Hole, Sunderland Name: Back Richard Street Operator Location: Not Supplied Boundary Accuracy: As Supplied Provider Reference: EAHLD06647 First Input Date: Not Supplied Last Input Date: Not Supplied Specified Waste Type: Not Supplied EA Waste Ref: 0 Regis Ref: Not Supplied WRC Ref: Not Supplied BGS Ref: Not Supplied Other Ref: TW 318 SL	A18SW (N)	498	2	435586 547335
86	**Historical Landfill Sites** Licence Holder: Not Supplied Location: Easington Lane, Sunderland Name: Dorset Street Operator Location: Not Supplied Boundary Accuracy: As Supplied Provider Reference: EAHLD06725 First Input Date: Not Supplied Last Input Date: Not Supplied Specified Waste Type: Not Supplied EA Waste Ref: 0 Regis Ref: Not Supplied WRC Ref: 4500/0243 BGS Ref: Not Supplied Other Ref: SL 006	A8SE (S)	823	2	436026 545989
87	**Licensed Waste Management Facilities (Locations)** Licence Number: 100412 Location: Unit 19, Former Pearsons Yard, Colliery Lane, Hetton Lyons Ind Est, Houghton Le Spring, Tyne & Wear, DH5 0BG Operator Name: Michael OBrien, Sarah Jane OBrien, Michael Johnny OBrien and Davis Cole OBrien Operator Location: Not Supplied Authority: Environment Agency - North East Region, North East Area Site Category: HCI Waste TS + treatment **Licence Status: Transferred** Issued: Not Supplied Last Modified: Not Supplied Expires: Not Supplied Suspended: Not Supplied Revoked: Not Supplied Surrendered: Not Supplied IPPC Reference: Not Supplied Positional Accuracy: Located by supplier to within 10m	A13NW (NW)	235	2	435536 547010

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
88	**Licensed Waste Management Facilities (Locations)** Licence Number: 64139 Location: Unit 6, Hetton Lyons Industrial Estate, Hetton-le- Hole, Houghton Le Spring, Tyne & Wear, DH5 0RH Operator Name: Green Energy Power Ltd Operator Location: Not Supplied Authority: Environment Agency - North East Region, North East Area Site Category: HCI Waste TS + treatment **Licence Status: Revoked** Issued: 10th February 2005 Last Modified: 23rd June 2011 Expires: Not Supplied Suspended: Not Supplied Revoked: 3rd November 2015 Surrendered: Not Supplied IPPC Reference: Not Supplied Positional Accuracy: Located by supplier to within 10m	A13NE (N)	297	2	435845 547150
	Local Authority Landfill Coverage Name: Sunderland City Council - Has supplied landfill data		0	3	435771 546818
89	**Local Authority Recorded Landfill Sites** Location: Hetton Lyons Reference: O Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department **Last Reported Status: Closed** Types of Waste: Not Supplied Date of Closure: Not Supplied Positional Accuracy: Positioned by the supplier Boundary Quality: Moderate	A14NW (E)	342	3	436180 546833
90	**Local Authority Recorded Landfill Sites** Location: Dorset Street (North) Reference: Q Authority: Sunderland City Metropolitan Borough Council, Environmental Health Department **Last Reported Status: Closed** Types of Waste: Not Supplied Date of Closure: Not Supplied Positional Accuracy: Manually positioned within the geographical locality Boundary Quality: Not Applicable	A8SE (S)	892	3	435900 545900

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Permian Rocks (Undifferentiated)	A13NW (NW)	0	1	435768 546820
	BGS 1:625,000 Solid Geology Description: Zechstein Group	A13NW (E)	0	1	435771 546818
91	**BGS Recorded Mineral Sites** Site Name: Lyons Colliery Quarry Location: Lyons, Hetton Le Hole, Houghton-Le-Spring, Tyne And Wear Source: British Geological Survey, National Geoscience Information Service Reference: 104098 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Permian Geology: Raisby Formation (Lower Magnesian Limestone) Commodity: Dolomite Positional Accuracy: Located by supplier to within 10m	A13NE (N)	145	1	435779 546997
92	**BGS Recorded Mineral Sites** Site Name: Lyons Sand Pit Location: Lyons, Hetton Le Hole, Houghton-Le-Spring, Tyne And Wear Source: British Geological Survey, National Geoscience Information Service Reference: 104099 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Permian Geology: Raisby Formation (Lower Magnesian Limestone) Commodity: Sand and Gravel Positional Accuracy: Located by supplier to within 10m	A13SE (SE)	172	1	435994 546717
93	**BGS Recorded Mineral Sites** Site Name: Pemberton Quarry Location: Moorsley, Hetton Le Hole, Houghton-Le-Spring, Tyne And Wear Source: British Geological Survey, National Geoscience Information Service Reference: 104034 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Permian Geology: Raisby Formation (Lower Magnesian Limestone) Commodity: Dolomite Positional Accuracy: Located by supplier to within 10m	A13SW (SW)	331	1	435530 546502
	Coal Mining Affected Areas Description: In an area which may be affected by coal mining activity. It is recommended that a coal mining report is obtained from the Coal Authority. Contact details are included in the Useful Contacts section of this report.	A13NW (E)	0	6	435771 546818
	Mining Instability Mining Evidence: Inconclusive Coal Mining Source: Ove Arup & Partners Boundary Quality: As Supplied	A13NW (E)	0	-	435771 546818
	Non Coal Mining Areas of Great Britain No Hazard				
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	0	1	435763 546800
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SE (SE)	185	1	435913 546620
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	0	1	435763 546800

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13SE (SE)	185	1	435913 546620
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	157	1	435551 546849
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	0	1	435763 546800
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SE (SE)	185	1	435913 546620
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (SW)	0	1	435763 546800
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (SE)	185	1	435913 546620
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (W)	242	1	435469 546881
	Radon Potential - Radon Affected Areas Affected Area: The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13NW (E)	0	1	435771 546818

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
94	**Contemporary Trade Directory Entries** Name: Cathedral Garden Furniture Location: Colliery La, Hetton-le-Hole, Houghton Le Spring, Tyne & Wear, DH5 0BD Classification: Garden & Patio Furniture Manufacturers & Distributors **Status: Inactive** Positional Accuracy: Manually positioned to the road within the address or location	A13NW (NW)	17	-	435694 546858
94	**Contemporary Trade Directory Entries** Name: Houghton Location: Colliery Lane, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0BG Classification: Trailers & Towing Equipment **Status: Inactive** Positional Accuracy: Automatically positioned in the proximity of the address	A13NW (NW)	58	-	435662 546884
95	**Contemporary Trade Directory Entries** Name: L & H Clothing Ltd Location: Unit 2/3, Hetton Lyons Industrial Estate, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0RH Classification: Clothing & Fabrics - Manufacturers **Status: Inactive** Positional Accuracy: Automatically positioned in the proximity of the address	A13NE (N)	22	-	435792 546874
96	**Contemporary Trade Directory Entries** Name: Moguntia Location: Hetton Lyons Industrial Estate, Hetton-le-Hole, HOUGHTON LE SPRING, Tyne and Wear, DH5 0RH Classification: Food Colouring, Flavouring & Additive Manufacturers & Distributors **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (N)	52	-	435737 546904
96	**Contemporary Trade Directory Entries** Name: Oris Ltd Location: Hetton Lyons Indust Est, Hetton Le Hole, Houghton Le Spring, Tyne & Wear, DH5 0RG Classification: Food Products - Manufacturers **Status: Inactive** Positional Accuracy: Manually positioned to the address or location	A13NW (N)	99	-	435738 546952
97	**Contemporary Trade Directory Entries** Name: Pallet Furniture Uk Location: Unit 3v Colliery Lane, Hetton-Le-Hole, Houghton le Spring, Tyne And Wear, DH5 0BG Classification: Garden & Patio Furniture Manufacturers & Distributors **Status: Active** Positional Accuracy: Manually positioned to the address or location	A13NW (N)	167	-	435725 547020
98	**Contemporary Trade Directory Entries** Name: Cisco Cleaning Solutions Location: Unit 5, Colliery Lane, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0BG Classification: Commercial Cleaning Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NW (NW)	182	-	435546 546931
98	**Contemporary Trade Directory Entries** Name: Dover'S Coaches Location: Unit 5, Colliery Lane, Hetton-le-Hole, HOUGHTON LE SPRING, Tyne and Wear, DH5 0BG Classification: Bus & Coach Operators & Stations **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NW (NW)	182	-	435546 546931
98	**Contemporary Trade Directory Entries** Name: Cummings & Pattison North East Ltd Location: Unit 11, Colliery Lane, Hetton-le-hole, Houghton Le Spring, DH5 0BG Classification: Wallpapers & Wall Coverings **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (NW)	182	-	435546 546931
98	**Contemporary Trade Directory Entries** Name: North East Garden Machinery Location: Unit 16 Colliery Lane, Hetton-Le-Hole, Houghton le Spring, Tyne And Wear, DH5 0BG Classification: Lawnmowers & Garden Machinery - Sales & Service **Status: Active** Positional Accuracy: Manually positioned to the address or location	A13NW (NW)	220	-	435506 546934
99	**Contemporary Trade Directory Entries** Name: Cygnal Location: Unit 1, Hetton Lyons Industrial Estate, Houghton-le-Spring, DH5 0RH Classification: Radio Communication Equipment **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (N)	187	-	435723 547040

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
99	**Contemporary Trade Directory Entries** Name: J T Dove Ltd Location: Unit 1, Hetton Lyons Industrial Estate, Houghton-le-Spring, DH5 0RH Classification: Builders' Merchants **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (N)	187	-	435723 547040
99	**Contemporary Trade Directory Entries** Name: Braketech Northern Location: Houghton-le-Spring, DH5 0RH Classification: Brake & Clutch Service Centres **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (N)	187	-	435723 547040
99	**Contemporary Trade Directory Entries** Name: Friskies Pet Care Location: Hetton Lyons Industrial Estate, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0RH Classification: Pet Foods & Animal Feeds **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NW (N)	217	-	435761 547069
99	**Contemporary Trade Directory Entries** Name: B M Stafford & Sons Ltd Location: Milburn House, Hetton Lyons Industrial Estate, Hetton-le-Hole, Houghton le Spring, DH5 0RH Classification: Road Haulage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (N)	227	-	435761 547079
99	**Contemporary Trade Directory Entries** Name: Gillboon Ltd Location: Hetton Lyons Indust Est, Hetton Le Hole, Houghton Le Spring, Tyne & Wear, DH5 0RH Classification: Clothing & Fabrics - Manufacturers **Status: Inactive** Positional Accuracy: Manually positioned within the geographical locality	A13NW (N)	251	-	435728 547104
100	**Contemporary Trade Directory Entries** Name: Roxbys Location: Kenton House, Station Road, Hetton-le-Hole, Houghton le Spring, DH5 0AX Classification: Garage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (W)	218	-	435497 546902
100	**Contemporary Trade Directory Entries** Name: Roxby'S Garage Location: Kenton House, Station Road, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0AX Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NW (W)	221	-	435496 546907
101	**Contemporary Trade Directory Entries** Name: Guys Coatings Ltd Location: Hetton Lyons Industrial Estate, Hetton-le-Hole, HOUGHTON LE SPRING, Tyne and Wear, DH5 0RH Classification: Coating Specialists **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NE (NE)	228	-	436042 546946
102	**Contemporary Trade Directory Entries** Name: G & G Travel Location: Montrose, Lyons Avenue, Easington Lane, Houghton le Spring, Tyne and Wear, DH5 0HR Classification: Bus & Coach Operators & Stations **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13SE (SE)	230	-	436047 546691
103	**Contemporary Trade Directory Entries** Name: J J Transport Location: Unit 3, Colliery Lane, Hetton-le-Hole, HOUGHTON LE SPRING, Tyne and Wear, DH5 0BG Classification: Mot Testing Centres **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (NW)	280	-	435507 547044
104	**Contemporary Trade Directory Entries** Name: Sparrow Location: Station Road, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0AX Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NW (W)	281	-	435434 546905

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
105	**Contemporary Trade Directory Entries** Name: Hetton Body Repair Centre Location: Unit 1a, Colliery Lane, Hetton-le-Hole, HOUGHTON LE SPRING, Tyne and Wear, DH5 0BG Classification: Car Body Repairs **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NW (NW)	287	-	435579 547108
105	**Contemporary Trade Directory Entries** Name: H B R C Location: Unit 20b, Colliery Lane, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0BG Classification: Car Body Repairs **Status: Active** Positional Accuracy: Automatically positioned to the address	A13NW (NW)	287	-	435579 547108
106	**Contemporary Trade Directory Entries** Name: Ward Catering Services Ltd Location: 31, Station Road, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0AT Classification: Catering Equipment - Servicing & Repairs **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NW (NW)	295	-	435442 546976
107	**Contemporary Trade Directory Entries** Name: Decorpanel Ltd Location: 8, Hetton Lyons Industrial Estate, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0RH Classification: Wood Products, Except Furniture - Manufacturers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NE (NE)	298	-	435938 547133
108	**Contemporary Trade Directory Entries** Name: R & R Motors Location: Pearons Industrial Estate, Hetton-Le-Hole, Houghton le Spring, Tyne And Wear, DH5 0GB Classification: Garage Services **Status: Active** Positional Accuracy: Manually positioned to the road within the address or location	A13SE (SE)	323	-	436063 546558
109	**Contemporary Trade Directory Entries** Name: Eazi Clean Location: Hetton-Le-Hole, Houghton le Spring, Tyne And Wear, DH5 0EW Classification: Cleaning Services - Domestic **Status: Inactive** Positional Accuracy: Manually positioned within the geographical locality	A12SE (SW)	375	-	435371 546610
110	**Contemporary Trade Directory Entries** Name: Pro Clean Plus Ltd Location: 7, Seymour Terrace, Easington Lane, Houghton le Spring, Tyne and Wear, DH5 0JE Classification: Commercial Cleaning Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A8NE (S)	383	-	435802 546407
111	**Contemporary Trade Directory Entries** Name: Durham Cars 4 U Location: Imperial House, Station Road, Hetton-Le-Hole, Houghton le Spring, Tyne And Wear, DH5 9JB Classification: Car Dealers - Used **Status: Active** Positional Accuracy: Manually positioned to the address or location	A12NE (NW)	457	-	435351 547135
112	**Contemporary Trade Directory Entries** Name: Hetton Car Sprays Location: Logan Street, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0AS Classification: Car Body Repairs **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A12NE (NW)	464	-	435304 547076
113	**Contemporary Trade Directory Entries** Name: Norman Hall Location: Imperial House, Station Road, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9JB Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	471	-	435382 547190

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
114	**Contemporary Trade Directory Entries** Name: Sydney Sparrow Ltd Location: BACK SMITHS TERRACE, EASINGTON LANE, HOUGHTON LE SPRING, DH5 0JQ Classification: Garage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A8NE (S)	476	-	435876 546315
115	**Contemporary Trade Directory Entries** Name: George Vardy Ltd Location: REAR OF, RICHARD STREET, HETTON-LE-HOLE, HOUGHTON LE SPRING, DH5 9HN Classification: Road Haulage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A18SW (N)	514	-	435595 547353
116	**Contemporary Trade Directory Entries** Name: Fotocoll Location: 2, Station Road North, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9HQ Classification: Photographic Processors **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	535	-	435357 547254
116	**Contemporary Trade Directory Entries** Name: E & N Ritchie Location: Triumph Garage, Station Road, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9JB Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	569	-	435348 547290
116	**Contemporary Trade Directory Entries** Name: Ritchie Transport & Hetton Le Hole Ltd Location: Triumph Garage, Station Road, Hetton-le-Hole, Houghton le Spring, DH5 9JB Classification: Road Haulage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	572	-	435351 547297
117	**Contemporary Trade Directory Entries** Name: Mobile Car Van Servicing Location: 18, Mardale Street, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 0DJ Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A12SW (W)	626	-	435090 546659
118	**Contemporary Trade Directory Entries** Name: H & E L Joinery Ltd Location: Pavilion Works, Pavilion Terrace, Hetton-le-Hole, Houghton le Spring, DH5 9HP Classification: Builders' Merchants **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A18SW (N)	637	-	435531 547463
119	**Contemporary Trade Directory Entries** Name: Energy Save Solutions Ltd Location: Flat 2, Houghton Le Spring, Tyne And Wear, DH5 9NF Classification: Heat Exchangers **Status: Inactive** Positional Accuracy: Manually positioned within the geographical locality	A17SE (NW)	666	-	435247 547330
119	**Contemporary Trade Directory Entries** Name: Scott'S Joinery Services Location: Flat 1, Wesleyan House, Front Street, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9NF Classification: Architectural Woodwork **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	666	-	435247 547330
119	**Contemporary Trade Directory Entries** Name: Heatpack Healthcare Location: Wesleyan House, Front Street, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9NF Classification: Medical Equipment Manufacturers **Status: Inactive** Positional Accuracy: Automatically positioned in the proximity of the address	A17SE (NW)	666	-	435248 547330

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
120	**Contemporary Trade Directory Entries** Name: Ashcroft'S Auto Repairs Location: 71-75, High Street, Easington Lane, Houghton le Spring, Tyne and Wear, DH5 0JR Classification: Mot Testing Centres **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A9NW (SE)	666	-	436169 546211
121	**Contemporary Trade Directory Entries** Name: North East Cutting Service Location: The Avenue, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9DH Classification: Clothing & Fabrics - Manufacturers **Status: Inactive** Positional Accuracy: Automatically positioned in the proximity of the address	A18NW (N)	686	-	435561 547521
122	**Contemporary Trade Directory Entries** Name: Office Place Garage Location: Office, Office Place, Houghton-le-Spring, DH5 9JG Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	705	-	435193 547331
123	**Contemporary Trade Directory Entries** Name: Bog Row Garage Location: Bog Row, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9JN Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned in the proximity of the address	A17SW (NW)	736	-	435043 547163
124	**Contemporary Trade Directory Entries** Name: Danbys Auto Repairs Location: 103-104, Brickgarth, Easington Lane, Houghton le Spring, DH5 0LE Classification: Garage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A9SW (SE)	781	-	436154 546076
125	**Contemporary Trade Directory Entries** Name: G W Wright Location: Park View, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9JH Classification: Agricultural Merchants **Status: Active** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	791	-	435119 547377
126	**Contemporary Trade Directory Entries** Name: Lylds Mot Location: 32a, Murton Lane, Easington Lane, Houghton le Spring, Tyne and Wear, DH5 0NB Classification: Mot Testing Centres **Status: Active** Positional Accuracy: Automatically positioned to the address	A9NW (SE)	792	-	436359 546192
127	**Contemporary Trade Directory Entries** Name: C Jackson Location: 72, Brickgarth, Easington Lane, Houghton le Spring, DH5 0LB Classification: Pet Foods & Animal Feeds **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A8SE (S)	799	-	436018 546011
128	**Contemporary Trade Directory Entries** Name: Howden'S Joinery Location: 14, Brickgarth, Easington Lane, Houghton le Spring, Tyne and Wear, DH5 0LA Classification: Kitchen Furniture Manufacturers **Status: Active** Positional Accuracy: Automatically positioned to the address	A8SE (S)	816	-	435860 545974
129	**Contemporary Trade Directory Entries** Name: Mcmurchie Meat Ltd Location: Caroline Street, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9DB Classification: Meat - Wholesale **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17NE (NW)	879	-	435326 547642
130	**Contemporary Trade Directory Entries** Name: W Christer & Son Location: 8, Houghton Road, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9PG Classification: Printers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17NE (NW)	919	-	435264 547655

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
131	**Contemporary Trade Directory Entries** Name: Fb Glass Location: 68, Caroline Street, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9DE Classification: Leaded Lights & Windows **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A18NW (N)	955	-	435486 547781
132	**Contemporary Trade Directory Entries** Name: Hetton Cemetery Location: Houghton Road, Hetton-le-Hole, Houghton le Spring, Tyne and Wear, DH5 9PH Classification: Cemeteries & Crematoria **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A17NE (NW)	990	-	435196 547698
133	**Fuel Station Entries** Name: Sydney Sparrow Ltd Location: Station Road , Hetton-Le-Hole , Houghton-Le-Spring, Tyne And Wear, DH5 0AX Brand: Wcf Premises Type: Not Applicable **Status: Obsolete** Positional Accuracy: Manually positioned to the address or location	A13NW (W)	281	-	435434 546905
134	**Fuel Station Entries** Name: Triumph Garage Location: Station Road , Hetton-Le-Hole , Houghton-Le-Spring, Tyne And Wear, DH5 9JB Brand: UNBRANDED Premises Type: Not Applicable **Status: Obsolete** Positional Accuracy: Automatically positioned to the address	A17SE (NW)	595	-	435329 547308

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
135	**Local Nature Reserves** Name: Hetton Bogs Multiple Area: N Area (m2): 189394.9 Source: Natural England Designation Date: 15th August 2003	A17NW (NW)	968	7	435089 547594
136	**Nitrate Vulnerable Zones** Name: Lumley Park Burn From Herrington Burn To R Wear Nvz Description: Surface Water Source: Environment Agency, Head Office	A13NW (E)	0	4	435771 546818
137	**Nitrate Vulnerable Zones** Name: Durham Description: Groundwater Source: Environment Agency, Head Office	A13NW (E)	0	4	435771 546818
138	**Sites of Special Scientific Interest** Name: Eppleton Grassland Multiple Areas: N Total Area (m2): 130418.21 Source: Natural England Reference: 2000735 Designation Details: Site Of Special Scientific Interest Designation Date: 27th April 2012 Date Type: Notified	A19SW (NE)	707	7	436421 547248

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices		
Environment Agency - Head Office	June 2020	Annually
Durham City Council (now part of Durham County Council) - Environmental Health Department	November 2008	
Chester-le-Street District Council (now part of Durham County Council) - Environmental Health Department	October 2008	
Easington District Council (now part of Durham County Council) - Environmental Health Department	October 2008	
Durham County Council (Unitary) - Environmental Health Department	October 2017	Annually
Sunderland City Metropolitan Borough Council - Environmental Health Department	October 2017	Annually
Discharge Consents		
Environment Agency - North East Region	January 2023	Quarterly
Enforcement and Prohibition Notices		
Environment Agency - North East Region	March 2013	
Integrated Pollution Controls		
Environment Agency - North East Region	January 2009	
Integrated Pollution Prevention And Control		
Environment Agency - North East Region	January 2023	Quarterly
Local Authority Integrated Pollution Prevention And Control		
Durham County Council (Unitary) - Environmental Health Department	April 2015	Variable
Chester-le-Street District Council (now part of Durham County Council) - Environmental Health Department	December 2008	Not Applicable
Durham City Council (now part of Durham County Council) - Environmental Health Department	March 2009	Not Applicable
Sunderland City Metropolitan Borough Council - Environmental Health Department	May 2016	Variable
Easington District Council (now part of Durham County Council) - Environmental Health Department	October 2008	Not Applicable
Local Authority Pollution Prevention and Controls		
Durham County Council (Unitary) - Environmental Health Department	April 2015	Annually
Chester-le-Street District Council (now part of Durham County Council) - Environmental Health Department	December 2008	Not Applicable
Durham City Council (now part of Durham County Council) - Environmental Health Department	March 2009	Not Applicable
Sunderland City Metropolitan Borough Council - Environmental Health Department	May 2016	Annual Rolling Update
Easington District Council (now part of Durham County Council) - Environmental Health Department	October 2008	Not Applicable
Local Authority Pollution Prevention and Control Enforcements		
Durham County Council (Unitary) - Environmental Health Department	April 2015	Variable
Chester-le-Street District Council (now part of Durham County Council) - Environmental Health Department	December 2008	Not Applicable
Durham City Council (now part of Durham County Council) - Environmental Health Department	March 2009	Not Applicable
Sunderland City Metropolitan Borough Council - Environmental Health Department	May 2016	Variable
Easington District Council (now part of Durham County Council) - Environmental Health Department	October 2008	Not Applicable
Nearest Surface Water Feature		
Ordnance Survey	December 2022	
Pollution Incidents to Controlled Waters		
Environment Agency - North East Region	December 1998	
Prosecutions Relating to Authorised Processes		
Environment Agency - North East Region	July 2015	
Prosecutions Relating to Controlled Waters		
Environment Agency - North East Region	March 2013	
Registered Radioactive Substances		
Environment Agency - North East Region	June 2016	As notified

Agency & Hydrological	Version	Update Cycle
River Quality Environment Agency - Head Office	November 2001	Not Applicable
River Quality Biology Sampling Points Environment Agency - Head Office	April 2012	
River Quality Chemistry Sampling Points Environment Agency - Head Office	April 2012	
Substantiated Pollution Incident Register Environment Agency - North East Region - North East Area Environment Agency - North East Region - Northumbria Area	January 2023 January 2023	Quarterly Quarterly
Water Abstractions Environment Agency - North East Region	January 2023	Quarterly
Water Industry Act Referrals Environment Agency - North East Region	October 2017	
Groundwater Vulnerability Map Environment Agency - Head Office	June 2018	As notified
Groundwater Vulnerability - Soluble Rock Risk Environment Agency - Head Office	June 2018	As notified
Bedrock Aquifer Designations Environment Agency - Head Office	January 2018	Annually
Superficial Aquifer Designations Environment Agency - Head Office	January 2018	Annually
Source Protection Zones Environment Agency - Head Office	September 2022	Bi-Annually
Extreme Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2022	Quarterly
Flooding from Rivers or Sea without Defences Environment Agency - Head Office	November 2022	Quarterly
Areas Benefiting from Flood Defences Environment Agency - Head Office	November 2022	Quarterly
Flood Water Storage Areas Environment Agency - Head Office	August 2022	Quarterly
Flood Defences Environment Agency - Head Office	August 2022	Quarterly
OS Water Network Lines Ordnance Survey	January 2023	Quarterly
BGS Groundwater Flooding Susceptibility British Geological Survey - National Geoscience Information Service	May 2013	As notified

Data Currency

Waste	Version	Update Cycle
BGS Recorded Landfill Sites		
British Geological Survey - National Geoscience Information Service	November 2002	As notified
Historical Landfill Sites		
Environment Agency - Head Office	November 2022	Quarterly
Integrated Pollution Control Registered Waste Sites		
Environment Agency - North East Region	January 2009	Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries)		
Environment Agency - North East Region - North East Area	January 2023	Quarterly
Environment Agency - North East Region - Northumbria Area	January 2023	Quarterly
Licensed Waste Management Facilities (Locations)		
Environment Agency - North East Region - North East Area	January 2023	Quarterly
Environment Agency - North East Region - Northumbria Area	January 2023	Quarterly
Local Authority Landfill Coverage		
Chester-le-Street District Council (now part of Durham County Council)	February 2003	Not Applicable
Durham City Council (now part of Durham County Council)	February 2003	Not Applicable
Durham County Council - Economic Development and Planning Department	February 2003	Not Applicable
Easington District Council (now part of Durham County Council) - Environmental Health Department	February 2003	Not Applicable
Sunderland City Metropolitan Borough Council - Environmental Health Department	February 2003	Not Applicable
Local Authority Recorded Landfill Sites		
Chester-le-Street District Council (now part of Durham County Council)	October 2018	
Durham City Council (now part of Durham County Council)	October 2018	
Durham County Council - Economic Development and Planning Department	October 2018	
Easington District Council (now part of Durham County Council) - Environmental Health Department	October 2018	
Sunderland City Metropolitan Borough Council - Environmental Health Department	October 2018	
Registered Landfill Sites		
Environment Agency - North East Region - North East Area	March 2006	Not Applicable
Environment Agency - North East Region - Northumbria Area	March 2006	Not Applicable
Registered Waste Transfer Sites		
Environment Agency - North East Region - North East Area	April 2018	
Environment Agency - North East Region - Northumbria Area	April 2018	
Registered Waste Treatment or Disposal Sites		
Environment Agency - North East Region - North East Area	June 2015	
Environment Agency - North East Region - Northumbria Area	June 2015	

Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH)		
Health and Safety Executive	January 2022	Bi-Annually
Explosive Sites		
Health and Safety Executive	March 2017	Annually
Notification of Installations Handling Hazardous Substances (NIHHS)		
Health and Safety Executive	August 2001	
Planning Hazardous Substance Enforcements		
Durham City Council (now part of Durham County Council)	December 2008	Not Applicable
Durham County Council (Unitary) - Planning Department	February 2016	Variable
Sunderland City Metropolitan Borough Council - Planning	February 2016	Variable
Durham County Council - Economic Development and Planning Department	July 2007	Annual Rolling Update
Easington District Council (now part of Durham County Council)	July 2008	Not Applicable
Chester-le-Street District Council (now part of Durham County Council)	March 2009	Not Applicable
Planning Hazardous Substance Consents		
Durham City Council (now part of Durham County Council)	December 2008	Not Applicable
Durham County Council (Unitary) - Planning Department	February 2016	Variable
Sunderland City Metropolitan Borough Council - Planning	February 2016	Variable
Durham County Council - Economic Development and Planning Department	July 2007	Annual Rolling Update
Easington District Council (now part of Durham County Council)	July 2008	Not Applicable
Chester-le-Street District Council (now part of Durham County Council)	March 2009	Not Applicable

Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology		
British Geological Survey - National Geoscience Information Service	January 2009	As notified
BGS Recorded Mineral Sites		
British Geological Survey - National Geoscience Information Service	November 2022	Bi-Annually
CBSCB Compensation District		
Cheshire Brine Subsidence Compensation Board (CBSCB)	August 2011	
Cheshire Brine Subsidence Compensation Board (CBSCB)	November 2020	As notified
Coal Mining Affected Areas		
The Coal Authority - Property Searches	February 2023	Annual Rolling Update
Mining Instability		
Ove Arup & Partners	June 1998	Not Applicable
Non Coal Mining Areas of Great Britain		
British Geological Survey - National Geoscience Information Service	May 2015	Not Applicable
Potential for Collapsible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	April 2020	As notified
Potential for Compressible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Ground Dissolution Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Landslide Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Running Sand Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Shrinking or Swelling Clay Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	As notified
Radon Potential - Radon Affected Areas		
British Geological Survey - National Geoscience Information Service	September 2022	Annually
Radon Potential - Radon Protection Measures		
British Geological Survey - National Geoscience Information Service	September 2022	Annually

Industrial Land Use	Version	Update Cycle
Contemporary Trade Directory Entries		
Thomson Directories	January 2023	Quarterly
Fuel Station Entries		
Catalist Ltd - Experian	January 2023	Quarterly
Gas Pipelines		
National Grid	October 2021	Bi-Annually
Underground Electrical Cables		
National Grid	February 2023	Bi-Annually
Sensitive Land Use	**Version**	**Update Cycle**
Ancient Woodland		
Natural England	February 2021	Bi-Annually
Areas of Adopted Green Belt		
Chester-le-Street District Council (now part of Durham County Council)	July 2022	Quarterly
Durham City Council (now part of Durham County Council)	July 2022	Quarterly
Durham County Council (Unitary) - Planning Department	July 2022	Quarterly
Easington District Council (now part of Durham County Council)	July 2022	Quarterly
Sunderland City Metropolitan Borough Council - Planning	July 2022	Quarterly
Areas of Unadopted Green Belt		
Chester-le-Street District Council (now part of Durham County Council)	July 2022	Quarterly
Durham City Council (now part of Durham County Council)	July 2022	Quarterly
Durham County Council (Unitary) - Planning Department	July 2022	Quarterly
Easington District Council (now part of Durham County Council)	July 2022	Quarterly
Sunderland City Metropolitan Borough Council - Planning	July 2022	Quarterly
Areas of Outstanding Natural Beauty		
Natural England	August 2022	Bi-Annually
Environmentally Sensitive Areas		
Natural England	January 2017	
Forest Parks		
Forestry Commission	April 1997	Not Applicable
Local Nature Reserves		
Natural England	February 2021	Bi-Annually
Marine Nature Reserves		
Natural England	July 2019	Bi-Annually
National Nature Reserves		
Natural England	February 2023	Bi-Annually
National Parks		
Natural England	February 2018	Bi-Annually
Nitrate Sensitive Areas		
Natural England	April 2016	Not Applicable
Nitrate Vulnerable Zones		
Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	April 2016	
Environment Agency - Head Office	June 2017	Bi-Annually
Ramsar Sites		
Natural England	August 2020	Bi-Annually
Sites of Special Scientific Interest		
Natural England	February 2021	Bi-Annually
Special Areas of Conservation		
Natural England	July 2020	Bi-Annually
Special Protection Areas		
Natural England	February 2021	Bi-Annually

Data Suppliers

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	
Environment Agency	
Scottish Environment Protection Agency	
The Coal Authority	
British Geological Survey	
Centre for Ecology and Hydrology	
Natural Resources Wales	
Scottish Natural Heritage	
Natural England	
Public Health England	
Ove Arup	
Stantec UK Ltd	

Useful Contacts

Contact	Name and Address	Contact Details
1	**British Geological Survey - Enquiry Service** British Geological Survey, Environmental Science Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
2	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 03708 506 506 Email: enquiries@environment-agency.gov.uk
3	**Sunderland City Metropolitan Borough Council - Environmental Health Department** Civic Centre, P O Box 107, Burden Road, Sunderland, Tyne And Wear, SR2 7DN	Telephone: 0191 553 1699 Fax: 0191 553 1660 Website: www.sunderland.gov.uk
4	**Environment Agency - Head Office** Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, Avon, BS32 4UD	Telephone: 01454 624400 Fax: 01454 624409
5	**Ordnance Survey** Adanac Drive, Southampton, Hampshire, SO16 0AS	Telephone: 03456 05 05 05 Email: customerservices@ordnancesurvey.co.uk Website: www.ordnancesurvey.gov.uk
6	**The Coal Authority - Property Searches** 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG	Telephone: 0345 762 6848 Fax: 01623 637 338 Email: groundstability@coal.gov.uk Website: www2.groundstability.com
7	**Natural England** County Hall, Spetchley Road, Worcester, WR5 2NP	Telephone: 0300 060 3900 Email: enquiries@naturalengland.org.uk Website: www.naturalengland.org.uk
-	**Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards** Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / Natural Resources Wales / SEPA have a charging policy in place for enquiries.