A63 Castle Street Improvements, Hull
Environmental Statement

Volume 3 Appendix 11.4

ROAD DRAINAGE AND THE WATER ENVIRONMENT – GROUNDWATER REPORT

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A63 Castle Street Improvements, Hull

Environmental Statement

Appendix 11.4 Groundwater report

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1. Introduction

1.1 Scheme description

1.1.1 The A63, Castle Street, Hull is located to the south of Hull city centre. The current road is a dual carriageway that provides a vital route link between the M62 motorway, the Humber Bridge and A15 to the west of the city, and the Port of Humber to the east of the city. The route is reputed to be one of the busiest sections of road within East Yorkshire, where the current daily traffic flow along Castle Street is in excess of 54,000 annual average daily traffic (AADT). The route currently experiences congestion, particularly around the Mytongate Junction, due to the traffic signals and high proportion of heavy goods vehicles.

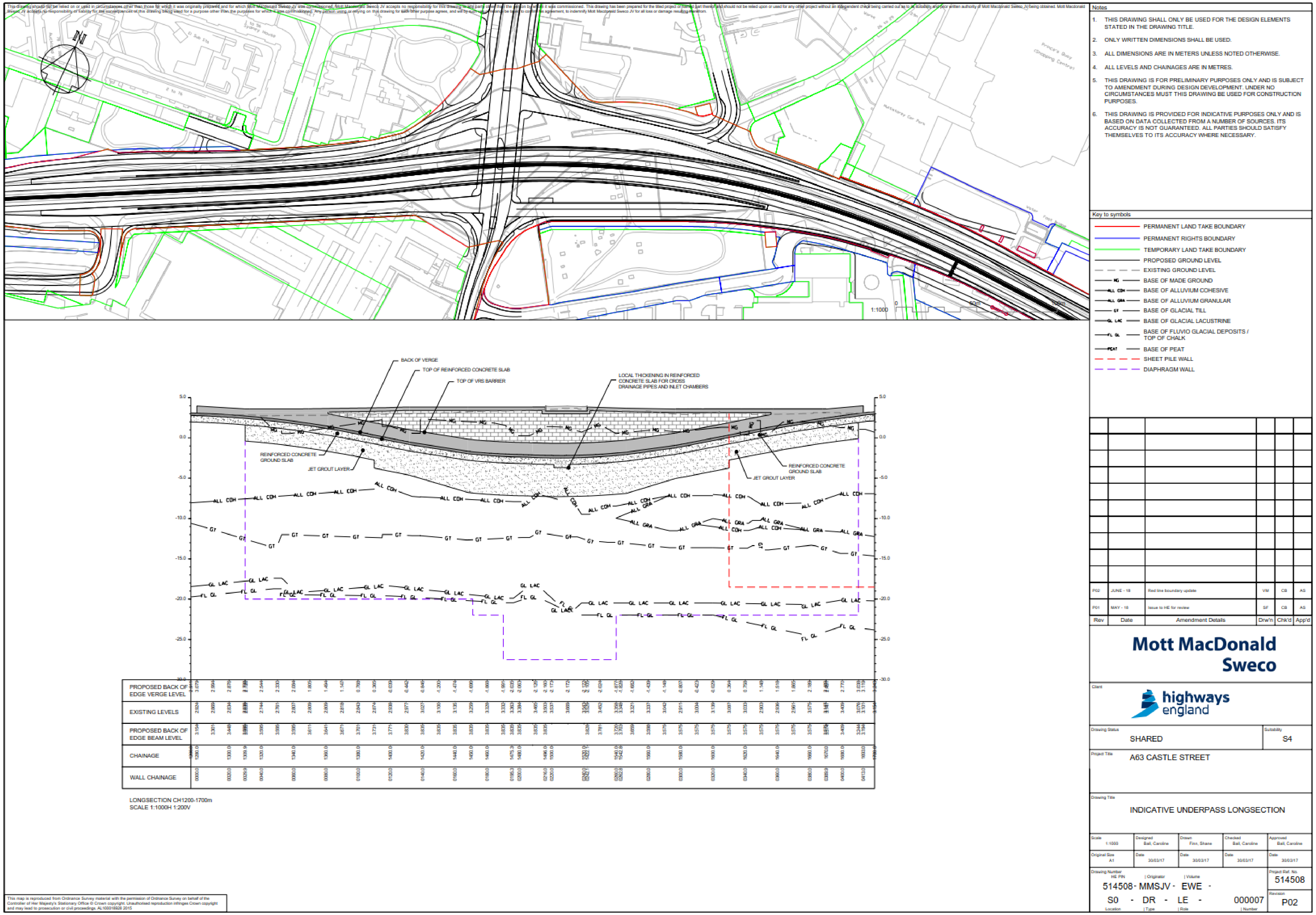
1.1.2 Highways England is proposing to relieve congestion and provide better access to the Port of Hull by improving the A63 Castle Street between the St James Street/ Porter Street junctions and the Market Place/Queen Street junctions (the Scheme).

1.1.3 The preferred option comprises a grade separated junction with the alignment of the A63 lowered approximately 7m below ground level (bgl). To provide the grade separated geometry in the congested urban environment of Hull, an embedded retaining wall solution is proposed. A cast in-situ concrete slab is to be constructed at the maximum excavation depth, acting as the permanent prop and providing the foundation to the new carriageway. Tension piles are required beneath the slab to counteract the uplift pressures induced by the shallow groundwater conditions across the Scheme. In addition to the grade separated junction, a number of other structures are to be constructed as part of the Scheme, including the Mytongate Bridge, two footbridges, an offline pumping station, and an additional retaining wall between between the Mytongate Junction westbound diverge sliproad and the grounds of the Holiday Inn. The proposed works are described in more detail in Section 4.

1.1.4 A plan of the proposed Scheme, including the A63 proposed realignment is presented in Volume 2, Figure 2.3 Scheme site boundary, and the locations of site compounds are shown in Volume 2, Figure 2.12 Construction site compound locations.

1.1.5 Figure 11.4.1 shows an indicative section along the main line of the grade separated junction (referred to in this report as the underpass). The chainages included in this figure are referenced throughout this report.

Figure 11.4.1: Indicative underpass long section



1.2 Background to groundwater investigation

1.2.1 Groundwater levels in the centre of Hull are sub-artesian in both the superficial deposits and underlying chalk aquifers. These, coupled with difficult ground conditions, have contributed to the failure of two major construction schemes in the area in recent years, as described below. Both scheme failures highlight the need for a comprehensive ground and groundwater investigation due to the geological and hydrogeological complexity of the area, as well as the need for careful design.

Kingston upon Hull wastewater tunnel collapse (Yorkshire Water humbercare sewerage tunnel)

1.2.2 In 1999, this large-diameter sewerage tunnel was around 80% complete when a collapse occurred 200m behind the tunnel boring machine (TBM)[1]. The area where the collapse occurred is located approximately 50 to 100m south of the eastern end of the proposed A63 Castle Street Improvement Scheme. As such, the ground conditions that are thought to have contributed to the collapse of the tunnel are likely to be similar to those present beneath the Scheme.

1.2.3 Following the collapse, a supplementary ground investigation was undertaken, which concluded that the collapse was primarily caused by ground conditions and water pressures as summarised below:

- The collapse occurred in an area where the tunnel horizon was entirely within alluvium. In other locations the tunnel horizon had been within glacial deposits. This variation was thought to be due to encountering the former channel of the River Hull.

- The collapse was the result of a leak that occurred in the area where an access shaft joined the tunnel. The leak was thought have resulted from movement between the access shaft and tunnel liner, possibly triggered by stress release in peat/compressible strata present in the area of the connection.

- The leak continued and worsened due to high water pressures in an underlying layer of laminated clay containing a layer of single sized sand particles. Under pressure, water, sand and clay flowed into the tunnel and it was calculated that approximately 2000m^3 of material had entered the tunnel, resulting in significant localised surface settlement.

1.2.4 To recover the TBM and complete the tunnel, a ground freezing technique was deployed, using liquid nitrogen as this was considered the safest and most reliable

[1] Grose, W. J. and Benton, L. (2005) Hull wastewater flow transfer tunnel: tunnel collapse and causation investigation. Geotechnical Engineering. Issue 158. Paper 13799. October 2005.

method. Rapid freezing resulted in a high integrity frozen structure and did not alter the salinity of the surrounding groundwater. Conventional groundwater control and excavation was discounted due to the instability of the alluvial material, the likelihood of causing extreme settlement at surface and the high groundwater pressures encountered[2].

Ennerdale link road, River Hull – flooded cofferdam

1.2.5 This scheme involved the attempted construction of an 81m long cut and cover tunnel through the bed of the River Hull. The works were part of a 2.5km dual carriageway designed to relieve congestion in eastern Hull and provide direct access to Hull's docks.

1.2.6 Ground conditions from the initial investigations identified alluvium over Boulder Clay (glacial till) over the Chalk. Groundwater was present within the alluvium and confined within the Chalk aquifer. The cofferdam was constructed primarily using sheet piles driven into the Boulder Clay to cut off the groundwater within the alluvium. The Boulder Clay was a minimum of 4m thick and confined the Chalk aquifer so preventing groundwater ingress into the base of the excavation.

1.2.7 Whilst initial dewatering operations were underway, a 2m diameter sink hole opened up in the river bed close to the northwest corner of the cofferdam and another within the cofferdam itself. The cofferdam excavation filled with water overnight. After an extensive investigation, the cofferdam's exposed faces were jet grouted whilst a permanent solution was found. The tunnel was eventually abandoned and a lift bridge was constructed at an abortive cost of £10 million.

1.2.8 It was eventually understood that the Boulder Clay was thinner than expected and may have contained perched water lenses. It was thought that water flooding the cofferdam originated from the river and most likely entered through declutched sheet piles. Piping of the sands within the alluvium possibly created a pathway from the river bed into the cofferdam.

1.2.9 Discussions with the dewatering contractor (WJ Groundwater) indicated that dewatering of the Chalk aquifer was required to lower the groundwater head so as to minimise the risk of upwards leakage through Boulder Clay and the potential risk of ground heave. The Environment Agency required the abstracted water to be reinjected into the Chalk so as to minimise the potential for seawater intrusion.

1.3 Consultation

1.3.1 Our approach to this groundwater assessment was discussed and agreed in principle with the Environment Agency in 2014. A full summary of consultation undertaken is provided in the Environmental Statement.

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[2] Brown, D. A. (2004) Hull wastewater flow transfer tunnel: recovery of tunnel collapse by ground freezing. Geotechnical Engineering, Volume 157, Issue 2, April 2004.

1.3.2 Consultation with stakeholders such as British Waterways Marinas Ltd, the Marine Management Organisation, landowners and local residents was held throughout the planning and implementation of the chalk pumping test. This is detailed in the Pumping Test Report (Appendix 11.5).

1.4 Scope of this report

1.4.1 This report has the following aims:

- to develop a baseline hydrogeological conceptual model of the A63 Castle Street based on the findings of previous studies and the 2013 and 2015/16 ground investigations (GI), testing and subsequent monitoring;
- to outline the potential risks from groundwater during the construction and operation of the new road, to inform the detailed design; and
- to assess the potential impacts of key structures associated with the construction and operation of the Scheme on groundwater receptors.

1.4.2 This Appendix Report informs Chapter 11 Road Drainage and the water environment of the Environmental Statement, where a full groundwater impact assessment based on DMRB guidance is provided.

1.4.3 This Appendix Report is supported by the following key supplementary reports (also provided as in Volume 3 as appendices to the Environmental Statement), which are cross-referenced in the text where relevant:

- Appendix 11.5 Pumping test report - 1168-10-223-RE-002-PD1[3]
- Appendix 11.6 Groundwater modelling report - 1168-10-223-RE-003-PD1[4]
- Appendix 11.7 Groundwater modelling update – HE514508-MMSJV-EWE-S0-RP-LE-000006[5]

1.5 Report layout

1.5.1 This report is presented in the following structure: -

- Section 1 – Introduction
- Section 2 – Baseline Conditions
- Section 3 – Groundwater Receptors

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[3] MMG JV (2014) A63 Castle Street Improvements, Hull - Pumping Test Report 1168-10-223-RE-002-PD1

[4] JBA (2014) A63 Castle Street, Hull: Groundwater Modelling Report 1168-10-223-RE-003-PD1 for Mott MacDonald Grontmij Joint Venture (MMG JV)

[5] Mott MacDonald Sweco JV (2018) A63 Castle Street Improvements, Hull - Environmental Statement - Groundwater Modelling Update HE514508-MMSJV-EWE-SO-RP-LE-000006

- Section 4 – Proposed Works
- Section 5 – Potential Impacts on Groundwater Receptors
- Section 6 – Conclusions

2. Baseline conditions

2.1 Methodology for the determination of baseline conditions

Overview

2.1.1 Prior to commencement of the Scheme, there had been few hydrogeological investigations covering the centre of Hull and groundwater conditions were not particularly well understood. In view of the potentially critical risks from groundwater to the construction and operational Phases of the Scheme, a detailed investigation was considered necessary to gain a clearer understanding of the baseline groundwater regime.

2.1.2 This groundwater assessment is based on the findings of a desk study, ground investigations and monitoring undertaken between 2013 and 2017, and a numerical groundwater model developed for the Scheme. The study area is shown in Figure 11.4.2. This encompasses the Scheme Site Boundary and a 4km buffer around it, extended to include source protection zones for Hull area sources (as discussed further in Section 2.5).

2.1.3 The Scheme encompasses a 1.6km section of the A63 between Ropery Street (NGR TA 0868 2806) and High Street (TA 1013 2845), between Hull City Centre and the docks area, plus a number of site compounds and materials storage areas. The centreline of the proposed A63 carriageway deviates from the existing centreline of the A63 by up to 20m and encroaches into Trinity Burial Ground land. The Scheme also extends southwards towards the Humber Estuary where a rising main is to be installed between the Mytongate Junction pumping station and the Humber Estuary. Table 11.4.1 summarises key elements of the Scheme that have been considered in this investigation. These key areas are also shown in Figure 11.4.2 for reference.

Figure 11.4.2: The study area

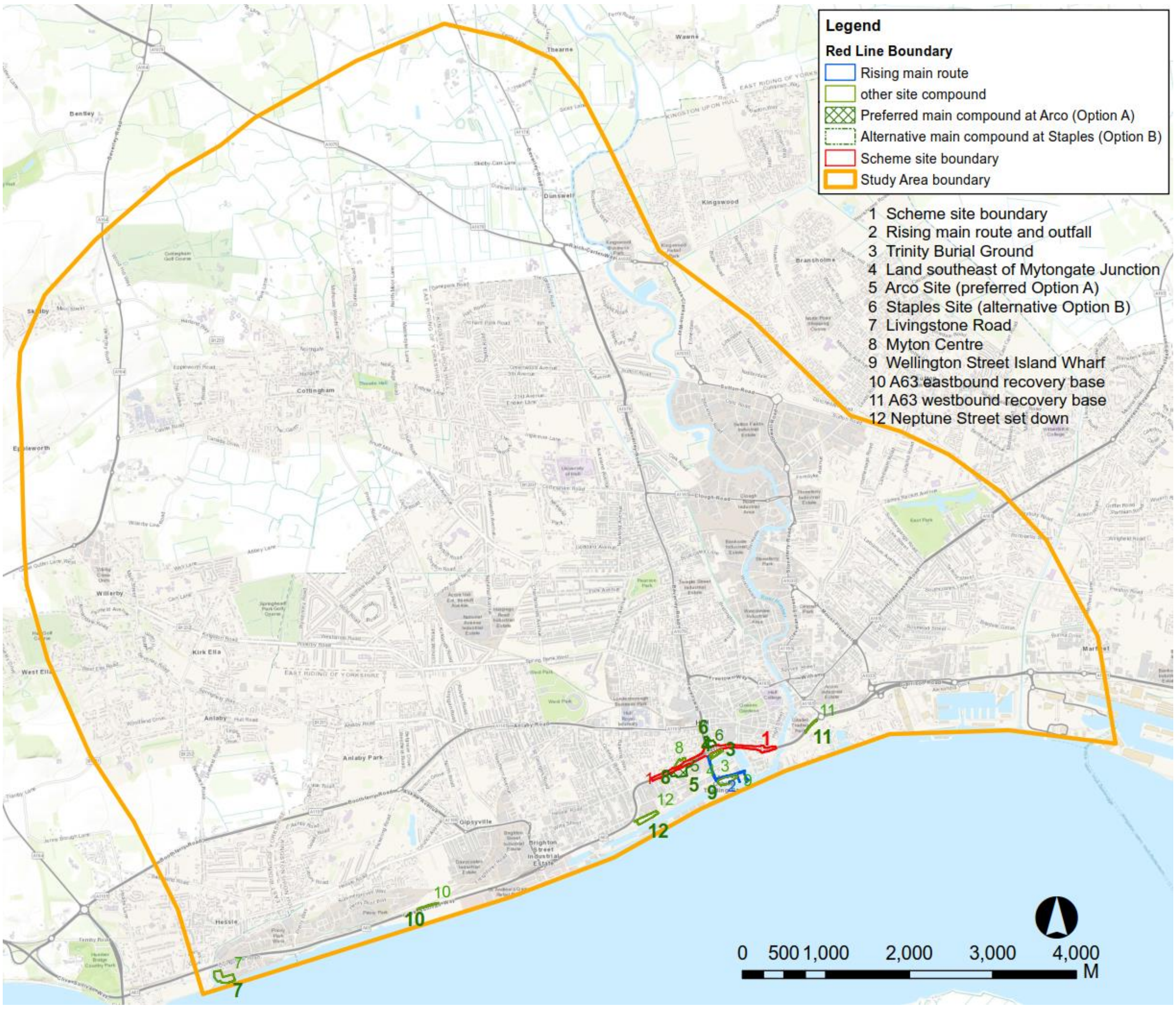


Table 11.4.1: Summary of key elements of the Scheme

	Area reference	NGR	Description	Additional comments
1	A63 / Construction Footprint	TA087281 – TA101285	Linear route of A63 realignment, running approximately east – west. Mytongate Junction located roughly in the centre along the route at TA093284.	Proposed realignment diverts from current route by up to 20m to the south at Mytongate Junction, and into the Trinity Burial Ground land
2	Underpass drainage rising main	TA093284 – TA098280	Linear route running from Mytongate Junction south along Commercial Road and east along Wellington Street Island Wharf before discharging into the Humber Estuary.	
3	Trinity Burial Ground	TA094283	Historic burial ground.	Part of the burial ground is to be excavated and human remains exhumed as part of ground works.

	Area reference	NGR	Description	Additional comments
	Yorkshire Water sewer diversion route[6]	TA094283	Yorkshire water's proposed sewer diversion runs between the Trinity Burial Ground and the Holiday Inn	Other diversion route options are being considered.
4	Land southeast of Mytongate Junction	TA093283	Pumping station to be constructed within grassed area adjacent to the burial ground.	Remaining land to be used as site compound for the Trinity Burial Ground works
5	Arco Site	TA090281	Site compound to the south of the A63, approximately 200m to the west of Mytongate Junction.	Preferred option (option a) for main compound, including bentonite, jet grouting and concrete batching plants, materials treatment and storage
6	Staples Site	TA093285	Site compound to the northeast of the Mytongate Junction	Alternative option (option b) for main compound, including bentonite, jet grouting and concrete batching plants, materials treatment and storage
7	Livingstone Road	TA035256	Site compound to the south of the A63, and adjacent to Fleet Drain and the Humber Estuary (approximately 6.4km to west of Mytongate Junction).	Materials Compound
8	Myton Centre	TA090282	Buildings to be demolished and the site restored as public open space.	Site may be used car parking during construction phase
9	Wellington Street Island Wharf	TA095280	Site compound to the south of Mytongate Junction, and adjacent to Albert Dock entrance and the Humber Estuary.	Main site offices, accommodation.
10	A63 eastbound recovery base	TA062266	A63 layby eastbound to the north of St Andrews Quay, approximately 3.1km west of the Scheme.	Used for recovery vehicles during construction
11	A63 westbound recovery base	TA105287	A63 bus layby west of Roger Millard Way Roundabout, approximately 400m east of the Scheme.	Used for recovery vehicles during construction
12	Neptune Street set down compound	TA086276	Site compound to the south of the A63, approximately 365m to the southwest of the Scheme.	Princes Quay Bridge compound, recovery vehicle drop-off and TM during the improvements

Desk study

2.1.4 The desk study assessment of baseline groundwater conditions included a review of the following information and reports:

[6] Sewer diversion routes not shown on Figure 11.4.2. See Options Assessment Report for the Yorkshire Water Sewer Diversion at Mytongate Junction (Arup, 2018; HE514508-ARP-HDG-SO_JN_HI-RP-CD-00503) for further details.

Table 11.4.2: Summary of desk study information

Source	Source detail	Information available / Study conclusions
Acer & AEG	Acer (1995)[7] Ground Investigation Report for the A63 Castle Street, describing the findings of the ground investigation undertaken by Allied Engineering & Geotechnics (AEG)[8] in 1994	Ground conditions at the site and limited information on aquifer properties, groundwater levels and groundwater quality. Groundwater monitoring was restricted to some short periods of daily water level readings in 16 monitoring boreholes between February and May 1994, three rounds of water level measurements in 1995 and one day of hourly monitoring in four boreholes to assess tidal impacts.
Arup	Ground Investigation Report for A63 Castle Street Improvement (2016)[9]	This report presents the findings of further ground investigation works carried out in 2015 and 2016. It includes details of geotechnical features and relevant data, and confirms or amplifies the issues identified in the Pell Frischmann PSSR and subsequent investigations . This report includes a geotechnical evaluation of the information, stating the assumptions made in the interpretation of the data. This report aims to identify the geotechnical risks to the Scheme. This report has been written considering the design elements, geometry and construction techniques proposed for the Scheme as outlined in the Arup/Balfour Beatty value engineering design.
Arup	Approval in Principle (AIP)[10] reports for the underpass, pumping station[11], Holiday Inn retaining wall[12] and Porter Street Bridge (2016)	These reports provide details of the 'approval in principle' value engineering design for the underpass, the pumping station, the Holiday Inn retaining wall and Porter Street Bridge.
Arup	Geotechnical Design Report (2016)[13]	This report identifies geotechnical design parameters, makes design recommendations and identifies risks to the Scheme. Separate appendix reports available for the Porter Street pedestrian, cycle and disabled user bridge, Holiday Inn retaining wall, pumping station, underpass and Mytongate Bridge.
Arup	Options Assessment Report for the Yorkshire Water Sewer Diversion at Mytongate Junction (2018)[14]	This report presents a number of options for Yorkshire Water sewer diversion routes. The diversion is required as the existing sewers pass below the area where the Mytongate grade separated junction is to be constructed.

[7] Acer (1995) A63 Trunk Road Improvements, Castle Street, Hull – Geotechnical Interpretative Report on Ground Investigation

[8] Allied Exploration & Geotechnics Ltd. (AEG) (1994) A63 Trunk Road Improvement, Castle Street Hull – Ground Investigation

[9] Arup (2016) Ground Investigation Report, A63 Castle Street Improvements, Version P01

[10] Arup (2016) A63 Castle Street, Underpass – Approval in Principle, Issue 2

[11] Arup (2016) A63 Castle Street, Mytongate Pumping Station – Approval in Principle, Issue 2

[12] Arup (2016) A63 Castle Street, Holiday Inn Retaining Wall – Approval in Principle, Issue 2

[13] Arup (2016) Geotechnical Design Report, A63 Castle Street Improvements, Version P01

[14] Arup (2018) A63 Castle Street Improvement – Options Assessment Report for the Yorkshire Water Sewer Diversion at Mytongate Junction. HE514508-ARP-HDG-SO_JN_HI-RP-CD-00503. P03

Source	Source detail	Information available / Study conclusions
British Geological Survey (BGS)	1:50,000 geological map - Sheet 80 - Kingston upon Hull (1983)[15]. Existing borehole records[16] LithoFrame viewer v2.0	Geological information, including approximate extents of granular alluvium. Limited hydrogeological information including water strikes from historical well records. LithoFrame viewer software tool allows viewing and querying of complex 3D geological models constructed by BGS, including the Holderness model (see below)
British Geological Survey (BGS)	A 3D geological model of the superficial deposits of the Holderness Area (Burke et al., 2010)[17] Lithoframe-50 ESRI data for the area around the A63 in Hull (BGS, 2013)[18]	3D geological model of the superficial deposits lithology across Hull and Holderness using 1398 BGS borehole records and 74 cross-sections to create an "egg crate" model, from which gridded surfaces were generated for 28 made ground and superficial deposits layers. Gridded data derived from the geological model
Environment Agency	Hull and East Riding Abstraction Licensing Strategy (CAMS) (2013)[19]	Baseline information regarding the abstraction licensing strategy for surface water and groundwater bodies in the Hull area, including the East Yorkshire Chalk.
Environment Agency	The Humber Environment in Focus (2011)[20]	Baseline information including groundwater designations, regional influences and environmental considerations.
Environment Agency	What's in your backyard interactive maps[21]	Nitrate vulnerable zones (NVZ), groundwater source protection zones (SPZ), groundwater vulnerability, aquifer designations, and Water Framework Directive (WFD) River Basin Management Plans (RBMP)[22] water bodies, and their current and predicted status, objectives and pressures.

[15] British Geological Survey (BGS) (1983) Sheet 80 Kingston upon Hull, 1:50,000 scale, Drift Edition

[16] http://mapapps2.bgs.ac.uk/geoindex/home.html Accessed 31 January 2017

[17] Burke, H. F., Morgan, D. J., Kessler, H. and Cooper, A. H. (2010) A 3D geological model of the superficial deposits of the Holderness area. British Geological Survey commissioned report No. CR/09/132. Available online at http://nora.nerc.ac.uk/id/eprint/16850/1/CR09132N.pdf

[18] British Geological Survey (BGS) (2013). Lithoframe-50 ESRI data for the area around the A63 in Hull

[19] Environment Agency (2013) Hull and East Riding Abstraction Licensing Strategy. Reference LIT 7867. Available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/305452/lit_7867_a7b9fe.pdf

[20] Environment Agency (2011) The Humber Environment in Focus 2011. Available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/297466/gene0611btzc-e-e.pdf

[21] http://www.environment-agency.gov.uk/homeandleisure/37793.aspx Accessed 3 May 2017

[22] Environment Agency (2009) River Basin Management Plan: Humber River Basin District. Available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/297488/gene0910bsqr-e-e.pdf

Source	Source detail	Information available / Study conclusions
Environment Agency	Information request (February 2017)	Licensed abstraction information within the study areafor the Scheme. Associated borehole records, and pumping test details including water quality.
ESG	Factual Report on Ground Investigations for A63 Castle Street (2016)[23]	Balfour Beatty and Ove Arup commissioned further GIs, covering the areas within the Scheme Site Boundary, the Trinity Burial Ground[24] and the Princes Quay pedestrian, cycle and disabled user bridge[25]. The Factual reports include borehole logs and groundwater level measurements, as well as other geotechnical and geoenvironmental field and laboratory test results.
ESI	East Yorkshire Chalk Aquifer: Conceptual Model Report (ESI, 2010)[26]	Baseline information regarding the Chalk aquifer including geology, recharge and regional groundwater flow.
ESI	East Yorkshire Chalk Model: Model Update and Refinement (2015)[27]	Conceptual model refinement includes inclusion of additional data in the Hull area to improve understanding of hydraulic relationships between Chalk, superficial deposits and the Humber Estuary.
Gale and Rutter	The Chalk Aquifer of Yorkshire. BGS Research Report RR/06/04 (2010)[28]	Detailed baseline information regarding the Chalk Aquifer.
Geotechnics	Ground Investigation for A63 Castle Street (2013)[29]	MMG JV commissioned a comprehensive ground investigation (GI) of the Scheme footprint. The GI report summarised local ground conditions and included data collected as part of the GI, including borehole logs, groundwater level dip data, aquifer properties derived from falling head and packer tests, and water quality data.

[23] ESG (2016) A63 Garrison Road, Castle Street Improvement, Hull, Factual Report on Ground Investigation. Report No A5066-15A. For Balfour Beatty Limited and Ove Arup & Partners

[24] ESG (2016) Trinity Burial Ground, A63 Castle Street Improvement, Hull, Factual Report on Ground Investigation. Report No A5049-15. For Balfour Beatty Limited and Ove Arup & Partners

[25] ESG (2016) Princess Quay Footbridge, A63 Castle Street Improvement, Hull, Factual Report on Ground Investigation. Report No A5066-15. For Balfour Beatty Limited and Ove Arup & Partners

[26] ESI (2010) East Yorkshire Chalk Aquifer: Conceptual Model. Prepared for the Environment Agency. Ref: 602711R1D1

[27] ESI (2015) East Yorkshire Chalk Aquifer Investigation: Model Update and Recalibration. Prepared for the Environment Agency. Ref: 62986 R2, June 2015

[28] Gale, I. N. and Rutter, H. K. (2006) The Chalk Aquifer of Yorkshire. British Geological Survey. Research Report RR/06/04

[29] Geotechnics Ltd. (2013) Ground Investigation at A63 Castle Street Improvements. For MottMacDonald Grontmij Joint Venture (JV).

Source	Source detail	Information available / Study conclusions
Highways Agency[30]	Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment (2009)[31]	Relevant groundwater legislation and impact assessment methodology.
Hull City Council	Information request (February 2017)	Unlicensed abstractions within of the study areafor the Scheme.
Landmark Information Group Services	Envirocheck report (2013)[32]	Environmental data e.g. designated sites, abstraction locations.
MMG JV [33]	Environmental Statement Scoping Report (2013)[34]	Report setting out the proposed scope of work and methods to be applied in carrying out the Stage 3 EIA for the Preferred Option, and the proposed structure of the ES. The Drainage and Water Environment chapter summarised baseline conditions and the potential effects of construction and operation of the highway on the quality of surface water and groundwater, on water resources and on flood risk, based on the work carried out to date. Groundwater risks highlighted in this report included: • The potential for groundwater movement through cohesive superficial deposits classified as unproductive. • Evidence from other major below-ground construction projects in the area suggests that more permeable horizons within the superficial deposits associated with granular deposits and the differential groundwater heads between these can result in groundwater leakage and potential ground failure due to running sand under some conditions. • The more permeable horizons within the superficial deposits, particularly within the shallow, alluvial deposits may also act as pathways for the lateral migration of near-surface groundwater or estuarine waters • High groundwater levels and potential upwards leakage from the underlying chalk are likely to require managing within

[30] From April 2015 Highways Agency was rebranded Highways England

[31] The Highways Agency, Scottish Government, Welsh Assembly Government Llywodraeth Cynulliad Cymru and The Department for Regional Development Northern Ireland (2009) Design Manual for Roads and Bridges. Available online at http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section1.htm

[32] Landmark Information Group Services (2013) Report Ref. 43865337-1, Envirocheck Report on Castle Street, Hull

[33] From April 2016 Grontmij was rebranded Sweco and MMG JV became MMS JV (Mott Macdonald Sweco Joint Venture)

[34] MMG JV (2013) A63 Castle Street Improvements, Hull – Environmental Statement Scoping Report - 1168-10-221-RE-001-PD1

Source	Source detail	Information available / Study conclusions
		excavations during construction through dewatering. Due consideration of potential groundwater contaminants which that may be present as a result of land contamination will be required and shall be assessed as part of the planned intrusive investigations and follow-up monitoring. Both the construction and operation phases have the potential to impact on local groundwater levels outside the Scheme Site Boundary. The report indicated that the following would be carried out to inform the ES: • A detailed groundwater assessment, taking into account the findings of previous investigations as well as the 2013 site investigation. The assessment would take into account WFD requirements. • Development of a numerical groundwater model to both inform the design and to assess the impact on groundwater receptors up- and down-gradient of the Scheme, as well as the impact of mitigation measures. • Assessment of groundwater quality and potential impacts during construction and operation. It was not anticipated that pumped groundwater will be discharged to soakaway during either the construction or operation phases and therefore assessments relating to these would not be undertaken.
Pell Frischmann	Preliminary Sources Study Report (PSSR) (2004)[35]	The PSSR provided information on five options for the improvement of the A63 Castle Street, Hull. The PSSR details (but is not limited to) topography and site history (historical mapping review), geology, mineral extraction, aerial photography, ground conditions, contaminated land, seismicity, hydrogeology, hydrology, flooding land use and archaeology. Details of the programme of statutory consultations that were undertaken are also presented.
Pell Frischmann	Environmental Assessment Report (EAR) (Options Selection Stage) (2010)[36]	Stage 2 Environmental Assessment of two preferred options for improvement of the A63 Castle Street, including identification and assessment of adverse and/or beneficial impacts, proposals to mitigate adverse impacts and consideration of opportunities for environmental enhancement. The preferred options comprised:

[35] Pell Freshman (2004) A63 Castle Street Improvements, Hull, Project Support Framework – Preliminary Sources Study Report, Report Reference W11189/VAA/02 Revision 1.

[36] Pell Frischmann (2010) A63 Castle Street Improvement Hull - Environmental Assessment Report (Options Selection Stage), Report Reference W11189/T13/02 Final Rev 2

Source	Source detail	Information available / Study conclusions
		• A63 in cutting at Mytongate Junction (the "Underground Option") • A63 on flyover at Mytongate Junction (the "Overground Option") The EAR assigned a qualitative ranking to each preferred option. Both options were ranked equal in terms of an overall water environment impact of "neutral". The EAR noted that preliminary design work had shown that secant pile walls extending into the glacial till would be needed to support the Underground Option excavation and that this would eliminate groundwater ingress into the structure. It also noted that a previous report had showed, via the use of flow nets, that groundwater seepage into the excavation could be adequately managed using sump pumps and that it was unlikely that this would have a significant effect on groundwater levels outside the excavation. The EAR included a baseline hydrogeological assessment. This appears to be based on publicly available information only and it makes no reference to the previous (1994) GI by AEG. The assessment concluded that the magnitude of impact was minor adverse but that the significance was neutral owning to the low groundwater quality
Pell Frischmann	Environmental Statement Scoping Report (ESSR) (2011)[37]	Preliminary design stage environmental scoping report for the Preferred Option (Underground Option) for the improvement of the A63 Castle Street. The report set out how the Scheme was to be assessed and the scope of the Environmental Impact Assessment (EIA), and was circulated to statutory environmental bodies and other key stakeholders for consultation and comment. Groundwater issues were covered in the Road Drainage and Water Environment chapter. This made reference to the findings of the EAR and concluded that a Detailed Assessment was required that included in the scope of work: • an update of baseline information including abstraction licences; • a full flood risk assessment (FRA); and • identification of mitigation measures in the design where required. However, as no discharges to groundwater were being considered, a DRMB Volume 11 Method C – Assessment of Pollution Impacts from Runoff to Groundwater would not be required. Moreover, further groundwater assessment of the Operational Phase would also not be required.

[37] Pell Frischmann (2011) A63 Castle Street Improvements – Environmental Statement Scoping Report

Source	Source detail	Information available / Study conclusions
Pell Frischmann	Scheme Handover Report (2011)[38]	Handover report summarising the history of the Scheme to date and details of work undertaken in the preliminary design stage. This included a summary of groundwater strike and level data collected to date, including that collected during the 1994 ground investigation and a very small amount of information from investigations predating this (Acer in 1990; Holst in 1977; and Soil Mechanics in 1987).
The Planning Inspectorate	Scoping Opinion Proposed A63 Castle Street Improvements, Hull (2013)[39]	Comments relating to groundwater aspects of the Drainage and Water Environment chapter of the ES are detailed below: The Environmental Statement Scoping Report addresses the issues we would wish to see in the Environmental Impact Assessment relating to groundwater and contaminated land. Details of the hydrogeological assessments referred to in sections 10.6.3 and 15.6.15 [these relate to pumping tests] must be agreed with the Environment Agency prior to carrying out any works where pumping of groundwater is proposed. Consent may be required under Section 32/3 of the Water Resources Act 1991 and pumping tests may not be approved. This is because the status of the Hull and East Riding Chalk groundwater body is poor due to intrusion of saline water in the Hull area. Additional pumping in this area may have a detrimental effect on water quality in this important aquifer. The assessment within this topic chapter will inform other assessments within the ES, in particular the assessment of impact to groundwater and soils. It will also inform the Nature Conservation assessment, and it is noted that ecological receptors are identified in Paragraph 15.5.1 of the Scoping Report. Under this section impacts on features of Cultural Heritage interest (particularly buried assets) are not identified as potential receptors however, this is identified as a potential effect in Section 7 of the Scoping Report. The SoS considers that the drainage chapter should also inform the Cultural Heritage assessment and that potential impacts on heritage assets should be identified within this topic chapter.
Riley, M.	Note of the A63 Castle Street Pumping Test. (2015)[40]	Alternative approach to analysis of the 2013 pumping test (see Appendix 11.5 pumping test report). Transmissivity values agreed with analytical values presented in Appendix 11.5 Pumping test report.

[38] Pell Freshman (2011) A63 Castle Street Improvements – Scheme Handover Report

[39] The Planning Inspectorate (2013) Scoping Opinion Proposed A63 Castle Street Improvements, Hull

[40] Riley, M. (2015) A note on the A63 Castle Street Pumping Test

Source	Source detail	Information available / Study conclusions
Various	Ennerdale Link Tunnel and Humbercare Sewerage Tunnel failures and lessons learnt (articles)	Ground conditions and predicted groundwater conditions to the east of the A63 Castle Street Scheme.

2.1.5 The above list is not exhaustive. A number of studies covering the regional geology, hydrogeology and groundwater quality have also been reviewed to inform understanding of the baseline hydrogeological regime. Where these studies or any additional information has been used, these are referenced in the body of the report.

Ground investigation

2.1.6 GIs have been undertaken within the Scheme Site Boundary in 2013 and 2015/16 to inform the Project design.

2013 GI

2.1.7 The 2013 GI is described in detail in the Ground Investigation Report (GIR) (Annex A). The purpose of this intrusive investigation was to confirm and supplement the geotechnical and hydrogeological findings from the PSSR and other previous investigations, and to inform the preliminary design and ES.

2.1.8 The 2013 GI intrusive investigation comprised exploratory boreholes, trial pits, window samples, self-boring pressure meter tests (SBPT) and archaeological standard cone penetration tests (SCPTs). These were supplemented by geophysical surveys, permeability tests, a pumping test, and groundwater level and quality monitoring. The investigation was restricted to the construction footprint of the Scheme.

2.1.9 The following aspects are of particular relevance to this groundwater investigation:

- Water strike information for the 51 exploratory boreholes
- Completion of seven chalk boreholes and 35 superficial deposits exploratory boreholes as 50mm diameter observation boreholes
- Collection of manual dip data in completed observation boreholes at approximately daily intervals between July 2013 and October 2013 while the intrusive investigation was ongoing, and less frequently between October 2013 and January 2014. Additional data was collected on a monthly basis between May and August 2014
- Installation of groundwater dataloggers in selected monitoring boreholes between November 2013 and August 2014
- Groundwater quality sampling

- Falling head tests and packer tests undertaken during construction and following completion of monitoring installations
- Completion of two larger diameter boreholes in the Chalk and superficial deposits, and test pumping of the Chalk borehole in December 2013

2.1.10 The permeability test programme and analyses are described in detail in Section 2.6.

2.1.11 The larger diameter borehole drilling and test pumping programme, results and analysis are described in detail in the LDBH01 Pumping Test Report (Appendix 11.5). The findings of the pumping test and associated monitoring are summarised in Section 2.6.

2.1.12 The 2013 groundwater quality investigation is described in detail in the GIR (Annex A) and the findings included in Volume 3 Appendix 12.1 Ground contamination assessment. The findings are also considered in this report, both in terms of baseline conditions and potential groundwater quality impacts during the construction and Operational Phases of the Scheme.

2015/16 GI

2.1.13 The purpose of the 2015/16 GI was to confirm and supplement the geotechnical and hydrogeological findings of the previous studies, and to inform the detailed design and construction of the Scheme. The 2015/16 GI focussed on the Trinity Burial Ground and the Princes Quay footprint, as well as also covering the main realignment route. Factual reports for the 2015/16 GIs are provided in Annex B – D.

2.1.14 The 2015/16 GI intrusive investigation comprised exploratory boreholes, window samples, cone penetration tests (CPTs), and geotechnical and geoenvironmental laboratory testing. The investigation was restricted to the Scheme Site Boundary.

2.1.15 The following aspects were of particular relevance to this groundwater investigation:-

- Water strike information for the 31 exploratory boreholes
- Completion of two chalk boreholes and 21 superficial deposits exploratory boreholes as 50mm diameter observation boreholes
- Collection of manual dip data in all the completed observation boreholes whilst the intrusive investigation was ongoing
- Collection of groundwater level from data loggers in all the completed observation boreholes. Additional data was collected following completion of the GI, to give a monitoring record of at least six months

2.2 Topography and land use

2.2.1 The Scheme is low-lying and of relatively low relief, with ground levels varying from about 3m above Ordnance Datum (AOD) to 5m AOD and-use at the site is urban, with an existing road and junction. Domestic, industrial and commercials buildings are located along the entire route, with green areas limited to within the current Mytongate traffic island, the Trinity Burial Ground and land surrounding William Booth House and the Myton Centre. Docks associated with the River Humber are situated immediately to the north and south of the Scheme near the Princes Quay shopping centre, and to the south of Trinity Burial Ground.

2.2.2 Historic aerial photos available on Google Earth Pro[41] suggest that the proposed site compounds at Livingstone Road, Wellington Street Island Wharf and the Neptune Street set down compound are brownfield sites that are currently either partially vegetated wasteland or semi-permeable hardstanding for vehicle parking or storage. The Arco and Staples sites, and the Myton Centre are currently a mixture of buildings, car parking and public open space. The eastbound and westbound recovery bases are located in existing road laybys.

2.3 Regional geology

Bedrock

2.3.1 The bedrock underlying the city of Hull consists of Cretaceous Chalk. This extends as far as Flamborough Head to the north, the Yorkshire Wolds to the west, the Humber Estuary to the south, and the North Sea to the east.

2.3.2 The Yorkshire Wolds largely comprise Chalk downland, consisting of steep west and north facing escarpments, with a dip slope gently south and eastwards beneath Quaternary deposits, which thicken to the east. The Chalk typically dips between 1- 2° eastwards[42] and is contorted in places with some minor faulting (though this is not apparent in the vicinity of the construction footprint).

2.3.3 The Chalk Group of Yorkshire is part of the Northern Province Chalk, and is split into four lithostratigraphic units. In ascending order these are the Ferriby Chalk, Welton Chalk, Burnham Chalk and Flamborough Chalk formations[28]. The chalk beneath Hull is part of the Burnham Chalk Formation.

2.3.4 North of the Humber Estuary, the Burnham Chalk is approximately 140m thick and is characterised by thinly bedded chalks with discontinuous and tabular flint bands[28].

[41] Accessed 19 January 2018

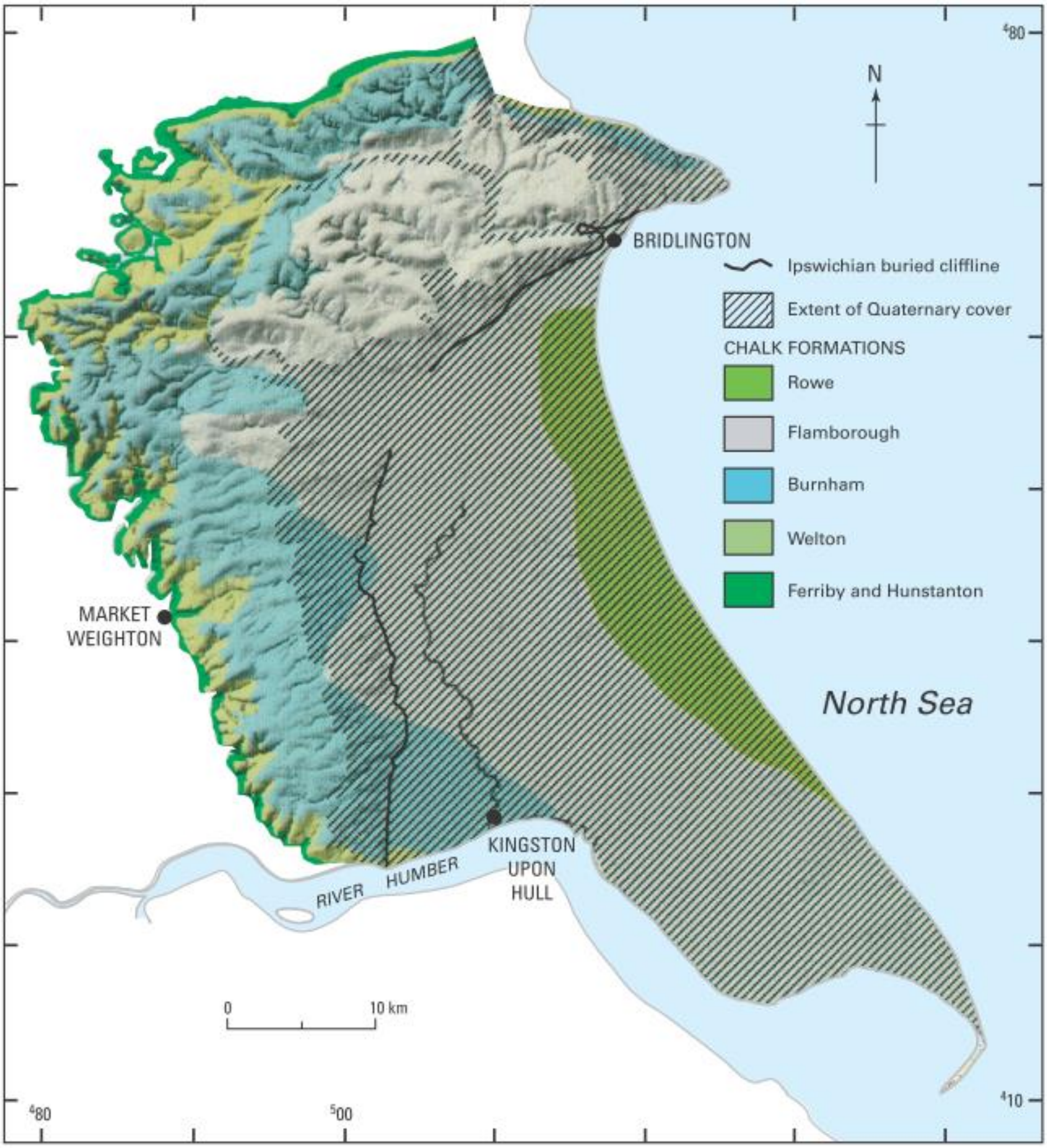
[42] Smedley, P. L., Neumann, I. and Farrel, R. (2004) Baseline Report Series: 10. The Chalk Aquifer of Yorkshire and North Humberside. British Geological Survey. CR/04/128N. Environment Agency Technical Report NC/99/74/10

2.3.5 The Chalk rockhead strongly influences topography in the region. Upland areas of the Yorkshire Wolds where the Chalk outcrops extensively to form the crest and plateau areas reach elevations of around 180m, but elevations quickly decrease to the east. In the area around the Humber Estuary where the Quaternary superficial deposits become thicker, the land is a relatively low lying coastal plain, draining to the Humber Estuary and the North Sea.

2.3.6 A buried sea cliff formed in the Ipswichian interglacial stage can be traced beneath the Quaternary cover from the current coastline near Bridlington down to the Humber Estuary near Hessle and Barton. This significantly influences aquifer productivity and groundwater chemistry in the region (see Section 2.6).

2.3.7 Figure 11.4.3 shows the regional distribution of the Cretaceous Chalk bedrock and Quaternary cover in the Yorkshire area along with the location of the buried cliff line and the River Hull.

Figure 11.4.3: Regional geology overview of East Yorkshire[28]



Soils

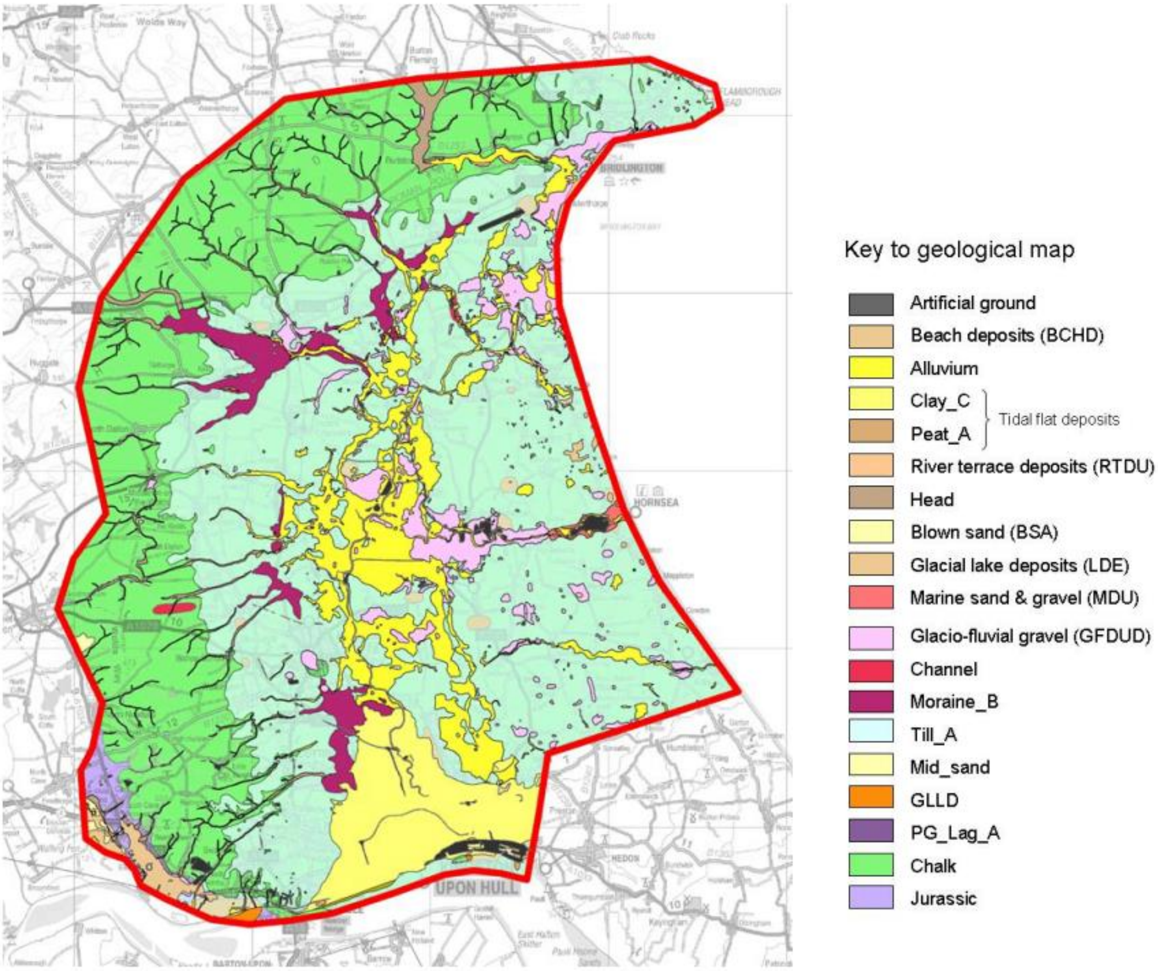
2.3.8 ESI (2010) report seasonally wet deep clay and seasonably wet deep loam as the dominant soil types.

Superficial Deposits

The British Geological Survey (BGS) created a 3D model showing the thickness and distribution of Quaternary deposits in the Holderness area[17]. The model used borehole logs from the region to interpret the spatial distribution and thicknesses of different superficial deposits.

2.3.9 Figure 11.4.4 shows a summary of the superficial deposits across the Holderness plain.

Figure 11.4.4: British Geological Survey model output – superficial deposits[17]



Notes on Key: Mid_sand = glaciofluvial sand and gravel lenses in glacial till, GLLD –=glaciolacustrine clay near middle glacial sequence, PG_Lag_A = glaciofluvial sand and gravel at the base of the glacial sequence.

2.3.10 The Quaternary deposits in the eastern parts of the Yorkshire and Holderness region are mainly Devensian (late Pleistocene) glacial tills, glacial sands and gravels, and post-glacial (Holocene) coastal and marsh sediments. In the lowland areas of Holderness, these are commonly between 20 and 30m thick, and can locally exceed 50m to the south[28].

2.3.11 The regional superficial deposits are characterised by deposits laid down during periods of glaciation and inter-glaciation, and subsequently post-glacial estuarine environments. It is subject to lateral and vertical variation on a localised scale, and as such is highly complex. However a summary of the Quaternary geology directly relevant to the Hull area is provided below, to add context to the local geology.

2.3.12 Directly overlying the Chalk are fluvio-glacial sands and gravels, which are discontinuous across the region. A layer of fine grained and well sorted blown sand (aeolian) overlies the fluvio-glacial deposits. These are considered to have been deposited during a period of denudation, and are discontinuous due to subsequent periods of erosion. Locally, where present, the blown sands are difficult to differentiate from the fluvio-glacial deposits.

2.3.13 The glaciolacustrine deposits overlie the fluvio-glacial and aeolian deposits, which were subsequently overlain by glacial till from a subsequent phase of glaciation. Alluvial deposits are present as channel features cutting down into the glacial till, for example the former channel of the River Hull that crosses the Scheme (Section 2.5). Highly variable alluvial deposits cover the region. These cohesive deposits contain layers of peat, particularly towards the base and reflect the marshland environment found even up until development of the area.

2.3.14 Sand lenses, bands and horizons are found throughout the superficial deposits, reflecting fluctuations in the depositional environment and historical channels associated with braided river systems.

2.3.15 This section of the report focusses on providing an overview of the regional geology in context with the geology which is important beneath the Scheme. The general regional geology of East Yorkshire and the Holderness plain, including aquifer units which are not present beneath the site, are described in much more detail in a number of published studies. Key publications are referenced in Table 11.4.2.

2.4 Local geology

2.4.1 Geological details for the Scheme and for the site compounds are provided separately below.

The Scheme

2.4.2 The understanding of the local geology is based upon exploratory boreholes constructed as part of the 1994, 2013 and 2015/16 ground investigations. Locations of the 2013 GI exploratory boreholes are presented in Drawing 1168-09-01-DR-001-PD8 of the 2013 GIR (Annex A). Geological cross sections based on the 1994[7,8,43] and 2013[29] GI exploratory borehole logs have been created to show the geology underlying the site (Drawing Nos.1168-09-01-DR-004 to 015 of the GIR; see Annex A).

2.4.3 Made ground, comprising both granular and cohesive material, is recorded across the full extent of the Scheme. The composition of the made ground varies, depending on previous land use and the presence of historical structures.

2.4.4 The made ground is directly underlain by superficial deposits of the Quaternary Period. These comprise varying thicknesses of cohesive and granular estuarine alluvial deposits, and peat, underlain by cohesive and granular glacial deposits.

[43] Acer (1995) A63 Trunk Road Improvements, Castle Street, Hull – Geotechnical Interpretative Report on Ground Investigation

2.4.5 A channel feature is present below the eastern half of the Scheme, where glacial deposits (the glacial till, glaciolacustrine and fluvio-glacial deposits) were locally eroded and subsequently infilled with granular alluvium. A review of BGS borehole logs across the Hull area suggest that the alluvial channel has an approximately northwest – southeast orientation and extends towards the Humber Estuary. The superficial deposits are underlain by chalk bedrock of the Burnham Chalk Formation. Chalk rockhead is typically 20 – 30mbgl across the Scheme. It is characterised by a layer of weathered chalk up to 9m thick, overlying more intact chalk.

2.4.6 Table 11.4.3: summarises the geology underlying the Scheme.

Table 11.4.3: Summary of the geology underlying the Scheme

Lithology	Description
Made ground	Made ground is encountered across the full extent of the Scheme. The greatest thickness is recorded at approximately Ch. 850, near the Humber Docks, but the made ground thickness is generally variable, ranging from 0.3m to 13.0m. Trial pits have identified old walls, floors and foundations, old service pipes and an old brick culvert within the made ground between 0.5m and 2.2m depth. The granular made ground occurs between ground surface and 13.0mbgl, and has a maximum recorded thickness of 9.2m. It is described as slightly to very gravelly clayey to silty SAND with occasional cobbles. The gravel comprises fine to coarse limestone, sandstone, flint, brick and concrete. Cobbles typically comprise chalk, brick or concrete. The cohesive made ground occurs between ground surface and a maximum recorded depth of 12.0mbgl, and has a maximum recorded thickness of 8.0m. It is described as slightly gravelly to gravelly slightly sandy to sandy CLAY with a low cobble content in some areas. Cobbles typically comprise chalk, brick or concrete. The cohesive and granular made ground are locally interbedded.
Cohesive alluvium	Cohesive alluvium is continuously present beneath the made ground within the Scheme between 0.6mbgl and 15.8mbgl. The thickness of the deposits varies from 0.7m to 11.6m. Field logs describe the cohesive alluvium as very soft to firm slightly sandy CLAY with some peat pockets and bands of organic material. In some areas, the cohesive alluvium is described as sandy SILT. Comparison between field descriptions and particle size distribution data suggests that all of the cohesive alluvial deposits may be described as slightly sandy SILT. The silt is slightly gravelly in some areas, very soft to soft, occasionally firm and commonly organic. A firm clay is often observed at the base of the unit. Locally, peat and granular alluvium are interbedded within the cohesive alluvium.
Granular alluvium	Granular alluvium deposits were encountered mainly towards the eastern end of the Scheme at chainages over Ch. 600. The granular alluvium was encountered directly under the cohesive alluvium between 4.1mbgl and 24.0mbgl. The thickness of the deposit varies between 0.05m and 13.6m, with the greatest thickness in the area of the Humber Docks. Field logs and particle size distribution data describe the granular alluvium as comprising slightly silty to silty, gravelly SAND to sandy GRAVEL with occasional cobbles. The gravel is of various content including flint and chalk. confirms this description.

Lithology	Description
Peat	Layers of relic peat and organic lenses were found within the alluvium. These layers are discontinuous and encountered mainly in the central and western parts of the Scheme. The peat layers, where present, vary between 0.2m and 1.8m thick and were encountered at depths ranging from 6.9mbgl to 22.6mbgl. The peat layers are described as firm brown to black slightly clayey pseudo- fibrous PEAT. Locally the peat is described as soft or very soft.
Glacial till	Glacial till was encountered directly below the alluvium across the majority of the Scheme. The only area where it is not present is in the area of the Humber Docks. The glacial till was encountered between 8.2mbgl and 23.5mbgl, with the thickness of between 0.4m and 6.8m. The glacial till is predominantly cohesive, and field logs describe the deposits as firm to stiff slightly sandy to sandy slightly gravelly to gravelly CLAY. The gravel is fine to medium of chalk and some flint.
Glaciolacustrine deposits	Glaciolacustrine material is present across the entire Scheme, typically underlying the glacial till but occasionally immediately underlying the alluvium. The glaciolacustrine deposits were encountered between 13.3mbgl and 26.6mbgl, with a thickness of between 3.4m and 9.7m. They are at their thickest in the middle and western parts of the Scheme, and become thinner towards the east. Field logs and the single particle size distribution (PSD) analysis describe the material as firm to stiff thinly laminated slightly sandy CLAY with occasional sand and silt partings. In some areas the material is slightly gravelly slightly sandy CLAY.
Fluvio-glacial deposits	The base of the superficial deposits comprises fluvio-glacial material. This overlies the Chalk bedrock across most of the Scheme, but is thickest towards the eastern end. The fluvio-glacial deposits are encountered between 19.0mbgl and 33.6mbgl, and vary in thickness between 1.0m and 9.6m. The deposits are described as silty to very silty gravelly SAND to sandy GRAVEL. The gravel comprises fine to coarse chalk and some flint. A relatively thin horizon (0 – 5m) of fine to medium grained sand was identified to the east of Mytongate Junction in the 2015/16 GI, which may represent blown (aeolian) sand. It is assumed that previous GIs did not differentiate between this horizon and the fluvio-glacial deposits. For the purposes of this hydrogeological assessment, the blown sand is considered part of the fluvio-glacial deposits horizon.
Chalk	Chalk bedrock was encountered across the Scheme. A layer of weathered chalk overlaying more intact chalk is characteristic of the upper horizon of this formation. The top of the weathered chalk is at a minimum recorded depth of 20.6mbgl (-17.94 m AOD) in Borehole BH04 and at a maximum depth of 33.6m (-28.96m AOD) in Borehole BH45. The maximum recorded thickness of weathered chalk is 9.0m, with an average thickness of 4.6m. The weathered chalk is described as very weak to medium and structureless. It is generally recovered as strong sub-angular to angular gravel and cobbles. Flints are recorded throughout.

2.4.7 Full descriptions of the geological units described above and their tested properties can be found in the GIR (Annex A - D).

2.4.8 There are no known faults or dissolution features below the Scheme. There is also no historical or current mining activity in or near this area.

Site compounds and public spaces

2.4.9 A summary of the geology underlying the site compounds and rising main route, based on existing borehole records available from BGS is provided in Annex E. Key differences from the geology within the Scheme Site Boundary are provided below:

- Along the rising main route and at the Wellington Street Island Wharf compound, there are greater thicknesses of made ground adjacent to the Humber Estuary and Albert Dock.
- The granular alluvium is absent or only partially present beneath all site compounds, including the A63 westbound recovery base located to the east of the River Hull. The granular alluvium is only present in some borehole logs at the land south east of Mytongate Junction and at the Staples site.
- At Livingstone Road, the Chalk rockhead is at much shallower depths (9 – 12mbgl) than within the Scheme Site Boundary. Fluvio-glacial deposits directly underlie the alluvium in two boreholes, and Chalk directly underlies the alluvium in one borehole.
- ‘Warp clay’ (soft laminated silt and clay) is identified in some borehole logs at Livingstone Road and the Neptune Street set down compound.
- At the Staples site, the glacial till is granular.

2.5 Regional hydrogeology

Chalk

Overview

2.5.1 The Chalk aquifer is a major source of water supply to Hull, Driffield and other urban centres in East Yorkshire. Discharge from the Chalk is the primary source of baseflow to watercourses in the Holderness Plain, including the Gypsey Race and the River Hull. The Chalk also provides baseflow to streams draining to the north and west, within the catchments of the rivers Derwent and Foulness.

2.5.2 Regional groundwater movement tends to follow the dip of the Chalk with a significant groundwater divide along the Chalk escarpment of the Yorkshire Wolds. The Chalk aquifer is unconfined across the Wolds where it outcrops but becomes confined to the east by impermeable superficial deposits. Clay bands within the Chalk may also act as locally confining layers.

2.5.3 The unconfined/confined boundary generally coincides with the buried cliff line, to the east of which the thickness of the superficial deposits increases markedly[28]. Much of the groundwater flowing down-gradient from the Wolds to the east emerges as springs or is pumped from the aquifer in the vicinity of this buried cliff line.

2.5.4 Seasonal changes in groundwater head are low in the confined aquifer but can be as much as 30m in the unconfined aquifer. Historically, the Chalk underlying Hull was artesian and groundwater discharged from springs adjacent to the Humber Estuary. However, a long-term decline in groundwater heads due to abstraction caused the springs to dry up and reversed the hydraulic gradient, leading to saline intrusion[26,28]. The Environment Agency and Yorkshire Water are currently conducting investigations into the current extent of saline intrusion below Hull.

Aquifer properties

2.5.5 The Chalk is described as a dual porosity aquifer with groundwater flow occurring within both the matrix (primary porosity) and through fractures (secondary porosity). Although the chalk matrix has a high primary porosity, the small pore throat size means a very low hydraulic conductivity (K) of less than 10^{-3}m/day for laboratory tested samples[28]. The secondary porosity due to fractures and fissures is relatively low, but most groundwater flow occurs through these and the secondary hydraulic conductivity can be high.

2.5.6 As the Northern Province Chalk is harder and better cemented in comparison to southern chalks, it tends to have cleaner fractures of increased frequency and greater secondary permeability[26]. It also means that the weathered chalk tends to be in the form of more permeable rubbly chalk “bearings” as opposed to the fine-grained putty chalk found in the south of England[28,44 45].

2.5.7 Although the thickness of the Chalk is considerable, there is a significant variation in hydraulic properties with depth. The effective aquifer thickness is greater in the unconfined Chalk where there is a better developed secondary hydraulic conductivity, particularly in the zone of water table fluctuation where fracture hydraulic conductivity is enhanced by dissolution. The effective aquifer thickness is usually significantly reduced in the confined aquifer and flow tends to be associated with particular horizons of higher hydraulic conductivity (which can be associated with flint bands). ESI assumed the effective aquifer thickness to be the upper 30 to 50m of unconfined Chalk and the upper 10 to 15m of the confined Chalk[26].

2.5.8 Transmissivity (T) is a measure of the aquifer’s ability to transmit water, where T = Kb (b = saturated aquifer thickness). Transmissivity within the Chalk depends to a great extent on fracture hydraulic conductivity. In the confined Chalk in the east of Holderness, it can be as low as 50m^2/d while in the unconfined aquifer, Allen et al[46] reported values up to over 10,000m^2/d.

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[44] Younger, P. L., Teusch, G., and 10 others. (1997) Groundwater resources and climate change effects – GRACE. Final report of EC Framework 3 Environmental Programme Contract CEC EV5V – CT94-0471.

[45] Price, M., Downing, R. A. and Edmunds, W. M. (1993) The Chalk as an Aquifer. 35 – 58 in The hydrogeology of the chalk of North-West Europe. Oxford: Clarendon Press).

[46] Allen, D. J., Brewerton, L. J., Coleby, L. M., Gibbs, B. R. Lewis, M. A., MacDonald, A. M., Wagstaff, S. J. and Williams, A. T. (1997) The physical properties of major aquifers in England and Wales. British Geological Survey Technical Report, WD/97/34.

2.5.9 Allen et al. collated storage values estimated for the Northern Province Chalk as a whole[46]. These ranged from 1.5×10^{-4} to 1.0×10^{-1} with a geometric mean of 7.2×10^{-3}. Higher storage values (above 0.01) are associated with the presence of chalk bearings at the top of the confined chalk[28].

Designations

2.5.10 The following information is taken from the Environment Agency's What's in your backyard website[47].

2.5.11 The Chalk underlying Hull is classed as a principal aquifer. The Environment Agency uses aquifer designations that are consistent with the WFD and are based on BGS geological mapping. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. Principal aquifers are defined by the Environment Agency as 'geological strata that have high permeability and usually provide a high level of water storage. They are capable of supporting water supply on a strategic scale and are often of major importance to river base flow'. In most cases, principal aquifers were formerly known as major aquifers.

2.5.12 The Environment Agency's groundwater vulnerability classification for the Chalk underlying central Hull (and also across the Scheme Site Boundary) is Low due to the soil and overlying geology, which will limit the transport of contaminants to the Chalk. To the west and northwest, the Chalk is classified as Medium and Medium–High. The Chalk is also classified as Medium – High along the banks of the Humber Estuary.

2.5.13 Within the WFD Humber River Basin Management Plan, the Schemeis located within the Humber GW Management Catchment and the Hull and East Riding Chalk Operational Catchment, and the Chalk is identified as water body ID GB40401G700700 (Hull & East Riding Chalk). The Cycle 2 review (2016)[48] classified the groundwater body as having poor quantitative status (due to saline intrusion and dependent surface water body elements) and poor chemical status (general chemical test, drinking water protected area and saline intrusion elements). Chemical pressures include diffuse pollution (agricultural nutrient management and also suspected pollution from towns, cities and transport) and point source pollution (discharge from sewage treatment plant or untreated sewage discharge plus agricultural point sources), while quantitative pressures include saline intrusion due to abstraction. The groundwater body is designated as a drinking water protected area (DrWPA) under WFD.

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[47] http://apps.environment-agency.gov.uk/wiyby/ Accessed 19 January 2018.

[48] http://environment.data.gov.uk/catchment-planning/OperationalCatchment/1101 Accessed 19 January 2018.

2.5.14 To the west of Hull and the Scheme is Nitrate Vulnerable Zone (NVZ) G106; Yorkshire Chalk. Site compounds located to the west of the Scheme Site Boundary and adjacent to Fleet Drain are situated within this NVZ. The Scheme is also within an area delineated as a non-statutory groundwater Safeguard Zone for nitrate by the Environment Agency.

2.5.15 The Chalk underlying Hull is included in Groundwater Management Unit (GWMU) South in the Environment Agency's Hull and East Riding Abstraction Licensing Strategy[19]. Water is available for licensing but restrictions will be placed on licences to protect both groundwater and surface water resources, as well as to minimise the risk of saline intrusion.

2.5.16 The Environment Agency's Groundwater Source Protection Zones for the Hull area are presented in Figure 11.4.5[49]. The Scheme lies within SPZ3 (total catchment) for a number of public and private water supply groundwater abstractions that are located approximately 8km to the north west of the Scheme Site Boundary. SPZ3 is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.

2.5.17 Groundwater abstractions are discussed in more detail below.

2.5.18 There are no statutory designated groundwater-dependent terrestrial ecosystems within the study area[50].

Superficial deposits

Overview

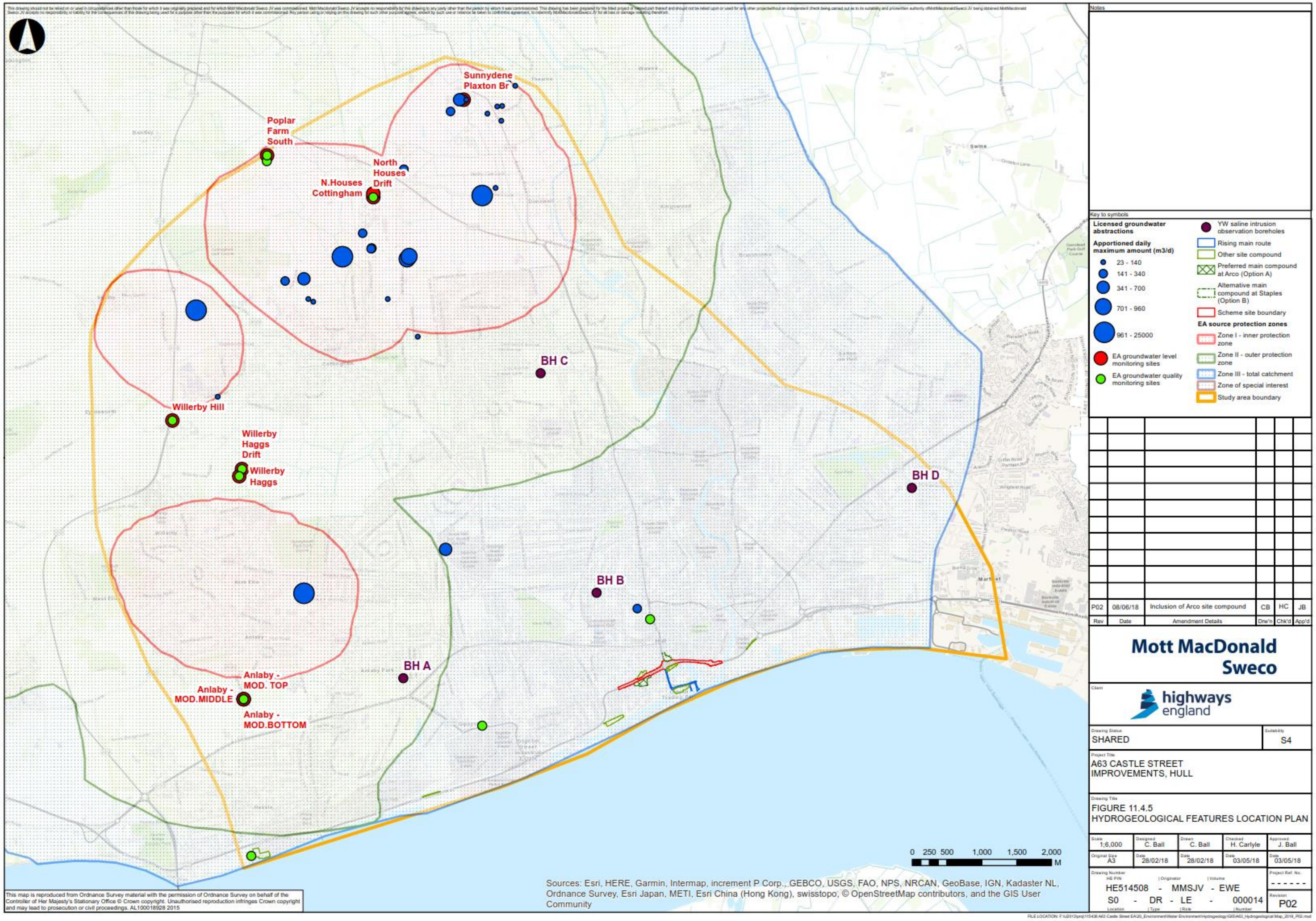
2.5.19 The main component of the Quaternary cover across the Holderness Plain is glacial till as described in Table 11.4.3:. The low permeability clays within the till (and more locally, the glaciolacustrine deposits) confine the underlying Chalk in most areas. However, where there are lenses of sand and gravel within the till, the Chalk aquifer can be in local hydraulic continuity with the superficial deposits above.

2.5.20 In some areas, including in Hull, fluvio-glacial sands and gravels directly overlie and are in hydraulic continuity with the Chalk. Where these deposits are thick, they can provide significant additional storage to the Chalk aquifer[26,27].

[49] http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683&y=355134&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=groundwater Accessed 19 January 2018

[50] http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx Accessed 19 January 2018

Figure 11.4.5: Hydrogeological features location plan



2.5.21 The alluvium overlying the glacial till largely consists of peat, silt and clay and is generally of low hydraulic conductivity. However, localised, perched groundwater is present where sandy horizons occur within the alluvium, and particularly within the alluvial channel where extensive granular alluvium is present.

2.5.22 Similarly, localised, perched aquifers are present in the made ground.

Designations

2.5.23 Although the superficial deposits across the region are generally designated as Secondary A or Secondary (undifferentiated) aquifers, they are not designated as an aquifer beneath Hull and directly below the Scheme, and are classed by the Environment Agency as unproductive strata that have negligible significance for water supply or river base flow. However, this does not necessarily mean that they do not contain permeable horizons that transmit groundwater.

Groundwater quality

2.5.24 The unconfined Chalk aquifer is vulnerable to the effects of pollution, particularly from diffuse agricultural sources, which are a major issue for water supply. Nitrate concentrations frequently exceed the UK drinking water standard (DWS) of 11.3 mg/l nitrate-N and pesticides can also be a significant issue. Further to the east where the Chalk becomes confined, reducing conditions are present, leading to the dissolution of metals such as arsenic, boron, iron and manganese, and denitrification. Figure 11.4.6 shows a schematic of the redox boundary and summarises major reactions that are likely to occur in the confined, reducing aquifer environment (Smedley *et al*., 2004).

2.5.25 The confined Chalk underlying Hull is also affected by saline intrusion from the River Humber due to historical over-abstraction from the early 1900s onwards. Foster *et al.*[51] concluded that the saline water present comprise a mix of connate or old formation water and recent saline water from the Humber Estuary. Chadha[52] suggested that there was little evidence of ingress of poor quality water from the River Hull or associated alluvial deposits. Howard and Lloyd's 1983[53] study of groundwater major ion composition indicated the presence of 'Type B' saline water in the Hull area (referred to as 'Type 2' by Chadha[52]), along with the more recent saline intrusion from the Humber estuary. Type B saline water is relatively shallow saline water related to the Middle/Late Flandrian marine transgressions.

[51] Foster, S. S. D., Parry, E. L. and Chilton, P. J. (1976) Groundwater resource development and saline water intrusion in the Chalk aquifer of North Humberside. Rep. Inst. Geol. Sci. No. 76/4. HMSO. 34 pp.

[52] Chadha, D. S. (1986) Saline intrusion in the Chalk aquifer of North Humberside, UK. Bockelman, R. H. Et al. (editors). Proceedings of the 9th Salt Water Intrusion Meeting (SWIM), Delft, The Netherlands.

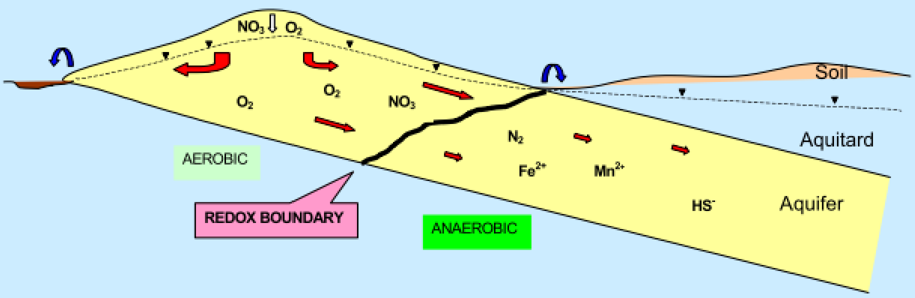
[53] Howard, K. W. F. And Lloyd, J. W. (1983) Major Ion Characterization of Coastal Saline Ground Waters. GROUNDWATER. Vol. 21, No. 4, July – August.

2.5.26 Chadha[52] also proposed that the saline front had stabilised. Little work has been carried out until recently to investigate the position of the saline front beneath Hull, and the relationship between the Chalk aquifer and the Humber Estuary is still not fully understood. Four monitoring boreholes were constructed in December 2016 to inform a Yorkshire Water and Environment Agency joint saline intrusion study. The locations of the monitoring boreholes are shown in Figure 11.4.5. Data loggers collect information on water level and electrical conductivity.

2.5.27 Groundwater quality in the superficial deposits and made ground is dependent on a number of factors, including the nature of the material, the degree of hydraulic continuity with other aquifer units and the presence of contaminants.

Figure 11.4.6: Yorkshire chalk redox schematic[42]

Box 6.2 Redox boundary (schematic)



Recharging water is generally saturated with dissolved oxygen at the partial pressure of the atmosphere (10–12 mg l^{-1} depending upon barometric conditions). Passing through the soil and the unsaturated zone some of this O_2 will react as a result of microbiological processes and oxidation-reduction reactions. However, almost all water reaching the water table still contains several mg l^{-1} dissolved O_2. Geochemical reactions (oxidation of traces of pyrite, organic matter and Fe^{2+} present in minerals) progressively remove the O_2 along flow lines. Once all the oxygen has reacted, an abrupt change of water chemistry takes place. This zone is known as the redox boundary. Other changes may occur at and further down-gradient of the redox boundary, especially denitrification and increased concentrations of dissolved iron (Fe^{2+}) concentrations. Sulphate reduction and the production of sulphide (H_2S as HS^- in solution) may also occur at greater depths.

Rainfall and recharge

2.5.28 Rainfall across East Yorkshire had a long term average (LTA) of 685 mm between 1981 and 2010[27]. Rainfall is orographic (i.e. controlled by topographic variations), with LTAs varying from 832mm at the top of the Chalk escarpment in the Wolds to 584 mm in the southern part of the Holderness Plain. Seasonal variations typical for the UK climate is evident, with the greatest rainfall occurring in autumn and winter, and the lowest rainfall occurring in spring and summer.

2.5.29 Recharge to the Chalk aquifer is a complex combination of slow matrix flow and rapid bypass flow controlled by the effective rainfall, the thickness and hydraulic conductivity of the superficial deposits, the thickness and lithology of the unsaturated zone and the potential for rapid bypass flow[28]. The aquifer is largely supplied by direct recharge through the unconfined chalk where it outcrops in the Yorkshire Wolds, with bypass recharge being the most significant recharge mechanism, whereby rainfall bypasses the soil zone and rapidly reaches the water table via preferential pathways such as fractures.

2.5.30 The time taken for recharge to reach the Chalk is estimated to be between seven and 46 days[26]. The dominant bypass recharge mechanism means that there does not appear to be a direct correlation between unsaturated zone thickness and recharge lag time, except where the unsaturated thickness is very large[26].

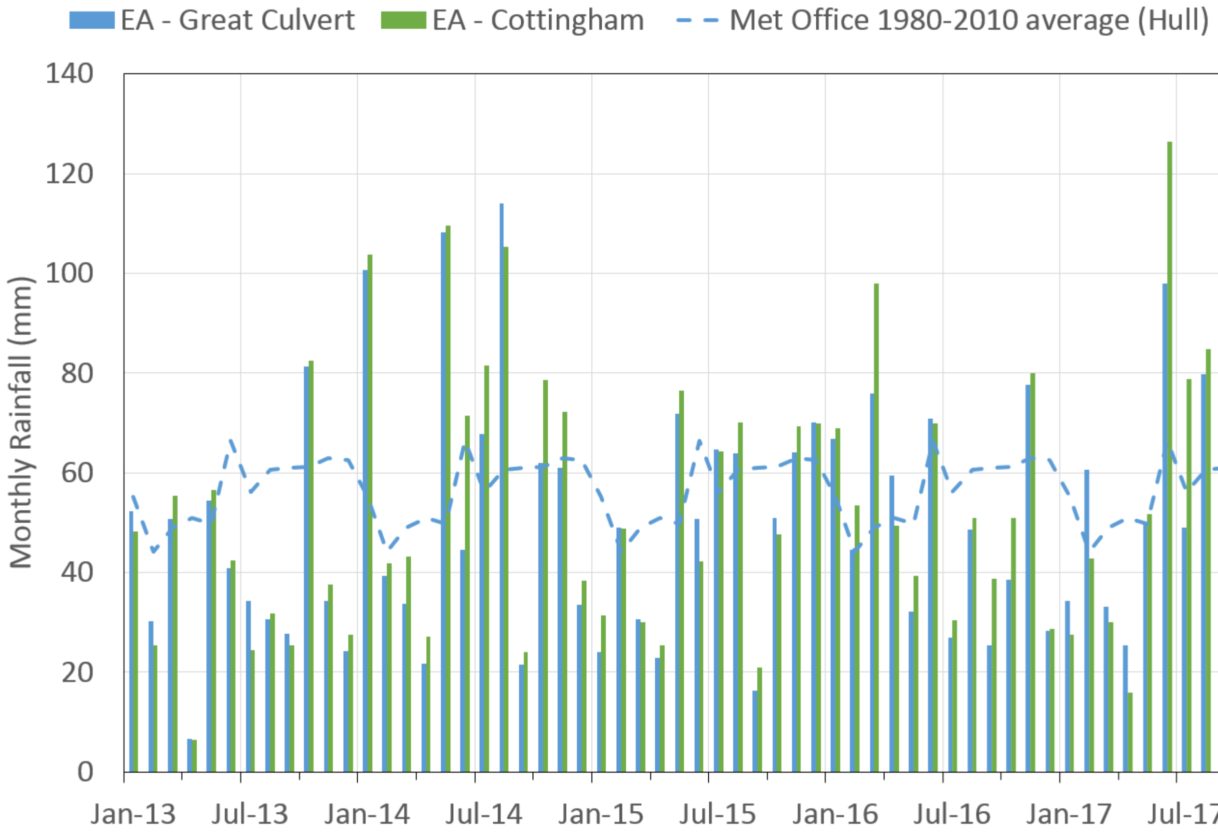
2.5.31 Smedley *et al.*[42] report that the long-term average effective recharge is estimated to be around 300 mm per year, usually concentrated in the months October to March.

2.5.32 Indirect recharge of the Chalk through the superficial deposits will depend on the presence of more permeable horizons (sands and gravels), their lateral and vertical extent, the degree of interconnectivity between them and the underlying Chalk and the hydraulic gradient. Where there is an upwards hydraulic gradient between the Chalk and superficial deposits and the more impermeable deposits separating them are relatively thin, upwards leakage from the Chalk will contribute to recharge of the superficial deposits.

2.5.33 The recharge/discharge relationship between the Chalk aquifer and Humber Estuary is not well understood. However, there is evidence of springs along the bank of the Humber, for example close to the Humber Bridge in Hessle, although these have mostly dried up due to the impact of long-term abstraction.

2.5.34 Monthly rainfall data is available from the Environment Agency Great Culvert (national grid reference TA 11455 35556) and Cottingham (national grid reference TA 04791 34188) rain gauges over the monitoring period and are presented in Figure 11.4.7, along with Met Office 1981 – 2010 averages for Hull. This shows that generally speaking the majority of 2014 and summer 2017 were wetter than average, and summer 2013, winter/spring 2015 and summer 2016 – spring 2017 were drier than average.

Figure 11.4.7: Rainfall data



Abstraction

2.5.35 Most of the major abstractions from the southern Yorkshire Chalk are located close to the divide between the unconfined and confined aquifers, and are used for public water supply (PWS). While some springs still flow in the area (e.g. north of Beverley), urbanisation has led to changes in the natural groundwater flow conditions. Over a century ago, shaft and adit systems were built to increase groundwater abstraction for public water supply from locations including Cottingham, Springhead and Dunswell. As a result of heavy abstraction, particularly from Cottingham pumping station, most springs between Beverley and Hull have dried up over the last century[52], and the former artesian boreholes in this area now require pumping.

2.5.36 Historically, groundwater abstraction for public water supply, and industrial, domestic and agricultural uses has not only resulted in the drying up of springs in the Yorkshire Chalk, but has also reduced flows in the River Hull. In the first half of the 20th century, many industries in the Hull area relied on their own boreholes for water supply and the combined abstraction resulted in saline intrusion. Many of these boreholes have now been abandoned and the remaining groundwater abstraction in the region is managed to ensure that the saline front is stable or retreating. Chadha[52] suggested that the saline front had stabilised by the mid 80's, but there is some uncertainty as to the current situation as there is little groundwater quality monitoring in central Hull. Elsewhere, abstraction is managed to ensure that environmental needs are sustained, particularly in relation to river flows.

2.5.37 The Environment Agency has supplied groundwater abstraction licence information for the study area[54]. The locations of licensed abstractions are shown in Figure 11.4.5 and details given in Table 11.4.4. All abstractions are from the Chalk, with the exception of two that are from the superficial deposits.

2.5.38 Hull City Council is not aware of any additional unlicensed groundwater abstractions within the study area.

Table 11.4.4: Licensed groundwater abstractions within the study area

Licence No.	Name	Use	Abstraction horizon	Grid reference	Max Daily Quantity (m^3/d)
2/26/32/026	STADIUM (VICAR LANE) LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 0580 3310	122.7
2/26/32/045	ANCHOR NURSERIES LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk (two boreholes)	TA 0694 3640 TA 0701 3641	273
2/26/32/053	LAWSON	Agriculture (General) - Spray Irrigation Direct	Superficial deposits	TA 0423 3364	68.2
2/26/32/059	IDEAL STANDARD MANUFACTURING (UK) LTD	Industrial, Commercial and Public Services (Machinery & Electronics) - General Use (medium loss)	Chalk	TA 0620 3005	700
2/26/32/087	WHELDON NURSERIES	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Superficial deposits	TA 0720 3670	109.1
2/26/32/126	YORKSHIRE WATER SERVICES LTD	Water Supply (Public) - Potable Water Supply	Chalk (four adit sources)	TA 02 33 [1] TA 04 29 [1] TA 04 34 [1] TA 06 35 [1]	100000
2/26/32/134	KEYGROWING LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 0640 3650	600
2/26/32/204	SEWELL	Amenity (Private Non-Industrial) - Make-up or Top Up Water	Chalk	TA 0430 3360	68

[54] Data provided 29 December 2017

2/26/32/2 06	C H PLAXTON & CO	Agriculture (General) - Spray Irrigation Direct	Chalk	TA 0700 3620	90.9
2/26/32/2 17	KEYGROWI NG LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 0627 3633	340
2/26/32/2 35	GLEN AVON SERVICES	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 0417 3393	450
2/26/32/2 65	TWINACRE NURSERIES LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 0293 3224	23
2/26/32/2 79	J LANCASTE R & SON	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 0650 3650	114
2/26/32/2 88	COLETTA & TYSON LTD	Agriculture (General) - Spray Irrigation Direct	Chalk (two boreholes)	TA 0560 3550 TA 0560 3550	381.2
2/26/32/3 44	COLETTA & TYSON LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 0710 3675	140
2/26/32/4 23	Hull Truck Theatre Co Ltd	Industrial, Commercial and Public Services (Other) - Non-evapourative Cooling	Chalk	TA 0895 2920	168
NE/026/0 032/024	COLETTA & TYSON LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 05131 34361	160
NE/026/0 032/025	COLETTA & TYSON LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 06917 35233	82
NE/026/0 032/026	COLETTA & TYSON LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 06800 36300	82
NE/026/0 032/033	Kirk	Agriculture (General) - Spray Irrigation Direct	Chalk	TA 05370 33640	91
NE/026/0 032/035	J P COLBRIDGE LTD	Agriculture (Horticulture & Nurseries) - Spray Irrigation Direct	Chalk	TA 03898 33899	250

NE/026/0 032/046	RED ROOFS NURSERY LTD	Agriculture (General) - Spray Irrigation Direct	Chalk	TA 05012 34586	200
NE/026/0 032/048	Durnford	Agriculture (Horticulture & Nurseries) - Heat Pump	Chalk (two boreholes)	TA 05650 34215 TA 05677 34252	1920

Notes: [1] Precise grid references not given

Surface water

Overview

2.5.39 There are two principal natural surface water features in the area, the Humber Estuary and the River Hull. Details of these and key surface water features within 1km of the Scheme (including the site compounds) are summarised in Table 11.4.5, together with distances from the Scheme.

Table 11.4.5: Summary of key surface water features in the area

Water features	Approximate distance from Scheme (m)	Location in relation to the Scheme	Additional comments
Humber Estuary	540m south	Proposed rising main to discharge to Humber Estuary. Wellington Street Island Wharf and Livingstone Road site compounds adjacent to Humber Estuary.	The tidal Humber estuary is formed by the confluence of the tidal rivers Ouse and Trent at Trent Falls, Faxfleet. Upstream of Hull, the Market Weighton Canal meets the estuary on its northern shore, while the River Ancholm discharges to the estuary on its southern shore.
River Hull	80m east	Located approximately 50m to the east of the Scheme Site Boundary. A63 westbound recovery base approximately 425m east of the River Hull.	Tidal in lower reaches. River flows in southwards through Hull and discharges to the River Humber close to the eastern extent of the Scheme. It is protected from flooding by a tidal barrier at the mouth of the river.
Beverley and Barmston Drain	1.23km north	Discharges to the River Hull 1.23km north of the Scheme Site Boundary.	
Ganstead / Holderness Drain	3km east	Located approximately 3km to the east of the Scheme Site Boundary.	Discharges to the Humber Estuary Hydraulically isolated from the Chalk
Fleet Drain	5.5km west	Livingstone Road site compound adjacent to Fleet Drain.	Discharges to the Humber Estuary
Albert Dock	385m south	Wellington Street Island Wharf site compound and Neptune Street set down compound adjacent to Albert Dock.	Connected to the Humber Estuary via lock (lock opens for three hours either side of high tide). Approx. area: 2.73ha
Railway Dock	73m south	Located immediately south of the Scheme Site Boundary.	Connected to Humber Dock. Approx. area: 10,000m^2

Water features	Approximate distance from Scheme (m)	Location in relation to the Scheme	Additional comments
		Yorkshire Water sewer diversion routes may run adjacent to Railway Dock.	
Humber Dock (Marina)	20m south	Princes Quay Bridge to be constructed adjacent to Humber Dock	Connected to the Humber Estuary via locks and the Humber Dock Basin. 6.4 – 7.9m deep (depending on tides). Topped up by pumping from the Humber Estuary (water lost by normal use of lock gates). Impound pumps set to keep levels at an optimum for the marina pontoons[55] Approx. area: 27,000m^2
Princes Dock	20m north	Princes Quay Bridge to be constructed adjacent to Princes Dock	Historically connected to the Humber Dock, now hydraulically isolated. Average depth: 5.8m. Prince's Quay shopping centre built over part of Prince's Dock on stilts.

Docks

2.5.40 Details of the construction of Humber Dock and Princes Dock are available[56] and are summarised as follows.

- The dock walls are brick built and faced with a coarse grit sandstone (Millstone Grit) above average tide and pointed with a pozzuolana mortar (lime mortar with pozzuolanic ash added to ensure the mortar set and endured in wet environments).
- The dock walls are around 1.8 to 2.7m thick with more than 1m of infill behind, and 8 to 9m deep. They are underlain by wooden piled foundations.

2.5.41 During construction of the Humber Dock lock pit, a freshwater spring was found. This caused problems during construction and created subsidence issues thereafter, and remedial works were required as a result.

2.5.42 BH503 was drilled through the base of Humber Dock as part of the 2015/16 GI. Below the 5m water column, the base of the dock was found to be underlain by 1m of clayey silts (interpreted as dock silts), 1m of sandy slightly clayey gravel with low cobble content (made ground) and 3.3m of clayey silt and silty clay (cohesive alluvium).

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[55] MMG JV (2014) A63 Castle Street Improvements, Hull – Underpass Drainage Outfall Location Review 1168-08-005-RE-003

[56] Timperley, J. (1836). "An Account of the Harbour and Docks at Kingston-Upon-Hull. (Including Plates)". ICE Transactions. 1 (1836): 1. doi:10.1680/itrcs.1836.24437.

Designations

2.5.43 The current (2016 Cycle 2) RBMP status and objectives of surface water bodies are summarised in Table 11.4.6.

Table 11.4.6: Water body status and objectives[57]

Water body ID	GB104026067210	GB530402609202	GB104026066750
Water Body Name	River Hull from Arram Beck to Humber	Humber Middle	Fleet Drain
Hydromorphological Designation	Heavily modified	Heavily Modified due to flood protection	Artificial
Current Ecological Quality (2016)	Moderate Potential	Moderate Potential	Moderate
Current Chemical Quality (2016)	Good	Fail	Good
Ecological Objectives	Good by 2027	Moderate by 2015	Good by 2027
Chemical Objectives	Good by 2015	Good by 2015	Good by 2015
Linked Protected Area	Nitrates Directive	Conservation of Wild Birds Directive Habitats Directive Nitrates Directive	Nitrates Directive

2.5.44 The Humber Estuary is designated as a Site of Special Scientific Interest (SSSI), Special Protection Area and Special Area of Conservation (SAC) for its nationally important habitats, which include coastal saltmarsh, intertidal mudflats and sandflats, saline lagoons and sand dunes. The estuary is also a wetland of international importance and is therefore designated as a RAMSAR site[58].

Abstraction

2.5.45 There are no surface water abstractions within a 1km radius of the Scheme. There are surface water abstractions located further afield, but these are upstream of the Scheme and are therefore not considered to the groundwater assessment.

Surface water – groundwater interaction

2.5.46 The hydraulic connection between the Humber Estuary and underlying groundwater is not well understood. As the Chalk beneath Hull is confined by significant thicknesses of low permeability superficial deposits, it is unlikely that watercourses receive any significant baseflow from the Chalk, although north of Hull where superficial deposits are less extensive, the River Hull and other surface water bodies do receive baseflow from the Chalk[26].

[57] http://environment.data.gov.uk/catchment-planning/OperationalCatchment/3274 Accessed 19 January 2018

[58] http://www.natureonthemap.naturalengland.org.uk/ Accessed 19 January 2019

2.5.47 Historically, groundwater discharged from submarine springs and seepages such as the Hessle Whelps, although this is no longer the case as heavy abstraction from the Chalk aquifer caused the springs to dry up and has reversed hydraulic gradients. Saline intrusion from the estuary into the aquifer has more recently been an issue although investigations during the drought of 1976 suggested that this has in fact now ceased. It has been suggested that this may be as a result of the clogging of macro-pores in the estuary bed by fine sediment with the onset of leakage[26]

2.5.48 Site investigations for the Humber Gas Pipeline Replacement Project[59] between Goxhill (Lincolnshire) and Paull have found there to be variable thicknesses of superficial deposits horizons underlying the Humber Estuary, affecting the hydraulic connection between the Chalk and the Humber. Near Goxhill, for example, no hydraulic barrier was identified between permeable alluvial deposits and the Chalk beneath the Humber Estuary, whereas further northeast towards Paull, low permeability glacial till deposits thickened beneath the estuary and are overlain by less than 1m of alluvial deposits.

2.5.49 As part of the Environment Agency's East Chalk model update[27], which takes into account the findings of the A63 hydrogeological investigations, the southern boundary (Humber Estuary) conditions were updated to allow a degree of connection between the Chalk aquifer and the River Humber. This was found to better replicate the zone of influence of the PWS abstractions to the north and west of Hull and naturalised heads along the southern boundary. The updated model suggests that under high groundwater level conditions, the Humber Estuary gains water from the Chalk aquifer, whereas under extreme low groundwater level conditions, (i.e. drought conditions), along much of the estuary it forms a source of water to the aquifer, probably supporting groundwater abstraction from the Chalk.

2.5.50 It is possible that there is some leakage through the base of the docks, although the extent of which is not fully understood, especially in the Humber Marina where water levels are maintained by pumping from the Humber Estuary.

2.6 Local hydrogeology

Groundwater levels

The study area

2.6.1 The Environment Agency has a number of monitoring boreholes in the study area, all located on the west and north western outskirts of Hull, and with response zones in the confined Chalk. The locations are shown in Figure 11.4.5, along with the locations of Yorkshire Water's public water supply boreholes and saline

[59] Hyder (2015) River Humber Gas Pipeline Replacement Project. Environmental Statement Document 6.13.3 – Hydrogeological Impact Assessment for National Grid

intrusion monitoring boreholes[60] in central Hull. Hydrographs for these boreholes are provided in Figure 11.4.8 and Figure 11.4.9. Groundwater level contours for February 2017 are presented in Figure 11.4.10 and Figure 11.4.11 for high tide and low tide respectively.

2.6.2 Figure 11.4.8 indicates that the seasonal groundwater head variation within the confined Chalk in the study area is between 5 and 10m. Groundwater levels to the west of the study area are generally higher, indicative of their presence in relation to the buried cliff line, the limits of the confined Chalk, and recharge through the unconfined Chalk of the Yorkshire Wolds. To the north and northwest, groundwater levels are controlled by abstractions from the public water supply sources. These controls are thought to extend as far south as the saline intrusion monitoring borehole BH C. Further south, and across the Scheme, groundwater levels are relatively flat and controlled by local tidal influences.

2.6.3 Figure 11.4.9 shows that there are tidal influences from the Humber Estuary as far north as BH C (approximately 10km from the estuary), although the tidal response varies at each location. This may be due to the fracture geometry in the Chalk and/or the effect of variable thicknesses and composition of superficial deposits underlying the Humber Estuary (see Section 2.5).

[60] Saline intrusion boreholes installed December 2016

Figure 11.4.8: Chalk hydrographs across the study area

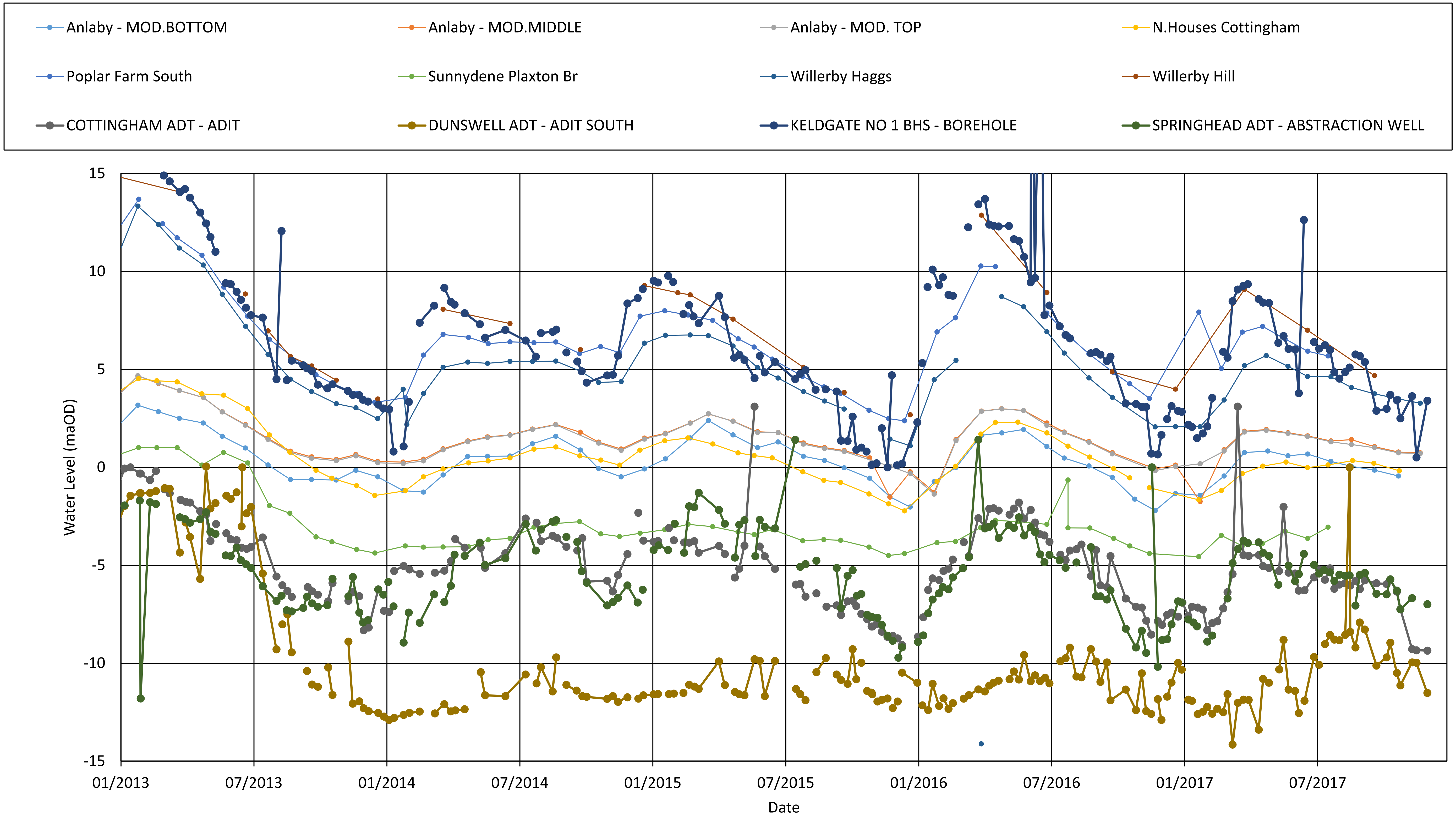


Figure 11.4.9: Chalk hydrographs for saline intrusion monitoring boreholes

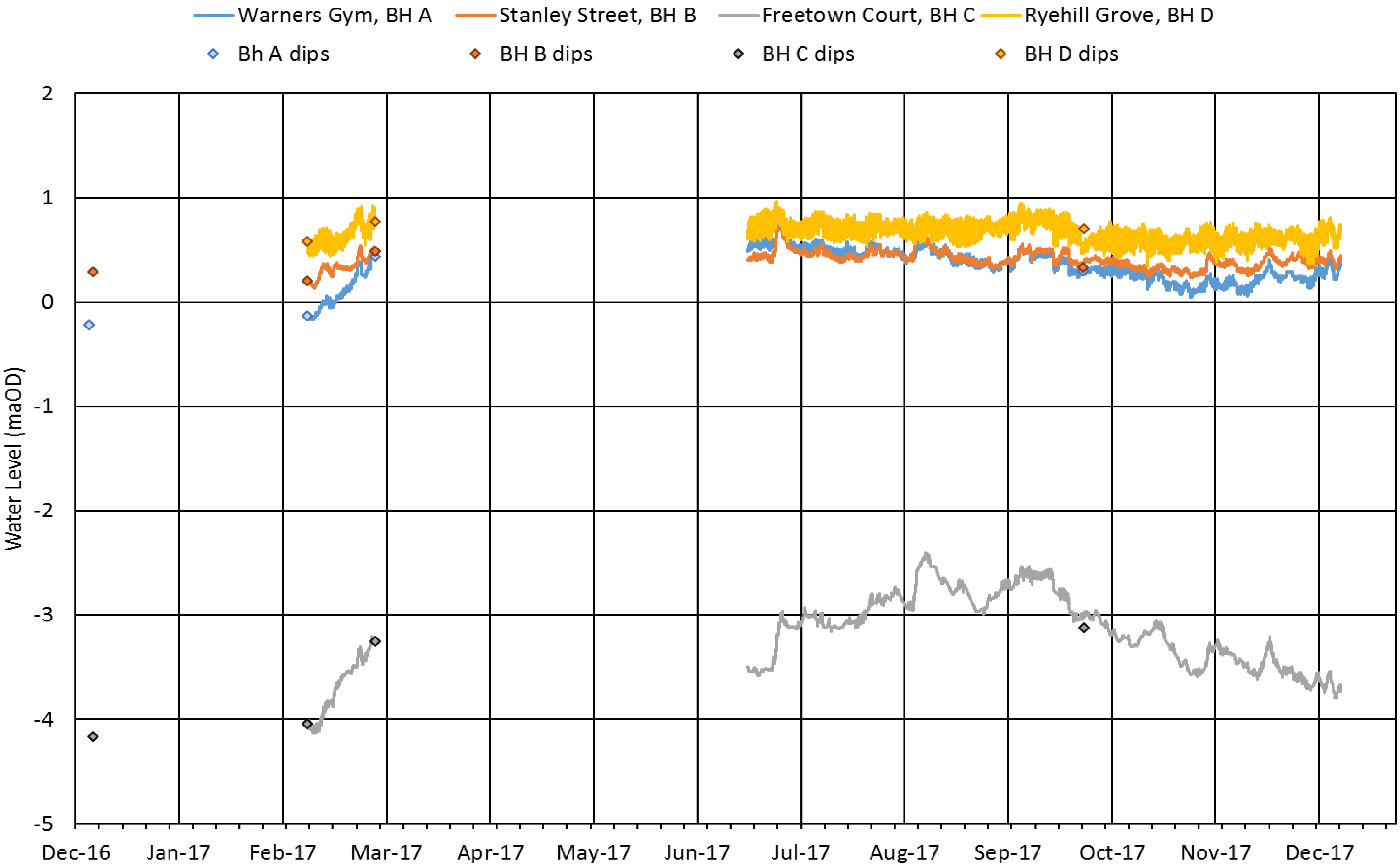


Figure 11.4.10: Chalk groundwater level contours, February 2017; high tide

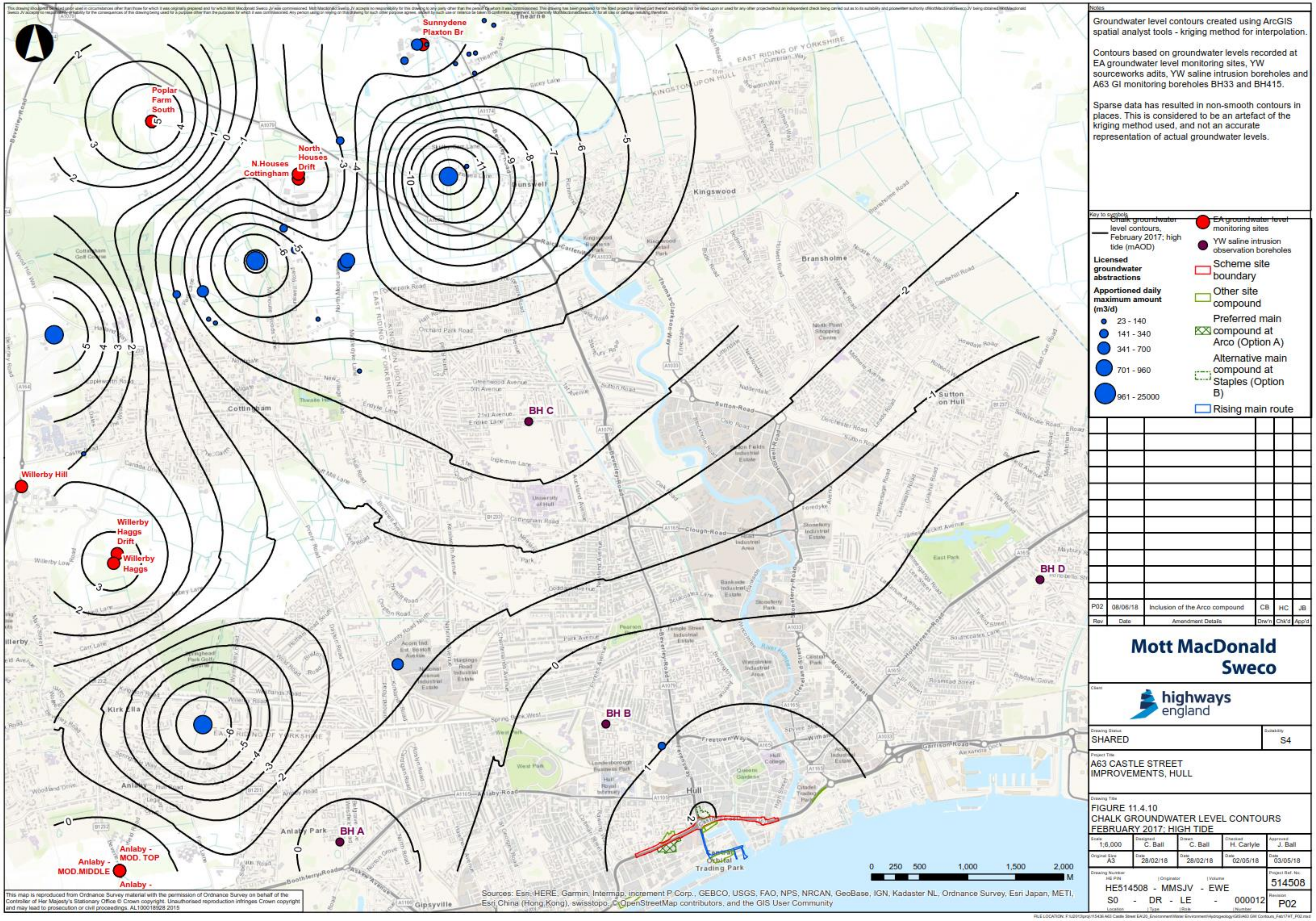
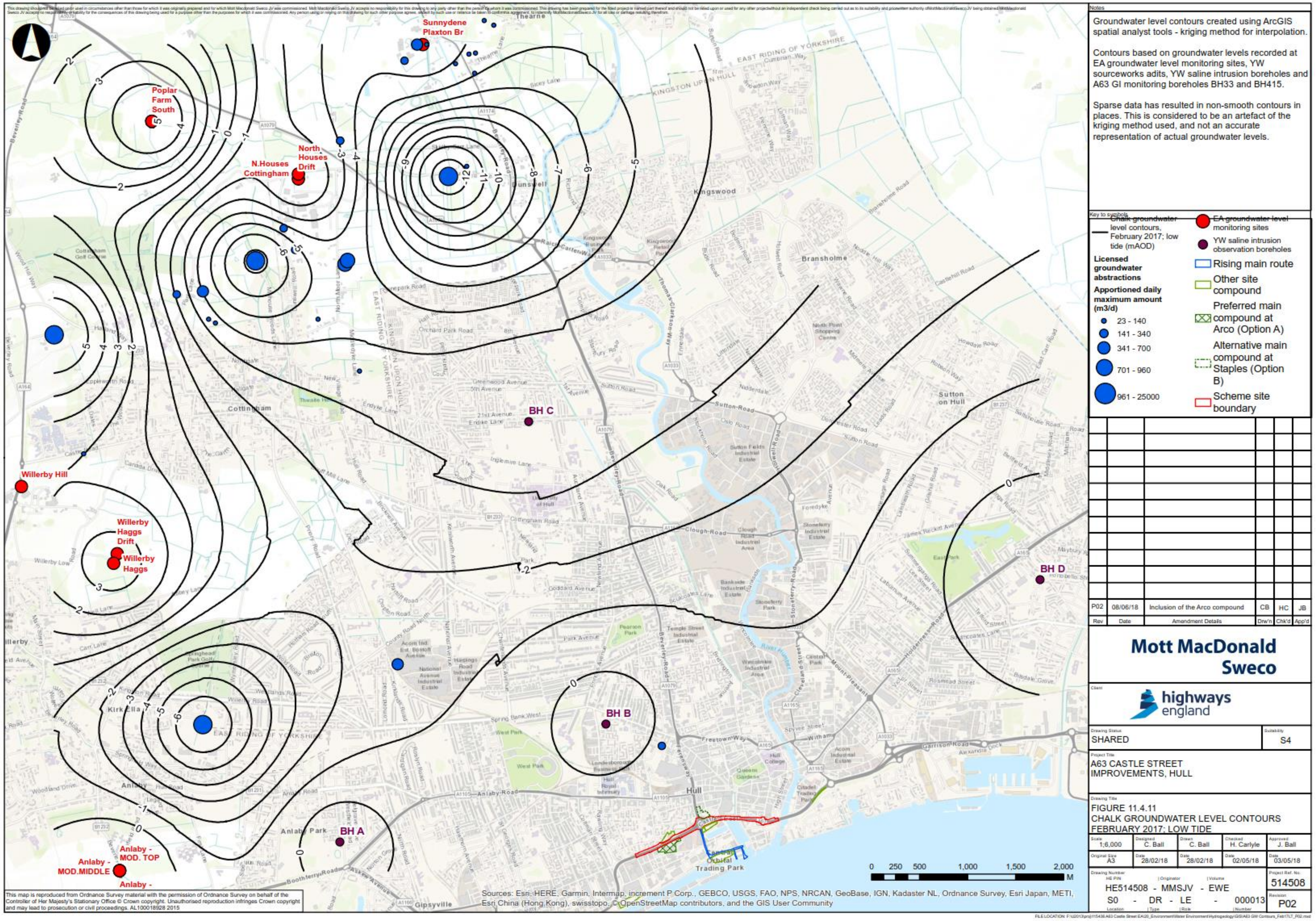


Figure 11.4.11: Chalk groundwater level contours, February 2017; low tide



The Scheme - overview

2.6.4 The following discussion is based on the findings of the 2013 and 2015/16 GIs (Annex A – D), and the subsequent groundwater monitoring programmes. As part of these GIs, a total of nine boreholes in the Chalk and 56 boreholes in the superficial deposits were completed as observation boreholes. A summary of the hydrogeological investigations carried out and data collected as part of the GIs is provided in Section 2.2 of this report. Borehole installation details are summarised in Annex F, while Figure 11.4.12 shows the location of these monitoring boreholes and the response zone lithology.

2.6.5 Whilst vibrating wire piezometers were installed as part of both the 2013 and 2015/16 GIs, data collected has not been presented in this report as due to the questionable reliability of some of the early results.

2.6.6 Groundwater level monitoring across the Scheme can be summarised into the following key periods:

- 17 July – 4 October 2013: Groundwater dip data was recorded roughly daily while the intrusive works were ongoing for the 2013 GI. The dip monitoring schedule depended on the construction schedule over this period and when each borehole was completed.

- 6 November – 13 December 2013: Groundwater monitoring was undertaken in selected monitoring boreholes in association with the drilling and testing of the two larger diameter pumping test boreholes, LDBH01 and LDBH02. During the LDBH01 pumping test (9 to 13 December 2013), frequent water level data was recorded in LDBH01 (Chalk), BH24 (Chalk), BH25 (glacial till (GT)), BH26 (peat/GT), BH27 (sandy clay – cohesive alluvium (CA)), BH28 (GT) and BH29 (Chalk). Dipped water levels were also taken in BH14 (peat), BH15 (GT), BH18A (Chalk) and SPB04 (sandy silt – CA).

- January – August 2014: With the agreement of Highways England, MMS JV undertook a further period of monitoring to capture any seasonal variations. Five groundwater data loggers were deployed between January and August, and groundwater level dip data was recorded monthly between May and August for the majority of monitoring boreholes. During this period, the data loggers were deployed in selected boreholes for a few days at a time to determine hydraulic relationships between superficial deposits and the Chalk, and also hydraulic gradients within individual aquifer units.

- August 2015 – October 2017: Monitoring continued in the selected boreholes from the 2013 GI and all monitoring boreholes installed in the 2015/16 GI, as summarised in Table 11.4.7. Full details of the dip and logger data datasets are provided in Annex G.

Table 11.4.7: Summary of Monitoring Boreholes

Response zone geology	Monitoring Boreholes	
	Dip data only	Dip and logger data
Made Ground		BH416
Cohesive Alluvium		SBP04, BH32, BH301, BH302, BH307, BH309, BH402, BH405, BH413, BH417
Granular Alluvium	BH21, BH37, BH38, BH40A, BH42, BH46	BH34, BH308, BH411, BH414, BH502
Glacial Till	BH01, BH13, BH26	BH303, BH404, BH406
Glaciolacustrine deposits	BH03, BH06, BH20	BH412, BH501
Fluvio-glacial deposits	BH42	BH305
Chalk		BH33, BH306, BH415

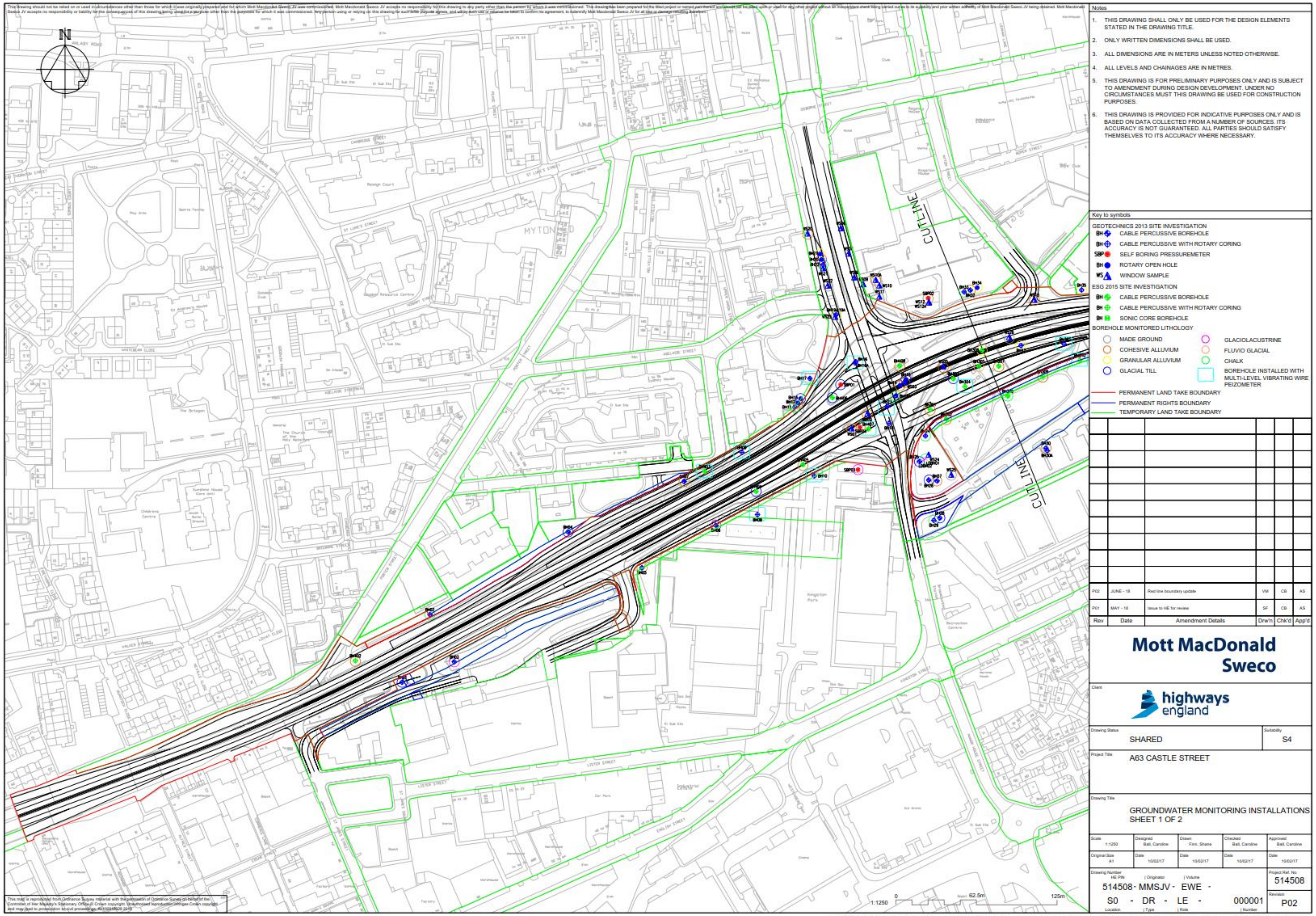
2.6.7 Groundwater level monitoring across the Scheme is presented in the following figures. Figure 11.4.12 shows the location of these monitoring boreholes and the response zone lithology.

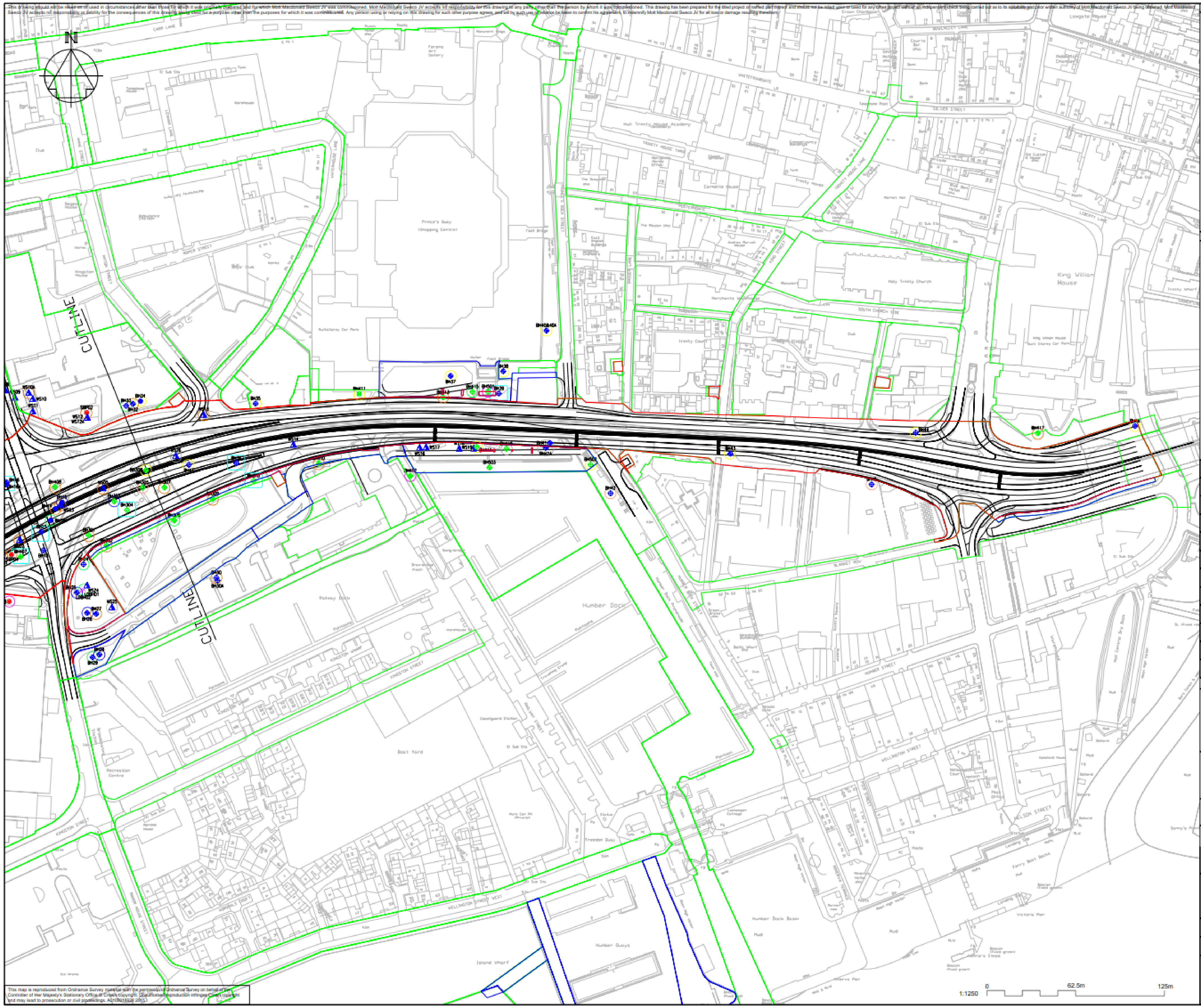
- Figure 11.4.13 to Figure 11.4.19 inclusive present dip data and logger data hydrographs for all boreholes in the superficial deposits and Chalk horizons for the full monitoring record (July 2013 to October 2017).
- Figure 11.4.20 focuses on groundwater levels in both the superficial deposits and Chalk during the LDBH01 pumping test. Full details of the pumping test, including the test analysis, are provided in the Pumping Test Report (MMG JV, 2014c).
- Figure 11.4.21 to

- Figure 11.4.24 inclusive show the hydrographs for the data loggers deployed in selected boreholes for shorter periods of one to three months. In Figure 11.4.21 and Figure 11.4.22, each hydrograph relates to different sets of boreholes in which the data loggers were installed in the period between January to August 2014. Figure 11.4.23 and

- Figure 11.4.24 focus on logger data for boreholes centred around Trinity Burial Ground and the Princes Quay Bridge location respectively.
- Figure 11.4.25 presents dip data taken at high and low tides on 27 February 2017.
- Figure 11.4.26 and Figure 11.4.27 present a long-section and cross-section respectively through the Scheme. These show the general geology, the lithology encountered in each groundwater monitoring borehole and the response zone for that borehole, and mean groundwater levels based on the initial water level monitoring period (up to and including 24th January 2014). A plan showing borehole locations and the line of section is shown above each geological section.

Figure 11.4.12: Groundwater monitoring installations





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Key to symbols

GEOTECHNICS 2013 SITE INVESTIGATION
- BH CABLE PERCUSSIVE BOREHOLE
- BH CABLE PERCUSSIVE WITH ROTARY CORING
- SBP SELF BORING PRESSUREMETER
- BH ROTARY OPEN HOLE
- WS WINDOW SAMPLE

ESG 2015 SITE INVESTIGATION
- BH CABLE PERCUSSIVE BOREHOLE
- BH CABLE PERCUSSIVE WITH ROTARY CORING
- BH SONIC CORE BOREHOLE

BOREHOLE MONITORED LITHOLOGY
- MADE GROUND
- COHESIVE ALLUVIUM
- GRANULAR ALLUVIUM
- GLACIAL TILL
- GLACIOLACUSTRINE
- FLUVIO GLACIAL
- CHALK
- BOREHOLE INSTALLED WITH MULTI-LEVEL VIBRATING WIRE PEIZOMETER

- PERMANENT LAND TAKE BOUNDARY
- PERMANENT RIGHTS BOUNDARY
- TEMPORARY LAND TAKE BOUNDARY

Rev	Date	Amendment Details	Drw'n	Chk'd	App'd
P02	JUNE - 18	Red line boundary update	VM	CB	AS
P01	MAY - 18	Issue to HE for review	SF	CB	AS

Mott MacDonald Sweco

Client: highways england

Drawing Status	Suitability
SHARED	S4

Project Title: A63 CASTLE STREET

Drawing Title: GROUNDWATER MONITORING INSTALLATIONS SHEET 2 OF 2

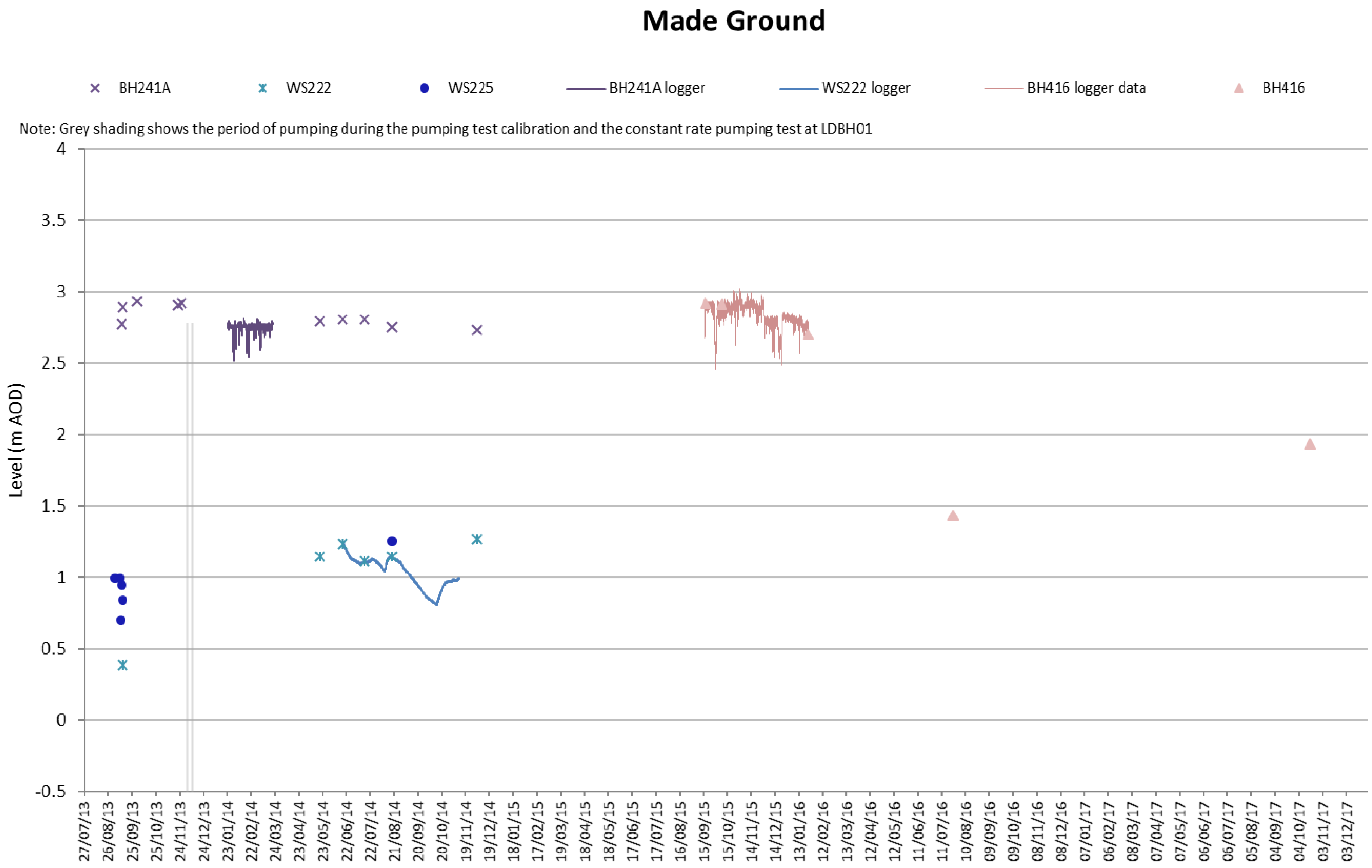
Scale	Designed	Drawn	Checked	Approved
1:1250	Ball, Caroline	Finn, Shane	Ball, Caroline	Ball, Caroline
Original Size: A1	Date: 10/02/17	Date: 10/02/17	Date: 10/02/17	Date: 10/02/17

Drawing Number (HE PIN | Originator | Volume | Location | Type | Role | Number): 514508 - MMSJV - - S0 - DR - LE - 000002

Project Ref. No.: 514508

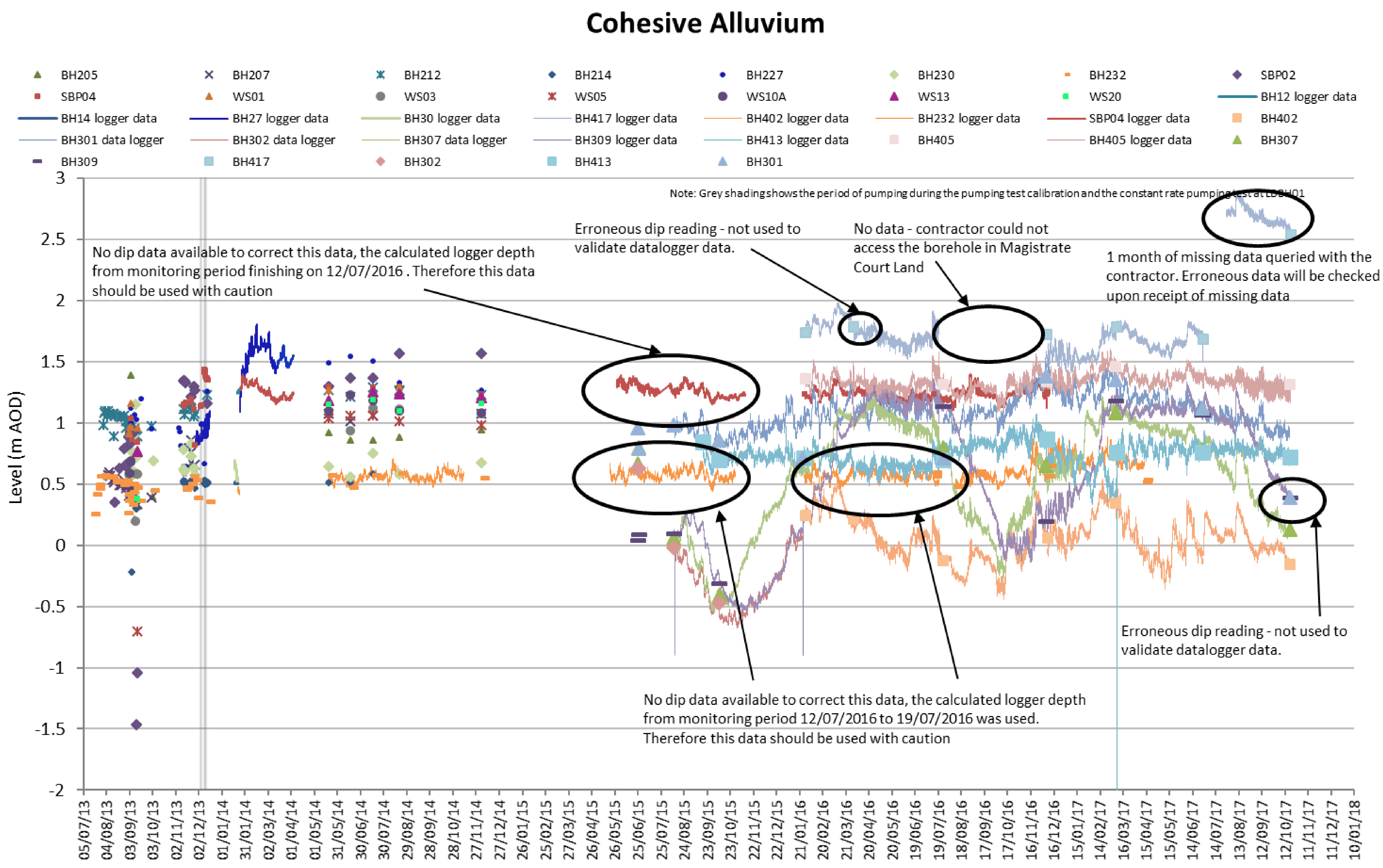
Revision: P02

Figure 11.4.13: Hydrographs for Scheme boreholes in superficial deposits – made ground (from Arup, 2018)



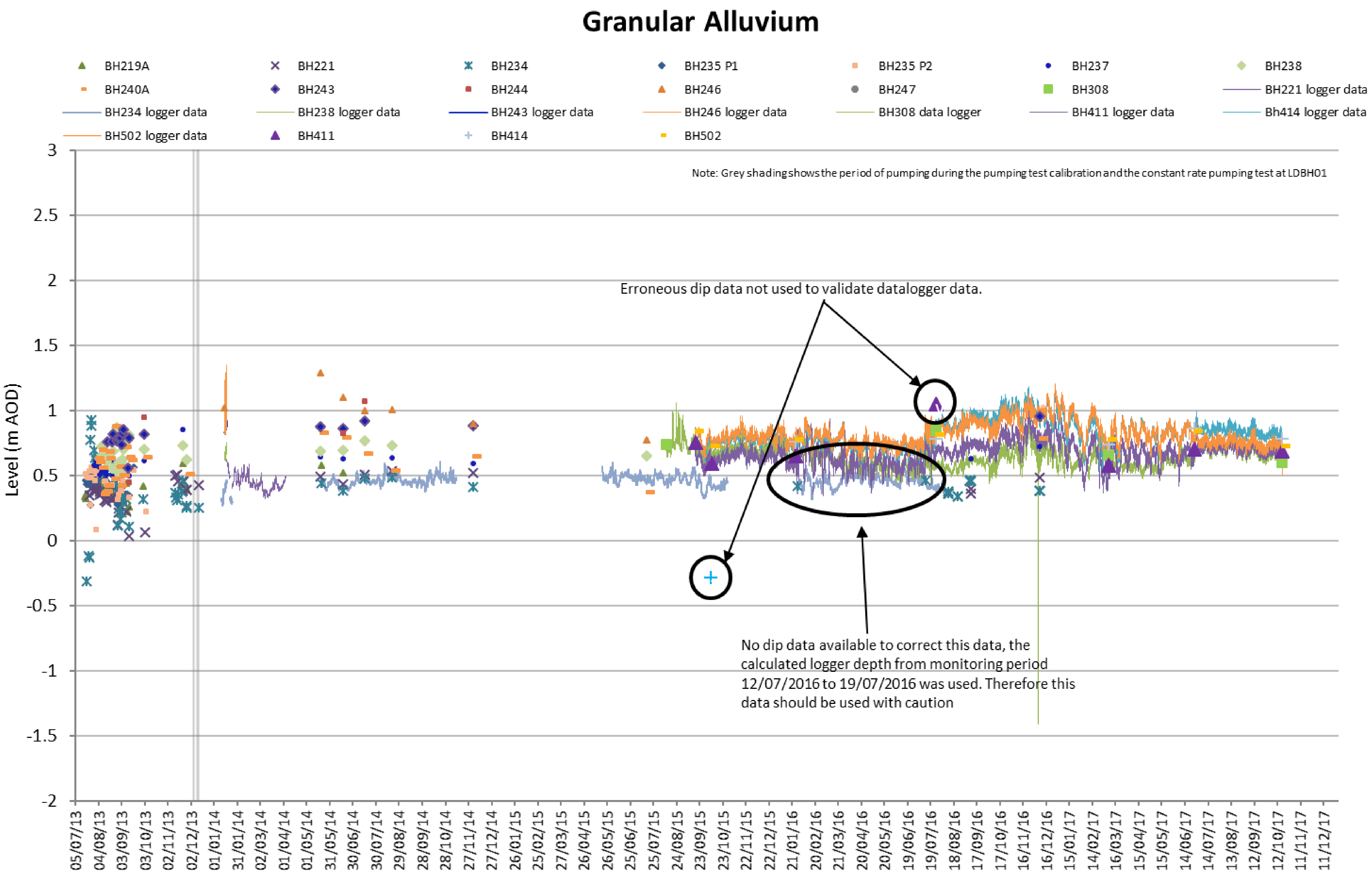
Note: Arup monitoring has placed a 2## prefix to all 2013 GI monitoring installations, i.e. BH41A becomes BH241A

Figure 11.4.14: Hydrographs for Scheme boreholes in superficial deposits – cohesive alluvium (from Arup, 2018)



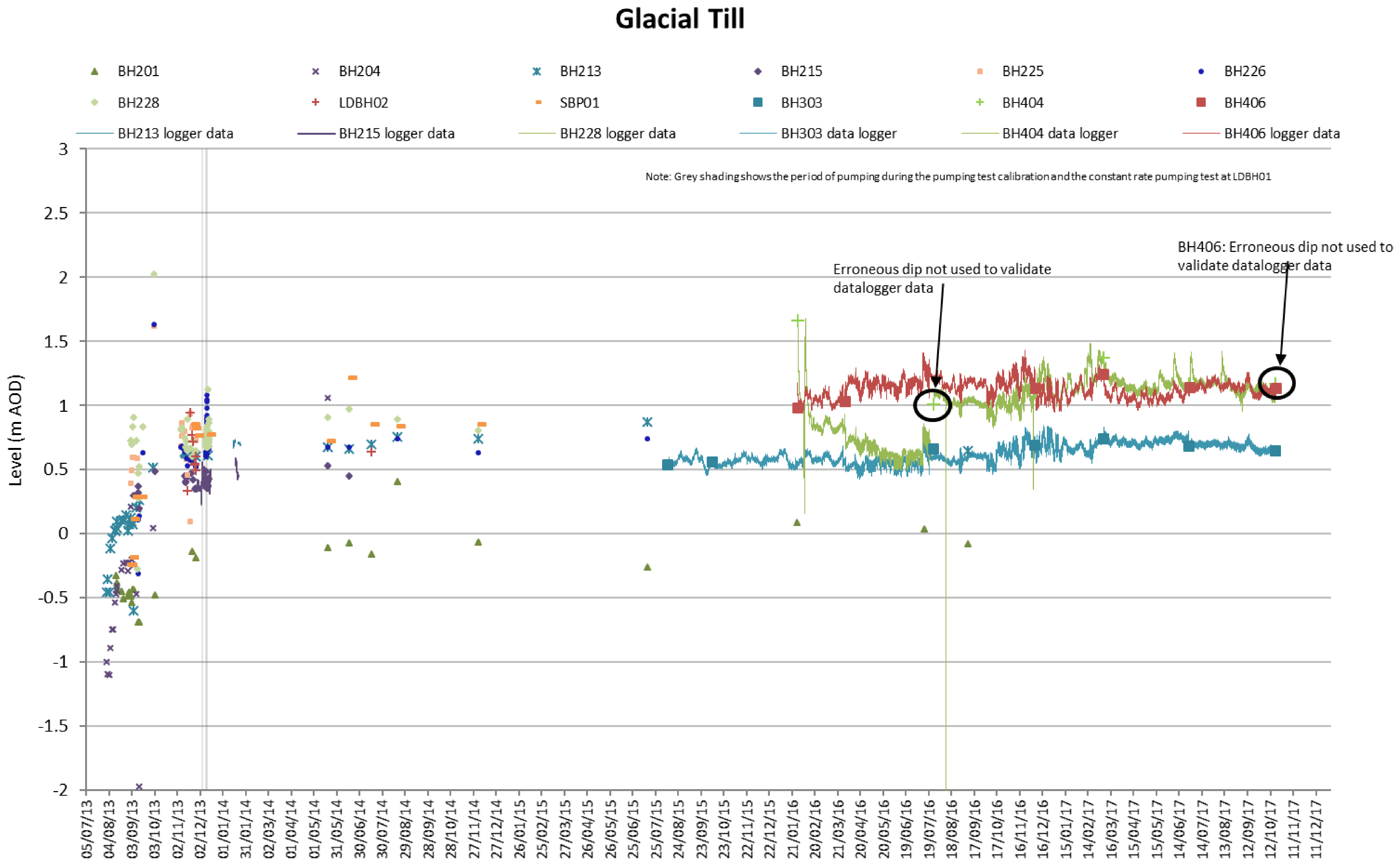
Note: Arup monitoring has placed a 2## prefix to all 2013 GI monitoring installations, i.e. BH12 becomes BH212.

Figure 11.4.15: Hydrographs for Scheme boreholes in superficial deposits – granular alluvium (from Arup, 2018)



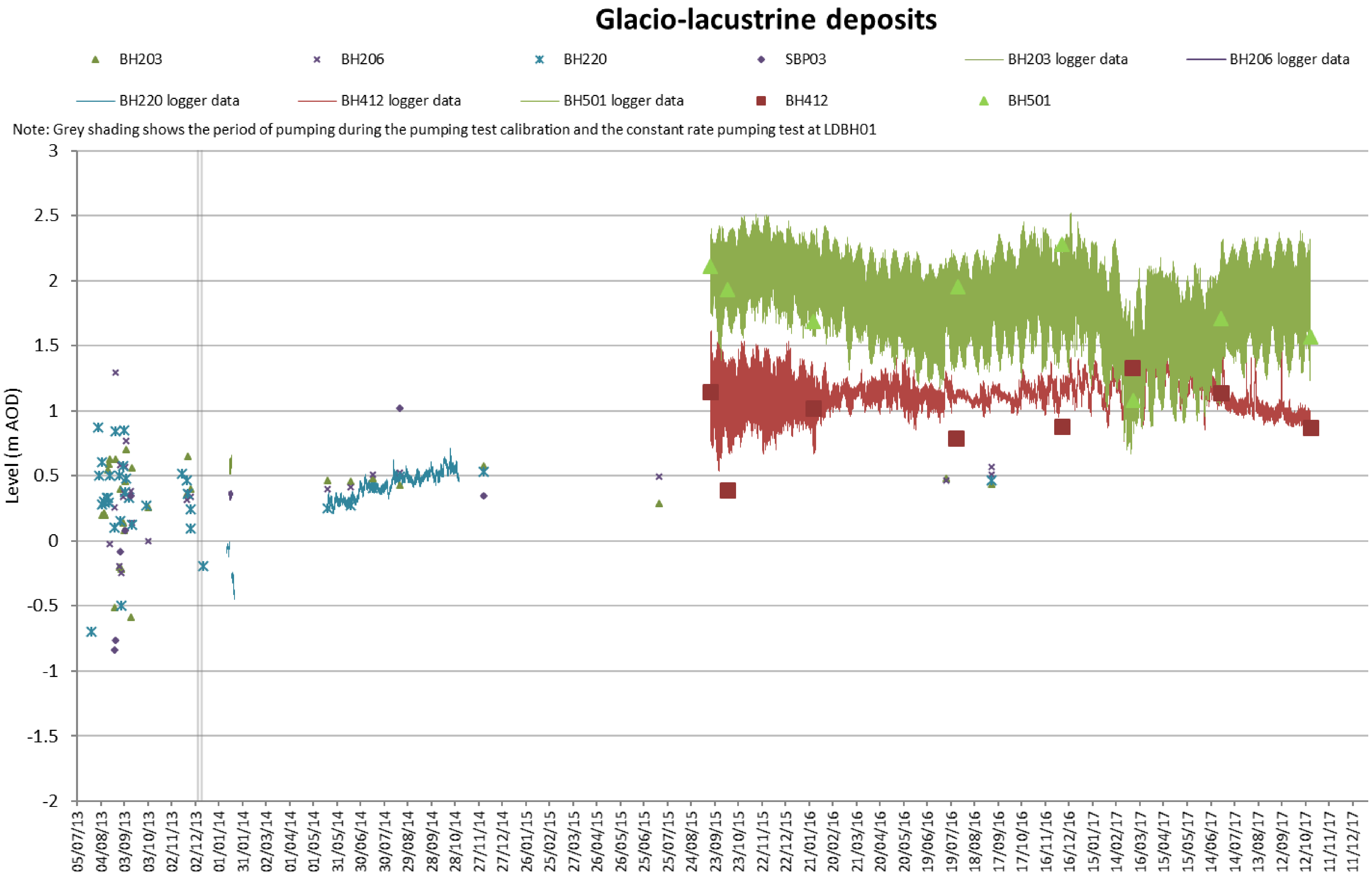
Note: Arup monitoring has placed a 2## prefix to all 2013 GI monitoring installations, i.e. BH21 becomes BH221.

Figure 11.4.16: Hydrographs for Scheme boreholes in superficial deposits – glacial till (from Arup, 2018)



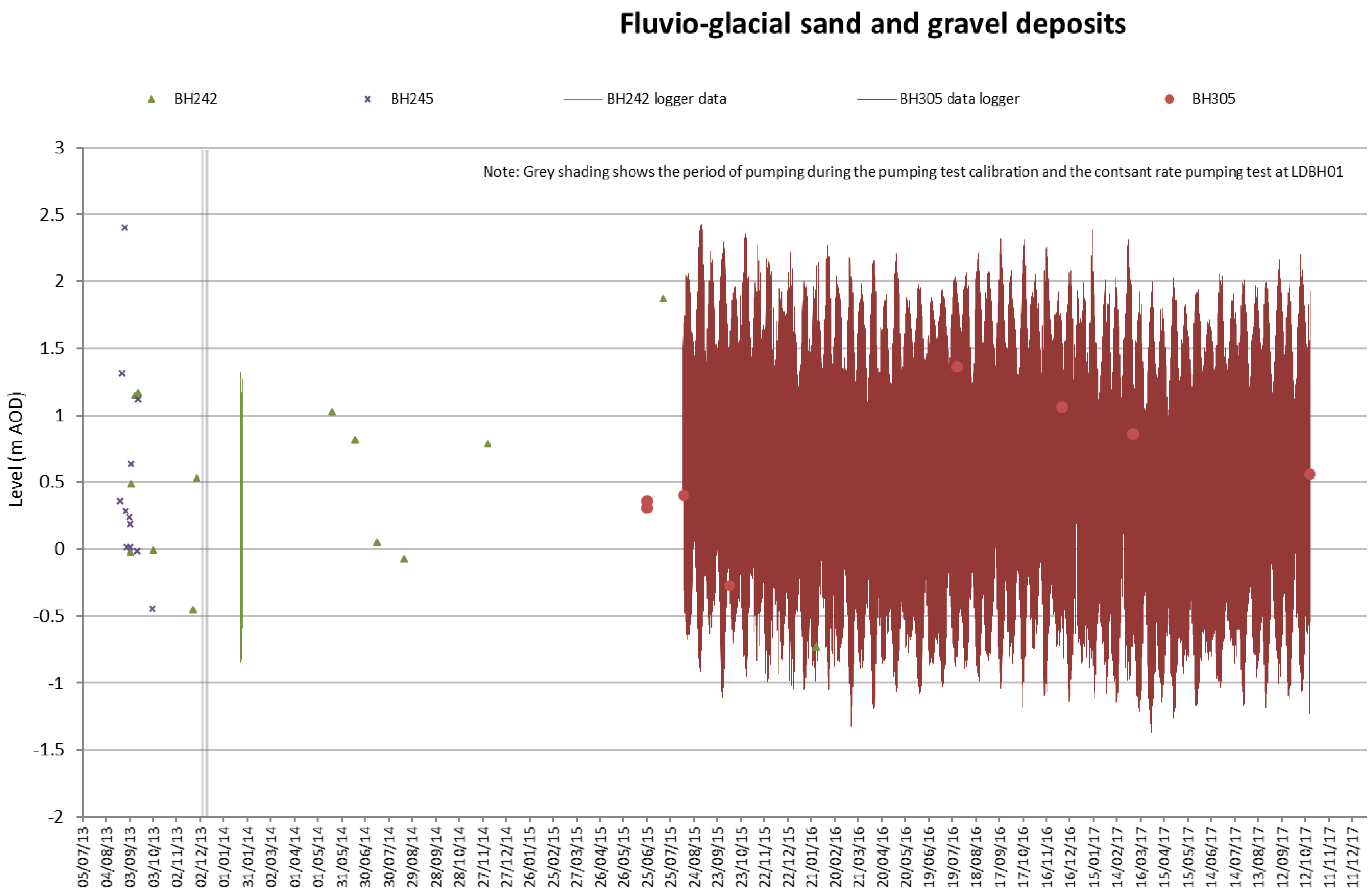
Note: Arup monitoring has placed a 2## prefix to all 2013 GI monitoring installations, i.e. BH13 becomes BH213.

Figure 11.4.17: Hydrographs for Scheme boreholes in superficial deposits – glaciolacustrine deposits (from Arup, 2018)



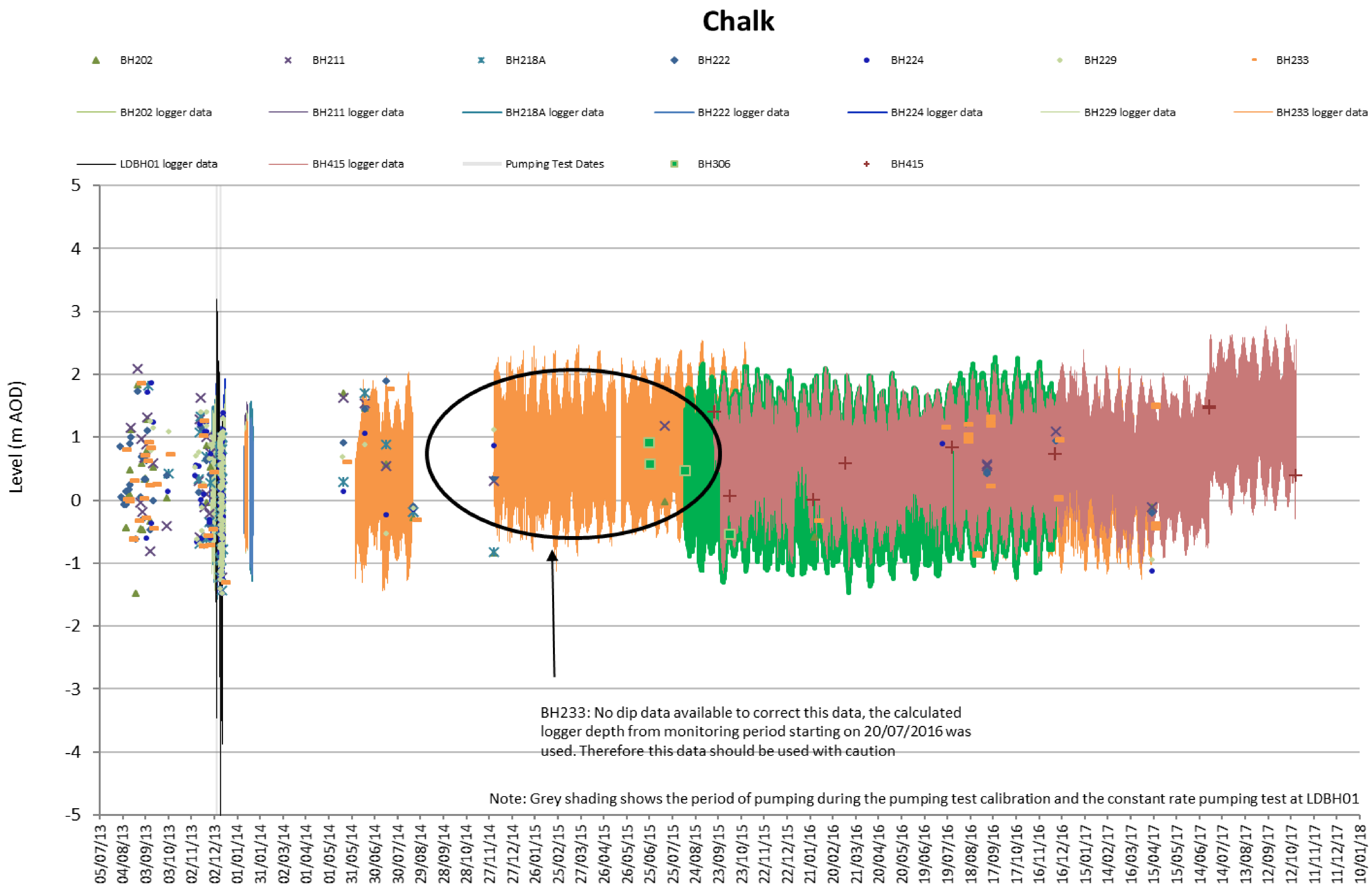
Note: Arup monitoring has placed a 2## prefix to all 2013 GI monitoring installations, i.e. BH03 becomes BH203.

Figure 11.4.18: Hydrographs for Scheme boreholes in superficial deposits – fluvio-glacial deposits (from Arup, 2018)



Note: Arup monitoring has placed a 2## prefix to all 2013 GI monitoring installations, i.e. BH42 becomes BH242.

Figure 11.4.19: Hydrographs for Scheme boreholes in Chalk (from Arup, 2018)



Note: Arup monitoring has placed a 2## prefix to all 2013 GI monitoring installations, i.e. BH33 becomes BH23

Figure 11.4.20: LDBH01 pumping test hydrographs

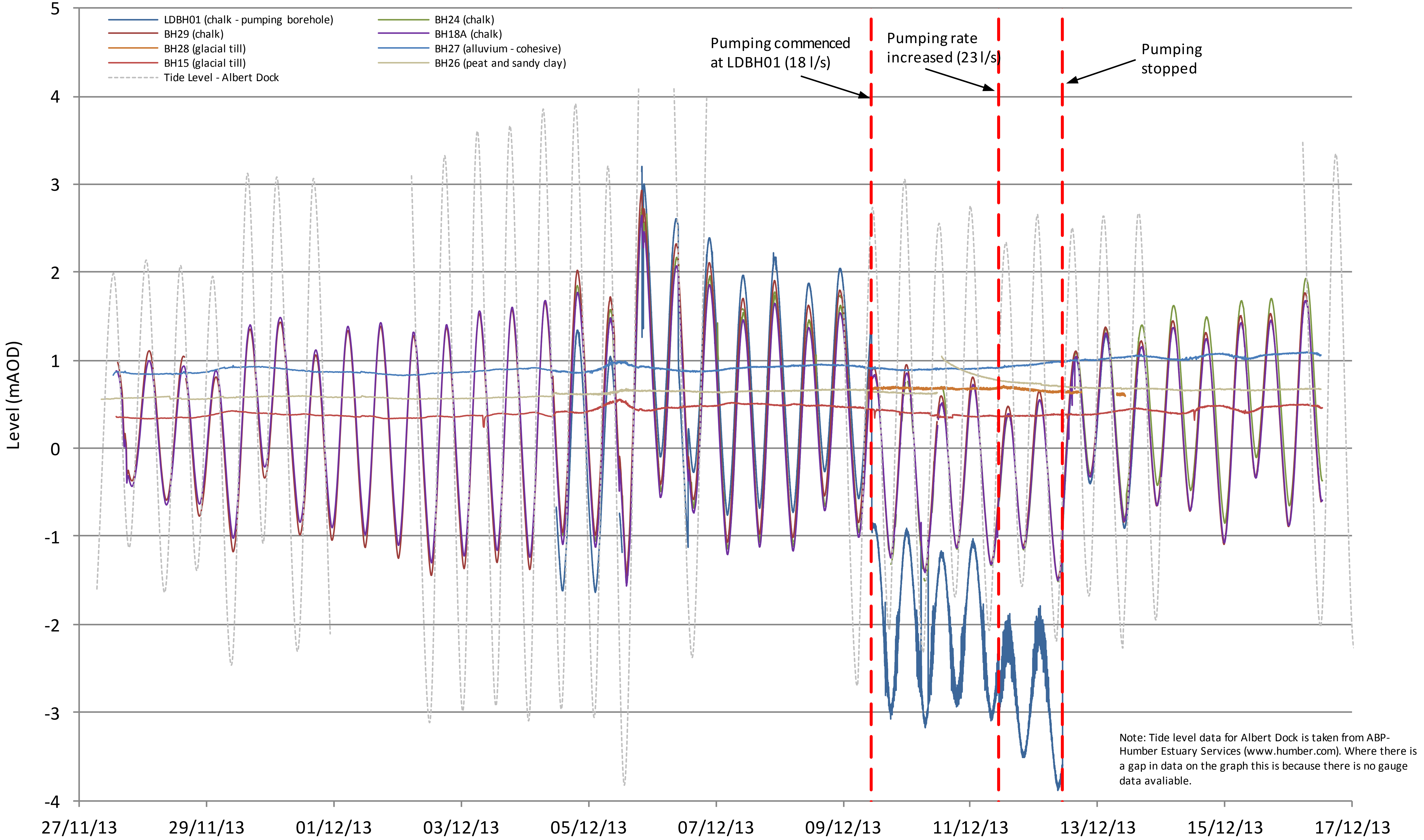
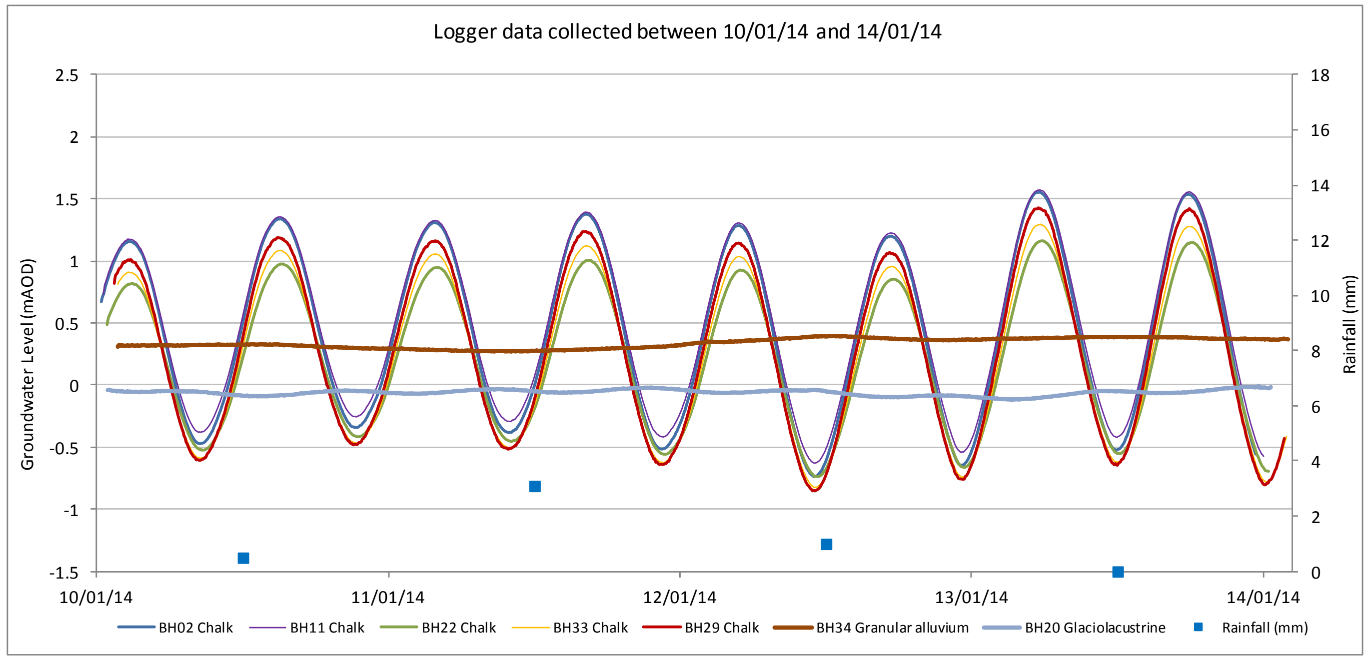
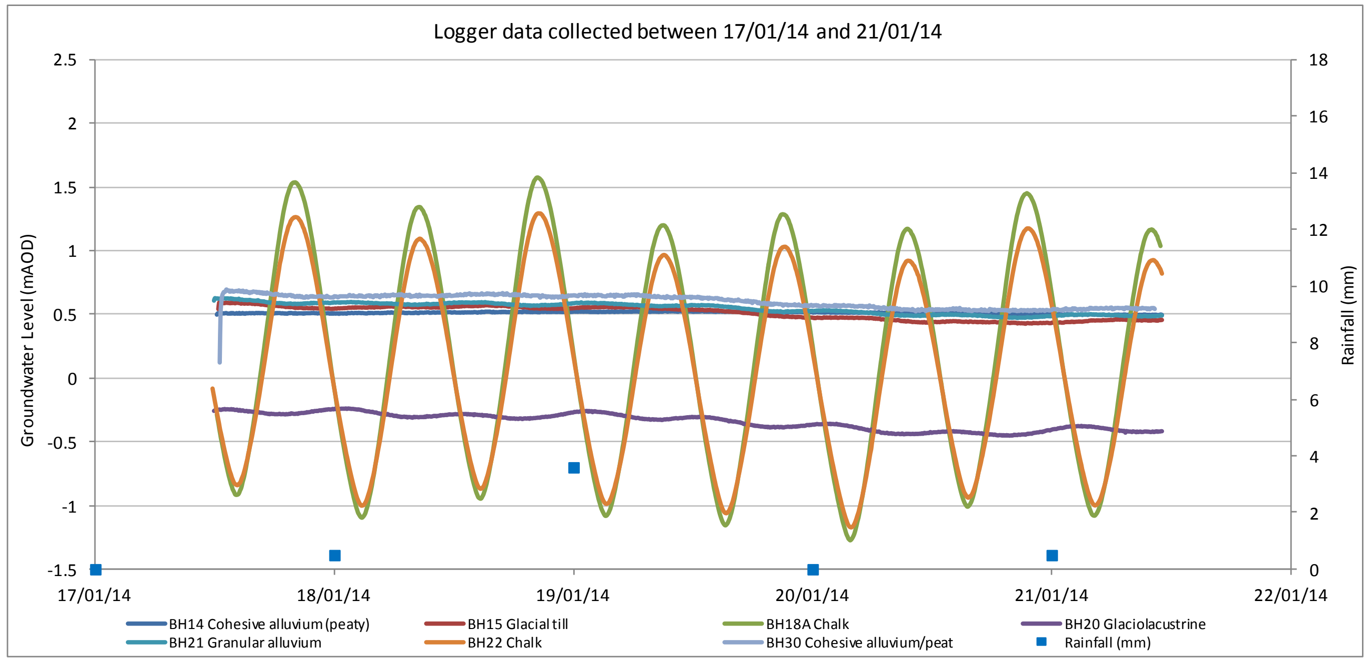
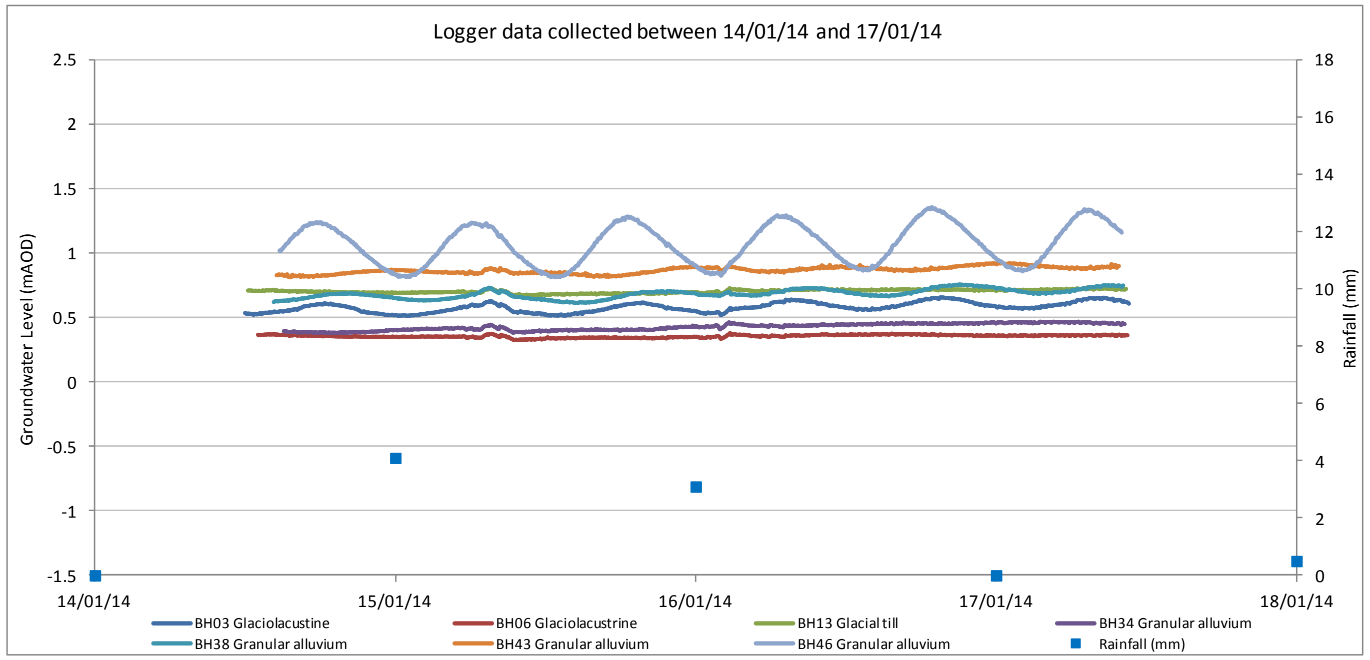


Figure 11.4.21: Hydrographs for boreholes monitored using dataloggers – January 2014







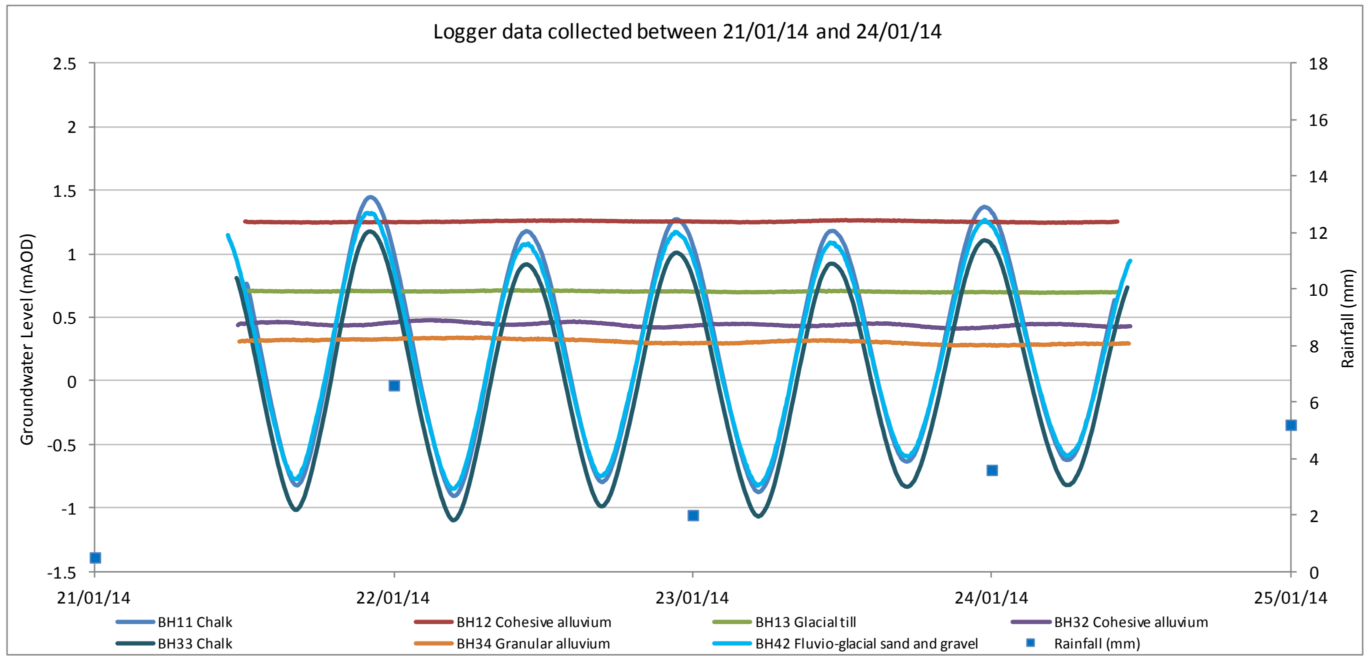
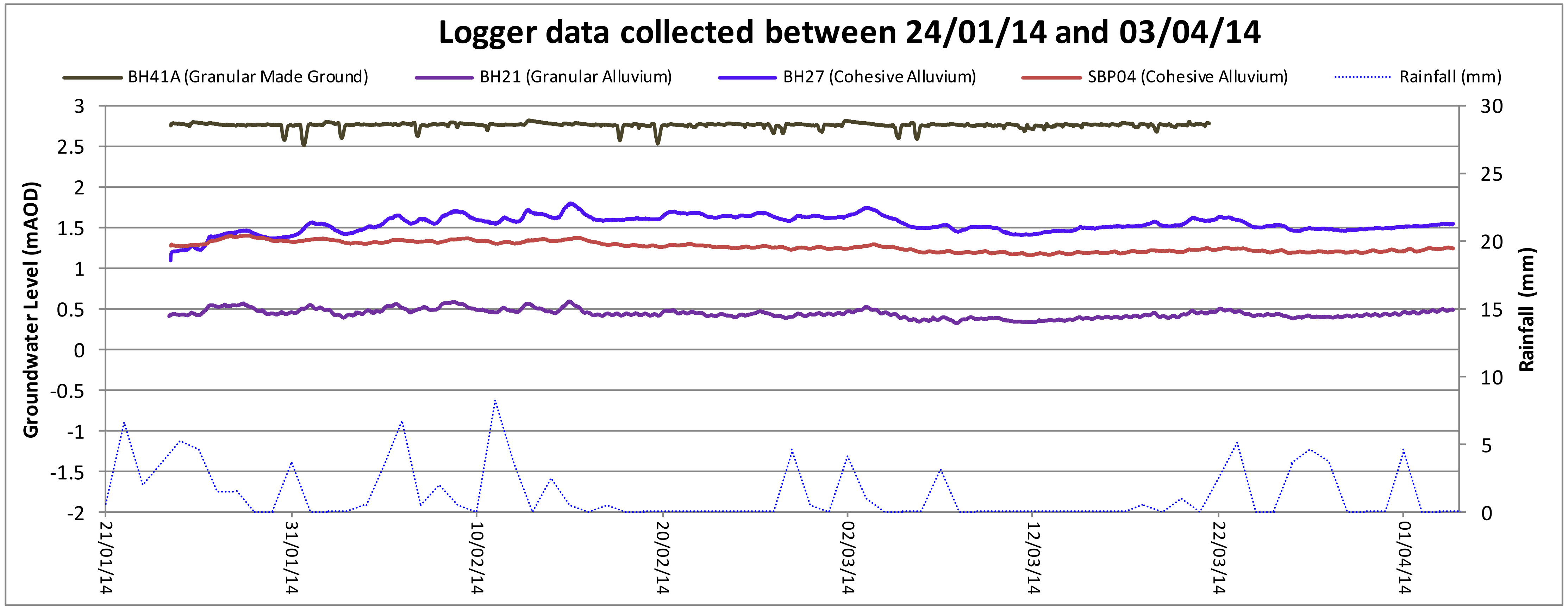


Figure 11.4.22: Hydrographs for boreholes monitored using dataloggers – January to August 2014



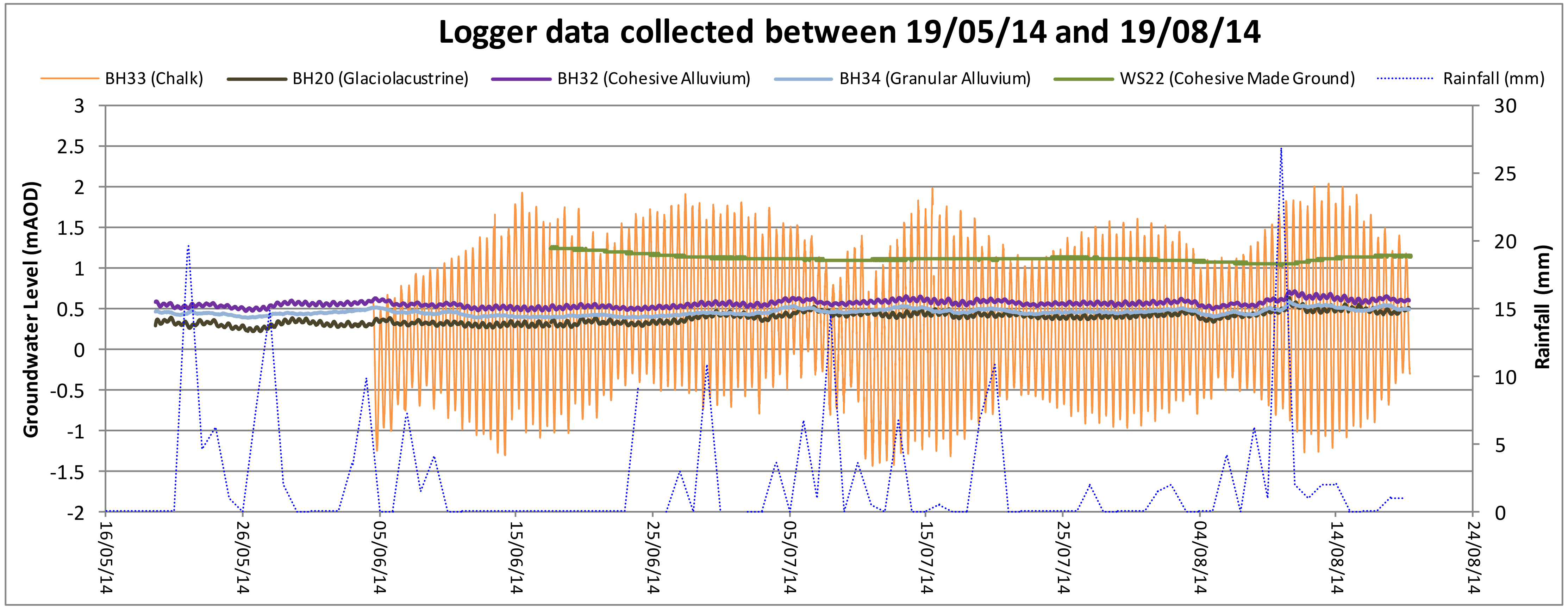


Figure 11.4.23: Hydrographs for boreholes adjacent to Trinity Burial Ground – April 2016

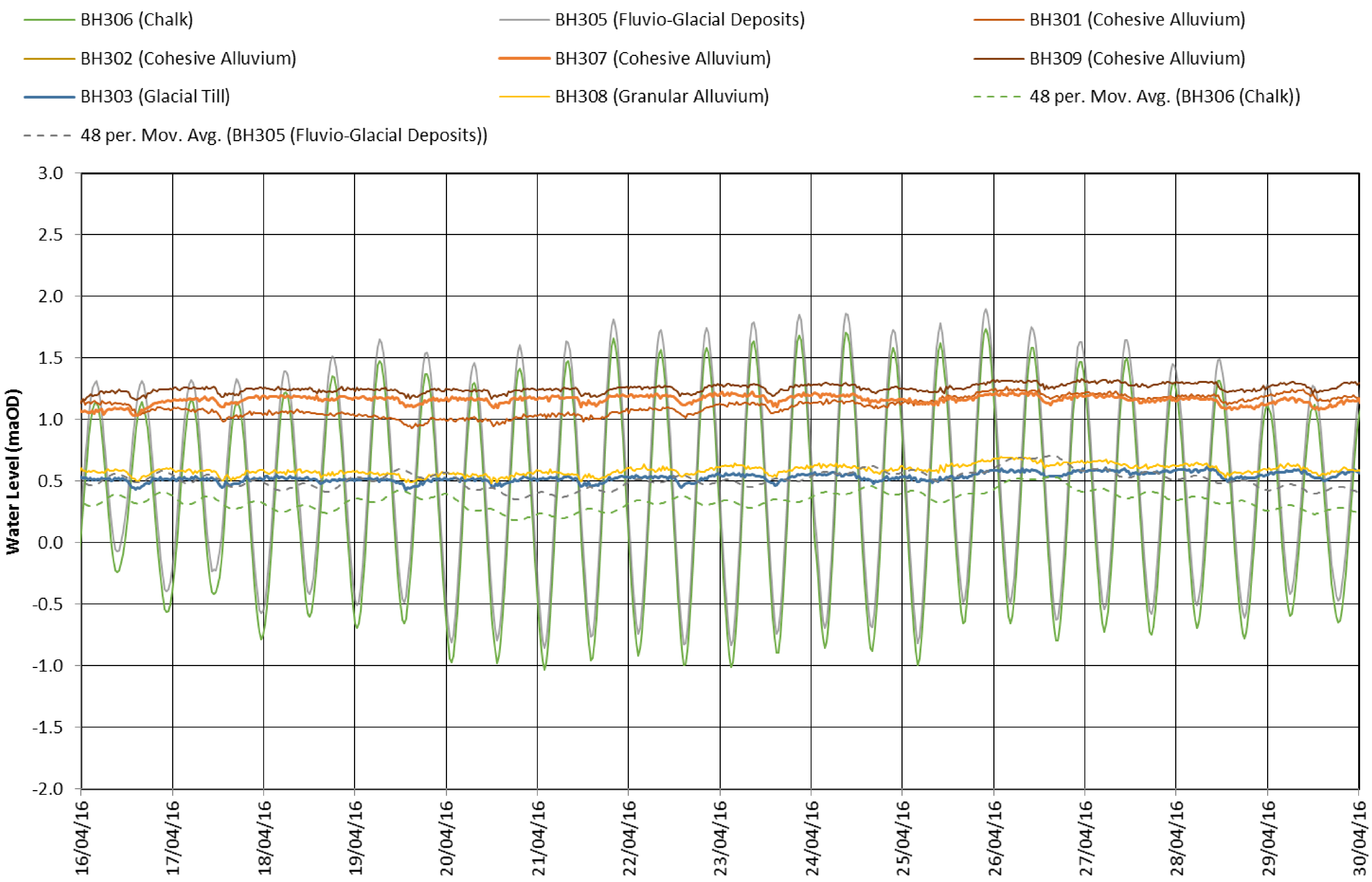


Figure 11.4.24: Hydrographs for boreholes adjacent to Princes Quay Bridge – September to October 2015

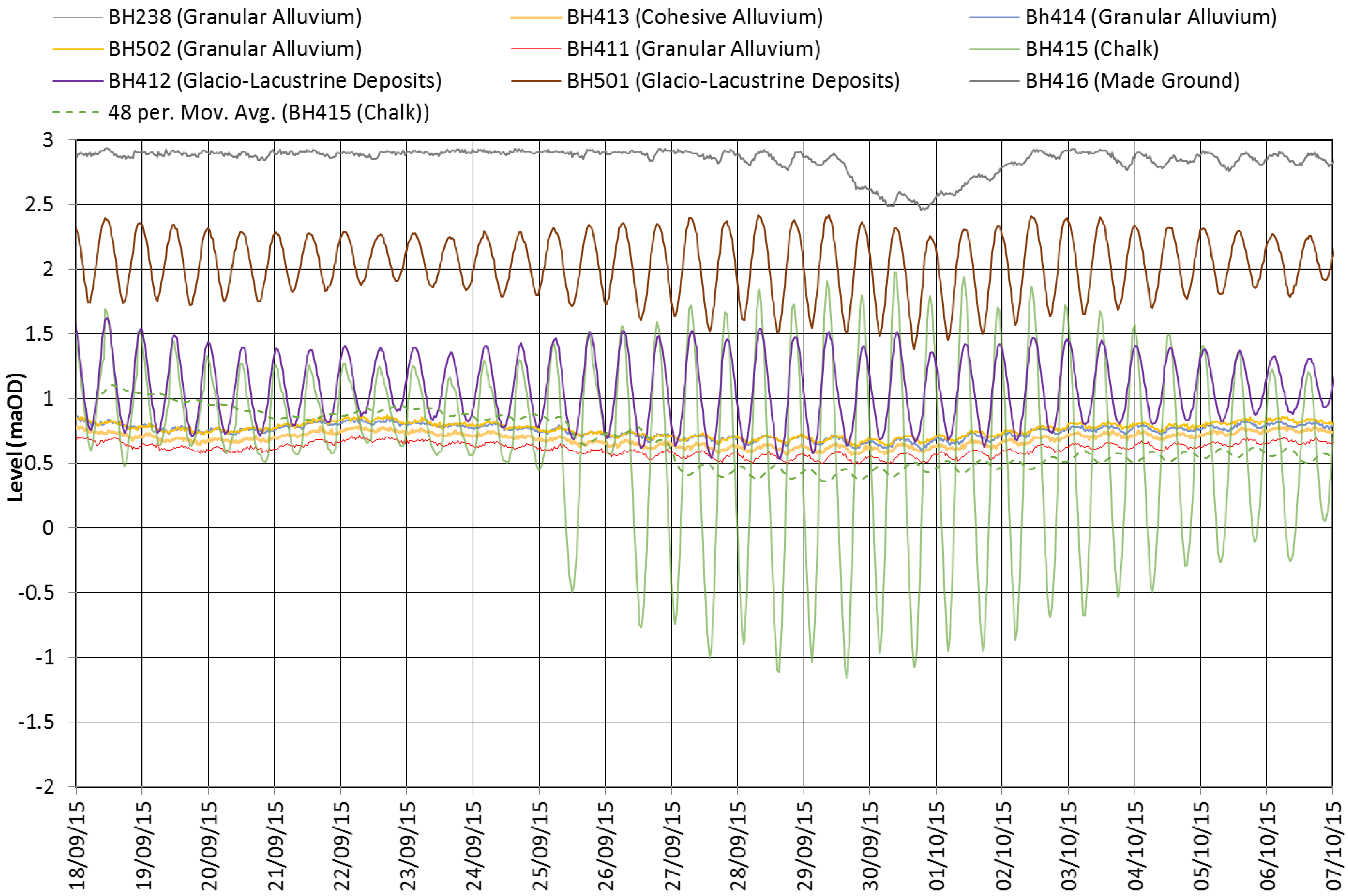


Figure 11.4.25: Chalk groundwater levels at high tide and low tide, 28 February 2017

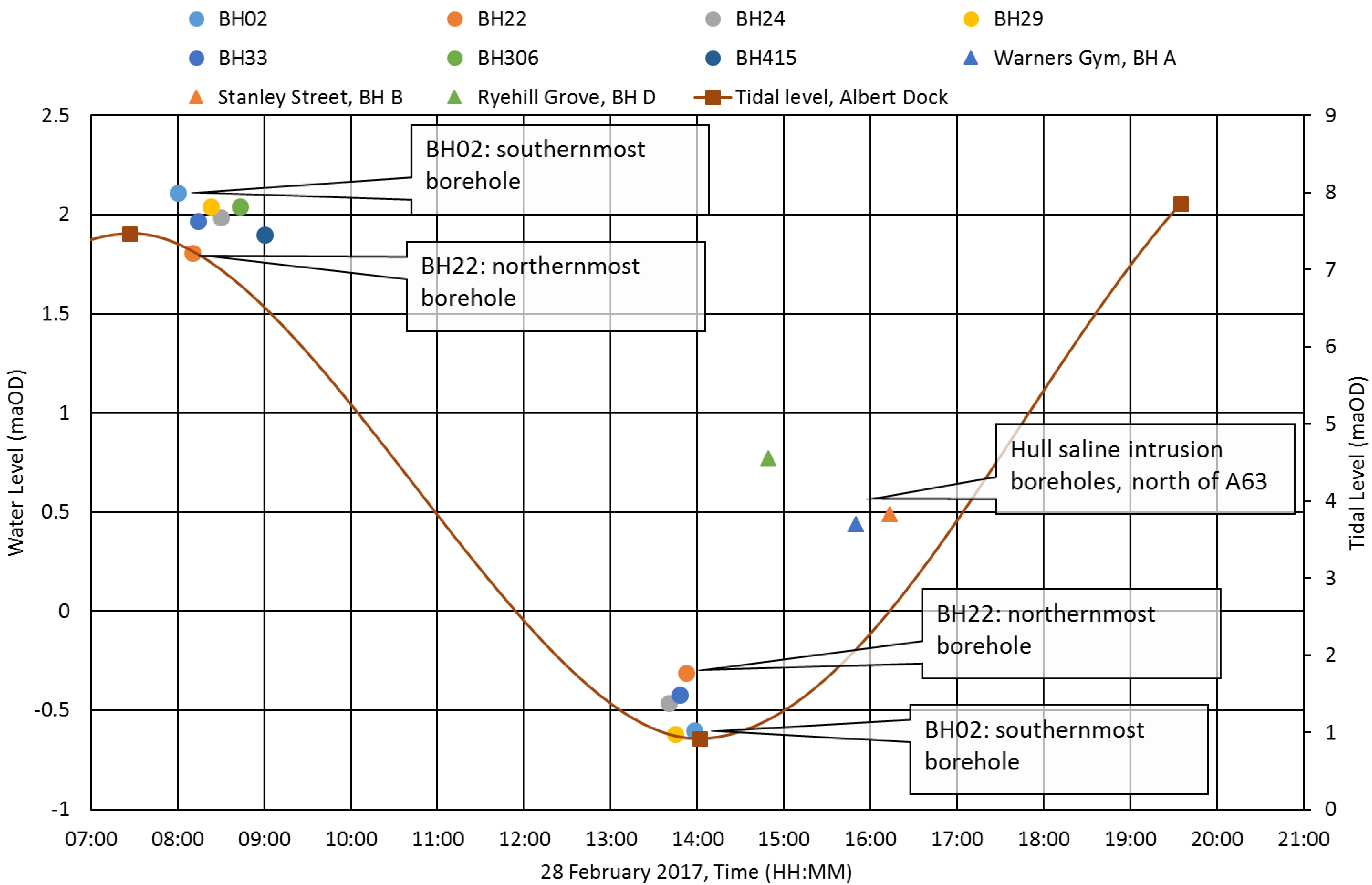
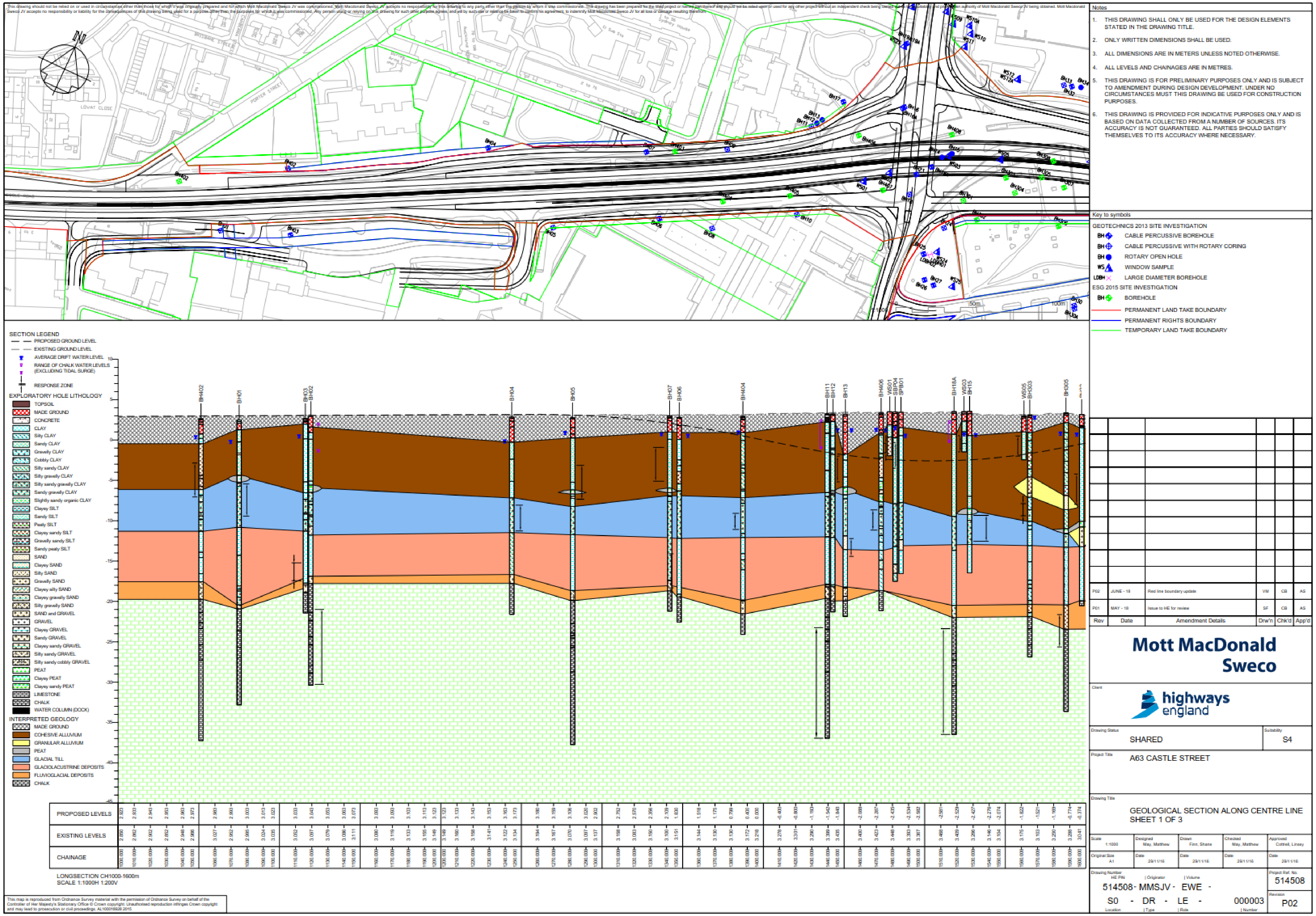
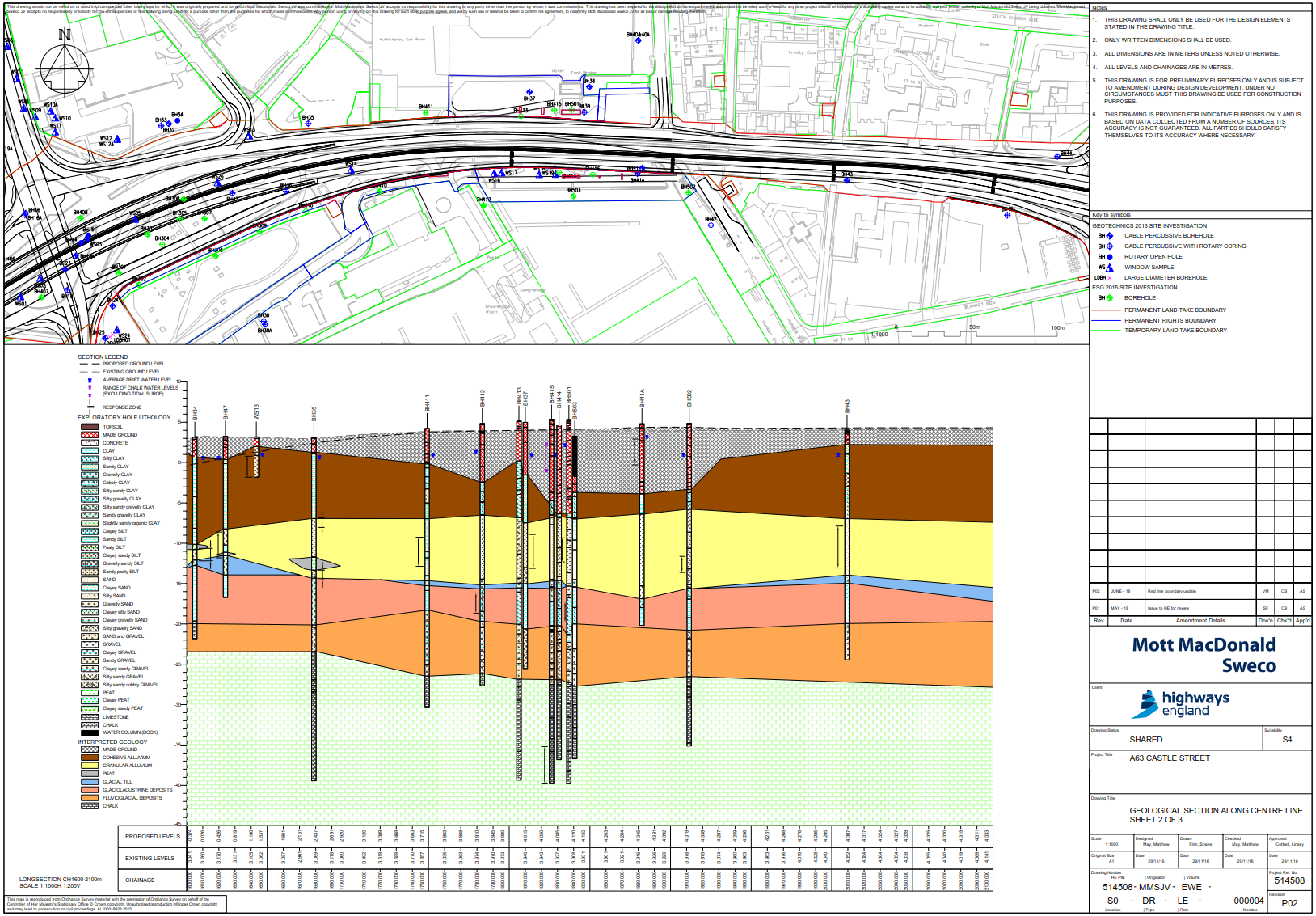


Figure 11.4.26: Geological section along centre line (a – c)

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Key to symbols
GEOTECHNICS 2013 SITE INVESTIGATION
CABLE PERCUSSIVE BOREHOLE
CABLE PERCUSSIVE WITH ROTARY CORING
ROTARY OPEN HOLE
WINDOW SAMPLE
LARGE DIAMETER BOREHOLE
ESG 2015 SITE INVESTIGATION
BOREHOLE
PERMANENT LAND TAKE BOUNDARY
PERMANENT RIGHTS BOUNDARY
TEMPORARY LAND TAKE BOUNDARY
SECTION LEGEND
PROPOSED GROUND LEVEL
EXISTING GROUND LEVEL
AVERAGE DRIFT WATER LEVEL
RANGE OF CHALK WATER LEVELS (EXCLUDING TIDAL SURGE)
RESPONSE ZONE
EXPLORATORY HOLE LITHOLOGY
INTERPRETED GEOLOGY
MADE GROUND
COHESIVE ALLUVIUM
GRANULAR ALLUVIUM
PEAT
GLACIAL TILL
GLACIOLACUSTRINE DEPOSITS
FLUVIOGLACIAL DEPOSITS
CHALK
PROPOSED LEVELS
EXISTING LEVELS
CHAINAGE
LONGSECTION CH1600-2100m
SCALE 1:1000H 1:200V
P02 JUNE - 18 Red line boundary update
P01 MAY - 18 Issue to HE for review
Rev Date Amendment Details Drw'n Chk'd App'd
Mott MacDonald Sweco
highways england
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A63 CASTLE STREET
GEOLOGICAL SECTION ALONG CENTRE LINE SHEET 2 OF 3
514508 - MMSJV - EWE - S0 - DR - LE - 000004
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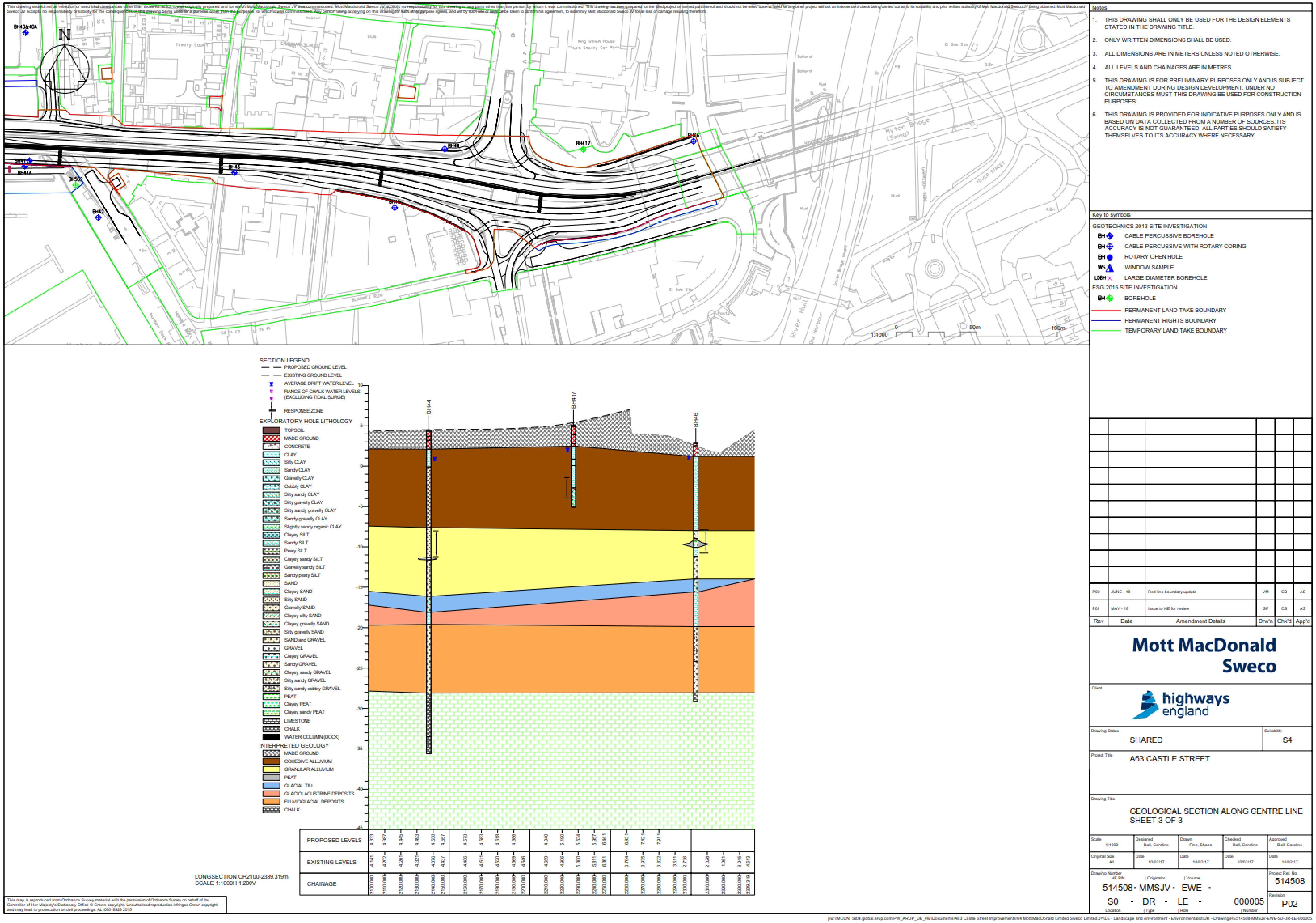
P02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ROTARY OPEN HOLE
WINDOW SAMPLE
LARGE DIAMETER BOREHOLE
ESG 2015 SITE INVESTIGATION
BOREHOLE
PERMANENT LAND TAKE BOUNDARY
PERMANENT RIGHTS BOUNDARY
TEMPORARY LAND TAKE BOUNDARY
BH44
BH417
BH46
BH43
BH42
1:1000
0
50m
100m
SECTION LEGEND
PROPOSED GROUND LEVEL
EXISTING GROUND LEVEL
AVERAGE DRIFT WATER LEVEL
RANGE OF CHALK WATER LEVELS (EXCLUDING TIDAL SURGE)
RESPONSE ZONE
EXPLORATORY HOLE LITHOLOGY
TOPSOIL
MADE GROUND
CONCRETE
CLAY
Silty CLAY
Sandy CLAY
Gravelly CLAY
Cobbly CLAY
Silty sandy CLAY
Silty gravelly CLAY
Silty sandy gravelly CLAY
Sandy gravelly CLAY
Slightly sandy organic CLAY
Clayey SILT
Sandy SILT
Peaty SILT
Clayey sandy SILT
Gravelly sandy SILT
Sandy peaty SILT
SAND
Clayey SAND
Silty SAND
Gravelly SAND
Clayey silty SAND
Clayey gravelly SAND
Silty gravelly SAND
SAND and GRAVEL
GRAVEL
Clayey GRAVEL
Sandy GRAVEL
Clayey sandy GRAVEL
Silty sandy GRAVEL
Silty sandy cobbly GRAVEL
PEAT
Clayey PEAT
Clayey sandy PEAT
LIMESTONE
CHALK
WATER COLUMN (DOCK)
INTERPRETED GEOLOGY
MADE GROUND
COHESIVE ALLUVIUM
GRANULAR ALLUVIUM
PEAT
GLACIAL TILL
GLACIOLACUSTRINE DEPOSITS
FLUVIOGLACIAL DEPOSITS
CHALK
PROPOSED LEVELS
EXISTING LEVELS
CHAINAGE
LONGSECTION CH2100-2339.319m
SCALE 1:1000H 1:200V
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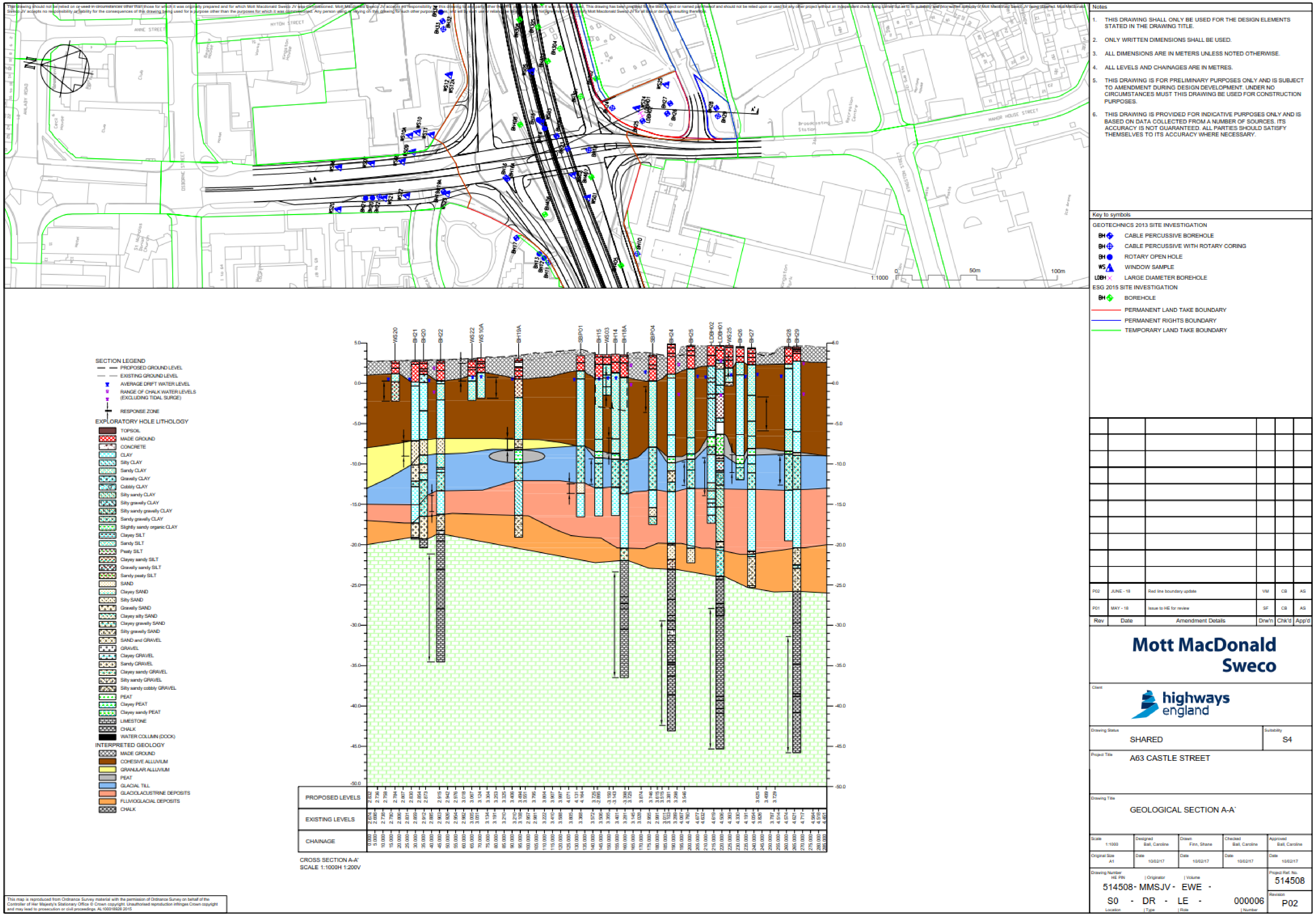
Drawing Status SHARED
Suitability S4
Project Title A63 CASTLE STREET
Drawing Title GEOLOGICAL SECTION ALONG CENTRE LINE SHEET 3 OF 3
Scale 1:1000
Designed Ball, Caroline
Drawn Finn, Shane
Checked Ball, Caroline
Approved Ball, Caroline
Original Size A1
Drawing Number
514508 - MMSJV - EWE - S0 - DR - LE - 000005
Project Ref. No. 514508
Revision P02

Figure 11.4.27: Geological section A – A'



2.6.8 Water level data for monitoring boreholes within the Scheme confirm that groundwater in the more permeable, natural superficial deposits is generally confined by the cohesive deposits (see Figure 11.4.13 to Figure 11.4.18 inclusive). Table 11.4.8 presents the range of groundwater heads in each horizon, along with the observed tidal response.

Table 11.4.8: Groundwater head ranges and tidal responses

Horizon	Groundwater Head Range (m AOD)	Tidal Response	Comments
Made Ground	0-5 – 3.0	None	Perched groundwater. Limited seasonal/temporal variations
Cohesive Alluvium	-0.5 – 2.0	<0.1m at BH32 and BH413 only	Considered to confine underlying permeable superficial deposits and the Chalk
Granular Alluvium	0 – 1.3	0.1m (BH08; Western extents) – 0.4 (BH46; Eastern extents)	Muted tidal impact towards western extent of granular alluvium within Scheme Site Boundary, which reflects limited thickness in this area.
Glacial Till	-1 – 1.5	None	
Glaciolacustrine Deposits	-1 – 2.5	<0.1 (BH20) – 1m (BH412 & BH501)	
Fluvio-glacial Deposits	-1 – 2.5	Up to 3.5m	In hydraulic continuity with the Chalk
Chalk	-1.5 – 2.5	1.5m (neap tides) - 3m (spring tides)	

Groundwater heads in the superficial deposits

2.6.9 Groundwater in the made ground is typically perched. The nature of the made ground suggests that perched aquifers are laterally and possibly vertically discontinuous, but this cannot be confirmed from the data available.

2.6.10 The hydrographs for the cohesive alluvium and glacial till boreholes do not show any obvious response to individual rainfall events or seasonal variation, due to limited flow within these horizons. As little response was seen in the unconfined made ground and shallow horizons within the cohesive alluvium, it is also possible that the large areas of hard standing and artificial drainage within the Scheme also confine the site, meaning that recharge to the superficial deposits in general is largely indirect.

2.6.11 There are, however, three cohesive alluvium monitoring boreholes at the Trinity Burial Ground (BH302, BH307 and BH309) that do show some response to seasonal rainfall. Water levels show a seasonal variation of up to 1.5m. They reached a minimum in the October of both 2015 and 2016, followed by a clear recovery and water levels reaching a maximum between February and March of the following year (see Figure 11.4.14). It is possible that these represent limited perched groundwater within the cohesive alluvium.

2.6.12 The hydrographs for the granular alluvium, glaciolacustrine deposits and fluvio-glacial deposits show a very slight seasonal variation in groundwater heads, although the primary influence on groundwater heads appears to be tidal impacts, especially in the glaciolacustrine and fluvio-glacial deposits. The seasonal peaks occur in Autumn and lows occur in early Summer, suggesting that recharge is indirect and possibly via the Chalk.

2.6.13 With the exception of the Chalk, the greatest tidal impact is seen in the fluvio-glacial deposits, which are in hydraulic continuity with the Chalk.

2.6.14 Tidal impacts are much smaller in the granular alluvium and glaciolacustrine deposits, and a very small tidal impact can also be seen in two boreholes in the cohesive alluvium (BH32 to the north of the burial ground and BH413 close to Princes Quay Bridge). In these horizons, the tidal response is always dampened and delayed in comparison to that seen in the Chalk. The level of the response is presumably dependent on the level of response in the underlying aquifer unit, the proximity to the Humber Estuary and/or the alluvial channel feature, the degree of leakage and hydraulic properties. It is also possible that the alluvial channel feature (granular alluvium) is in hydraulic continuity with the Humber Estuary. Zektser et al.[61] notes that the lithologies typical of the superficial deposits within the Scheme have higher storage and lower transmissivity values than the Chalk, leading to a lower tidal efficiency, and a more subdued tidal response.

Groundwater heads in the Chalk

2.6.15 Chalk groundwater heads have typically varied between -1.5 and 2.5m AOD over the monitoring period. The most significant impact on groundwater heads is the mixed semi diurnal tidal response of the Humber Estuary. There is no obvious response to rainfall events or seasonal variation, as the Chalk is strongly confined beneath Hull.

2.6.16 The tidal impact on Chalk groundwater heads results in fluctuations of up to 3m during spring tides and 1.5m during neap tides (see Figure 11.4.19). On 5 December 2013, water levels in LDBH01 and nearby Chalk monitoring boreholes rose by 4m in response to a combination of the spring tide and a tidal surge, which inundated Commercial Road and the area around Mytongate (see Figure 11.4.20).

2.6.17 The tidal lag time in the Chalk was estimated from groundwater head and estuary water level data to be around 53 minutes at BH18A (in the centre of the Mytongate roundabout). A similar lag time of 48 minutes was obtained for BH29, located approximately 100m south of BH18A. However, a greater lag time of 64 minutes was obtained at BH24, located between BH29 and BH18A, which suggests

[61] Zektser, I. S., Dzhamalov, R. G. and Everett, L. G. (2007) Submarine Groundwater. CRC Press. Taylor and Francis Group.

anisotropy within the Chalk and/or a variable thickness of superficial deposits in the Humber Estuary such as that seen between Goxhill and Paull (see Section 2.5).

2.6.18 There is an upwards hydraulic gradient within the Chalk at low tide when groundwater levels in the deeper Chalk (BH415: monitoring horizon 8 – 12m below rockhead) are typically 0.25m higher than levels in the shallow Chalk (BH306: monitoring horizon 0 – 1.5m below rockhead). Groundwater levels are very similar within the shallow and deeper Chalk at high tide (see Figure 11.4.19).

2.6.19 There are, however, periods when there is a smaller tidal response in the deep Chalk compared to the shallow Chalk at low tide. It is not clear why this is the case, although it may perhaps be due to the thickness of superficial deposits in the Humber Estuary varying with time.

Hydraulic relationships between aquifer units

2.6.20 Although there is a small tidal response in some boreholes monitoring the more permeable superficial deposits overlying the cohesive glacial till and glaciolacustrine deposits, the water level data collected to date suggests that there is minimal leakage through these deposits. There might be more leakage where they thin in the eastern part of the Scheme, but this isn't particularly apparent from the data.

Vertical hydraulic gradients depend on the state of the tide. The hydrographs in Figure 11.4.21 and Figure 11.4.22 show that there is generally a downwards hydraulic gradient between the superficial deposits above the glaciolacustrine deposits, and the fluvio-glacial deposits and Chalk at low tide, but that this reverses at high tide.

2.6.21 Figure 11.4.24 shows that in the area around the Princes Quay Bridge, groundwater heads in the glaciolacustrine deposits are higher than heads within the overlying cohesive and granular alluvium.

2.6.22 Mean daily groundwater heads are generally slightly higher in the superficial deposits than in the Chalk.

Hydraulic gradients – superficial deposits

2.6.23 In view of the strongly linear nature of the Scheme, the concentration of monitoring boreholes towards the centre of this area, the complexity of the superficial deposits and the tidal impacts, groundwater head contour maps for the Scheme have not been prepared. However, some conclusions can be drawn from the water level data for the boreholes monitoring the superficial deposits. This indicates that there is no discernible hydraulic gradient across the Scheme other than within the granular alluvium where there appears to be some groundwater flow towards the west. Note that the granular alluvium is only present across the eastern half of the Scheme, where it exists in the form of an alluvial channel feature (Figure 11.4.26).

2.6.24 With the present dataset, it is difficult to determine whether there is a north-south component of flow in either the granular alluvium or other superficial deposits. The GI monitoring boreholes are restricted to within the Scheme Site Boundary and monitoring boreholes in the superficial deposits elsewhere in the study area are sparse. It is assumed, however, that the groundwater flow within the granular alluvium is likely to follow the path of the alluvial channel feature, which has an approximately northwest – southeast orientation as well as the slight westwards flow path mentioned above.

Hydraulic gradients – Chalk

2.6.25 The groundwater level contour maps for the wider study area based on data from the saline intrusion monitoring boreholes and the Environment Agency monitoring network (Figure 11.4.10 and Figure 11.4.11) suggest that at high tide, there is a slight northwards hydraulic gradient across the Scheme, and that this is reversed at low tide. Groundwater level dip data taken at high tide and low tide on 28 February 2017 across the Scheme is plotted in Figure 11.4.25 and is in agreement with the data for the study area. These hydraulic gradients are small at both low and high tide, however (~7×10^{-4}, as measured between BH01 and BH22, BH02 and BH B and BH22 and BH B).

2.6.26 Logger data from January 2014 (Figure 11.4.21A) suggests that there may be other influences on Chalk groundwater heads across the Scheme itself, however. At low tide, water levels are lowest in BH29, followed by (in order of increasing water level) BH33, BH22 and BH02, with the highest levels in BH11. BH11 appears to be the anomaly of the group as it consistently has the highest water levels no matter what the phase of the tide, even though it is located towards the centre of the Scheme. This may be because of heterogeneity within the Chalk in terms of flow horizons and fracture geometry, as discussed previously, or due to the thickness of glacio-fluvial deposits overlying the Chalk.

Surface water – groundwater interactions

2.6.27 Although the Chalk and Humber Estuary are known to be in hydraulic continuity, there is little information that confirms the degree of hydraulic connection between the two. However, it is generally considered that clogging of the estuary bed by fine material as a consequence of saline intrusion due to historic heavy exploitation of the aquifer means that there is now only very limited leakage between the two[26] and the observed tidal fluctuations reflects a tidal loading effect on the confined aquifer[27]. Depending on the hydraulic gradient, the Chalk may either provide some baseflow to the estuary or be susceptible to further saline intrusion, although it does appear that the mean hydraulic gradient is broadly neutral. Groundwater from the permeable superficial deposits (and especially the granular alluvium) may also provide baseflow to the Humber estuary, although this is likely to be very limited due to their limited storage, and the presence of aquitards.

Aquifer properties

2.6.28 Aquifer properties have been determined from the results of permeability tests carried out as part of the 2013 GI, as well the LDBH01 pumping test. No permeability tests were carried out as part of the 2015/16 GI.

2.6.29 Permeability tests included falling head tests (FHT), constant head tests (CHT) and packer tests (Chalk only). Some tests were carried out part way through drilling in ‘open’ boreholes and some were undertaken in the completed monitoring installations.

2.6.30 The permeability tests were carried out and analysed by Geotechnics Ltd., and reported on in its GI report[29]. The results are summarised in Table 11.4.9 and

2.6.31 Table 11.4.10, together with comments on results which might be considered questionable when compared with well-established published values[62].

Table 11.4.9: Hydraulic conductivity (K) values derived from permeability tests – superficial deposits (Geotechnics Ltd., 2013)

BH number	Type of test	Test section depths (m AOD)	Geological unit under test	Derived K value (m/s)	Comments
BH07	FHT - Standpipe installation	-1.1 to -5.1	Cohesive alluvium (sandy clay)	7.43×10^{-7}	Derived from 1 test only
BH12	FHT - Standpipe installation	-2.09 to -5.09	Cohesive alluvium (sandy clay)	7.51×10^{-7}	Derived from 1 test only
BH13	FHT - Standpipe installation	-12.33 to -14.33	Glacial till (sand with a small section protruding into the glaciolacustrine)	*3.14×10^{-7}*	Derived from 1 test only
BH14	FHT - Standpipe installation	-6.9 to -8.7	Cohesive alluvium (sandy clay with peat)	2.68×10^{-6}	Derived from 1 test only
BH15	FHT - Standpipe installation	-9.45 to -12.45	Glacial till (sandy gravelly clay)	*1.41×10^{-6}*	Derived from 1 test only. K result appears high when compared with published values
BH20	FHT - Standpipe installation	-14.2 to -16.2	Glaciolacustrine	2.09×10^{-7}	Derived from 1 test only.
BH21	CHT – Standpipe installation	-7.13 to -9.03	Granular alluvium (gravel)	4.02×10^{-5}	
BH25	FHT - Standpipe installation	-9.85 to -12.55	Glacial till (sandy gravelly clay)	*2.29×10^{-7}*	Derived from 1 test only. K result appears slightly high when compared with published values
BH26	FHT - Standpipe installation	-8.96 to -10.96	Glacial till (with some peat and cohesive alluvium)	*1.77×10^{-7}*	Derived from 1 test only
BH28	FHT - Standpipe installation	-9.02 to -12.52	Glacial till (sandy gravelly clay)	*2.93×10^{-7}*	Derived from 1 test only. K result appears slightly high when compared with published values
BH32	CHT – Standpipe installation	-4.33 to -7.83	Cohesive alluvium	*1.15×10^{-5}*	K result appears slightly high when compared with published values

[62] Freeze, R. A. And Cherry, J. A. (1979) Groundwater. Prentice Hall International, Inc.

BH34	CHT – Standpipe installation	-10.37 to -12.08	Granular alluvium (gravel)	1.58×10^{-5}	
BH46	FHT - Standpipe installation	-7.97 to -10.67	Granular alluvium	1.01×10^{-5}	Derived from 1 test only
SBP01	CHT – Standpipe installation	-12.56 to -13.56	Glacial till (granular)	*4.52×10^{-6}*	K result appears very high compared with published values for a glacial till but are thought to be representative for a granular layer

Table 11.4.10: Hydraulic conductivity (K) values derived from permeability tests – Chalk (Geotechnics Ltd., 2013)

BH number	Type of test	Test section depths (m	Geological unit under	Derived K value (m/s)	Comments
BH08	FHT - Open borehole	-24.84 to -29.84	Chalk	9.98 x 10^{-6}	Derived from three tests
	FHT - Open borehole	-24.84 to -34.34	Chalk	2.27 x 10^{-5}	Derived from three tests
	Packer test	-33.34 to -34.34	Chalk	*9.45 x 10^{-8}*	Packer test interval restricted to a thin 1m horizon so the result may be unrepresentative of bulk Chalk properties. The K result is much lower when compared to published values
BH11	FHT - Open borehole	-21.97 to -23.47	Chalk	*4.17 x 10^{-7}*	Derived from two tests. Test restricted to a <2m horizon in the Chalk so the result may be unrepresentative. The K result is much lower when compared to published values
	FHT - Open borehole	-21.97 to -27.97	Chalk	4.20 x 10^{-5}	Derived from three tests
	Packer test	-25.97 to -27.97	Chalk	1.06 x 10^{-6}	Packer test interval was 2m. Result appears to be similar to other test values
BH22	Packer test	-24.55 to 25.55	Chalk	*9.12 x 10^{-7}*	Packer test restricted to a thin 1m horizon in the Chalk so results may be unrepresentative of bulk Chalk properties. The K result is much lower when compared to published values
BH24	FHT - Open borehole	-26.8 to -29.8	Chalk	2.43 x 10^{-5}	Derived from three tests. Only a 3m horizon in the Chalk was tested and therefore the result may be unrepresentative but result appears to be similar to other test values
	FHT - Open borehole	-26.8 to -33.8	Chalk	5.95 x 10^{-5}	Derived from three tests
	Packer test	-34.3 to -36.3	Chalk	4.29 x 10^{-6}	Packer test interval was 2m. Result appears to be similar to other test values.
BH29	FHT - Open borehole	-29.7 to -31.1	Chalk	1.49 x 10^{-4}	Derived from three tests. Test interval was <2 m and therefore the result may be unrepresentative.

					However, the result appears to be similar to other test values
	FHT - Open borehole	-29.7 to -35.3	Chalk	1.06 x 10 $^{-4}$	Derived from three tests
BH33	FHT - Open borehole	-22.02 to - 23.82	Chalk	*6.56 x 10 $^{-8}$*	Derived from two tests. Test interval was <2m and therefore the result may be unrepresentative. The K result is much lower when compared to published values
	FHT - Open borehole	-22.02 to - 28.32	Chalk	1.99 x 10 $^{-5}$	Derived from three tests
	Packer test	-27.82 to - 29.82	Chalk	2.00 x 10 $^{-6}$	Packer test interval was 2m. Result appears to be similar to other test values.
BH36	Packer test	-29.19 to 30.19	Chalk	7.35 x 10 $^{-6}$	Packer test interval was restricted to 1m so results may be unrepresentative of bulk Chalk properties. Result appears to be similar to other test values.
		-35.69 to - 36.69	Chalk	3.23 x 10 $^{-6}$	
BH39	Packer Test	-34.01 to - 35.01	Chalk	5.22 x 10 $^{-6}$	Packer test interval was 2m. Result appears to be similar to other test values.

Other than the results highlighted in red and in italics in Table 11.4.9 and

2.6.32 Table 11.4.10, the hydraulic conductivity values generally lie within the range of published values for each lithology.

2.6.33 Removing the results which appear to be unrepresentative (highlighted in red and in italics), the maximum, minimum and mean K results for each geological unit tested are summarised in the Table 11.4.11 below.

Table 11.4.11: Summary of hydraulic conductivity (K) values by geological unit

Geological Unit	Tests Used	Number of Tests	K Value (m/s): Maximum, minimum and mean results
Cohesive alluvium	FHT	3 (3 BHs)	7.43×10^{-7} to 2.68×10^{-6} (Average 1.39×10^{-6})
Granular alluvium	FHT CHT	1 (1 BH) 15 (2 BHs)	1.01×10^{-5} (FHT) 1.05×10^{-5} to 4.57×10^{-5} (CHT) (Total Average 2.40×10^{-5})
Glacial till	FHT CHT (in sandy layer)	4 (4 BHs) 5 (1 BH)	1.77×10^{-7} to 3.14×10^{-7} (FHT) 3.03×10^{-6} to 7.00×10^{-6} (CHT) (Total Average 2.53×10^{-7})*
Glaciolacustrine deposits	FHT	1 (1 BH)	2.09×10^{-7}
Chalk	FHT Packer Tests	36 (5 BHs) 8 (7 BHs)	9.98×10^{-6} to 1.49×10^{-4} (FHT) 7.35×10^{-6} to 1.06×10^{-6} (Packer Tests) (Total Average 3.26×10^{-5})

*Although test results appear to give relatively high results compared with published values for glacial till, the majority are consistently of the same order of magnitude for this geological unit (except for the test on BH15, and SBP01, which targeted a granular horizon). All results for the glacial till given in **Table 2.6** have been used to provide the maximum, minimum and mean values given in **Table 2.8**. except BH15.

2.6.34 Chalk aquifer properties derived from the pumping test results are summarised in Table 11.4.12 below. These transmissivity and storativity values, as obtained from the pumping test analysis detailed in Volume 3, Appendix 11.5 Pumping test report, were corroborated by numerical modelling and alternative analytical methods conducted by Riley[40].

Table 11.4.12: Aquifer properties derived from LDBH01 pumping test

Test	Transmissivity (T) (m^2/d):	Storativity (S)	Hydraulic Conductivity (m/s)*
Constant rate test of LDBH01	1379 - 1631	3.20×10^{-4} to 4.40×10^{-4}	7.98×10^{-4} to 9.44×10^{-4}

*assuming an effective aquifer thickness of 20m

2.6.35 There are no records of other permeability tests being conducted within the Scheme and none appear to have been carried out as part of the 1994 GI. Data for the wider area is also sparse. A rising head test undertaken in a shallow borehole approximately 250m east of the Scheme gave a hydraulic conductivity of 5.35×10^{-8}m/s for a silty clay. As the lithology of the superficial deposits within the Scheme is likely to be similar at this borehole, it should have intersected the cohesive alluvium. The hydraulic conductivity is lower than any of the values derived from the 2013 GI permeability tests, possibly because of a higher clay content in the alluvium and/or because the response zone became silted up during the test.

2.6.36 Information provided by the Environment Agency indicates that a Chalk pumping test carried out in 2005 at Hull Truck Theatre, approximately 850m north of the Scheme, gave a transmissivity of 45.7m^2/d.

2.6.37 Similar information from a pumping test carried out on the D J Broady borehole, approximately 2km to the north east of the Scheme, gave a transmissivity range of between 230 and 280m^2/d.

2.6.38 These values are at least an order of magnitude lower than the value calculated from the Chalk pumping test carried out at LDBH01 in December 2013 and provides further evidence that the Chalk is more extensively fractured in the vicinity of LDBH01 than it is further to the north and northeast.

2.6.39 No storage values appear to have been derived from the Hull Truck and D J Broady pumping tests. However, the values derived from the LDBH01 pumping test is indicative of a confined aquifer and compares well with the value of 1.00×10^{-4} used in the Environment Agency's regional groundwater model (ESI, 2013).

2.6.40 From the above discussion, it can be concluded that the geological sequence within the Scheme can be broadly categorised as follows in terms of aquifer properties:

- Made ground – **Aquifer** or **aquitard** depending on material composition. Commonly dry but with some perched groundwater
- Cohesive alluvium – **Aquitard**
- Granular alluvium – **Aquifer**
- Glacial till – **Aquitard**
- Glaciolacustrine deposits – **Aquitard**
- Fluvio-glacial deposits – **Aquifer**
- Chalk – **Aquifer**

Groundwater quality

2.6.41 The 2013 GI water quality sampling programme comprised two full groundwater sampling rounds (of all accessible monitoring boreholes) in October 2013 and one partial round prior to this in August and September. Additional groundwater and surface water samples were undertaken in the Chalk as part of the pumping test programme in December 2013.

2.6.42 Wellhead (in situ) measurements, including pH, temperature, specific conductivity, dissolved oxygen (DO) and oxidation reduction potential (ORP) were taken using multi-meter in conjunction with the sampling. Surface water samples and in situ readings were also taken and are summarised in Volume 3, Appendix 12.1 Ground contamination assessment and Volume 3, Appendix 11.5 Pumping test report along with full details of the groundwater sampling schedules and results. Surface water sampling locations are shown in Drawing 1168-10-211-DR-011 of Volume 3, Appendix 12.1 Ground Contamination Assessment.

2.6.43 Sample results were screened against the relevant groundwater and surface water Environmental Quality Standards (EQS) to provide an assessment of the potential risks to groundwater and surface water receptors. For the groundwater samples, sample results were also screened against the UK DWS. The Tier 1 screening tables for the groundwater sampling results and DWS and EQS exceedances in the Chalk and superficial deposits monitoring boreholes (drawings 1168-10-211-DR-007, 1168-10-211-DR-008, 1168-10-211-DR-009 and 1168-10-211-DR-010) are presented in Volume 3, Appendix 12.1 Ground Contamination Assessment.

2.6.44 The Ground Contamination Assessment concluded the following in relation to groundwater quality within the Scheme:

- Elevated concentrations of PAHs and TPH were recorded in shallow, perched groundwater from BH41A and SBP02. These two monitoring boreholes are both installed within made ground and are in areas where elevated hydrocarbons have also been identified in soils/leachability analysis (BH41A, WS12A, SCPT20).

- Copper was recorded as being elevated above the DWS in groundwater within the Chalk and superficial deposits. Comparable, elevated concentrations above the EQS have also been reported in local surface water receptors including the docks.

- Smedley *et al*.[42] reported elevated concentrations of arsenic, boron, iron, manganese, sulphate and ammonium within the confined Yorkshire Chalk aquifer. These correlated with measured concentrations recorded during the 2013 investigation.

- Concentrations of calcium, chromium, nickel and selenium recorded in groundwater and in surface water during the 2013 investigation were also reflective of quoted regional concentrations.

- Ammoniacal nitrogen (as N and NH_4) concentrations were measured to be consistently higher within the superficial deposits than the Chalk. This is likely due to the anaerobic degradation of organic material present within the superficial deposits (peat and organic-rich clay).

- These elevated concentrations, coupled with relatively low concentrations of nitrate, are indicative of a reducing environment in the confined Chalk and superficial deposits.
- This is reflected by the low, negative ORP wellhead readings for all water samples taken from Chalk boreholes and most water samples taken from boreholes in the superficial deposits during the 2013 investigation (Annex H). The only consistently positive ORP readings were from groundwater in the made ground (BH41A), which is unconfined at this location, although ORP readings from samples taken from BH30 (cohesive alluvium), BH04 and BH15 (glacial till) and BH14 (peat) were sometimes positive and sometimes negative (and not close to zero, hence not reflecting neutral conditions).
- Elevated concentrations of chloride, sodium, potassium and sulphate are likely to be due to saline intrusion from the Humber Estuary, although it is thought that some upconing of connate groundwater has also occurred in this area[63].
- The electrical conductivity of shallow groundwater within the superficial deposits exceeds 400 µS/cm.

2.6.45 Box and whisker plots of major ions for samples taken from the superficial deposits and the Chalk in 2013 are presented in Figure 11.4.28. The results from surface water sampling point SW1 in the Humber Estuary and Environment Agency regional Chalk groundwater sampling boreholes (for locations see Figure 11.4.5) are also shown for comparison.

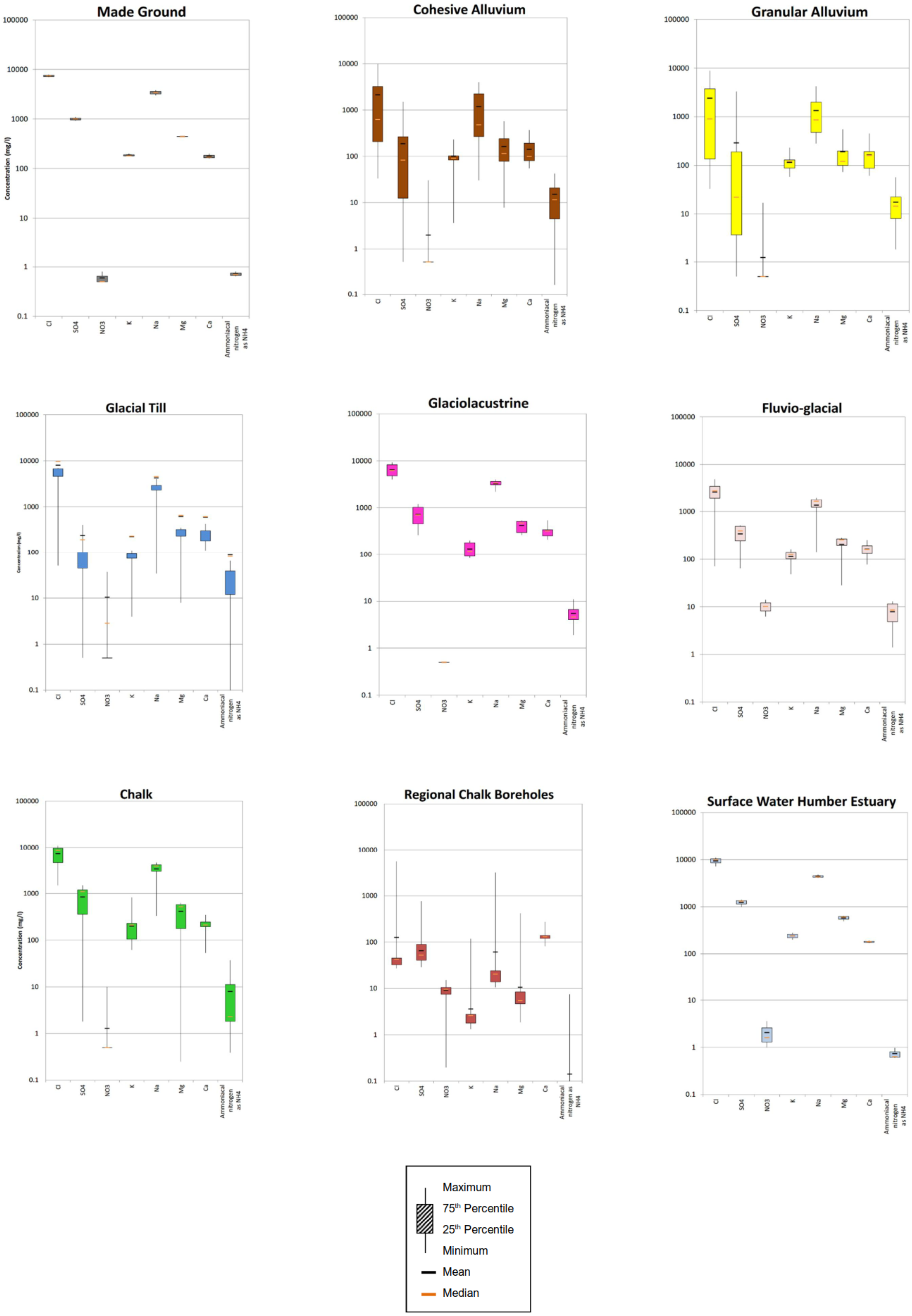
2.6.46 With the exception of ammonium (NH_4), major ion concentrations in both the Chalk and the lower superficial deposits approach those in the Humber Estuary, as would be expected if saline intrusion was occurring. Although nitrate concentrations are reasonably similar, ammonium concentrations are higher in the Chalk and lower superficial deposits than in the estuary, probably due to the confined conditions and input from organic material within the superficial deposits (the average hydraulic gradient between the superficial deposits and Chalk is slightly downwards, although the gradient reverses depending on the state of the tide).

2.6.47 Also of note is the wider range of concentrations in the groundwater compared to the estuary. For example, chloride concentrations (which act as an inert tracer) appeared to range from 3,000 mg/l to 10,000 mg/l in the samples taken from LDBH01, while those in the Humber Estuary range from 7000 mg/l to 11,000 mg/l in the limited number of samples taken over the same monitoring period. This suggests that the degree of mixing between saline and fresh groundwater may

[63] Foster, S. S. D. and Milton, V. A. (1976) Hydrogeological basis for large-scale development of groundwater storage capacity in the East Yorkshire Chalk. Report of the Institute of Geological Sciences, 76/7

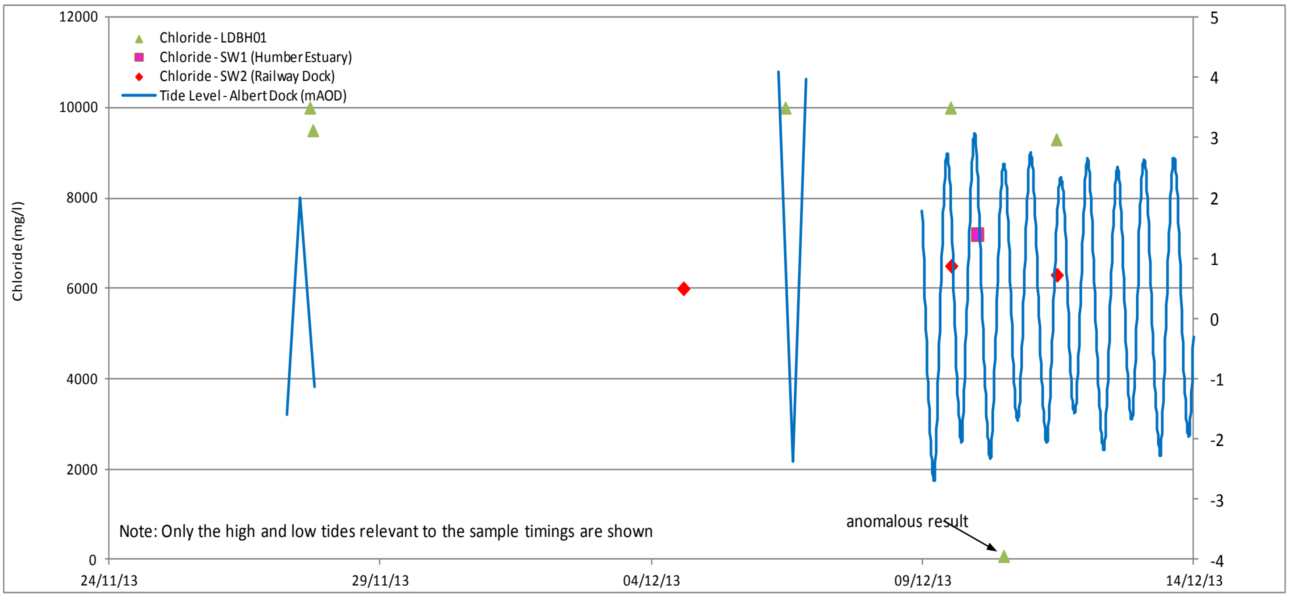
depend to some extent on the state of the tide and the therefore the local hydraulic gradient within the Chalk. This could have been investigated by comparing chloride concentrations with groundwater and tide levels. However, precise sampling times were not always recorded except during the pumping test sampling programme because the tidal impact on groundwater had not been fully understood when the earlier samples were taken.

Figure 11.4.28: Box and whisker plots showing major ions



Note: Chemical species below detection limit were recorded at <0.5, but are shown as 0.5 above.

Figure 11.4.29: Chloride levels in the chalk plotted against tide times



2.6.48 Figure 11.4.29 shows the few chloride results from time-stamped LDBH01 samples plotted against the tidal data, together with chloride results from samples collected from the Humber Estuary and Railway Dock over the same period. This does not show any particular correlation between the phase of the tide and Chalk chloride concentration, although this might be because the chloride data is very sparse. Conductivity logging and data from other boreholes in the area would help to resolve this.

2.6.49 Figure 11.4.29 also suggests that chloride levels in Railway Dock are generally lower than those in the Humber Estuary. This may be because of surface water drainage to the dock and/or upwards leakage into the dock from the underlying superficial deposits (whilst the dock sides are lined, the base is not).

2.6.50 The box and whisker plots also allow comparison of water quality between the different geological layers within the superficial deposits. Ammonium concentrations are relatively high throughout but appear to be highest in the peat and glacial till. As discussed previously, it is considered that the elevated ammonium is due to the bacterial degradation of organic material present, particularly in the peat and organic-rich clay in particular (the peat lies directly above the glacial till in most places where it is present).

2.6.51 The box and whisker plots show a similar range of major ion concentrations in both the cohesive and granular alluvium, but generally a wider range in concentrations for most parameters in the upper superficial deposits compared to the lower superficial deposits. The wide range in parameter concentrations (including wellhead parameters such as ORP) perhaps reflects the numerous factors affecting water quality in the superficial deposits, including complex lithology and associated hydraulic relationships, and the impact of regional water quality and local chemical and biological processes.

Site compounds and public spaces

2.6.52 A summary of hydrogeological information available from BGS borehole logs at each of the site compounds is provided in Annex E. All site compounds are generally underlain by a substantial thickness of poorly permeable cohesive superficial deposits. Of particular importance is the absence of confining glacial till and glaciolacustrine deposits at the Livingstone Road compound and A63 eastbound recovery base, however, where the Chalk is potentially in hydraulic connection with any groundwater contained within the cohesive alluvium. At this location the groundwater vulnerability classification is Medium-High, suggesting there may be some leakage through the cohesive alluvium.

2.7 Summary of hydrogeological conceptual understanding

2.7.1 From the baseline geological and hydrogeological review, the following can be concluded:

- The geological sequence roughly comprises a series of aquifer and aquitards within the superficial deposits (20 - 30m thick), including made ground, cohesive alluvium, granular alluvium, glacial till, glaciolacustrine deposits and fluvio-glacial deposits. The fluvio-glacial deposits directly overlie Chalk bedrock.
- In reality, the geological sequence is more complex than this. For example, the granular alluvium is only present across the eastern half of the Scheme, representing an alluvial channel feature cutting through glacial deposits (the glacial till, glaciolacustrine and fluvio-glacial deposits).
- The Chalk aquifer is confined and has a strong tidal influence reflected in groundwater levels which have varied by up to 4m over the monitoring period. There is evidence of heterogeneity within the Chalk in this area.
- Other than the made ground, the permeable superficial deposits are generally confined, though there may be some localised unconfined units.
- Neither the Chalk nor the majority of the superficial deposits have exhibited an obvious response to short term recharge events or seasonal recharge during the monitoring period, and are thought to be recharged indirectly.
- In general, the local hydraulic gradient in the Chalk across the Scheme is slightly to the north during high tide, and southwards during low tide.
- Monitoring across the Hull area and the groundwater model suggest that groundwater flow is generally to the south, towards the Humber Estuary, as verified by monitoring across Hull on 28 February 2017.
- Similarly, monitoring to date does not indicate a measurable hydraulic gradient in any of the superficial deposits, except in the granular alluvium across the eastern part of the Scheme. Here, the hydraulic gradient appears

to have an east to west component, although it is assumed that there may also be a north-south component due to the orientation of the alluvial channel.

- Vertical hydraulic gradients depend on the state of the tide, with a downwards hydraulic gradient between the superficial deposits above the glaciolacustrine deposits and the fluvio-glacial deposits and Chalk at low tide and a reversal of this relationship at high tide. The data suggests that leakage between aquifer units is minimal except where the more impermeable superficial deposits thin towards the eastern end of the Scheme.

- Although the hydraulic connection between the Humber Estuary and the underlying Chalk is not well understood, and it is considered unlikely that watercourses receive any significant baseflow from the Chalk, it is possible that the Humber Estuary gains water from the Chalk aquifer under high groundwater level conditions. This relationship may be reversed under drought conditions, however.

- The walls of all three docks are lined and so are likely to be largely isolated from groundwater within the superficial deposits, except through their bases.

- The Chalk groundwater quality is representative of a confined aquifer with reducing conditions that has been subject to modern saline intrusion (due to historical over-abstraction) as well as a component of paleo saline groundwater.

- Water quality is the superficial deposits is also representative of generally (though not always) reducing conditions. There is evidence of mixing with saline water.

2.7.2 The findings above support evidence from past studies e.g. the Yorkshire Water Humbercare Sewerage Tunnel failure, where it is thought that running sands caused tunnel collapse due to high upward hydraulic gradients from the Chalk. The results from the GI and subsequent monitoring support the theory that there is some hydraulic connection between the Chalk aquifer, the glacial deposits and in some areas (particularly to the east) the alluvium.

3. Receptors

3.1.1 This section summarises the groundwater receptors potentially impacted by the Scheme. An assessment of impacts on these receptors due to the construction and Operational Phases of the Scheme is provided in Volume 1, Chapter 11 and summarised in Section 5 of this report.

3.1.2 For the purpose of this impact assessment, the receptors are split into two categories: - direct and indirect receptors. Direct groundwater receptors are considered to be the aquifer units themselves, whilst indirect receptors are classed as those potentially affected when groundwater is considered to be the pathway, including surface water features, abstractions, and structures and cultural heritage.

3.2 Groundwater receptors

3.2.1 Groundwater receptors include the permeable superficial deposits as well as the Chalk aquifer. The regional and local characteristics of these aquifer units are described in Sections 2.5 and 2.6 respectively. The Hull and East Riding Chalk is classed as a principal aquifer by the Environment Agency and is designated as a DrWPA. Its WFD current (2016) and predicted quantitative and chemical status is poor due to saline intrusion and nitrates.

3.2.2 The superficial deposits directly underlying the Scheme are not designated as an aquifer and are classed by the Environment Agency as unproductive strata. However, permeable horizons within the superficial deposits such as the granular alluvium and fluvio-glacial deposits are reasonably extensive and locally productive (as evidenced by substantial and uncontrolled inflow accompanied by running sand from the alluvium during previous construction projects, and anecdotal reports of a substantial freshwater spring during construction of the Humber Dock[35].

3.2.3 Both the Chalk and permeable superficial deposits will also act as pathways in terms of groundwater head and water quality.

3.3 Surface water receptors

3.3.1 Surface water bodies potentially in hydraulic continuity with groundwater are considered as indirect receptors in this assessment in that water level, flows and water quality could be adversely impacted by changes to the groundwater regime arising from the Scheme. These include the Humber Estuary, the River Hull, the nearby docks (Railway Dock, Albert Dock and Humber Dock) and Fleet Drain. Aside from the underpass and associated structures, the following site compounds are located adjacent to surface water receptors:

- Livingstone Road – Fleet Drain and Humber Estuary
- Wellington Street Island Wharf – Humber Estuary and Albert Dock

- Neptune Street set down compound – Albert Dock
- Land south east of Mytongate Junction – Railway Dock

3.3.2 A full assessment of the surface water receptors is provided in Volume 1 Chapter 11 Road drainage and water environment, but a summary of these surface water bodies and their designations is provided in Section 2.5 of this report.

3.4 Abstractions

3.4.1 Details of groundwater abstractions within the study area are provided in Section 2.5 and are summarised below. The locations of abstractions are also shown in Figure 11.4.5.

- Two licensed abstractions from the Chalk aquifer for industrial use (both less than 1000m^3/d)
- 18 licensed abstractions from the Chalk aquifer for agricultural use (spray irrigation and vegetable washing; all less than 1000m^3/d)
- Two licensed abstractions from the superficial deposits for agricultural use (spray irrigation; both less than 1000m^3/d)
- One licensed abstraction from the Chalk aquifer for amenity use (less than 1000m^3/d)
- One abstraction licence for a ground source heat pump within the Chalk (two boreholes, combined licensed rate 1,096m^3/d)
- One abstraction licence (relating to four pumping shafts within the Chalk) for potable water supply (combined licensed rate 90,000m^3/d)

3.4.2 The Environment Agency's default SPZ 3 (catchment area) of 1km is considered appropriate for industrial use and spray irrigation abstractions of less than 1,000 m^3/d. Only the Hull Hull Truck Theatre Co Ltd's abstraction is less than 1km from the Scheme and could therefore be potentially affected in terms of the groundwater quality and the loss of resource.

3.4.3 There are four public water supply abstractions from the Chalk aquifer located approximately 8km to the northwest of the Scheme. The Scheme falls within the catchment area (i.e. SPZ3) for these abstractions and could therefore potentially impact the abstractions in terms of groundwater quality and the loss of resource.

3.5 Environmentally sensitive sites

3.5.1 The Humber Estuary is designated as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) for its nationally important habitats, which include coastal saltmarsh, intertidal mudflats and sandflats, saline lagoons and sand dunes. The estuary is also a wetland of international importance and is therefore designated as a RAMSAR site.

3.5.2 There are no other environmentally sensitive sites within 3km of the Scheme.

3.6 Structures

3.6.1 Subsidence due to significant changes in groundwater level over and above natural variations is a particular risk to structures, including property and infrastructure, given the geotechnical properties of the ground and the cohesive alluvium in particular. In addition to drawdown arising from dewatering operations, groundwater flooding could occur if below ground structures associated with the Scheme, and the underpass in particular, act as groundwater dams. This is of particular concern due to the proximity of structures to the Scheme.

3.6.2 Groundwater quality changes arising from changes to the groundwater regime could also potentially impact on buildings and infrastructure if, for example, the groundwater becomes more aggressive or contaminant migration occurs.

3.6.3 The nearest buildings to the Scheme are William Booth House, approximately 60m north of Mytongate Junction and the Whittington and Cat Public House, approximately 110m to the south of Mytongate Junction.

3.7 Cultural heritage

3.7.1 Archaeological sites of importance could also be adversely impacted by changes in the groundwater regime. The archaeology in the area of the Scheme can be separated into three categories: - archaeological remains, historic buildings and historic landscapes. The potential impacts on archaeology due to changes in the groundwater regime is discussed separately to this report in the Environmental Statement.

4. Proposed works

4.1 Overview

4.1.1 The preferred option for the Scheme comprises a grade separated junction with the alignment of the A63 lowered approximately 7mbgl. A plan of the Scheme is presented in Volume 2, Figure 2.3 Scheme Site Boundary, whilst a cross section through the underpass along the main line is shown in Figure 11.4.1.

4.1.2 The full description of the preliminary design is provided in Volume 1 Chapter 2 The Scheme. This takes into account the difficult ground conditions at the site. The underpass is to be formed in open cut, up to approximately 7m deep (at maximum dredge level) and approximately 20m wide. The underpass will be located between chainage 1250m and 1750m. The centreline of the proposed A63 carriageway deviates from the existing centreline between chainage 1450m and 1750m by up to 20m and encroaches into Trinity Burial Ground land.

4.1.3 In addition to the road underpass and grade separated junction with Mytongate Bridge crossing from Commercial Road to Ferensway, two pedestrian, cycle and disables user bridges crossing the road at Porter Street (chainage 1050m) and the Princes Quay Shopping Centre (chainage 1825m) and slip roads are also included in the design. An off line pumping station is also to be constructed as part of the drainage arrangements.

4.1.4 In accordance with BS EN 1997-1:2004, the geotechnical category for the underpass structure is Category 3 - 'structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions'. The sub-artesian groundwater presents a major difficulty for the design of the structures described above.

4.1.5 Key groundwater risks that have influenced the design include the following:

- Groundwater heads have been recorded close to ground level (as high as 0.86mbgl) within the Scheme Site Boundary. As the maximum dredge depth of the underpass at the Mytongate Junction will be up to approximately 7m below existing ground level (within the alluvium), a substantial dewatering operation could be required. Due to the constraints imposed by the surrounding structures, services and archaeology, general groundwater lowering of the area is not considered a feasible option, and dewatering from within a confined box will be necessary.

- The discharge arising from dewatering may require either disposal or treatment for contamination. Depending on discharge volumes and water quality, the Environment Agency and Natural England may not permit discharge to the Humber Estuary, and Yorkshire Water may not permit discharge to sewer.

- As groundwater heads within the Chalk aquifer are sub-artesian, upwards leakage through the cohesive glacial deposits could cause the excavation base to become unstable. However, this risk is reduced because the design includes for jet grouting and/or other ground stabilisation techniques within the alluvium and the top of the glacial till to improve ground stability.

- Part of the Trinity Burial Ground is included within the Scheme Site Boundary. As part of the enabling works, excavation of trenches of around 2mbgl will be required to allow removal of human remains. This will require special consideration in terms of potential dewatering requirements and associated groundwater level and quality issues.

4.1.6 Special consideration has been given to the groundwater risks associated with the Scheme and the preliminary design takes these into account within the context of the findings of the 2013 and 2015/16 GI.

4.1.7 The following discussion focusses on the below ground aspects of the preliminary design (Arup, 2016c – g, Arup, 2017 and Balfour Beatty, 2016) that have the potential to impact on groundwater receptors.

4.2 Underpass

Retaining walls and base slab

4.2.1 The cutting will be formed within low strength alluvial deposits that are assumed to be saturated. Diaphragm retaining walls have therefore been recommended. These walls will be designed to prevent excessive settlement behind them and excessive groundwater entry into the excavation under both the construction and operational scenarios.

4.2.2 The diaphragm walls will comprise a series of ~2.8m wide, 1m thick, and 1m long panels, connected together using water bars to ensure ‘water tightness’. Table 11.4.13 summarises the depth of the diaphragm wall along the length of the cutting, together with the aquifer units intersected.

Table 11.4.13: Diaphragm wall depths

Location	Approximate chainage (m) (length of section in brackets)	Depth to base of diaphragm wall (m AOD)	Aquifer units intersected
West of Mytongate Junction	1310 – 1470 (160)	-20	Fluvio-glacial deposits Chalk (0 – 2m)
Mytongate Junction	1470 – 1540 (70)	-27.5	Granular Alluvium, where present Fluvio-glacial deposits Chalk (~5. 5m)
East of Mytongate	1540 – 1690 (150)	-22	Granular Alluvium Fluvio-glacial deposits Chalk (0 – 1m)

4.2.3 The diaphragm walls will be constructed by cutting a narrow trench that is temporarily supported by a bentonite mud until the full panel dimensions can be excavated, after which the bentonite mud will be replaced by reinforced concrete. Bentonite mud is likely to be supplied via tremie pipes from a fixed position bentonite plant for the duration of the Scheme. The preferred location for the bentonite plant is the Arco site compound, which is approximately 400m from the Mytongate Junction. Intermediate booster pumps would therefore also be required. If this site compound cannot be used, the bentonite plant will be located at the Staples site.

4.2.4 The road junction will be formed using a top down method. Once the diaphragm walls are in place, the jet grout layer will be injected from current ground level to the required depth and thickness, reinforced concrete bored tension piles bored through the pre-installed jet grout layer and further guide walls and additional piles for the Mytongate Bridge piers constructed. The ground will then be excavated to expose the underpass ground slab formation level (i.e. the top of the jet grout layer), allowing for installation of temporary props where required. This top down method potentially significantly reduces the need for dewatering.

4.2.5 Following excavation, the ground slab will be formed and completed with a waterproof coating and finishes such as the cladding system, and a longitudinal, combined kerb and drainage system installed.

4.2.6 Water bars will be provided at all joints between diaphragm wall panels and all construction joint locations for the ground slab.

4.2.7 In accordance with BS EN1992-3:2006 Table 7.105, the classification of tightness for the underpass structure is Class 1, i.e. leakage to be limited to a small amount, with some surface staining or damp patches acceptable. Whilst not included in the outline design, drainage channels or relief wells may be included in the design should groundwater mounding on either side of the cutting be a problem. These would discharge to the underpass drainage system, and could require an abstraction (transfer) licence.

4.2.8 Suitable geotechnical monitoring systems will be required to monitor wall movement, settlement and pore water pressures.

Tension piles

4.2.9 Tension piles may be required to enable the permanent slab to resist buoyancy and are preferred over ground anchors to avoid maintenance issues. The tension piles are likely to be 750mm diameter, installed from surface and broken down to connect into the permanent propping slab. They are likely to extend into the top of the Chalk, to a maximum depth of -27m AOD, to provide reasonable resistances, and are to be placed at a 4m spacing, decreasing to 2m under the footprint of the leaf pier.

Ground stabilisation

4.2.10 To mitigate the ground risk prior to bulk excavation of the underpass, ground stabilisation works are proposed in the form of jet grouting and potentially soil mixing of the alluvial superficial deposits between approximately 8 and 11m depth (at the lowest point in the excavation). The thickness of this improved zone would be subject to design, but could be between 2 and 5m thick, depending on the depth of excavation at a given location.

4.2.11 Jet grouting would involve a cement/lime slurry to be injected into the ground via an augur and high pressure pumps. The grout mix is likely to be supplied from a fixed position via supply pipes. These are likely to be buried in high risk areas, such as at road crossings.

4.2.12 Very large volumes of waste material are likely to be produced, which will require treatment via settlement, rotary drying and/or lime treatment, and also storage prior to removal from site. To minimise the movement of tankers on site, backflow waste may be pumped back to the jet grouting plant via pipes.

4.2.13 The preferred location for the jet grout plant is the Arco site compound. If this site compound cannot be used, the jet grout plant would be located at the Staples site.

4.2.14 The alluvium which is to be excavated from the underpass may also be rotivated with lime or lime and cement to bind it prior to removal. This would effectively reduce the amount of groundwater within the box that will require dewatering prior to excavation.

4.3 Trinity Burial Ground

4.3.1 Approximately a third of the burial ground lies within the Scheme Site Boundary. As part of the enabling works, excavation to a depth of around 2mbgl will be required in this area to allow the removal of human remains.

4.3.2 It is proposed that temporary sheet piles are installed to a depth of 8mbgl along the perimeter of the entire area to form a groundwater cut-off wall. The excavation will take place from four individual areas in phases, with arisings being sorted in the north-eastern corner. Any arisings that do not contain remains will be reinstated.

4.3.3 Although groundwater inflow will be minimised through the temporary installation of sheet pile wall, there is still a risk of some seepage and therefore potential impacts on groundwater levels and quality, as well as issues associated with the discharge of potentially contaminated water.

4.3.4 Once the excavation is complete, the sheet piles will be removed to ensure that they do not interfere with the piling for the main cutting.

4.4 Holiday Inn retaining wall

4.4.1 A permanent sheet pile wall will be formed between the westbound diverge slip road, and the grounds of the Holiday Inn and the Trinity Burial Ground, to act as a permanent retaining wall for areas where the slip road is below grade. The retaining wall will be approximately 110m long, extending from chainage 1610m in the centre of the Trinity Burial Ground to chainage 1750m at the existing Holiday Inn entrance. The sheet pile wall solution has been proposed in order to minimise the impact on the Holiday Inn with a reduced construction depth. The wall will support the hotel service road and the re-positioned electricity sub-station above the new western diverge slip road.

4.4.2 There may be a small amount of dewatering of perched groundwater during construction, should this be encountered.

4.5 Bridges

4.5.1 Two bridges will be constructed to cross the A63 as part of the Scheme; the Princes Quay Bridge and the Porter Street Bridge. The locations of the bridges are shown in Volume 2, Figure 2.3 Scheme Site Boundary.

Princes Quay bridge

4.5.2 The bridge and ramps are to be founded on a total of sixteen bored piles of diameters ranging between 900mm and 1500mm with spacings ranging between 2.7m and 13.98m. Pile lengths range between 32 and 38.5m. The bridge design includes a platform over the Humber Marina. This is to be founded on 30m long steel piles of diameters between 1016 and 1168mm, driven through the marina water column.

Porter Street bridge

4.5.3 All the bridge and ramp/stair columns are to be founded on reinforced concrete bored, cast-in-place piles. There are to be two 1000mm piles per column at a 3m spacing across the bridge width and approximately every 13.78m along the bridge ramps. Pile depths have not been confirmed.

4.6 Pumping station and rising main outfalls

4.6.1 Surface water drainage will be pumped from the underpass through a rising main to a consented discharge point. The pumping station will be located offline to the south of the mainline at a depth such that the tops of the storage tanks will be at carriageway level at the deepest point of the underpass. The pumping station will be constructed using secant pile walls. The secant pile wall will comprise 1200mm diameter piles, overlapping by 251 mm, and to depth of -27.5m AOD, and with 750 mm diameter tension piles to a depth of -28.5m AOD.

4.6.2 The pumping station will be located in the parcel of land approximately 10m south of Mytongate Junction, adjacent to borehole LDBH02.

4.6.3 Two potential rising main outfall options are being considered:

- a rising main following Commercial Road, Manor House Street and Wellington Street West to a discharge point into the Humber Estuary at Hull Marina Island Wharf
- a rising main connecting to a Yorkshire Water combined sewer close to the pumping station

4.6.4 It is assumed that the rising main would be installed surrounded by a granular fill bed and with stanks to avoid the bedding becoming a conduit for groundwater flow and mobilisation of existing contamination.

4.7 Yorkshire Water sewer diversion

4.7.1 The A63 Castle Street at Mytongate Junction currently passes above a gravity-fed Yorkshire Water sewer, running from the north of the city to the south, down Myton Street. At the intersection of Myton Street and Waterhouse Lane, the sewer then divides. The main sewer runs to the west, around the north side of the existing junction to connect into a system at Porter Street. The second branch of the sewer crosses the A63 and runs beneath Commercial Road, connecting to a sewer tunnel running along Kingston Street (Arup, 2018). This branch of the sewer will need to be diverted due to the proposed underpass at the Mytongate grade-seperated junction.

4.7.2 Yorkshire Water developed a preliminary design for a gravity diversion on the route, which would run along the Holiday Inn access road, passing between the Trinity Burial Ground and the Holiday Inn car park before connecting into the existing network on Commercial Road. Alternative options have also been developed with the aim of mitigating additional impacts to the Holiday Inn, but a final diversion route has not yet been agreed. The alternative options include routes that run below the proposed westbound diverge slip road, directly below Trinity Burial Ground, below the Railway Dock lock (between Railway Dock and Humber Marina) to connect into the Kingston Street tunnel directly, or along the northern boundary of the Railway Dock.

4.7.3 Depending on the agreed route, the sewer diversion is likely to require sewer pipes of between 900 and 2100mm diameter, and with invert levels (base of sewer) at between 0.5 and -0.1m AOD. Some options include to double pipes or box culverts (maximum dimensions 3000mm wide by 1800mm high). Manholes are generally 5000mm diameter, but may be as large as 8000mm.

4.8 Site compounds and public open space

4.8.1 It is assumed that an impermeable surface will be created at all site compounds (if not already present), with no infiltration of rainfall runoff to the ground. Although drainage details are not yet available, it is assumed that compounds used for car parking and storage of heavy machinery will have a positive drainage system installed and bunding for chemicals and fuels. Surface water runoff from cabins will enter either surface water sewers or highways drainage, and waste water from wash facilities will be to foul sewer.

4.8.2 It is assumed that no changes will be made to the current road drainage at the eastbound and westbound recovery bases.

4.8.3 The Arco site is the preferred location (Option A) for the bentonite, jet grouting and concrete batching plants, which all require large amounts of construction and waste materials to be stored and treated, and washout and drainage facilities, including catchpits. The alternative location for siting these plants is the Staples site (Option B), if the Arco site is not used. If the Arco compound is used, there would be no compound at the Staples site.

4.8.4 It is assumed that the existing drainage on the Arco (or the Staples site, if used) can be modified to incorporate plant requirements, although sewer diversions may be required at both sites.

4.8.5 The Arco site (or the Staples site, if used) require the demolition of buildings prior to development as a construction compound.

4.8.6 Other high risk site compounds, where materials will be stored, include the land southeast of Mytongate Junction, Livingstone Road, and the Neptune Street set down compound.

4.8.7 The public open space to be created in the current location of the Myton Centre is likely to comprise a grassed area with a network of footpaths and trees, although this area may first be used for car parking following demolition of the Myton Centre. It is assumed that during use as a car park, the site will have a positive drainage system installed.

4.9 Construction phasing

4.9.1 The proposed phases of construction relevant to the groundwater assessment are set out in Table 11.4.14 below.

Table 11.4.14: Construction phases

Phase and duration	Construction activities
Phase 0 17 months	• Trinity Burial Ground (TBG) enabling works and archaeology, including sheet piling and exhumation programme.
Phase 1 5 months	• Completion of burial ground works and commence earthworks for underpass. • Commence Princes Quay Bridge and Porter Street Bridge foundations. • Ground improvement to Mytongate roundabout and westbound off slip.
Phase 2 3 Months	• Completion of Porter Street Bridge. • Western underpass ground improvement and wall commencement. • Westbound off slip piling, jet grouting to east underpass.

Phase and duration	Construction activities
	• Princes Quay Bridge foundations.
Phase 3 6 months	• Continue west underpass wall construction. • Piling to pumping station. • Installation of rising main to outfall.
Phase 4 3 months	• Continuation of underpass works west of Mytongate. • Eastern underpass south wall construction.
Phase 5 12 months	• Continue underpass construction. • Continue underpass wall to eastern end.
Phase 6 5 months	• Complete underpass construction. • Continue underpass wall to eastern end.

4.9.2 Table 11.4.14 indicates that the underpass will be completed in phases comprising the Mytongate junction, east of the junction and west of the junction, with construction of the central junction underpass spanning almost the entire Scheme programme (up to 34 months). All other construction works will coincide with construction of the underpass, with the exception of the burial ground where exhumation works will precede all other works.

5. Potential impacts to groundwater receptors

5.1 Overview

5.1.1 This section discusses the potential impacts to groundwater receptors during the Construction Phase and Operational Phase of the Scheme following mitigation measures included in the preliminary design.

5.1.2 The impact assessment considers the design discussed in Section 4 in the context of the baseline hydrogeological conceptual model outlined in Sections 2 and 3 of this report. These are also presented in Figure 11.4.30.

5.1.3 In addition, a numerical groundwater flow model has been constructed to investigate potential impacts on groundwater receptors during the Construction Phase and Operational Phase of the Scheme. This focusses on the underpass as this structure is considered most likely to impact the groundwater regime, although the findings are also considered applicable to the Holiday retaining wall, the Trinity Burial Ground sheet piling and the pumping station. The model design, calibration and findings are described in Volume 3, Appendix 11.6 Groundwater modelling report and Volume 3, Appendix 11.7 Groundwater modelling update. A brief summary is provided in the following section.

5.1.4 An impact assessment, taking appropriate mitigation measures into account, is provided in Volume 1, Chapter 11 Road drainage and the water environment. The assessment conforms to DMRB guidance unless agreed otherwise with Highways England, relevant stakeholder or statutory environmental body.

5.2 Groundwater model

5.2.1 The groundwater model was developed using MODFLOW (GW Vistas). It is a nine-layer, finite difference model that represents the Chalk and the overlying superficial deposits, and is based on the hydrogeological conceptual model described in earlier sections of this report. The model was calibrated using groundwater level data from the 2013 GI and subsequent monitoring. Despite this, the model is considered as a simplified version of the complex hydrogeological system that exists beneath Hull, and this should be borne in mind when reviewing the results.

5.2.2 The model was updated in 2017 to take into account changes to construction design, as proposed by Balfour Beatty as part of their preliminary design[10,11,12,64,65]

[64] Arup (2017) A63 Castle Street Improvements, Drainage Impact Assessment. Document Reference HE514508-ARP-HDG-S0-RP-CD-000505. 15 November 2017

[65] Balfour Beatty (2016) A63 Castle Street Improvements, Princes Quay Bridge Piling Specification. Document Reference 514508-ARP-V3-B3-SP-CG-00002. P01. 28 Jan 2016

5.2.3 The model aimed to investigate the following scenarios:

- Construction Phase – the effect of the open-based underpass excavation on groundwater levels and flows (including the effect of diaphragm walls and tension piles on superficial deposits and Chalk groundwater levels and flows, and the effect of seepage into the excavation on groundwater levels and flows in the superficial deposits).

- Operational Phase – the effect of the completed structure (including diaphragm walls and tension piles, basal slab and road deck) on groundwater levels and flows in the Chalk and superficial deposits, including the effect of groundwater seepage into the completed structure (above road deck).

5.2.4 The model was run under steady state and transient conditions. The steady state model uses average groundwater heads to model impacts without tidal influence, while the transient model investigates potential impacts due to the groundwater tidal response.

5.2.5 The conceptual model and numerical modelling approach were discussed and agreed in principle with the Environment Agency on 13 December 2013 and 14 January 2014.

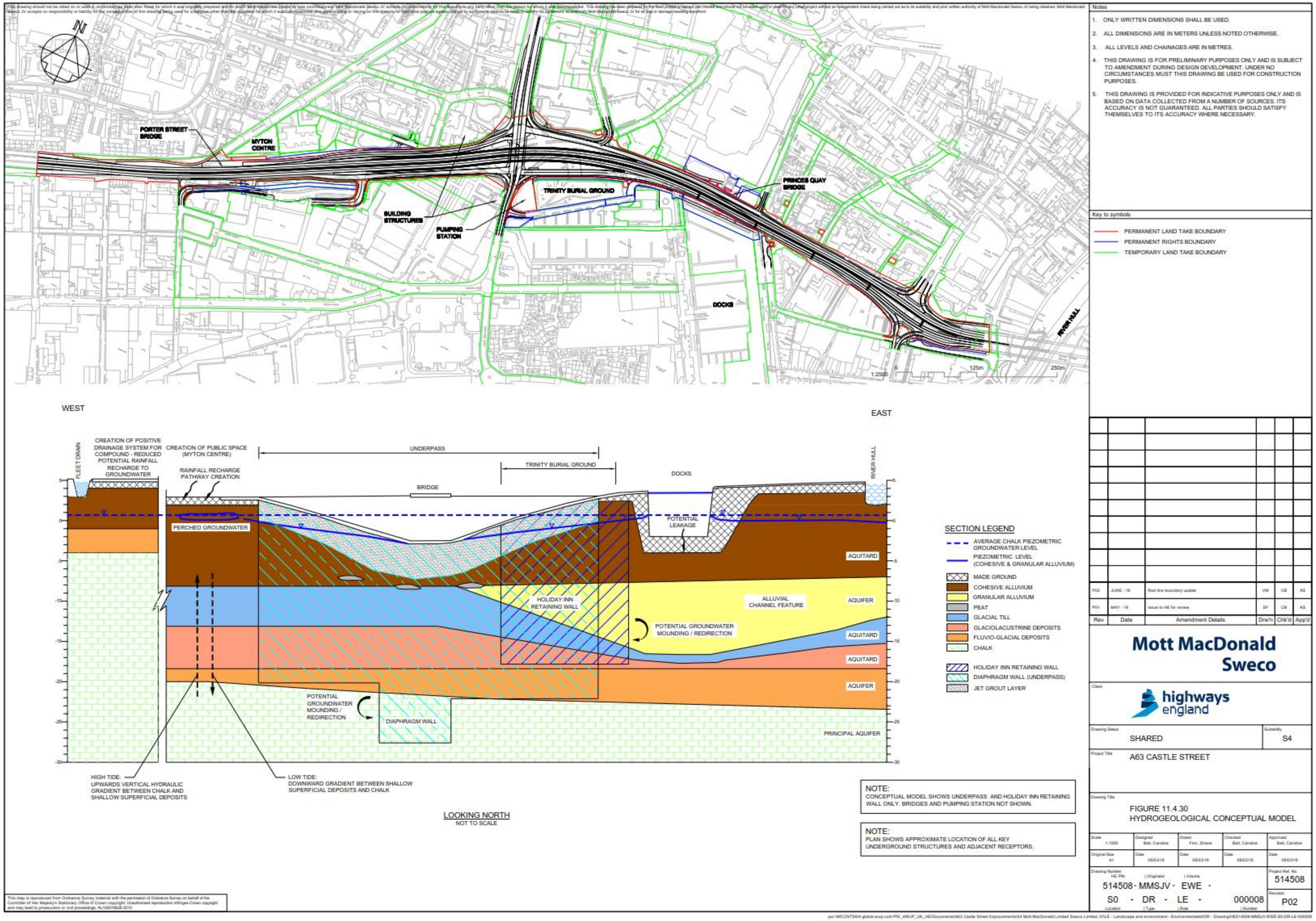
5.2.6 The numerical model focuses on the impact of the underpass. The size and orientation of this structure mean that it is likely to have a far greater impact on groundwater levels and flow than any other excavation or below-ground structure currently included in the Scheme, for example the Holiday Inn retaining wall, Trinity Burial Ground excavation and sheet pile retaining walls, bridge pier piles, slip roads, pumping station and the rising main.

5.2.7 As the east-west extents of the Holiday Inn and burial ground retaining walls are broadly similar to that of the modelled underpass, the model is also considered applicable to these structures.

5.2.8 The depth and location of the pumping station is sufficiently similar to the placement of the diaphragm walls of the underpass that the model is also considered appropriate for this structure.

5.2.9 An additional two-dimensional model was created to investigate the impact of underpass tension piles and bridge pier piles on groundwater levels and flow within the Chalk.

Figure 11.4.30: Hydrogeological conceptual model



5.3 Potential impacts during construction

Groundwater – groundwater levels and flows

5.3.1 The assessment of potential impacts on groundwater levels using the numerical groundwater models has focussed on the underpass, as described in Section 5.2, although this is also considered appropriate for the Holiday Inn retaining wall, the burial ground sheet piling and the pumping station. Results are presented for Layer 2 (cohesive alluvium) and Layer 7 (uppermost Chalk) of the steady state model.

5.3.2 Layer 2 of the model is considered appropriate for consideration of impacts on adjacent building structures and archaeology which are most likely founded within this or the overlying made ground (Layer 1). The extremely heterogeneous nature of the made ground meant that it was not possible to adequately simulate groundwater levels in this layer however. Furthermore, the greatest impacts were observed in Layer 2 and therefore this provides the most conservative approach.

5.3.3 Layer 7 is considered appropriate for consideration of impacts on the Principal aquifer.

5.3.4 All other potential impacts have been assessed qualitatively.

Underpass and other structures

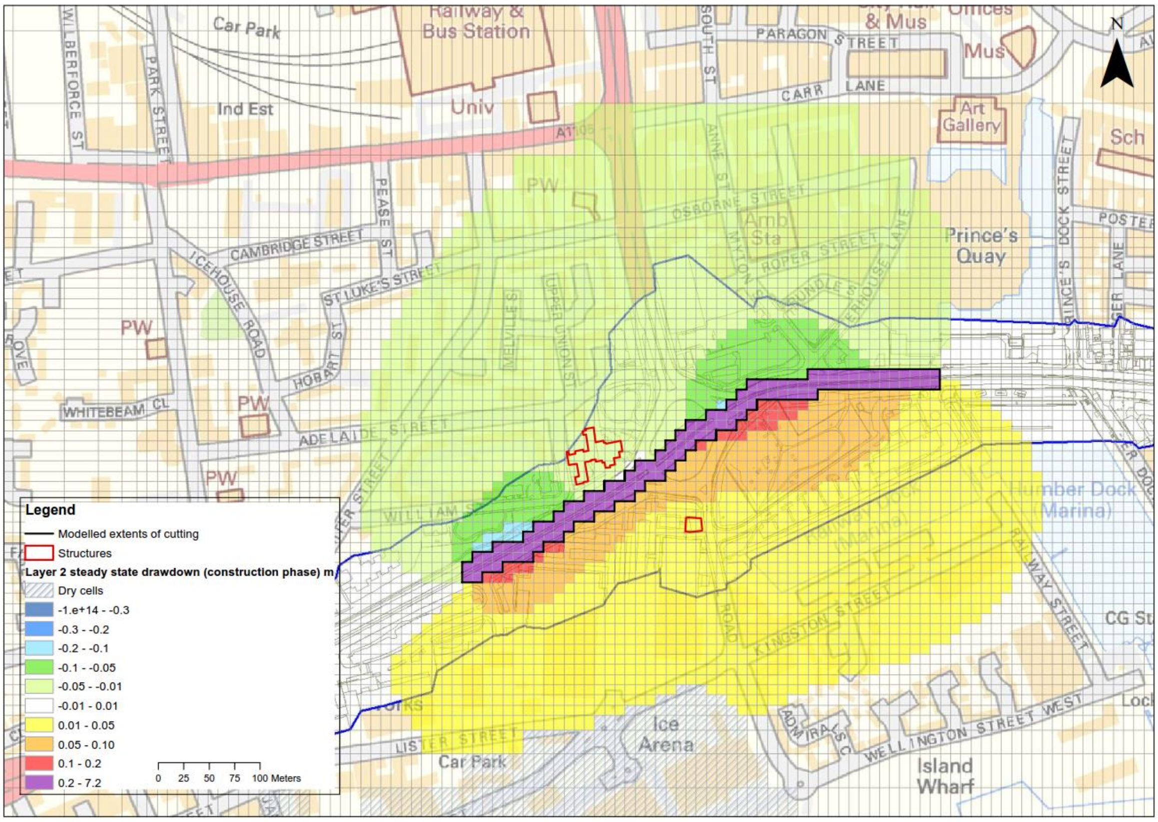
5.3.5 The following observations are based on the results of the numerical groundwater model.

5.3.6 The main quantitative predictions from the steady state model (which represents average groundwater levels) are:

- No significant impact on cohesive deposits and Chalk groundwater levels and flow due to the diaphragm walls and tension piles.
- Maximum drawdown of 7.0m in the central part of the excavation inside the diaphragm walls (reflecting the drawdown required to fully dewater the excavation).
- Changes in groundwater levels (resulting in drawdown or mounding, depending on the tides) in the superficial deposits (cohesive alluvium) immediately outside the diaphragm walls of up to 0.13m.
- Drawdown / mounding in the Chalk immediately outside of the diaphragm walls of less than 0.05m.
- Groundwater inflow to the open excavation through the walls and base of less than $10m^3/d$.

- Changes in groundwater level (additional to natural variation) in the cohesive alluvium at the nearest structures of less than +/-0.05m (refer to Figure 11.4.31 below).
- The two-dimensional model of the tension piles showed very little impact on groundwater levels and flow in both the superficial deposits and Chalk, with groundwater readily flowing around the piles.
- The zone of influence, which is taken as the area where changes in groundwater levels within the cohesive alluvium exceed 0.01m, is highlighted in Figure 11.4.31. This zone of influence is also considered appropriate for the Chalk. The modelled area where changes in Chalk groundwater levels exceed 0.01m is actually smaller, as presented in Volume 3, Appendix 11.7 Groundwater modelling update.

Figure 11.4.31: Modelled steady state drawdown in the cohesive alluvium for the construction scenario



5.3.7 The transient model reveals a similar picture, with the underpass structure causing small, local changes in groundwater level in Layer 2, representing the uppermost superficial deposits (cohesive alluvium). The diaphragm walls and tension piles are therefore not predicted to have a significant impact on groundwater heads or flows in either the cohesive deposits or the Chalk.

5.3.8 In both the steady state and transient models, the zone of measurable drawdown extends southwards, with “damming” of groundwater to the north due to the underpass structure. Although the regional hydraulic gradient apparent in the model is an artefact of the boundary conditions rather than real groundwater heads, the baseline model hydraulic gradient was verified using groundwater level monitoring data from the saline intrusion observation boreholes and GI boreholes on 28 February 2017. The zone of measurable drawdown does not extend beyond this verified area.

5.3.9 It is worth noting that as water levels decline in unsaturated aquifer units within the superficial deposits, the saturated aquifer thickness will decrease and therefore the transmissivity of these units will also reduce close to the excavation. The model assumes that excavation to maximum dredge level occurs instantaneously. In reality, the cutting will be excavated in three phases (see Table 11.4.14) and the superficial deposits will be dewatered gradually as the excavation is deepened. Inflow rates will reduce as the more permeable horizons become dewatered. Furthermore, the model does not include the impact of any ground stabilisation techniques such as jet grouting, which may locally reduce the permeability and further reduce inflows into the cutting.

5.3.10 The diaphragm wall has been modelled as a continuous impermeable wall extending to 5.5m below the top of the Chalk along the full length of the underpass cutting. In reality, the wall becomes increasingly shallow towards both ends of the underpass and therefore will not present as great a barrier to flow in the Chalk.

5.3.11 The hydraulic gradient in the granular alluvium present across the eastern part of the underpass footprint appears to be slightly towards the west, although it is also assumed that the hydraulic gradient also follows the northwest to southeast orientation of the alluvium channel feature. Therefore, the diaphragm wall at the eastern end of the underpass may act as a groundwater dam, causing heads to rise in this confined aquifer layer. However, the diaphragm wall only extends around 100m into the alluvial channel where the granular alluvium is found. It is therefore likely that groundwater will find an alternative pathway. Unfortunately, groundwater heads in the granular alluvium borehole closest to the River Hull could not be accurately represented in the groundwater model due to the influence of tidal effects, which varied within this horizon.

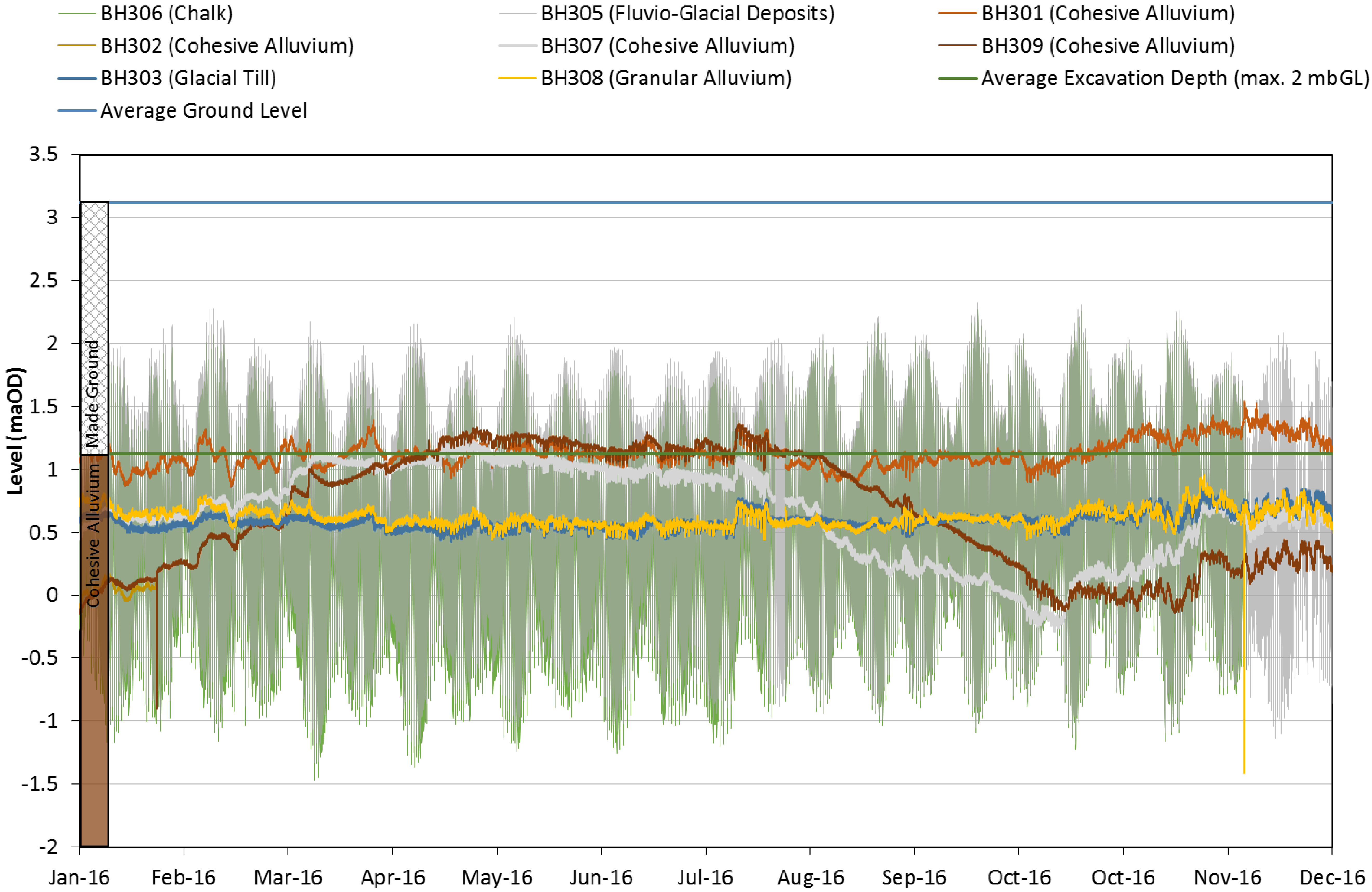
5.3.12 Bentonite grout would be used to stabilise excavations during the construction of the diaphragm walls for the underpass. Any bentonite losses during circulation have the potential to block fissures within Chalk, which could exacerbate flow barrier effects and potential groundwater mounding, although monitoring and mitigation of such losses would be closely managed on site.

Trinity Burial Ground excavation

5.3.13 Excavation of the burial ground may result in some local dewatering of the shallow superficial deposits (permeable units within the made ground and cohesive alluvium), but this will be minimised by the presence of sheet piles, which are primarily required for ground stability purposes. Hydrographs in Figure 11.4.32 suggests that horizons due to be excavated during the exhumation of human remains (represented by BH307 and BH309) are dry during winter months, with groundwater levels rising to above the base of the excavation during spring and summer months (March to August). However, these are considered to represent relatively limited perched groundwater within the cohesive alluvium, as discussed in Section 2.6, and any groundwater inflows into the excavation are likely to be adequately controlled with local dewatering.

5.3.14 The monitoring horizon in BH301 is within deeper horizons of the cohesive alluvium (between -5 and -3m AOD), so although groundwater piezometric heads are consistently above the base of the excavation, the thickness of the overlying cohesive deposits is such that seepage into the excavation due to upwards leakage from this horizon is not likely to be measurable.

Figure 11.4.32: Groundwater levels at Trinity Burial Ground in comparison to excavation depth



Bridges

5.3.15 The two-dimensional model of the bridge tension piles showed very little impact on groundwater levels and flow in both the superficial deposits and Chalk, with groundwater readily flowing around the piles.

Pumping station rising main

5.3.16 The rising main is close to ground level, located in made ground and/or cohesive alluvium. Whilst the rising main may be bedded in a granular infill, stanks are proposed to prevent the pipe trench from acting as a conduit for preferential groundwater flow.

5.3.17 Dewatering requirements are likely to be minimal, as any groundwater present will belimited and perched within the cohesive alluvium present in this location..

Yorkshire Water sewer diversion

5.3.18 Sewer diversions are close to ground level, and located in made ground and/or cohesive alluvium. Whilst the sewers may be bedded in a granular infill, stanks are proposed to prevent the pipe trench from acting as a conduit for preferential groundwater flow.

5.3.19 One of the sewer diversion route options crosses the Trinity Burial Ground. Although it is considered unlikely that this route will be selected, as pipeline depths are lower than the agreed exhumation depths, shallow groundwater may be encountered.

5.3.20 Dewatering requirements are considered to be minimal, due to limited groundwater within shallow horizons. Consequently any impacts due to dewatering are likely to be localised, even at Trinity Burial Ground.

Site compounds

5.3.21 Whilst the construction of an impermeable surface on all site compounds will reduce direct infiltration to the underlying groundwater bodies, this is only likely to affect perched groundwater within the made ground and cohesive alluvium. However most site compound locations are currently covered by hardstanding, and as such are already largely impermeable. Furthermore, the more extensive groundwater bodies such as the granular alluvium, fluvio-glacial deposits, and ultimately the Chalk, are all confined by overlying low permeability superficial deposits and as such do not receive direct recharge.

5.3.22 The only site compound where there is the potential for recharge to aquifer units to be reduced is at Livingstone Road, where the fluvio-glacial deposits directly underlie up to 8m of cohesive alluvium, and the Chalk was found at much shallower depths of between 9 and 13mbgl. It is assumed that groundwater is contained within more granular horizons in the cohesive alluvium at this location and leakage may occur through the superficial deposits (see Annex E Summary of geology and hydrogeology of site compounds).

Groundwater - groundwater quality

Underpass and other structures

5.3.23 Within the small, predicted zone of influence due to dewatering of the underpass "box", there may be local migration of contaminants (PAH, inorganics and some metals) or generation of suspended solids due to changes in hydraulic gradients. Similarly, other structures may locally affect the existing groundwater quality regime.

5.3.24 Groundwater in both the superficial deposits and the Chalk could potentially be impacted by the introduction of materials during, for example, the construction of the diaphragm walls (including the circulation of bentonite slurry during wall construction), jet grouting and installation of piles. Lime and lime cement may be used to bind the alluvium prior to excavation within the diaphragm wall box. As the materials will be in direct contact with groundwater within both the superficial deposits and the Chalk, they have the potential to affect the groundwater quality due to their material properties and disturbance of the ground, which may mobilise contaminants already present. There also is the potential for transfer of contamination during construction through use of piling and other machinery, and tools.

5.3.25 Pipelines carrying bentonite grout and jet grouting arisings may be buried in high risk locations, such as road crossings. Booster pumps (which have the potential to increase the risk of pipe bursts and accidental spillages) will also be required due to the distance between site and the bentonite and jet grouting plants at the Arco site compound. Without mitigation there is therefore a risk of groundwater contamination due to use of the pipelines.

5.3.26 All routine drainage will be collected and disposed of off-site and no soakaways or other means of discharging water to the ground are included in the preliminary design. Therefore, there is no requirement for a DMRB Volume 11 Section C assessment (i.e. assessment of pollution impacts from routine runoff to groundwater).

5.3.27 Other potential impacts on groundwater quality, for example spillages, can be mitigated through appropriate practices during construction.

Pumping station and rising main

5.3.28 The pumping station is to be situated adjacent to the existing large diameter Chalk borehole LDBH02. Without appropriate abandonment, the borehole has the potential to act as a preferential pathway for pollution migration between ground surface, the made ground and shallow superficial deposits, and the Chalk aquifer.

5.3.29 The rising main has the potential to act as a preferential pathway for migration of contaminants or suspended solids (from accidental spillages of construction materials), between ground surface and the made ground and shallow superficial deposits. However, groundwater within the cohesive alluvium is likely to be limited to localised sandy horizons and stanks within the granular fill will minimise the movement of any contaminants or suspended solids.

Yorkshire Water sewer diversion

5.3.30 The sewer diversion route has the potential to act as a preferential pathway for migration of contaminants (from accidental spillages of construction materials or raw sewage during construction), between ground surface and the made ground and shallow superficial deposits. However, groundwater within the cohesive alluvium is likely to be limited to localised sandy horizons and stanks within the granular fill will minimise the movement of any contaminants or suspended solids. If present below the sewer diversion route, the granular alluvium is considered to be protected by significant thicknesses of cohesive alluvium.

Site compounds

5.3.31 It is assumed that all site compounds will be covered by hardstanding and drainage will be collected and disposed of off-site. Therefore, the potential impact of construction activities on groundwater quality is likely to be very low.

5.3.32 There is the potential risk of mobilisation of suspended solids or existing contamination, or creation of preferential pathways during any pre-construction site preparations. These site preparations include the demolition of buildings at the Arco site (or the Staples site, if used). However it is unlikely that this would result in groundwater contamination as these sites are already covered by hard standing and contain site drainage.

5.3.33 There is a slightly increased risk of groundwater contamination during pre-construction site preparations at the Livingstone Road site, where the fluvio-glacial deposits aquifer directly underlies the cohesive alluvium.

Surface water

Underpass and other structures

5.3.34 All surface water bodies other than Railway Dock and a small section of Humber Dock lie outside the predicted zone of influence due to seepage into the underpass. Therefore, impacts due to dewatering on these receptors are considered to be negligible.

5.3.35 The dock walls are lined and so are likely to be largely isolated from groundwater except potentially through their bases (unless there is also significant seepage through the walls). Predicted drawdowns in the uppermost natural superficial deposits layer (cohesive alluvium) within the footprint of the docks were 0.05m at most. Whilst there is the potential for seepage into the underpass to impact very slightly on groundwater heads adjacent to the Humber Dock, this would be far outweighed by the impact of Humber Dock losing water through the opening and closing of the locks and being regularly topped up with water from the Humber Estuary.

5.3.36 For the same reason, the predicted water quality impacts on surface water due to construction activities affecting the groundwater regime are also considered to be negligible.

Yorkshire Water Sewer Diversion

5.3.37 One of the sewer diversion route options runs alongside the northern edge of the Railway Dock. Any dewatering required for this route has the potential to result in dewatering of the docks, although the dock walls are lined and the dock is likely to be largely isolated from groundwater within the superficial deposits. Similarly, any spillages of construction materials are unlikely to migrate into the dock. Mitigation measures such as the use of sheet piling will still be required as a precautionary measure, however.

Site compounds

5.3.38 Fleet Drain, Albert Dock and the Humber Estuary are considered to be indirect groundwater receptors with respect to potential impacts from adjacent site compounds. However, the site compounds are to be covered with hardstanding and have positive drainage systems installed to redirect all recharge-runoff to sewers, the potential impact on surface water quality from routine runoff and accidental spillages would be extremely low. The potential impact in terms of loss of recharge is also considered to be low due to the low permeability nature of the existing ground cover and near-surface deposits.

Abstractions

5.3.39 No groundwater abstractions are located within the zone of influence, as shown in Figure 11.4.31. However, the Scheme does fall within the catchment areas (SPZ3) for the Hull Truck Theatre abstraction borehole to the north and four public water supply abstraction shaft and adit systems to the northeast. All abstractions are from the Chalk.

5.3.40 The groundwater model predicts that the potential impact on the Chalk due to the underpass excavation dewatering operation is negligible (less than 0.05 metres). Moreover, the Chalk is heavily confined by the overlying cohesive superficial deposits and therefore protected from any surface contamination. It is anticipated that suitable techniques will be adopted to ensure that the Chalk is not affected by mobilisation of contaminants or suspended solids during installation of the diaphragm walls and tension piles.

Environmentally sensitive sites

5.3.41 The Humber Estuary is the only environmentally sensitive site within the study area. As stated above, it lies outside the zone of influence of the underpass and therefore is unlikely to be affected by this or other construction activities affecting the groundwater regime.

5.3.42 Historically, springs discharged into the Humber, but these have largely dried up since abstraction dramatically increased in the early to mid-1900s. Although the groundwater model predicts a regional Chalk hydraulic gradient towards the estuary, and recent monitoring data suggests that the local Chalk hydraulic gradient is either slightly southward or northward depending on the state of the tide, freshwater inputs to the Humber are unlikely to be affected.

Structures and cultural heritage – groundwater levels

5.3.43 Ground conditions are such that any impact on groundwater levels in the cohesive alluvium that exceeds approximately 1m over and above natural variations, could result in a potential risk of settlement to structures, including infrastructure and archaeological remains.

5.3.44 Drawdown in the cohesive alluvium due to dewatering the underpass excavation is only predicted to exceed 1m within the Scheme site boundary, and within the diaphragm walls. Changes in groundwater levels within the cohesive alluvium underlying the nearest buildings (the Whittington and Cat public house south west of Mytongate and Booth House northwest of Mytongate) is predicted to be less than 0.05m.

5.3.45 It is therefore considered that potential changes in groundwater heads as a result of construction of the underpass are unlikely to cause significant settlement issues, particularly as groundwater monitoring undertaken during 2013 and 2014 indicates that the natural groundwater level variation in the cohesive alluvium in this area is in the order of 0.05m.

5.3.46 Groundwater flooding is also unlikely to be a significant issue as increases in groundwater level due to the underpass construction are minimal in comparison to the natural range in groundwater levels.

Structures and cultural heritage – groundwater quality

5.3.47 Adverse impacts can potentially arise because of contact between new materials and groundwater, effects on structure integrity and mobilisation of contaminants due to ground disturbance.

5.3.48 As discussed previously, within the zone of influence due to dewatering the underpass excavation, there may be local migration of contaminants (PAH, inorganics and some metals) due to changes in hydraulic gradient. Similarly, other structures may locally affect the existing groundwater quality regime.

5.3.49 Groundwater quality could potentially be impacted by the introduction of materials during, for example, the jet grouting and installation of piles, and by other site activities such as excavations, compound site preparation works, and transferring materials between site compounds and the site via partially buried pipelines. However, these should not impact on structures outside the Scheme Site Boundary providing appropriate techniques and construction environmental management practices are adopted.

5.3.50 The zone of influence does not extend to the Humber Estuary and therefore the risk of additional saline intrusion occurring as a result of the Construction Phase of the Scheme is considered to be negligible.

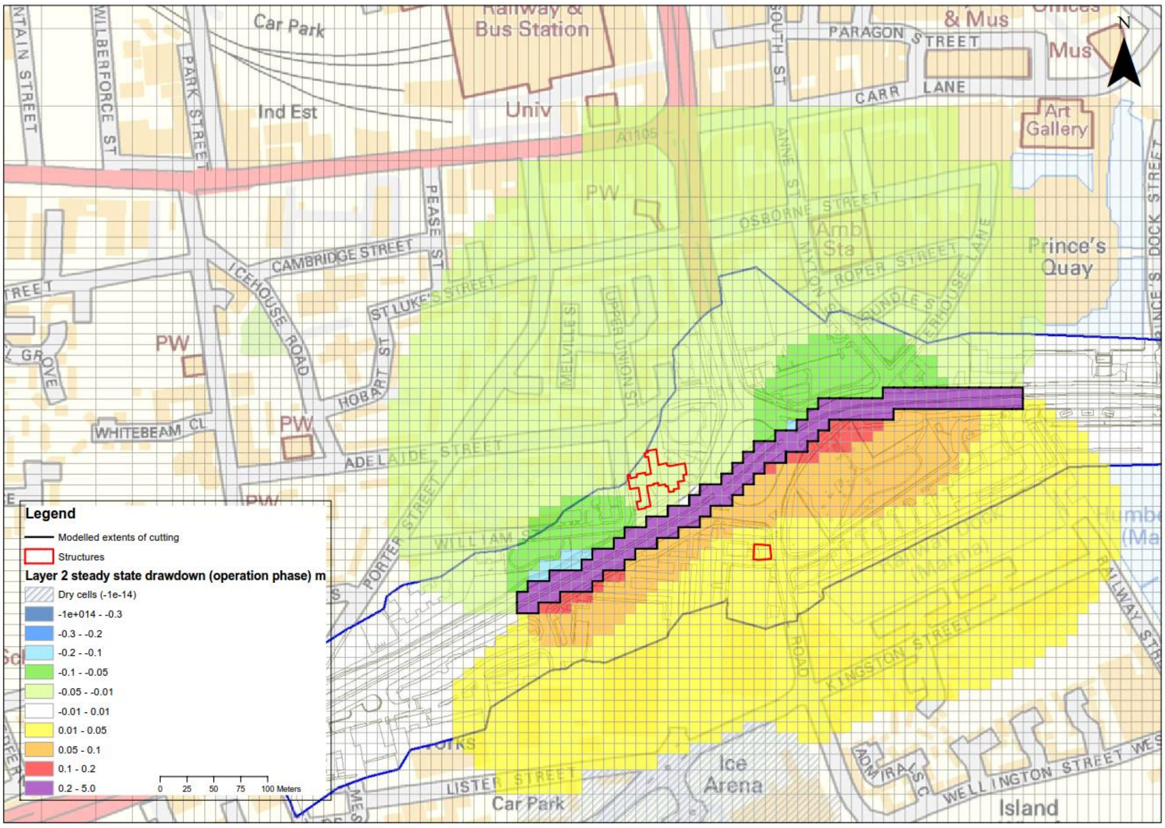
5.4 Potential impacts during operation

Groundwater – groundwater levels and flows

5.4.1 The main quantitative predictions from the steady state groundwater model (which represents average groundwater levels) are:

- No significant impact on cohesive deposits and Chalk groundwater levels or flow
- Maximum drawdown of 4.8m inside the diaphragm walls in the central part of the Scheme (approximate road deck level)
- Changes in groundwater levels (resulting in drawdown or mounding, depending on the tides) in the superficial deposits (cohesive alluvium) immediately outside the diaphragm walls of up to 0.13m
- Groundwater inflow to the underpass (intercepted by the road drainage system) of 1.36m^3/d
- Changes in groundwater level (additional to natural variation) in the cohesive alluvium at the nearest structures of +/-0.04m (refer to Figure 11.4.33 below)
- The two-dimensional model of the tension piles showed very little impact on groundwater levels and flow in both the superficial deposits and Chalk, with groundwater readily flowing around the piles
- The zone of influence, which is taken as the area where changes in groundwater levels within the cohesive alluvium exceed 0.01m, is highlighted in Figure 11.4.33. This zone of influence is also considered appropriate for the Chalk. The modelled area where changes in Chalk groundwater levels exceed 0.01m is smaller, as presented in Volume 3, Appendix 11.7 Groundwater modelling update.

Figure 11.4.33: Modelled steady state drawdown in the cohesive alluvium for the operational scenario



5.4.2 The relationships between steady state and transient model results reflect those of the Construction Phase scenario.

5.4.3 As with the construction scenario, the pumping station and the Holiday Inn retaining wall are likely to cause similar impacts to those modelled for the underpass cutting for reasons and the bridge foundations are likely to cause a minimal impact on groundwater levels and flows.

Public open space creation

5.4.4 The creation of the public open space at the Myton Centre will increase the permeable area at this location, and subsequently increase the potential for direct infiltration to underlying groundwater bodies. This is only considered to be a small potential impact, however, due to the low permeability nature of near surface superficial deposits (made ground and cohesive alluvium) at this location.

Groundwater - groundwater quality

5.4.5 Within the small, predicted zone of influence due to dewatering within the underpass "box", there may be local migration of existing contaminants (PAH, inorganics and some metals) or suspended solids due to changes in hydraulic gradients.

Surface water

5.4.6 All surface water bodies other than Railway Dock lie outside the zone of influence due to road drainage within the underpass. Therefore, impacts on these receptors are considered to be negligible.

5.4.7 The dock walls are lined and so are likely to be largely isolated from groundwater except potentially through its base (unless there is also significant seepage through the walls). Predicted drawdowns in the uppermost natural superficial deposits layer (cohesive alluvium) within the footprint of the docks were 0.05m at most, so the potential impact on surface water levels is likely to be negligible.

5.4.8 For the same reason, the predicted water quality impacts on surface water due to activities affecting the groundwater regime are also considered to be negligible.

Abstractions

5.4.9 No groundwater abstractions are located within the zone of influence, as shown in Figure 11.4.33. As in the construction scenario, the groundwater model predicts that the potential impact on the Chalk, and therefore abstractions from the Chalk, due to drainage to the underpass "box" is negligible.

5.4.10 The Chalk is heavily confined by the overlying cohesive superficial deposits and therefore protected from any surface contamination. It is anticipated that suitable piling techniques will be adopted to ensure that the Chalk is not affected by mobilisation of contaminants or suspended solids during installation of the diaphragm walls and tension piles.

Environmentally sensitive sites

5.4.11 As discussed above, the Humber Estuary lies outside the zone of influence due to drainage to the underpass therefore is unlikely to be affected by this or other construction activities affecting the groundwater regime.

5.4.12 Historically, springs discharged into the Humber, but these have largely dried up since abstraction dramatically increased in the early to mid 1900s. Although the groundwater model predicts a regional Chalk hydraulic gradient towards the estuary, and recent monitoring data suggests that the local Chalk hydraulic gradient is either slightly southward or northward depending on the state of the tide, freshwater inputs to the Humber are unlikely to be affected.

Structures and cultural heritage – groundwater levels

5.4.13 Ground conditions are such that any impact on groundwater levels in the cohesive alluvium that exceed approximately 1m over and above natural variations, then there is a potential risk of settlement to structures, including infrastructure and archaeological remains.

5.4.14 Drawdown in the cohesive alluvium due to drainage to the underpass "box" is predicted to exceed 1m only in the immediate vicinity of the retaining walls. Changes in groundwater levels within the cohesive alluvium underlying the nearest buildings (the Whittington and Cat public house south west of Mytongate and Booth House northwest of Mytongate) is predicted to be no more than 0.04m.

5.4.15 Therefore, it is considered that potential changes in groundwater levels due to drainage to the underpass are unlikely to cause significant settlement issues, particularly as groundwater monitoring during 2013 and 2014 indicates that the natural groundwater level variation in the cohesive alluvium in this area has been in the order of 0.5m.

5.4.16 Groundwater flooding is also unlikely to be a significant issue as increases in groundwater level due to the underpass operation are minimal in comparison to the natural range in groundwater levels. During operation there may be slightly less infiltration to made ground due to an increase in hard standing around Mytongate Junction. Groundwater in made ground is perched and not laterally extensive. Therefore, indirect impact of infiltration reduction is considered to be negligible.

Structures and cultural heritage – groundwater quality

5.4.17 As discussed previously, within the zone of influence due to drainage to the underpass, there may be local migration of contaminants (PAH, inorganics and some metals) due to changes in hydraulic gradients. Similarly, other structures may locally affect the existing groundwater quality regime.

5.4.18 In view of the contaminants identified during the 2013 GI and the concentrations of these contaminants, impacts within the zone of influence are likely to be minimal in terms of the effects on quality due to direct contact between new materials and groundwater, and effects on structure integrity.

5.4.19 The zone of influence does not extend to the Humber Estuary and therefore the risk of additional saline intrusion occurring as a result of the Operational Phase of the Scheme is considered to be negligible.

6. Conclusions and recommendations

6.1 Conclusions

6.1.1 This report aims to:

- develop a baseline hydrogeological conceptual model of the A63 Castle Street Scheme based on the findings of previous studies and the 2013 an 2015/16 GIs, testing and subsequent monitoring
- outline the potential risks from groundwater during the construction and operation of the Scheme, to inform the detailed design mitigation measures
- assess the potential impacts of key structures associated with the construction and operation of the Scheme on groundwater receptors

6.1.2 The baseline conceptual hydrogeological model is largely based on information from the following sources:

- 2013 GI and 2015/16 GI, which comprised exploratory boreholes, trial pits, window samples, self-boring pressuremeter tests (SBPT) and archaeological SCPTs. These were supplemented by geophysical surveys, permeability tests, a Chalk pumping test, and groundwater level and quality monitoring (manual dips and deployment of dataloggers). The GI was restricted to the Scheme Site Boundary.
- Earlier reports relating to the Scheme
- Publicly available information from the BGS and Environment Agency, and other publications
- A nine-layer numerical groundwater model developed as part of this investigation using MODFLOW
- Chalk groundwater level monitoring undertaken from observation boreholes around Hull and GI boreholes

6.1.3 Key aspects of the baseline conceptual model are as follows:

- The geological sequence roughly comprises a series of aquifer and aquitards within the superficial deposits (20 - 30m thick), including made ground, cohesive alluvium, granular alluvium, glacial till, glaciolacustrine deposits and fluvio-glacial deposits. The fluvio-glacial deposits directly overlie Chalk bedrock.
- In reality, the geological sequence is more complex than this. For example, the granular alluvium is only present across the eastern half of the Scheme, where a channel feature that cut through glacial deposits (the glacial till, glaciolacustrine and fluvio-glacial deposits) was subsequently infilled.

- The Chalk aquifer is confined and has a strong tidal influence reflected in groundwater levels which have varied by up to 4m over the monitoring period. here is evidence of significant heterogeneity within the Chalk in this area.
- Other than the made ground, the permeable superficial deposits are generally confined though there may be some localised unconfined units.
- Neither the Chalk nor the majority of the superficial deposits have exhibited an obvious response to short term recharge events or seasonal recharge during the monitoring period and are thought to be recharged indirectly.
- In general, the local hydraulic gradient in the Chalk is slightly to the north during high tide, and southwards during low tide.
- Monitoring across the Hull area and the groundwater model suggest that groundwater flow is generally to the south, towards the Humber Estuary, as verified by monitoring across Hull on 28 February 2017.
- Similarly, monitoring to date does not indicate a measurable hydraulic gradient in any of the superficial deposits, except in the granular alluvium across the eastern part of the Scheme. Here, the hydraulic gradient appears to have an east to west component, although it is assumed that there may also be a north-south component due to the orientation of the alluvial channel.
- Vertical hydraulic gradients depend on the state of the tide, with a slight downwards hydraulic gradient between the superficial deposits above the glaciolacustrine deposits and the fluvio-glacial deposits and Chalk at low tide and a reversal of this relationship at high tide. The data suggests that leakage between aquifer units is minimal except where the more impermeable superficial deposits thin towards the eastern end of the Scheme.
- Although the hydraulic connection between the Humber Estuary and the underlying Chalk is not well understood, and it is considered unlikely that watercourses receive any significant baseflow from the Chalk, it is possible that the Humber Estuary gains water from the Chalk aquifer under high groundwater level conditions. This relationship may be reversed under drought conditions, however.
- The wall of all three docks are lined and so are likely to be largely isolated from groundwater within the superficial deposits, except through their bases.
- The Chalk groundwater quality is representative of a confined aquifer with reducing conditions that has been subject to modern saline intrusion (due to historical over-abstraction) as well as a component of paleo saline groundwater.

- Water quality is the superficial deposits is also representative of generally (though not always) reducing conditions. There is evidence of mixing with saline water.

6.1.4 Potential impacts on groundwater receptors during construction and operation of the Scheme are summarised below:

- Receptors have been divided into direct receptors (groundwater units) and indirect receptors potentially affected when groundwater is considered as a pathway.
- Groundwater receptors include the Chalk aquifer and superficial deposits (although the latter is not classed as an aquifer by the Environment Agency).
- Surface water receptors include the Humber Estuary, which is also an environmentally sensitive site, the River Hull, the Railway, Humber and Albert docks and Fleet Drain.
- Other potential receptors include groundwater and surface abstractions, structures and cultural heritage (buildings and archaeological remains).

6.1.5 Potential Construction Phase impacts based on the findings of this investigation are considered to be as follows:

- No significant impact on Chalk groundwater levels or flow.
- Changes in groundwater levels (resulting in drawdown or mounding, depending on the tides) in the superficial deposits (cohesive alluvium) immediately outside of the diaphragm walls of less than 0.13m due to the underpass excavation. However, this is small in comparison to the natural range of water level variation and is therefore unlikely to result in groundwater flooding.
- Groundwater inflow to the open excavation through the excavation retaining walls and base of less than $10m^3/d$.
- Negligible impact on surface water receptors due to changes in groundwater levels, flow or water quality.
- Potentially small impacts on groundwater receptors within the zone of influence of the underpass excavation due to changes in groundwater levels and quality, but these are unlikely to be of significance.

6.1.6 Potential Operational Phase impacts based on the findings of this investigation are considered to be as follows:

- No significant impact on Chalk groundwater levels or flow.
- Changes in groundwater levels (resulting in drawdown or mounding, depending on the tides) in the superficial deposits (cohesive alluvium)

immediately outside of the diaphragm walls of less than 0.13m due to the underpass. However, this is small in comparison to the natural range of water level variation and is therefore unlikely to result in groundwater flooding.

- Groundwater inflow to the underpass (intercepted by the road drainage system) of 1.36m^3/d.
- Negligible impact on surface water receptors due to changes in groundwater levels, flow or water quality.
- Potentially small impacts on groundwater receptors within the zone of influence of the underpass excavation due to changes in groundwater levels and quality, but these are unlikely to be of significance.

6.2 Recommendations

6.2.1 A groundwater monitoring and sampling plan must be agreed with the Environment Agency and implemented throughout the construction period. Regular dialogue between the contactor and regulatory bodies will be required during this process. It is also recommended that baseline groundwater monitoring prior to construction continues, to capture seasonal changes.

6.2.2 The construction and operation phase monitoring and sampling plan should form part of the Groundwater Management, Dewatering and Discharge Control Plan, outlined in the Outline Environmental Management Plan (PINS reference TR010016/APP/7.3).

7. Annexes

Annex A: MMG JV (2014) A63 Castle Street Improvements, Hull – Ground Investigation Report (GIR)

HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

Ground Investigation Report

A63 Castle Street Improvement, Hull

1168-09-152-RE-001

An executive agency of the
Department for transport

Ground Investigation Report

A63 Castle Street Improvement, Hull

1168-09-152-RE-001

Revision Record

Revision No	Date	Originator	Checker	Approver	Description
PD1	10.03.14	AHR / RP	MD		Ground Investigation Report
PD2	19.09.14	AHR / RP	MD		Addition of omitted sections from PD1
PD3	29.09.14	AHR / RP	MD		Final

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1 Executive Summary

The proposed A63 Castle Street Improvement Scheme (*the scheme*) aims to improve access to the Port of Hull, relieve congestion and improve safety. At the time of writing this is to be achieved by constructing a reduced level grade separated junction (GSJ) at or about the location of the existing Mytongate junction. The scheme also seeks to reduce the severance caused by the A63 between the city centre to the north and developments, tourist and recreational facilities to the south.

The scheme is located over varied ground conditions including made ground, saturated, compressible weak alluvium and granular and cohesive glacial deposits. Bedrock in the region is chalk and is a principal aquifer with sub artesian groundwater pressures.

To manage the ground risk a detailed site investigation was undertaken in 2013 that complimented historical investigations and targeted the GSJ cutting with conventional and more specialist ground investigation techniques alike. The 2013 site investigation also included archaeological, hydrogeological and land contamination investigations all of which have helped to improve the understanding of the ground conditions throughout the scheme. The site investigation confirmed the variable and challenging nature of the ground conditions.

A major constraint to the scheme is Trinity Burial Ground to the south east of the existing Mytongate Junction. Site investigation in this location was placed into abeyance due to access and permission constraints. This area has been recorded on the exploratory hole location plans and will need to be investigated by a confirmatory investigation exercise during detailed design.

2 Introduction

The existing A63 highway at Castle Street is located 0.25km to the south of Hull city centre. The existing highway is a dual carriageway running east to west with a traffic signal controlled junction, known as Mytongate Junction, accommodating traffic movements from the north and south. The existing A63 highway provides a strategically important route linking the M62 motorway, the Humber Bridge and A15 to the west, with the city centre and the Port of Hull to the east.

The proposed Castle Street Improvement Scheme (*the scheme*) aims to improve access to the Port of Hull, relieve congestion and improve safety. In addition, the scheme seeks to reduce the severance caused by the A63 between the city centre to the north and developments, tourist and recreational facilities to the south.

The proposed scheme involves improvements to approximately 1.5km stretch of the A63. The improvements are to be implemented by lowering the level of the A63 dual carriageway into a cutting by approximately 7 m at Mytongate Junction. Ferensway to the north and Commercial Road to the south are proposed to pass over the A63 on a central bridge increasing levels nominally to create a grade separated junction. In addition to the grade separated junction and central bridge, two footbridges are proposed to improve pedestrian access over the A63.

The scheme is currently in the Preliminary Design Stage (or Stage 3) of the Highways Agency Project Control Framework (PCF). The Mott Macdonald Grontmij Joint Venture (MMGJV) is working directly for the Highways Agency to take the A63 Improvement Scheme to Development Consent Order (DCO) submission.

In 2013, a detailed and targeted ground investigation was undertaken by Geotechnics Limited (Ground Investigation, A63 Castle Street Improvement, Hull, Reference PC135220, October 13) to both supplement and expand upon the existing historical ground investigation information. The 2013 ground investigation utilised a variety of investigation techniques focusing on the area of the proposed cutting where the majority of the exploratory holes were undertaken. Where the alignment was to remain at or about grade there was a reduced frequency of exploratory holes were undertaken.

Drawing 1168-09-01-DR-001-PD9 depicts the exploratory hole locations where ground investigation was undertaken during the 2013 ground investigation.

2.1 Scope and Objective of the Report

The aim of this Ground Investigation Report (GIR) is to present an account of the ground investigation works that have been undertaken for the A63 Castle Street Improvement Scheme and to prepare a review of the ground and groundwater conditions, geo-environmental limitations, constraints and ground hazards and risks determined from the investigations undertaken by MMGJV.

A detailed interpretation of the ground conditions, together with material properties is presented in the following sections.

An updated geotechnical risk register corresponding to this stage of the scheme is presented within Section 7.

This report has been prepared in general accordance with the reporting requirements of BS EN 1997-2:2007 ‘Eurocode 7. Geotechnical Design. Ground Investigation and Testing’, in conjunction with HD 22/08 ‘Managing Geotechnical Risk’ (DMRB, 2008). It should be noted that the historical investigation data (where considered) is reported to BS5930:1999.

2.2 Description of the Project

The section of the existing A63 to be improved by the scheme runs from the former junction with Porter Street in the west to just beyond the Market Place Junction in east with the signalised Mytongate Junction located in the approximate centre. The existing dual carriageway and the side roads that join at the

Mytongate Junction are generally at grade and constructed at existing ground level, which ranges from approximately 3.0m to 4.5m above ordnance datum (OD).

The proposed mainline does not deviate from the existing vertical alignment until Chainage 280 where the highway reduces in level into a cutting reaching the minimum road level of 7m below ground level (bgl) or -5m OD at around Chainage 505 before rising to existing ground level by Chainage 730.

The proposed horizontal alignment of the mainline deviates from the existing alignment between Chainage 350 and Chainage 1050. Between Chainage 350 and 1050the proposed alignment is located to the south of the existing alignment, and encroaches on to the land that currently forms the Trinity Burial Ground. It is proposed to clear this section of the burial ground prior to the commencement of construction works.

There are four proposed slip roads, the eastbound diverge, the eastbound merge, the westbound diverge and the westbound merge. All slip roads excluding the westbound diverge are generally at grade with minor increases in height up to a maximum level difference of a metre. The westbound diverge reduces in level by a maximum depth of 3m or 0m OD, the diverge then increases in level by up to 1m in the area of the proposed over bridge.

A central over bridge is proposed to link Ferensway and Commercial Road and provide access to and from the four slip roads. The level of the over bridge is proposed to be approximately 1m above existing ground level and crosses the proposed A63 at Chainage 500.

Two footbridges are proposed to provide pedestrian access across the highway; the first is proposed at Chainage 50 and will take the form of a standard footbridge with pedestrian access ramps, the second is proposed between Chainage 800 to 850. The form of the second footbridge has not yet been finalised but it is likely to take the form of an ‘enhanced’ crossing with helical access ramps.

The proposed westbound carriageway and associated footpath encroaches on land that was formerly a dock between Chainage 770 and Chainage 910, in these area alterations to the wall forming the historical dock boundary will be required.

2.3 Geotechnical Categorisation

BS EN 1997-1:2004 describes the three Geotechnical Categories that can be introduced to establish geotechnical design requirements. The Geotechnical Category is an assessment of the ground conditions and nature of proposed construction. A description of these categories is presented below;

- Geotechnical Category 1 – Applies to small and relatively simple structures where there is negligible risk. The procedures should be used only where there is negligible risk in terms of the overall stability or ground movements, and where the ground conditions are considered to be relatively straightforward.

- Geotechnical Category 2 – Applies to conventional types of structures and foundation where there is no exceptional risk or difficult soil or loading conditions such as; piled foundations, retaining walls, earthworks, embankments and bridge piers and abutments.

- Geotechnical Category 3 – Applies to structures or parts of structures, which fall outside the limits of Geotechnical Categories 1 and 2. This would include very large or unusual structures and structures involving abnormal risks, unusual or exceptionally difficult ground conditions or abnormal loading conditions.

Geotechnical Category 3 is generally considered to be the most appropriate approach for geotechnical design for the A63 Castle Street Improvement Scheme.

The principal reason for the Category 3 categorisation is due to the complexity of the proposed scheme.

2.4 Other Relevant Information

Not Used.

3 Existing Information

The proposed scheme has been under consideration for many years, as such, numerous reports and surveys of the area have been undertaken to assist in the determination of the most suitable option. This section, 'Existing Information' summarises all relevant geotechnical information known about the scheme prior to the commencement of the 2013 ground investigation.

In 1994 Allied Engineering & Geotechnics carried out a site investigation along the A63 Castle Street. The associated Ground Investigation Report for this project was published in 1995 by Acer (Acer, 1995).

A summary of the existing information relevant to the proposed improvements is presented in the Preliminary Sources Study Report (PSSR) produced by Pell Frischmann (PF, 2009a). The report details (but is not limited to) topography and site history, geology, mineral extraction, aerial photography, ground conditions, contaminated land, seismicity, hydrogeology, hydrology, flooding, land use and archaeology. Details of the programme of statutory consultations that were undertaken are presented in the PSSR.

An Envirocheck Report was obtained in January 2013. This report confirmed that the information summarised in the PSSR detailed above was still current.

In 2013, MMGJV produced an Annex A to Preliminary Sources Study – 27282 to provide advice on the likely requirements of any subsequent ground investigation.

The main reports that were reviewed during the preparation of this report together with other relevant supporting information are listed in Section 8 of this report. No warranty is given or implied with regard to the accuracy of reports referenced within Section 8.

3.1 Topographical Maps

Historical and recent topographical maps for the area of the proposed scheme, are available from two Envirocheck reports (2002 and 2013), and a Ground Sure report (2008). The PSSR (PF, 2009a) provides a detailed commentary on the findings from these maps, together with information depicted on Ordnance Survey Maps. Salient changes or features that are likely to affect the scheme are summarised within Table 3.1. The associated historical maps are presented in Appendix A.

Full details of the information relating to the topographical maps are contained within the PSSR (PF, 2009a).

Table 3.1 – Historical Mapping Review

Date	Scale	Feature / Chainages
1856	1:10,000 & 1:2,500	Castle Street is marked on the map but covers a smaller area than present. The existing eastern end of Castle Street is named Mytongate with Castle Street originating at Humber Docks. Castle Street subsequently proceeds westwards approximately along the current line of the A63 to Waterhouse Lane, where it terminates and becomes Myton Place. This lies in the vicinity of the intersection of the A63, Ferensway and Commercial Road. Prince's Dock and Humber Dock are present; there is a lock (with gates) linking the two docks. Castle Street crosses the lock via a lift bridge named Mytongate Bridge. Residential housing is present on both sides of Mytongate and to the north of Castle Street and Myton Place. To the southeast of Myton Place, there are four timber yards surrounding the Trinity Burial Ground. Dense residential housing with associated roads (e.g. Nile Street and Great Passage) is present to the east of Myton Place but the alignment of the streets is significantly different from current alignments. A chapel and gardens are present in the vicinity of what is now the Mytongate Junction.

Date	Scale	Feature / Chainages
1891-1893	1:10,000 & 1:2,500	There has been little change over the majority of the scheme area. The Trinity Burial Ground is now marked as disused. Tramways are indicated crossing the alignment at Market Place, Prince's Dock Street/Humber Dock Street, Railway Street and Porter Street. A brewery/malthouse and several abattoirs are indicated at the western end of the alignment. The Albert Dock has been constructed to the south of the site, as well as two stations. More railway sidings have also appeared and a Cattle Market is present immediately west of Railway Dock and south of the current A63 alignment.
1910-1911	1:10,000 & 1:2,500	No significant changes have occurred throughout the majority of the scheme area. Mytongate Bridge is now marked 'swing bridge' and the residential area in the vicinity of Nile Street and Great Passage Street (now the Mytongate Junction) has been redeveloped.
1926-1938	1:10,000 & 1:2,500	No significant changes.
1948-1949	1:10,000 1:2,500 & 1:1,250	The area previously marked Humber Works is now shared with Humber Lead Works. The redeveloped area between Nile Street and Great Passage Street is shown to contain a dairy and metal works as well as a number of dwellings. Many of the buildings at the western end of the alignment and to the north and south of this area are no longer indicated - some buildings are indicated to be ruined and are possibly an indication of the affects of World War II bombing. The tramways on Porter Street and Market Place are no longer indicated.
1952-1959	1:10,000 1:2,500 & 1:1,250	No significant changes.
1968-1972	1:10,000 1:2,500 & 1:1,250	The Brewery/Malthouse and the remainder of the residential buildings on the western end of the alignment are no longer indicated. A food processing factory is now depicted in place of the Malthouse.
1975-1979	1:10,000 1:2,500 & 1:1,250	Porter Street is in shown to be closed off and the A63 'Hessle Road' has been constructed after the demolition of the remaining buildings along the western end of the alignment including the food processing factory. Myton Place has been demolished and Castle Street, which has been widened to dual carriageway, now extends further west with a new roundabout present at the junction (Mytongate Junction) of Hessle Road, Castle Street, Commercial Road and a third unnamed street to the north that links to Osborne Street. Prince's Dock is now marked as disused and Humber Dock as a marina. William Booth House is indicated adjacent to the new roundabout. Castle Street, between the two docks, has been widened towards the south and covers the area previously occupied by two warehouses.
1983-1987	1:10,000 & 1:1,250	The revetment wall at the northern end of the Humber dock is now indicated. The Docks are now marked as disused. As well as the interchange at Commercial Road, the A63/Queen Street Junction is shown. To the east of the site Myton Swing Bridge is now present.
1988-1989	1:1250	The warehouse at the north-western corner of the Humber Dock has now been demolished and replaced with a hotel. An electrical sub-station is indicated between the hotel and Trinity Burial Ground adjacent to the A63 road. The A63 carriageway now passes through Mytongate Junction as a through-about.
1991-1996	1:10,000 1:2,500 & 1:1,250	No significant changes have occurred along the alignment of the A63. The 1991 section of the map shows the presence of the shopping centre car park at the southern end of Prince's Dock. Prince's Quay Shopping Centre is indicated on the 1992 section of the map.

Information within Table 3.1 obtained from PSSR (PF 2009a)

3.2 Geological Maps and Memoirs

Map and Memoir Coverage

The references for the geological maps relevant to the scheme are shown in Table 3.2.

Table 3.2 – British Geological Mapping Sources

Scale	Sheet No.	Coverage	Published
1:50,000	80	Kingston upon Hull (Solid and Drift)	1983, British Geological Survey
1:10,560	TA02NE	West of the scheme (Solid/Bedrock and Drift/Superficial deposits)	1971, British Geological Survey
1:10,560	TA12NW	East of the scheme (Solid/Bedrock and Drift/Superficial deposits)	1986, British Geological Survey

The following Geological Memoirs are relevant to the area:-

- Geology of the Country around Kingston upon Hull and Brigg, Memoir for 1:50,000 geological sheets 80 and 89. HMSO 1992

Geological Summary

Reference to the available geological maps and historical information indicate that deposits below the site comprise the following:

Made Ground

Made ground is present across the site is likely to be present in many different forms associated with the previous industrial uses, historical structures, the docks and the burial ground.

Superficial Deposits

The made ground is underlain by superficial deposits of the Quaternary Period. The site area is underlain by a series of estuarine alluvial deposits (including peat); which are further underlain by glacial deposits.

Solid Geology

The solid geology below the site comprises Upper Cretaceous bedrock of the Burnham Chalk Formation. This unit is typically in the region of 100m to 150m thick and is predominantly thinly bedded and characterised by continuous tabular and lenticular flints.

3.3 Aerial Photographs

Historical aerial photography was consulted by BACTEC as part of their explosive ordnance threat assessment (BACTEC, 2008). The information contained within the BACTEC report was revisited by EOD Contracts Limited in 2013 prior to the commencement of the ground investigation.

It is not intended to provide a commentary of all of the features and changes evident on the available photographs within this GIR, as this has already been undertaken by Pell Frischmann and is contained within the PSSR and the EAR (PF, 2010).

3.4 Records of Mines and Mineral Deposits

The PSSR (PF, 2009a) states that the site is not affected by any underground coal mining, the Envirocheck reports, 2002 & 2013 indicate the risk due to mining subsidence to be very low. Furthermore the geological memoir indicates that quarrying has taken place within the Cretaceous Chalk; however, this is quarrying is likely to have been undertaken in areas of higher ground where the thickness of superficial deposits is reduced. There are no active or former quarries that have been identified within the vicinity of the scheme. .

3.5 Land Use and Soil Survey Information

The scheme area lies within an urban environment so soil survey information was not deemed to be required.

3.6 Archaeological and Historical Investigations

An Archaeological Deposits Model will be available for the scheme areas, at the time of compilation the Deposits Model has not been finalised, (reference to follow).

3.7 Existing Ground Investigation

Intrusive Ground Investigations

The following sources of ground investigation data were obtained for the scheme prior to undertaking the 2013 ground investigation:

- Factual Site Investigation Report – Allied Exploration and Geotechnical Ltd (AEG), 1994
- Geotechnical Interpretive Report – Acer Consultants, 1995
- Online geological maps provided by the British Geological Survey

The following historical exploratory holes relevant to the scheme are summarised in Tables 3.3 and 3.4. Exploratory holes in 'bold' text are located within the boundaries of the proposed road layout. All other exploratory holes are located outside of the boundary of the current proposed scheme.

Table 3.3 - Exploratory holes from 1994 AEG Ground Investigation

Type	Exploratory hole number
Borehole	BH-01, BH-02, **BH-03**, BH-04, BH-05, **BH-06**, **BH-07**, BH-08, **BH-09**, **BH-10**, BH-11, **BH-12**, **BH-13**, **BH-14**, **BH-15**, BH-16, BH-17, **BH-18**, BH-19, **BH-20**, BH-21, BH-21A, **BH-22**, BH-23, BH-24, BH-25, BH-26, BH-27, BH-28, BH-29, BH-30, BH-31
Trial Pit	TP-01, **TP-02**, **TP-02A**, **TP-03**, TP-04, TP-04A, TP-04A, TP-05, TP-06, TP-07, TP-08, **TT-01**

Table 3.4 - BGS historical borehole records

Type	Exploratory hole number
Borehole	TA02NE73, TA02NE109, TA02NE527, TA02NE528, **TA02NE529**, **TA02NE530**, TA02NE531, TA02NE532, **TA02NE534**, **TA02NE535**, TA12NW638, TA02NE700, TA02NE702, TA02NE813, TA02NE814, **TA02NE815**, **TA02NE816**, TA02NE841, TA02NE862, TA02NE865
Trial Pit	**TA2NE866**, TA02NE869, TA02NE870

3.8 Consultation with Statutory Bodies and Agencies

Throughout the assessment process the Highways Agency (HA) has been committed to an ongoing engagement with the stakeholders and statutory consultees.

Statutory and non-statutory bodies that have been consulted as part of the Environmental Assessment include:

- The Health and Safety Executive
- Hull County Council (HCC)
- Humber Archaeology Partnership (HAP)
- English Heritage
- Natural England
- Environment Agency (EA)
- The Marine Management Organisation
- British Waterways
- Various Health Bodies
- Various Transportation Bodies
- The Crown Estate
- Utility services and regulation bodies
- The relevant emergency service providers

A summary of the consultation undertaken to date is discussed within the EAR (2010).

3.9 Flood Records

Following the advice of the Environment Agency a flood risk assessment was undertaken by Pell Frischmann in 2007. The findings of the Flood Risk Assessment (FRA) are discussed within the Pell Frischmann Flood Risk Assessment Report (ref. W11189/VDH/03). The FRA confirmed that the proposed scheme lies within a Flood Zone 3a of the indicative flood plain.

Further discussions with the Environment Agency, undertaken during Stage 3 of the PCF, indicated that the FRA undertaken in 2007 is out of date and is therefore in need of revision.

It was confirmed in the EAR – Options Selection that the FRA was under revision in conjunction with the current environmental assessment.

3.10 Contaminated Land

A summary of the existing information relevant to the proposed improvements is presented in the Preliminary Sources Study Report (PSSR) produced by Pell Frischmann (PF, 2009a).

A number of potential sources of contaminated land have been identified in and around the Project area. These are detailed in the PSSR (PF, 2009a) and are summarised here.

- Historic potentially contaminating activities within the Project area including: former warehousing; docks; timber yards; saw mill; metal works; the Humber works (brass and copper); Humber lead works; pig market; railway lines; and the disused Trinity Burial Ground.

- Historic potentially contaminating activities within the surrounding area including: docks, dock infrastructure and warehousing, various industrial uses (e.g. chemical works, paint works, oil works), timber yards on Waterhouse Street and various works (e.g. engineering, leather, rubber and warehousing).

- Domestic waste reported within trial pits excavated as part of the previous investigations and located in the vicinity of Commercial Road roundabout.

- Localised strong hydrocarbon odours and black discolouration of soils reported during the previous investigation, immediate north east of the burial ground.

3.11 Other Relevant Information

Hydrology and Hydrogeology

A description of the hydrology and hydrogeology of the area are detailed in the PSSR (PF, 2009a), the EAR (PF, 2010), and the Technical Appraisal Report (HA, 2008). Groundwater monitoring was undertaken during the scheme's previous site investigation (Acer, 1995 and AEG, 1994). The findings have been summarised as follows:

- The nearest surface watercourses are the Humber Estuary, located to the south of the site, and the River Hull which is located to the east of the scheme. Both rivers have flows which are subject to tidal influence.
- There are no surface water abstractions within the scheme area.
- The drift within the scheme has low permeability and negligible significance for water supply or river base flow. The underlying chalk was identified as a Principal Aquifer.
- The scheme area is not situated within a Groundwater Protection Zone. There are four groundwater abstractions for commercial use within 1km of A63 Castle Street, three of which lie within the scheme area (i.e. within 500m).
- The Environment Agency's River Basin Management Plan (RBMP) for the Humber River Basin District identifies the presence of groundwater beneath the site. A significant proportion of drinking water comes from the groundwaters of the chalk and sandstone in this District. Data maps from the RBMP indicate that the quantitative and chemical status of the groundwater underlying the site and surrounding area is poor.
- Groundwater monitoring from the previous site investigation indicated that groundwater levels vary significantly (from 0.2 m to 13.8 m bgl) throughout the scheme area.

Unexploded Ordnance

An assessment of the risk posed from the presence of unexploded ordnance (UXO) was undertaken; a summary of the details from the BACTEC report are presented in the PSSR (2009).

In summary the report considers that there is a risk from unexploded ordnance on the site which applies to both an intrusive ground investigation and also construction work. It indicates that the areas to the west and east of the site are of medium risk, and the remainder is low risk. These levels of risk are based on an evaluation of "the probability of occurrence, the risk of detonation, and the consequences".

4 Field and Laboratory Studies

4.1 Walkover Survey

Prior to the commencement of the site investigation work several site walkover surveys were undertaken. During the walkover survey the engineers recorded details of any features of note within the scheme area. The walkover survey enabled the positioning of proposed exploratory holes in locations that were both practical in terms of access and in close proximity to the proposed scheme.

4.2 Geomorphologic and Geological Mapping

The scheme area lies within an urban environment; as such a geomorphological and geological mapping exercise was not undertaken.

4.3 Ground Investigation

4.3.1 Description of Fieldwork

The 2013 ground investigation was designed specifically to confirm and expand the geotechnical, and hydrogeological findings outlined within the Preliminary Sources Desk Study and the 1994 Ground Investigations. In addition, the investigation also obtained samples to assess the presence of contamination and provided chemical testing results to assist in determining material reuse and disposal requirements.

Table 4.1 – Rational for Scope of Investigation

Site Investigation Element	Investigation Technique Utilised	Rationale
Central Area (underground element)	• Cable percussive boring • Rotary Coring • Trial Pitting • Insitu testing • Permeability testing • Monitoring • Laboratory testing	• Assess buildability of the underground option • To improve understanding of ground conditions and related risks • To improve understanding of groundwater related risks • To locate anomalies/obstruction • To determine likely disposal requirement of excavated material
Investigation for Footbridges		• Determination of foundation type. • To size foundations
Pressuremeter Testing	• Self Boring Pressuremeter to assess large/small strain at depth (>15/20m bgl)	• To provide information on large/small strain stiffness's within the deeper cohesive deposits. • Data for finite element modelling and analysis.
Investigation in West of Mytongate	• Exploratory Holes • Insitu Testing • Monitoring • Laboratory Testing	• To provide information on the ground and groundwater conditions present in the wider area of the scheme.

Site Investigation Element	Investigation Technique Utilised	Rationale
Investigation East of Mytongate	• Exploratory Holes • Insitu Testing • Monitoring • Laboratory Testing	• To provide information on the ground and groundwater conditions present in the wider area of the scheme.
Archaeological element of the Investigation	• Exploratory Holes • Sampling	• To locate archaeological earthworks in the area of the dock thought to be associated with the old city walls • To inform archaeological deposits model.
Investigation of the dock	• Exploratory Holes • Insitu Testing • Monitoring • Laboratory Testing	• To determine the infill properties of the material behind dock walls.
Contamination sampling and testing	• Laboratory Contamination Testing	• To provide information for disposal of material • To assess implications for Human Health during and post construction • To determine presence of contaminants within groundwater
Pumping Test	• Pump Test Hole • Monitoring	• To improve understanding of potential impacts during construction and operation phases. • To determine likely discharge rates during construction dewatering. • To determine potential groundwater contaminant migration during construction dewatering and potential discharge water quality issues.

Exploratory holes relevant to the scheme are summarised in Tables 4.2. Exploratory holes in **bold** are located within the boundaries of the proposed road layout. All other exploratory holes are outside of these boundaries.

Table 4.3 summarises the overall number of holes undertaken for the scheme to date.

Table 4.2 - Exploratory holes from 2013 Ground Investigation

Type	Exploratory hole number
Borehole	**BH01**, BH02, BH03, **BH04**, BH05, **BH06**, **BH07**, BH08, **BH09**, BH10, **BH11**, **BH12**, **BH13**, **BH14**, **BH15**, **BH16**, **BH16A**, BH17, **BH18**, **BH18A**, BH19, **BH19A**, BH20, BH21, BH21A, BH22, **BH23**, BH24, BH25, BH26, BH27, BH28, BH29, BH30, BH30A, BH32, BH33, BH34, BH35, **BH36**, BH37, BH38, BH39, BH40, BH40A, BH41, BH41A, BH42, BH43, BH44, BH45, BH46, BH47
Static cone penetration test (SCPT)	SCPT01, SCPT02, SCPT03, SCPT04, SCPT05, **SCPT06**, **SCPT07**, **SCPT08**, **SCPT09**, SCPT10, **SCPT11**, SCPT12, **SCPT13**, **SCPT14/1**, **SCPT14/2**, SCPT15, SCPT16, SCPT17, **SCPT18/1**, **SCPT18/2**, **SCPT19**, SCPT20, **SCPT21**, **SCPT22**, SCPT23, SCPT24A, SCPT24B, SCPT24C, **SCPT25**, SCPT26, SCPT27, SCPT28, SCPT29, **SCPT30**, SCPT31, **SCPT32**, SCPT33, SCPT34, SCPT35

Type	Exploratory hole number
Window sample	**WS01**, **WS02**, **WS03**, **WS04**, **WS05**, WS06, WS07, **WS08**, WS09, WS10, WS10A, WS11, WS12, WS12A, **WS13**, **WS14**, **WS16**, WS17, WS18, WS19, WS20, WS21, WS22, WS23, WS24, WS25, **WS26**
Trial pit	**TP04**, **TP05**, **TP05A**, **TP11**, TP13, **TP14**, TP16, TP18, TP18A
Self-boring Pressuremeter test (SBPT)	**SBP01**, SBP02, SBP03, **SBP04**
Archaeological SCPTs	A01, A02, A03, A04, A04A, A05, A06, A06A, A07, A08, A09, A09A, A10, A10A

Table 4.3 - Summary of total number of hole undertaken for the scheme.

Type of exploratory hole	Historical	BGS	2013
Borehole	32	20	53
Trial pit	12	3	9
Static cone penetration test	-	-	39
Window sample	-	-	26
Self-boring Pressuremeter test (SBPT)	-	-	4
Archaeological SCPTs	-	-	14

For details of the investigations, including logs, in situ and laboratory testing results, monitoring data etc please refer to the relevant factual ground investigation reports. A detailed summary of all groundwater monitoring is provided in the Groundwater Report (1168-10-223-RE-001-PD1).

4.3.2 Ground Investigation Report

Refer to Geotechnics Limited’s report on Ground Investigation, A63 Castle Street Improvement (October 2013) for all factual information.

4.3.3 Results of In situ tests

Refer to Geotechnics Ground Investigation, A63 Castle Street Improvement (October 2013) for details of the insitu testing undertaken for the scheme. In addition a summary of permeability test results is provided in the Groundwater Report (1168-10-223-RE-001-PD1).

4.4 Drainage Studies

Not Used.

4.5 Geophysical Surveys

Whilst downhole geophysical testing was not undertaken within the bored / cored boreholes, the following geophysical techniques were utilised whilst undertaking the Static Cone Penetration Testing (SCPT) as part of the methods used to form the parametric analysis:

- Seismic Cone Penetration Tests.
- Magnetometer Cone Testing (for UXO clearance).

4.6 Pile Tests

No pile tests were carried during the site investigation phase of the work.

4.7 Other Fieldwork

4.7.1 Aerial Imagery

A LiDAR aerial image was commissioned for the proposed scheme. In addition recent aerial photography of the Hull region is available from on-line resources.

4.7.2 Pumping Test

Due to the expected sub-artesian conditions and high upwards pressures from the chalk groundwater, methods of construction for the proposed Mytongate Junction underpass during feasibility phases considered the possibility of dewatering the top of the chalk. There was insufficient existing information, however, to define parameters required to confirm the impacts of dewatering the junction.

Therefore, Grontmij installed two new boreholes in the chalk and overlying drift close to Mytongate Junction, with a view to test-pumping both boreholes and analysing the results to determine aquifer parameters.

The Pumping Test Report - 1168-10-223-RE-002-PD1 provided detailed information regarding the set up, construction, testing and analysis of this part of the GI.

Two new boreholes were drilled into the chalk (LDBH01) and overlying drift (LDBH02). These are located approximately 30 m southeast of the Mytongate Junction. LDBH01 and LDBH02 are 2.5 m apart. A summary of the borehole details are provided in the table below.

Table 4.4 - LDBH01 and LDBH02 construction details

	LDBH01	LDBH02
Construction Date	26 Nov 13	14 Nov 13
Location (NGR)	509380.4 428334.3	509378.4 428332.9
Ground level (m AOD)	4.674	4.657
Total depth (m bgl)	50	22
Top and bottom of monitored aquifer unit (m bgl)	Chalk (28.6 – 50)	Glacial Till (11.3 - 19)
Monitored interval (m bgl)	32.7 – 50	14 – 18.5
Rest water level (m bgl)	1.48 – 6.31	0.34 – 0.95

Insufficient water was found in the drift horizons during drilling of the drift borehole LDBH02 and therefore a pumping test could not be undertaken from this borehole.

A three day constant rate pumping test was undertaken at LDBH01 by a specialist contractor in December 2013. Several of the GI boreholes were monitored during this period. Analysis of the test data and background monitoring was undertaken to provide an understanding of the interaction between chalk and drift aquifers and between the chalk aquifer and the Humber estuary.

The assessment provided supplementary hydrogeological information for the preliminary design. In addition the information was utilised for the production of the groundwater model required for the Environmental Impact Assessment (EIA) for the scheme.

Refer to the following reports for a detailed discussion of the findings:

- The Groundwater Report - 1168-10-223-RE-001-PD1
- The Pumping Test Report - 1168-10-223-RE-002-PD1
- The Groundwater Modelling Report - 1168-10-223-RE-003-PD1

Note: these reports form appendices to the Road Drainage and Water Environment Chapter of the Environmental Statement (MMGJV, 2014 Reference to be confirmed).

4.7.3 Structural Inspection

A structural inspection survey was undertaken by MMGJV.

The inspection comprised the visual and non-intrusive survey on ten structures of varying age surrounding the Mytongate roundabout.

The purpose of the survey was to visually assess the current exterior and report (any) defects present prior to the commencement of the pumping testing.

A full and detailed discussion of the findings is contained within the MMGJV Structural Inspection Report (September, 2013).

4.7.4 Unexploded Ordnance

During the commissioning of the recent site investigation works it was recognised that there was a requirement to revisit the risks identified in the original desk study.

An Explosive Ordnance Desk Study was commissioned by Geotechnics Ltd and conducted by EOD Contracts Ltd (2013). The purpose of this study was to review the existing BACTEC report in line with the planned geotechnical investigation, and to revisit / refine the mitigation requirements.

Full details of the EOD report are contained within Volume 2 of the Geotechnics Ground Investigation at A63 Castle Street Improvement (October 2013).

The following risk mitigation measures have been extracted from the full report in order to highlight the salient points / measures identified in the report:

- A requirement for UXO safety monitoring of all the “at risk” excavations, including geotechnical or archaeological trial pits.

- Cable Percussive boring and rotary coring should be pre-checked using a magnetometer cone.

- A UXO Safety and Awareness Presentation (Toolbox) should be given to all personnel, undertaking excavation works.

- Static cones should be pre-checked using the magnetometer cone.

- Self boring pressuremeters should be pre-checked using the magnetometer cone.

- Prior to any intrusive piling or drilling commencing, UXO safety testing and appropriate clearance certification into the ground to sufficient depth to provide clearance from UXO.

4.7.5 Contamination Assessment

A contamination assessment formed part of the 2013 Geotechnics site investigation. The information derived from the site investigation was used to update an existing conceptual site model. The site investigation identified several sources of contamination which include (though are not limited to) the following:

- Localised Hydrocarbons.
- Heavy metals and organics.
- Localised areas of asbestos.
- Elevated copper concentrations.
- High conductivity of groundwater.

Refer to the Ground Contamination Assessment 1168-10-211-RE-001 for a full discussion of the findings and interpretation of results.

4.7.8 Future Investigations

To date no ground investigation or archaeological investigation works have been carried out within the Trinity Burial Ground (TBG) due to permission constraints and concern over disturbing human remains.

A future ground investigation is required within Trinity Burial Ground to inform the temporary works design, the permanent works design and the proposed burial ground clearance works.

The ground investigation or archaeological evaluation works within the burial ground would serve to:

- Provide additional data[1] on ground conditions and fill 'gaps' from ground investigations completed to date.
- Inform the design of the westbound diverge slip road.
- Inform the design of the temporary and permanent works within the TBG.
- Provide information on the likely number, depth and condition of the remains to inform the archaeological evaluation and clearance of TBG.

4.8 Laboratory Investigation

4.8.1 Description of tests

Table 4.4 and 4.5 summarise the geotechnical laboratory testing carried out across the scheme. This includes the number of test from all previous investigations.

Table 4.4 – Laboratory Testing undertaken on Soils.

Type of test	No. of tests undertaken	Testing Standard BS 1377
Moisture content	218	BS 1377 (1990) Part 2.3
Atterberg limits	120	BS 1377 (1990) Part 2.4 & 2.5
Particle size distribution (PSD)	51	BS 1377 (1990) Part 2:9
Sedimentation	39	BS 1377 (1990) Part 2:9

[1] Geotechnical, hydrogeological, environmental (contamination) and archaeological

Type of test	No. of tests undertaken	Testing Standard BS 1377
Undrained shear strength		BS 1377 (1990) Part 7
Bulk Density	29	BS 1377 (1990) Part 2
Chemical testing: pH, water soluble sulphate,	262	BS 1377 (1990) Part 3
Organic Matter	20	BS 1377 (1990) Part 3.3
Californian Bearing Ratio (CBR) - recompacted	1	BS 1377 (1990) Part 4.7
One dimensional consolidation	36	BS 1377 (1990) Part 5.3
Quick Undrained Triaxial (single stage)	51	BS 1377 (1990) Part 7.9
Quick Undrained Triaxial (multi-stage)	25	BS 1377 (1990) Part 7.9
Soluble Suplhate, Acid Soluble Sulphate, Total Sulphur, pH	25	BRE Special Digest 1 Suite

Table 4.5 – Laboratory Testing undertaken on Chalk

Laboratory Test	No. of tests undertaken	Testing Standard ISRM
Consolidated Undrained Triaxial Test	14	BS 1377 (1990) Part 8.7
Point load	66	ISRM (1985)
Unconfined Compressive Strength Determination	17	ISRM (1985)

Details of the contamination testing undertaken can be found in the Ground Contamination Assessment 1168-10-211-RE-001 (2014).

4.8.2 Copies of Test Results

Please refer to the ground investigation report listed in section 4.3.2 for laboratory testing results.

5 Ground Summary

5.1 Topography and Land Use

The section of the existing A63 to be improved runs from the former junction with Porter Street in the west (Chainage 0) to just beyond the Market Place Junction in east (Chainage 1250) with the signalised Mytongate Junction (Chainage 450 to 550) located slightly west of the centre of the scheme. The existing dual carriageway and the side roads that join at the Mytongate Junction are generally at grade and constructed at existing ground level that generally varies from 3.0m to 4.5m above ordnance datum (OD).

5.2 Geology

The general geological sequence underlying the scheme is well understood and has been confirmed with thorough an additional extensive ground investigation undertaken in 2013. Whilst the recent investigation was comprehensive, it should be noted that as with any form of investigation techniques there is the potential for localised lateral and vertical variations outside those identified during the investigation.

Geological long sections reference 1168-09-01-DR-004, 1168-09-01-DR-005 and cross section 1168-09-01-DR-015 are included within Section 9 of this report.

Superficial Deposits

The information contained within the 2013 investigation, together with the available geological maps indicates extensive drift deposits are present across the site. The superficial deposits are summarised in table 5.1, and described below:

Made ground

Made ground comprising both granular and cohesive material, is recorded across the full extent of the scheme. The greatest thickness is recorded between Chainage 850 and Chainage 890, near the Humber Docks. Generally the thickness of the made ground is variable across the site, with thicknesses ranging from a minimum of 0.3m to a maximum of 13m. Trial pits undertaken identified old walls, floors and foundations, old service pipes and an old brick culvert between 0.5 and 2.2m depth.

The granular made ground is encountered from the surface to a maximum recorded depth of 13m. The granular made ground has a maximum recorded stratum thickness of 9.2m. Locally multiple granular strata are present interbedded with cohesive made ground.

The granular made ground is typically described as slightly gravelly to very gravelly clayey to silty SAND with occasional cobbles. Gravel is fine to coarse limestone, sandstone, flint, brick and concrete. Cobbles typically comprise chalk, brick or concrete.

The cohesive made ground occurs from the surface to a maximum depth of 12m and has a maximum recorded strata thickness of 8m. Cohesive made ground is typically a soft to firm, slightly sandy to sandy, slightly gravelly to gravelly CLAY.

Cohesive Alluvium

Cohesive alluvium is encountered directly below the made ground, and extends across the whole of the site. The Cohesive Alluvium occurs at a minimum depth of 0.6m to a maximum depth of 15.75m. The thickness of the deposits varies from 0.7m to 11.6m.

The Cohesive Alluvium is described as very soft to soft, locally firm slightly sandy CLAY with some peat pockets and bands of organic material. In some areas the cohesive alluvium is described as sandy SILT. Locally peat and granular alluvium are interbedded within the alluvium.

Granular Alluvium

Granular deposits were encountered mainly towards the eastern extent of the site at chainages over Chainage 600. The granular alluvium was encountered directly under the cohesive alluvium, and was recorded between a minimum depth of 4.1m and a maximum depth of 24.0m. The thickness of the deposit varies between 0.05m and 13.6m. The greatest thickness was in the area of the Humber Docks.

The deposits were described as slightly silty to silty, gravelly SAND and sandy GRAVEL with occasional cobbles. The gravel is of various lithologies including flint and chalk.

Comparison between field descriptions and particle size distribution data confirms that the deposits may be described as slightly silty to silty, gravelly SAND to sandy GRAVEL with occasional cobbles.

Layers of relict Peat and organic lenses were found within the alluvium deposits. These layers are discontinuous and were encountered mainly towards the middle and western extent of the site. The peat, where present, varies between 0.2m and 1.75m at depths ranging from 6.85m to 22.6m.

The peat layers were described as firm brown to black slightly clayey pseudo-fibrous PEAT. Locally the peat was described as soft or very soft.

Cohesive Glacial Till

Glacial Till was encountered directly below the alluvium, and extended under the majority of the site, excluding the area of the Humber Docks where it was noted to be absent. It was encountered between a minimum depth of 8.2m and a maximum depth of 23.5m. The individual layer thickness varied between 0.4m and 6.75m.

The cohesive glacial till is described as firm to stiff slightly sandy to sandy slightly gravelly to gravelly CLAY. The gravel is fine to medium of chalk and some flint.

Glaciolacustrine

Glaciolacustrine deposits comprising firm to stiff thinly laminated slightly sandy CLAY are found extensively across the site typically underlying the glacial till but occasionally immediately underlying the alluvium. The deposits were encountered between a minimum depth of 13.3m, and a maximum depth of 26.6m, with a thickness of between 3.4m and 9.7m. The greatest thickness of the deposits is towards the middle and western side of the site. Generally the deposit thins towards the east.

Fluvio-Glacial

The Fluvio-Glacial deposits described as silty to very silty gravelly SAND to sandy GRAVEL (gravel is of chalk and flint) overlay the chalk bedrock across the majority of the site with the greatest thickness towards to eastern end of the site. The deposits are encountered between a minimum depth of 19 m and a maximum depth of 33.6 m and vary in thickness between 0.96m and 9.6m.

Solid Geology

Chalk

The site is underlain by sedimentary deposits of Cretaceous age – the Burnham Chalk Formation. This unit is typically between 100 m to 150 m thick. It is described as predominantly thinly bedded with tabular and lenticular flints.

The bedrock was encountered across the site. A layer of weathered chalk overlaying more intact chalk is characteristic of the upper horizon. The weathered chalk is present from a minimum recorded depth of 20.6

m (-17.94 m OD) in Borehole BH04 to a maximum depth of 33.6 m (-28.96 m OD) in Borehole BH45. The maximum recorded thickness of weathered chalk is 9 m, and the average thickness is 4.6 m.

The weathered chalk described as structureless ranges in strength from very weak to medium. It is generally recovered as strong sub-angular to angular gravel and cobbles. Flints are recorded throughout.

Structure

There are no known geological feature (faulting, dissolution etc) indicated within the available published maps or memoirs.

Table 5.1 – Summary of the general strata and units underlying the site.

Stratum	Unit	Notes
Made Ground	Cohesive *Clay and ash fill*	Variable compositions across the scheme
	Granular *Gravel of brick, concrete, mixed natural rock*	
Superficial - Alluvium	Cohesive Alluvium *Clay and silt*	Continuous across the site
	Granular Alluvium *Sand and gravel*	Not found to be present west of Mytongate Junction
	Relic Peat & Organic Lenses	Discontinuous Lenses The peat is seen as a firm consolidated layer rather than the familiar compressible material.
Superficial - Glacial	Glacial Till *Sandy gravelly clay*	Continuous west of Mytongate potential discontinuous further east
	Glaciolacustrine *Laminated clay and silt*	Continuous layer to the west of Mytongate, and discontinuous further east
	Fluvio-Glacial *Chalk gravel with sand*	Relatively continuous
Bedrock	Chalk	Continuous, weathered in upper few meters,

Stratum	Unit	Notes
		undulating rock head level. Cretaceous Chalk of the Burnham Chalk Formation. This unit is typically in the region of 100 to 150m thick and is predominantly thinly bedded and characterised by continuous tabular and lenticular flints

5.3 Hydrology

For details of the hydrology regime across the scheme area refer to Chapter 11 of the Environmental Statement Scoping Report (MMGJV, 2013).

5.4 Hydrogeology

Refer to the following reports for a detailed discussion of the findings:

- The Groundwater Report - 1168-10-223-RE-001-PD1.
- The Pumping Test Report - 1168-10-223-RE-002-PD1.

Monitoring data and hydrographs are presented in the above reports. Groundwater strikes are presented in Appendix B.

During the GI and subsequent post site work monitoring groundwater has been found in all of the main geological layers. Observations, permeability testing and supporting desk study show that the hydrogeology of the main strata can be summarised as follows: -

Made ground – **Aquifer** or **aquitard** depending on material composition (commonly dry but with some perched groundwater).

Cohesive alluvium – **Aquitard**

Granular alluvium – **Aquifer**

Glacial till – **Aquitard**

Glaciolacustrine deposits – **Aquitard**

Fluvio-glacial deposits – **Aquifer**

Chalk – **Aquifer**

In reality the geological sequence and hydrogeology across the Project footprint is more complex.

Other than the made ground, the permeable superficial deposits are generally confined though there may be some localised unconfined units.

Groundwater Levels

The groundwater levels recorded during the GI and subsequent monitoring are presented in the form of hydrographs, and discussed in detail in the Groundwater Report (report no. 1168-10-223-RE-001-PD1,). The text below summarises the main findings.

Made ground water levels were only monitored at two boreholes and typically ranged from 2.5 to 3.0 m AOD. The nature of the made ground suggests that perched aquifers are laterally and possibly vertically discontinuous, but this cannot be confirmed from the limited data currently available.

Groundwater heads within the natural superficial deposits overlying the fluvio-glacial deposits are typically between -0.5 and 1.5 m AOD. Within the fluvio-glacial deposits, which directly overlie and are in hydraulic continuity with the Chalk, the range is typically -1 to 2.5 m AOD due to the tidal impact. For comparison, ground level is around 3 m AOD.

Groundwater heads in the granular alluvium generally, but not always, show a small tidal impact. This increases towards the eastern end of the construction footprint (particularly in BH46, where the diurnal range in water level was up to 0.4 m), which suggests a degree of hydraulic continuity with the tidal River Hull.

Water levels in some boreholes with response zones in cohesive alluvium also exhibit a very small, measurable tidal response (0.1m or less), but water levels in others do not. If present, the tidal response seen in the superficial deposits (other than the fluvio-glacial layer, which is in direct hydraulic continuity with the underlying Chalk) is always dampened and delayed in comparison to that seen in the Chalk.

The hydrographs presented in the Groundwater Report (report no. 1168-10-223-RE-001-PD1) for the superficial deposits boreholes do not show any obvious groundwater level response to individual rainfall events, possibly because the monitoring coincided with a relatively dry period and/or because most of the superficial deposits are confined.

Chalk groundwater heads have typically varied between -1.5 and 2.5 m AOD over the monitoring period. The most significant impact on groundwater heads has been the mixed semi diurnal tidal impact from the Humber Estuary, with the groundwater heads fluctuating by up to 3m during spring tides and 1.5m during neap tides. Groundwater in the Chalk rose by around 4m during the tidal surge event which occurred on 5 December 2013.

The lag time between tides in the Humber Estuary and the tidal variations seen in the Chalk within the Project footprint has been measured between 48 and 63 minutes. Variations in the tidal lag show that there is anisotropy within the Chalk.

The current dataset does not show any obvious responses to rainfall events. Although this may be because there were no major rainfall events in Hull during the monitoring period, it is more likely to be because the Chalk is strongly confined beneath Hull, with recharge largely occurring over the Chalk outcrop in the Yorkshire Wolds, some distance from the Project.

Groundwater Flow

Monitoring to date does not indicate a measurable hydraulic gradient in any of the superficial deposits, except in the granular alluvium across the eastern part of the construction footprint. Here, the hydraulic gradient (and groundwater flow) appears to have an east to west component.

In general, the local hydraulic gradient in the Chalk is slightly to the north during high tide, and more or less flat during low tide. Monitoring to date does not indicate that there is a regional hydraulic gradient within the Chalk, although the groundwater model (see Groundwater Modelling Report, 1168-10-223-RE-003-PD1) suggests that groundwater flow is to the south, towards the Humber Estuary.

Depending on the state of the tide, between aquifer units, there is either no vertical hydraulic gradient between the superficial deposits and the Chalk, or a slight downwards hydraulic gradient. The data suggests that leakage between aquifer units is minimal except where the more impermeable superficial deposits thin towards the eastern end of the construction footprint.

Groundwater quality sampling is summarised in the Ground Contamination Assessment 1168-10-211-RE-001 (2014).

5.5 Geomorphology

Not Used.

5.6 Man-made features

The principal man-made features that are affected by the scheme are as follows:

- The proposed westbound carriageway and associated footpath encroaches on land that was formerly a dock between Chainage 770 and Chainage 910, in these area alterations to the wall forming the historical dock boundary will be required.

- The proposed horizontal alignment of the mainline deviates from the existing alignment between Chainage 350 and Chainage 1050 where the proposed alignment is south of the existing alignment and encroaches on to the land currently forming the Trinity Burial Ground. It is proposed to clear this section of the burial ground prior to the commencement of construction works.

The following services are known to exist along the scheme:

- Open reach Equipment.
- Kingston Communications.
- National Power grid (L.V, 11 kV).
- Northern Gas Networks.
- Water.
- Sewerage.

Details of the anticipated utilities within the site area are shown in Table UT1 in Section 7.

5.7 Historical Development

Refer to Section 3.1.

5.8 Obstructions

Obstruction encountered during the site investigation was as follows:

- Shallow foundations and buried structures around William Booth House
- Buried basement / foundations encountered in trial pits within the Mytongate roundabout.

6 Ground Conditions

The geotechnical properties for the superficial materials are summarised in this section, 'Ground Conditions'. Ground conditions are summarised in Section 5 with test results presented in the Geotechnics Limited's report on Ground Investigation, A63 Castle Street Improvement (October 2013).

6.1 Topsoil

A thin cover of topsoil is present across isolated areas of the site, generally between 0.1 and 0.2m thick. There was no laboratory geotechnical testing undertaken for topsoil as it is anticipated that any topsoil present beneath the area will be removed prior to construction.

6.2 Made Ground

Table 6.1 – Summary of testing on Granular Made Ground

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	28	0 to >50 (17 Average)

Made ground, both granular and cohesive, has been encountered across the full extent of the area. It is present in the most significant thicknesses at between Chainage 850 and Chainage 900, near the Humber Docks. The thickness of the made ground is variable across the site, ranging from a minimum of 0.6m to a maximum of 13m. Trial pits have identified old walls, floors and foundations, old service pipes and an old brick culvert within the made ground between 0.5 m bgl and 2.2 m bgl.

The granular made ground occurs from the surface to a maximum recorded depth of 13m. The granular made ground has a maximum recorded stratum thickness of 9.2m although on occasion multiple granular strata are interbedded with cohesive made ground. Between Ch. 850 and Ch. 900 three layers of granular made ground are present, interbedded with two layers of cohesive made ground. The top layer of granular made ground is present from the surface to a maximum depth of 1.2m. The middle layer of granular made ground is present from a minimum depth of 0.6 m to a maximum depth of 9.8 m, with thickness ranging from 0.2m to 9.2m. The bottom layer of granular made ground is present from a minimum depth of 7.8m to a maximum depth of 13m, with thickness ranging from 0.2m to 1m.

Field descriptions confirm that the granular made ground is typically a slightly to very gravelly clayey to silty SAND with occasional cobbles. Gravel is fine to coarse limestone, sandstone, flint, brick and concrete. Cobbles typically comprise chalk, brick or concrete.

SPT 'N' Values indicate that the material is generally medium dense. The results are presented in figure 6.2.1 ; they indicate a highly variable material and show no obvious variation with depth.

Based moderately conservatively on the SPT *N* values, a characteristic friction angle, φ' of 31 degrees has been selected. The friction angle has been derived using the empirical relationship with SPT 'N' from Peck et al (1974). All characteristic values are moderately conservative and derived by a statistical method, which takes the characteristic value of a set of data as the mean value minus the standard deviation multiplied by a factor dependant on the number of values in the data set.

The modulus of elasticity has been derived based on empirical relationships with SPT 'N' contained within Ciria Report 143 (1995), where *E'* is shown to be 1.0 N (MN/m^2) for granular material. On this basis an *E'* of 13.6 MN/m^2 was considered to be an appropriate characteristic value.

Due to the limited geotechnical information available, a unit weight, γ, of 19 kN/m^3 has been selected for the granular made ground, based on published values (Barnes, 2000).

Table 6.2 – Summary of testing on Cohesive Made Ground

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	46	0 to 12 (average 4)
Laboratory:		
Particle Size Distribution (PSD)	2	See text
Moisture Content	17	26 to 64 % (average 38%)
Atterberg Limits	15	LL: 26 to 86 % (average 44%) PL: 17 to 28 % (average 22%) PI: 17 to 37 % (average 23%)
Triaxial test	14	20 to 40 kN/m^2 (average 29 kN/m^2)
Bulk Density	10	1.73 to 1.97 Mg/m^3 (average 1.89 Mg/m^3)
Oedometer Test	4	M_v: 0.12 to 0.97 m^2/MN (average 0.50 m^2/MN) C_{v90}: 3.0 to 16.9 m^2/year (average 8.11m^2/year)

The cohesive made ground occurs from the surface to a maximum depth of 12 m and has a maximum recorded strata thickness of 10.5 m.

Between Ch. 850 and Ch. 900 two layers of cohesive made ground are present, interbedded between three layers of granular made ground. The upper layer of cohesive made ground is present from a minimum depth of 0.1 m to a maximum depth of 6.5 m, and is between 0.5 and 6.1m thick. The lower layer of cohesive made ground is present between a minimum depth of 6.7 m to a maximum depth of 12 m, and ranges in thickness from 0.1 m to 5.3 m.

Comparison between field descriptions and particle size distribution data confirms that the cohesive made ground is typically a slightly gravelly to gravelly slightly sandy to sandy CLAY with a low cobble content in some areas. Cobbles typically comprise chalk, brick or concrete.

The laboratory testing indicates the material is typically low strength. The results are presented in figure 6.2.2. They show no obvious variation with depth.

Atterberg limit tests on the cohesive made ground indicate a plasticity range from low to very high, with the majority of the results falling into the intermediate category, as shown in figure 6.2.3. Plasticity index results are summarised in figure 6.2.4, and are generally between 15 and 25 % and do not vary with depth.

Based on a moderately conservative plasticity index, a characteristic friction angle, ϕ' of 27 degrees has been selected. The friction angle has been derived from an empirical relationship between angle of friction and plasticity index for cohesive soils (Gibson, 1953).

The modulus of elasticity has been derived based on empirical relationships with SPT 'N' contained within Ciria Report 143 (1995), where E' is approximated to be equal to 0.9N (MN/m^2) and E_u is approximated to be 1.1N (MN/m^2) for cohesive soils. On this basis an E' of 1.96 MN/m^2 and an E_u of 2.40 MN/m^2 were considered to be appropriate characteristic values.

The undrained shear strength, c_u, was derived from a combination of the results from the triaxial tests, the SCPT pressuremeter tests, the SBPM tests and the SPTs as shown in figure 6.2.5. The triaxial, SCPT and SBPM testing all gave direct results in terms of c_u, while c_u was derived from the SPT '*N*' values using the empirical relationship given by Stroud (1974). The characteristic c_u was derived using a statistical approach for all of these results combined, and on this basis a value of 16kN/m^2 has been deemed to be appropriate.

Based on the results from the laboratory bulk density shown in figure 6.2.6 testing a characteristic value of 19 kN/m^3 has been derived.

Oedometer tests gave results for the coefficient of volume compressibility, m_v, and the coefficient of consolidation, C_v as shown in figures 6.2.7 and 6.2.8 respectively. Characteristic values were derived statistically from these results, giving an m_v of 0.61 m^2/MN and a C_{v90} of 10.1 m^2/year.

6.3 Superficial and Solid

Cohesive Alluvium

Table 6.3 – Summary of testing on Cohesive Alluvium

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	188	0 to 19 (2 average)
Permeability (falling head test)	3	7.43E-07 to 2.68E-06 (Average 1.39E-06) *k*
Permeability (constant head test)	5	9.36E-06 to 1.81E-05 (Average 1.15E-05) *k*
Laboratory:		

Type of Test	No. of tests undertaken	Results
Particle Size Distribution (PSD)	7	See text
Moisture Content	75	23 to 68% (39% average)
Atterberg Limits	59	LL: 27 to 78 % (average 42%) PL: 19 to 38 % (average 22%) PI: 13 to 48 % (average 21%)
Triaxial Test	91	1 to 47 kN/m^2 (average 21 kN/m^2)
Bulk Density	46	1.2 to 2.62 Mg/m^3 (average 1.82 Mg/m^3)
Oedometer	23	M_v: 0.14 to 3.67 m^2/MN (average 0.90 m^2/MN) C_{v90}: 0.8 to 31.5 $m^2/year$ (average 7.7$m^2/year$)

Cohesive alluvium is present beneath the made ground across the whole of the site. The cohesive alluvium occurs at a minimum depth of 0.6 m to a maximum depth of 15.75 m. The thickness of the stratum varies from 0.7 to 11.6m, although on occasion peat and granular alluvium strata are present interbedded with the cohesive alluvium.

Field logs generally describe the deposits as very soft to soft, locally firm slightly sandy CLAY with some peat pockets and bands of organic material. In some areas the cohesive alluvium is described as sandy SILT.

Comparison between field descriptions and particle size distribution data shows that all of the cohesive alluvial deposits may be described as slightly sandy CLAY/SILT. It is slightly gravelly in some areas.

Laboratory testing indicates that the material is generally very low strength to low strength, locally medium strength. The results are shown in figures 6.3.1 to 6.3.3, and show a medium strength/firm crust at the top of the alluvium, as well as a slight stiffening of the very low strength material with depth.

The results of permeability testing are shown in figure 6.3.11. The tests gave a minimum permeability of 7.43E-07 and a maximum permeability of 1.81E-05. The results indicate that the material has a low degree of permeability.

Atterberg limit tests on the cohesive alluvium indicate a plasticity range from low to very high, with the majority of the results falling into the intermediate category, as shown in figure 6.3.4. Plasticity index results are summarised in figure 6.3.5, and are generally between 10 and 30 % and do not vary with depth.

Based moderately conservatively on plasticity index, a characteristic friction angle, ϕ' of 28 degrees has been selected. The friction angle has been derived from an empirical relationship between angle of friction and plasticity index for cohesive soils (Gibson, 1953).

The modulus of elasticity has been derived based on a relationship with undrained shear strength, where E' has been approximated to be 100C_u (MN/m^2) (Yandzio, 1998) and E_u has been approximated to be 1.25 E'. It was found that elasticity of the cohesive alluvium was significantly different above and below a depth of approximately 8 m, and correspondingly different characteristic values were derived for above and below 8 m bgl. At greater than 8 m bgl the elasticity was found to increase linearly with depth. On this basis an E' of

0.80 MN/m^2 for above 8 m bgl was considered to be an appropriate characteristic value. Below 8 m bgl a characteristic relationship with depth was derived of *E'* equals 0.80 MN/m^2 plus an increase of 0.4 MN/m^2 for every metre increase in depth. Similarly an E_u of 1.00 MN/m^2 for above 8 m bgl was selected as the characteristic value. Below 8 m bgl a characteristic relationship with depth was derived of E_u equals 1.00 MN/m^2 plus an increase of 0.5 MN/m^2 for every metre increase in depth.

The undrained shear strength, c_u, was derived from a combination of results from triaxial tests, SCPT pressuremeter testing, SBPM testing and the SPT tests as shown in figures 6.3.6 and 6.3.7. The triaxial, SCPT and SBPM testing all gave direct results in terms of c_u, while c_u was derived from the SPT '*N*' values and using the empirical relationship given by Stroud (1974). A Characteristic c_u was derived for above 8 m bgl, and, as with the elasticity, a characteristic relationship of c_u increasing with depth was derived for below 8 m bgl. On this basis a c_u of 8 kN/m^2 for above 8 m bgl was considered to be an appropriate characteristic value. Below 8 m bgl a characteristic relationship with depth was derived of c_u equals 8 kN/m^2 plus an increase of 4 kN/m^2 for every metre increase in depth.

Based on the results from the laboratory bulk density testing (figure 6.3.8) a characteristic value of 18 kN/m^3 has been derived.

Oedometer tests gave results for the coefficient of volume compressibility, m_v, and the coefficient of consolidation, $C_{v,}$ as shown in figures 6.3.9 and 6.3.10 respectively. Characteristic values were derived statistically from these results, giving an m_v of 1.03 m^2/MN and a C_{v90} of 8.9 m^2/year.

Granular Alluvium

Table 6.4 – Summary of testing on Granular Alluvium

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	113	1 to >50 (average 19)
Permeability (falling head test)	1	1.01E-05 *k*
Permeability (constant head test)	15	1.05E-05 to 4.57E-05 (Average 2.40E-05) *k*
Laboratory:		
Particle Size Distribution (PSD)	16	See text

Granular alluvium deposits were encountered mainly in the eastern side of the site, underlying the cohesive alluvium at chainages greater than about 600m. It was found between a minimum depth of 4.1 m and a maximum depth of 24.0 m. The thickness of the deposit, where present, varies between 0.05m and 13.6m, and is at its thickest in the area of the Humber Docks.

The deposits were described as slightly silty to silty, gravelly SAND to sandy GRAVEL with occasional cobbles. The gravel is of various lithologies including flint and chalk.

Comparison between field descriptions and particle size distribution data confirms that the deposits may be described as slightly silty to silty, gravelly SAND to sandy GRAVEL with occasional cobbles.

SPT 'N' values indicate that the material is generally medium dense. The results are presented in figure 6.4.1 and show an increase in density with depth.

The results of the permeability testing are shown in figure 6.4.2. The tests gave a minimum permeability of 1.01E-05 and a maximum permeability of 4.57E-05. The results indicate that the material has a low degree of permeability.

Based moderately conservatively on the SPT *N* values, a characteristic friction angle, ϕ' of 31 degrees has been selected. The friction angle has been derived using the empirical relationship with SPT 'N' from Peck et al (1974).

The modulus of elasticity has been derived based on empirical relationships with SPT 'N' contained within Ciria Report 143 (1995), where *E'* is approximated to be 1.0N (MN/m^2) for granular material. On this basis an *E'* of 13.7MN/m^2 was considered to be an appropriate characteristic value.

Due to the limited geotechnical information available, a unit weight, γ, of 19 kN/m^3 has been selected for the granular made ground, based on published values (Barnes, 2000).

Relic Peat and Organic Lenses

Table 6.5 – Summary of testing on Relic Peat and Organic Lenses

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	7	5 to 34 (18 average)
Laboratory:		
Moisture Content	4	81 to 190 % (117 % average)
Atterberg Limits	3	LL: 38 to 48 % (average 44 %) PL: 25 to 36 % (average 29 %) PI: 22 to 50 % (average 35 %)
Triaxial Test	10	35 to 50 kN/m^2 (average 43 kN/m^2)
Bulk Density	3	1.27 to 1.41 Mg/m^3 (average 1.33)
Oedometer	1	M_v: 0.37 to 0.65 m^2/MN (average 0.48 m^2/MN) C_{v90}: 0.8 to 7.8 m^2/year (average 3.8 m^2/year)

Layers of Relic Peat and organic lenses were encountered within the alluvium deposits. These layers are discontinuous and were encountered mainly in the middle and western areas of the site. The peat layers, where present, vary between 0.2m and 1.75m thickness and were encountered at depths ranging from 6.85 m to 22.6 m.

Throughout the majority of the site the peat layers were described as firm brown to black slightly clayey pseudo fibrous PEAT. However in some boreholes up to a chainage of 500 m the peat is described as soft or very soft.

SPT 'N' values indicate that the material is generally medium dense. The results are presented in figure 6.5.1 and show that the peat has been compacted to a reasonable density.

Atterberg limit tests on the peat indicate an intermediate plasticity, with all the results shown to be clayey, as shown in figure 6.5.2. Plasticity index results are summarised in figure 6.5.3, and are between 20 and 50 %.

Based moderately conservatively on plasticity index, a characteristic friction angle, ϕ' of 20.5 degrees has been selected. The friction angle has been derived from an empirical relationship between angle of friction and plasticity index for cohesive soils (Gibson, 1953).

The modulus of elasticity has been derived based on empirical relationships with SPT 'N' contained within Ciria Report 143 (1995), where E' is approximated to be 0.9N (MN/m^2) and E_u is approximated to be 1.1N (MN/m^2) for cohesive material. On this basis an E' of 5.74 MN/m^2 and an E_u of 7.01 MN/m^2 were considered to be appropriate characteristic values.

The undrained shear strength, c_u, was derived from a combination or the results from triaxial tests, SCPT pressuremeter tests, SBPM tests and SPT tests, as shown in figure 6.5.4. The triaxial, SCPT and SBPM testing all gave direct results in terms of c_u, while c_u was derived from the SPT '*N*' values and using the empirical relationship given by Stroud (1974). The Characteristic c_u was derived using a statistical approach for all of these results combined, and on this basis a value of 38 kN/m^2 has been deemed to be appropriate.

Based on the results from the laboratory bulk density testing (Figure 6.5.5) a characteristic value of 13 kN/m^3 has been derived.

Oedometer tests gave results for the coefficient of volume compressibility, m_v, and the coefficient of consolidation, C_v, as shown in figures 6.5.6 and 6.5.7 respectively. Characteristic values were derived statistically from these results, giving an m_v of 0.56 m^2/MN and a C_{v90} of 6.36 m^2/year.

Cohesive Glacial Till

Table 6.6 – Summary of testing on (cohesive) Glacial Till

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	45	10 to 42 (25 average)
Permeability (falling head test)	4	1.77E-07 to 1.41E-06 (average 4.85E-07) *k*
Permeability (constant head test)	5	3.03E-06 to 7.00E-06 (average 2.53E-07) *k*
Laboratory:		
Particle Size Distribution (PSD)	10	See text
Moisture Content	14	12 to 28 % (19% average)

Type of Test	No. of tests undertaken	Results
Atterberg Limits	12	LL: 39 to 73 % (average 47 %) PL: 15 to 25 % (average 21 %) PI: 11 to 26 % (average 16 %)
Triaxial Test	21	21 to 315 kN/m^2 (average 180 kN/m^2)
Bulk Density	18	2.05 to 2.27 Mg/m^3 (average 2.19 Mg/m^3)
Oedometer	4	M_v: 0.10 to 1.48 m^2/MN (average 4.40 m^2/MN) C_{v90}: 4.4 to 30.1 m^2/year (average 12.2m^2/year)

Glacial till deposits were found to be present and underlying the alluvium in the majority of the site and only not encountered in the region of the Humber Docks. The glacial till was encountered between a minimum depth of 8.2 m and a maximum depth of 23.5 m , with the thickness of the layer varying between 0.4m and 6.75m.

The glacial till is predominantly cohesive, and field logs describe the deposits as firm to stiff slightly sandy to sandy slightly gravelly to gravelly CLAY. The gravel is fine to medium of chalk and some flint.

Comparison between field descriptions and particle size distribution data shows that glacial till is in fact firm to stiff slightly sandy to sandy slightly gravelly to gravelly SILT.

Laboratory testing indicates that the material is generally medium to very high strength. The results are presented in figure 6.6.1 and show no apparent relationship with depth.

The results of permeability testing are shown in figure 6.6.8. The tests gave a minimum permeability of 1.77E-07 and a maximum permeability of 7.00E-06. The results indicate that the material has a low degree of permeability.

Atterberg limit tests on the glacial till indicate a plasticity range from intermediate to very high, with the majority of the results falling into the intermediate category, as shown in figure 6.6.2. Plasticity index results are summarised in figure 6.6.3, and are generally between 10 and 20 % and do not vary with depth.

Based moderately conservatively on plasticity index, a characteristic friction angle, ϕ' of 29 degrees has been selected. The friction angle has been derived from an empirical relationship between angle of friction and plasticity index for cohesive soils (Gibson, 1953).

The modulus of elasticity has been derived based on a relationship with undrained shear strength, where E' has been approximated to be 400C_u (MN/m^2) (Yandzio, 1998) and E_u has been approximated to be 1.25 E'. On this basis an E' of 45.6MN/m^2 and an E_u of 57.0 MN/m^2 were considered to be appropriate characteristic values.

The undrained shear strength, c_u, was derived from a combination of the results from triaxial tests, SCPT pressuremeter tests, SBPM tests and SPT tests, as shown in figure 6.6.4. The triaxial, SCPT and SBPM testing all gave direct results in terms of c_u, while c_u was derived from the SPT '*N*' values and using the empirical relationship given by Stroud (1974). On this basis a value of 114 kN/m^2 has been deemed to be appropriate.

Based on the results from the laboratory bulk density testing (figure 6.6.5) a characteristic value of 22 kN/m^3 has been derived.

Oedometer tests gave results for the coefficient of volume compressibility, m_v, and the coefficient of consolidation, C_v, as shown in figures 6.6.6 and 6.6.7 respectively. Characteristic values were derived statistically from these results, giving an m_v of 0.56 m^2/MN and a C_{v90} of 15.1 $m^2/year$.

Glaciolacustrine

Table 6.7 – Summary of testing on Glaciolacustrine

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	92	9 to 37 (22 average)
Laboratory:		
Particle Size Distribution (PSD)	1	See text
Moisture Content	29	18 to 31 % (26 % average)
Atterberg Limits	24	LL: 36 to 56 % (average 45 %) PL: 13 to 42 % (average 21 %) PI: 15 to 32 % (average 23 %)
Triaxial Test	58	31 to 128 kN/m^2 (average 74 kN/m^2)
Bulk Density	31	1.95 to 2.09 Mg/m^3 (average 2.03 Mg/m^3)
Oedometer	3	M_v: 0.08 to 1.28 m^2/MN (average 0.39 m^2/MN) C_{v90}: 9.7 to 65.1 $m^2/year$ (25.0 $m^2/year$)

Glaciolacustrine material is present across the entire site area, typically underlying the glacial till but occasionally immediately underlying the alluvium. The glaciolacustrine was found between a minimum depth of 13.3 m and a maximum depth of 26.6 m, with a thickness of between 3.4m and 9.7m. The stratum is at its thickest in the middle and western side of the site, becoming thinner towards the east.

Field logs typically describe the material as firm to stiff thinly laminated slightly sandy CLAY with occasional sand and silt partings. In some areas the material is slightly gravelly slightly sandy CLAY.

The single particle size distribution test confirms the Glaciolacustrine to be slightly sandy CLAY.

Laboratory testing indicates that the material is generally medium strength. The results are presented in figure 6.7.1 and show no apparent relationship with depth.

Atterberg limit tests on the glaciolacustrine indicate a plasticity range from intermediate to high, with the majority of the results falling into the intermediate category, as shown in figure 6.7.2. Plasticity index results are summarised in figure 6.7.3, and are generally between 15 and 30 % and do not vary with depth.

Based moderately conservatively on plasticity index, a characteristic friction angle, ϕ', of 28 degrees has been selected. The friction angle has been derived from an empirical relationship between angle of friction and plasticity index for cohesive soils (Gibson, 1953).

The modulus of elasticity has been derived based on a relationship with undrained shear strength, where *E'* has been approximated to be $400C_u$ (MN/m^2) (Yandzio, 1998) and E_u has been approximated to be 1.25 *E'*. On this basis an *E'* of 28.0 MN/m^2 and an E_u of 35.0 MN/m^2 were considered to be appropriate characteristic values.

The undrained shear strength, c_u, was derived from a combination or the results from triaxial tests, SCPT pressuremeter tests, SBPM tests and SPT tests, as shown in figure 6.7.4. The triaxial, SCPT and SBPM testing all gave direct results in terms of c_u, while c_u was derived from the SPT '*N*' values and using the empirical relationship given by Stroud (1974). On this basis a value of 70 kN/m^2 has been deemed to be appropriate.

Based on the results from the laboratory bulk density testing (figure 6.7.5) a characteristic value of 20 kN/m^3 has been derived.

Oedometer tests gave results for the coefficient of volume compressibility, m_v, and the coefficient of consolidation, C_v, as shown in figures 6.7.6 and 6.7.7 respectively. Characteristic values were derived statistically from these results, giving an m_v of 0.57 m^2/MN and a C_{v90} of 41.4 $m^2/year$.

Fluvio-glacial

Table 6.8 – Summary of testing on Fluvio-glacial

Type of Test	No. of tests undertaken	Results
In situ:		
Standard Penetration Test (SPT)	94	7 to >50 (36 average)
Laboratory:		
Particle Size Distribution (PSD)	15	See text

Fluvio-glacial deposits overlay the chalk bedrock across the majority of the site and are thickest towards the east end of the site. It is encountered between a minimum depth of 19.0 m and a maximum depth of 33.6 m and varies in thickness, where encountered, between 0.9m and 9.6m.

Comparison between field descriptions and particle size distribution data confirms that the fluvio-glacial deposits may be described as silty to very silty gravelly SAND to sandy GRAVEL. Gravel is fine to coarse predominantly chalk and some flint.

SPT 'N' values indicate that the material is generally dense. The results are presented in figure 6.8.1 and show no apparent relationship with depth.

Based conservatively on the SPT *N* values, a characteristic friction angle, ϕ' of 34 degrees has been selected. The friction angle has been derived using the empirical relationship with SPT 'N' from Peck et al (1974). All characteristic values were derived following the statistical procedure set out in Eurocode EN 1990, which takes the characteristic value of a set of data as the mean value minus the standard deviation multiplied by a factor dependant on the number of values in the data set.

The modulus of elasticity has been derived based on empirical relationships with SPT 'N' contained for over-consolidated sands, where *E'* is approximated to be 1.8+0.75N (MN/m^2) (Yandzio, 1998). On this basis an *E'* of 35.5 MN/m^2 was considered to be an appropriate characteristic value.

Due to the limited geotechnical information available, a unit weight, γ, of 19 kN/m^3 has been selected for the granular made ground, based on published values (Barnes, 2000).

Table 6.9 – Summary of Soil Parameters

Stratum	Material Parameter	Characteristic Value	Rationale	Reference
Made Ground (granular)	Unit weight (kN/m^3)	19	Published value	Barnes (2000)
	Angle of friction, φ (°)	31	Moderately conservative value derived statistically from SPT results	Peck et al (1974)
	Drained stiffness, *E'* (MN/m^2)	13.6	Moderately conservative value derived statistically from SPT results	CIRIA 143 (1995)
	Earth pressure coefficient, k_0	0.485	1-sinφ	Jaky (1948)
	Poisson's ratio, μ	0.3	Engineering Judgement	
Made Ground (cohesive)	Unit weight (kN/m^3)	19	Average value derived from bulk density tests on samples	
	Undrained shear strength, C_u (kN/m^2)	16	Moderately conservative value derived from combined SPT, SBPM, SCPT and triaxial test results	
	Angle of friction, φ (°)	27.4	Moderately conservative value derived statistically from plasticity index.	Gibson (1953)
	Cohesion, *c'* (kN/m^2)	0	Conservative assumption	
	Coefficient of volume compressibility, m_v (m^2/MN)	0.61	Moderately conservative value derived statistically from oedometer results	
	Coefficient of consolidation, C_{v90} (m^2/year)	10.1	Moderately conservative value derived statistically from oedometer results	
	Undrained stiffness, E_u (MN/m^2)	2.40	Moderately conservative value derived statistically from SPT results	CIRIA 143 (1995)
	Drained stiffness, *E'*	1.96	Moderately conservative value derived from SPT	CIRIA 143 (1995)

Stratum	Material Parameter	Characteristic Value	Rationale	Reference
	(MN/m^2)		results	
	Earth pressure coefficient, k_0	0.540	1-sinφ	Jaky (1948)
	Poisson's ratio, μ	0.3	Engineering Judgement	
Cohesive Alluvium	Unit weight (kN/m^3)	18	Average value derived from bulk density tests on samples	
	Undrained shear strength, C_u (kN/m^2)	Depths <8 m bgl: 8 Depths >8 m bgl: 8+(Depth-8)X4	Moderately conservative value derived from combined SPT, SBPM, SCPT and triaxial test results	
	Angle of friction, φ (°)	28.3	Moderately conservative value derived statistically from plasticity index.	Gibson (1953)
	Cohesion, c' (kN/m^2)	0	Conservative assumption	
	Coefficient of volume compressibility, m_v (m^2/MN)	1.03	Moderately conservative value derived statistically from oedometer results	
	Coefficient of consolidation, C_{v90} (m^2/year)	8.9	Moderately conservative value derived statistically from oedometer results	
	Undrained stiffness, E_u (MN/m^2)	Depths <8 m bgl: 1.0 Depths >8 m bgl: 1.0 + (Depth-8)X0.5	E_u = 1.25E'	
	Drained stiffness, E' (MN/m^2)	Depths <8 m bgl: 0.8 Depths >8 m bgl: 0.8 + (Depth-8)X0.4	Moderately conservative value derived from relationship with Cu	Yandzio (1998)
	Earth pressure coefficient, k_0	0.526	1-sinφ	Jaky (1948)
	Poisson's ratio, μ	0.3	Engineering Judgement	
Granular Alluvium	Unit weight (kN/m^3)	19	Published value	Barnes (2000)
	Angle of friction, φ (°)	31	Moderately conservative value derived statistically from SPT results	Peck et al (1974)
	Drained stiffness, E' (MN/m^2)	13.7	Moderately conservative value derived statistically from SPT results	
	Earth pressure coefficient, k_0	0.526	1-sinφ	Jaky (1948)
	Poisson's ratio, μ	0.3	Engineering Judgement	
Relic Peat and organic lenses	Unit weight (kN/m^3)	13	Average value derived from bulk density tests on samples	
	Undrained shear strength, C_u (kN/m^2)	38	Moderately conservative value derived from combined SPT, SBPM, SCPT and triaxial test results	
	Angle of friction, φ (°)	21	Moderately conservative value derived statistically from plasticity index	Gibson (1953)
	Cohesion, c' (kN/m^2)	0	Conservative assumption	

Stratum	Material Parameter	Characteristic Value	Rationale	Reference
	Coefficient of volume compressibility, m_v (m^2/MN)	0.56	Moderately conservative value derived statistically from oedometer results	
	Coefficient of consolidation, C_{v90} (m^2/year)	6.4	Moderately conservative value derived statistically from oedometer results	
	Undrained stiffness, E_u (MN/m^2)	7.01	Moderately conservative value derived statistically from SPT results	CIRIA 143 (1995)
	Drained stiffness, E' (MN/m^2)	5.74	Moderately conservative value derived statistically from SPT results	CIRIA 143 (1995)
	Earth pressure coefficient, k_0	0.650	1-sinφ	Jaky (1948)
	Poisson's ratio, μ	0.3	Engineering Judgement	
Glacial Till (cohesive)	Unit weight (kN/m^3)	22	Average value derived from bulk density tests on samples	
	Undrained shear strength, C_u (kN/m^2)	114	Moderately conservative value derived from combined SPT, SBPM, SCPT and triaxial test results	
	Angle of friction, φ (°)	29.3	Moderately conservative value derived statistically from plasticity index	Gibson (1953)
	Cohesion, c' (kN/m^2)	0	Conservative assumption	
	Coefficient of volume compressibility, m_v (m^2/MN)	0.56	Moderately conservative value derived statistically from oedometer results	
	Coefficient of consolidation, C_{v90} (m^2/year)	15.1	Moderately conservative value derived statistically from oedometer results	
	Undrained stiffness, E_u (MN/m^2)	52.6	$E_u = 1.5E'/(1+\mu)$	Vermeer (1998)
	Drained stiffness, E' (MN/m^2)	45.6	Moderately conservative value derived from relationship with Cu	Yandzio (1998)
	Earth pressure coefficient, k_0	0.75	Engineering Judgement	
	Poisson's ratio, μ	0.3	Engineering Judgement	
Glaciolacustrine	Unit weight (kN/m^3)	20	Average value derived from bulk density tests on samples	
	Undrained shear strength, C_u (kN/m^2)	70	Moderately conservative value derived from combination of SPT, SBPM, SCPT and triaxial test results	
	Angle of friction, φ (°)	27.8	Moderately conservative value derived statistically from plasticity index	Gibson (1953)

Stratum	Material Parameter	Characteristic Value	Rationale	Reference
	Cohesion, c' (kN/m^2)	0	Conservative assumption	
	Coefficient of volume compressibility, m_v (m^2/MN)	0.57	Moderately conservative value derived statistically from oedometer results	
	Coefficient of consolidation, C_{v90} (m^2/year)	41.4	Moderately conservative value derived statistically from oedometer results	
	Undrained stiffness, E_u (MN/m^2)	32.3	$E_u = 1.5E'/(1+\mu)$	Vermeer (1998)
	Drained stiffness, E' (MN/m^2)	28.0	Moderately conservative value derived from relationship with Cu	Yandzio (1998)
	Earth pressure coefficient, k_0	0.75	Engineering Judgement	
	Poisson's ratio, μ	0.3	Engineering Judgement	
Fluvio-glacial	Unit weight (kN/m^3)	19	Published value	Barnes (2000)
	Angle of friction, φ (°)	34	Moderately conservative value derived statistically from SPT results	Peck et al (1974)
	Drained stiffness, E' (MN/m^2)	35.5	Moderately conservative value derived statistically from SPT results	Yandzio (1998)
	Earth pressure coefficient, k_0	0.75	Engineering Judgement	
	Poisson's ratio, μ	0.3	Engineering Judgement	

Chalk

Table 6.10 – Summary of testing on Chalk

Type of Test	No. of tests	Results
In situ:		
Standard Penetration Test (SPT)	93	31 to >50 (49 average)
Permeability (packer test)	8	9.45E-08 to 7.35E-06 (Average 3.02E-06)
Permeability (falling head test)	28	5.44E-08 to 1.49E-04 (average 4.65E-05)
Laboratory:		
Point Load	211	Is_{50}: 0.004 to 1.494 MN/m^2
Moisture Content	10 (47)	0.9 to 18.8 %
Density	10	Bulk Density: 2.10 to 2.26 Mg/m^3

Type of Test	No. of tests	Results
	(12)	Dry Density: 1.77 to 2.24 Mg/m^3
Unconfined Compressive Strength	10	4.7 to 14.1 MPa

* Numbers in brackets include results taken in other tests.

Chalk bedrock was encountered across the site, with a layer of weathered chalk overlying more solid chalk. The weathered chalk occurs from a minimum recorded depth of 20.6 m (-17.94 m AOD) in Borehole BH04 to a maximum depth of 33.6 m (-28.96 m AOD) in Borehole BH45. The maximum recorded thickness of weathered chalk is 9 m (average thickness 4.6 m where fully penetrated).

Weathered chalk ranges from very weak to medium strong sub-angular to angular gravel and cobbles. The chalk bedrock is of White Chalk sub-group and contains seams of flints throughout.

SPT 'N' values indicate that the material is very dense, as is expected from chalk bedrock. The results are presented in figure 6.10.1.

The results of permeability testing are shown in figure 6.10.4. The tests gave a minimum permeability of 5.44E-08 and a maximum permeability of 1.49E-04. The results indicate that the permeability of the chalk varies from very low to medium.

Based moderately conservatively on the SPT *N* values, a characteristic friction angle, ϕ' of 37 degrees has been selected. The friction angle has been derived using the empirical relationship with SPT 'N' from Peck et al (1974).

A characteristic unconfined compressive strength of the rock of 6.5MN/m^2 was derived statistically from the laboratory test results, as shown in figures 6.10.2 and 6.10.3.

Due to the limited geotechnical information available, a unit weight, γ, of 20 kN/m^3 has been selected for the chalk, based on published values (Barnes, 2000).

The deformation modulus for intact rock, E_i, and the deformation modulus for the rock mass, E_m, were derived from the SPT results using approximated relationships of E_i = 50N (MN/m^2) and E_m = 5N (MN/m^2) (Ciria Report 143 (1995)).

Table 6.11- Summary of Chalk Parameters

Material Parameter	Characteristic Value	Rationale	Reference
Unit weight (kN/m^3)	20	Published value	Barnes (2000)
Angle of friction, φ (°)	37	Moderately conservative value derived from SPT results	Peck et al (1974)
Unconfined Compressive Strength (MN/m^2)	6.5	Moderately conservative value derived conservatively from point load test results	
Deformation Modulus for intact rock, E_i (GN/m^2)	2.50	Moderately conservative value derived statistically from SPT results	CIRIA 143 (1995)
Deformation Modulus for the rock mass, E_m (GN/m^2)	0.250	Moderately conservative value derived statistically from SPT	CIRIA 143 (1995)

Material Parameter	Characteristic Value	Rationale	Reference
		results	
Earth pressure coefficient, k_0	0.75	Published value	
Poisson's ratio, μ	0.3	Engineering Judgement	

6.4 Groundwater Chemistry

Please refer to the Ground Contamination Assessment 1168-10-211-RE-001 (2014)

7 Geotechnical Risk Register

7.1 Risk Rating

The risk rating is derived from Risk Rating = Risk Likelihood x Risk Severity. Where risk likelihood and risk severity are defined as:

RISK LIKELIHOOD
1. LOW (Unlikely)
2. MEDIUM (Possible)
3. HIGH (Probable)

RISK SEVERITY
1. LOW
2. MEDIUM
3. HIGH

This result in a risk that can be described as MINIMAL (0-3), RESIDUAL (4) or SIGNIFICANT (6-9) as per the risk matrix in Table 7.1:

Table 7.1 – Risk Matrix

		Severity		
		1	2	3
Likelihood	1	**Minimal**	**Minimal**	**Minimal**
	2	**Minimal**	**Residual**	**Significant**
	3	**Minimal**	**Significant**	**Significant**

7.2 Geotechnical Risks

Table 7.2 presents site wide geotechnical risks relating to the scheme.

Table 7.2 – Geotechnical Risks

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
1	Central cutting	Glacial till, potentially acting as an aquiclude, may be discontinuous and may not be suitable to form a groundwater cut off.	Potential uplift of slab. Unmanageable groundwater inflow into excavation.	Continuous groundwater monitoring and pump tests during GI to try to gain a better understanding of material properties. Installation of tension piles. Use of jet grouting ground improvement.	2	2	**Residual**	Contractor to consider appropriate sequencing of work.
2	Central cutting	Under drainage of soft alluvium	Potential dewatering induced settlement.	Provide adequate cut off by secant piling. Installation of secant piled wall and jet grouting ground improvement to reduce groundwater ingress	2	2	**Residual**	-
3	Central cutting	Variable ground conditions - anticipated variability of the material properties	Could result in unexpected failures and differential settlements.	Installation of secant piled wall. Jet grouting ground improvement.	2	2	**Residual**	Contractor to consider appropriate sequencing of work.
4	Central cutting	High groundwater level with tidal influence	High water pressures could result in uplift of slab and excessive groundwater flow into excavation.	Continuous ground water monitoring and pump tests during GI to try to gain a better understanding of material properties. Installation of tension piles and secant piled wall. Jet grouting ground improvement.	2	2	**Residual**	Contractor to consider appropriate sequencing of work
5	Central cutting	Artesian and sub artesian pressures within chalk/fluvio-glacial and glacial till	High water pressures could result in uplift of slab and damage the toe of deep piles during excavation.	Tension piles **are** required. Use of jet grouting ground improvement to increase resistance in alluvial layer to potentially reduce pile lengths.	2	3	**Minimal**	Contractor to consider appropriate sequencing of work
6	Excavation and	Piping sands if pile interlock	Failure of retaining	NA	2	3	**Minimal**	If used potential

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
	Construction outside of main excavation.	is not adequately achieved on minor retaining walls and temporary works	wall					significant risk
7	Central cutting	Unmanageable temporary and permanent seepage quantities	Serviceability failure	Use of secant bored piles and appropriate permanent waterproofing utilising hydrophilics, water bars etc	2	2	**Residual**	
8	Central cutting	Ground gas (methane)	Migration, accumulation and potential for asphyxiation / explosion. Delay in progress of works. Could cause major traffic disruption and reputational risk to client.	Protection measures to be outlined in the Construction Environmental Management Plan (CEMP) and implemented during construction (e.g. PPE, personal monitors/alarms) Migration pathways to adjacent site users to be considered and mitigated, as outlined in CEMP.	2	2	**Residual**	Contractor monitoring of gases during operations. All excavations undertaken to be treated as confined spaces. Contractor to consider the installation of an appropriate gas monitoring regime with the potential for a 'traffic light' system to provide an early warning
9	Central cutting	Ground gas (other / depleted oxygen)	Migration, accumulation and	Protection measures to be outlined in the CEMP and implemented during construction (e.g. PPE,	2	2	**Residual**	Contractor monitoring of

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
			potential for asphyxiation / explosion. Delay in progress of works.	personal monitors/alarms) Migration pathways to adjacent site users to be considered and mitigated, as outlined in CEMP.				gases during operations. All excavations undertaken to be treated as confined spaces. Contractor to consider the installation of an appropriate gas monitoring regime with the potential for a 'traffic light' system to provide an early warning
10	Scheme wide area	Work force coming into contact with contaminated materials	Delay progress of works and a risk to health of the workforce through direct contact and ingestion.	CEMP to outline requirements for mitigation required during construction (e.g. personal protective equipment (PPE)). Additional sampling to be undertaken during earthworks in accordance with a Materials Management Plan (MMP) to establish suitability for material re-use and/or requirements for disposal. Ensure that measures are in place to contain and deal with contamination.	2	2	**Residual**	Contractor to undertake ongoing sampling and testing, ensure working practices are appropriate, provision of appropriate PPE

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
11	Central cutting	Vibration causing clay/silt instability in sensitive cohesive materials	Could result in excessive settlement or instability.	The preliminary design specifies that vibrations caused by pile installation are kept to a minimum throughout use	1	3	**Minimal**	Ongoing monitoring of vibrations throughout construction.
12	Central Cutting and foot bridges	Aggressivity of ground towards concrete	Deterioration / decrease in strength of concrete slab and pile foundations could be affected.	Testing undertaken during site investigation and class of ground aggressivity evaluated.	1	2	**Minimal**	-
13	Central Cutting	Soft material underlying structures	Excessive/differential settlement. Bearing capacity failure.	Bearing resistance / settlement calculations undertaken.	1	3	**Minimal**	Formation inspections during construction and monitoring.
14	Central Cutting	Working / forming excavation with cutting.	Retaining wall instability /failure of earthwork.	Retaining wall stability assessment undertaken, the propping to be used in the temporary case..	1	3	**Minimal**	Formation inspections during construction.
15	Central Cutting	Ground conditions/groundwater conditions resulting in pile integrity issues during construction	Would result in serious delays to the works and would require replacement of piles at substantial cost.	Employment of a bored piling system to form retaining and cut off walls.	1	2	**Minimal**	-
16	Central Cutting	Encountering obstructions	Obstructions could cause delays in excavation and installation of piles.	Extend guide wall excavation for the secant piled walls to base of made ground	2	1	**Minimal**	-
17	Scheme wide	Encountering services/Interaction with services	Service strike. Injury/death	Services survey to be undertaken prior to site works. Deflections and settlements to be minimised outside of construction area. Service diversions to be undertaken.	1	2	**Minimal**	-

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
18	Scheme wide	Excavation, piling and trafficking ground in an area with a moderate risk of UXO encounter.	Serious injury/death. Delays to construction programme. Major traffic disruption. Reputational risk to client	BACTECH and EOD reports obtained and surveys undertaken.	1	2	**Residual**	Contractor to undertake further surveys during construction works. A UXO specialist should either supervise works or clear higher risk areas.
19	Central Cutting	Unstable ground conditions	Progress of works and site workers safety at risk from failure of ground	Only appropriate plant/equipment to be used. Ensure save working distance from any excavations. Continual visual inspections of surrounding ground conditions of work area. Ensure stabilizers on any equipment are in place. Ground improvement of very low strength material prior to excavation.	1	2	**Minimal**	-
20	Underground Option - formation of a cutting	Excavations in an area of poor ground, high groundwater with sensitive structures in close proximity	General construction risks, ground instability, excavation collapse, groundwater ingress, settlement	Installation of Secant Pile Wall and use of Jet Grouting Ground Improvement to reduce the risk likelihood of ground instability, excavation collapse, groundwater ingress and settlement. The installation of stiff low permeability structure will reduce the magnitude of any remaining risk thus reducing the risk severity (Refer to reference	1	1	**Minimal**	-

					Post Design Measure			
Ref No.	Design Concept	Hazard / Activity	Risk / Potential outcomes	Design measures taken to remove or reduce risk	Risk Likelihood	Risk Severity	Risk	Residual risk actions
				2 and 5).				
21	Secant Piling to form groundwater cut off	Operating piling rigs in an urban environment in close proximity to live traffic and other site operations	Injury to personnel general public or damage to property caused by piling operations. Spillage of contaminated material	Construction Phasing has been considered during the preliminary design stage and should be developed further during detailed design stage to ensure that piling operations are appropriately sequenced to avoid unnecessary interaction between plant/personnel.	2	2	**Residual**	Contractor to consider appropriate sequencing of work to ensure safety of operatives and general public.
22	Tension Piling	Operating piling rigs in an urban environment in close proximity to live traffic and other site operations and piling in to ground with elevated groundwater pressure	Injury to personnel, general public. Installation of tension piles potentially creating preferential pathway for groundwater flows. Instability of ground beneath piling rig	Tension piles are required, no design measures taken to reduce the risk	2	2	**Residual**	Contractor to consider appropriate sequencing of work to ensure safety of operatives and general public
23	Other piling activities	Operating piling rigs in an urban environment in close	Injury to site personnel , damage to nearby	The Preliminary Design Specifies that vibrations caused by pile	1	3	**Minimal**	Contractor to ensure that

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
		proximity to live traffic and other site operations. Sheet piling installation causing vibration	structures	installation shall be kept to a minimum through the use of suitable installation techniques				vibrations are monitored throughout construction.
24	Jet Grouting and Ground Improvement (Mainline)	Operating jet grouting equipment in an urban environment with ground that is susceptible to heave	Injury to personnel caused by grouting operations, generation of contaminated slurry/arisings, potential for ground heave	The Preliminary Design Specifies that vibrations caused by pile installation shall be kept to a minimum through the use of suitable installation techniques	1	2	**Minimal**	Contractor to consider appropriate sequencing of work to ensure safety of general public
25	Excavation of material within cutting	Formation of excavations in urban environment using large plant	Injury to personnel due to restricted working areas and instability of material to be excavated	Ground Improvement (lime stabilisation) will increase the stability of the material to be excavated making the material more manageable	2	1	**Minimal**	NA

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
26	Excavations below groundwater level	Forming excavations below natural groundwater level	Excessive groundwater inflow if groundwater cut off is not adequately achieved and ground instability either when working below groundwater level or induced through dewatering activities	Installation of Secant Pile Wall and use of Jet Grouting Ground Improvement to reduce groundwater ingress by reducing permeability	2	1	**Minimal**	NA
27	Dewatering activities	Dewatering activities causing groundwater levels to be locally depressed	Movement, settlement and instability of surrounding structures	Installation of Secant Pile Wall and use of Jet Grouting Ground Improvement to reduce groundwater ingress and thus reducing the likely scope of the dewatering operations.	2	1	**Minimal**	NA
28	Ground Improvement (side roads)	General construction risks	Injury to personnel, generation of contaminated slurry/arisings.	NA	2	1	**Minimal**	Contractor to implement suitable control measures, RAMS to manage risks

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
29	Construction works and clearance of burial ground	Excavation of human remains both above and below groundwater level	Human Health related issues, infectious diseases, injuries due to confined working environment	A pre enabling works Ground Investigation is planned. After the investigation more will be known about the potential condition of any human remains which will allow suitable methods of working to be specified	2	3	**Significant** *area not investigated*	Contractor to implement control procedures such as ongoing contamination assessment to ensure that PPE is suitable
30	Piling and Construction in the vicinity of the dock	Piling and excavation in close proximity to the docks. Alteration to the old dock wall	Injury to personnel caused by piling operations. Damage to the structure of the dock due to piling/excavation	Additional Ground Investigation has been recommended in the area of the docks to take account of a proposed change to design	2	2	**Residual**	If additional GI is undertaken this information should be built in to temporary works design. Contractor to implement suitable control measures for working in close proximity to water. A

					Post Design Measure			
Ref No.	**Design Concept**	**Hazard / Activity**	**Risk / Potential outcomes**	**Design measures taken to remove or reduce risk**	**Risk Likelihood**	**Risk Severity**	**Risk**	**Residual risk actions**
								monitoring and inspection programme should be implemented

Table UT1 - Services

Utility	New / Existing / To divert	Affected Area
Existing Openreach Equipment	Existing, not affected	Scheme wide
Existing Kingston Communications Equipment	To divert	
Existing Kingston Communications Equipment	Existing, not affected	
Existing National Power Grid (LV) Equipment	To divert	
Existing National Power Grid (HV 11kV)	To divert	
Existing National Power Grid (LV and HV 11kV)	Existing, not affected	
Existing Northern Gas Network (low pressure)	To divert	
Existing Northern Gas Network	Existing, not affected	
Yorkshire Water Sewer	Existing, not affected	Commercial Road and Queen Street

8 References

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Geotechnics Ltd.	A63 Castle Street Improvement, Hull, Reference PC135220, October 13	2013

Site Specific Reports

Acer	A63 Trunk Road Improvements, Castle Street, Hull – Geotechnical Interpretative Report on Ground Investigation	1995
Landmark Information Group Services	Report Ref 166624-1-1, Envirocheck Report on Castle Street, Hull	2002
BACTEC	Explosive Ordnance Threat Assessment of A63, Castle Street, Hull	2008
GroundSure Ltd	Report ref EMS_65650_82556, Environmental Data Report	2008
Highways Agency	A63 Trunk Road Improvements – Hull, Technical Appraisal Report	2008
Pell Frischman	A63 Castle Street Improvement Hull, Flood Risk Assessment	2009b
Pell Frischman	A63 Castle Street Improvement Hull - Environmental Assessment Report (Options Selection Stage), Report Reference W11189/T13/02 Final Rev 2	2010
Pell Frischman	A63 Castle Street Improvements – Environmental Statement Scoping Report	2011
Landmark Information Group Services	Report Ref. 43865337-1, Envirocheck Report on Castle Street, Hull	2013

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MMGJV The Groundwater Report - 1168-10-223-RE-001-PD1

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MMGJV The Groundwater Modelling Report - 1168-10-223-RE-003-PD1

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FIGURES

HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: SPT N-Value

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.2.1**	Strata:	**Made Ground Granular**

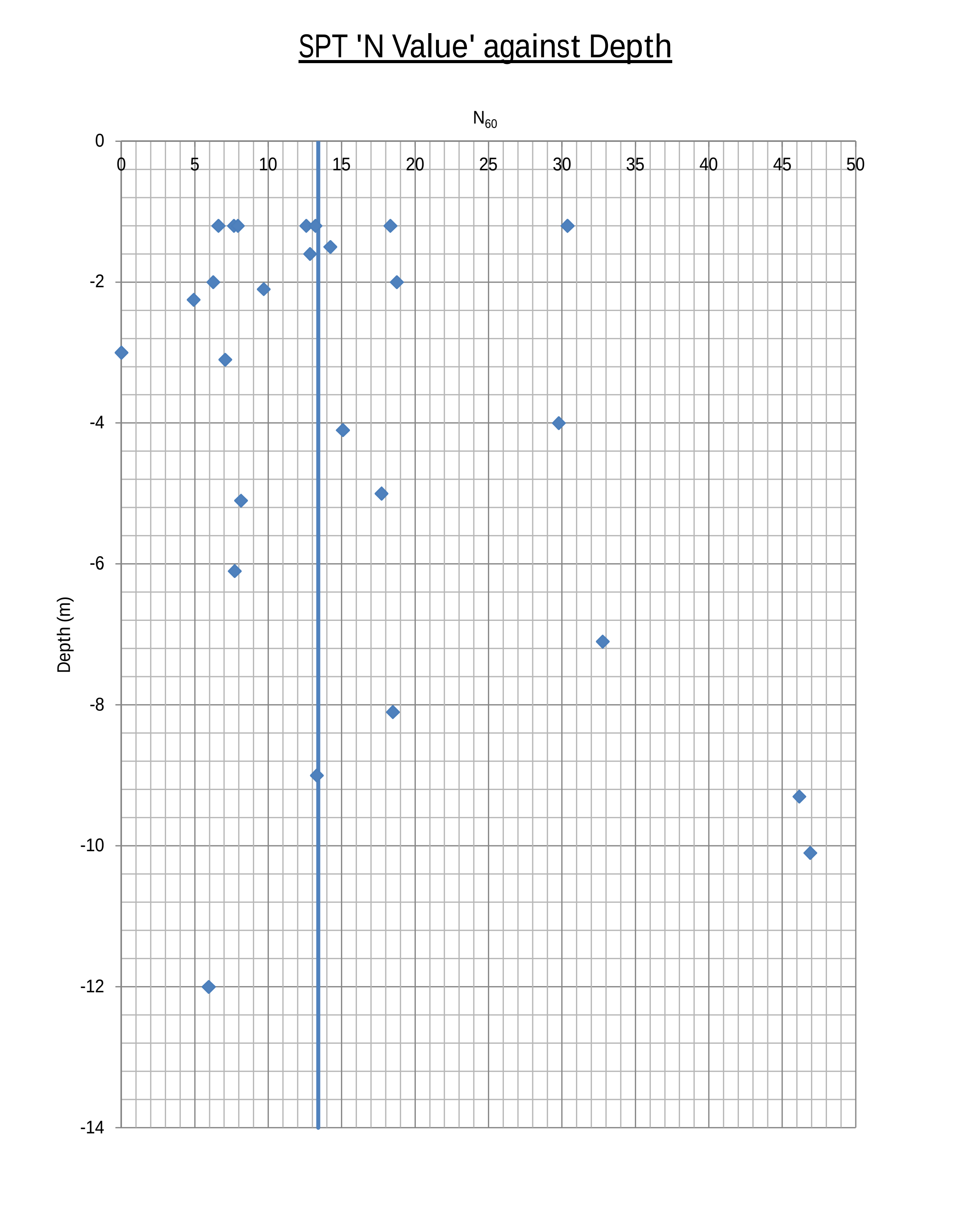

Figure Title: SPT N-Value

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.2.2**	Strata:	**Made Ground Cohesive**

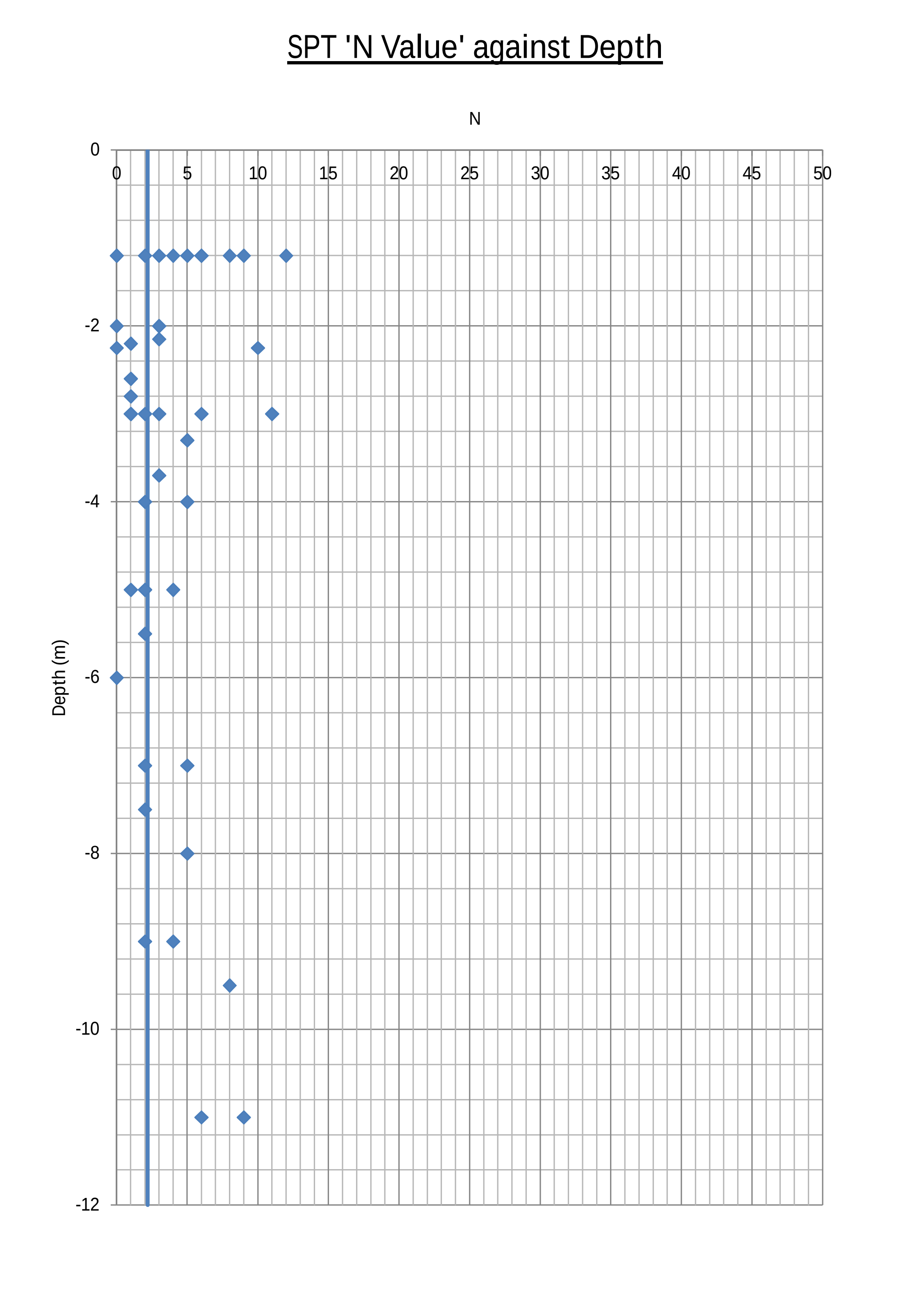

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Figure Title: Plasticity Chart

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.2.3**	Strata:	**Made Ground Cohesive**

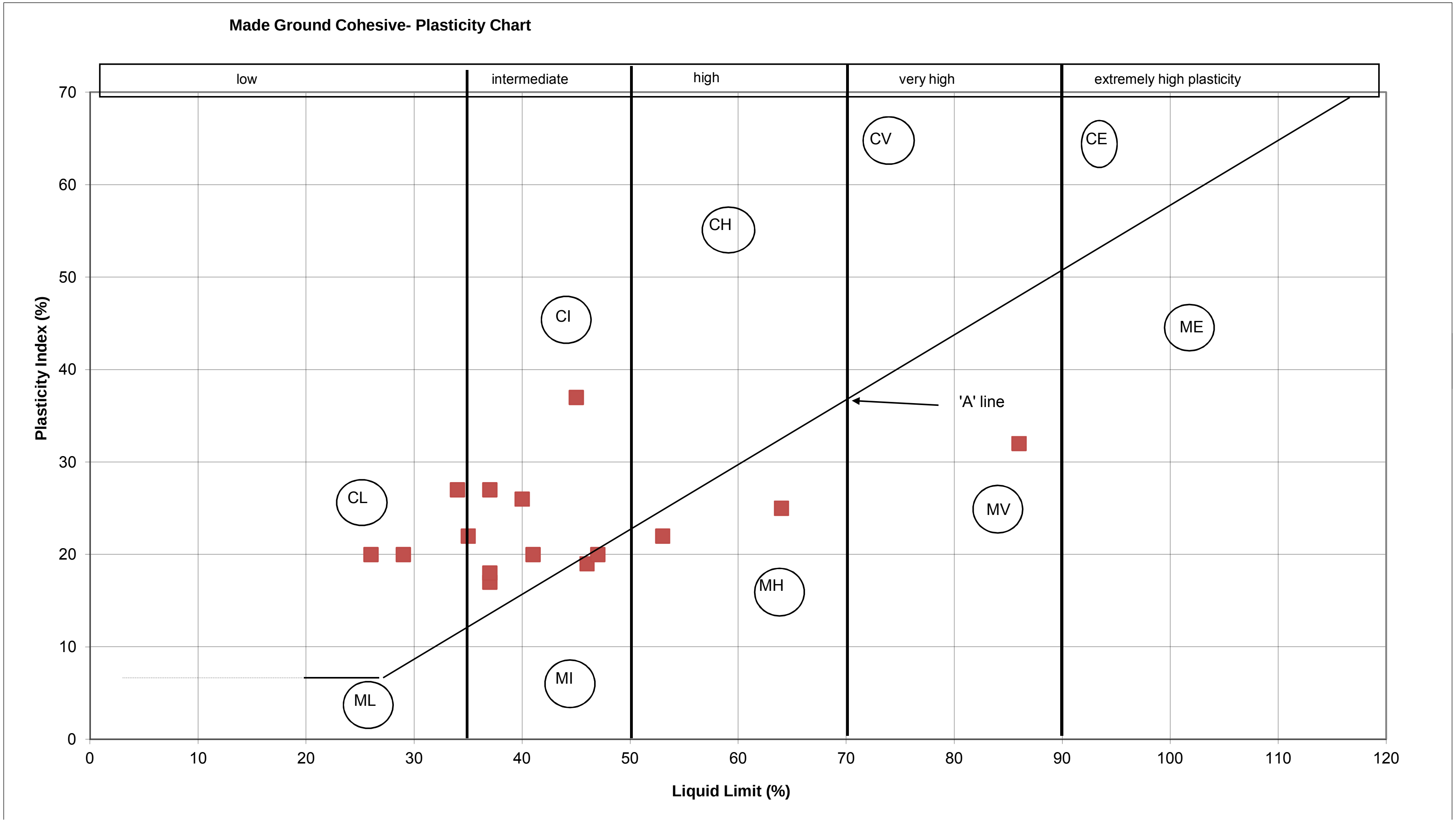
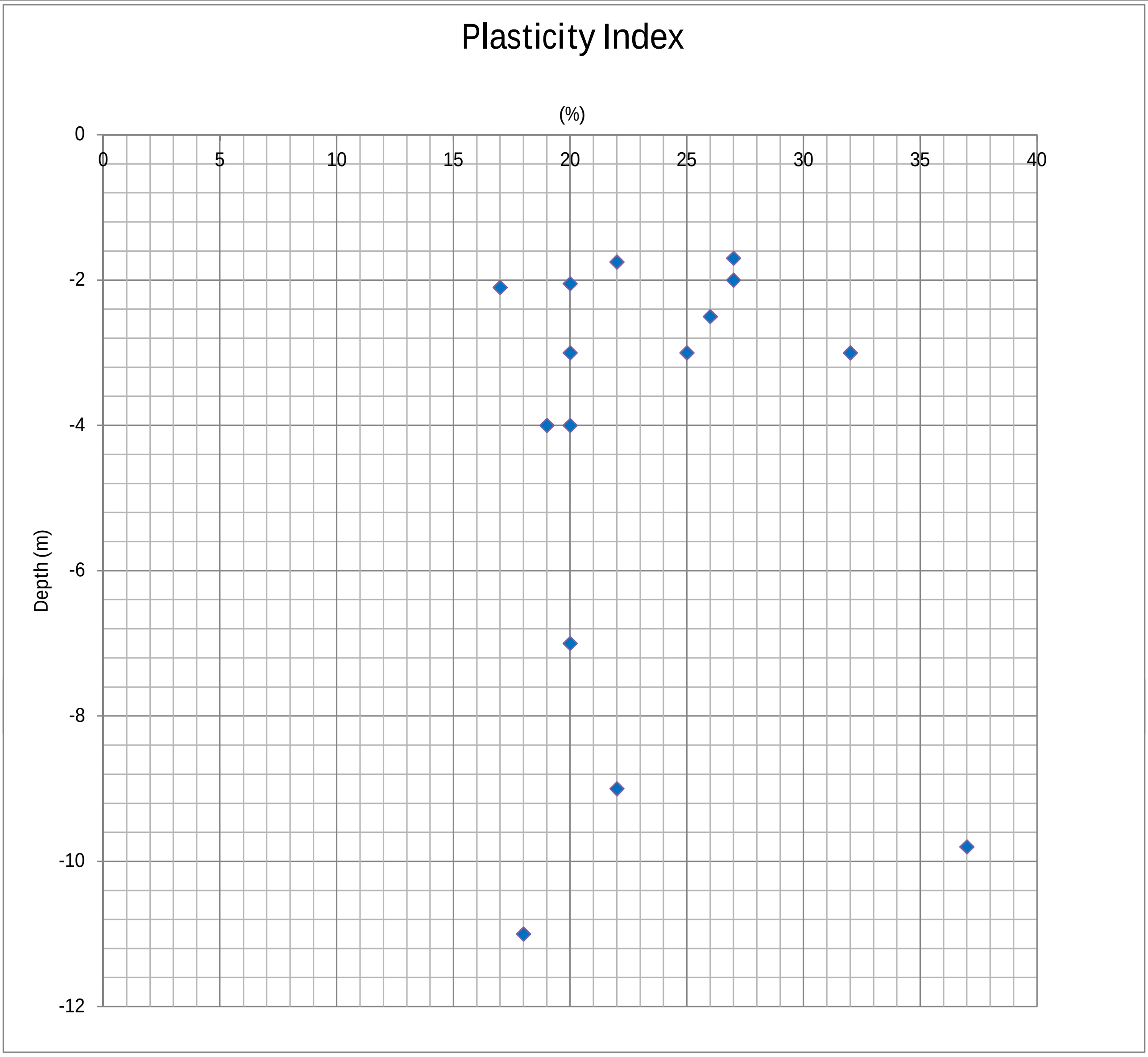


Figure Title: Plasticity Index

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.2.4**	Strata:	**Made Ground Cohesive**



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Undrained Cohesion

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.2.5**	Strata:	**Made Ground Cohesive**

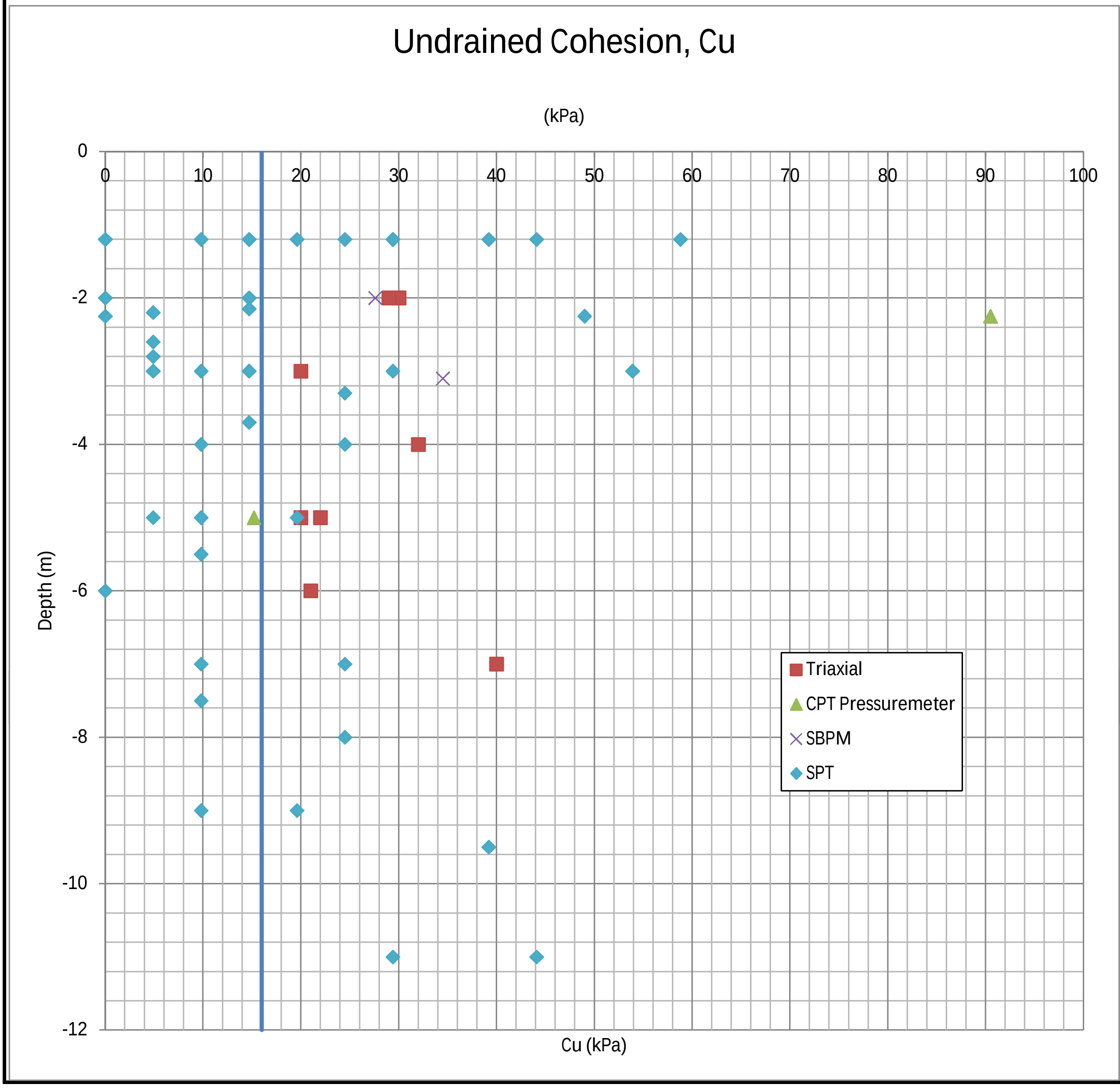


Figure Title: Bulk Density

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.2.6**	Strata:	**Made Ground Cohesive**

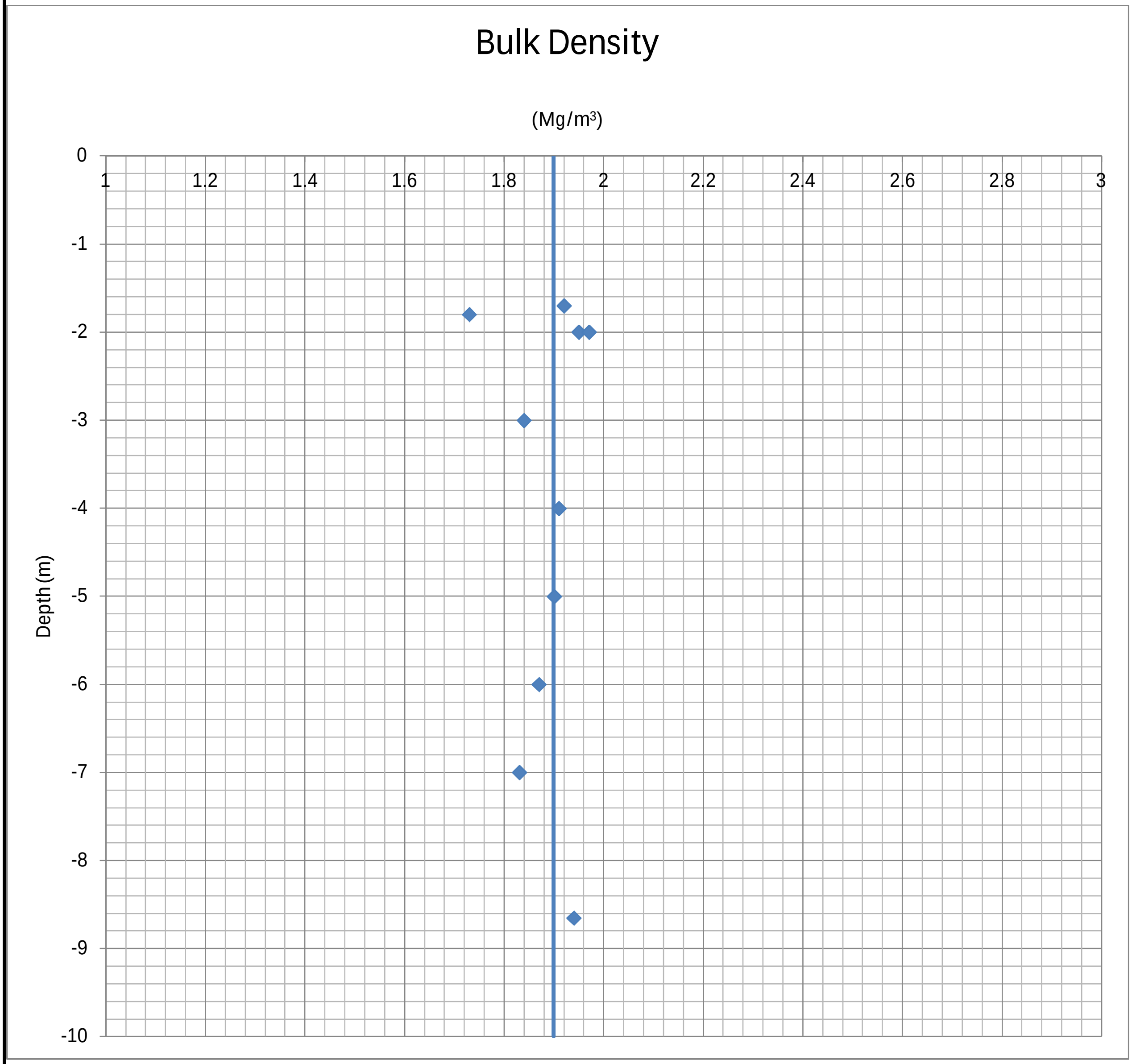


Figure Title: Coefficient of Volume Compressibility

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.2.7**	Strata:	**Made Ground Cohesive**

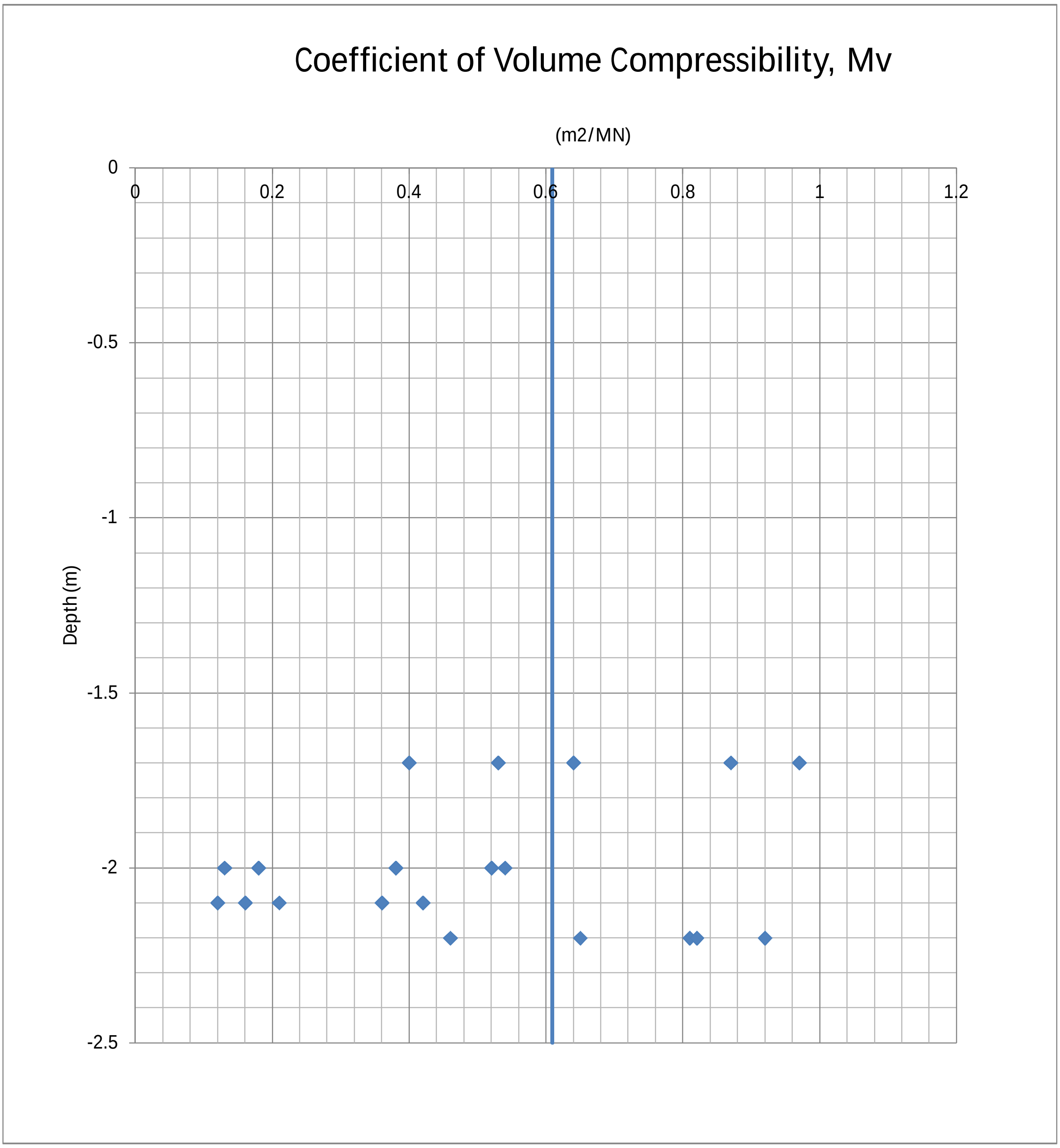
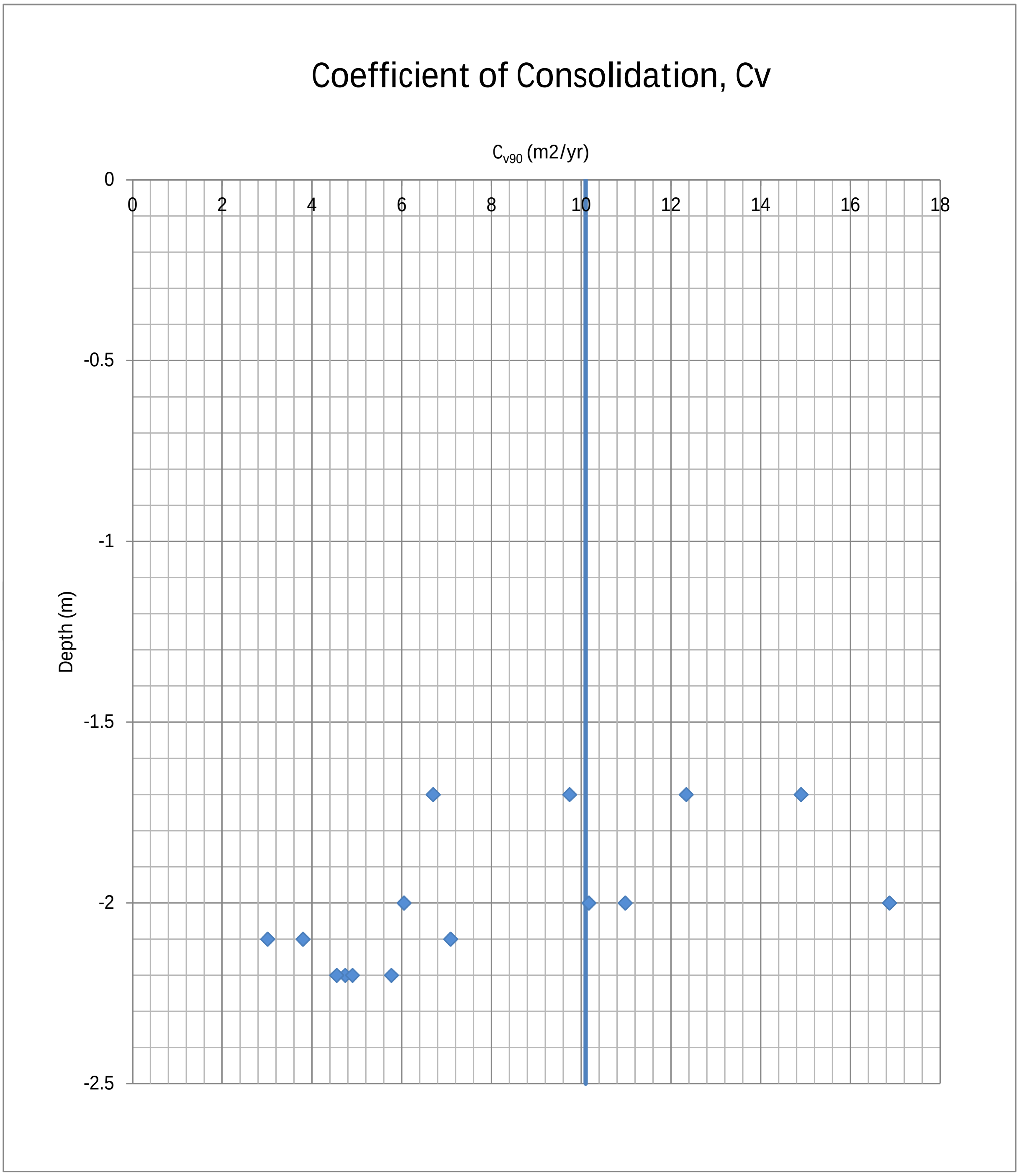


Figure Title: Coefficient of Consolidation

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.2.8**	Strata:	**Made Ground Cohesive**



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Angle of Friction		
Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.2.9**	Strata:	**Made Ground Granular**

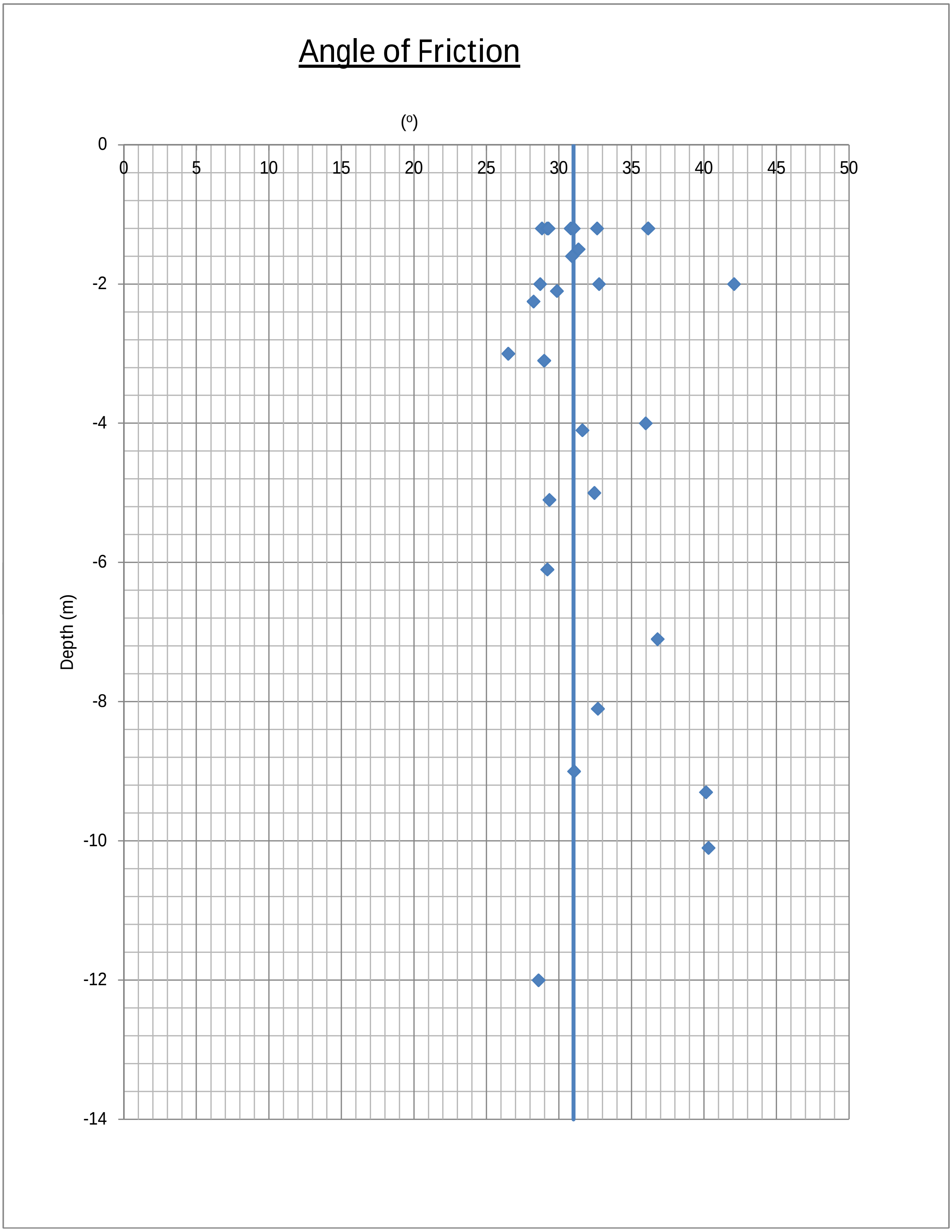


Figure Title: Angle of Friction

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.2.10**	Strata:	**Made Ground Cohesive**

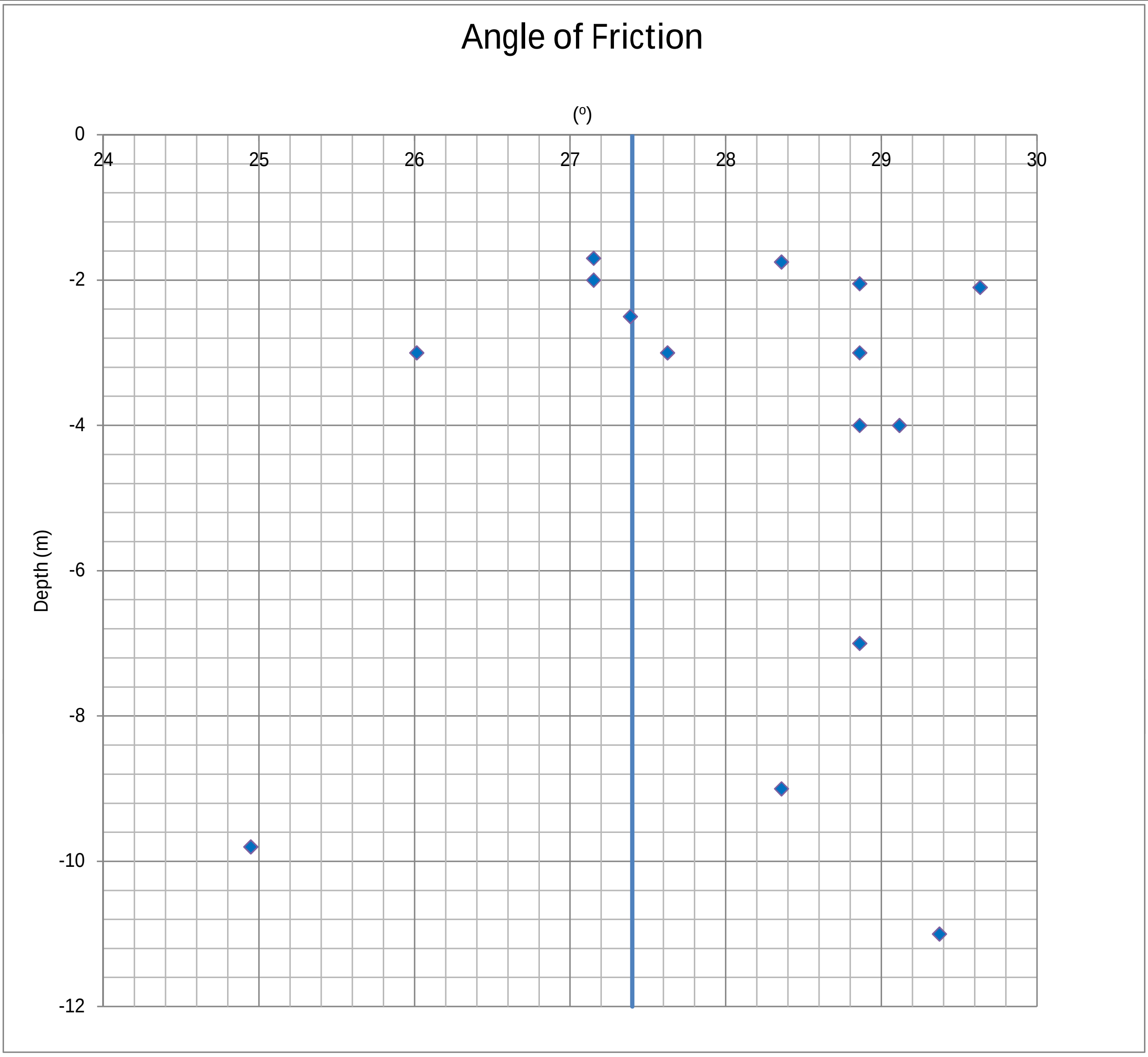


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Figure Title: SPT N-Value

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street Improvements
Figure Reference:	Figure 6.3.1	Strata:	Cohesive Alluvium

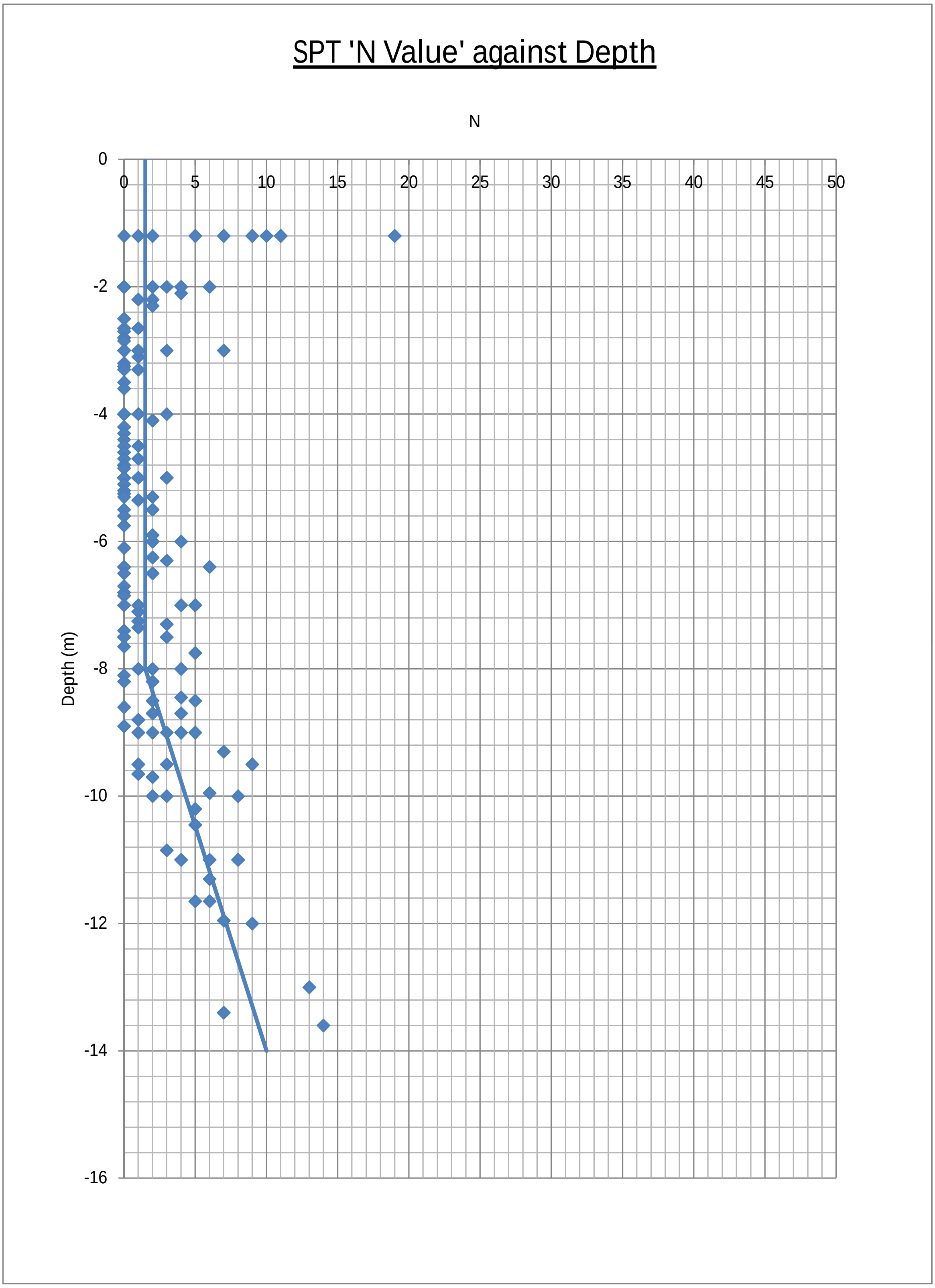

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Figure Title: SPT N-Value

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street Improvements
Figure Reference:	Figure 6.3.2	Strata:	Cohesive Alluvium <8m bgl

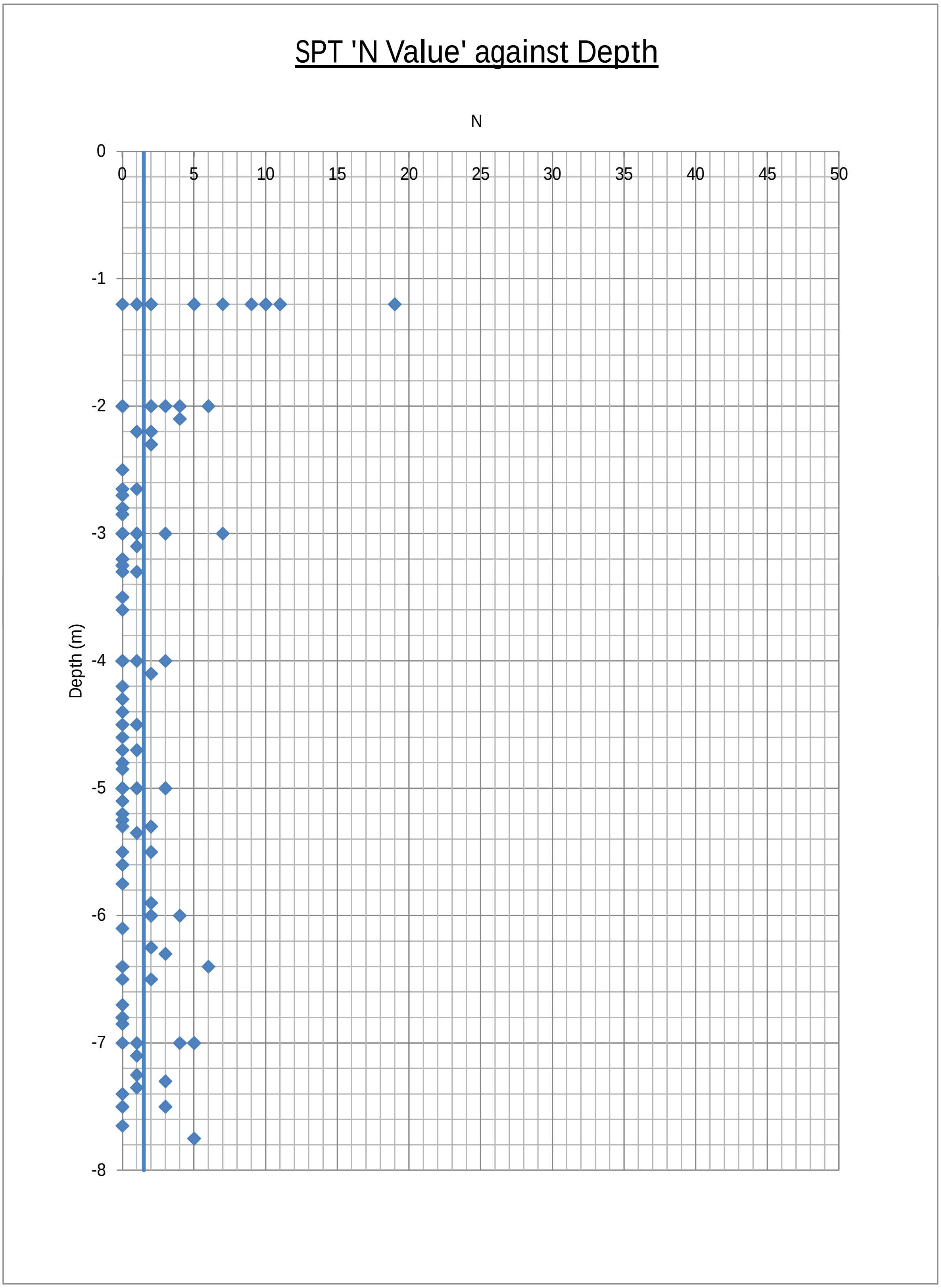

Figure Title: SPT N-Value

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.3.3**	Strata:	**Cohesive Alluvium >8m bgl**

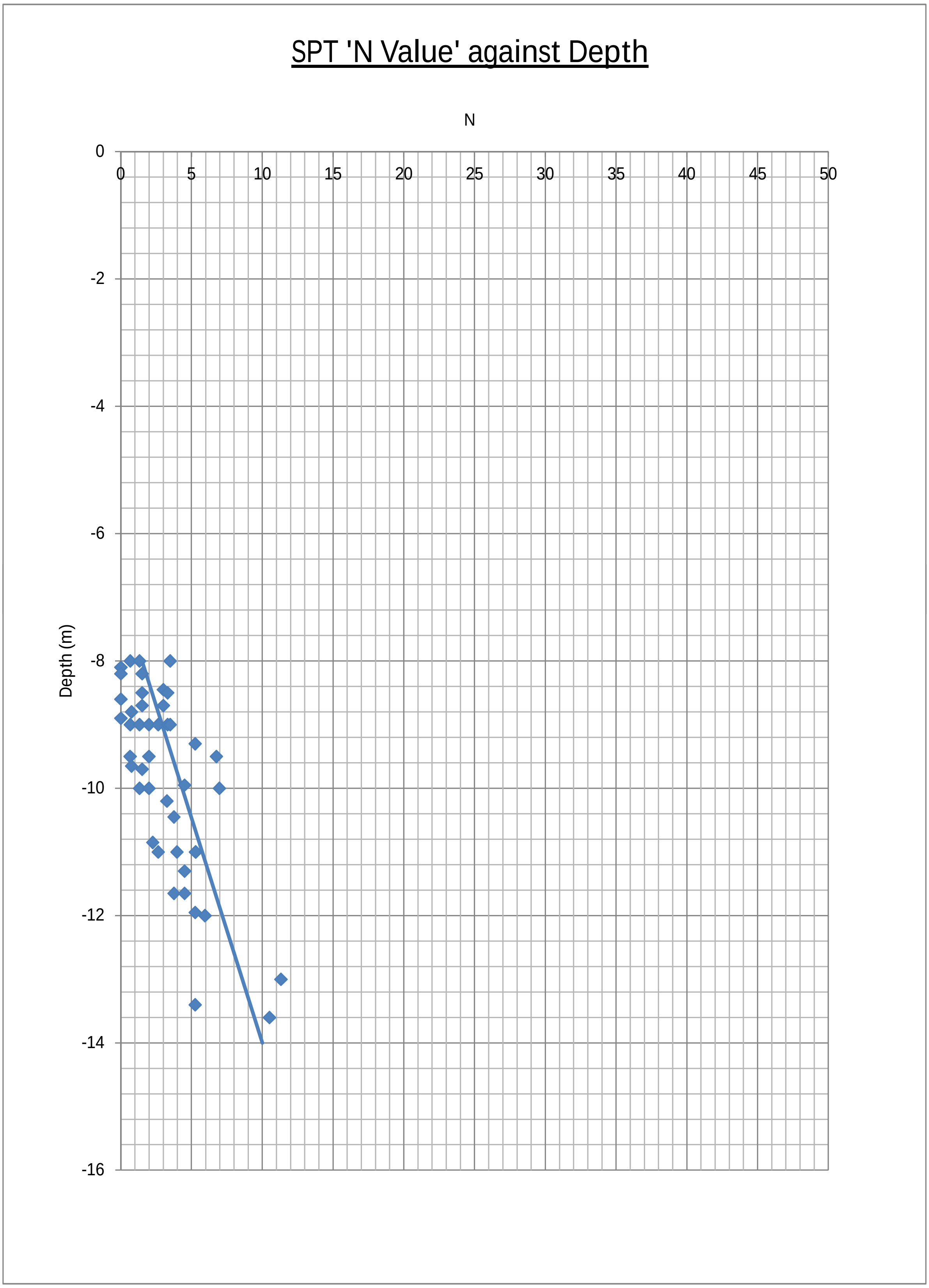

Figure Title: Plasticity Chart

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.3.4**	Strata:	**Cohesive Alluvium**

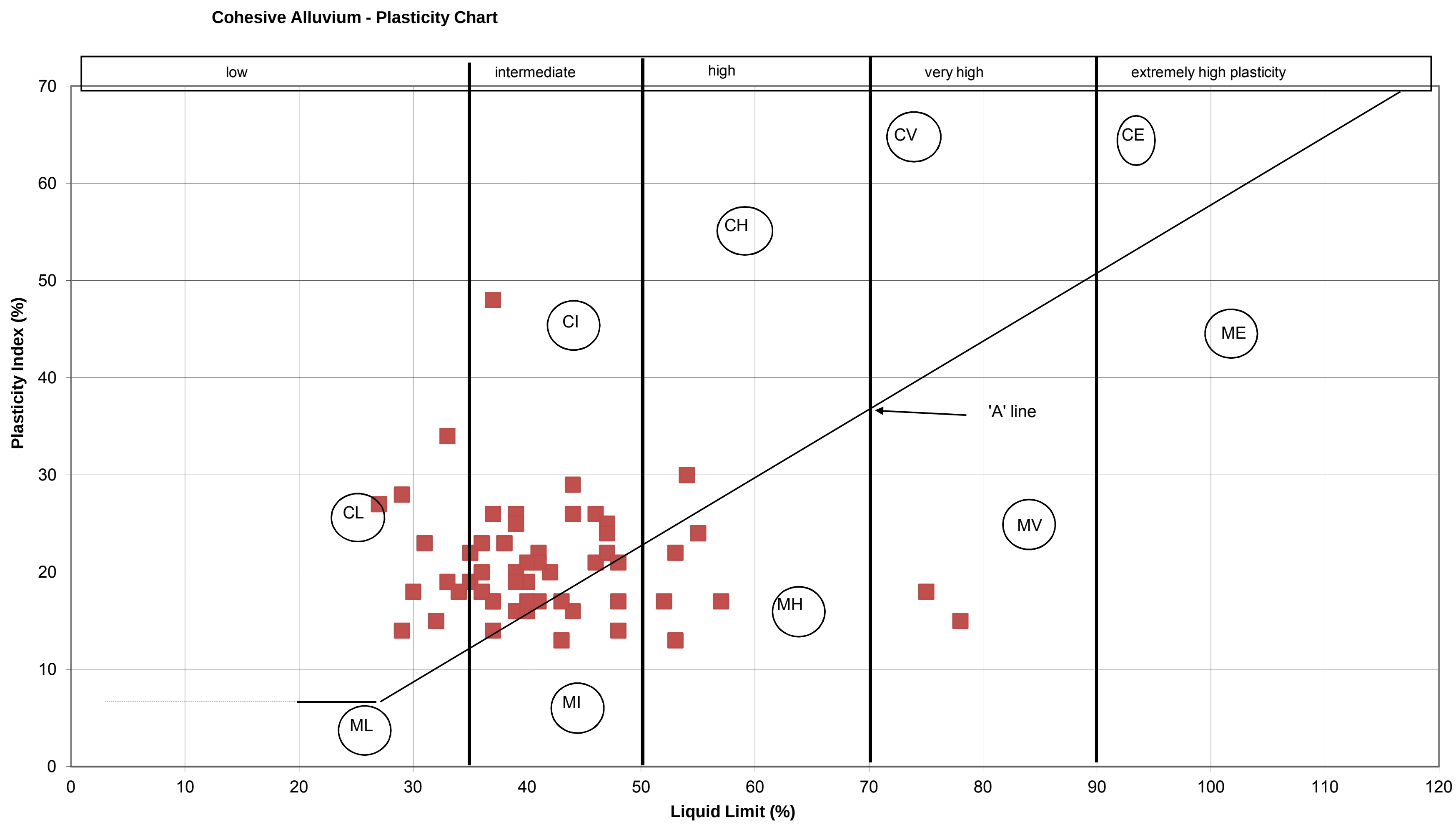

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Figure Title: Plasticity Index

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.3.5**	Strata:	**Cohesive Alluvium**

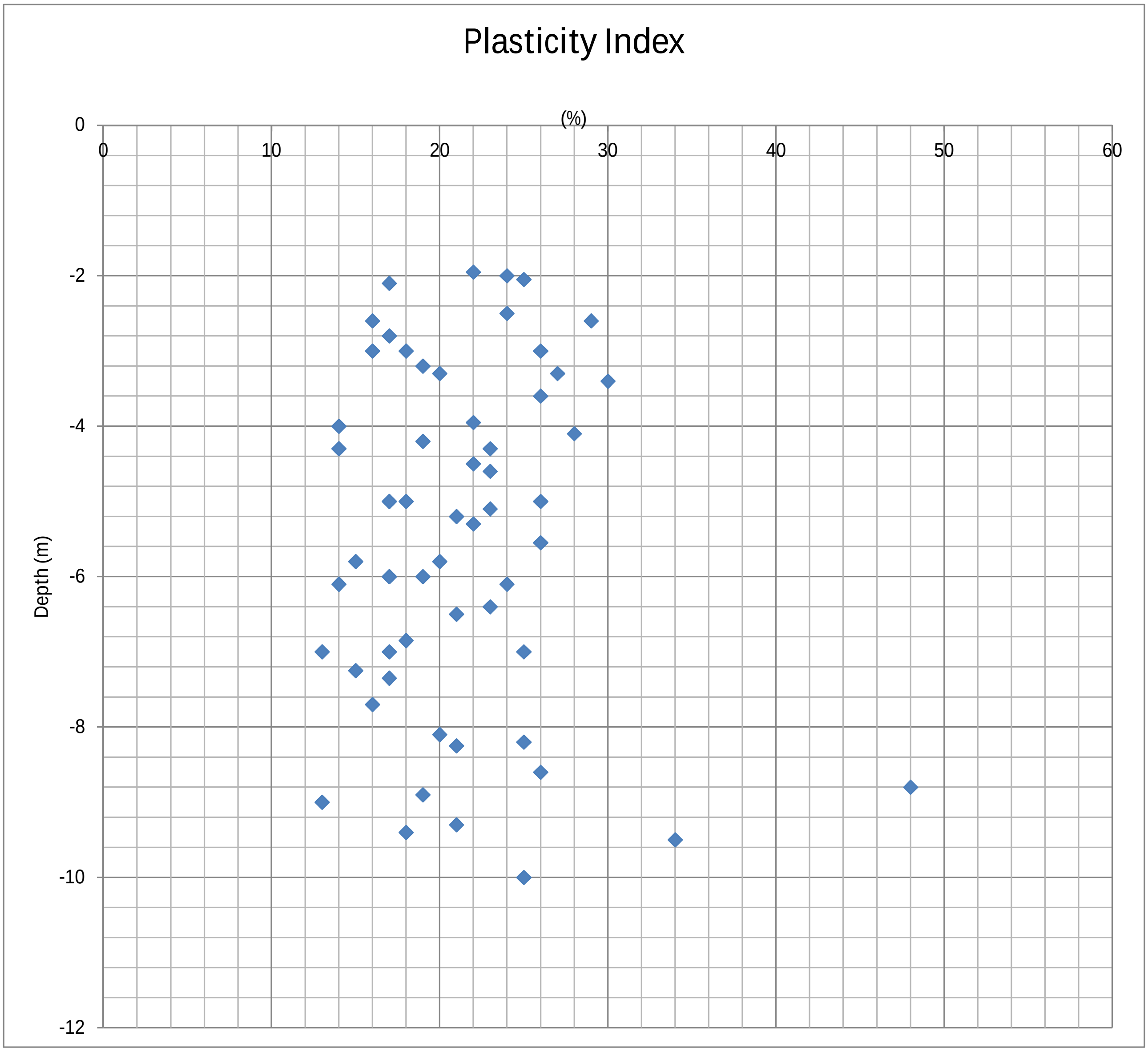

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Figure Title: Undrained Cohesion

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.3.6**	Strata:	**Cohesive Alluvium (<8m)**

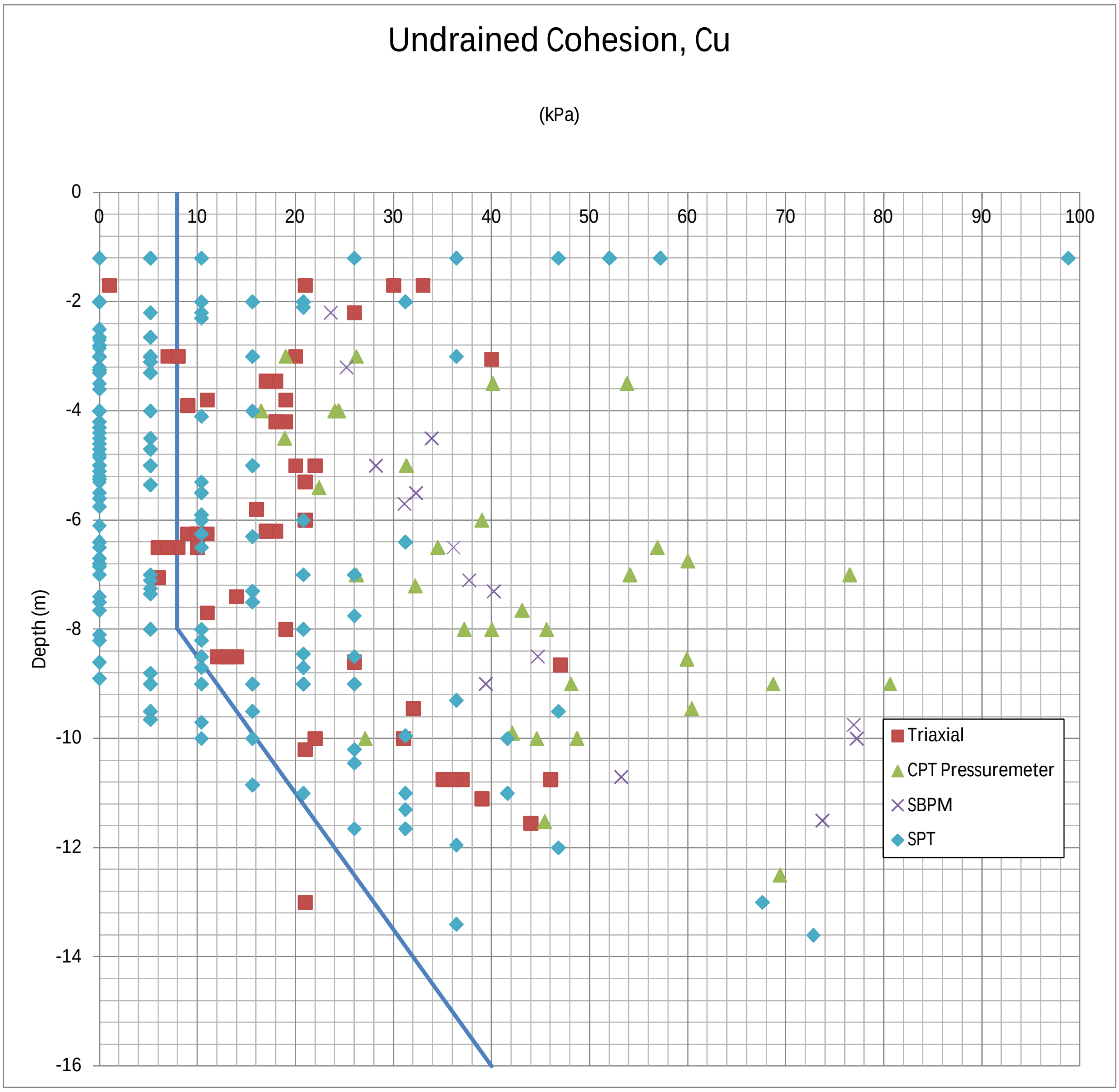

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Figure Title: Undrained Cohesion

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.3.7a**	Strata:	**Cohesive Alluvium (<8m)**

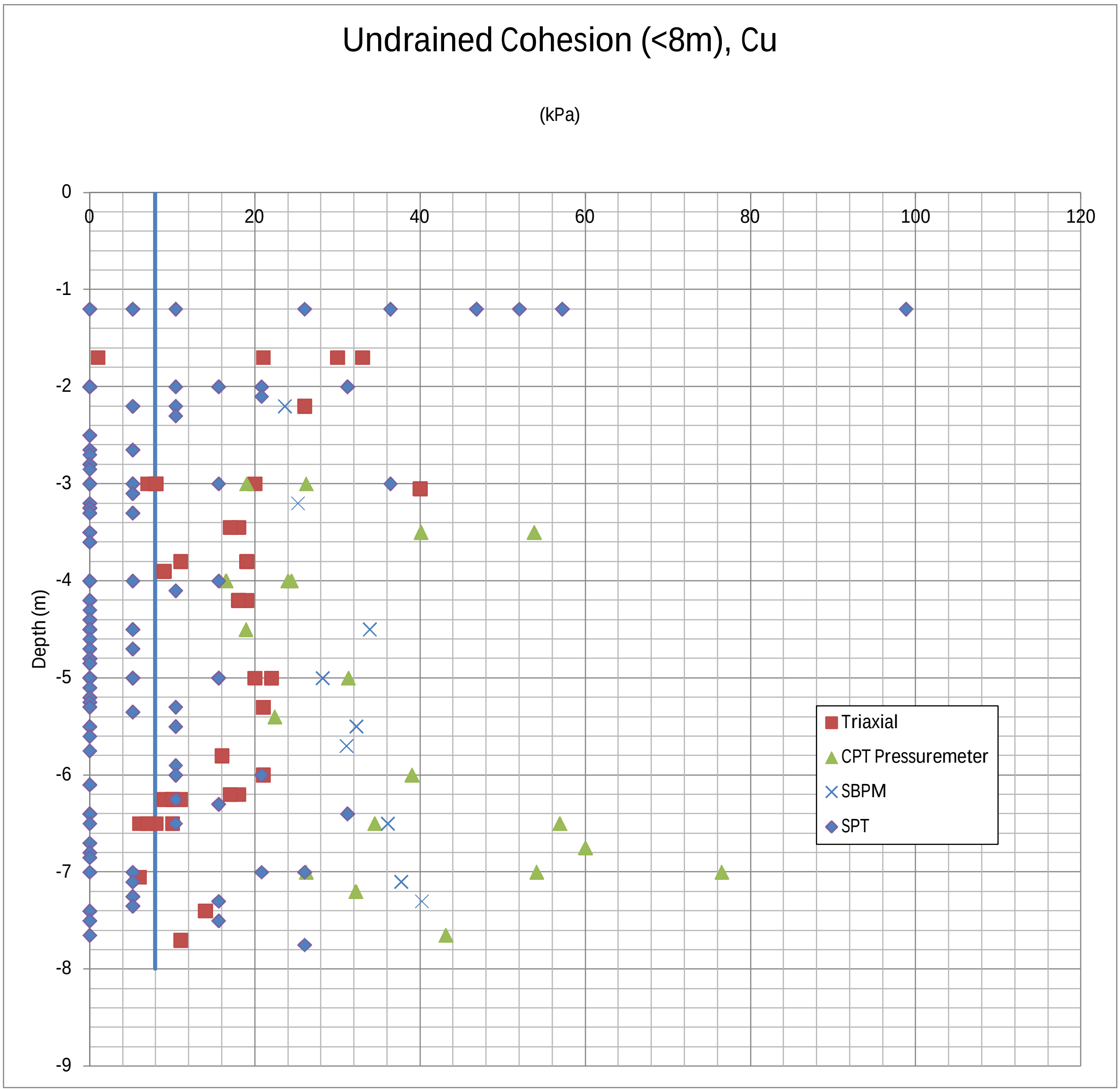

Figure Title: Undrained Cohesion

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Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.3.7b	Strata:	Cohesive Alluvium (>8m)

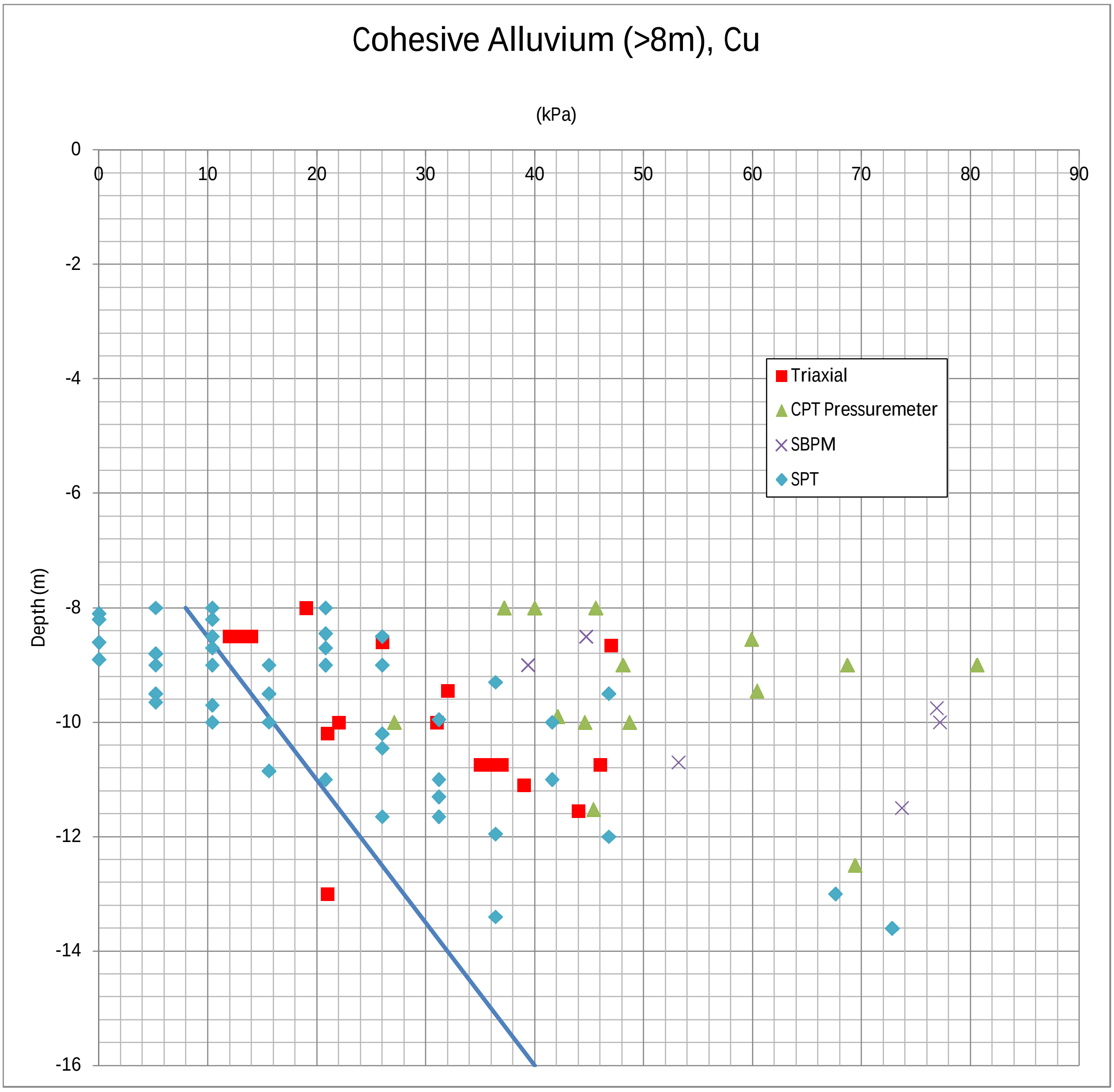

Figure Title: Bulk Density

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.3.8**	Strata:	**Alluvium Cohesive**

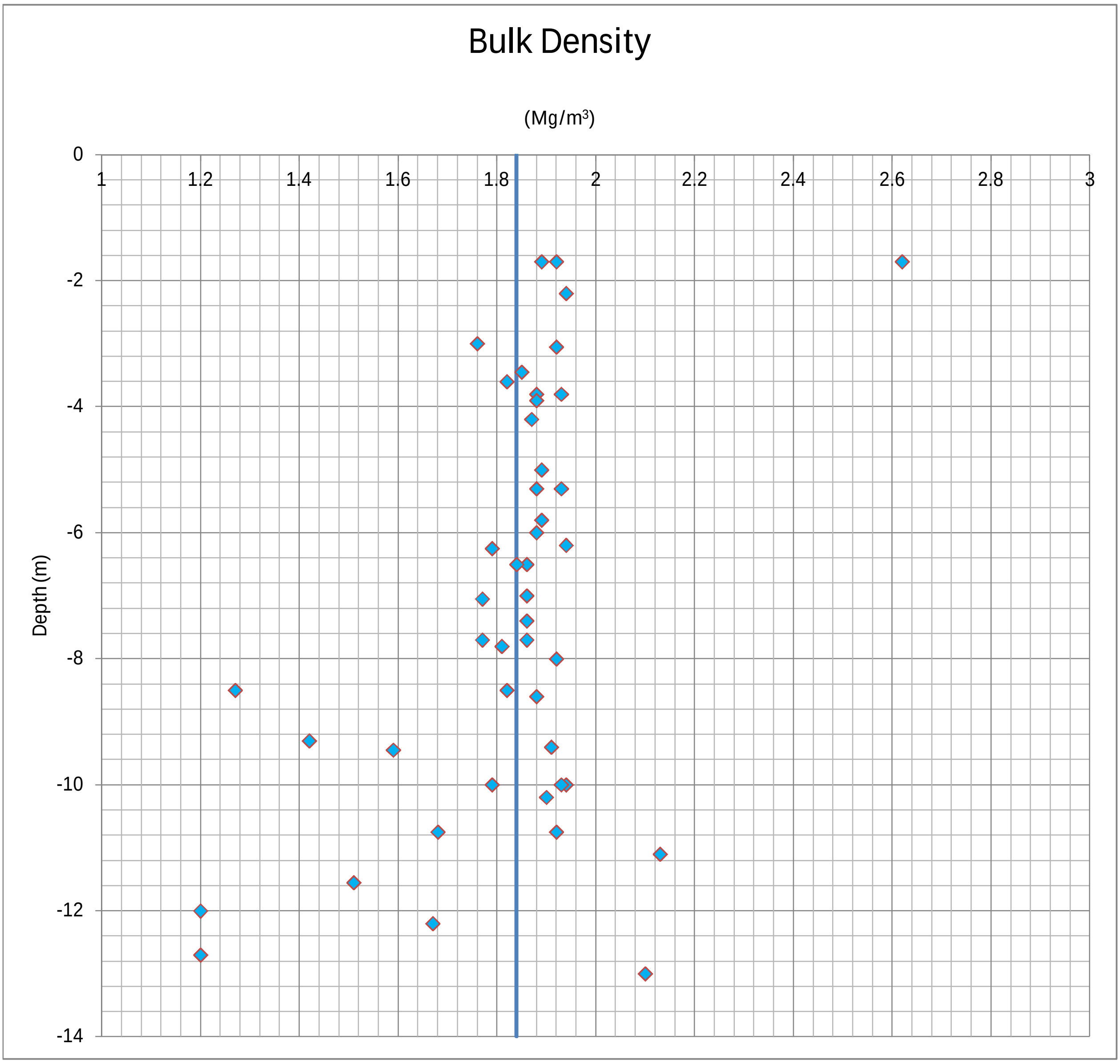

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Figure Title: Coefficient of Volume Compressibility

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.3.9**	Strata:	**Alluvium Cohesive**

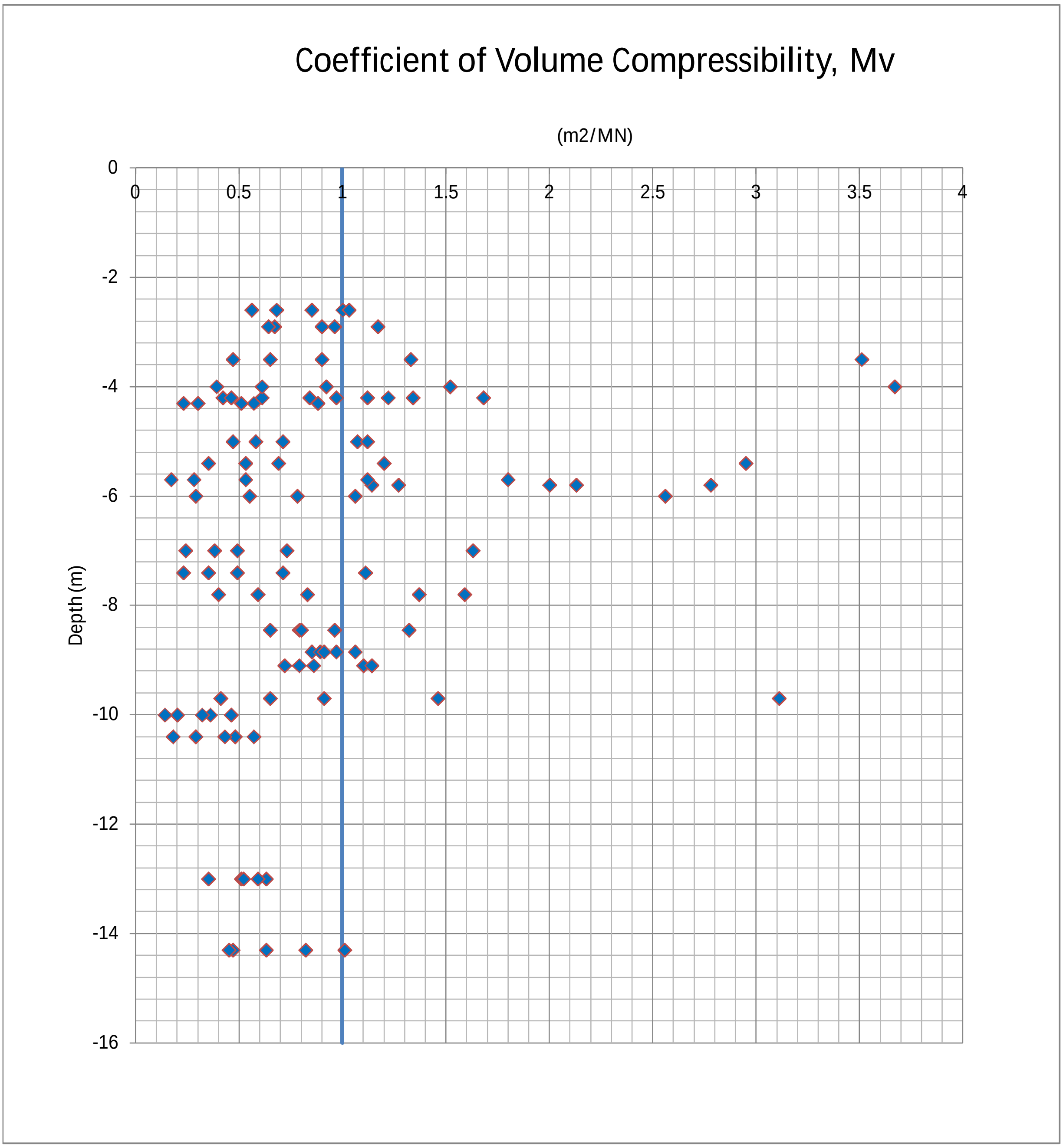

Figure Title: Coefficient of Consolidation

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.3.10	Strata:	Alluvium Cohesive

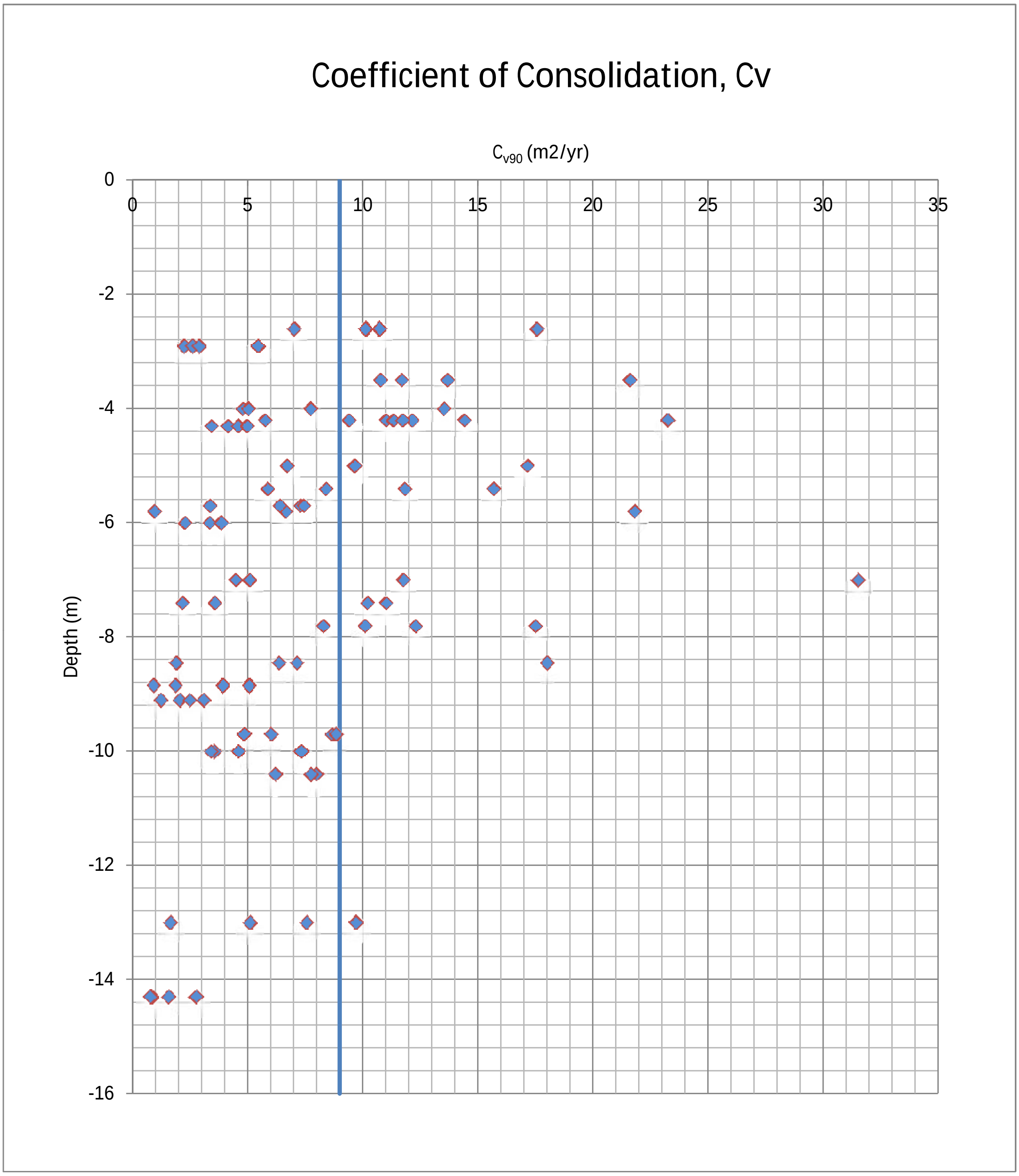

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Figure Title: Permeability

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.3.11**	Strata:	**Cohesive Alluvium**

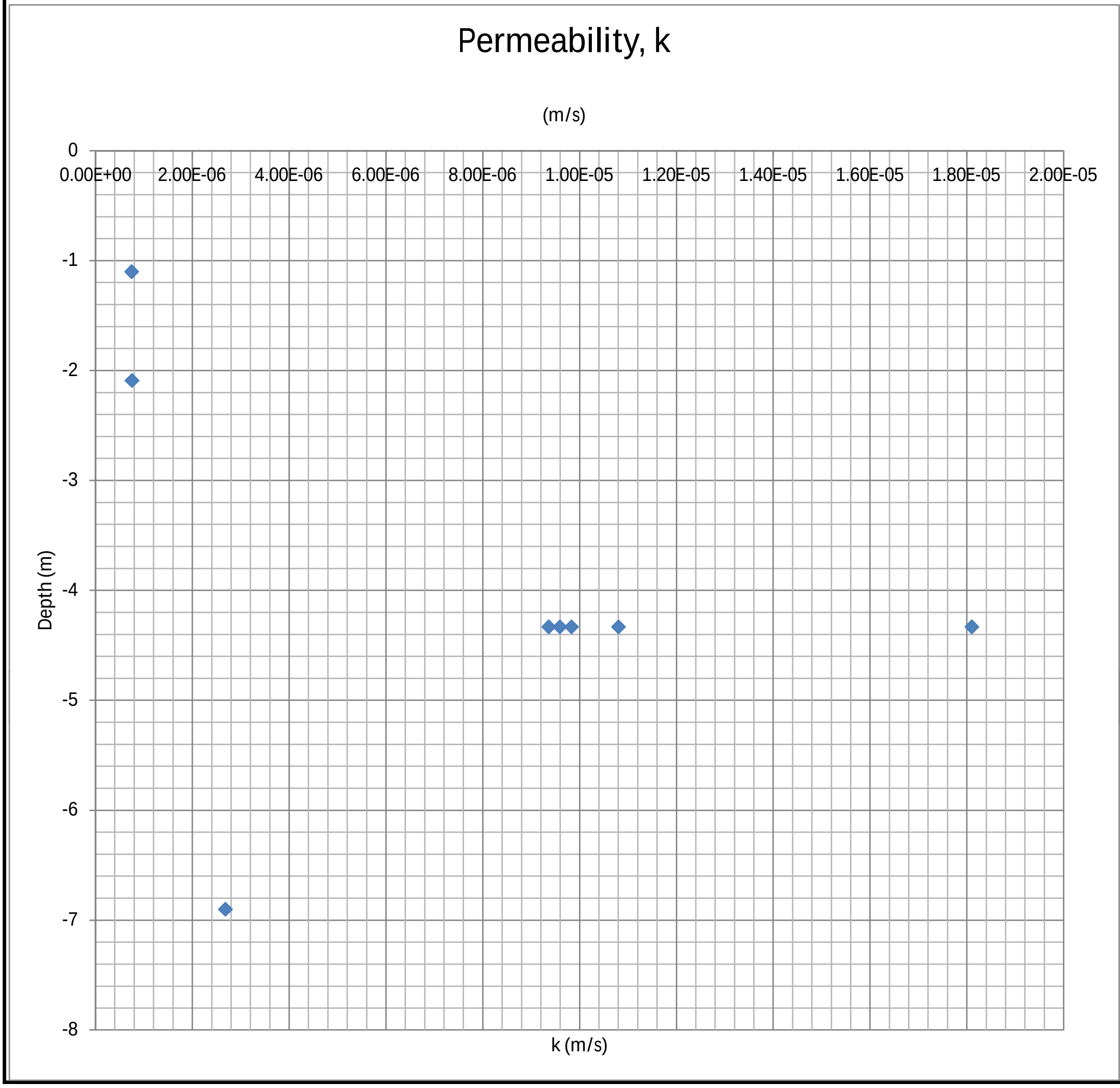

Figure Title: Angle of Friction

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.3.12	Strata:	Cohesive Alluvium

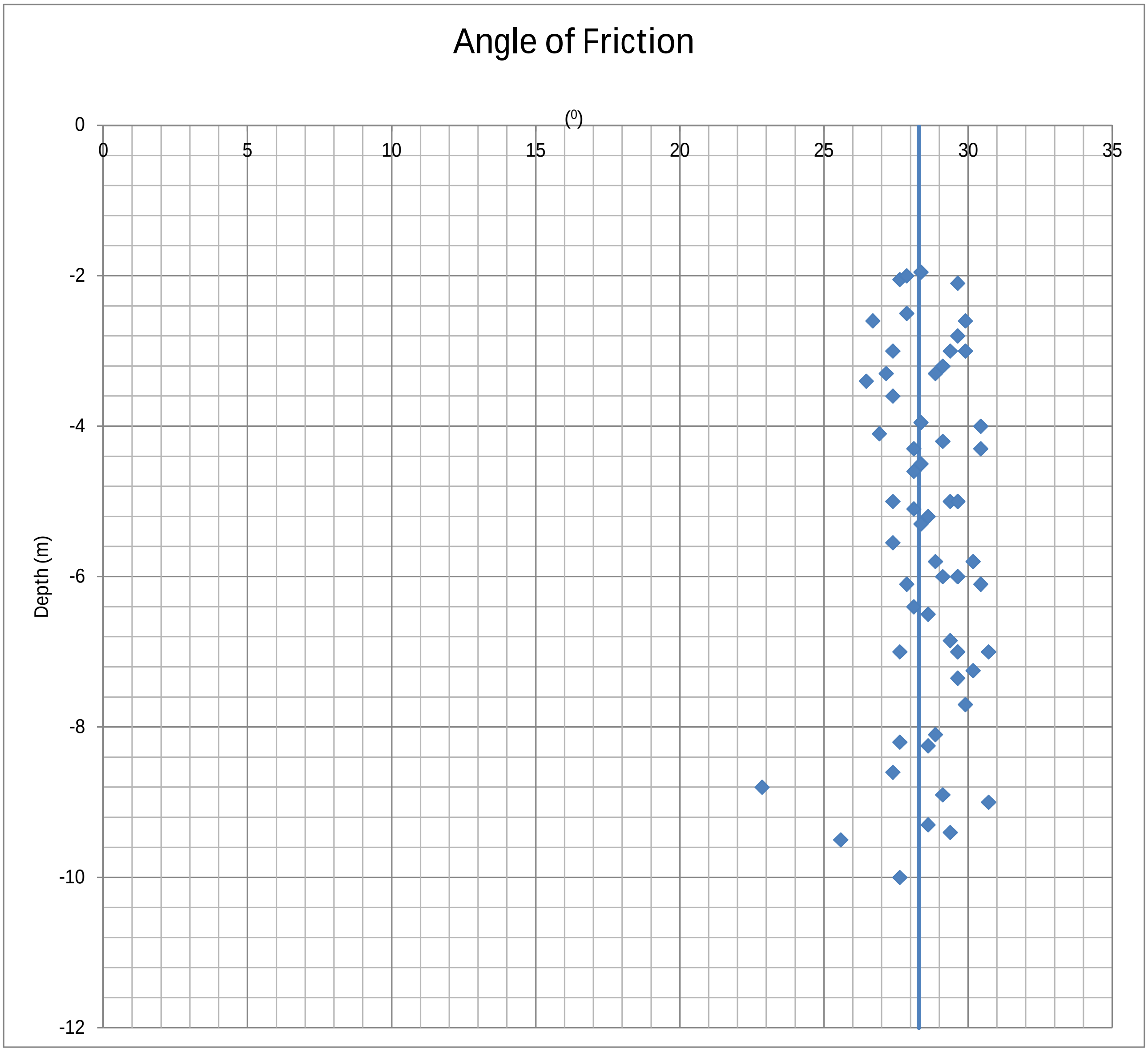

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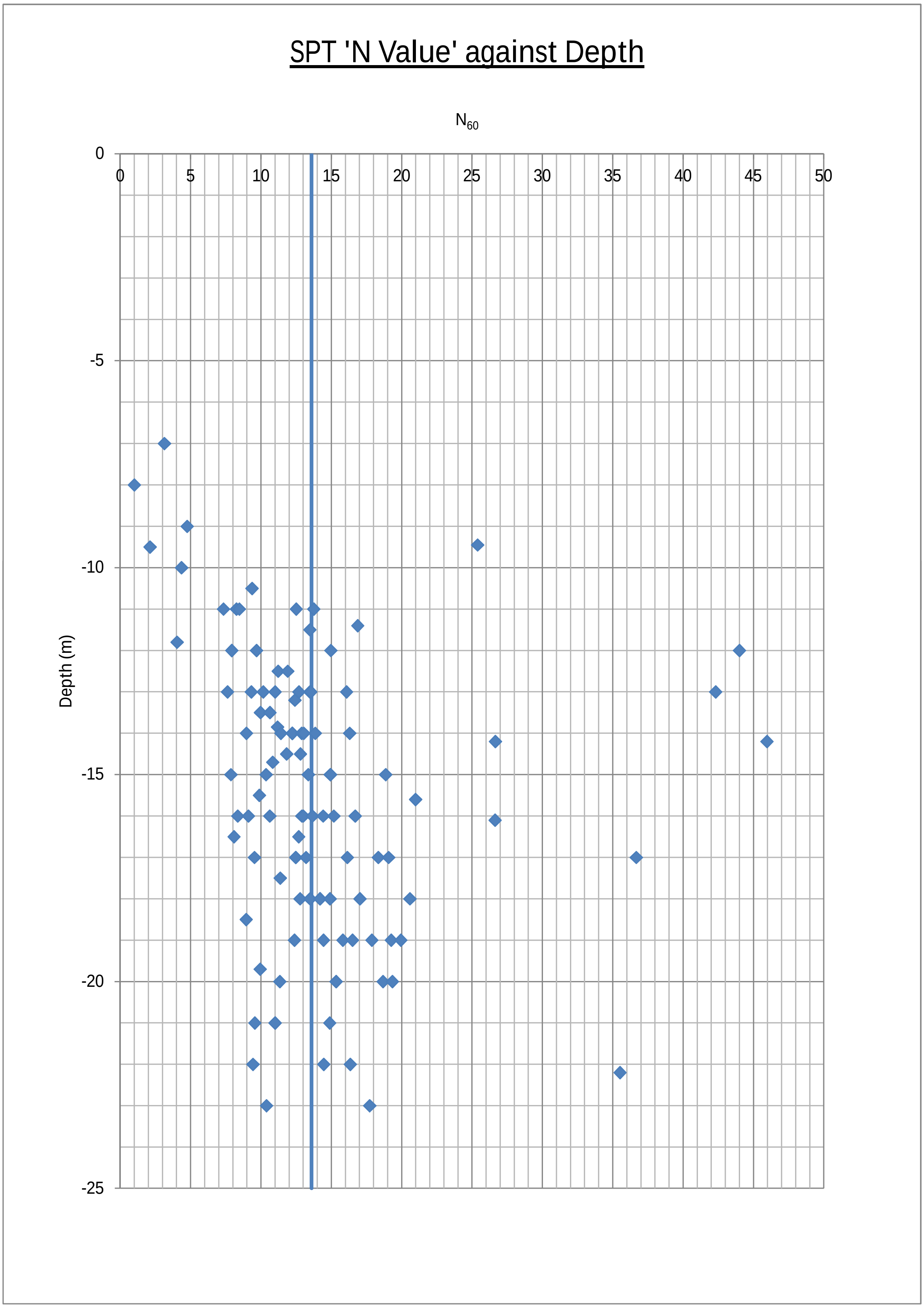
Figure Title: SPT N-Value

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.4.1**	Strata:	**Granular Alluvium**



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Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**6.4.2**	Strata:	**Granular Alluvium**

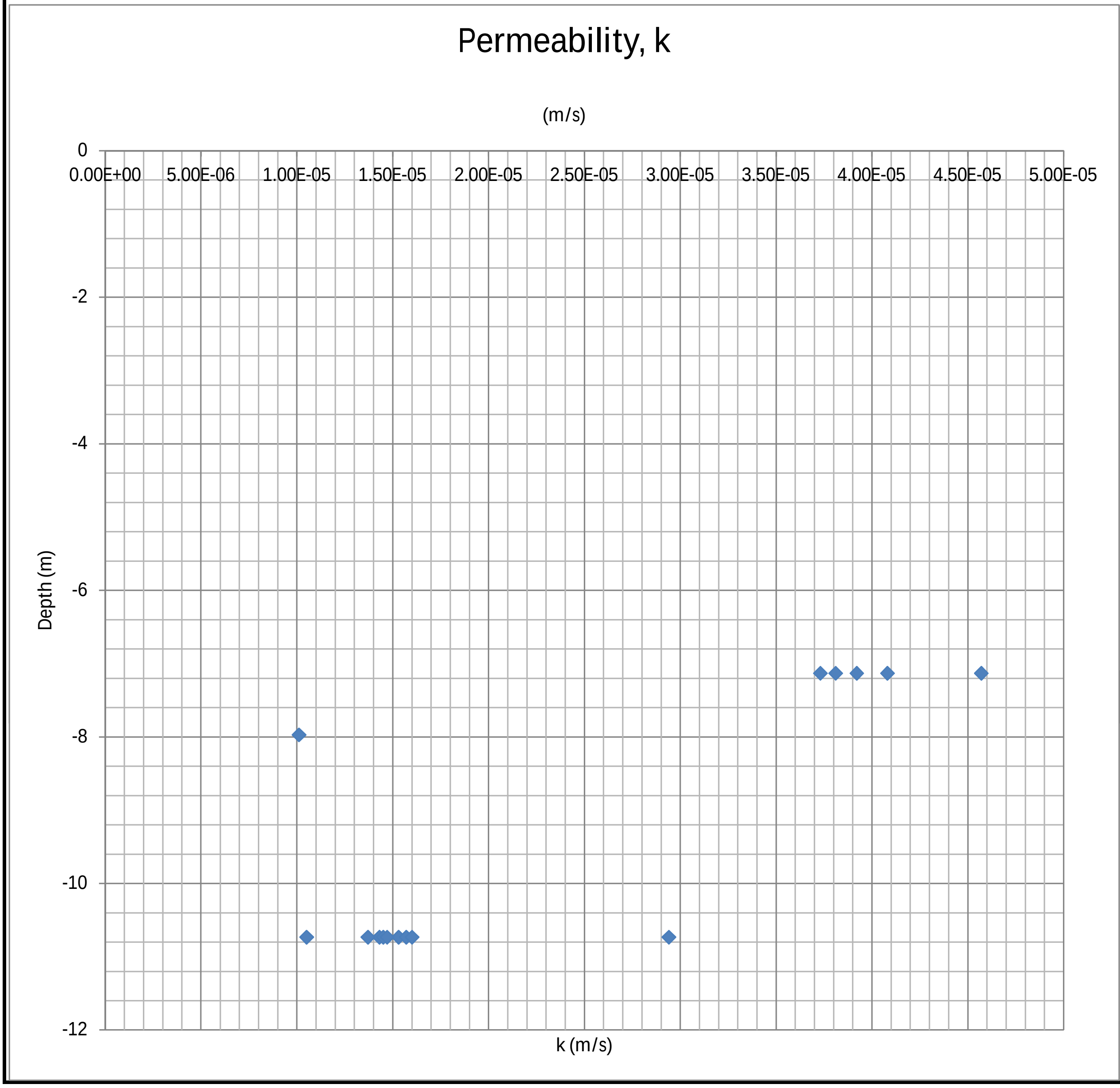

Figure Title: Angle of Friction

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.4.3**	Strata:	**Granular Alluvium**

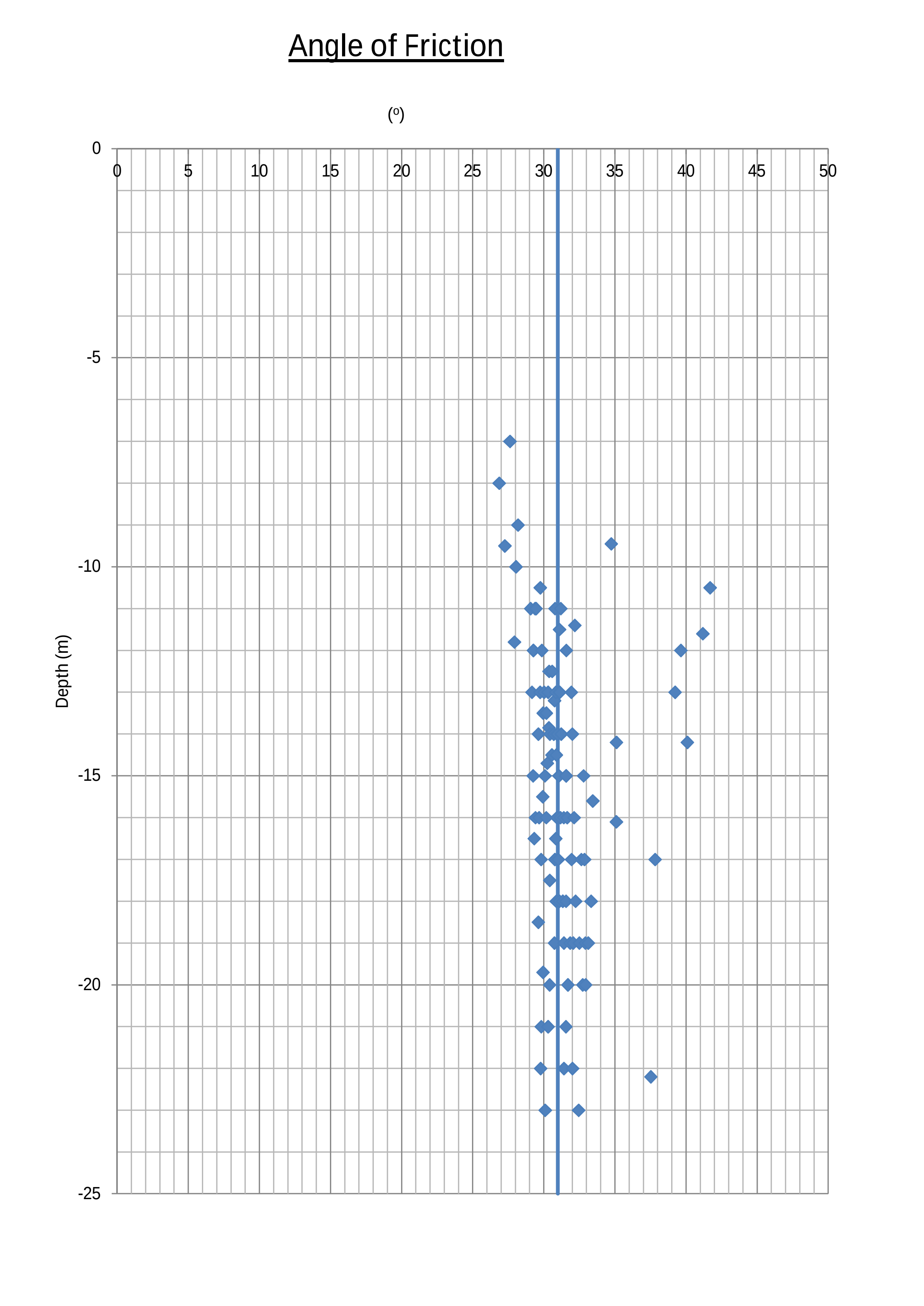

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Figure Title: SPT N-Value

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.5.1**	Strata:	**Peat**

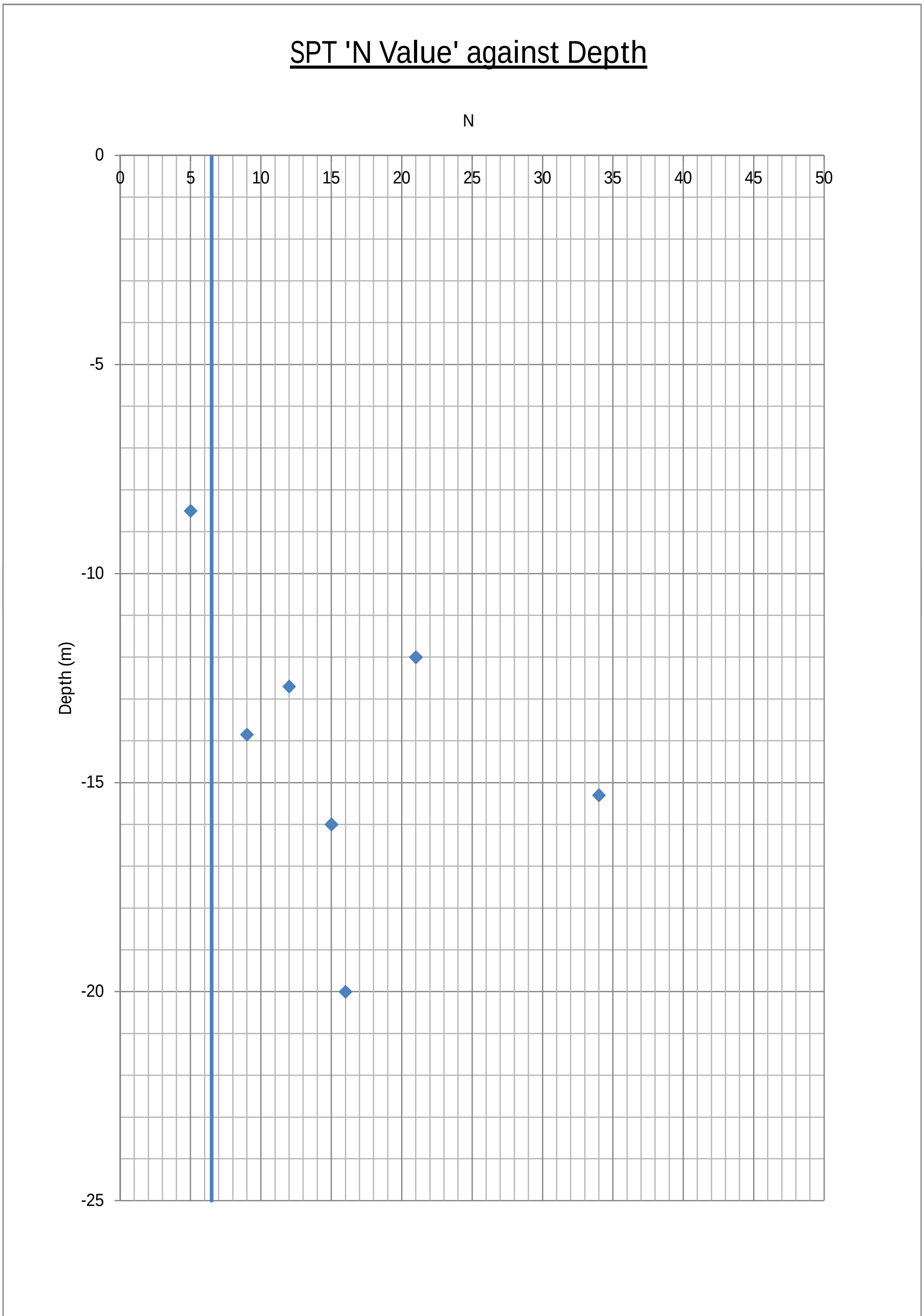

Figure Title: Plasticity Chart

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.5.2**	Strata:	**Peat**

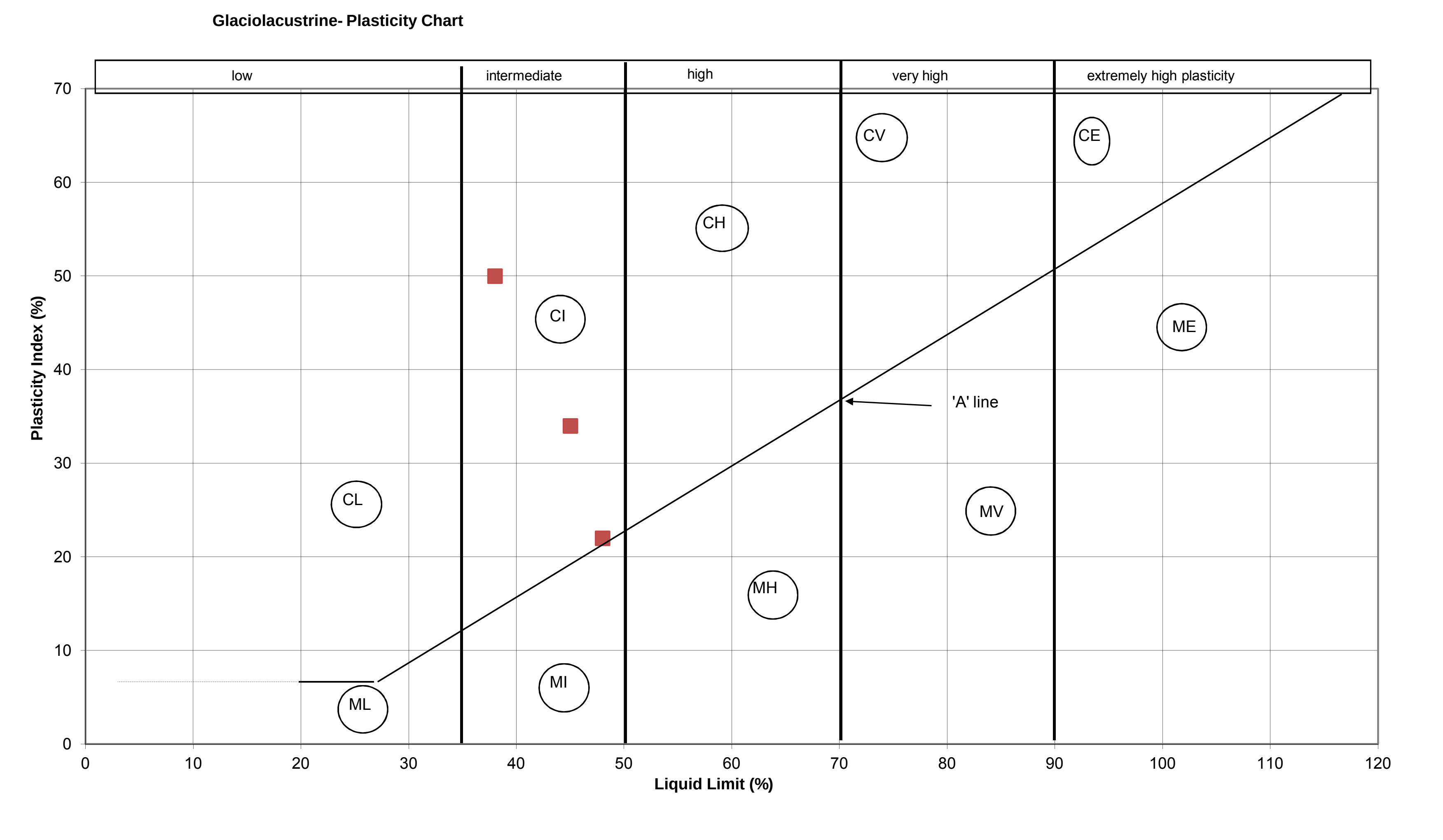

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Figure Title: Plasticity Index

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.5.3	Strata:	Peat

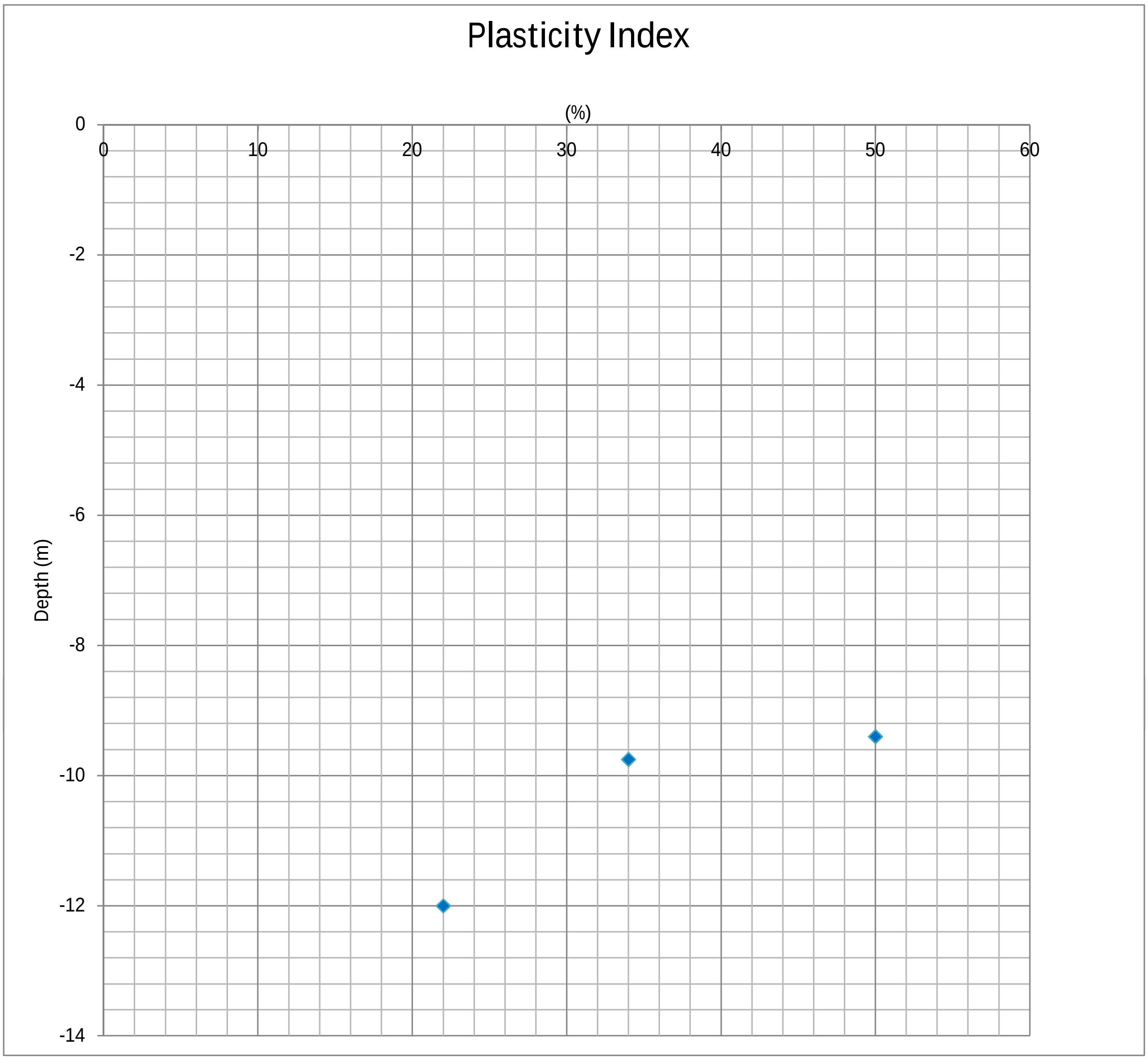

Figure Title: Undrained Cohesion

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.5.4**	Strata:	**Peat**

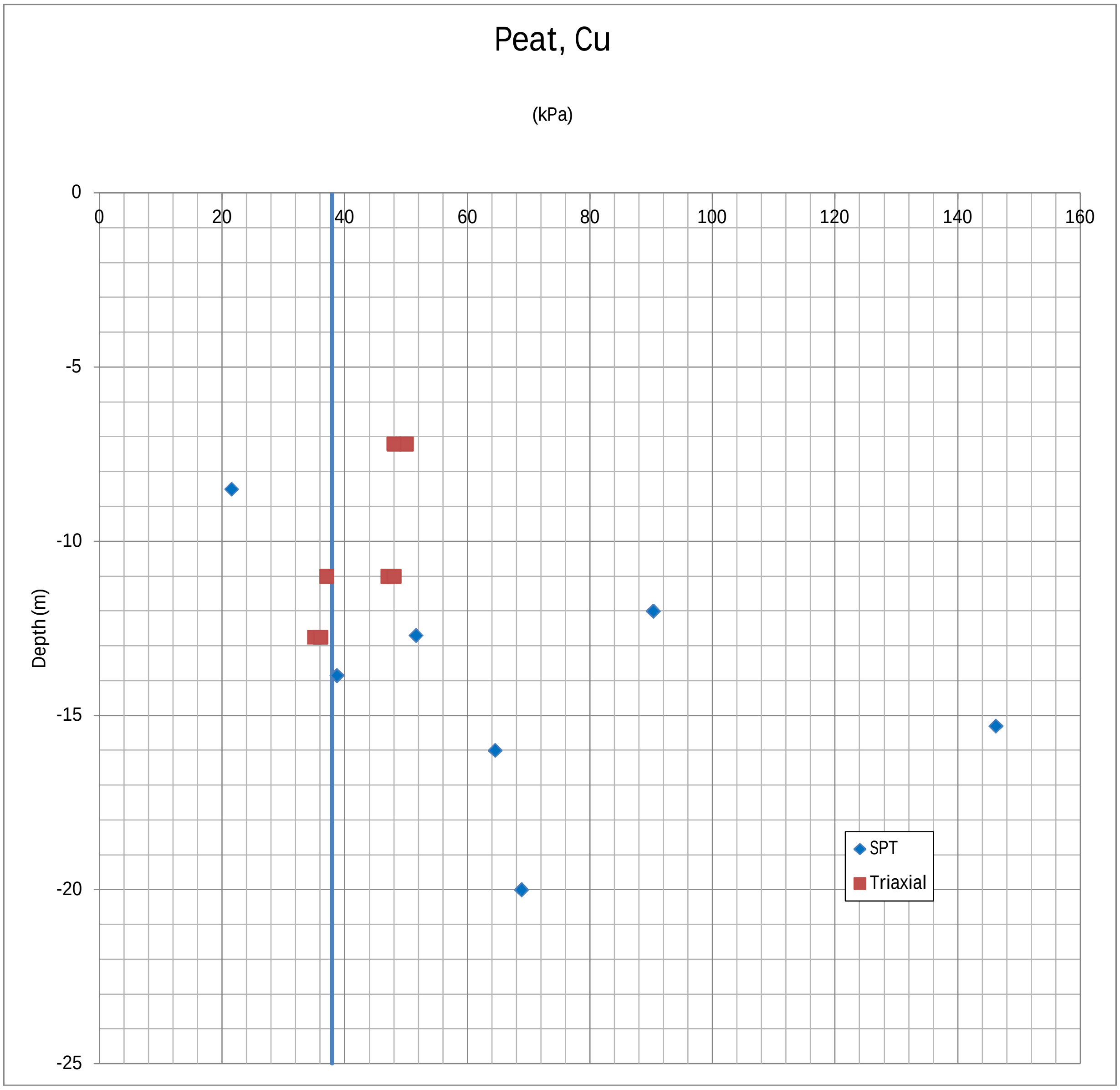

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Figure Title: Bulk Density

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.5.5**	Strata:	**Peat**

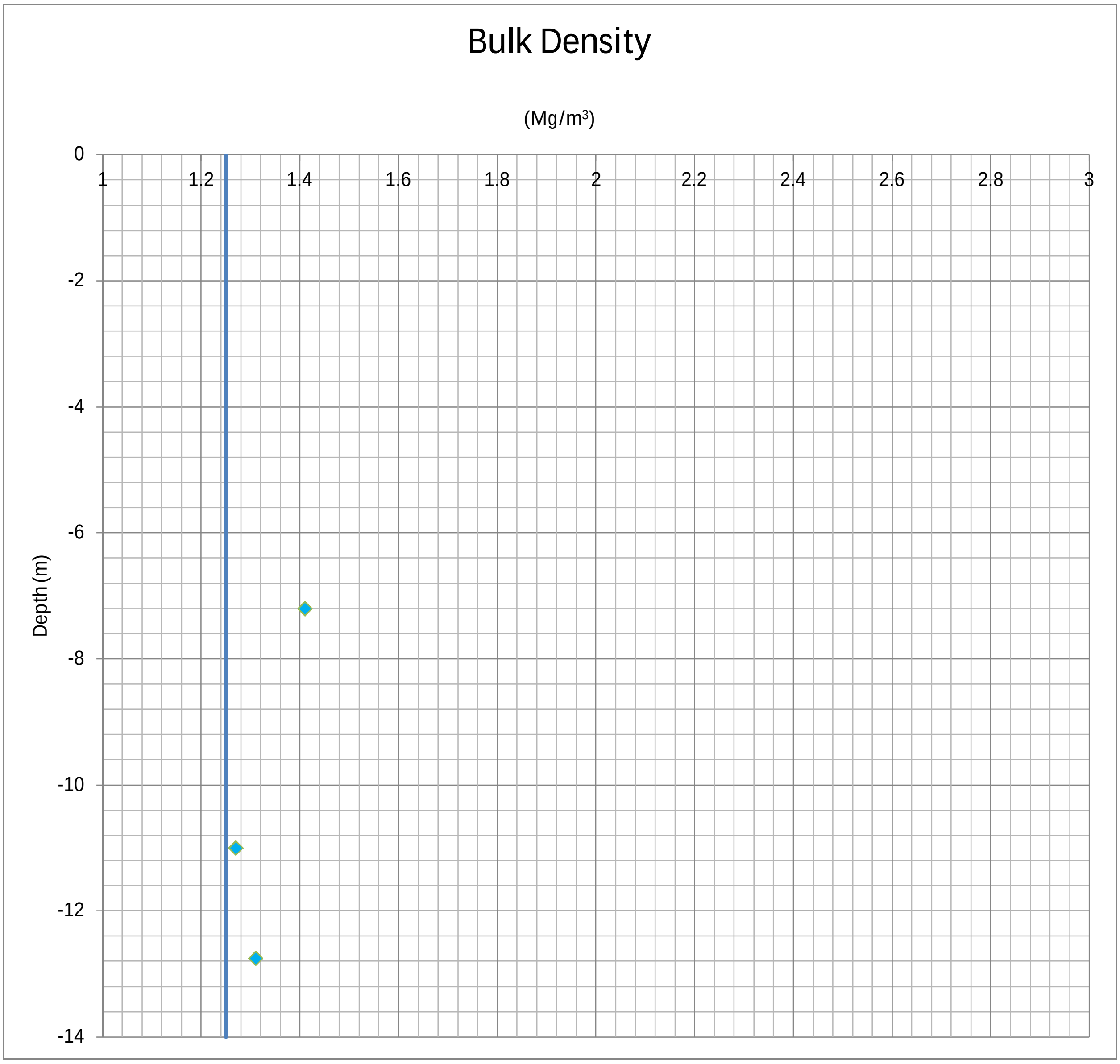

Figure Title: Coefficient of Volume Compressibility

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.5.6**	Strata:	**Peat**

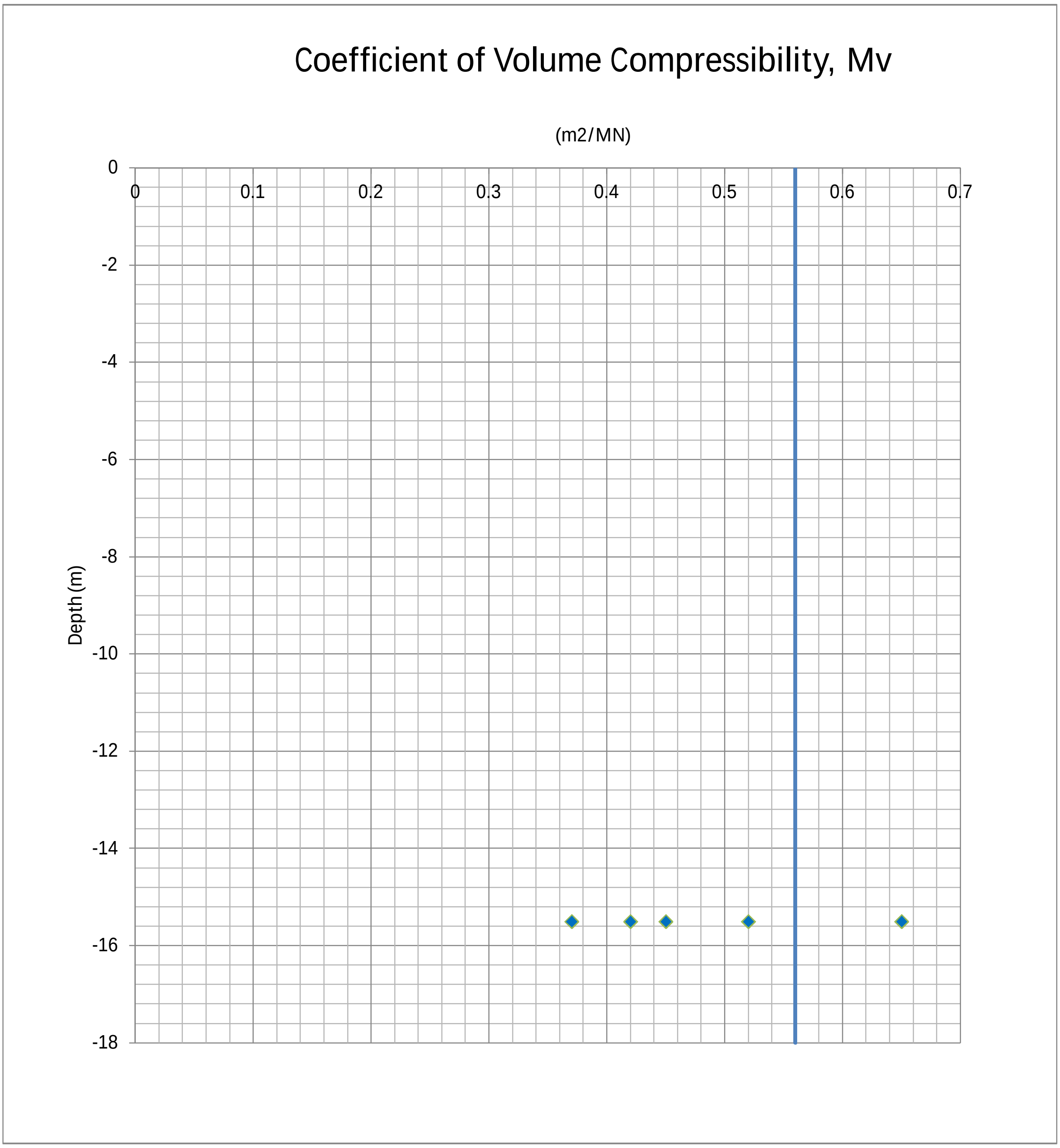

Figure Title: Coefficient of Consolidation

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.5.7**	Strata:	**Peat**

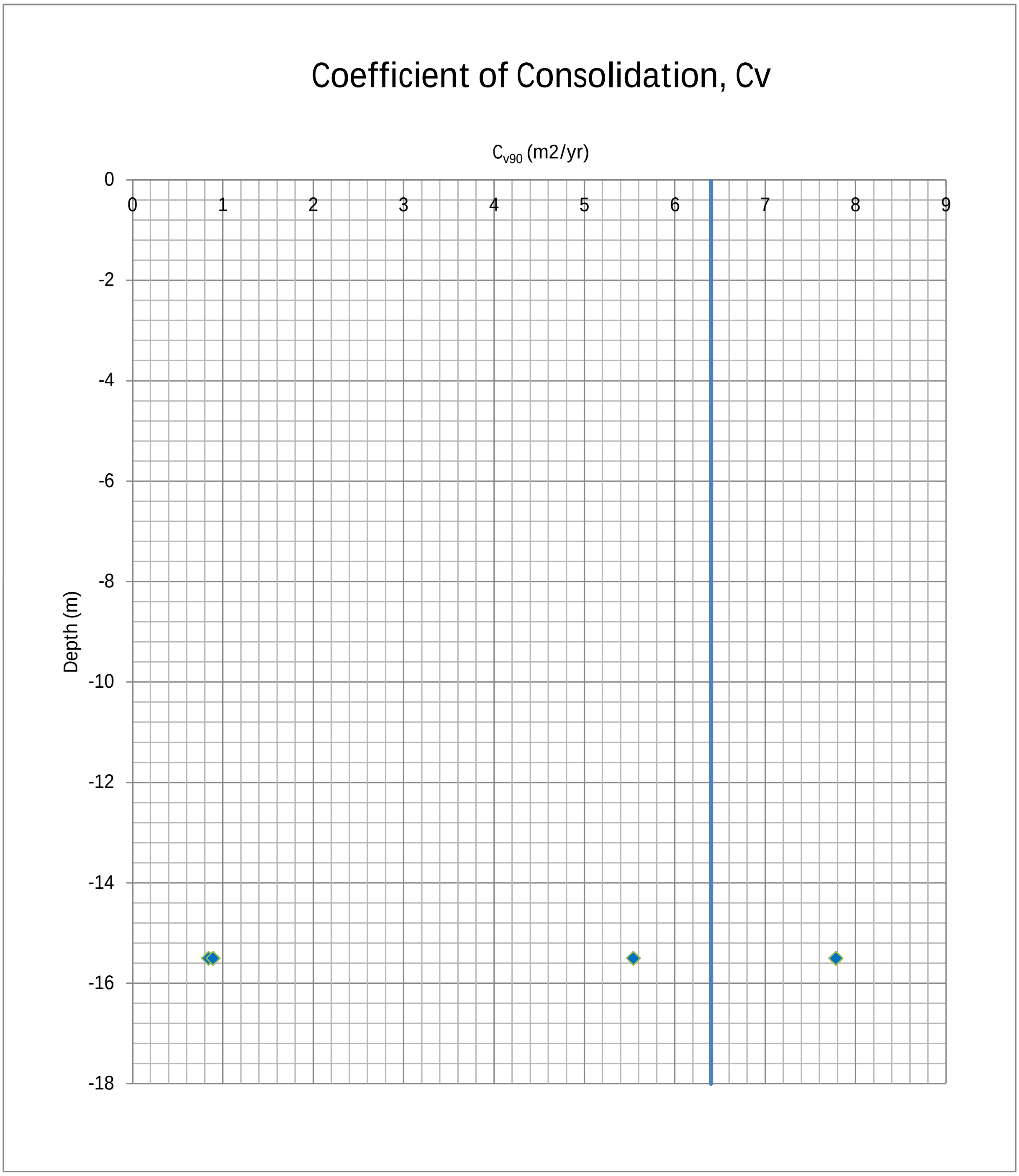

Figure Title: Angle of Friction

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.5.8	Strata:	Peat

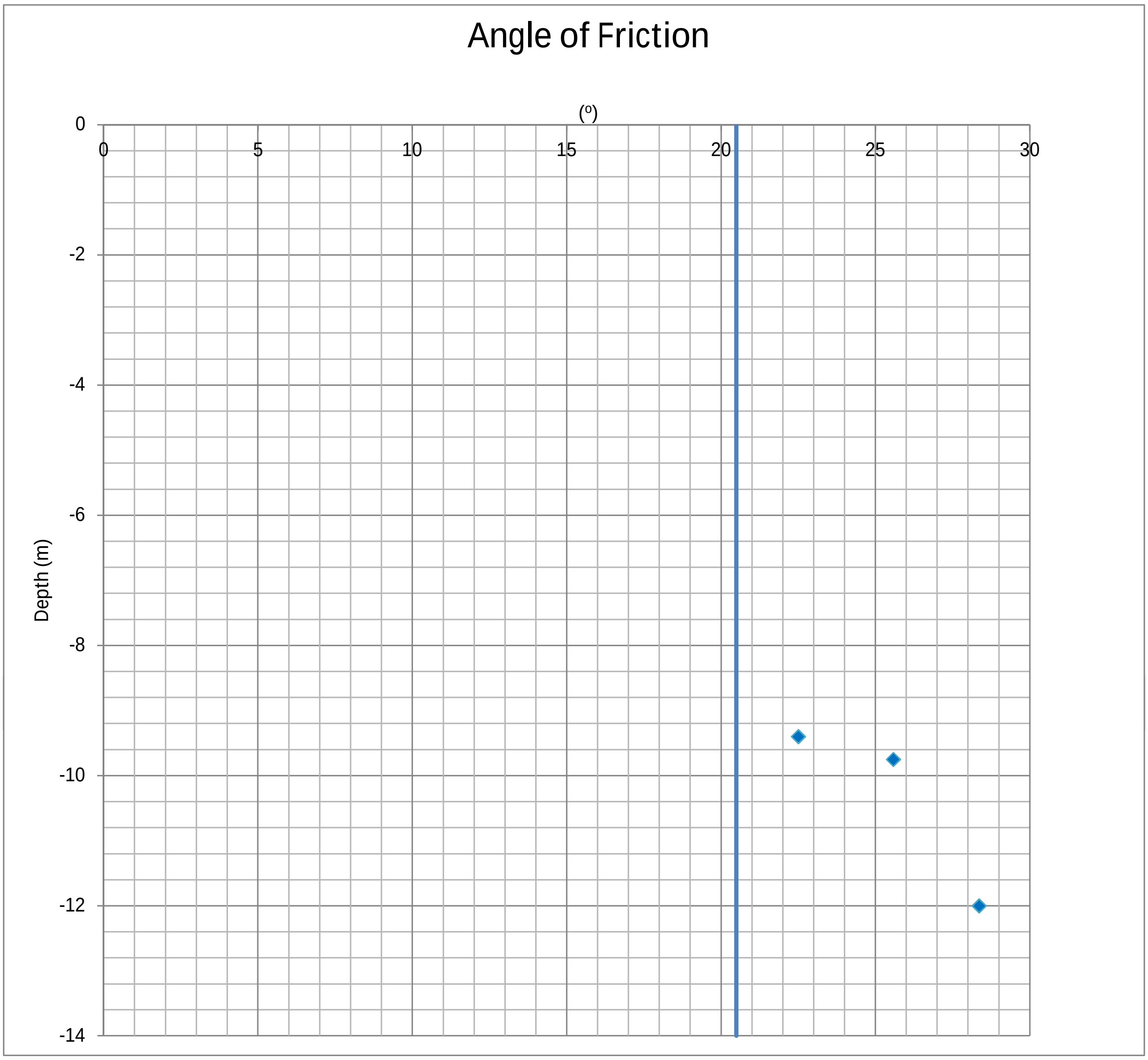

Figure Title: SPT N-Value

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street Improvements
Figure Reference:	Figure 6.6.1	Strata:	Glacial Till

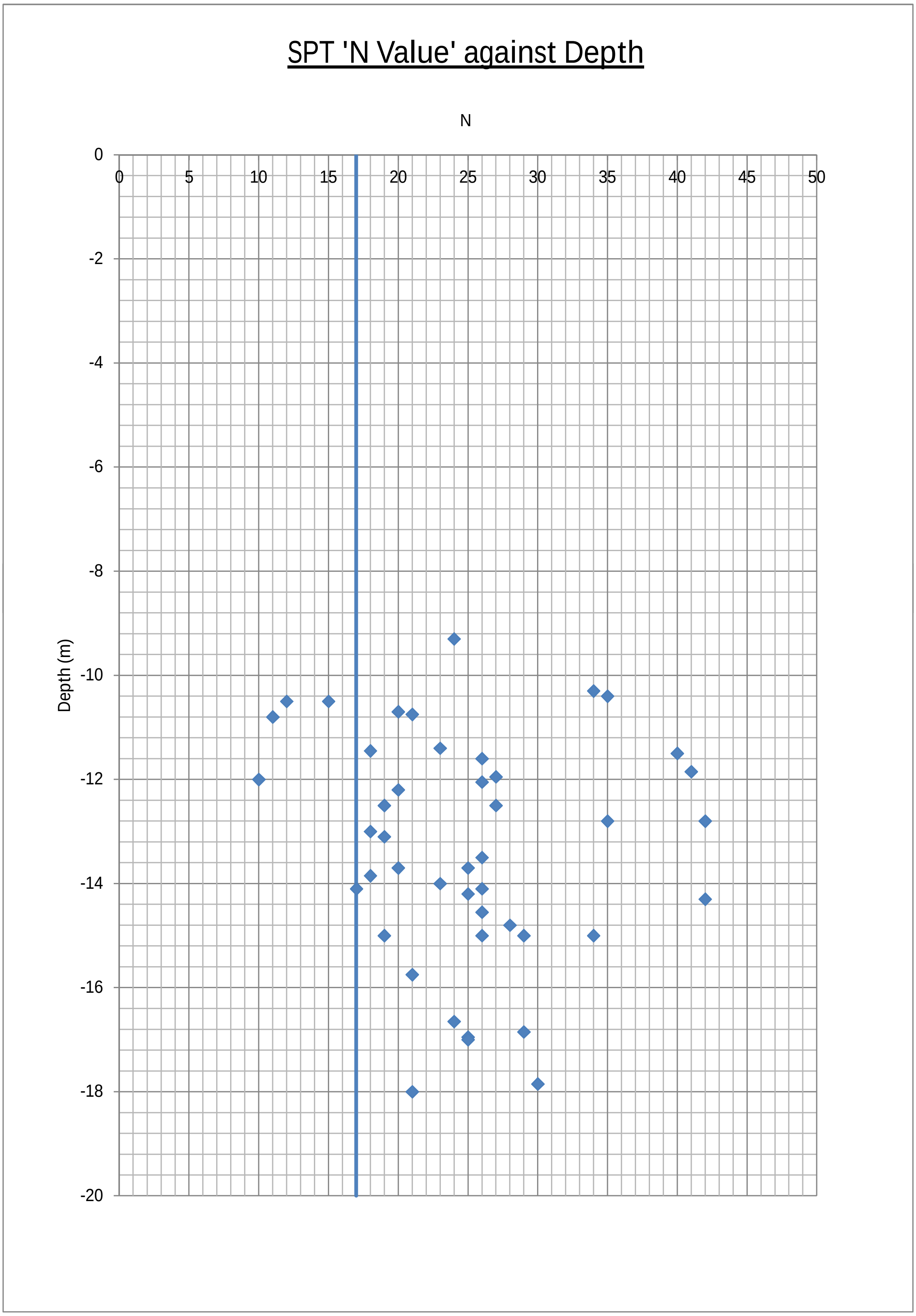

Figure Title: Plasticity Chart

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.6.2**	Strata:	**Glacial Till**

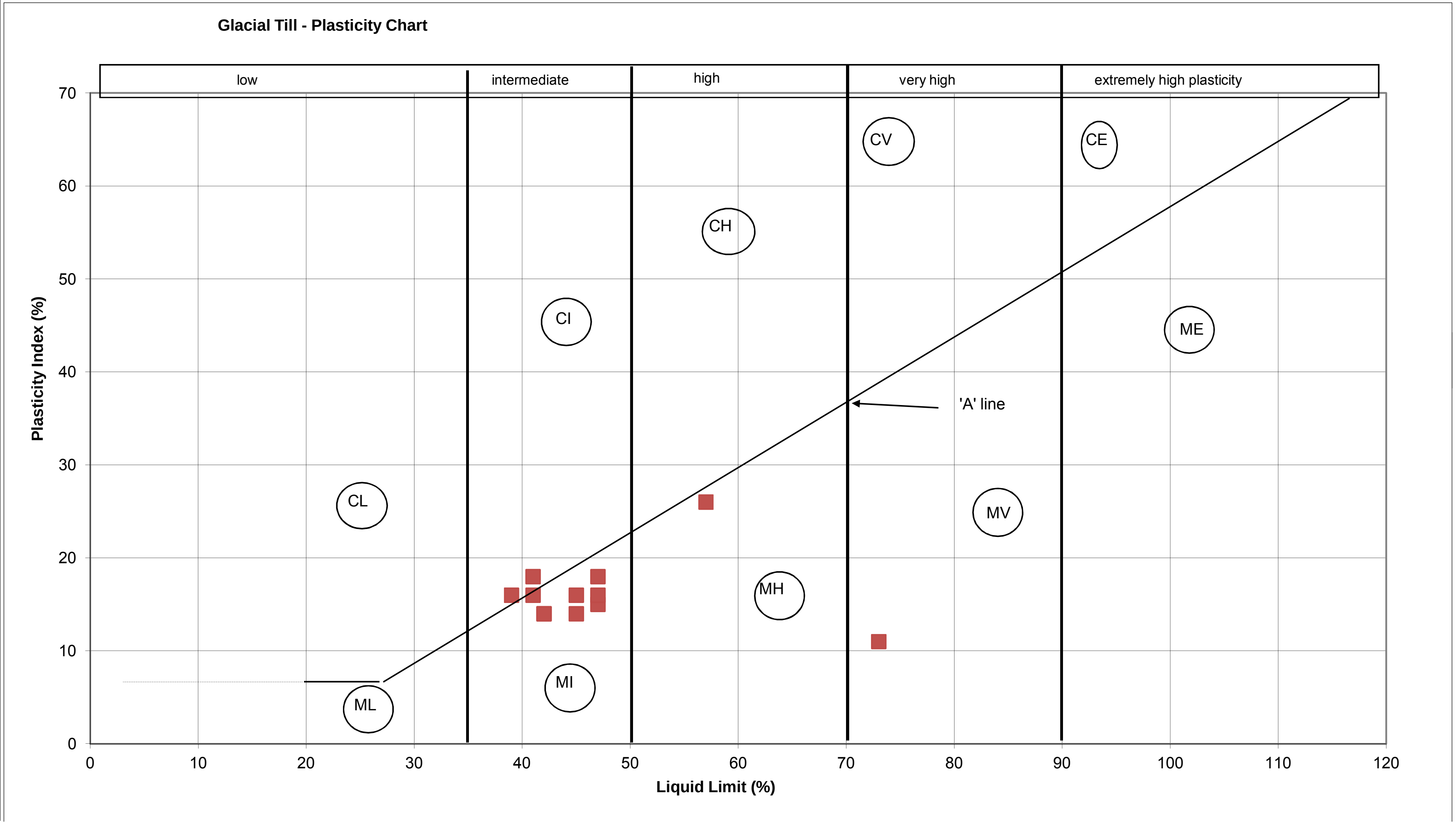

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Figure Title: Plasticity Index

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.6.3**	Strata:	**Glacial Till**

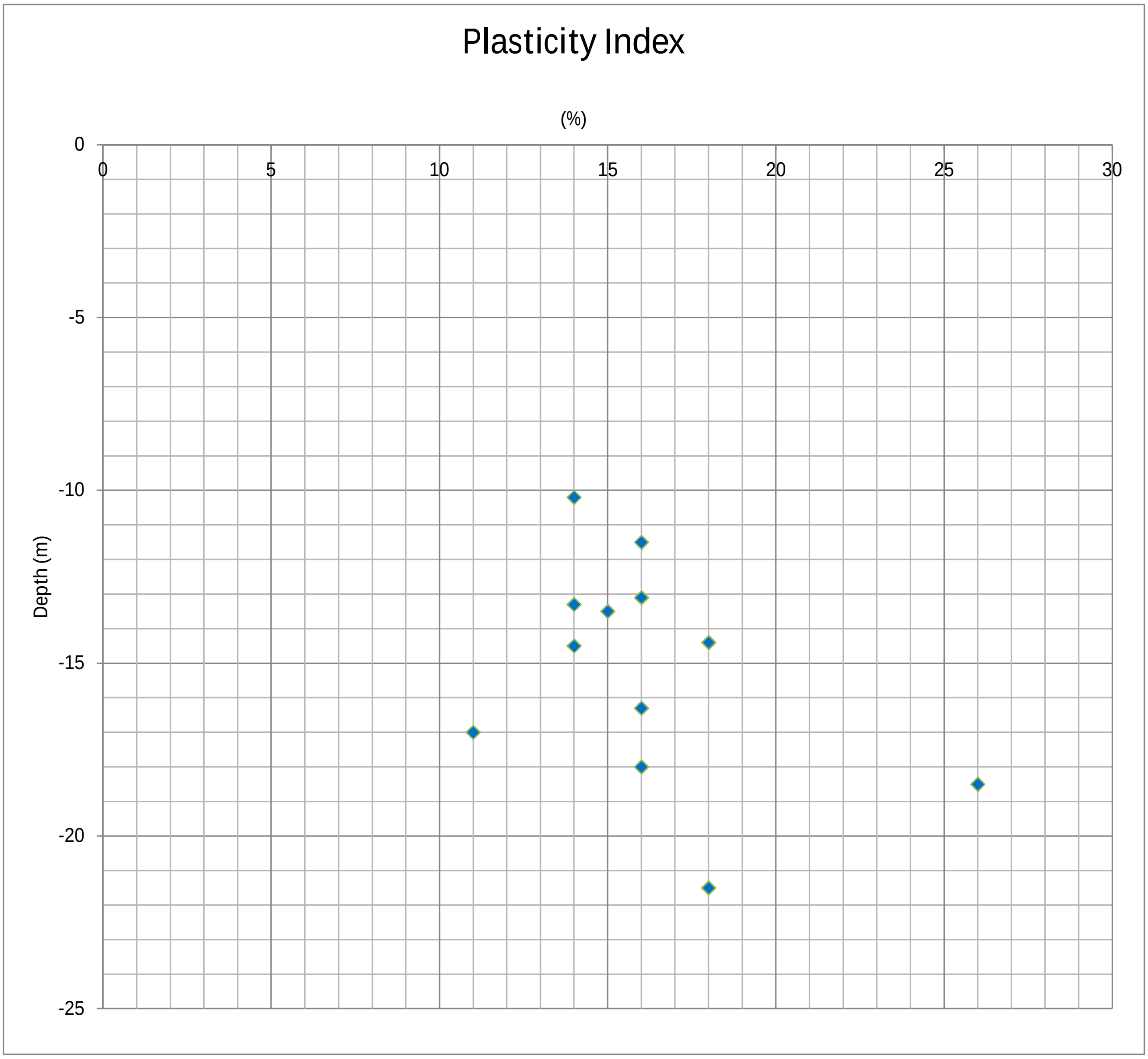

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Figure Title: Undrained Cohesion

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.6.4	Strata:	Glacial Till

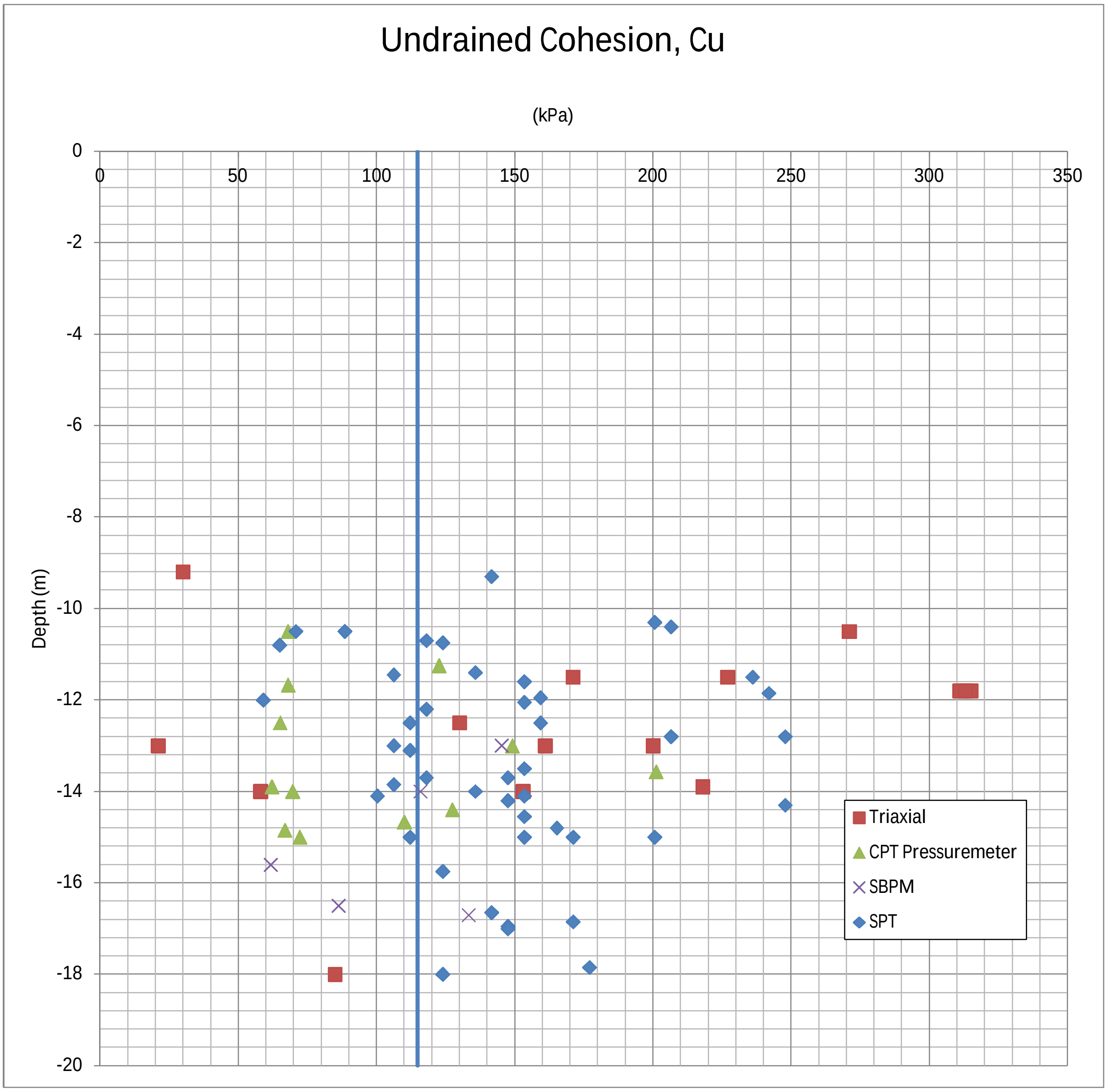

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Figure Title: Bulk Density

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.6.5	Strata:	Glacial Till

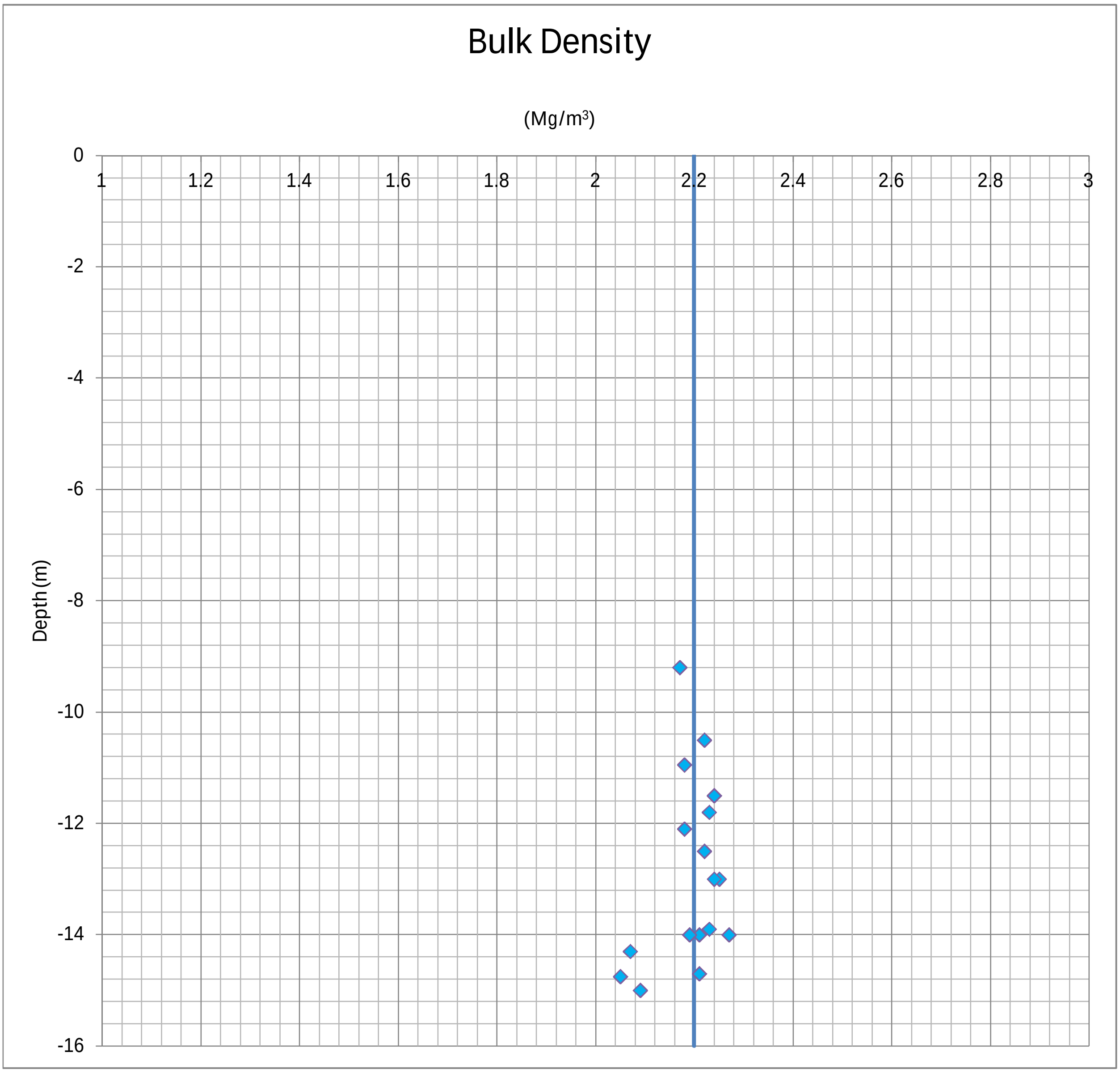

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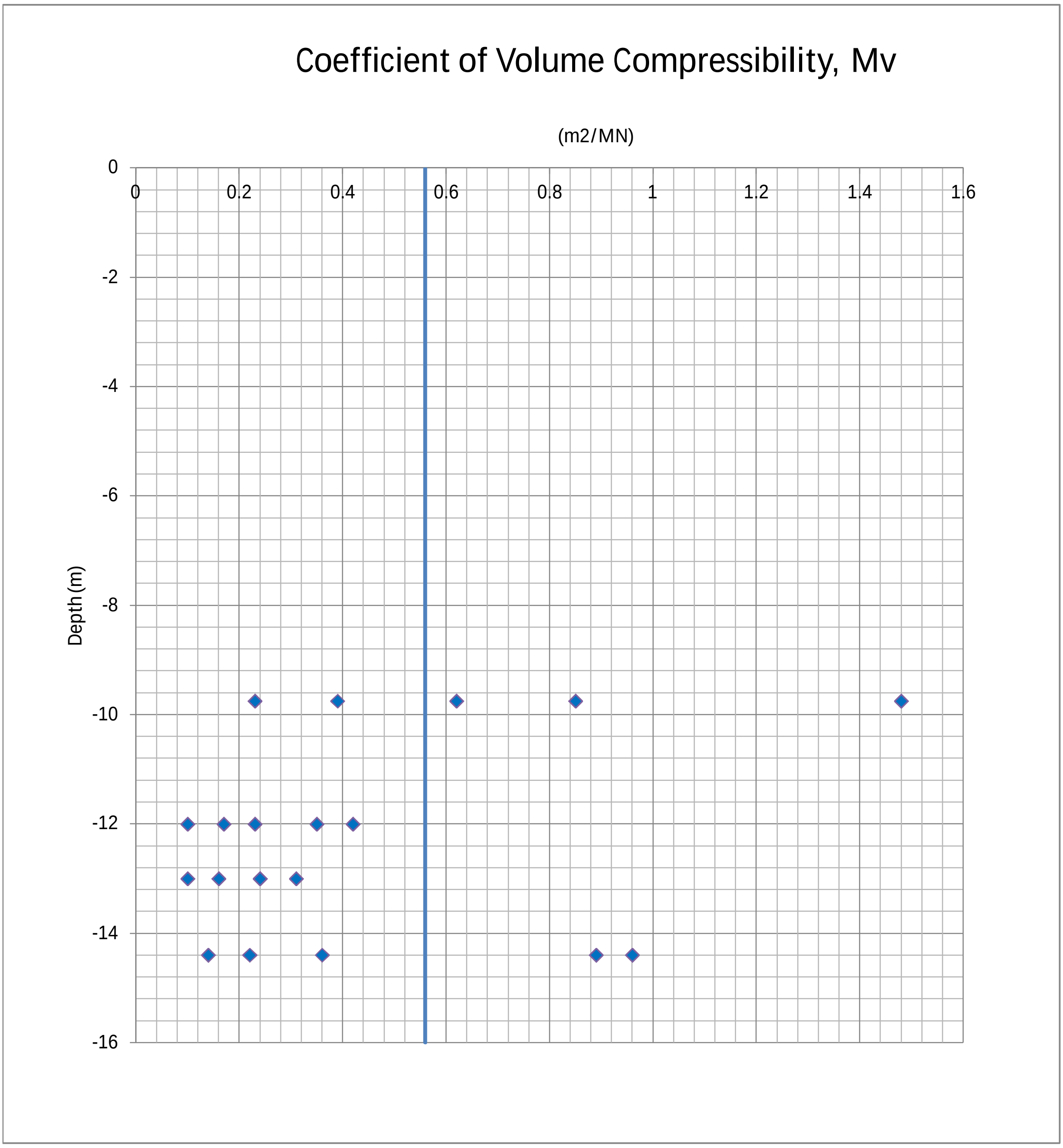
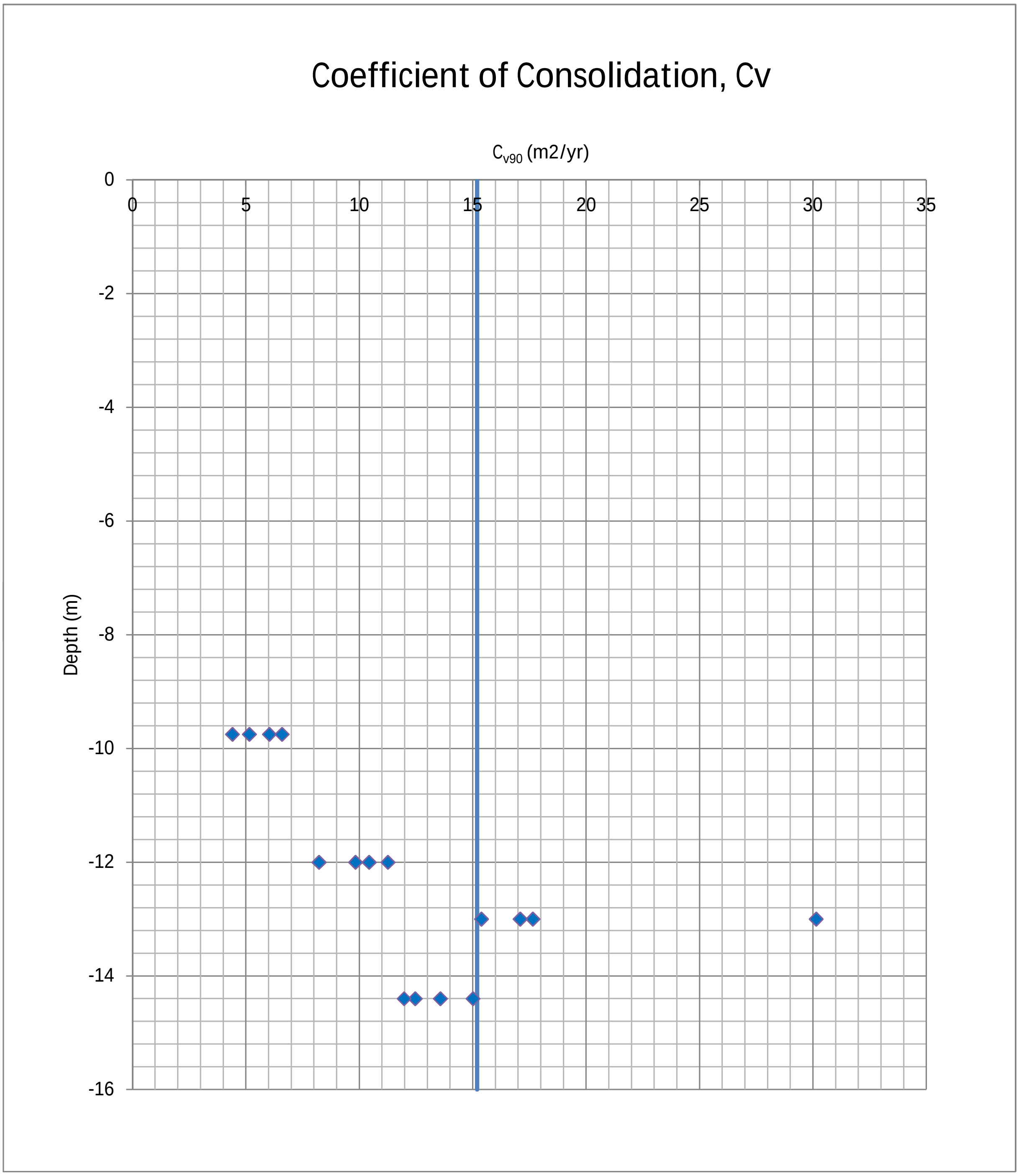
Figure Title: Coefficient of Volume Compressibility

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.6.6**	Strata:	**Glacial Till**



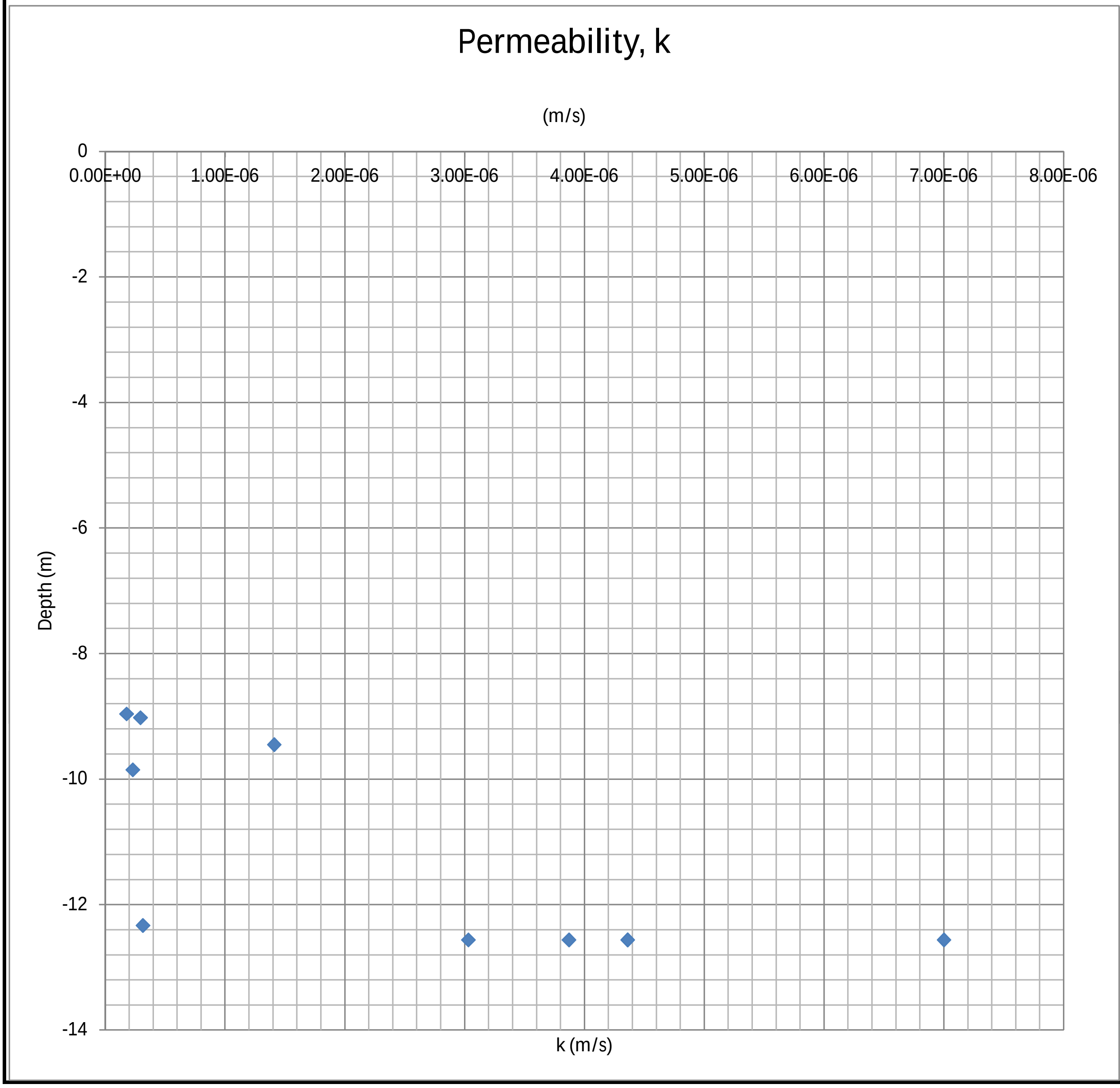
HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	# Figure Title: Coefficient of Consolidation

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.6.7**	Strata:	**Glacial Till**



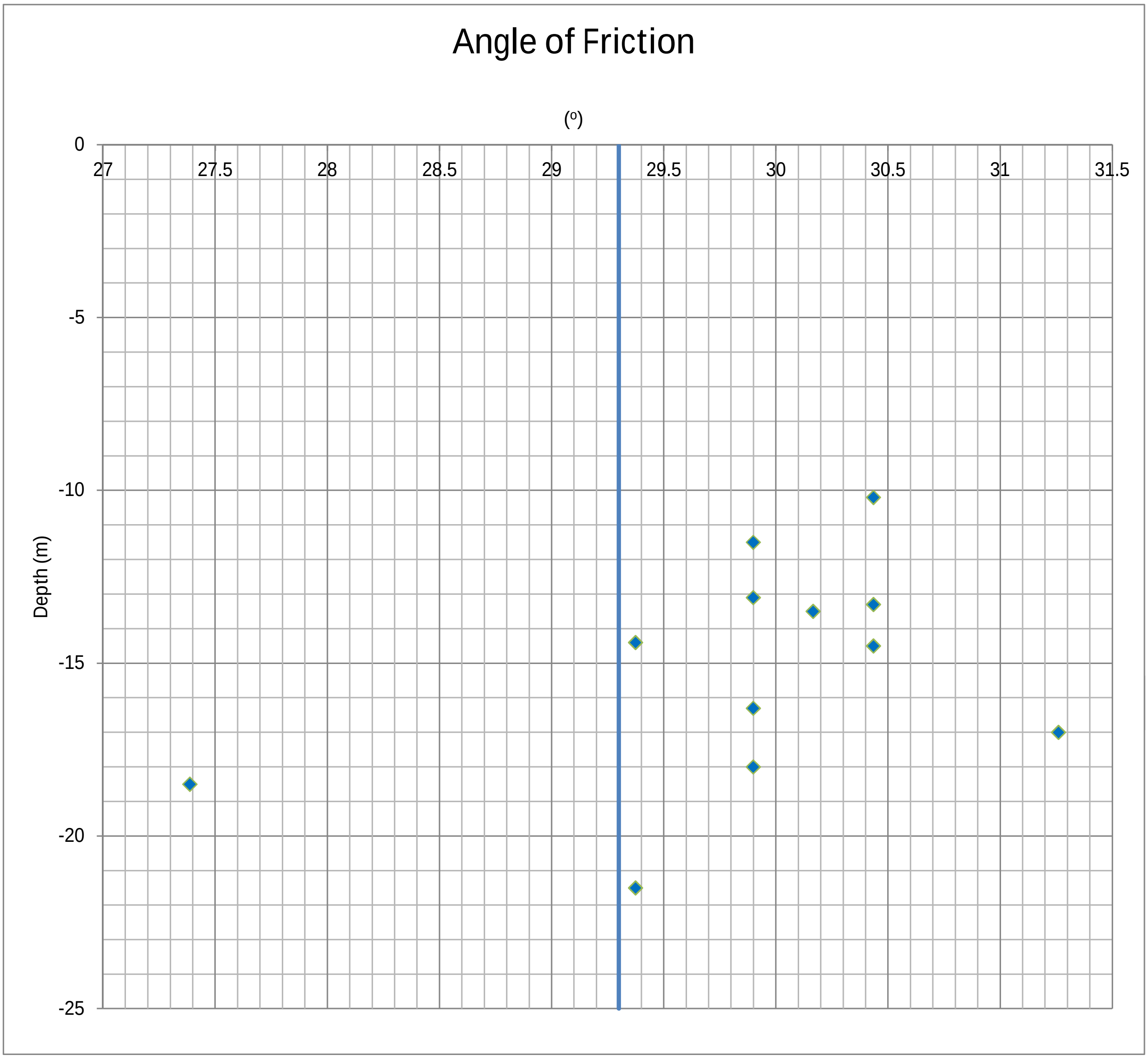
HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Permeability

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.6.8**	Strata:	**Glacial Till**



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Angle of Friction

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.6.9**	Strata:	**Glacial Till**



Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street Improvements
Figure Reference:	Figure 6.7.1	Strata:	Glaciolucustrine

Figure Title: SPT N-Value

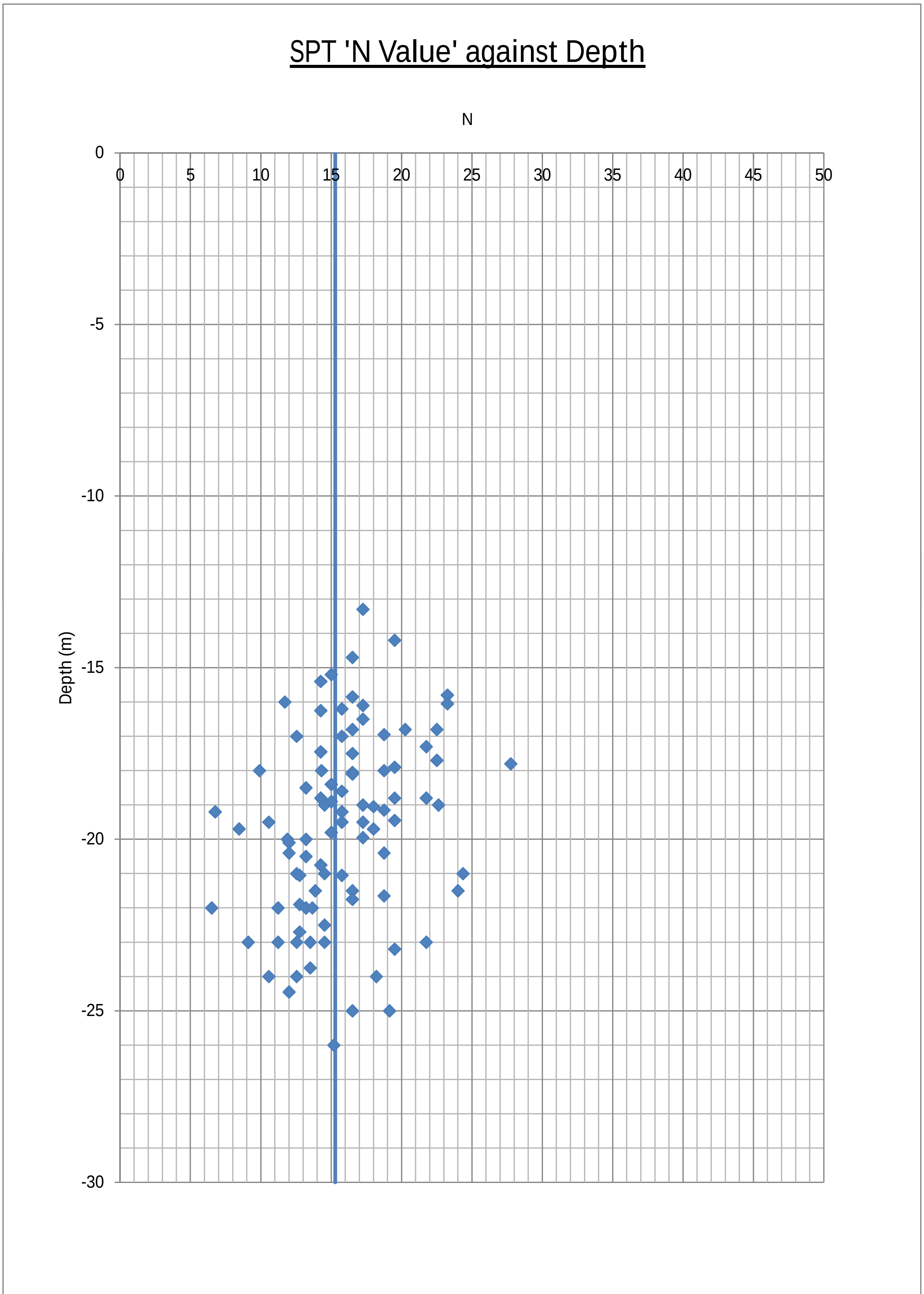


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Figure Title: Plasticity Chart

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.7.2	Strata:	Glaciolacustrine

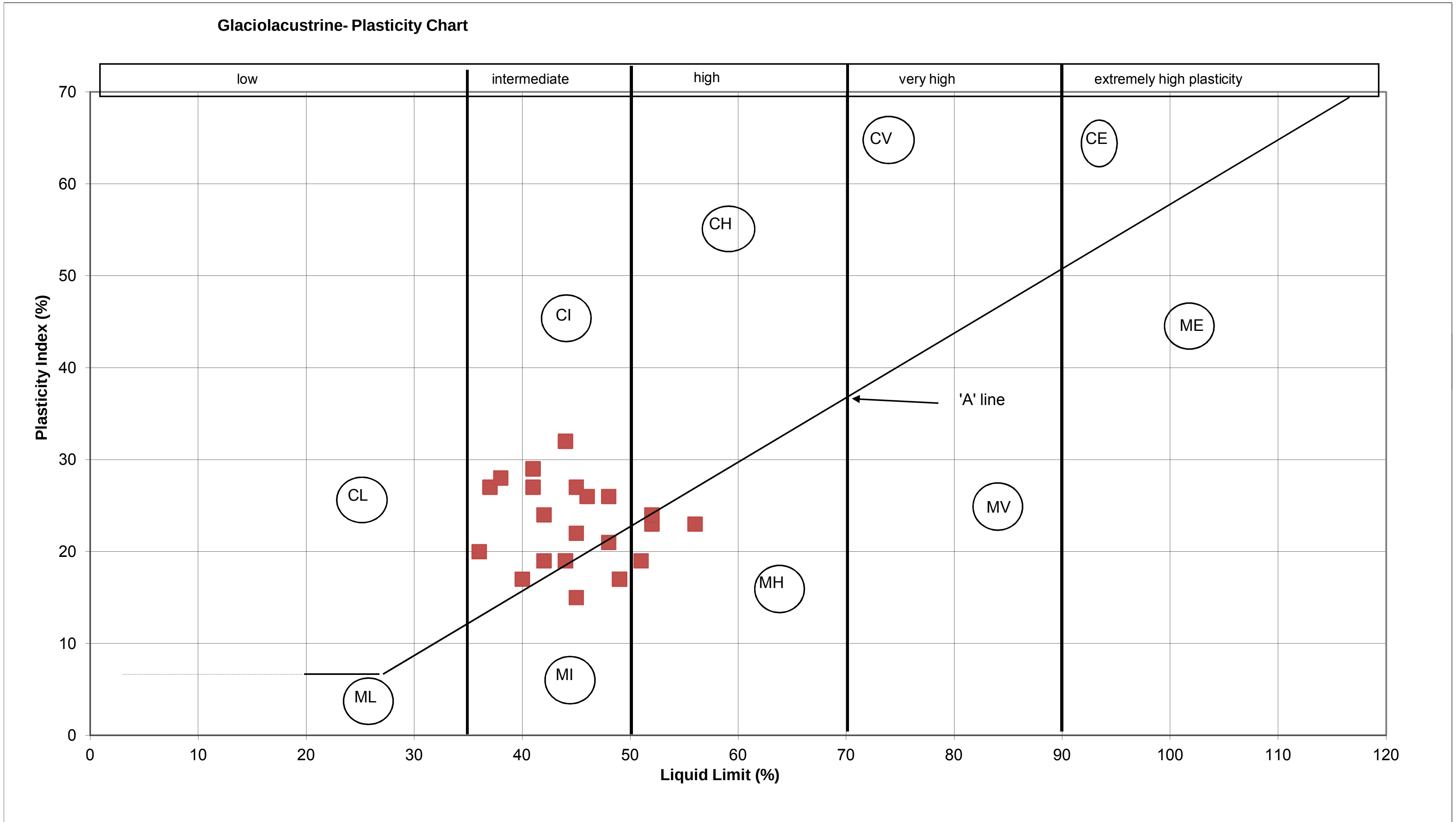

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Figure Title: Plasticity Index

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.7.3	Strata:	Glaciolustrine Deposits

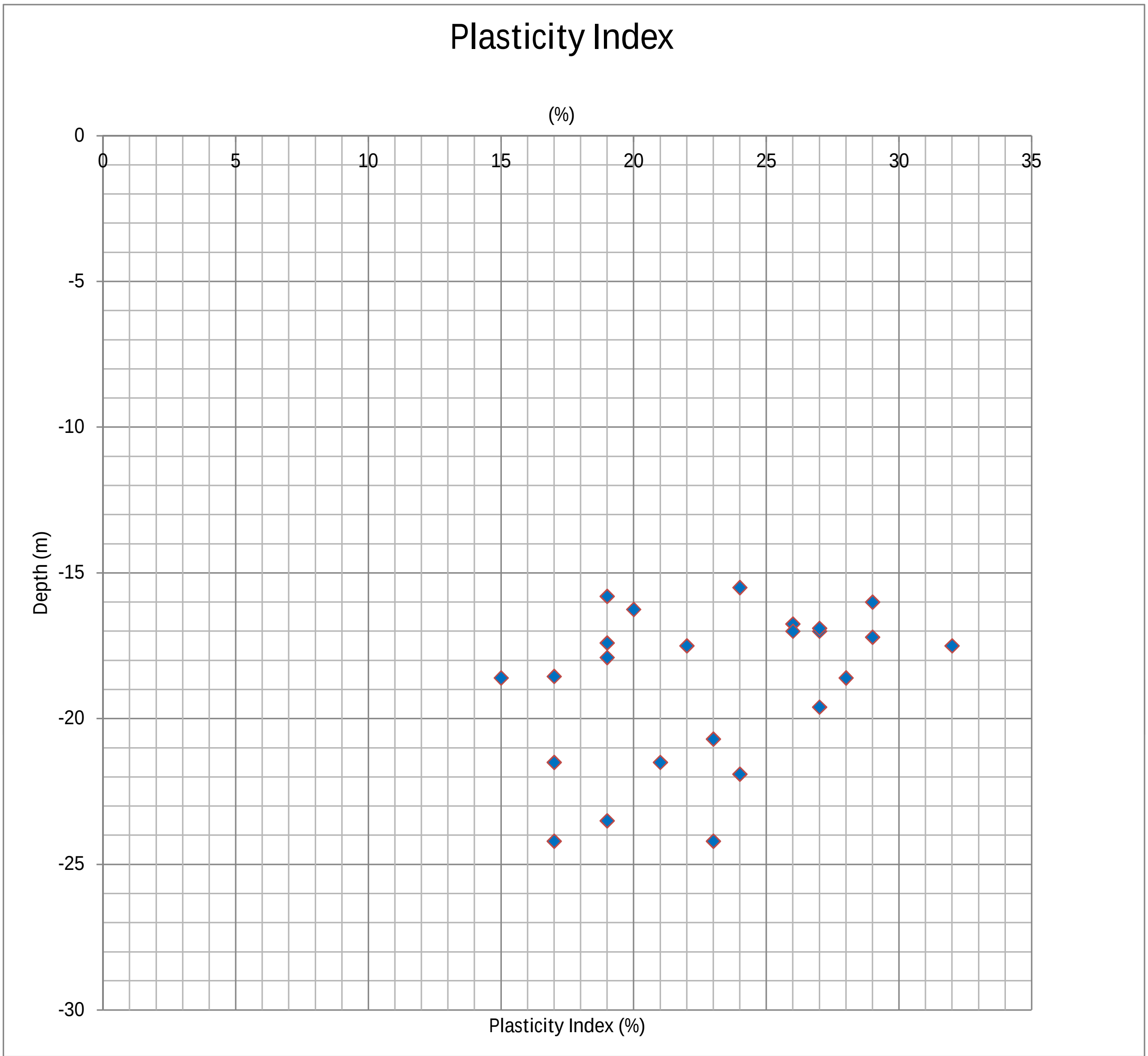

Figure Title: Coefficient of Consolidation

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.6.7**	Strata:	**Glacial Till**

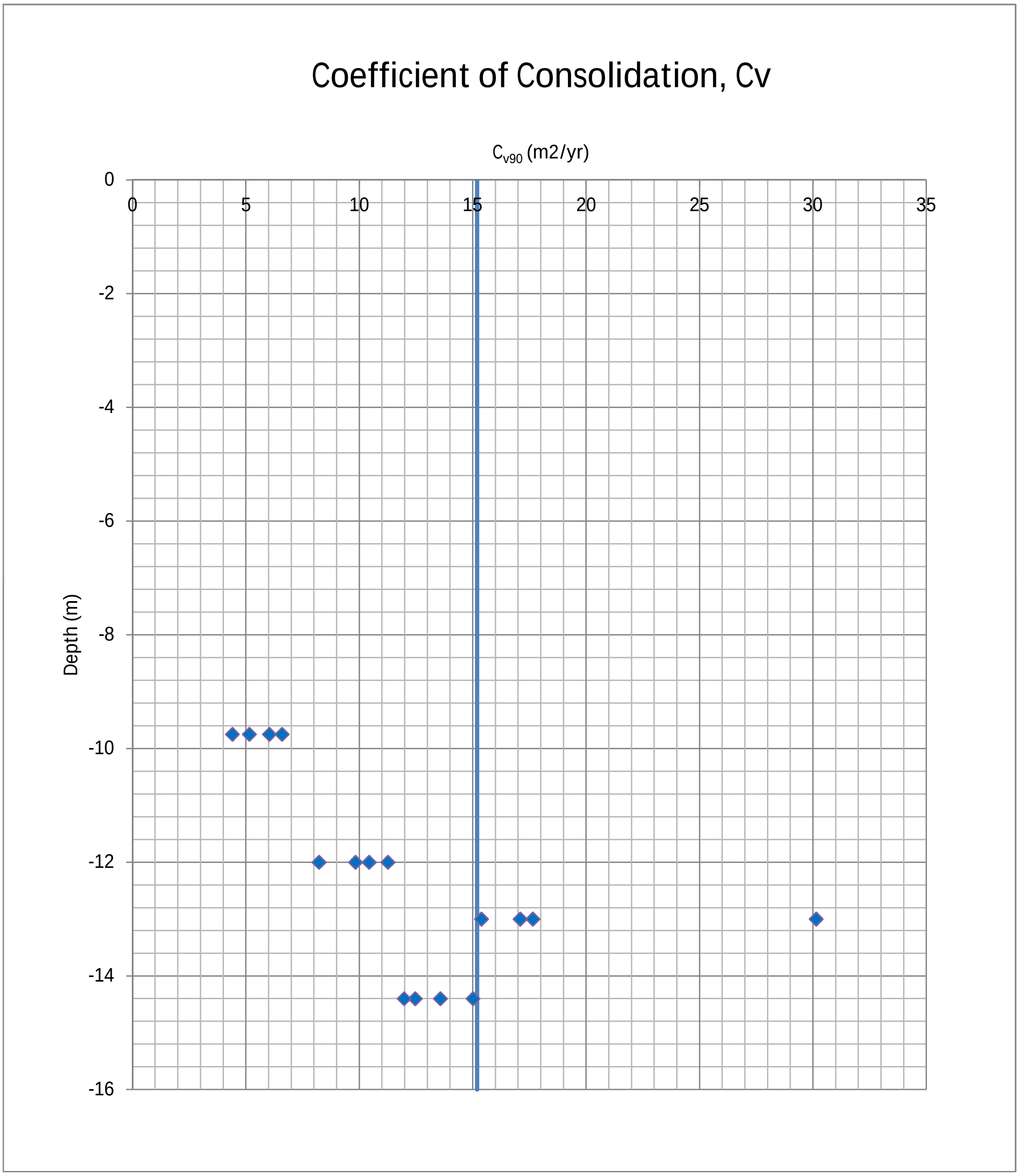

Figure Title: Permeability			
Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.6.8	Strata:	Glacial Till

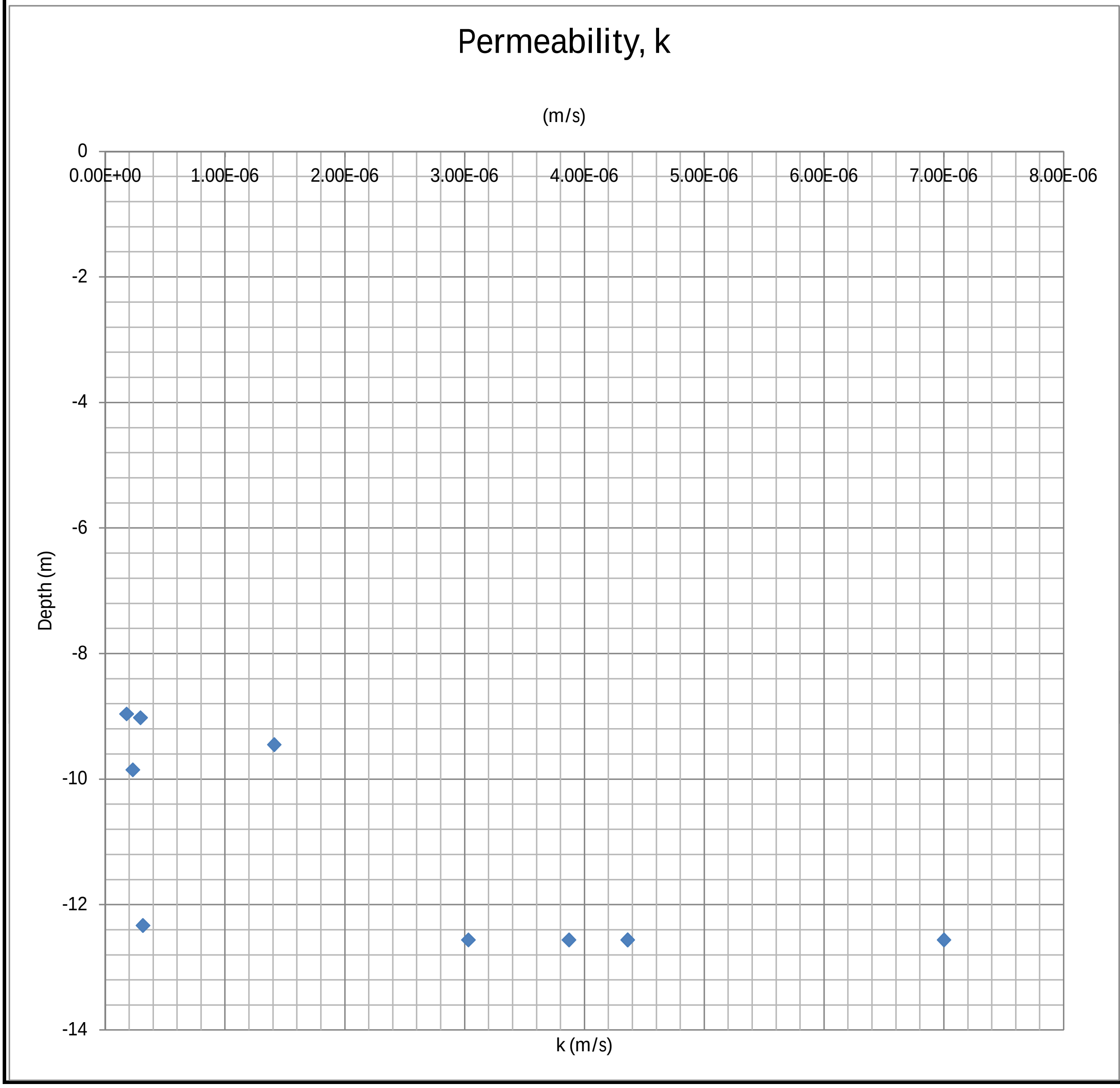

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Figure Title: Angle of Friction

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.6.9	Strata:	Glacial Till

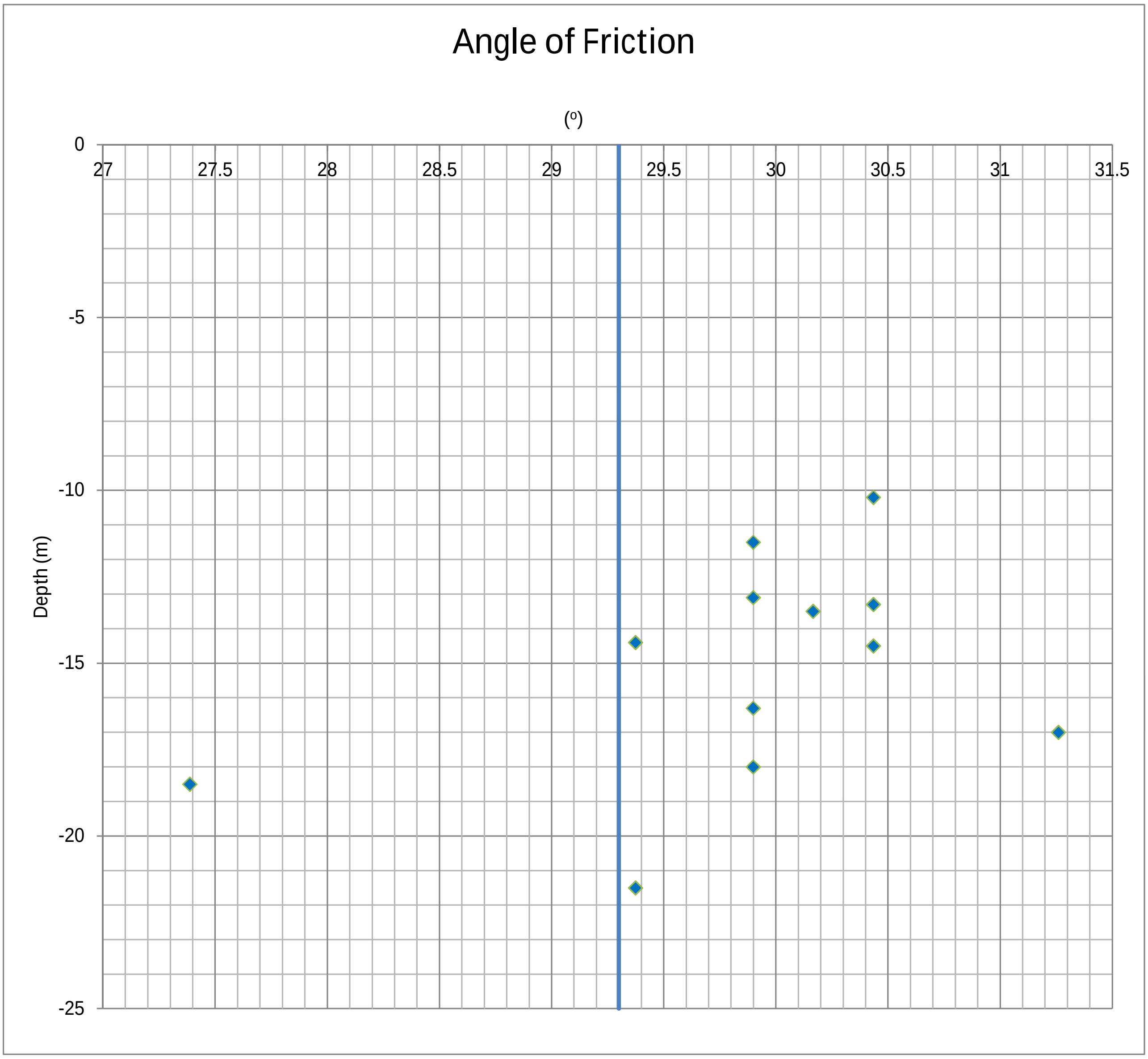

Figure Title: SPT N-Value

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street Improvements
Figure Reference:	Figure 6.7.1	Strata:	Glaciolucustrine

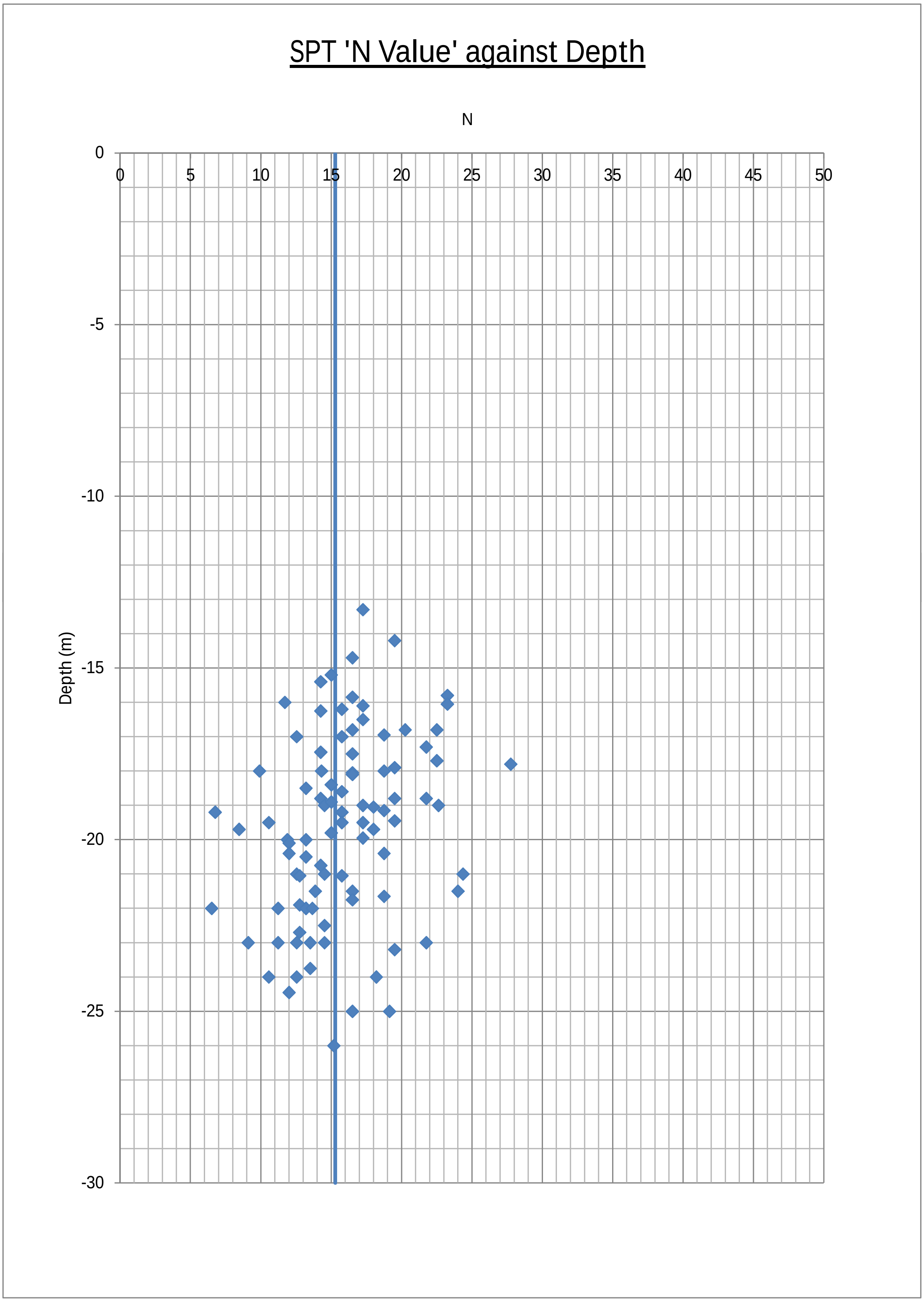

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Figure Title: Plasticity Chart

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.7.2**	Strata:	**Glaciolacustrine**

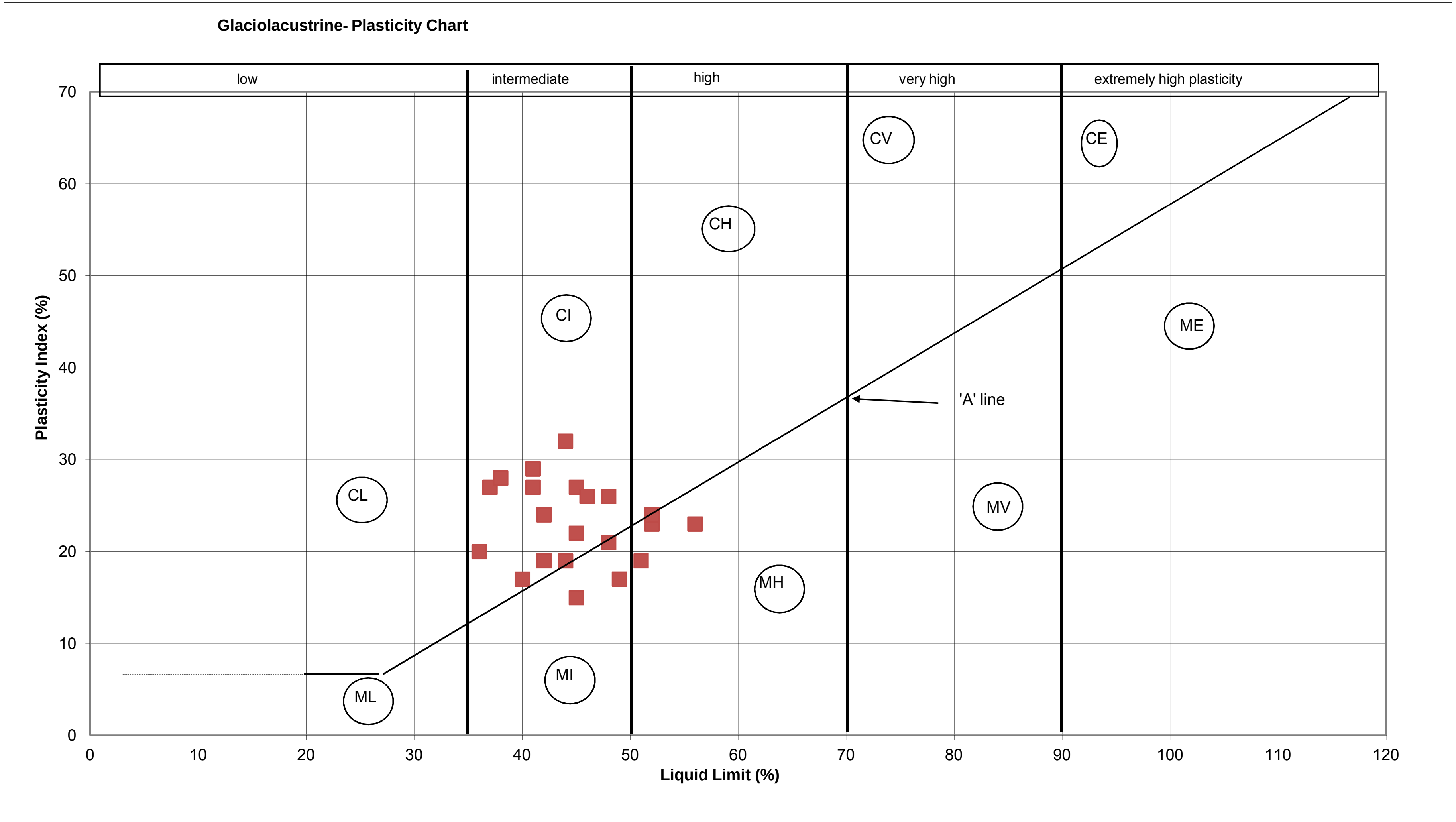

Figure Title: Plasticity Index

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.7.3	Strata:	Glaciolustrine Deposits

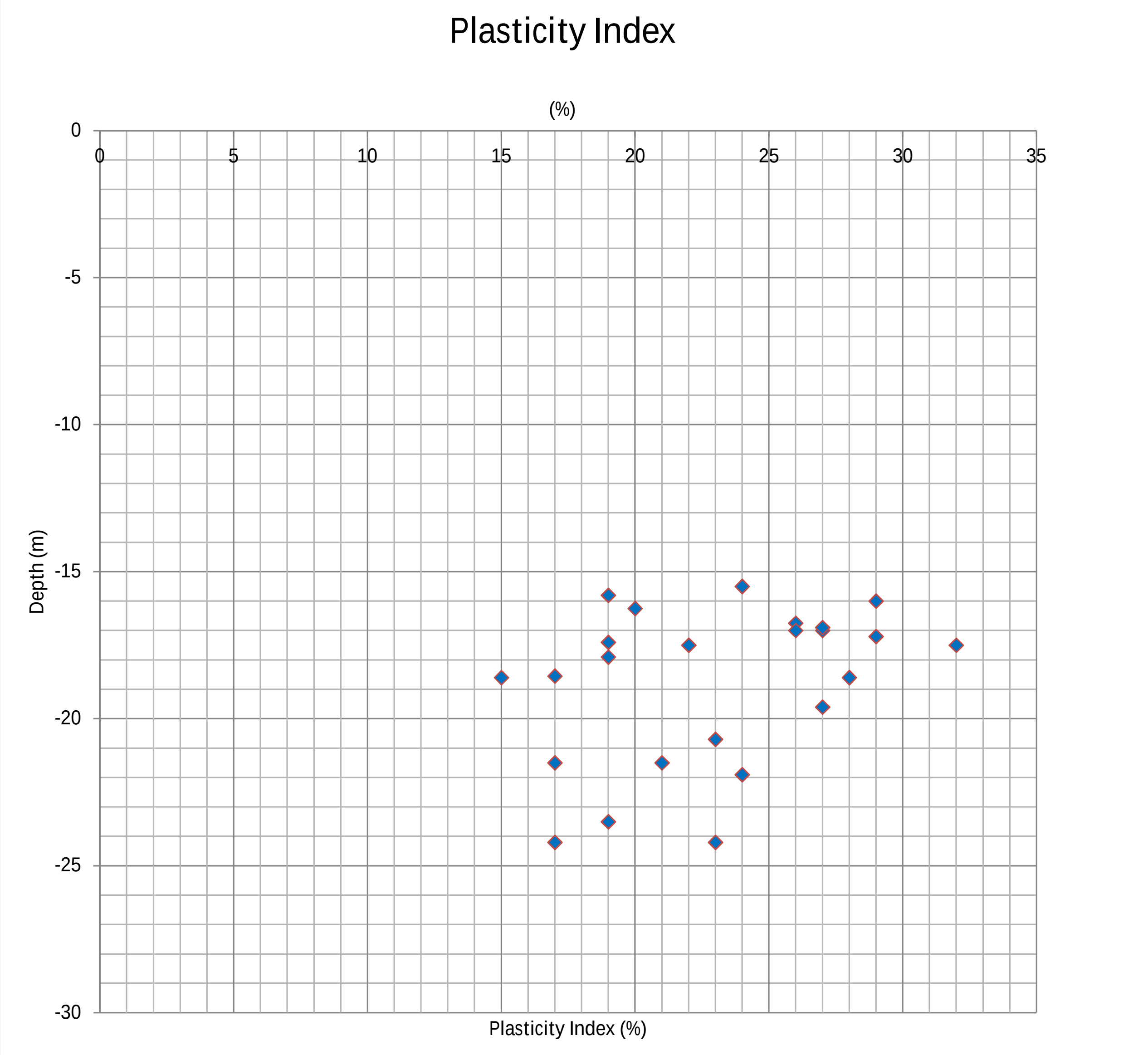

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Figure Title: Undrained Cohesion

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.7.4	Strata:	Glaciolustrine Deposits

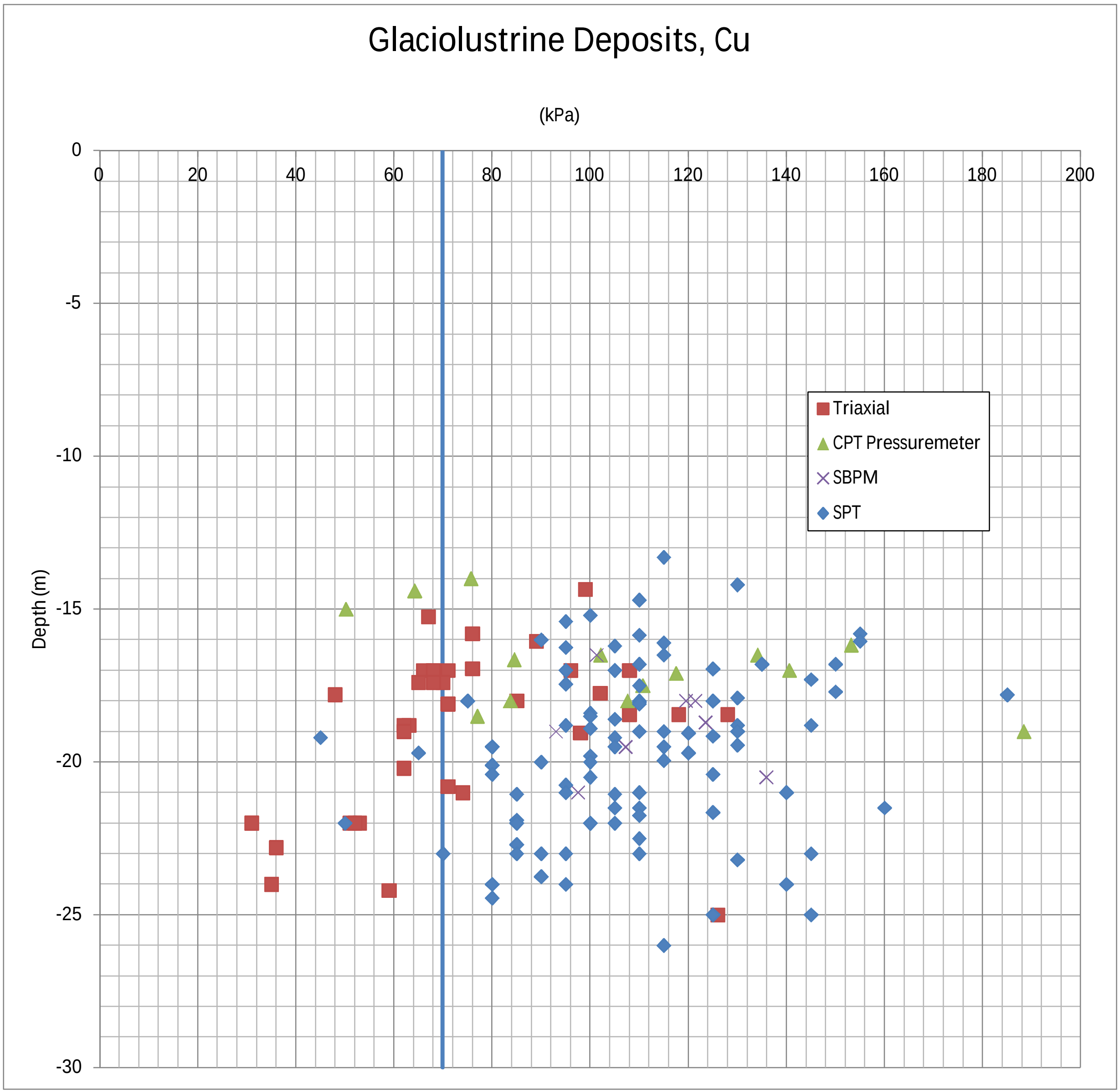

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Figure Title: Bulk Density

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.7.5	Strata:	Glaciolucustrine

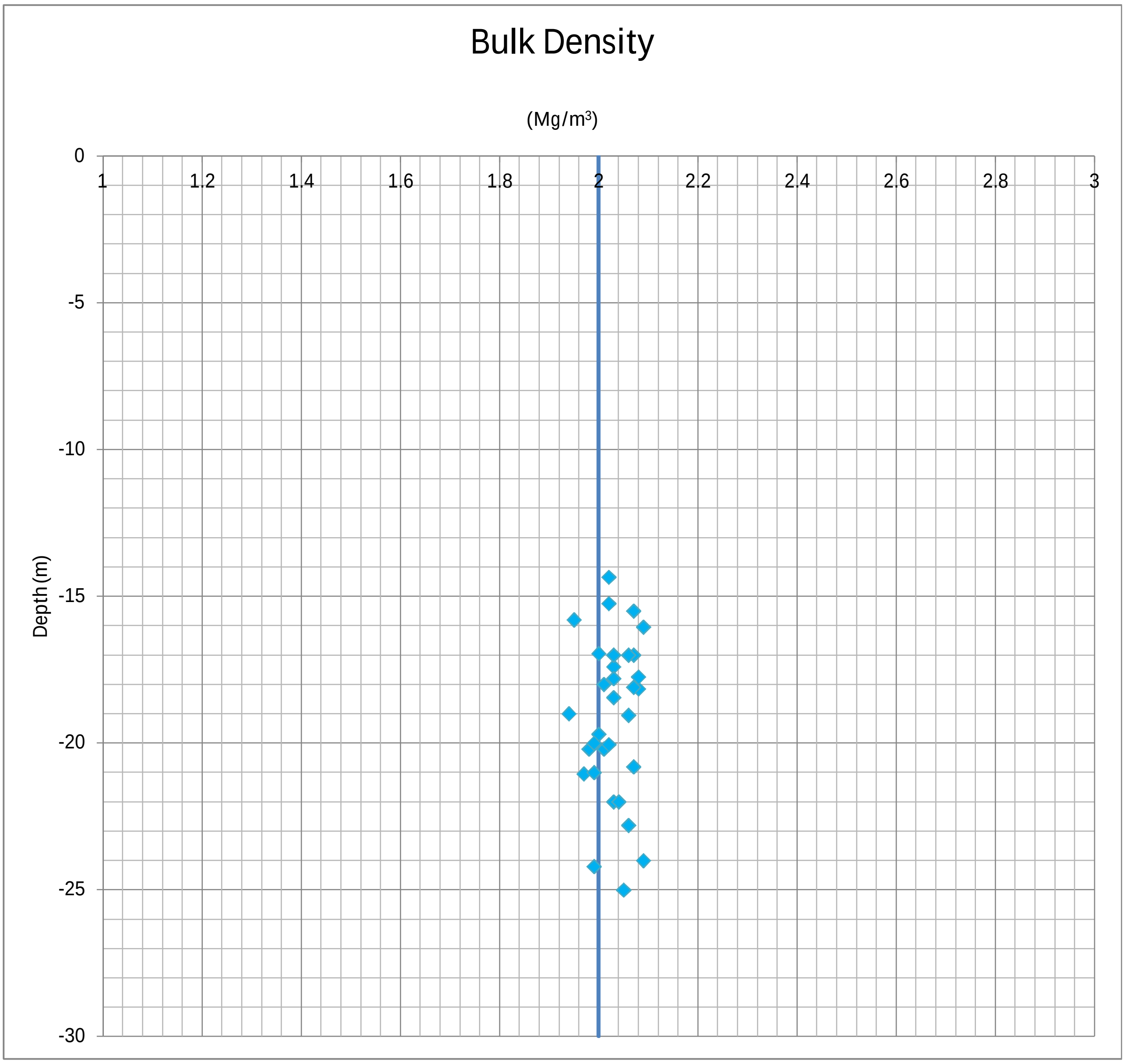

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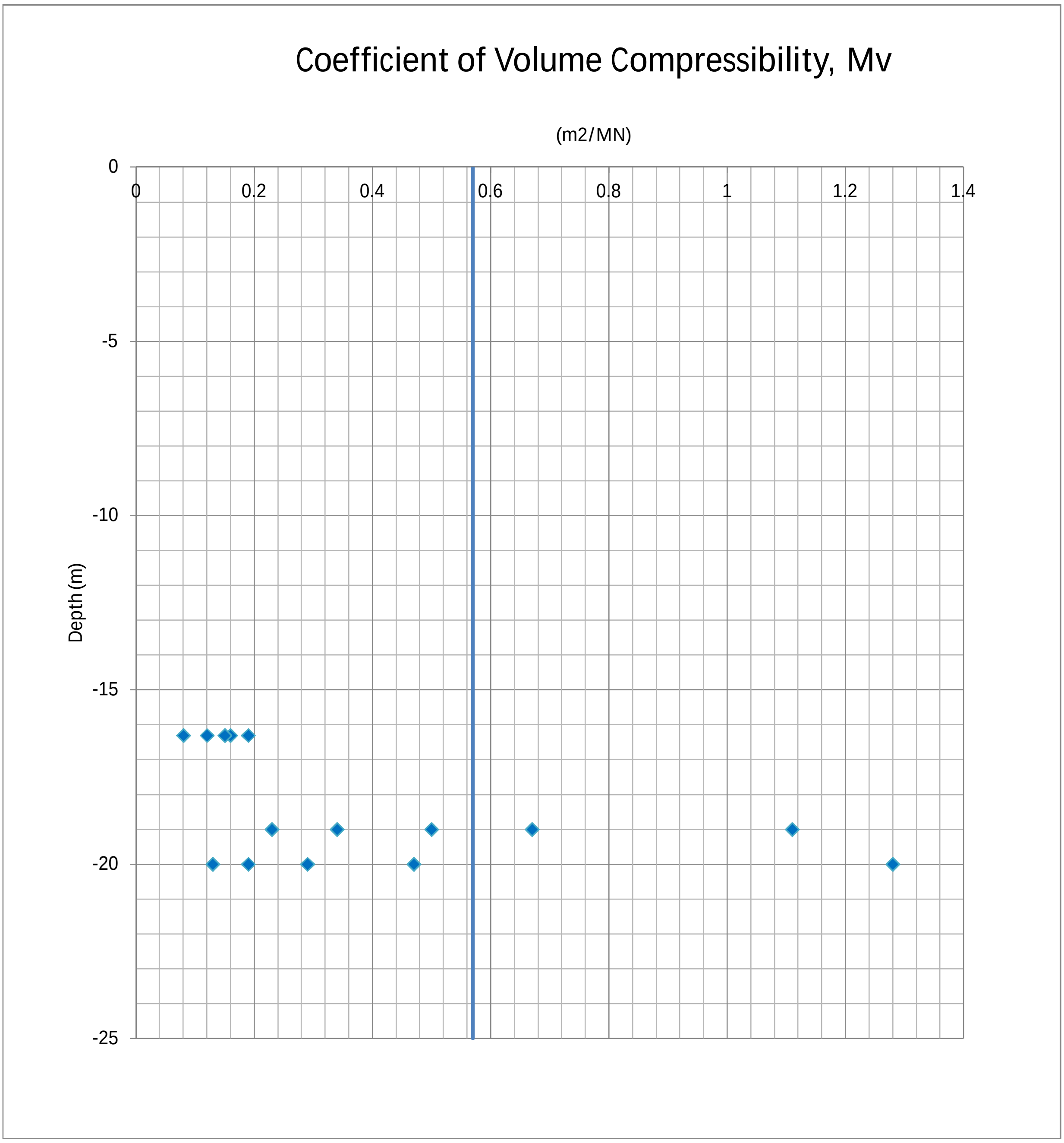
Figure Title: Coefficient of Volume Compressibility

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.7.6**	Strata:	**Glaciolucustrine**



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Coefficient of Consolidation

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.7.7**	Strata:	**Glaciolucustrine**

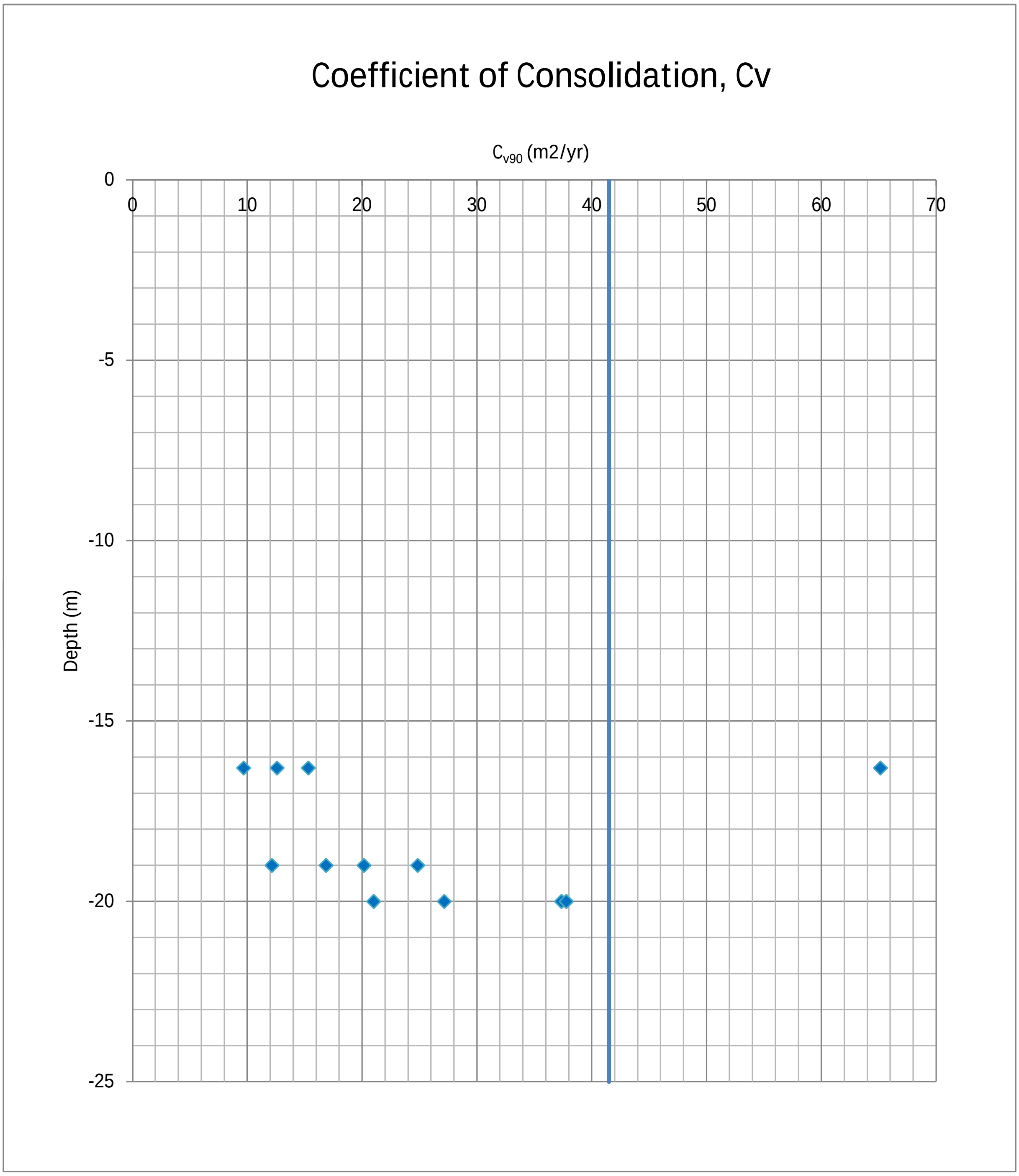


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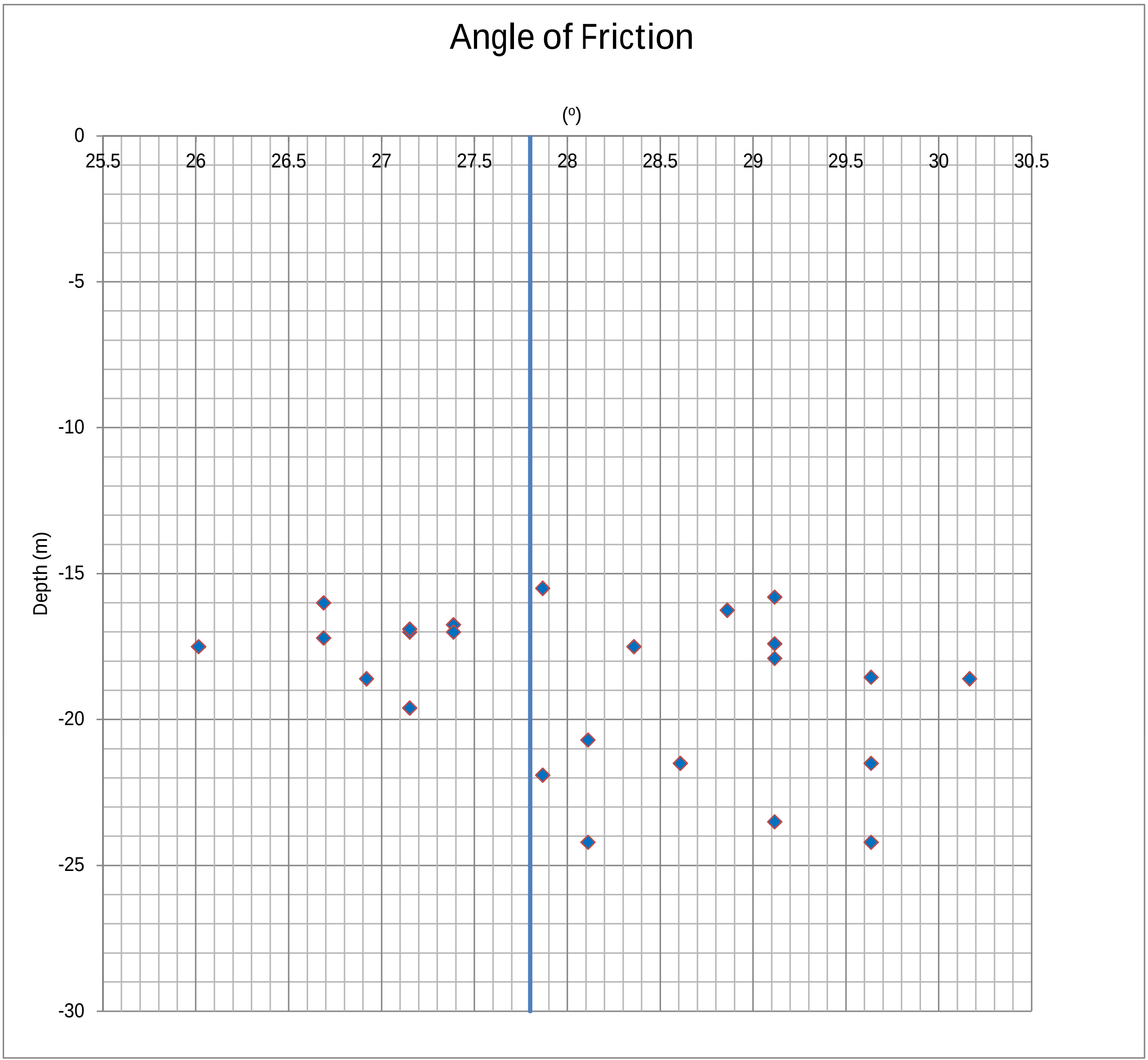
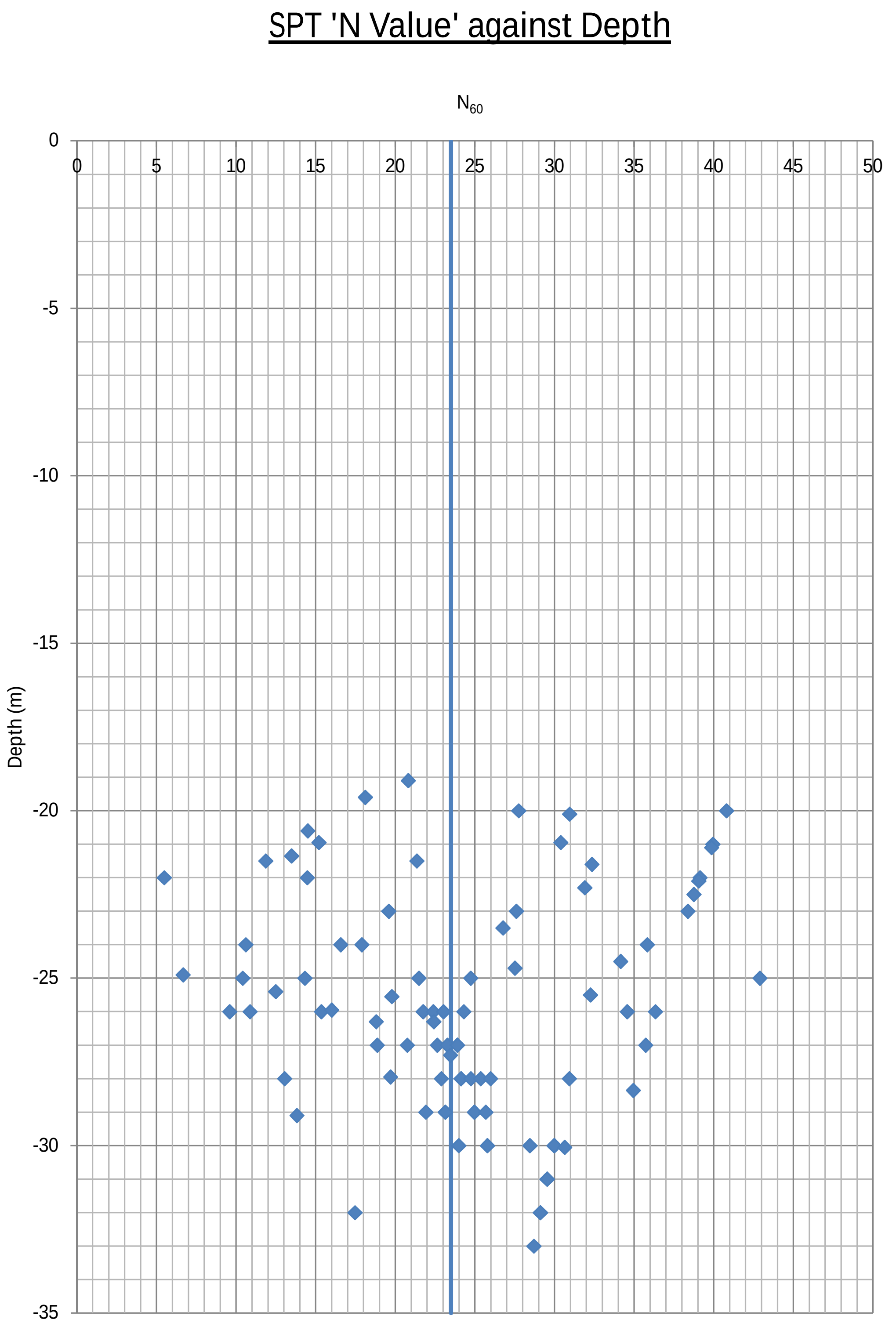
Figure Title: Angle of Friction

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.7.8**	Strata:	**Glaciolustrine Deposits**



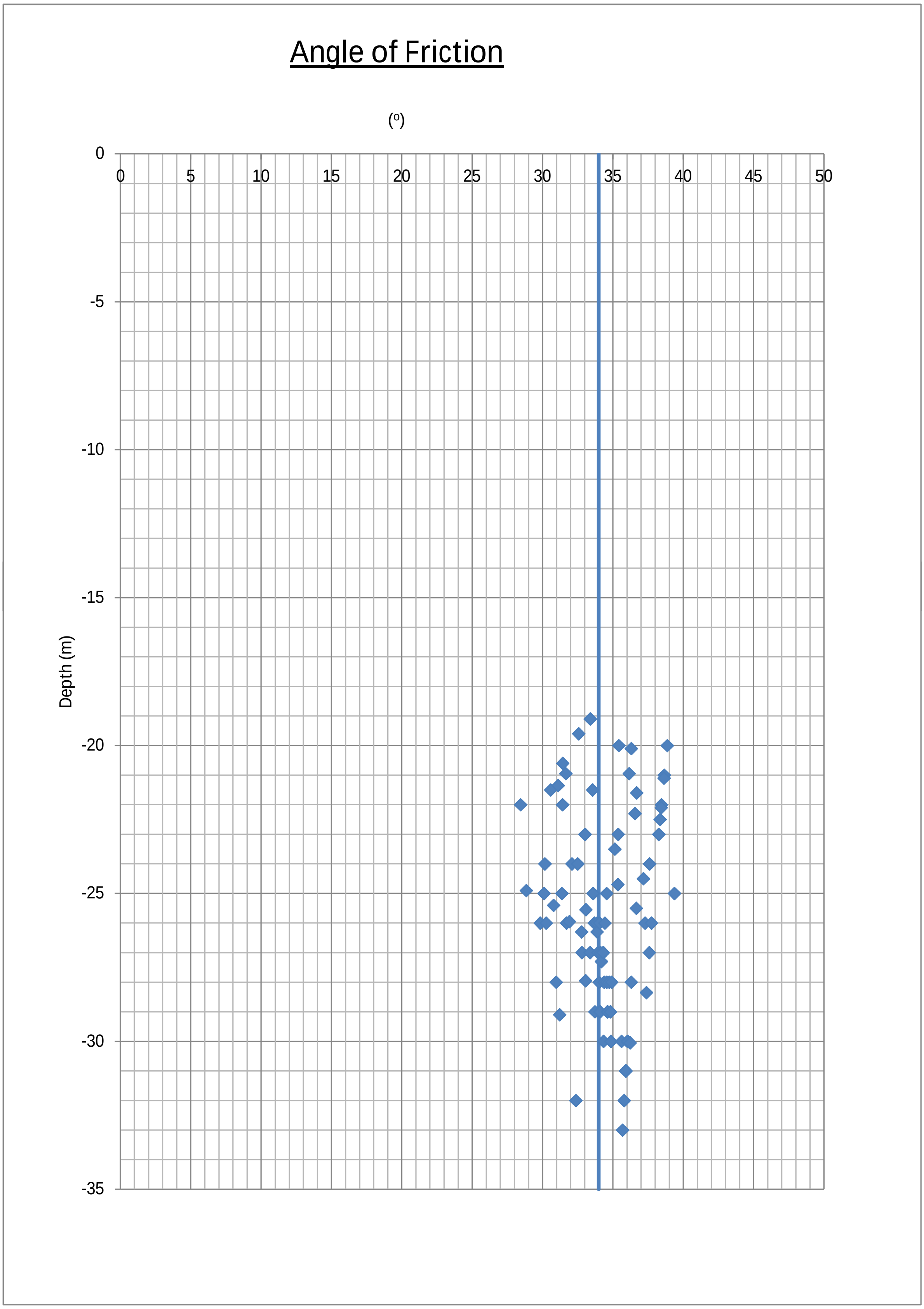
HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: SPT N-Value

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street Improvements
Figure Reference:	Figure 6.8.1	Strata:	Fluvio Glacial Deposits



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Angle of Friction

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.8.2**	Strata:	**Fluvio Glacial Deposits**



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	# Figure Title: SPT N-Value

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street Improvements**
Figure Reference:	**Figure 6.10.1**	Strata:	**Chalk**

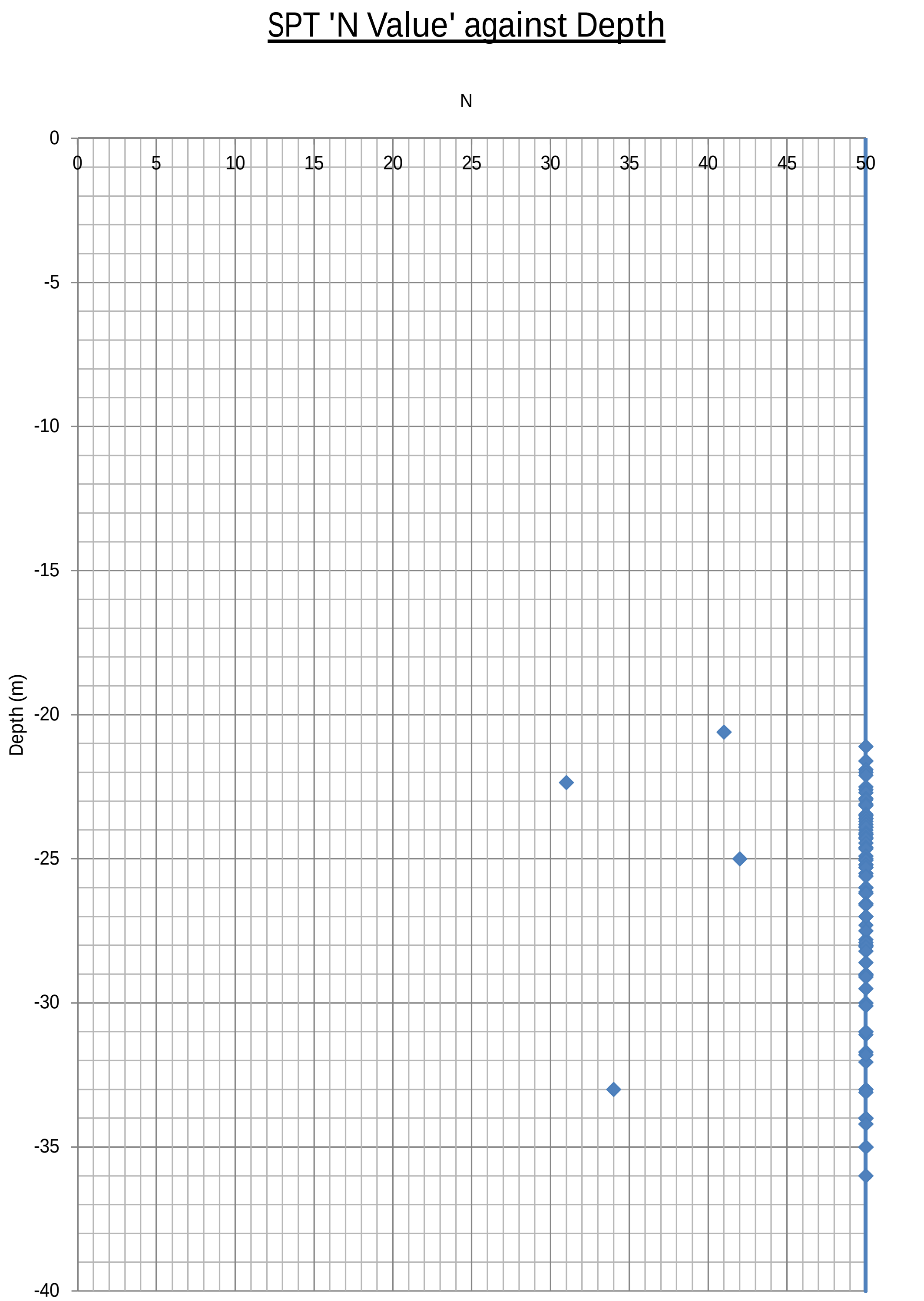


Figure Title: Point Load against Unconfined Compressive Strength

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.10.2	Strata:	Chalk

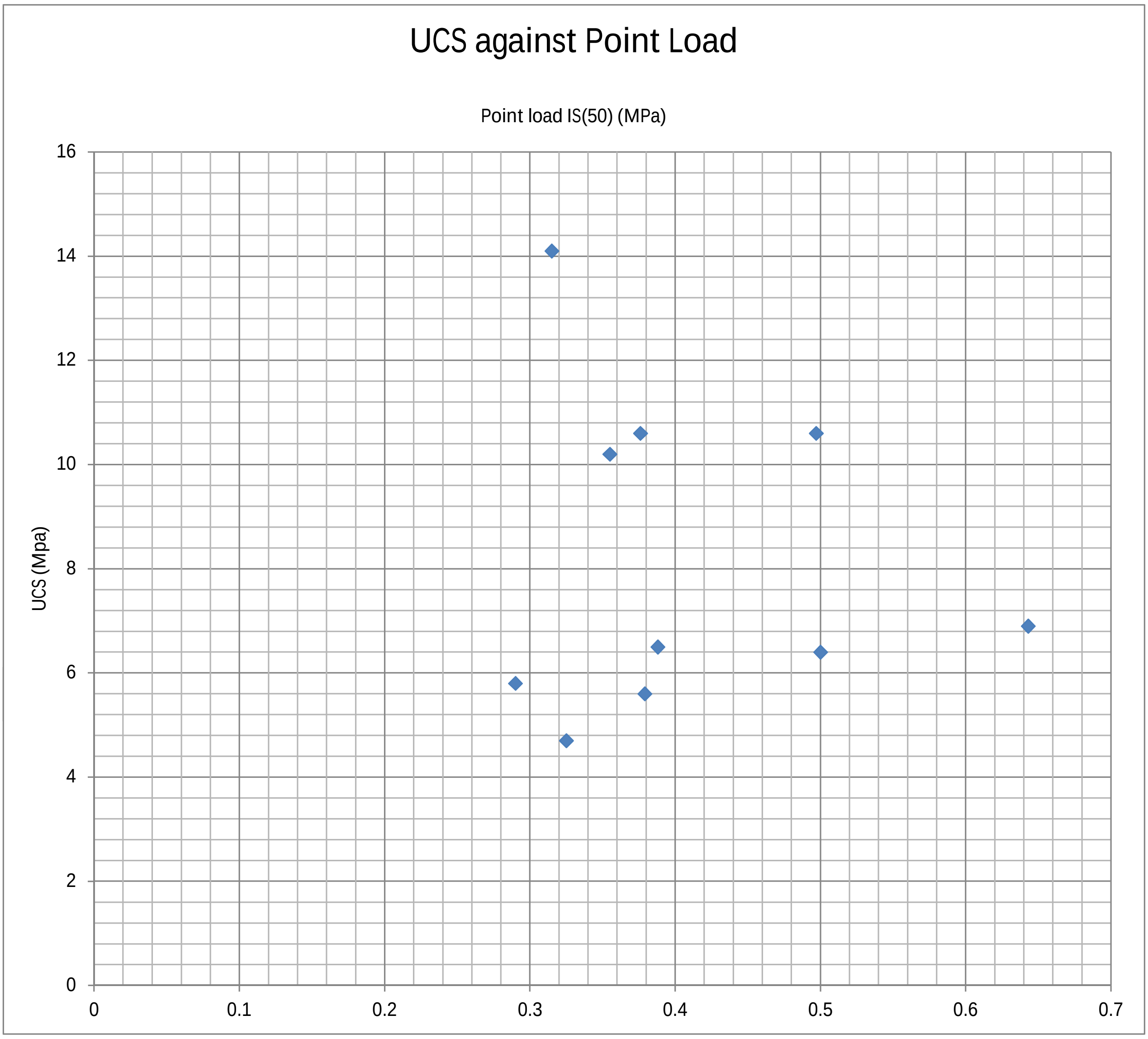


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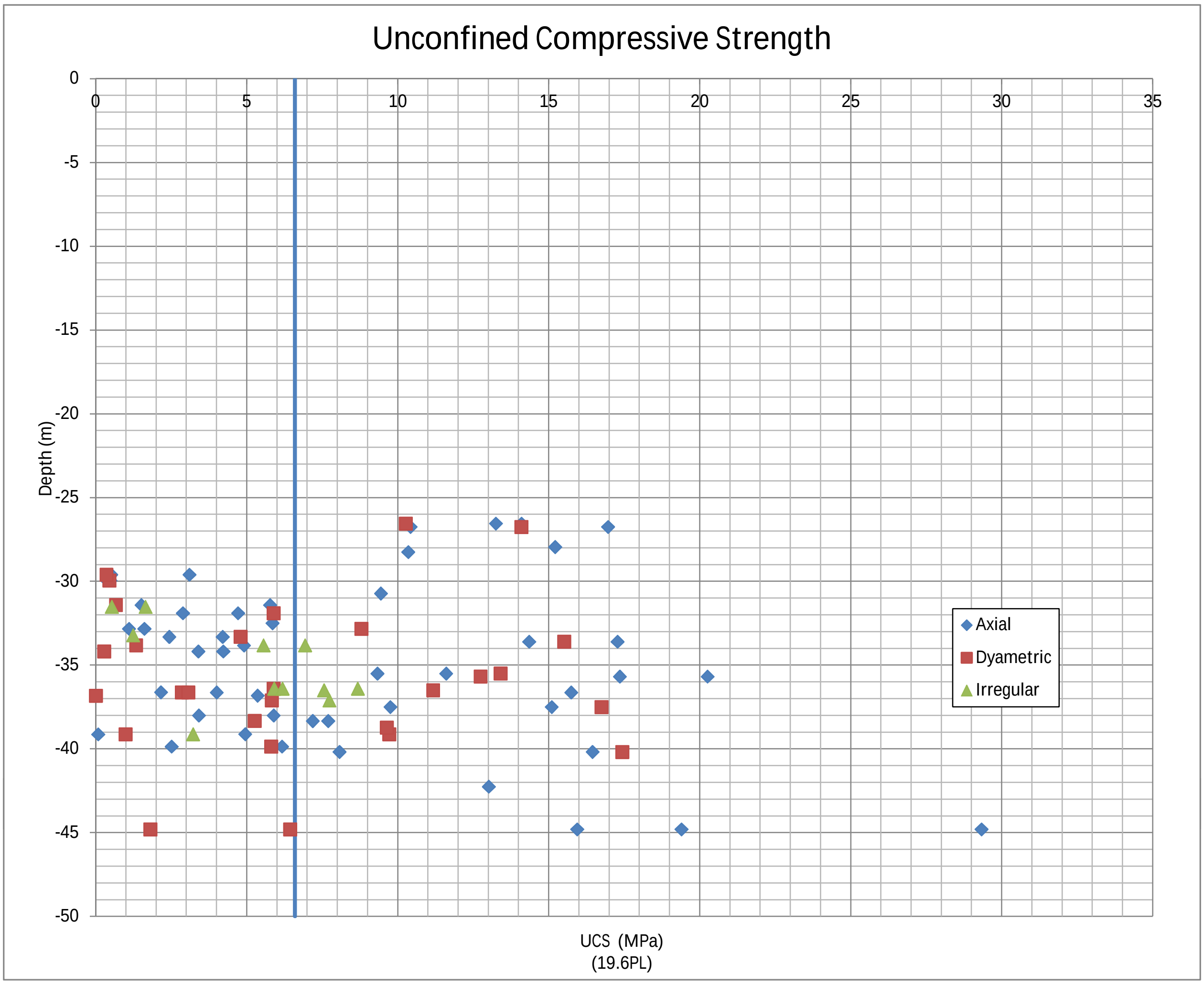
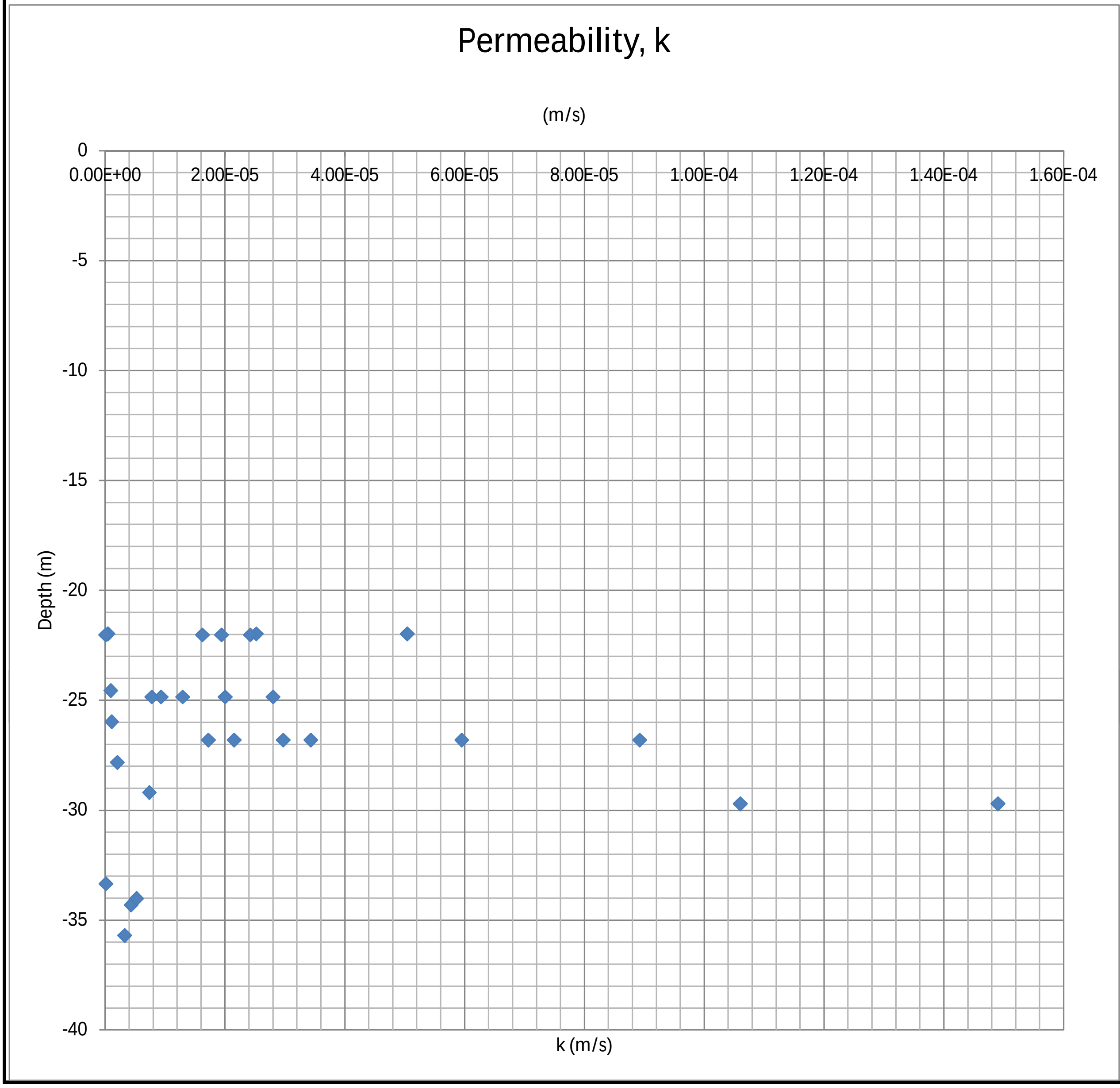
Figure Title: Unconfined Compressive Strength

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Figure 6.10.3	Strata:	Chalk



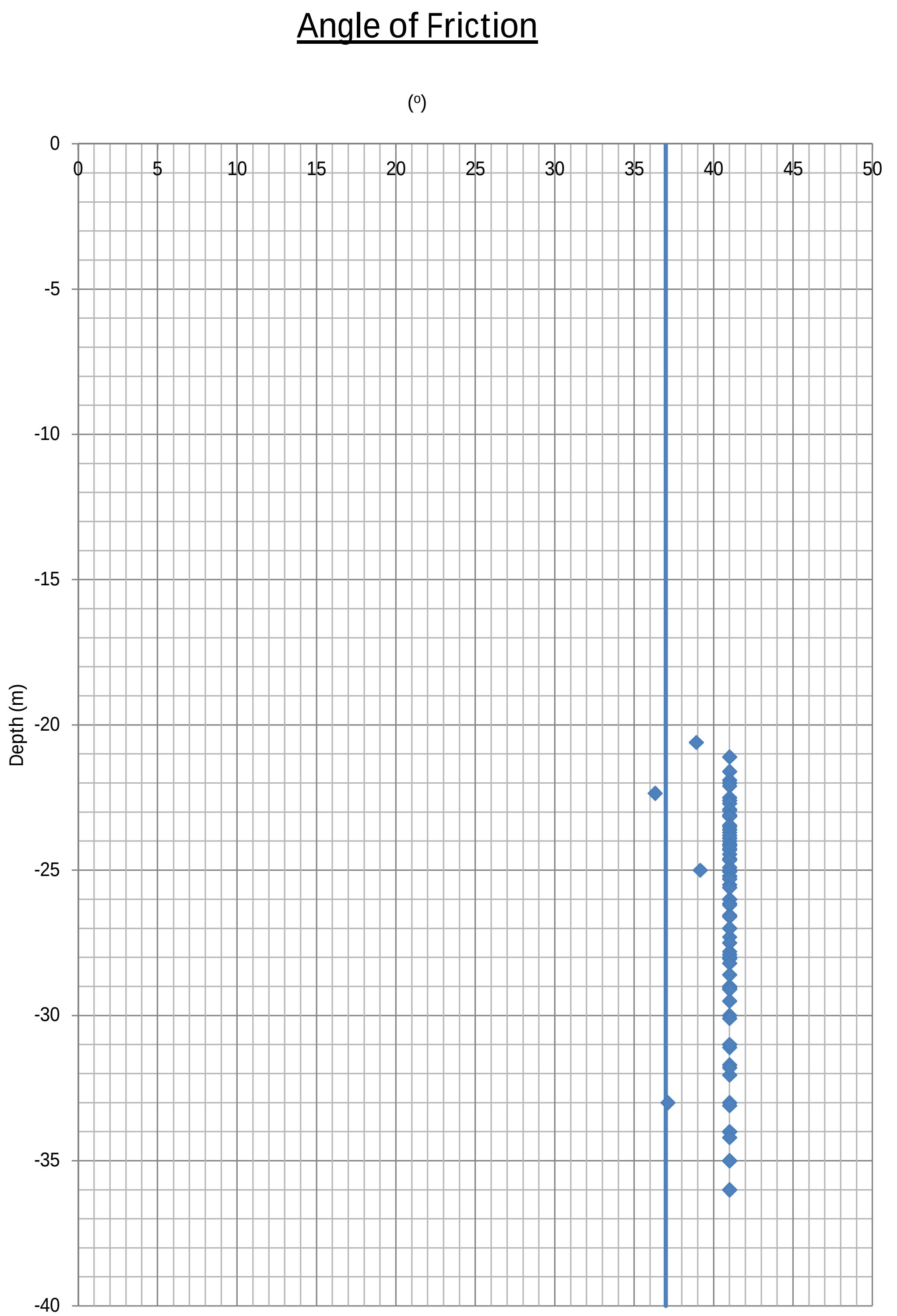
HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Permeability

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Figure 6.10.4**	Strata:	**Chalk**



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Angle of Friction

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street Improvements
Figure Reference:	Figure 6.10.5	Strata:	Chalk



DRAWINGS

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	ENG	CAT II	APP'D
PD9	07.11.13	BOREHOLE LOCATIONS CHANGED TO AS BUILT LOCATIONS	GH	AR			MD
PD7	02.09.13	LOCATION OF SCPT24 AMENDED	GH	AR			MD
PD6	30.08.13	BH23,BH18,BH15,BH14 LOCATIONS AMENDED	GH	AR			MD
PD5	23.08.13	AMENDED TRIAL PITS TO WINDOW SAMPLES	RE	ZM			MD
PD4	18.06.13	REVISE 6No. HOLE LOCATIONS FOLLOWING SITE VISIT WITH LAND OWNERS	GH	AR/RJ			MD
PD3	13.06.13	AMENDED LOCATIONS OF EXPLORATORY HOLES AND RENUMBERING THROUGHOUT. FOR ISSUE TO SITE INVESTIGATION CONTRACTOR	GH	AR/RJ			MD
PD2	05.06.13	AMENDED LOCATIONS OF EXPLORATORY HOLES AND RENUMBERING THROUGHOUT. FOR ISSUE TO SITE INVESTIGATION CONTRACTOR	GH	AR/RJ			MD
PD1	15.05.13	LAND OWNER LIAISON DISCUSSIONS AND LANDOWNER INITIAL MEETINGS	PSN	AR/RJ			MD

NOTES:

1. THIS DRAWING SHALL ONLY BE USED FOR THE DESIGN ELEMENTS STATED IN THE DRAWING TITLE.
2. ONLY WRITTEN DIMENSIONS SHALL BE USED.
3. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
4. ALL LEVELS AND CHAINAGES ARE IN METRES.
5. THIS DRAWING IS FOR PRELIMINARY PURPOSES ONLY AND IS SUBJECT TO AMENDMENT DURING DESIGN DEVELOPMENT. UNDER NO CIRCUMSTANCES MUST THIS DRAWING BE USED FOR CONSTRUCTION PURPOSES.
6. THIS DRAWING IS PROVIDED FOR INDICATIVE PURPOSES ONLY AND IS BASED ON DATA COLLECTED FROM A NUMBER OF SOURCES. ITS ACCURACY IS NOT GUARANTEED. ALL PARTIES SHOULD SATISFY THEMSELVES TO ITS ACCURACY WHERE NECESSARY.

PRE INVESTIGATION

SERVICE LOCATION PITS (TO BE UNDERTAKEN AT ALL SITE OF PROPOSED INVESTIGATION PRIOR TO COMMENCEMENT OF EXPLORATORY HOLES)

KEY:

BH	CABLE PERCUSSIVE BORE HOLES
BH	CABLE PERCUSSIVE WITH ROTARY CORING
TP	TRIAL PITS
SCPT	SCPT
A10A	ARCHAEOLOGICAL SCPT
SBP	SELF BORING PRESSUREMETER
BH	ROTARY OPEN HOLE
WS	WINDOW SAMPLE
	AREA IN ABEYANCE

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Fax: +44 (0)113 262 0737
www.grontmij.co.uk

CLIENT

HIGHWAYS AGENCY

PROJECT

A63 CASTLE STREET IMPROVEMENTS

TITLE

EXPLORATORY HOLE LOCATION PLAN

STATUS

FOR INFORMATION

DRAWN	CHECKED	APPROVED
PSN	AHR/RJ	MD
DATE 15/05/13	DATE 15/05/13	DATE 15/05/13

DRAWING SCALE	ORIGINAL DRAWING SIZE
1:1250	841 x 594 - A1

DRAWING No	REV.
1168-09-01-DR-001	PD9

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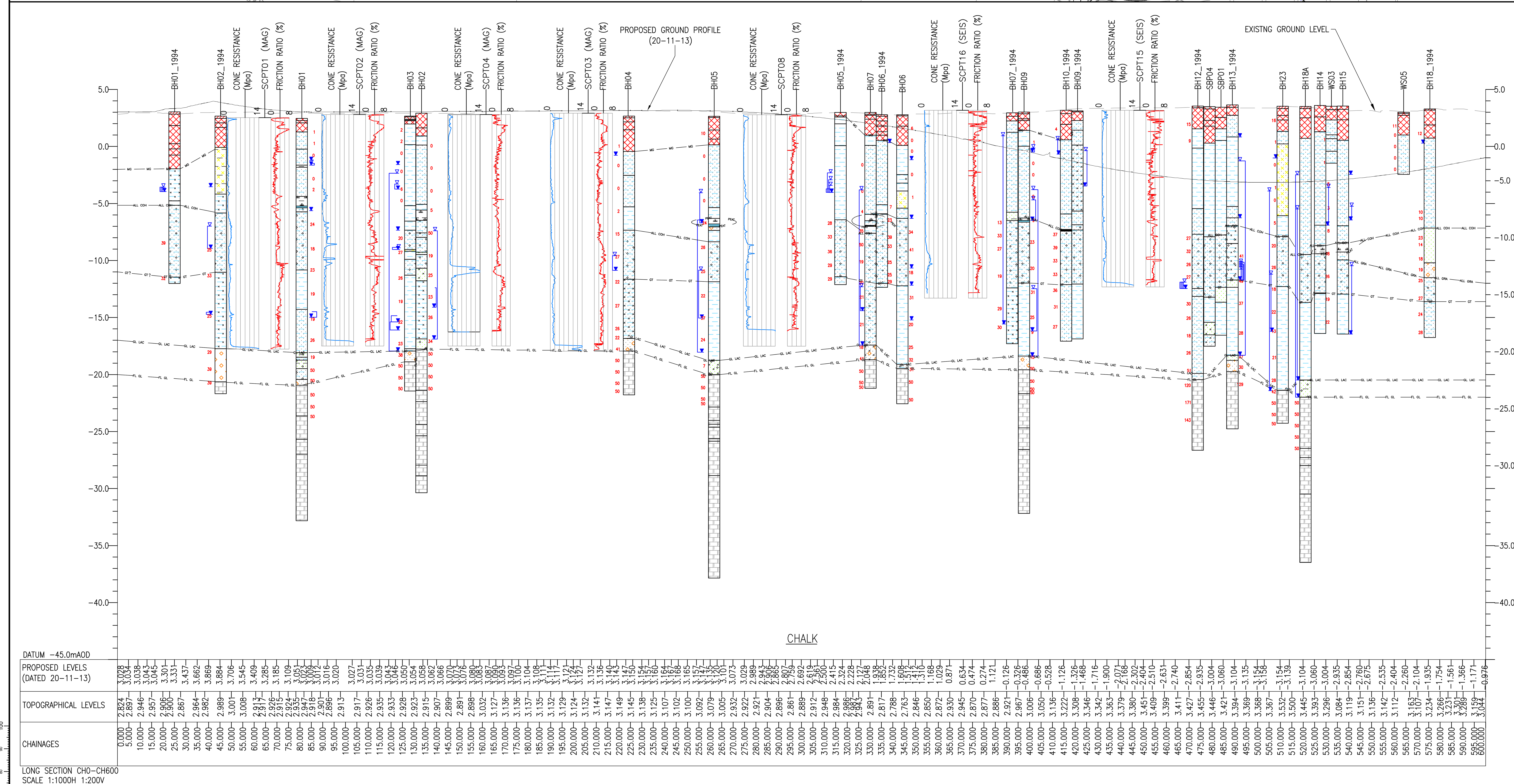

EXPLORATORY HOLE LITHOLOGY:

- TOPSOIL
- MADE GROUND
- Bituminous Material
- CONCRETE
- CLAY
- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- Bouldery CLAY
- Silty sandy CLAY
- Silty gravelly CLAY
- Silty sandy gravelly CLAY
- Silty organic CLAY
- Sandy gravelly CLAY
- SILT
- Clay/Silt
- Sandy SILT
- Peaty SILT
- Sandy gravelly SILT
- SAND
- Clayey SAND
- Silty SAND
- Gravelly SAND
- Clayey gravelly SAND
- Clayey gravelly cobbly SAND
- Silty gravelly SAND
- SAND and GRAVEL
- SAND and GRAVEL
- GRAVEL
- Sandy GRAVEL
- Clayey sandy GRAVEL
- Silty sandy GRAVEL
- PEAT
- Clayey PEAT
- Clayey sandy PEAT
- COBBLES
- CHALK

SECTION LEGEND:

- BASE OF MADE GROUND
- BASE OF COHESIVE ALLUVIUM
- BASE OF GRANULAR ALLUVIUM
- BASE OF GLACIAL TILL
- BASE OF GLACIOLACUSTRINE
- BASE OF FLUVIO-GLACIAL DEPOSITS
- BASE OF PEAT
- ? DENOTES UNCERTAIN GEOLOGICAL BOUNDARY
- WATER STRIKE
- WATER STRIKE RISE
- PROPOSED GROUND PROFILE (20-11-13)
- EXISTING GROUND PROFILE

NOTE: SOME CPT RESULTS AND BOREHOLES HAVE BEEN OMITTED FOR CLARITY

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	ENG	CAT II	APP'D

NOTES:

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KEY:

- BH — CABLE PERCUSSIVE BORE HOLES
- BH — CABLE PERCUSSIVE WITH ROTARY CORING
- TP — TRIAL PITS
- SCPT — SCPT
- SBP — SELF BORING PRESSUREMETER
- BH — ROTARY OPEN HOLE
- WS — WINDOW SAMPLE

HISTORICAL SITE INVESTIGATION

- BH — BOREHOLE
- TP — TRIAL PIT

Mott MacDonald
Grontmij
Grove House
Mansion Gate Drive
Leeds
LS7 4DN
Tel : +44 (0)113 262 0000
Fax: +44 (0)113 262 0737
www.grontmij.co.uk

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PROJECT
A63 CASTLE STREET IMPROVEMENTS

TITLE
GEOLOGICAL SECTIONS SHEET 1 OF 12

STATUS
FOR INFORMATION

DRAWN	CHECKED	APPROVED
GH	AHR/RJ	MD
DATE 04/10/13	DATE 04/10/13	DATE 04/10/13

DRAWING SCALE	ORIGINAL DRAWING SIZE
AS SHOWN	841 x 594 - A1

DRAWING No	REV.
1168-09-01-DR-004	-

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	ENG	CAT II	APP'D

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PROJECT
A63 CASTLE STREET IMPROVEMENTS

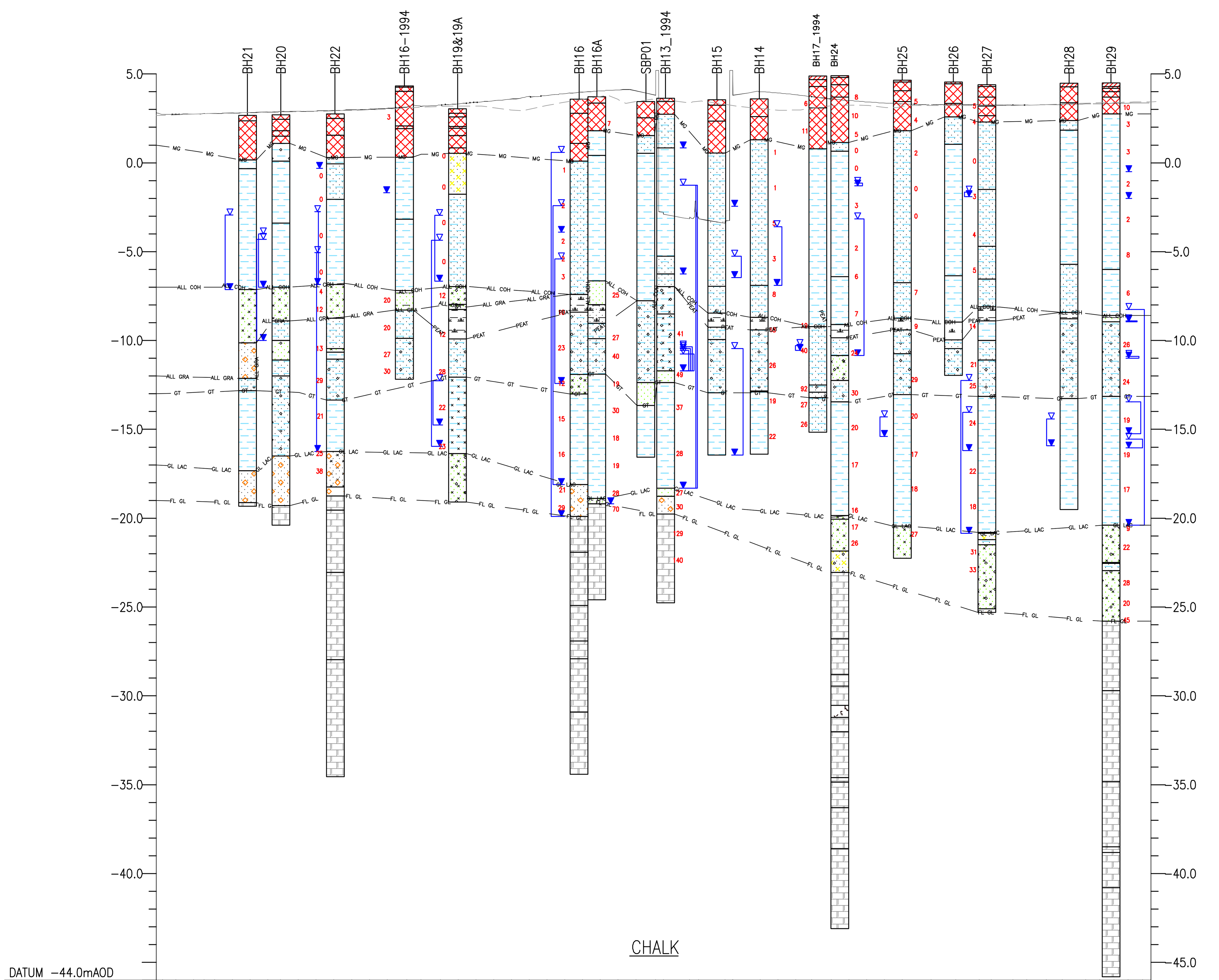
TITLE
GEOLOGICAL SECTIONS SHEET 2 OF 12

STATUS
FOR INFORMATION

DRAWN	CHECKED	APPROVED
GH	AHR/RJ	MD
DATE 04/10/13	DATE 04/10/13	DATE 04/10/13

DRAWING SCALE	ORIGINAL DRAWING SIZE
AS SHOWN	841 x 594 - A1

DRAWING No	REV.
1168-09-01-DR-005	-



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TOPOGRAPHICAL LEVELS	2.674, 2.698, 2.738, 2.780, 2.807, 2.832, 2.859, 2.913, 2.886, 2.905, 2.928, 2.957, 2.984, 3.007, 3.079, 3.133, 3.192, 3.211, 3.211, 3.210, 3.108, 2.957, 2.980, 3.220, 3.407, 3.594, 3.804, 3.356, 3.447, 3.573, 3.510, 3.359, 3.436, 3.289, 3.159, 3.054, 3.025, 2.954, 3.084, 3.234, 3.242, 3.242, 3.105, 3.225, 3.228, 3.155, 3.255, 3.235, 3.203, 3.252, 3.231, 3.231, 3.270, 3.296, 3.337, 3.392, 3.410, 3.421, 3.440
CHAINAGES	0.000, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000, 35.000, 40.000, 45.000, 50.000, 55.000, 60.000, 65.000, 70.000, 75.000, 80.000, 85.000, 90.000, 95.000, 100.000, 105.000, 110.000, 115.000, 120.000, 125.000, 130.000, 135.000, 140.000, 145.000, 150.000, 155.000, 160.000, 165.000, 170.000, 175.000, 180.000, 185.000, 190.000, 195.000, 200.000, 205.000, 210.000, 215.000, 220.000, 225.000, 230.000, 235.000, 240.000, 245.000, 250.000, 255.000, 260.000, 265.000, 270.000, 275.000, 280.000

CROSS SECTION A-A'
SCALE 1:1000H 1:200V

EXPLORATORY HOLE LITHOLOGY:

- TOPSOIL
- MADE GROUND
- Bituminous Material
- CONCRETE
- CLAY
- Silty CLAY
- Sandy CLAY
- Gravelly CLAY
- Bouldery CLAY
- Silty sandy CLAY
- Silty gravelly CLAY
- Silty sandy gravelly CLAY
- Silty organic CLAY
- Sandy gravelly CLAY
- SILT
- Clay/Silt
- Sandy SILT
- Peaty SILT
- Sandy gravelly SILT
- SAND
- Clayey SAND
- Silty SAND
- Gravelly SAND
- Clayey gravelly SAND
- Clayey gravelly cobbly SAND
- Silty gravelly SAND
- SAND and GRAVEL
- SAND and GRAVEL
- GRAVEL
- Sandy GRAVEL
- Clayey sandy GRAVEL
- Silty sandy GRAVEL
- PEAT
- Clayey PEAT
- Clayey sandy PEAT
- COBBLES
- CHALK

SECTION LEGEND:

- MG — BASE OF MADE GROUND
- ALL COH — BASE OF COHESIVE ALLUVIUM
- ALL GRA — BASE OF GRANULAR ALLUVIUM
- GT — BASE OF GLACIAL TILL
- GL LAC — BASE OF GLACIOLACUSTRINE
- FL GL — BASE OF FLUVIO-GLACIAL DEPOSITS
- PEAT — BASE OF PEAT
- ? — DENOTES UNCERTAIN GEOLOGICAL BOUNDARY
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REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	ENG	CAT II	APP'D

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- BH — BOREHOLE
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PROJECT
A63 CASTLE STREET IMPROVEMENTS

TITLE
GEOLOGICAL SECTIONS SHEET 12 OF 12

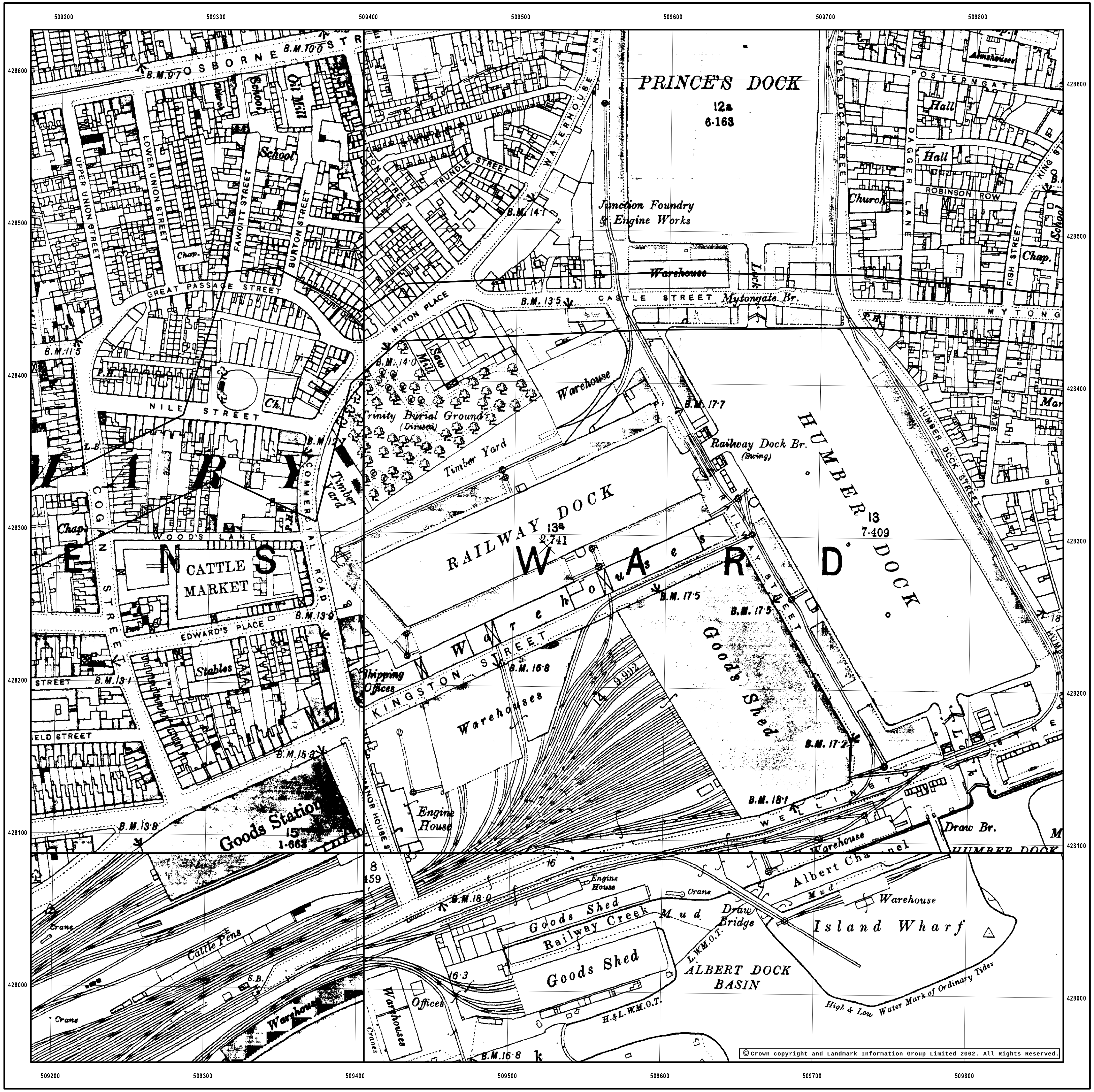
STATUS
FOR INFORMATION

DRAWN	CHECKED	APPROVED
GH	AHR/RJ	MD
DATE 04/10/13	DATE 04/10/13	DATE 04/10/13

DRAWING SCALE: AS SHOWN
ORIGINAL DRAWING SIZE: 841 x 594 - A1
DRAWING No: 1168-09-01-DR-015
REV.: -

Appendices

Appendix A – Historical Maps



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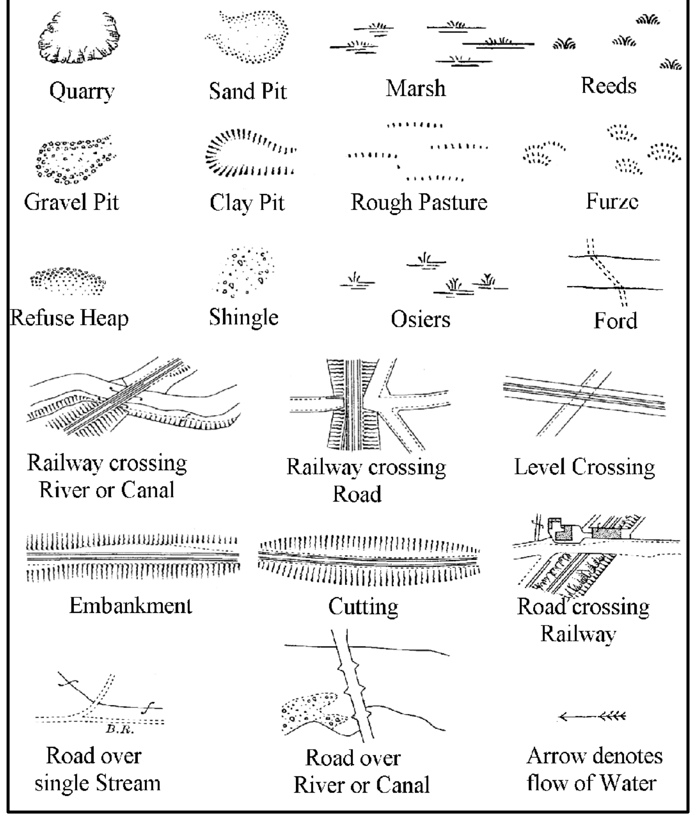
Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



YORKSHIRE

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Source map scale - 1:2,500

1893	1893
1893	1891

Date(s) of Publication

2_1

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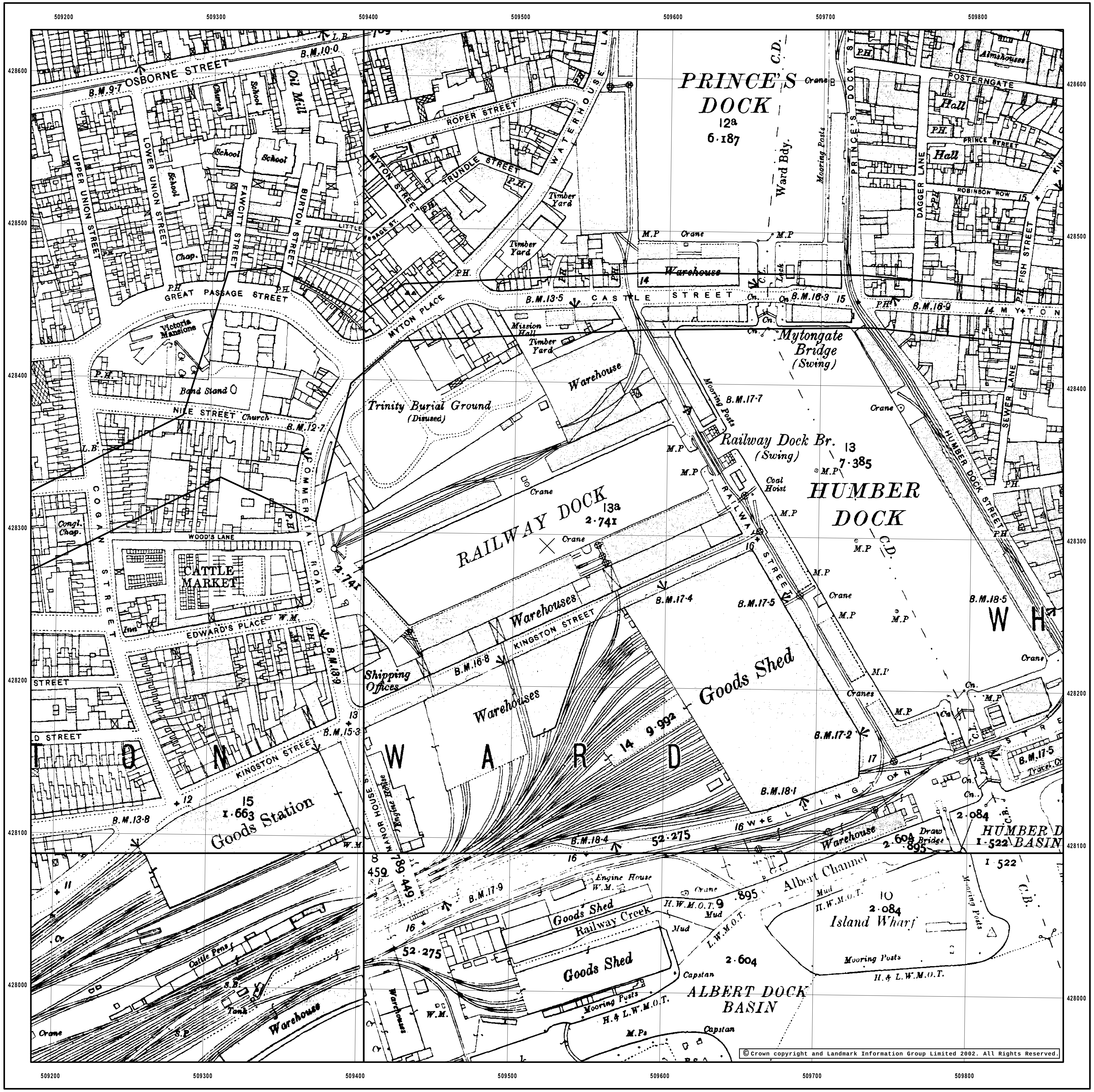

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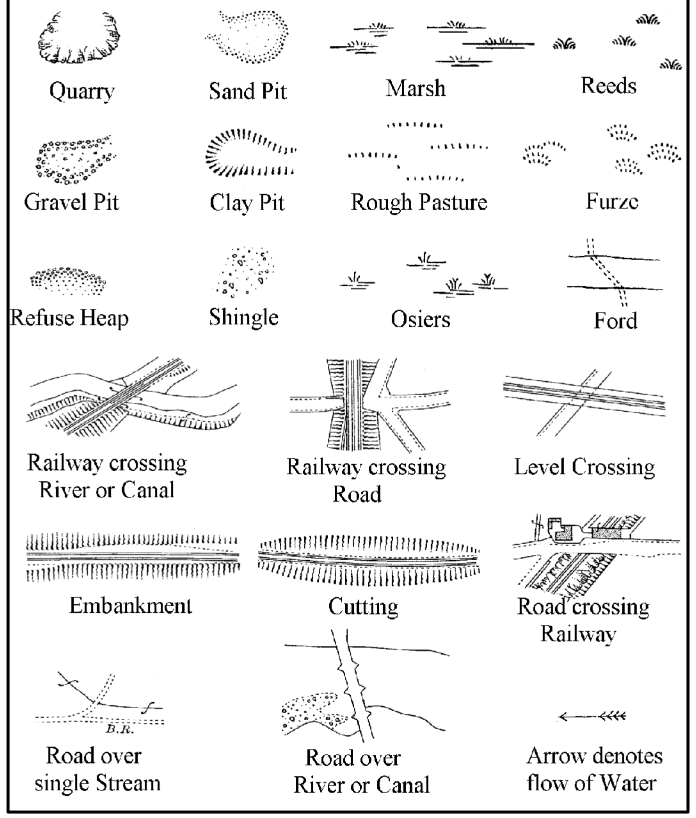
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



YORKSHIRE

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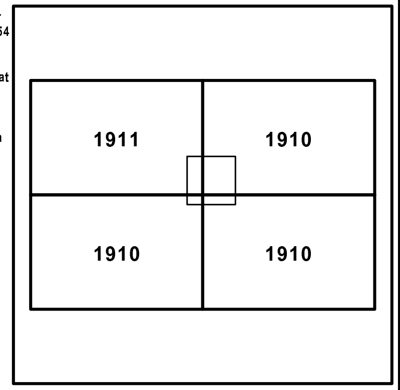

Date(s) of Publication

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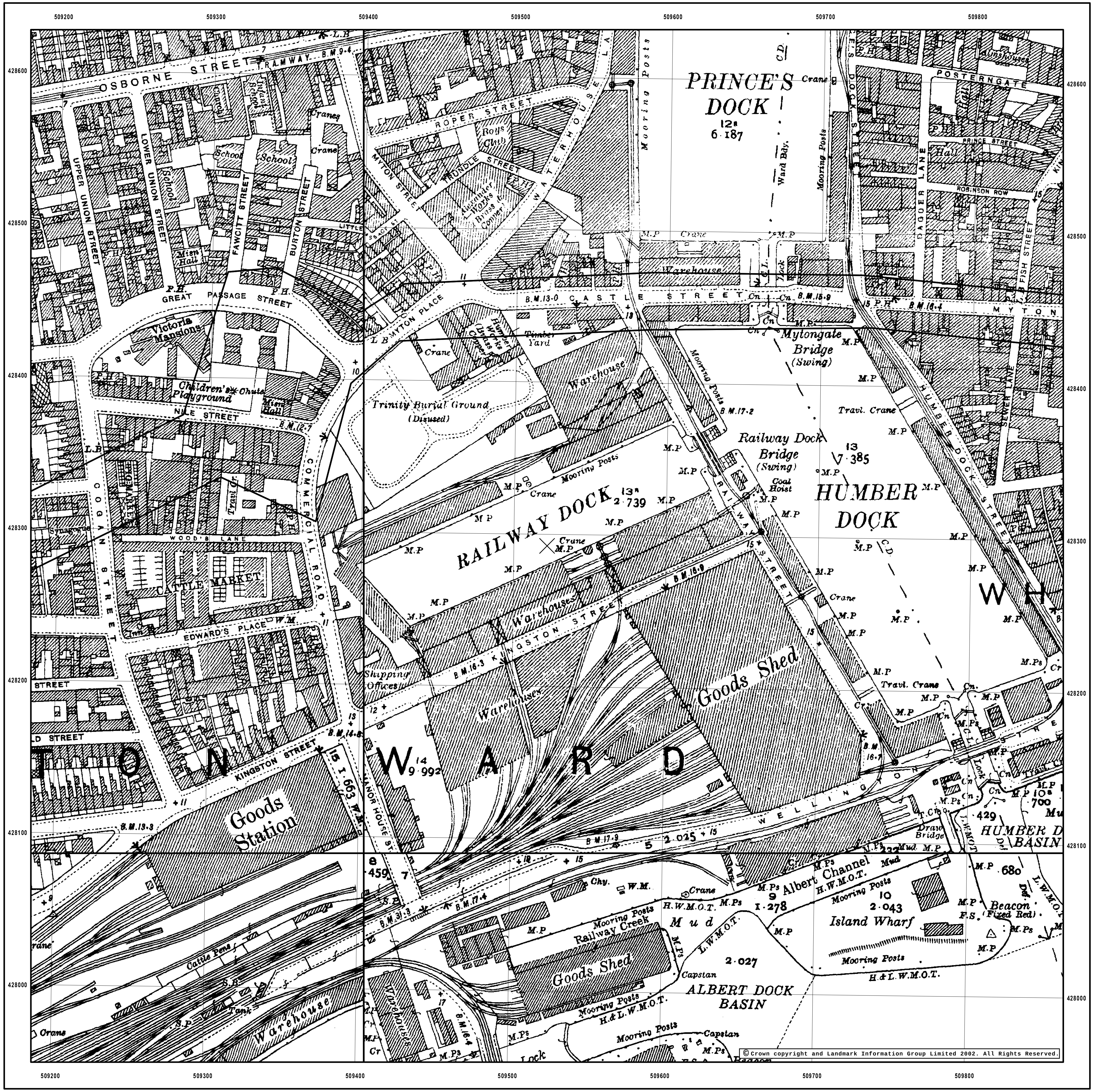

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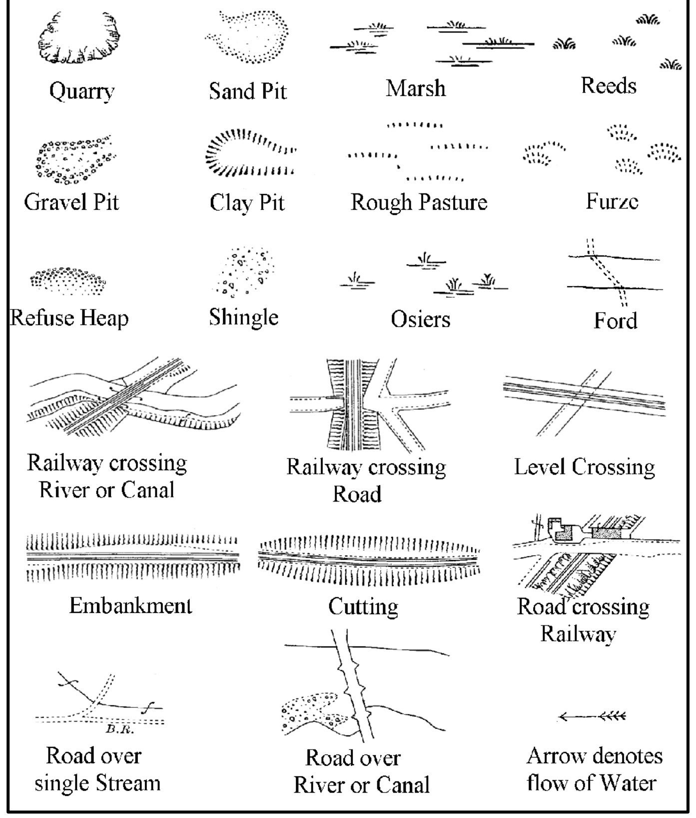
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



YORKSHIRE

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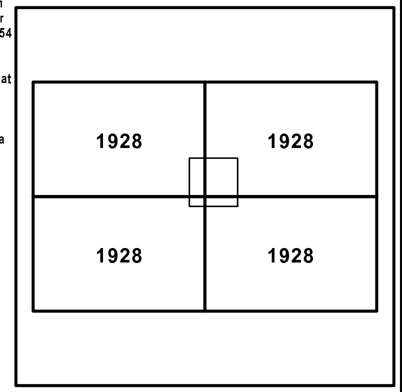
Source map scale - 1:2,500



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2_3

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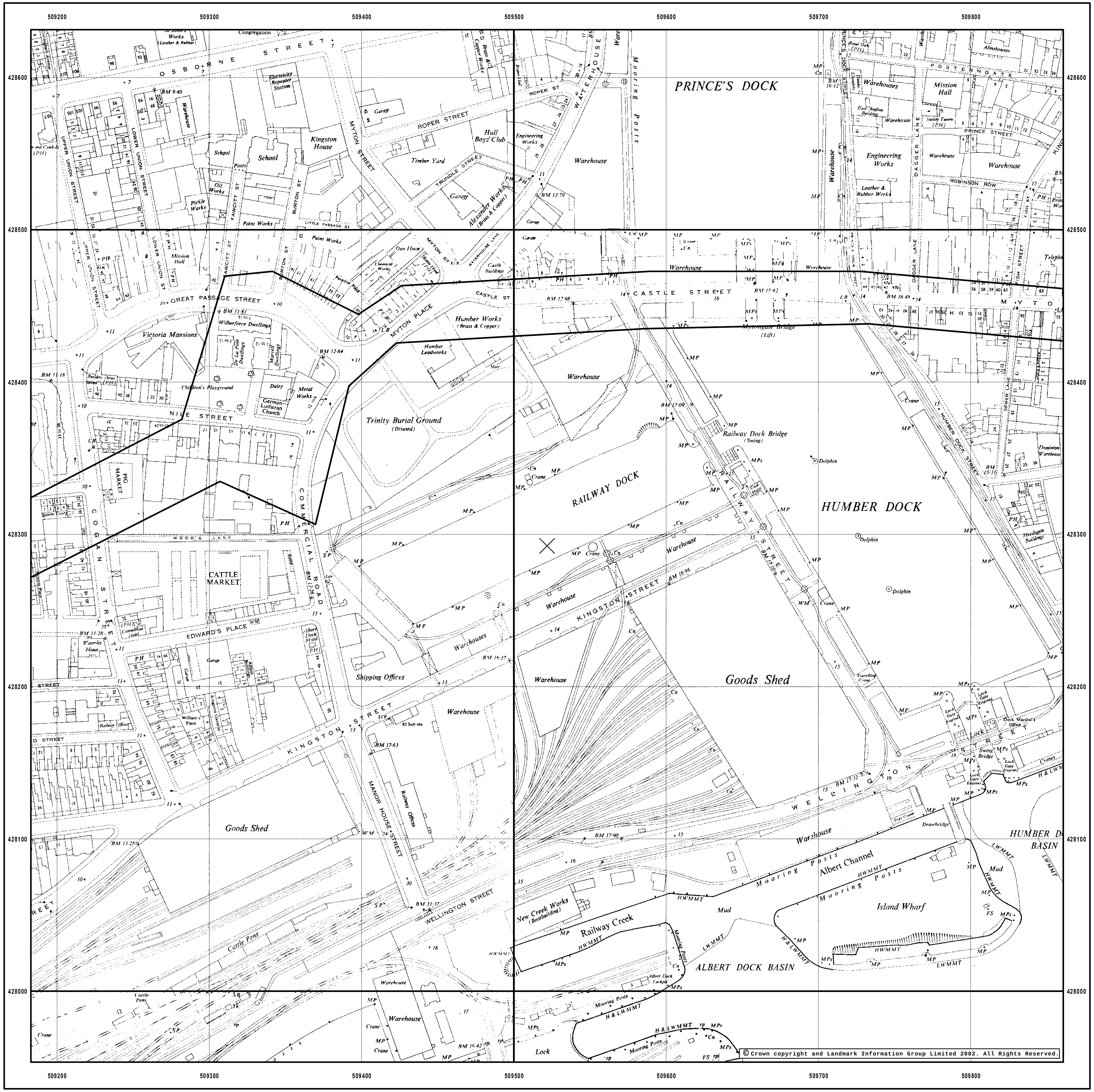

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WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS

Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend

Inactive Quarry, Chalk Pit or Clay Pit
Active Quarry, Chalk Pit or Clay Pit
Culvert
Slope
Slope
Pylon
Electricity Transmission Line
Direction of Water flow
Coppice, Osier
Marsh
Saltings
Orchard Tree
Reeds
Rough Grassland
Scrub
Heath
Bracken
Coniferous Tree (Surveyed)
Coniferous Tree (Not Surveyed)
Non-coniferous Tree (Surveyed)
Non-coniferous Tree (Not Surveyed)

ORDNANCE SURVEY PLAN

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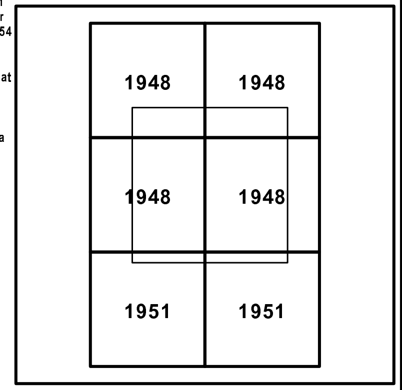
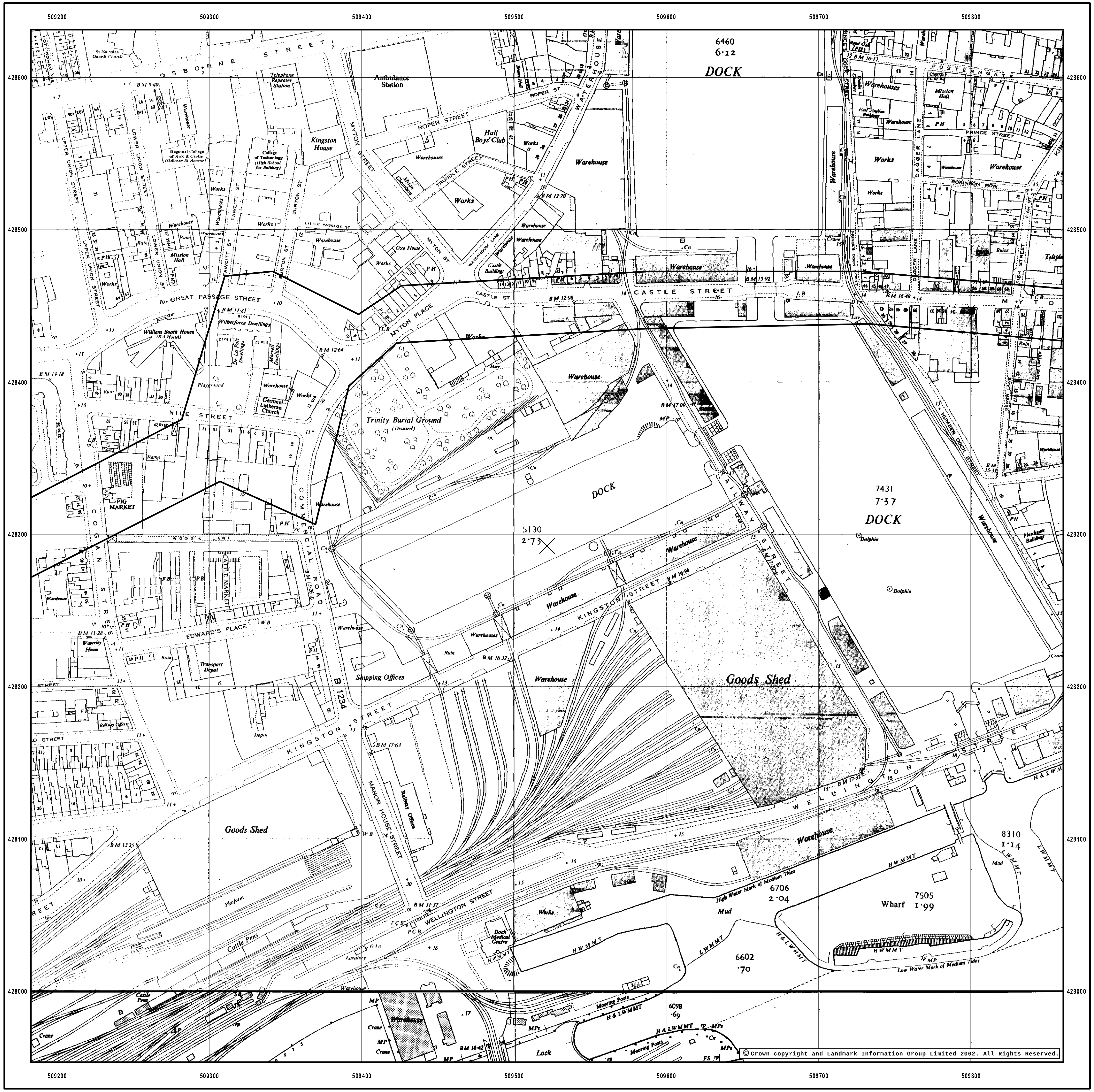
Source map scale - 1:1,250



Date(s) of Publication

3_A5



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George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend

Inactive Quarry, Chalk Pit or Clay Pit
Active Quarry, Chalk Pit or Clay Pit
Culvert
Slope
Slope
Pylon
Electricity Transmission Line (ETL)
Direction of Water flow
Coppice, Osier
Marsh
Saltings
Orchard Tree
Reeds
Rough Grassland
Scrub
Heath
Bracken
Coniferous Tree (Surveyed)
Coniferous Tree (Not Surveyed)
Non-coniferous Tree (Surveyed)
Non-coniferous Tree (Not Surveyed)

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Source map scale - 1:2,500

Date(s) of Publication
1959
1951

2_A5

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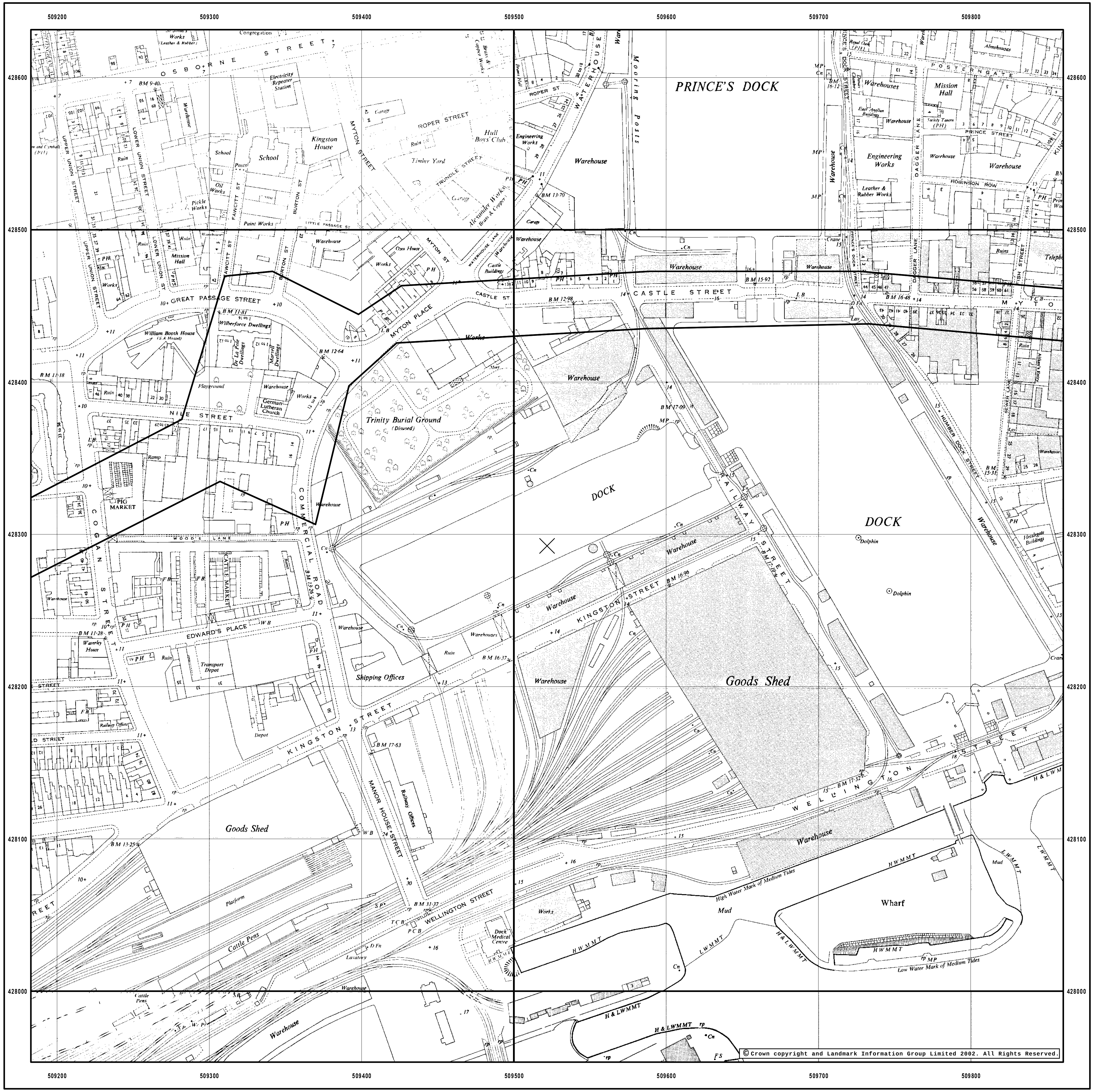

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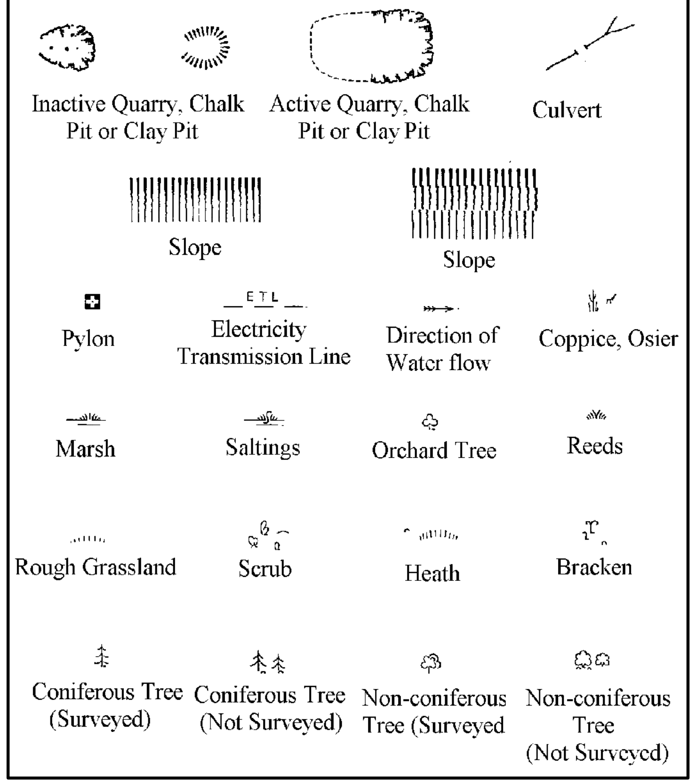
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS — Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



ORDNANCE SURVEY PLAN

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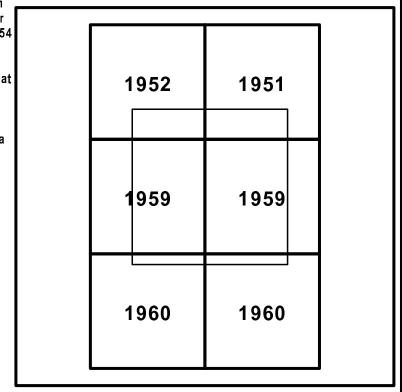
Source map scale - 1:1,250



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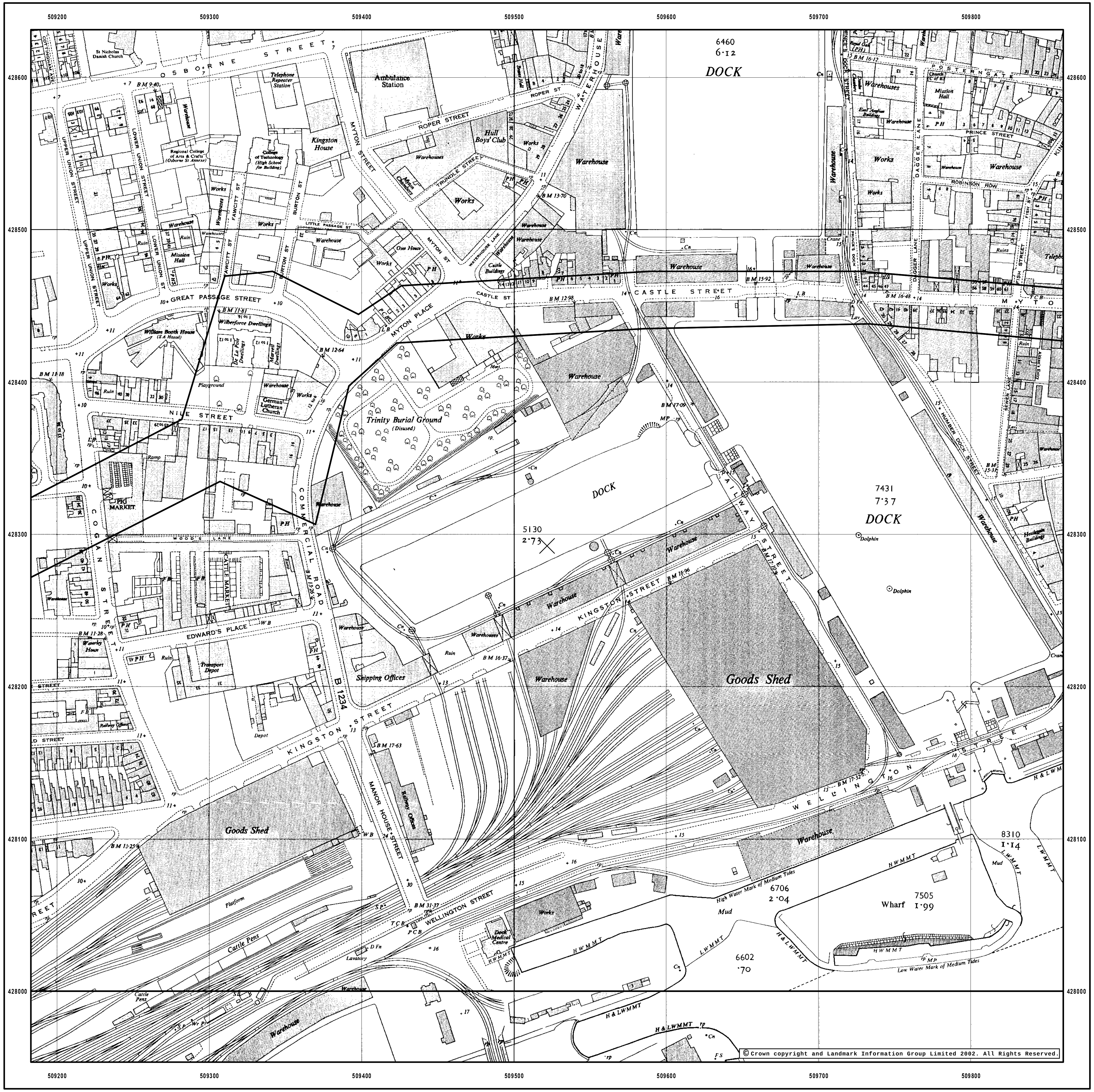

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Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend

Inactive Quarry, Chalk Pit or Clay Pit
Active Quarry, Chalk Pit or Clay Pit
Culvert
Slope
Slope
Pylon
Electricity Transmission Line (ETL)
Direction of Water flow
Coppice, Osier
Marsh
Saltings
Orchard Tree
Reeds
Rough Grassland
Scrub
Heath
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Coniferous Tree (Surveyed)
Coniferous Tree (Not Surveyed)
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Non-coniferous Tree (Not Surveyed)

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Source map scale - 1:2,500

1959

1962

Date(s) of Publication

2_B6

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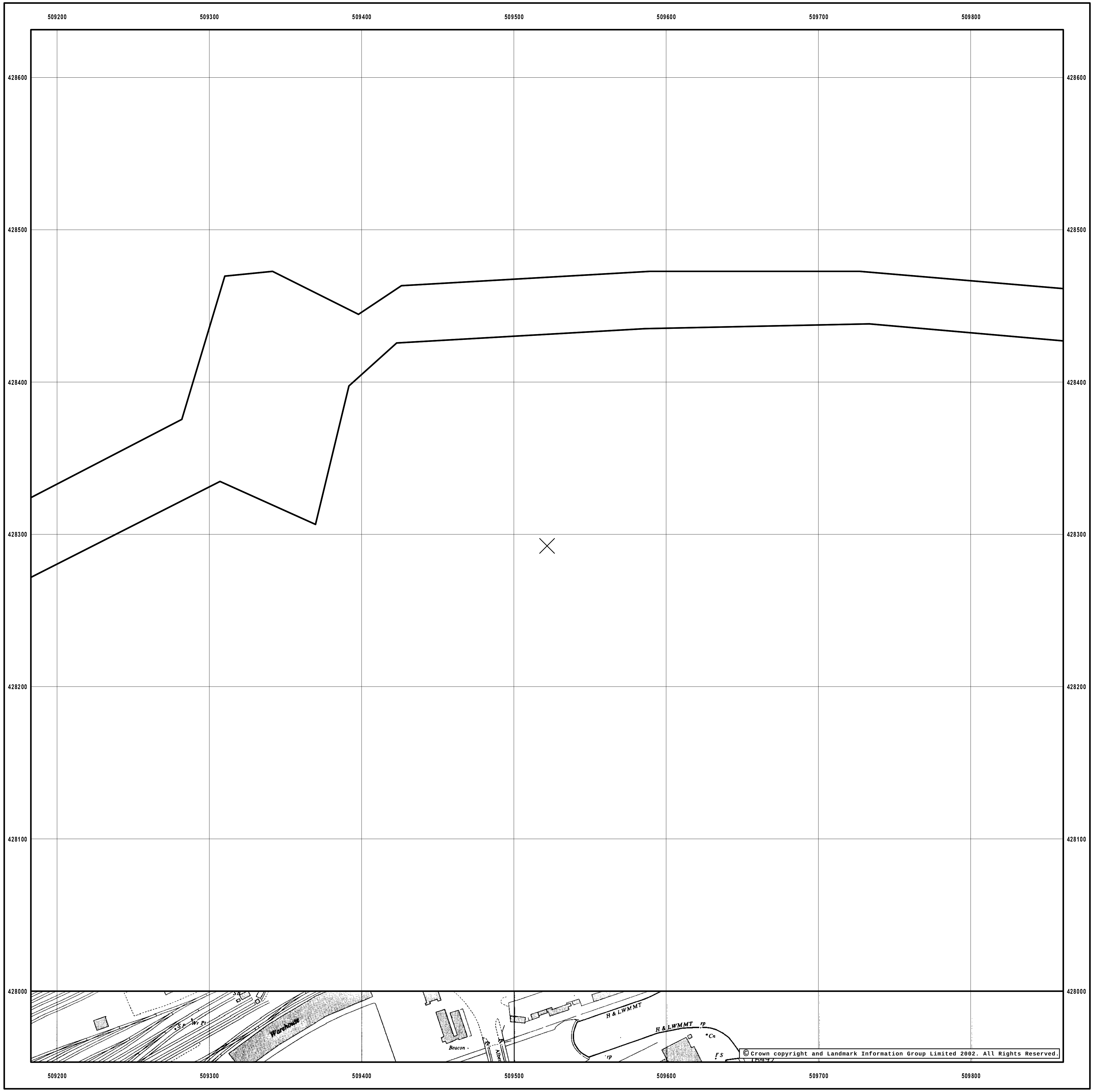

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Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

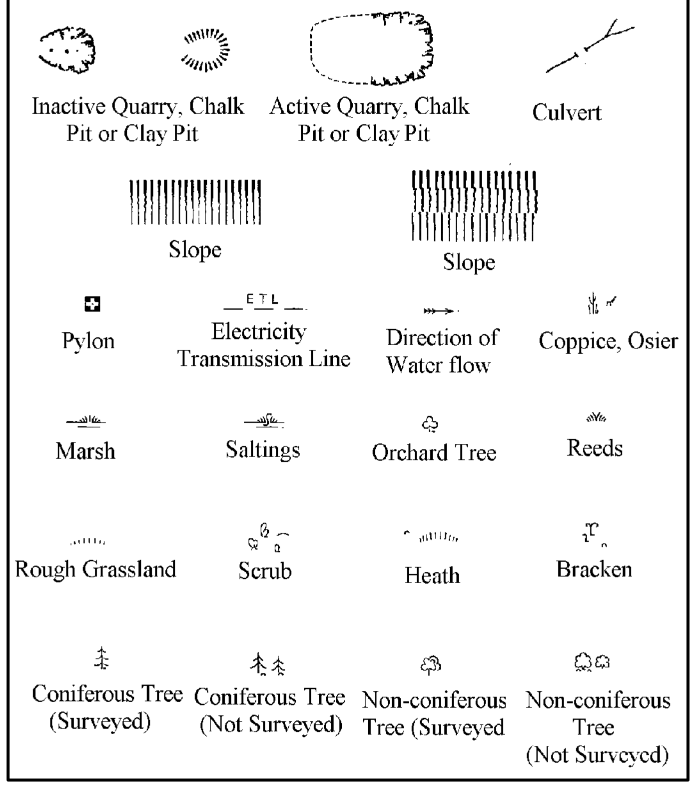
SITE DETAILS

Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



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Source map scale - 1:2,500

1970

Date(s) of Publication

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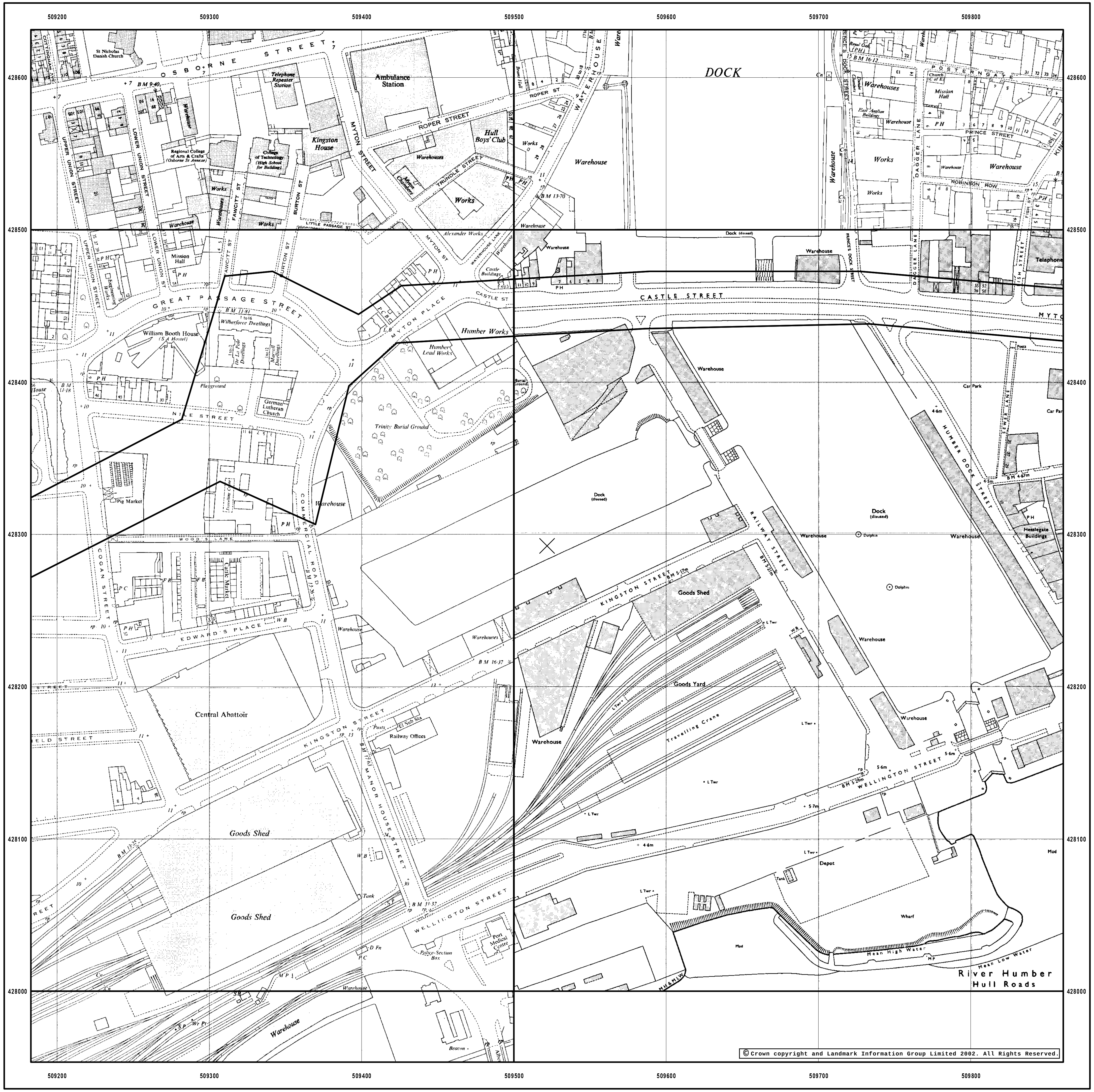

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CLIENT DETAILS Envirocheck Order No. EC166624_1_1
(06-Sep-2002 14:17)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

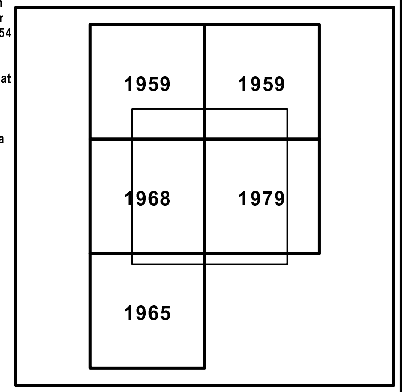
Historical Map Legend

Inactive Quarry, Chalk Pit or Clay Pit
Active Quarry, Chalk Pit or Clay Pit
Culvert
Slope
Slope
Pylon
Electricity Transmission Line
Direction of Water flow
Coppice, Osier
Marsh
Saltings
Orchard Tree
Reeds
Rough Grassland
Scrub
Heath
Bracken
Coniferous Tree (Surveyed)
Coniferous Tree (Not Surveyed)
Non-coniferous Tree (Surveyed)
Non-coniferous Tree (Not Surveyed)

ORDNANCE SURVEY PLAN

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given on the right is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Source map scale - 1:1,250



Date(s) of Publication

3_C7

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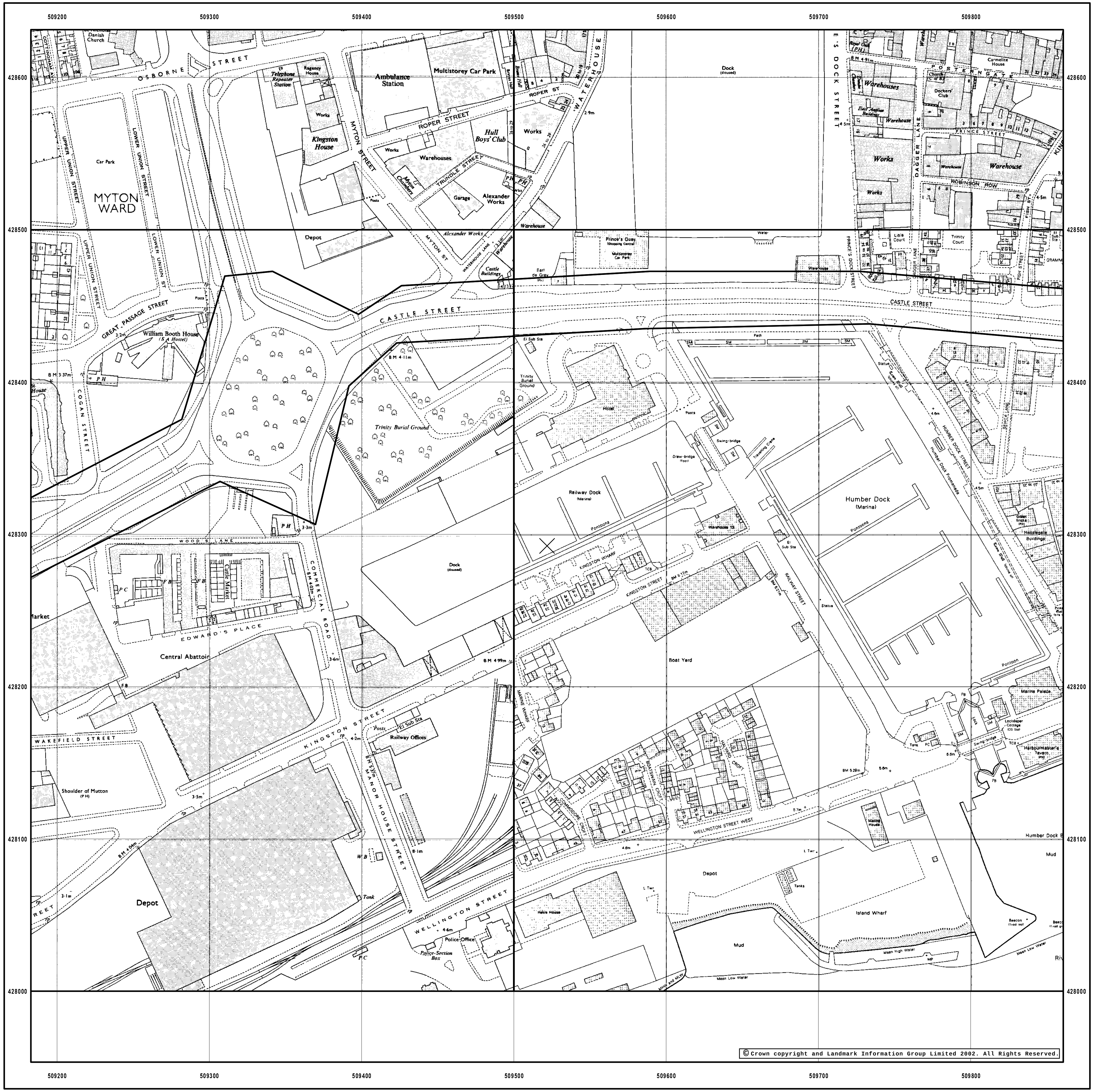

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CLIENT DETAILS

Envirocheck Order No. EC166624_1_1
(06-Sep-2002 14:18)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

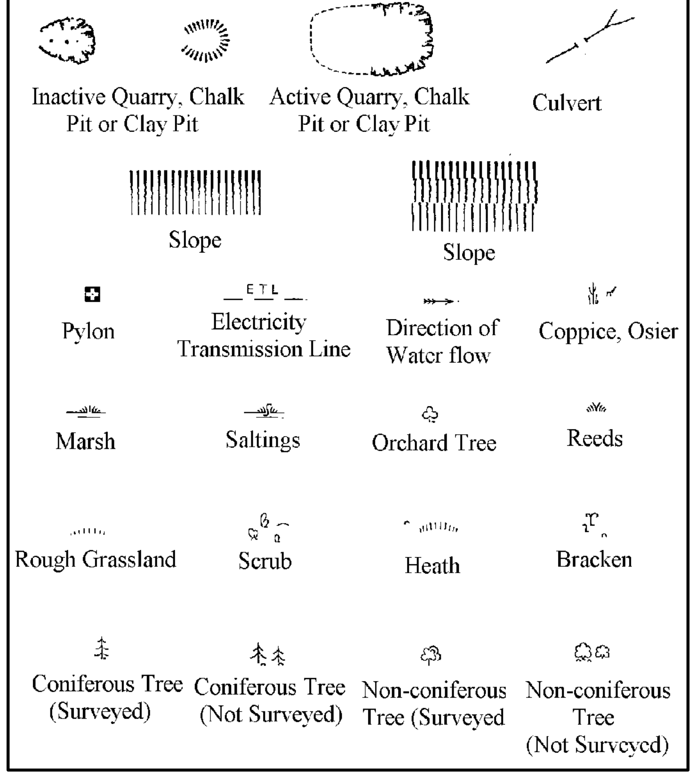
SITE DETAILS

Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



ORDNANCE SURVEY PLAN

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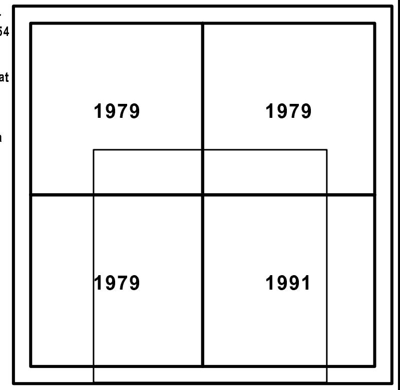
Source map scale - 1:1,250



Date(s) of Publication

3_D8

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(06-Sep-2002 14:18)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend

Inactive Quarry, Chalk Pit or Clay Pit
Active Quarry, Chalk Pit or Clay Pit
Culvert
Slope
Slope
Pylon
Electricity Transmission Line
Direction of Water flow
Coppice, Osier
Marsh
Saltings
Orchard Tree
Reeds
Rough Grassland
Scrub
Heath
Bracken
Coniferous Tree (Surveyed)
Coniferous Tree (Not Surveyed)
Non-coniferous Tree (Surveyed)
Non-coniferous Tree (Not Surveyed)

ORDNANCE SURVEY PLAN

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Source map scale - 1:1,250

1991

Date(s) of Publication

3_E9

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(06-Sep-2002 14:20)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend

- Quarry
- Shingle
- Railway over Road
- Road over Railway
- Gravel Pit
- Sand Pit
- Level Crossing
- Railway over River
- Other Pits
- Road over Stream
- Road over Stream
- Rough Pasture
- Furze
- Road over River or Canal
- Marsh
- Reeds
- Sunken Road
- Raised Road
- Osiers
- Instrumental Contour
- Arrow denotes flow of Water
- Sketched Contour

YORKSHIRE

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given on the right therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Source map scale - 1:10,560

1856

Date(s) of Publication

1_1

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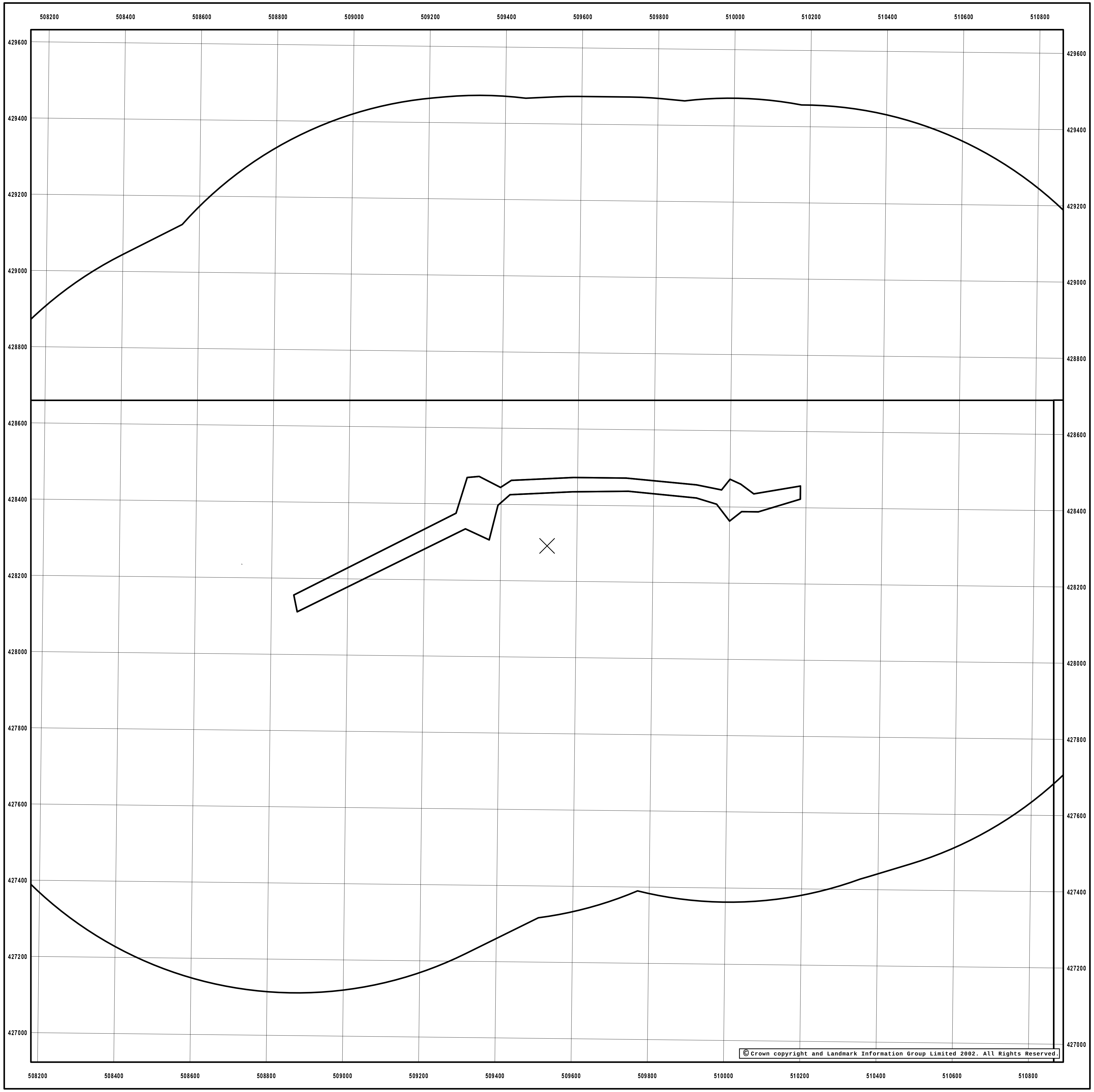

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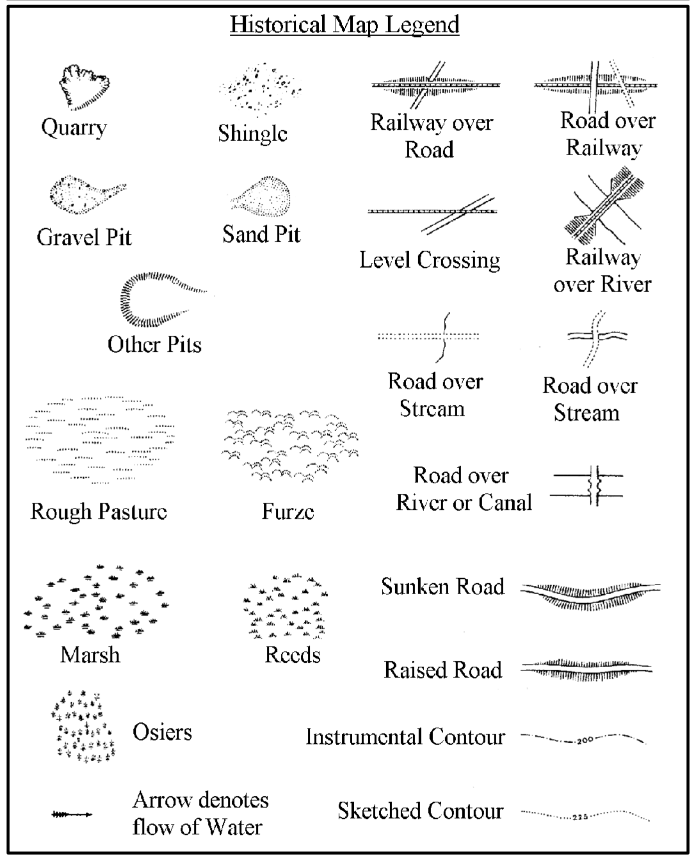
(06-Sep-2002 14:19)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull



LINCOLNSHIRE

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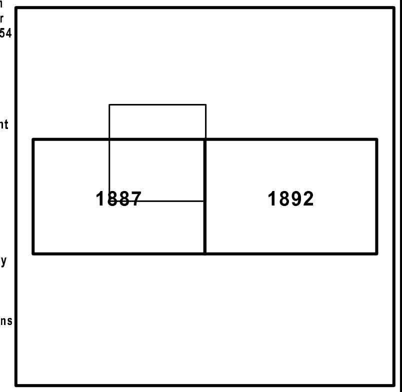
Source map scale - 1:10,560



Date(s) of Publication

1_1

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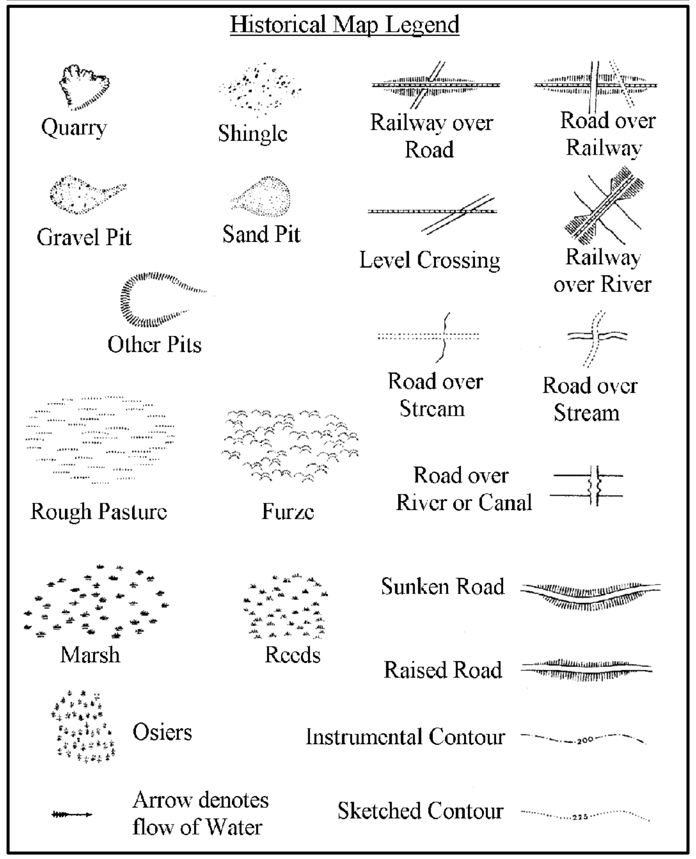
Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS

Grid Reference 509520 428290

Castle Street

Hull



YORKSHIRE

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Source map scale - 1:10,560

1893	1894

Date(s) of Publication

1_2

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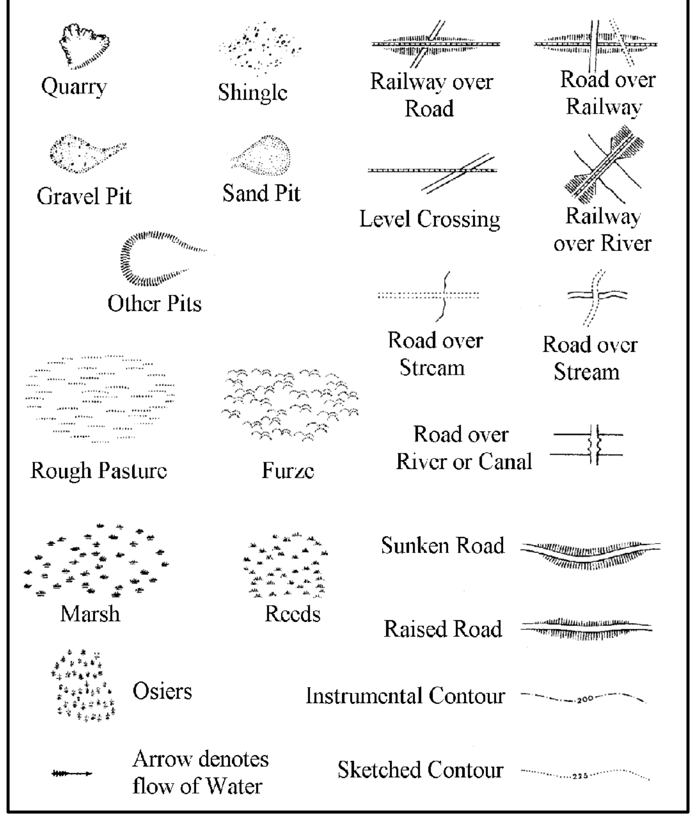
(06-Sep-2002 14:21)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS **Grid Reference 509520 428290**

Castle Street

Hull



LINCOLNSHIRE

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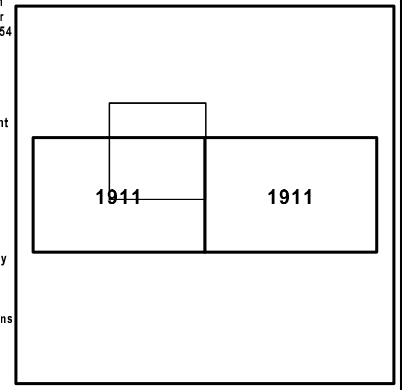
Source map scale - 1:10,560



Date(s) of Publication

1_2

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CLIENT DETAILS Envirocheck Order No. EC166624_1_1 (06-Sep-2002 14:22)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC

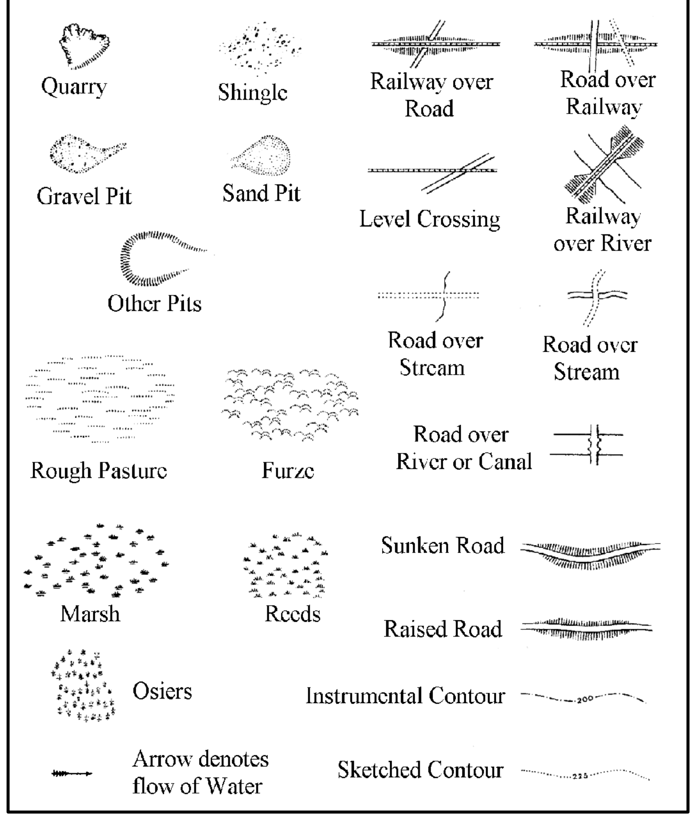
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



YORKSHIRE

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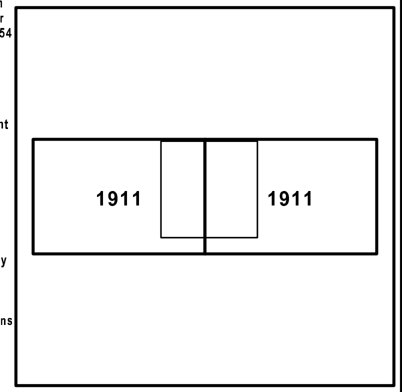
Source map scale - 1:10,560



Date(s) of Publication

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(06-Sep-2002 14:25)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC

Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

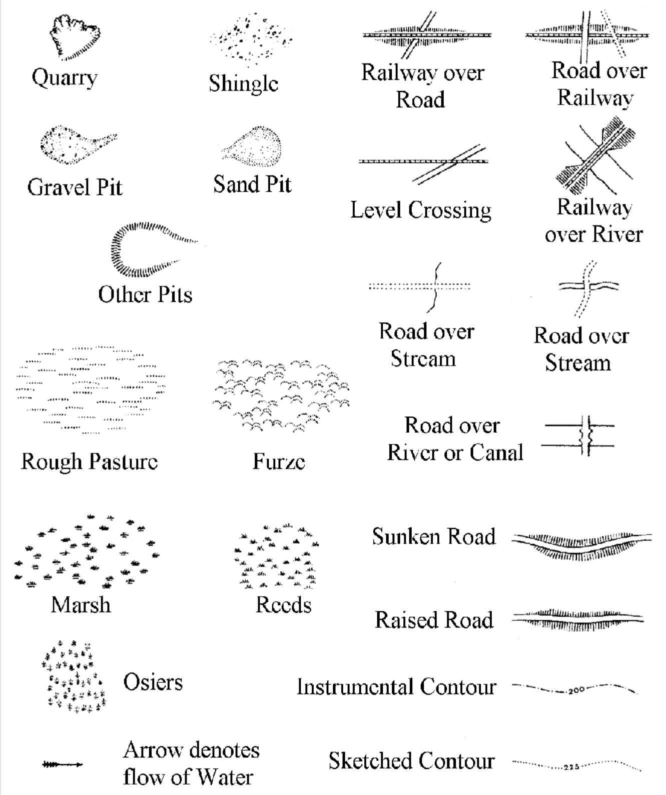
SITE DETAILS

Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



YORKSHIRE

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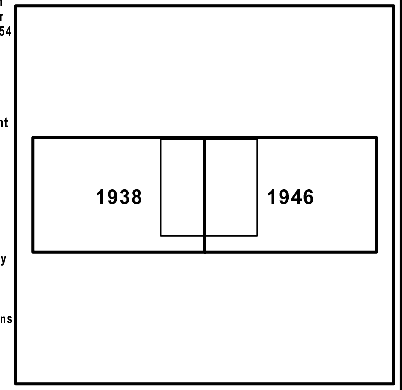
Source map scale - 1:10,560



Date(s) of Publication

1_4

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CLIENT DETAILS Envirocheck Order No. EC166624_1_1
(06-Sep-2002 14:23)

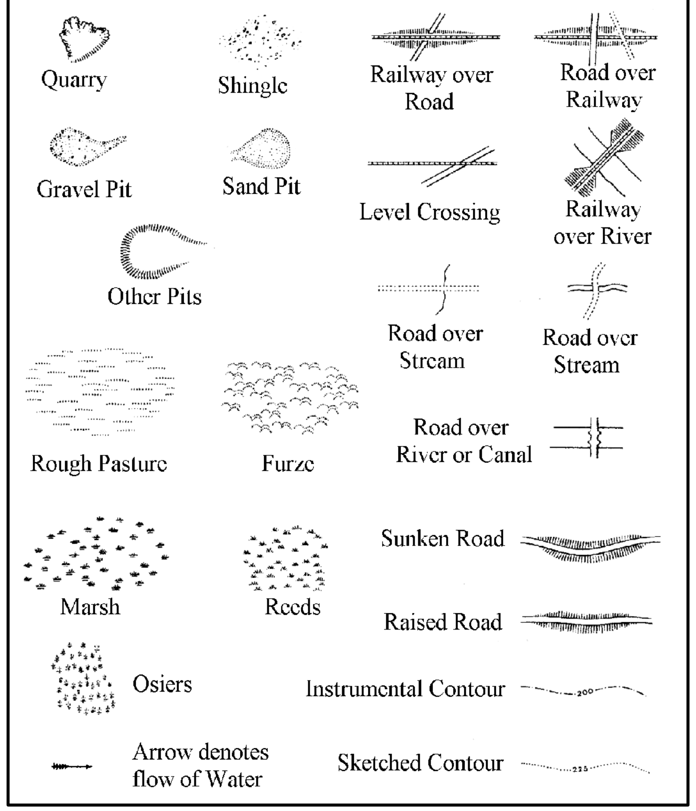
Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



LINCOLNSHIRE

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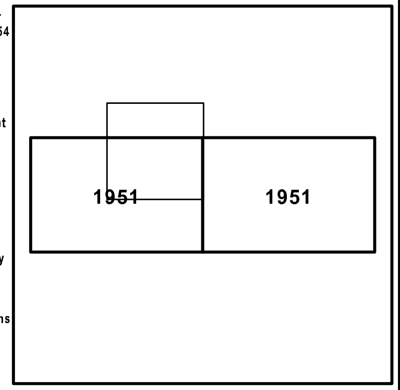
Source map scale - 1:10,560



Date(s) of Publication

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CLIENT DETAILS

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(06-Sep-2002 14:25)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

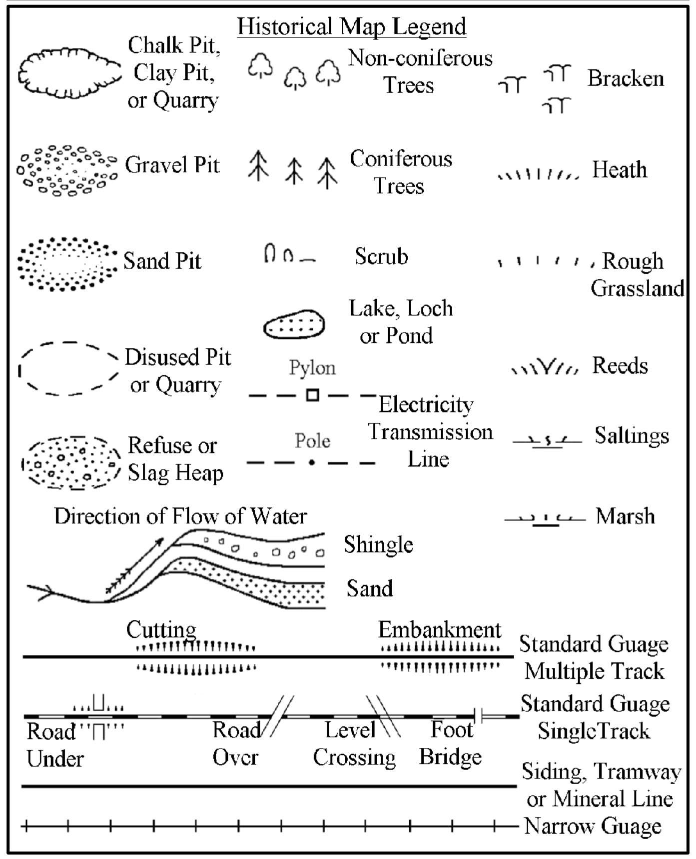
SITE DETAILS

Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



ORDNANCE SURVEY PLAN

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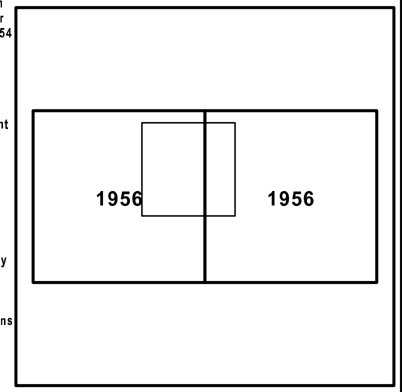
Source map scale - 1:10,560



Date(s) of Publication

1_I5

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Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC

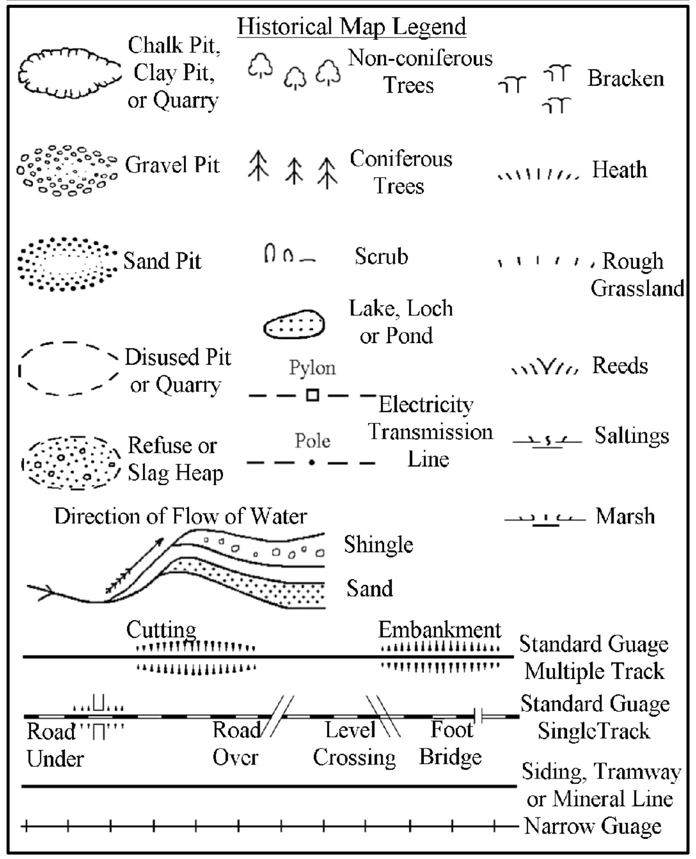
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



ORDNANCE SURVEY PLAN

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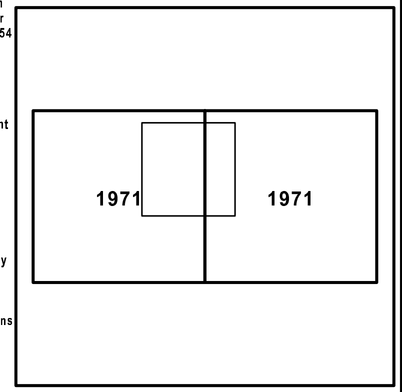
Source map scale - 1:10,000



Date(s) of Publication

1_M5

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(06-Sep-2002 14:27)

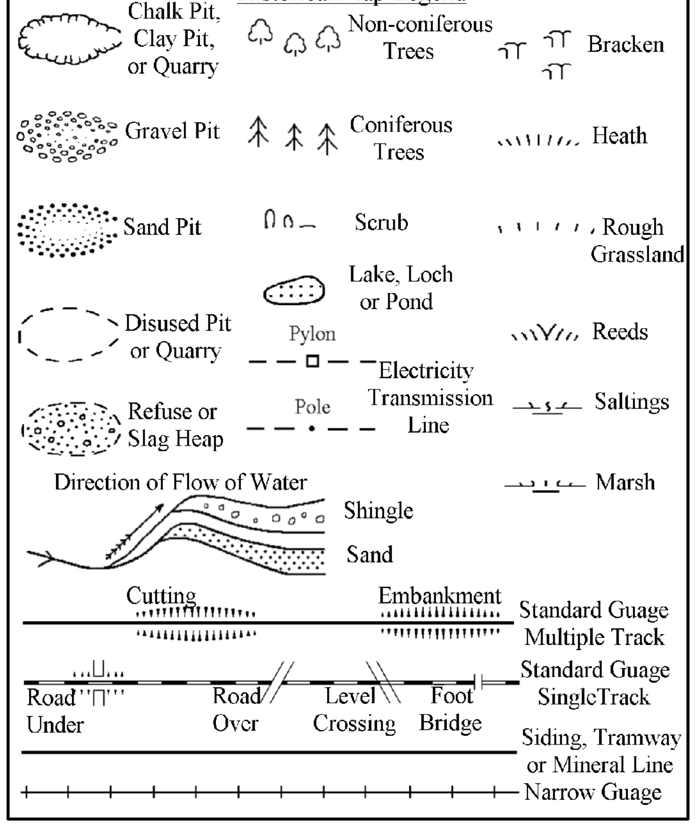
Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend



ORDNANCE SURVEY PLAN

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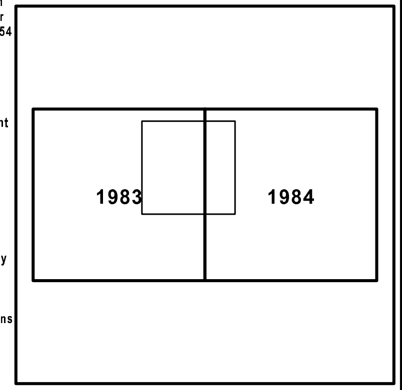
Source map scale - 1:10,000



Date(s) of Publication

1_M6

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CLIENT DETAILS Envirocheck Order No. EC166624_1_1
(06-Sep-2002 14:28)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend

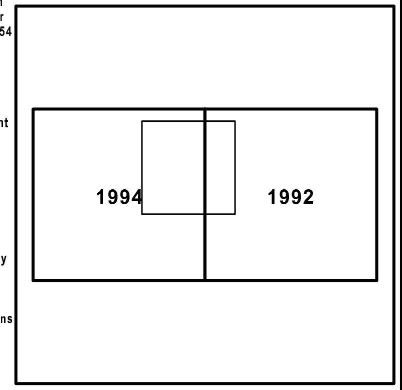
- Chalk Pit, Clay Pit, or Quarry
- Non-coniferous Trees
- Bracken
- Gravel Pit
- Coniferous Trees
- Heath
- Sand Pit
- Scrub
- Rough Grassland
- Lake, Loch or Pond
- Disused Pit or Quarry
- Pylon
- Electricity Transmission Line
- Pole
- Reeds
- Refuse or Slag Heap
- Saltings
- Direction of Flow of Water
- Marsh
- Shingle
- Sand
- Cutting
- Embankment
- Standard Guage Multiple Track
- Standard Guage SinglcTrack
- Road Under
- Road Over
- Level Crossing
- Foot Bridge
- Siding, Tramway or Mineral Line
- Narrow Guage

ORDNANCE SURVEY PLAN

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given on the right therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Source map scale - 1:10,000



Date(s) of Publication

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Envirocheck

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CLIENT DETAILS Envirocheck Order No. EC166624_1_1
(06-Sep-2002 14:28)

Customer Ref: MS C MCINTOSH,W10021/A02/T01_EC
Pell Frischmann
George House George Street
WAKEFIELD
West Yorkshire WF1 1LY

SITE DETAILS Grid Reference 509520 428290

Castle Street

Hull

Historical Map Legend

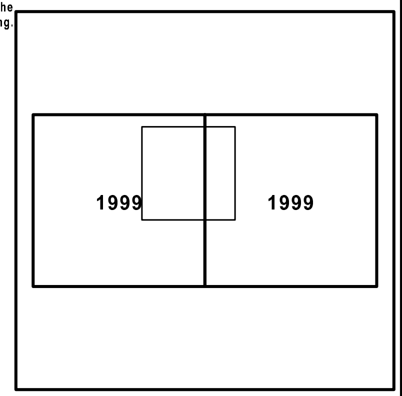
Non-coniferous Trees	Pylon
Coniferous Trees	Telephone Line (where shown)
Orchard	Electricity Transmission Line (with poles)
Rough Grassland	Gravel Pit
Heath	Shingle
Scrub	Refuse Tip or Slag Heap
Marsh, Salt Marsh or Reeds	Sand
County Boundary (England only)	Sand Pit
Civil Parish or Community Boundary	Slopes
Constituency Boundary	District, Unitary, Metropolitan, London Borough Boundary

ORDNANCE SURVEY PLAN

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan® which replaced the old 1:10,000 maps originally published in 1970.

The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Source map scale - 1:10,000



Date(s) of Publication

crm

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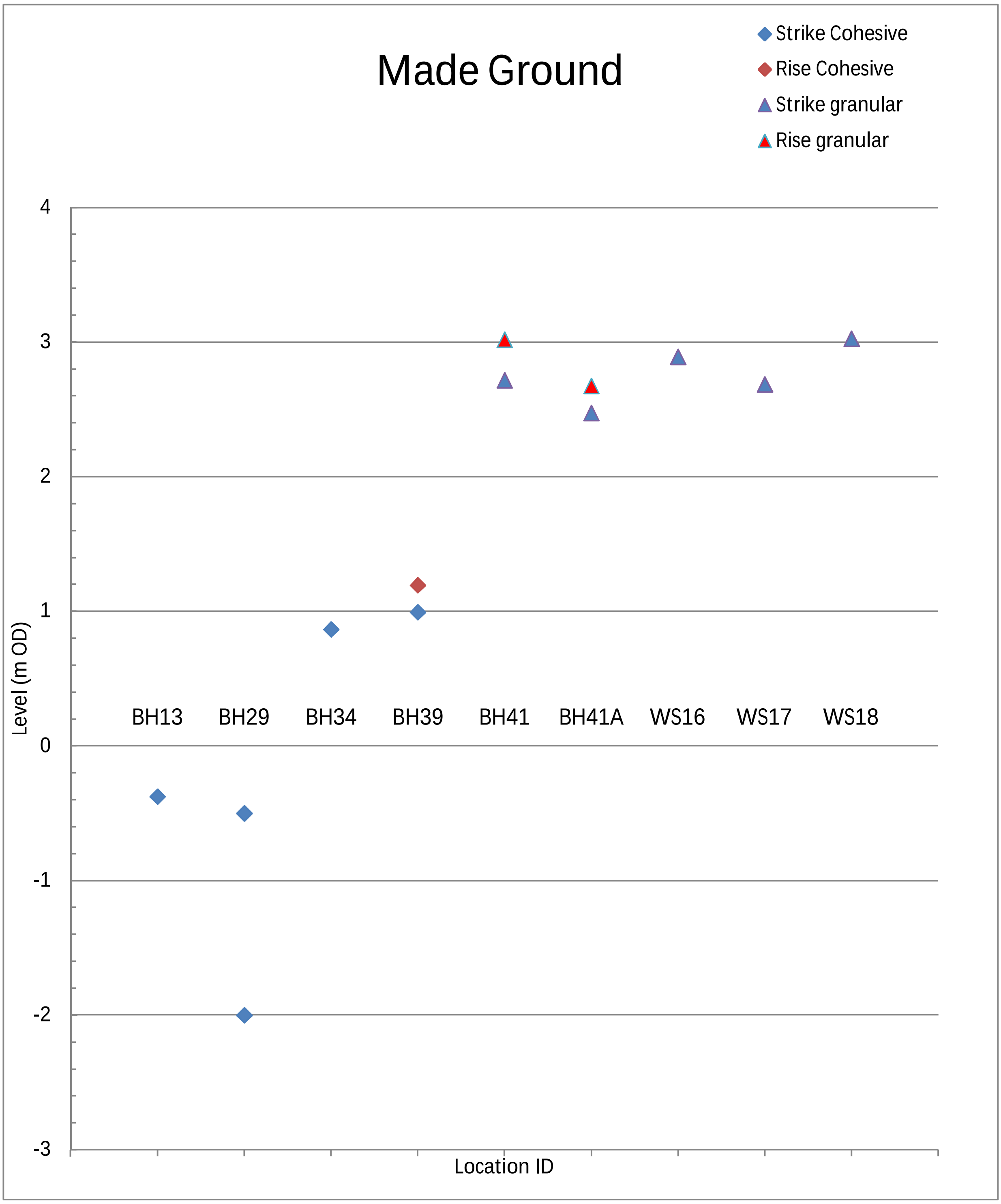
Appendix B – Groundwater Strikes

Figure Title: Groundwater Strikes

Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Appendix B	Strata:	Made Ground



HIGHWAYS AGENCY
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Figure Title: Groundwater Strikes

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Appendix B**	Strata:	**Cohesive Alluvium**

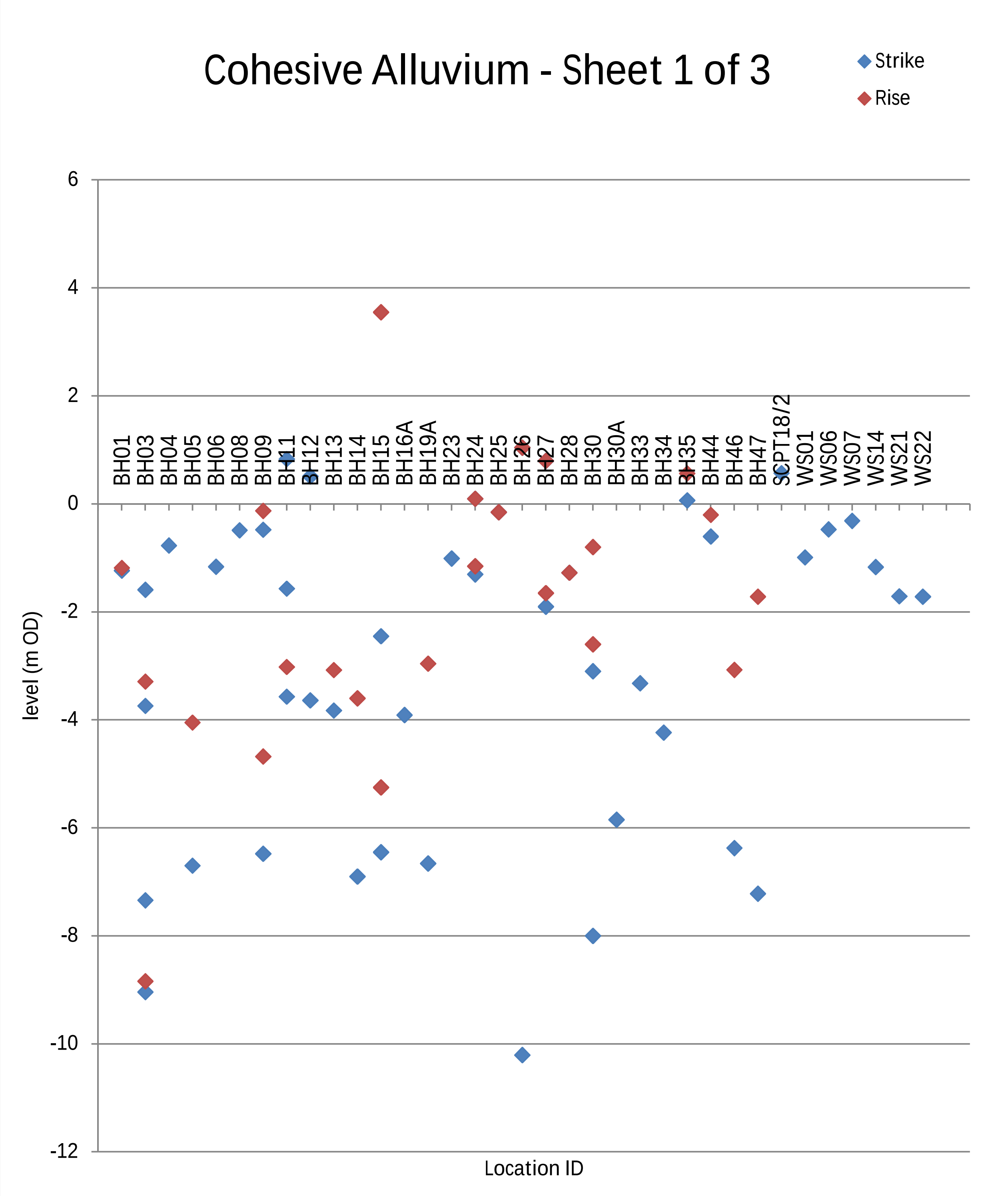

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Figure Title: Groundwater Strikes

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Appendix B**	Strata:	**Cohesive Alluvium**

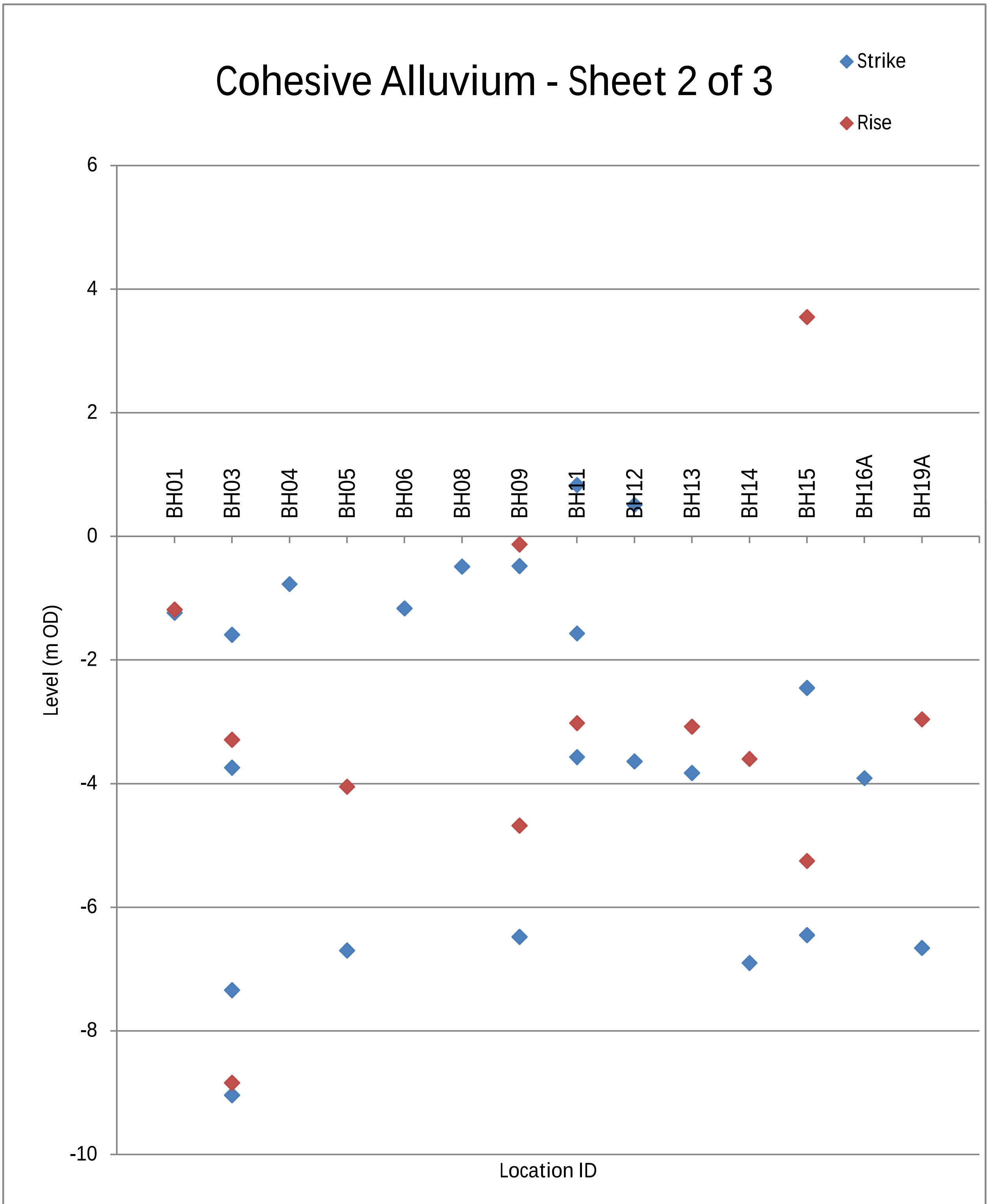

Figure Title: Groundwater Strikes

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Appendix B**	Strata:	**Cohesive Alluvium**

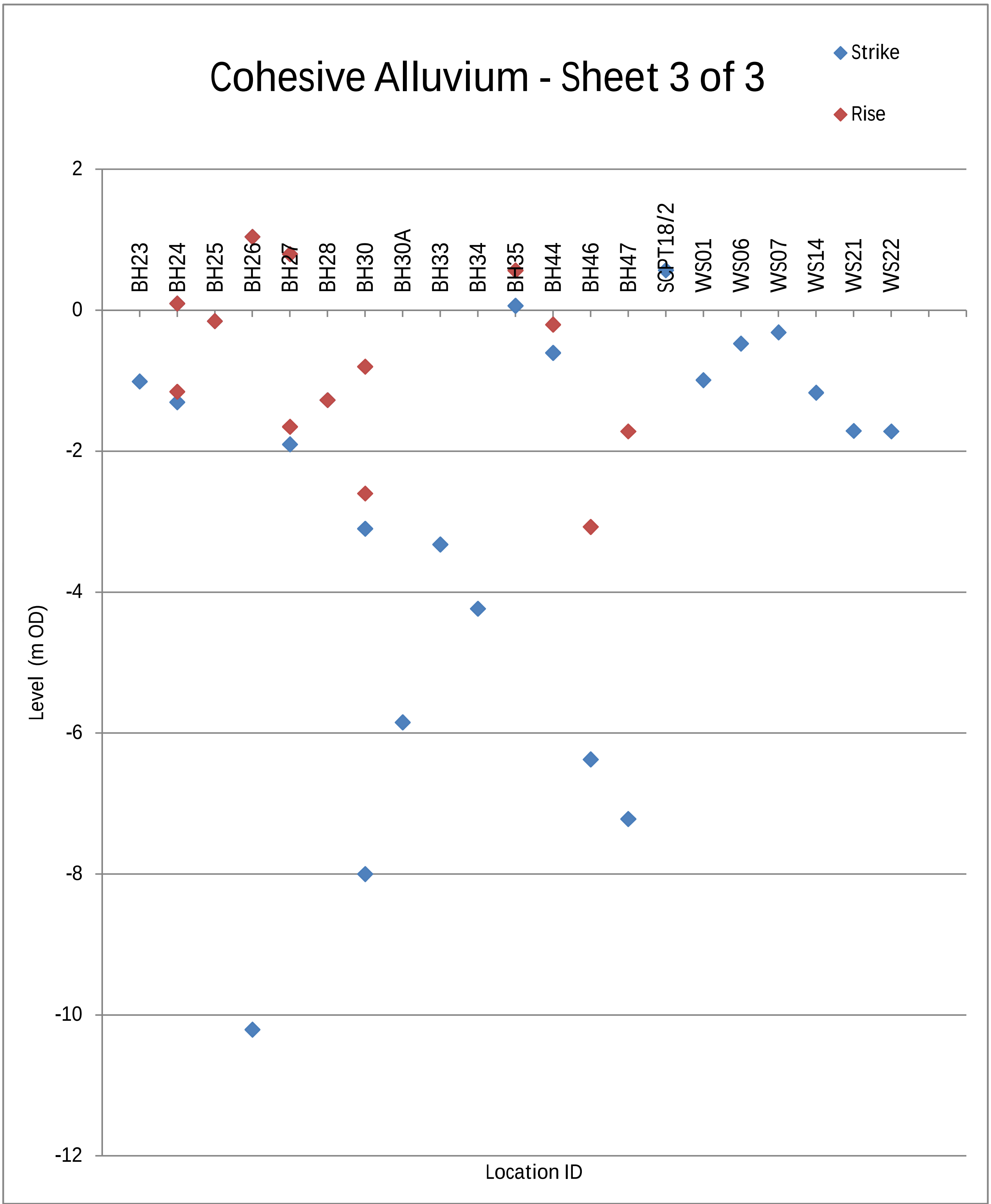

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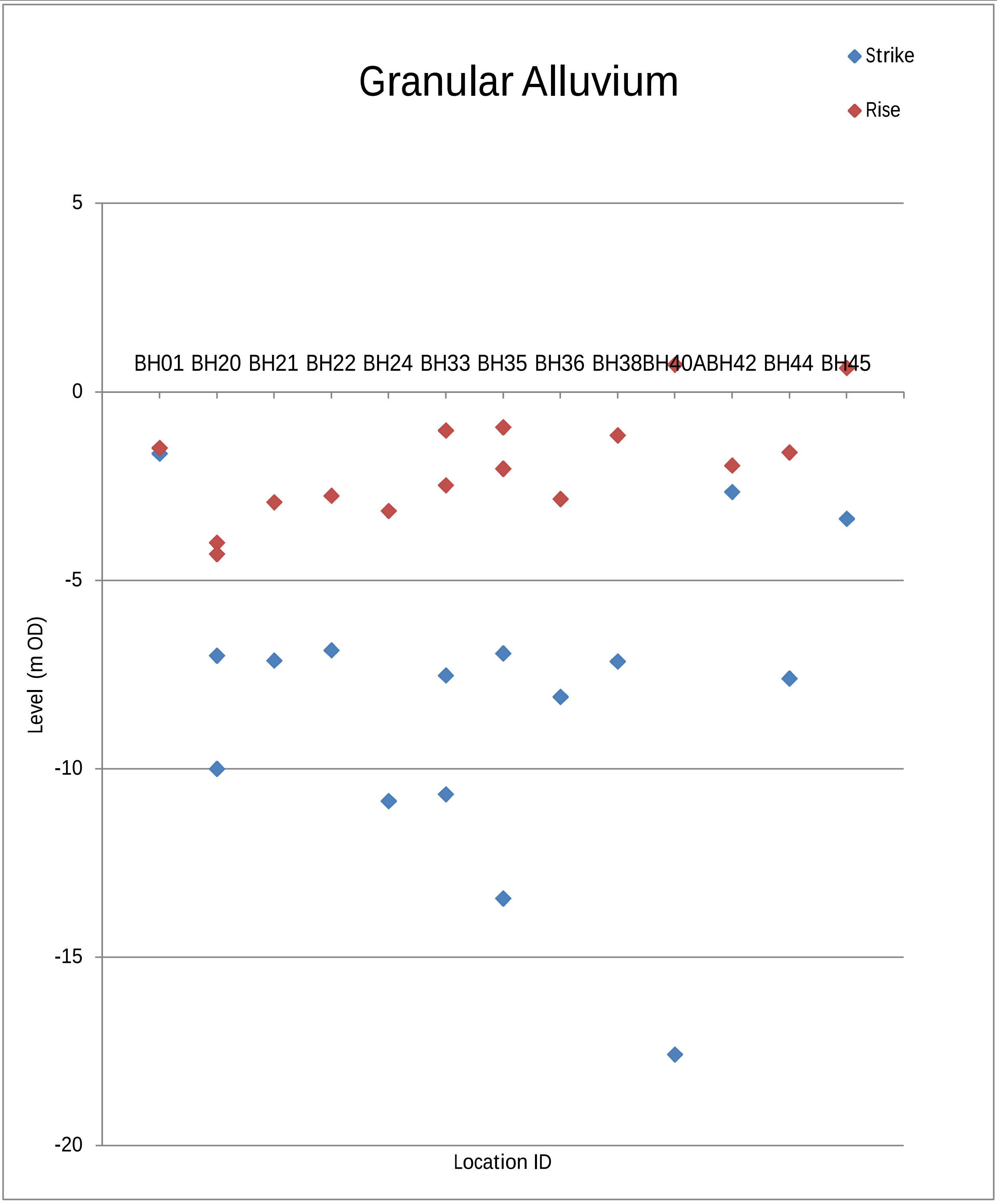
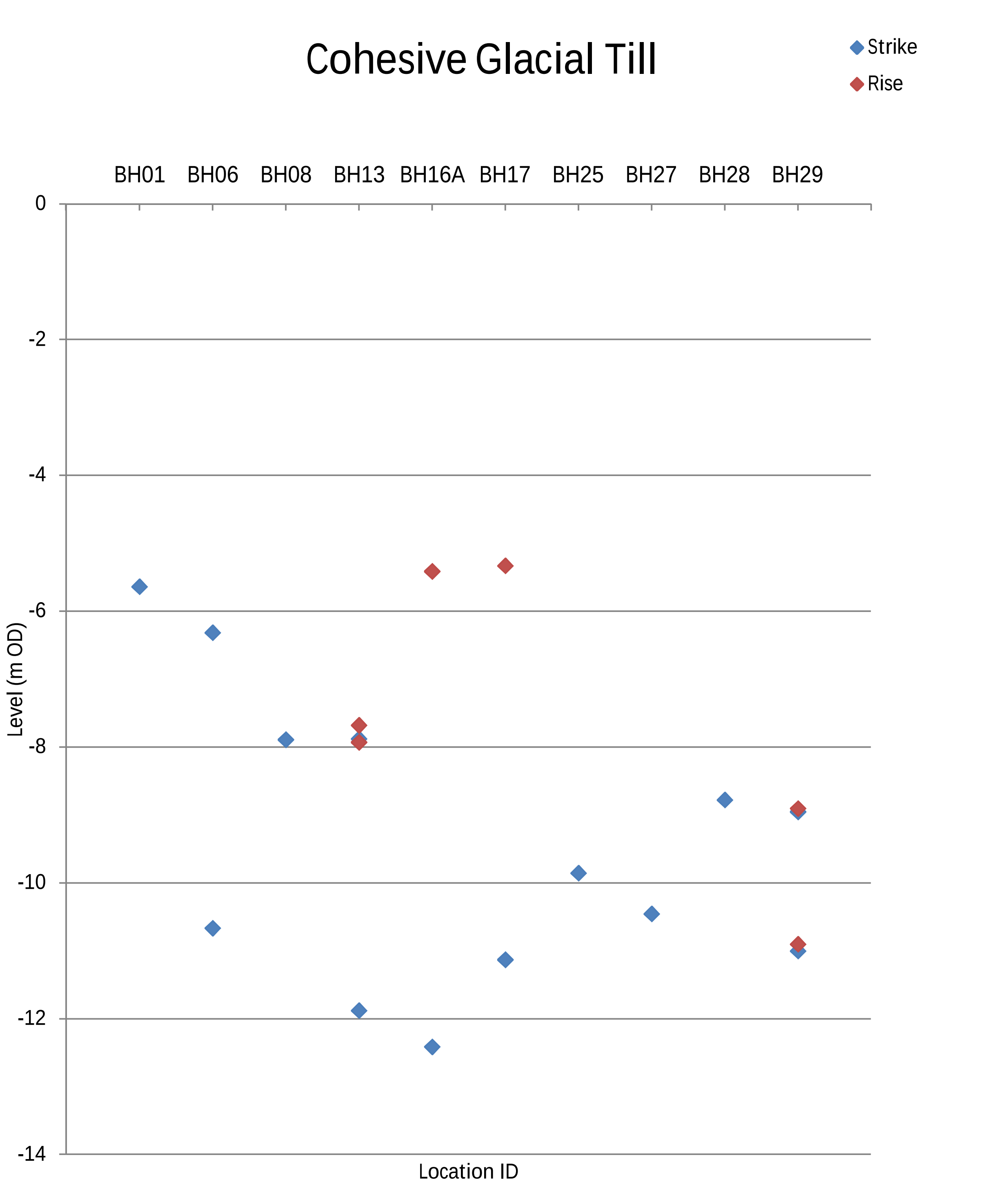
Figure Title: Groundwater Strikes

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Appendix B**	Strata:	**Granular Alluvium**



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij		Figure Title: Groundwater Strikes	
Report Reference:	1168-09-152-RE-001	Project Title:	A63 Castle Street
Figure Reference:	Appendix B	Strata:	Cohesive Glacial Till



HIGHWAYS AGENCY Safe roads, reliable journeys, informed travellers Grontmij	Figure Title: Groundwater Strikes		
Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Appendix B**	Strata:	**Glaciolucustrine**

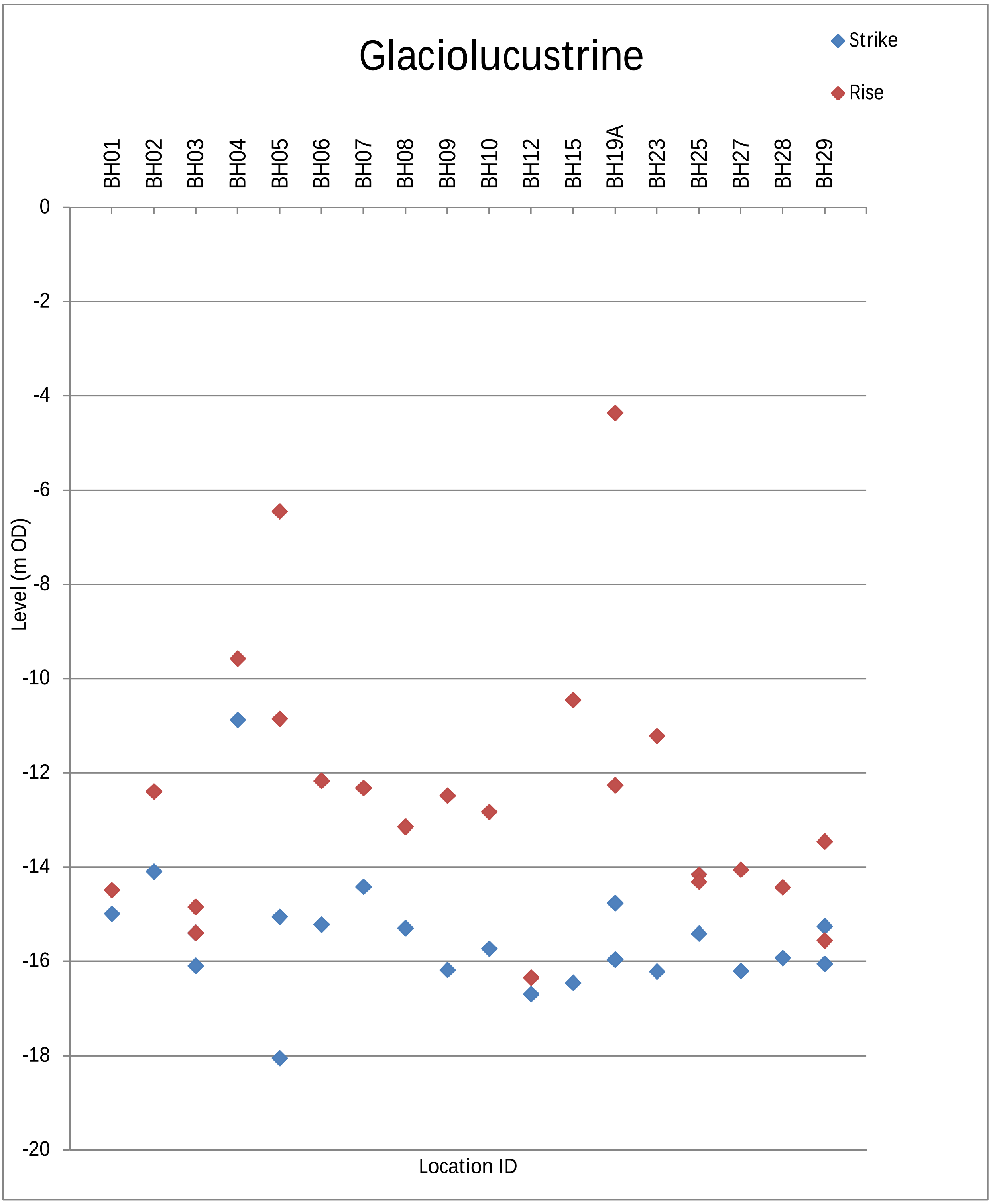


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Figure Title: Groundwater Strikes

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Appendix B**	Strata:	**Fluvio-Glacial**

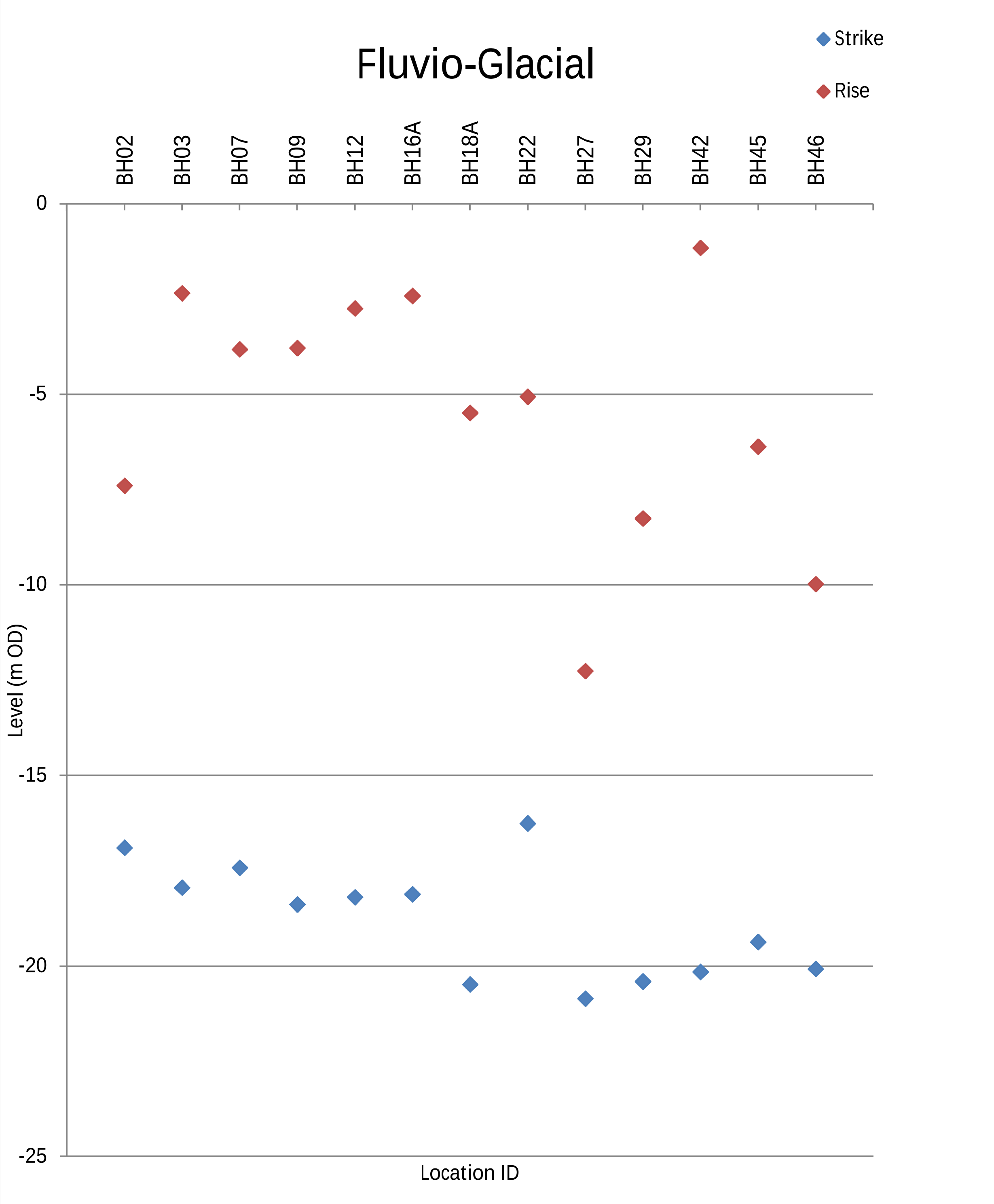

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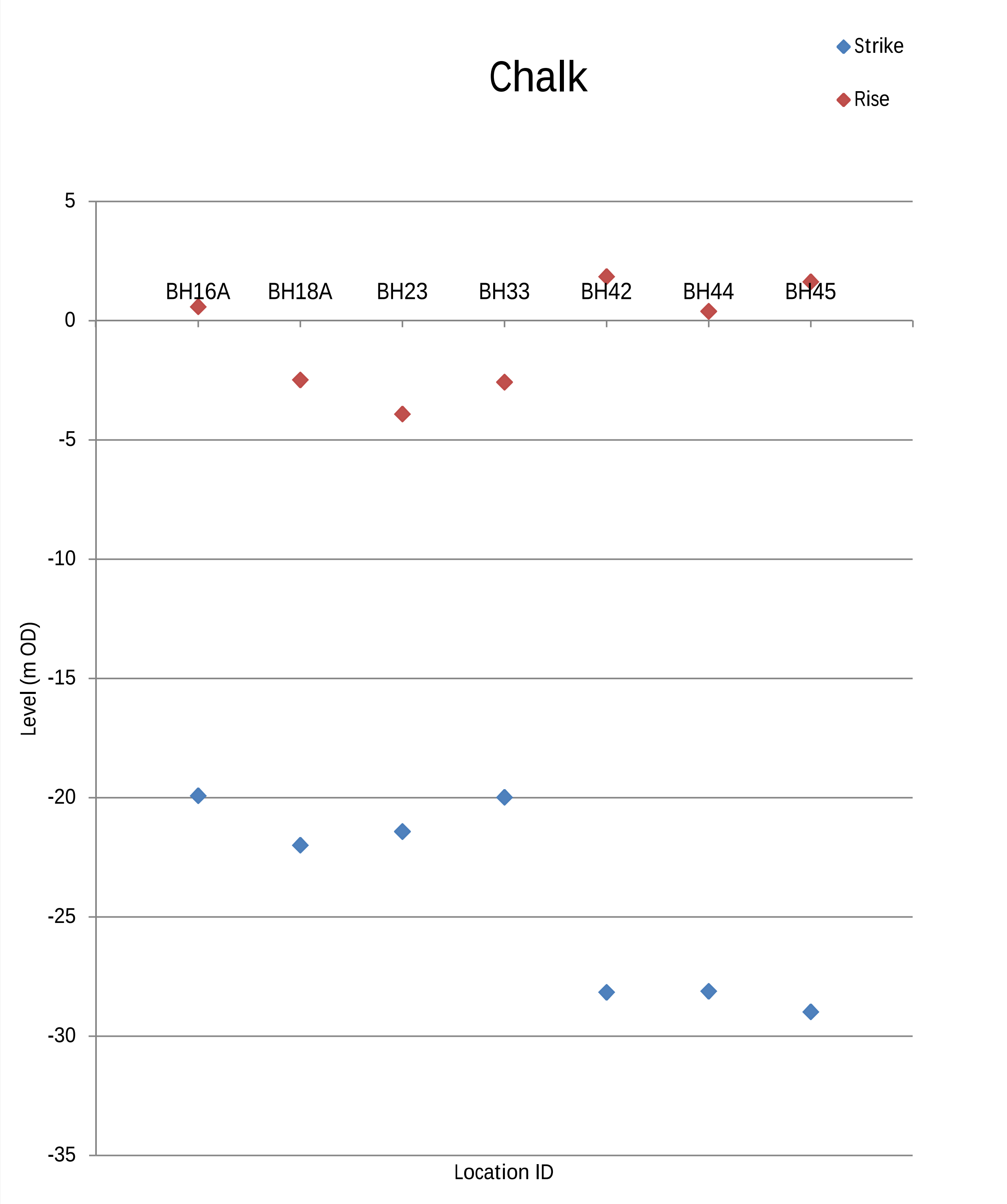
Figure Title: Groundwater Strikes

Report Reference:	**1168-09-152-RE-001**	Project Title:	**A63 Castle Street**
Figure Reference:	**Appendix B**	Strata:	**Chalk**



Annex B: ESG (2016) A63 Garrison Road, Castle Street Improvement, Hull, Factual Report on Ground Investigation. Report No A5066-15A. For Balfour Beatty Limited and Ove Arup & Partners

A63 CASTLE STREET IMPROVEMENTS
MAIN SITE GI

FACTUAL REPORT ON GROUND INVESTIGATION

Report No A5085-15

April 2016

Carried out for:
Balfour Beatty Limited
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Report No A5085-15

April 2016

Issue No Date	Status	Prepared by	Checked by	Approved by
1 Mar 2016	Draft report	NAME and QUALIFICATIONS T Clifford BEng	NAME and QUALIFICATIONS P Hepton BSc PhD	NAME and QUALIFICATIONS T Clifford BEng
		SIGNATURE [redacted]	SIGNATURE [redacted]	SIGNATURE [redacted]
2 Apr 2016	Final report	NAME and QUALIFICATIONS T Clifford BEng	NAME and QUALIFICATIONS P Hepton BSc PhD	NAME and QUALIFICATIONS P Hepton BSc PhD
		SIGNATURE [redacted]	SIGNATURE [redacted]	SIGNATURE [redacted]
		NAME and QUALIFICATIONS	NAME and QUALIFICATIONS	NAME and QUALIFICATIONS
		SIGNATURE	SIGNATURE	SIGNATURE

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APPENDIX B EXPLORATORY HOLE RECORDS

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1 INTRODUCTION

In April 2015 ESG was commissioned by Ove Arup & Partners, on behalf of Balfour Beatty Limited, to carry out a ground investigation for the A63 Castle Street Improvement project in Hull. The investigation was required to obtain supplementary geotechnical and geoenvironmental information to assist in the design and construction of the A63 Castle Street Improvement works.

The scope of the investigation was specified by Ove Arup & Partners and comprised boreholes by cable percussion and rotary drilling, dynamic sampling, pavement coring, cone penetration testing (CPT), dynamic cone penetration testing (DCP), laboratory testing and monitoring. The investigation was performed in accordance with the contract specification, and the general requirements of BS 5930 (2015), BS EN 1997-2 (2007), BS EN ISO 22475-1 (2006) and other relevant related standards identified below. The fieldwork took place between 30 November 2015 and 25 January 2016.

This report presents the factual records of the fieldwork and laboratory testing. The information is also presented as digital data as defined in AGS (2010).

2 SITE SETTING

2.1 Location and Description

The A63 runs in an east-west direction through the southern part of Hull, on the north side of the Humber estuary. The Castle Street Improvement section runs between Porter Street, at National Grid Reference TA 089 281, and Hull Magistrates Court, at TA 101 284, see Site Location Plan in Appendix A.

2.2 Published Geology

The published geological map for the area, BGS Sheet 80 (1983), and the BGS Geology of Britain Viewer (2016) show the site located on superficial deposits comprising Tidal Flat Deposits overlying bedrock of the Burnham Chalk Formation, part of the White Chalk Subgroup of Cretaceous age.

Granular and cohesive Glacial Deposits are shown at distance from the Humber and would be expected to be present beneath the Tidal Flat Deposits. Ove Arup & Partners indicate the likely presence of Glacial Till, Glacial Lacustrine Silt and Clay and Fluvioglacial Sand and Gravel/Aeolian Sand. A covering of Made Ground associated with historical use of the site is also indicated.

3 FIELDWORK

3.1 General

The fieldwork was carried out in general accordance with BS 5930 (2015), BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006).

The exploratory hole and in situ test locations were selected by Ove Arup & Partners. The locations were set out from local features. The co-ordinates and reduced levels were surveyed by ESG to National Grid and Ordnance Datum. The exploratory hole and in situ test locations are shown on the Site Plan in Appendix A.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

TABLE 1 : SUMMARY OF EXPLORATORY HOLES

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Cable Percussion Boring	7	28.50	BH403, 404, 405, 406, 407, 408 and 417
Cable Percussion Boring extended by Rotary Core Drilling	1	39.90	BH402
Dynamic Sampling	4	5.00	WS401, 402, 403, 404
Road Pavement Coring	10	0.56	CR2, CR3, CR4, CR5, EB3, EB4, WB1, WB2, WB3, WB4

The exploratory hole logs are presented in Appendix B. These provide information including the equipment and methods used, samples taken, tests carried out, water observations and descriptions of the strata encountered. Explanation of the terms and abbreviations used on the logs is given in the Key to Exploratory Hole Records in Appendix B, together with other explanatory information. The logging of soil and rock materials is in accordance with BS EN ISO 14688-1+A1 (2013) for soils and BS EN ISO 14689-1 (2003) for rocks, as amplified by BS 5930 (2015).

Selected undisturbed samples were extruded and split for detailed description. The records, including a representative photograph, are also included in Appendix B. Full photographs of the samples are presented on in Appendix H.

Standard penetration tests (SPT) in the boreholes were carried out in accordance with BS EN ISO 22476-3+A1 (2011) and the SPT hammer energy ratio certificate is included in Appendix B. The SPT results are presented on the logs as uncorrected N values.

Photographs of the rotary drilled core are presented in Appendix H.

The dynamic sampling boreholes were undertaken under instruction from Balfour Beatty. These were to allow for the installation of groundwater monitoring standpipe piezometers and to obtain geoenvironmental samples.

On completion of the fieldwork geotechnical samples were transported to ESG's Doncaster office for temporary retention, with those required for testing being transferred to ESG's geotechnical laboratory at Doncaster. Geoenvironmental samples were transported from site directly to ESG's Environmental Chemistry laboratory at Burton-on-Trent.

3.3 Groundwater Monitoring

Instrumentation installed in the exploratory holes for groundwater monitoring are shown on the logs and summarised in Appendix C. Records of monitoring carried out by ESG following the fieldwork period are presented in Appendix C.

4 CONE PENETRATION TESTING

4.1 General

Cone magnetometer penetration tests were carried out in advance of other intrusive works at exploratory hole locations to confirm the absence of detectable unexploded ordnance (UXO). The testing used a combined piezocone/magnetometer unit operated from a 20 tonne CPT truck. Testing was performed at six borehole locations (BH404, 405, 406, 407, 408 and 417) to a maximum depth of 17.4 m, and two dynamic sampling locations (WS02 and 04) to a maximum depth of 5.8 m. At some locations more than one attempt was necessary to achieve penetration where shallow obstructions were encountered. Testing also occurred at eight specific CPT locations to a maximum depth of 22.9 m. The programme of testing is shown in Table 1 in Appendix D, together with the corresponding Cone Magnetometer plots.

Ten conventional CPTs were carried out to a maximum depth of 23 m using electric piezocones operated from a 20 tonne CPT truck. These piezocones were fitted with porepressure sensor filters located on the cone face, in the so-called u_1 location. Twenty two dissipation tests were carried out in conjunction with the CPTs. The programme of testing is summarised in Table 2 and the test plots are presented in Appendix D.

CPT was carried out in accordance with Part 9 of BS 1377 (1990). The serial numbers of the cones used are indicated on the test plots. The calibration certificates are included in Appendix D and provide details of the manufacturer, cone dimensions, capacity and geometry.

Any opinions and interpretations presented are outside the scope of the UKAS accreditation for cone penetration testing.

4.2 Data Processing

Test control and data acquisition during CPT was carried out using GeoExplorer, a proprietary software supplied by Gouda Geo-Equipment BV of Holland. The measured cone end resistance, sleeve friction, dynamic porewater pressure and inclination were recorded at 1 cm intervals of penetration.

Interpretation of the data was carried out using CPTask, a software proprietary software supplied by Geomil Equipment BV of Holland. The interpretation follows the recommendations of Lunne et al (1997) to derive (where appropriate): friction ratio, pore pressure ratio, undrained shear strength (minimum and maximum range presented using typical cone factors of 20 and 12 respectively), relative density, angle of friction and soil type. The soil classification uses the soil behaviour type chart of Robertson (1990). Groundwater levels based on inspection of the data have been used in the interpretation, as shown on the test plots.

Explanation of the terms used and derivations of the cone and soil parameters are given in the Key in Appendix D. The data are presented as plots relative to depth below ground level on the CPT logs in Appendix D. The records of dissipation tests as pore pressure against time are also included in Appendix D.

Note to records for CPT409 and 414

The porewater pressure data obtained during CPTs at locations CPT409 and 414 appear to have been attenuated somewhat in comparison with other tests measuring porewater pressure with a u_1 filter position. The reason for this is uncertain but it is probable that the filter has become desaturated during penetration through unsaturated material in the upper part of the test, particularly where this may be Made Ground.

5 DYNAMIC CONE PENETRATION TESTS

Dynamic cone penetrometer tests (DCP) were carried out at locations CR2, CR3, CR4, CR5, EB4, WB1, WB2, WB4, and series D positions 01 to 12, 12a, 13, 16 and 17. Tests proposed at locations D14 and D15 were not completed due to concrete obstructions beneath the surface paving.

The results are presented in Appendix E.

6 LABORATORY TESTING

6.1 Geotechnical Testing

Geotechnical laboratory testing was scheduled by Ove Arup & Partners and was carried out in accordance with BS 1377 (1990) unless otherwise stated. The testing is summarised below and the results are presented in Appendix F.

- Water Content Determination
- Atterberg Limits Determination
- Particle Size Distribution Analysis
- Unconsolidated Undrained Triaxial Compression Testing
- Consolidated Undrained Triaxial Compression Testing
- One Dimensional (Oedometer) Consolidation Testing
- Dry Density / Moisture Content Relationship (Light Compaction 2.5kg rammer)
- Acid Soluble Sulphate Content, Water Soluble Sulphate Content, Total Sulphur Content and pH Value of Soils.
- Organic Matter Content

6.2 Geoenvironmental Testing

Geoenvironmental laboratory testing was scheduled by Ove Arup & Partners on soil samples recovered during the fieldwork. The testing was carried out by the laboratory at Burton-on-Trent. The results are presented in Appendix G.

Additional to the sampling carried out by ESG, four samples were recovered by Balfour Beatty for WAC analysis. These were from shallow depths in two trenches, designated S4 and S7, the results are included in Appendix G.

REFERENCES

AGS : 2010 : Electronic transfer of geotechnical and geoenvironmental data (Edition 4 including Addendum 3. October 2011). Association of Geotechnical and Geoenvironmental Specialists.

BGS England and Wales Sheet 80 : 1983 : Kingston upon Hull. 1:50000 geological map (solid). British Geological Survey.

BGS England and Wales Sheet 80 : 1983 : Kingston upon Hull. 1:50000 geological map (drift). British Geological Survey.

BGS Geology of Britain Viewer : 2016. www.bgs.ac.uk. March 2016. British Geological Survey.

BRE Special Digest 1 : 2005 : Concrete in aggressive ground. Building Research Establishment.

BS 1377 : 1990 : Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930 : 2015 : Code of practice for ground investigations. British Standards Institution.

BS EN 1997-2 : 2007 : Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

BS EN ISO 14688-1:2002+A1 : 2013 : Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description. British Standards Institution.

BS EN ISO 14688-2:2004+A1 : 2013 : Geotechnical investigation and testing - Identification and classification of soil - Part 2 Principles for a classification. British Standards Institution.

BS EN ISO 14689-1 : 2003 : Geotechnical investigation and testing - Identification and classification of rock - Part 1 Identification and description. British Standards Institution.

BS EN ISO 22475-1 : 2006 : Geotechnical investigation and testing – Sampling methods and groundwater measurements - Part 1 Technical principles for execution. British Standards Institution.

BS EN ISO 22476-3:2005+A1 : 2011 : Geotechnical investigation and testing - Field testing - Part 3 Standard penetration test. British Standards Institution.

Lunne T, Robertson PK and Powell JJM : 1997 : Cone Penetration Testing in Geotechnical Practice. Blackie Academic & Professional.

Robertson P K : 1990 : Soil classification using the cone penetration test. Canadian Geotechnical Journal, 27(1), 151-8

APPENDIX A

FIGURES AND DRAWINGS

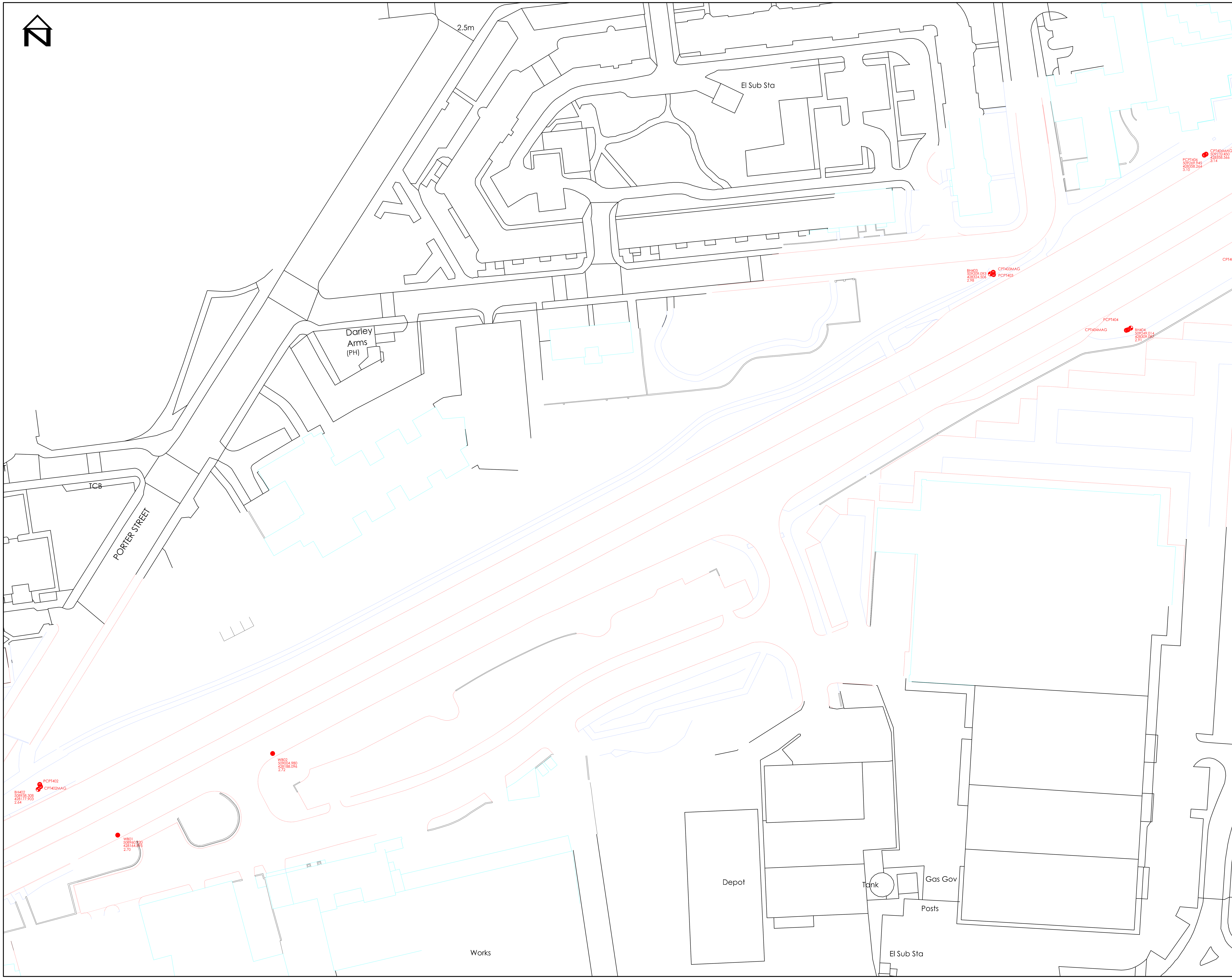
Site Location Plan	A1
Site Plan	A2.1 to A2.4

Site Location Plan

N

THE SITE

Notes: Scale 1:50 000	Project	A63 CASTLE STREET IMPROVEMENTS – MAIN SITE GI	Figure A1
	Project No.	A5085-15	
	Carried out for	Balfour Beatty Limited	



CONTROL & DATUM INFORMATION

Co-ordinates and levels are based upon OSGB 1936 National Grid (OSGB36) and Ordnance Survey Datum Newlyn (ODN).

They are derived using realtime on site GPS survey, that utilises the National Grid Transformation OSTN02 and the National Geoid Model OSGM02GB.

The data obtained for use in this drawing involved the use of realtime GPS survey and total station survey.

COORDINATES

Ground Investigation Co-ordinates

Reference	East	North	Elevation	Description
BH402	508938.308	428177.903	2.64	Borehole
BH403	509209.093	428324.506	2.98	Borehole
BH404	509249.014	428309.087	2.91	Borehole
BH405	509285.247	428329.816	3.16	Borehole
BH406	509308.109	428381.759	3.33	Borehole
BH406MAG	509308.106	428382.416	3.27	Borehole
BH407	509336.018	428357.421	3.48	Borehole
BH407MAG	509335.464	428358.787	3.51	Cone Penitration Test
BH408	509360.271	428406.492	3.61	Borehole
BH413	509633.182	428469.642	5.15	Borehole
BH413MAG	509632.379	428469.555	5.14	Cone Penitration Test
BH414	509656.910	428434.766	4.69	Borehole
BH414MAG	509656.969	428434.017	4.67	Cone Penitration Test
BH415	509653.957	428473.563	5.28	Borehole
BH415MAG	509653.357	428473.467	5.26	Cone Penitration Test
BH416	509677.834	428433.497	4.59	Borehole
BH416MAG	509678.814	428433.588	4.61	Cone Penitration Test
BH417	510051.715	428444.474	5.08	Borehole
BH417MAG	510050.548	428445.141	5.00	Cone Penitration Test
CPT402MAG	508938.983	428178.675	2.63	Cone Penitration Test
CPT403MAG	509209.907	428324.967	2.98	Cone Penitration Test
CPT404MAG	509247.765	428308.459	2.90	Cone Penitration Test
CPT405MAG	509284.625	428329.625	3.07	Cone Penitration Test
CPT406MAG	509270.450	428358.566	3.14	Cone Penitration Test
CPT407MAG	509298.114	428353.420	3.28	Cone Penitration Test
CPT408MAG	509360.068	428405.904	3.59	Cone Penitration Test
CPT409MAG	509392.324	428423.735	3.20	Cone Penitration Test
CPT415MAG	509393.181	428412.056	2.94	Cone Penitration Test
CR03	509660.697	428454.927	3.94	Pavement Core
CR04	509776.789	428446.688	4.00	Pavement Core
CR05	509983.588	428415.050	4.33	Pavement Core
EB03	509642.132	428461.279	3.91	Pavement Core
EB04	509840.718	428444.865	3.86	Pavement Core
PCPT402	508938.737	428179.313	2.62	Cone Penitration Test
PCPT403	509210.003	428324.292	2.99	Cone Penitration Test
PCPT404	509248.223	428308.609	2.86	Cone Penitration Test
PCPT405	509286.025	428330.027	3.13	Cone Penitration Test
PCPT406	509269.945	428358.264	3.10	Cone Penitration Test
PCPT407	509296.763	428352.594	3.26	Cone Penitration Test
PCPT408	509360.328	428407.697	3.57	Cone Penitration Test
PCPT409	509393.192	428424.225	3.20	Cone Penitration Test
PCPT412	509654.693	428473.540	5.26	Cone Penitration Test
PCPT413	509676.768	428433.481	4.59	Cone Penitration Test
PCPT414	510050.416	428447.082	4.93	Cone Penitration Test
PCPT415	509392.486	428411.515	2.92	Cone Penitration Test
WATER_REF	509664.922	428424.706	3.58	Benchmark
WB01	508960.920	428164.895	2.70	Pavement Core
WB02	509004.980	428188.096	2.72	Pavement Core
WB03	509720.516	428445.037	3.85	Pavement Core
WB04	509930.581	428427.446	3.94	Pavement Core
WS04	510042.654	428426.606	4.42	Window Sample
WS04MAG	510041.249	428426.489	4.38	Cone Penitration Test
WS401	509458.260	428428.367	3.22	Window Sample
WS402	509513.921	428447.522	3.32	Window Sample
WS403	509596.779	428440.376	4.12	Window Sample

LEGEND TO SYMBOLS

Denotes Borehole Location

Denotes Cone Test Location

Denotes Pavement Core Location

Denotes Window Sample Location

Title

SITEPLAN

Project

A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Client

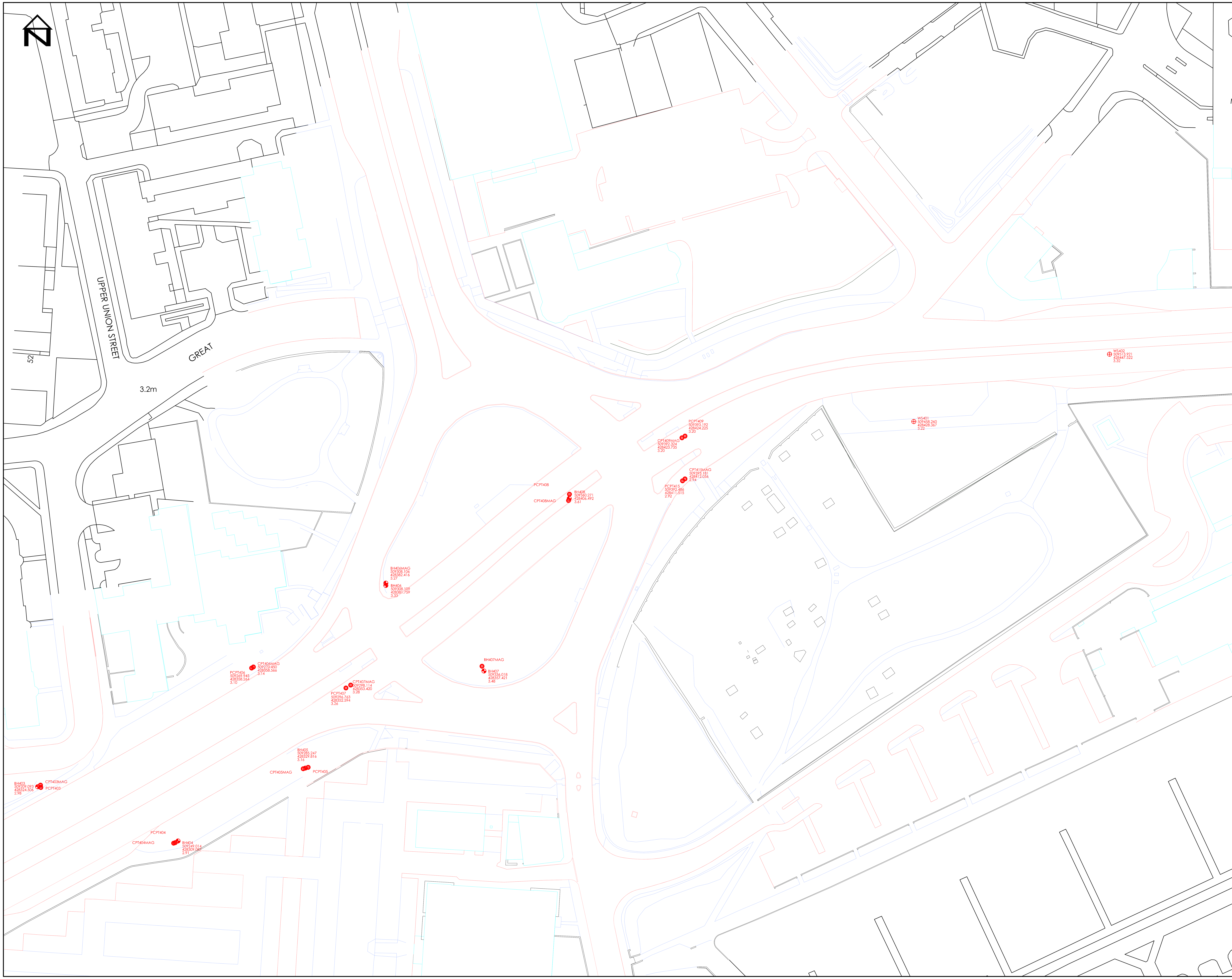
Balfour Beatty Limited

ESG

Date	Drawn By	Approv. By
08.02.16	HSL	TC

Sheet Size	Scale	Project No
A1	1:500	A5085-15

Drawing No	Rev
A2.1	0



CONTROL & DATUM INFORMATION

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They are derived using realtime on site GPS survey, that utilises the National Grid Transformation OSTN02 and the National Geoid Model OSGM02GB.

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COORDINATES

Ground Investigation Co-ordinates

Reference	East	North	Elevation	Description
BH402	508938.308	428177.903	2.64	Borehole
BH403	509209.093	428324.506	2.98	Borehole
BH404	509249.014	428309.087	2.91	Borehole
BH405	509285.247	428329.816	3.16	Borehole
BH406	509308.109	428381.759	3.33	Borehole
BH406MAG	509308.106	428382.416	3.27	Borehole
BH407	509336.018	428357.421	3.48	Borehole
BH407MAG	509335.464	428358.787	3.51	Cone Penitration Test
BH408	509360.271	428406.492	3.61	Borehole
BH413	509633.182	428469.642	5.15	Borehole
BH413MAG	509632.379	428469.555	5.14	Cone Penitration Test
BH414	509656.910	428434.766	4.69	Borehole
BH414MAG	509656.969	428434.017	4.67	Cone Penitration Test
BH415	509653.957	428473.563	5.28	Borehole
BH415MAG	509653.357	428473.467	5.26	Cone Penitration Test
BH416	509677.834	428433.497	4.59	Borehole
BH416MAG	509678.814	428433.588	4.61	Cone Penitration Test
BH417	510051.715	428444.474	5.08	Borehole
BH417MAG	510050.548	428445.141	5.00	Cone Penitration Test
CPT402MAG	508938.983	428178.675	2.63	Cone Penitration Test
CPT403MAG	509209.907	428324.967	2.98	Cone Penitration Test
CPT404MAG	509247.765	428308.459	2.90	Cone Penitration Test
CPT405MAG	509284.625	428329.625	3.07	Cone Penitration Test
CPT406MAG	509270.450	428358.566	3.14	Cone Penitration Test
CPT407MAG	509298.114	428353.420	3.28	Cone Penitration Test
CPT408MAG	509360.068	428405.904	3.59	Cone Penitration Test
CPT409MAG	509392.324	428423.735	3.20	Cone Penitration Test
CPT415MAG	509393.181	428412.056	2.94	Cone Penitration Test
CR03	509660.697	428454.927	3.94	Pavement Core
CR04	509776.789	428446.688	4.00	Pavement Core
CR05	509983.588	428415.050	4.33	Pavement Core
EB03	509642.132	428461.279	3.91	Pavement Core
EB04	509840.718	428444.865	3.86	Pavement Core
PCPT402	508938.737	428179.313	2.62	Cone Penitration Test
PCPT403	509210.003	428324.292	2.99	Cone Penitration Test
PCPT404	509248.223	428308.609	2.86	Cone Penitration Test
PCPT405	509286.025	428330.027	3.13	Cone Penitration Test
PCPT406	509269.945	428358.264	3.10	Cone Penitration Test
PCPT407	509296.763	428352.594	3.26	Cone Penitration Test
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PCPT413	509676.768	428433.481	4.59	Cone Penitration Test
PCPT414	510050.416	428447.082	4.93	Cone Penitration Test
PCPT415	509392.486	428411.515	2.92	Cone Penitration Test
WATER_REF	509664.922	428424.706	3.58	Benchmark
WB01	508960.920	428164.895	2.70	Pavement Core
WB02	509004.980	428188.096	2.72	Pavement Core
WB03	509720.516	428445.037	3.85	Pavement Core
WB04	509930.581	428427.446	3.94	Pavement Core
WS04	510042.654	428426.606	4.42	Window Sample
WS04MAG	510041.249	428426.489	4.38	Cone Penitration Test
WS401	509458.260	428428.367	3.22	Window Sample
WS402	509513.921	428447.522	3.32	Window Sample
WS403	509596.779	428440.376	4.12	Window Sample

LEGEND TO SYMBOLS

Denotes Borehole Location

Denotes Cone Test Location

Denotes Pavement Core Location

Denotes Window Sample Location

Title

SITEPLAN

Project

A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Client

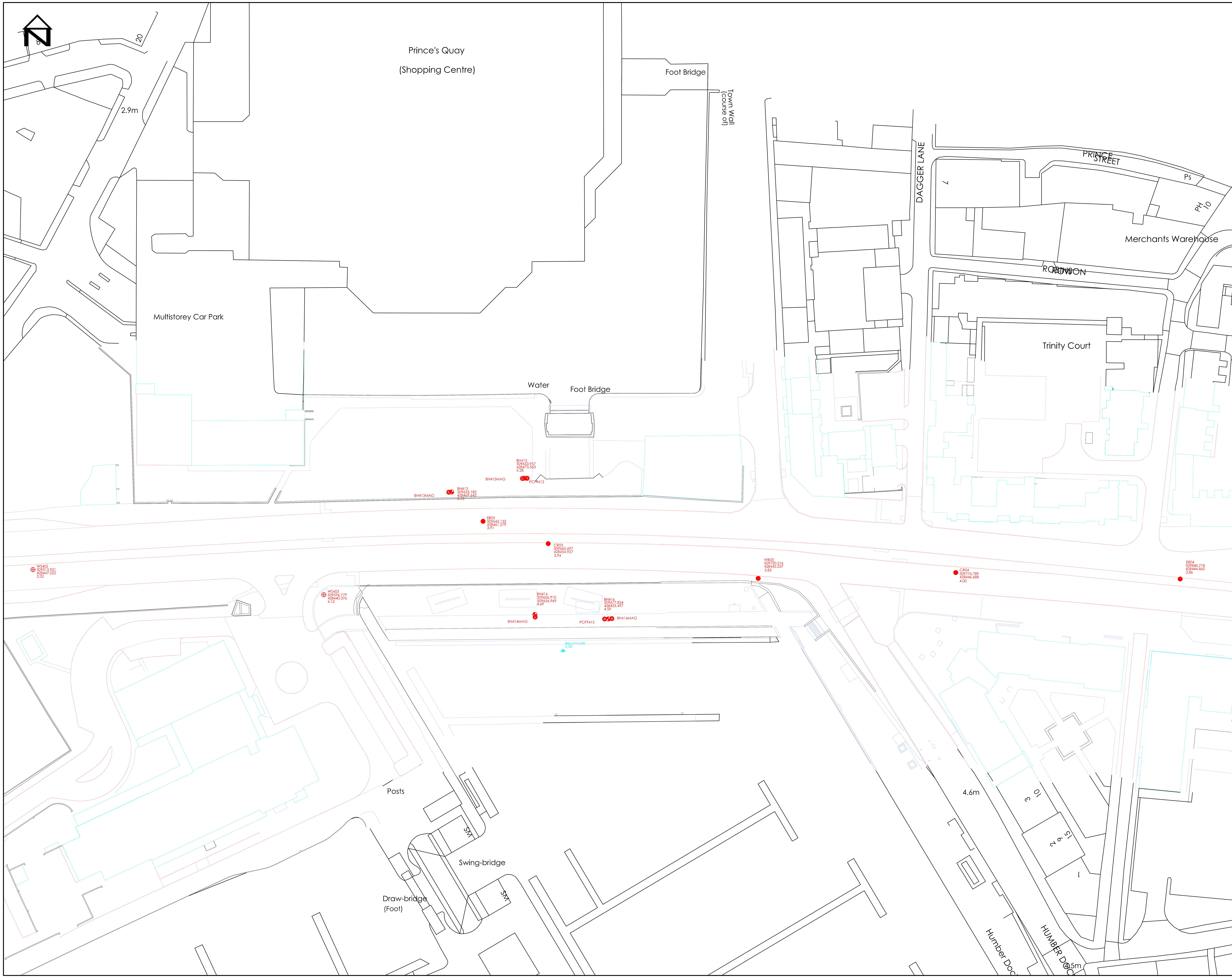
Balfour Beatty Limited

ESG

Date	Drawn By	Approv. By
08.02.16	HSL	TC

Sheet Size	Scale	Project No
A1	1:500	A5085-15

Drawing No	Rev
A2.2	0



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Title
SITEPLAN

Project
A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Client
Balfour Beatty Limited

ESG

Date	Drawn By	Approv. By
08.02.16	HSL	TC

Sheet Size	Scale	Project No
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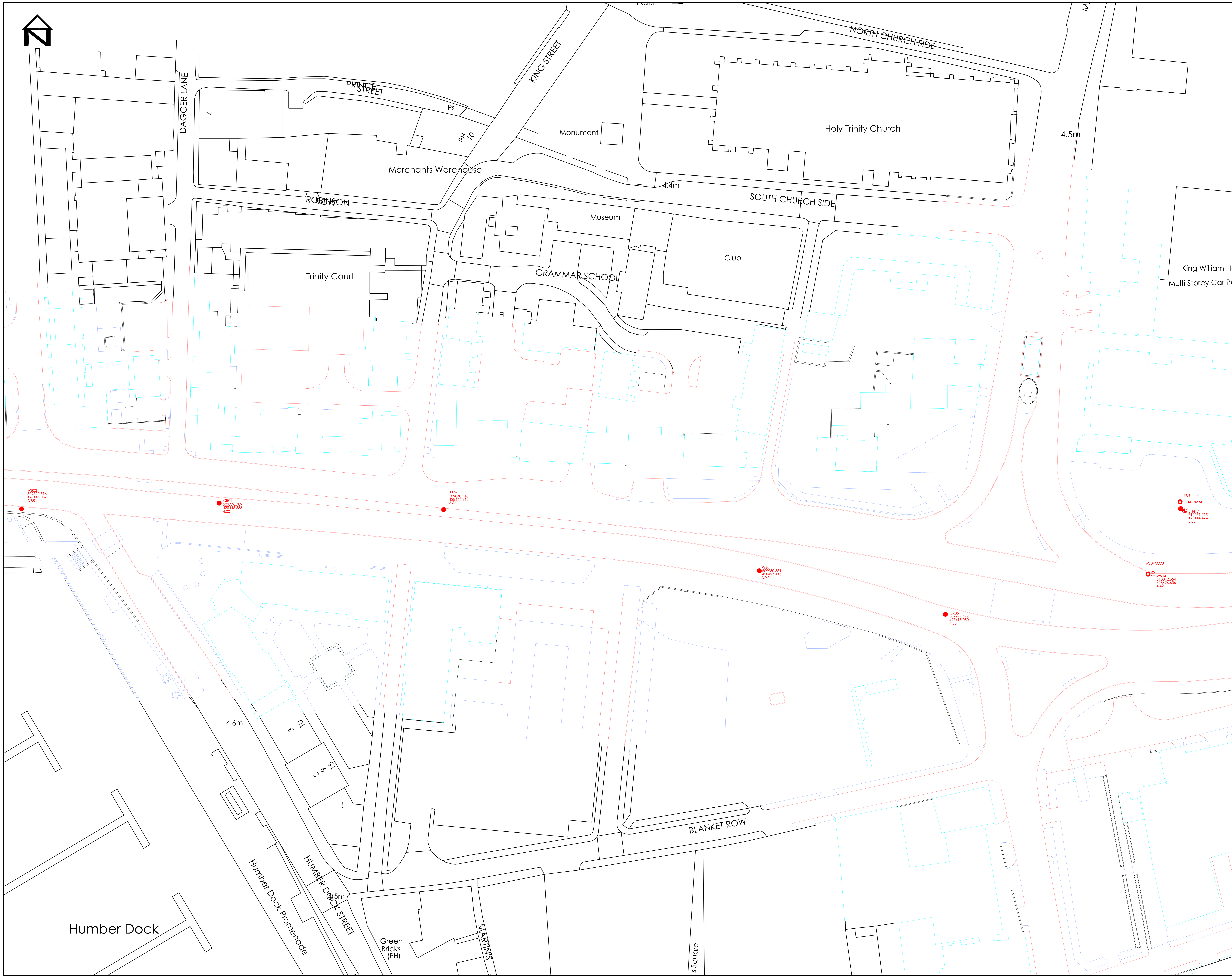

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Denotes Cone Test Location
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Title: SITEPLAN

Project: A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Client: Balfour Beatty Limited

Date	Drawn By	Approv. By
08.02.16	HSL	TC

Sheet Size	Scale	Project No
A1	1:500	A5085-15

Drawing No	Rev
A2.4	0

APPENDIX B

EXPLORATORY HOLE RECORDS

Key to Exploratory Hole Records	Key
SPT Hammer Energy Ratio Report	SPT Hammer References – TS2 024 SM37
Cable Percussion Boring	BH403, 404, 405, 406, 407, 408 and 417
Cable Percussion Boring extended by Rotary Core Drilling/Open Hole Drilling	BH402
Split Tube Sample Descriptions	BH402 (22), 403 (21), 404 (22), 405 (18), 406 (24), 407 (33), 408 (27) and 417 (6)
Dynamic Sampling	WS401, 402, 403, 404
Road Pavement Coring	CR2, CR3, CR4, CR5, EB3, EB4, WB1, WB2, WB3, WB4

Key to Exploratory Hole Records

SAMPLES

Undisturbed

U	Driven tube sample	nominally 100 mm diameter and full recovery unless otherwise stated
UT	Driven thin wall tube sample	
TW	Pushed thin wall tube sample	
P	Pushed piston sample	
L	Liner sample (from Windowless or similar sampler), full recovery unless otherwise stated	
CBR	CBR mould sample	
BLK	Block sample	
CS	Core sample (from rotary core) taken for laboratory testing	
AMAL	Amalgamated sample	

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample
	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

Comments Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that attempt was made to take a tube sample, however, there was no recovery.

Monitoring samples taken after completion of hole construction are not shown on the exploratory hole logs.

TESTS

SPT S or SPT C Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS EN ISO 22476-3:2005+A1:2011. The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 the total blow count beyond the seating drive is given (without the N = prefix).

IV	*in situ* Vane shear strength, peak (p) and remoulded (r)
HV	Hand vane shear strength, peak (p) and remoulded (r)
PP	Pocket penetrometer test, converted to shear strength
KFH, KRH, KPI	Permeability tests (KFH = falling head, KRH = rising head; KPI = packer inflow); results provided in Field Records column (one value per stage for packer tests)

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930:2015

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented. The term non-intact (NI) is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER

▼	Groundwater strike
▽	Groundwater level after standing period

Notes:
See report text for full references of standards

Project	A63 CASTLE STREET IMPROVEMENTS – MAIN SITE GI
Project No.	A 5085-15
Carried out for	Balfour Beatty

Key

Key to Exploratory Hole Records

INSTALLATION

Standpipe/ piezometer

Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.

The type of instrument installed is indicated by a code in the Legend column at the depth of the response zone:

SP Standpipe
SPIE Standpipe piezometer
PPIE Pneumatic piezometer
EPIE Electronic piezometer

Inclinometer or Slip Indicator

The installation of vertical profiling instruments is indicated on the Record. The base of tubing is shown in the Legend column.

The type of instrument installed is indicated by a code in the Legend column at the base of the tubing:

ICE Biaxial inclinometer
ICM Inclinometer tubing for use with probe
SLIP Slip indicator

Settlement Points or Pressure Cells

The installation of single point instruments is indicated on the Record. The location of the measuring device is shown in the Legend column.

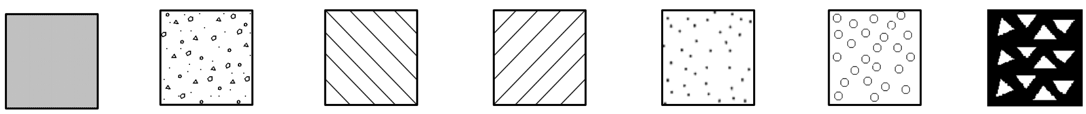
The type of instrument installed is indicated by a code in the Legend column:

ESET Electronic settlement cell/gauge
ETM Magnetic extensometer settlement point
EPCE Electronic embedment pressure cell
PPCE Electronic push in pressure cell

INSTALLATION LEGENDS

A legend describing the installation is shown in the rightmost column. Legends used to describe the backfill materials as indicated below.

Arisings Concrete Grout Bentonite Sand Gravel Macadam



NOTES

1 Soils and rocks are described in accordance with BS EN ISO 14688-1:2002+A1:2013 and 14689-1:2003 respectively as amplified by BS 5930:2015.

2 For fine soils, consistency determined during description is reported for those strata where undisturbed samples are available. Where the logger considers that the sample may not be representative of the condition in situ, for whatever reason, the reported consistency is given in brackets. The reliability of the sample is indicated by Probably or Possibly as appropriate. Hence (Probably firm) indicates the logger is reasonably confident of the assessment, but (Possibly firm) means less certainty. Where the samples available are too disturbed to allow a reasonable assessment of the in situ condition, no consistency is given.

3 Evidence of the occurrence of very coarse particles (cobbles and boulders) is presented on the logs, however, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.

4 The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.

5 The assessment of SCR, RQD and Fracture Spacing excludes artificial fractures

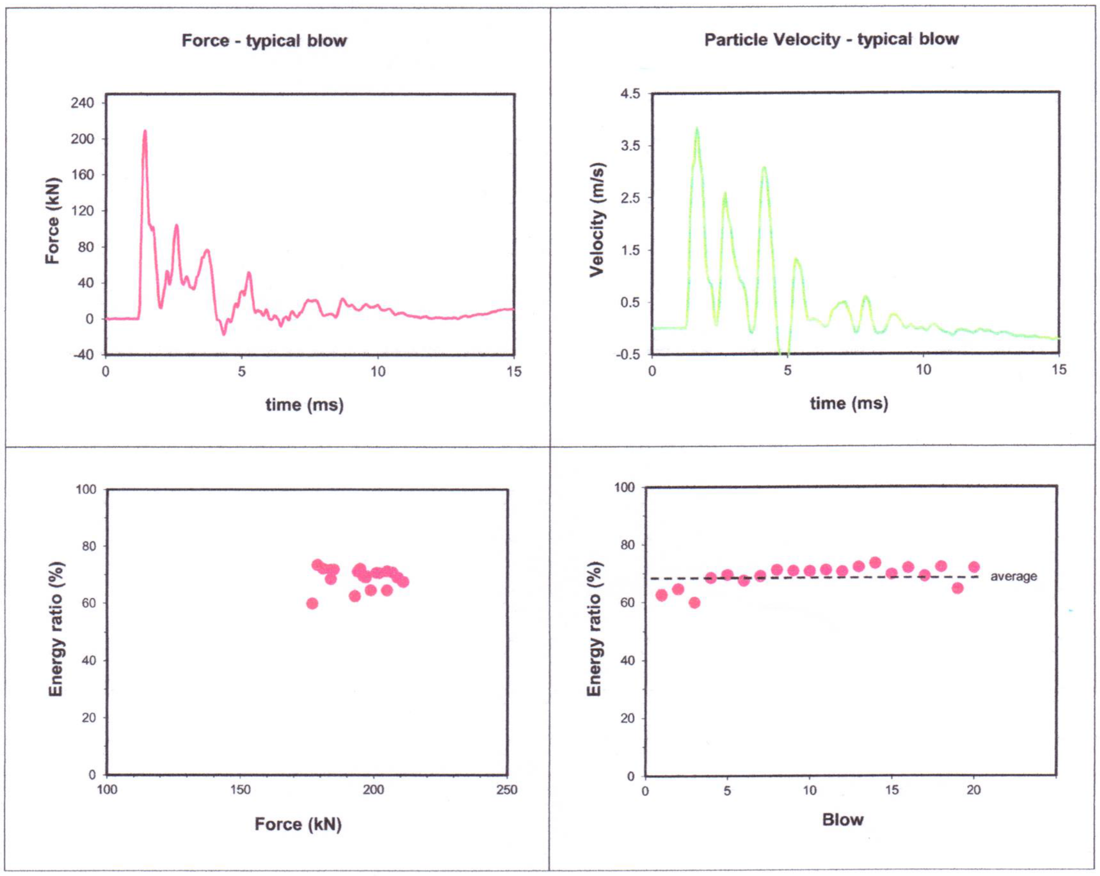
6 Water level observations of discernible entries during the advancing of the exploratory hole are given at the foot of the log and in the Legend column. The term "none observed" is used where no discrete entries are identified although this does not necessarily indicate that the hole has not been advanced below groundwater level. Under certain conditions groundwater cannot be observed, for instance, drilling with water flush or overwater, or boring at a rate much faster than water can make its way into the borehole In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.

7 The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (eg high hydraulic head or where very coarse particles are present) some judgement may be necessary in considering whether the results are representative of in situ mass conditions.

Hammer Energy Report

Date of test:	17/04/2015	**Hammer ID:**	TS2
		Hammer mass (*m*)	63.5 kg
Instrumented rod:		**Fall height (*h*)**	0.76 m
Type	NWY	**Test type:**	SPT
Cross-sectional area (*A* a)	11.30 cm^2	**Manufacturer:**	Archway
Young's modulus (*E* a)	207000 MPa	**Model:**	Automatic Trip Hammer
Length	0.60 m		
		Rig:	Beretta T44
Test rod type:	NWY	**Rig ID:**	R60
		Type:	Cable Percussion
		Foreman:	N Turnbull

Remarks:
Data obtained from test carried out in BH1, located in ESG Doncaster yard. Test carried out at depth of 5.52 mbgl, with a total blow count of 20. Energy determined from every blow.



Theoretical energy (E_{theor}) = *m x g x h* = **0.473 kN-m (473 J)**

Measured energy (E_{meas}) *average of 20 blows* = **0.326 kN-m**

Energy ratio = $\frac{E_{meas}}{E_{theor}}$ = **69 %**

Test carried out by: Malcolm Carr

Signed for issue: [redacted]

Test carried out in accordance with BS EN ISO 22476-3:2005

Equipment used: SPT Analyzer Serial No. 4032T

Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling uk ltd
Unit 8.
Victory park way.
Victory road.
Derby.
DE24 8ZF

Hammer Ref:	024
Test Date:	09/03/2015
Report Date:	
File Name:	024.spt
Test Operator:	TP

Instrumented Rod Data

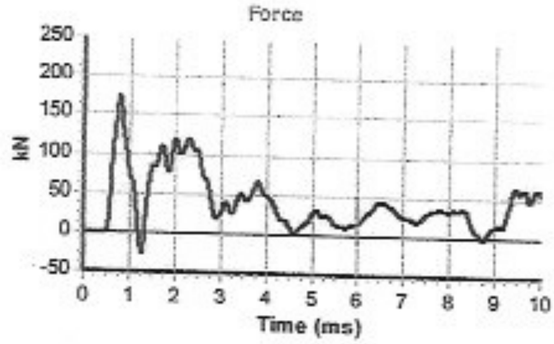
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.9
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6455
Accelerometer No.2:	6457

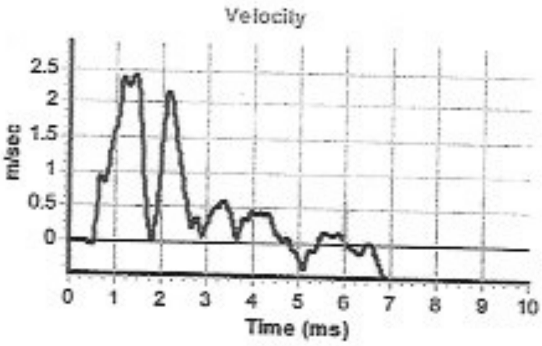
Hammer Information

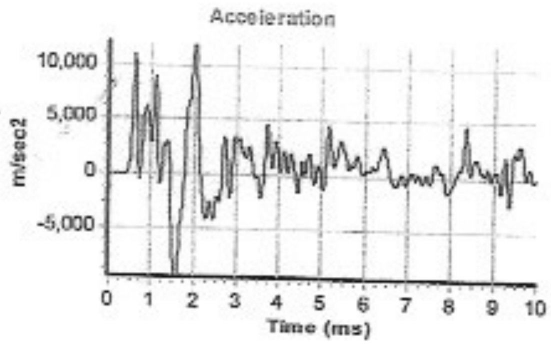
Hammer Mass m (kg):	63.5
Falling Height h (mm):	750
String Length L (m):	15.0

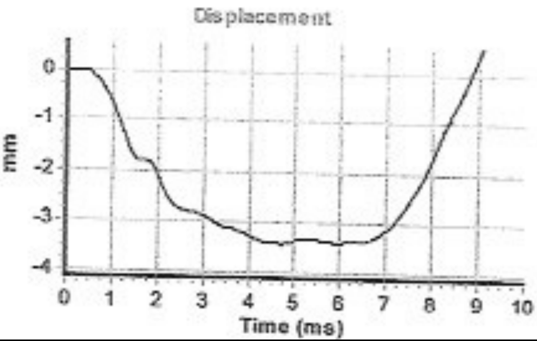
Comments / Location

Tested at Dynamic sampling yard.









Calculations

Area of Rod A (mm2):	1021
Theoretical Energy E_{theor} (J):	467
Measured Energy E_{meas} (J):	341

Energy Ratio E_r (%): **73**

[redacted]

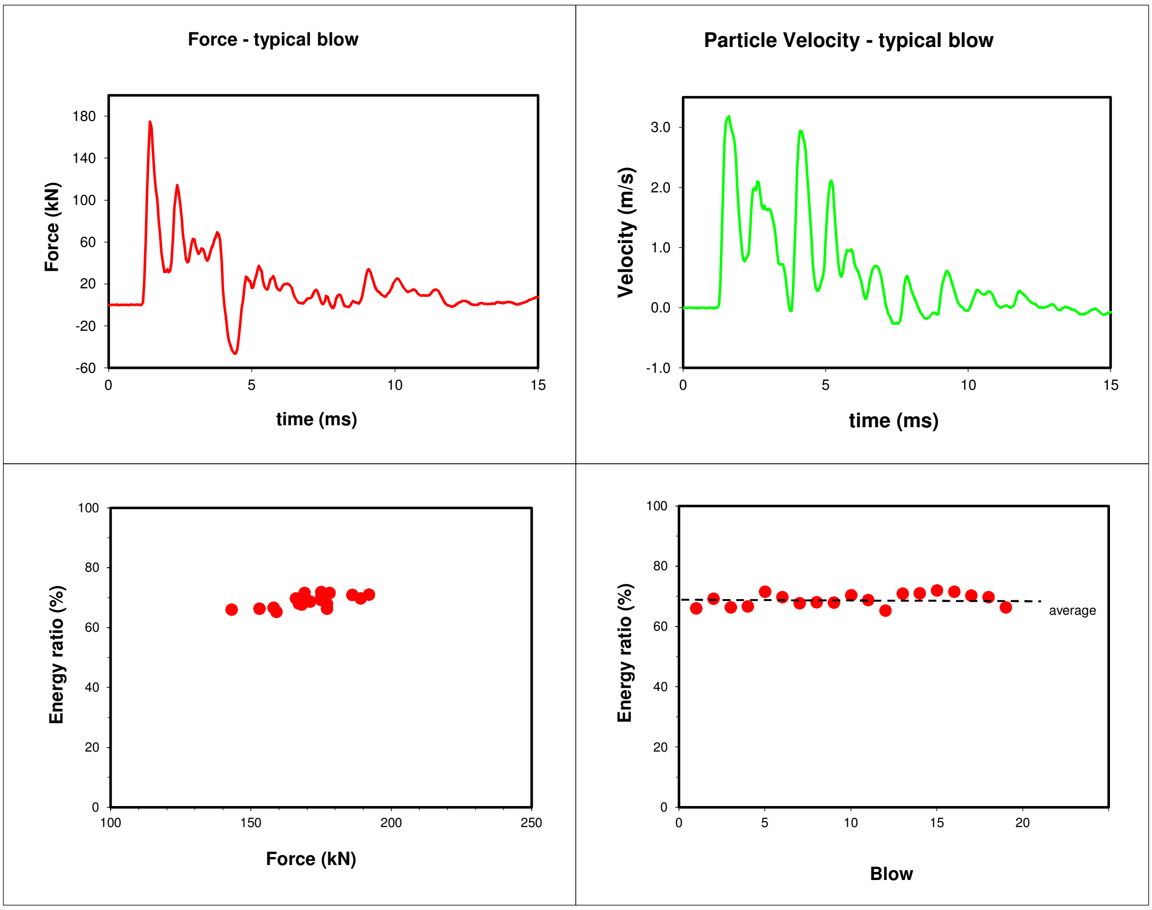
Signed: T.parker
Title: operations manager

The recommended calibration interval is 12 months

Hammer Energy Report

Date of test:	07/01/2015	**Hammer ID:**	SM37
		Hammer mass (*m*)	63.5 kg
Instrumented rod:		**Fall height (*h*)**	0.76 m
Type	BW	**Test type:**	SPT
Cross-sectional area (*A*a)	11.30 cm^2	**Manufacturer:**	Archway
Young's modulus (*E*a)	206840 MPa	**Model:**	Automatic Trip Hammer
Length	0.60 m		
		Rig:	Dando 3000
Test rod type:	NWY	**Rig ID:**	CT62
		Type:	Cable Percussion
		Foreman:	A Dodd

Remarks:
Data obtained from test carried out in BH1, located in SM Doncaster yard. Test carried out at depth of 5.33mbgl, with a total blow count of 20. Energy determined from every blow.



Theoretical energy (E_{theor}) = *m x g x h* = **0.473 kN-m (473 J)**

Measured energy (E_{meas}) *average of 20 blows* = **0.326 kN-m**

Energy ratio = $\frac{E_{meas}}{E_{theor}}$ = **69 %**

Test carried out by: Malcolm Carr

Signed for issue: [redacted]

Test carried out in accordance with BS EN ISO 22476-3:2005

Equipment used: SPT Analyzer Serial No. 4032T

Borehole Log

ESG

Drilled	SS/DS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.64 mOD
Logged	GS/RM/	13/01/2016	Dando 175/R63 Geotech 6.	0.00	10.00	250	10.00	Coordinates (m)	E 508938.31
Checked	TC	End	Cable percussion boring/followed by rotary core drilling (SWF size) using water flush.	10.00	24.00	200	23.00	National Grid	N 428177.90
Approved	TC	25/01/2016	SPT Hammer ID: 024, Rod type: 1 1/2 Whitworth.,	24.00	39.30	146	26.10		

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
0.20 - 1.20	B 1	0.00-1.20 Hand excavated inspection pit.		
1.20 - 1.65	SPTS	N=8 (2,2/2,2,2,2)		dry
1.20 - 1.65	D 2			
1.20 - 2.00	B 3			
2.00 - 2.45	SPTS	N=2 (1,0/1,0,1,0)	1.50	dry
2.00 - 2.45	B 5			
2.00 - 2.45	D 4			
			13/01/16	1800
			1.50	dry
2.45 - 2.90	UT 6	14 blows 100% rec	1.50	dry
			14/01/16	0800
			1.50	dry
2.90 - 3.10	D 7			
3.10 - 3.75	UT NR	16 blows No Recovery	3.00	damp
3.10 - 3.55	B 8			
3.75 - 4.75	P 9	80% rec 76Psi	3.70	damp
4.75 - 5.75	P 10	95% rec 74Psi	4.70	3.10
5.75 - 6.20	UT 11	21 blows 100% rec 5.75-6.20 S&D record unavailable	5.70	2.00
6.20 - 6.40	D 12			
6.40 - 7.40	P 13	77% rec 82Psi	6.40	2.00
7.40 - 8.40	P 14	85% rec 80Psi	7.40	1.80
8.20 - 8.40	D 15		14/01/16	1800
			7.40	1.80
8.40 - 8.85	UT 16	40 blows 100% rec	8.40	5.60
			15/01/16	0715
			7.40	5.60
9.05 - 9.25	D 17			
9.25 - 9.70	SPTS	N=8 (2,2/2,1,2,3)	9.25	5.10
9.25 - 9.65	D 18			
9.25 - 9.65	B 19			
9.65 - 10.10	UT 20	50 blows 100% rec	9.65	8.10

Strata Description

Main	Detail	Depth	Level	(Thickness)
TOPSOIL.		0.15	+2.49	(0.15)
Soft to firm light brownish grey slightly gravelly sandy CLAY. Gravel is angular to subangular fine to coarse brick, concrete and occasional sandstone. (MADE GROUND)		0.40	+2.24	(0.25)
BRICK courses. (MADE GROUND)		0.70	+1.94	(0.30)
Firm, locally indistinctly thinly and thickly laminated, brown, locally mottled grey, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of chalk, brick and sandstone. (MADE GROUND)		1.90	+0.74	(1.20)
Soft indistinctly thinly and thickly laminated brown, locally mottled grey and orangish brown, slightly sandy CLAY, with occasional dustings of silt on laminae surfaces.		2.45	+0.19	(0.55)
Soft, locally firm, indistinctly thinly and thickly laminated, indistinctly fissured brown CLAY. With dustings of light brown silt on laminae surfaces. Fissures closely spaced randomly orientated. Occasional lenses up to 3mm of light brown fine sand.		3.10	-0.46	(0.65)
Soft to firm indistinctly thinly and thickly laminated brownish grey sandy clayey SILT with occasional pockets of fine orangish brown sand.	3.90 becoming with dustings and thin laminae (<5mm) of dark orangish brown fine to medium sand. 4.75 becoming locally firm. 6.20-6.40 Greyish brown slightly clayey SAND.	7.03	-4.39	(3.93)
Dark orangish brown and greyish brown sandy SILT with occasional thin laminae of greyish brown clay.		7.43	-4.79	(0.40)
Firm indistinctly thinly laminated dark brown very organic CLAY, locally tending to peat. With frequent plant remains up to 20mm.		8.40	-5.76	(0.97)
Brownish grey and brown sandy to very sandy SILT.	8.63-8.78 slightly organic.	8.78	-6.14	(0.38)
Light brownish grey slightly clayey SAND with rare gravel.		9.48	-6.84	(0.70)
Firm greyish brown, locally mottled dark yellowish brown and grey, slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies.	9.48-9.65 mottled bluish grey and orange. 9.65 becoming stiff.			(0.82)

Legend / Backfill: 1

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	4.70	Rose to 3.10 m after 20 minutes.	

Depth Related Remarks

Depths (m)	Remarks
4.70 - 8.40	Water added to assist boring.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Borehole BH402

Borehole Log

Drilled	SS/DS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.64 mOD
Logged	GS/RM/	13/01/2016	Dando 175/R63 Geotech 6.	0.00	10.00	250	10.00	Coordinates (m)	E 508938.31
Checked	TC	End	Cable percussion boring/followed by rotary core drilling (SWF size) using water flush.	10.00	24.00	200	23.00	National Grid	N 428177.90
Approved	TC	25/01/2016	SPT Hammer ID: 024, Rod type: 1 1/2 Whitworth.,	24.00	39.30	146	26.10		

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
10.10 - 10.30	D 21			
10.30 - 10.75	UT 22	83 blows 100% rec	9.65	dry
10.75 - 10.95	D 23			
10.95 - 11.40	UT 24	81 blows 88% rec	9.65	dry
11.40 - 11.60	D 25			
11.60 - 12.05	UT 26	79 blows 88% rec	9.65	dry
12.05 - 12.25	D 27			
12.25 - 12.70	UT 28	77 blows 100% rec	9.45	8.80
12.70 - 12.90	D 29			
			15/01/16	1530
			12.90	8.70
13.30 - 13.75	UT 30	51 blows 100% rec	~~13.30~~	~~5.10~~
			18/01/16	0800
			12.90	5.10
13.75 - 13.95	D 31			
13.95 - 14.40	UT 32	54 blows 84% rec	13.30	dry
14.40 - 14.60	D 33			
14.60 - 15.05	UT 34	49 blows 100% rec	14.50	dry
15.05 - 15.25	D 35			
15.25 - 15.70	UT 36	61 blows 100% rec	14.50	dry
15.70 - 15.90	D 37			
15.90 - 16.35	UT 38	62 blows 100% rec	14.50	dry
16.35 - 16.55	D 39			
16.55 - 17.00	UT 40	48 blows 100% rec	14.50	dry
17.00 - 17.20	D 41			
17.20 - 17.65	UT 42	63 blows 100% rec	14.50	damp
17.65 - 17.85	D 43			
17.85 - 18.30	UT 44	61 blows 100% rec	17.80	11.05
18.30 - 18.50	D 45			
18.50 - 18.95	UT 46	59 blows 78% rec	18.50	9.80
18.95 - 19.10	D 47			
19.10 - 19.55	UT 48	61 blows 100% rec	19.10	8.10
19.55 - 19.75	D 49		18/01/16	1630
			19.75	8.10
19.75 - 20.20	UT 50	54 blows 88% rec	~~19.75~~	~~4.70~~
			19/01/16	0800
			19.75	4.70

Strata Description

Main	Detail	Depth	Level	(Thickness)
Very stiff brown, locally grey, slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of chalk, sandstone, flint and rare igneous lithologies.	10.30-10.75 occasional relict rootlet traces. 11.40-11.60 gravelly.	10.30	-7.66	(1.30)
Very stiff indistinctly thinly and thickly laminated greyish brown slightly sandy CLAY. With rare subangular to subrounded fine to coarse gravel of sandstone, chalk and igneous lithologies.	11.60-11.67 with thin laminae (<4mm) of orangish brown fine to medium sand.	11.60	-8.96	(0.45)
Firm to stiff indistinctly thinly and thickly laminated light greyish brown slightly sandy slightly gravelly CLAY, with low cobble content. Gravel is subangular to subrounded fine to coarse sandstone, igneous lithologies and occasionally chalk.		12.05	-9.41	(0.43)
Very stiff greyish brown, locally mottled grey, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of quartzite, sandstone and chalk.	13.30-13.45 occasional steeply inclined fissures, locally polished. 13.30-13.95 stiff.	12.48	-9.84	(1.47)
Stiff thinly to thickly laminated brown and greyish brown CLAY. With dustings of silt on laminae surfaces and extremely closely to very closely spaced thin laminae (<2mm) of light brown silt.	13.95-14.33 locally fissured. 14.40-14.60 very stiff. 15.25-15.70 locally very stiff. 15.47 subvertical polished fissure. 15.63 with rare fine gravel of chalk. 15.90-16.35 indistinctly fissured.	13.95	-11.31	(2.60)
Stiff, locally thinly and thickly laminated, locally indistinctly fissured, greyish brown CLAY. With very closely spaced thin laminae (<4mm) of orangish brown fine to medium sand. Fissures are extremely closely spaced, randomly orientated.	16.87-16.93 with rare fine to medium gravel of chalk.	16.55	-13.91	(0.65)
Stiff indistinctly thinly to thickly laminated indistinctly fissured greyish brown CLAY with occasional thin laminae (<1mm) of orangish brown fine to medium silty sand. Fissures are extremely closely spaced and randomly orientated.	17.65-18.01 with frequent thin laminae of silt and fine sand. 17.88 with rare gravel. 18.01-18.18 with thin and thick laminae of orangish brown fine to medium sand. 18.78-18.85 occasional thin laminae are <2mm.	17.20	-14.56	(2.00)
Stiff thinly to thickly laminated greyish brown CLAY with frequent dustings and thin laminae (<1mm) of light brown silt.. With occasional thin laminae (<4mm) of orangish brown fine to medium sand.	19.20-19.33 indistinctly laminated. 19.98-20.13 with rare gravel of chalk.	19.20	-16.56	(1.00)

Legend / Backfill: water strikes 2 (12.55) and 3 (17.40) marked.

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
2	12.55	Rose to 8.70 m after 20 minutes. Medium inflow.	
3	17.40	Rose to 11.96 m after 20 minutes.	

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited
Borehole	BH402

Borehole Log

Drilled	SS/DS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.64 mOD
Logged	GS/RM/	13/01/2016	Dando 175/R63 Geotech 6.	0.00	10.00	250	10.00	Coordinates (m)	E 508938.31
Checked	TC	End	Cable percussion boring/followed by rotary core drilling (SWF size) using water flush.	10.00	24.00	200	23.00	National Grid	N 428177.90
Approved	TC	25/01/2016	SPT Hammer ID: 024, Rod type: 1 1/2 Whitworth.,	24.00	39.30	146	26.10		

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water
20.20 - 20.65	SPTS	N=30 (4,4/7,7,7,9)	20.20	4.50
20.20 - 20.65	D 51			
20.20 - 21.00	B 52			
21.00 - 21.45	SPTS	N=39 (5,6/9,10,10,10)	21.00	5.10
21.00 - 21.45	D 53			
21.00 - 22.00	B 54			
22.00 - 22.45	SPTS	N=53 (6,10/11,14,13,15)	22.00	5.90
22.00 - 22.45	D 55			
22.00 - 23.00	B 56			
23.00 - 23.45	SPTS	N=68 (7,11/13,17,17,21)	23.00	5.90
23.00 - 23.45	D 57			
23.00 - 23.60	B 58			
23.60 - 23.80	SPTC	50 (14,16 for 70mm/50 for 50mm)	23.00	5.90
			19/01/16 24.00	1630 5.90
24.00 - 25.30	TCR 85, SCR 0, RQD 0; If NI NI NI	Flush: 24.00 - 25.30 Water 50%	22/01/16 24.00	0800 6.90
24.65 - 25.00		B 67		
25.30 - 26.30	TCR 55, SCR 0, RQD 0	Flush: 25.30 - 26.30 Water 80%		
26.30 - 27.70	TCR 100, SCR 7, RQD 0; If NI NI 25	Flush: 26.30 - 27.70 Water 90%		
27.70 - 29.20	TCR 100, SCR 17, RQD 8; If NI 70 120	Flush: 27.70 - 30.80 Water 90%	22/01/16 26.10	1600 3.90
			25/01/16 26.10	0800 0.82
29.20 - 30.80				

Main	Detail	Depth	Level	(Thickness)
Dense greyish brown and cream sandy silty subangular fine to coarse GRAVEL of chalk and occasional flint.	20.05 thick lamination (8mm) of fine to medium sand. 20.11-20.13 thick lamination (20mm) of fine to medium sand. 20.13-20.20 slightly gravelly. 22.00-22.40 very dense.	20.20	-17.56	(2.20)
Structureless CHALK composed of sandy silty subangular to subrounded fine to coarse GRAVEL. Gravel is extremely weak to weak ,low density. (Grade Dc)		22.40	-19.76	(1.60)
Structureless CHALK composed of slightly sandy silty subangular to subrounded GRAVEL and COBBLES. Clasts are weak, low to medium density, white with local greyish brown speckling, matrix is greyish brown. With some gravel of flint. (Grade Dc)	24.00-24.20 AZCL. 24.40-24.60 brown clayey matrix.	24.00	-21.36	(1.30)
Partial recovery. Core loss presumed to be more weathered material. Structureless CHALK composed of greyish brown speckled white sandy slightly clayey silty subangular to subrounded fine to medium GRAVEL. (Grade Dc)	25.30-25.65 AZCL.	25.30	-22.66	(0.70)
Weak. medium to high density, white, locally cream, CHALK. Predominantly NI. (Grade Dc)		26.00	-23.36	(2.00)
Weak. medium to high density, white, locally cream, CHALK. Discontinuities are subhorizontal to 45 deg, very closely to closely spaced, planar, rough, occasionally with cream clay infill. (Grade B4)	28.25-28.30 with gravel of flint. 29.60-29.90 NI. 29.75-29.90 with gravel of flint.	28.00	-25.36	(1.90)
		29.90	-27.26	

Hole continues on next sheet

Groundwater Entries

No. Depth Strike (m) Remarks — Depth Sealed (m)

Depth Related Remarks

Depths (m) Remarks

Hard Boring

Depths (m) Duration (mins) Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited
Borehole	BH402

Borehole Log

Drilled	SS/DS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.64 mOD
Logged	GS/RM/	13/01/2016	Dando 175/R63 Geotech 6.	0.00	10.00	250	10.00	Coordinates (m)	E 508938.31
Checked	TC	End	Cable percussion boring/followed by rotary core drilling (SWF size) using water flush.	10.00	24.00	200	23.00	National Grid	N 428177.90
Approved	TC	25/01/2016	SPT Hammer ID: 024, Rod type: 1 1/2 Whitworth.,	24.00	39.30	146	26.10		

Samples and Tests / Strata Description

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
	94 36 6		Flush: 30.80 - 39.90 Water 95%			Weak, medium to high density, white, locally cream, CHALK. Discontinuities are 1) very closely to closely spaced, locally medium spaced, subhorizontal, planar, rough, locally stained yellow brown, with occasional cream sandy clay infill (<3mm). 2) subvertical, occasionally undulating, rough, clean. (Grade B4)				
30.80 - 32.30	100 45 0						31.27-31.42 dark grey flint. 31.53-31.63 NI			
32.30 - 33.80	100 39 13						32.80-32.89 dark grey flint.			
33.80 - 35.40	100 34 6	NI 180 280					34.10-34.20 NI; 34.80-34.96 highly fractured with subvertical fracture through flint horizon. 35.05-35.40 NI	(10.00)		
35.40 - 36.90	93 57 40						35.65-35.90 highly fractured with intersecting subvertical fractures. 36.00-36.08 dark grey gravel of flint.			
36.90 - 38.40	100 55 7						37.22-37.65 subvertical fracture intersected with subhorizontal fractures 37.52-37.65 NI 37.74-37.82 dark grey flint.			
38.40 - 39.90	100 60 48			25/01/16 26.10	1730 3.85		39.00-39.10 dark grey flint. 39.20-39.40 dark grey flint. 39.40-39.75 fossil inclusions in chalk 39.80-39.90 fractures infilled with dark grey silty clay (<5mm).	39.90 -37.26		
						END OF EXPLORATORY HOLE				

Groundwater Entries No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks Depths (m)	Remarks

Hard Boring Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH402**

Borehole Log

Drilled	SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.98 mOD
Logged	GS/RM	05/01/2016	Dando 175. Cable percussion boring. SPT Hammer ID: 024, Rod type: 1 1/2" Whitworth.	0.00	15.00	200	15.00	Coordinates (m)	E 509209.09
Checked	TC	End		15.00	24.77	150	24.55	National Grid	N 428324.51
Approved	TC	08/01/2016							

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
		0.00-1.20 Hand excavated inspection pit.		
1.20 - 1.65	SPTS	N=9 (2,2/2,3,2,2)		
1.20	D 1			
1.20 - 1.65	D 2			
1.20 - 1.65	B 3			
1.65 - 2.10	UT 4	20 blows 50% rec	1.50	
2.10 - 2.30	D 5			
2.30 - 2.75	UT 6	14 blows 87% rec	1.50	
2.75 - 2.95	D 7			
2.95 - 3.40	UT 8	11 blows	1.50	
2.95 - 3.60	B 9			
3.60 - 4.60	P 10	88% rec 75Psi	3.00	
4.00 - 5.00	L			
4.60 - 5.00	B 11			
5.00 - 6.00	P 12	75% rec 77Psi	4.50	
6.00 - 7.00	P 13	74Psi 6.00-7.00 S&D record unavailable	6.00	
			05/01/16 7.00	1800
7.00 - 8.00	P 14	80% rec 75Psi		
7.00 - 8.00	D 16		06/01/16 7.00	0800 3.20
8.00 - 8.45	UT 17	28 blows 8.00-8.45 S&D record unavailable	8.00	
8.65 - 9.10	UT 18	29 blows 78% rec		
9.30 - 9.75	UT 20	29 blows 9.30-9.75 S&D record unavailable	9.00	
9.30	W 19			
9.75 - 9.95	D 21			
9.95 - 10.40	UT 22	52 blows 100% rec	9.00	

Strata Description

Main	Detail	Depth	Level	(Thickness)
Tarmacadam.		0.15	+2.83	(0.15)
Yellowish brown fine to coarse SAND. (MADE GROUND)		0.30	+2.68	(0.15)
Soft to firm light brownish grey slightly gravelly sandy CLAY. Gravel is angular to subangular fine to coarse brick, concrete and occasional sandstone. (MADE GROUND)		0.60	+2.38	(0.30)
BRICK courses. (MADE GROUND)		0.80	+2.18	(0.20)
Firm to stiff indistinctly fissured orangish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse of brick and concrete. (MADE GROUND)		1.20	+1.78	(0.40)
Firm indistinctly thinly and thickly laminated, indistinctly fissured, orangish brown, locally mottled greyish brown, slightly sandy silty CLAY. With occasional dustings of light brown and grey silt and fine sand on laminae surfaces.	1.65-1.81 with frequent relict rootlet tracks infilled grey.	2.30	+0.68	(1.10)
Firm indistinctly thinly to thickly laminated orangish brown and brown slightly sandy silty CLAY with frequent dustings of grey silt and orangish brown fine sand on laminae surfaces.	2.40-2.85 locally soft	3.25	-0.27	(0.95)
Soft, locally firm, indistinctly thinly and thickly laminated dark grey slightly organic slightly sandy silty CLAY.	3.80-7.00 greyish brown, locally oxidised brown. 5.00-7.00 with dustings of silt on laminae surfaces and very closely spaced thin laminae (<2mm) of light brown fine sand.	7.00	-4.02	(3.75)
Soft to firm thinly to thickly interlaminated greyish brown silty CLAY and orangish brown fine to medium SAND.	7.00-7.10 strong organic odour. 8.65-8.79 locally greyish brown clayey silty fine to medium sand.	9.00	-6.02	(2.00)
Firm dark brown oxidising to black pseudo fibrous PEAT with wood fragments up to 20mm.		9.10	-6.12	(0.10)
Soft to firm dark grey sandy gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse of flint and igneous lithologies. Description from arisings only.		9.30	-6.32	(0.20)
Soft brown slightly gravelly sandy CLAY. Gravel is subangular fine to coarse of chalk, sandstone		9.75	-6.77	(0.45)

Legend | Backfill

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	4.60	Rose to 3.90 m after 20 minutes.	

Depth Related Remarks

Depths (m)	Remarks
7.00 - 7.00	Slight hydraulic oil leak noted during recovery of piston sample.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project: A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No.: A5085-15

Carried out for: Balfour Beatty Limited

Borehole: **BH403**

Borehole Log

Drilled	SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.98 mOD
Logged	GS/RM	05/01/2016	Dando 175. Cable percussion boring. SPT Hammer ID: 024, Rod type: 1 1/2" Whitworth.	0.00	15.00	200	15.00	Coordinates (m)	E 509209.09
Checked	TC	End		15.00	24.77	150	24.55	National Grid	N 428324.51
Approved	TC	08/01/2016							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date Casing	Time Water
10.40 - 10.60	D 23			
10.60 - 11.05	UT 24	61 blows 100% rec	10.50	
11.05 - 11.25	D 25			
11.25 - 11.70	UT NR	49 blows No Recovery	10.50	
11.25 - 11.90	B 26			
11.90 - 12.35	UT 27	100% rec		
12.35 - 12.55	D 28			
12.55 - 13.00	UT 29	63 blows 100% rec	10.50	
13.00 - 13.20	D 30			
13.20 - 13.85	UT NR	53 blows No Recovery	10.50	
13.20 - 13.85	B 31			
13.85 - 14.20	UT 32	100% rec		
14.20 - 14.40	D 33		06/01/16 10.50	1800
14.40 - 14.85	UT 34	58 blows 66% rec	~~10.50~~ 07/01/16 10.50	0800 6.30
14.85 - 15.05	D 35			
15.05 - 15.50	UT 36	63 blows 100% rec	15.00	
15.50 - 15.70	D 37			
15.70 - 16.15	UT 38	69 blows 100% rec	15.00	
16.15 - 16.35	D 39			
16.35 - 16.80	UT 40	59 blows 77% rec	15.00	
16.80 - 17.00	D 41			
17.00 - 17.45	UT 42	60 blows 100% rec	17.00	
17.45 - 17.65	D 43			
17.65 - 18.10	UT 44	51 blows 100% rec	17.00	
18.10 - 18.30	D 45			
18.30 - 18.75	UT 46	49 blows 88% rec	18.30	
18.75 - 18.95	D 47			
18.95 - 19.40	UT 48	49 blows 88% rec	18.30	
19.40 - 19.60	D 49			
19.60 - 20.05	UT 50	47 blows 19.60-20.05 S&D record unavailable	19.60	

Main	Detail	Depth, Level (Thickness)
and igneous lithologies.		
Stiff locally very stiff, locally indistinctly laminated, dark brown and greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, flint, sandstone and igneous lithologies.	9.95-10.40 with dark reddish brown relict rootlet tracks (<2mm) with grey mottling. 10.60 becoming brown and grey brown. 10.90 cobble of quartzite noted. 11.25 becoming sandy.	(2.15)
Very stiff brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and quartzite.	11.90 becoming very stiff, locally stiff. 12.55 becoming brownish grey and brown. 13.85 reduction in proportion of gravel. 13.85-14.20 locally indistinctly laminated. 14.40-14.70 locally firm, occasional softening (wet) adjacent to gravel.	11.90 -8.92 (3.15)
Stiff thinly to thickly laminated, locally cross laminated, greyish brown silty CLAY with occasional dustings of light brown and grey silt along laminae surfaces.	15.05-15.30 locally firm to stiff. 15.50-17.00 locally soft to firm. 15.96 Thin lamination (4mm) of orangish brown fine to medium sand. 16.35-16.46 rare inclined fissures, locally polished.	15.05 -12.07 (1.95)
Stiff thinly laminated greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. With extremely closely to very closely spaced thin laminae (<3mm) of orangish brown fine to medium sand. Rare fine gravel of chalk.		17.00 -14.02 (0.65)
Stiff indistinctly thinly and thickly laminated, locally indistinctly fissured, greyish brown CLAY. With occasional thin laminae (<4mm) of orangish brown fine to medium sand. Fissures are extremely closely spaced, randomly orientated.	17.75 rare gravel of chalk. 18.35-18.47 thinly and thickly laminated. 18.45 rare gravel of chalk.	17.65 -14.67 (1.30)
Stiff thinly and thickly laminated greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. With extremely closely to very closely spaced thin laminae (<3mm) of orangish brown fine to medium sand.	18.99-19.10 Indistinctly laminated. 19.16 Thick lamination (12mm) of orangish brown fine to medium sand.	18.95 -15.97

Legend | Backfill

1

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	13.00	Rose to 12.60 m after 20 minutes.	15.05

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited
Borehole	**BH403**

Borehole Log

Drilled	SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.98 mOD
Logged	GS/RM	05/01/2016	Dando 175. Cable percussion boring. SPT Hammer ID: 024, Rod type: 1 1/2" Whitworth.	0.00	15.00	200	15.00	Coordinates (m)	E 509209.09
Checked	TC	End		15.00	24.77	150	24.55	National Grid	N 428324.51
Approved	TC	08/01/2016							

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
20.05 - 20.25	D 51			
20.25 - 20.70	SPTS	N=15 (3,3/4,4,3,4)	20.25	16.10
20.25 - 20.65	D 52			
20.25 - 20.65	B 53			
20.65 - 21.10	UT 54	33 blows 100% rec	20.00	11.05
			07/01/16	1800
			20.25	16.10
21.10 - 21.30	D 55			
			08/01/16	0800
21.30 - 21.75	SPTS	N=50 (5,7/10,14,17,9)	20.25	11.05
21.30 - 21.75	B 57		21.00	10.70
21.30 - 21.75	D 56			
21.75 - 22.20	SPTS	N=20 (5,5/5,5,5,5)	21.75	10.50
21.75 - 22.10	B 59			
21.75 - 22.10	D 58			
22.10 - 22.55	SPTS	N=23 (3,5/7,5,6,5)	22.10	4.00
22.10 - 22.55	D 60			
22.10 - 22.55	B 61			
22.55 - 23.00	SPTS	N=50 (4,5/9,11,17,13)	22.55	2.00
22.55 - 23.00	D 62			
22.55 - 23.00	B 63			
23.00 - 23.38	SPTS	50 (7,10/10,14,26 for 75mm)	23.00	2.00
23.00 - 23.30	D 64			
23.00 - 24.00	B 65			
24.00 - 24.22	SPTS	40 (11,16/40 for 75mm)	24.00	2.00
24.00 - 24.22	D 66			
24.00 - 24.55	B 67			
24.55 - 24.77	SPTC	50 (11,17/50 for 70mm)	24.55	2.00
24.55 - 24.77	B 68		08/01/16	1800
			~~24.55~~	~~2.00~~

Strata Description

Main	Detail	Depth, Level (Thickness)
	21.10-21.30 with extremely closely spaced thin laminae of black fine sand.	(2.55) 21.50 -18.52
Medium dense orangish brown very sandy clayey subangular to subrounded fine to coarse GRAVEL of chalk, flint and sandstone.		(1.30) 22.80 -19.82
Structureless CHALK. Recovered as silty subangular to subrounded fine to coarse gravel.		(1.97) 24.77 -21.79
END OF EXPLORATORY HOLE		

Groundwater Entries

No. Depth Strike (m) Remarks — Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks
22.00 - 24.77	Water added to assist boring.

Hard Boring

Depths (m)	Duration (mins)	Tools used
24.00 - 24.55	60	Chisel.

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project: A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No.: A5085-15

Carried out for: Balfour Beatty Limited

Borehole: **BH403**

Borehole Log

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.91 mOD
Logged	RM	14/01/2016	Dando 2000. Cable percussion boring. SPT Hammer ID: TS2, Rod type: 1 1/2" Whitworth.	0.00	18.00	200	18.00	Coordinates (m)	E 509249.01
Checked	TC	End		18.00	27.00	150	25.00	National Grid	N 428309.09
Approved	TC	21/01/2016							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)
		0.00-1.20 Hand excavated inspection pit.			TOPSOIL.		0.10 (0.10) +2.81
					Greyish brown sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of chalk. (MADE GROUND)		0.30 (0.20) +2.61
0.80	ES 1				Red brick. (Possible Foundations) (MADE GROUND)		0.40 (0.10) +2.51
1.20	D 2				Greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of chalk and brick. (MADE GROUND)		(0.80) 1.20 +1.71
1.50 - 1.95	UT 3	45 blows 84% rec	1.40	dry	Stiff indistinctly thinly to thickly laminated dark orangish brown mottled grey CLAY with rare pockets of subangular to subrounded fine to medium gravel of chalk and brick and relict rootlets up to 2mm. (MADE GROUND)	1.83 cobble of concrete.	(0.80)
2.00	D 4						2.00 +0.91
2.50 - 2.95	UT 5	25 blows 55% rec 2.50-2.95 S&D record unavailable	2.50	dry	Firm indistinctly thinly and thickly laminated dark greyish brown, locally mottled grey, slightly sandy silty CLAY with rare thin laminae of orangish brown fine sand.	2.50 becoming stiff.	(1.00)
3.00 3.00 - 4.00	D 6 P 7	88% rec 72Psi	2.90	dry	Firm indistinctly thinly and thickly laminated greyish green, becoming dark brownish grey, slightly sandy silty CLAY. With occasional dustings of brownish grey silt along laminae surfaces. Locally oxidised brown adjacent to laminae.	3.35-3.60 inclined (65 deg) colour change. 3.52-3.88 rare relict rootlet tracks.	3.00 -0.09
4.00 - 5.00	P 8	90Psi 4.00-5.00 S&D record unavailable	2.90	dry			(3.00)
5.00 - 6.00	P 9	95Psi 5.00-6.00 S&D record unavailable	4.70	dry			
			14/01/16 6.00 ~~6.00~~ 18/01/16 6.00	1800 3.50 ~~3.50~~ 0800 3.50			
6.00 - 7.00	P 10	82% rec 90Psi			Firm thinly and thickly laminated dark brownish grey and greyish brown sandy silty CLAY with occasional thin and thick laminae of greyish brown silty fine to medium sand.		6.00 (0.42) -3.09
					Thinly and thickly interlaminated greyish brown and brown slightly clayey silty fine to medium SAND and firm greyish brown CLAY.		6.42 (0.58) -3.51
7.00 - 8.00 7.00 - 8.00	P 11 B 12	65% rec 90Psi	6.00	3.90	Firm thinly and thickly laminated dark brownish grey slightly sandy silty CLAY. With extremely closely to very closely spaced thin laminae of orangish brown and greyish brown silt and fine to medium sand. Locally oxidised dark orangish brown adjacent to laminae.		7.00 -4.09
8.00 - 9.00 8.00 8.00 - 9.00	P 14 D 13 B 15	78% rec 90Psi	7.40	4.50		8.35 thick lamination (15mm) of orangish brown fine to medium sand.	(2.00)
9.00 - 10.00 9.00 9.00 - 10.00	P 17 D 16 B 18	30% rec 90Psi	8.90	5.50	Firm dark brown and black pseudo fibrous PEAT, with wood fragments up to 25mm.		9.00 (0.20) -6.09
					Firm to stiff dark greyish brown CLAY with frequent pockets of pseudo fibrous peat.		9.20 (0.85) -6.29

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks
3.00 - 6.00	Water added to assist boring.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited
Borehole	**BH404**

Borehole Log

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.91 mOD
Logged	RM	14/01/2016	Dando 2000.	0.00	18.00	200	18.00	Coordinates (m)	E 509249.01
Checked	TC	End	Cable percussion boring.	18.00	27.00	150	25.00	National Grid	N 428309.09
Approved	TC	21/01/2016	SPT Hammer ID: TS2, Rod type: 1 1/2" Whitworth.						

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
10.00 - 10.45	UT NR	60 blows No Recovery	9.95	6.70
10.00	D 19			
10.00 - 10.50	B 20			
10.50 - 10.95	UT NR	70 blows No Recovery	9.95	6.80
10.50	D 21			
10.50 - 11.00	B 22			
11.00 - 11.45	UT NR	75 blows No Recovery	10.70	7.30
11.00	D 23			
11.00 - 11.50	B 24			
11.50 - 11.95	UT 26	75 blows 71% rec	10.70	7.70
11.50	D 25			
12.00 - 12.45	UT 28	75 blows 100% rec	10.70	8.20
12.00	D 27			
12.50 - 12.95	UT 30	75 blows 84% rec	10.70	dry
12.50	D 29			
13.00 - 13.45	UT 32	80 blows 100% rec	10.70	dry
13.00	D 31			
13.50 - 13.95	UT NR	80 blows No Recovery	10.70	dry
13.50	D 33			
13.50 - 14.00	B 34			
14.00 - 14.45	UT 36	85 blows 88% rec	10.70	dry
14.00	D 35			
14.50 - 14.95	UT 38	75 blows 100% rec	10.70	dry
14.50	D 37			
15.00 - 15.45	UT 40	80 blows 100% rec	10.70	dry
15.00	D 39			
15.50 - 15.95	UT 42	80 blows 100% rec	10.70	dry
15.50	D 41			
16.00 - 16.45	UT 44	80 blows 100% rec	10.70	dry
16.00	D 43			
16.50 - 16.95	UT NR	78 blows No Recovery	10.70	dry
16.50	D 45			
16.50 - 17.00	B 46			
17.00 - 17.45	UT NR	80 blows No Recovery	10.70	dry
17.00	D 47			
17.00 - 17.50	B 48			
17.50 - 17.95	UT 50	80 blows 100% rec	10.70	dry
17.50	D 49			
			18/01/16	1800
			10.70	dry
18.00 - 18.45	UT NR	80 blows No Recovery	~~18.00~~	~~3.20~~
18.00	D 51		19/01/16	0800
18.00 - 18.50	B 52		10.70	3.95
18.50 - 18.95	UT 54	75 blows 100% rec	18.00	3.50
18.50	D 53			
19.00 - 19.45	UT 56	75 blows 87% rec	18.90	4.10
19.00	D 55			
19.50 - 19.95	UT 58	80 blows 88% rec	18.90	4.00
19.50	D 57			

Strata Description

Main	Detail	Depth	Level	(Thickness)
Firm dark greyish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse of chalk, quartzite and igneous lithologies.		10.05	-7.14	(0.70)
Stiff, locally very stiff, greyish brown locally mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk, quartzite and igneous lithologies.	12.50 becoming sandy. 12.77 with rare polished fissures. 13.50-14.50 no mottling.	10.75	-7.84	(3.75)
Stiff, locally very stiff, indistinctly thinly and thickly laminated, locally cross laminated, greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. Rare thin laminae (<2mm) of light brown silty fine sand.	14.75 with rare fine gravel of chalk.	14.50	-11.59	(0.50)
Stiff indistinctly thinly and thickly laminated fissured brown and greyish brown CLAY with occasional dustings of light grey silt on laminae surfaces. Fissures are randomly orientated and extremely closely spaced, occasionally polished.	16.10-16.16 steeply inclined polished fissure. 16.28 becoming with thin laminae of light brown silt. 16.50 with rare fine gravel of chalk, and no fissuring.	15.00	-12.09	(2.00)
Stiff thinly and thickly laminated greyish brown CLAY with occasional dustings of silt on laminae surfaces.		17.00	-14.09	(0.75)
Firm to stiff indistinctly thinly and thickly laminated, indistinctly fissured, greyish brown slightly sandy CLAY. With occasional dustings and extremely closely to very closely spaces thin laminae (<3mm) of orangish brown silt and fine sand. Fissures are extremely closely spaced and randomly orientated.	17.71-17.76 Orangish brown slightly gravelly silty sand. 18.65 with rare gravel of chalk.	17.75	-14.84	(1.25)
Stiff thinly and thickly laminated greyish brown CLAY. With frequent dustings of light brown silt along laminae surfaces and frequent thin laminae (<3mm) of silt and fine sand.	19.00-19.17 with thin laminae (<6mm) of orangish brown fine to medium sand. 19.33 with rare gravel of chalk. 19.50 firm to stiff	19.00	-16.09	

Legend | Backfill

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited
Borehole	BH404

Borehole Log

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	2.91 mOD
Logged	RM	14/01/2016	Dando 2000. Cable percussion boring. SPT Hammer ID: TS2, Rod type: 1 1/2" Whitworth.	0.00 18.00	18.00 27.00	200 150	18.00 25.00	Coordinates (m)	E 509249.01
Checked	TC	End						National Grid	N 428309.09
Approved	TC	21/01/2016							

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
20.00 - 20.45	UT 60	60 blows 87% rec	19.70	5.05
20.20	D 59			
20.45 - 20.65	D 61			
20.65 - 21.10 20.65 - 21.10 20.65 - 21.10	SPTS D 62 B 63	N=29 (3,5/7,7,7,8)	20.50	5.50
21.10 - 21.55	UT 64	80 blows 100% rec	21.00	5.80
21.55 - 21.75	D 65			
21.70 - 22.20 21.75 - 22.20 21.75 - 22.20	B 67 SPTS D 66	N=29 (4,6/6,6,8,9)	21.00	6.10
22.20 - 22.65	UT 68	100 blows 58% rec	22.10	6.50
22.65 - 22.85	D 69			
22.85 - 23.30 22.85 - 23.30	SPTS D 70	N=27 (4,5/5,6,8,8)	22.10	6.90
23.80 - 24.25 23.80 - 24.25	SPTC B 71	N=32 (4,7/7,8,8,9)	23.80	7.00
24.25 - 24.80	B 72			
24.80 - 25.25 24.80 - 25.25 24.80 - 25.30	SPTS D 73 B 74	N=35 (6,7/8,8,9,10)	24.80	7.90
25.80 - 26.25 25.80 - 26.30	SPTC B 75	N=39 (7,8/8,9,10,12)	25.00	8.10
26.50 - 26.91 26.50 26.50 - 27.00	SPTC D 76 B 77	50 (8,11/11,13,16,10 for 38mm)	25.00	8.50
			19/01/16 25.00	1800 8.50

Strata Description

Main	Detail	Depth, Level (Thickness)
	21.10-21.55 firm to stiff. 22.34-22.40 greyish brown slightly gravelly silty sand.	(3.75)
Orangish brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of chalk.		22.75 -19.84 (0.10)
Medium dense to dense dark brown very gravelly clayey fine to coarse SAND. Gravel is angular to subrounded fine to coarse of chalk, flint and sandstone.		22.85 -19.94 (1.60)
Structureless CHALK. Recovered as cream and white sandy silty subangular to subrounded fine to coarse gravel. Gravel is weak. low density.		24.45 -21.54 (2.55)
END OF EXPLORATORY HOLE		27.00 -24.09

Legend | Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used
26.30 - 26.50	30	Chisel
26.75 - 27.00	30	Chisel

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH404**

Borehole Log

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.16 mOD
Logged	GS/RM	05/01/2016	Dando 2000 MK2. Cable percussion boring. SPT Hammer ID: 024, Rod type: 1 1/2" Whitworth.	0.00	17.50	200	17.50	Coordinates (m)	E 509285.25
Checked	TC	End		17.50	27.12	150	25.10	National Grid	N 428329.82
Approved	TC	12/01/2016							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)
		0.00-1.20 Hand excavated inspection pit.			TOPSOIL.		0.15 (0.15) +3.01
0.50	ES 1				Greyish brown sandy gravelly CLAY. Gravel is subangular to subrounded of chalk and rare brick. (MADE GROUND)		0.40 (0.25) +2.76
					Red BRICK. (MADE GROUND)		0.50 (0.10) +2.66
1.50 - 1.95 1.50 - 2.00	SPTC B 2	N=13 (2,3/3,4,4,2)	1.40	dry	Soft to firm, locally stiff, greyish brown and brown sandy gravelly CLAY low cobble content and rare roots and rootlets. Gravel is subangular to subrounded fine to coarse of brick, chalk, concrete and fabric. Cobbles are subangular of chalk. (MADE GROUND)		(1.75)
2.05 - 2.50	B 4						
2.25	D 3						2.25 +0.91
2.50 - 2.95	UT 5	12 blows 100% rec	1.70	dry	Soft to firm indistinctly thinly and thickly laminated greyish brown mottled orangish brown slightly sandy CLAY with occasional dustings of silt and fine sand on laminae surfaces. Frequent relict root tracks and rare rootlets up to 2mm.		(1.25)
			05/01/16 1.70 ~~2.80~~	1800 dry ~~2.30~~			
3.00 3.00 - 4.00	D 6 P 7	99% rec 3.00-4.00 S&D record unavailable	06/01/16 1.70	0800 2.30			
					Soft thinly and thickly laminated greyish brown and dark grey slightly sandy silty slightly organic CLAY. With occasional dustings of light brown and greyish brown silt and fine sand on laminae surfaces.		3.50 -0.34
4.00 - 5.00	P 8	50% rec	2.80	2.70			
5.00 5.00 - 6.00	D 9 P 10	83% rec 5.00-6.00 S&D record unavailable	4.70	3.20			
6.00 - 7.00	P 11	78% rec	5.90	3.60		6.00-7.00 firm, locally soft, with extremely closely to very closely spaced thin and thick laminae (<12mm) of greyish brown fine to medium sand.	(5.50)
7.00 7.00 - 8.00	D 12 P 13	85% rec 7.00-8.00 S&D record unavailable	5.90	3.80			
8.00 8.00 - 9.00	D 14 P 15	80% rec	7.70	4.10		8.00-9.00 with extremely closely spaced thin laminae (<4mm) of light grey sand.	
9.00 9.00 - 10.00	D 16 P 17	70% rec	9.00	3.50	Firm dark brownish grey, locally mottled black, slightly sandy organic CLAY. With plant remains up to 20mm and occasional wood fragments up to 35mm.	9.50-9.65 very organic.	9.00 -5.84 (0.65)
			06/01/16 9.00	1800 3.50	Firm dark brown pseudo fibrous PEAT.		9.65 -6.49 (0.35) 10.00 -6.84

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks
3.00 - 9.00	Water added to assist boring.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH405**

Borehole Log

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.16 mOD
Logged	GS/RM	05/01/2016	Dando 2000 MK2. Cable percussion boring. SPT Hammer ID: 024, Rod type: 1 1/2" Whitworth.	0.00 17.50	17.50 27.12	200 150	17.50 25.10	Coordinates (m)	E 509285.25
Checked	TC	End						National Grid	N 428329.82
Approved	TC	12/01/2016							

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
10.00 - 10.45 10.00	UT 19 D 18	23 blows 55% rec 10.00-10.45 S&D record unavailable	10.00 07/01/16 9.00	4.50 0800 4.50
10.50 - 10.95 10.50	UT 21 D 20	60 blows 70% rec	10.40	6.70
11.00 - 11.45 11.00	UT 23 D 22	80 blows 70% rec 11.00-11.45 S&D record unavailable	10.40	7.50
11.50 - 11.95 11.50	UT 25 D 24	80 blows 80% rec 11.50-11.95 S&D record unavailable	11.40	9.10
12.00 - 12.45 12.00	UT 27 D 26	80 blows 100% rec	11.80	10.70
12.50 - 12.95 12.50	UT 29 D 28	80 blows 100% rec	12.00	dry
13.00 - 13.45 13.00	UT 31 D 30	80 blows 100% rec	12.00	dry
13.50 - 13.95 13.50 13.50 - 14.00	UT NR D 32 B 33	100 blows No Recovery	12.00	dry
14.00 - 14.45 14.00	UT 35 D 34	90 blows 100% rec	12.00	dry
14.50 - 14.95 14.50	UT 37 D 36	100% rec	12.00	dry
15.00 - 15.45 15.00	UT 39 D 38	80 blows 100% rec	12.00	dry
15.50 - 15.95 15.50	UT 41 D 40	65 blows 89% rec	12.00	dry
16.00 - 16.45 16.00	UT 43 D 42	70 blows 89% rec	12.00	dry
16.50 - 16.95 16.50	UT 45 D 44	70 blows 87% rec	12.00	dry
			07/01/16 12.00	1800 dry
17.00 - 17.45 17.00	UT 48 D 46	70 blows 100% rec	12.00 08/01/16 12.00	4.70 0800 4.70
17.50 - 17.95 17.50	UT NR D 49	70 blows No Recovery	17.50	5.10
			08/01/16 18.00	1800 5.10
18.00 - 18.45 18.00 - 18.50	UT NR B 51	70 blows No Recovery	18.00 11/01/16 18.00	4.50 0800 4.50
18.50 - 18.95	UT 52	70 blows 100% rec	18.00	4.50
19.00 - 19.45 19.00 19.00 - 19.50	UT NR D 53 B 54	100 blows No Recovery	18.90	5.10
19.50 - 19.95 19.50 - 20.00	UT NR B 55	95 blows No Recovery	19.40	6.20

Strata Description

Main	Detail	Depth, Level (Thickness)
Firm greyish brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, quartzite and flint.	10.55-10.58 with undulating sand filled fissures (<5mm).	(1.50)
Stiff greyish brown, locally mottled light grey, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies.	12.00-12.45 locally softening around gravel. 12.00-13.00 locally firm. 12.87 cobble of chalk noted. 14.00-14.50 locally very stiff. 14.06-14.10 locally indistinctly laminated. 14.50-14.95 locally indistinctly laminated.	11.50 -8.34 (3.85)
Stiff indistinctly thinly and thickly laminated indistinctly fissured brownish grey and greyish brown silty CLAY with frequent dustings and very closely spaced thin laminae (<2mm) of light brown silt. Fissures are extremely closely and closely spaced.	16.50 becoming locally very stiff.	15.35 -12.19 (1.65)
Orangish brown slightly gravelly silty fine to medium SAND.		17.00 -13.84 (0.17)
Stiff, locally firm to stiff, thinly and thickly laminated greyish brown silty CLAY with frequent dustings of light brown silt on laminae surfaces.	17.45-17.50 rare gravel sized pockets of fine to medium sand. 18.50 becoming very closely fissured, occasionally polished. 18.70 becoming locally firm.	17.17 -14.01 (1.61)
Stiff indistinctly fissured greyish brown friable CLAY. Fissures are extremely closely to very closely spaced randomly orientated with occasional light brown silt on surfaces. With rare pockets of orangish brown fine sand.		18.78 -15.62 (1.72)

Legend | Backfill

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used
13.75 - 14.00	45	Chisel.

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH405**

Borehole Log

ESG

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.16 mOD
Logged	GS/RM	05/01/2016	Dando 2000 MK2. Cable percussion boring. SPT Hammer ID: 024, Rod type: 1 1/2" Whitworth.	0.00 17.50	17.50 27.12	200 150	17.50 25.10	Coordinates (m)	E 509285.25
Checked	TC	End						National Grid	N 428329.82
Approved	TC	12/01/2016							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Strata Main	Detail	Depth, Level (Thickness)	Legend	Backfill
20.00 - 20.45 20.00 - 20.50	UT NR B 56	95 blows No Recovery	19.40	6.30					
20.50 - 20.95 20.50 - 20.95 20.50 - 21.00	SPTS D 57 B 58	N=25 (3,5/6,6,6,7)	20.40	6.90	Firm to stiff greyish brown indistinctly thinly laminated CLAY, with occasional dustings of grey silt on laminae surfaces and extremely closely spaced thin laminae (<4mm) of orangish brown fine to medium sand.		20.50 -17.34		
21.00 - 21.45 21.00 - 21.45 21.00 - 21.50	SPTS D 59 B 60	N=27 (3,6/6,6,7,8)	20.90	7.30					
21.50 - 21.95 21.50 - 22.00	UT NR B 61	100 blows No Recovery	21.40	8.10		21.50-22.00 with occasional laminae of black sand.	(2.65)		
22.00 - 22.45 22.00 - 22.50	UT NR B 62	100 blows No Recovery	21.40	8.60					
22.50 - 22.95 22.50 - 22.95 22.50 - 23.00	SPTS D 63 B 64	N=28 (3,6/6,7,7,8)	22.40	9.50					
23.00 - 23.45	UT 65	100% rec	22.80	11.10	Stiff indistinctly thinly and thickly laminated dark orange brown slightly sandy silty CLAY.	23.05-23.15 orangish brown very gravelly sand.	23.15 -19.99 (0.40)		
23.50 23.60 - 24.05 23.60 - 24.10	D 66 SPTC B 67	N=34 (4,7/8,8,8,10)	23.50	11.70	Dense greyish brown very sandy, becoming sandy with depth, silty subangular to subrounded fine to coarse GRAVEL of chalk, flint and igneous lithologies.		23.55 -20.39 (1.05)		
24.10 - 24.60	B 68								
			11/01/16 24.60 ~~24.60~~	1800 11.80 ~~3.90~~					
24.60 - 25.05 24.60 - 25.60	SPTC B 69	N=34 (5,7/8,8,8,10)	12/01/16 24.60	0800 3.90	Structureless CHALK, recovered as cream mottled light grey subangular to subrounded fine to coarse GRAVEL to COBBLES of chalk. Gravel and cobbles are very weak, low density.		24.60 -21.44		
25.60 - 26.05 25.60 - 26.60	SPTC B 70	N=37 (6,8/8,9,9,11)	25.10	4.70		25.60 locally recovered as cream slightly gravelly silty clay.	(2.52)		
26.70 - 27.12	SPTC	50 (7,10/11,14,15,10 for 49mm)	25.10 12/01/16 25.10	6.30 1800 6.30					
					END OF EXPLORATORY HOLE		27.12 -23.96		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used
24.30 - 24.50	30	Chisel.
26.20 - 26.70	60	Chisel.

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH405**

Borehole Log

ESG

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.33 mOD
Logged	RM	30/11/2015	Dando 2000 MK2 Cable percussion boring SPT Hammer ID: TS2, Rod Type: 1 1/2" Whitworth.	0.00 16.70	16.70 24.10	200 150	16.70 24.10	Coordinates (m)	E 509308.11
Checked	TC	End						National Grid	N 428381.76
Approved	TC	10/12/2015							

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
		0.00-1.20 Hand excavated inspection pit.	01/12/15	1900
0.50 - 1.20	B 2			
0.70	ES 1			
			01/12/15	0500
1.20	D 3			
			02/12/15	1900
1.50 - 1.95 1.50 - 1.95 1.50 - 2.20	SPTS ES 4 B 5	N=32 (4,7/7,8,8,9)	1.50	
2.00 - 2.50	B 7			
2.20	D 6			
2.50 - 2.95 2.50	UT 9 D 8	22 blows 89% rec	2.50	dry
3.00 - 3.45 3.00	UT 11 D 10	9 blows 97% rec	2.40	dry
3.50 3.50 3.50 - 4.50	ES D 12 P 13	80% rec		
4.50 - 4.95 4.50	UT D 14	12 blows 78% rec	4.40	dry
5.00 - 5.45 5.00	UT 16 D 15	13 blows 71% rec	4.70	dry
5.50 - 5.95 5.50 5.50 - 6.00	UT NR D 17 B 18	11 blows No Recovery	5.45	dry
6.00 - 6.45 6.00 6.00 - 6.50	UT NR ES B 19	10 blows No Recovery	5.95	dry
6.50 6.50 - 7.50	D 20 P 21	70% rec		
			02/12/15 6.20	0500
7.50 - 7.95 7.50 7.50 - 8.00	UT NR D 22 B 23	9 blows No Recovery	~~7.50~~ 03/12/15 6.20	~~5.70~~ 1900
8.00 8.00 - 9.00	D 24 P 25	95% rec		
9.00 - 9.50 9.00 9.00 - 9.50	UT NR B 26 B 27	15 blows No Recovery	8.90	6.30
9.50 - 9.95 9.50 - 10.00	UT NR B 28	16 blows No Recovery	9.10	5.50

Strata Description

Main	Detail	Depth	Level	(Thickness)
Dark brown silty sandy CLAY with rootlets up to 2mm and plant fragments up to 5mm. (TOPSOIL)		0.20	+3.13	(0.20)
Greyish brown gravelly CLAY with plant fragments up to 3mm. Gravel is subangular to subrounded fine to coarse of chalk, brick and sandstone. (MADE GROUND)		0.50	+2.83	(0.30)
Stiff dark greyish brown slightly sandy slightly gravelly CLAY with plant fragments up to 3mm. Gravel is subangular to subrounded fine to coarse brick, chalk, sandstone and occasional tarmacadam. (MADE GROUND)		2.10	+1.23	(1.60)
Stiff thinly and thickly laminated greyish brown and orangish brown, locally mottled grey, silty CLAY with dustings of greyish brown silt on laminae surfaces. Occasional roots up to 3mm and rare subrounded fine to medium chalk gravel. (MADE GROUND)		2.50	+0.83	(0.40)
Firm thinly and thickly laminated greyish brown and orangish brown silty CLAY with dustings of greyish brown silt on laminae surfaces.		2.70	+0.63	(0.20)
Firm, becoming soft at 3.0m, indistinctly thinly and thickly laminated dark grey and dark brownish grey slightly sandy silty CLAY with frequent dustings of light brown and dark grey silt on laminae surfaces.	3.00-3.70 locally very soft. 3.50-5.00 slightly organic. 3.61 becoming dark grey. 4.50-4.85 with lenses and thin and thick laminae of orangish brown fine sand.	5.00	-1.67	(2.30)
Soft, locally very soft, indistinctly thinly to thickly laminated greyish brown, locally slightly sandy, silty CLAY with rare plant debris up to 20mm in length.		5.50	-2.17	(0.50)
Soft thinly and thickly laminated greyish brown slightly sandy clayey SILT. With dustings and occasional thin and thick laminae (<10mm) of light brown silt and fine sand.		8.00	-4.67	(2.50)
Soft thinly and thickly laminated dark greyish brown and orangish brown silty CLAY with extremely closely to very closely spaced thin and thick laminae (<10mm) of orangish brown fine to medium sand.		8.45	-5.12	(0.45)
Firm dark brownish grey slightly sandy organic, locally very organic, CLAY. With wood fragments up to 25mm.	9.00 becoming soft.	9.50	-6.17	(1.05)
Soft, locally firm, dark brownish grey slightly sandy clayey SILT with plant remains.		~~10.00~~	~~-6.67~~	(0.50)

Hole continues on next sheet

Groundwater Entries			
No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks	
Depths (m)	Remarks

Hard Boring		
Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole

BH406

Borehole Log

ESG

Drilled	IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.33 mOD
Logged	RM	30/11/2015	Dando 2000 MK2	0.00	16.70	200	16.70	Coordinates (m)	E 509308.11
Checked	TC	End	Cable percussion boring	16.70	24.10	150	24.10	National Grid	N 428381.76
Approved	TC	10/12/2015	SPT Hammer ID: TS2, Rod Type: 1 1/2" Whitworth.						

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
10.00 - 10.45 10.00 - 10.50	UT NR B 29	16 blows No Recovery	10.00	6.20
10.50 - 10.95 10.50 - 11.00	UT NR B 30	20 blows No Recovery	10.40	6.30
11.00 - 11.45 11.00 - 11.50	UT NR B 31	22 blows No Recovery	10.70	6.50
11.50 - 11.95 11.50 11.50 - 11.95 11.50 - 12.00	SPTS D 32 D 33 B 34	N=18 (3,3/4,4,4,6)	10.70	4.90
12.00 - 12.45 12.00 12.00 - 12.50	UT NR D 35 B 36	65 blows No Recovery	11.90	9.70
12.50 - 12.95 12.50	UT 38 D 37	120 blows 56% rec	12.10	10.10
13.00 - 13.45 13.00 13.00 - 13.50	UT 40 D 39 B 42	100 blows 73% rec	12.10	10.70
			03/12/15 12.10 ~~12.10~~	0500 10.70 ~~3.00~~
13.50 - 13.95 13.50	UT 43 D 41	85 blows 67% rec	07/12/15 12.10	1900 3.00
14.00 - 14.45 14.00	UT 45 D 44	80 blows 53% rec	13.70	3.50
14.50 - 14.95 14.50	UT 47 D 46	95 blows 67% rec	13.70	3.90
15.00 - 15.45 15.00	UT 49 D 48	80 blows 100% rec	13.70	4.90
15.50 - 15.95 15.50	UT 51 D 50	100 blows 78% rec	15.20	5.60
16.00 - 16.45 16.00	UT 53 D 52	100 blows 100% rec	15.20	5.95
16.50 - 16.95 16.50	UT 55 D 54	100 blows 71% rec	15.20	6.70
17.00 - 17.45 17.00	UT 57 D 56	100 blows 100% rec	16.70	7.50
17.50 - 17.95 17.50	UT 59 D 58	100 blows 100% rec	16.70	8.50
18.00 - 18.45 18.00	UT 61 D 60	100 blows 100% rec	16.70	9.40
18.50 - 18.95 18.50	UT 63 D 62	100 blows 100% rec	16.70	11.10
19.00 - 19.45 19.00	UT 65 D 64	110 blows 100% rec	16.70	12.10
19.50 - 19.95 19.50	UT 67 D 66	100 blows 100% rec	16.70	13.50

Strata Description

Main	Detail	Depth	Level	(Thickness)
Firm greyish brown indistinctly thinly laminated slightly sandy organic CLAY with fragments of pseudo fibrous peat.	10.00-11.50 indistinctly laminated and locally varying to PEAT.			(1.00)
Firm dark brown, oxidising to black, organic CLAY, with fragments of pseudo fibrous peat.		11.00	-7.67	(0.55)
Firm light brownish grey slightly gravelly sandy CLAY with frequent thin and thick laminae (<10mm) of fine to coarse sand. Gravel is subangular to subrounded fine to medium of chalk.		11.55	-8.22	(0.15)
Stiff dark brown mottled grey slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies.	12.00 locally mottled yellowish brown.	11.70	-8.37	(0.80)
Stiff, locally very stiff, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies. Rare steeply inclined fissures, infilled grey.	13.00-14.00 very stiff to hard. 13.74-13.80 very gravelly.	12.50	-9.17	(1.50)
Firm indistinctly thinly and thickly laminated greyish brown and grey slightly sandy CLAY with dustings of light brown silt and fine sand on laminae surfaces.		14.00	-10.67	(0.30)
Stiff, locally firm, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, quartzite and igneous lithologies.		14.30	-10.97	(0.87)
Stiff indistinctly fissured brown and greyish brown silty CLAY with dustings of light brown silt on fissure surfaces. Fissures are extremely to very closely spaced randomly orientated with occasional polished surfaces.	15.17-15.22 orangish brown fine to medium sand. 15.50 locally very stiff.	15.17	-11.84	(0.83)
Stiff indistinctly thinly and thickly laminated fissured greyish brown CLAY with dustings of light brown silt on laminae surfaces. Fissures are extremely closely to very closely spaced randomly orientated and polished.	16.37 fissures are inclined at 45 deg and polished. 16.68-16.73 laminae are inclined at 45 deg.	16.00	-12.67	(1.00)
Firm to stiff thinly and thickly laminated, locally indistinctly fissured, greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. Rare subrounded fine to medium gravel of chalk. Fissures are extremely to very closely spaced, randomly orientated, occasionally polished.	16.73-16.82 laminae are undulating.	17.00	-13.67	(1.23)
Stiff indistinctly fissured greyish brown sandy CLAY, with occasional pockets (<5mm) of orangish brown fine to medium sand.	18.16-18.23 occasional pockets of orange brown fine to medium sand. 18.75-19.32 very closely spaced thin laminae of orangish brown fine to medium sand.	18.23	-14.90	(1.09)
Stiff thinly and thickly laminated greyish brown silty CLAY. With dustings of silt on laminae and extremely closely to very closely spaced thin laminae (<3mm) of orangish brown fine to medium sand. Rare subrounded fine to medium gravel of		19.32	-15.99	

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole

BH406

Borehole Log

Drilled IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.33 mOD
Logged RM	30/11/2015	Dando 2000 MK2 Cable percussion boring SPT Hammer ID: TS2, Rod Type: 1 1/2" Whitworth.	0.00 16.70	16.70 24.10	200 150	16.70 24.10	Coordinates (m)	E 509308.11
Checked TC	End						National Grid	N 428381.76
Approved TC	10/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)
20.00 - 20.45 20.00	UT 69 D 68	95 blows 100% rec	16.70	14.90	chalk.	20.00-20.45 locally firm.	
20.50 20.50 - 20.95 20.50 - 21.00	D 70 D 71 B 72		07/12/15 16.70	0500 16.50			(2.68)
21.00 - 21.45 21.00 - 21.50	UT NR B 73	100 blows No Recovery	~~21.00~~ 08/12/15 16.70	~~7.90~~ 1900 6.95			
21.50 - 21.95	UT 74	100 blows 100% rec	21.00	8.50		21.50-21.64 locally firm.	
22.00 - 22.45 22.00 22.00 - 22.45 22.00 - 22.50	SPTS D 75 D 76 B 77	N=28 (2,3/6,6,8,8)	21.95	9.40	Structureless CHALK composed of light greyish brown sandy silty subangular fine to coarse GRAVEL. Gravel is very weak to weak, low density.		22.00 -18.67
22.50 - 22.95 22.50 22.50 - 22.95	SPTS D 78 D 79	N=28 (4,6/6,7,7,8)	22.40	10.70			
23.00 - 23.45 23.00 23.00 - 23.45 23.00 - 23.50	SPTS D 80 D 81 B 82	N=31 (5,7/7,7,8,9)	22.70	11.10			(2.50)
23.50	D 83						
24.00 - 24.31 24.00 - 24.45 24.00 - 24.50	SPTS D 84 B 85	40 (9,10 for 10mm/12,13,15 for 73mm)	24.00 08/12/15	12.10 0500			
24.50	D 86				END OF EXPLORATORY HOLE		24.50 -21.17

Legend / Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used
24.00 - 24.50	60	

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project: A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No.: A5085-15

Carried out for: Balfour Beatty Limited

Borehole: **BH406**

Borehole Log

Drilled	MR/IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.48 mOD
Logged	RM	02/12/2015	Dando 2000	0.00	13.30	200	13.30	Coordinates (m)	E 509336.02
Checked	TC	End	Cable percussion boring.	13.30	28.50	150	27.70	National Grid	N 428357.42
Approved	TC	16/12/2015	SPT Hammer ID: TS2, Rod Type: 1 1/2" Whitworth.						

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
0.00 - 0.70	ES 1	0.00-1.20 Hand excavated inspection pit.	02/12/15	0330
0.50 - 1.20	B 2			
			02/12/15 1.20	2113
1.20 - 1.65 1.20 1.20 - 1.70	SPTS D 3 B 4	N=12 (2,3/3,2,3,4)	~~1.20~~ 03/12/15 1.20	0330
1.70 - 2.15	UT 5	50 blows 67% rec	1.20	dry
2.15	D 6			
2.40 - 2.85	UT 7	30 blows 100% rec 2.40-2.85 S&D record unavailable	1.20	dry
2.85	D 8			
3.10 - 3.55	UT 9	10 blows 80% rec	1.20	dry
3.50	ES 10			
4.00 - 5.00	P 11	90% rec 4.00-5.00 S&D record unavailable		
			03/12/15 5.00	2125
5.00 - 5.45	UT 12	10 blows 100% rec		
			04/12/15 5.00	0015 dry
5.45	D 13			
5.60 - 6.05	UT 14	10 blows 100% rec		
6.05 - 7.05	P 15	100% rec		
6.50	ES 16			
7.10 - 7.55	UT 17	10 blows 100% rec		
7.60 - 8.05	UT 18	10 blows 82% rec		
			04/12/15 8.20	0430 dry
8.05 8.05 - 8.50	D 19 B 20		11/12/15 8.20	1900 4.70
8.50 - 8.95	UT 21	27 blows 100% rec	8.20	4.70
9.00 - 10.00	P 22	80% rec 75Psi		

Strata Description

Main	Detail	Depth	Level	(Thickness)
Dark brown silty sandy CLAY with rootlets up to 2mm and plant fragments up to 5mm. (TOPSOIL)		0.20	+3.28	(0.20)
Greyish brown gravelly CLAY with plant fragments up to 3mm. Gravel is subangular to subrounded fine to coarse of chalk, brick and sandstone. (MADE GROUND)		0.50	+2.98	(0.30)
Stiff dark greyish brown sandy gravelly CLAY with plant fragments up to 3mm. Gravel is subangular to subrounded fine to coarse of brick, chalk, sandstone and occasional macadam. (MADE GROUND)		1.20	+2.28	(0.70)
Stiff brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of brick and chalk. (MADE GROUND)		1.70	+1.78	(0.50)
Firm to stiff indistinctly thinly and thickly laminated orangish brown mottled grey CLAY with occasional thin laminae of fine sand and occasional rootlets up to 2mm. Occasional vertical relic rootlet traces, infilled light grey.	2.50-3.00 occasional rootlet tracks infilled grey.	2.50	+0.98	(0.80)
Firm, locally soft, thinly and thickly, locally indistinctly, laminated greyish brown silty CLAY with occasional dustings of silt and fine sand along laminae surfaces. Locally oxidised orangish brown adjacent to laminae.	5.00-5.18 very soft to soft and indistinctly fissured.	5.18	-1.70	(2.68)
Firm, locally soft, thinly and thickly laminated greyish brown slightly sandy clayey organic SILT with dustings of light brown fine sand on laminae surfaces.	5.18-5.50 soft, locally very soft.	7.60	-4.12	(2.42)
Firm black and dark grey very organic CLAY with wood fragments up to 10mm.	7.71-7.78 interlaminations of sandy silt.	8.05	-4.57	(0.45)
Firm, locally soft, thinly and thickly laminated greyish brown and brownish grey sandy slightly organic CLAY with dustings of silt on laminae and occasional thin and thick laminae (<10mm) of fine sand.		9.00	-5.52	(0.95)
Firm brownish grey, locally mottled black, slightly sandy organic CLAY, locally silt. With plant remains up to 25mm.		10.00	-6.52	(1.00)

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH407**

Borehole Log

Drilled	MR/IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.48 mOD
Logged	RM	02/12/2015	Dando 2000 Cable percussion boring. SPT Hammer ID: TS2, Rod Type: 1 1/2" Whitworth.	0.00 13.30	13.30 28.50	200 150	13.30 27.70	Coordinates (m)	E 509336.02
Checked	TC	End						National Grid	N 428357.42
Approved	TC	16/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)
10.00 - 10.45	UT 23	23 blows 100% rec	8.20	4.90	Soft, locally very soft, locally indistinctly thinly and thickly laminated greyish brown sandy clayey SILT with occasional thin laminae (<3mm) of greyish brown fine to medium sand.		(0.25) 10.25 -6.77
10.50 - 10.95 10.50	UT 25 D 24	50 blows 100% rec	10.40	5.90	Firm brownish grey, locally mottled black, slightly sandy organic CLAY, locally silt. With plant remains up to 25mm.	10.29 pocket (15 x 25mm) of dark orangish brown fine to medium sand. 10.50-11.00 firm to stiff with wood fragments up to 20mm.	(0.75) 11.00 -7.52
11.00 - 11.45 11.00	UT 27 D 26	50 blows 78% rec	10.40	6.20	Firm locally stiff dark brown oxidising to black pseudofibrous PEAT with local wood fragments up to 20mm thick.		(0.40) 11.40 -7.92
11.50 - 11.95 11.50	UT 29 D 28	56 blows 100% rec	11.40	6.50	Interbedded with firm bluish grey mottled black slightly organic CLAY.		
					Firm light brownish grey and greyish brown, locally organic, sandy CLAY. With occasional fragments of wood debris up to 8mm thick.		(0.36) 11.76 -8.28
12.00 - 12.45 12.10	UT 31 D 30	60 blows 100% rec	11.40	6.90	Firm greyish brown and yellowish brown, locally mottled grey, slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of sandstone, quartzite and igneous lithologies.		
12.50 - 12.95 12.50	UT 33 D 32	80 blows 68% rec	12.10	7.50			(1.74)
13.00 - 13.45 13.00	UT 35 D 34	95 blows 80% rec	12.10	8.50		13.00-13.36 locally stiff. 13.12-13.23 gravelly.	13.50 -10.02
13.50 - 13.95 13.50	UT 37 D 36	110 blows 100% rec	13.30	9.70	Stiff, locally very stiff, greyish brown, locally yellowish brown, slightly sandy slightly gravelly CLAY. Gravel subangular to subrounded fine to coarse sandstone, quartzite, chalk and igneous lithologies.	13.60-13.71 sandy.	
14.00 - 14.45 14.00	UT 39 D 38	120 blows 80% rec	13.30	10.20			(1.50)
14.50 - 14.95 14.50	UT 41 D 40	120 blows 93% rec	13.30	10.70			
15.00 - 15.45 15.00	UT 43 D 42	110 blows 100% rec	14.90	11.30	Stiff locally indistinctly thinly and thickly laminated greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium, occasionally coarse of sandstone, quartzite, chalk and igneous lithologies.		15.00 -11.52
			11/12/15 14.90 ~~15.20~~ 14/12/15 14.90	0500 11.30 ~~9.70~~ 1900 9.70			
15.50 - 15.95 15.50	UT 45 D 44	120 blows 56% rec					(1.00)
16.00 - 16.45 16.00	UT 47 D 46	120 blows 78% rec	15.20	10.50	Stiff to very stiff indistinctly thinly and thickly laminated, fissured, greyish brown CLAY with occasional dustings of yellowish brown fine sand on laminae surfaces. Fissures are extremely closely spaced, randomly orientated, occasionally polished with occasional dustings of grey silt.		16.00 -12.52 (0.58)
16.50 - 16.95 16.50	UT 49 D 48	100 blows 100% rec	16.40	10.90	Indistinctly thinly laminated greyish brown and yellowish brown slightly clayey fine to medium SAND with occasional thin laminae of firm clay.		16.58 -13.10 (0.42)
17.00 - 17.45 17.00	UT 51 D 50	100 blows 89% rec	16.40	11.10	Stiff thinly and thickly, locally indistinctly, laminated, fissured, greyish brown CLAY with occasional dustings and very closely spaced thin laminae of yellowish brown silt and fine sand. Fissures are extremely closely spaced randomly orientated, occasionally polished.	17.15 with rare subrounded fine gravel of chalk along laminae. 17.50-17.65 firm.	17.00 -13.52
17.50 - 17.95 17.50	UT 53 D 52	100 blows 78% rec	16.40	11.60			(1.50)
18.00 - 18.45 18.00	UT 55 D 54	100 blows 100% rec	17.80	12.10			
18.50 - 18.95 18.50	UT 57 D 56	100 blows 100% rec	17.80	12.50	Stiff thinly and thickly, locally indistinctly, laminated greyish brown and brownish grey CLAY with dustings and extremely closely to very closely spaced thin laminae (<5mm) of yellowish brown silt and fine to medium sand.	18.40-18.45 with extremely closely spaced laminae of sand. 18.50-18.95 locally very closely fissured, occasionally polished.	18.50 -15.02
19.00 - 19.45 19.00 19.00 - 19.50	UT NR D 58 B 59	95 blows No Recovery	18.80	13.10			(1.50)
19.50 - 19.95	UT 60	100 blows 89% rec	18.80	13.70		19.54 becoming with rare gravel of chalk and flint.	
					Hole continues on next sheet	~~20.00-20.45 locally~~ firm.	~~20.00 -16.52~~

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Borehole
Project No.	A5085-15	BH407
Carried out for	Balfour Beatty Limited	Sheet 2 of 3

Borehole Log

Drilled	MR/IT	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.48 mOD
Logged	RM	02/12/2015	Dando 2000 Cable percussion boring. SPT Hammer ID: TS2, Rod Type: 1 1/2" Whitworth.	0.00 13.30	13.30 28.50	200 150	13.30 27.70	Coordinates (m)	E 509336.02
Checked	TC	End						National Grid	N 428357.42
Approved	TC	16/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)
20.00 - 20.45 20.00	UT 62 D 61	100 blows 89% rec	18.80	14.10	Stiff thinly and thickly laminated brown and greyish brown CLAY with frequent dustings and thin laminae (<6mm) of light brown silt along laminae.		
20.50 - 20.95 20.50 20.50 - 20.95 20.50 - 21.00	SPTS D 63 D 64 B 65	N=27 (3,5/5,7,7,8)	20.40	14.80			
21.00 - 21.45	UT 66	100 blows 100% rec	20.40	15.00		21.22-21.28 indistinctly laminated.	
21.50 - 21.95 21.50 21.50 - 21.95 21.50 - 22.00	SPTS D 67 D 68 B 69	N=29 (4,6/6,7,7,9)	21.40	15.50			(3.50)
22.00 - 22.45	UT 70	95 blows 100% rec	21.40	15.80		22.13 with rare gravel of flint.	
22.50 - 22.95 22.50 22.50 - 22.95 22.50 - 23.00	SPTS D 71 D 72 B 73	N=29 (5,5/6,6,8,9)	22.40	16.10			
23.00 - 23.45 23.00 - 23.50	UT NR B 74	80 blows No Recovery	22.40	16.30			
23.50 - 23.95	UT 75	100 blows 89% rec	22.40	16.50	Firm to stiff thinly and thickly laminated, locally cross laminated, greyish brown CLAY with dustings of light greyish brown silt and fine sand on laminae surfaces. Closely spaced thin and thick laminae (<10mm) of dark brown and light brown silt and fine sand.		23.50 -20.02 (0.50)
24.00 - 24.45 24.00 24.00 - 24.45 24.00 - 24.50	SPTS D 76 D 77 B 78	N=35 (5,8/8,8,9,10)	23.90	16.70	Stiff indistinctly thinly and thickly laminated locally indistinctly fissured greyish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine of chalk.		24.00 -20.52 (0.50)
24.50 - 24.95	UT 79	100 blows 100% rec	23.90	17.10	Firm to stiff indistinctly laminated dark orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine of chalk and rarely flint. Thinly interbedded with orangish brown, locally dark grey / black, slightly clayey fine to medium SAND.		24.50 -21.02
			14/12/15 23.90 ~~24.90~~	0500 17.10 ~~9.70~~			
25.00 - 25.45 25.00 25.00 - 25.45 25.00 - 25.50	SPTS D 80 D 81 B 82	N=27 (3,4/6,6,7,8)	15/12/15 24.90	1900 9.70			(1.50)
25.50 - 25.95 25.50 - 26.00	UT NR B 83	65 blows No Recovery	24.90	10.10			
26.00 - 26.45 26.00 - 26.50	SPTC B 84	N=32 (4,7/7,8,8,9)	25.95	10.60	Greyish brown and cream clayey sandy subrounded fine to coarse GRAVEL of chalk, with medium cobble content. Gravel and cobbles are weak to medium strong, medium density. With rare cobbles of flint.		26.00 -22.52
26.50 - 27.00	B 85						(1.50)
27.00 - 27.45 27.00 - 27.50	SPTC B 86	N=36 (5,7/8,9,9,10)	26.90	8.50			
					Structureless CHALK composed of cream gravelly COBBLES. Gravel is angular to subangular fine to coarse of chalk and rare flint. Cobbles are subangular weak to medium strong, low to medium density, occasionally stained orangish brown.		27.50 -24.02 (1.00)
28.00 - 28.43 28.00 - 28.50	SPTC B 87	50 (7,10/10,12,15,13 for 58mm)	27.70	8.60			
			15/12/15	0500			
					END OF EXPLORATORY HOLE		28.50 -25.02

Legend / Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used
28.10 - 28.50	60	

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project: A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No.: A5085-15

Carried out for: Balfour Beatty Limited

Borehole: **BH407**

Borehole Log

Drilled	JB/SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.61 mOD
Logged	RM	30/11/2015	Dando 175 Cable percussion boring Hammer ID: 024, Rod Type: 1 1/2 Whitworth., Hammer ID: 02, Rod Type: 1 1/2 Whitworth.	0.00 20.00	20.00 26.30	200 150	20.00 25.50	Coordinates (m)	E 509360.27
Checked	TC	End						National Grid	N 428406.49
Approved	TC	10/12/2015							

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
		0.00-1.20 Hand excavated inspection pit.	01/12/15	1900
1.40 - 1.85 1.40 - 1.85 1.40 - 2.00	SPTS D 1 B 2	N=9 (1,2/2,3,2,2)		
2.00 - 2.45	UT 3	21 blows 89% rec	2.00	dry
2.45 - 2.65	D 4			
2.70 - 3.15	UT 5	12 blows 89% rec	2.50	dry
3.15 - 3.35	D 6			
3.35 - 3.80	UT 7	10 blows 89% rec	3.30	dry
3.80 - 4.00	D 8			
4.00 - 4.45	UT 9	12 blows 89% rec	4.00	dry
4.45 - 4.65	D 10			
			01/12/15 4.90	0500
4.90 4.90 - 5.90	ES 12 P 11	100% rec	03/12/15 4.90	1900
6.00 - 6.45	UT 13	16 blows	6.00	dry
6.45 - 6.65	D 14			
6.70 - 7.15	UT 15	19 blows 80% rec	6.70	dry
7.15 - 7.35	D 16			
7.40 - 7.85	UT 17	27 blows	7.40	dry
7.85 - 8.05	D 18			
8.05 - 9.05	P 19	90% rec		
9.05 - 10.05	P 20	100% rec		

Strata Description

Main	Detail	Depth	Level	(Thickness)
MACADAM and CONCRETE. No samples available. (MADE GROUND)		1.40	+2.21	(1.40)
Firm indistinctly fissured orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse of concrete, brick and chalk. Fissures are extremely closely spaced, randomly orientated, locally polished. (MADE GROUND)	2.00-2.45 stiff, locally indistinctly laminated.	2.45	+1.16	(1.05)
Firm to stiff indistinctly thinly and thickly laminated, locally indistinctly fissured, dark orangish brown slightly sandy silty CLAY with occasional relict root tracks infilled reddish brown and grey. Fissures are randomly orientated.		3.05	+0.56	(0.60)
Firm thinly and thickly, locally indistinctly, laminated dark orangish brown slightly sandy silty organic CLAY.		3.42	+0.19	(0.37)
Greyish brown and brown slightly clayey subangular to subrounded fine to coarse GRAVEL of limestone, quartzite and flint.		3.55	+0.06	(0.13)
Firm indistinctly thinly and thickly laminated dark greyish brown and dark grey slightly sandy silty organic CLAY. Rare orangish brown discolouration adjacent to laminae.	4.00-4.40 locally soft.	4.60	-0.99	(1.05)
Soft locally firm indistinctly thinly and thickly laminated, fissured, dark brownish grey slightly sandy silty organic CLAY with rare rootlets up to 2mm. Locally oxidising to brown. Fissures are extremely closely spaced randomly orientated.	6.70 becoming firm, locally soft, with occasional dustings of orangish brown silt and fine sand on laminae surfaces. 6.85 becoming with extremely closely to very closely spaced thin and thick laminae of fine sand. Locally interlaminated SAND and CLAY.	8.05	-4.44	(3.45)
Firm indistinctly thinly and thickly laminated dark grey, locally greyish brown, slightly sandy silty CLAY.	8.27-8.78 thinly and thickly interlaminated with dark grey and greyish brown silty fine to medium SAND. 8.78-9.05 more distinctly laminated, and with thin and thick laminae of silty fine to medium sand.	9.05	-5.44	(1.00)
Firm indistinctly thinly and thickly laminated greyish brown and brownish grey sandy silty CLAY with occasionally thick laminae of silt and fine to medium sand.	9.50-10.05 interlaminated with fine to medium sand, locally cross laminated.			(1.50)

Hole continues on next sheet

Groundwater Entries No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks Depths (m)	Remarks

Hard Boring Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH408**

Borehole Log

Drilled	JB/SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.61 mOD
Logged	RM	30/11/2015	Dando 175 Cable percussion boring Hammer ID: 024, Rod Type: 1 1/2 Whitworth., Hammer ID: 02, Rod Type: 1 1/2 Whitworth.	0.00 20.00	20.00 26.30	200 150	20.00 25.50	Coordinates (m)	E 509360.27
Checked	TC	End						National Grid	N 428406.49
Approved	TC	10/12/2015							

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
10.10 - 10.55	UT 21	13 blows 67% rec	10.00	8.50
10.55 - 10.75	D 22			
10.80 - 11.25	UT 23	16 blows 90% rec	10.80	8.90
11.25 - 11.45	D 24			
11.50 - 11.95 11.50	UT 25 W 27	29 blows 44% rec	11.25	6.25
11.95 - 12.15	D 26			
12.15 - 12.52 12.15 - 12.60 12.15 - 12.60	SPTS D 28 B 29	8 (4,2/2,3,3 for 75mm)	12.00	7.65
12.60 - 13.05	UT 30	27 blows 65% rec	12.60	7.60
13.05 - 13.25	D 31			
13.25 - 13.70 13.25 - 13.70	UT NR B 33	32 blows No Recovery	~~13.00~~ 07/12/15 13.50 03/12/15 ~~13.00~~	~~7.83~~ 1900 4.10 0500 ~~7.83~~ 6.00
13.70 - 14.15	UT 34	59 blows 89% rec		
14.15 - 14.60	UT 35	61 blows 100% rec		
14.60 - 14.80	D 36			
14.80 - 15.25	UT 37	49 blows		
15.25 - 15.45	D 38			
15.45 - 15.90	UT 39	69 blows 100% rec		
15.90 - 16.10	D 40			
16.10 - 16.55	UT 41	58 blows 100% rec		
16.55 - 16.75	D 42			
16.75 - 17.20	UT 43	63 blows 89% rec		
17.20 - 17.40	D 44			
17.40 - 17.85	UT 45	61 blows 100% rec		
17.85 - 18.05	D 46			
18.05 - 18.50	UT 47	59 blows 100% rec		
18.50 - 18.70	D 48			
18.70 - 19.15	UT 49	56 blows 100% rec		
19.15 - 19.35	D 50			
19.35 - 19.80	UT 51	48 blows 51% rec		
19.80 - 20.00	D 52		07/12/15 13.50	0500 6.00

Strata Description

Main	Detail	Depth, Level (Thickness)
	10.10-10.40 frequent pockets (10 x 15mm) of orangish brown fine to medium sand.	
Soft, locally very soft, dark grey slightly sandy clayey organic SILT.		10.55 -6.94 (0.35)
Dark grey and greyish brown clayey fine to coarse SAND with rare subangular fine to medium gravel of quartzite and frequent shell fragments.	10.90-11.10 mottled orangish brown, slightly organic. 11.75 becoming greyish reddish brown.	10.90 -7.29 (1.10)
Firm dark greyish brown very sandy silty CLAY.		12.00 -8.39 (0.40)
Firm black, oxidised to dark brown, pseudo fibrous PEAT. With wood fragments up to 20mm,		12.40 -8.79 (0.85)
Stiff, locally firm, dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded fine to coarse of chalk, sandstone and igneous lithologies.	14.15-14.60 firm. 14.20-14.30 grey. 15.45-15.90 locally very stiff. 15.70-15.90 grey infill to indistinct irregular fissures.	13.25 -9.64 (2.96)
Stiff, locally very stiff, indistinctly fissured, greyish brown silty CLAY with frequent dustings of light brown silt and fine sand on fissures surfaces. Fissures are extremely closely to very closely spaced, randomly orientated, occasionally polished.	16.75-17.20 locally stiff, occasionally indistinctly thinly and thickly laminated.	16.21 -12.60 (2.14)
Stiff thinly and thickly laminated greyish brown silty CLAY with frequent dustings of orangish brown sand on laminae surfaces.	18.43 with rare gravel of chalk.	18.35 -14.74 (0.40)
Stiff fissured, indistinctly thinly and thickly laminated, greyish brown silty CLAY with occasional dustings and thin laminae (<3mm) of orangish brown silt on laminae surfaces. Fissures are extremely closely spaced, randomly orientated.	18.70 with thin laminae (<2mm) of fine to medium sand. 19.52 thin lamination (3mm) of orangish brown fine to medium sand.	18.75 -15.14 (1.05)
Stiff, locally firm, thinly and thickly laminated		19.80 -16.19
Hole continues on next sheet	20.00-20.45 with rare subrounded fine gravel of chalk.	

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
	10.05	Rose to 8.50 m after 20 minutes.	

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Borehole
Project No.	A5085-15	BH408
Carried out for	Balfour Beatty Limited	Sheet 2 of 3

Borehole Log

ESG

Drilled	JB/SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.61 mOD
Logged	RM	30/11/2015	Dando 175 Cable percussion boring Hammer ID: 024, Rod Type: 1 1/2 Whitworth., Hammer ID: 02, Rod Type: 1 1/2 Whitworth.	0.00 20.00	20.00 26.30	200 150	20.00 25.50	Coordinates (m)	E 509360.27
Checked	TC	End						National Grid	N 428406.49
Approved	TC	10/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
20.00 - 20.45 20.00 20.00 - 20.45	SPTS W 53 D 54	N=19 (3,4/4,5,5,5)	20.00 08/12/15 13.50	12.10 1900 8.90	greyish brown CLAY with frequent dustings of silt on laminae surfaces and thin laminae of orangish brown, locally black, fine sand.				
20.45 - 20.90 20.45 - 20.90	UT NR B 55	No Recovery	20.00	11.45					
20.90 - 21.35 20.90 - 21.35	SPTS D 56	N=19 (3,4/5,4,5,5)	20.00	11.40					
21.35 - 21.80	UT 57	79 blows 100% rec	21.00	11.05		21.35-21.40 indistinctly laminated.	(3.75)		
21.80 - 22.00	D 58								
22.00 - 22.45 22.00 - 22.45	SPTS D 59	N=20 (3,4/4,5,5,6) 22.00-22.45 S&D record unavailable	22.00	11.00					
22.45 - 22.90	UT 60	71 blows 100% rec	22.00	11.00		22.45-22.90 with thin and thick laminae (<10mm) of orangish brown fine sand.			
22.90 - 23.10	D 61					22.59 steeply inclined polished fissure.			
23.10 - 23.55 23.10 - 23.55 23.10 - 23.55	SPTS D 62 B 63	N=18 (3,3/5,4,5,4)	23.00	10.90		22.65 with rare gravel of chalk.			
23.55 - 24.00	UT 64	67 blows 100% rec	23.00	5.00	Firm to stiff thinly and thickly laminated dark orangish brown sandy gravelly CLAY. Gravel is subangular fine to coarse of chalk with occasional pockets of dark grey and black sand.		23.55 -19.94 (0.40)		
24.00 - 24.20	D 65						23.95 -20.34		
24.20 - 24.65 24.20 - 24.65	SPTS D 66	N=39 (4,4/4,8,12,15)	24.00 08/12/15 24.00 09/12/15 24.00	5.00 0500 5.00 1900 6.40	Structureless CHALK composed of greyish brown sandy silty subangular fine to coarse GRAVEL. Gravel is very weak to weak, low density.				
25.00 - 25.45 25.00 - 25.50	SPTC B 68	N=33 (6,5/7,7,9,10)	25.00	6.40			(2.35)		
25.50 - 25.88 25.50 - 26.00	SPTC B 69	54 (9,10/15,17,22 for 75mm)	25.50	6.40					
26.00 - 26.29	SPTC	60 (9,18/22,38 for 65mm)	25.50 09/12/15	6.40 0500					
					END OF EXPLORATORY HOLE		26.30 -22.69		

Groundwater Entries				Depth Related Remarks		Hard Boring		
No.	Depth Strike (m)	Remarks	Depth Sealed (m)	Depths (m)	Remarks	Depths (m)	Duration (mins)	Tools used
						25.60 - 26.00	60	

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Borehole BH408

Borehole Log

Drilled	SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	5.08 mOD
Logged	RM	15/12/2015	Dando 175	0.00	10.15	150	9.50	Coordinates (m)	E 510051.72
Checked	TC	End	Cable percussion boring					National Grid	N 428444.47
Approved	TC	16/12/2015	Hammer ID: 02, Rod Type: 1 1/2 Whitworth.						

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)
		0.00-1.20 Hand excavated inspection pit.			TOPSOIL		0.20 +4.88 (0.20)
0.70	ES 1				Greyish brown sandy gravelly CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse of chalk, limestone, brick and igneous lithologies. Cobbles are angular to subrounded chalk, brick, clay pipe and roof slate. (MADE GROUND)		(1.00) 1.20 +3.88
1.20 - 1.65 1.20 - 1.65 1.20 - 2.00	SPTS D 2 B 3	N=10 (2,3/3,2,3,2)		dry	Loose to medium dense dark brown sandy clayey GRAVEL with low cobble content. Gravel is subangular to subrounded fine to coarse of mortar, brick, concrete and chalk. Cobbles are subangular brick. (MADE GROUND)		(1.10) 2.30 +2.78
2.00 - 2.45 2.00 - 2.45 2.00 - 2.45	SPTS D 4 B 5	N=7 (2,1/3,2,1,1)	1.50	dry			
2.45 - 2.90 2.45 - 2.90 2.45 - 2.90	SPTS B 7 D 6	N=8 (2,2/2,2,2,2)	2.40	dry	Firm indistinctly thinly and thickly laminated orangish brown slightly sandy silty CLAY with rare angular to subangular medium to coarse gravel os mortar and brick. (MADE GROUND)	2.50-3.55 Relict root tracks infilled light grey and black.	(0.30) 2.60 +2.48
2.90 - 3.35	UT 8	21 blows 84% rec	2.90	dry	Firm indistinctly thinly and thickly laminated, indistinctly fissured, orangish brown, mottled grey, slightly sandy CLAY. With very closely spaced thin laminae (<3mm) of light brown fine sand. Fissures are very closely spaced randomly orientated.		(1.60) 4.20 +0.88
3.35 - 3.55	D 9						
3.55 - 4.00	UT 10	32 blows 3.55-4.10 S&D record unavailable	3.55	dry			
4.00 - 4.20	D 11						
4.20 - 4.65	UT 12	31 blows	4.20	dry	Firm thinly and thickly, locally indistinctly, laminated dark orangish brown slightly sandy CLAY with occasional dustings of light orangish brown fine sand on laminae surfaces.		(0.80) 5.00 +0.08
4.65 - 4.85	D 13						
4.85 - 5.25	UT 14	28 blows 100% rec	4.85	damp			
5.25 - 5.45	D 15		14/12/15 4.85	0500 damp	Soft thinly and thickly laminated greyish brown and dark grey slightly sandy silty organic CLAY, with dustings and closely spaced laminae of light brown silt.	5.00-5.25 locally firm.	(2.75) 7.75 -2.67
5.45 - 5.90 5.45 - 5.90	UT NR B 16	20 blows No Recovery	15/12/15 4.85	2000 2.40			
6.00 - 7.00	P 17	100% rec 75Psi				6.00-7.00 occasional vertical rootlet tracks infilled with organic material. 6.05 subvertical fissure infilled with organic material, strong odour.	
7.00 - 7.50	B 18						
7.50 - 7.95	UT 19	21 blows	7.00	damp			
7.95 - 8.15	D 20				Soft locally firm indistinctly thinly and thickly laminated dark brownish grey slightly sandy clayey organic SILT.		(0.25) 8.00 -2.92
8.15 - 8.50	B 21				Firm indistinctly thinly and thickly laminated dark grey and dark greyish brown slightly sandy silty slightly organic CLAY. Locally oxidised brown adjacent to laminae.		(2.15)
8.50 - 8.95	UT 22	22 blows 71% rec	8.50	damp		8.50-8.82 locally slightly sandy clayey silt.	
8.95 - 9.15	D 23						
9.15 - 9.50	B 24						
9.50 - 9.95	UT 25	24 blows 9.50-9.95 S&D record unavailable	9.50	damp			
9.95 - 10.15	D 26		15/12/15 9.50	0500 damp			

Hole continues on next sheet

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
	10.00	Rose to 3.60 m after 20 minutes.	

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **BH417**

Borehole Log

ESG

Drilled	SS	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	5.08 mOD
Logged	RM	15/12/2015	Dando 175 Cable percussion boring Hammer ID: 02, Rod Type: 1 1/2 Whitworth.	0.00	10.15	150	9.50	Coordinates (m)	E 510051.72
Checked	TC	End						National Grid	N 428444.47
Approved	TC	16/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
					END OF EXPLORATORY HOLE		10.15 -5.07		

Groundwater Entries			
No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks	
Depths (m)	Remarks

Hard Boring		
Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole

BH417

Split Tube Sample Description

Borehole No	BH402
Sample No	6
Sample Depth, mBGL	2.45 - 2.90
Sample Type	UT

Description

2.45 - 2.71m:
Soft, locally firm, indistinctly thinly and thickly laminated, indistinctly fissured brown, CLAY. With dustings of light brown silt on laminae surfaces. Fissures closely spaced randomly orientated. Occasional lenses up to 3mm of light brown fine sand.

2.71 - 2.90m:
Sample unavailable due to lab tests.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	9		
Sample Depth, mBGL	3.75	-	4.75
Sample Type	P		

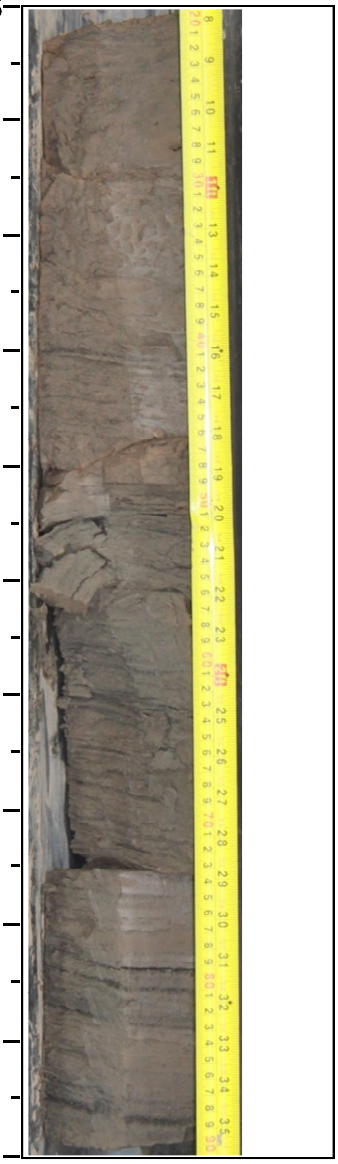
Description

3.75 - 3.90m:
Greyish brown sandy clayey SILT.

3.90 - 4.55m:
Thinly and thickly laminated greyish brown sandy clayey SILT with occasional interlaminations of firm clay. Frequent thin laminae of dark grey fine to medium, locally coarse, sand.

4.55 - 4.75m:
No recovery

3.75



4.75

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

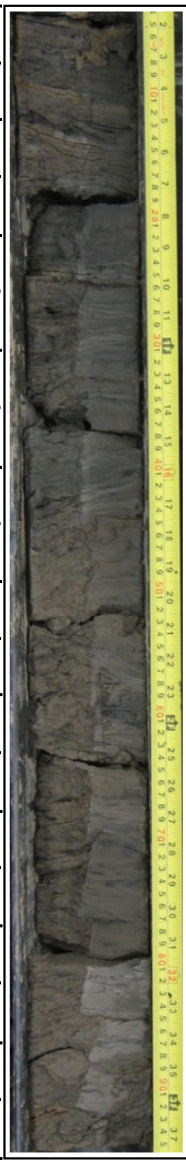
Borehole No	BH402		
Sample No	10		
Sample Depth, mBGL	4.75	-	5.75
Sample Type	P		

Description

4.75 - 5.75m:
Soft, locally firm, indistinctly thinly and thickly laminated, dark brownish grey, slightly sandy clayey organic SILT.

4.75 - 4.85m, with very closely spaced thin laminae (<5mm) of brownish grey fine to medium sand.

4.75



5.75

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	13		
Sample Depth, mBGL	6.40	-	7.40
Sample Type	P		

Description

6.40 - 7.03m:
Soft locally firm, indistinctly thinly and thickly laminated greyish brown and brown slightly sandy clayey SILT with occasional dustings of dark grey silt along laminae surfaces. With very closely spaced thin laminae (<5mm) of dark orangish brown fine to medium sand.

6.40

7.40

7.03 - 7.17m:
Dark orangey brown and grey brown fine to medium sand with occasional thin laminations of grey brown clay.

7.17 - 7.40m:
No recovery.

Remarks:

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth **BH402**

Split Tube Sample Description

Borehole No	BH402		
Sample No	14		
Sample Depth, mBGL	7.40	-	8.40
Sample Type	P		

Description

7.4 - 7.43m:
Grey fine to medium sand.
7.43 - 8.25m:
Firm indistinctly thinly laminated dark brown very organic CLAY.
With frequent plant remains up to 20mm.

7.40

8.40

8.25 - 8.40m:
No recovery

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	16		
Sample Depth, mBGL	8.40	-	8.85
Sample Type	UT		

Description

8.40 - 8.78m:
Brownish grey and brown sandy to very sandy SILT.

8.63 - 8.78m:
Slightly clayey. Slightly organic.
8.67m - 1No:
Flattened plant debris 60 x 4mm.

8.78 - 8.85m:
Sample unavailable due to lab testing.

8.40

8.85

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	20		
Sample Depth, mBGL	9.65	-	10.10
Sample Type	UT		

Description

9.65 - 10.10m:
Stiff, locally firm to stiff greyish brown locally mottled dark yellowish brown and grey, slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithology.

9.65

10.10

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	22		
Sample Depth, mBGL	10.30	-	10.75
Sample Type	UT		

Description

10.30 - 10.75m:
Very stiff brown locally grey slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk, flint and quartzite. Occasional carbonaceous relict rootlet tracks.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	24		
Sample Depth, mBGL	10.95	-	11.40
Sample Type	UT		

Description

10.95 - 11.40m:
Very stiff brown, locally greyish brown, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, quartzite and sandstone.

10.95

11.40

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	26		
Sample Depth, mBGL	11.60	-	12.05
Sample Type	UT		

Description

11.60 - 12.05m:
Very stiff indistinctly thinly and thickly laminated greyish brown slightly sandy CLAY with rare subangular to subrounded, predominantly fine to medium, gravel of chalk igneous material.
Detail - 11.60 - 11.67m:
Extremely closely spaced thin laminae (<4mm) of orangish brown fine to medium sand.

11.60

12.05

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	28		
Sample Depth, mBGL	12.25	-	12.70
Sample Type	UT		

Description

12.25 - 12.48m:
Firm to stiff indistinctly thinly to thickly laminated light greyish brown slightly sandy slightly gravelly CLAY.
Gravel is subrounded to subangular fine to coarse sandstone, igneous material occasional chalk.

12.45m:
Subrounded cobble of sandstone

12.48 - 12.70m:
Very stiff greyish brown slightly sandy slightly gravelly, locally gravelly CLAY.
Gravel is subrounded to subangular fine to coarse sandstone, chalk and igneous material.

12.25

12.70

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	30		
Sample Depth, mBGL	13.30	-	13.75
Sample Type	UT		

Description

13.30 - 13.65m:
Stiff locally indistinctly thinly and thickly laminated, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and quartzite with occasional igneous material. Occasional steeply inclined fissures, locally polished.

13.30

13.75

13.65 - 13.75m:
No sample available due to lab testing.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	32		
Sample Depth, mBGL	13.95	-	14.40
Sample Type	UT		

Description

13.95 - 14.33m:
Stiff locally indistinctly thinly and thickly laminated, locally indistinctly fissured brown and greyish brown CLAY with occasional dustings and thin laminae (<2mm) of light brown silt. Fissures extremely closely to very closely spaced, randomly orientated, occasionally polished.

13.95

14.40

14.33 - 14.40m:
No recovery

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	34		
Sample Depth, mBGL	14.60	-	15.05
Sample Type	UT		

Description

14.60 - 15.05m:
Stiff, thinly and thickly laminated, locally cross laminated, greyish brown and light brown CLAY with dustings of light greyish brown silt on laminae surfaces. Extremely closely and closely spaced thin laminae (<2mm) of light greyish brown silt.

14.60

15.05

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	36		
Sample Depth, mBGL	15.25	-	15.70
Sample Type	UT		

Description

15.25 - 15.70m:
Stiff, locally very stiff, thinly and thickly laminated greyish brown CLAY with occasional dusting of light brown silt along laminae surfaces.

15.47m:
Subvertical polished fissured surface.

15.63m:
Rare subrounded fine gravel of chalk along laminae surfaces.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	38		
Sample Depth, mBGL	15.90	-	16.35
Sample Type	UT		

Description

15.90 - 16.35m:
Stiff thinly and thickly laminated indistinctly fissured, greyish brown CLAY with occasional dustings of light brown silt along laminae surfaces. Fissures are very closely to closely spaced, steeply inclined, occasionally polished.

15.90

16.35

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	40		
Sample Depth, mBGL	16.55	-	17.00
Sample Type	UT		

Description

16.55 - 17.00m:
Stiff locally thinly and thickly laminated, locally indistinctly fissured, greyish brown CLAY. With very closely spaced thin laminae (<4mm) of orangish brown fine to medium sand. Fissures are extremely closely spaced, randomly orientated.

16.87 - 16.93m:
With rare subangular to subrounded fine to medium gravel of chalk.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	42		
Sample Depth, mBGL	17.20	-	17.65
Sample Type	UT		

Description

17.20 - 17.65m:
Stiff indistinctly thinly and thickly laminated, indistinctly fissured, greyish brown CLAY with occasional dustings and thin laminae (<1mm) of orangish brown and light brown fine sand and silt. Rare subangular to subrounded gravel of chalk. Fissures are extremely closely spaced and randomly orientated.
17.22m:
60 degree inclined fissure, planar, rough.

17.44m:
Parting up to 5mm of light brown sand.

17.20

17.65

Remarks:

Notes:

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
Project No.	A5085-15	BH402
Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	44		
Sample Depth, mBGL	17.85	-	18.30
Sample Type	UT		

Description

17.85 - 18.30m:
Stiff indistinctly thinly to thickly laminated locally indistinctly fissured greyish brown CLAY. Fissures extremely closely spaced randomly orientated.
17.88m:
Subangular coarse gravel of chalk.

18.01 - 18.18m:
Extremely close to very close spaced thin and thick laminae (<9mm) of orangish brown fine to medium sand.
18.04 - 18.15m:
Rare subangular to subrounded fine to medium gravel of chalk.

17.85

18.30

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	46		
Sample Depth, mBGL	18.50	-	18.95
Sample Type	UT		

Description

18.50 - 18.95m:
Stiff indistinctly thinly to thickly laminated indistinctly fissured greyish brown CLAY. Fissures are extremely closely to very closely spaced and randomly orientated.

Detail 18.78 - 18.85m:
With occasional thin laminae (<2mm) of orangish brown silty fine to medium sand.

18.85 - 18.95m:
No recovery

18.50

18.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	48		
Sample Depth, mBGL	19.10	-	19.55
Sample Type	UT		

Description

19.10 - 19.20m:
Stiff indistinctly fissured greyish brown CLAY.

19.20 - 19.55m:
Stiff thinly and thickly laminated greyish brown CLAY with frequent dustings and thin laminae (<4mm) and dustings of light brown silt and orangish brown fine to medium sand.
19.12m:
Subrounded medium gravel of chalk
19.20 - 19.33m:
Indistinctly laminated
19.25m:
Angular coarse gravel of flint.

19.10

19.55

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH402		
Sample No	50		
Sample Depth, mBGL	19.75	-	20.20
Sample Type	UT		

Description

19.75 - 20.20m:
Stiff thinly to thickly, locally cross, laminated greyish brown CLAY with frequent dustings and thin laminae (<3mm) of light brown silt and fine to medium orangish brown sand.

19.75

20.20

Detail:
19.98 - 20.13m:
Rare subangular to subrounded fine to coarse gravel of chalk.

20.05m:
Thick lamination (8mm) of orangish brown fine to medium sand.

20.11 - 20.13m:
Thick lamination (20mm) of orangish brown fine to medium sand.
20.13 - 20.20m:
Slightly gravelly. Gravel is subangular to subrounded fine to medium of chalk.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH402
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	4		
Sample Depth, mBGL	1.65	-	2.10
Sample Type	UT		

Description

1.65 - 1.90m:
Firm orangish brown indistinctly thinly and thickly laminated silty CLAY. Occasional dustings of light brown and grey silt on laminae surfaces.

1.65 - 1.81m:
Locally mottled dark brownish orange and grey. Frequent relic rootlet tracks infilled grey.

1.90 - 2.10m:
No recovery

1.65

2.10

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	6		
Sample Depth, mBGL	2.30	-	2.75
Sample Type	UT		

Description

2.30 - 2.63m:
Firm indistinctly thinly to thickly laminated orangish brown and brown slightly sandy silty CLAY with frequent dustings of grey silt and orangish brown fine sand on laminae surfaces.

2.40 - 2.48m:
Locally soft.

2.63 - 2.75m:
No recovery.

2.30

2.75

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	8		
Sample Depth, mBGL	2.95	-	3.40
Sample Type	UT		

Description

2.95 - 3.25m:
Firm orangish brown, locally mottled dark brown, slightly sandy silty CLAY.

3.25 - 3.30m:
Firm locally soft, indistinctly thinly and thickly laminated dark greysilty CLAY. With occasional dusting of light brown fine sand on laminae surfaces.

3.30 - 3.40m:
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	10		
Sample Depth, mBGL	3.60	-	4.60
Sample Type	P		

Description

3.60 - 4.60m
Soft, locally firm, thinly and thickly locally indistinctly, laminated greyish brown oxidised brown silty slightly organic CLAY with occasional dustings of grey silt along laminae surfaces.
3.60 - 3.80m Locally dark grey.

3.60

4.60

4.48 - 4.60m
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

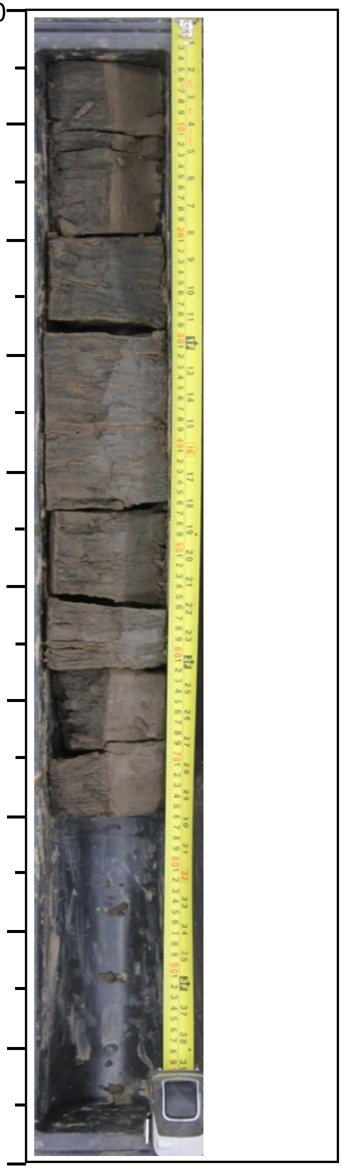
Borehole No	BH403		
Sample No	P12		
Sample Depth, mBGL	5.00	-	6.00
Sample Type	UT		

Description

5.00 - 5.75m:
Soft, locally firm, indistinctly thinly and thickly laminated greyish brown and dark grey, silty, slightly organic CLAY. With dustings of silt on laminae surface and very closely spaced thin laminae (<2m) of light brown fine sand.

5.75 - 6.00m:
No recovery.

5.00



6.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	14		
Sample Depth, mBGL	7.00	-	8.00
Sample Type	P		

Description

7.00 - 7.80m:
Soft to firm thinly to thickly interlaminated greyish brown silty CLAY and fine to medium SAND.

Detail:
7.00 - 7.10m:
Strong organic odour.
7.05 - 7.08m:
Grey.

7.63 - 7.80m:
Locally interlaminated grey.

7.80 - 8.00m:
No recovery

7.00

8.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	18		
Sample Depth, mBGL	8.65	-	9.10
Sample Type	UT		

Description

8.65 - 8.79m:
Greyish brown, clayey, silty, fine to medium SAND.

8.79 - 9.00m:
Soft to firm thinly to thickly interlaminated greyish brown, silty CLAY and greyish brown fine to medium SAND.

9.00 - 9.10m:
No recovery

8.65

9.10

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	22		
Sample Depth, mBGL	9.95	-	10.40
Sample Type	UT		

Description

9.95 - 10.40m:
Stiff, locally very stiff, indistinctly laminated, dark brown, locally mottled brown, slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse, of chalk, flint, sandstone and igneous lithologies. With local dark reddish brown relict root tracks, up to 2mm, associated with grey mottling.

9.95

10.40

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	24		
Sample Depth, mBGL	10.60	-	11.05
Sample Type	UT		

Description

10.60 - 11.05m:
Stiff locally, very stiff, indistinctly laminated brown and greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to course of chalk, sandstone and igneous lithologies. Occasional grey infill to laminae surfaces.

10.97m:
1N^{o} subrounded cobble of quartzite.

10.60

11.05

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	27		
Sample Depth, mBGL	11.90	-	12.35
Sample Type	UT		

Description

11.90 - 12.35m:
Very stiff brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and quartzite.

12.23 - 12.35m:
Sample unavailable due to lab testing.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	29		
Sample Depth, mBGL	12.55	-	13.00
Sample Type	UT		

Description

12.55 - 13.00m:
Stiff, locally very stiff, brownish grey and brown slightly sandy, slightly gravelly CLAY.
Gravel is subangular to subrounded fine to coarse sandstone, quartzite, igneous lithologies and occasional chalk.

12.55

13.00

12.94m:
1N^{o} subrounded sandstone cobble.

Remarks:

Notes:

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
Project No.	A5085-15	BH403
Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	32		
Sample Depth, mBGL	13.85	-	14.20
Sample Type	UT		

Description

13.85 - 14.20m:
Stiff, locally indistinctly laminated, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, flint, sandstone and quartzite.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	34		
Sample Depth, mBGL	14.40	-	14.85
Sample Type	UT		

Description

14.40 - 14-70m:
Stiff, locally firm, greyish brown slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse, of chalk, flint and sandstone.
Occasional softening (wet) adjacent to gravel fraction.

14.70 - 14.85m:
No recovery

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	**BH403**
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403
Sample No	36
Sample Depth, mBGL	15.05 - 15.50
Sample Type	UT

Description

15.05 - 15.50m:
Stiff thinly and thickly, locally cross laminated, greyish brown silty CLAY with occasional dustings of light brown silt along laminae surfaces.
15.05 - 15.30m:
Locally firm to stiff (possible sample disturbance)
Rare inclined polished fissure surfaces throughout.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	38		
Sample Depth, mBGL	15.70	-	16.15
Sample Type	UT		

Description

15.70 - 15.80m:
Sample disturbed. Recovered as soft greyish brown CLAY.

15.80 - 16.15m:
Stiff indistinctly thinly and thickly, locally cross, laminated, greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces.

15.96m:
Thin lamination (4mm) of orangish brown fine to medium sand.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	40		
Sample Depth, mBGL	16.35	-	16.80
Sample Type	UT		

Description

16.35 - 16.46m:
Stiff thickly, locally cross laminated greyish brown CLAY with occasional dusting of light brown silt along laminae surfaces. Rare inclined, locally polished, fissures.

16.46 - 16.80m:
Sample unavailable due to lab testing.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	42		
Sample Depth, mBGL	17.00	-	17.45
Sample Type	UT		

Description

17.00 - 17.45m:
Stiff thinly and thickly laminated, locally fissured, greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. With rare subangular fine to medium gravel of chalk. Fissures are very closely and closely spaced, locally polished, locally dusted with light brown silt, randomly orientated.

Detail:
17.00 - 17.12m - possible sample disturbance (very soft).

17.00

17.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

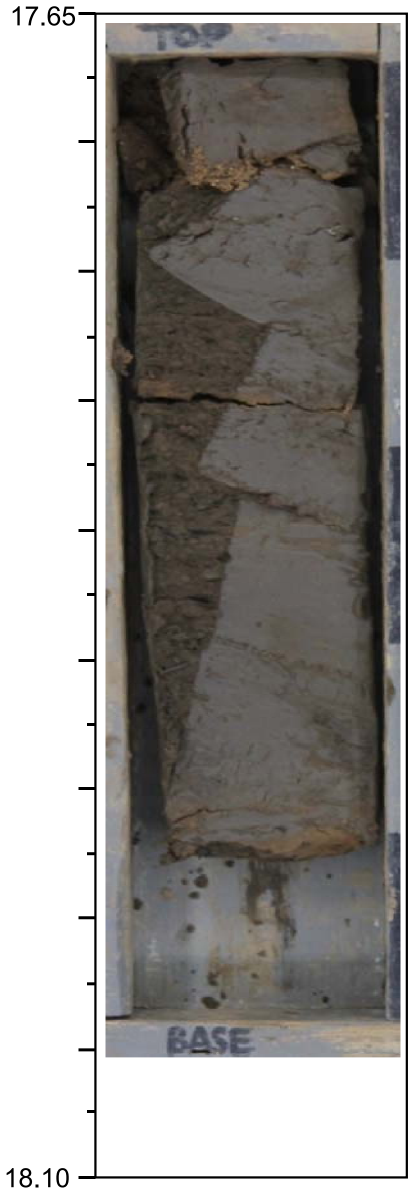
Split Tube Sample Description

Borehole No	BH403
Sample No	44
Sample Depth, mBGL	17.65 - 18.10
Sample Type	UT

Description

17.65 - 18.10m:
Stiff indistinctly thinly and thickly laminated, locally indistinctly fissured, greyish brown CLAY. With occasional thin laminae (<4mm) of orangish brown fine to medium sand. Fissures extremely closely spaced, randomly orientated.

17.75m:
1No subangular medium gravel of chalk.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	46		
Sample Depth, mBGL	18.30	-	18.75
Sample Type	UT		

Description

18.30 - 18.75m:
Stiff indistinctly thinly and thickly laminated greyish brown CLAY. With extremely closely spaced thin laminae (<3mm) of orangish brown fine to medium sand. Rare subrounded fine to medium gravel of chalk.

18.35 - 18.47m:
More distinctly laminated.

18.45m:
1 No. subrounded coarse gravel of chalk.

18.30

18.75

Remarks:

Split Tube Sample Description

Borehole No	BH403		
Sample No	48		
Sample Depth, mBGL	18.95	-	19.40
Sample Type	UT		

Description

18.95 - 19.40m:
Stiff thinly and thickly laminated greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. With extremely closely to very closely spaced thin laminae (<3mm) of orangish brown fine to medium sand.

Detail:
18.99 - 19.10m:
Indistinctly laminated.

19.16m:
Thick lamination (12mm) of orangish brown fine to medium sand.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH403		
Sample No	54		
Sample Depth, mBGL	20.75	-	21.10
Sample Type	UT		

Description

20.65 - 21.10m:
Stiff thinly and thickly laminated greyish brown silty CLAY with frequent dustings of light brown silt on laminae surface. With very closely spaced thin laminae (<3mm) of orangish brown, silt and fine to medium sand.

20.69m:
Rare subrounded fine to medium gravel of chalk.

20.94m:
Rare subrounded fine to medium grains to chalk.

20.75

21.10

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH403
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	3		
Sample Depth, mBGL	1.50	-	1.95
Sample Type	UT		

Description

1.50-1.95m:
Stiff indistinctly thinly and thickly laminated dark orangey brown mottled grey CLAY. Rare relic and rootlet tracks throughout. (MADE GROUND)

1.83m:
1N^{o} subangular cobble of concrete 90mm by 60mm.

1.88 - 1.95m:
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	7		
Sample Depth, mBGL	3.00	-	4.00
Sample Type	P		

Description

3.00 - 3.88m:
Firm indistinctly thinly and thickly laminated greyish green slightly sandy, locally sandy, silty slightly organic CLAY occasional dusting of brownish grey silt along laminae surfaces.

3.35 - 3.88m:
Dark brownish grey, colour change inclined at approximately 65^{o}

3.52 - 3.88m:
Locally dark orangish brown adjacent to laminae and with rare relic rootlet tracks throughout.

3.88 - 4.00m:
No recovery.

3.00

4.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

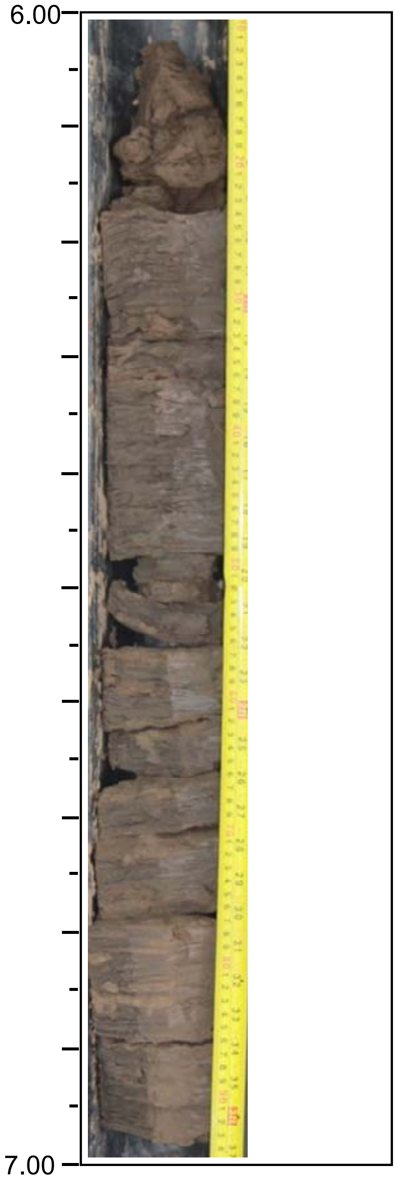
Borehole No	BH404		
Sample No	10		
Sample Depth, mBGL	6.00	-	7.00
Sample Type	P		

Description

6.00 - 6.42m:
Firm thinly and thickly laminated dark brownish grey and greyish brown sandy silty CLAY with occasional thin and thick laminae of greyish brown silty fine to medium sand.

6.42 - 6.82m: Thinly and thickly interlaminated greyish brown and dark brown slightly clayey silty fine to medium SAND and firm greyish brown CLAY.

6.82 - 7.00m:
No recovery.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	11		
Sample Depth, mBGL	7.00	-	8.00
Sample Type	P		

Description

7.00 - 7.50m:
Firm thinly and thickly laminated brownish grey slightly sandy silty CLAY. With extremely closely to very closely spaced thin laminae of greyish brown and orangish brown silt and fine sand.

7.31 - 7.50m:
Laminae are indistinct.

7.50 - 8.00m:
Unavailable due to lab testing.

7.90 - 8.00m:
No recovery.

7.00

8.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404
Sample No	14
Sample Depth, mBGL	8.00 - 9.00
Sample Type	P

Description

8.00 - 8.50m:
Firm dark brownish grey thinly and thickly laminated slightly sandy silty CLAY. With extremely closely to very closely spaced thin laminae of orangish brown and greyish brown silty fine to medium sand.
Locally oxidised dark orangish brown adjacent to laminae.

8.33m:
15mm thick parting of orangey brown fine to medium sand.

8.50 - 8.78m: Sample unavailable due to laboratory testing.

8.78 - 9.00m:
No recovery

8.00

9.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	17		
Sample Depth, mBGL	9.00	-	10.00
Sample Type	P		

Description

9.00 - 9.20m:
Firm dark brown and black, pseudo fibrous PEAT with wood fragments up to 25mm.

9.20 - 9.30m:
Sample disturbed. Recovered as dark brown silty CLAY with fragments of sealing wax.

9.30 - 10.00m:
No recovery

9.00

10.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	26		
Sample Depth, mBGL	11.50	-	11.95
Sample Type	UT		

Description

11.50- 11.82m:
Stiff, locally very stiff, greyish brown locally mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk quartzite and igneous lithologies.

11.82 - 11.95m:
No recovery.

Remarks:
Two portions of sample photographed seperately and presented together.

Notes:	Project	A63 CASTLE STREET	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	28		
Sample Depth, mBGL	12.00	-	12.45
Sample Type	UT		

Description

12.00 - 12.45m:
Stiff, locally very stiff, greyish brown and brown slightly sandy slightly gravelly CLAY.
Gravel subangular fine to coarse of chalk, quartzite and igneous lithologies.

12.00

12.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	30		
Sample Depth, mBGL	12.50	-	12.95
Sample Type	UT		

Description

12.50 - 12.95m:
Very stiff, locally stiff, dark greyish brown, locally dark, orangish brown, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone, quartzite and igneous lithologies.

12.77m:
1N^{o} inclined polished fissure.

12.50

12.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	32		
Sample Depth, mBGL	13.00	-	13.45
Sample Type	UT		

Description

Stiff, locally very stiff, greyish brown and brown slightly sandy slightly gravelly CLAY. Gravel subangular to subrounded fine to coarse of chalk, quartzite and igneous lithologies.

13.00

13.45

Remarks:

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH404

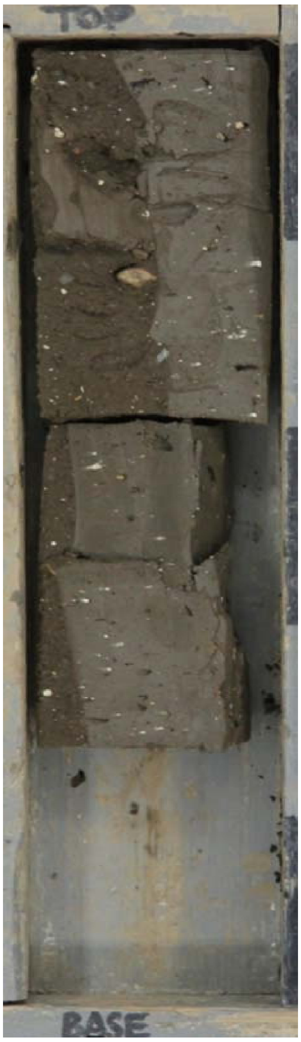
Split Tube Sample Description

Borehole No	BH404
Sample No	36
Sample Depth, mBGL	14.00 - 14.45
Sample Type	UT

Description

14.00 - 14.40m:
Stiff, locally firm, dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, quartzite, sandstone and igneous lithologies.

14.00



14.45

14.40 - 14.45m:
No Recovery.

Remarks:

Split Tube Sample Description

Borehole No	BH404		
Sample No	38		
Sample Depth, mBGL	14.50	-	14.95
Sample Type	UT		

Description

15.50 - 14.95m:
Stiff, locally very stiff, indistinctly thinly and thickly, locally cross, laminated greyish brown silty CLAY with occasional dustings of light brown silt along laminae surfaces.

14.50

14.95

14.75m:
Occasional subrounded fine gravel of chalk.

14.80m:
Thin laminations (2mm) of light brown silty fine sand.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	40		
Sample Depth, mBGL	15.00	-	15.45
Sample Type	UT		

Description

15.00 - 15.45m:
Stiff indistinctly thinly and thickly laminated, fissured, greyish brown silty CLAY with frequent dustings of light brown silt on laminae and fissure surfaces. Fissures are extremely closely to very closely spaced, randomly orientated, occasionally polished.

15.00

15.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	42		
Sample Depth, mBGL	15.50	-	15.95
Sample Type	UT		

Description

15.50 - 19.95m:
Stiff, locally very stiff, indistinctly thinly and thickly laminated fissured, brown and greyish brown silty CLAY with occasional dusting of light brown silt on laminae, and occasional fissure, surfaces.
Fissures very closely spaced, randomly orientated and locally polished.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	44		
Sample Depth, mBGL	16.00	-	16.45
Sample Type	UT		

Description

16.00 - 16.26m:
Stiff, indistinctly thinly and thickly laminated, fissured, greyish brown CLAY with occasional dustings of light brown silt along laminae and fissure surfaces. Fissures are very closely spaced and randomly orientated.

16.10 - 16.16m:
Steeply inclined fissures, polished.

16.26 - 16.45m:
Stiff thinly to thickly laminated greyish brown CLAY.

16.28m:
Thin lamination (1mm) of light brown silt.

16.37m:
Thin lamination (1mm) of light brown silt.

16.00

16.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	50		
Sample Depth, mBGL	17.50	-	17.95
Sample Type	UT		

Description

17.50 - 17.95m:
Stiff thinly and thickly laminated greyish brown CLAY, occasional dustings of light brown silt along laminae surfaces.

17.66m:
Thin lamination (3mm) thick parting of light brown to fine to coarse sand.

17.71 - 17.76m:
Orangish brown slightly gravelly silty fine to coarse SAND. Gravel subangular to subrounded fine to coarse predominantly chalk.

17.76 - 17.95m:
Stiff indistinctly fissured greyish brown CLAY. Fissures are extremely closely spaced and randomly orientated.

17.50

17.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	54		
Sample Depth, mBGL	18.50	-	18.95
Sample Type	UT		

Description

18.50 - 18.95m:
Firm to stiff, locally indistinctly thinly and thickly laminated, indistinctly fissured greyish brown silty CLAY. With extremely closely to very closely spaced thin laminae (2mm) of orangish brown fine to medium sand.

Detail:
18.65m:
1N^{o} subrounded coarse gravel of chalk.

18.65 - 18.95m:
Fissures are extremely closely spaced and randomly orientated.

18.50

18.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	56		
Sample Depth, mBGL	19.00	-	19.45
Sample Type	UT		

Description

Stiff thinly and thickly laminated greyish brown CLAY. With frequent dustings of light brown silt along laminae surfaces and frequent thin laminae (<3mm).
19.00 - 19.17m:
Very closely spaced thin laminae (<6mm) of orangish brown fine to medium sand.

19.33m:
1N° subrounded fine gravel of chalk.

19.36m:
Thin laminations (3mm) of orangish brown fine to medium sand.

19.39 - 19.45m:
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	58		
Sample Depth, mBGL	19.50	-	19.95
Sample Type	UT		

Description

19.50 - 19.95m:
Firm to stiff thinly, locally thickly, laminated greyish brown CLAY with frequent dustings and laminae (<3mm) of light brown silt.

19.67m - Thin laminae (<2mm) of orangish brown fine to medium sand.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404
Sample No	60
Sample Depth, mBGL	20.00 - 20.45
Sample Type	UT

Description

20.00 - 20.45m:
Stiff, locally firm, thinly and thickly laminated greyish brown CLAY. With closely spaced thin laminae (<3mm) of orangish brown fine sand. Frequent dustings of greyish brown silt on laminae surfaces.
20.00 - 20.03m:
Possible local sample disturbance - tending to firm.

20.00

20.45

20.39 - 20.45m:
No recovery

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404
Sample No	64
Sample Depth, mBGL	21.10 - 21.55
Sample Type	UT

Description

21.10 - 21.55m:
Firm to stiff thinly, locally thickly, laminated greyish brown CLAY with frequent dustings and very closely spaced thin laminae (<5mm) of light brown silt and fine sand.

21.10

21.55

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH404		
Sample No	68		
Sample Depth, mBGL	22.20	-	22.65
Sample Type	UT		

Description

22.20 - 22.46m:
Stiff thinly and thickly, locally indistinctly, laminated greyish brown silty CLAY.

22.27 - 22.31m:
Extremely closely spaced thin laminae of orangish brown fine sand.

22.34 - 22.40m:
Greyish brown fine to medium silty sand with occasional subrounded fine gravel of chalk.

22.40 - 22.46m:
Extremely closely spaced thin laminae (<3mm) of orangish brown fine sand.

22.46 - 22.65m:
No recovery.

22.20

22.65

Remarks:

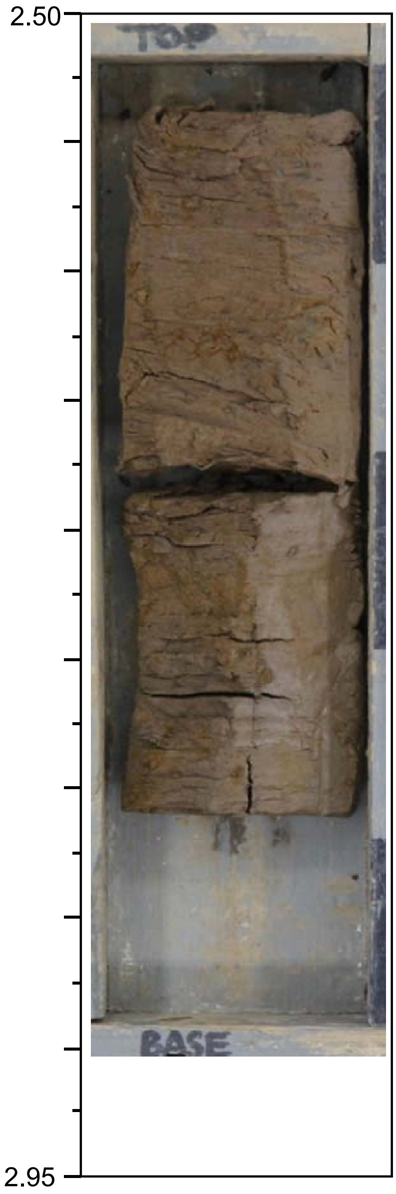
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH404
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	5		
Sample Depth, mBGL	2.50	-	2.95
Sample Type	UT		

Description

2.50 - 2.95m:
Firm to stiff indistinctly thinly and thickly laminated greyish brown mottled orangish brown slightly sandy silty CLAY with occasional relict rootlet tracks infilled grey.



2.88 - 2.95m:
Sample unavailable due to lab testing.

Remarks:

Notes:	Project	A63 CASTLE STREET	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405	
Sample No	8	
Sample Depth, mBGL	4.00	5.00
Sample Type	P	

Description

4.00 - 4.26m:
Soft thinly and thickly laminated greyish brown and dark grey slightly sandy silty organic CLAY with occasional dusting of light brown silt and fine sand on laminae surfaces.

4.26 - 4.50m:
Sample unavailable due to lab testing.

4.50 - 5.00m:
No recovery.

4.00

5.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

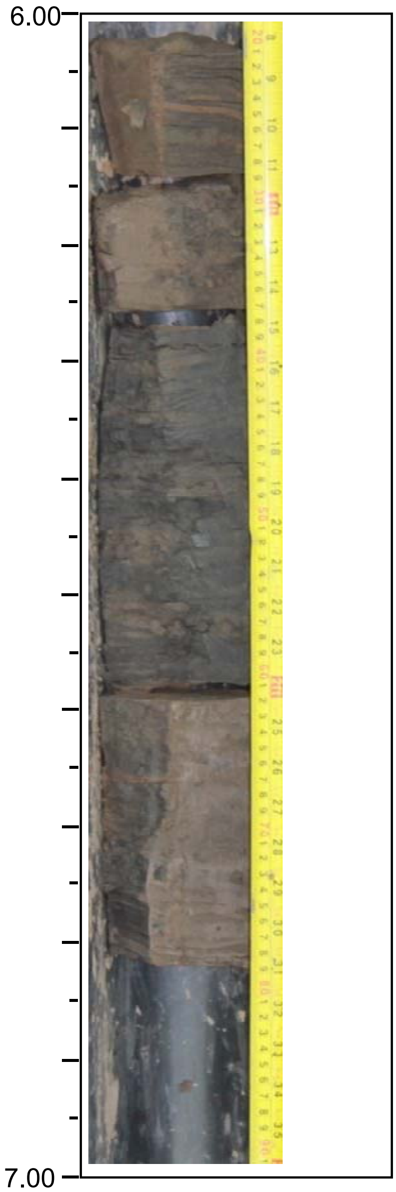
Borehole No	BH405	
Sample No	11	
Sample Depth, mBGL	6.00	7.00
Sample Type	P	

Description

6.00 - 6.60m:
Firm, locally soft, thinly and thickly laminated greyish brown and dark grey slightly sandy silty slightly organic CLAY with occasional dustings of grey brown silt along laminae surfaces. Extremely closely to very closely spaced thin and thick laminae (<12mm) thick of grey brown fine to medium sand.

6.60 - 6.78m:
Sample unavailable due to lab testing.

6.78 - 7.00m:
No recovery.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

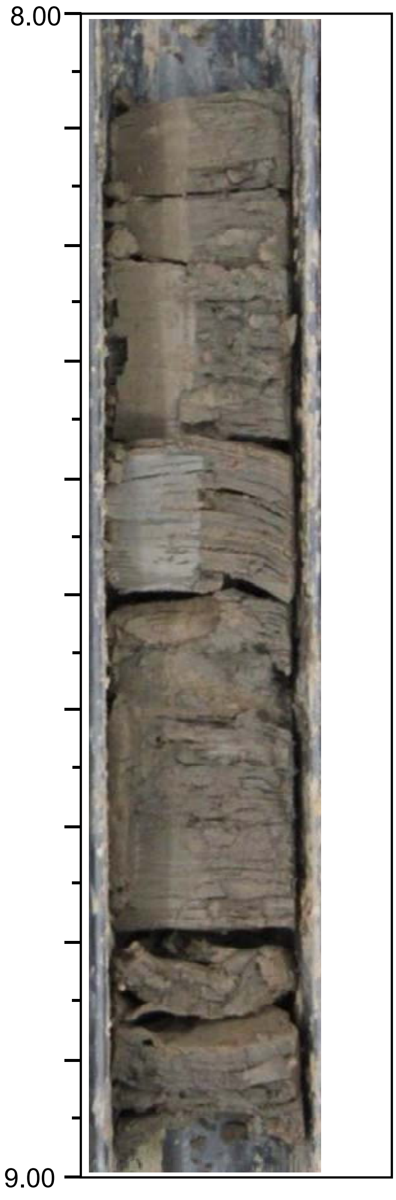
Borehole No	BH405		
Sample No	15		
Sample Depth, mBGL	8.00	-	9.00
Sample Type	P		

Description

8.00 - 8.80m:
Soft thinly and thickly laminated greyish brown and dark grey slightly sandy silty organic CLAY with extremely closely spaced thin laminae (<4mm) of light grey fine sand.

8.50 - 8.80m:
Sample unavailable due to laboratory testing.

8.80 - 9.00m:
No recovery.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	17		
Sample Depth, mBGL	9.00	-	10.00
Sample Type	P		

Description

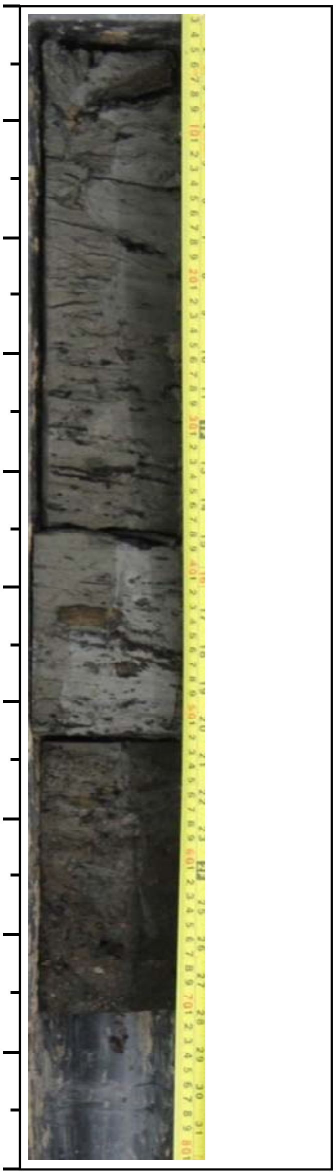
9.00 - 9.50m:
Firm dark brownish grey locally mottled black slightly sandy organic CLAY. With plant fragments up to 20mm and occasional wood fragments up to 35mm.

9.50 - 9.65m:
Very organic.

9.65 - 9.70m:
Firm dark brown pseudo fibrous PEAT.

9.70 - 10.00m:
No recovery

9.00



10.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	21		
Sample Depth, mBGL	10.50	-	10.95
Sample Type	UT		

Description

10.50 - 10.75m:
Firm indistinctly thinly and thickly laminated indistinctly fissured brownish grey locally mottled light grey, slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk, flint, sandstone. Fissures are closely spaced randomly orientated.

10.55 - 10.58m:
Planar undulated fissure infilled up to 5mm with dark brown fine and medium sand.

10.75 - 10.95m:
No recovery.

10.50

10.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	27		
Sample Depth, mBGL	12.00	-	12.45
Sample Type	UT		

Description

12.00 - 12.45m:
Stiff, locally firm, greyish brown, locally mottled light grey, slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies. Frequent localised softening of material noted associated with gravel content.

12.00 - 12.10:
Sample disturbance (very wet and soft).

12.00

12.45

Remarks:

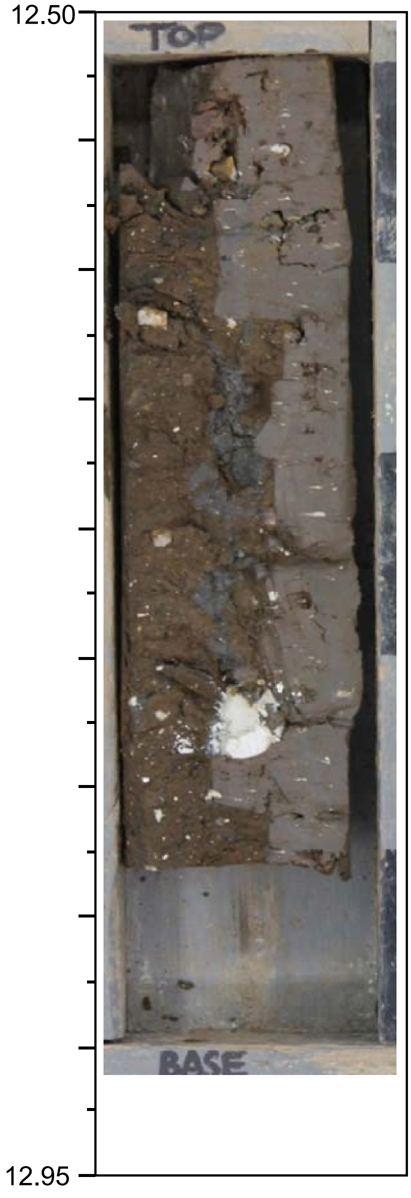
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	29		
Sample Depth, mBGL	12.50	-	12.95
Sample Type	UT		

Description

12.50 - 12.95m:
Stiff, locally firm, greyish brown, locally mottled light grey, slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies. Localised softening of material associated with gravel noted.



12.65 - 12.85m:
Mottled light grey material possibly associated with infilled relict root tracks up to 2mm.
12.87m:
1No. subrounded cobble of chalk.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	31		
Sample Depth, mBGL	13.00	-	13.45
Sample Type	UT		

Description

13.00 - 13.45m:
Stiff greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, quartzite and igneous lithologies.

13.00

13.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	35		
Sample Depth, mBGL	14.00	-	14.45
Sample Type	UT		

Description

14.00 - 14.45m:
Stiff, locally very stiff, greyish brown slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies.

14.06 - 14.10m:
Locally indistinctly thickly laminated.

14.00

14.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405	
Sample No	37	
Sample Depth, mBGL	14.50	14.95
Sample Type	UT	

Description

14.50 - 14.95m:
Stiff indistinctly thickly laminated greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk, sandstone and igneous lithologies.

14.50

14.95

Remarks:

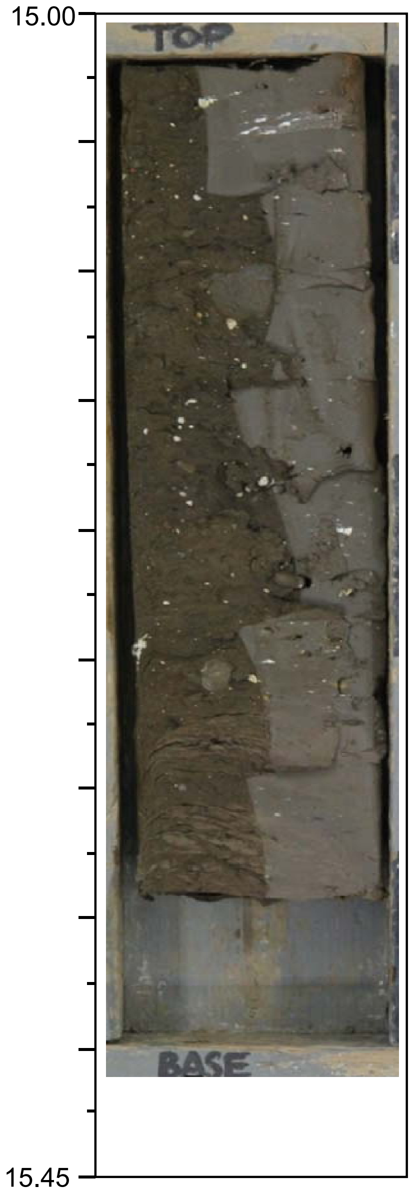
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	39		
Sample Depth, mBGL	15.00	-	15.45
Sample Type	UT		

Description

15.00 - 15.35m:
Stiff, greyish brown slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies. Softening of material associated with gravel noted.



15.35 - 15.45m:
Stiff indistinctly thinly and thickly laminated indistinctly fissured greyish brown silty CLAY with frequent dustings of light brown silt on laminae surfaces. Fissures are extremely closely to closely spaced and randomly orientated.

Remarks:

Split Tube Sample Description

Borehole No	BH405		
Sample No	41		
Sample Depth, mBGL	15.50	-	15.95
Sample Type	UT		

Description

15.50 - 15.95m:
Stiff indistinctly thinly and thickly laminated, indistinctly fissured, greyish brown silty CLAY with frequent dustings of light brown silt on laminae surfaces and very closely spaced thin laminae (<2mm) of light brown silt. Fissures are extremely closely and closely spaced and randomly orientated.

15.50

15.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405
Sample No	43
Sample Depth, mBGL	16.00 - 16.45
Sample Type	UT

Description

16.00 - 16.45m:
Stiff, locally very stiff, indistinctly thinly and thickly laminated, indistinctly fissured, brown and greyish brown silty CLAY with occasional, dustings of light brown silt along laminae surfaces. Fissures are extremely close to very closely spaced randomly orientated.

16.24 - 16.40m:
Dustings of silt are frequent.

16.40 - 16.45m:
No recovery.

16.00

16.45

Remarks:

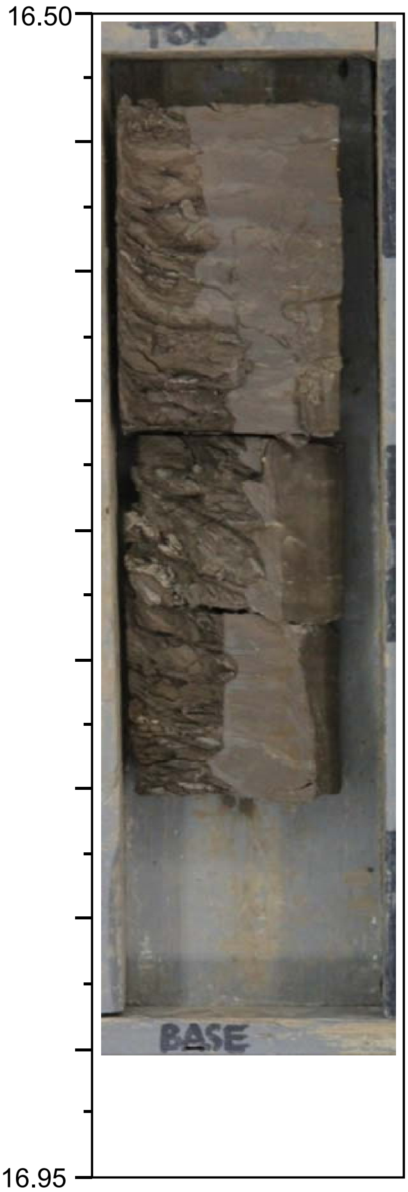
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	45		
Sample Depth, mBGL	16.50	-	16.95
Sample Type	UT		

Description

16.50 - 16.89m:
Stiff, locally very stiff, indistinctly thinly and thickly laminated, indistinctly fissured, greyish brown silty CLAY with frequent dustings and rare thin laminae (<2mm) thick of light brown silt along laminae and fissures. Fissures are extremely closely to very closely spaced and randomly orientated.



16.89 - 16.95m:
No recovery

Remarks:

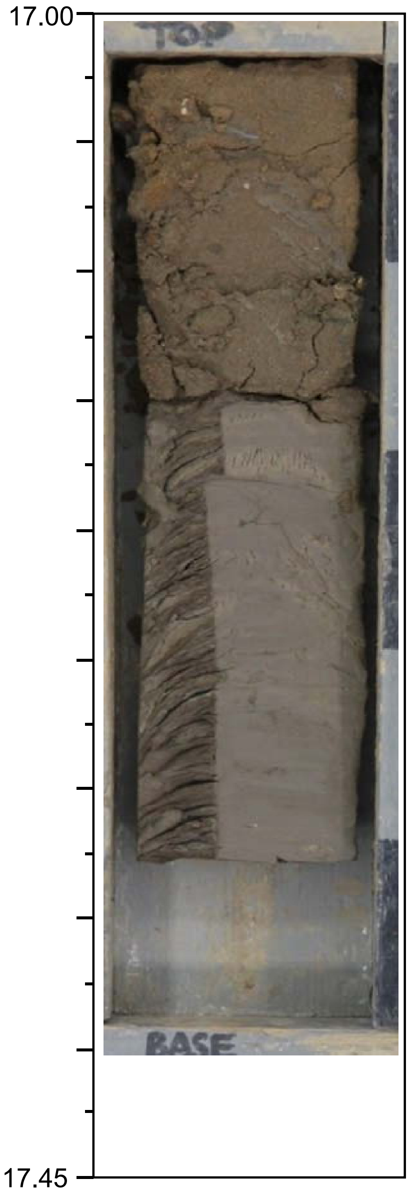
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	48		
Sample Depth, mBGL	17.00	-	17.45
Sample Type	UT		

Description

17.00 - 17.17m:
Orangish brown silty fine to medium SAND with rare subangular to subrounded fine to medium gravel of chalk with occasional thick laminae of brown silty clay.



17.17 - 17.45m:
Stiff, locally firm to stiff, thinly and thickly laminated greyish brown silty CLAY with frequent dustings of light brown silt along laminae surfaces.

17.40m:
Subrounded fine gravel of chalk.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405		
Sample No	52		
Sample Depth, mBGL	18.50	-	18.95
Sample Type	UT		

Description

18.50 - 18.95m:
Stiff thin, and thickly laminated, fissured, greyish brown silty CLAY. Very closely spaced fissured, randomly orientated, locally polished.

18.70 - 18.95m:
Indistinctly laminated and indistinctly fissured with occasional light brown silt on surface.
18.70 - 18.78m:
Locally firm.
18.78m:
Occasional subrounded fine to medium gravel of chalk.

18.50

18.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH405
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH405
Sample No	65
Sample Depth, mBGL	23.00 - 23.45
Sample Type	UT

Description

23.00 - 23.11m:
Stiff indistinctly thinly and thickly laminated, indistinctly fissured, greyish brown CLAY with occasional thin laminae (<3mm) of orangish brown fine sand.

23.11 - 23.15m:
Orangish brown very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of chalk and flint.

23.15 - 23.45m:
Stiff, locally very stiff, indistinctly thinly and thickly laminated dark orangish brown slightly sandy silty CLAY.

23.40 - 23.45m:
With occasional thin laminae (<3mm) of orangish brown and black fine to medium sand.

Remarks:

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH405

Split Tube Sample Description

Borehole No	BH406		
Sample No	9		
Sample Depth, mBGL	2.50	-	2.95
Sample Type	UT		

Description

2.50 - 2.70m:
Firm thinly and thickly laminated greyish brown and orangish brown silty CLAY with dustings of greyish brown silt on laminae surfaces.

2.70 - 2.95m:
Firm thinly and thickly laminated dark grey silty CLAY with dustings of greyish brown silt on laminae surfaces.

2.50

2.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	11		
Sample Depth, mBGL	3.00	-	3.45
Sample Type	UT		

Description

3.00 - 3.45m:
Soft, locally very soft, indistinctly thinly and thickly laminated greyish brown, locally dark grey, silty CLAY with dustings of light brown silt on laminae surfaces.

3.00

3.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	13		
Sample Depth, mBGL	3.50	-	4.50
Sample Type	P		

Description

3.50 - 3.70m:
Soft, locally very soft, indistinctly thinly and thickly laminated dark greyish brown, slightly organic silty CLAY with occasional dustings of grey fine sand on laminae surfaces.

3.61m:
Becoming dark grey.

3.70 - 4.50m:
Sample unavailable due to lab testing

3.50

4.50

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	14		
Sample Depth, mBGL	4.50	-	4.95
Sample Type	UT		

Description

4.50 - 4.85m:
Soft, indistinctly thinly and thickly laminated, indistinctly fissured dark grey mottled orangish brown silty slightly organic CLAY with lenses and thick to thick laminae (<10mm) of orangish brown fine sand.

4.85 - 4.95m:
No recovery.

4.50

4.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	16		
Sample Depth, mBGL	5.00	-	5.45
Sample Type	UT		

Description

5.00 - 5.45m:
Soft, locally very soft, indistinctly thinly to thickly laminated greyish brown, locally slightly sandy, silty CLAY with rare plant debris up to 20mm in length.

5.00

5.45

Remarks:

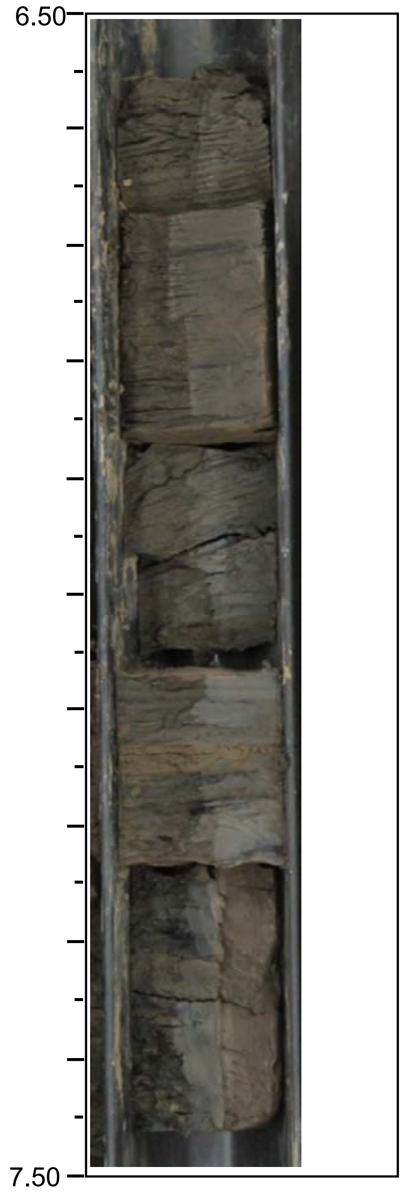
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	21		
Sample Depth, mBGL	6.50	-	7.50
Sample Type	P		

Description

6.50 - 7.20m:
Soft thinly and thickly laminated, locally cross laminated, dark greyish brown slightly sandy clayey SILT. With dustings of silt on laminae surfaces and occasional thin and thick laminae (<10mm) of light brown silt and fine sand.



7.00m:
Thick lamination (<10mm) of light brown fine sand.

7.20 - 7.50m:
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	25		
Sample Depth, mBGL	8.00	-	9.10
Sample Type	P		

Description

8.00 - 8.45m:
Soft thinly and thickly laminated dark greyish brown and orangish brown silty CLAY with extremely closely to very closely spaced thin and thick laminae (<10mm) of orangish brown fine to medium sand.

8.45 - 8.80m:
Firm dark brownish grey slightly organic to organic CLAY. With wood fragments up to 25mm.

8.80 - 9.10m:
Sample not available due to lab testing.

8.00

9.10

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406
Sample No	38
Sample Depth, mBGL	12.50 - 12.95
Sample Type	UT

Description

12.50 - 12.75m:
Stiff, locally very stiff, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk, sandstone and igneous lithologies.
Rare steeply inclined fissures, infilled grey.

12.75 - 12.95m:
No recovery.

Remarks:

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH406

Split Tube Sample Description

Borehole No	BH406		
Sample No	40		
Sample Depth, mBGL	13.00	-	13.45
Sample Type	UT		

Description

13.00 - 13.33m:
Very stiff dark brown mottled orangish brown, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, quartzite and sandstone with rare igneous and coal.

13.33 - 13.45m:
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	43		
Sample Depth, mBGL	13.50	-	13.95
Sample Type	UT		

Description

13.50 - 13.80m:
Very stiff to hard dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk, sandstone, quartzite and igneous lithologies.

13.74 - 13.80m:
Very gravelly.

13.80 - 13.95m:
No recovery.

13.50

13.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	45		
Sample Depth, mBGL	14.00	-	14.45
Sample Type	UT		

Description

14.00 - 14.24m:
Firm indistinctly thinly and thickly laminated greyish brown and grey slightly sandy silty organic CLAY with dustings of light brown silt and fine sand on laminae surfaces.

14.24 - 14.45m:
No recovery.

14.00

14.45

Remarks:
See engineers log.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	47		
Sample Depth, mBGL	14.50	-	14.95
Sample Type	UT		

Description

14.50 - 14.80m:
Stiff, locally firm, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium, locally coarse, of chalk, quartzite, sandstone and igneous lithologies.

14.80 - 14.95m:
No recovery.

14.50

14.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

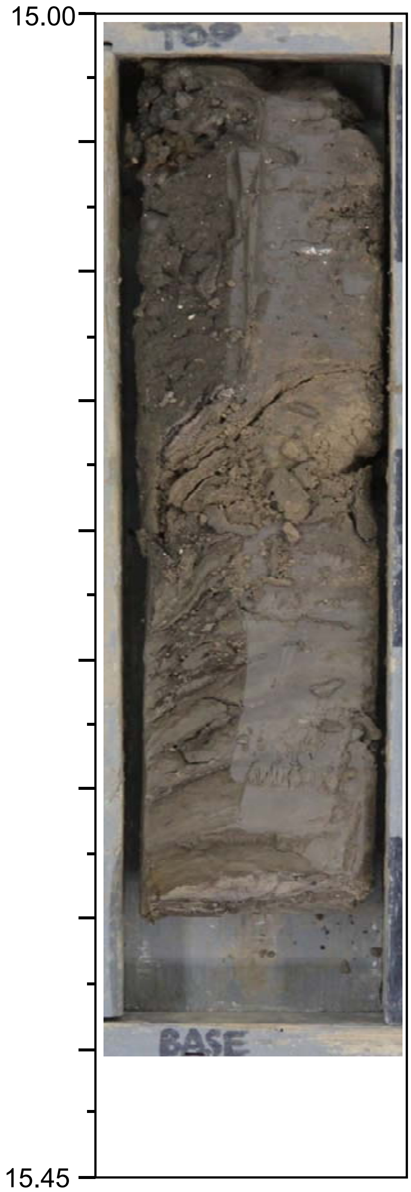
Borehole No	BH406		
Sample No	49		
Sample Depth, mBGL	15.00	-	15.45
Sample Type	UT		

Description

15.00 - 15.17m:
Stiff, locally firm, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular subrounded fine to coarse of chalk, sandstone and igneous lithologies.

15.17 - 15.22m:
Orangish brown fine to medium SAND with occasional thin laminae of clay.

15.22 - 15.45m:
Stiff indistinctly fissured brown, locally greyish brown, CLAY with occasional dustings of light brown silt on fissure surfaces. Fissures extremely close to very close spaced randomly orientated.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406	
Sample No	51	
Sample Depth, mBGL	15.50	15.95
Sample Type	UT	

Description

15.50 - 15.85m:
Stiff, locally very stiff, indistinctly fissured brown silty CLAY with occasional dustings of light brown silt along fissure surfaces. Fissures are extremely closely to very closely spaced, randomly orientated.

15.85 - 15.95m:
No recovery.

15.50

15.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	53		
Sample Depth, mBGL	16.00	-	16.45
Sample Type	UT		

Description

16.00 - 16.45m:
Stiff indistinctly thinly and thickly laminated, fissured, greyish brown CLAY with dustings of light brown silt on laminae surfaces. Fissures are extremely closely to closely spaced, randomly orientated, locally polished.

16.37m:
Fissure surfaces are inclined at approximately 45 degree planar, polished.

16.00

16.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	55		
Sample Depth, mBGL	16.50	-	16.95
Sample Type	UT		

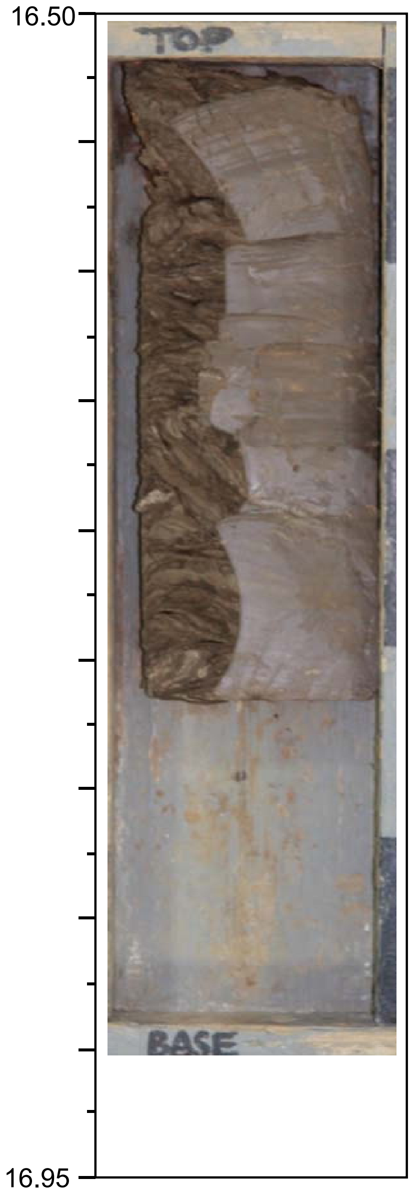
Description

16.50 - 16.82m:
Stiff locally indistinctly thinly and thickly laminated, indistinctly fissured, silty CLAY occasional dusting of light brown silt on fissure surfaces.
Fissures extremely closely to very closely spaced, randomly orientated, occasionally polished.

16.68 - 16.73m:
Laminae are at approximately 45o and undulating.

16.73 - 16.82m:
Laminae are undulating.

16.82 - 16.95m:
No recovery.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	57		
Sample Depth, mBGL	17.00	-	17.45
Sample Type	UT		

Description

17.00 - 17.45m:
Firm to stiff thinly and thickly laminated, locally indistinctly fissured, greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. Rare subrounded fine to medium gravel of chalk. Fissures are extremely to very closely spaced, randomly orientated, occasionally polished.

17.17m:
Becoming stiff.

17.00

17.45

Remarks:

Notes:

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
Project No.	A5085-15	BH406
Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	59		
Sample Depth, mBGL	17.50	-	17.95
Sample Type	UT		

Description

17.50 - 17.95m:
Stiff thinly and thickly, locally indistinctly, laminated, indistinctly fissured, greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces. Fissures are extremely closely to very closely spaced, randomly orientated, occasionally polished.

17.50

17.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

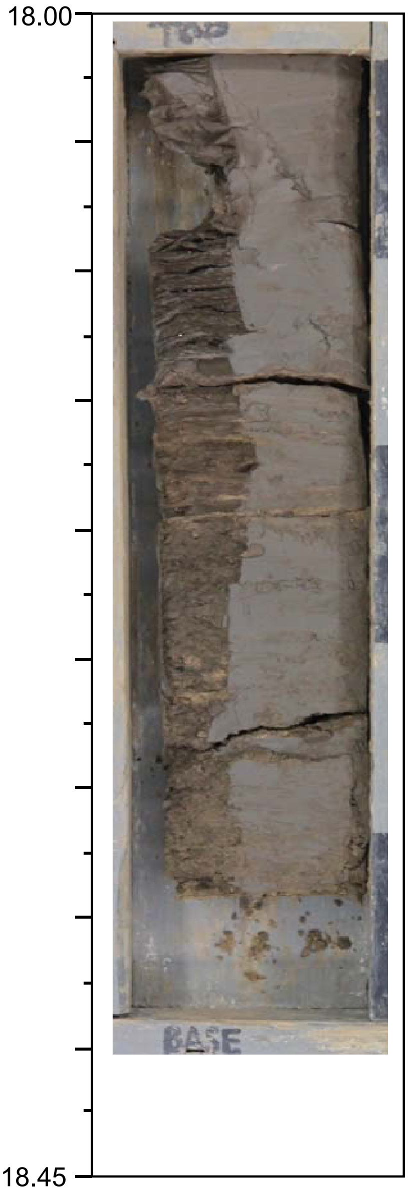
Borehole No	BH406		
Sample No	61		
Sample Depth, mBGL	18.00	-	18.45
Sample Type	UT		

Description

18.00 - 18.45m:
Stiff indistinctly thinly and thickly laminated, fissured, greyish brown CLAY. Fissures are extremely closely spaced, randomly orientated, locally polished.

18.16 - 18.23m:
Stiff thinly and thickly laminated greyish brown CLAY. With frequent dustings of light brown silt on laminae surfaces and extremely closely spaced thin laminae (<2mm) of orangish brown fine to medium sand. Rare subrounded to medium gravel of chalk.

18.23 - 18.45m:
Stiff indistinctly fissured greyish brown sandy CLAY. With occasional pockets (<5mm) of orangish brown fine to medium sand.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	63		
Sample Depth, mBGL	18.50	-	18.95
Sample Type	UT		

Description

18.50 - 18.95m:
Stiff, locally indistinctly fissured, indistinctly thinly and thickly laminated greyish brown silty CLAY with occasional dustings of light brown silt on laminae surfaces and rare subrounded fine to medium gravel of chalk. Fissures are extremely closely to very closely spaced, randomly orientated, occasionally polished.

18.71 - 18.75m:
Very clayey fine to medium sand.

18.75 - 18.95m:
Very closely spaced thin laminae (<4mm) of orangish brown occasionally dark grey, fine to medium sand.

18.50

18.95

Remarks:

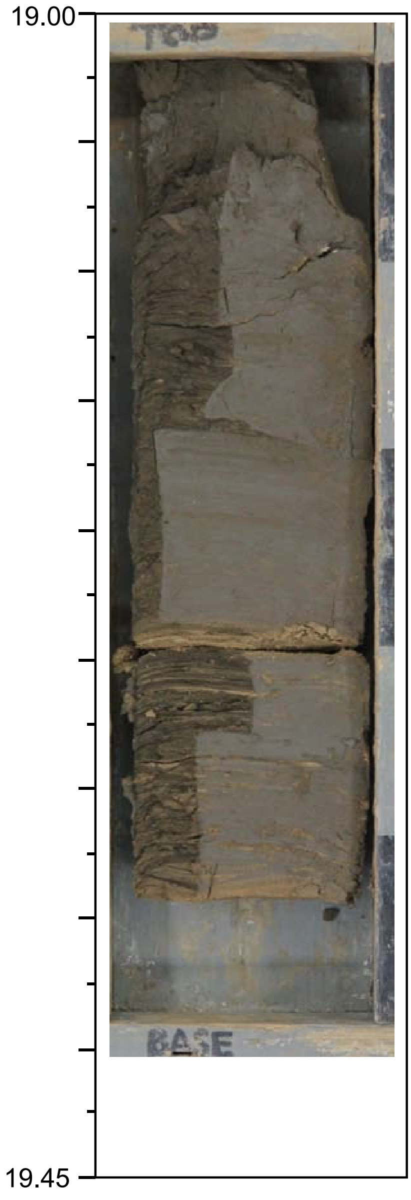
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	65		
Sample Depth, mBGL	19.00	-	19.45
Sample Type	UT		

Description

19.00 - 19.32m:
Stiff indistinctly thinly and thickly, locally cross, laminated greyish brown silty CLAY with occasional laminae (<3mm) of orangish brown fine sand.



19.32 - 19.45m:
Stiff thinly and thickly laminated greyish brown silty CLAY. With dustings of silt on laminae and extremely closely to very closely spaced thin laminae (<3mm) of orangish brown fine to medium sand. Rare subrounded fine to medium gravel of chalk.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	67		
Sample Depth, mBGL	19.50	-	19.95
Sample Type	UT		

Description

19.50 - 19.95m
Stiff thinly and thickly laminated greyish brown silty CLAY with frequent dustings of silt on laminae and thin laminae (<2mm) of light brown silt.
Extremely closely to very closely spaced thin and thickly laminae (<8mm) of orangish brown fine to medium sand.

19.74 - 19.95m:
Rare subrounded fine gravel of chalk.

19.82m:
thick laminations (10mm) of orangish brown and black fine to medium sand.

19.50

19.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	69		
Sample Depth, mBGL	20.00	-	20.45
Sample Type	UT		

Description

20.00 - 20.45m:
Stiff, locally firm, thinly and thickly laminated greyish brown silty CLAY with dustings of light grey silt on laminae surfaces. Frequent extremely closely and closely spaced laminae (<5mm) of fine yellowish brown sand.

20.00

20.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH406		
Sample No	74		
Sample Depth, mBGL	21.50	-	21.95
Sample Type	UT		

Description

21.50 - 21.95m:
Stiff thinly and thickly laminated greyish brown silty CLAY with frequent dustings of light brown and dark grey silt on laminae surfaces. Extremely closely to very closely spaced thin laminae (<6mm) of orangish brown fine to medium sand.
21.50 - 21.64m:
Firm to stiff.

21.75m:
1No. subrounded fine gravel of chalk.

21.50

21.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH406
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	5		
Sample Depth, mBGL	1.70	-	2.15
Sample Type	UT		

Description

1.70 - 2.15m:
Stiff, locally firm, fissured orangish and yellowish brown sandy CLAY. Fissures are extremely closely spaced, randomly orientated, locally polished.
(MADE GROUND)

Remarks:
Sample disturbed during testing.

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH407

Split Tube Sample Description

Borehole No	BH407		
Sample No	9		
Sample Depth, mBGL	3.10	-	3.55
Sample Type	UT		

Description

3.10 - 3.40m:
Firm thinly and thickly, locally indistinctly, laminated greyish brown, locally orangish brown, silty CLAY with occasional dustings of grey silt and fine sand on laminae surfaces.

3.10

3.55

3.40 - 3.46m:
Sample unavailable due to lab testing.

3.46 - 3.55m:
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	12		
Sample Depth, mBGL	5.00	-	5.45
Sample Type	UT		

Description

5.00m:
Soft, locally very soft, indistinctly fissured greyish brown slightly sandy, silty CLAY. Fissures very closely spaced randomly orientated.

5.18m:
Soft, locally very soft thinly and thickly laminated greyish brown slightly sandy, clayey SILT. Dustings of light brown fine sand on laminae surfaces

Remarks:

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH407

Split Tube Sample Description

Borehole No	BH407		
Sample No	14		
Sample Depth, mBGL	5.60	-	6.05
Sample Type	UT		

Description

5.60 - 6.05m:
Firm, locally soft, dark greyish brown and brownish grey slightly sandy clayey slightly organic SILT.

5.60

6.05

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	15		
Sample Depth, mBGL	6.05	-	7.05
Sample Type	P		

Description

6.05 - 7.05m:
Soft to firm thinly and thickly laminated, locally cross laminated, greyish brown and dark grey organic clayey SILT with dustings of light brown silt and fine sand on laminae surfaces.

6.05

7.05

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	17		
Sample Depth, mBGL	7.10	-	7.55
Sample Type	UT		

Description

7.10 - 7.55m:
Firm, locally soft, thinly and thickly laminated brownish grey slightly sandy clayey slightly organic SILT. With dustings of light brown fine sand on laminae surfaces.

7.10

7.55

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	18		
Sample Depth, mBGL	7.60	-	8.05
Sample Type	UT		

Description

7.60 - 7.78m:
Firm black and dark grey organic CLAY with wood fragments up to 10mm thick.

7.71 - 7.78m:
Firm thinly and thickly interlaminated sandy CLAY and sandy SILT.

7.78 - 7.97m:
Sample unavailable due to lab testing.

7.97 - 8.05m:
No recovery.

Remarks:

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH407

Split Tube Sample Description

Borehole No	BH407		
Sample No	21		
Sample Depth, mBGL	8.50	-	8.95
Sample Type	UT		

Description

8.50 - 8.80m:
Soft, locally firm thinly and thickly laminated dark brownish grey and dark grey silty slightly organic CLAY with dustings of light brown fine sand on laminae surfaces. Closely spaced lenses up to 10mm of light brown fine and medium sand.

8.80 - 8.95m:
No recovery.

8.50

8.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407
Sample No	22
Sample Depth, mBGL	9.00 - 10.00
Sample Type	P

Description

9.00 - 10.00m:
Firm dark greyish brown, locally mottled black, slightly sandy organic CLAY. With plant remains up to 25mm.

9.60 - 10.00m:
NO RECOVERY.

9.00

10.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	23		
Sample Depth, mBGL	10.00	-	10.45
Sample Type	UT		

Description

10.00 - 10.25m:
Soft, locally very soft, locally indistinctly thinly and thickly laminated greyish brown sandy clayey SILT with occasional thin laminae (<3mm) of greyish brown fine to medium sand.

10.25 - 10.45m:
Firm indistinctly thinly and thickly laminated grey and greyish brown organic CLAY.

10.29m:
Pocket (25mm x 15mm) of dark orangish brown fine to medium sand.

10.00

10.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	25		
Sample Depth, mBGL	10.50	-	10.95
Sample Type	UT		

Description

10.50 - 10.95m:
Firm to stiff dark greyish brown, locally dark grey, organic CLAY. With wood fragments up to 20mm.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	27		
Sample Depth, mBGL	11.00	-	11.45
Sample Type	UT		

Description

11.00 - 11.35m:
Very thinly to thickly interbedded (<80mm) firm, locally stiff, dark brown oxidising to black pseudo fibrous and fibrous PEAT with local wood fragments up to 30mm thick and plant fragments up to 5mm and firm bluish grey mottled black silty sandy CLAY.

11.35 - 11.45m:
No recovery.

11.00

11.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407
Sample No	29
Sample Depth, mBGL	11.50 - 11.95
Sample Type	UT

Description

11.50 - 11.76m:
Firm light brownish grey and greyish brown sandy locally organic, sandy CLAY. With occasional fragments of wood debris up to 8mm thick.

11.76 - 11.95m:
Firm light browngrey and greyish brown slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of sandstone quartzite, chalk and igneous material. With occasional thin laminae (<3mm) of fine to medium sand.

11.50

11.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	31		
Sample Depth, mBGL	12.00	-	12.45
Sample Type	UT		

Description

12.00 - 12.45m:
Firm greyish brown mottled dark yellowish brown and grey slightly sandy, locally sandy, gravelly CLAY. Gravel is subangular to subrounded fine to coarse sandstone, igneous lithologies and occasional chalk.

12.32m:
Becoming stiff.

12.00

12.45

Remarks:
Sample disturbed during testing.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	33		
Sample Depth, mBGL	12.50	-	12.95
Sample Type	UT		

Description

12.50 - 12.65m:
Firm greyish brown, locally mottled dark grey, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone, quartzite and igneous lithologies. Rare pockets of carbonaceous material.

12.65m - 12.81m:
Sample unavailable due to lab testing.

12.81 - 12.95m:
No recovery.

12.50

12.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407
Sample No	35
Sample Depth, mBGL	13.00 - 13.45
Sample Type	UT

Description

13.00 - 13.36m:
Firm, locally stiff, greyish brown, locally mottled grey, slightly gravelly slightly sandy CLAY.Gravel is subangular to subrounded fine to coarse of sandstone, quartzite and igneous material, rare chalk.

13.12 - 13.23m:
Gravelly.

13.36 - 13.45m:
No recovery.

13.00

13.45

Remarks:
Sample disturbed during testing.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	37		
Sample Depth, mBGL	13.50	-	13.95
Sample Type	UT		

Description

13.50 - 13.95m:
Stiff, locally very stiff, greyish brown, locally yellowish brown, slightly sandy slightly gravelly CLAY. Gravel subangular to subrounded fine to coarse sandstone, quartzite, chalk and igneous lithologies.

13.60 - 13.71m:
Sandy.

13.62m:
1N^{o} subangular cobble of sandstone

13.50

13.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	39		
Sample Depth, mBGL	14.00	-	14.45
Sample Type	UT		

Description

14.00 - 14.35m:
Very stiff, locally stiff, greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone, quartzite, igneous lithologies and occasional chalk.

14.35 - 14.45m:
No recovery.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	41		
Sample Depth, mBGL	14.50	-	14.95
Sample Type	UT		

Description

14.50 - 14.95m:
Stiff, greyish brown, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of igneous lithologies, sandstone and quartzite.

14.70m:
Becoming locally very stiff.

14.85m:
Becoming locally yellowish brown.

14.50

14.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	43		
Sample Depth, mBGL	15.00	-	15.45
Sample Type	UT		

Description

15.00 - 15.45m:
Stiff locally indistinctly laminated greyish brown slightly sandy slightly gravelly CLAY. Gravel subangular to subrounded fine to coarse sandstone chalk, quartzite and igneous material.

15.30 - 15.45m:
Locally firm to stiff.

15.00

15.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	45		
Sample Depth, mBGL	15.50	-	15.95
Sample Type	UT		

Description

15.50 - 15.95m:
Stiff greyish brown slightly sandy slightly gravelly CLAY.
Gravel subangular to subrounded fine to coarse chalk, sandstone and igneous lithologies.
15.50 - 15.55m:
Locally indistinctly thinly and thickly laminated.

15.50

15.95

Remarks:
Sample disturbed during testing.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	47		
Sample Depth, mBGL	16.00	-	16.45
Sample Type	UT		

Description

16.00 - 16.35m:
Stiff to very stiff indistinctly thinly and thickly laminated, fissured greyish brown and brown CLAY with occasional dustings of light brown silt on laminae surfaces. Fissures are extremely closely spaced, randomly orientated, occasionally polished.

16.35 - 16.45m:
No recovery.

16.00

16.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	49		
Sample Depth, mBGL	16.50	-	16.95
Sample Type	UT		

Description

16.50 - 16.58m:
Stiff indistinctly laminated greyish brown and brown CLAY with occasional dustings of light brown silt on laminae.

16.58 - 16.95m:
Indistinctly thinly and thickly laminated greyish brown and yellowish brown slightly clayey fine to medium SAND with local laminae of firm greyish brown clay.

Remarks:
Sample disturbed during testing.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	51		
Sample Depth, mBGL	17.00	-	17.45
Sample Type	UT		

Description

17.00 - 17.45m:
Stiff, locally very stiff, locally indistinctly thinly and thickly laminated, fissured greyish brown CLAY with occasional dustings of light brown silt along laminae and fissure surfaces. Fissures are extremely closely spaced, randomly orientated, occasionally polished.

17.15m:
Rare subrounded fine gravel of chalk along laminae surface.

17.00

17.45

Remarks:

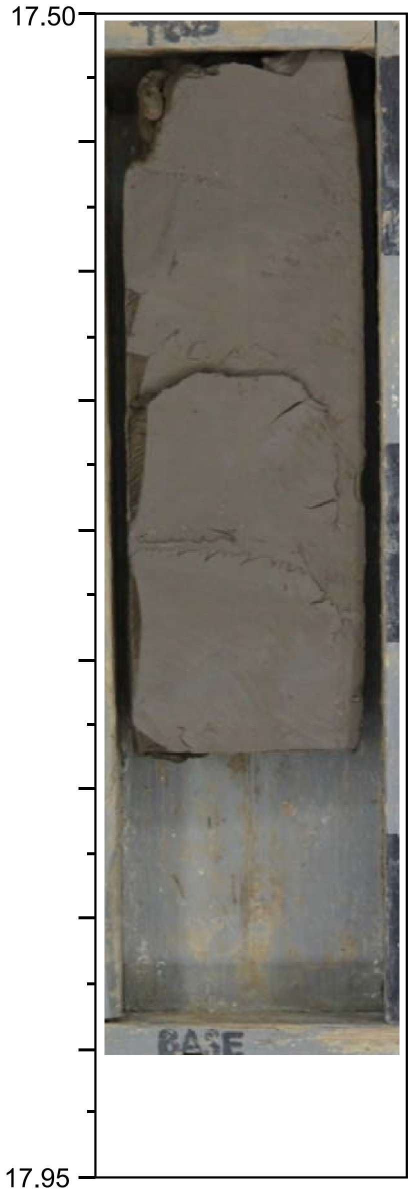
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	53		
Sample Depth, mBGL	17.50	-	17.95
Sample Type	UT		

Description

17.50 - 17.85m:
Firm to stiff, indistinctly thinly and thickly laminated, fissured, greyish brown CLAY with occasional dustings of grey silt along laminae and fissure surfaces. Fissures are extremely closely to very closely spaced, randomly orientated, occasionally polished.



17.65m:
Becoming stiff.

17.85 - 17.95m:
No recovery.

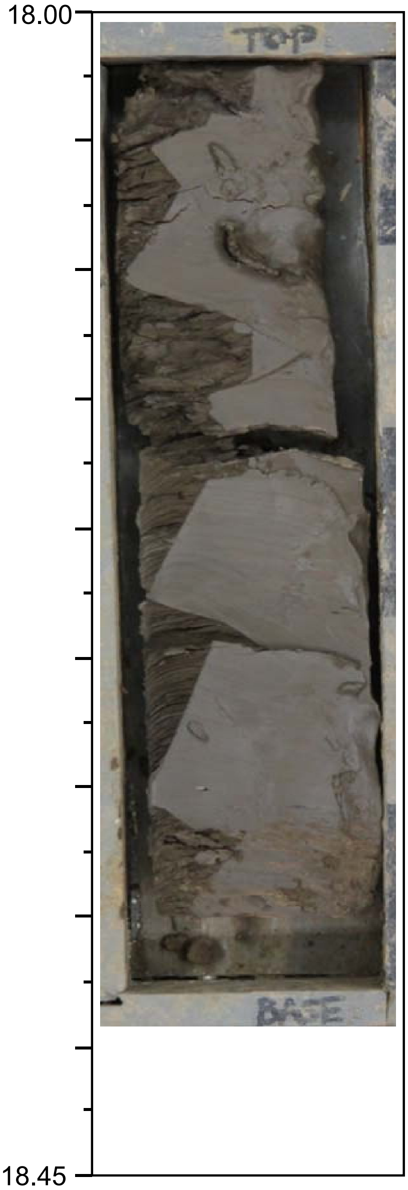
Remarks:

Split Tube Sample Description

Borehole No	BH407		
Sample No	55		
Sample Depth, mBGL	18.00	-	18.45
Sample Type	UT		

Description

18.00 - 18.19m:
Stiff indistinctly thinly and thickly laminated, fissured, greyish brown CLAY with rare dustings of light brown silt along fissure and laminae surfaces. Fissures are extremely closely to very closely spaced and randomly orientated.



18.19 - 18.45m:
Stiff thinly and thickly laminated brownish grey CLAY with occasional dusting of light brown silt on laminae surfaces.

18.40 - 18.45m:
With extremely closely spaced thin laminae (<2mm) of orangish brown fine sand.

Remarks:

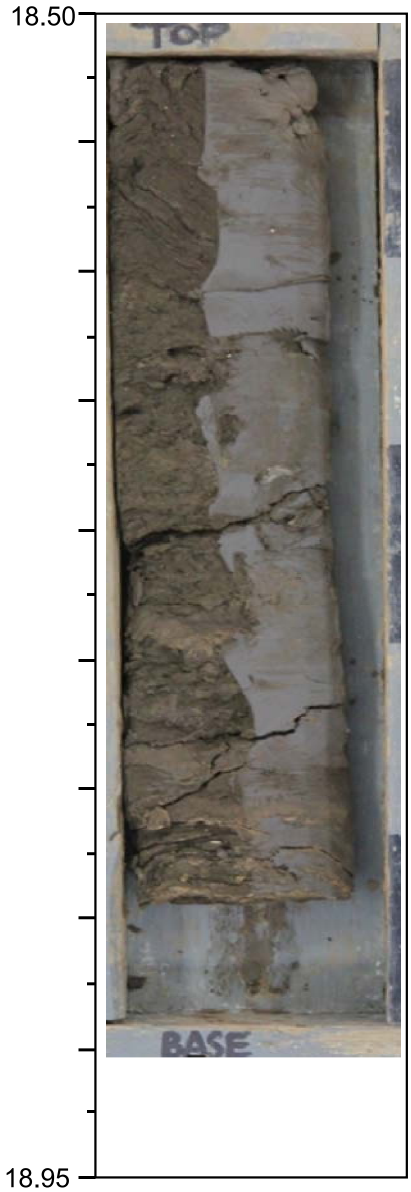
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	57		
Sample Depth, mBGL	18.50	-	18.95
Sample Type	UT		

Description

18.50 - 18.95m:
Stiff indistinctly thinly and thickly laminated, locally fissured, greyish brown and brownish grey CLAY with dustings of light brown silt and fine sand on laminae surfaces and closely spaced thin laminae (<2mm) of light brown fine sand. Rare subangular fine to medium gravel of chalk and flint. Fissures are very closely spaced, randomly orientated, locally polished.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	60		
Sample Depth, mBGL	19.50	-	19.95
Sample Type	UT		

Description

19.50 - 19.95m:
Stiff thinly and thickly locally indistinctly, laminated brown and greyish brown CLAY. With extremely closely spaced thin laminae (<5mm) of orangish brown and black fine to medium sand.
19.54m:
1No subangular coarse gravel of flint.

19.64 - 19.95m:
With occasional dustings and thin laminae (<2mm) of light brown silt along laminae surfaces.

19.68 - 19.72m:
Rare subangular to subrounded fine to medium gravel of chalk and flint.

19.50

19.95

Remarks:
Sample disturbed during testing.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	62		
Sample Depth, mBGL	20.00	-	20.45
Sample Type	UT		

Description

20.00 - 20.45m:
Stiff, locally firm, thinly and thickly, locally indistinctly, laminated greyish brown CLAY with dustings of light brown silt on laminae surfaces and very closely spaced thin laminae (<5mm) of orangish brown fine sand.

20.00

20.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407	
Sample No	66	
Sample Depth, mBGL	21.00	21.45
Sample Type	UT	

Description

21.00 - 21.45m:
Stiff thinly and thickly laminated brown and greyish brown CLAY with frequent dustings and thin laminae (<6mm) of light brown silt along laminae.

21.11 - 21.22m:
Extremely closely spaced thick and thin laminae (<7mm) of orangish brown fine to medium sand.

21.22 - 21.28m:
Indistinctly laminated.

21.00

21.45

Remarks:
Sample disturbed during testing.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407
Sample No	70
Sample Depth, mBGL	22.00 - 22.45
Sample Type	UT

Description

22.00 - 22.45m:
Stiff thinly and thickly, locally indistinctly, laminated greyish brown CLAY with occasional dustings of light brown silt on laminae surfaces. Extremely closely to very closely spaced thin laminae (<5mm) of orangish brown fine to medium sand.

Detail:
22.13m:
1No. subangular coarse gravel of flint.

22.00

22.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	75		
Sample Depth, mBGL	23.50	-	23.95
Sample Type	UT		

Description

23.50 - 23.95m:
Firm to stiff thinly and thickly laminated, locally cross laminated, greyish brown CLAY with dustings of light greyish brown silt and fine sand on laminae surfaces and closely spaced thin and thick laminae (<10mm) of dark brown and light brown silt and fine sand.

23.50

23.95

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH407		
Sample No	79		
Sample Depth, mBGL	24.50	-	24.95
Sample Type	UT		

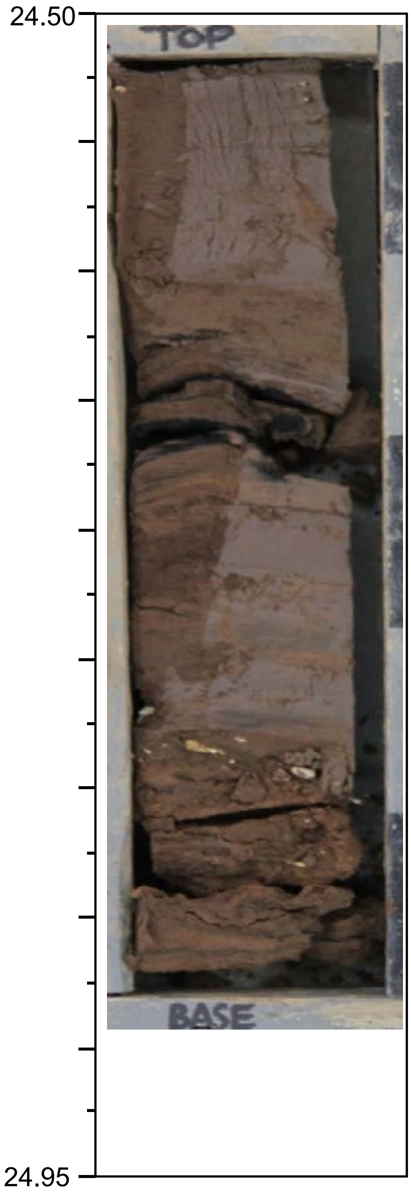
Description

24.50 - 24.62m:
Firm, locally stiff, indistinctly thinly and thickly laminated, locally indistinctly fissured, orangish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine, locally medium, of chalk, locally flint. Fissures are very closely spaced and randomly orientated.

24.62 - 24.72m:
Thinly and thickly laminated orangish brown, locally dark grey and black, slightly clayey fine to medium SAND with thin laminae (<4mm) of dark grey and black medium sand.

24.72 - 24.86m:
Firm, locally stiff, indistinctly thinly and thickly laminated, locally indistinctly fissured, orangish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine, locally medium, of chalk, locally flint. Fissures are very closely spaced and randomly orientated.

24.86 - 24.95m:
Indistinctly thinly and thickly laminated orangish brown, locally dark grey and black, slightly gravelly slightly clayey fine to medium SAND. Gravel is subangular to subrounded fine to medium of chalk and flint.



Remarks:

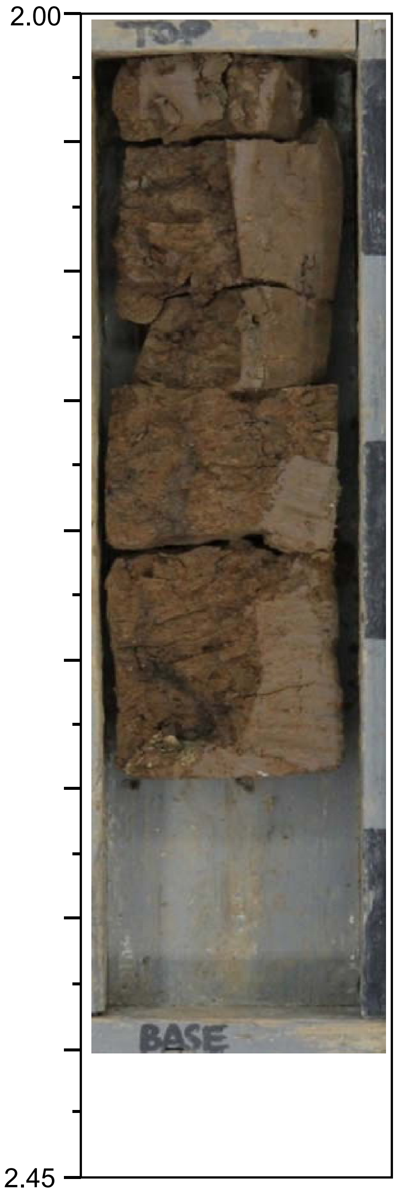
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH407
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	3		
Sample Depth, mBGL	2.00	-	2.45
Sample Type	UT		

Description

2.00 - 2.45m:
Stiff indistinctly fissured, locally indistinctly laminated, orangish brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of chalk, brick and concrete. Fissures are extremely closely spaced, randomly orientated, locally polished.
(MADE GROUND)



Remarks:
Sample disturbed during testing.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	5		
Sample Depth, mBGL	2.70	-	3.15
Sample Type	UT		

Description

2.70 - 3.15m:
Firm, locally stiff, indistinct thinly and thickly laminated orangish brown slightly sandy silty CLAY with occasional relict root tracks infilled grey.
Rare indistinct randomly oriented fissures.

3.05 - 3.15m:
More distinctly laminated.

2.70

3.15

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408
Sample No	7
Sample Depth, mBGL	3.35 - 3.80
Sample Type	UT

Description

3.35 - 3.42m:
Firm indistinctly thinly and thickly laminated orangish brown slightly sandy silty CLAY.

3.42 - 3.55m:
Greyish brown and brown sandy very clayey GRAVEL. Gravel is subangular to subrounded fine to coarse of limestone, quartzite and flint.

3.55 - 3.80m:
Firm indistinctly thinly and thickly laminated dark greyish brown and dark grey slightly sandy silty organic CLAY.

3.35

3.80

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408
Sample No	9
Sample Depth, mBGL	4.00 - 4.45
Sample Type	UT

Description

4.00 - 4.45m:
Firm, locally soft dark, greyish brown and dark grey thinly and thickly laminated slightly sandy silty CLAY.

4.24m:
Discoloured orangish brown adjacent to lamination.

4.00

4.45

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	11		
Sample Depth, mBGL	4.90	-	5.90
Sample Type	P		

Description

4.90 - 5.05m:
Soft, locally firm. Indistinctly thinly laminated, and fissured dark brownish grey oxidising to brown silty CLAY. Fissures are extremely closely spaced and randomly orientated.

5.05 - 5.74m:
Sample unavailable due to lab testing.

4.90

5.90

5.74 - 5.78m:
Soft indistinctly laminated greyish brown CLAY.
5.78 - 5.90m:
Soft, locally firm. Indistinctly thinly laminated, and fissured dark brownish grey oxidising to brown silty CLAY. Fissures are extremely closely spaced and randomly orientated.

Remarks:
5.05 - 5.75m not available due to testing procedures.

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	13		
Sample Depth, mBGL	6.00	-	6.45
Sample Type	UT		

Description

6.00m:
Soft, locally firm, thinly and thickly laminated greyish brown slightly sandy, clayey SILT.

Detail. 6.27 - 6.30m Undulating lenses up to 5mm light brown fine sand.

Detail. 6.40m Horizontal lenses up to 5mm of light brown fine sand.

6.00

6.45

Remarks:

Notes:	Project	A63 CASTLE STREET	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	15		
Sample Depth, mBGL	6.70	-	7.15
Sample Type	UT		

Description

6.70 - 7.06m:
Firm, locally soft, thinly and thickly laminated slightly sandy silty CLAY with occasional dustings of orangish brown fine sand along laminae surfaces.

6.85 - 7.01m:
Firm, with extremely closely to very closely spaced thin laminae (<4mm) of orangish brown fine sand.

7.06 - 7.15m:
No recovery.

6.70

7.15

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408
Sample No	17
Sample Depth, mBGL	7.40 - 7.85
Sample Type	UT

Description

7.40 - 7.60m:
Soft dark brownish grey slightly sandy silty CLAY.

7.60 - 7.85m:
Firm, locally soft, thinly and thickly laminated dark grey slightly sandy silty CLAY. With dustings of light brown fine sand on laminae surfaces.
7.60 - 7.65m:
Light brown (wet)

7.40

7.85

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

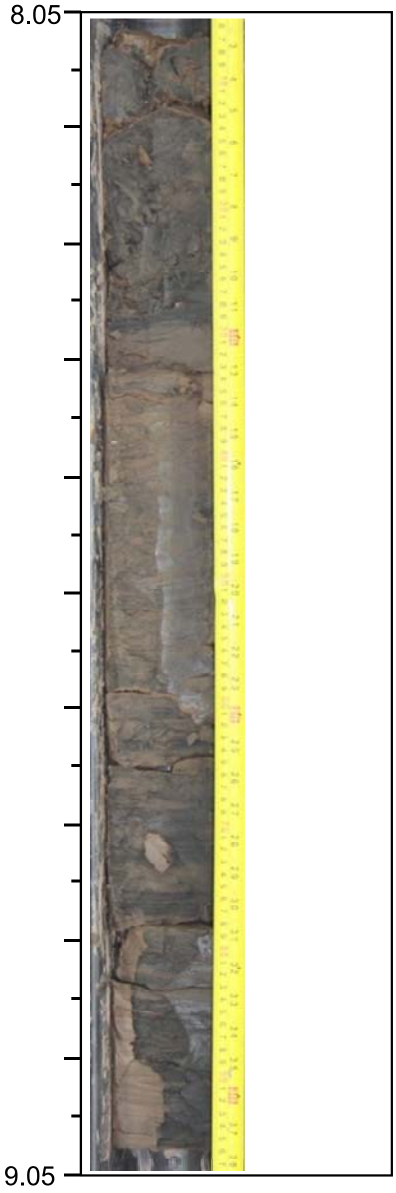
Borehole No	BH408		
Sample No	19		
Sample Depth, mBGL	8.05	-	9.05
Sample Type	P		

Description

8.05 - 8.27m:
Firm indistinctly thinly and thickly laminated dark grey, locally greyish brown, slightly sandy silty CLAY.

8.27 - 8.78m:
Thinly and thickly interlaminated dark grey and greyish brown silty fine to medium SAND and firm silty CLAY.

8.78 - 9.05m:
Firm thinly and thickly laminated dark grey and greyish brown sandy silty CLAY with frequent thin and thick laminae of silty fine to medium sand.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	20		
Sample Depth, mBGL	9.05	-	10.05
Sample Type	P		

Description

9.05 - 9.50m:
Firm indistinctly thinly and thickly laminated greyish brown and brownish grey sandy silty CLAY with occasionally thick laminae of silt and fine to medium sand.

9.50 - 10.05m:
Thinly and thickly interlaminated greyish brown and grey firm silty CLAY and fine to medium SAND, locally cross interlaminated.

9.05

10.05

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	21		
Sample Depth, mBGL	10.10	-	10.55
Sample Type	UT		

Description

10.10 - 10.40m:
Firm indistinctly thinly and thickly laminated dark greyish brown and brownish grey sandy silty CLAY with occasional dusting of silt and fine sand along laminae surfaces.
Frequent pockets (up to 10mm by 15mm) of orangish brown fine to medium sand.

10.40 - 10.55m:
No recovery.

10.10

10.55

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	23		
Sample Depth, mBGL	10.80	-	11.25
Sample Type	UT		

Description

10.80 - 10.90m:
Soft thinly laminated dark grey slightly sandy clayey organic SILT.

10.90m:
Rare subrounded to round fine to medium gravel.
10.90 - 11.10m:
Dark grey mottled orangish brown and greyish brown slightly clayey slightly organic fine to coarse SAND.
(ORGANIC ODOUR).

11.10 - 11.25m:
No recovery.

10.80

11.25

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408
Sample No	25
Sample Depth, mBGL	11.50 - 11.95
Sample Type	UT

Description

11.50 - 11.75m:
No recovery.

11.75 - 11.95m:
Greyish reddish brown fine to medium, occasionally coarse, SAND with rare subangular fine to medium gravel of quartzite and frequent shell fragments.

11.50

11.95

Remarks:
Sample is loose sand, disturbed during testing.

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH408

Split Tube Sample Description

Borehole No	BH408		
Sample No	30		
Sample Depth, mBGL	12.60	-	13.05
Sample Type	UT		

Description

12.60 - 12.75m:
Firm dark brownish black oxidising to dark brown pseudofibrous PEAT.

12.75 - 13.05m:
No recovery.

12.60

13.05

Remarks:

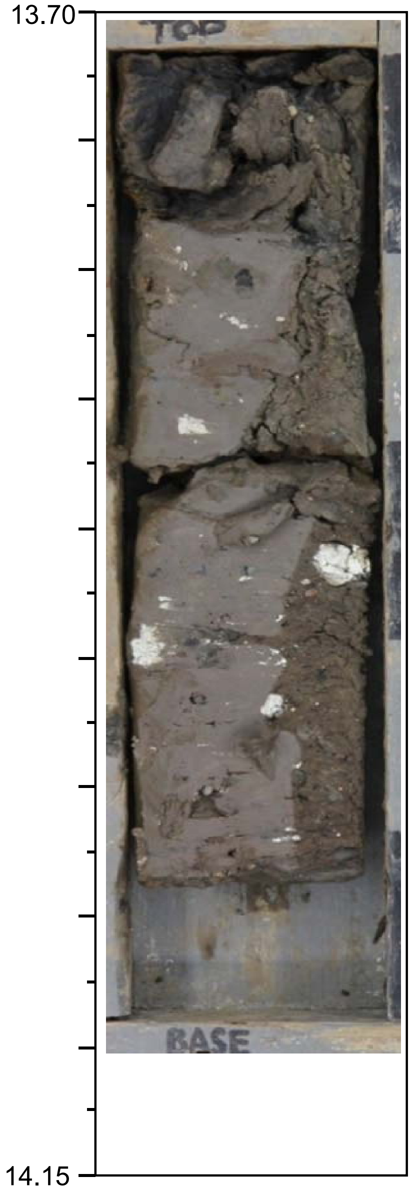
Split Tube Sample Description

Borehole No	BH408
Sample No	34
Sample Depth, mBGL	13.70 - 14.15
Sample Type	UT

Description

13.70 - 13.78m:
Firm dark brown sandy CLAY and dark grey organic CLAY. (SAMPLE DISTURBED).

13.78 - 14.15m:
Stiff, locally firm, dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded fine to coarse of chalk and igneous lithologies.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	35		
Sample Depth, mBGL	14.15	-	14.60
Sample Type	UT		

Description

14.15 - 14.60m:
Firm greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, sandstone and igneous lithologies.

14.20 - 14.30m:
Grey.

14.15

14.60

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	37		
Sample Depth, mBGL	14.80	-	15.25
Sample Type	UT		

Description

14.80 - 15.25m:
Stiff, locally firm, indistinctly fissured dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk and igneous lithologies.

14.80 - 15.01m:
Possible sample disturbance. Sample soft and wet.

14.80

15.25

Remarks:
Sample disturbed during testing.

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI A5085-15 Balfour Beatty Limited	Bh No/Depth BH408

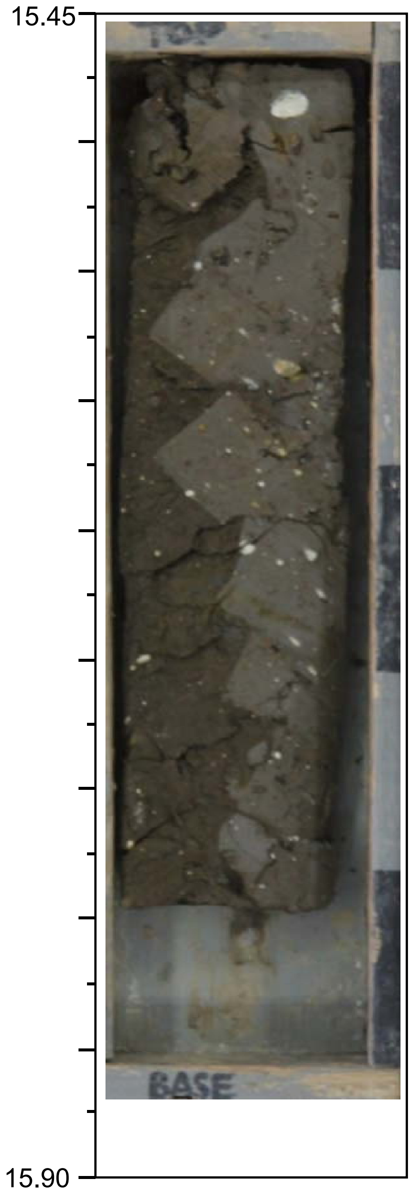
Split Tube Sample Description

Borehole No	BH408		
Sample No	39		
Sample Depth, mBGL	15.45	-	15.90
Sample Type	UT		

Description

15.45 - 15.90M:
Very stiff, locally stiff, greyish brown slightly sandy slightly gravelly CLAY. Gravel subangular to subrounded fine to coarse chalk, flint and igneous lithologies.
15.45 - 15.53m:
Locally firm to stiff (possible sample disturbance)

15.70 - 15.90m:
Grey infill to occasional indistinct irregular fissure.



Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	41		
Sample Depth, mBGL	16.10	-	16.55
Sample Type	UT		

Description

16.10 - 16.21m:
Stiff greyish brown slightly sandy slightly gravelly CLAY.
Gravel subangular to subrounded fine to medium chalk, sandstone, occasional igneous lithologies.

16.21 - 16.55m:
Stiff, locally very stiff, indistinctly fissured silty CLAY with frequent dustings of light brown silt along fissure surfaces.
Fissures are extremely closely to very closely spaced randomly orientated, occasionally polished.

16.10

16.55

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	43		
Sample Depth, mBGL	16.75	-	17.20
Sample Type	UT		

Description

16.75 - 17.20m:
Stiff, locally very stiff, occasionally indistinctly thinly and thickly laminated, fissured, brown CLAY with frequent dustings of light brown silt on fissure and laminae surfaces. Fissures are extremely closely to very closely spaced, randomly orientated, occasionally polished.

16.75

17.20

Remarks:

Notes:

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
Project No.	A5085-15	BH408
Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	45		
Sample Depth, mBGL	17.40	-	17.85
Sample Type	UT		

Description

17.40 - 17.85m:
Stiff fissured greyish brown silty CLAY with frequent dustings of light brown silt along fissure surface.
Fissures extremely closely spaced randomly orientated occasionaly polished.
17.40 - 17.57m:
Sample disturbed. Very soft and wet.

17.40

17.85

Remarks:

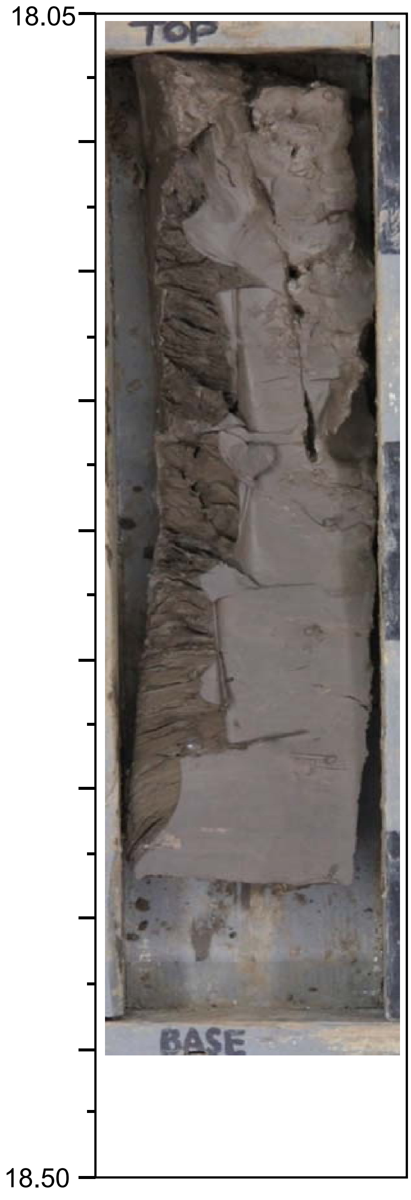
Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	47		
Sample Depth, mBGL	18.05	-	18.50
Sample Type	UT		

Description

18.05 - 18.35m:
Stiff, locally indistinctly fissured, greyish brown silty CLAY. Fissures are extremely closely to very closely spaced and randomly orientated.



18.35 - 18.50m:
Stiff thinly and thickly laminated greyish brown silty CLAY with frequent dustings of orangish brown sand on laminae surfaces.

18.43m:
1No. subrounded medium gravel of chalk.

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	49		
Sample Depth, mBGL	18.70	-	19.15
Sample Type	UT		

Description

18.70 - 18.75m:
Stiff thinly and thickly laminated greyish brown silty CLAY with frequent laminae (<2mm) of orangish brown fine sand.
18.75 - 19.15m:
Stiff, fissured, locally indistinctly thinly laminated, greyish brown silty CLAY with occasional dustings and irregular partings up to 2mm of orangish brown fine sand. Fissures are extremely to very closely spaced and randomly orientated.

19.01 - 19.09m:
Sample wet, locally soft to firm.

18.70

19.15

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	51		
Sample Depth, mBGL	19.35	-	19.80
Sample Type	UT		

Description

19.35 - 19.58m:
Stiff, locally firm, locally fissured, thinly and thickly laminated greyish brown silty CLAY. Fissures are extremely closely to very closely spaced, randomly orientated. With rare rounded fine gravel of chalk.

19.52m:
Thin laminae (3mm) of orangish brown fine to medium sand.

19.58 - 19.80m:
No recovery.

19.35

19.80

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	57		
Sample Depth, mBGL	21.35	-	21.80
Sample Type	UT		

Description

21.35 - 21.57m:
Stiff, locally firm, thinly and thickly laminated greyish brown CLAY. With extremely closely spaced thin laminae (<3mm) orangish brown, occasionally black, fine to medium sand.
21.35 - 21.40m:
Indistinctly laminated (with no dusting of thin laminae with silt or sand)

21.39m:
1N^{o} subrounded coarse gravel of igneous material.

21.57 - 21.80m:
Sample unavailable due to lab testing.

21.35

21.80

Remarks:

Notes:	Project Project No. Carried out for	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI A5085-15 Balfour Beatty Limited	Bh No/Depth **BH408**

Split Tube Sample Description

Borehole No	BH408		
Sample No	60		
Sample Depth, mBGL	22.45	-	22.90
Sample Type	UT		

Description

22.45 - 22.90m:
Stiff, locally firm, thinly and thickly laminated greyish brown CLAY. Occasional dustings of light brown silt along laminae surfaces. With extremely closely to very closely spaced thin and thick laminae (<10mm) of orangish brown fine sand.

22.59m:
Steeply inclined polished fissure.

22.65m:
Rare subrounded fine gravel of chalk.

22.45

22.90

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH408		
Sample No	64		
Sample Depth, mBGL	23.55	-	24.00
Sample Type	UT		

Description

23.55 - 23.61m:
Probable sample disturbance. Recovered as sandy gravelly CLAY.

23.61 - 23.95m:
Firm to stiff thinly and thickly laminated dark orangish brown sandy gravelly CLAY. Gravel is subangular fine to coarse of chalk with occasional pockets of dark grey and black sand.

23.95 - 24.00m:
Structureless CHALK composed of sandy silty subangular fine to coarse GRAVEL. Gravel is very weak to weak, low density.

23.55

24.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH408
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH417		
Sample No	8		
Sample Depth, mBGL	2.90	-	3.35
Sample Type	UT		

Description

2.90 - 3.22m:
Firm indistinctly fissured, indistinctly thinly and thickly laminated, reddish brown, mottled grey, slightly sandy CLAY with very closely spaced thin laminae (<3mm) of light brown fine sand. Relict root tracks up to 3mm infilled light grey and black. Rare subangular medium gravel of sandstone. Fissures are very closely spaced and randomly orientated.

3.22 - 3.28m:
Sample unavailable due to lab testing.

3.28 - 3.35m:
No recovery.

2.90

3.35

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH417
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH417		
Sample No	12		
Sample Depth, mBGL	4.20	-	4.65
Sample Type	UT		

Description

4.20 - 4.65m:
Firm thinly and thickly, locally indistinctly, laminated dark orangish brown slightly sandy CLAY with occasional dustings of light orangish brown fine sand on laminae surfaces.

4.20

4.65

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH417
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH417		
Sample No	14		
Sample Depth, mBGL	4.85	-	5.25
Sample Type	UT		

Description

4.85 - 5.25m:
Firm, locally soft, thinly and thickly laminated dark orangish brown slightly sandy CLAY with occasional dustings of dark grey silt along laminae surfaces

4.85

5.25

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	Bh No/Depth
	Project No.	A5085-15	BH417
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH417		
Sample No	17		
Sample Depth, mBGL	6.00	-	7.00
Sample Type	P		

Description

6.00 - 7.00m:
Soft thinly and thickly laminated, locally indistinctly greyish brown and dark grey slightly sandy silty organic CLAY. With dustings and closely spaced laminae (<2mm) of light brown silt.
Occasional vertical rootlets tracks infilled with organic material.
6.05m:
Subvertical fissure infilled with organic material with strong odour.

6.00

7.00

Remarks:

Notes:	Project	A63 CASTLE STREET IMPROVEMENTS - MAIN STREET GI	Bh No/Depth
	Project No.	A5085-15	BH417
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH417		
Sample No	19		
Sample Depth, mBGL	7.50	-	7.95
Sample Type	UT		

Description

7.50m:
Soft locally firm indistinctly thinly and thickly laminated dark brownish grey, slightly sandy, clayey, organic SILT

7.50

7.95

Remarks:
Recovery = 0.44m

Notes:	Project	A63 CASTLE STREET	Bh No/Depth
	Project No.	A5085-15	BH417
	Carried out for	Balfour Beatty Limited	

Split Tube Sample Description

Borehole No	BH417		
Sample No	22		
Sample Depth, mBGL	8.50	-	8.95
Sample Type	UT		

Description

8.50 - 8.82m:
Firm indistinctly thinly and thickly laminated dark brown grey, locally brown slightly sandy silty organic CLAY, locally grading to slightly sandy clayey SILT.
8.50 - 8.63m:
Probable sample disturbance.

8.50

8.95

8.82 - 8.95m:
No recovery.

Remarks:

Borehole Log

DRAFT

Drilled	Spektral	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.22 mOD
Logged	GS	16/12/2015	Competitor Dart 130 Carried out to facilitate the installation of standpipe piezometer, under instruction from Balfour Beatty.					Coordinates (m)	E 509458.26
Checked	TC	End						National Grid	N 428428.37
Approved		16/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
0.00 - 1.00	L				TOPSOIL		(0.30)		
0.30 - 0.80	ES 1				Dark brown slightly sandy clayey GRAVEL. Gravel is subrounded to rounded fine to coarse of predominantly quartzite. (MADE GROUND)		0.30 +2.92 (0.50)		
0.80 - 1.40	ES 2				Light brown mottled yellowish brown and greyish brown sandy clayey GRAVEL. Gravel is subangular to rounded fine to coarse of brick, mortar, limestone and quartzite. Rare pockets of black carbonaceous material. (MADE GROUND)		0.80 +2.42 (1.00)		
1.00 - 1.80	L								
1.60 - 1.80	ES 3								
					END OF EXPLORATORY HOLE		1.80 +1.42		

Groundwater Entries			
No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks	
Depths (m)	Remarks

Hard Boring		
Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole

WS401

Borehole Log

DRAFT

Drilled	Spektral	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	3.32 mOD
Logged	GS	16/12/2015	Competitor Dart 130 Carried out to facilitate the installation of standpipe piezometer, under instruction from Balfour Beatty.					Coordinates (m)	E 509513.92
Checked	TC	End						National Grid	N 428447.52
Approved		16/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)
0.00 - 1.00	L				CONCRETE. (MADE GROUND)		0.05 (0.05) +3.27
0.10 - 0.80	ES 1				Greyish brown mottled reddish brown sandy slightly clayey GRAVEL. Gravel is angular to subrounded fine to coarse of brick, quartzite and sandstone. (MADE GROUND)		(0.50) 0.55 +2.77
1.00 - 2.00	L				Firm locally indistinctly thinly laminated orangish brown, mottled grey, sandy CLAY with occasional rootlet tracks, discolouration along rootlet tracks. Occasional thin laminae of orangish brown fine and medium sand.	1.80-2.00 locally soft	(1.45) 2.00 +1.32
1.20 - 1.60	ES 2						
2.00 - 3.00	L				Soft indistinctly thinly laminated brownish grey slightly sandy silty CLAY with dustings of silt on laminae surfaces.		(1.00) 3.00 +0.32
2.50 - 2.60	ES 3						
3.00 - 4.00	L	No Recovery			NO RECOVERY. Base of sampler smeared with grey silty clay.		(1.00) 4.00 -0.68
					END OF EXPLORATORY HOLE		

Legend | Backfill

Groundwater Entries
No. Depth Strike (m) Remarks | Depth Sealed (m)

Depth Related Remarks
Depths (m) Remarks

Hard Boring
Depths (m) Duration (mins) Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole
WS402
Sheet 1 of 1

DRAFT

Borehole Log

Drilled	Spektral	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	4.12 mOD
Logged	GS	16/12/2015	Competitor Dart 130 Carried out to facilitate the installation of standpipe piezometer, under instruction from Balfour Beatty.					Coordinates (m)	E 509596.78
Checked	TC	End						National Grid	N 428440.38
Approved		16/12/2015							

Samples and Tests

Depth	Type & No	Records	Date / Casing	Time / Water
		0.00-0.70 Hand excavated inspection pit.		
0.70 - 1.00	L			
1.00 - 2.00	L			
1.25 - 1.60	ES 2			
2.00 - 3.00	L			
3.00 - 4.00	L			
3.50 - 4.00	ES 3			

Strata Description

Main	Detail	Depth, Level (Thickness)
Inspection pit.		(0.80) 0.80 +3.32
Firm indistinctly thinly laminated brown mottled orangish brown and grey sandy CLAY with dustings of silt and fine sand on laminae surfaces. Occasional thin laminae of orangish brown fine sand.		(1.25) 2.05 +2.07
Soft, locally firm, indistinctly thinly laminated dark grey, mottled brown, silty CLAY with rare black organic material and rootlets <2mm.	2.50-2.60 firm	(0.55) 2.60 +1.52
Soft indistinctly thinly laminated brown sandy CLAY.		(0.40) 3.00 +1.12
Soft to firm indistinctly thinly laminated dark grey and greyish brown silty CLAY with frequent thin laminae (<3mm) of fine to medium greyish brown sand.	3.80-4.00 very sandy 4.00-4.50 soft to very soft 4.50-5.00 firm	(2.00) 5.00 -0.88
END OF EXPLORATORY HOLE		

Legend | Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole **WS403**

Borehole Log

DRAFT

ESG

Drilled	Spektral	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	4.42 mOD
Logged	GS	16/12/2015	Competitor Dart 130 Carried out to facilitate the installation of standpipe piezometer, under instruction from Balfour Beatty.					Coordinates (m)	E 510042.65
Checked	TC	End						National Grid	N 428426.61
Approved		16/12/2015							

Samples and Tests / Strata Description

Depth	Type & No	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
0.00 - 1.00	L				Light brownish grey sandy GRAVEL with low cobble content. Gravel is subangular to subrounded fine to coarse of limestone, tarmac, concrete and fused slag. Cobbles are of concrete and fused slag. (MADE GROUND)		(1.10)		
0.10 - 1.00	ES 1								
1.00 - 2.00	L						1.10 +3.32		
1.10 - 1.20	ES 2				Firm brownish grey sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of brick, chalk and some shell fragments. (MADE GROUND)		(0.80)		
							1.90 +2.52		
2.00 - 3.00	L				Firm indistinctly thinly laminated orangish brown, mottled grey, slightly sandy silty CLAY with rootlet tracks (<2mm) frequently infilled grey.	2.60-2.65 black organic carbonaceous material 2.80 becoming stiff.	(1.10)		
2.50 - 3.00	ES 3								
3.00 - 4.00	L	No Recovery			NO RECOVERY. Base of sampler smeared with grey silty clay.		3.00 +1.42		
							(1.00)		
					END OF EXPLORATORY HOLE		4.00 +0.42		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

AGS

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Borehole

WS404

Client ESG (Carcroft)
Contact Neil Cooke

Contract A63 Castle Street, Hull

Diameter 150mm
Orientation Vertical

Report No. 51018417
Sample Ref. 55011320
Date Drilled 02/12/2015
Date Logged 02/12/2015
Date Reported 07/12/2015

Client Ref. **CR2 - CH200m - A63 Central reserve, southern/westbound side of pedestrian guard rail.**
Easting Coordinates **509076.9949**
Northing Coordinates **428232.9833**

UKAS TESTING
0001

ESG Environmental Scientifics Group
29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm) From	Depth (mm) To	Layer Description	Debonded @ lower interface	Voids	Aggregate Size (mm)	Aggregate Type	PAK Marker test*	Layer Comments
1	28	0	28	Dense Bituminous Material (DBM)	No	High	6	CR	Slight Positive	Red close grain
2	30	28	58	Dense Bituminous Material (DBM)	No	Medium	6	CR	Slight Positive	
3	63	58	121	Dense Bituminous Material (DBM)	N/A	High	20	CR	Slight Positive	

Key

Materials
B - Base
SC - Surface Course
BC - Binder Course
DBM - Dense Bituminous Material
HRA - Hot Rolled Asphalt
PCC - Pre Coated Chippings
CONC - Concrete

Aggregates
CR - Crushed Rock
GR - Gravel
HST - Hardstone
LST - Limestone
SL - Slag
SMA - Stone Mastic Asphalt
TAR - Tarbound

* PAK Marker test for presence of Coal Tar is NOT covered by the current scope of UKAS accreditation for this laboratory. Results are an indication only and not meant as a definitive test. ESG cannot be held responsible for decisions made on these results. More definitive tests are available.

Signed: [redacted] [x] J. Whitworth (Section Manager)

Client	ESG (Carcroft)	Report No.	51018417
Contact	Neil Cooke	Sample Ref.	55011324
		Date Drilled	03/12/2015
Contract	A63 Castle Street, Hull	Date Logged	03/12/2015
		Date Reported	07/12/2015
Diameter	150mm	**Client Ref.**	**CR3 - CH820m - A63 Central reserve, northern/eastbound side of pedestrian guard rail.**
Orientation	Vertical	**Easting Coordinates**	**509653.1537**
		Northing Coordinates	**428454.923**

0001

Environmental Scientifics Group
29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm)		Layer Description	Debonded @ lower interface	Voids	Aggregate		PAK Marker test*	Layer Comments
		From	To				Size (mm)	Type		
1	107	0	107	Concrete (CONC)	N/A	Medium	20	CR	Slight Positive	

Key

Materials

B - Base
SC - Surface Course
BC - Binder Course
DBM - Dense Bituminous Material
HRA - Hot Rolled Asphalt
PCC - Pre Coated Chippings
CONC - Concrete

Aggregates

CR - Crushed Rock
GR - Gravel
HST - Hardstone
LST - Limestone
SL - Slag
SMA - Stone Mastic Asphalt
TAR - Tarbound

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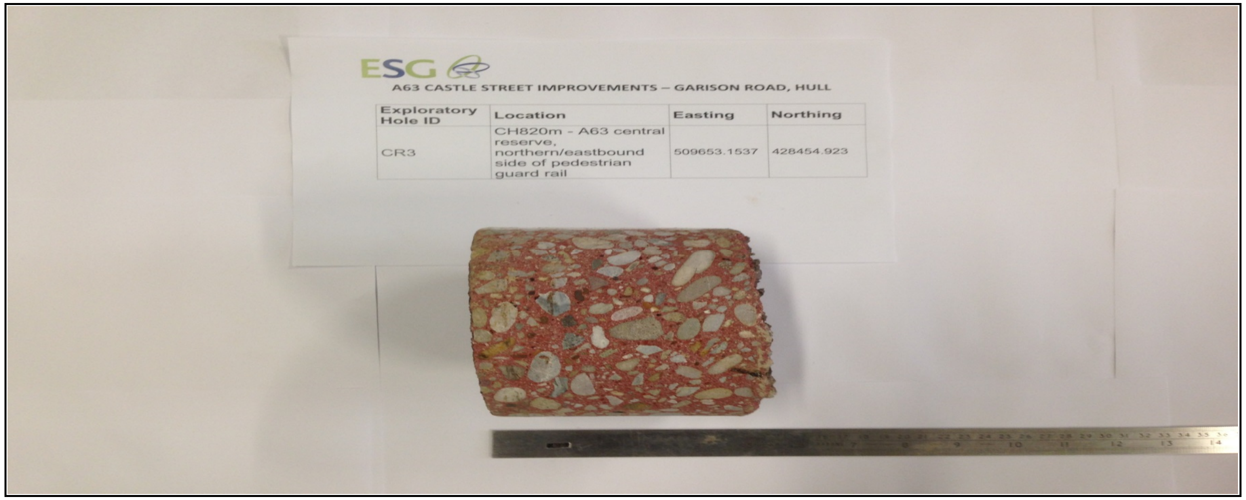
Signed: [redacted] x] J. Whitworth (Section Manager)



Client ESG (Carcroft)
Contact Neil Cooke

Contract A63 Castle Street, Hull

Diameter 150mm
Orientation Vertical

Report No. 51018417
Sample Ref. 55012619
Date Drilled 08/02/2016
Date Logged 08/02/2016
Date Reported 09/02/2016

Client Ref. **CR4 - CH950m - A63 Central reserve, southern/westbound side of pedestrian guard rail.**
Easting Coordinates **509779.5984**
Northing Coordinates **428446.6125**

UKAS TESTING
0001

ESG Environmental Scientifics Group
29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm)		Layer Description	Debonded @ lower interface	Voids	Aggregate		PAK Marker test*	Layer Comments
		From	To				Size (mm)	Type		
1	140	0	140	Concrete (CONC)	N/A	Medium	20	CR	Negative	

Key

Materials
B - Base
SC - Surface Course
BC - Binder Course
DBM - Dense Bituminous Material
HRA - Hot Rolled Asphalt
PCC - Pre Coated Chippings
CONC - Concrete

Aggregates
CR - Crushed Rock
GR - Gravel
HST - Hardstone
LST - Limestone
SL - Slag
SMA - Stone Mastic Asphalt
TAR - Tarbound

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Signed: [redacted] [x] J. Whitworth (Section Manager)

Client	ESG (Carcroft)	Report No.	51018417
Contact	Neil Cooke	Sample Ref.	55011325
		Date Drilled	03/12/2015
Contract	A63 Castle Street, Hull	Date Logged	03/12/2015
		Date Reported	07/12/2015
Diameter	150mm	**Client Ref.**	CR5 - CH1150m - A63 Central reserve, southern/westbound side of pedestrian guard rail.
Orientation	Vertical	Easting Coordinates	509977.8146
		Northing Coordinates	428418.1917

UKAS TESTING 0001

ESG Environmental Scientifics Group

29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm) From	Depth (mm) To	Layer Description	Debonded @ lower interface	Voids	Aggregate Size (mm)	Aggregate Type	PAK Marker test*	Layer Comments
1	23	0	23	Dense Bituminous Material (DBM)	No	High	6	CR	Slight Positive	
2	76	23	99	Concrete (CONC	N/A	High	20	CR	Slight Positive	

Key

Materials	**Aggregates**
B - Base	CR - Crushed Rock
SC - Surface Course	GR - Gravel
BC - Binder Course	HST - Hardstone
DBM - Dense Bituminous Material	LST - Limestone
HRA - Hot Rolled Asphalt	SL - Slag
PCC - Pre Coated Chippings	SMA - Stone Mastic Asphalt
CONC - Concrete	TAR - Tarbound

* PAK Marker test for presence of Coal Tar is NOT covered by the current scope of UKAS accreditation for this laboratory. Results are an indication only and not meant as a definitive test. ESG cannot be held responsible for decisions made on these results. More definitive tests are available.

Signed: [redacted] [x] J. Whitworth (Section Manager)

Client ESG (Carcroft)
Contact Neil Cooke

Contract A63 Castle Street, Hull

Report No. 51018417
Sample Ref. 55011316
Date Drilled 01/12/2015
Date Logged 01/12/2015
Date Reported 07/12/2015

0001

ESG Environmental Scientifics Group
29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Diameter 150mm
Orientation Vertical

Client Ref. **EB3 - CH800m - A63 eastbound carriageway lar**
Easting Coordinates **509626.1151**
Northing Coordinates **428460.686**

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm)		Layer Description	Debonded @ lower interface	Voids	Aggregate		PAK Marker test*	Layer Comments
		From	To				Size (mm)	Type		
1	38	0	38	Stone Mastic Asphalt (SMA)	No	High	14	CR	Negative	
2	60	38	98	Dense Bituminous Material (DBM)	Yes	Medium	20	CR	Negative	
3	290	98	388	Concrete (CONC)	N/A	Low	10	CR	Negative	

Key

Materials
B - Base
SC - Surface Course
BC - Binder Course
DBM - Dense Bituminous Material
HRA - Hot Rolled Asphalt
PCC - Pre Coated Chippings
CONC - Concrete

Aggregates
CR - Crushed Rock
GR - Gravel
HST - Hardstone
LST - Limestone
SL - Slag
SMA - Stone Mastic Asphalt
TAR - Tarbound

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Signed: [redacted] [x] J. Whitworth (Section Manager)

Client ESG (Carcroft)
Contact Neil Cooke

Contract A63 Castle Street, Hull

Diameter 150mm
Orientation Vertical

Report No. 51018417
Sample Ref. 55011323
Date Drilled 03/12/2015
Date Logged 03/12/2015
Date Reported 07/12/2015

Client Ref. **EB4 - CH1020m - A63 Eastbound carriageway lane 2**
Easting Coordinates **509846.5033**
Northing Coordinates **428444.4519**

0001

ESG Environmental Scientifics Group

29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm)		Layer Description	Debonded @ lower interface	Voids	Aggregate		PAK Marker test*	Layer Comments
		From	To				Size (mm)	Type		
1	42	0	42	Stone Mastic Asphalt (SMA)	No	High	14	CR	Slight Positive	
2	66	42	108	Dense Bituminous Material (DBM)	Yes	High	20	CR	Slight Positive	
3	319	108	427	Concrete (CONC)	N/A	High	20	CR	Slight Positive	

Key

Materials
B - Base
SC - Surface Course
BC - Binder Course
DBM - Dense Bituminous Material
HRA - Hot Rolled Asphalt
PCC - Pre Coated Chippings
CONC - Concrete

Aggregates
CR - Crushed Rock
GR - Gravel
HST - Hardstone
LST - Limestone
SL - Slag
SMA - Stone Mastic Asphalt
TAR - Tarbound

* PAK Marker test for presence of Coal Tar is NOT covered by the current scope of UKAS accreditation for this laboratory. Results are an indication only and not meant as a definitive test. ESG cannot be held responsible for decisions made on these results. More definitive tests are available.

Signed: [redacted] [x] J. Whitworth (Section Manager)

Client ESG (Carcroft)
Contact Neil Cooke

Contract A63 Castle Street, Hull

Diameter 150mm
Orientation Vertical

Report No. 51018417
Sample Ref. 55011319
Date Drilled 01/12/2015
Date Logged 01/12/2015
Date Reported 07/12/2015

Client Ref. **WB1 - CH70m - A63 Westbound carriageway lane 1**
Easting Coordinates **508966.0371**
Northing Coordinates **428167.4176**

0001

ESG Environmental Scientifics Group
29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm) From	Depth (mm) To	Layer Description	Debonded @ lower interface	Voids	Aggregate Size (mm)	Aggregate Type	PAK Marker test*	Layer Comments
1	40	0	40	Stone Mastic Asphalt (SMA)	No	High	14	CR	Slight Positive	
2	30	40	70	Dense Bituminous Material (DBM)	No	Medium	10	CR	Slight Positive	
3	155	70	225	Dense Bituminous Material (DBM)	Yes	Medium	32	CR	Slight Positive	
4	270	225	495	Concrete (CONC)	N/A	Medium	10	CR	Slight Positive	

Key

Materials
B - Base
SC - Surface Course
BC - Binder Course
DBM - Dense Bituminous Material
HRA - Hot Rolled Asphalt
PCC - Pre Coated Chippings
CONC - Concrete

Aggregates
CR - Crushed Rock
GR - Gravel
HST - Hardstone
LST - Limestone
SL - Slag
SMA - Stone Mastic Asphalt
TAR - Tarbound

* PAK Marker test for presence of Coal Tar is NOT covered by the current scope of UKAS accreditation for this laboratory. Results are an indication only and not meant as a definitive test. ESG cannot be held responsible for decisions made on these results. More definitive tests are available.

Signed: [redacted] [x] J. Whitworth (Section Manager)

Client	ESG (Carcroft)	Report No.	51018417
Contact	Neil Cooke	Sample Ref.	55011318
		Date Drilled	01/12/2015
Contract	A63 Castle Street, Hull	Date Logged	01/12/2015
		Date Reported	07/12/2015
Diameter	150mm	**Client Ref.**	**WB2 - CH150m - A63 Westbound carriageway lane 1**
Orientation	Vertical	**Easting Coordinates**	**509037.6797**
		Northing Coordinates	**428204.9824**

0001

ESG Environmental Scientifics Group
29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm) From	Depth (mm) To	Layer Description	Debonded @ lower interface	Voids	Aggregate Size (mm)	Aggregate Type	PAK Marker test*	Layer Comments
1	60	0	60	Stone Mastic Asphalt (SMA)	No	Medium	14	CR	Positive	
2	70	60	130	Dense Bituminous Material (DBM)	No	Medium	32	CR	Positive	
3	100	130	230	Dense Bituminous Material (DBM)	Yes	Low	32	CR	Positive	
4	330	230	560	Concrete (CONC)	N/A	Medium	10	CR	Positive	

Key

Materials	**Aggregates**
B - Base	CR - Crushed Rock
SC - Surface Course	GR - Gravel
BC - Binder Course	HST - Hardstone
DBM - Dense Bituminous Material	LST - Limestone
HRA - Hot Rolled Asphalt	SL - Slag
PCC - Pre Coated Chippings	SMA - Stone Mastic Asphalt
CONC - Concrete	TAR - Tarbound

* PAK Marker test for presence of Coal Tar is NOT covered by the current scope of UKAS accreditation for this laboratory. Results are an indication only and not meant as a definitive test. ESG cannot be held responsible for decisions made on these results. More definitive tests are available.

Signed: [redacted] [x] J. Whitworth (Section Manager)

Client	ESG (Carcroft)	Report No.	51018417
Contact	Neil Cooke	Sample Ref.	55011317
		Date Drilled	01/12/2015
Contract	A63 Castle Street, Hull	Date Logged	01/12/2015
		Date Reported	07/12/2015
Diameter	150mm	**Client Ref.**	**WB3 - CH890m - A63 westbound carriageway la**
Orientation	Vertical	**Easting Coordinates**	**509716.3554**
		Northing Coordinates	**428445.751**

UKAS TESTING 0001

ESG Environmental Scientifics Group

29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm) From	Depth (mm) To	Layer Description	Debonded @ lower interface	Voids	Aggregate Size (mm)	Aggregate Type	PAK Marker test*	Layer Comments
1	45	0	45	Stone Mastic Asphalt (SMA)	No	High	14	CR	Slight positive	
2	70	45	115	Dense Bituminous Material (DBM)	Yes	Medium	20	CR	Slight positive	
3	100	115	215	Concrete (CONC)	N/A	High	10	CR	Slight positive	

Key

Materials

B - Base
SC - Surface Course
BC - Binder Course
DBM - Dense Bituminous Material
HRA - Hot Rolled Asphalt
PCC - Pre Coated Chippings
CONC - Concrete

Aggregates

CR - Crushed Rock
GR - Gravel
HST - Hardstone
LST - Limestone
SL - Slag
SMA - Stone Mastic Asphalt
TAR - Tarbound

* PAK Marker test for presence of Coal Tar is NOT covered by the current scope of UKAS accreditation for this laboratory. Results are an indication only and not meant as a definitive test. ESG cannot be held responsible for decisions made on these results. More definitive tests are available.

Signed: [redacted] [x] J. Whitworth (Section Manager)

Client	ESG (Carcroft)	Report No.	51018417	
Contact	Neil Cooke	Sample Ref.	55012618	
		Date Drilled	08/02/2016	
Contract	A63 Castle Street, Hull	Date Logged	08/02/2016	
		Date Reported	09/02/2016	
Diameter	150mm	**Client Ref.**	**WB4 - CH1100m - A63 Westbound carriageway lane 2.**	
Orientation	Vertical	**Easting Coordinates**	**509924.8076**	
		Northing Coordinates	**428428.2499**	

0001

Environmental Scientifics Group
29 Rufford Court
Warrington
Cheshire
WA1 4RF
Tel: 01925 286220

Strata Description & Depth Details

Layer	Thickness (mm)	Depth (mm) From	Depth (mm) To	Layer Description	Debonded @ lower interface	Voids	Aggregate Size (mm)	Aggregate Type	PAK Marker test*	Layer Comments
1	50	0	50	Stone Mastic Asphalt (SMA)	No	High	14	CR	Slight Positive	
2	65	50	115	Dense Bituminous Material (DBM)	Yes	Medium	20	CR	Slight Positive	
3	310	115	425	Concrete (CONC)	N/A	Low	20	CR	Negative	

Key

Materials	**Aggregates**
B - Base	CR - Crushed Rock
SC - Surface Course	GR - Gravel
BC - Binder Course	HST - Hardstone
DBM - Dense Bituminous Material	LST - Limestone
HRA - Hot Rolled Asphalt	SL - Slag
PCC - Pre Coated Chippings	SMA - Stone Mastic Asphalt
CONC - Concrete	TAR - Tarbound

* PAK Marker test for presence of Coal Tar is NOT covered by the current scope of UKAS accreditation for this laboratory. Results are an indication only and not meant as a definitive test. ESG cannot be held responsible for decisions made on these results. More definitive tests are available.

Signed: [redacted] [x] J. Whitworth (Section Manager)

APPENDIX C

INSTRUMENTATION AND MONITORING

Installation Details	Table C1
Groundwater Monitoring	
Groundwater Level Summary (Diver data logger)	Figure C2.1
VWP Monitoring Data – Water Level (BH407)	Figure C2.2

Groundwater Installation Details

Instrument reference	Elevation (m OD)	Instrument type (see Notes)	Installation date	Pipe diameter (mm)	Instrument base		Response zone range (mbgl)	Pipe top details	Headworks	Remarks
					m OD	m BGL				
BH402	2.64	SP	19/01/2016	50	-5.36	8.00	5.50 to 9.40	Gas tap	Flush cover	
BH403	2.98	EPIE	12/01/2016	-	-3.52	6.50	6.00 to 7.00	-	Flush cover	
BH404	2.91	SP	21/01/2016	50	-11.09	14.00	11.50 to 14.00	Gas tap	Flush cover	
BH405	3.16	SP	13/01/2016	50	-5.84	9.00	7.00 to 9.00	Gas tap	Flush cover	
BH406	3.33	SP	09/12/2015	50	-11.17	14.50	12.50 to 14.50	Gas tap	Flush cover	
BH407	3.48	EPIE	16/12/2015	-	-5.02	8.50	8.00 to 9.00	-	Flush cover	
BH408	3.61	SP	09/12/2015	50	-7.89	11.50	9.50 to 11.50	Gas tap	Flush cover	
BH417	5.08	SP	15/12/2015	50	-3.92	9.00	7.00 to 9.00	Gas tap	Flush cover	
WS401	3.22	SP	16/12/2015	19	1.22	2.00	1.05 to 1.80	Gas tap	Flush cover	
WS402	3.32	SP	16/12/2015	19	0.62	2.70	1.70 to 2.70	Gas tap	Flush cover	
WS403	4.12	SP	16/12/2015	19	1.12	3.00	2.00 to 3.00	Gas tap	Flush cover	
WS404	4.42	SP	16/12/2015	19	1.92	2.50	1.50 to 2.50	Gas tap	Flush cover	

Notes: Notes: Type: SP - Standpipe, SPIE - Standpipe Piezometer, HPIE - Hydraulic Piezometer, PPIE - Pneumatic Piezometer, EPIE - Electronic Piezometer

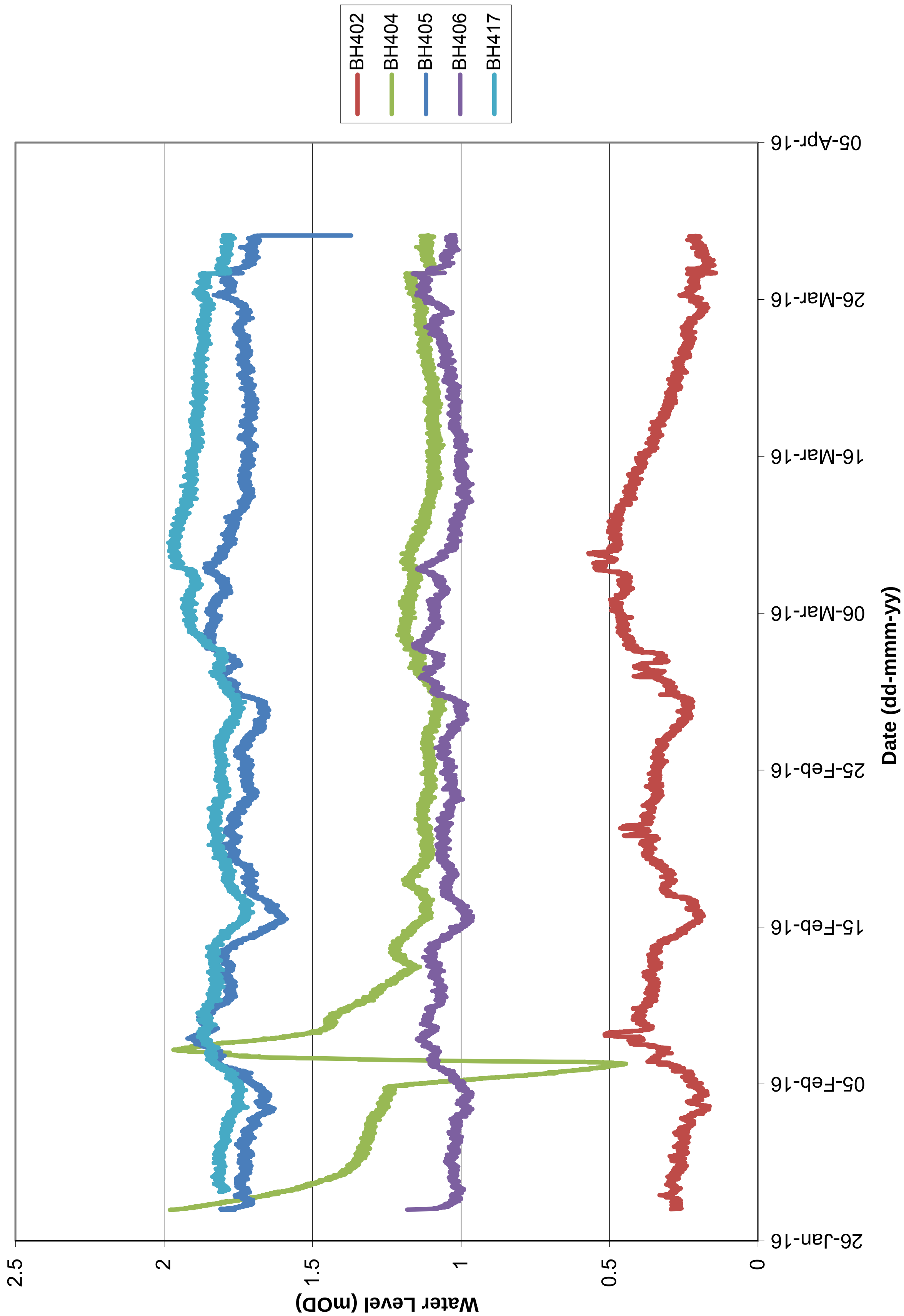
AGS

Project	**A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI**
Project No.	**A5085-15**
Carried out for	**Balfour Beatty Limited**

Table

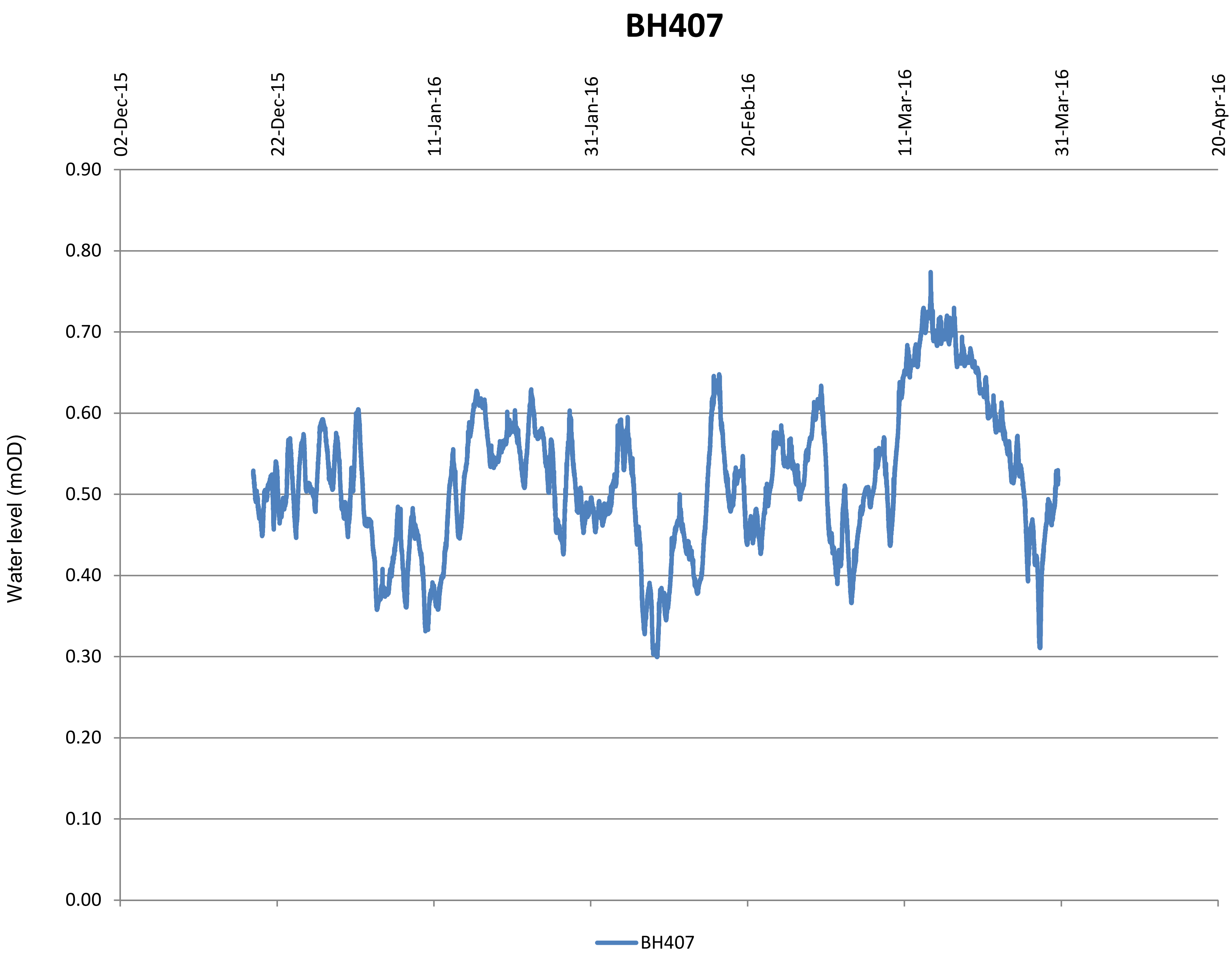
C1

Groundwater Level Summary



Notes:	**Project**	A6 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A508515	**C2.1**
	Carried out for	Balfour Beatty	

VWP Monitoring Data - Water Level



Notes:

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Figure C2.2

APPENDIX D

CONE PENETRATION TESTING

Summary of Cone Magnetometer Tests	Table 1
Cone Calibration Certificate	GS-1214-002
Cone Magnetometer Test Plots	see Table 1
Summary of Cone Penetration Tests	Table 2
Cone Calibration Certificates	C10.CFIP.125 and 126
Key to Cone Penetration Test Records	Key CPT
Cone Penetration Test Plots	see Table 2

Summary of Cone Magnetometer Tests

CPT No.	Depth of data (m)	Date	Easting	Northing	Elevation (mOD)	Remarks	No. of Sheets
BH404 MAG	11.74	01/12/2015	509249.01	428309.09	2.91	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
BH405 MAG	11.73	02/12/2015	509285.25	428329.82	3.16	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
BH406 MAG	11.74	02/12/2015	509308.11	428382.42	3.27	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
BH407 MAG	0.92	01/12/2015	509335.46	428358.79	3.51	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Refused on thrust	NA
BH407A MAG	18.00	01/12/2015	509335.46	428358.79	3.51	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Second attempt at this location	1
BH408 MAG	11.02	01/12/2015	509360.27	428406.49	3.61	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
BH417 MAG	1.63	14/12/2015	510050.55	428445.14	5.00	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Refused on thrust. Data not processed	NA
BH417A MAG	1.51	15/12/2015	510050.55	428445.14	5.00	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Second attempt at this location	NA
BH417B MAG	1.53	15/12/2015	510050.55	428445.14	5.00	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Third attempt at this location	NA
BH417C MAG	1.84	15/12/2015	510050.55	428445.14	5.00	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Fourth attempt at this location	NA
BH417D MAG	17.38	15/12/2015	510050.55	428445.14	5.00	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Fifth attempt at this location	1
WS02 MAG	2.10	17/12/2015	509513.92	428447.52	3.32	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Refused on thrust	1
WS04 MAG	0.88	16/12/2015	510041.25	428426.49	4.38	Test using combined magcone 15cm2 piezocone S15-CFIIP.1214 Refused on thrust. Data not processed	NA
WS04A MAG	5.78	16/12/2015	510041.25	428426.49	4.38	Test using combined magcone 15cm2 piezocone S15-CFIIP.1214 Second attempt at this location	1

Notes:

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Table**
Project No.	A5085-15	**1**
Carried out for	Balfour Beatty Limited	

Summary of Cone Magnetometer Tests

CPT No.	Depth of data (m)	Date	Easting	Northing	Elevation (mOD)	Remarks	No. of Sheets
CPT402 MAG	19.93	11/12/2015	508938.74	428179.31	2.62	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
CPT403 MAG	20.66	12/12/2015	509210.00	428324.29	2.99	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
CPT404 MAG	11.74	01/12/2015	509248.22	428308.61	2.86	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
CPT406 MAG	15.23	07/12/2015	509269.95	428358.26	3.10	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
CPT407 MAG	11.74	03/12/2015	509296.76	428352.59	3.26	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
CPT408 MAG	0.13	09/12/2015	509360.33	428407.70	3.57	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Refused on thrust	NA
CPT408A MAG	0.33	09/12/2015	509360.33	428407.70	3.57	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Second attempt at this location	NA
CPT408B MAG	0.29	09/12/2015	509360.33	428407.70	3.57	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214 Third attempt at this location	NA
CPT409 MAG	10.92	03/12/2015	509393.19	428424.23	3.20	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1
CPT425 MAG	22.85	08/02/2016	509392.49	428411.52	2.92	Test using combined magcone 15cm^2 piezocone S15-CFIIP.1214	1

Notes (unless indicated otherwise above)
- Tests carried out with 15cm^2 combined magcone without a friction reducer
- Piezocones fitted with polypropylene pore pressure filter located in the shoulder (u2) position
- Tests terminated at scheduled depth or maximum achievable depth (refusal)
- No backfilling to CPT holes
- Groundwater/collapse depths not recorded

point Systems bv

Rijksstraatweg 22F
2171 AL Sassenheim
Tel. : +31 71 301 92 51
Fax : +31 71 301 92 52
E-mail : info@geopoint.nl
BTW : NL814690178.B01
IBAN : NL28 INGB0682301396
BIC : INGBNL2A

Cone Calibration Certificate

Certificate:	**GS-1214-002**	
Instrument Type:	Electric Subtraction Cone	
Model:	S15-CFIIP	
Serial number:	1214	
Calibration date:	29-04-2015	
Client:	Soil Mechanics	
Calibrated by:	W. Volgering	
Calibration instruments		
Manufacturer:	Hottinger Baldwin Messtechnik GmbH	
HBM certificate no. :	FL1461	
Calibration conditions		
Ambient temperature:	19.9	°C
Atmospheric pressure:	1017	mBar
Cone specifications		
Cone base area:	1500	mm2
Load tip resistance (nom.):	50	kN
Friction sleeve area:	20000	mm2
Load tip + local friction (nom.):	50	kN
Load friction sleeve (nom.):	22.5	kN
Load pore pressure (nom.):	2	MPa
Inclination (nom.):	+/- 20	°
Temperature compensation (all channels):	0...+40	°C
Maximum overload capacity (all channels):	100	%
Cone area ratio (a):	0.79	
Max. Inaccuracy, relative to measurement value:	1.0	%

	Tip:		Sleeve:		Pore Pressure:		Inclinometer:		
	qc in kN	mV	fs in kN	mV	MPa	mV	Degrees	X (mV)	Y (mV)
Zero points:		0284		0223		0273			
	0	0	0	0	0	0	0	2394	2567
	5	0307	5	0321	0.4	1283	-20	0310	0557
	10	0616	10	0642	0.8	2563	20	4439	4603
	15	0926	15	0964	1.2	3840			
	20	1234	20	1286	1.6	5114			
	25	1544	25	1609	2.0	6385			
	30	1853	30	1932					
	35	2163	35	2255					
	40	2473	40	2578					
	45	2782	45	2902					
	50	3089	50	3223					

Max. eror, abs. qc: 35 kPa
Max. error, abs. fs: 2 kPa
Max. error, abs. u2: 10 kPa
Max. error, abs. I: 1 °

This calibration is compliant with GeoPoint Systems internal quality system, internal calibration procedures and meets the requirements of NEN2649, NEN5140, NORSOK G-001, ISSMFE and ASTM using calibration equipment traceable to (Inter-) National Standards.

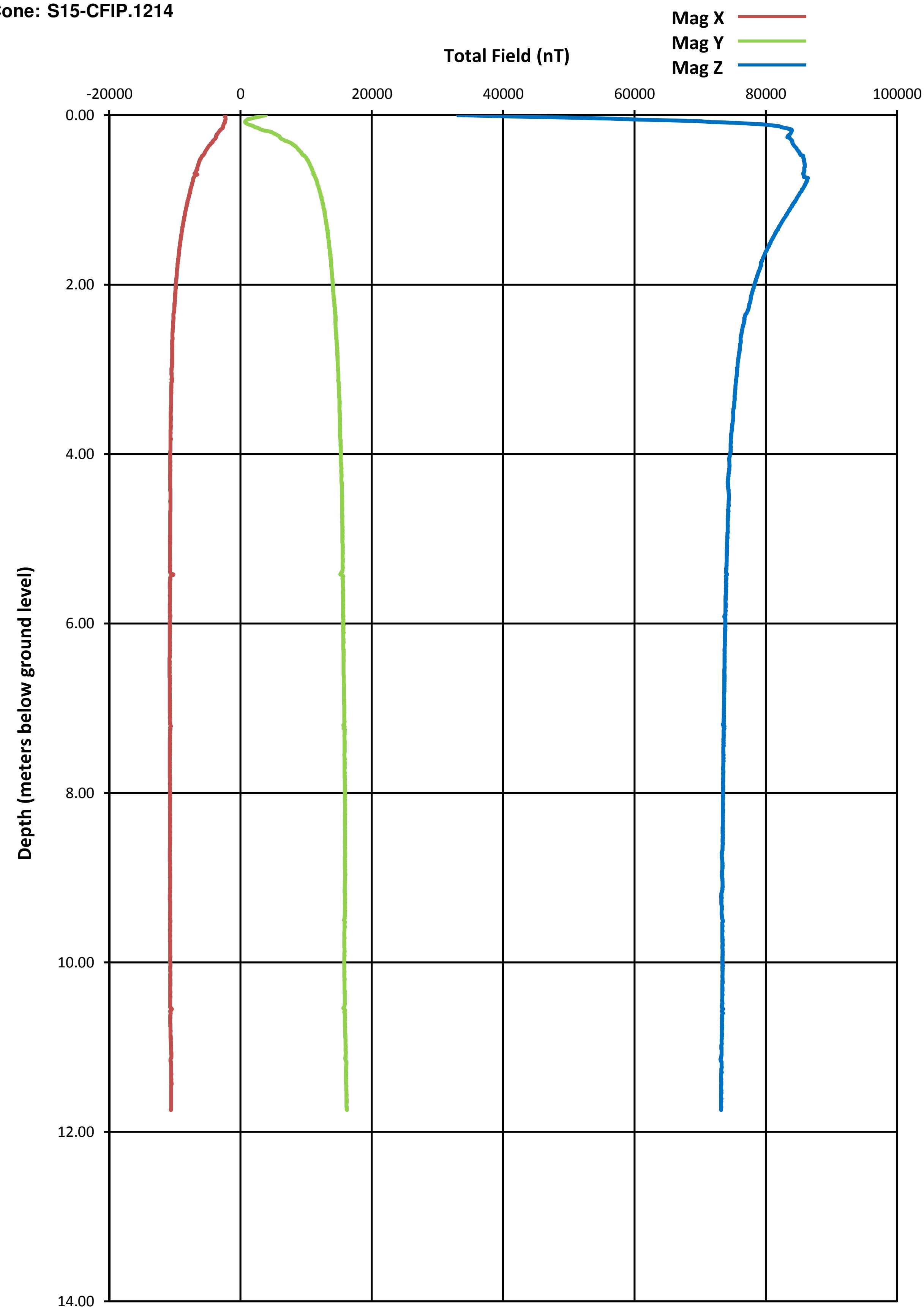
Approved by: B. van Eijk
Date: 29-04-2015

[redacted]

Cone Magnetometer

Date: 01-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 11.74



Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

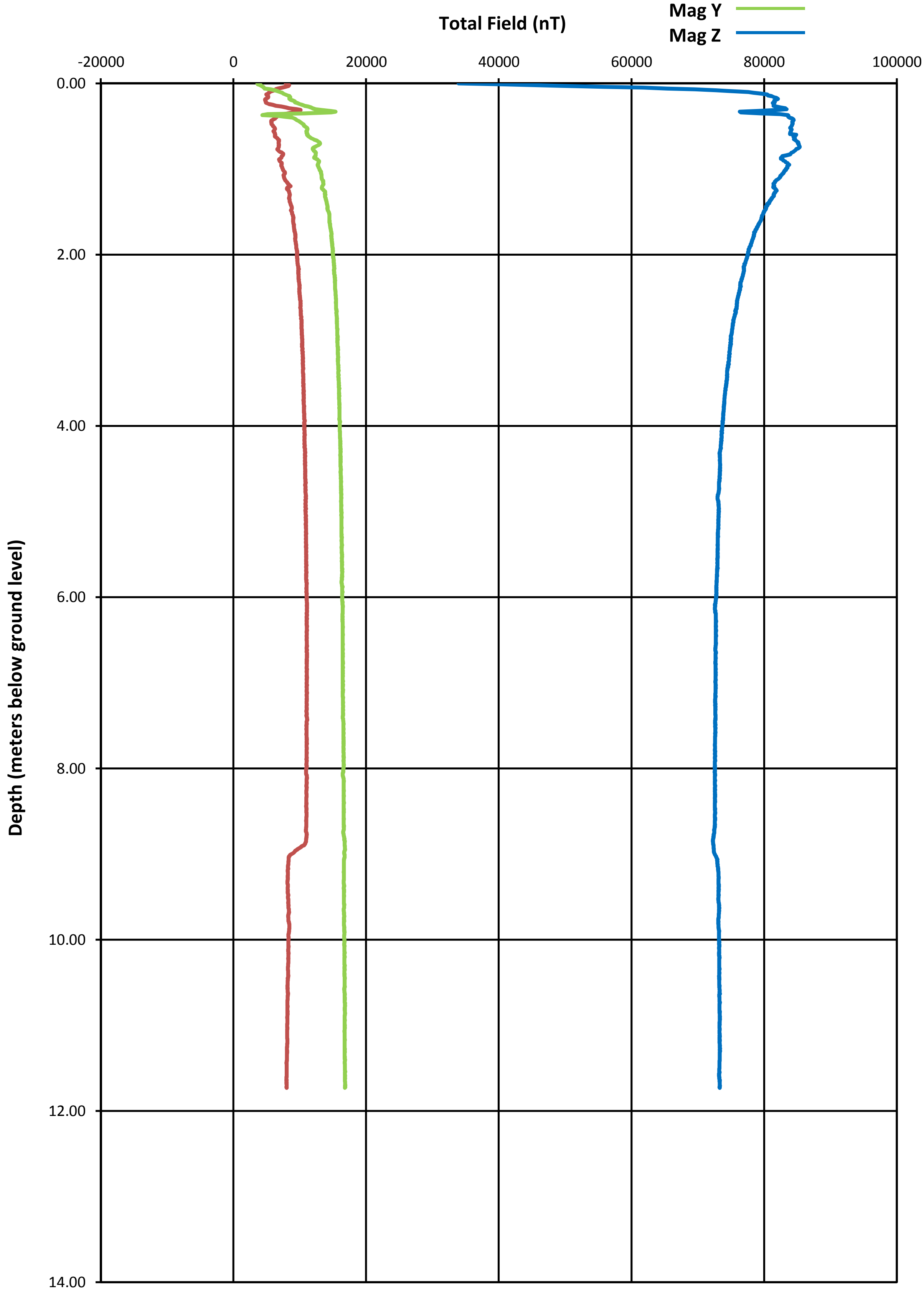
Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI
Project No.	A5066-15
Carried out for	Balfour Beatty Limited

Figure
BH404 MAG

Cone Magnetometer

Date: 02-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 11.73

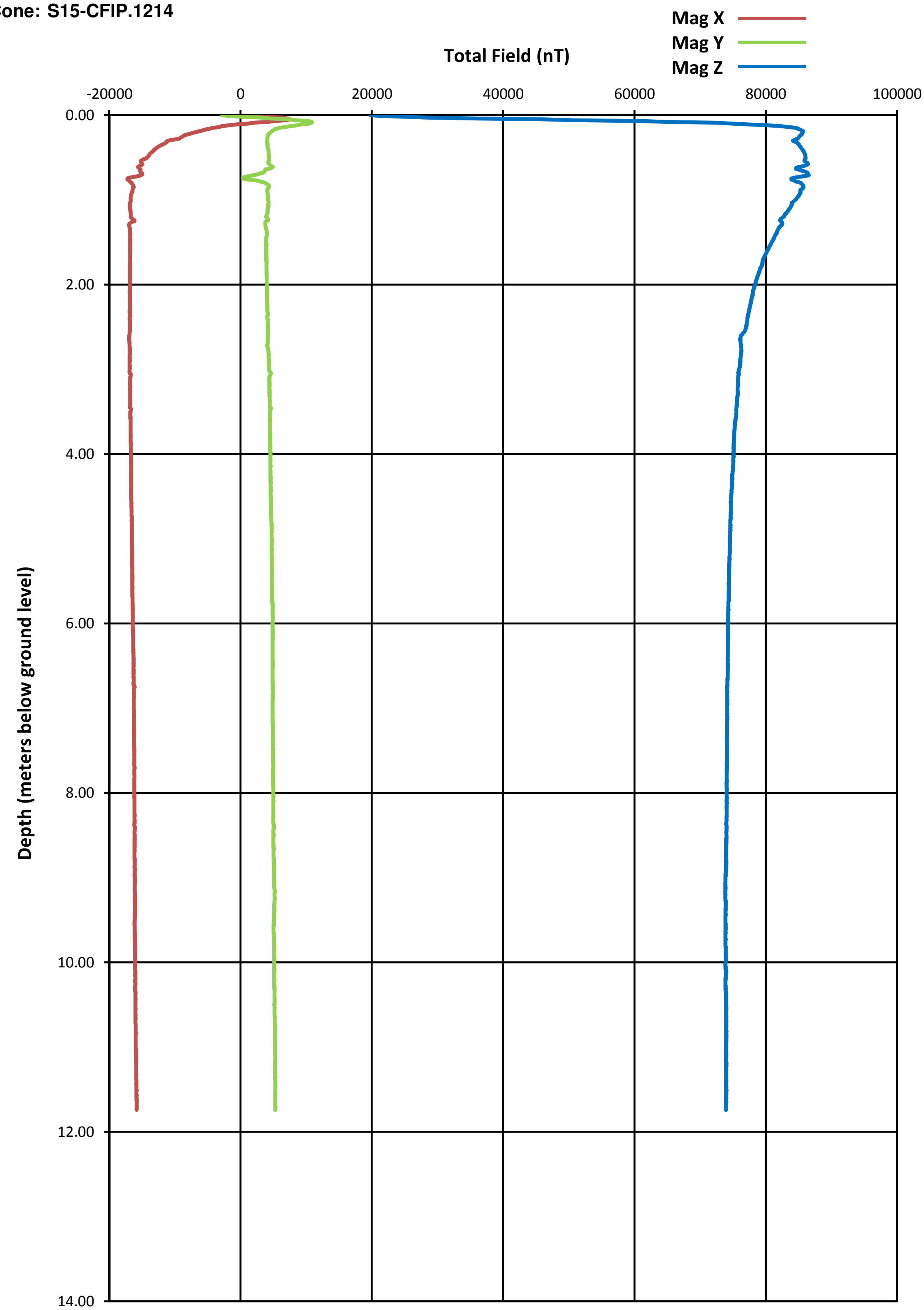


Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **BH405 MAG**

Cone Magnetometer

Date: 02-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 11.74

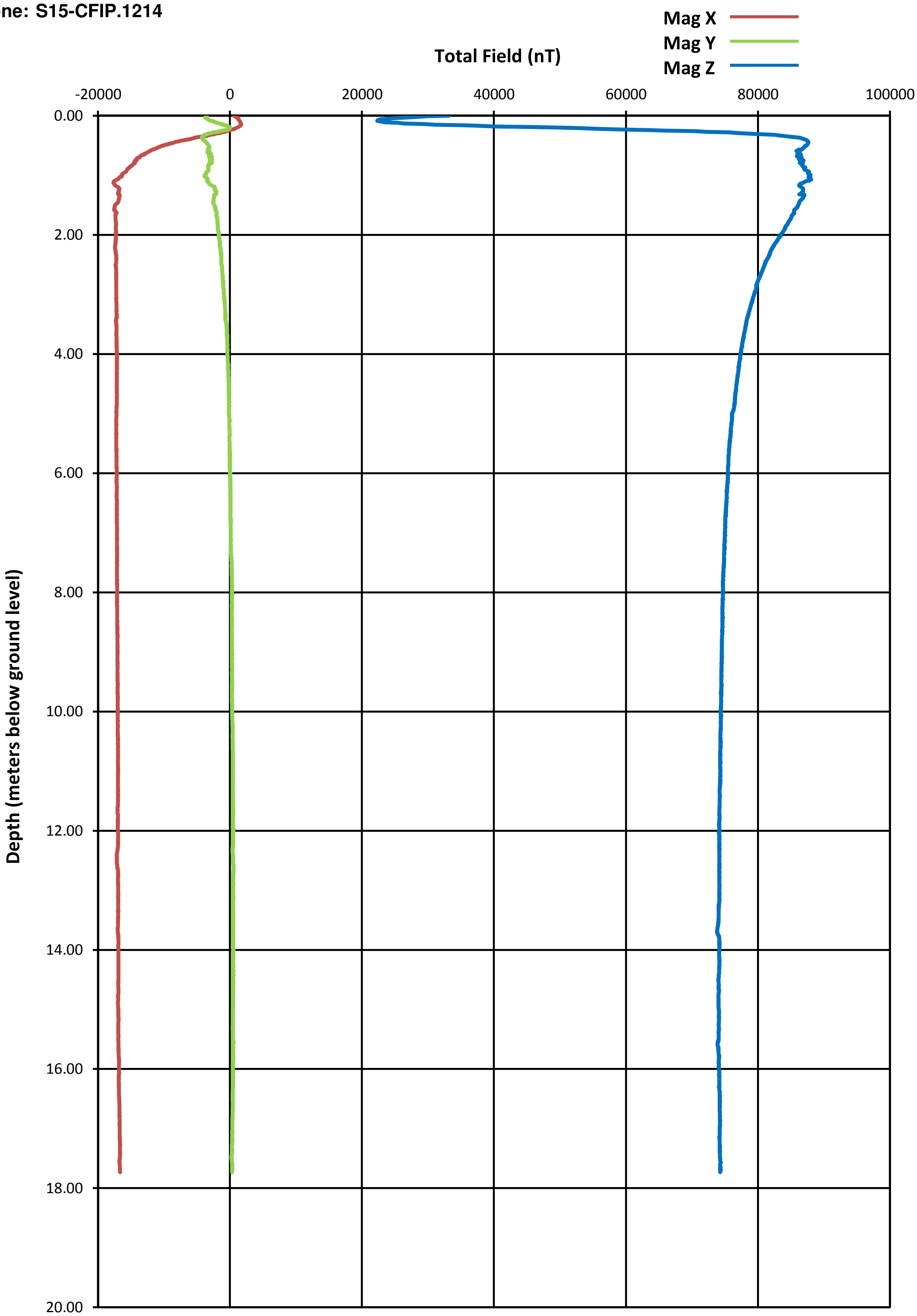


Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **BH406 MAG**

Cone Magnetometer

Date: 01-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 18.00



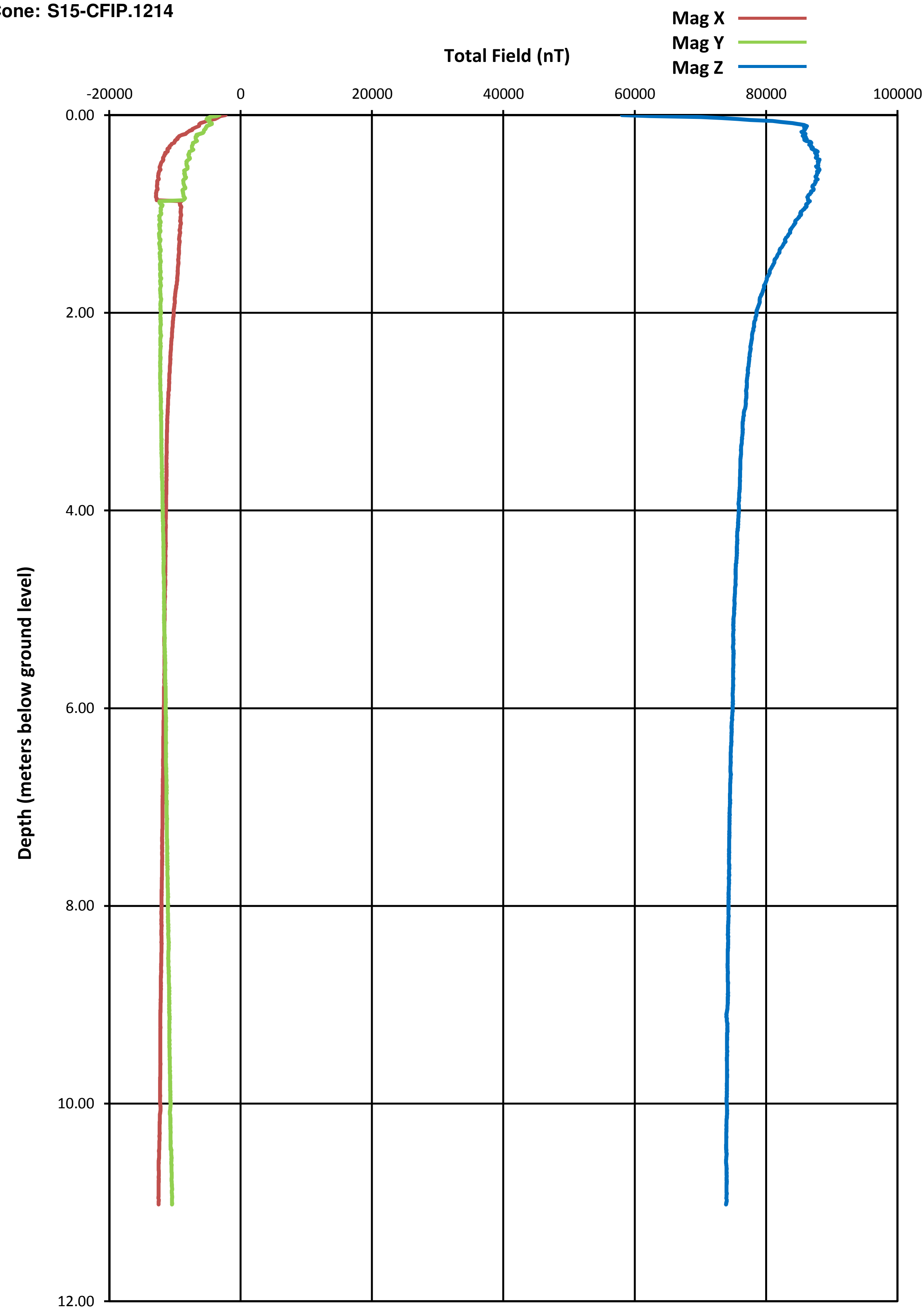
Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**BH407A MAG**
	Carried out for	Balfour Beatty Limited	

Cone Magnetometer

Date: 01-12-2015

Cone: S15-CFIP.1214

Max Depth (m): 11.02



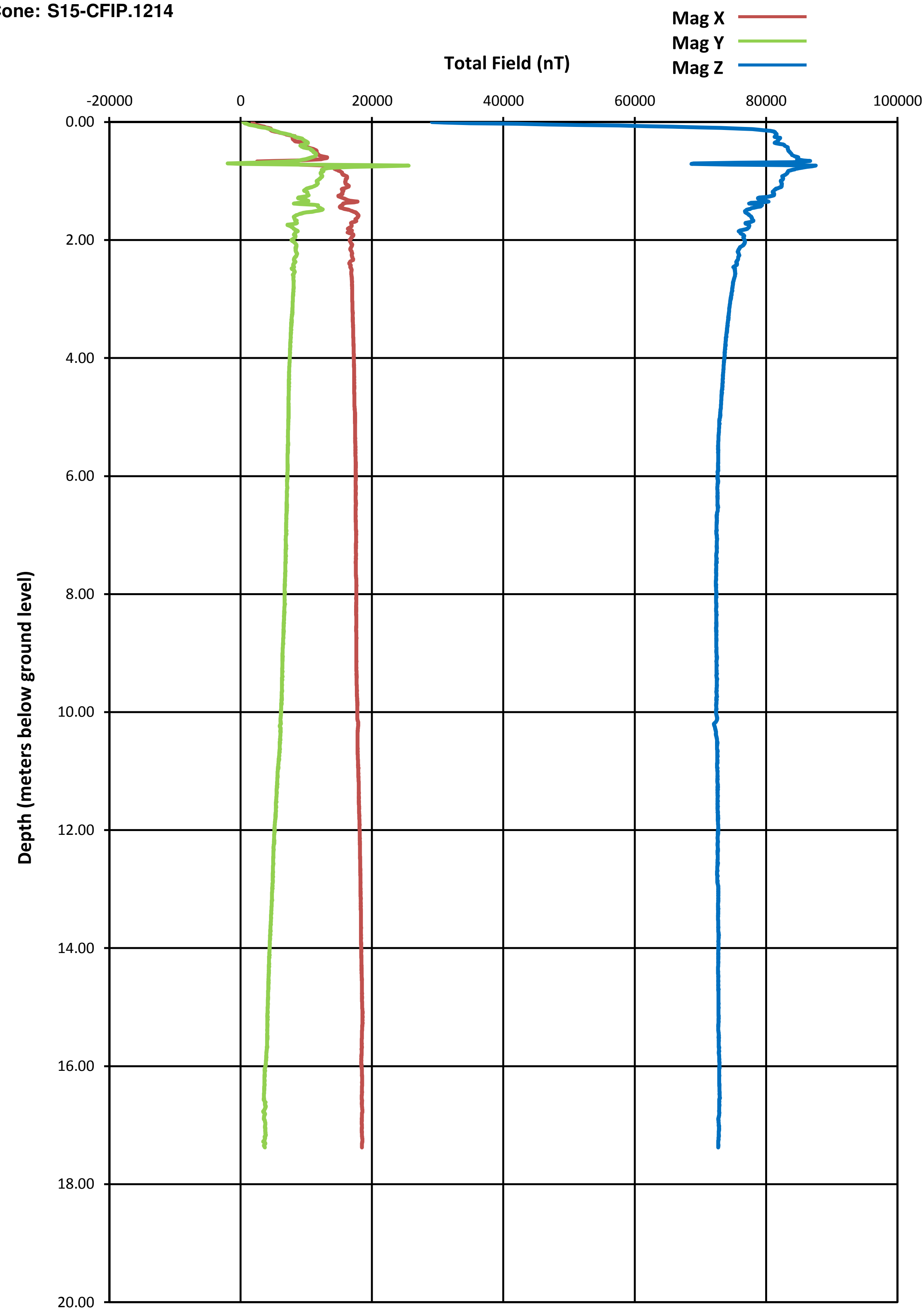
Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
Project No.	A5085-15	**BH408 MAG**
Carried out for	Balfour Beatty Limited	

Cone Magnetometer

Date: 15-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 17.38



Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

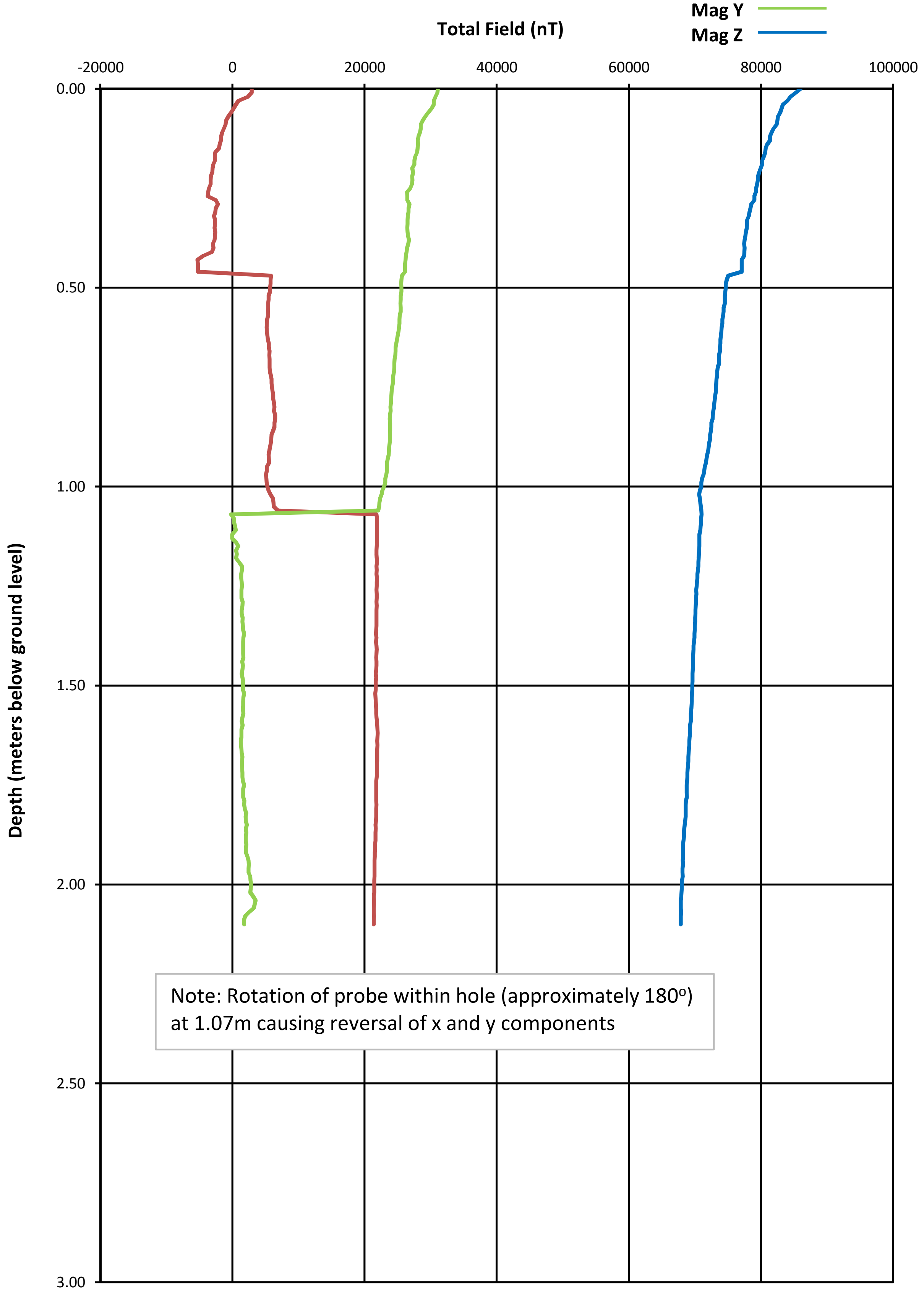
Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI
Project No.	A5066-15
Carried out for	Balfour Beatty Limited

Figure
BH417D MAG

Cone Magnetometer

Date: 17-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 2.10



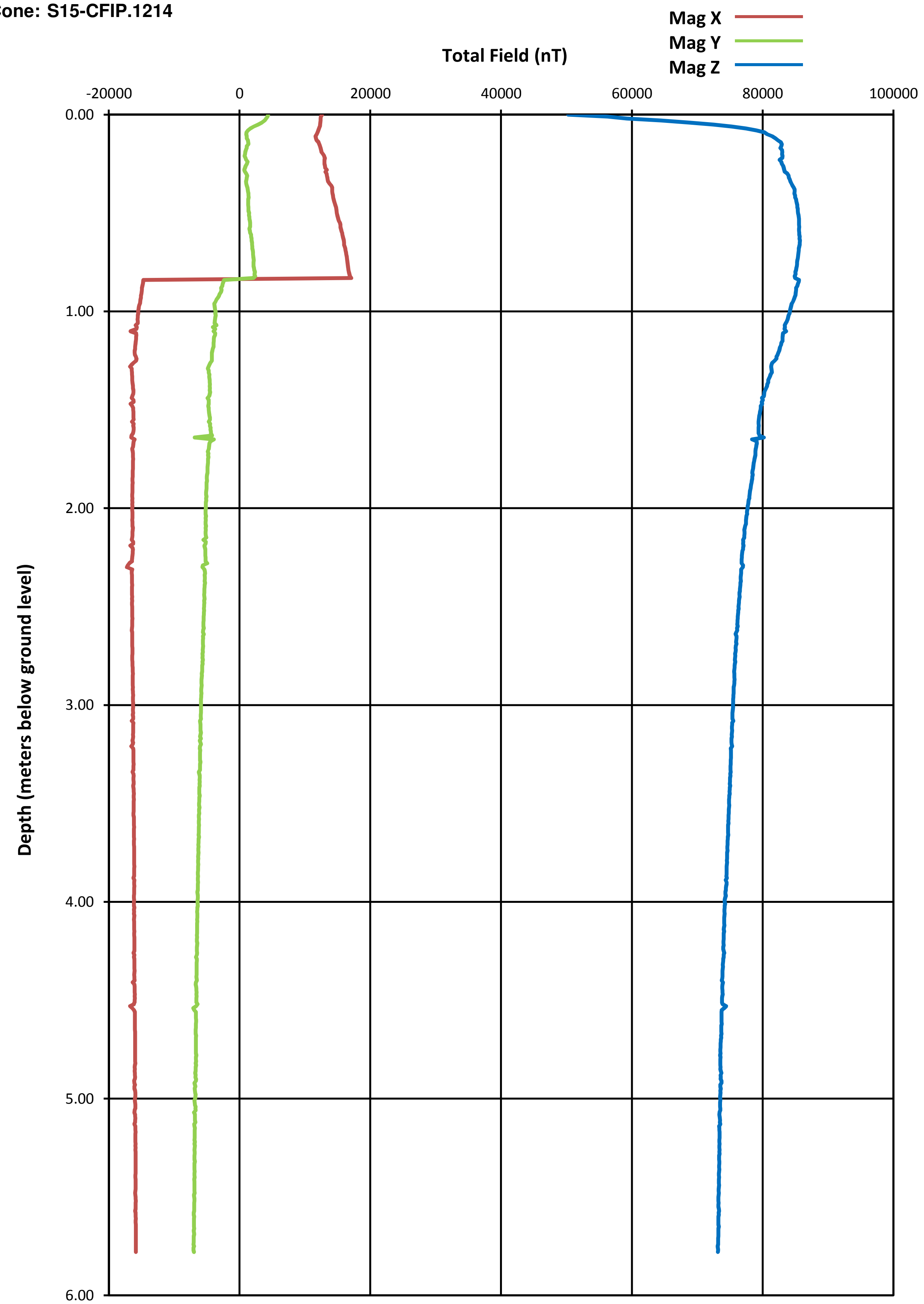
Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
Project No.	A5085-15	**WS02 MAG**
Carried out for	Balfour Beatty Limited	

Cone Magnetometer

Date: 16-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 5.78

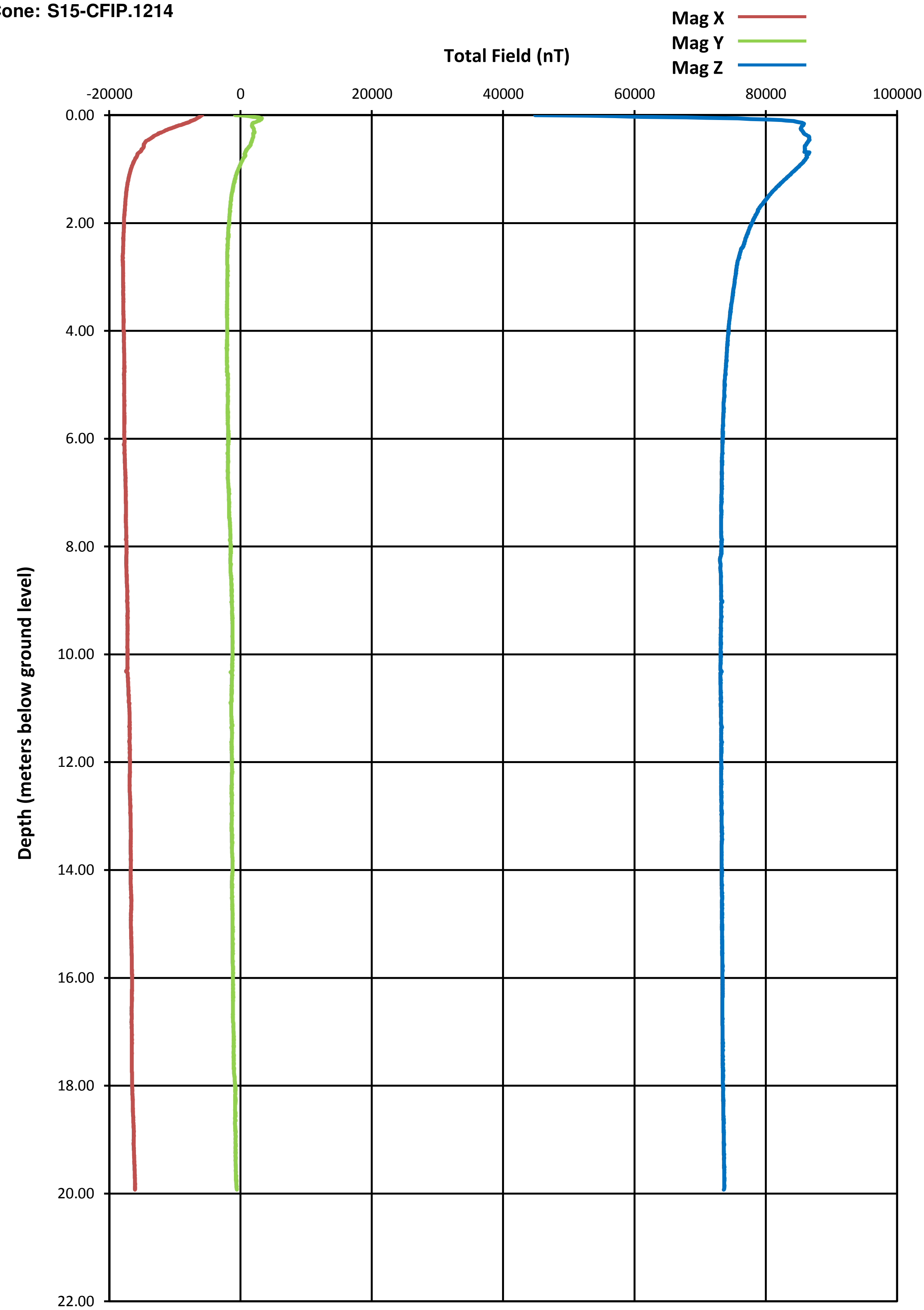


Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**WS04A MAG**
	Carried out for	Balfour Beatty Limited	

Cone Magnetometer

Date: 11-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 19.93

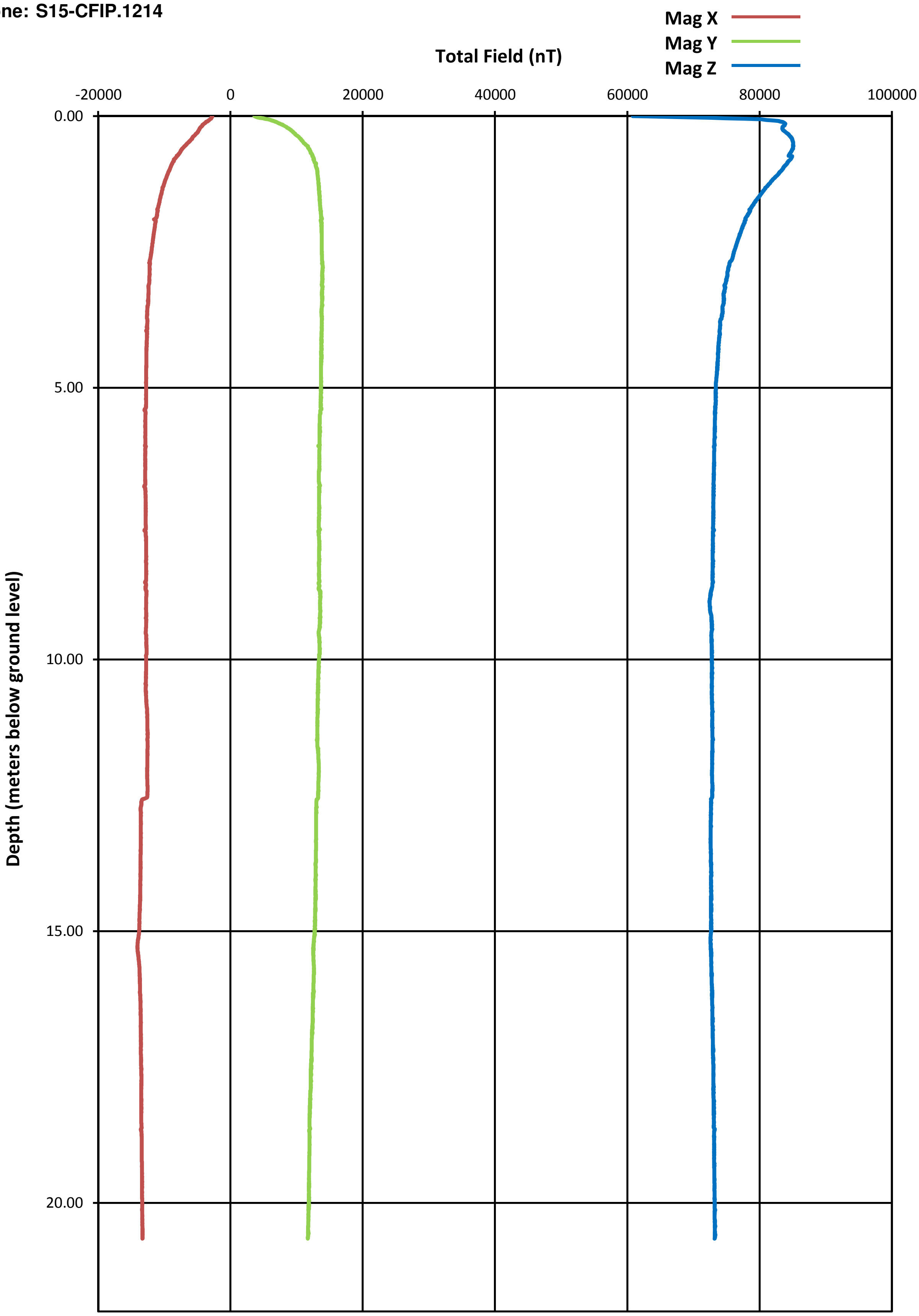


Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.	Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	Figure
	Project No.	A5066-15	PCPT402 MAG
	Carried out for	Balfour Beatty Limited	

Cone Magnetometer

Date: 12-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 20.66



Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

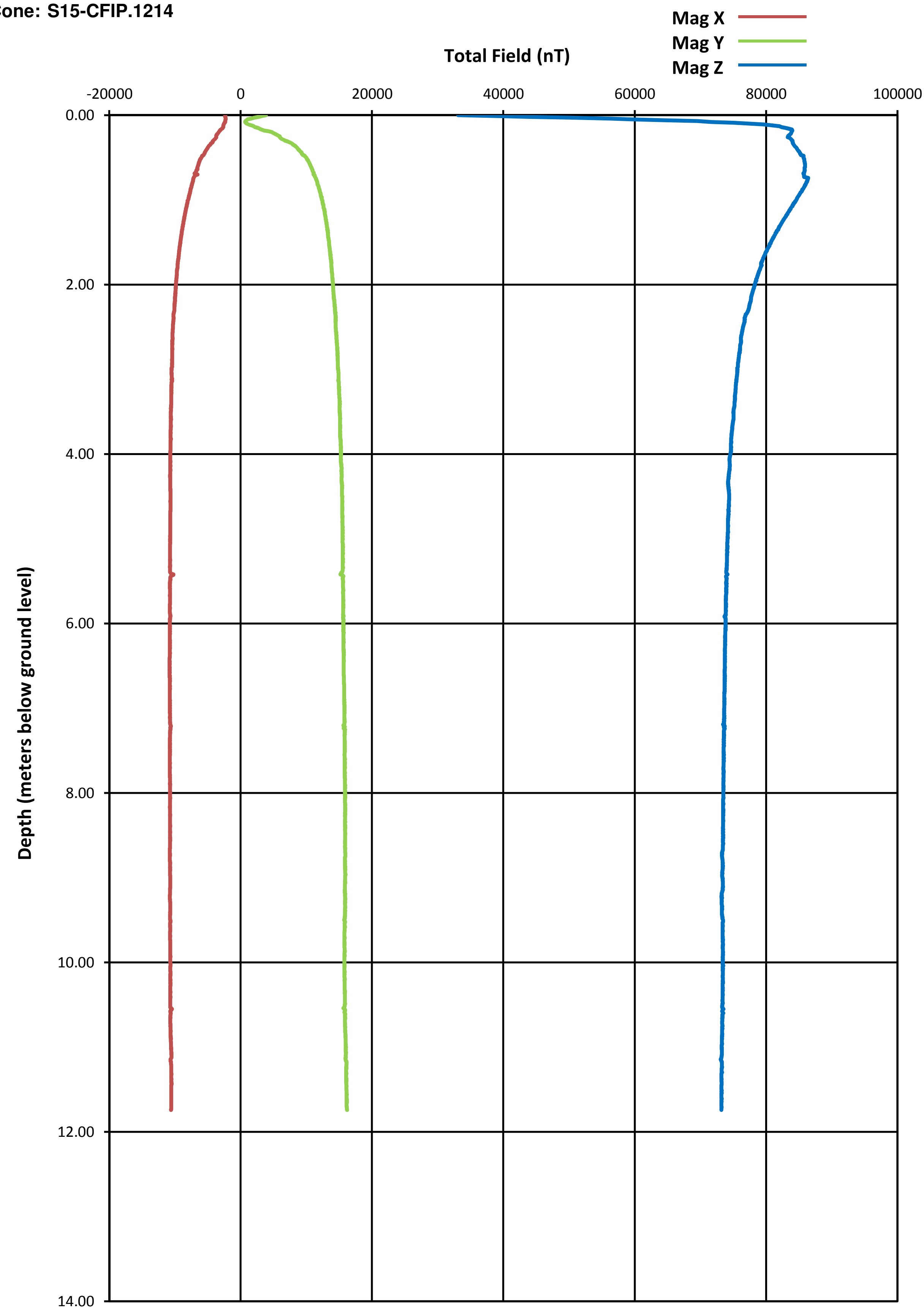
Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI
Project No.	A5066-15
Carried out for	Balfour Beatty Limited

Figure
PCPT403 MAG

Cone Magnetometer

Date: 01-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 11.74



Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

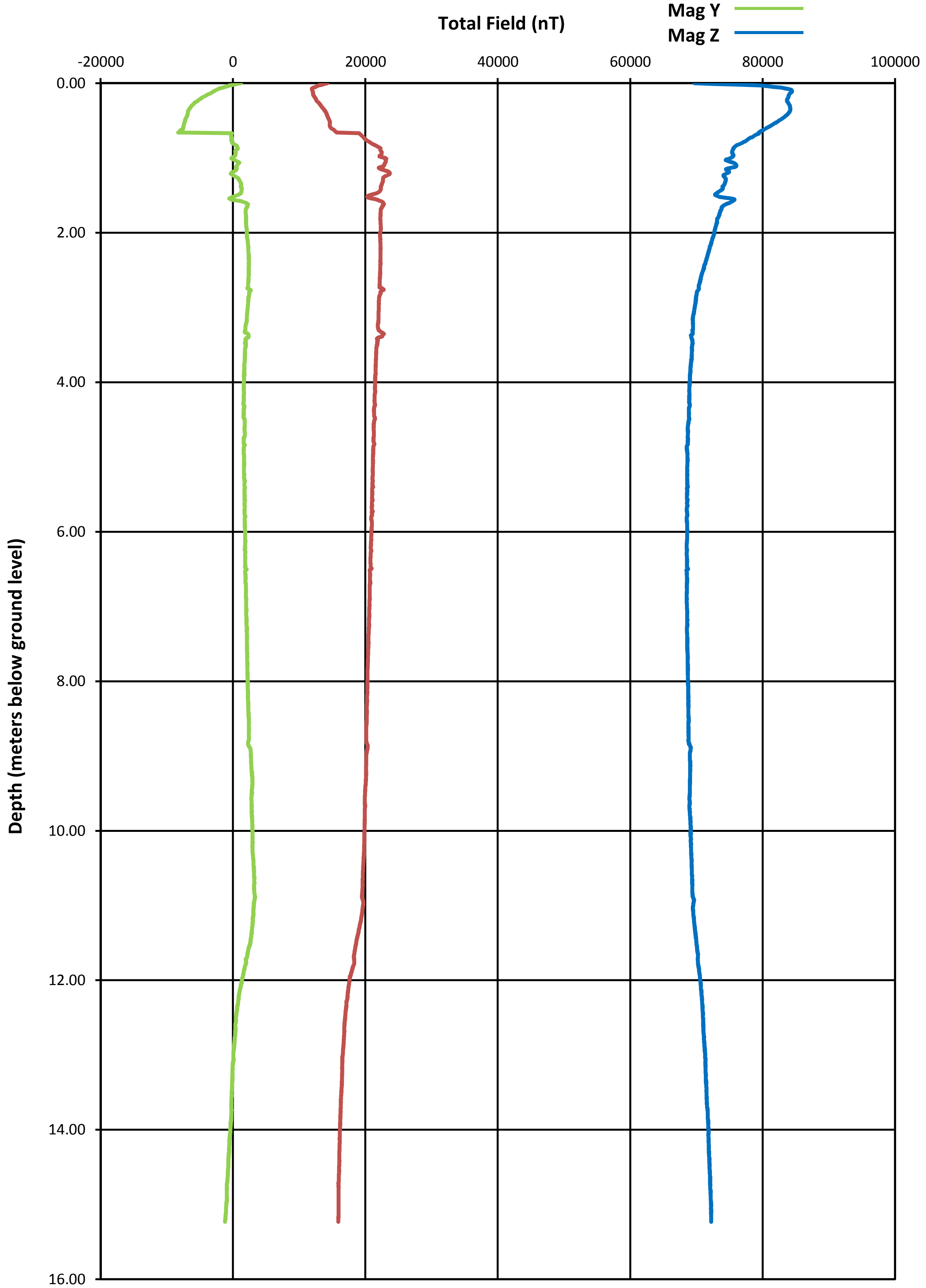
Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI
Project No.	A5066-15
Carried out for	Balfour Beatty Limited

Figure
PCPT404 MAG

Cone Magnetometer

Date: 07-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 15.23



Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

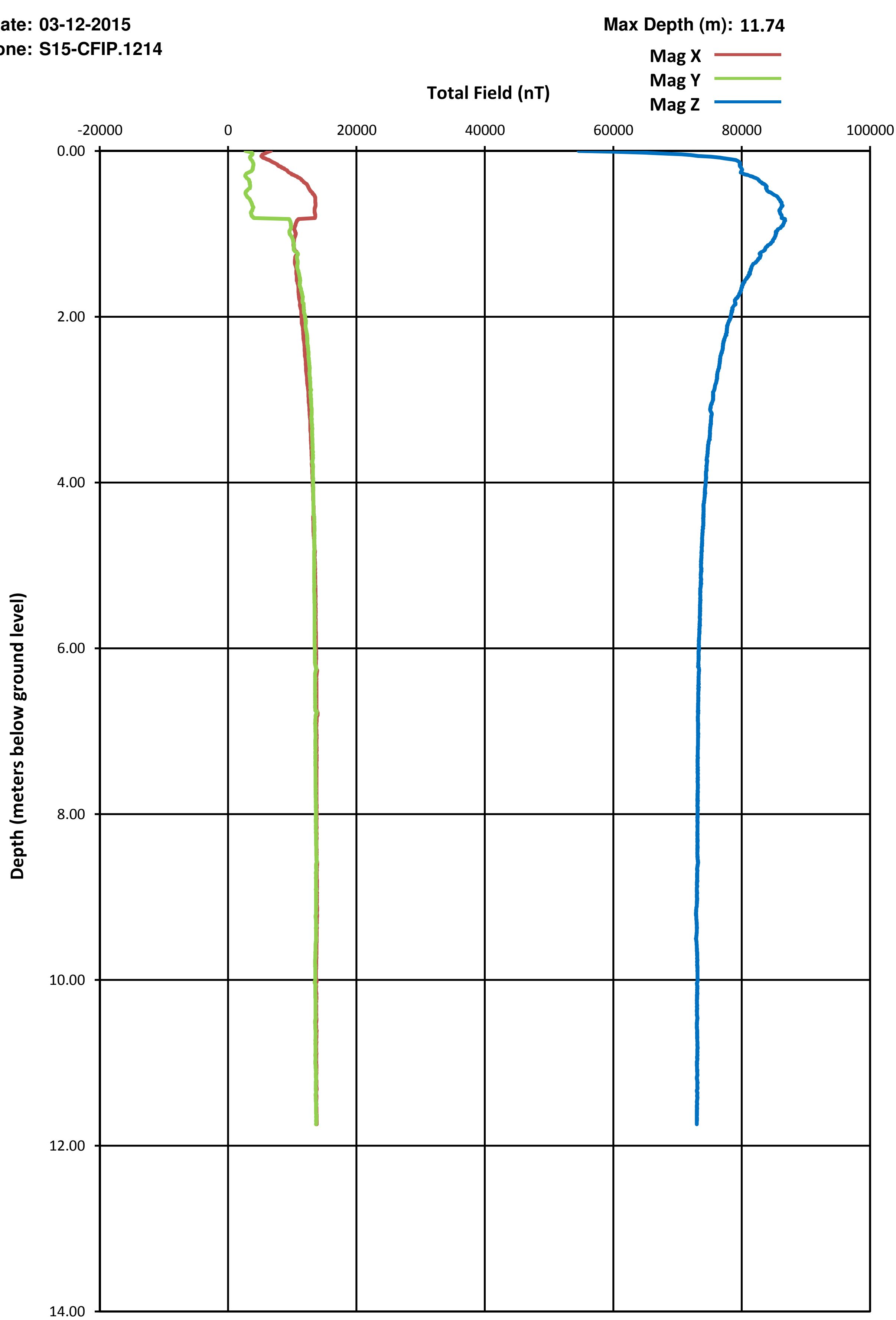
Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI
Project No.	A5066-15
Carried out for	Balfour Beatty Limited

Figure
PCPT406 MAG

Cone Magnetometer

Date: 03-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 11.74

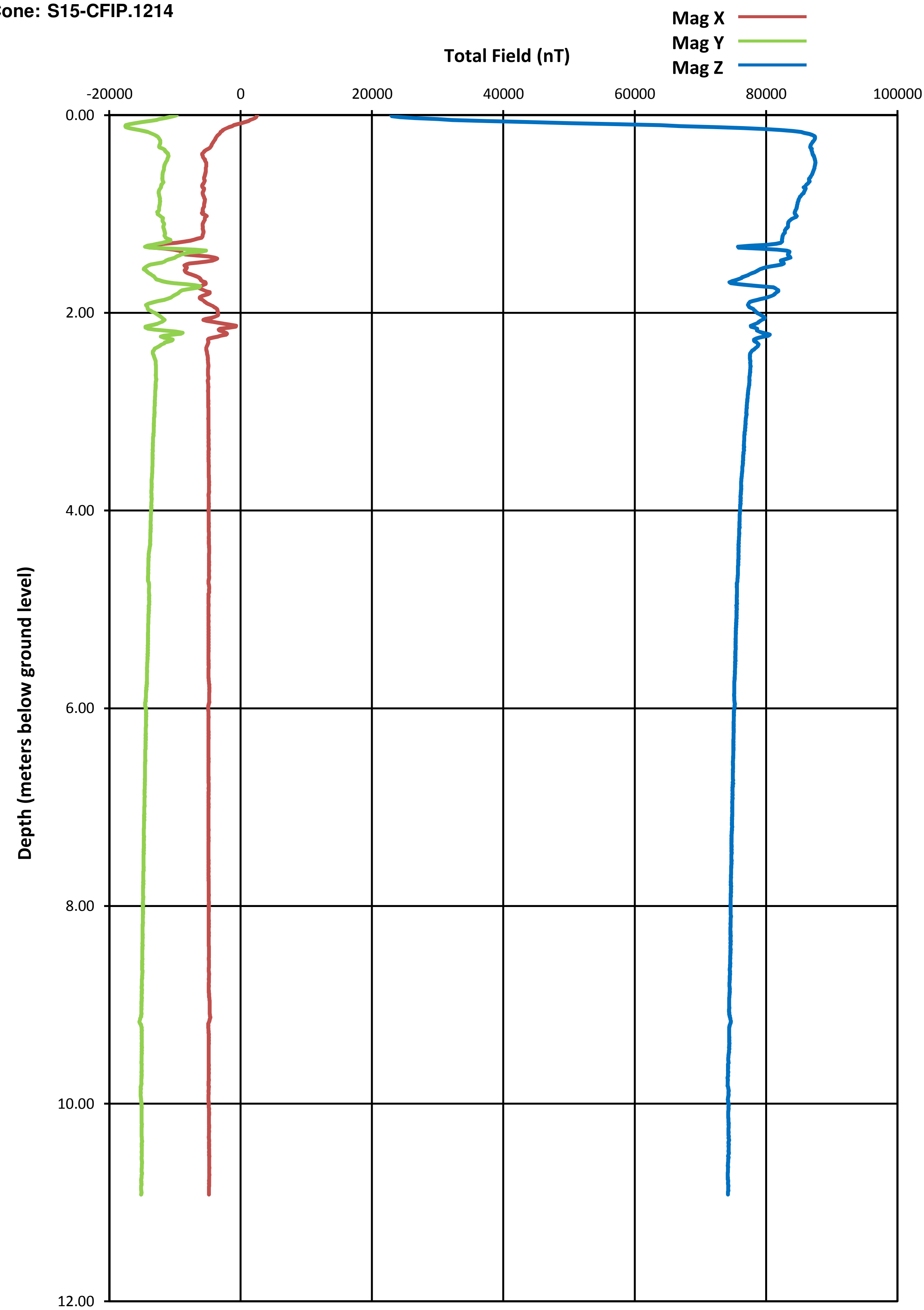


Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5066-15	**PCTP407 MAG**
	Carried out for	Balfour Beatty Limited	

Cone Magnetometer

Date: 03-12-2015
Cone: S15-CFIP.1214

Max Depth (m): 10.92

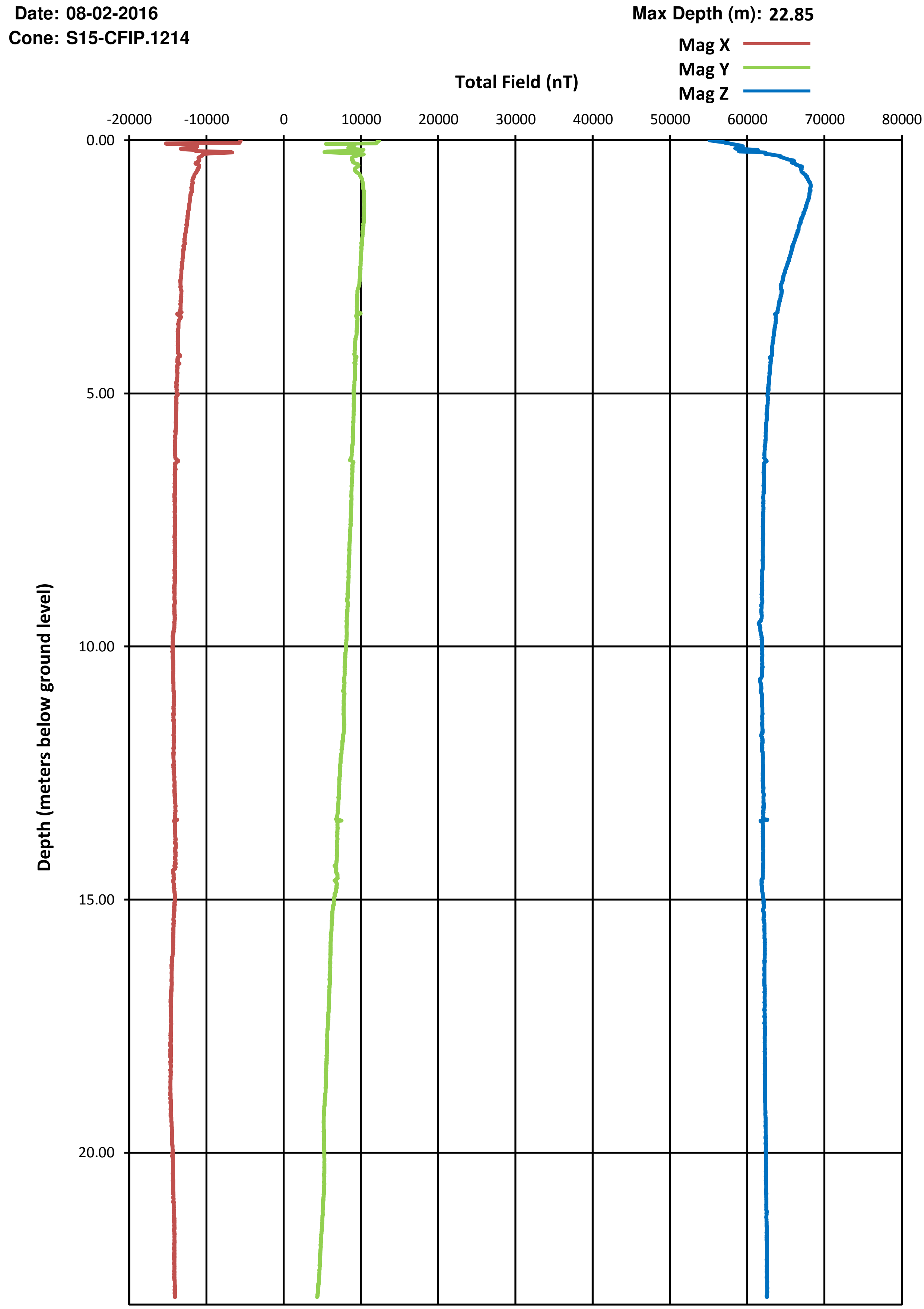


Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI
Project No.	A5066-15
Carried out for	Balfour Beatty Limited

Figure
PCTP409 MAG

Cone Magnetometer



Notes: Data obtained within 2 m of ground surface is likely to be affected by presence of CPT unit.	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5066-15	**PCTP425 MAG**
	Carried out for	Balfour Beatty Limited	

Summary of Cone Penetration Tests

CPT No.	Depth (m)	Date	Easting	Northing	Elevation (mOD)	Remarks	No. of Sheets
CPT401	-	-	-	-	-	Test delayed due to access restrictions	-
CPT402	17.19	16/12/2015	508938.74	428179.31	2.62	Test using 10cm^2 piezocone C10-CFIP.126 Dissipation tests at 5.06m & 15.99m Refusal on thrust	3
CPT403	20.89	15/12/2015	509210.00	428324.29	2.99	Test using 10cm^2 piezocone C10-CFIP.126 Dissipation tests at 3.50m & 6.74m Refusal on thrust	3
CPT404	16.46	08/12/2015	509248.22	428308.61	2.86	Test using 10cm^2 piezocone C10-CFIP.125 Dissipation tests at 4.50m & 7.50m Refusal on thrust	3
CPT405	22.70	08/12/2015	509286.03	428330.03	3.13	Test using 10cm^2 piezocone C10-CFIP.125 Dissipation tests at 5.15m, 6.13m & 7.65m Refusal on thrust	3
CPT406	15.03	08/12/2015	509269.95	428358.26	3.10	Test using 10cm^2 piezocone C10-CFIP.125 Dissipation tests at 4.99m, 5.50m, 9.00m & 11.44m Refusal on thrust	3
CPT407	15.03	10/12/2015	509296.76	428352.59	3.26	Test using 10cm^2 piezocone C10-CFIP.126 Dissipation tests at 7.93m, 8.28m, 11.23m & 11.64m Refusal on thrust	3
CPT408	20.15	11/12/2015	509360.33	428407.70	3.57	Test using 10cm^2 piezocone C10-CFIP.126 Dissipation tests at 10.56m, 11.75m & 14.11m Refusal on thrust	3
CPT409	22.98	04/12/2015	509393.19	428424.23	3.20	Test using 10cm^2 piezocone C10-CFIP.125 Dissipation tests at 6.50m & 8.50m Refusal on thrust	3
CPT414	13.71	17/12/2015	510050.42	428447.08	4.93	Test using 10cm^2 piezocone C10-CFIP.126 Dissipation tests at 4.01m & 6.56m Refusal on thrust	3
CPT425	13.15	09/02/2016	509392.49	428411.52	2.92	Test using 10cm^2 piezocone C10-CFIP.126 Dissipation tests at 9.18m, 9.30m, 11.51m & 11.66m Refusal on thrust	3

Notes (unless indicated otherwise above)

- Piezocones fitted with polypropylene pore pressure filter located in the tip (u1) position
- Tests with 10 cm^2 cone carried out with a friction reducer
- Tests terminated at maximum achievable depth (refusal)
- No backfilling to CPT holes
- Groundwater/collapse depths not recorded
- Inclinometer channel data not recorded for all CPTs

Notes:			Table
	Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**2**
	Project No.	A5085-15	
	Carried out for	Balfour Beatty Limited	

Sondeerapparatuur
Waterspanningsmeters
Hellingmeters
Veldmeet-apparatuur

GeoPoint Systems bv

Rijksstraatweg 22F
2171 AL Sassenheim
Tel. : +31 71 301 92 51
Fax : +31 71 301 92 52
E-mail : info@geopoint.nl
BTW : NL814690178.B01
IBAN : NL28 INGB0682301396
BIC : INGBNL2A

Cone Calibration Certificate

Certificate:	**GS-125-006**	
Instrument Type:	Electric Compression Cone	
Model:	C10-CFIP	
Serial number:	125	
Calibration date:	03-07-2015	
Client:	EGS	
Calibrated by:	M. van Es	
Calibration instruments		
Manufacturer:	Hottinger Baldwin Messtechnik GmbH	
HBM certificate no. :	FL1461	
Calibration conditions		
Ambient temperature:	22.1	°C
Atmospheric pressure:	1026	mBar
Cone specifications		
Cone base area:	1000	mm2
Load tip resistance (nom.):	50	kN
Friction sleeve area:	15000	mm2
Load local friction (nom.):	15	kN
Load pore pressure (nom.):	2	MPa
Inclination (nom.):	20	°
Temperature compensation (all channels):	0…+40	°C
Maximum overload capacity (all channels):	100	%
Cone area ratio (a):	0.80	
Max. inaccuracy, relative to measurement value:	1.0	%

	Tip:		Sleeve:		Pore Pressure:		Inclinometer:	
	qc in kN	mV	fs in kN	mV	MPa	mV	Degrees	mV
Zero points:		0234		0253		0229		
	0	0	0	0	0	0	0	0085
	5	0385	1.50	0520	0.4	1303	5	0350
	10	0771	3.00	1040	0.8	2601	10	0880
	15	1157	4.50	1560	1.2	3898	15	1675
	20	1541	6.00	2084	1.6	5186	20	2207
	25	1925	7.50	2609	2	6467	25	2740
	30	2309	9.00	3130				
	35	2695	10.50	3651				
	40	3081	12.00	4177				
	45	3465	13.50	4705				
	50	3848	15.00	5224				

Max. error, abs. qc: 35 kPa
Max. error, abs. fs: 2 kPa
Max. error, abs. u2: 10 kPa
Max. error, abs. I: 1 °

This calibration is compliant with GeoPoint Systems internal quality system, internal calibration procedures and meets the requirements of NEN2649, NEN5140, NORSOK G-001, ISSMFE and ASTM using calibration equipment traceable to (Inter-) National Standards.

Approved by: B. van Eijk [redacted]
Date: 03-07-2015

Environmental Scientifics Group.

CPT CONE

Cone No.	C10-CFIP.126	Date of Calibration	09/12/2015
Manufacturer	Geopoint	Reference Standards	BS1377: Part 9: 1990
Compression/ Subtraction	Compression	Reference Kit	Pressure meter: N026123 Vernier callipers: 0001942 Load cell: 22541/2 Voltmeter: 06402486
Pore Pressure Channel (Y/N)	Y		

Cone end area ratio (by dimension measurement), a	0.8	Sleeve end area ratio (by dimension measurement), b	1.0

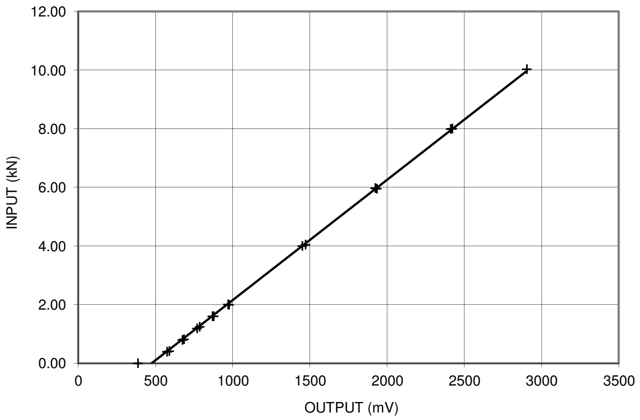
Note: Calibration Zero taken as no load in free air, Output taken as slope of linear regression line x maximum load.

Cone Type (S/ C/ M/ D/ T): C   Ch 3 (P/ C/ T/ N/ F): P

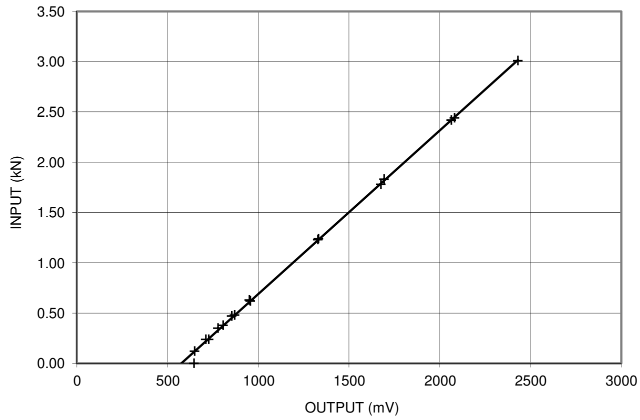
	Output		Input		Zero		Area		Alarm	
Channel 1	2438	mV	10	kN	356	mV	10	cm^2	8	kN
Channel 2	1854	mV	3	kN	262	mV	150	cm^2	3	kN
Channel 3	0	mV	16	Bar	267	mV			16	Bar

Inclination	0°	5°	10°	Alarm
	8	29	293	15
	15°	20°	25°	
	748	1563	2829	Extra Channels: N

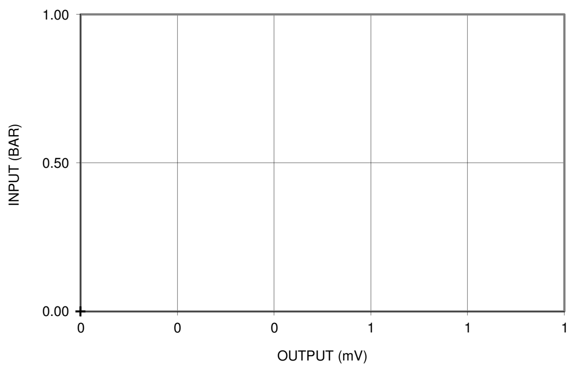
CHANNEL 1 - TIP



CHANNEL 2 - FRICTION SLEEVE



CHANNEL 3 - PRESSURE



ESG	Cone calibrated by: DkBowns Date: 09/12/2015	[redacted]thorised for use by: Manager

Key to Cone Penetration Test Records

Parameter	Unit	Description	Equation
Measured parameters			
q_c	MPa	Cone resistance	Measured parameter
f_s	MPa	Sleeve friction	Measured parameter
I	degrees	Inclination	Measured parameter
u	MPa	Dynamic pore pressure (Piezocone only)	Measured parameter. Denoted as u_1 and u_2 for pore pressure filter locations on cone face and cone shoulder respectively.
-	m, s	Penetration depth and corresponding time	Measured parameters
Derived cone parameters			
R_f	%	Friction ratio	$f_s / q_c . 100$ %
q_t	MPa	Corrected cone resistance (Piezocone only)	$q_c + (1 - a) . u_2$ where a = area ratio of cone = A_n/A_c A_n = cross sectional areas of cone tip shaft A_c = projected area of cone tip
f_t	MPa	Corrected sleeve friction (Piezocone only)	$(f_s – (u_2. A_{sb} – u_3. A_{st})) / A_s$ where b = area ratio of friction sleeve A_{sb} and A_{st} are bottom and top cross sectional areas of friction sleeve
q_e	MPa	Effective cone resistance (Piezocone only)	$q_t – u_2$
q_n	MPa	Net cone resistance (Piezocone or using $q_t = q_c$)	$q_t - \sigma_{vo}$ where σ_{vo} = vertical total stress
R_f'	%	Corrected friction ratio (Piezocone only)	$f_t / q_t . 100$ %
Δu	MPa	Excess pore pressure (Piezocone only)	$u - u_0$ where u_0 = equilibrium pore water pressure
B_q	-	Pore pressure ratio (Piezocone only)	$(u - u_0) / (q_t - \sigma_{vo}) = \Delta u/q_n$
-	-	Dynamic pore pressure ratio (Piezocone only)	u / q_c
Q_t	-	Normalised cone resistance (Piezocone or using $q_t = q_c$)	$(q_t - \sigma_{vo}) / \sigma'_{vo} = q_n / \sigma'_{vo}$ where σ'_{vo} = vertical effective stress
F_r	%	Normalised local friction (Piezocone or using $q_t = q_c$)	$f_s / (q_t - \sigma_{vo}) = f_s / q_n . 100$ %

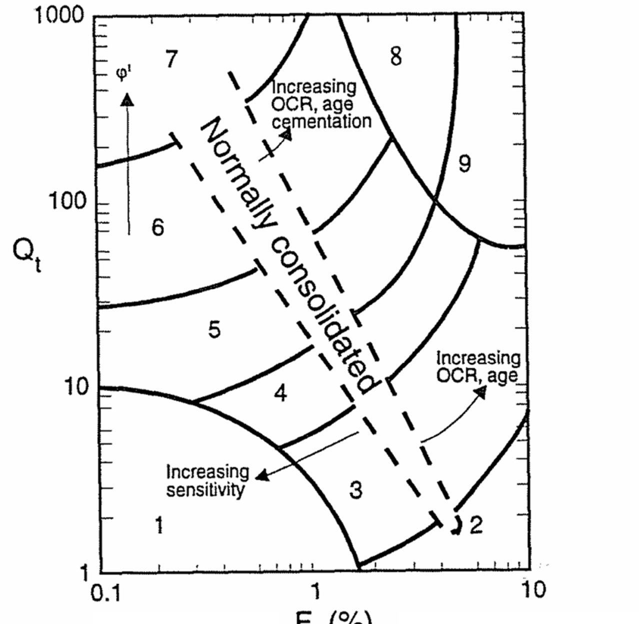
Key to Cone Penetration Test Records

Derived soil parameters

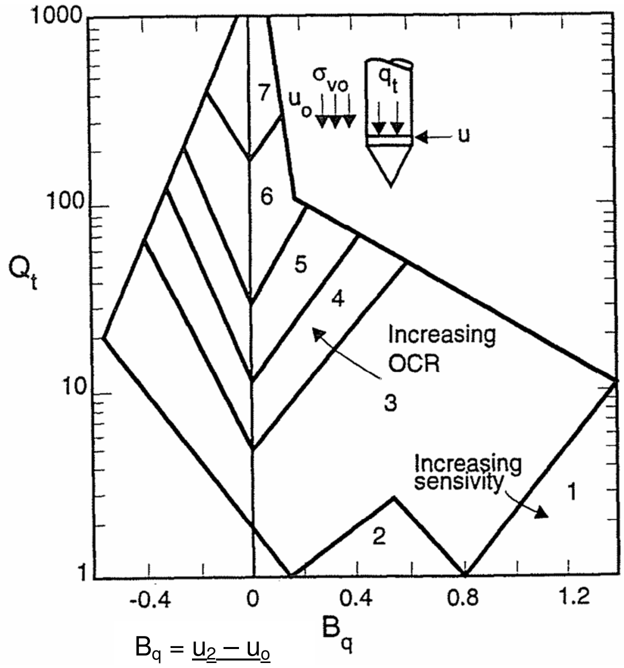
Parameter	Description	Remarks
-	Soil Type	Classification after Robertson (1990) using normalised cone resistance, normalised friction ratio and pore pressure ratio (piezocone only), see Figure 1.
s_u Su(min) and Su(max)	Undrained Shear Strength (Clays)	Interpretation for fine soils only – soil types 3 and 4. Based on net cone resistance (corrected where pore pressure data available) and empirical cone factor $= (q_c - \sigma_{vo}) / N_k$ Plots of minimum and maximum strength presented using N_k of 20 and 12.
D_r RD	Relative Density	Interpretation for coarse soils only – soil types 5, 6 and 7. After Baldi et al (1986) for moderately compressible, unaged, uncemented, silica sand $= (1 / C_2) . \mathrm{Ln} (q_c / C_0 (\sigma')\text{^}C_1)$ For NC sands : $C_0 = 157$, $C_1 = 0.55$, $C_2 = 2.41$, $\sigma' = \sigma'_{vo}$ For OC sands : $C_0 = 181$, $C_1 = 0.55$, $C_2 = 2.61$, $\sigma' = \sigma'_m$ and mean effective stress $= \sigma'_m = (\sigma'_{vo} + 2\ \sigma'_{ho}) / 3$
ϕ IFA	Internal Friction Angle	Interpretation for coarse soils only – soil types 5, 6 and 7. After Robertson and Campanella (1983) for uncemented, moderately incompressible, predominately silica sands $= \mathrm{Arctan} (0.105 + 0.16 . \mathrm{Ln} (q_c / \sigma'_{vo}))$

Key to Cone Penetration Test Records

Soil Behaviour Type Interpretation



$Q_t = \frac{q_t - \sigma_{vo}}{\sigma'_{vo}}$ $F_r = \frac{f_s}{q_t - \sigma_{vo}} \times 100\%$



$B_q = \frac{u_2 - u_o}{q_t - \sigma_{vo}}$

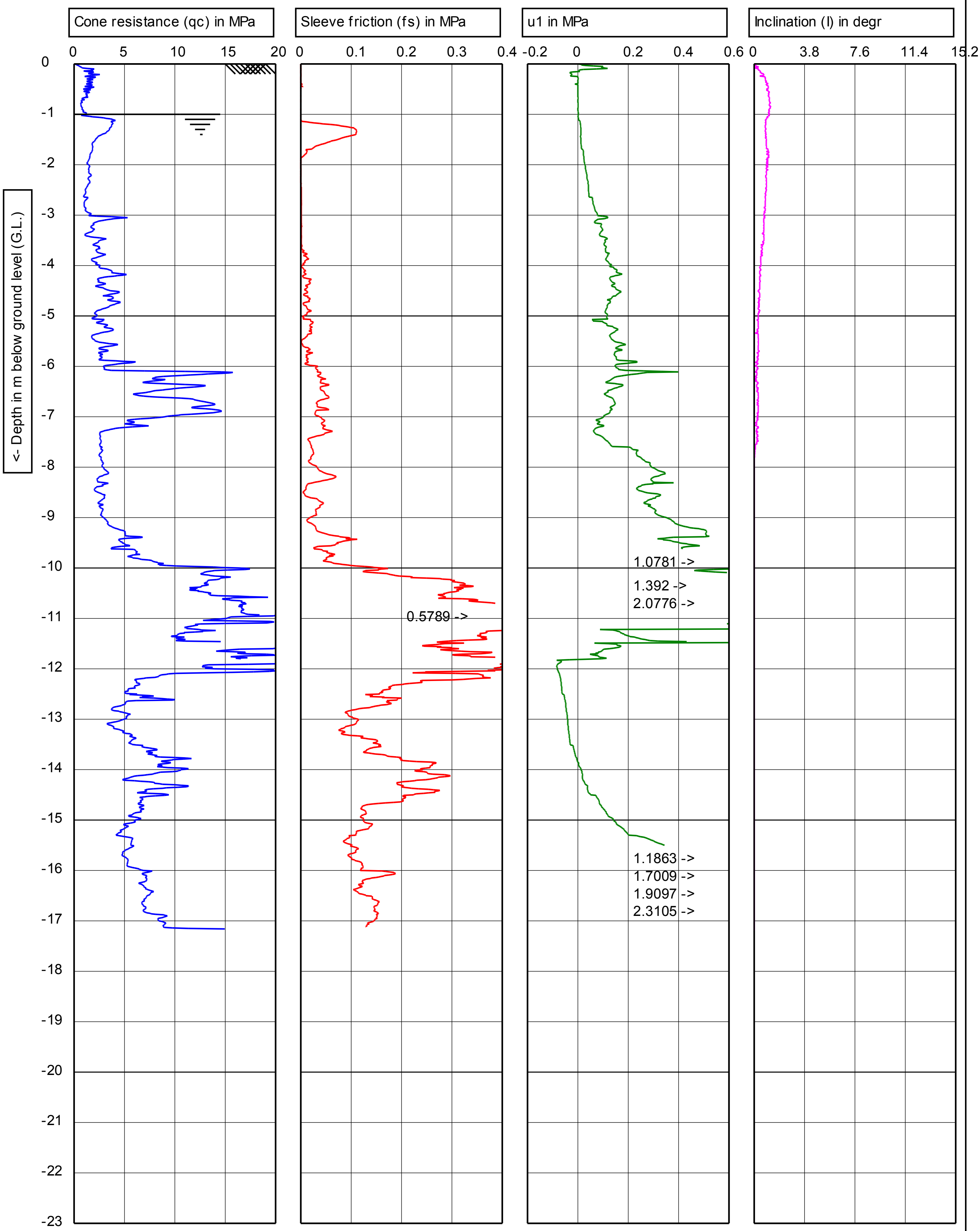
KEY TO SOIL BEHAVIOUR TYPES – after Robertson (1990)

ZONE	SOIL BEHAVIOUR TYPE	ZONE	SOIL BEHAVIOUR TYPE	ZONE	SOIL BEHAVIOUR TYPE
1	Sensitive fine grained	4	Silt mixtures: clayey silt to silty clay	7	Gravelly sand to sand
2	Organic soils – peats	5	Sand mixtures: silty sand to sandy silt	8	Very stiff sand to clayey sand
3	Clays: clay to silty clay	6	Sands: clean sand to silty sand	9	Very stiff fine grained

Notes:

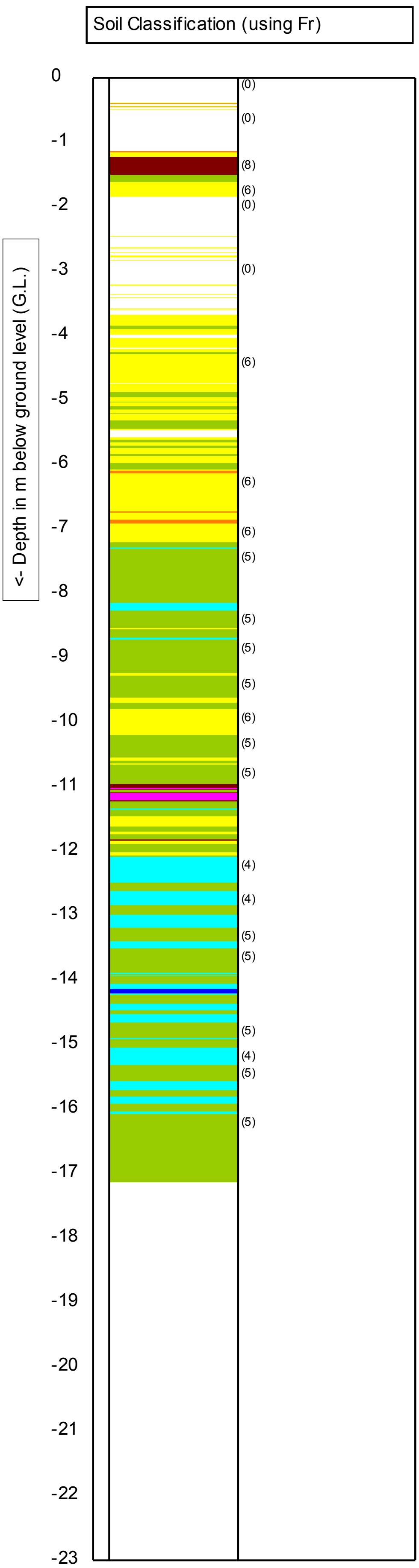
A63 CASTLE STREET IMPROVEMENT – MAIN GI
A5085-15
Balfour Beatty

Key CPT

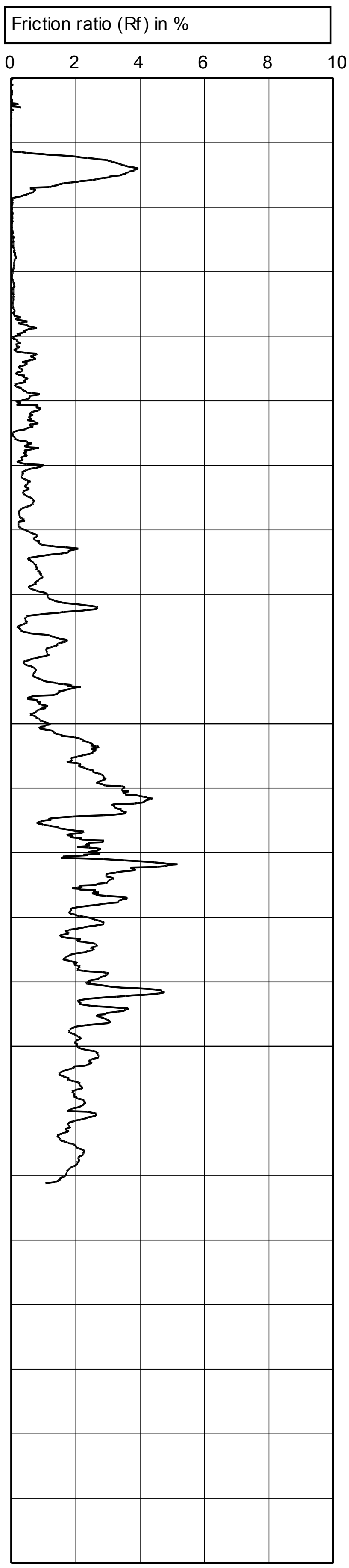


	BS1377 Part 9 : 1999	Predrill :	0
G.L. **0**	W.L.: **-1**	Date:	**15/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.126**
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**
Position:		CPT no.:	**CPT402** 1/3

CPTask V1.23

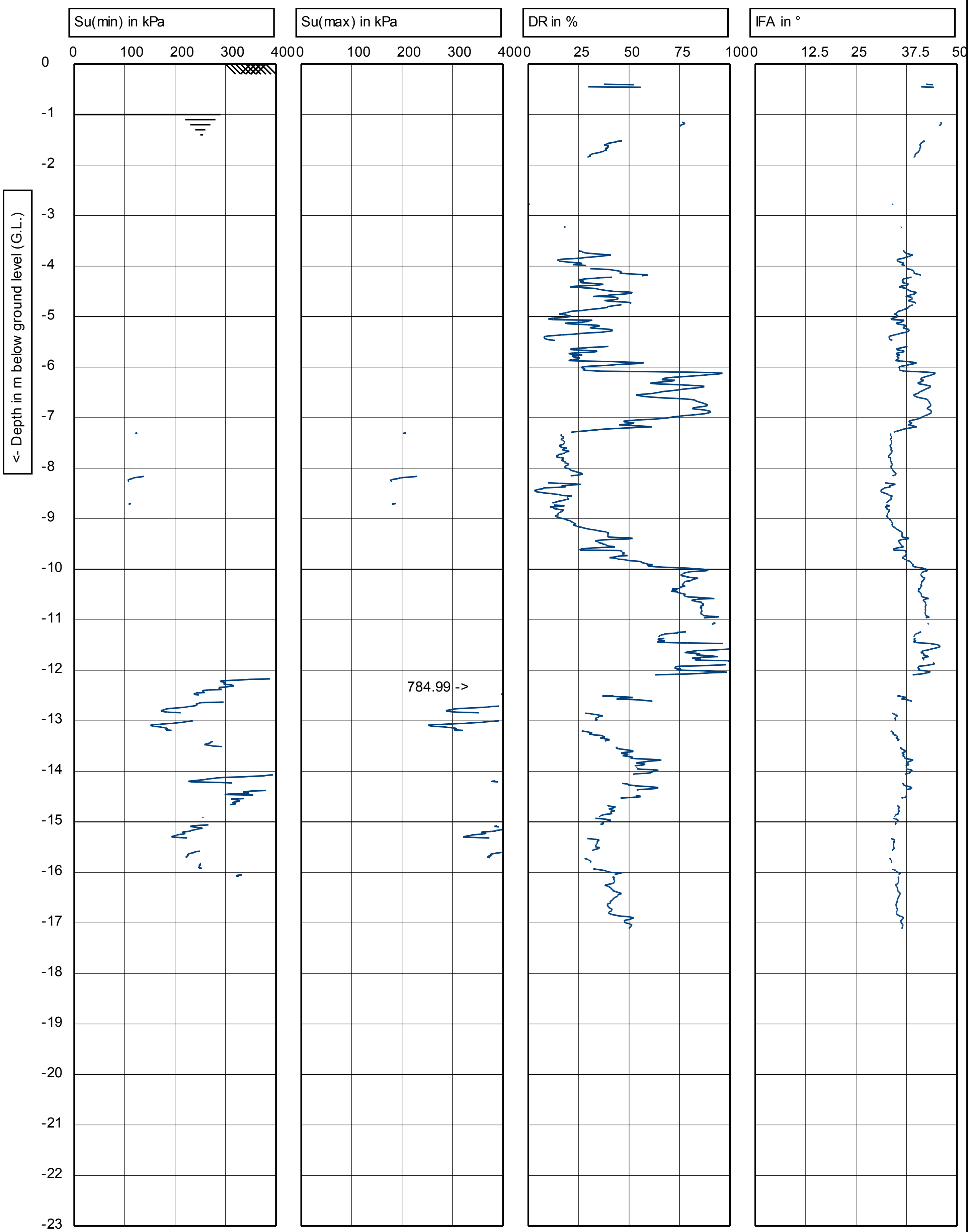


(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained



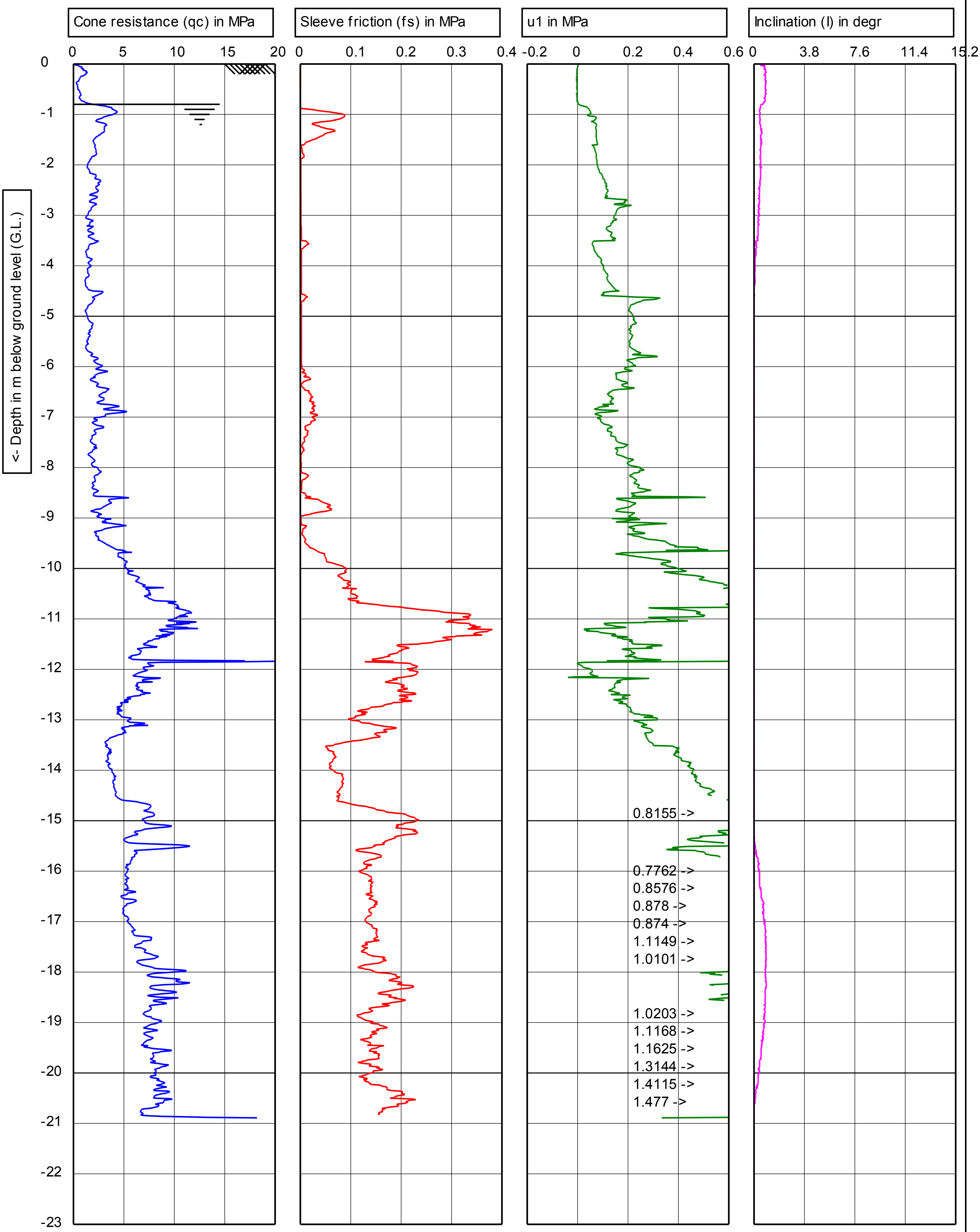
u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** W.L.: **-1**	Date:	**15/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.126**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT402** 2/3

CPTask V1.23



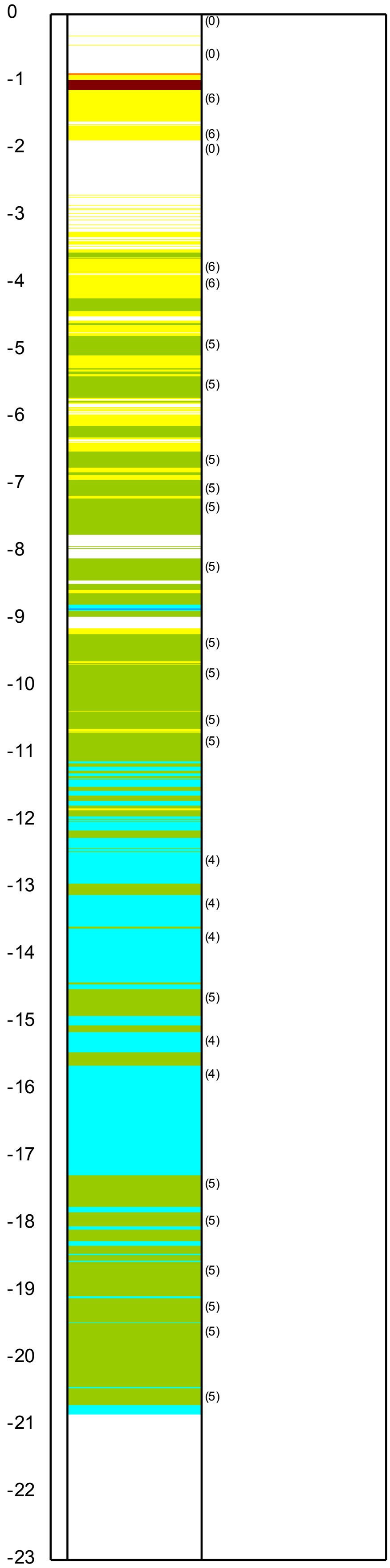
u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	0
	G.L. **0** W.L.: **-1**	Date:	**15/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.126**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT402** 3/3

CPTask V1.23

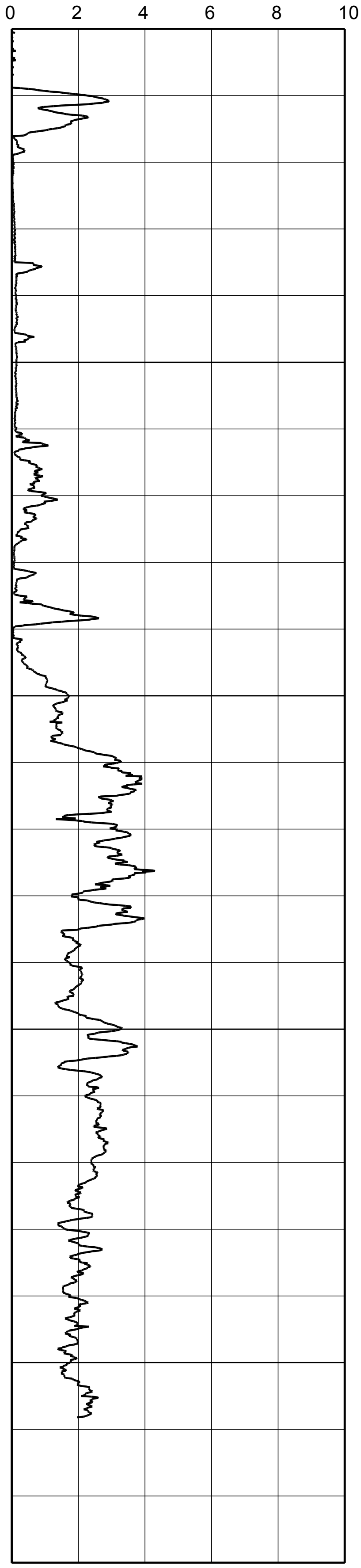


u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** W.L.: **-0.8**	Date:	**15/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.126**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT403** **1/3**

CPTask V1.23

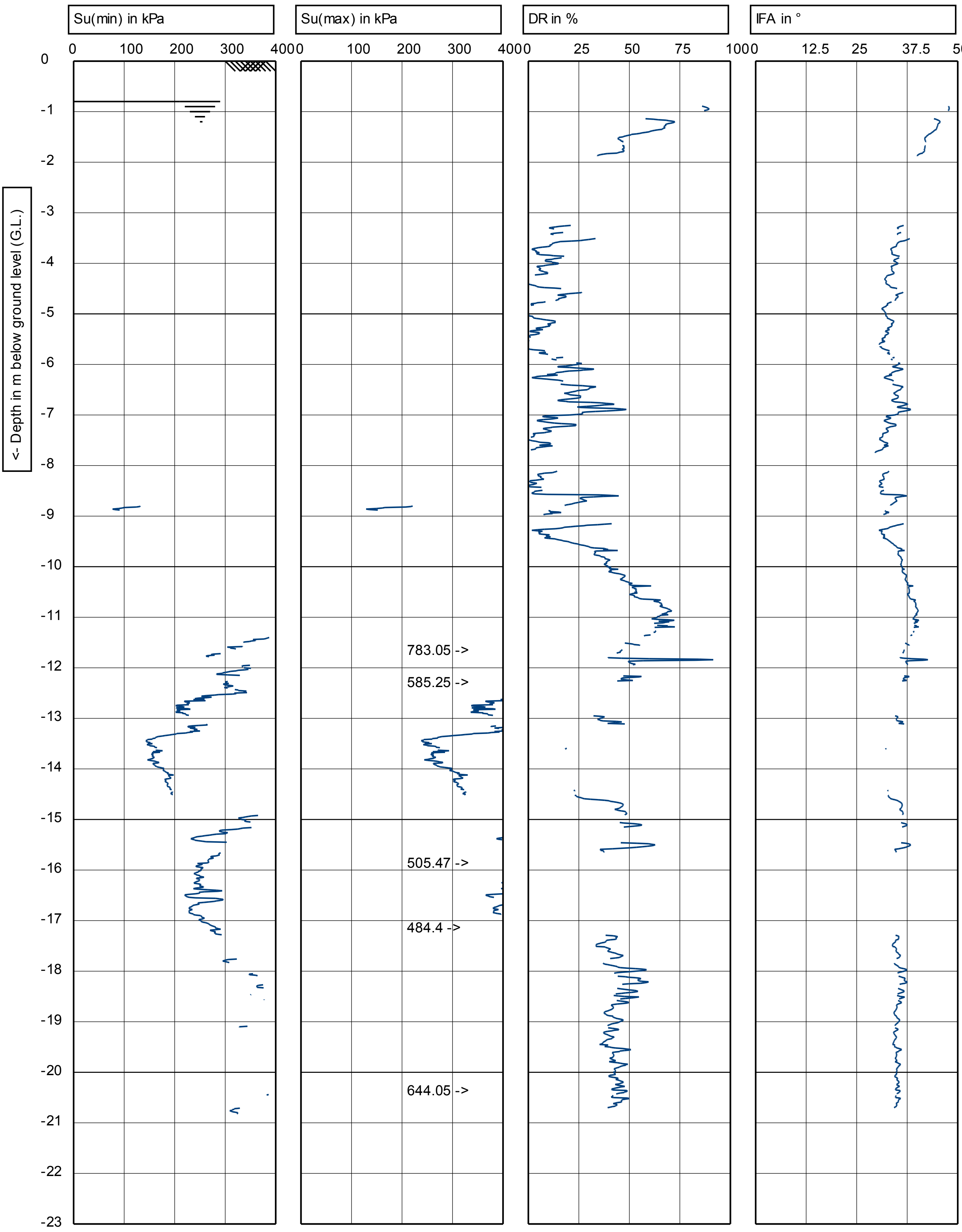


(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained



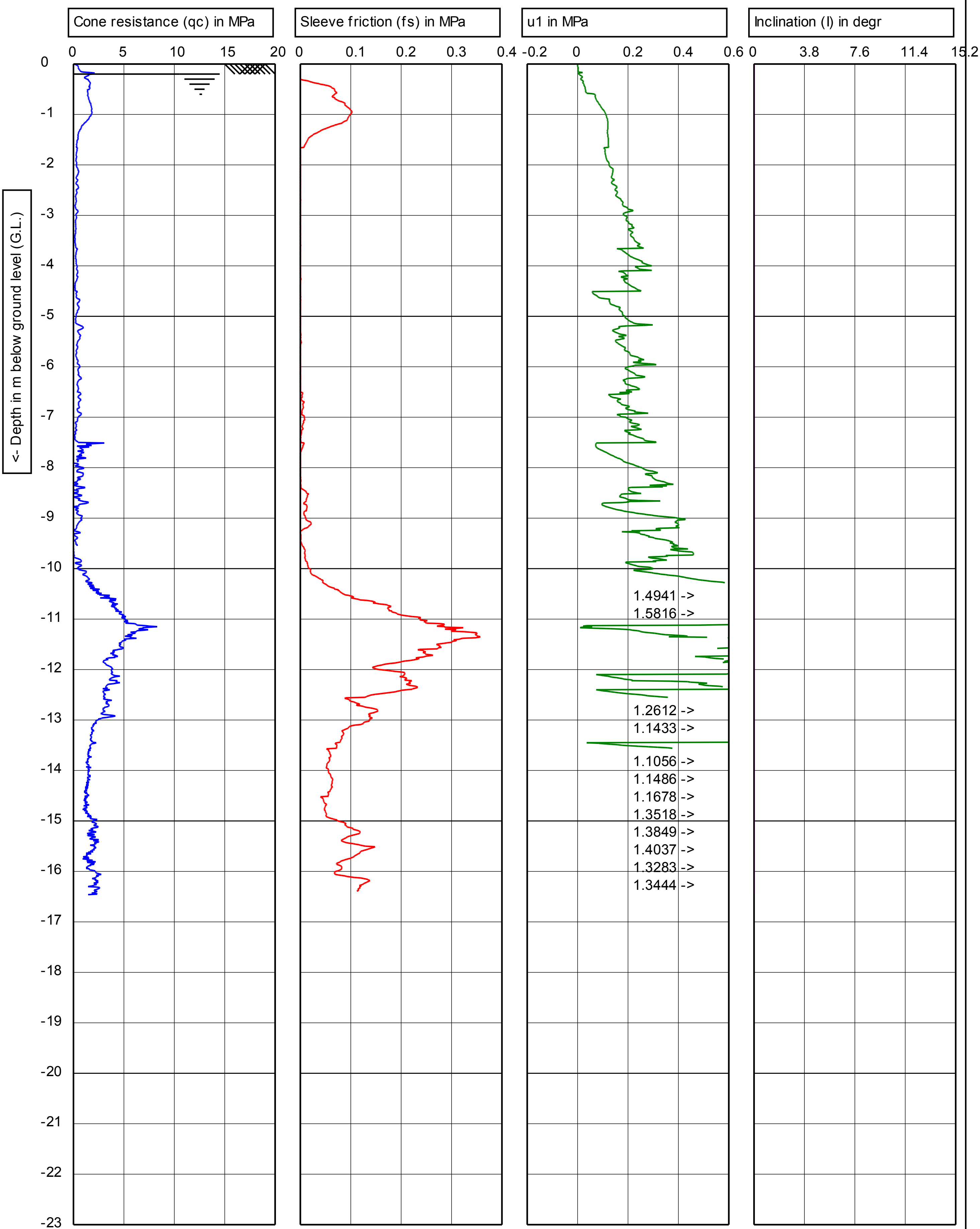
ESG	BS1377 Part 9 : 1999		Predrill : **0**
u1 150 cm² 10 cm²	G.L. **0**	W.L.: **-0.8**	Date: **15/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.: **C10-CFIP.126**
	Location: **MAIN GI - HULL**		Project no.: **A5085-15**
	Position:		CPT no.: **CPT403** **2/3**

CPTask V1.23



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	0
G.L. **0**	W.L.: **-0.8**	Date:	**15/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.126**
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**
Position:		CPT no.:	**CPT403** **3/3**

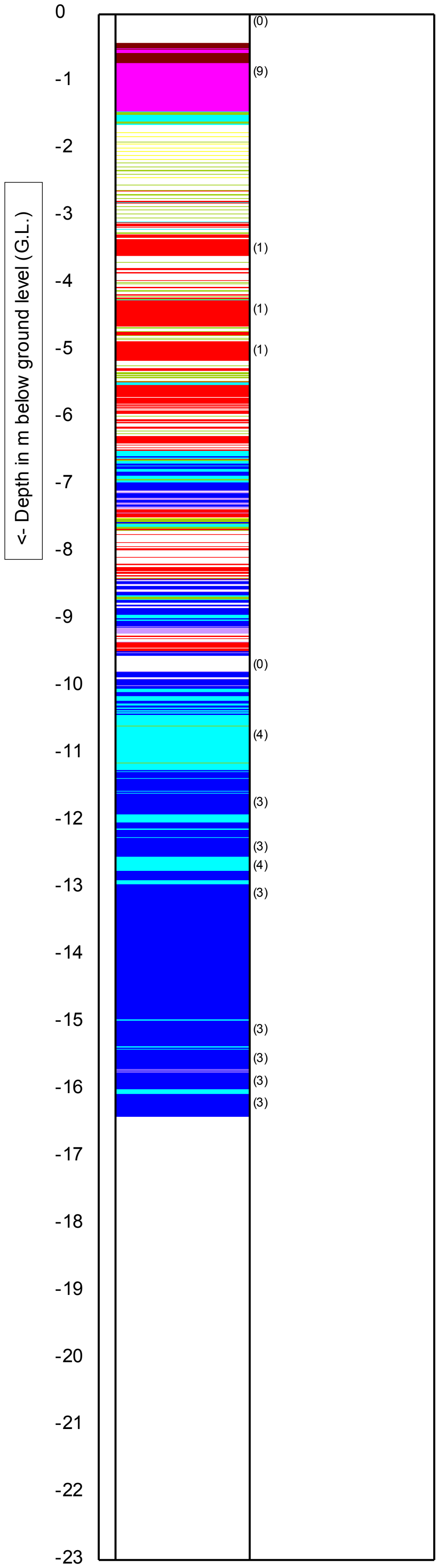
CPTask V1.23



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** W.L.: **-0.2**	Date:	**08/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.125**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT404** 1/3

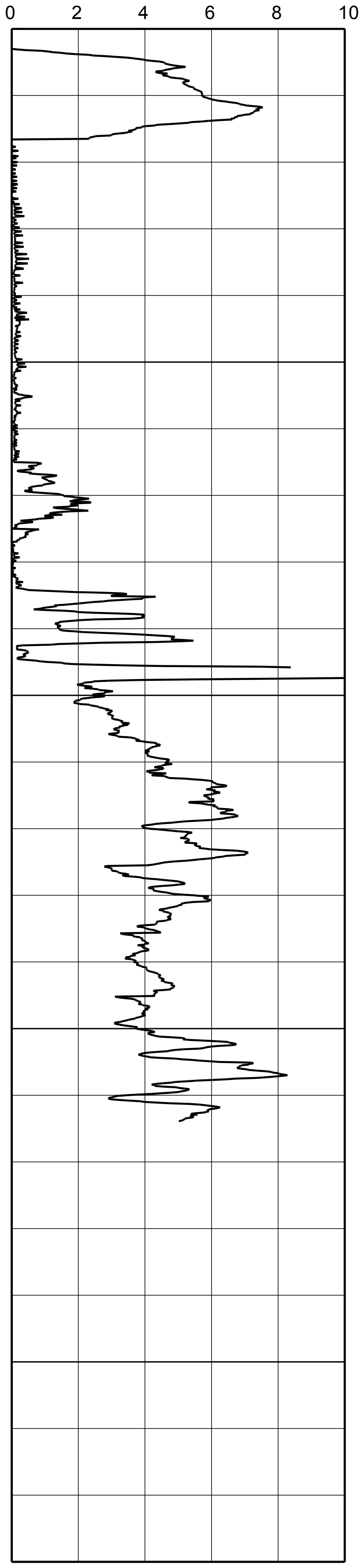
CPTask V1.23

Soil Classification (using Fr)



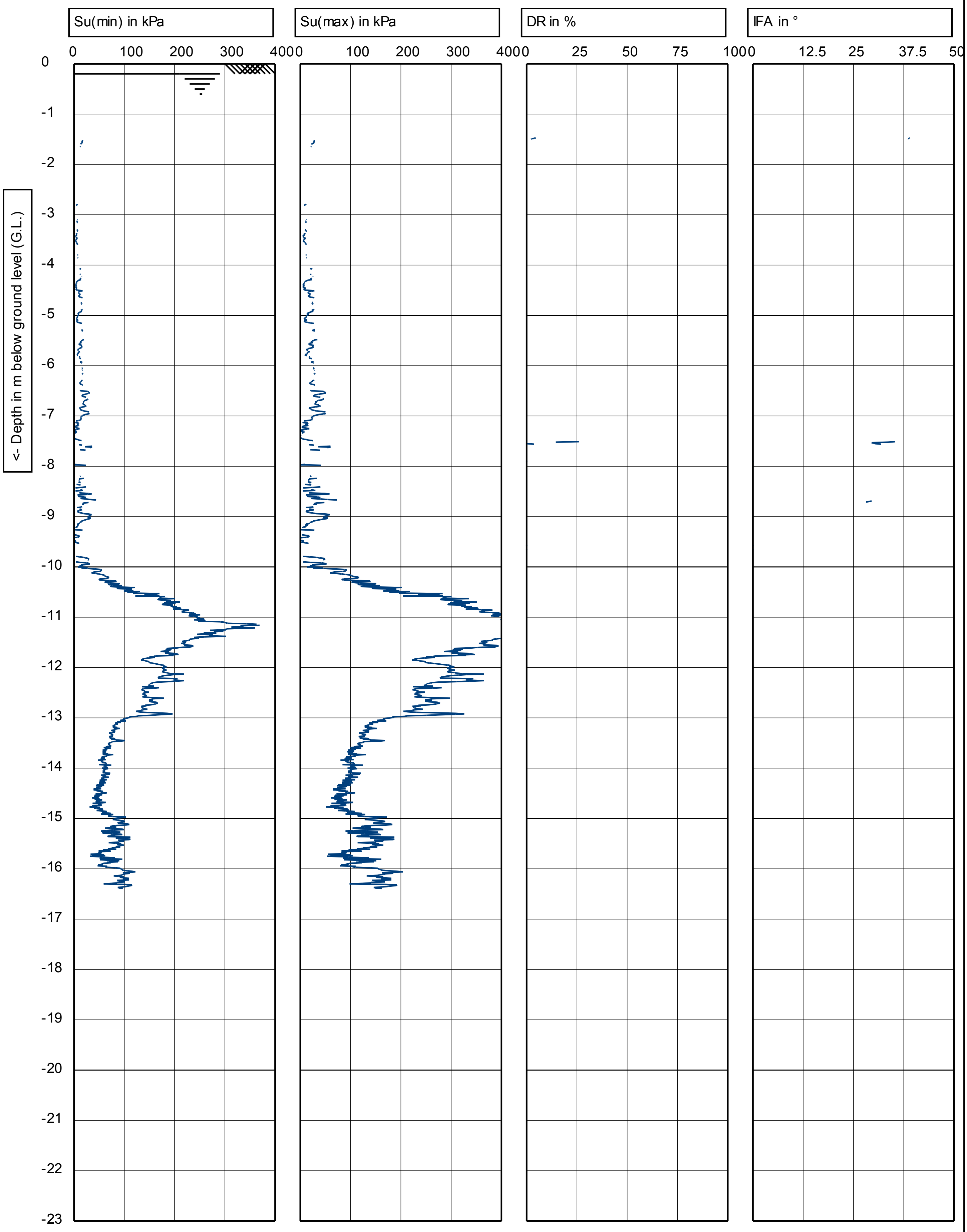
(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained

Friction ratio (Rf) in %



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** W.L.: **-0.2**	Date:	**08/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.125**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT404** 2/3

CPTask V1.23

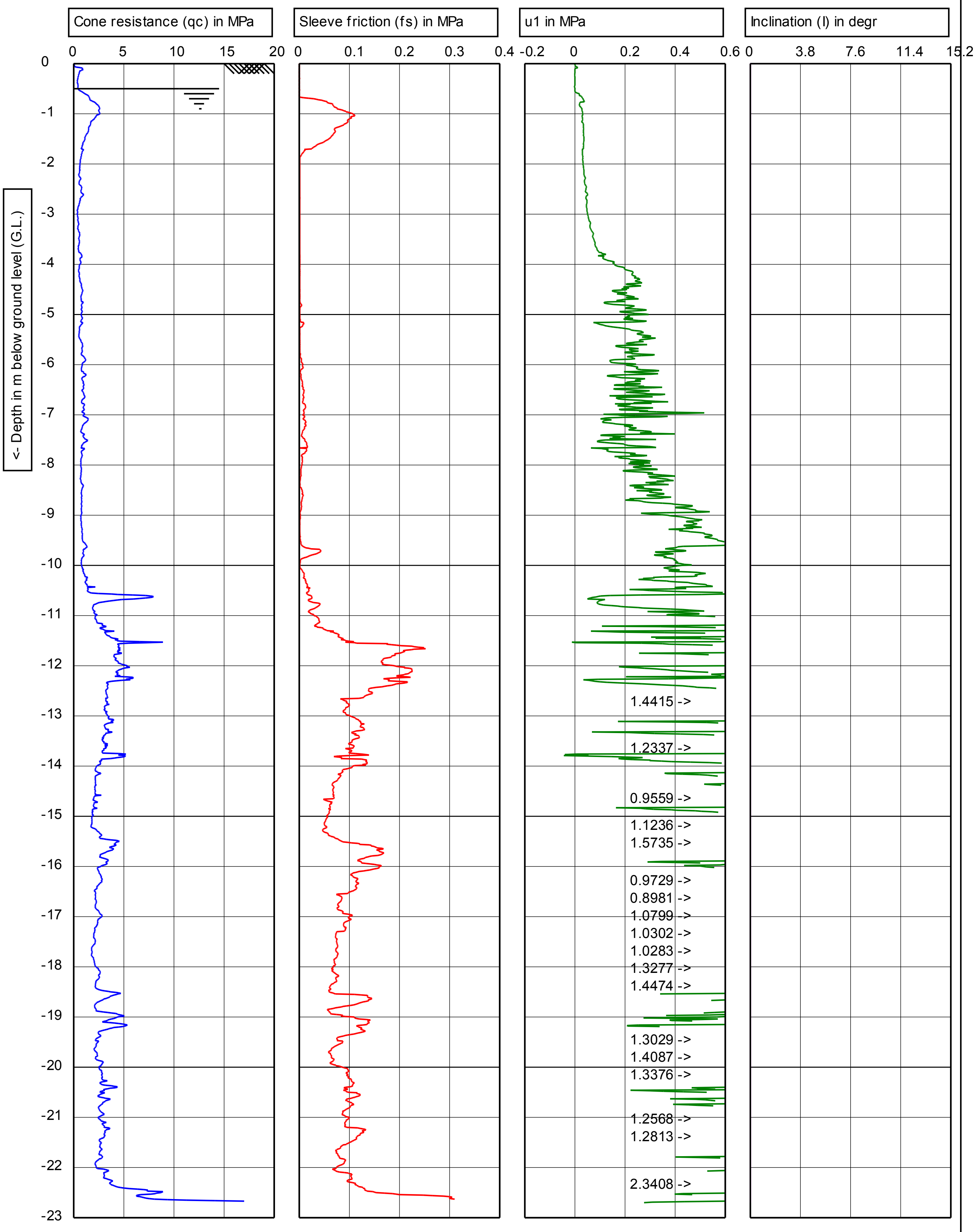


CPTask V1.23

ESG

u1
150 cm²
10 cm²

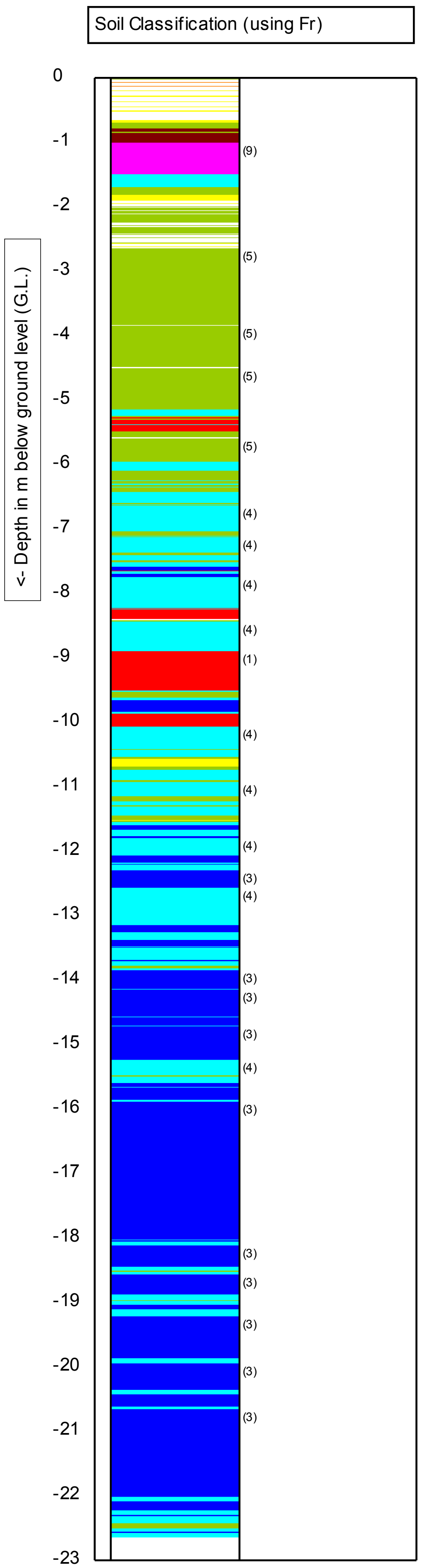
BS1377 Part 9 : 1999		Predrill :	0	
G.L. **0**	W.L.: **-0.2**	Date:	**08/12/2015**	
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.125**	
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**	
Position:		CPT no.:	**CPT404**	**3/3**



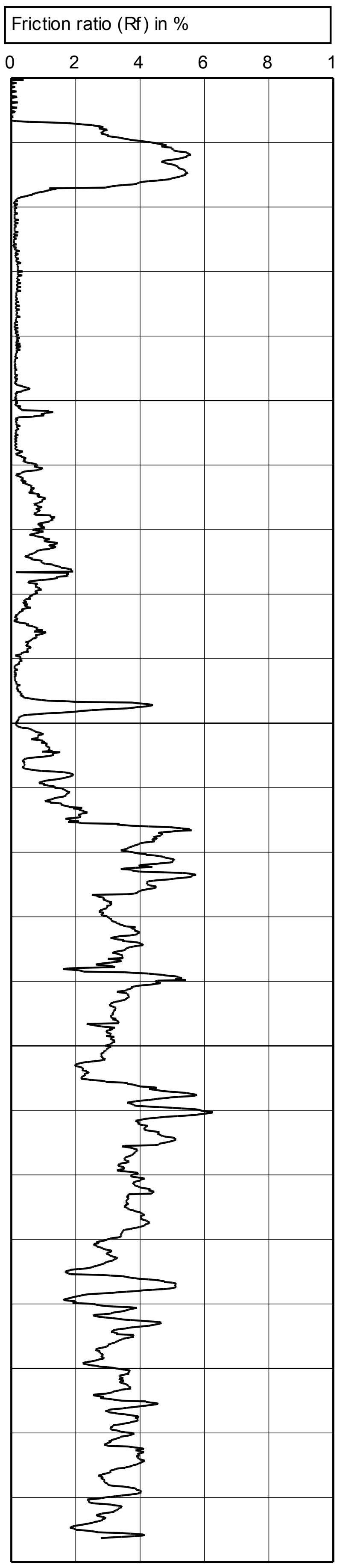
ESG

u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill :	0
	G.L. **0**	W.L.: **-0.5**	Date:	**08/12/2015**
Project:	**A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.125**
Location:	**MAIN GI - HULL**		Project no.:	**A5085-15**
Position:			CPT no.:	**CPT405** 1/3

CPTask V1.23

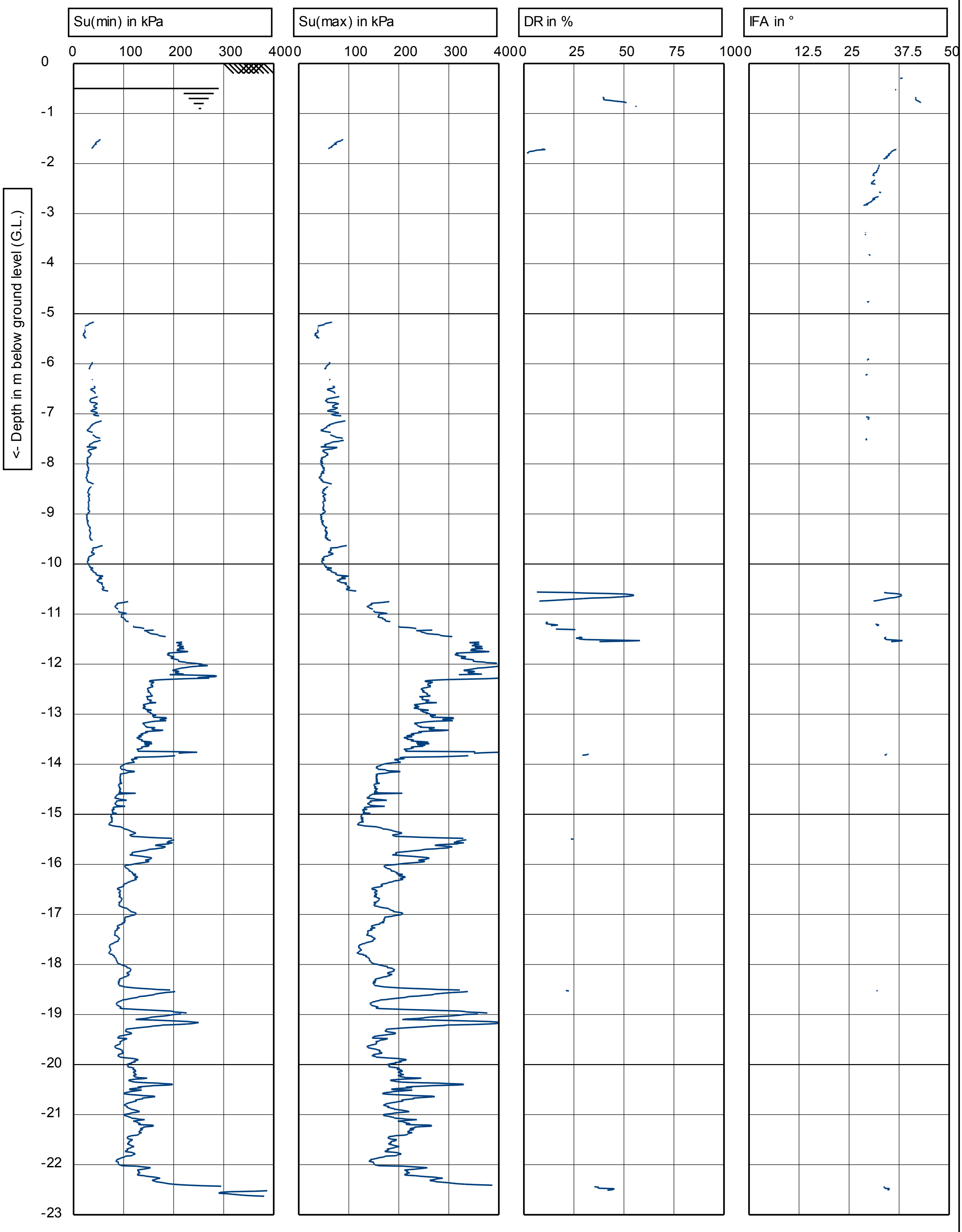


(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** W.L.: **-0.5**	Date:	**08/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.125**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT405** **2/3**

CPTask V1.23

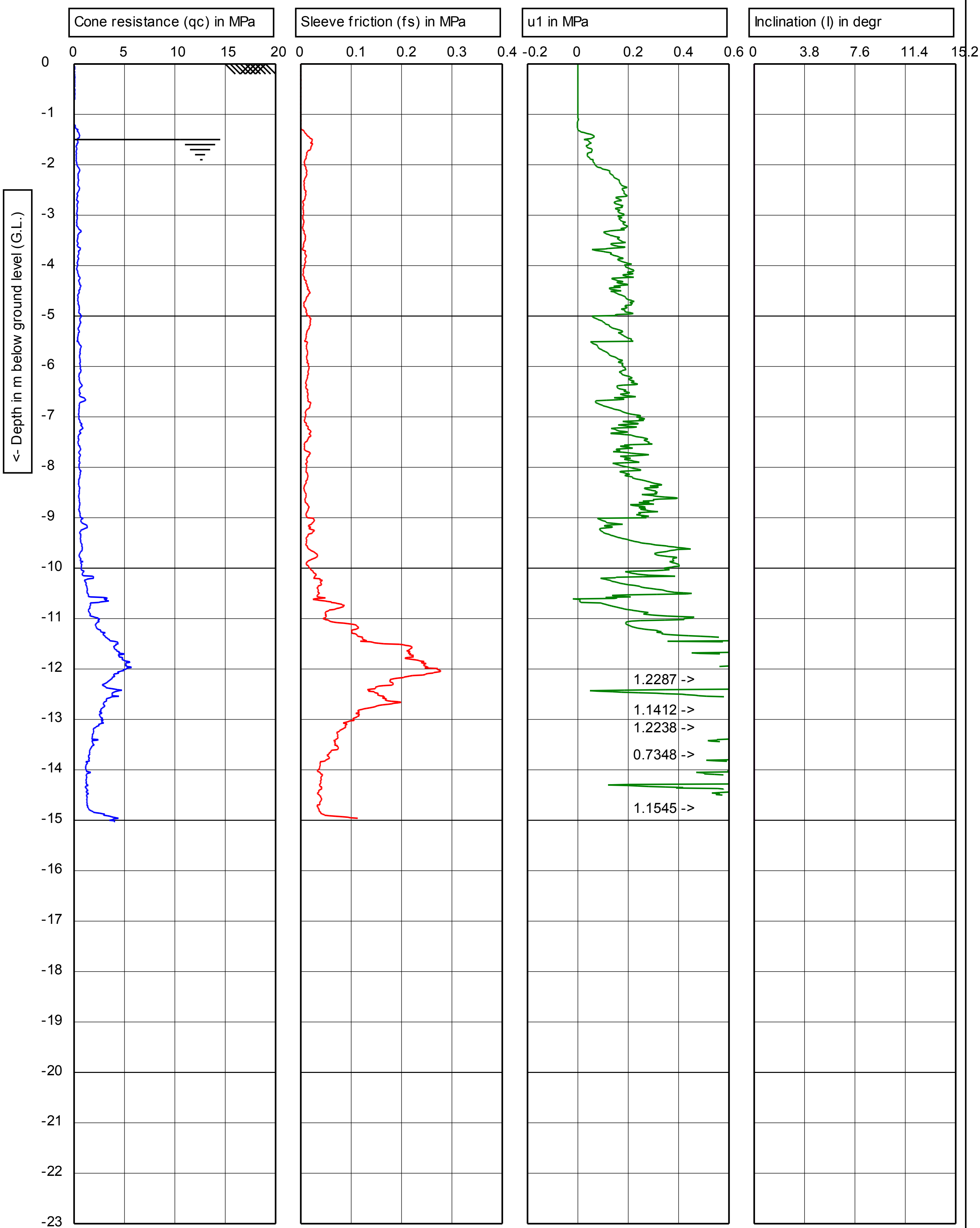


ESG

u1
150 cm²
10 cm²

BS1377 Part 9 : 1999		Predrill :	**0**
G.L. **0**	W.L.: **-0.5**	Date:	**08/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.125**
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**
Position:		CPT no.:	**CPT405** **3/3**

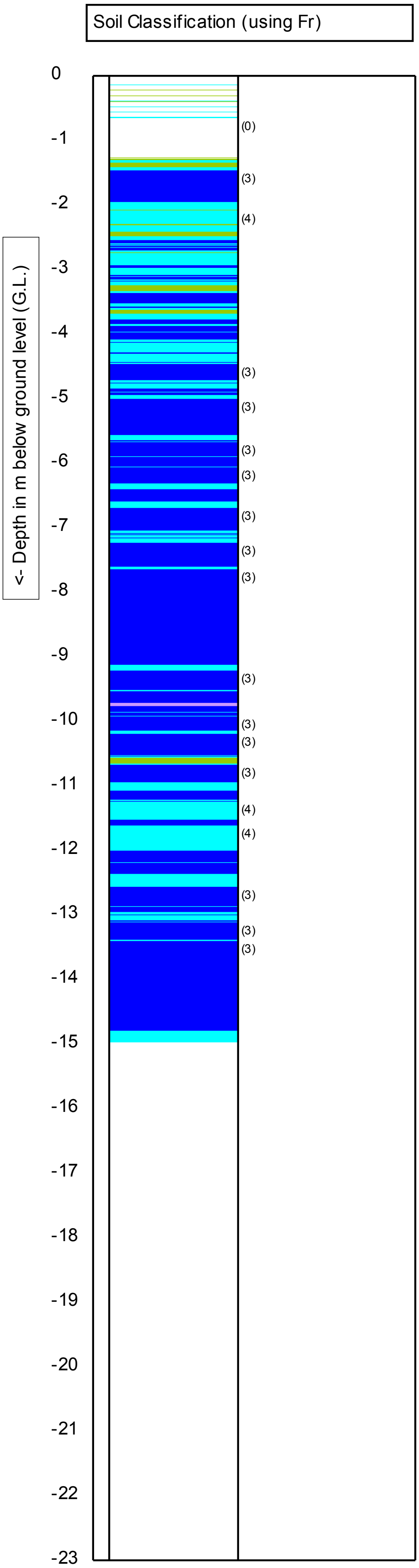
CPTask V1.23



ESG

CPTask V1.23

u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill :	**0**
	G.L. **0**	W.L.: **-1.5**	Date:	**08/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**			Cone no.:	**C10-CFIP.125**
Location: **MAIN GI - HULL**			Project no.:	**A5085-15**
Position:			CPT no.:	**CPT406** 1/3



(0) Not defined
(1) Sensitive, fine grained
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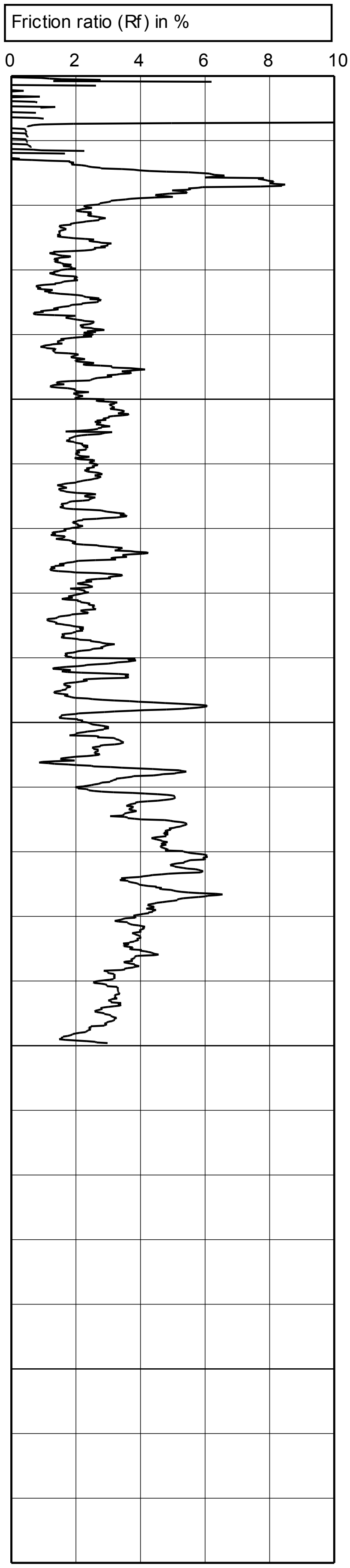
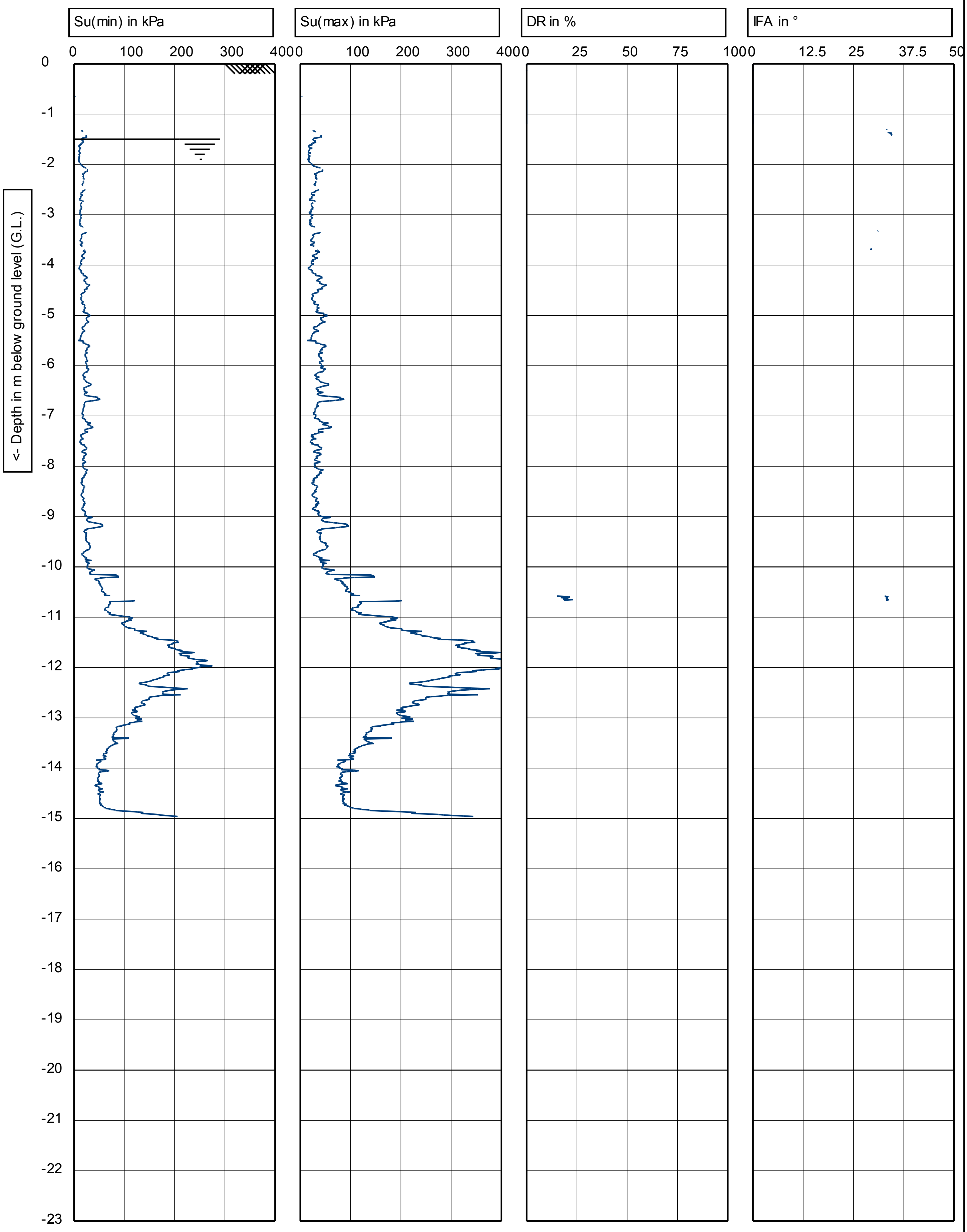
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** W.L.: **-1.5**	Date:	**08/12/2015**
Project:	**A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.125**
Location:	**MAIN GI - HULL**	Project no.:	**A5085-15**
Position:		CPT no.:	**CPT406** 2/3

CPTask V1.23

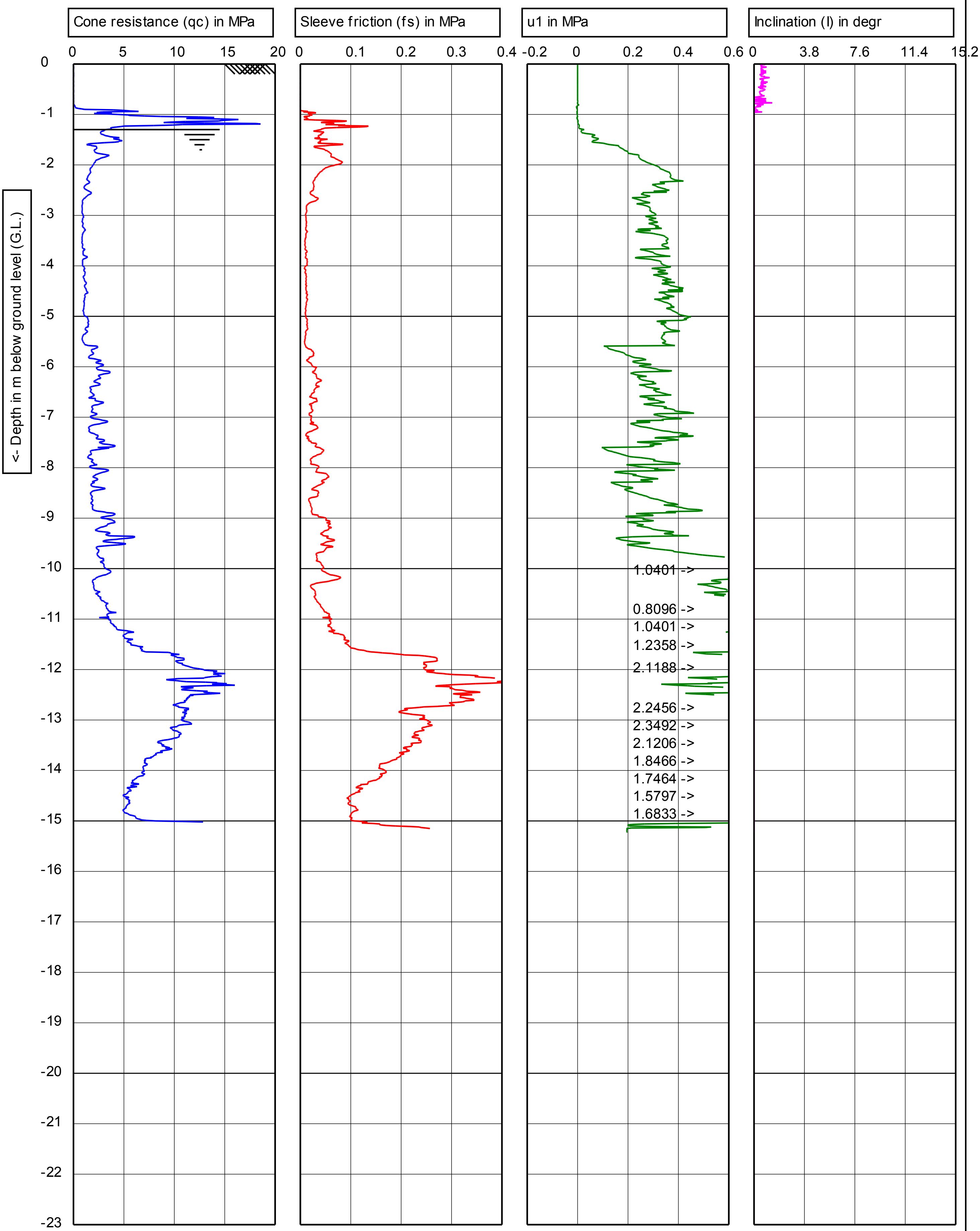


CPTask V1.23

ESG

u1
150 cm²
10 cm²

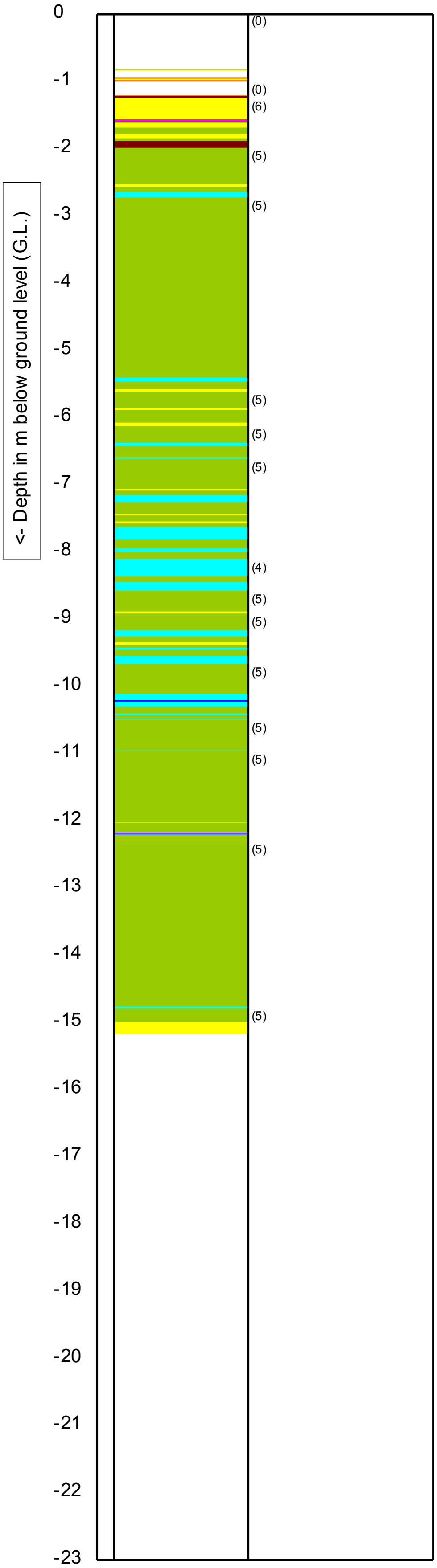
BS1377 Part 9 : 1999		Predrill :	0
G.L. **0**	W.L.: **-1.5**	Date:	**08/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.125**
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**
Position:		CPT no.:	**CPT406** 3/3



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill :	**0**
	G.L. **0**	W.L.: **-1.3**	Date:	**10/12/2015**
Project:	**A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.126**
Location:	**MAIN GI - HULL**		Project no.:	**A5085-15**
Position:			CPT no.:	**CPT407** 1/3

CPTask V1.23

Soil Classification (using Fr)



(0) Not defined
(1) Sensitive, fine grained
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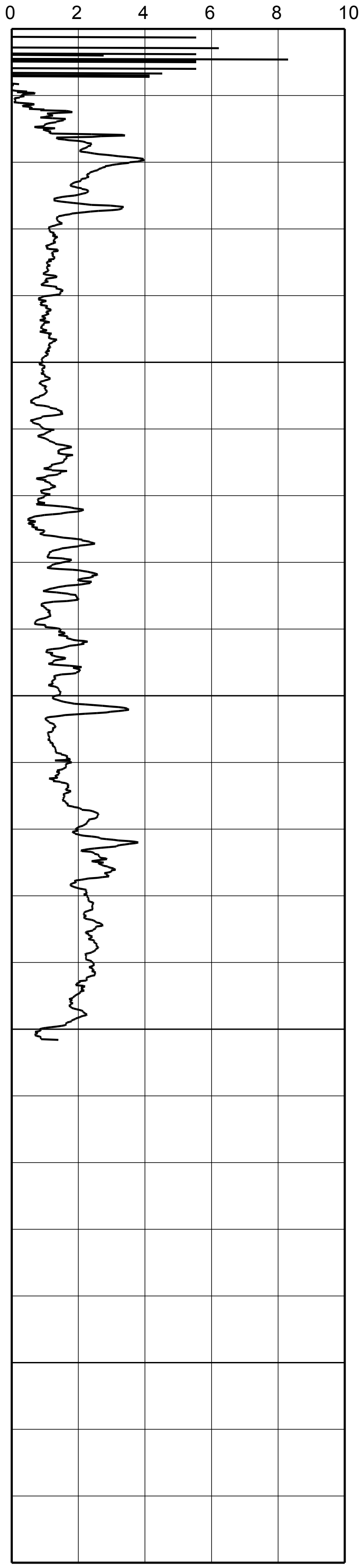
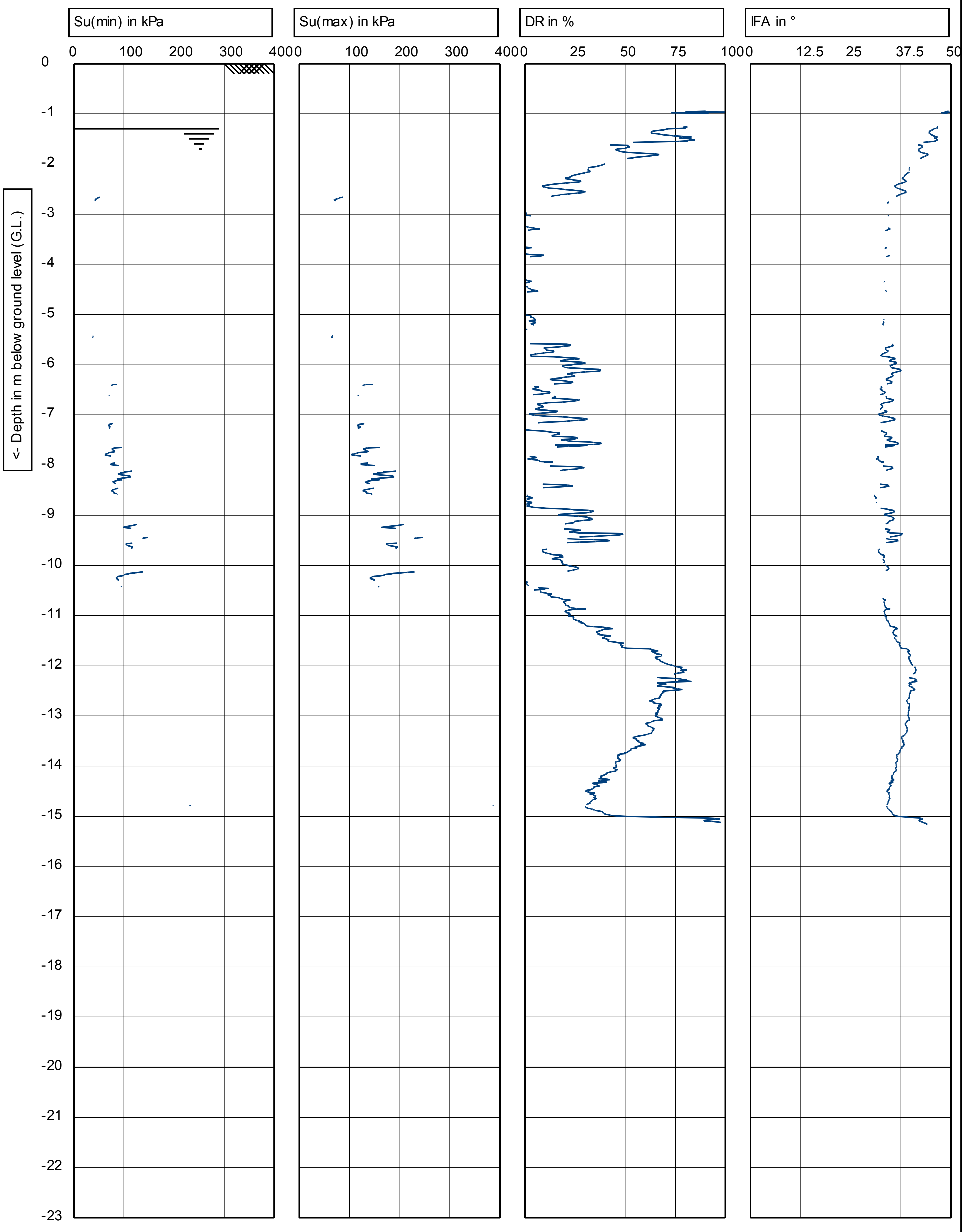
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained

Friction ratio (Rf) in %



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** / W.L.: **-1.3**	Date:	**10/12/2015**
ESG	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.126**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT407** 2/3

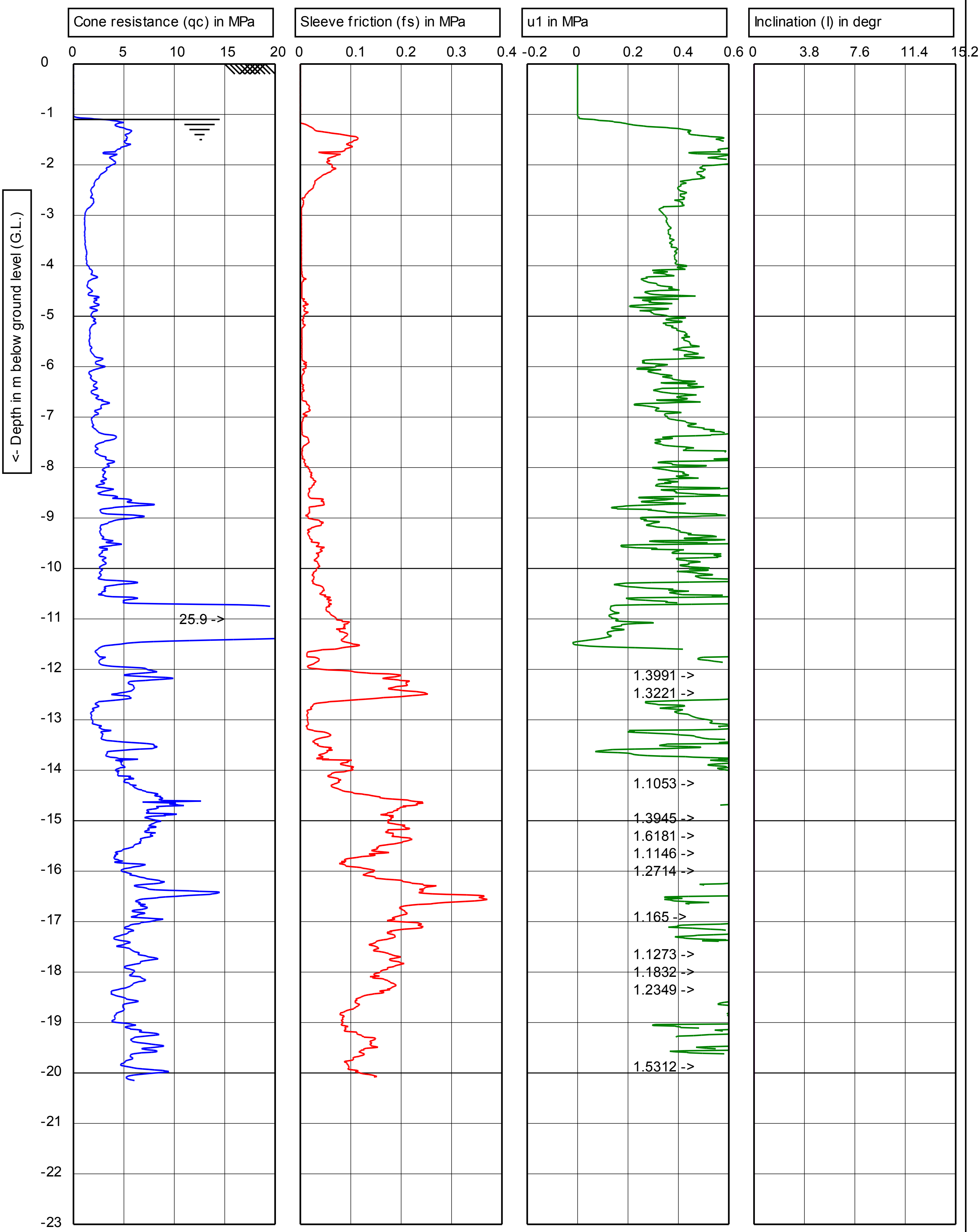
CPTask V1.23



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill : **0**
	G.L. **0**	W.L.: **-1.3**	Date: **10/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**			Cone no.: **C10-CFIP.126**
Location: **MAIN GI - HULL**			Project no.: **A5085-15**
Position:			CPT no.: **CPT407** **3/3**

ESG

CPTask V1.23



ESG

u1
150 cm²
10 cm²

BS1377 Part 9 : 1999

G.L. **0** W.L.: **-1.1**

Project: **A63 CASTLE STREET IMPROVEMENT**

Location: **MAIN GI - HULL**

Position:

Predrill : **0**

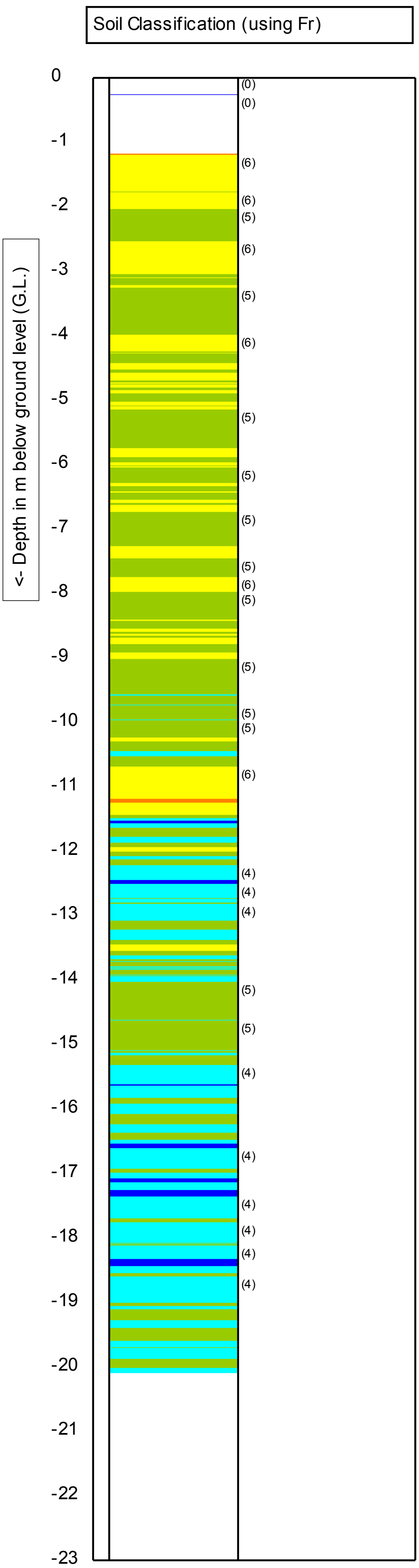
Date: **11/12/2015**

Cone no.: **C10-CFIP.126**

Project no.: **A5085-15**

CPT no.: **CPT408** **1/3**

CPTask V1.23



(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
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(6) Sands
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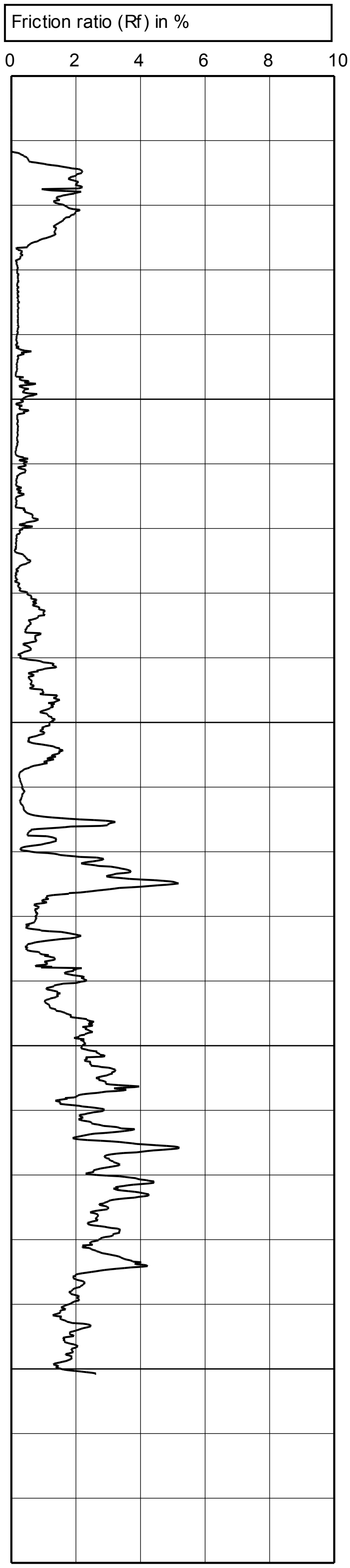
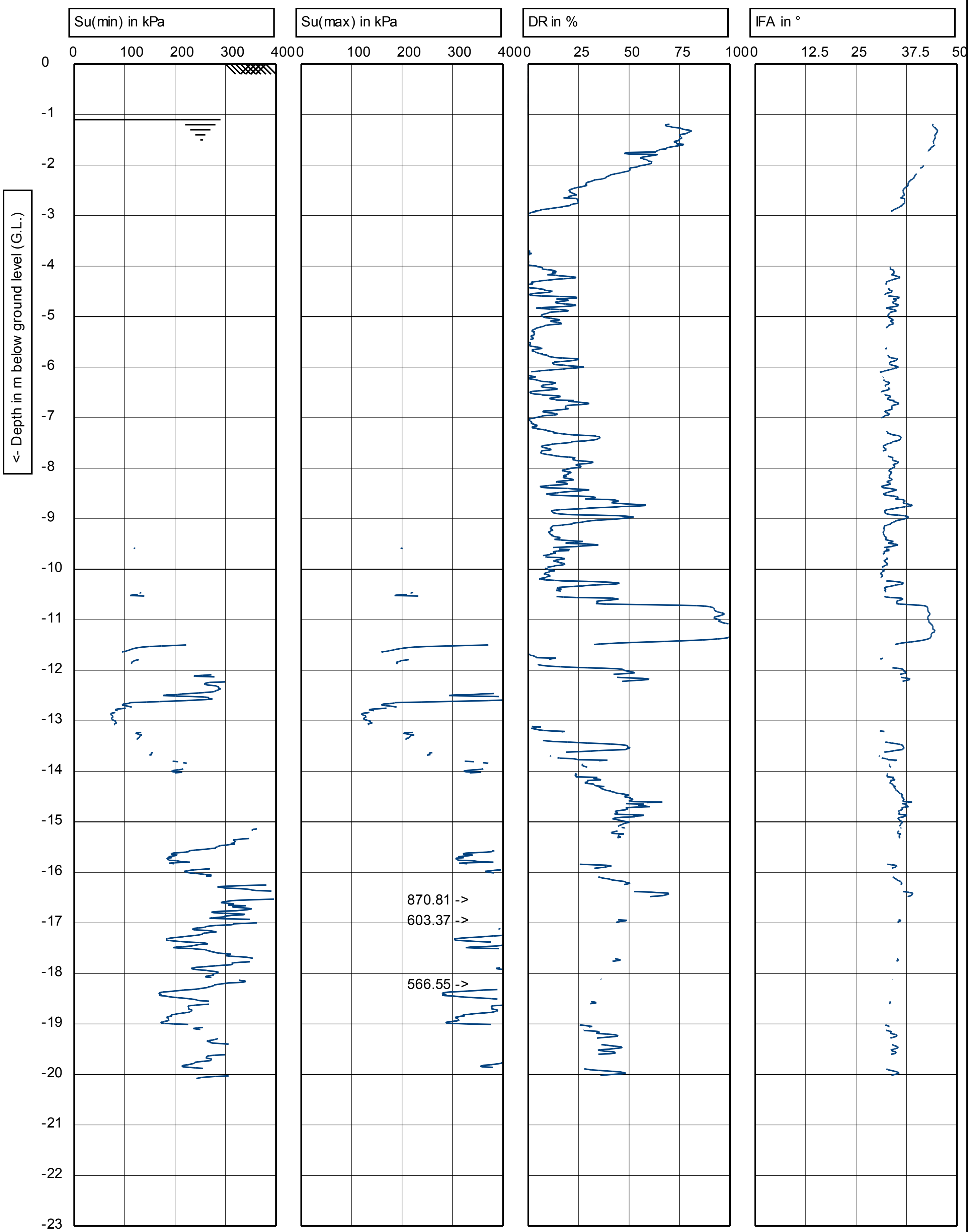


u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
	G.L. **0** W.L.: **-1.1**	Date:	**11/12/2015**
Project:	**A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.126**
Location:	**MAIN GI - HULL**	Project no.:	**A5085-15**
Position:		CPT no.:	**CPT408** **2/3**

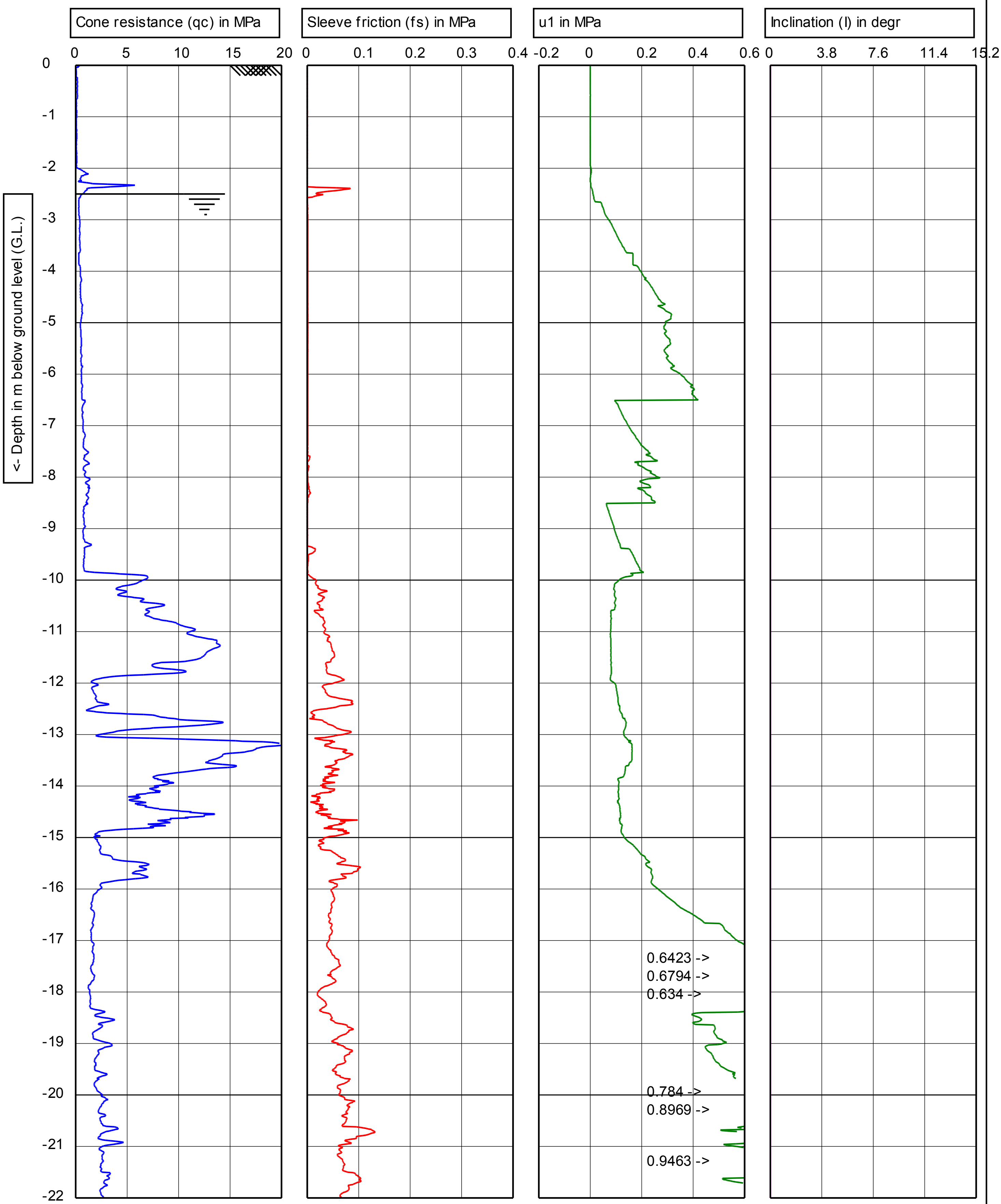
CPTask V1.23



CPTask V1.23

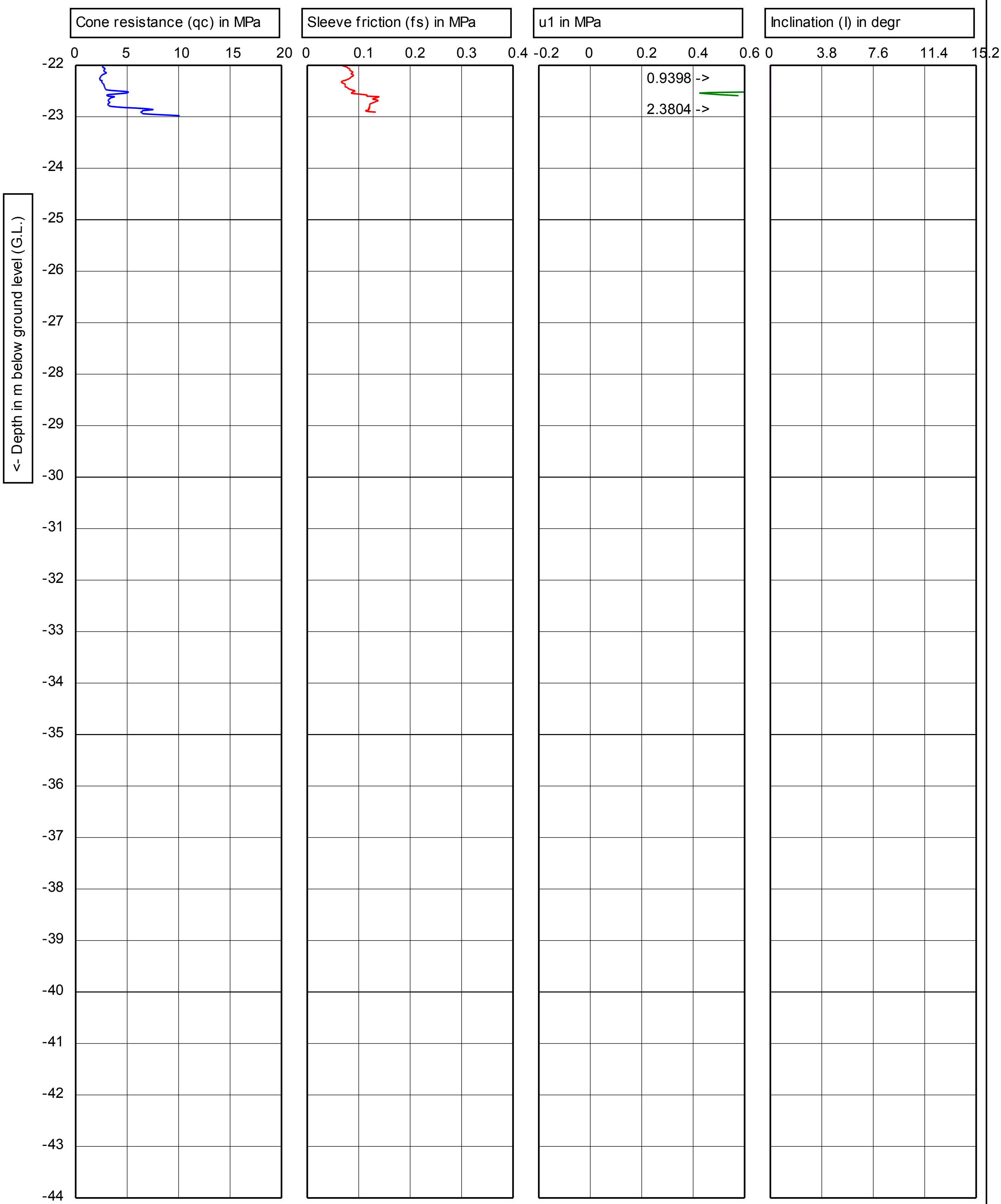
u1 150 cm² 10 cm²

BS1377 Part 9 : 1999		Predrill :	0
G.L. **0**	W.L.: **-1.1**	Date:	**11/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.126**
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**
Position:		CPT no.:	**CPT408** 3/3



ESG		BS1377 Part 9 : 1999	Predrill :	0
	u1 150 cm² 10 cm²	G.L. **0** W.L.: **-2.5**	Date:	**04/12/2015**
	Project:	**A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.125**
	Location:	**MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:		CPT no.:	**CPT409** **1/6**

CPTask V1.23

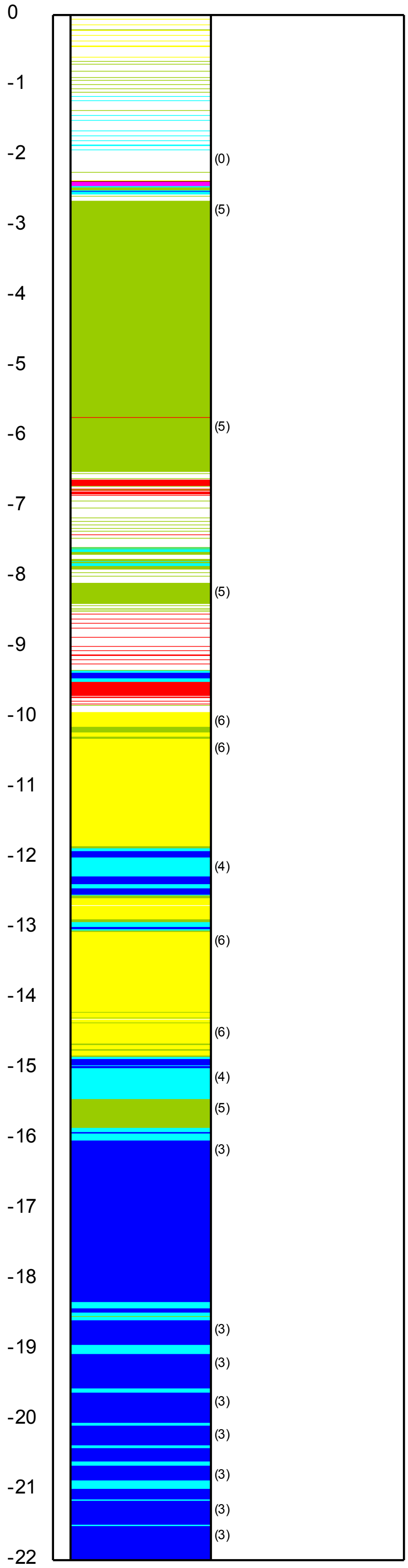


u1 pwp response muted, see text

ESG

u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
G.L. **0**	W.L.: **-2.5**	Date:	**04/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.125**
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**
Position:		CPT no.:	**CPT409** **2/6**

Soil Classification (using Fr)



(0) Not defined
(1) Sensitive, fine grained
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(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
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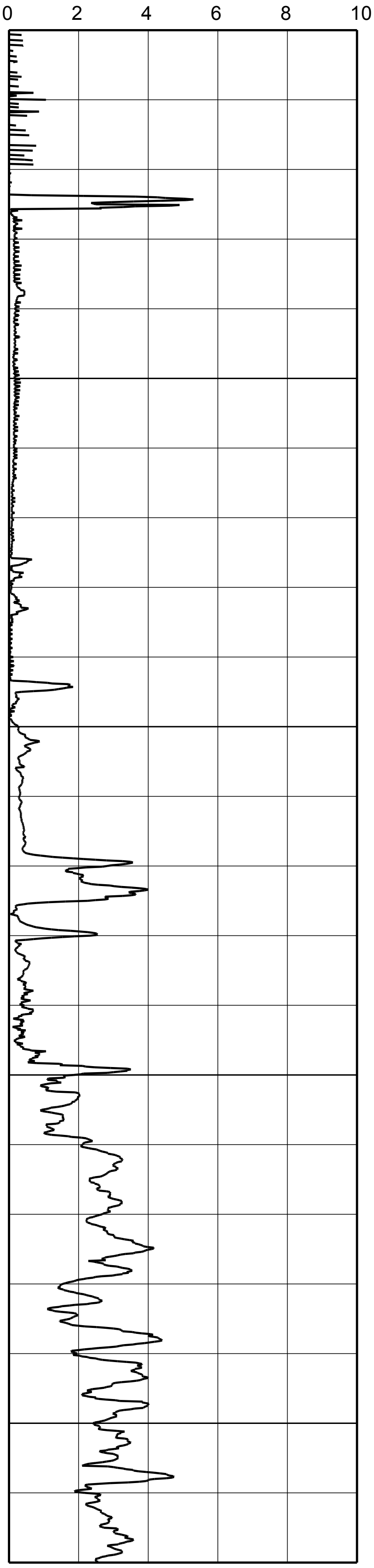
Friction ratio (Rf) in %

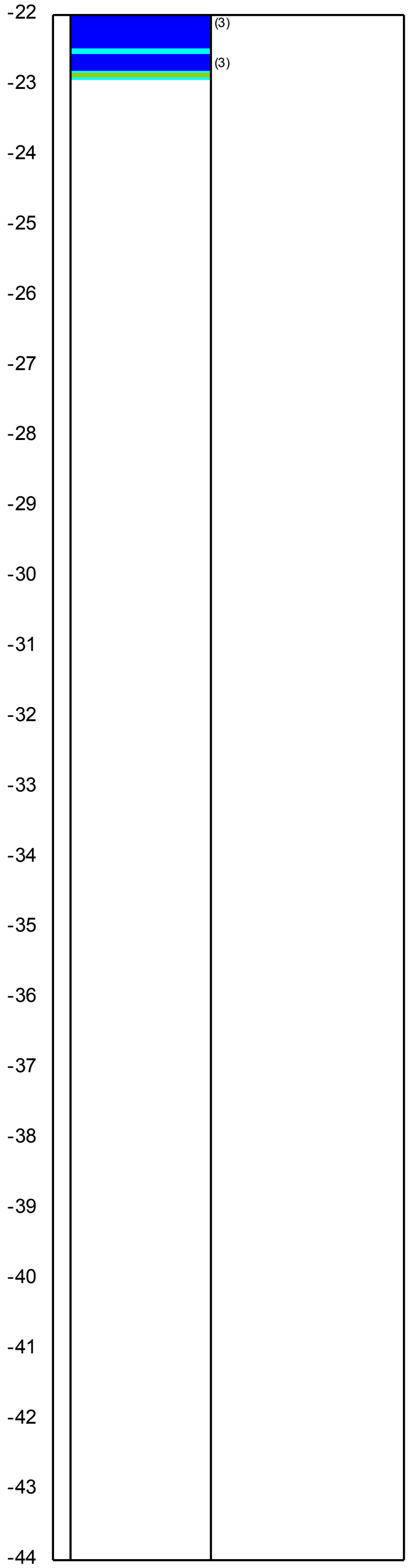


ESG

u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill : **0**
	G.L. **0**	W.L.: **-2.5**	Date: **04/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**			Cone no.: **C10-CFIP.125**
Location: **MAIN GI - HULL**			Project no.: **A5085-15**
Position:			CPT no.: **CPT409** **3/6**

CPTask V1.23

Soil Classification (using Fr)



(0) Not defined
(1) Sensitive, fine grained
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(3) Clays-clay to silty clay
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(5) Sand mixtures
(6) Sands
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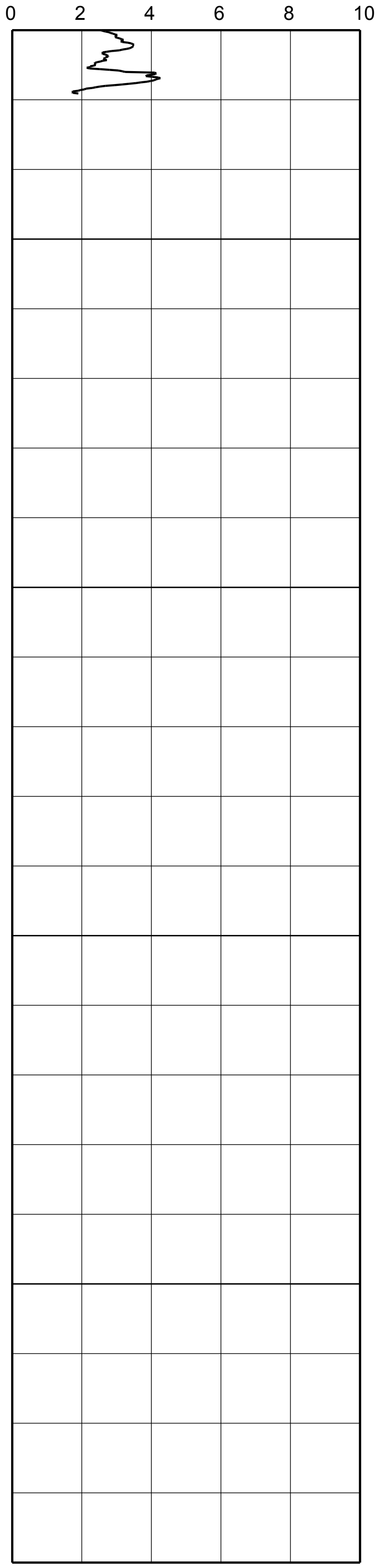
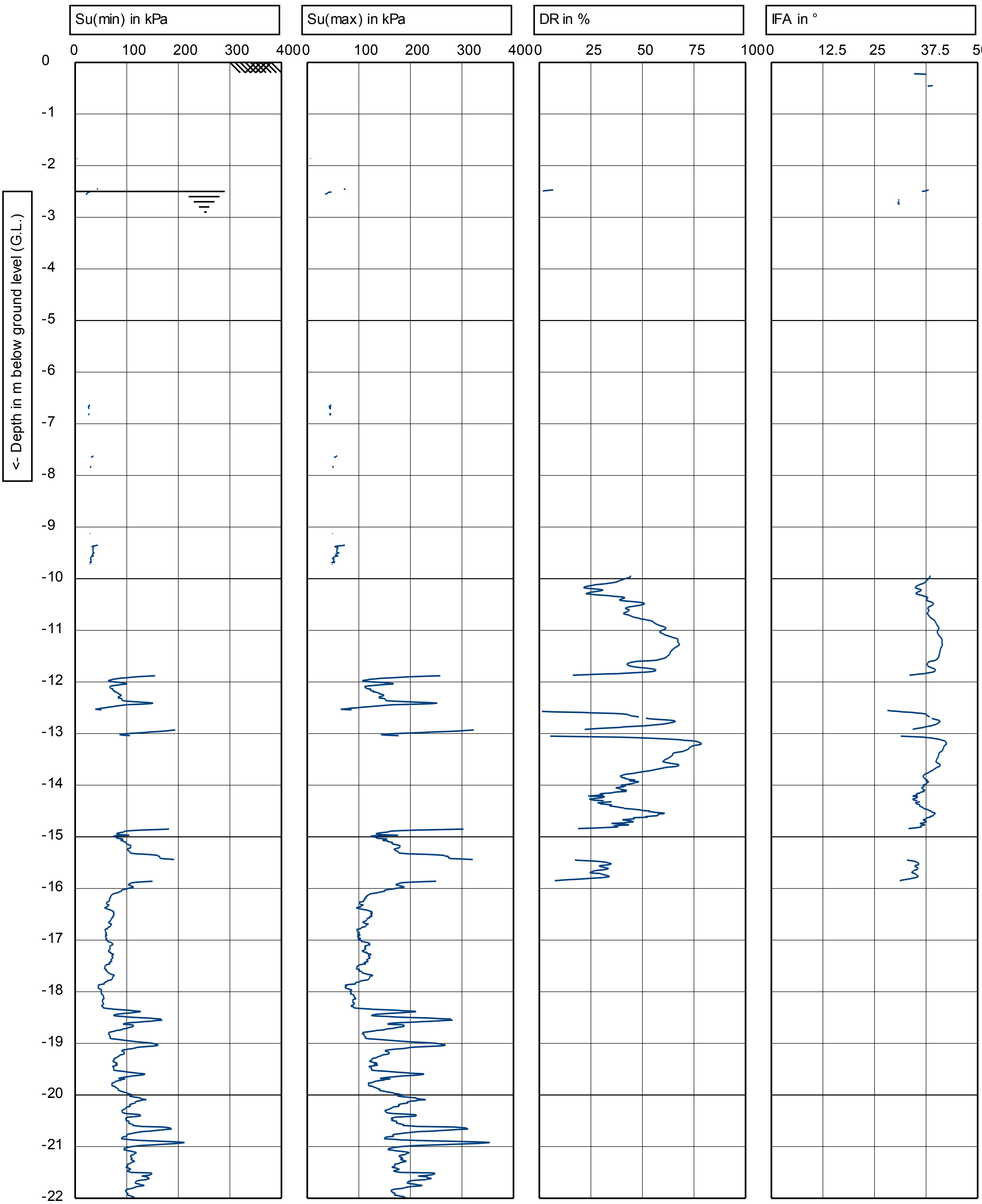
Friction ratio (Rf) in %



u1 pw p response muted, see text

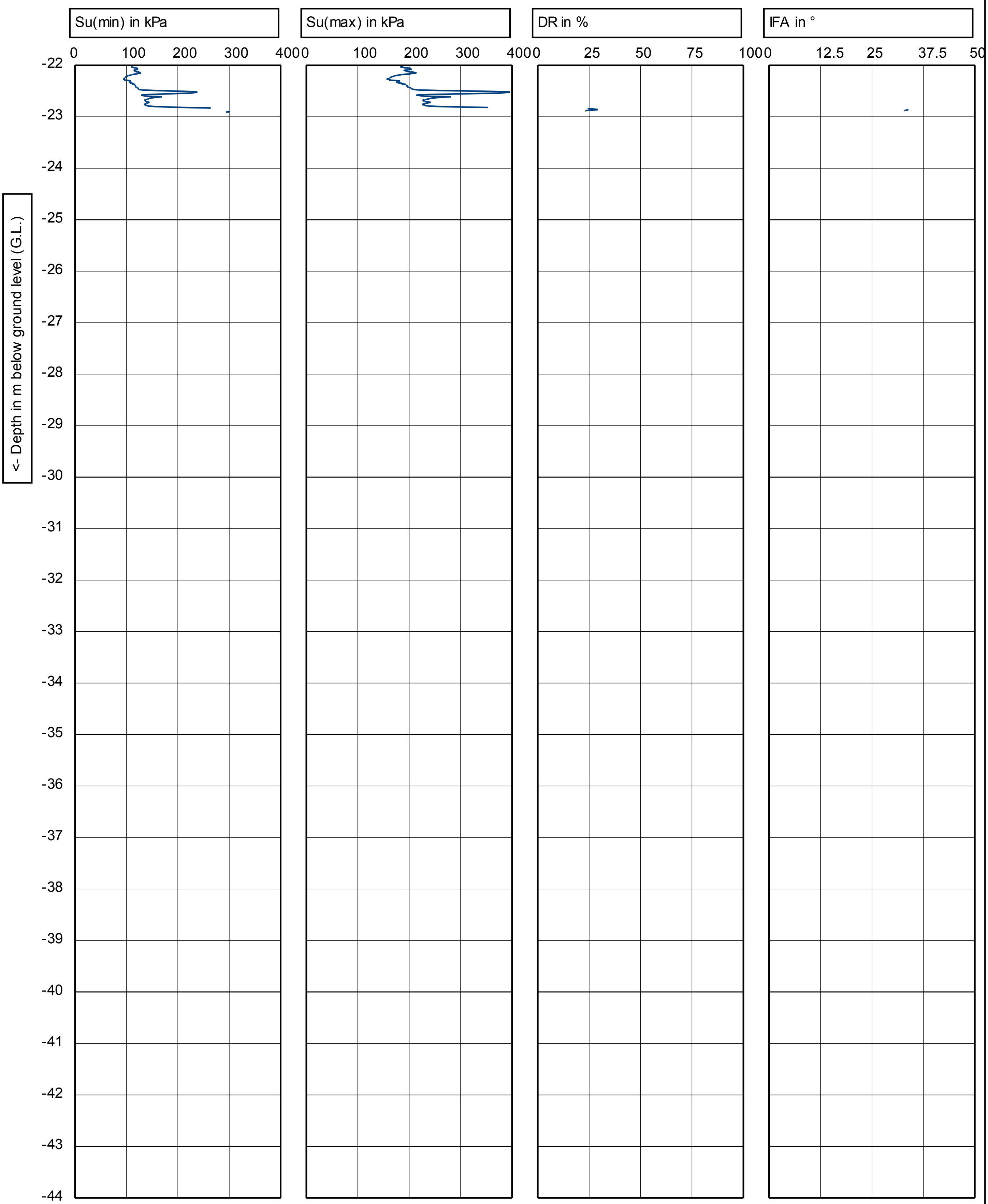
u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill : **0**
	G.L. **0**	W.L.: **-2.5**	Date: **04/12/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**			Cone no.: **C10-CFIP.125**
Location: **MAIN GI - HULL**			Project no.: **A5085-15**
Position:			CPT no.: **CPT409** **4/6**

CPTask V1.23



ESG	u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill : **0**
		G.L. **0** W.L.: **-2.5**	Date: **04/12/2015**
		Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.: **C10-CFIP.125**
		Location: **MAIN GI - HULL**	Project no.: **A5085-15**
		Position:	CPT no.: **CPT409** **5/6**

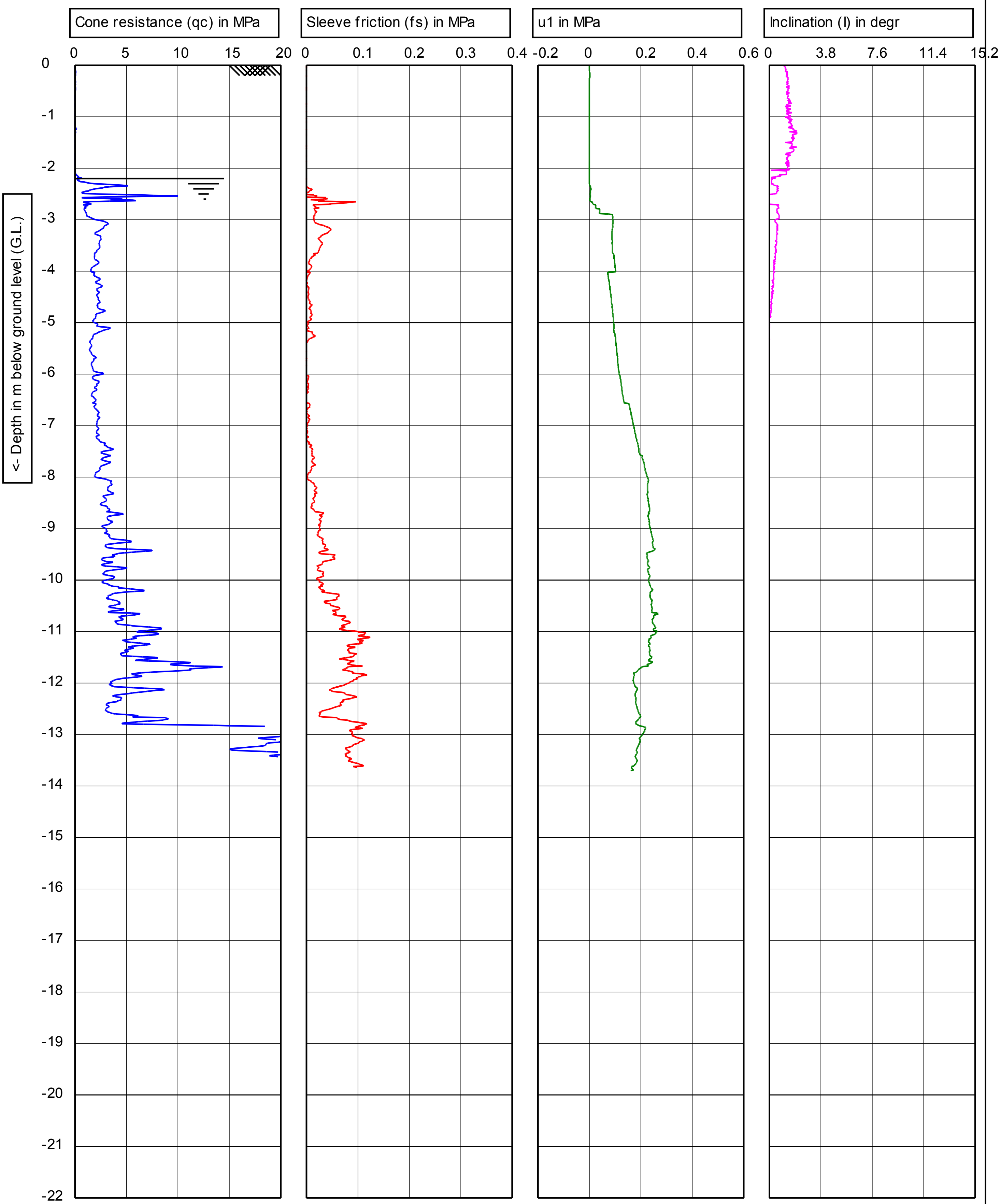
CPTask V1.23



u1 pwp response muted, see text

ESG	u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill : **0**
		G.L. **0** / W.L.: **-2.5**	Date: **04/12/2015**
		Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.: **C10-CFIP.125**
		Location: **MAIN GI - HULL**	Project no.: **A5085-15**
		Position:	CPT no.: **CPT409** **6/6**

CPTask V1.23



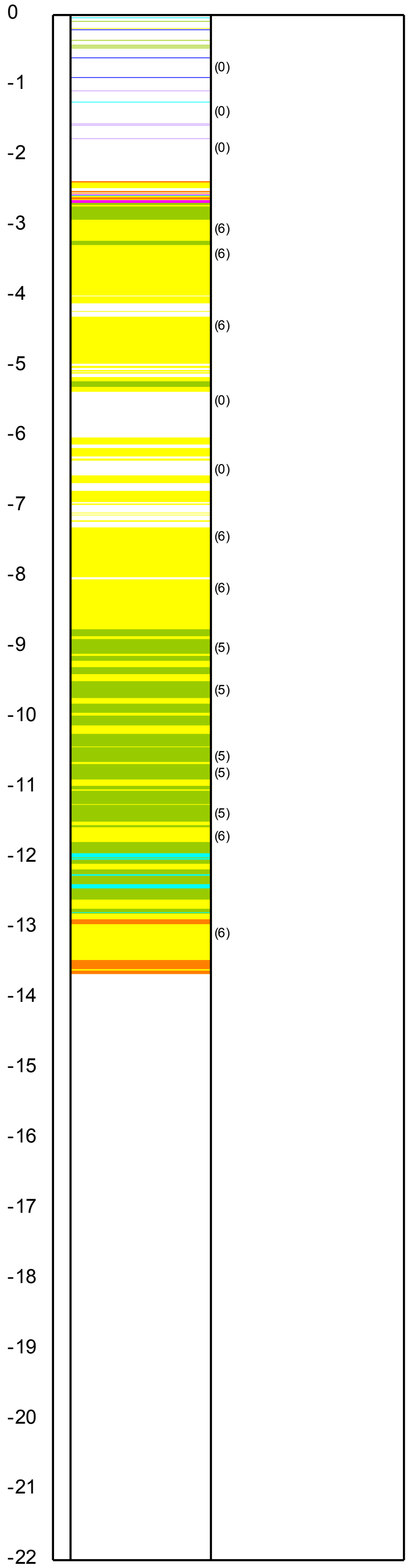
u1 pw p response muted, see text

ESG

u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill :	**0**
	G.L. **0**	W.L.: **-2.2**	Date:	**17/12/2015**
Project:	**A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.126**
Location:	**MAIN GI - HULL**		Project no.:	**A5085-15**
Position:			CPT no.:	**CPT414** **1/3**

CPTask V1.23

Soil Classification (using Fr)



(0) Not defined
(1) Sensitive, fine grained
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(6) Sands
(7) Gravelly sand to sand
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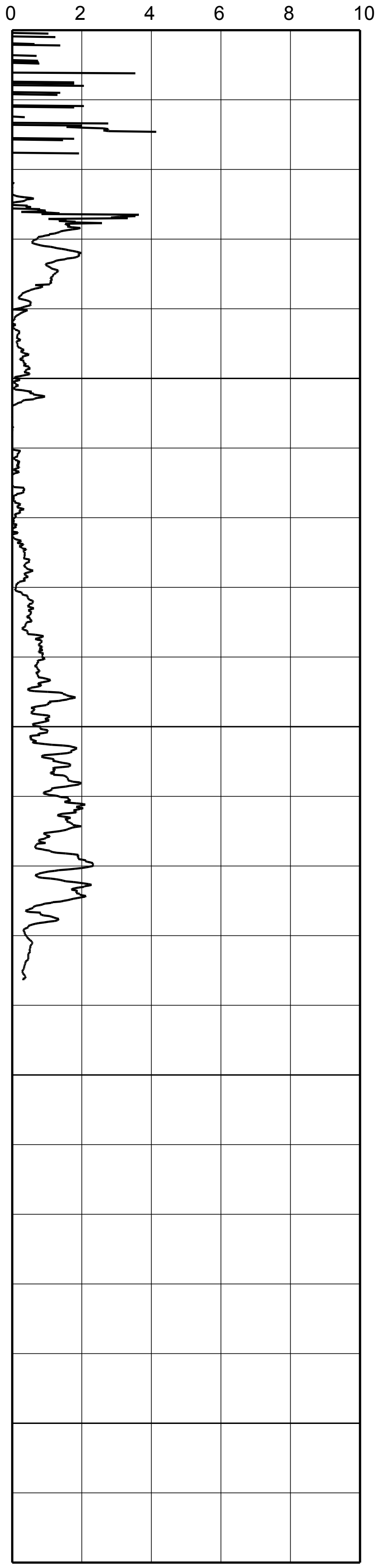
(9) Very stiff fine grained

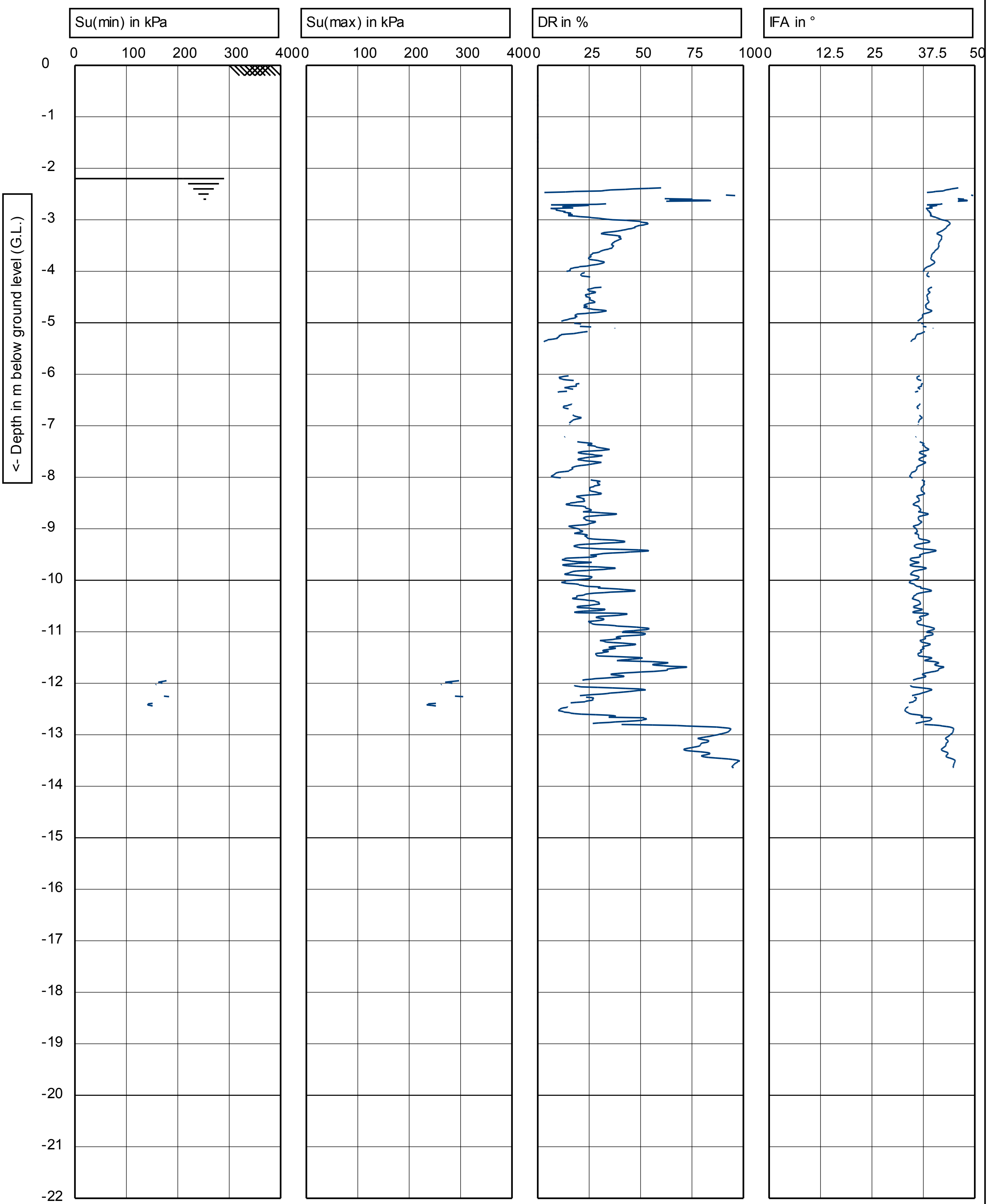
Friction ratio (Rf) in %



u1 pw p response muted, see text

u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill : 0
	G.L. 0	W.L.: -2.2	Date: 17/12/2015
Project: A63 CASTLE STREET IMPROVEMENT			Cone no.: C10-CFIP.126
Location: MAIN GI - HULL			Project no.: A5085-15
Position:			CPT no.: CPT414 2/3

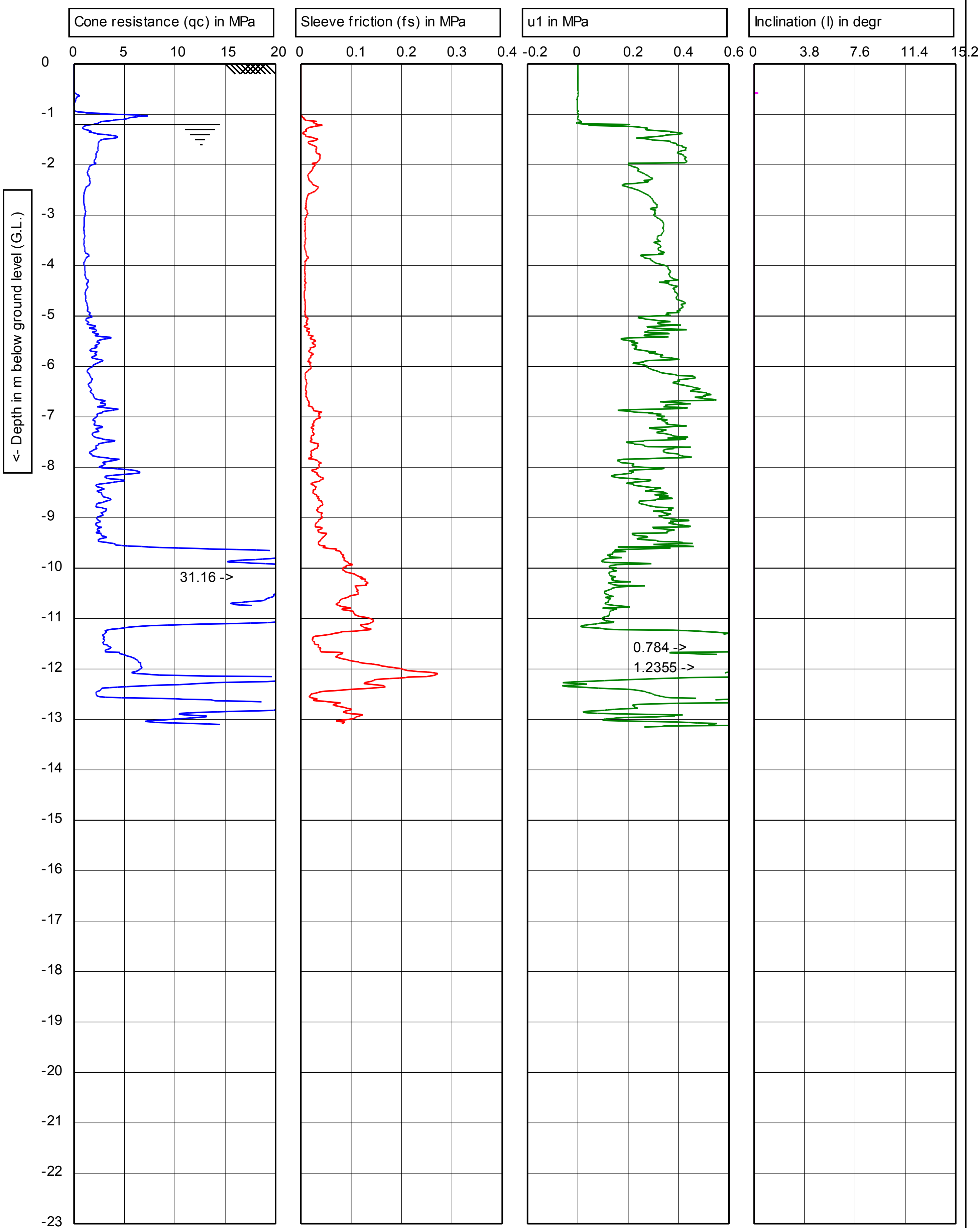
CPTask V1.23



u1 pw p response muted, see text

ESG	BS1377 Part 9 : 1999	Predrill :	0
u1 150 cm² 10 cm²	G.L. **0** W.L.: **-2.2**	Date:	**17/12/2015**
	Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.126**
	Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
	Position:	CPT no.:	**CPT414** 3/3

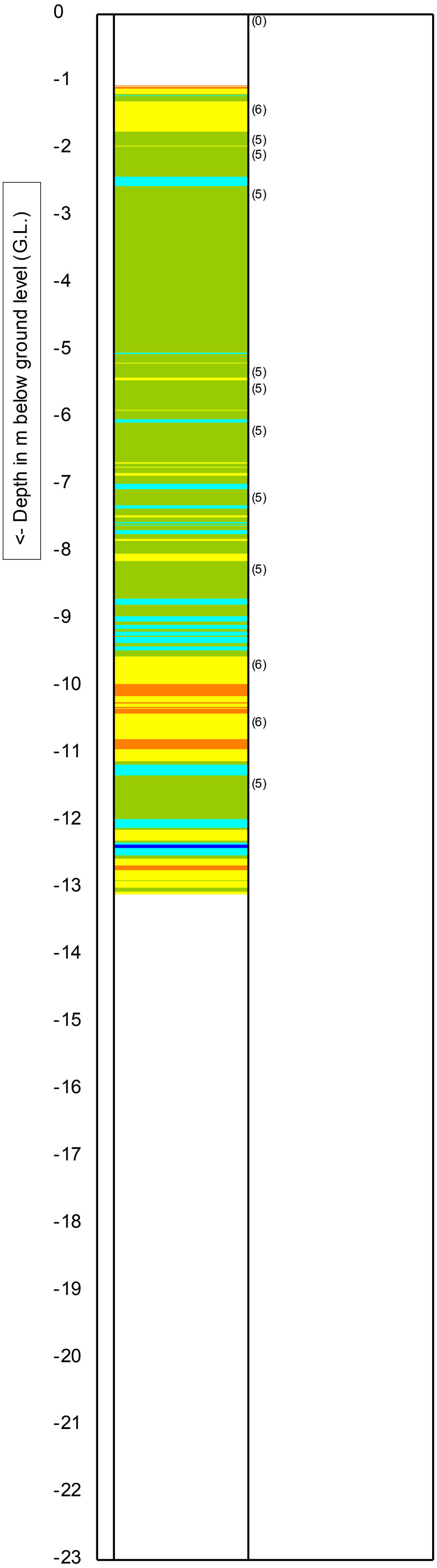
CPTask V1.23



u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
G.L. **0**	W.L.: **-1.2**	Date:	**09/02/2015**
Project: **A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.126**
Location: **MAIN GI - HULL**		Project no.:	**A5085-15**
Position:		CPT no.:	**CPT425** 1/3

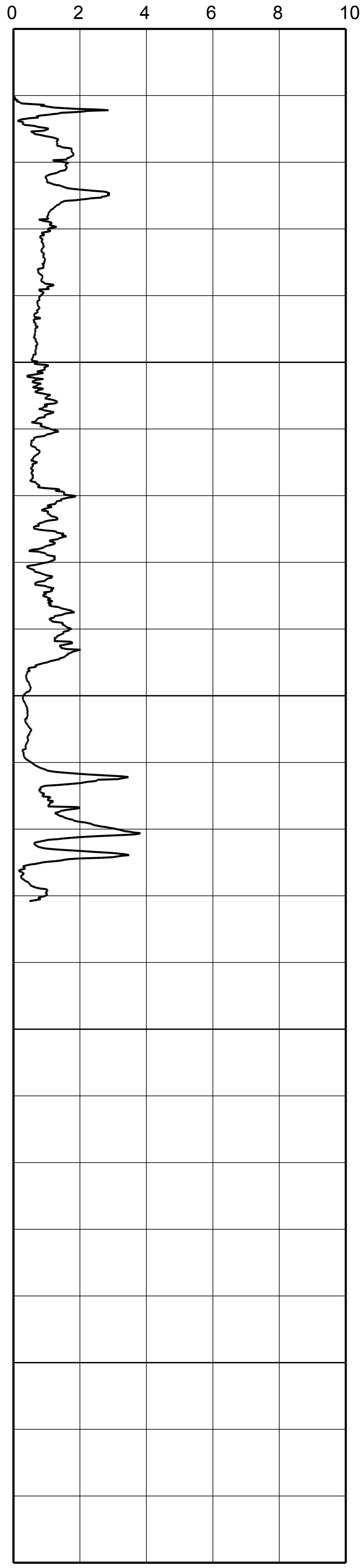
CPTask V1.23

Soil Classification (using Fr)



(0) Not defined
(1) Sensitive, fine grained
(2) Organic soils-peats
(3) Clays-clay to silty clay
(4) Clayey silt to silty clay
(5) Sand mixtures
(6) Sands
(7) Gravelly sand to sand
(8) Very stiff sand to clayey sand
(9) Very stiff fine grained

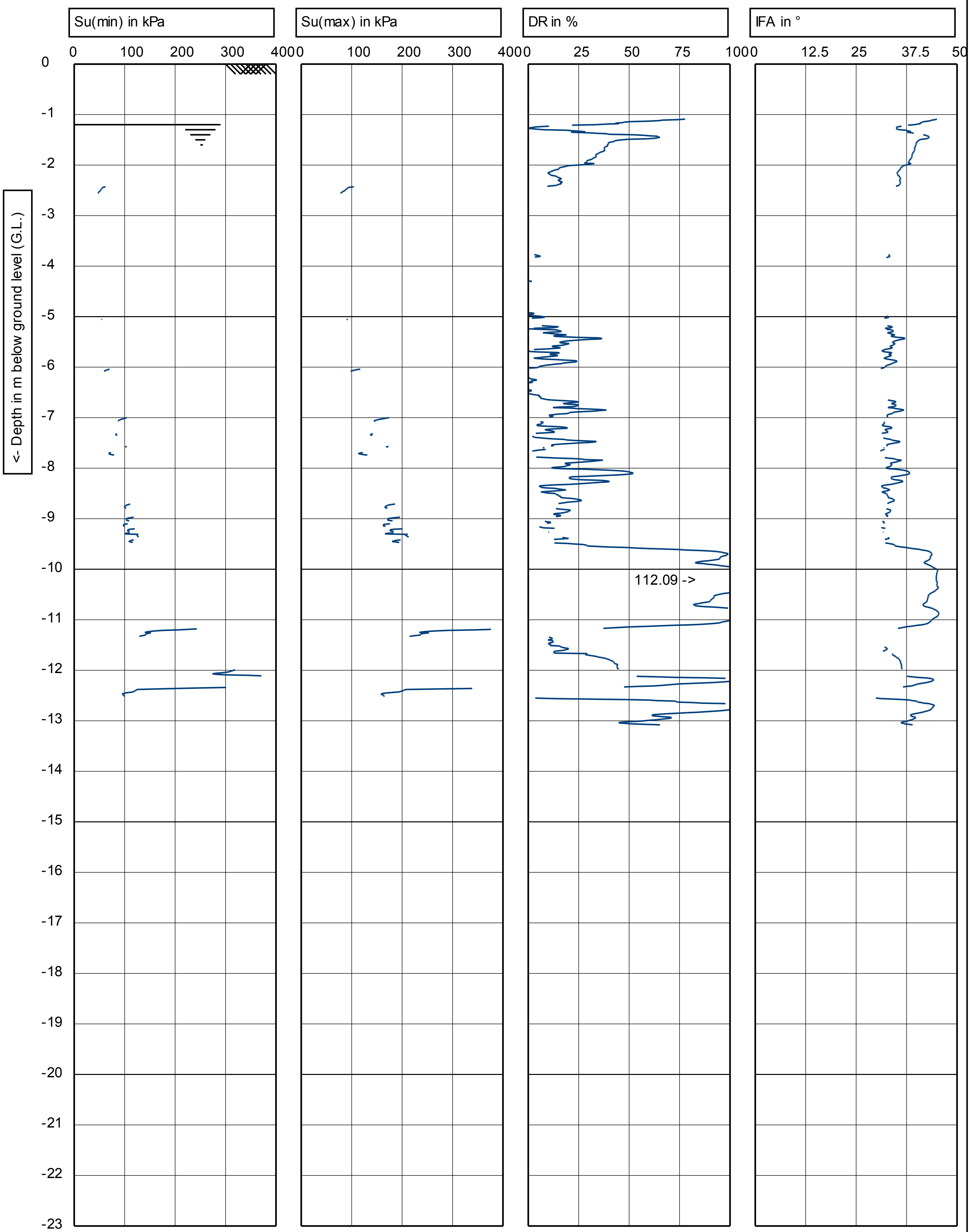
Friction ratio (Rf) in %



CPTask V1.23

ESG

u1 150 cm² 10 cm²	BS1377 Part 9 : 1999		Predrill :	**0**
	G.L. **0**	W.L.: **-1.2**	Date:	**09/02/2015**
Project:	**A63 CASTLE STREET IMPROVEMENT**		Cone no.:	**C10-CFIP.126**
Location:	**MAIN GI - HULL**		Project no.:	**A5085-15**
Position:			CPT no.:	**CPT425** **2/3**



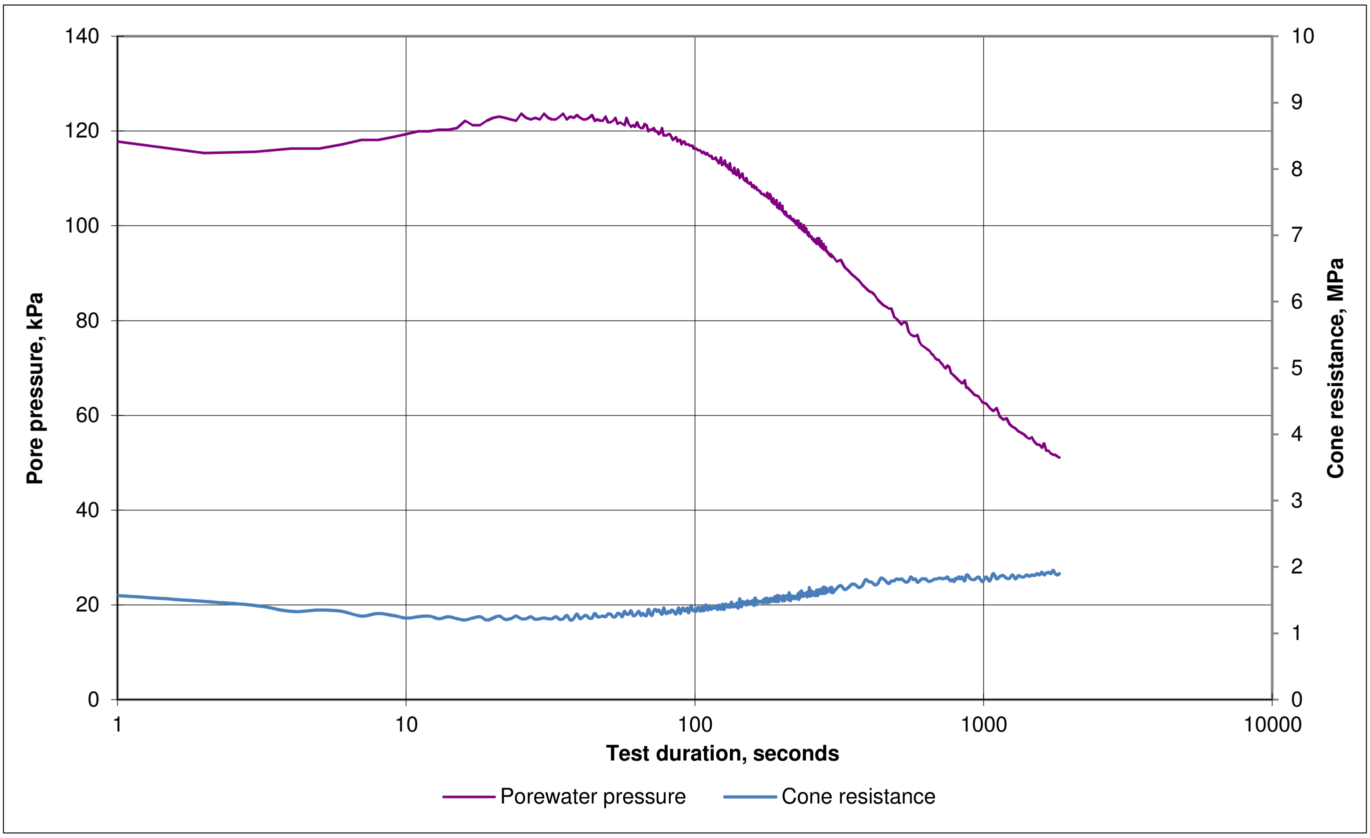
ESG	u1 150 cm² 10 cm²	BS1377 Part 9 : 1999	Predrill :	**0**
		G.L. **0** W.L.: **-1.2**	Date:	**09/02/2015**
		Project: **A63 CASTLE STREET IMPROVEMENT**	Cone no.:	**C10-CFIP.126**
		Location: **MAIN GI - HULL**	Project no.:	**A5085-15**
		Position:	CPT no.:	**CPT425** 3/3

CPTask V1.23

Dissipation Test Results

Cone Ref	C10.CFIP.126
PWP filter location	u1

CPT No	CPT 402
Depth, m	5.06

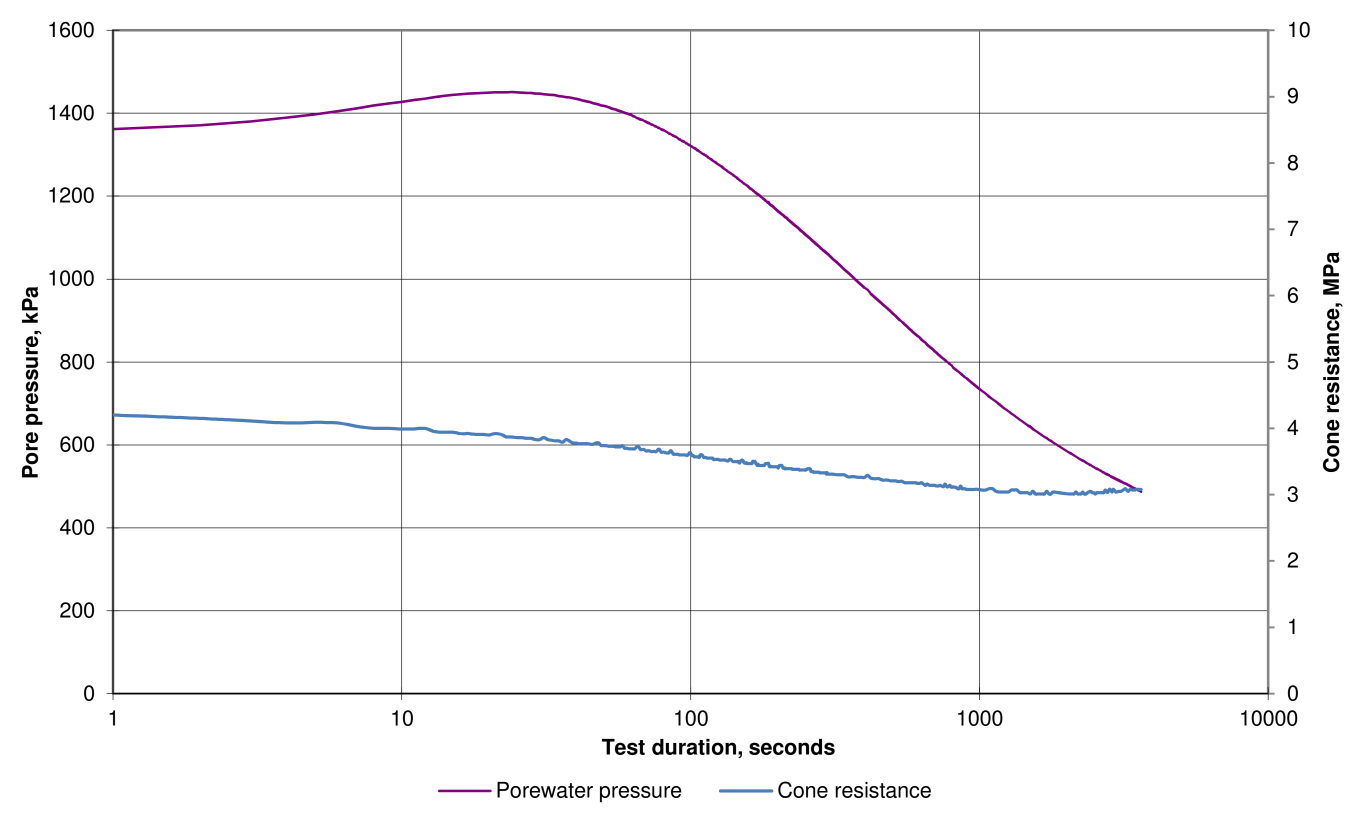


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **CPT 402 D01**

Dissipation Test Results

Cone Ref	C10.CFIP.126
PWP filter location	u1

CPT No	CPT 402
Depth, m	15.99

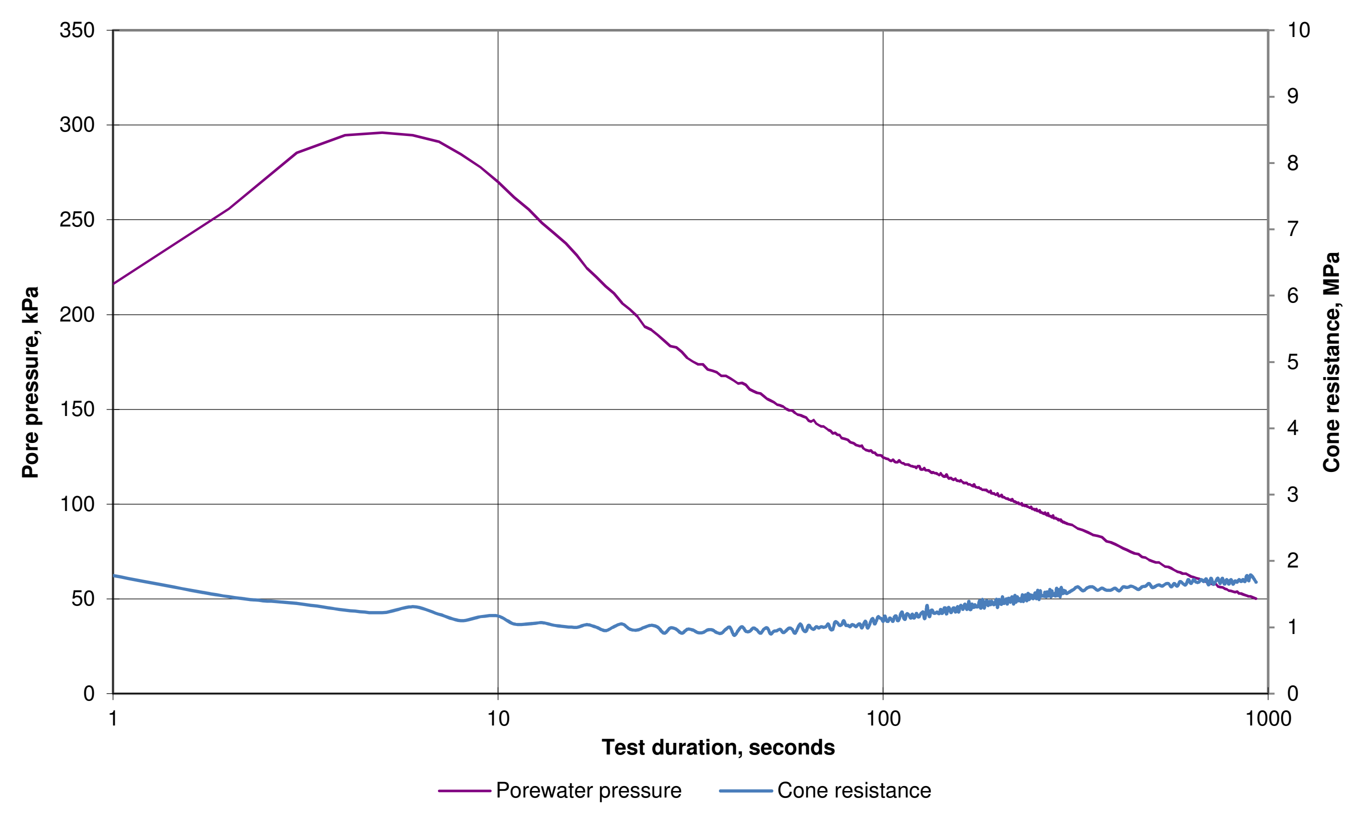


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 402 D02**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10.CFIP.126
PWP filter location	u1

CPT No	CPT 403
Depth, m	3.50



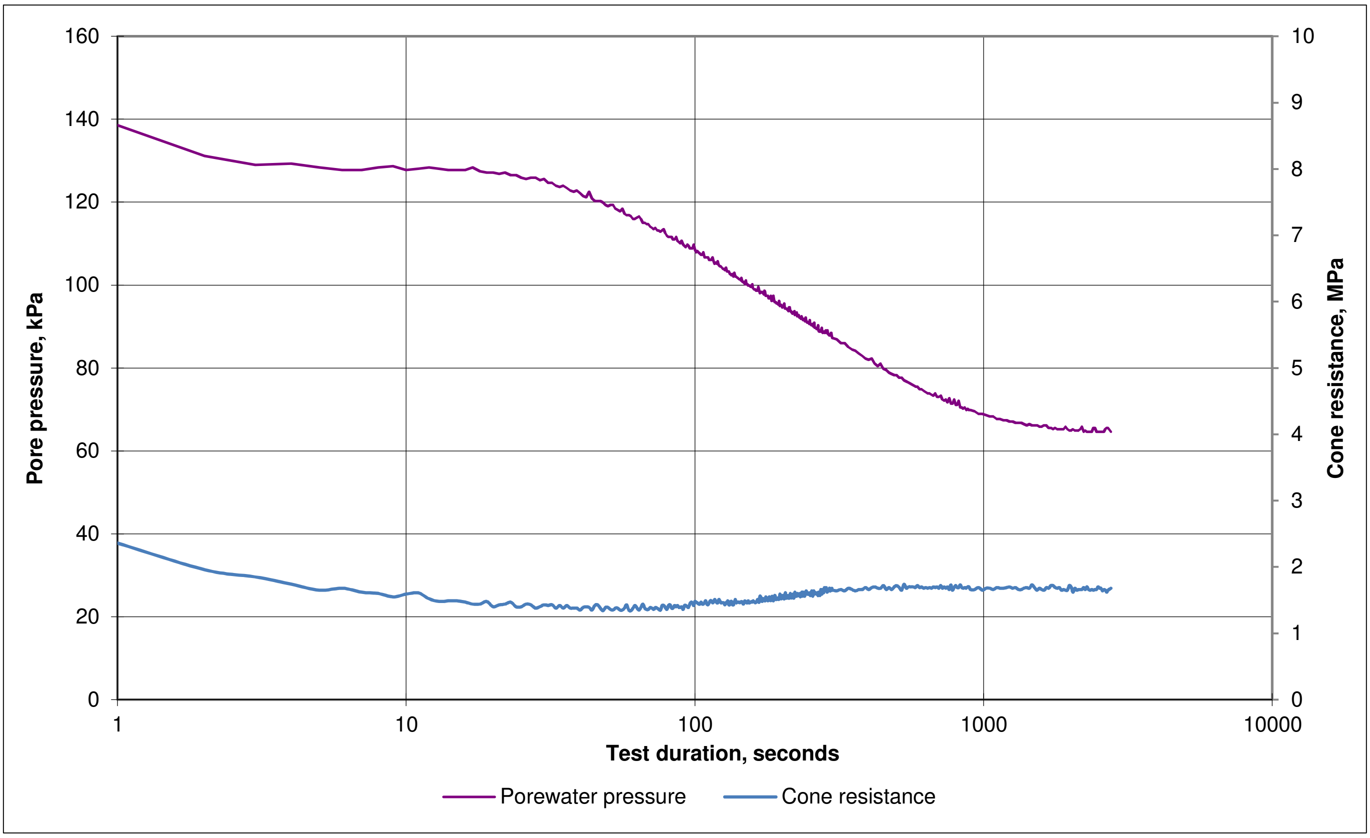
Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
Project No.	A5085-15	**CPT 403 D01**
Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10.CFIP.126
PWP filter location	u1

CPT No	CPT 403
Depth, m	6.74

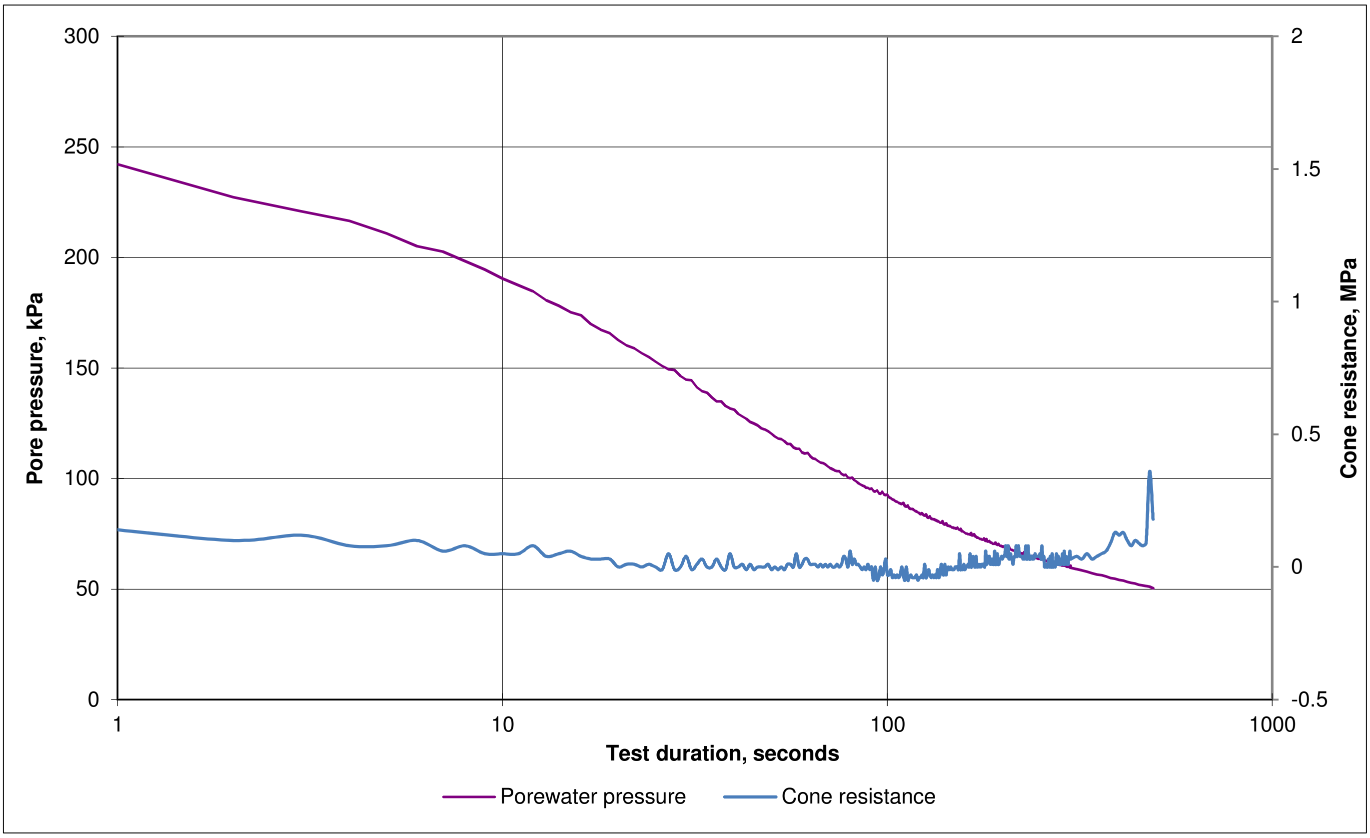


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 403 D02**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 404
Depth, m	4.50



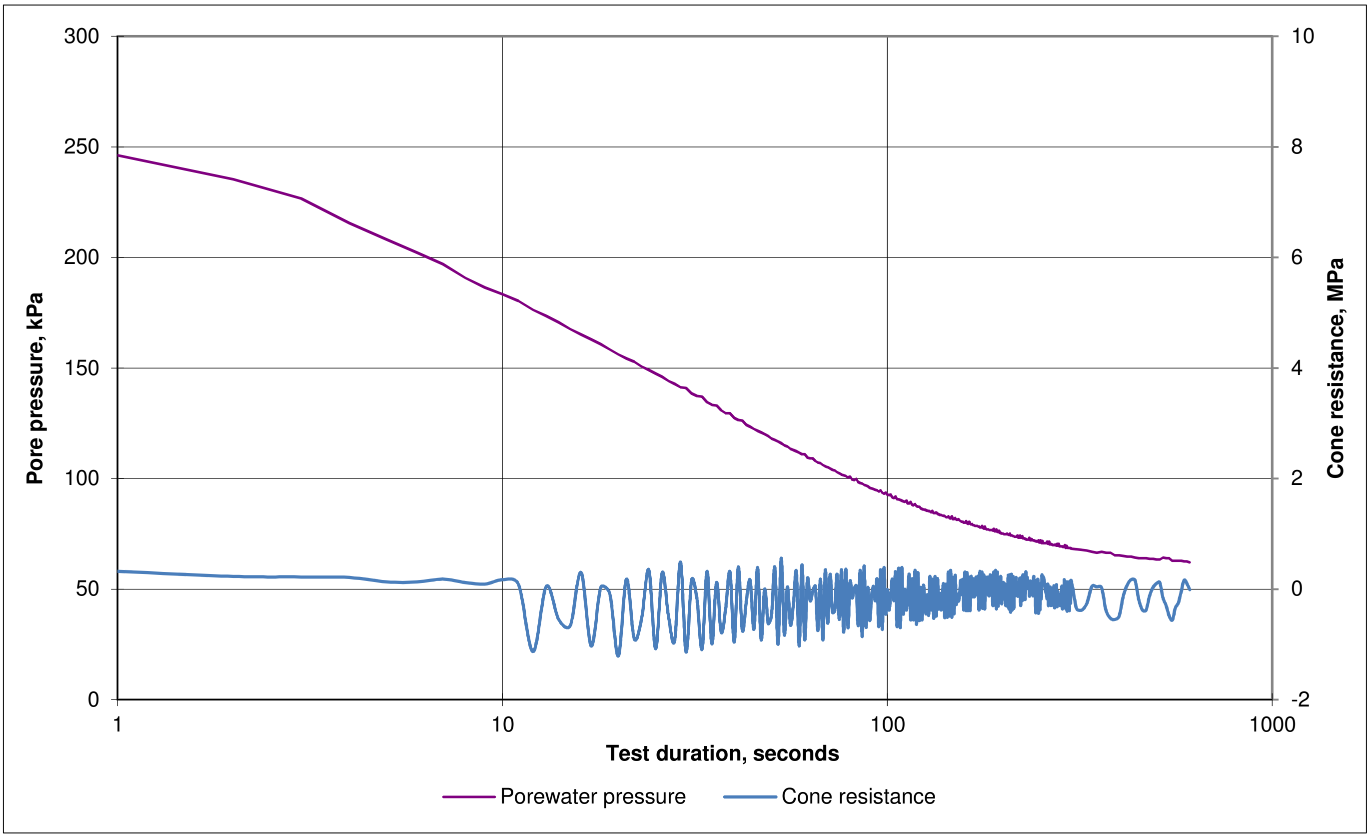
Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
Project No.	A5085-15	**CPT 404 D01**
Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 404
Depth, m	7.50

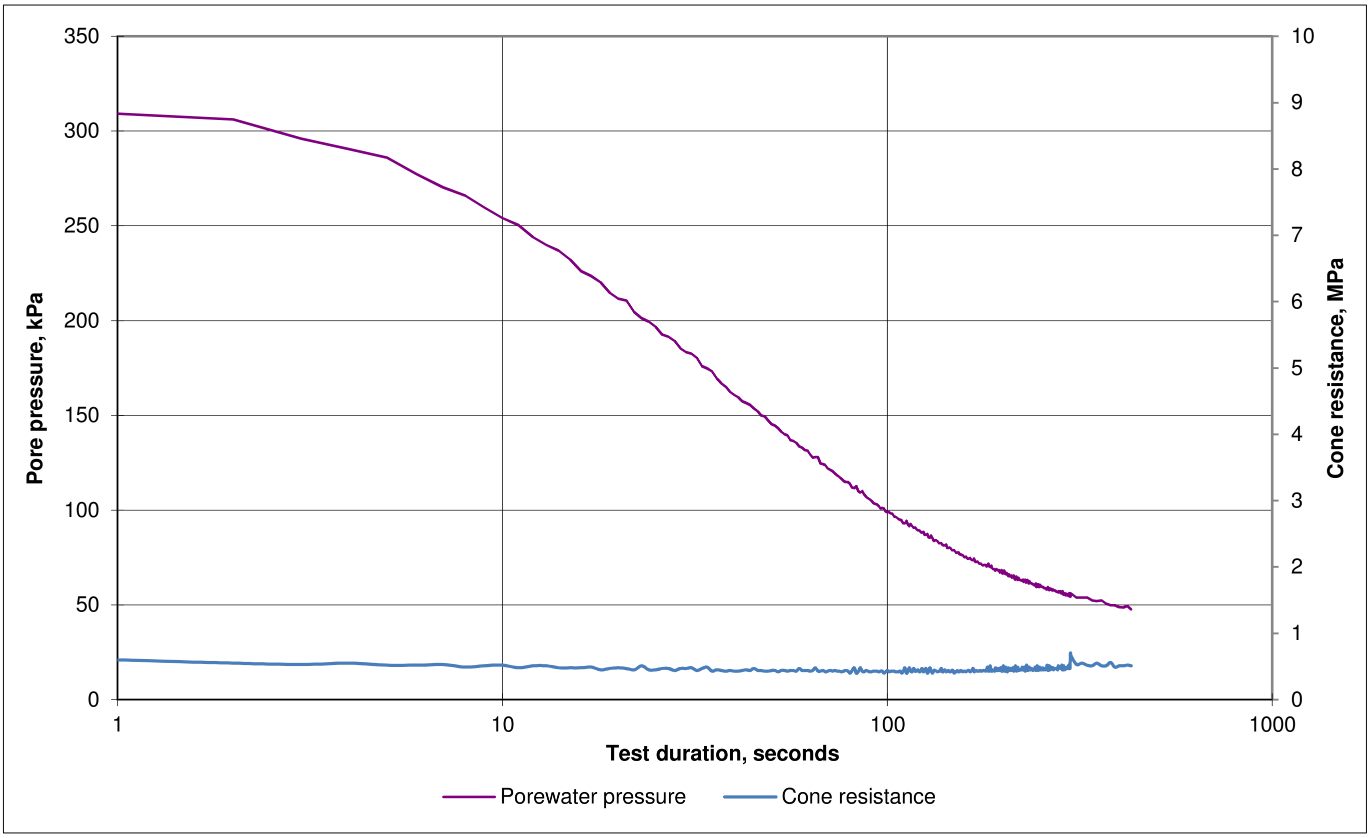


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	Figure
	Project No.	A5085-15	CPT 404 D02
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 405
Depth, m	5.15

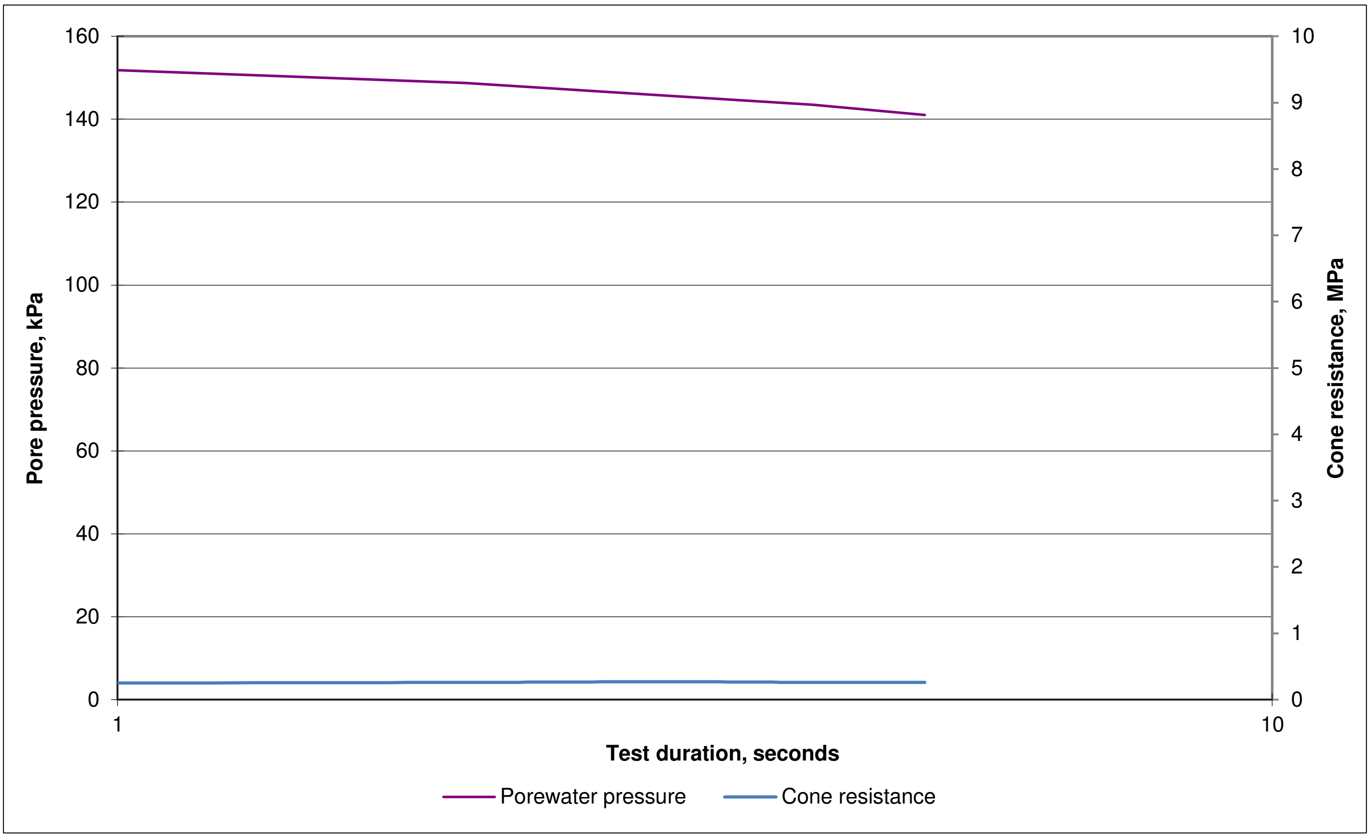


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 405 D01**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 405
Depth, m	6.13

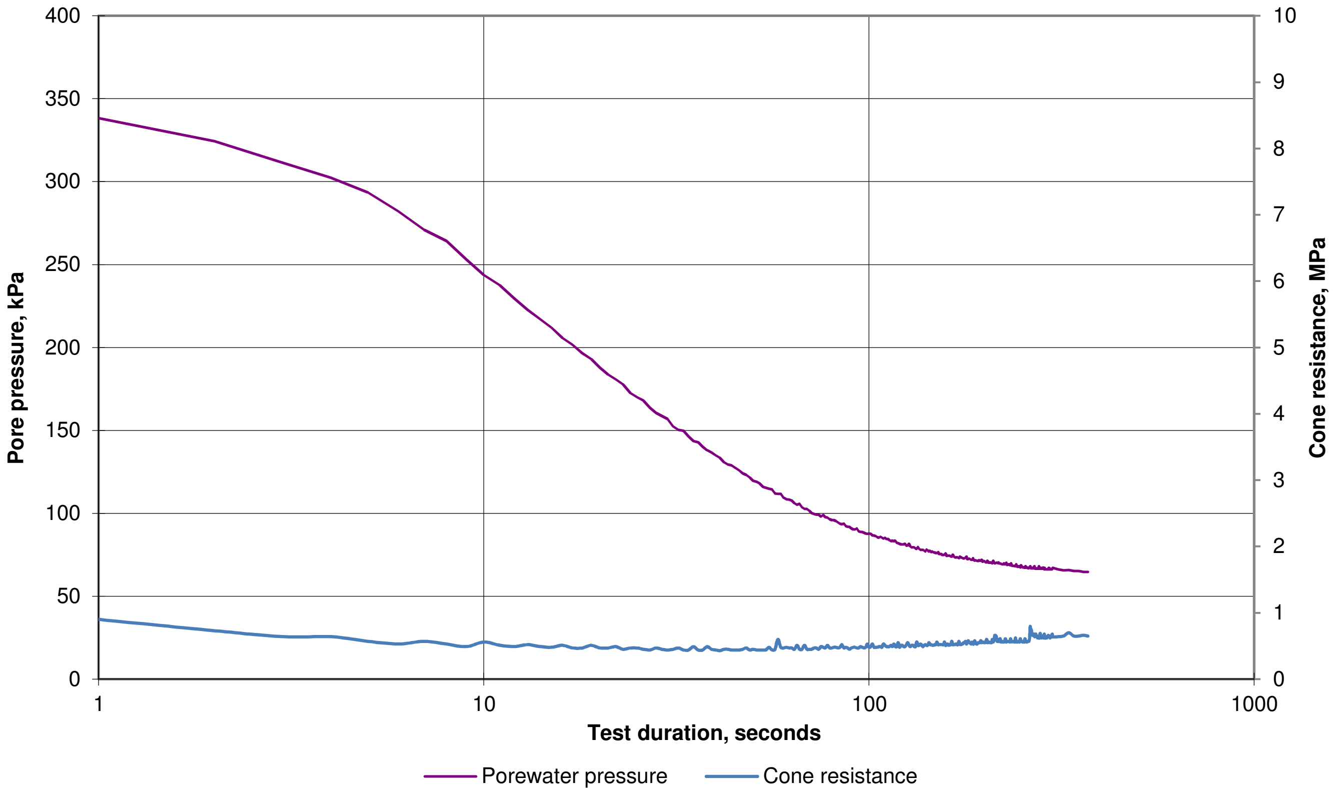


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	Figure
	Project No.	A5085-15	CPT 405 D02
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 405
Depth, m	7.65

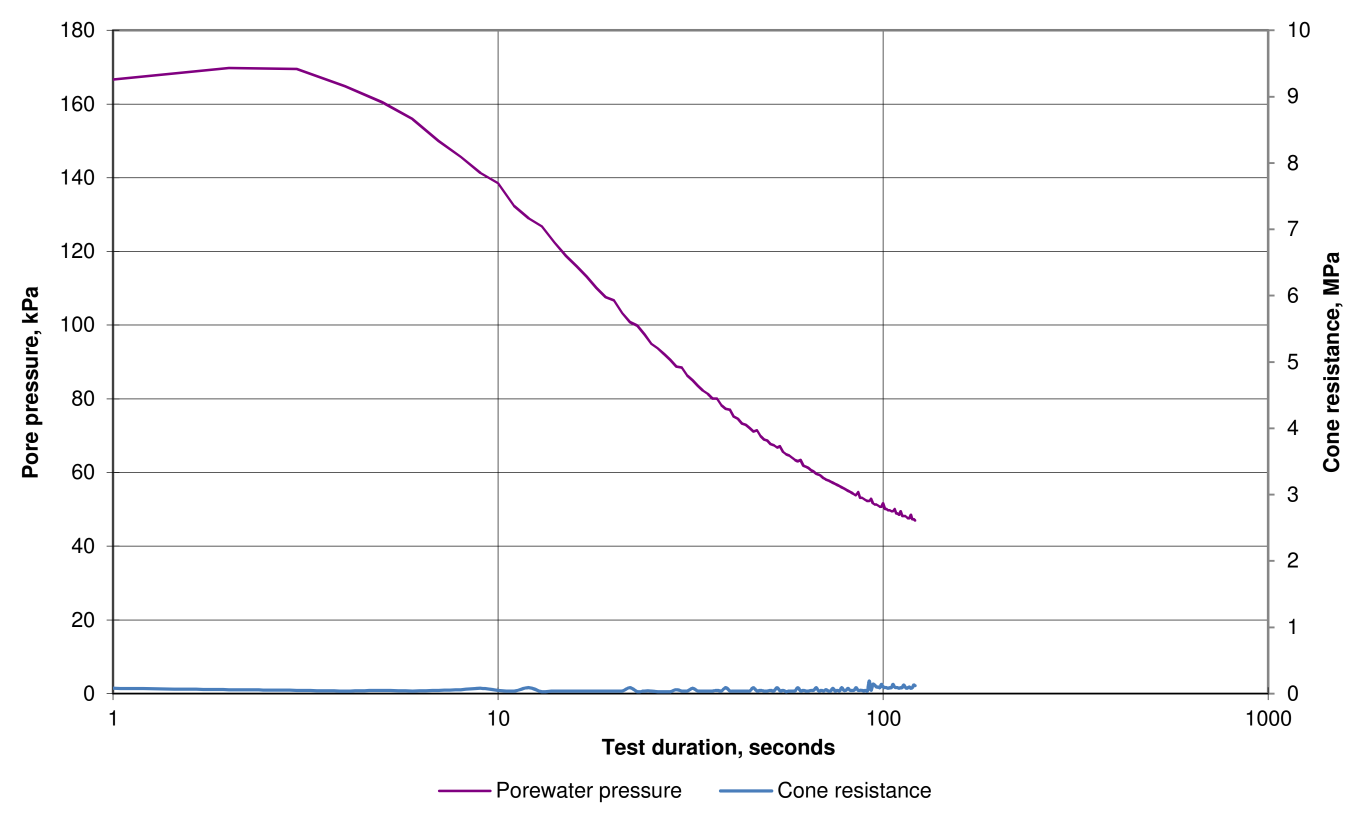


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	Figure
	Project No.	A5085-15	CPT 405 D03
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 406
Depth, m	4.99

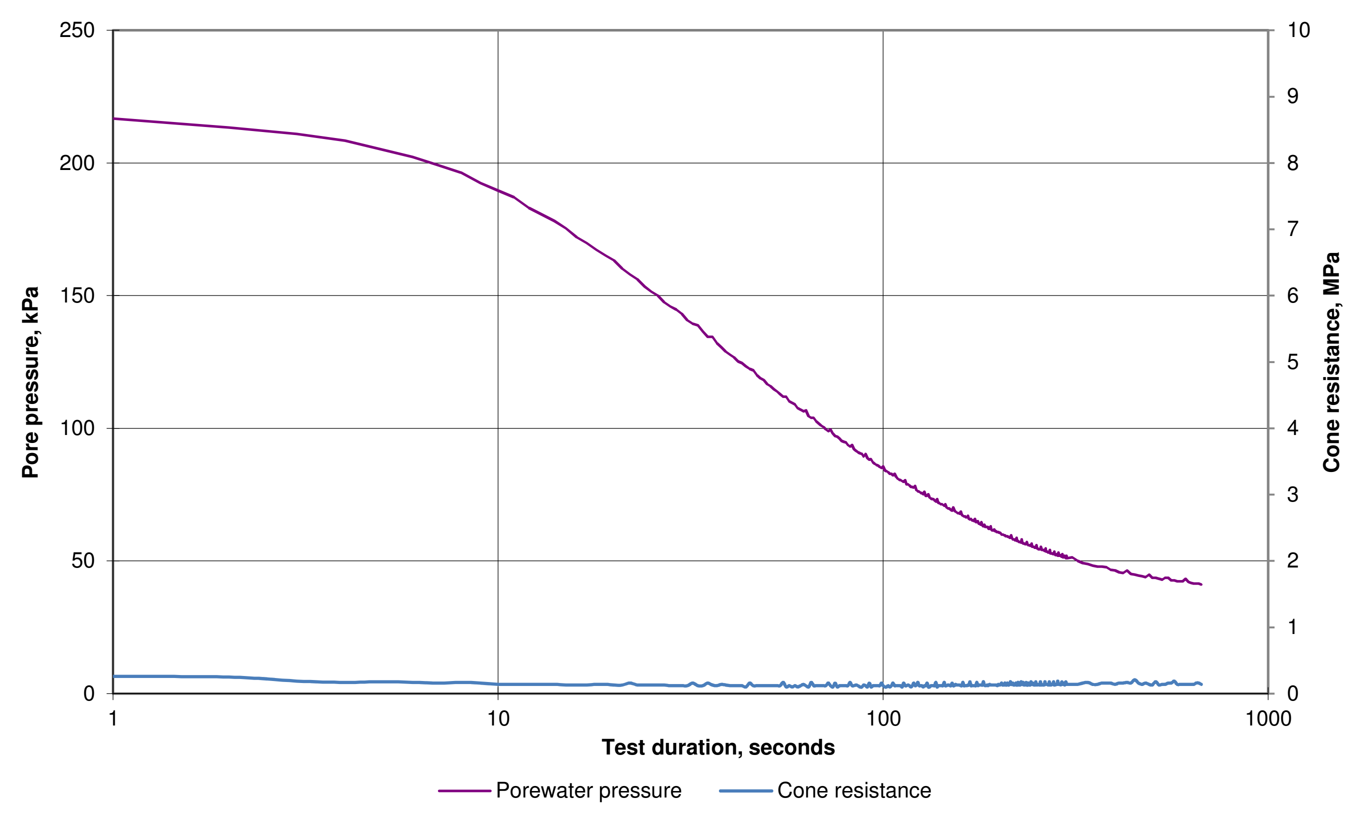


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 406 D01**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 406
Depth, m	5.50

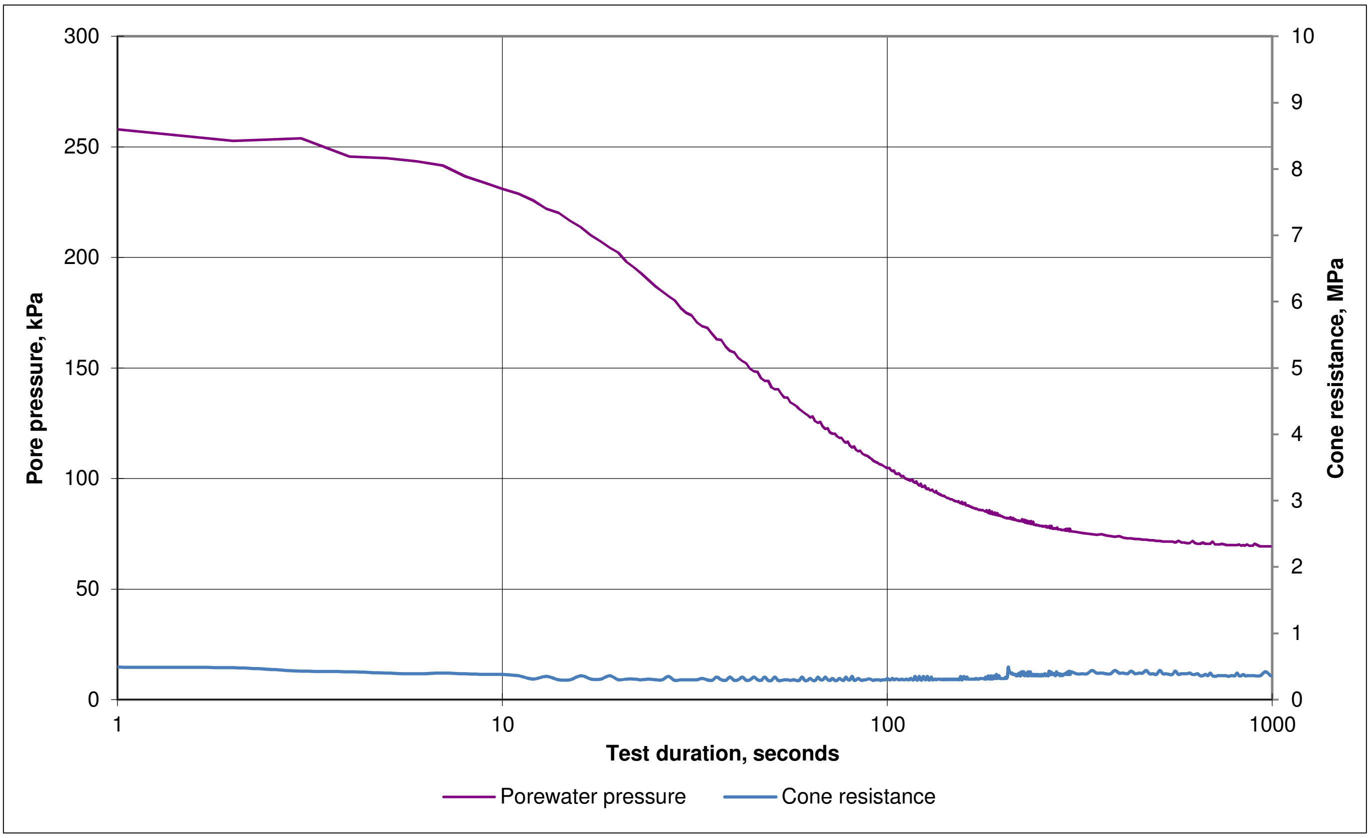


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **CPT 406 D02**

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 406
Depth, m	9.00



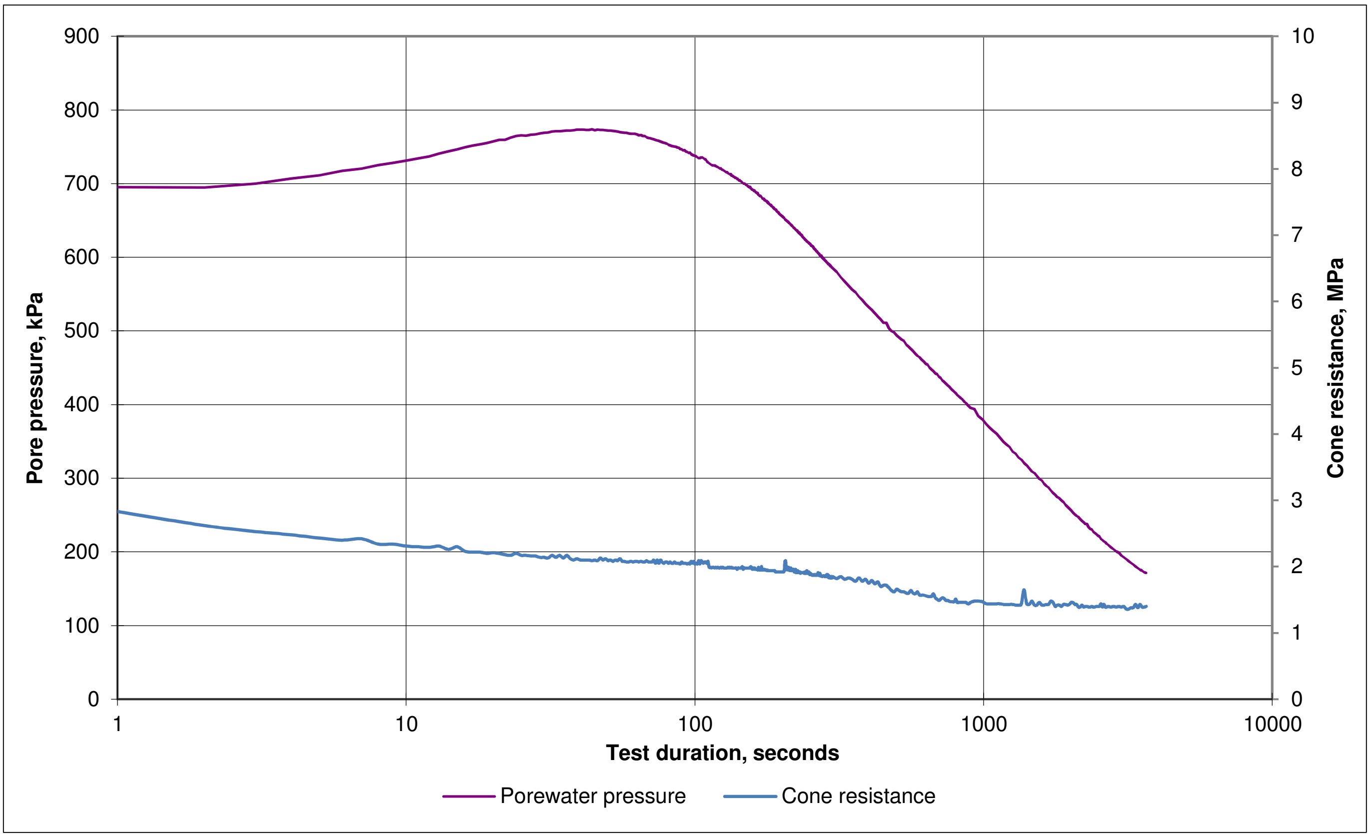
Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
Project No.	A5085-15	**CPT 406 D03**
Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 406
Depth, m	11.44

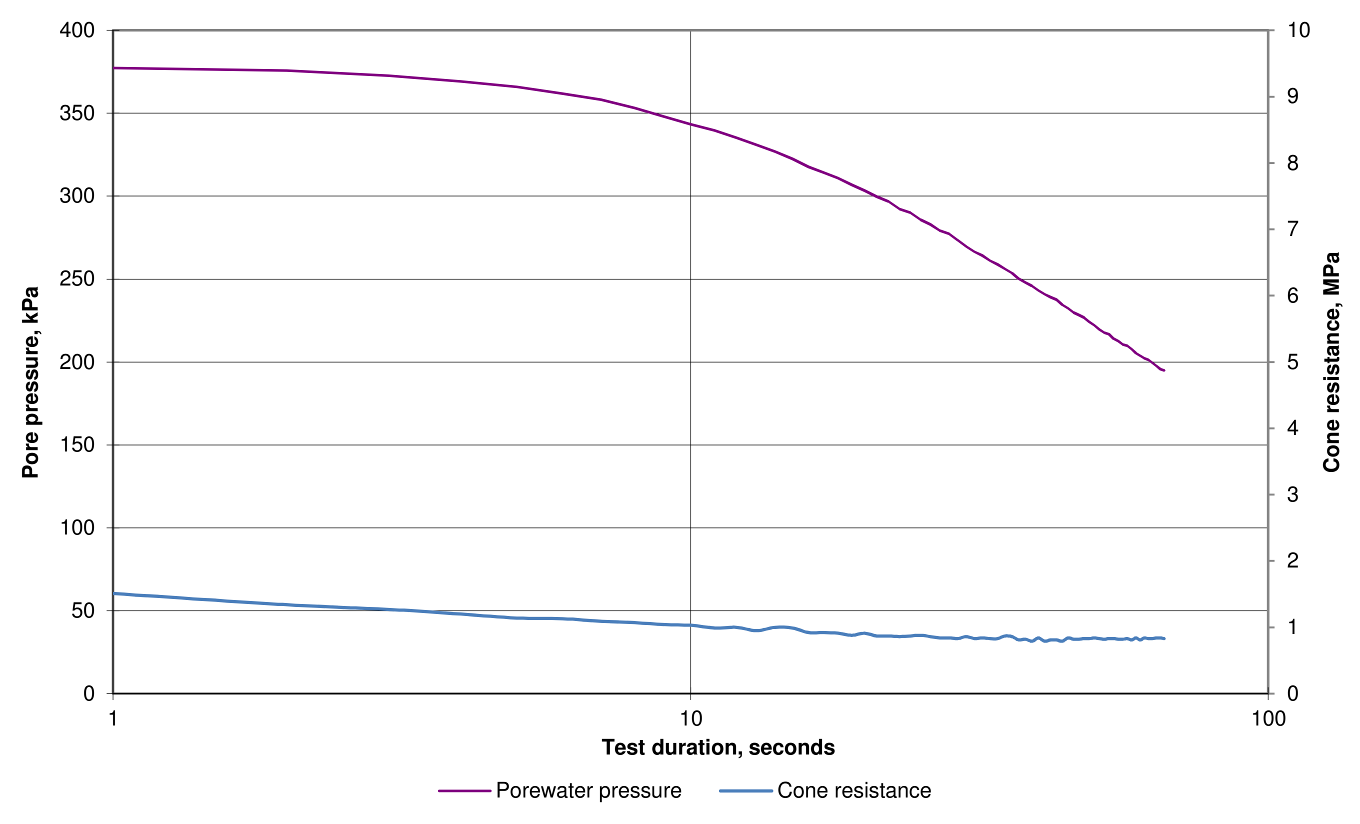


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 406 D04**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 407
Depth, m	7.93



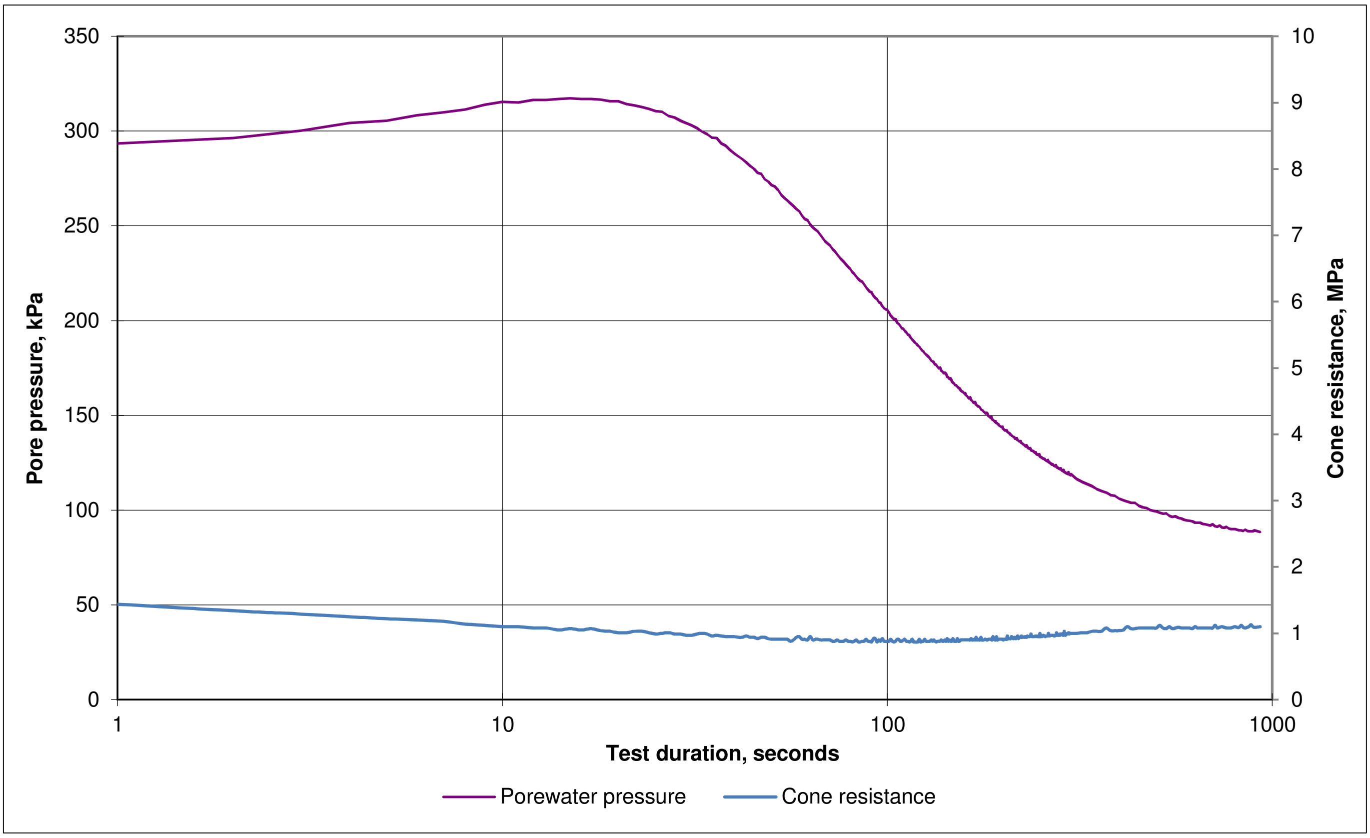
Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
Project No.	A5085-15	**CPT 407 D01**
Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 407
Depth, m	8.28

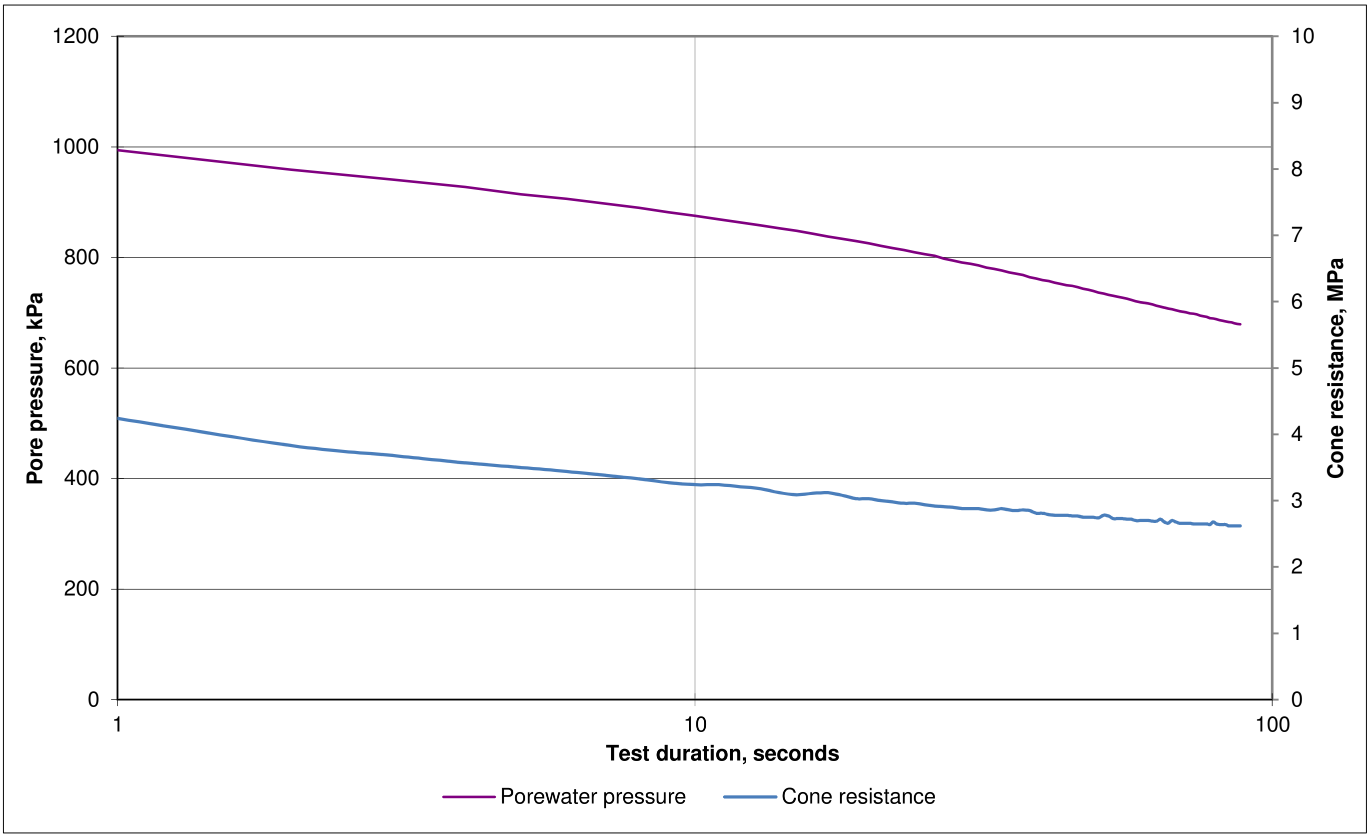


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 407 D02**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 407
Depth, m	11.23

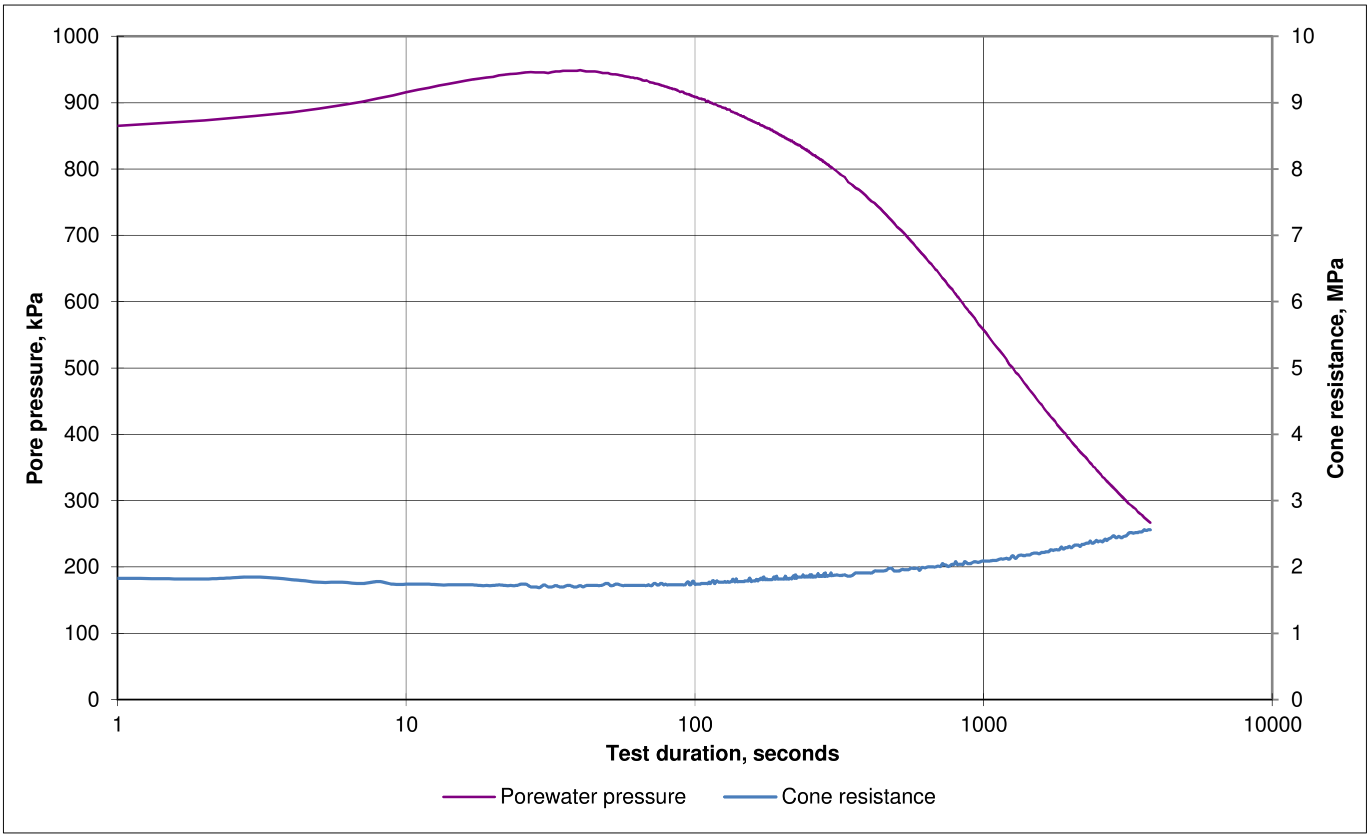


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **CPT 407 D03**

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 407
Depth, m	11.64

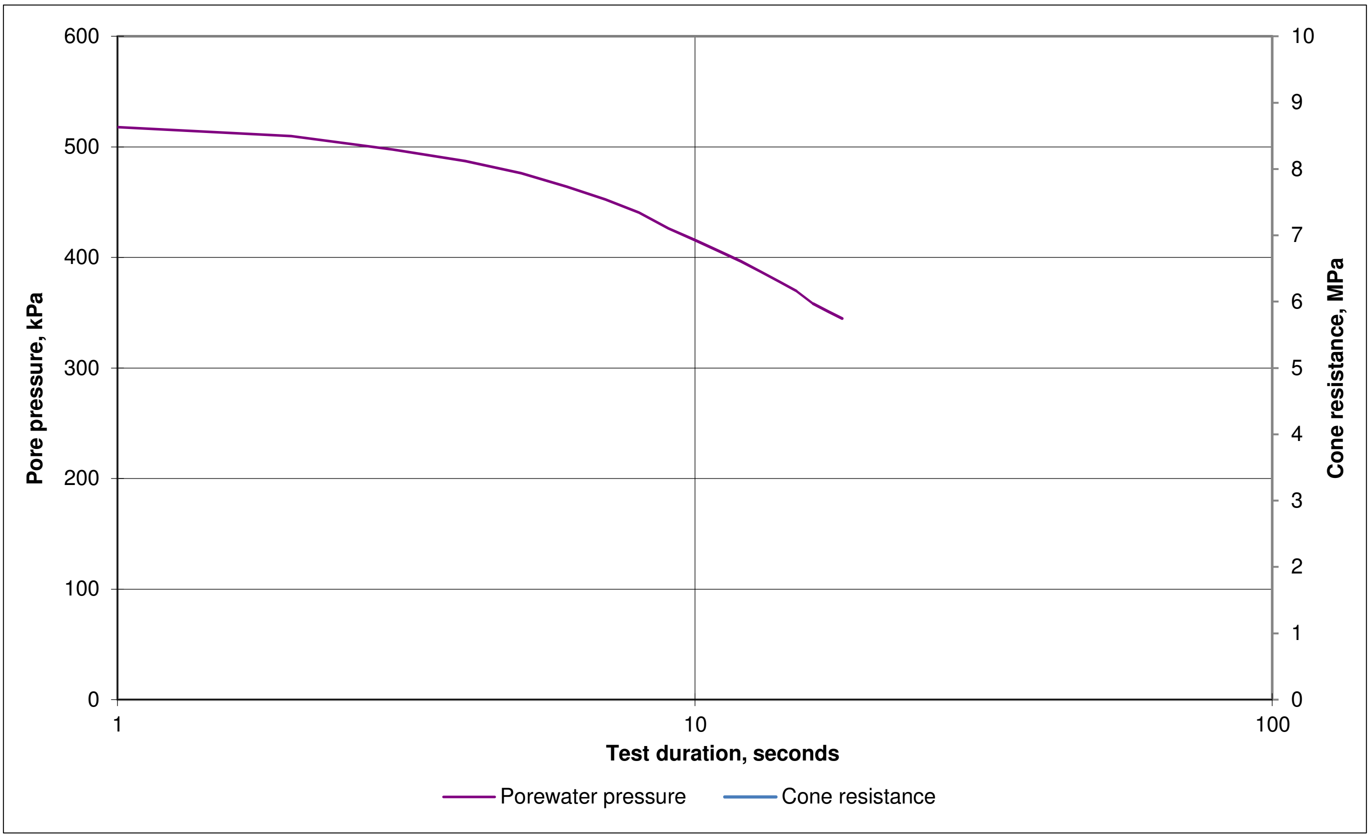


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 407 D04**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 408
Depth, m	10.56

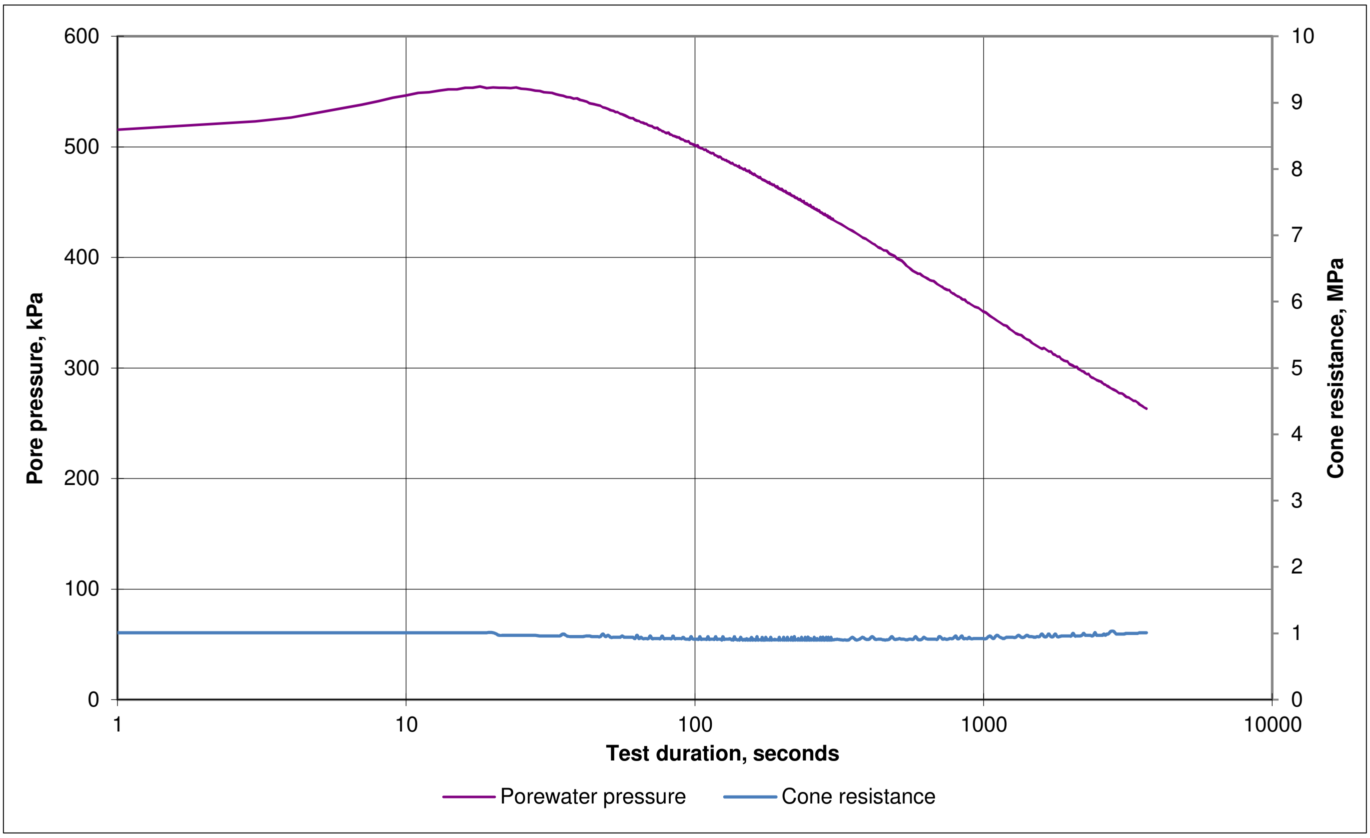


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 408 D01**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 408
Depth, m	11.75

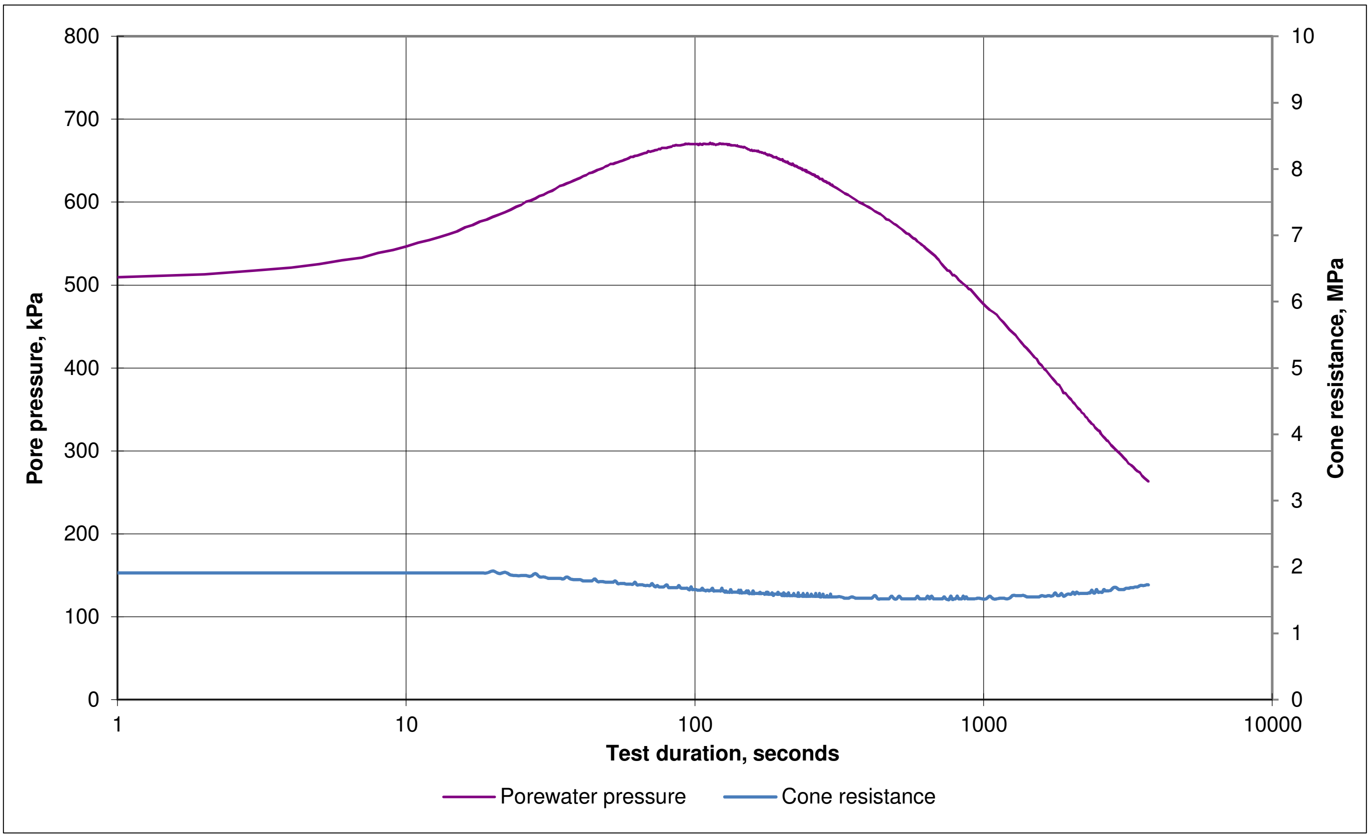


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 408 D02**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 408
Depth, m	14.11



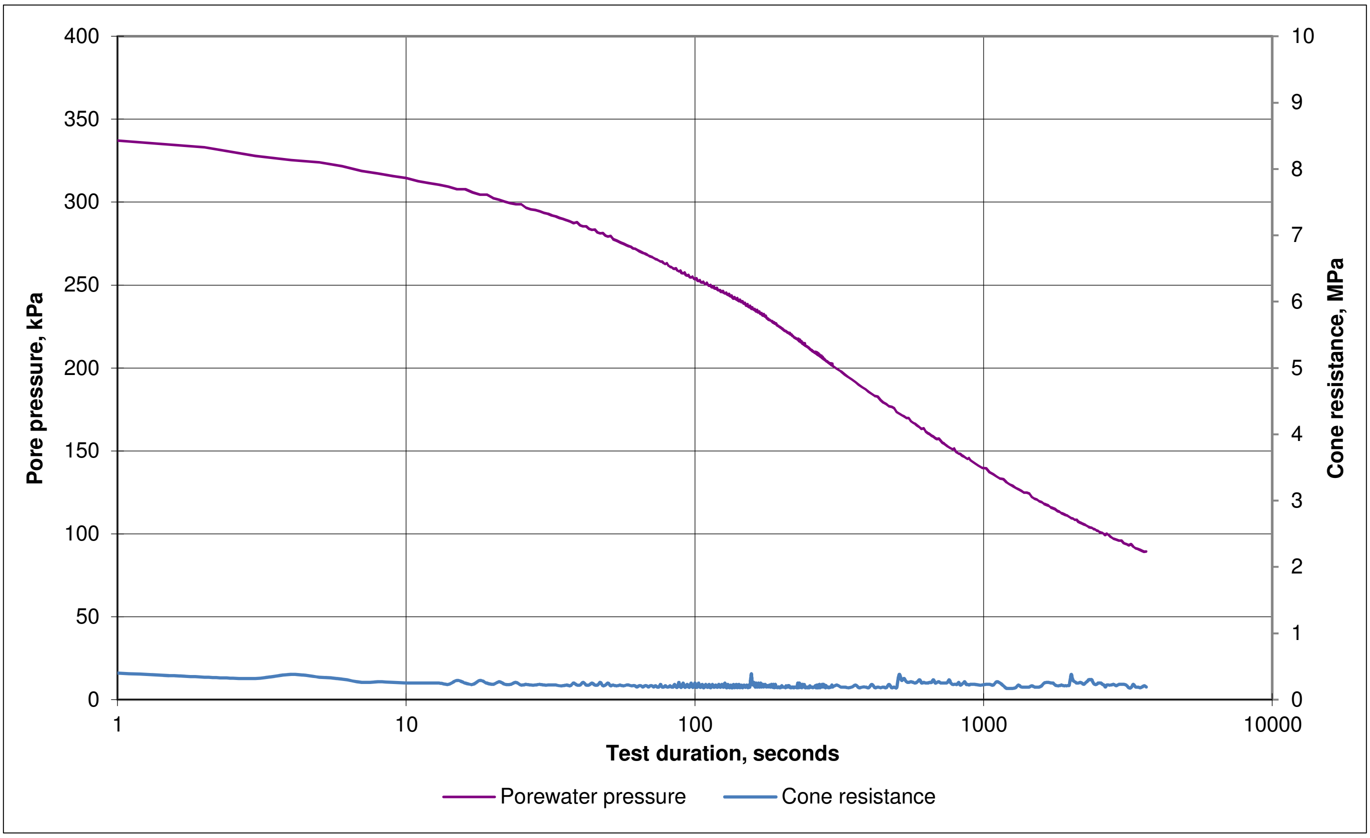
Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation

Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
Project No.	A5085-15	**CPT 408 D03**
Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 409
Depth, m	6.50

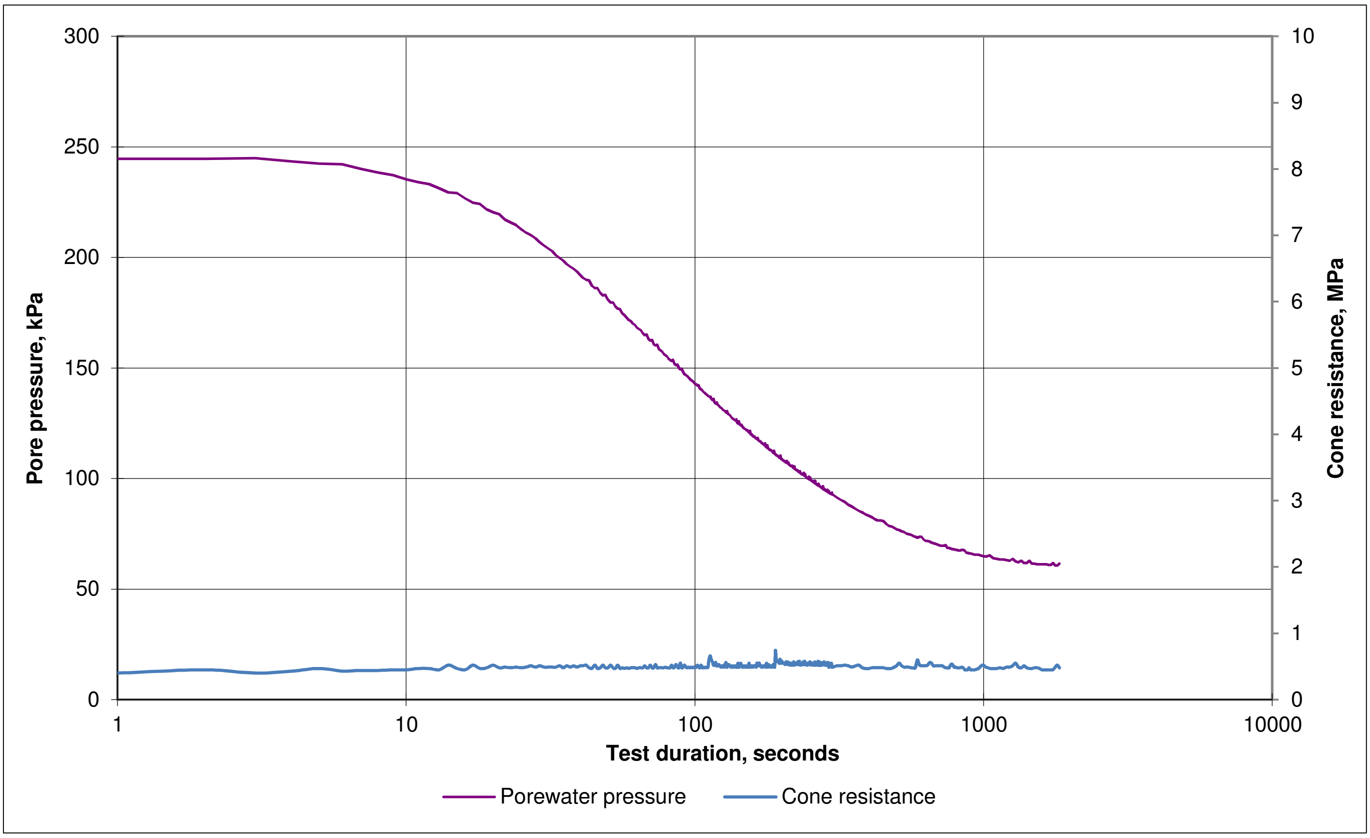


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **CPT 409 D01**

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 409
Depth, m	8.50

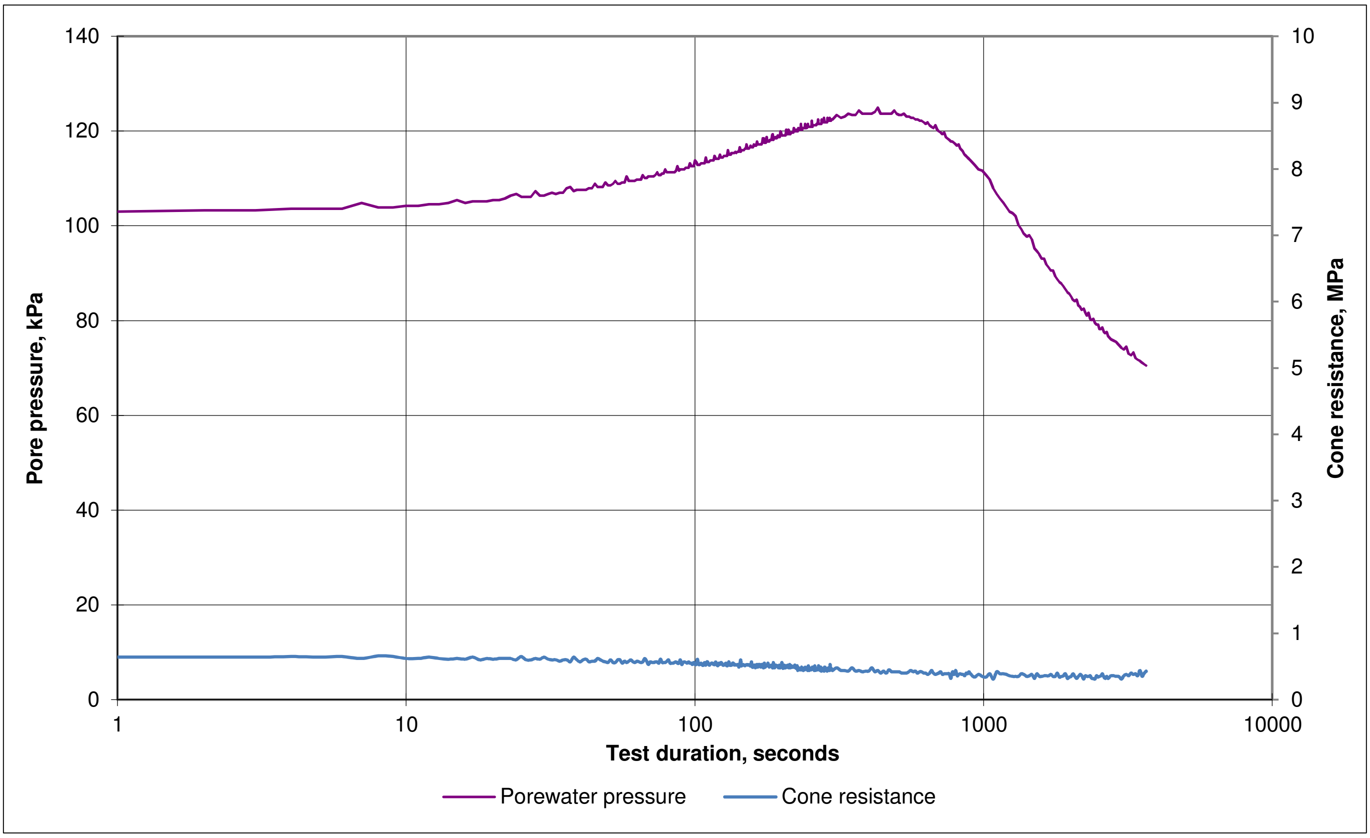


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 409 D02**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10.CFIP.126
PWP filter location	u1

CPT No	CPT 414
Depth, m	4.01



Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation

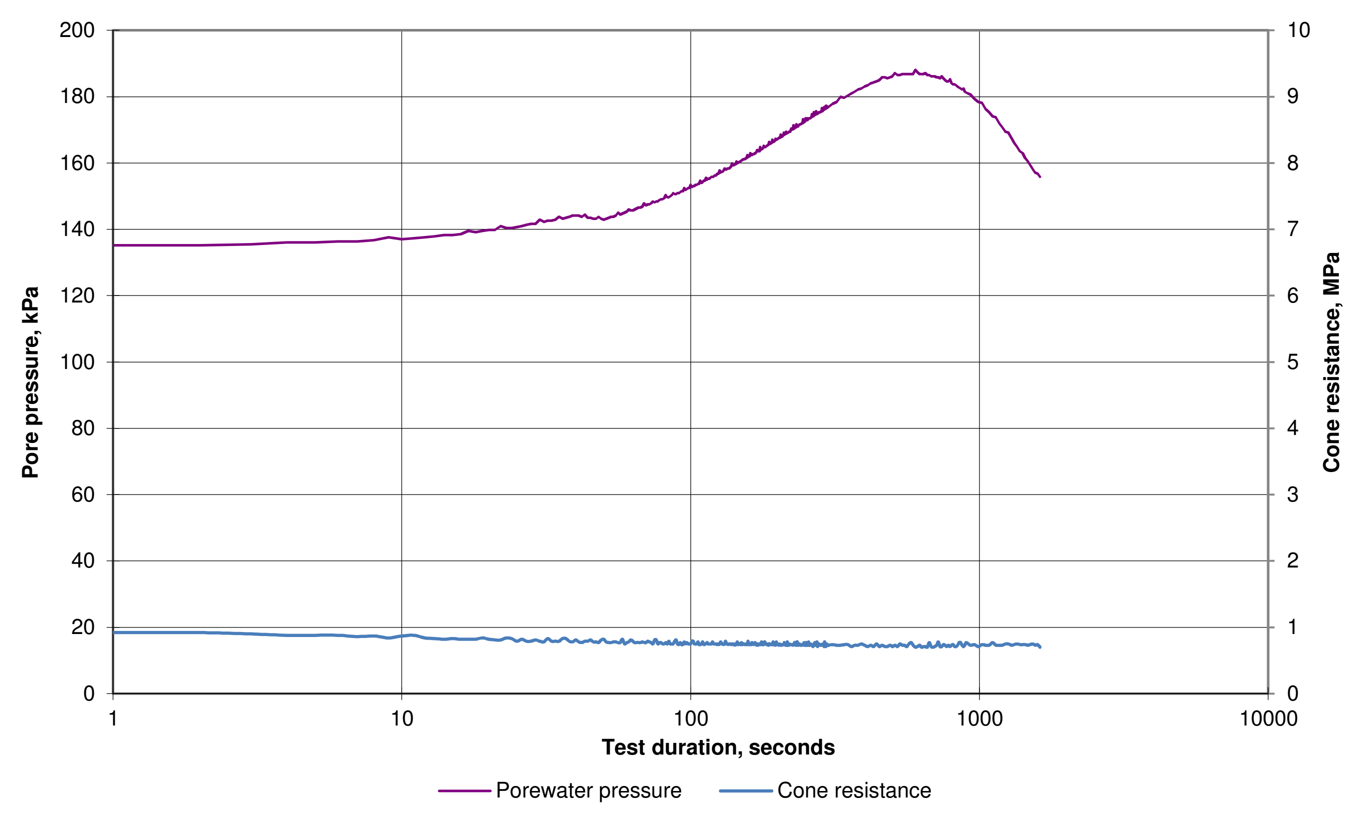
Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI
Project No.	A5085-15
Carried out for	Balfour Beatty Limited

Figure
CPT 414 D01

Dissipation Test Results

Cone Ref	C10.CFIP.126
PWP filter location	u1

CPT No	CPT 414
Depth, m	6.56

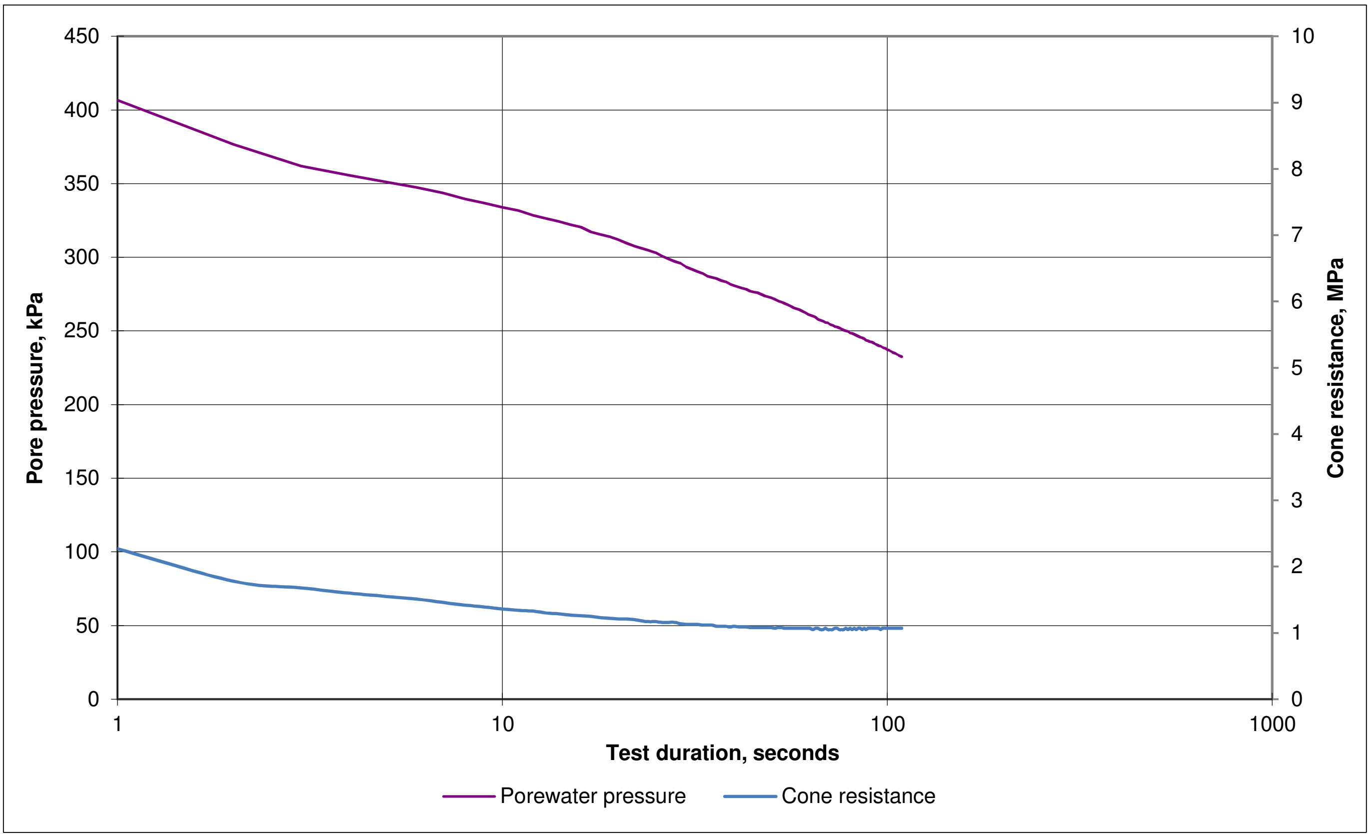


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	Project	A63 CASTLE STREET IMPROVEMENT - MAIN GI	Figure
	Project No.	A5085-15	CPT 414 D02
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 425
Depth, m	9.18

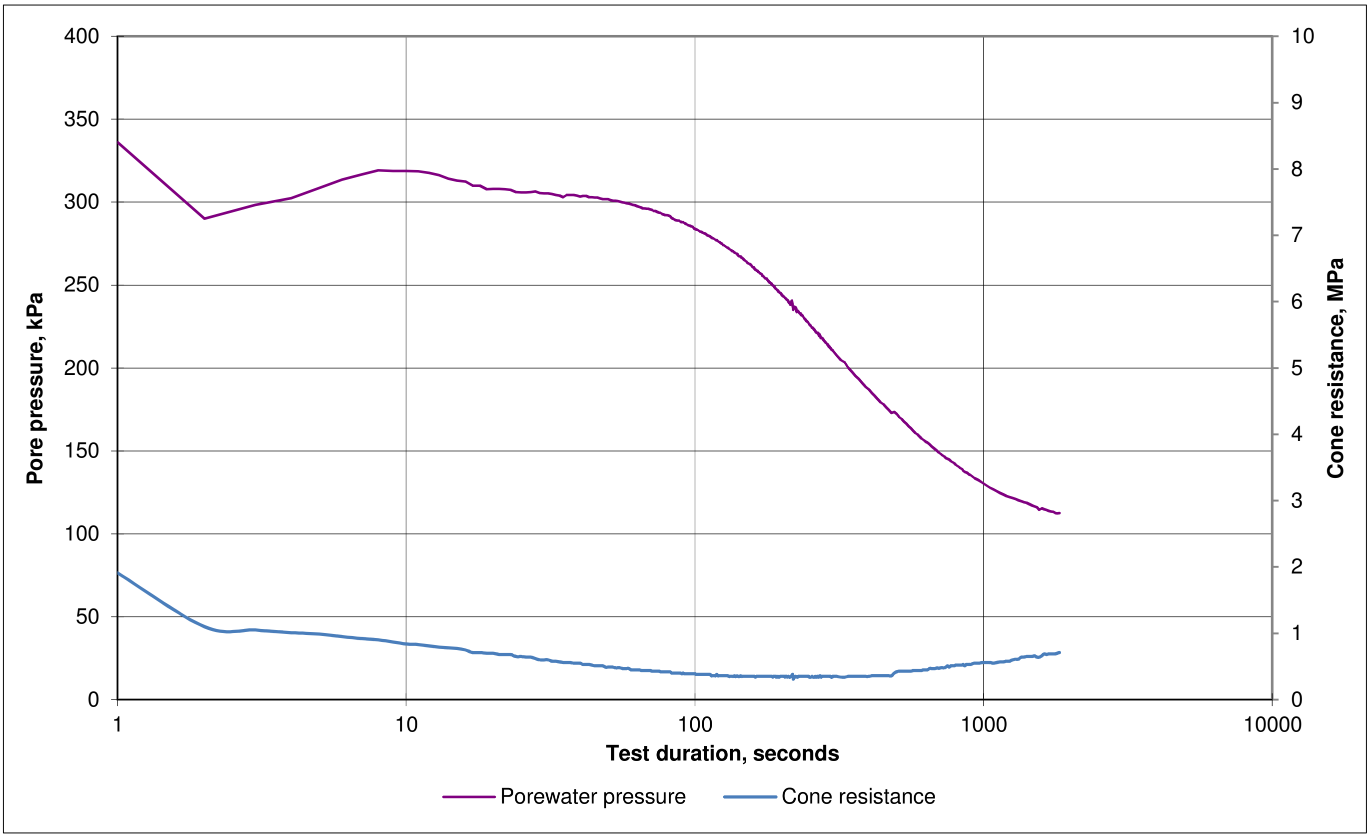


Notes		Figure
Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **CPT 425 D01**

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 425
Depth, m	9.30

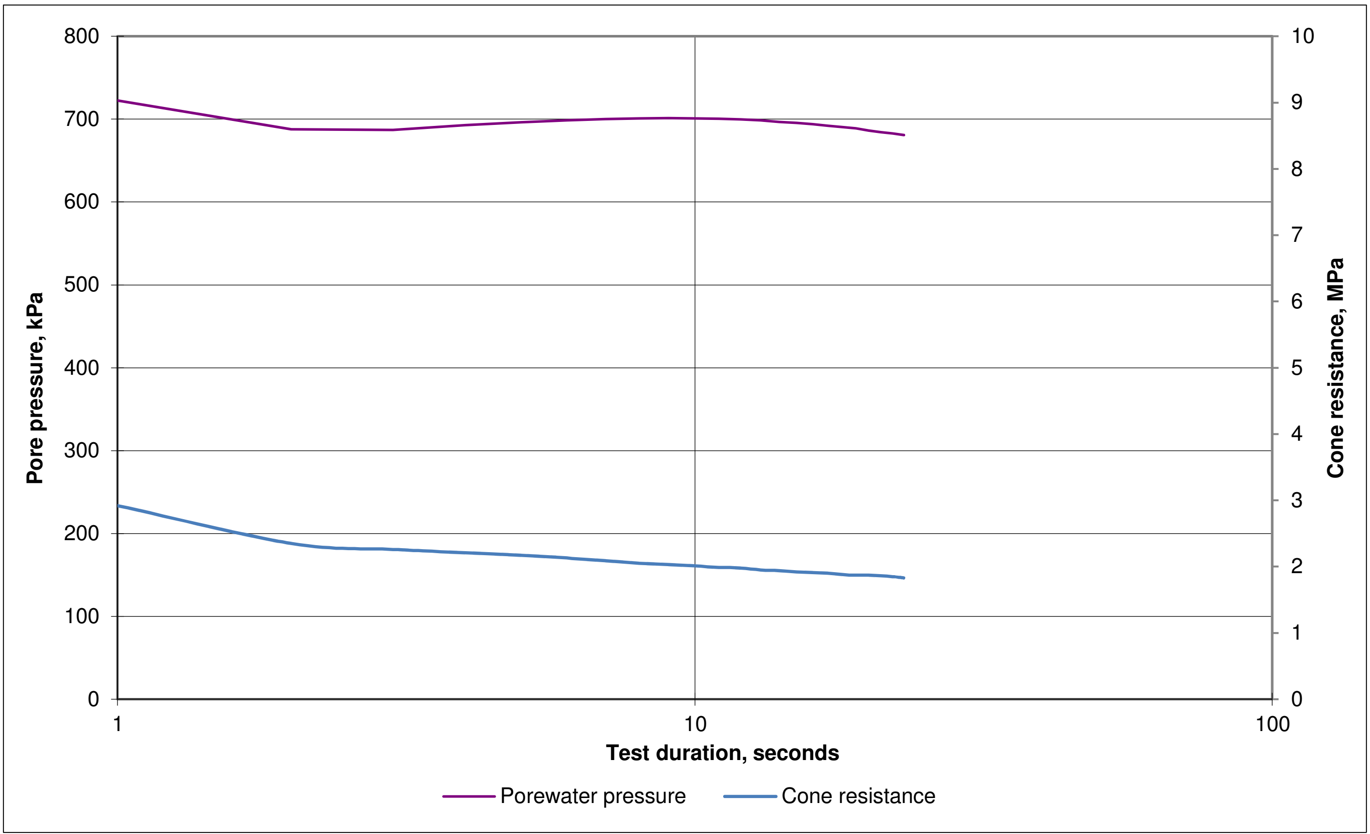


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project** A63 CASTLE STREET IMPROVEMENT - MAIN GI **Project No.** A5085-15 **Carried out for** Balfour Beatty Limited	**Figure** **CPT 425 D02**

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 425
Depth, m	11.51

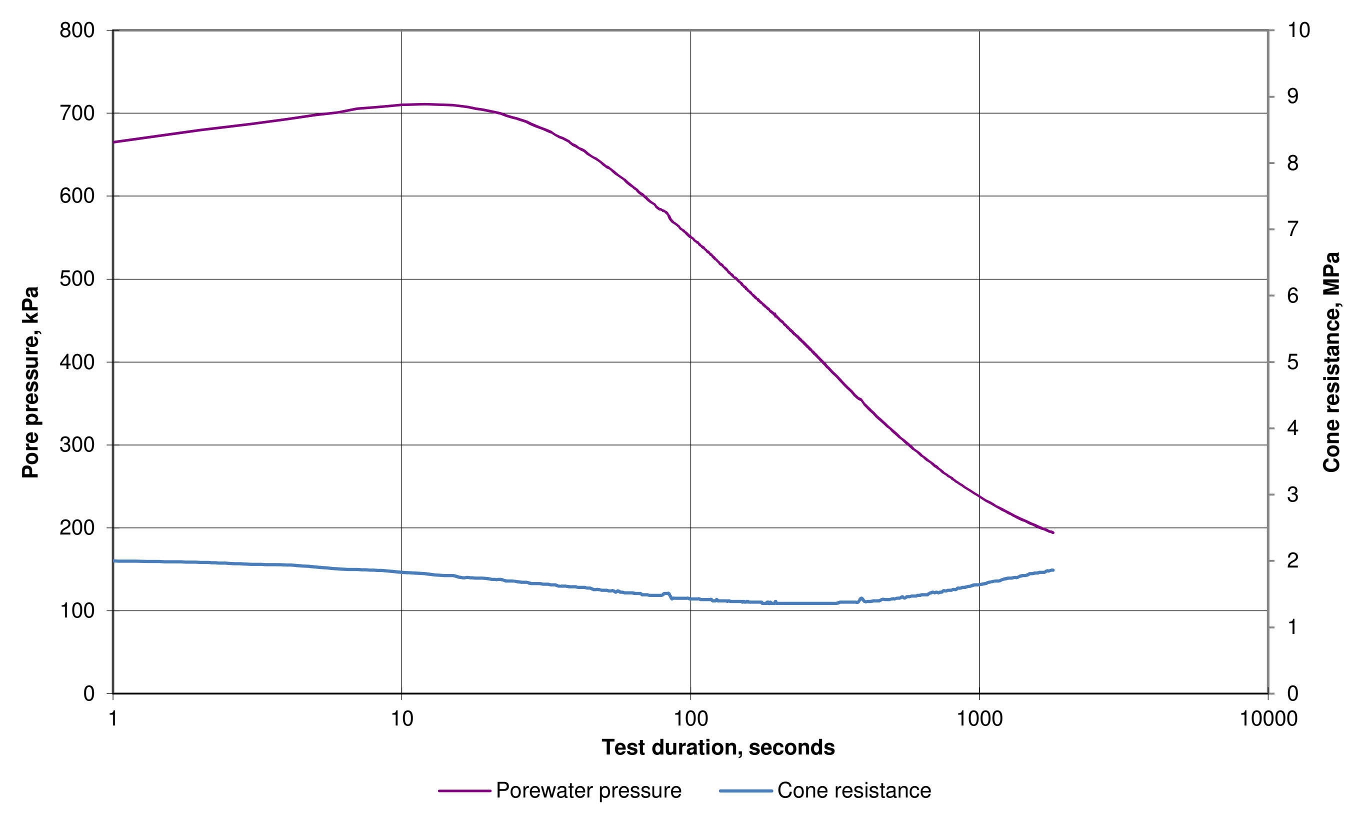


Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 425 D03**
	Carried out for	Balfour Beatty Limited	

Dissipation Test Results

Cone Ref	C10-CFIP.125
PWP filter location	u1

CPT No	CPT 425
Depth, m	11.66



Notes: Interpretation of dissipation tests is not covered by Geocone's UKAS accreditation	**Project**	A63 CASTLE STREET IMPROVEMENT - MAIN GI	**Figure**
	Project No.	A5085-15	**CPT 425 D04**
	Carried out for	Balfour Beatty Limited	

APPENDIX E

DYNAMIC CONE PENETROMETER TESTING

DCP Plots	CR2, CR3, CR4, CR5, EB4, WB1, WB2, WB4 D01 to 12, 12a, 13 to 17

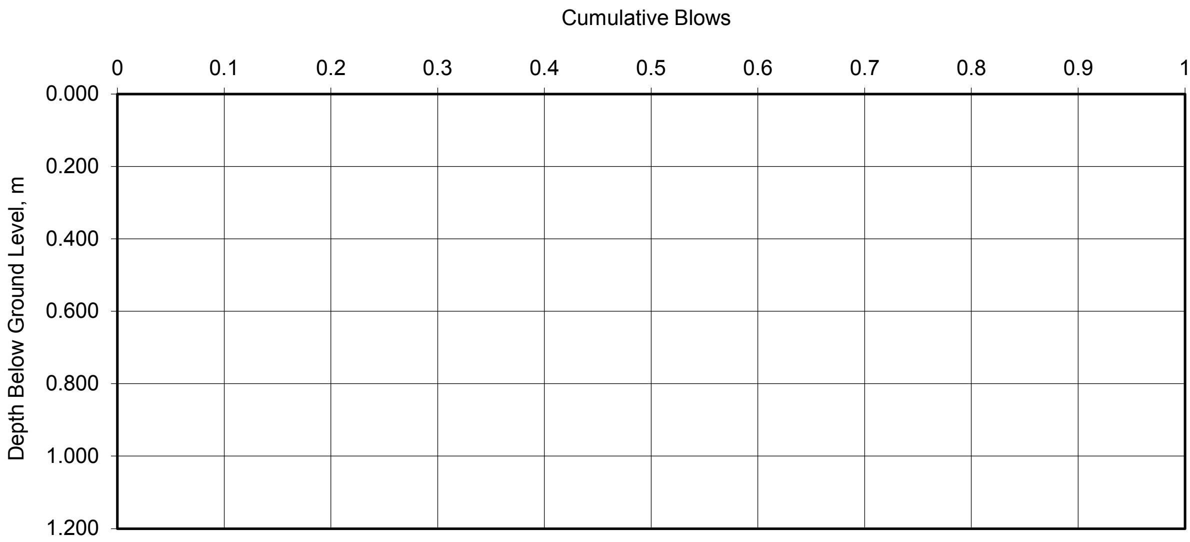
Dynamic Cone Penetrometer Test

Date of Test: 03/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks: Unable to find resistence, test abandoned.

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **CR2**

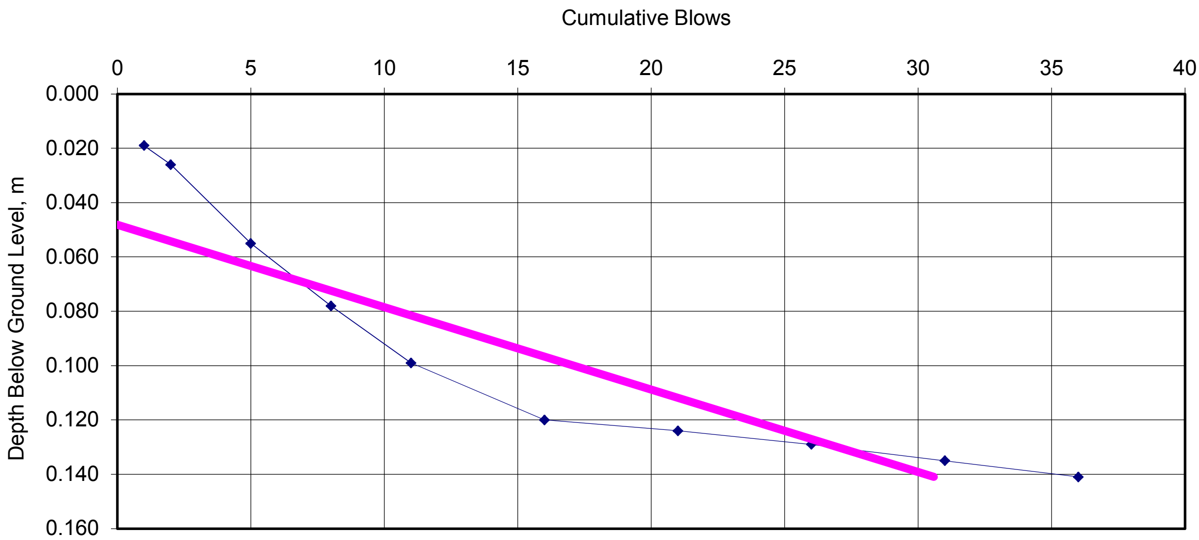
Dynamic Cone Penetrometer Test

Date of Test: 03/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.019	1								
0.026	2								
0.055	5								
0.078	8								
0.099	11								
0.120	16								
0.124	21								
0.129	26								
0.135	31								
0.141	36								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.02	0.14	93

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **CR3**

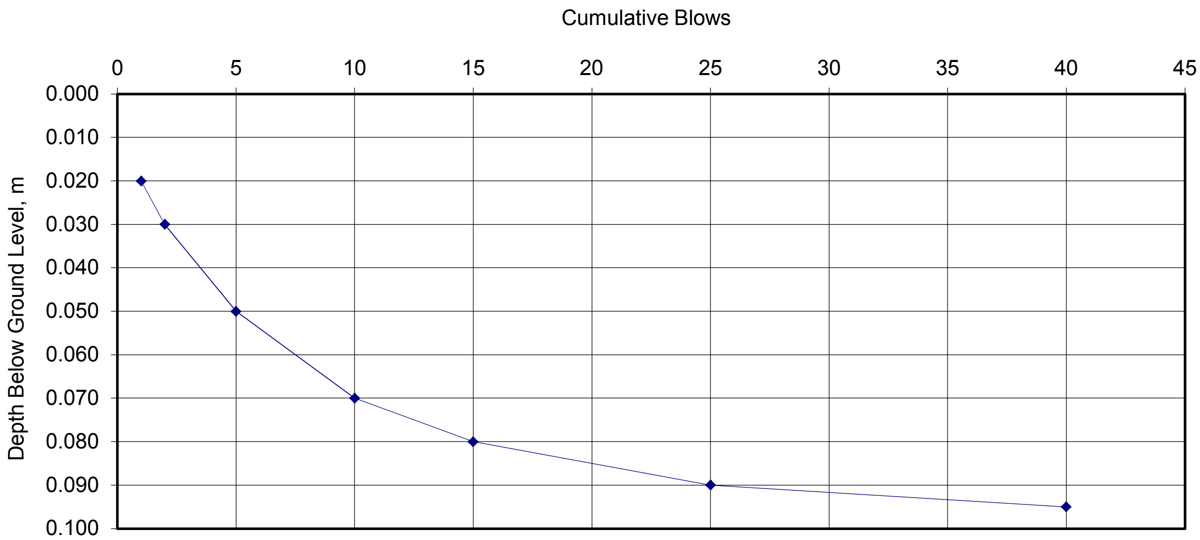
Dynamic Cone Penetrometer Test

Date of Test: 08/02/2016 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.020	1								
0.030	2								
0.050	5								
0.070	10								
0.080	15								
0.090	25								
0.095	40								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **CR4**

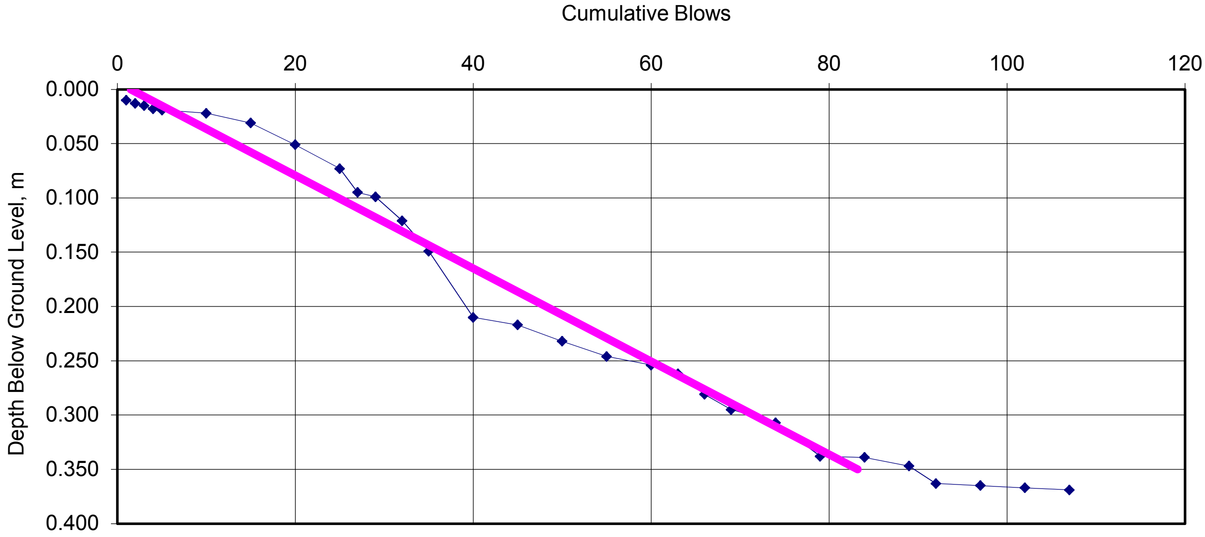
Dynamic Cone Penetrometer Test

Date of Test: 03/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.010	1	0.365	97						
0.013	2	0.367	102						
0.015	3	0.369	107						
0.018	4								
0.019	5								
0.022	10								
0.031	15								
0.051	20								
0.073	25								
0.095	27								
0.099	29								
0.121	32								
0.149	35								
0.210	40								
0.217	45								
0.232	50								
0.246	55								
0.254	60								
0.262	63								
0.281	66								
0.295	69								
0.307	74								
0.338	79								
0.339	84								
0.347	89								
0.363	92								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.00	0.35	64

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **CR5**

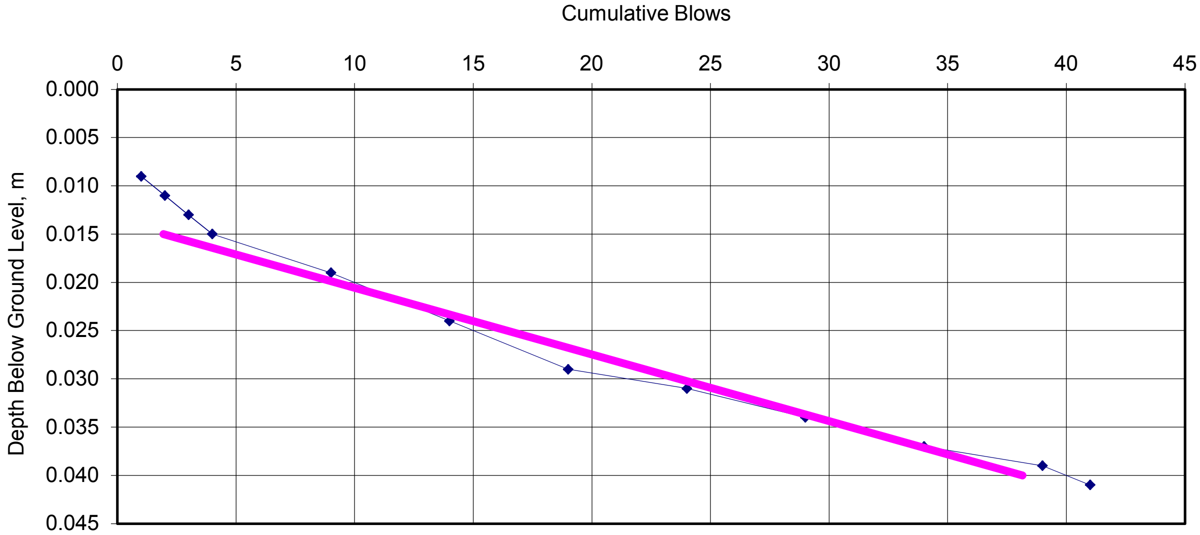
Dynamic Cone Penetrometer Test

Date of Test: 01/12/2015   Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.009	1								
0.011	2								
0.013	3								
0.015	4								
0.019	9								
0.024	14								
0.029	19								
0.031	24								
0.034	29								
0.037	34								
0.039	39								
0.041	41								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.02	0.04	440

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **EB3**

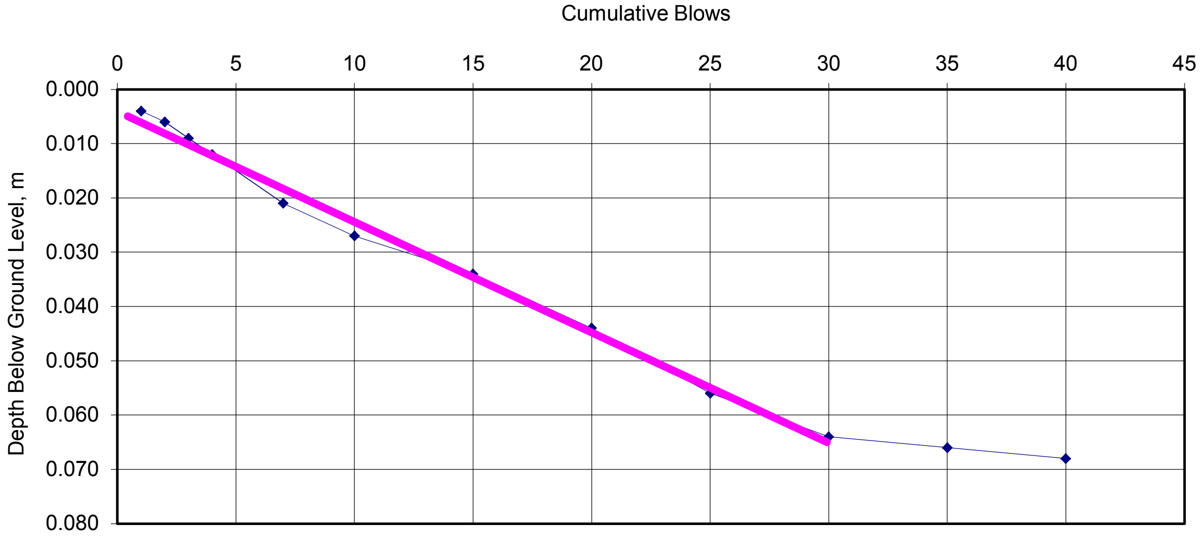
Dynamic Cone Penetrometer Test

Date of Test: 03/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.004	1								
0.006	2								
0.009	3								
0.012	4								
0.021	7								
0.027	10								
0.034	15								
0.044	20								
0.056	25								
0.064	30								
0.066	35								
0.068	40								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.01	0.07	140

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **EB4**

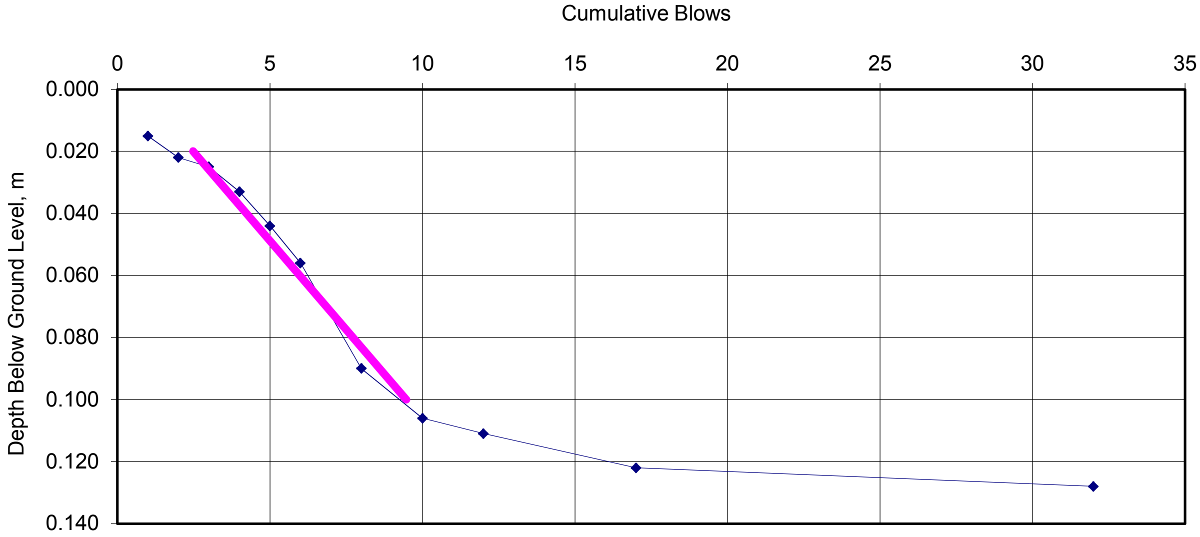
Dynamic Cone Penetrometer Test

Date of Test: 01/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.015	1								
0.022	2								
0.025	3								
0.033	4								
0.044	5								
0.056	6								
0.090	8								
0.106	10								
0.111	12								
0.122	17								
0.128	32								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.02	0.10	22

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **WB1**

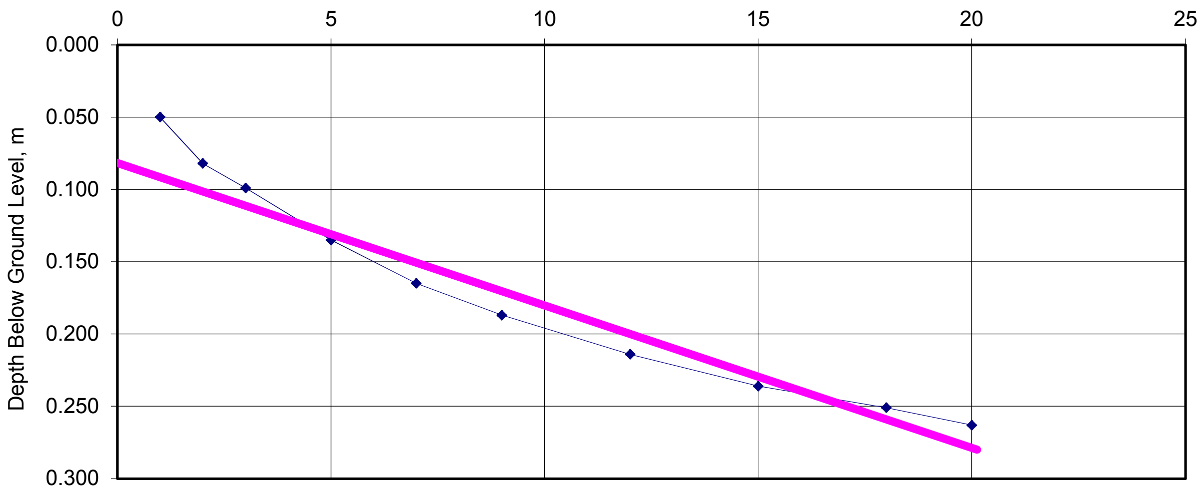
Dynamic Cone Penetrometer Test

Date of Test: 01/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.050	1								
0.082	2								
0.099	3								
0.135	5								
0.165	7								
0.187	9								
0.214	12								
0.236	15								
0.251	18								
0.263	20								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.08	0.28	26

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **WB2**

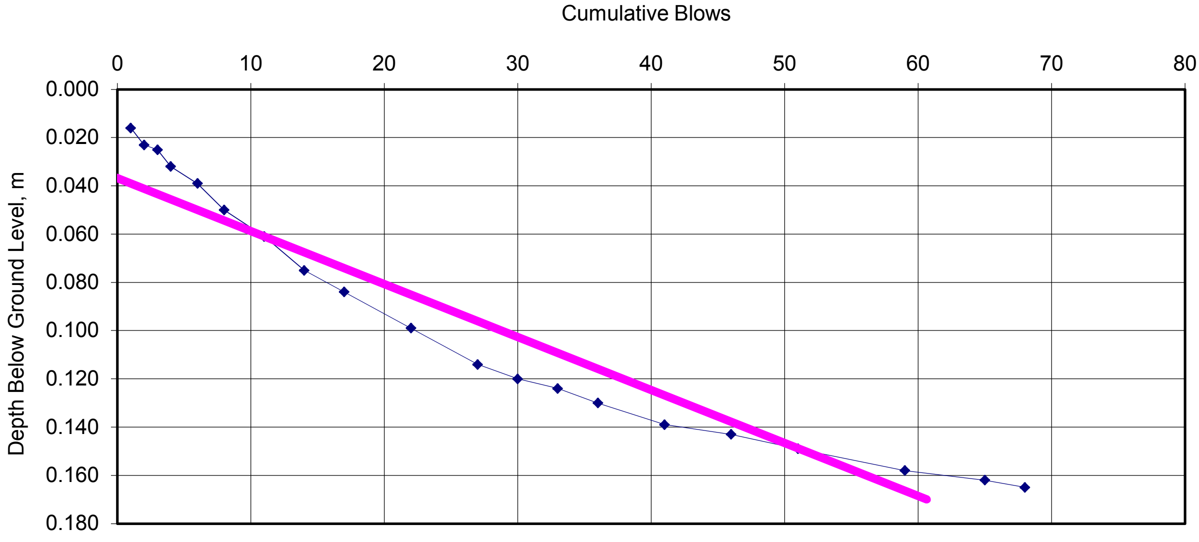
Dynamic Cone Penetrometer Test

Date of Test: 01/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.016	1								
0.023	2								
0.025	3								
0.032	4								
0.039	6								
0.050	8								
0.061	11								
0.075	14								
0.084	17								
0.099	22								
0.114	27								
0.120	30								
0.124	33								
0.130	36								
0.139	41								
0.143	46								
0.149	51								
0.158	59								
0.162	65								
0.165	68								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.02	0.17	130

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **WB3**

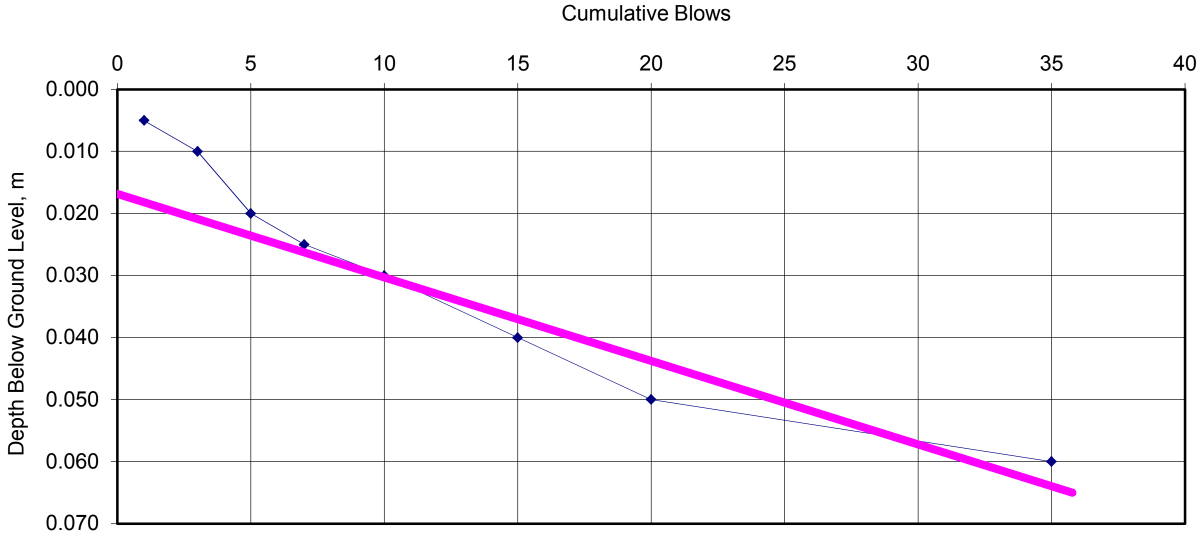
Dynamic Cone Penetrometer Test

Date of Test: 08/02/2016   Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.005	1								
0.010	3								
0.020	5								
0.025	7								
0.030	10								
0.040	15								
0.050	20								
0.060	35								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.02	0.07	220

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **WB4**

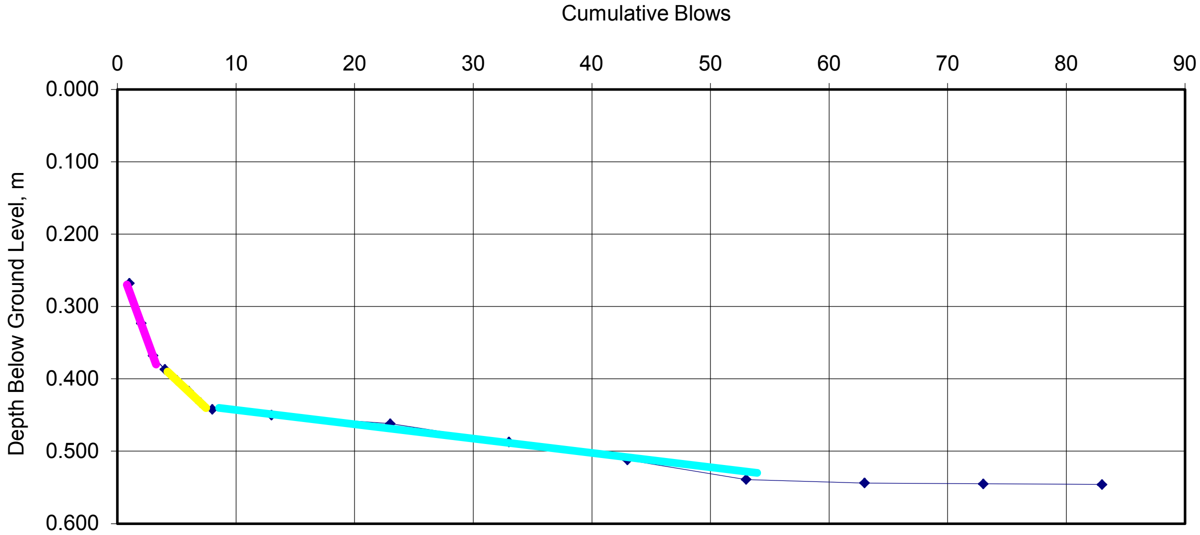
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.193 mBGL

Method: TRL DCP

Remarks: Refusal at 618mm

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.268	1								
0.323	2								
0.368	3								
0.387	4								
0.402	5								
0.417	6								
0.433	7								
0.442	8								
0.450	13								
0.462	23								
0.487	33								
0.512	43								
0.539	53								
0.544	63								
0.545	73								
0.546	83								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.27	0.38	5.4
0.39	0.44	16
0.44	0.53	140

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D01**

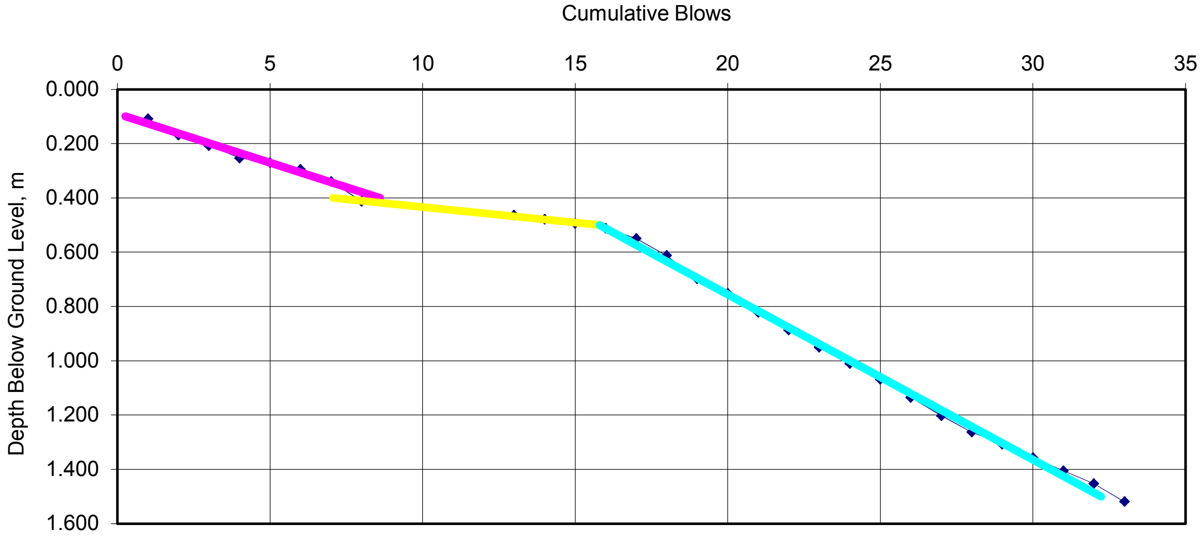
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.030 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.108	1	1.405	31						
0.169	2	1.453	32						
0.207	3	1.519	33						
0.253	4								
0.270	5								
0.295	6								
0.339	7								
0.412	8								
0.463	13								
0.479	14								
0.494	15								
0.512	16								
0.549	17								
0.612	18								
0.698	19								
0.752	20								
0.822	21								
0.886	22								
0.950	23								
1.010	24								
1.068	25								
1.135	26								
1.202	27								
1.263	28								
1.307	29								
1.357	30								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	0.40	6.8
0.40	0.50	23
0.50	1.50	3.9

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D02**

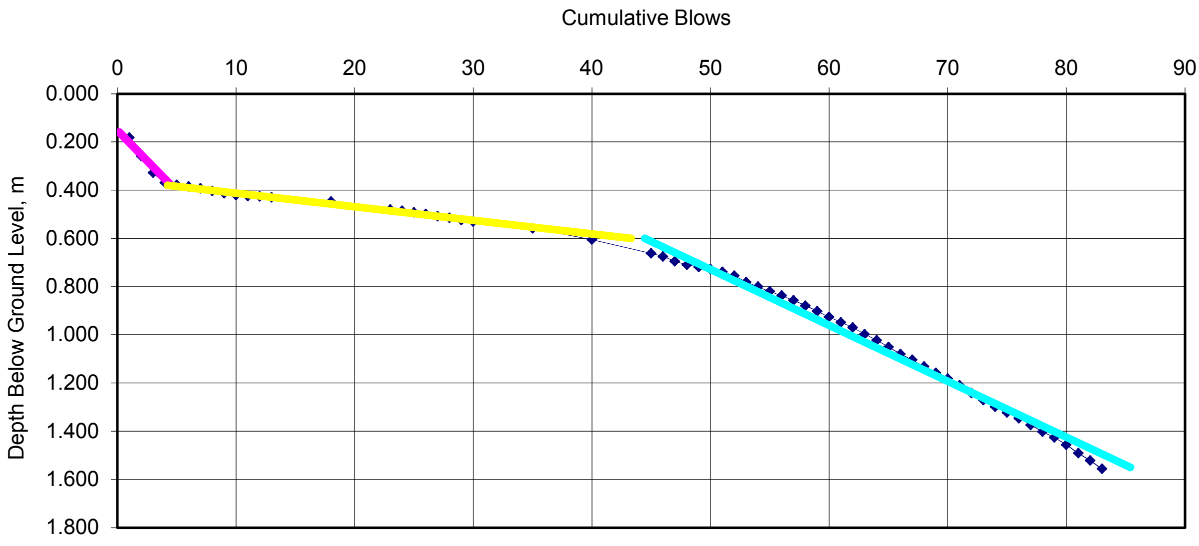
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.051 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.181	1	0.695	47	1.271	73				
0.259	2	0.709	48	1.298	74				
0.328	3	0.719	49	1.323	75				
0.369	4	0.728	50	1.346	76				
0.378	5	0.739	51	1.374	77				
0.384	6	0.754	52	1.402	78				
0.392	7	0.781	53	1.426	79				
0.403	8	0.800	54	1.456	80				
0.413	9	0.820	55	1.491	81				
0.420	10	0.837	56	1.521	82				
0.424	11	0.857	57	1.556	83				
0.426	12	0.879	58						
0.429	13	0.902	59						
0.447	18	0.926	60						
0.480	23	0.948	61						
0.486	24	0.970	62						
0.492	25	0.997	63						
0.499	26	1.022	64						
0.508	27	1.050	65						
0.515	28	1.079	66						
0.524	29	1.104	67						
0.530	30	1.131	68						
0.558	35	1.158	69						
0.605	40	1.182	70						
0.662	45	1.210	71						
0.675	46	1.241	72						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.16	0.38	4.7
0.38	0.60	48
0.60	1.55	10

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D03**

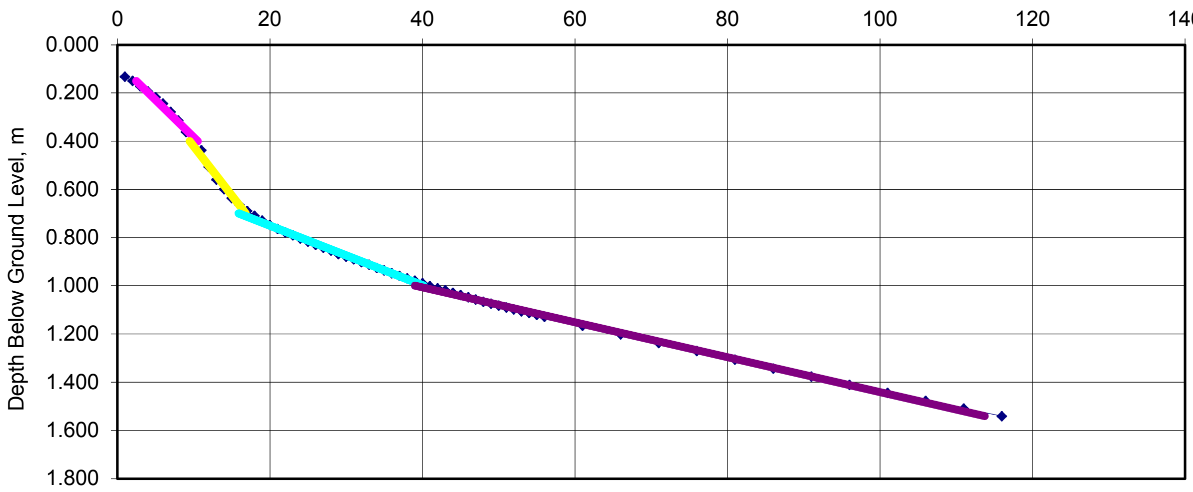
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.071 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.133	1	0.842	27	1.106	53				
0.150	2	0.854	28	1.113	54				
0.172	3	0.869	29	1.121	55				
0.194	4	0.879	30	1.129	56				
0.218	5	0.890	31	1.166	61				
0.244	6	0.902	32	1.202	66				
0.279	7	0.913	33	1.238	71				
0.314	8	0.926	34	1.271	76				
0.362	9	0.937	35	1.307	81				
0.397	10	0.948	36	1.344	86				
0.438	11	0.959	37	1.377	91				
0.507	12	0.969	38	1.411	96				
0.559	13	0.979	39	1.445	101				
0.600	14	0.990	40	1.477	106				
0.637	15	1.001	41	1.509	111				
0.664	16	1.010	42	1.541	116				
0.689	17	1.019	43						
0.710	18	1.029	44						
0.730	19	1.038	45						
0.748	20	1.048	46						
0.764	21	1.057	47						
0.778	22	1.066	48						
0.790	23	1.074	49						
0.804	24	1.082	50						
0.817	25	1.090	51						
0.830	26	1.098	52						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.15	0.40	8
0.40	0.70	5.9
0.70	1.00	21
1.00	1.54	37

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D04**

Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.032 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.114	1	1.280	27						
0.168	2	1.335	28						
0.220	3	1.384	29						
0.265	4	1.435	30						
0.306	5	1.488	31						
0.334	6								
0.370	7								
0.412	8								
0.456	9								
0.496	10								
0.533	11								
0.588	12								
0.638	13								
0.689	14								
0.744	15								
0.783	16								
0.820	17								
0.860	18								
0.908	19								
0.949	20								
0.994	21								
1.037	22								
1.078	23								
1.128	24								
1.177	25								
1.228	26								

CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	1.48	5.4

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D05**

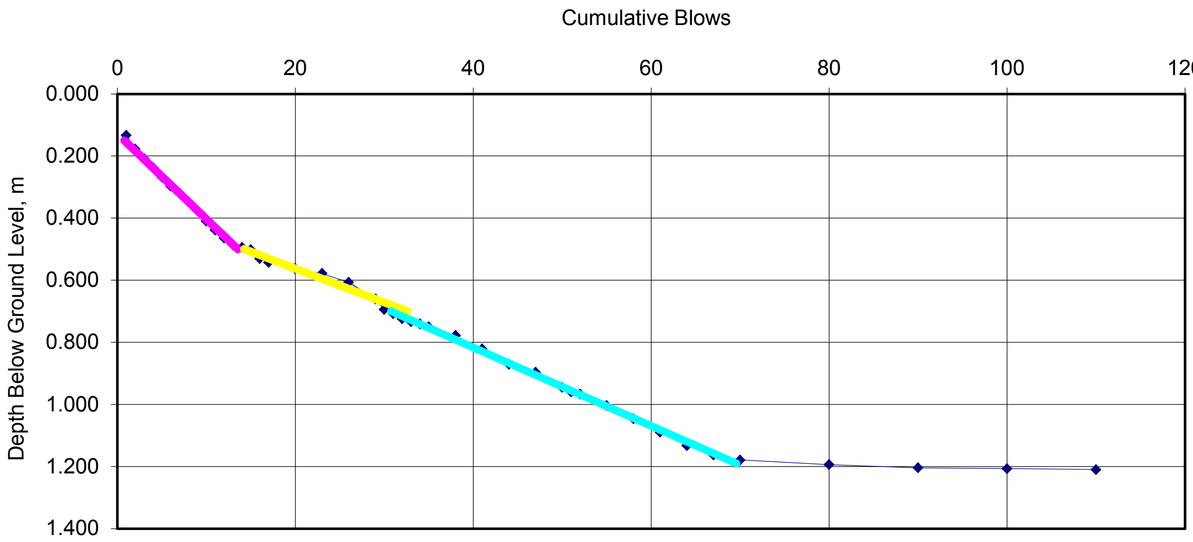
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.062 mBGL

Method: TRL DCP

Remarks: Refusal at 1282mmbgl

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.133	1	0.750	35						
0.177	2	0.778	38						
0.208	3	0.821	41						
0.237	4	0.871	44						
0.268	5	0.896	47						
0.297	6	0.945	50						
0.320	7	0.959	51						
0.348	8	0.967	52						
0.376	9	1.004	55						
0.409	10	1.046	58						
0.438	11	1.089	61						
0.464	12	1.133	64						
0.487	13	1.163	67						
0.494	14	1.179	70						
0.501	15	1.194	80						
0.530	16	1.204	90						
0.543	17	1.207	100						
0.562	20	1.210	110						
0.578	23								
0.607	26								
0.660	29								
0.694	30								
0.708	31								
0.724	32								
0.733	33								
0.741	34								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.15	0.50	9.1
0.50	0.70	24
0.70	1.19	20

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D06**

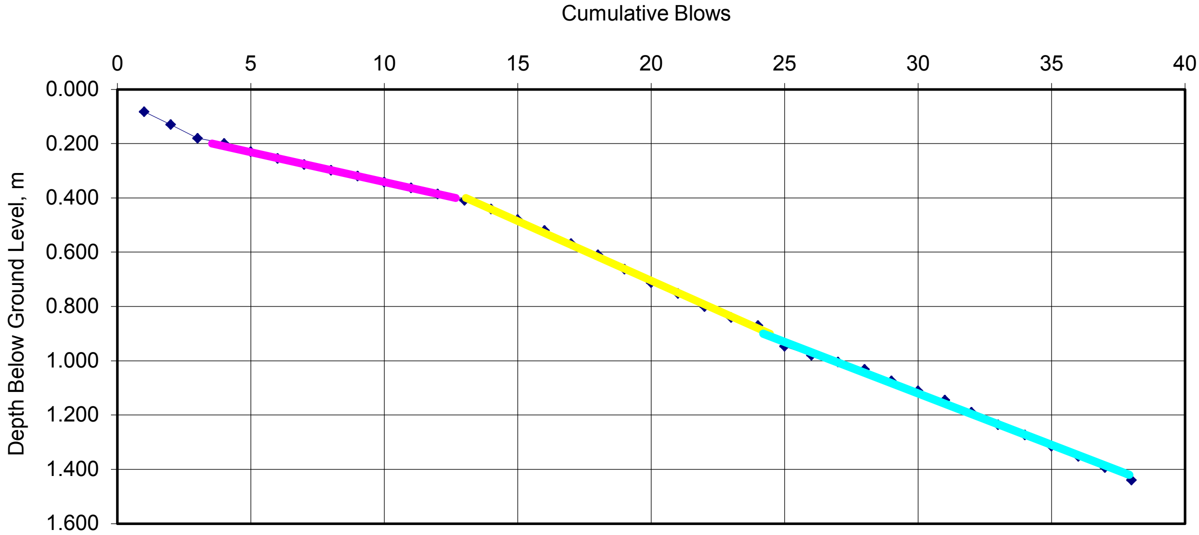
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.033 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.082	1	1.004	27						
0.130	2	1.032	28						
0.180	3	1.074	29						
0.199	4	1.111	30						
0.230	5	1.145	31						
0.255	6	1.190	32						
0.277	7	1.235	33						
0.298	8	1.273	34						
0.319	9	1.314	35						
0.342	10	1.352	36						
0.363	11	1.393	37						
0.385	12	1.440	38						
0.409	13								
0.441	14								
0.480	15								
0.520	16								
0.568	17								
0.609	18								
0.663	19								
0.712	20								
0.752	21								
0.801	22								
0.840	23								
0.870	24								
0.947	25								
0.980	26								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.20	0.40	11
0.40	0.90	5.5
0.90	1.42	6.4

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D07**

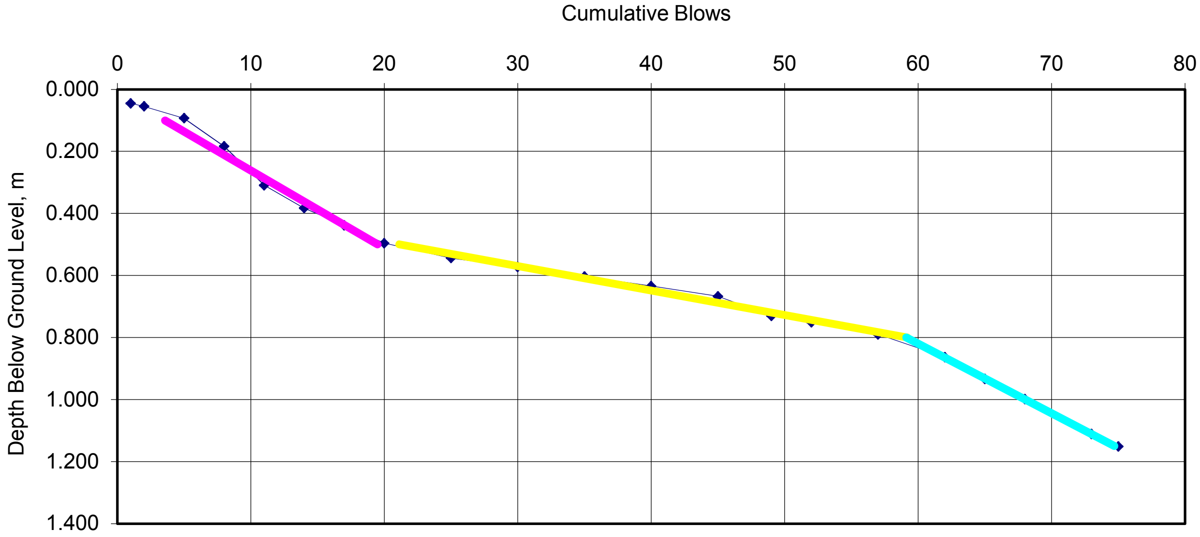
Dynamic Cone Penetrometer Test

Date of Test: 03/12/2015 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.045	1								
0.055	2								
0.093	5								
0.184	8								
0.309	11								
0.383	14								
0.438	17								
0.496	20								
0.544	25								
0.573	30								
0.603	35								
0.634	40								
0.667	45								
0.730	49								
0.751	52								
0.790	57								
0.863	62								
0.934	65								
0.999	68								
1.111	73								
1.151	75								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	0.50	10
0.50	0.80	34
0.80	1.15	11

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D08**

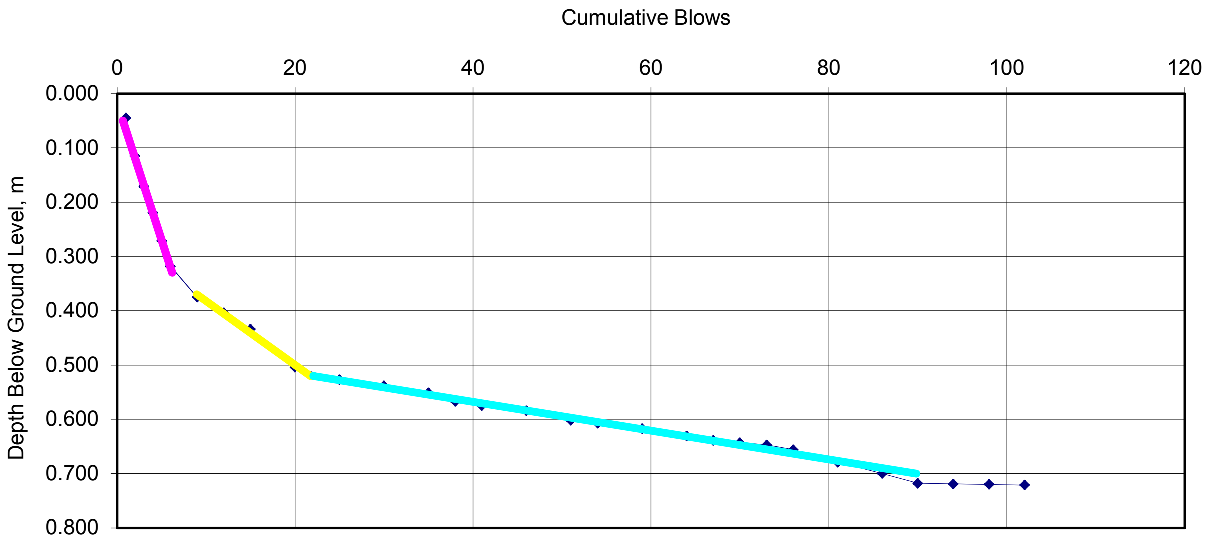
Dynamic Cone Penetrometer Test

Date of Test: 03/12/2015   Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.045	1	0.718	90						
0.115	2	0.719	94						
0.171	3	0.720	98						
0.219	4	0.721	102						
0.271	5								
0.318	6								
0.375	9								
0.404	12								
0.434	15								
0.504	20								
0.527	25								
0.538	30								
0.551	35								
0.567	38								
0.575	41								
0.584	46								
0.602	51								
0.607	54								
0.617	59								
0.631	64								
0.639	67								
0.643	70								
0.647	73								
0.656	76								
0.679	81								
0.700	86								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.05	0.33	4.7
0.37	0.52	22
0.52	0.70	100

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D09**

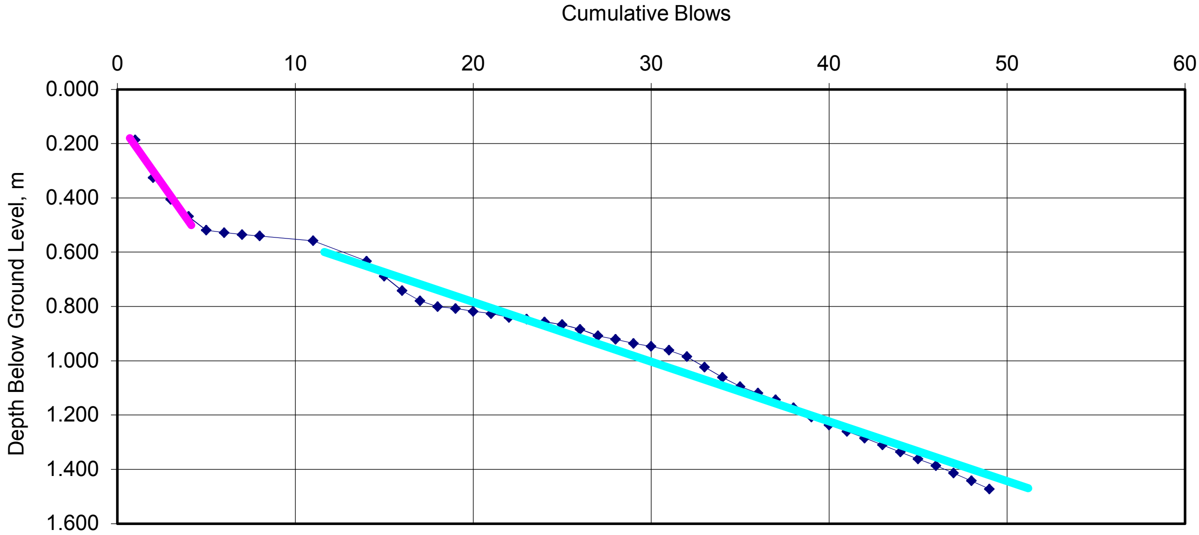
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.031 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.186	1	0.961	31						
0.325	2	0.985	32						
0.405	3	1.023	33						
0.468	4	1.061	34						
0.519	5	1.095	35						
0.528	6	1.119	36						
0.535	7	1.144	37						
0.540	8	1.173	38						
0.558	11	1.207	39						
0.633	14	1.237	40						
0.689	15	1.260	41						
0.742	16	1.285	42						
0.779	17	1.310	43						
0.801	18	1.336	44						
0.807	19	1.362	45						
0.818	20	1.386	46						
0.826	21	1.414	47						
0.840	22	1.442	48						
0.847	23	1.472	49						
0.857	24								
0.867	25								
0.884	26								
0.908	27								
0.921	28								
0.936	29								
0.947	30								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.18	0.50	2.5
0.60	1.47	11

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D10**

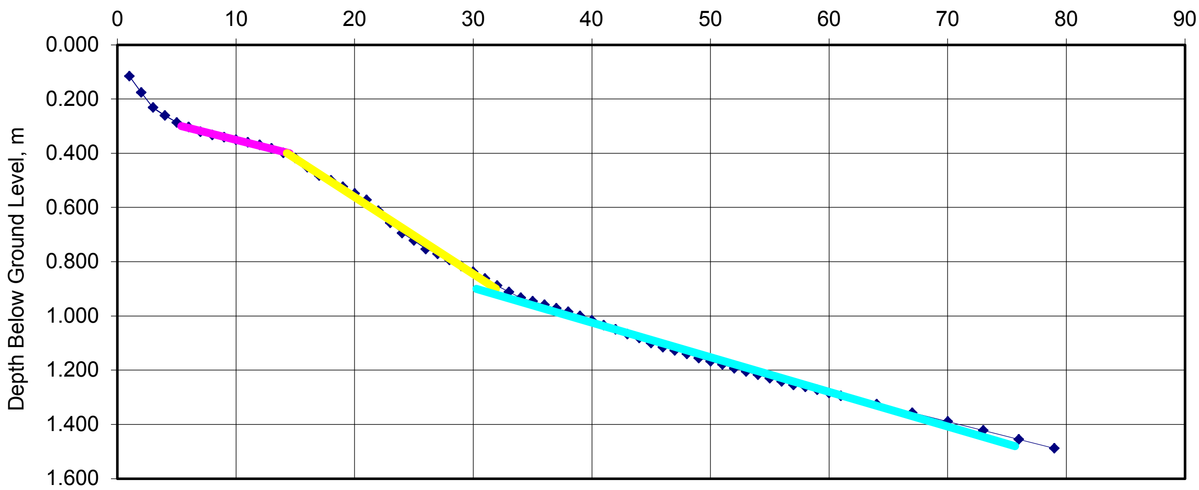
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.040 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.115	1	0.771	27	1.205	53				
0.175	2	0.793	28	1.217	54				
0.231	3	0.816	29	1.230	55				
0.260	4	0.837	30	1.242	56				
0.286	5	0.862	31	1.254	57				
0.303	6	0.888	32	1.262	58				
0.320	7	0.911	33	1.272	59				
0.332	8	0.933	34	1.284	60				
0.341	9	0.946	35	1.295	61				
0.350	10	0.959	36	1.325	64				
0.359	11	0.972	37	1.357	67				
0.369	12	0.984	38	1.389	70				
0.382	13	1.000	39	1.422	73				
0.398	14	1.016	40	1.455	76				
0.417	15	1.034	41	1.488	79				
0.451	16	1.049	42						
0.482	17	1.067	43						
0.500	18	1.081	44						
0.523	19	1.100	45						
0.548	20	1.115	46						
0.572	21	1.127	47						
0.612	22	1.140	48						
0.657	23	1.155	49						
0.694	24	1.167	50						
0.722	25	1.179	51						
0.753	26	1.193	52						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.30	0.40	24
0.40	0.90	8.7
0.90	1.48	20

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D11**

Dynamic Cone Penetrometer Test

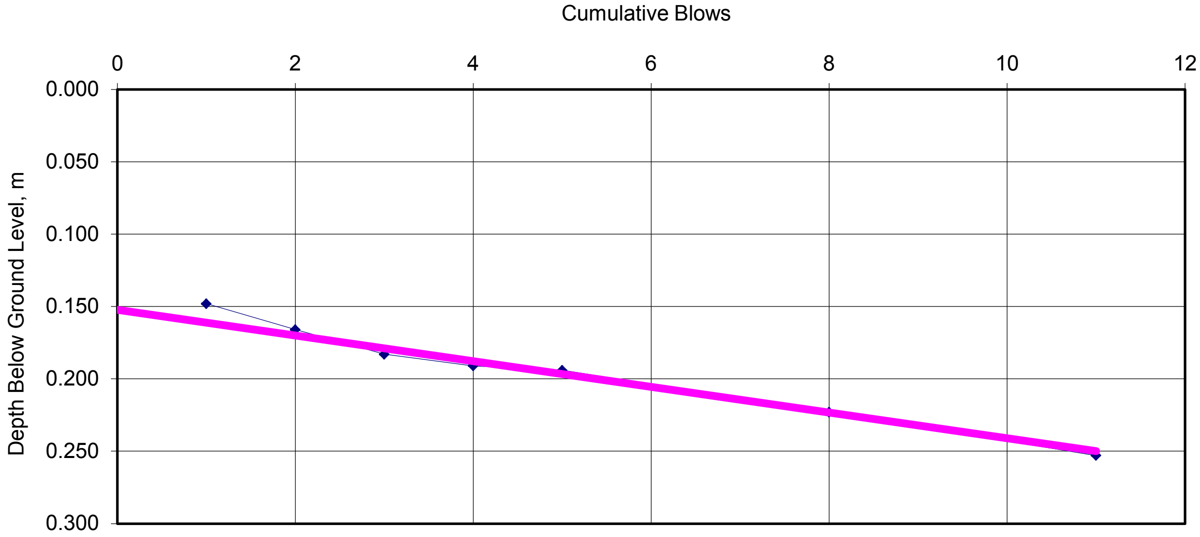
ESG

Date of Test: 14/12/2016 Test Depth: 0.112 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.148	1								
0.166	2								
0.183	3								
0.191	4								
0.194	5								
0.223	8								
0.253	11								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.15	0.25	30

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D12**

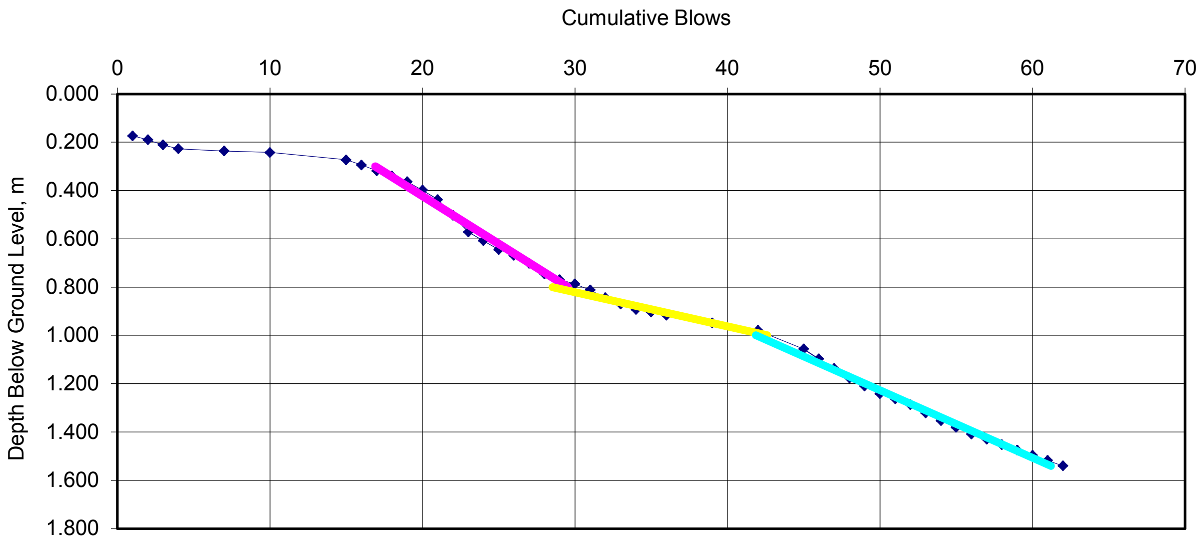
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.095 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.173	1	0.903	35						
0.190	2	0.916	36						
0.211	3	0.948	39						
0.227	4	0.979	42						
0.236	7	1.056	45						
0.242	10	1.097	46						
0.273	15	1.137	47						
0.294	16	1.176	48						
0.318	17	1.209	49						
0.339	18	1.242	50						
0.363	19	1.263	51						
0.398	20	1.287	52						
0.437	21	1.321	53						
0.503	22	1.353	54						
0.571	23	1.381	55						
0.608	24	1.408	56						
0.644	25	1.430	57						
0.668	26	1.452	58						
0.701	27	1.475	59						
0.745	28	1.496	60						
0.769	29	1.518	61						
0.787	30	1.540	62						
0.812	31								
0.844	32								
0.870	33								
0.892	34								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.30	0.80	6.1
0.80	1.00	18
1.00	1.54	8.9

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D12a**

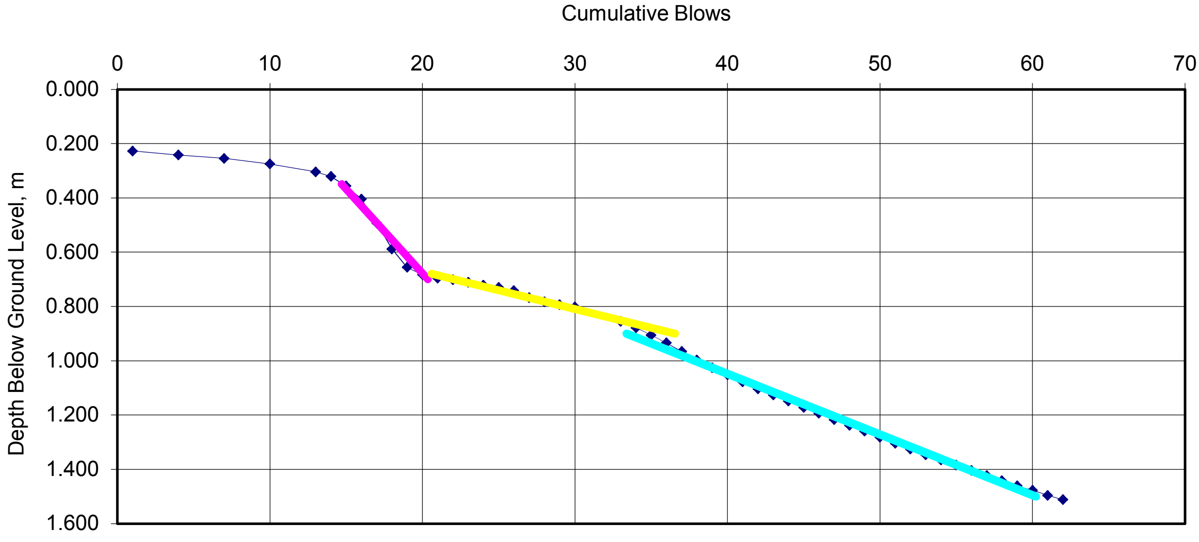
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.212 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.227	1	0.966	37						
0.242	4	0.997	38						
0.254	7	1.026	39						
0.275	10	1.052	40						
0.304	13	1.078	41						
0.321	14	1.103	42						
0.356	15	1.126	43						
0.404	16	1.148	44						
0.493	17	1.172	45						
0.588	18	1.193	46						
0.656	19	1.217	47						
0.683	20	1.238	48						
0.695	21	1.259	49						
0.702	22	1.281	50						
0.711	23	1.304	51						
0.721	24	1.325	52						
0.730	25	1.347	53						
0.742	26	1.365	54						
0.768	27	1.384	55						
0.783	28	1.404	56						
0.793	29	1.423	57						
0.802	30	1.442	58						
0.855	33	1.461	59						
0.878	34	1.477	60						
0.905	35	1.496	61						
0.934	36	1.512	62						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.35	0.70	3.8
0.68	0.90	18
0.90	1.50	11

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D13**

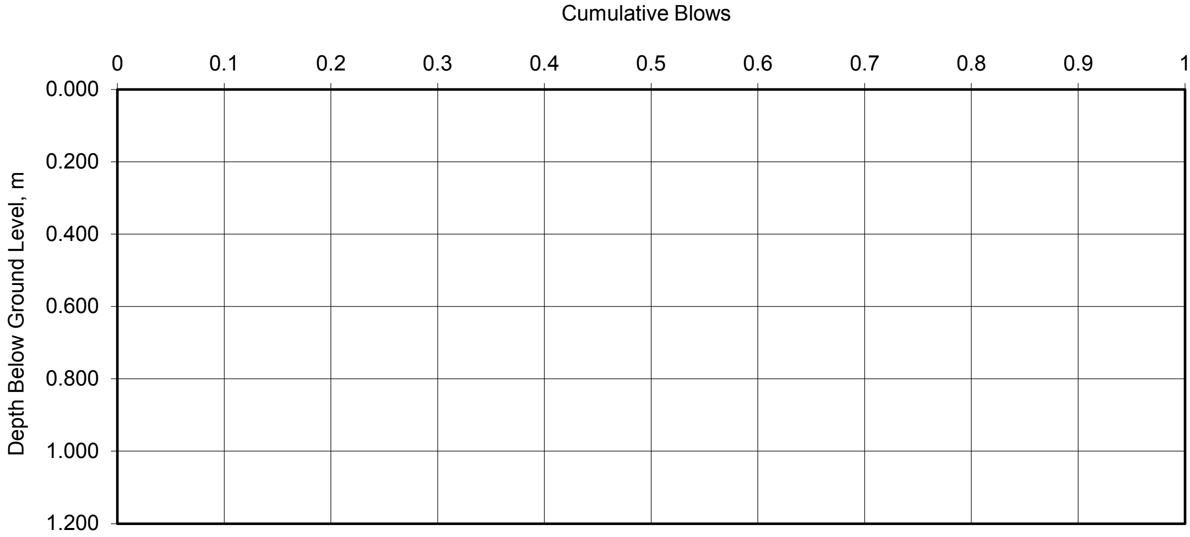
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks: Concrete obstruction below surface paving, no test undertaken.

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project	A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI	**Hole**
Project No.	A5085-15	**D14**
Carried out for	Balfour Beatty Limited	

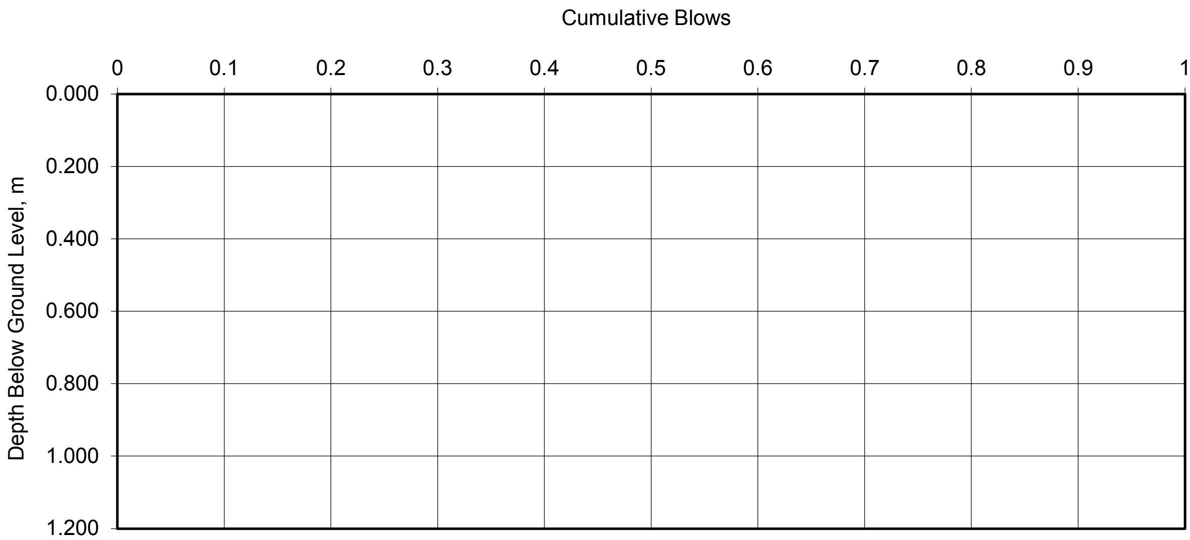
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.000 mBGL

Method: TRL DCP

Remarks: Concrete obstruction below surface paving, no test undertaken.

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET IMPROVEMENTS - MAIN SITE GI

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole D15

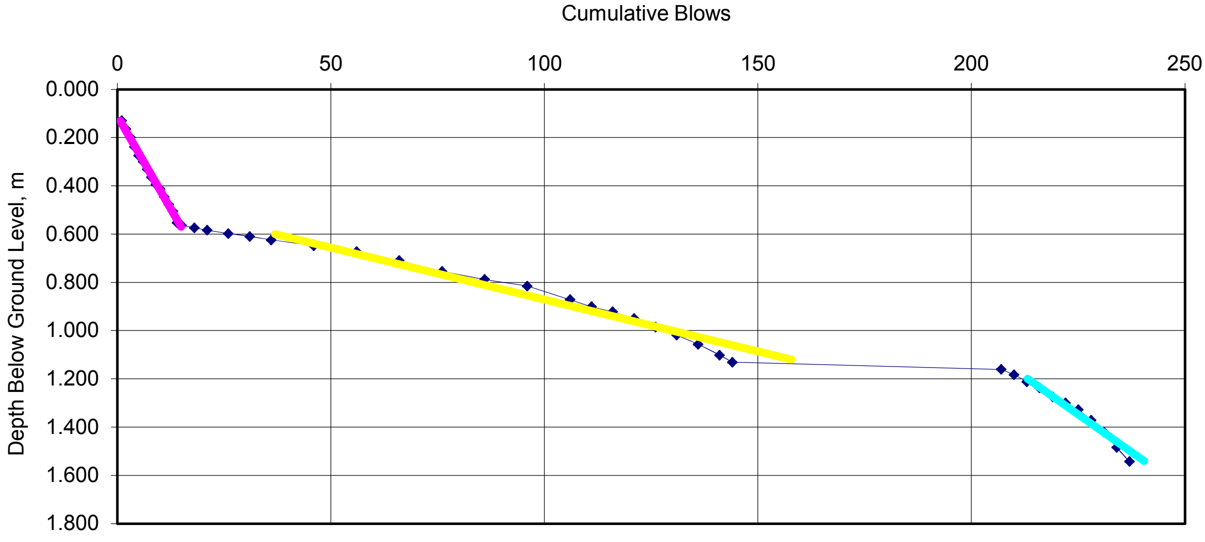
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.040 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.130	1	0.872	106						
0.164	2	0.901	111						
0.199	3	0.922	116						
0.239	4	0.950	121						
0.274	5	0.985	126						
0.300	6	1.019	131						
0.332	7	1.057	136						
0.364	8	1.102	141						
0.394	9	1.131	144						
0.413	10	1.161	207						
0.445	11	1.183	210						
0.478	12	1.212	213						
0.505	13	1.238	216						
0.553	14	1.274	219						
0.563	15	1.300	222						
0.574	18	1.328	225						
0.584	21	1.372	228						
0.598	26	1.421	231						
0.610	31	1.484	234						
0.624	36	1.543	237						
0.648	46								
0.672	56								
0.710	66								
0.754	76								
0.788	86								
0.815	96								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.13	0.57	8
0.60	1.12	64
1.20	1.54	20

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D16**

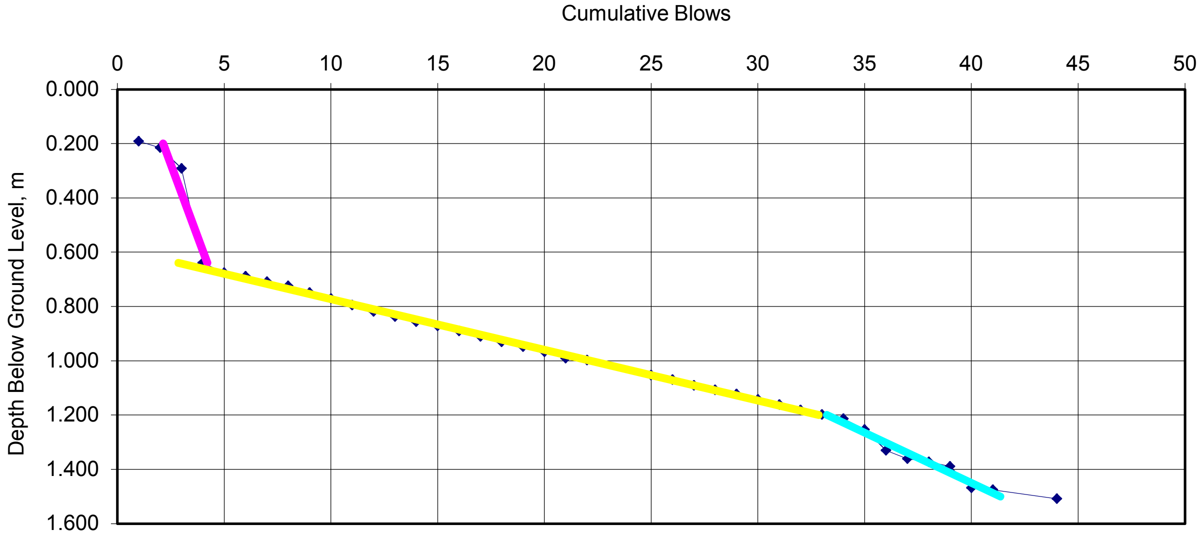
Dynamic Cone Penetrometer Test

Date of Test: 14/01/2016 Test Depth: 0.148 mBGL

Method: TRL DCP

Remarks:

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.191	1	1.122	29						
0.215	2	1.143	30						
0.291	3	1.161	31						
0.639	4	1.181	32						
0.675	5	1.198	33						
0.689	6	1.213	34						
0.708	7	1.253	35						
0.724	8	1.330	36						
0.749	9	1.361	37						
0.771	10	1.372	38						
0.795	11	1.389	39						
0.818	12	1.468	40						
0.837	13	1.475	41						
0.856	14	1.508	44						
0.871	15								
0.890	16								
0.910	17								
0.930	18								
0.948	19								
0.967	20								
0.990	21								
0.997	22								
1.053	25								
1.069	26								
1.091	27								
1.107	28								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.20	0.64	1
0.64	1.20	13
1.20	1.50	6.6

Notes:

Calculated using DMRB Vol 7, Section 3, Part 2, HD29/08 (2008)

Project A63 CASTLE STREET

Project No. A5085-15

Carried out for Balfour Beatty Limited

Hole **D17**

APPENDIX F

GEOTECHNICAL LABORATORY TEST RESULTS

Index Properties – Summary of Results	INDX 1 to 3
Particle Size Distribution Analyses	PSD 1 to 77
Unconsolidated Undrained Triaxial Compression Tests	UUSUM 1 and 2
Consolidated Undrained Triaxial Compression Tests	CU 1 to 45
One Dimensional (Oedometer) Consolidation Tests	OED 1 to 17
Dry Density / Moisture Content Relationship (Light Compaction 2.5 kg rammer) with Summary of Vane Test on Compaction Specimen	COMPL 1 to 8
Chemical Tests – Summary of Results	CHEM 1 and 2
Test Reports	EFS/160977
	EFS/161316
	EFS/161684
	EFS/161698
	EFS/161702
	EFS/162441
	EFS/162595

INDEX PROPERTIES - SUMMARY OF RESULTS

Project No	Project Name
A5085-15	A63 CASTLE STREET

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	p Mg/m³	p_d Mg/m³	w %	< 425 µm sieve %	W_L %	W_P %	I_P	p_s Mg/m³	Remarks
BH402	3	1.20	2.00	B	Brownish grey slightly sandy slightly gravelly CLAY.			39	96 n	64 a	32	32		
BH402	6	2.45	2.90	UT	Soft brown slightly sandy CLAY.			44	100 n	48 a	24	24		
BH402	9	3.75	4.75	P	Greyish brown slightly sandy clayey SILT.			42	98 n	36 a	25	11		
BH402	11	5.75	6.20	UT	Brownish dark grey sandy slightly clayey SILT.			34	99 n	49 a	29	20		
BH402	13	6.40	7.40	P	Greyish brown sandy clayey SILT.			34	99 n	33 a	26	7		
BH402	16	8.40	9.05	UT	Firm to stiff greyish brown sandy CLAY.			22	100 n	28 a	18	10		
BH402	24	10.95	11.40	UT	Very stiff greyish brown slightly gravelly sandy CLAY.			13	84 s	32 a	16	16		
BH402	26	11.60	12.05	UT	Very stiff brown slightly sandy slightly gravelly silty CLAY.			20	98 n	31 a	18	13		
BH402	30	13.30	13.75	UT	Stiff greyish brown slightly sandy slightly gravelly CLAY.			21	96 s	39 a	19	20		
BH402	38	15.90	16.35	UT	Stiff laminated greyish brown slightly sandy CLAY.			30	100 n	57 a	28	29		
BH402	46	18.50	18.95	UT	Stiff to very stiff brown slightly sandy silty CLAY.			23	100 n	39 a	23	16		
BH402	50	19.75	20.20	UT	Stiff greyish brown slightly sandy slightly gravelly CLAY with sand partings and			19	99 n	31 a	17	14		
BH403	4	1.65	2.10	UT	Soft brown slightly sandy silty CLAY.			28	100 n	45 a	25	20		
BH403	6	2.30	2.75	UT	Brown SILT.			31	100 n	40 a	23	17		
BH403	10	3.60	4.60	P	Soft to firm brown silty CLAY.			44	100 n	42 a	29	13		
BH403	12	5.00	6.00	P	Soft brown sandy silty CLAY.			37	100 n	36 a	22	14		
BH403	14	7.00	8.00	P	Brown slightly sandy SILT.			38	100 n	45 a	24	21		
BH403	18	8.65	9.30	UT	Very soft brown CLAY.			34	100 n	35 a	23	12		
BH403	27	11.90	12.35	UT	Stiff brown slightly sandy slightly gravelly CLAY.			14	88 s	32 a	17	15		
BH403	32	13.85	14.20	UT	Firm greyish brown slightly sandy slightly gravelly CLAY.			17	94 n	32 a	16	16		
BH403	38	15.70	16.15	UT	Soft to firm brown slightly sandy CLAY.			26	100 n	44 a	24	20		
BH403	48	18.95	19.40	UT	Firm greyish brown slightly sandy CLAY with sand partings.			28	100 n	39 a	22	17		
BH404	3	1.50	1.95	UT	Firm brown silty CLAY.			29	44 s	49 a	23	26		
BH404	5	2.50	2.95	UT	Soft brown slightly sandy CLAY.			33	100 n	48 a	27	21		
BH404	7	3.00	4.00	P	Light brown and black organic sandy clayey SILT.			42	100 n	43 a	24	19		
BH404	8	4.00	5.00	P	Dark grey slightly sandy clayey SILT.			44	100 n	45 a	23	22		
BH404	9	5.00	6.00	P	Dark grey slightly sandy clayey SILT.			41	100 n	39 a	22	17		
BH404	10	6.00	7.00	P	Dark brown sandy clayey SILT.			39	99 n	30 b	NP			
BH404	11	7.00	8.00	P	Brown slightly sandy silty CLAY.			39	100 n	33 a	21	12		
BH404	14	8.00	9.00	P	Dark brown silty CLAY.			34	100 n	50 a	23	27		
BH404	17	9.00	10.00	P	Firm dark brown organic CLAY.			121	98 n	155 a	109	46		
BH404	20	10.00	10.50	B	Dark brown slightly sandy slightly gravelly CLAY.			34	88 s	33 a	16	17		

General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See individual test reports for further details.

Key :

p bulk density, linear	W_L Liquid limit	W_P Plastic limit	<425um preparation	p_s particle density
p_d dry density	a 4 point cone test	NP non - plastic	n from natural soil	-g = gas jar
w moisture content	b 1 point cone test	I_P Plasticity Index	s sieved specimen	-p = small pyknometer

QA Ref

SLR 1
Rev 91
Mar 12

Environmental Scientifics Group

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Table

INDX

INDEX PROPERTIES - SUMMARY OF RESULTS

Project No	Project Name
A5085-15	A63 CASTLE STREET

Hole No.	Sample No.	Depth (m) from	Depth (m) to	Sample type	Soil Description	ρ (Mg/m³)	ρ_d (Mg/m³)	w (%)	< 425 µm sieve (%)	W_L (%)	W_P (%)	I_P	ρ_s (Mg/m³)	Remarks
BH404	24	11.00	11.50	B	Greyish dark brown slightly sandy slightly gravelly CLAY.			18	88 s	35 a	17	18		
BH404	30	12.50	12.95	UT	Very stiff greyish brown slightly gravelly sandy CLAY.			15	84 s	34 a	16	18		
BH404	36	14.00	14.45	UT	Firm to stiff greyish brown slightly gravelly sandy CLAY with chalk fragments.			15	92 s	29 a	16	13		
BH404	44	16.00	16.45	UT	Stiff laminated greyish brown slightly sandy CLAY.			30	100 n	60 a	27	33		
BH404	54	18.50	18.95	UT	Firm greyish brown silty CLAY.			25	100 n	35 a	22	13		
BH405	5	2.50	2.95	UT	Firm brown slightly sandy silty CLAY.			34	100 n	37 a	23	14		
BH405	8	4.00	5.00	P	Very soft dark grey slightly sandy organic silty CLAY.			41	99 n	42 a	25	17		
BH405	11	6.00	7.00	P	Soft dark brown slightly sandy silty CLAY.			38	99 n	35 a	25	10		
BH405	13	7.00	8.00	P	Very soft brown slightly sandy CLAY.			46	100 n	43 a	22	21		
BH405	15	8.00	9.00	P	Soft to firm greyish brown slightly sandy silty CLAY becoming organic clayey SILT towards			47	99 n	43 a	24	19		
BH405	17	9.00	10.00	P	Firm dark brown organic silty CLAY becoming silty amotphous PEAT with			66	100 n	79 a	61	18		
BH405	19	10.00	10.45	UT	Soft brownish dark grey slightly gravelly sandy CLAY.			26	93 n	39 a	25	14		
BH405	23	11.00	11.45	UT	Soft brown slightly sandy slightly gravelly CLAY.			19	87 s	33 a	19	14		
BH405	35	14.00	14.45	UT	Stiff greyish brown slightly sandy slightly gravelly CLAY with chalk fragments.			15	99 s	30 a	14	16		
BH405	45	16.50	16.95	UT	Stiff laminated brown slightly sandy silty CLAY.			25	100 n	51 a	25	26		
BH405	54	19.00	19.50	B	Brown slightly sandy slightly gravelly CLAY.			46	98 s	46 a	24	22		
BH405	60	21.00	21.50	B	Greyish brown slightly sandy CLAY.			48	100 s	35 a	19	16		
BH405	65	23.00	23.45	UT	Very stiff brown slightly sandy silty CLAY.			20	100 n	31 a	19	12		
BH406	9	2.50	2.95	UT	Soft to firm laminated greyish brown slightly sandy CLAY.			38	100 n	48 a	25	23		
BH406	11	3.00	3.45	UT	Soft brown silty CLAY.			85	100 n	46 a	29	17		
BH406	13	3.50	4.50	P	Brownish grey slightly sandy CLAY.			44	100 n	48 a	27	21		
BH406		4.50	4.95	UT	Brown slightly sandy silty CLAY.			91	100 n	39 a	25	14		
BH406	16	5.00	5.45	UT	Grey slightly sandy silty CLAY.			36	100 n	41 a	26	15		
BH406	18	5.50	6.00	B	Grey and brown slightly sandy CLAY.			23	99 n	39 a	22	17		
BH406	21	6.50	7.50	P	Brown sandy SILT.			49	100 n	36 a	26	10		
BH406	23	7.50	8.00	B	Greyish brown slightly sandy slightly gravelly SILT.			49	100 s	42 a	28	14		
BH406	25	8.00	9.10	P	Soft to firm brown silty CLAY with frequent wood fragments.			230	99 n	107 a	56	51		
BH406	27	9.00	9.50	B	Grey slightly sandy slightly gravelly CLAY.			58	95 s	47 a	25	22		
BH406	30	10.50	11.00	B	Greyish brown slightly sandy slightly gravelly SILT.			83	98 s	48 a	28	20		
BH406	40	13.00	13.45	UT	Very stiff greyish brown slightly sandy slightly gravelly CLAY			13	82 s	32 a	17	15		
BH406	47	14.50	14.95	UT	Firm to stiff greyish brown slightly sandy slightly gravelly CLAY.			16	87 s	33 a	16	17		
BH406	53	16.00	16.45	UT	Stiff brown CLAY.			23	100 n	45 a	24	21		

General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See individual test reports for further details.

Key :				
ρ bulk density, linear	W_L Liquid limit	W_P Plastic limit	<425um preparation	ρ_s particle density
ρ_d dry density	a 4 point cone test	NP non - plastic	n from natural soil	-g = gas jar
w moisture content	b 1 point cone test	I_P Plasticity Index	s sieved specimen	-p = small pyknometer

QA Ref			Table
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INDEX PROPERTIES - SUMMARY OF RESULTS

Project No	Project Name
A5085-15	A63 CASTLE STREET

Hole No.	Sample				Soil Description	p	p_d	w	< 425 µm sieve	W_L	W_P	I_P	p_s	Remarks
	No.	Depth (m)		type										
		from	to			Mg/m³		%	%	%	%		Mg/m³	
BH406	69	20.00	20.45	UT	Firm laminated greyish brown slightly sandy CLAY.			27	100 n	45 a	24	21		
BH407	3	1.20		D	Brown CLAY.			21	100 s	48 a	27	21		
BH407	5	1.70	2.15	UT	Firm to stiff brown slightly sandy silty CLAY with occasional partings of sand and silt.			22	100 n	53 a	25	28		
BH407	9	3.10	2.55	UT	Very soft brown slightly sandy silty CLAY.			36	99 n	38 a	23	15		
BH407	15	6.05	7.05	P	Brown slightly sandy silty CLAY.			41	99 n	37 a	25	12		
BH407	18	7.60	8.05	UT	Very soft black organic slightly sandy slightly gravelly CLAY.			66	71 s	51 b	36	15		
BH407	22	9.00	10.00	P	Dark grey organic slightly sandy silty CLAY with frequent wood fragments.			65	100 n	98 a	49	49		
BH407	25	10.50	10.85	UT	Firm brownish grey slightly sandy slightly gravelly CLAY with wood fragments.			120	94	149 a	72	77		
BH407	27	11.00	11.45	UT	Firm brownish grey slightly sandy organic CLAY with wood fragments.			63	100 n	76 a	42	34		
BH407	33	12.50	12.95	UT	Soft to firm brownish grey slightly sandy slightly gravelly CLAY.			18	85 s	27 a	15	12		
BH407	39	14.00	14.45	UT	Stiff brown slightly sandy slightly gravelly CLAY.			13	86 s	31 a	17	14		
BH407	41	14.50	14.95	UT	Stiff brown slightly gravelly sandy CLAY.			14	86 s	31 a	16	15		
BH407	47	16.00	16.45	UT	Stiff brown CLAY.			22	100 n	36 a	23	13		
BH407	62	20.00	20.45	UT	Stiff brown slightly sandy CLAY with occasional partings of sand.			22	100 n	40 a	21	19		
BH408	1	1.40	1.85	D	Brown slightly sandy slightly gravelly CLAY.			16	68 s	42 a	22	20		
BH408	3	2.00	2.45	UT	Firm to stiff brown slightly sandy CLAY with occasional partings of sand.			29	100 n	51 a	25	26		
BH408	7	3.35	3.80	UT	Dark greyish brown slightly sandy slightly gravelly clayey SILT.			31	89 s	40 a	25	15		
BH408	11	4.90	5.90	P	Soft dark grey silty CLAY becoming firm dark grey slightly sandy silty CLAY with organic			100	99 n	42 a	24	18		
BH408	15	6.70	7.15	UT	Very soft dark brown slightly sandy silty CLAY.			28	100 n	39 a	25	14		
BH408	19	8.05	9.05	P	Brown slightly sandy clayey SILT.			34	100 n	36 a	22	14		
BH408	20	9.05	1.05	P	Dark greyish brown sandy clayey SILT becoming very soft organic silty CLAY			35	100 n	37 a	22	15		
BH408	25	11.50	11.95	UT	Dark brown slightly gravelly slightly clayey SAND.			24	88 s	24 b	NP			
BH408	37	14.80	15.25	UT	Firm to stiff greyish brown slightly gravelly sandy CLAY.			16	86 s	31 a	22	9		
BH408	43	16.75	17.20	UT	Stiff brown CLAY.			23	100 n	43 a	24	19		
BH408	59	22.00	22.45	D	Brown slightly sandy CLAY.			30	100 n	42 a	20	22		
BH417	3	1.20	2.00	B	Greyish brown slightly sandy gravelly SILT.			20	36 s	37 a	29	8		
BH417	8	2.90	3.35	UT	Soft brown slightly sandy slightly gravelly CLAY.			25	100 n	42 a	22	20		
BH417	10	3.55	4.00	UT	Soft brown mottled grey slightly sandy CLAY.			30	100 n	45 a	23	22		
BH417	12	4.20	4.65	UT	Firm brown slightly sandy CLAY.			33	100 n	42 a	26	16		
BH417	17	6.00	7.00	P	Very soft greyish brown slightly sandy silty CLAY.			37	100 n	38 a	24	14		
BH417	22	8.50	8.95	UT	Soft brown slightly sandy silty CLAY.			32	100 n	38 a	25	13		
BH417	25	9.50	9.95	UT	Soft brownish dark grey slightly sandy slightly gravelly CLAY.			38	94 n	41 a	26	15		

General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See individual test reports for further details.

Key :

p bulk density, linear	W_L Liquid limit	W_P Plastic limit	<425um preparation	p_s particle density
p_d dry density	a 4 point cone test	NP non - plastic	n from natural soil	-g = gas jar
w moisture content	b 1 point cone test	I_P Plasticity Index	s sieved specimen	-p = small pyknometer

QA Ref			Table
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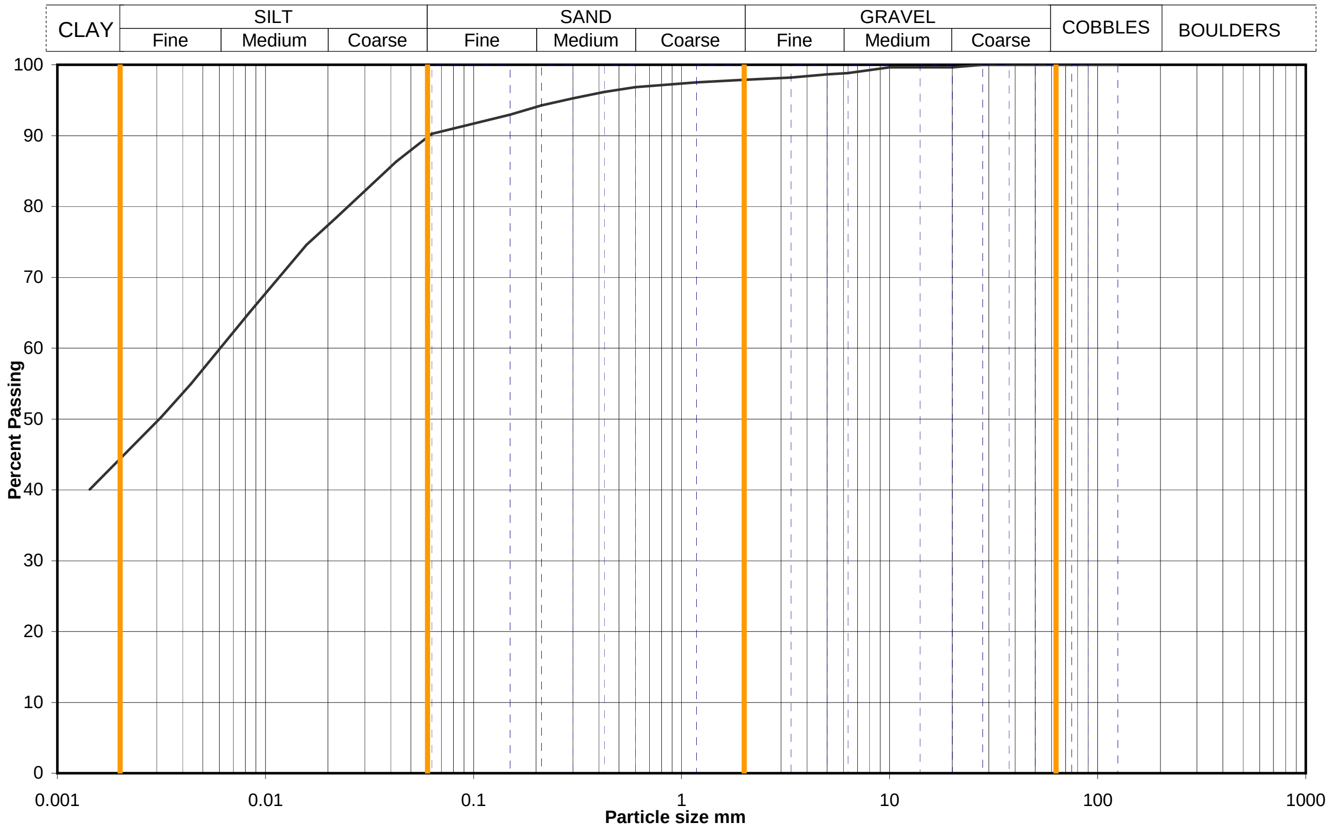
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.20		
			Samp No	3	Type	B
			ID	A5085-1520160125101036		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	90
90	100	0.0424	86
75	100	0.0305	82
63	100	0.0219	78
50	100	0.0158	75
37.5	100	0.0084	65
28	100	0.0044	55
20	100	0.0031	50
14	100	0.0014	40
10	100		
6.3	99		
5.0	99		
3.35	98		
2.00	98		
1.18	98	Particle density, Mg/m3	
0.600	97		
0.425	96	2.65 assumed	
0.300	95	Dry mass of sample, kg	
0.212	94		
0.150	93	6.5	
0.063	90		

Soil description	Brownish grey slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	2	2
*<60mm values to aid description only	Sand	8	8
	Silt	46	46
	Clay	44	44

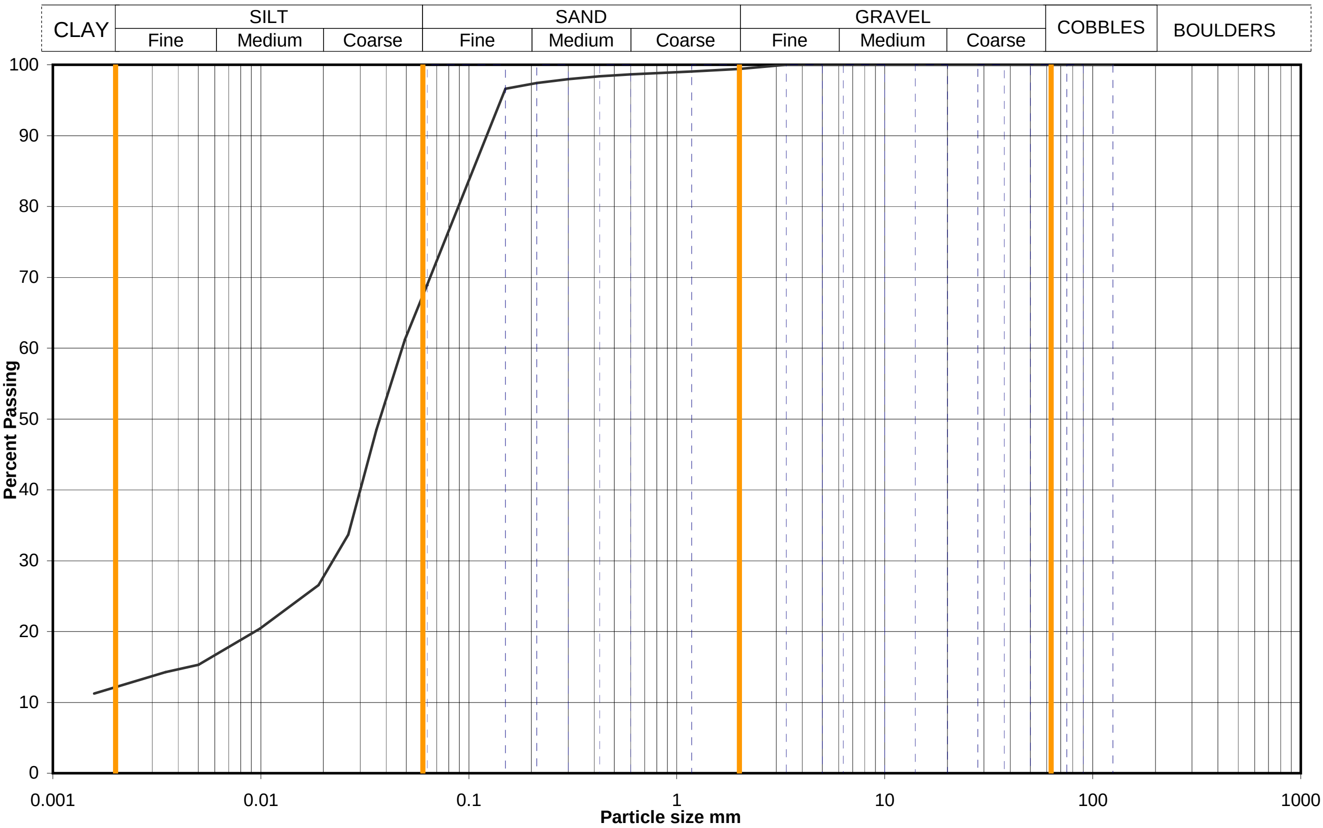
Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:10	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.75		
			Samp No	9	Type	P
			ID	A5085-1520160125101220		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	69
90	100	0.0493	61
75	100	0.0360	48
63	100	0.0264	34
50	100	0.0189	27
37.5	100	0.0099	20
28	100	0.0050	15
20	100	0.0035	14
14	100	0.0016	11
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	99		
1.18	99	Particle density, Mg/m3	
0.600	99		
0.425	98	2.65	assumed
0.300	98	Dry mass of sample, kg	
0.212	97		
0.150	97	6.5	
0.063	69		

Soil description	Greyish brown slightly sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	1	1
	Sand	32	32
	Silt	55	55
	Clay	12	12

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref
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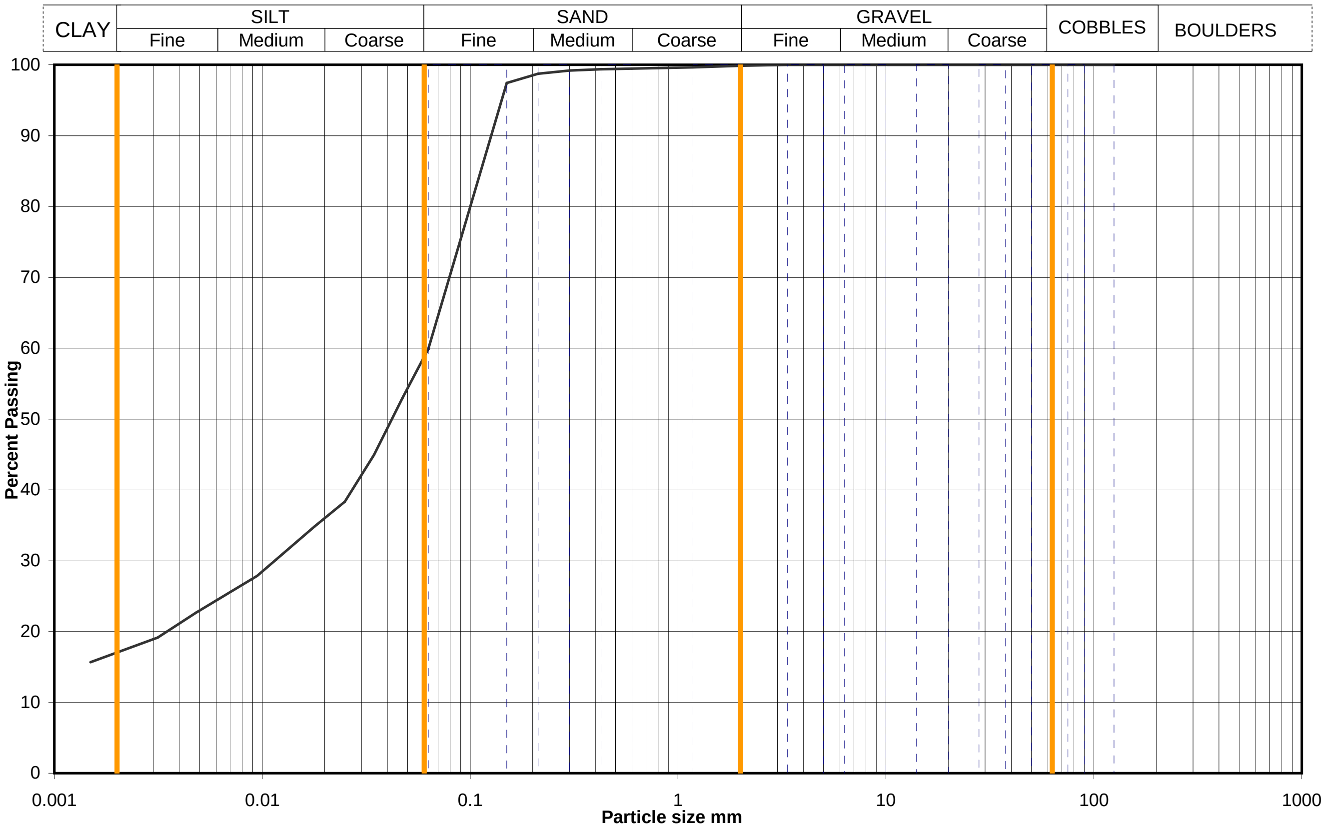
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.75		
			Samp No	11	Type	UT
			ID	A5085-1520160125101401		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	60
90	100	0.0472	53
75	100	0.0344	45
63	100	0.0250	38
50	100	0.0179	35
37.5	100	0.0095	28
28	100	0.0048	23
20	100	0.0031	19
14	100	0.0015	16
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	97	3.7	
0.063	60		

Soil description	Brownish dark grey sandy slightly clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	41	41
	Silt	42	42
	Clay	17	17

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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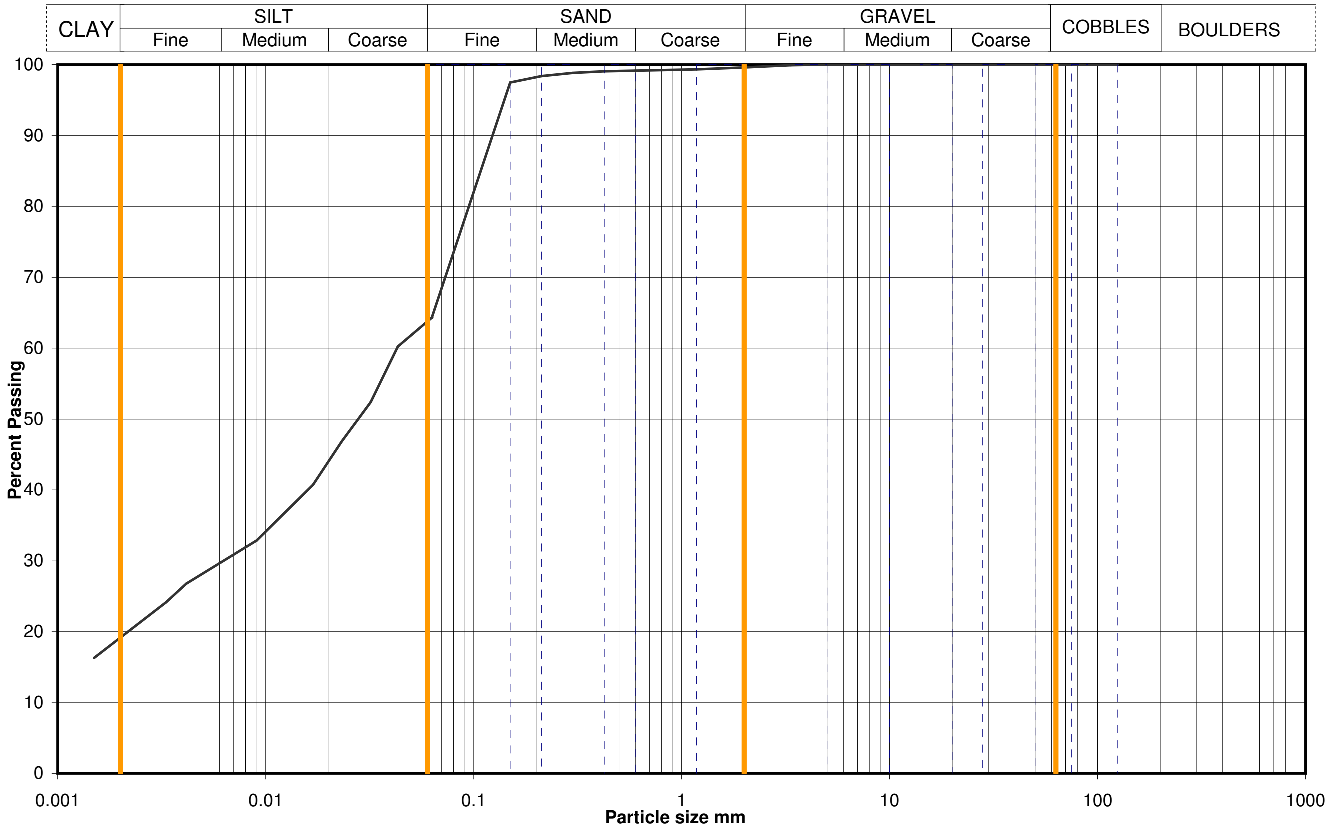
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.40		
			Samp No	13	Type	P
			ID	A5085-1520160125101438		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	64
90	100	0.0432	60
75	100	0.0319	52
63	100	0.0232	47
50	100	0.0169	41
37.5	100	0.0091	33
28	100	0.0042	27
20	100	0.0033	24
14	100	0.0015	16
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	99	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65 assumed	
0.300	99	Dry mass of sample, kg	
0.212	98		
0.150	97		
0.063	64	7.1	

Soil description	Greyish brown sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	36	36
	Silt	45	45
	Clay	19	19

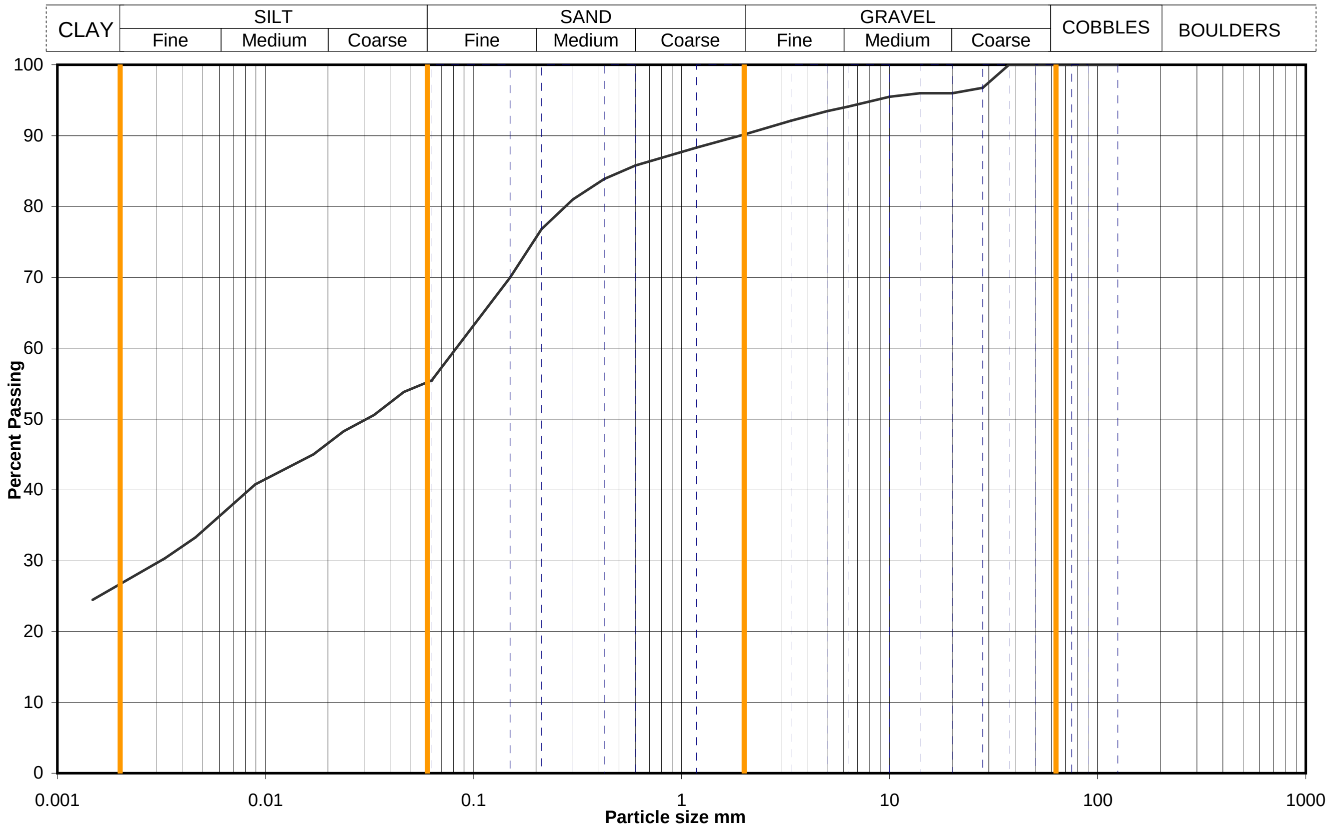
Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:30/03/2016 08:54
Figure	**PSD**		

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.95		
			Samp No	24	Type	UT
			ID	A5085-1520160125101741		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	55
90	100	0.0463	54
75	100	0.0332	51
63	100	0.0237	48
50	100	0.0170	45
37.5	100	0.0089	41
28	97	0.0046	33
20	96	0.0033	30
14	96	0.0015	24
10	95		
6.3	94		
5.0	93		
3.35	92		
2.00	90		
1.18	88	Particle density, Mg/m3	
0.600	86		
0.425	84	2.65	assumed
0.300	81	Dry mass of sample, kg	
0.212	77		
0.150	70		
0.063	55	5.0	

Soil description	Very stiff greyish brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	10	10
	Sand	35	35
	Silt	28	28
	Clay	27	27

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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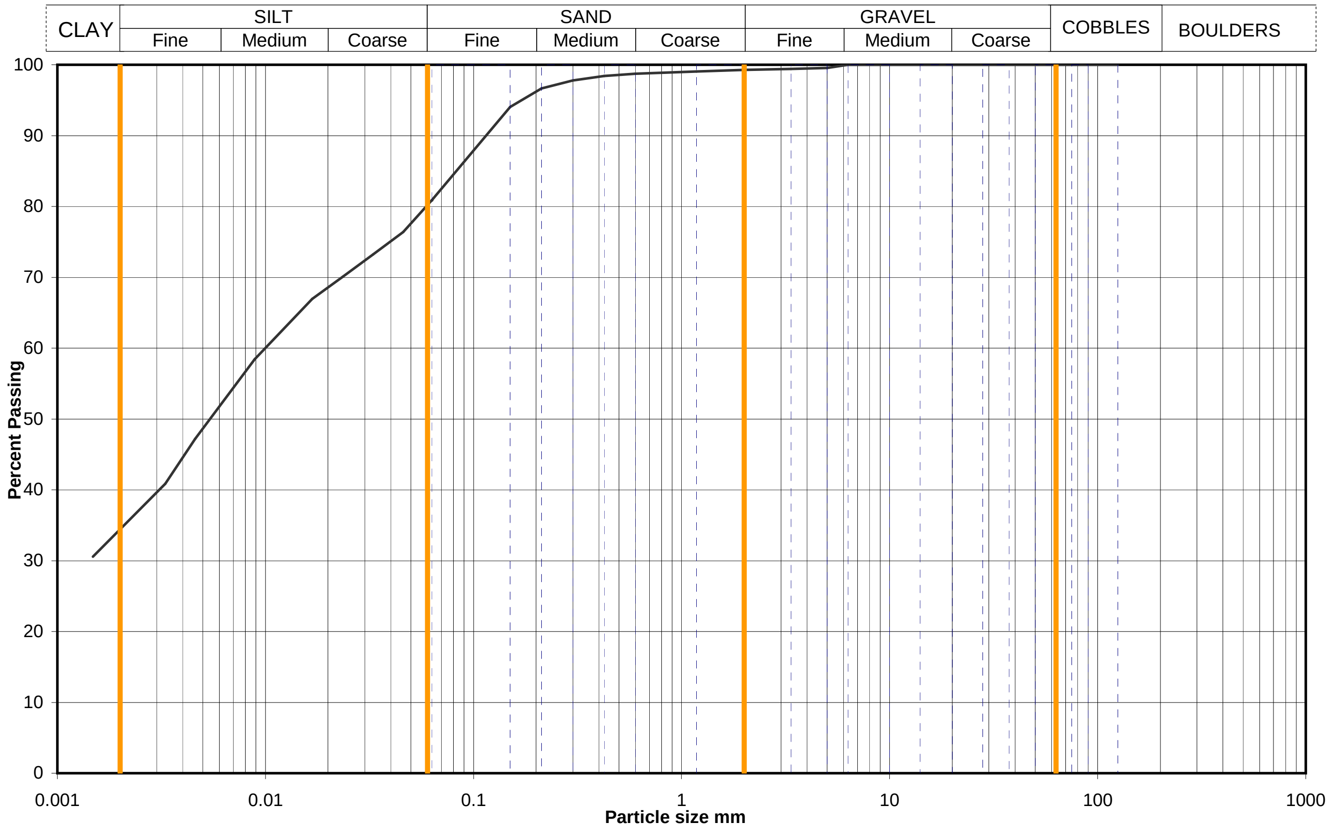
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	11.60		
			Samp No	26	Type	UT
			ID	A5085-1520160125101813		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	81
90	100	0.0460	76
75	100	0.0329	73
63	100	0.0235	70
50	100	0.0168	67
37.5	100	0.0089	58
28	100	0.0046	47
20	100	0.0033	41
14	100	0.0015	31
10	100		
6.3	100		
5.0	100		
3.35	99		
2.00	99		
1.18	99	Particle density, Mg/m3	
0.600	99		
0.425	98	2.65	assumed
0.300	98	Dry mass of sample, kg	
0.212	97		
0.150	94	5.6	
0.063	81		

Soil description	Very stiff brown slightly sandy slightly gravelly silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	1	1
	Sand	19	19
	Silt	46	46
	Clay	34	34

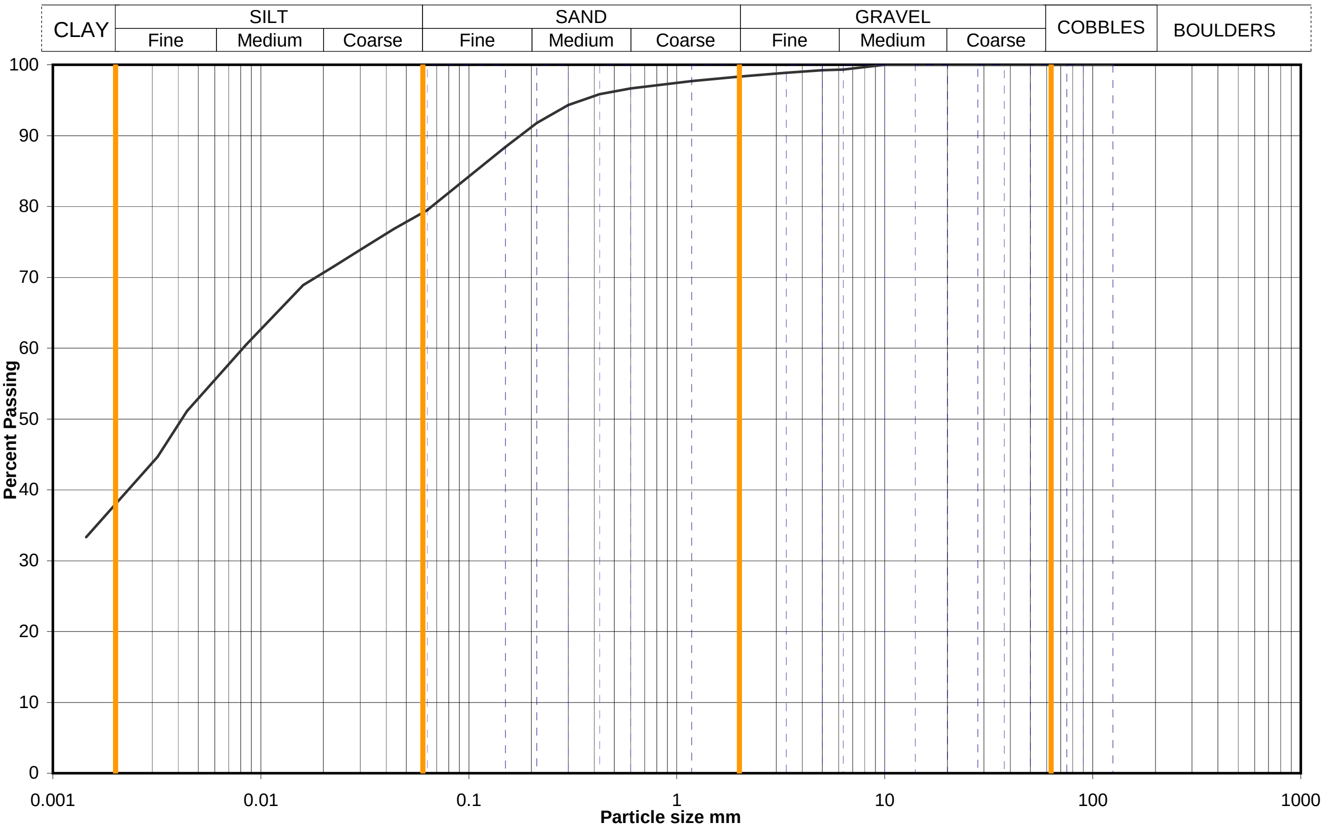
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Printed:18/03/2016 11:10	**Figure** PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402			
Project Name	A63 CASTLE STREET		Depth (m BGL)	13.30			
			Samp No	30	Type	UT	
			ID	A5085-1520160125101930			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	79
90	100	0.0437	77
75	100	0.0312	74
63	100	0.0223	72
50	100	0.0160	69
37.5	100	0.0085	61
28	100	0.0044	51
20	100	0.0032	45
14	100	0.0014	33
10	100		
6.3	99		
5.0	99		
3.35	99		
2.00	98		
1.18	98	Particle density, Mg/m3	
0.600	97		
0.425	96	2.65	assumed
0.300	94	Dry mass of sample, kg	
0.212	92		
0.150	88		
0.063	79	4.8	

Soil description	Stiff greyish brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	2	2
	Sand	19	19
	Silt	41	41
	Clay	38	38

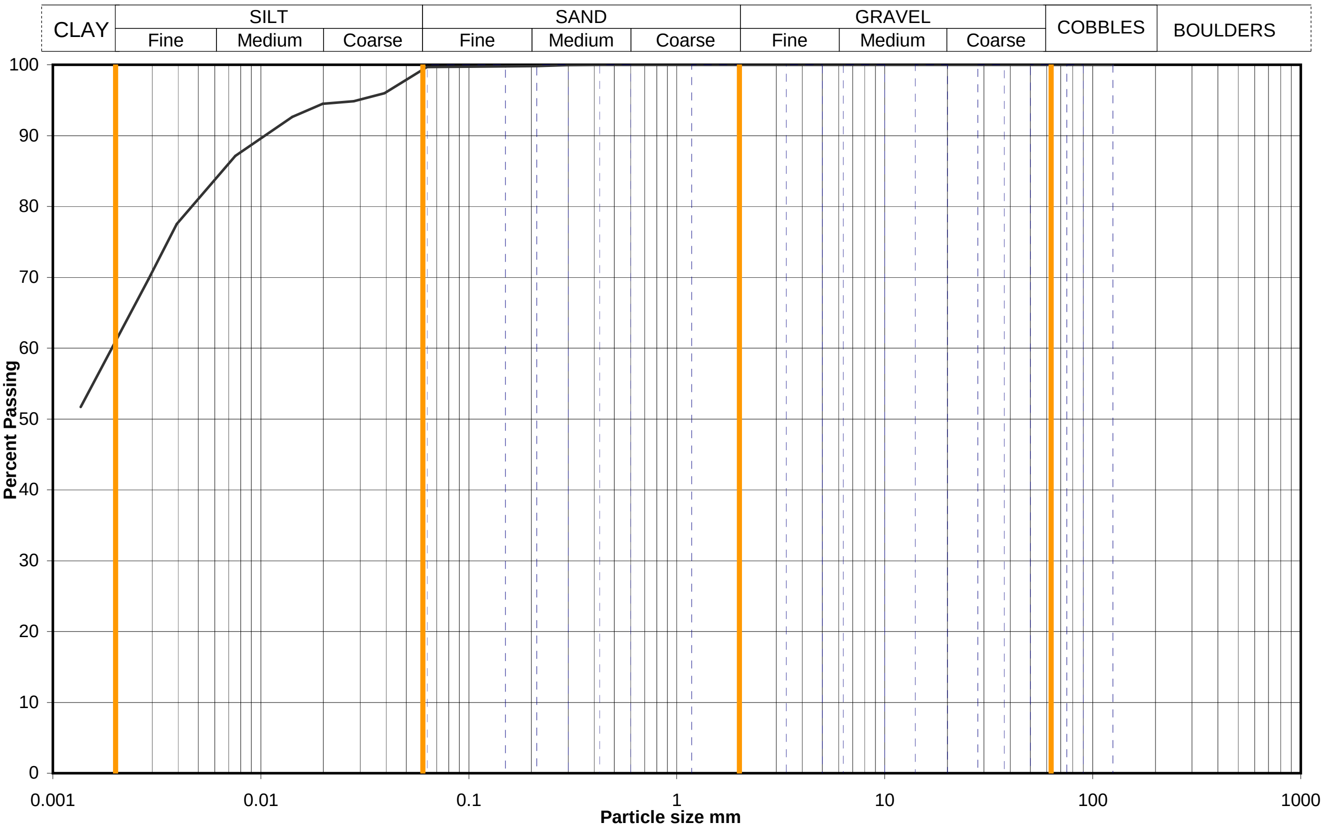
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:10	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	15.90		
			Samp No	38	Type	UT
			ID	A5085-1520160125102112		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	100
90	100	0.0393	96
75	100	0.0280	95
63	100	0.0198	95
50	100	0.0142	93
37.5	100	0.0075	87
28	100	0.0039	78
20	100	0.0029	70
14	100	0.0014	52
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	100	4.2	
0.063	100		

Soil description	Stiff laminated greyish brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	1	1
	Silt	38	38
	Clay	61	61

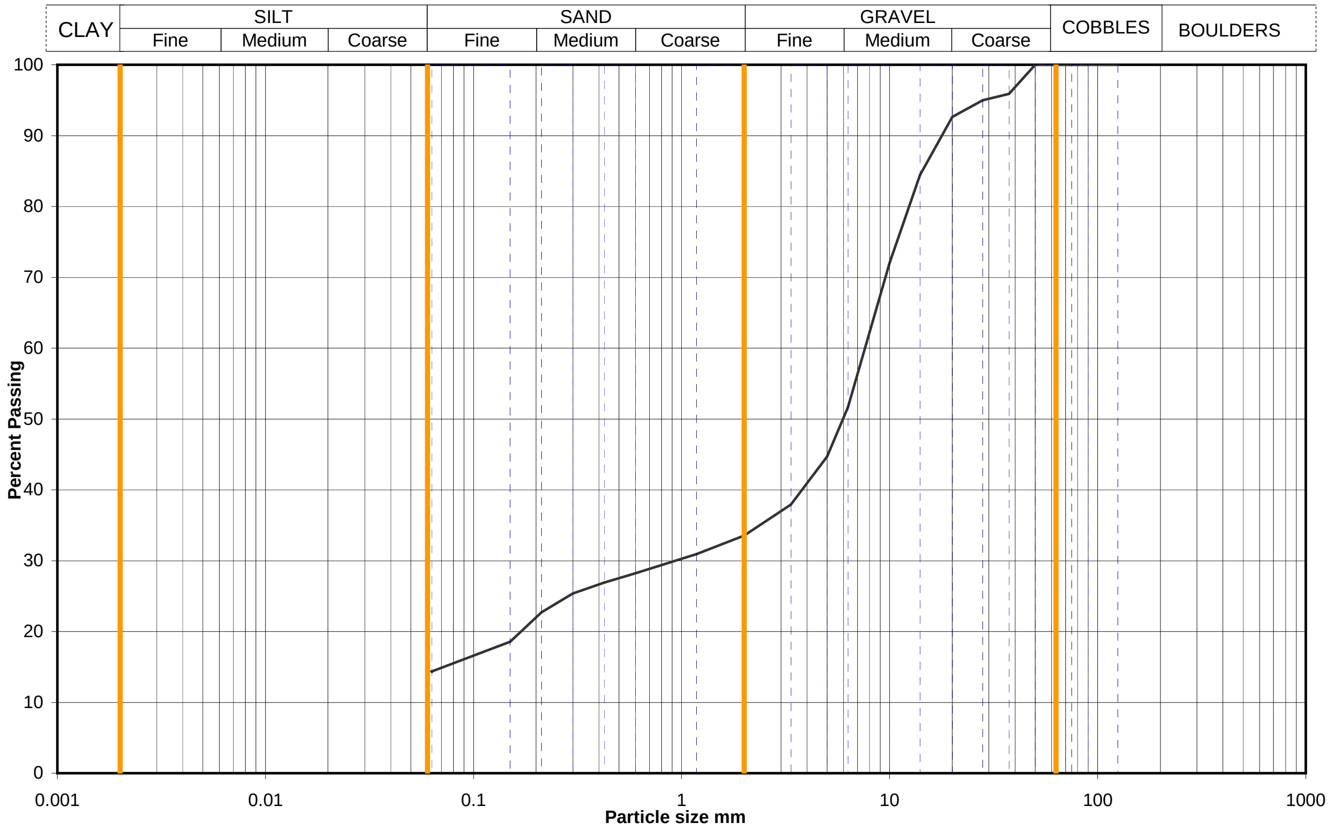
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:10	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	20.20		
			Samp No	52	Type	B
			ID	A5085-1520160125102553		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	95		
20	93		
14	84		
10	72		
6.3	52		
5.0	45		
3.35	38		
2.00	34		
1.18	31		
0.600	28		
0.425	27		
0.300	25	Dry mass of sample, kg	
0.212	23		
0.150	19	6.9	
0.063	14		

Soil description	Brownish grey sandy silty GRAVEL..		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	66	66
	Sand	19	19
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	15	15

Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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Figure
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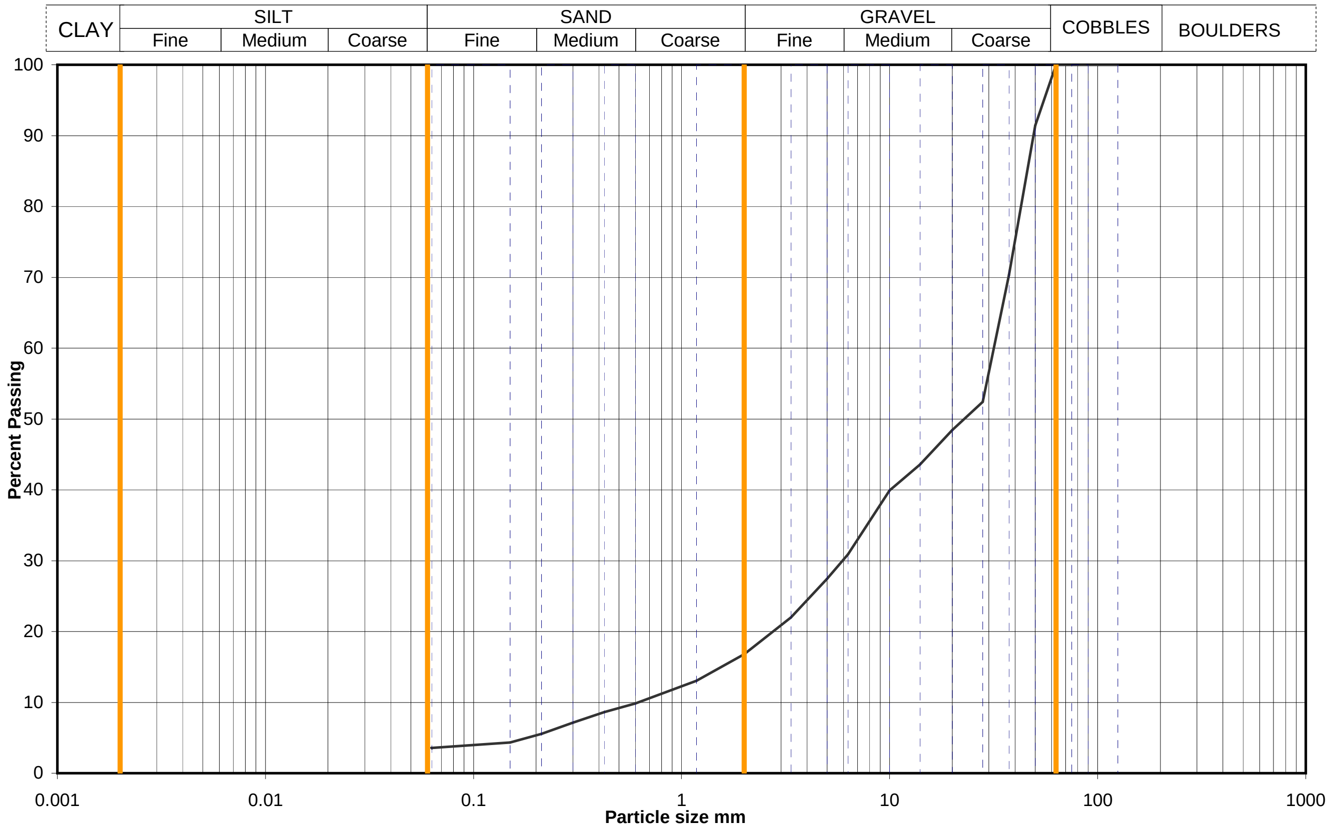
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH402			
Project Name	A63 CASTLE STREET		Depth (m BGL)	22.00			
			Samp No	56	Type	B	
			ID	A5085-1520160125102623			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	91		
37.5	70		
28	52		
20	48		
14	44		
10	40		
6.3	31		
5.0	27		
3.35	22		
2.00	17		
1.18	13		
0.600	10		
0.425	9		
0.300	7	Dry mass of sample, kg	
0.212	6		
0.150	4	6.8	
0.063	4		

Soil description	Cream CHALK composed of sandy silty gravel.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	83	83
	Sand	13	13
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	4	4

Uniformity Coefficient	D_{60} / D_{10}	51

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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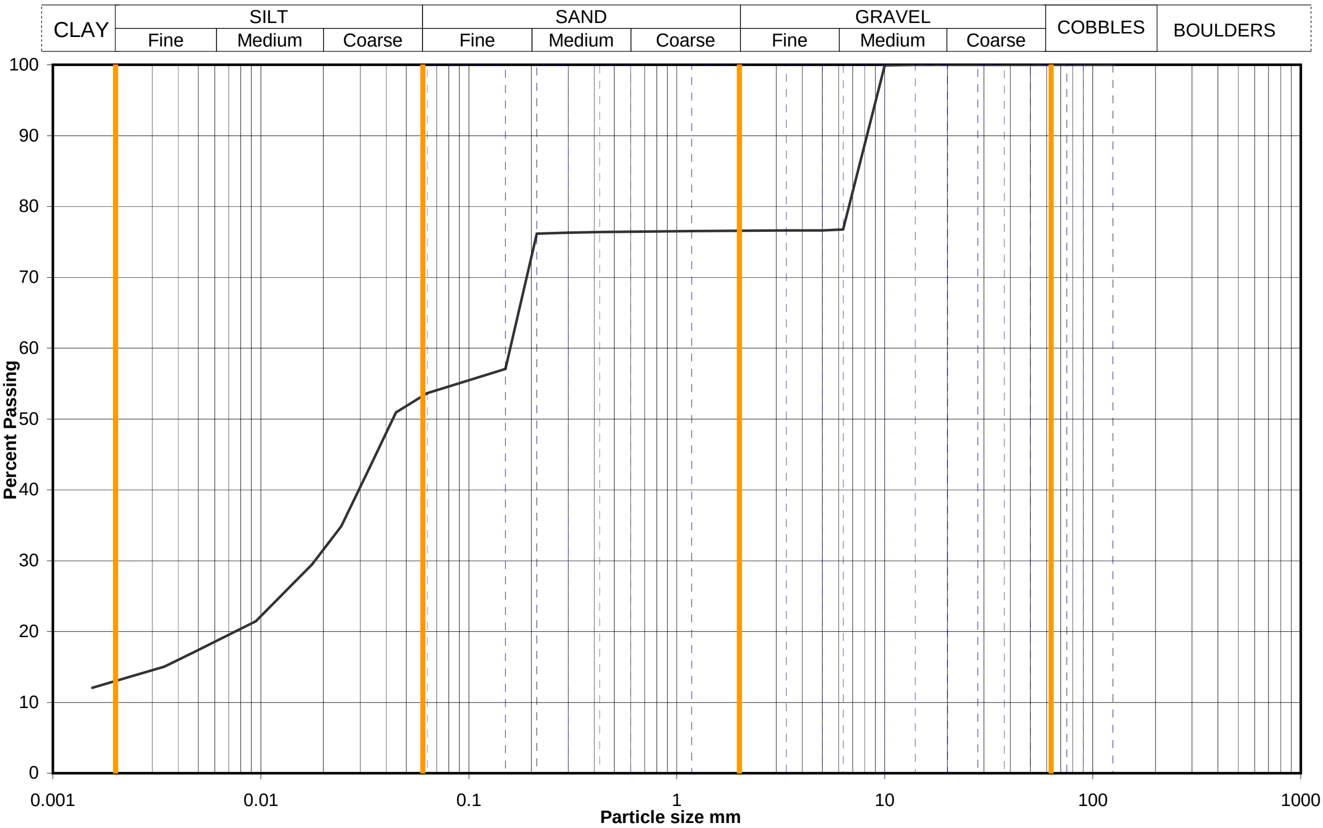
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.60			
			Samp No	11	Type	B	
			ID	A5085-1520160119124449			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	54
90	100	0.0446	51
75	100	0.0330	43
63	100	0.0243	35
50	100	0.0177	29
37.5	100	0.0095	21
28	100	0.0048	17
20	100	0.0034	15
14	100	0.0015	12
10	100		
6.3	77		
5.0	77		
3.35	77		
2.00	77		
1.18	77	Particle density, Mg/m3	
0.600	76		
0.425	76	2.65	assumed
0.300	76	Dry mass of sample, kg	
0.212	76		
0.150	57	12.6	
0.063	54		

Soil description	Grey and brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	23	23
	Sand	23	23
	Silt	41	41
	Clay	13	13

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Figure
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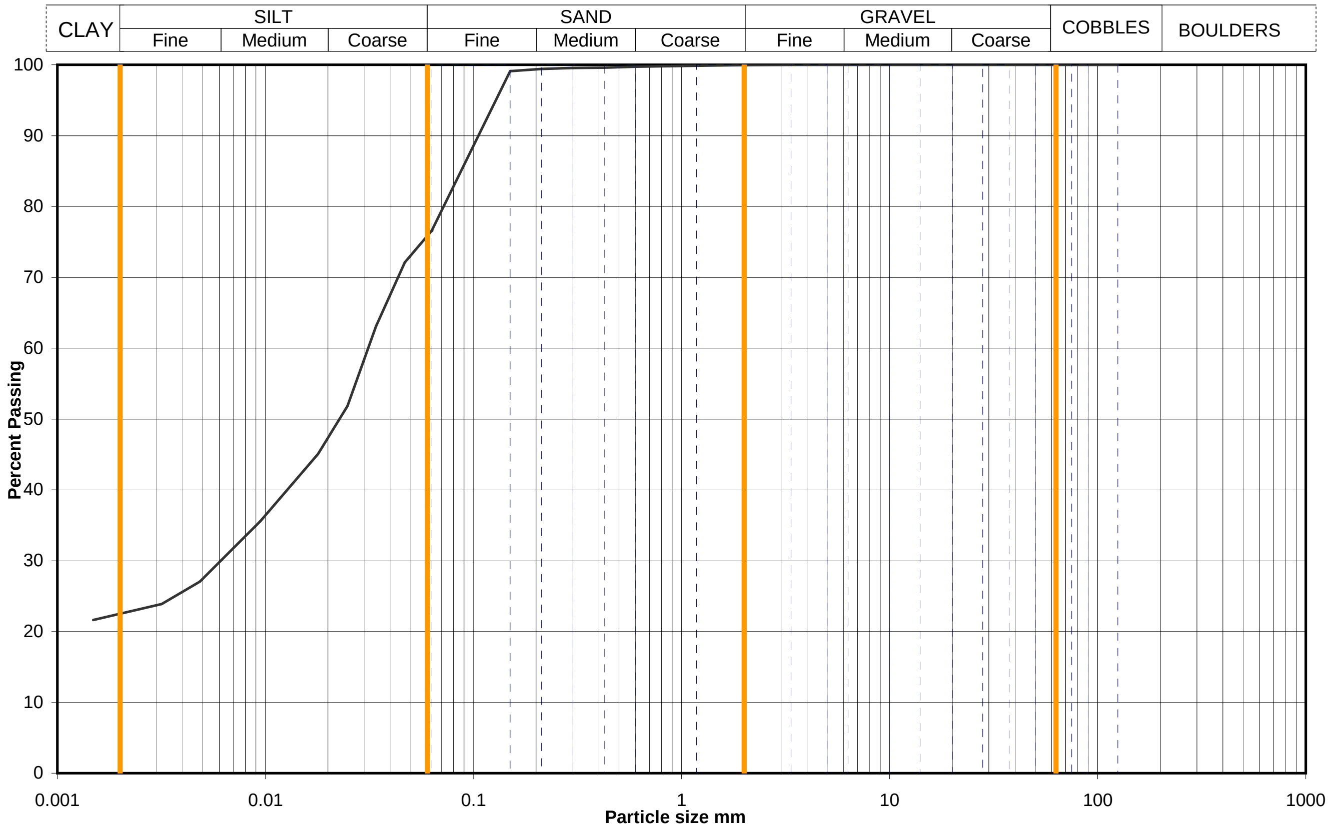
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00			
			Samp No	13	Type	P	
			ID	A5085-1520160119124513			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	77
90	100	0.0467	72
75	100	0.0339	63
63	100	0.0248	52
50	100	0.0179	45
37.5	100	0.0095	36
28	100	0.0048	27
20	100	0.0032	24
14	100	0.0015	22
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	99		
0.150	99	8.6	
0.063	77		

Soil description	Brown slightly sandy silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	24	24
	Silt	53	53
	Clay	23	23

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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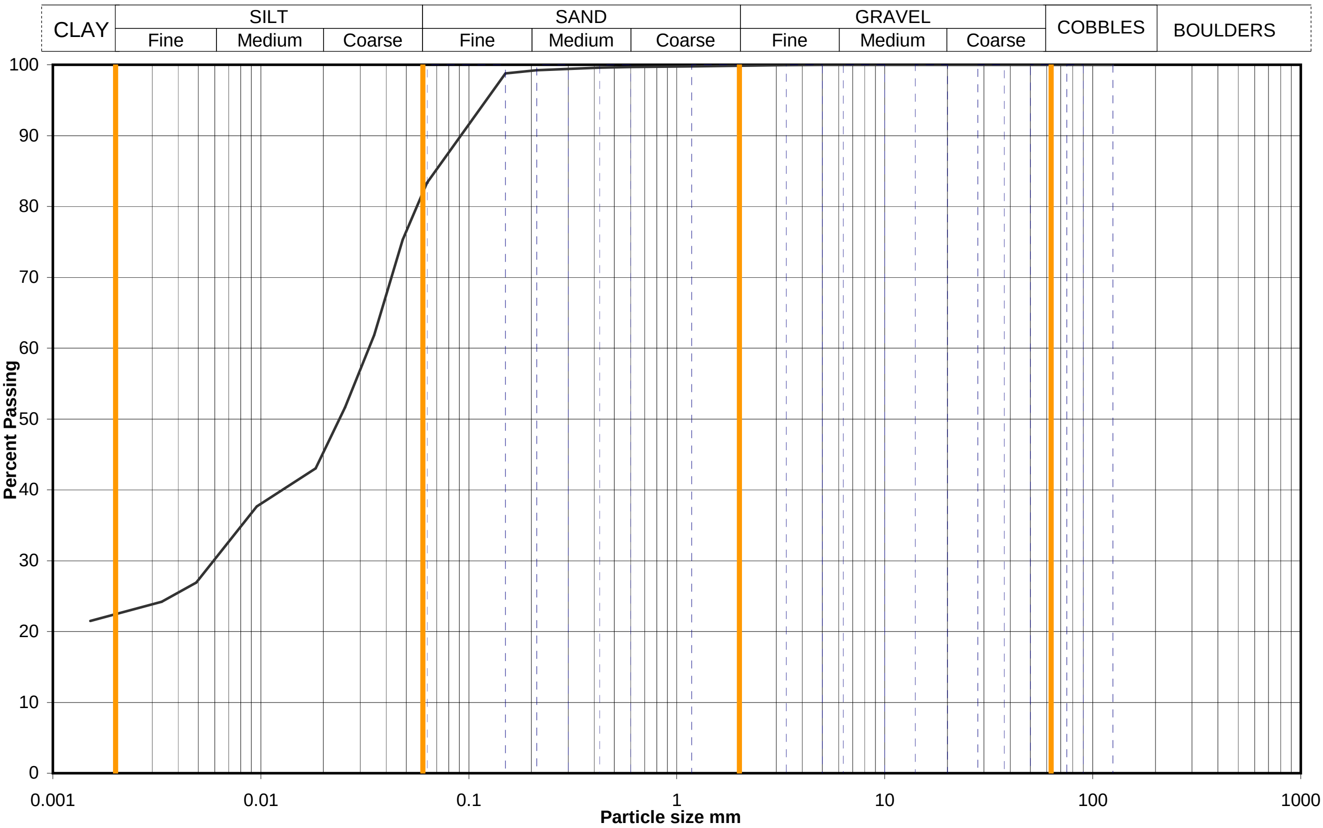
Figure **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00			
			Samp No	17	Type	UT	
			ID	A5085-1520160119124600			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	83
90	100	0.0480	75
75	100	0.0351	62
63	100	0.0254	52
50	100	0.0183	43
37.5	100	0.0096	38
28	100	0.0049	27
20	100	0.0033	24
14	100	0.0015	22
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65 assumed	
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	4.2	
0.063	83		

Soil description	Very soft brownish dark grey slightly sandy silty CLAY.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	18	18
	Silt	59	59
	Clay	23	23

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Figure
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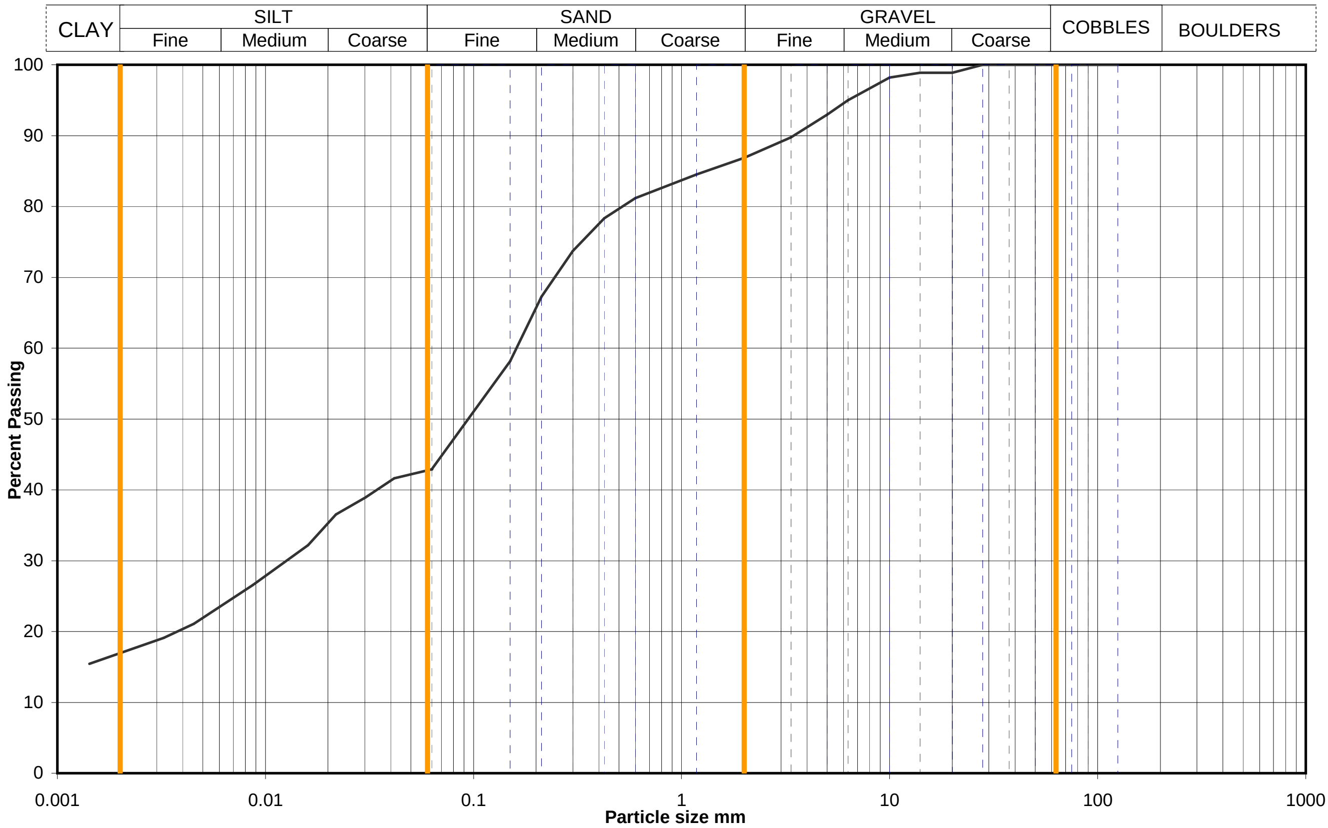
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.30		
			Samp No	20	Type	UT
			ID	A5085-1520160119124647		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	43
90	100	0.0416	42
75	100	0.0302	39
63	100	0.0218	37
50	100	0.0161	32
37.5	100	0.0087	27
28	100	0.0045	21
20	99	0.0032	19
14	99	0.0014	15
10	98		
6.3	95		
5.0	93		
3.35	90		
2.00	87		
1.18	85	Particle density, Mg/m3	
0.600	81		
0.425	78	2.65	assumed
0.300	74	Dry mass of sample, kg	
0.212	67		
0.150	58	6.2	
0.063	43		

Soil description	Soft brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	13	13
	Sand	44	44
*<60mm values to aid description only	Silt	26	26
	Clay	17	17

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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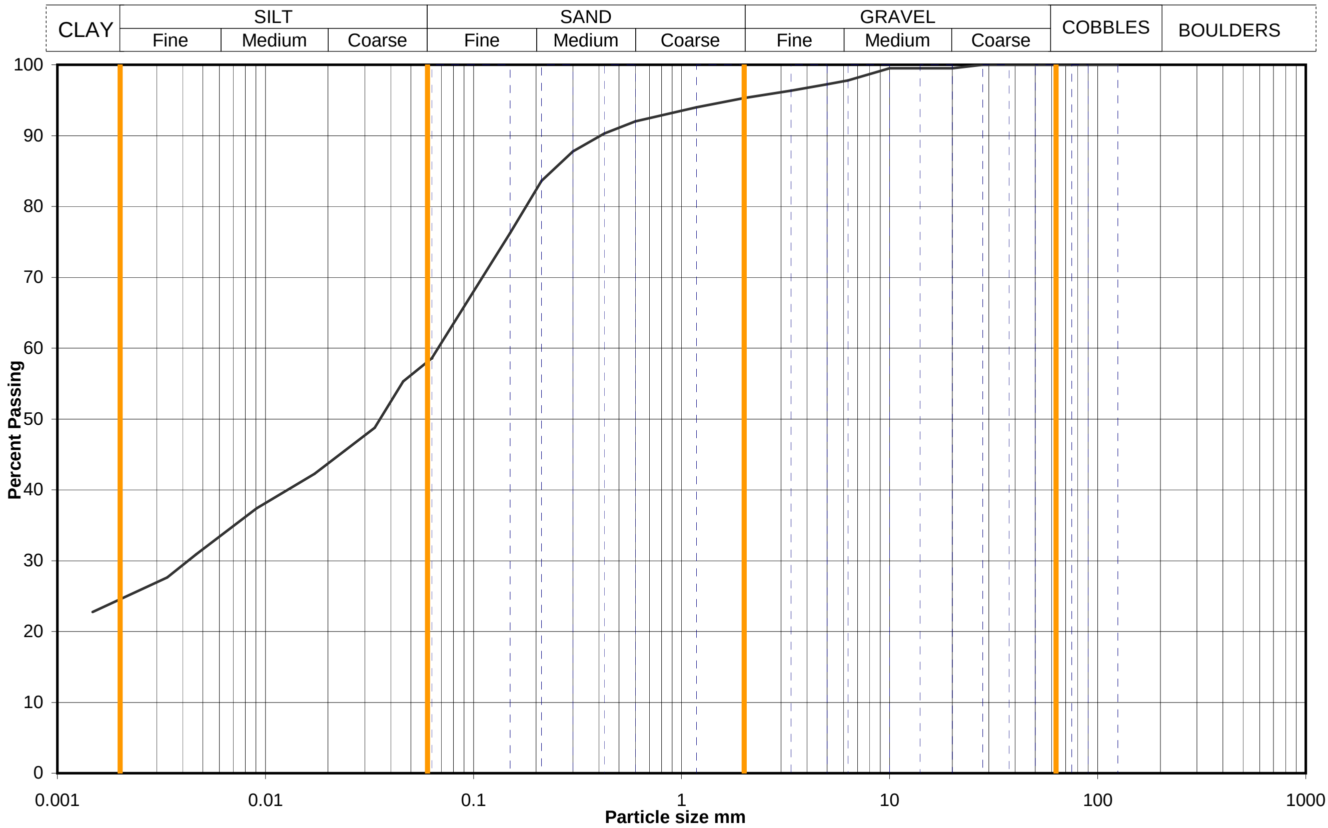
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	11.25			
			Samp No	26	Type	B	
			ID	A5085-1520160119124821			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	59
90	100	0.0460	55
75	100	0.0335	49
63	100	0.0240	46
50	100	0.0172	42
37.5	100	0.0091	37
28	100	0.0046	31
20	100	0.0034	28
14	100	0.0015	23
10	100		
6.3	98		
5.0	97		
3.35	96		
2.00	95		
1.18	94	Particle density, Mg/m3	
0.600	92		
0.425	90	2.65	assumed
0.300	88	Dry mass of sample, kg	
0.212	84		
0.150	76	10.7	
0.063	59		

Soil description	Brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	5	5
	Sand	37	37
	Silt	33	33
	Clay	25	25

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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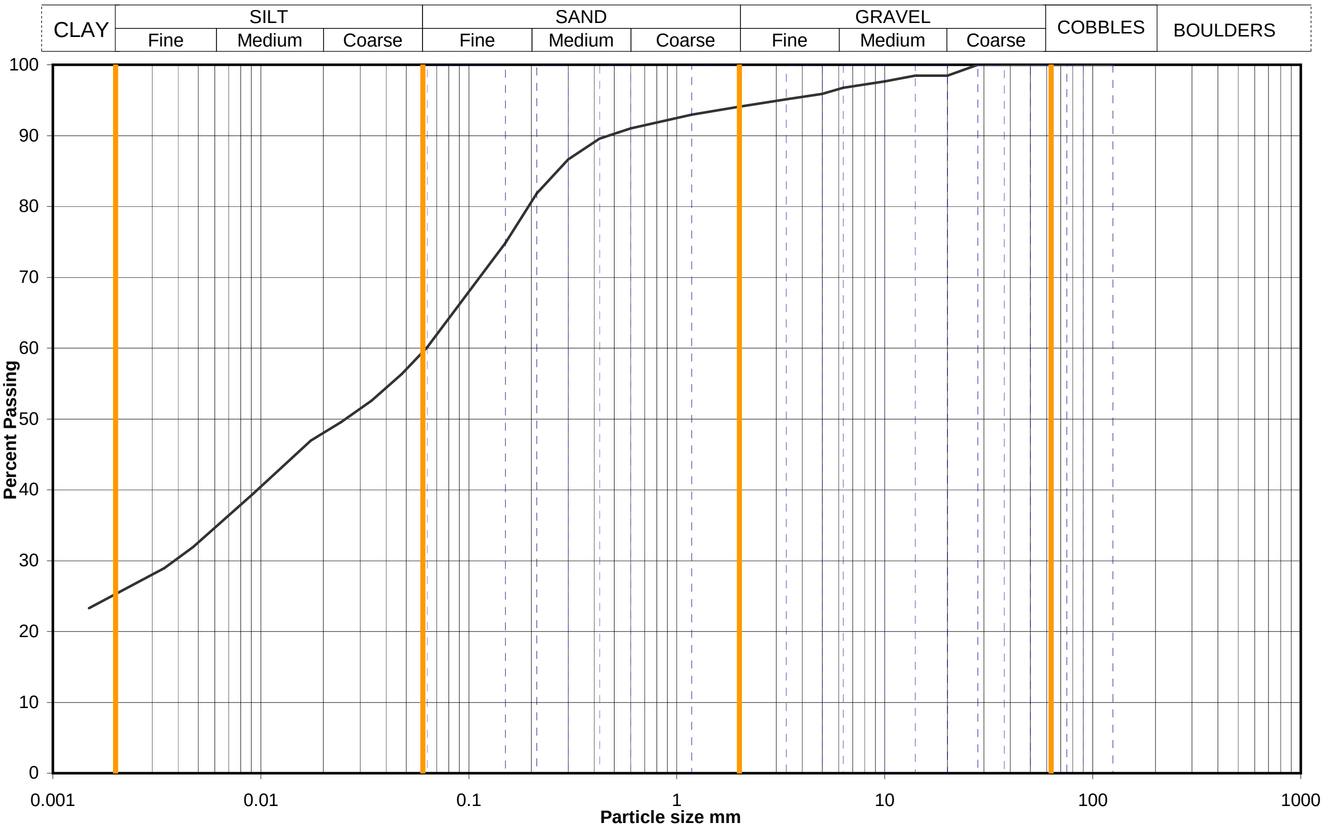
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	13.20			
			Samp No	31	Type	B	
			ID	A5085-1520160119125005			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	60
90	100	0.0475	56
75	100	0.0341	53
63	100	0.0243	50
50	100	0.0174	47
37.5	100	0.0092	39
28	100	0.0047	32
20	98	0.0034	29
14	98	0.0015	23
10	98		
6.3	97		
5.0	96		
3.35	95		
2.00	94		
1.18	93	Particle density, Mg/m3	
0.600	91		
0.425	90	2.65	assumed
0.300	87	Dry mass of sample, kg	
0.212	82		
0.150	75	9.6	
0.063	60		

Soil description	Greyish brown slightly gravelly sandy silty CLAY.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	6	6
*<60mm values to aid description only	Sand	35	35
	Silt	34	34
	Clay	25	25

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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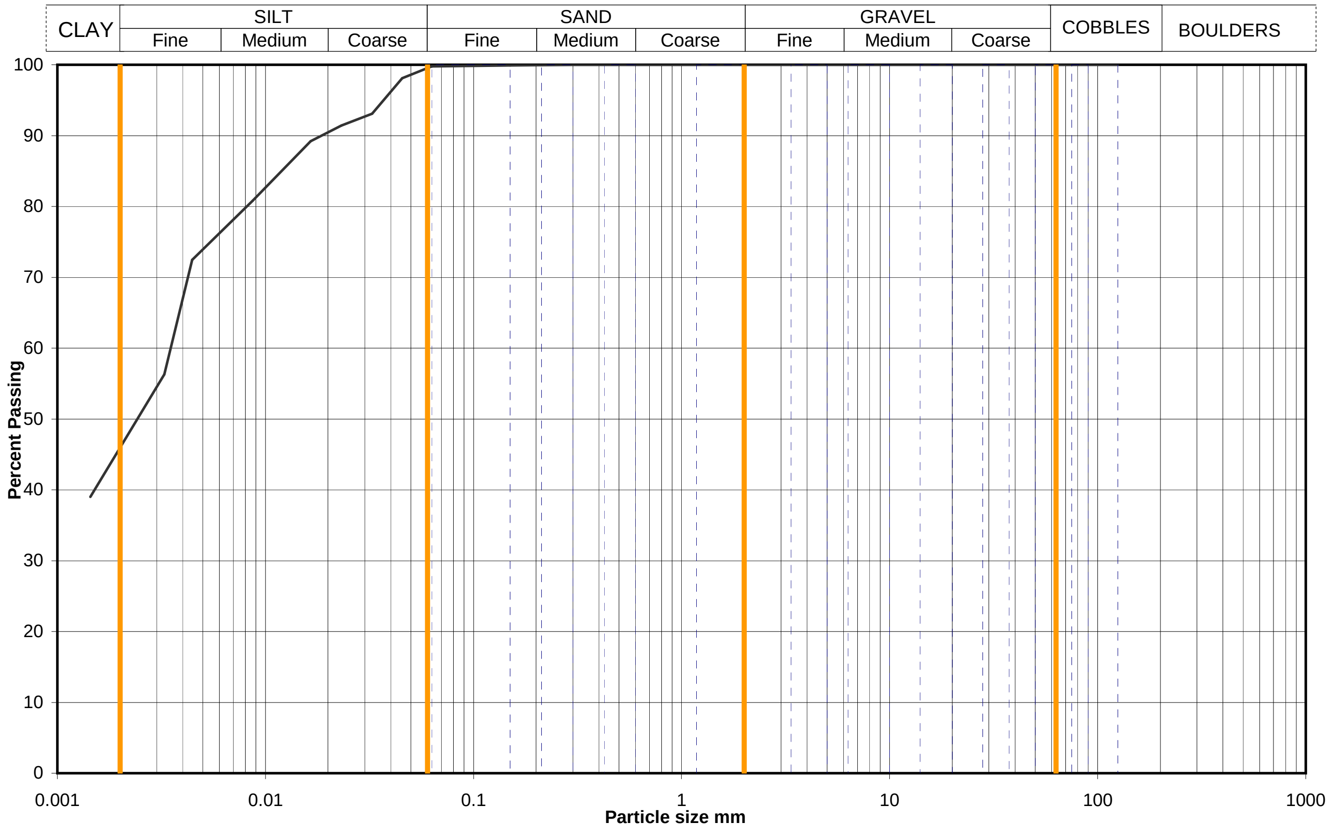
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.35		
			Samp No	40	Type	UT
			ID	A5085-1520160120111310		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	100
90	100	0.0455	98
75	100	0.0326	93
63	100	0.0232	91
50	100	0.0165	89
37.5	100	0.0087	81
28	100	0.0044	72
20	100	0.0033	56
14	100	0.0014	39
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	100	4.1	
0.063	100		

Soil description	Firm brown CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	0	0
	Silt	54	54
	Clay	46	46

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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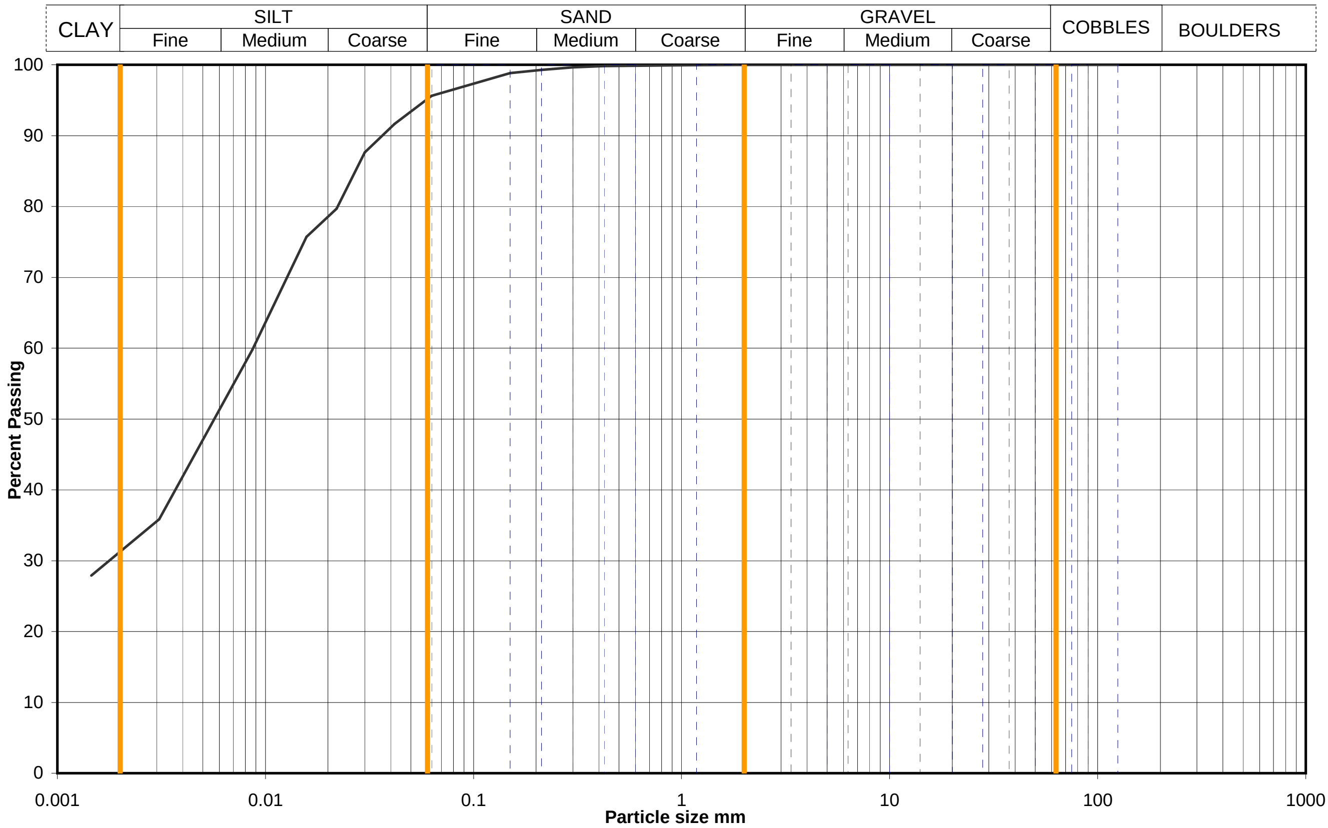
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	19.60			
			Samp No	50	Type	UT	
			ID	A5085-1520160120111454			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	96
90	100	0.0417	92
75	100	0.0300	88
63	100	0.0219	80
50	100	0.0158	76
37.5	100	0.0086	60
28	100		422
20	100	0.0031	36
14	100	0.0015	28
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65 assumed	
0.300	100	Dry mass of sample, kg	
0.212	99		
0.150	99		
0.063	96	5.4	

Soil description	Firm brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	5	5
	Silt	64	64
	Clay	31	31

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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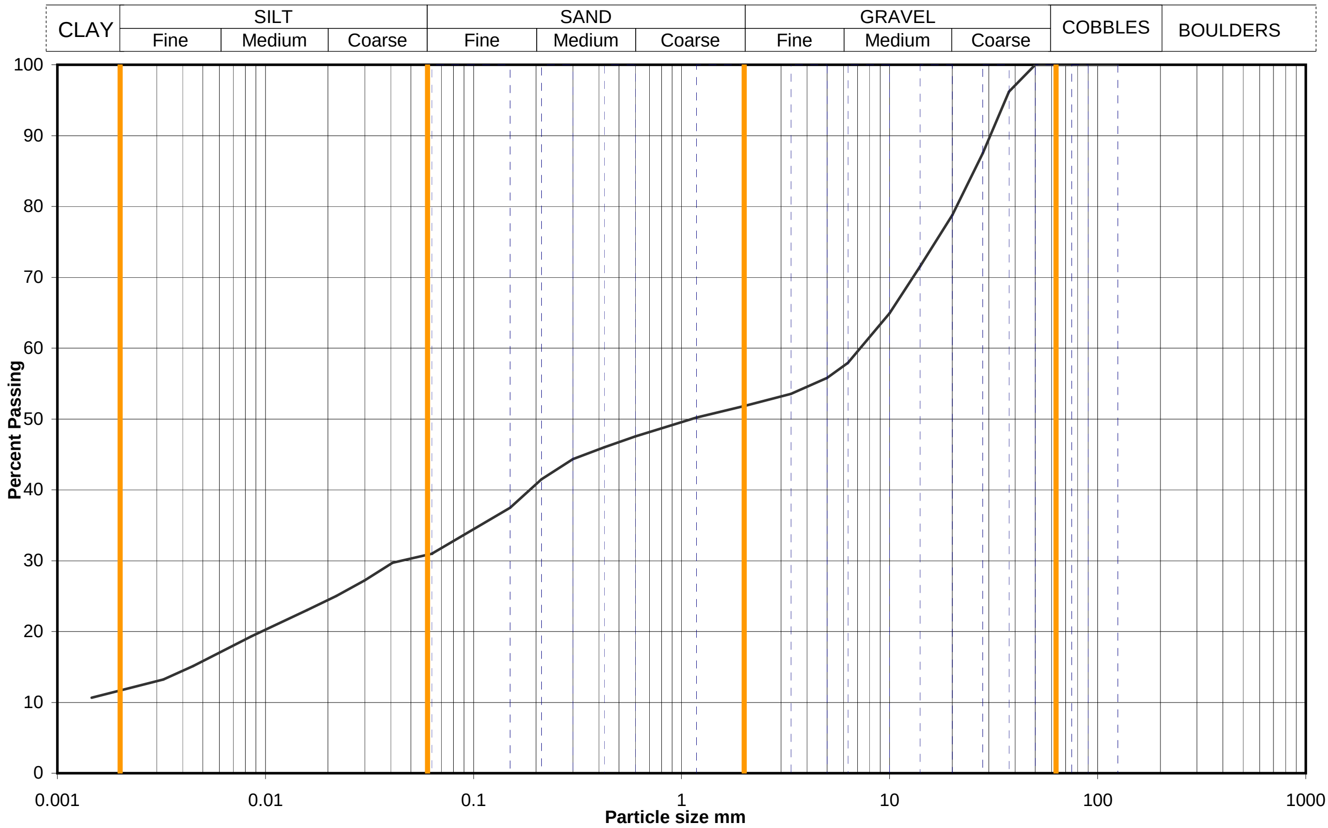
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	21.75		
			Samp No	59	Type	B
			ID	A5085-1520160120111635		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	31
90	100	0.0409	30
75	100	0.0300	27
63	100	0.0219	25
50	100	0.0159	23
37.5	96	0.0086	19
28	88	0.0045	15
20	79	0.0032	13
14	71	0.0015	11
10	65		
6.3	58		
5.0	56		
3.35	54		
2.00	52		
1.18	50	Particle density, Mg/m3	
0.600	48		
0.425	46	2.65	assumed
0.300	44	Dry mass of sample, kg	
0.212	42		
0.150	37	8.2	
0.063	31		

Soil description	Greyish brown slightly sandy gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	48	48
*<60mm values to aid description only	Sand	21	21
	Silt	19	19
	Clay	12	12

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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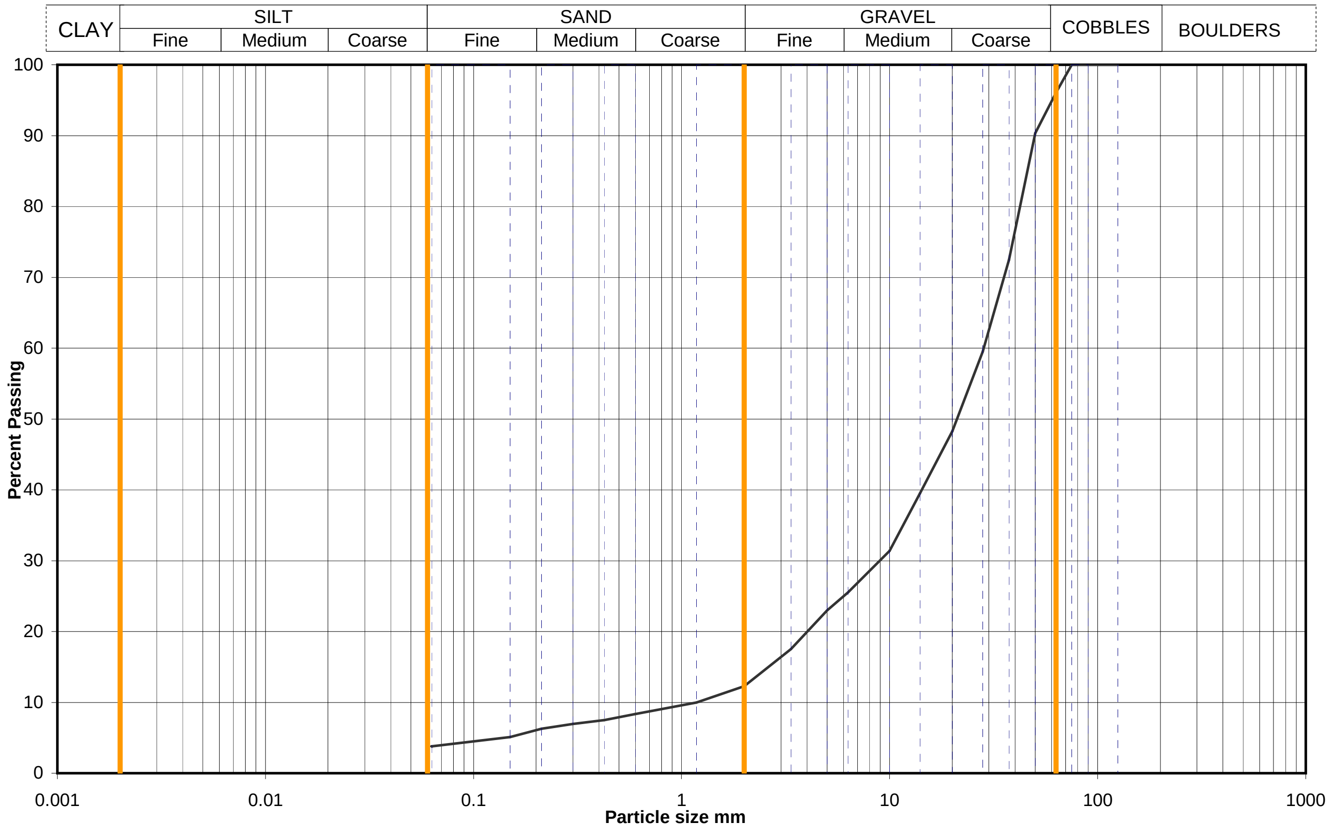
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	22.55			
			Samp No	63	Type	B	
			ID	A5085-1520160120111700			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	96		
50	90		
37.5	72		
28	59		
20	48		
14	40		
10	31		
6.3	26		
5.0	23		
3.35	18		
2.00	12		
1.18	10		
0.600	8		
0.425	8		
0.300	7	Dry mass of sample, kg	
0.212	6		
0.150	5	12.5	
0.063	4		

Soil description	Light brown and cream CHALK composed of sandy silty gravel with one cobble.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	4	0
	Gravel	84	88
	Sand	9	9
	Silt	silt+clay =	
	Clay	3	3

Uniformity Coefficient	D_{60} / D_{10}	24

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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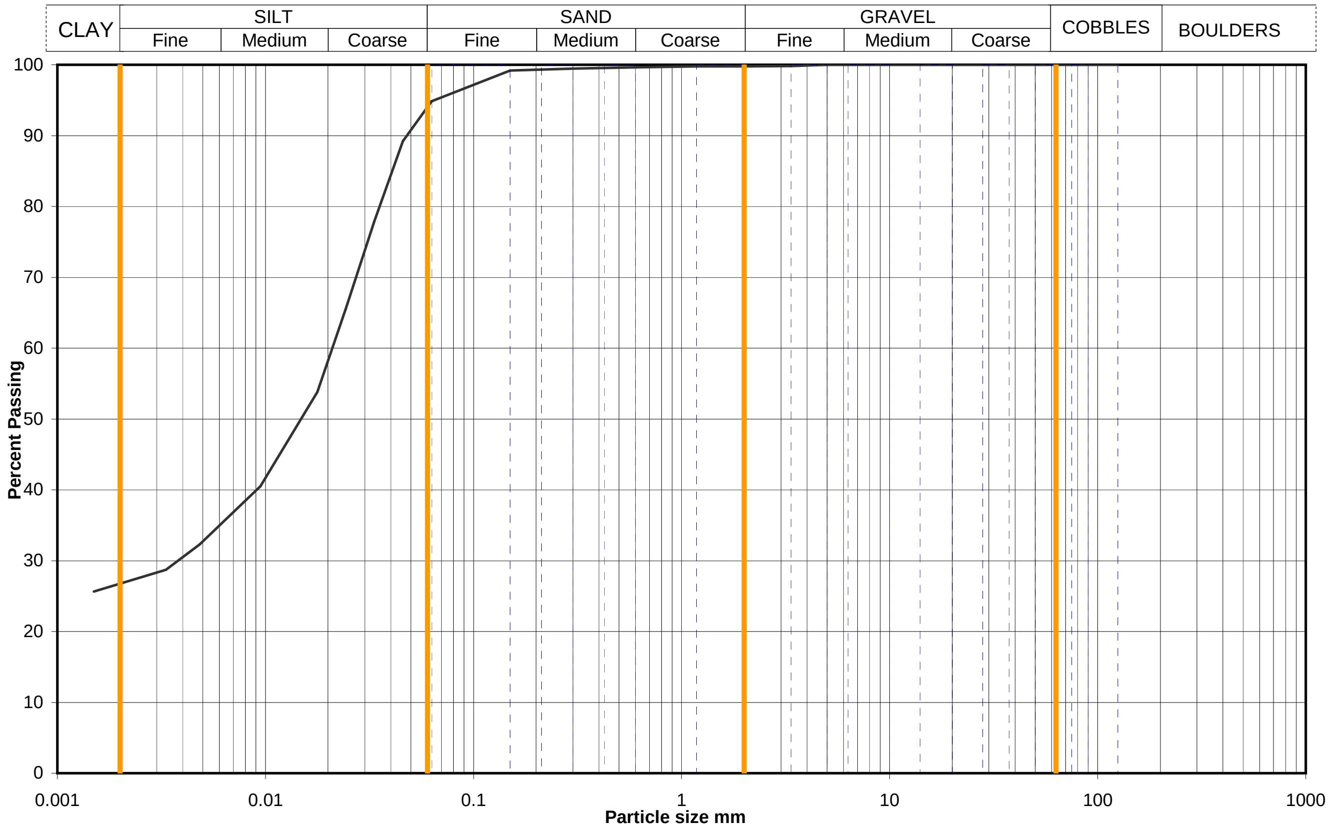
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	2.50		
			Samp No	5	Type	UT
			ID	A5085-1520160126094427		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	95
90	100	0.0457	89
75	100	0.0334	78
63	100	0.0244	66
50	100	0.0178	54
37.5	100	0.0095	40
28	100	0.0048	32
20	100	0.0033	29
14	100	0.0015	26
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	2.4	
0.063	95		

Soil description	Soft brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	6	6
	Silt	67	67
	Clay	27	27

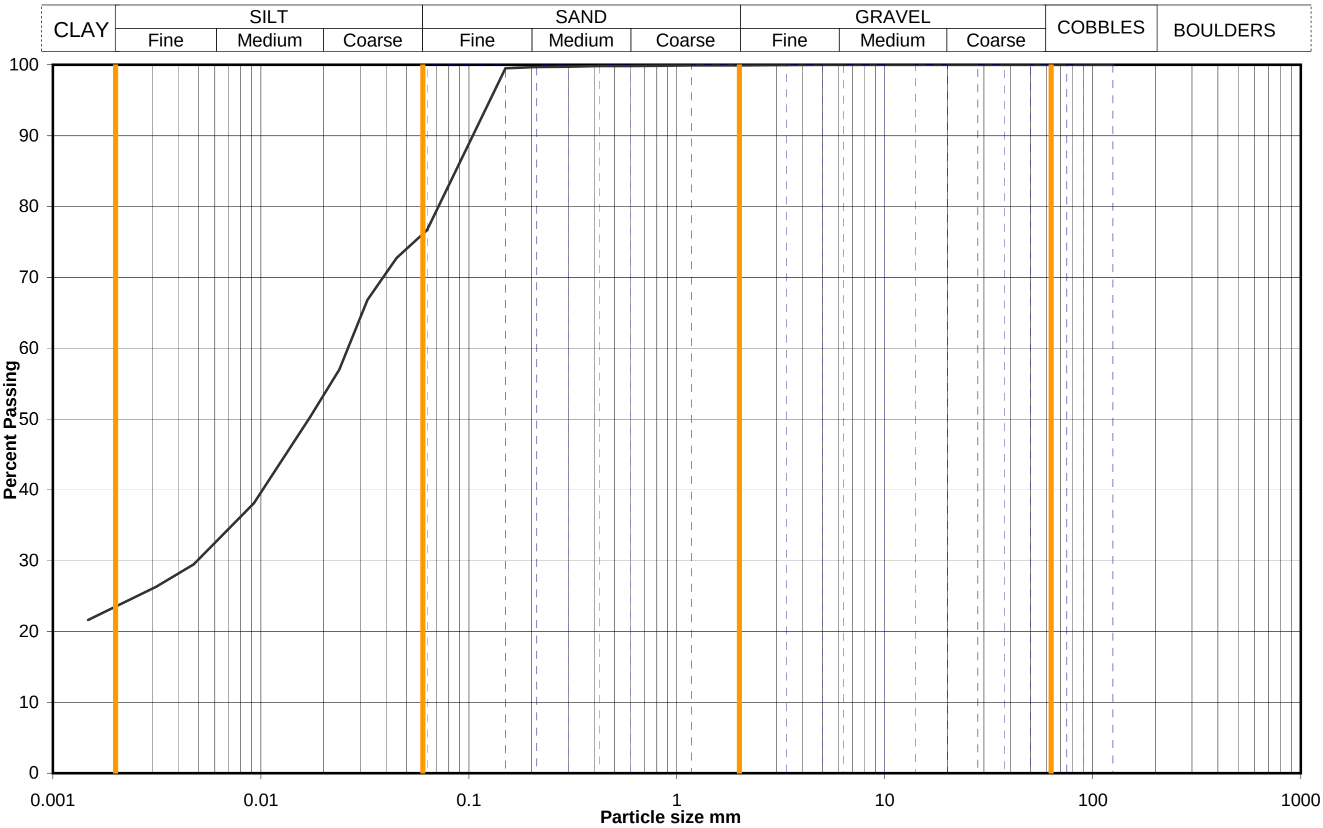
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404			
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.00			
			Samp No	8	Type	P	
			ID	A5085-1520160126094619			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	77
90	100	0.0449	73
75	100	0.0325	67
63	100	0.0238	57
50	100	0.0172	50
37.5	100	0.0093	38
28	100	0.0048	29
20	100	0.0031	26
14	100	0.0015	22
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	100	7.6	
0.063	77		

Soil description	Dark grey slightly sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	24	24
	Silt	53	53
	Clay	23	23

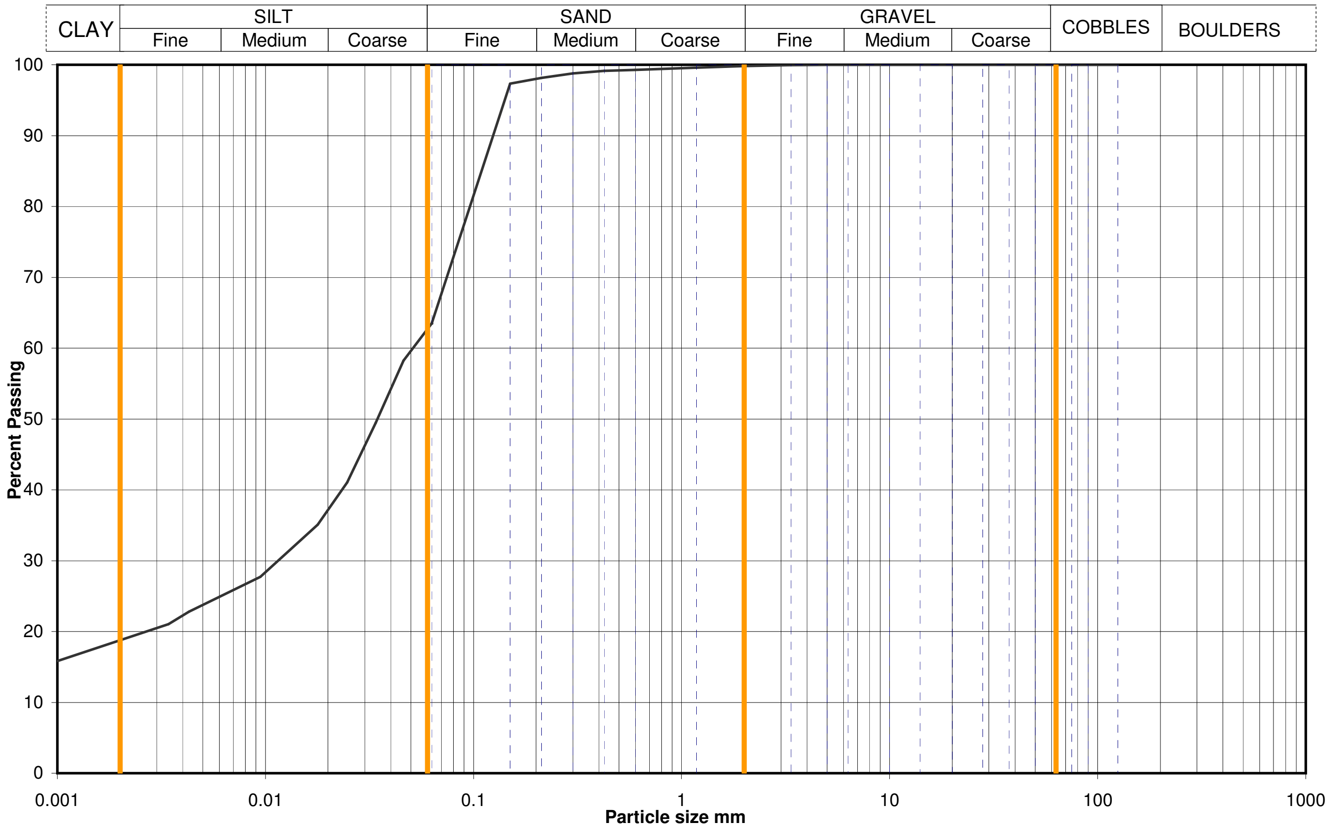
Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00			
			Samp No	10	Type	P	
			ID	A5085-1520160126094851			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	63
90	100	0.0461	58
75	100	0.0338	49
63	100	0.0247	41
50	100	0.0178	35
37.5	100	0.0095	28
28	100	0.0043	23
20	100	0.0034	21
14	100	0.0008	15
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65 assumed	
0.300	99	Dry mass of sample, kg	
0.212	98		
0.150	97		
0.063	63	6.8	

Soil description	Dark brown sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	37	37
	Silt	44	44
	Clay	19	19

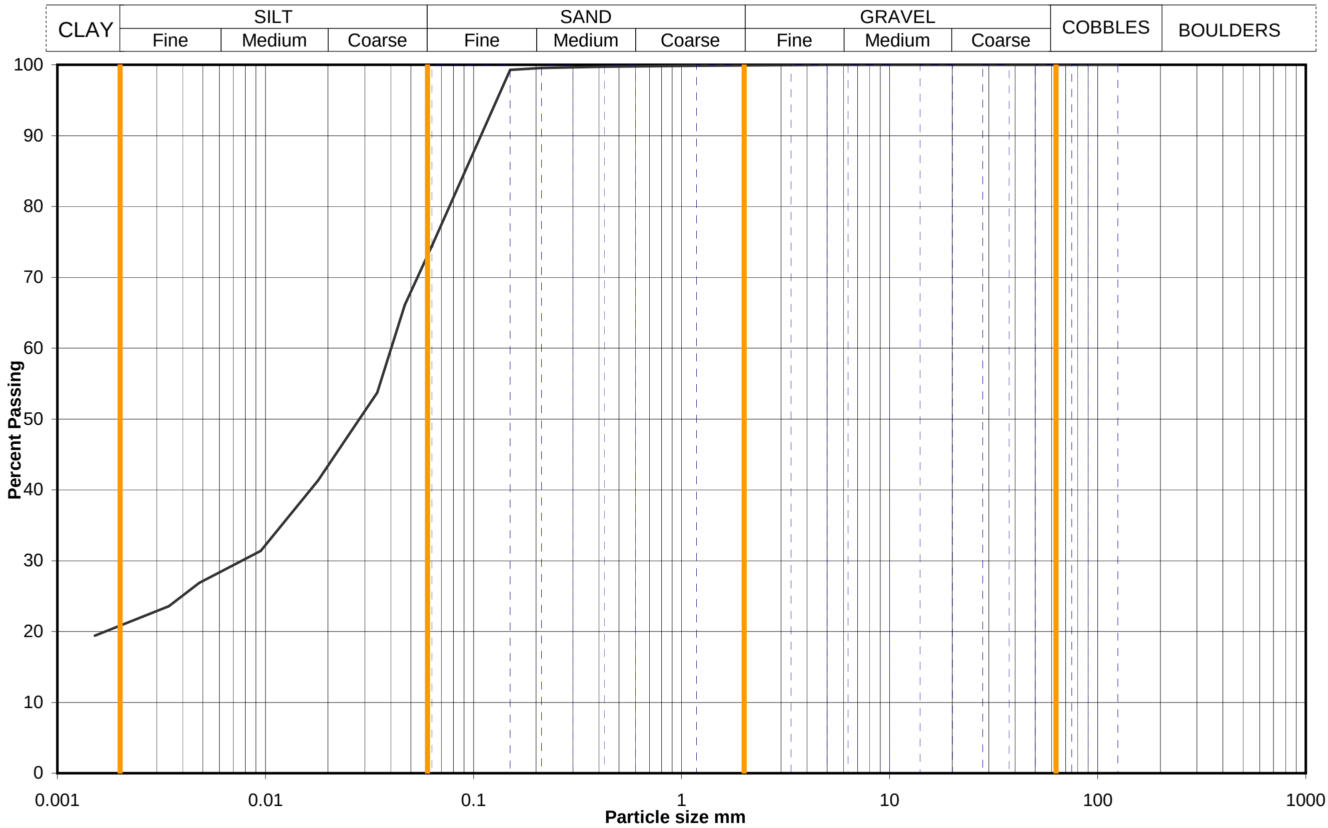
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:23/03/2016 11:45	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.00		
			Samp No	12	Type	B
			ID	A5085-1520160126095020		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	74
90	100	0.0467	66
75	100	0.0344	54
63	100	0.0248	48
50	100	0.0179	41
37.5	100	0.0095	31
28	100	0.0048	27
20	100	0.0034	24
14	100	0.0015	19
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	99	16.8	
0.063	74		

Soil description	Brownish grey slightly sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	27	27
	Silt	52	52
	Clay	21	21

Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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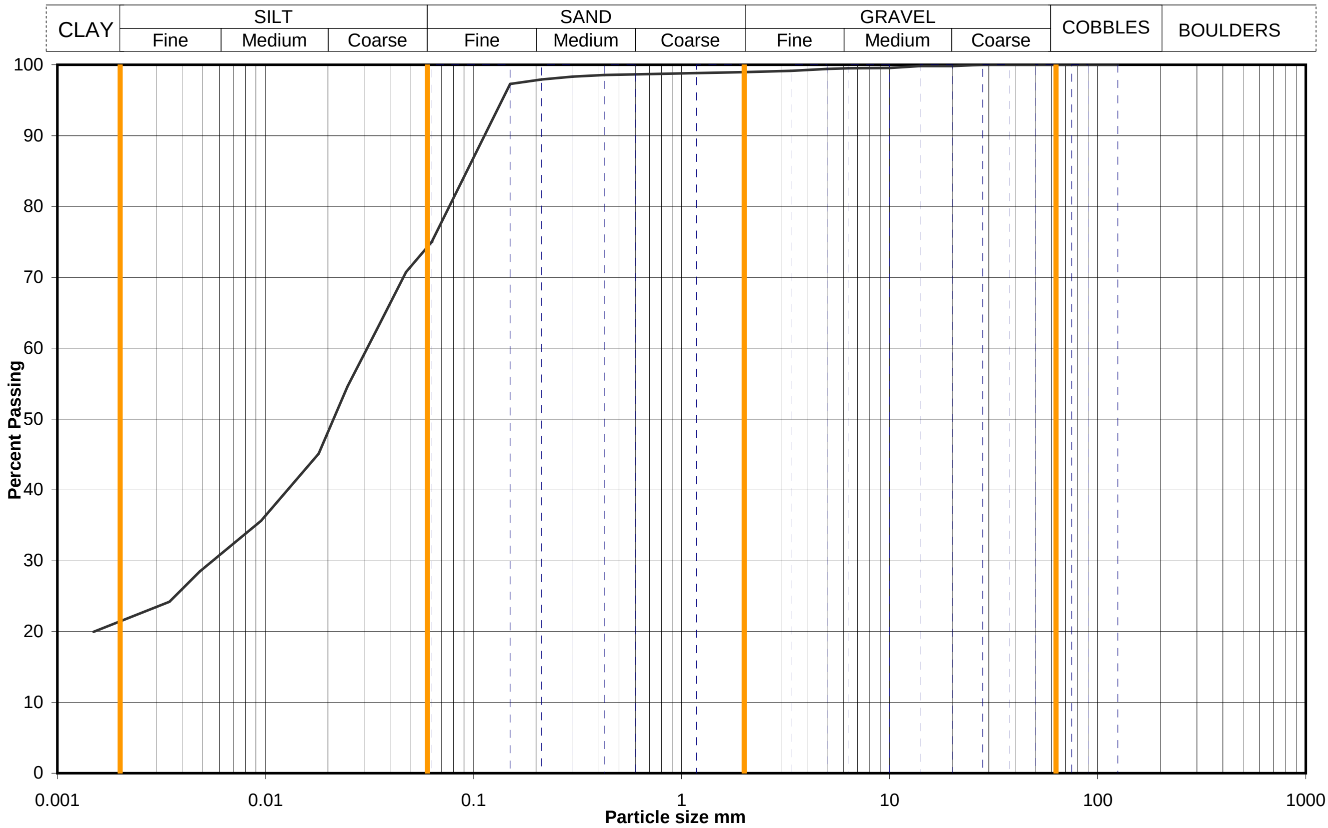
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00		
			Samp No	15	Type	B
			ID	A5085-1520160126095121		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	75
90	100	0.0474	71
75	100	0.0343	63
63	100	0.0248	55
50	100	0.0180	45
37.5	100	0.0095	36
28	100	0.0048	28
20	100	0.0035	24
14	100	0.0015	20
10	100		
6.3	100		
5.0	99		
3.35	99		
2.00	99		
1.18	99	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65	assumed
0.300	98	Dry mass of sample, kg	
0.212	98		
0.150	97	13.9	
0.063	75		

Soil description	Greyish brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	1	1
	Sand	25	25
	Silt	53	53
	Clay	21	21

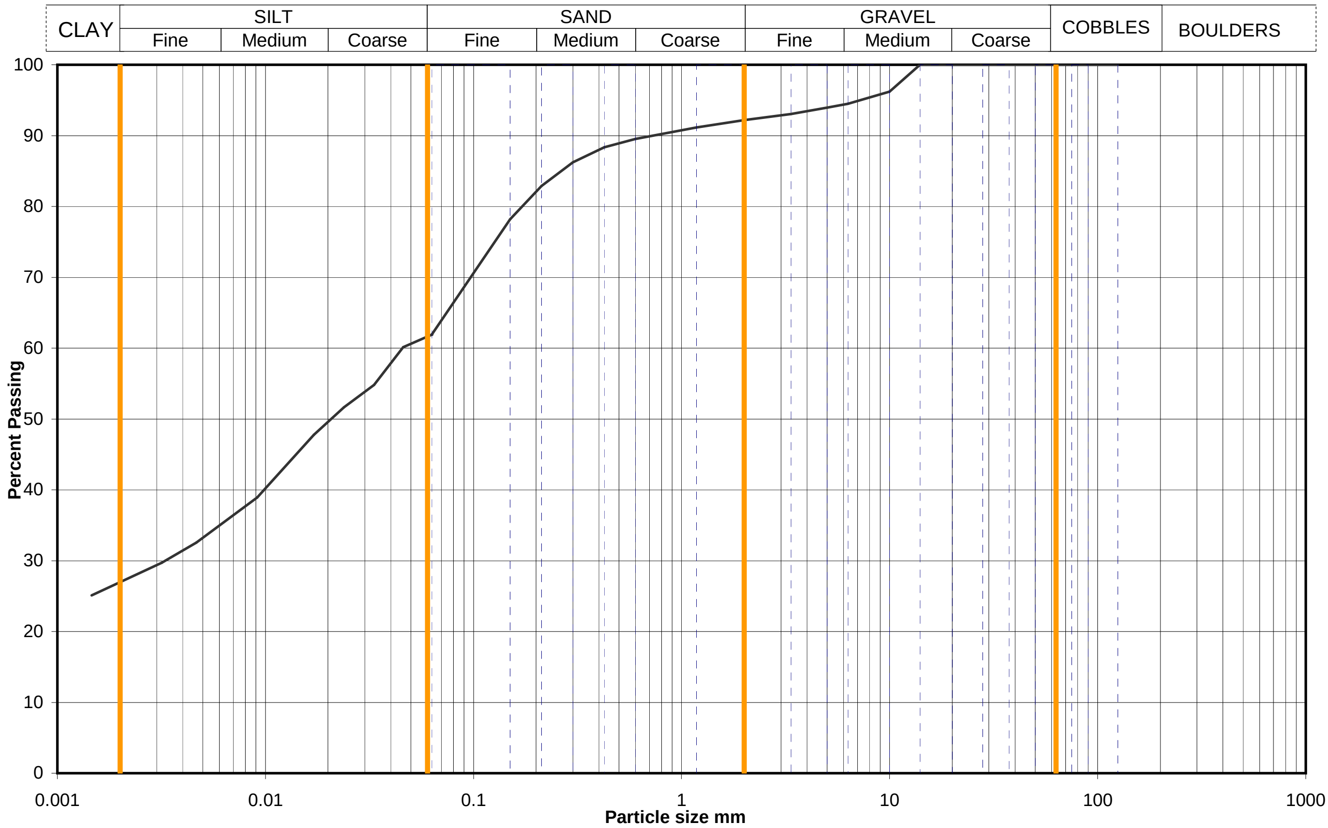
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404			
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.00			
			Samp No	20	Type	B	
			ID	A5085-1520160126095309			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	62
90	100	0.0460	60
75	100	0.0332	55
63	100	0.0238	52
50	100	0.0171	48
37.5	100	0.0091	39
28	100	0.0047	33
20	100	0.0032	30
14	100	0.0015	25
10	96		
6.3	94		
5.0	94		
3.35	93		
2.00	92		
1.18	91	Particle density, Mg/m3	
0.600	90		
0.425	88	2.65	assumed
0.300	86	Dry mass of sample, kg	
0.212	83		
0.150	78	12.1	
0.063	62		

Soil description	Dark brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	8	8
*<60mm values to aid description only	Sand	31	31
	Silt	34	34
	Clay	27	27

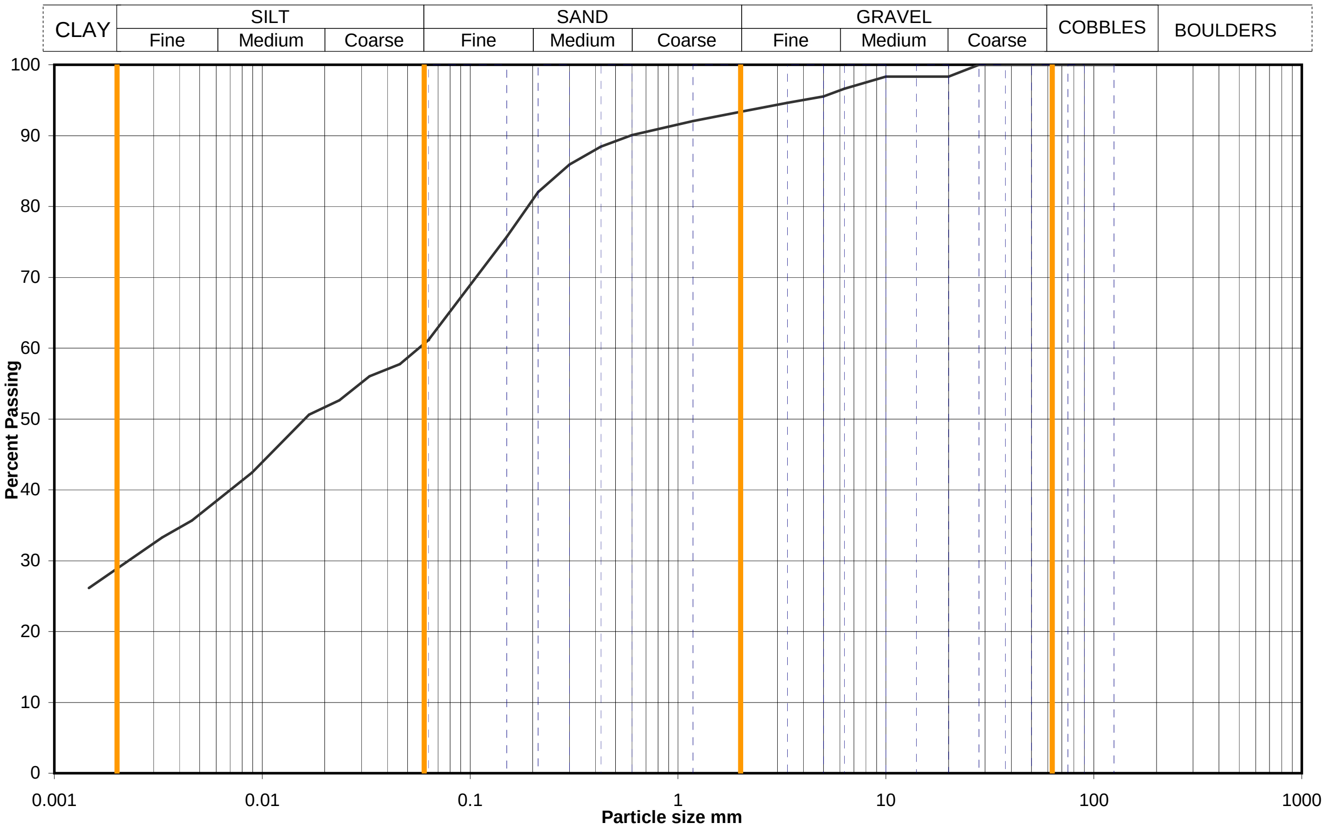
Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	11.00		
			Samp No	24	Type	B
			ID	A5085-1520160126095614		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	61
90	100	0.0460	58
75	100	0.0328	56
63	100	0.0235	53
50	100	0.0168	51
37.5	100	0.0089	42
28	100	0.0046	36
20	98	0.0033	33
14	98	0.0015	26
10	98		
6.3	97		
5.0	96		
3.35	95		
2.00	93		
1.18	92	Particle density, Mg/m3	
0.600	90		
0.425	88	2.65 assumed	
0.300	86	Dry mass of sample, kg	
0.212	82		
0.150	76	11.7	
0.063	61		

Soil description	Greyish dark brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
		Whole	*<63mm
Sample Proportions	Cobbles / boulders	0	0
	Gravel	7	7
*<60mm values to aid description only	Sand	33	33
	Silt	31	31
	Clay	29	29

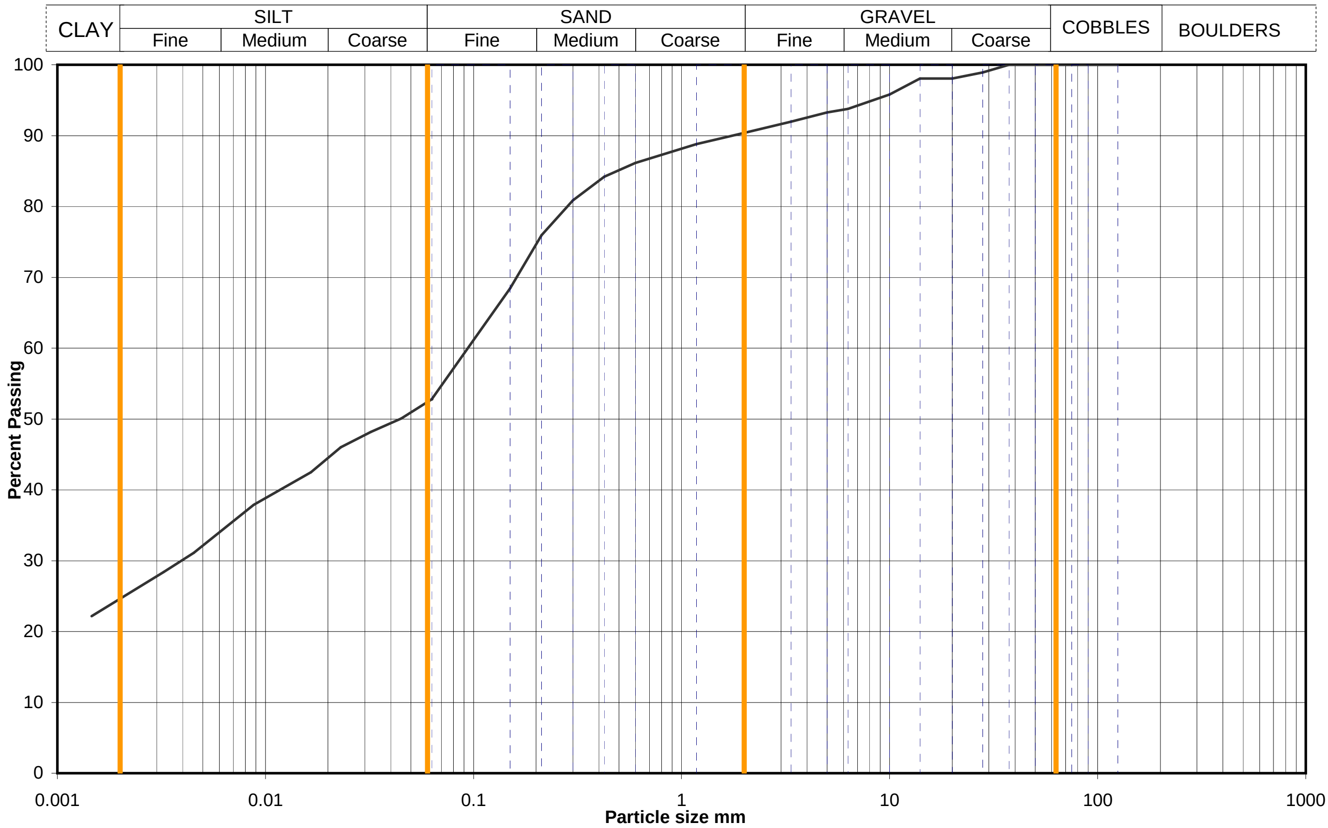
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	12.50		
			Samp No	30	Type	UT
			ID	A5085-1520160126100101		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	53
90	100	0.0449	50
75	100	0.0321	48
63	100	0.0230	46
50	100	0.0166	42
37.5	100	0.0088	38
28	99	0.0045	31
20	98	0.0032	28
14	98	0.0015	22
10	96		
6.3	94		
5.0	93		
3.35	92		
2.00	90		
1.18	89	Particle density, Mg/m3	
0.600	86		
0.425	84	2.65	assumed
0.300	81	Dry mass of sample, kg	
0.212	76		
0.150	68	5.7	
0.063	53		

Soil description	Very stiff greyish brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	10	10
	Sand	38	38
	Silt	28	28
	Clay	24	24

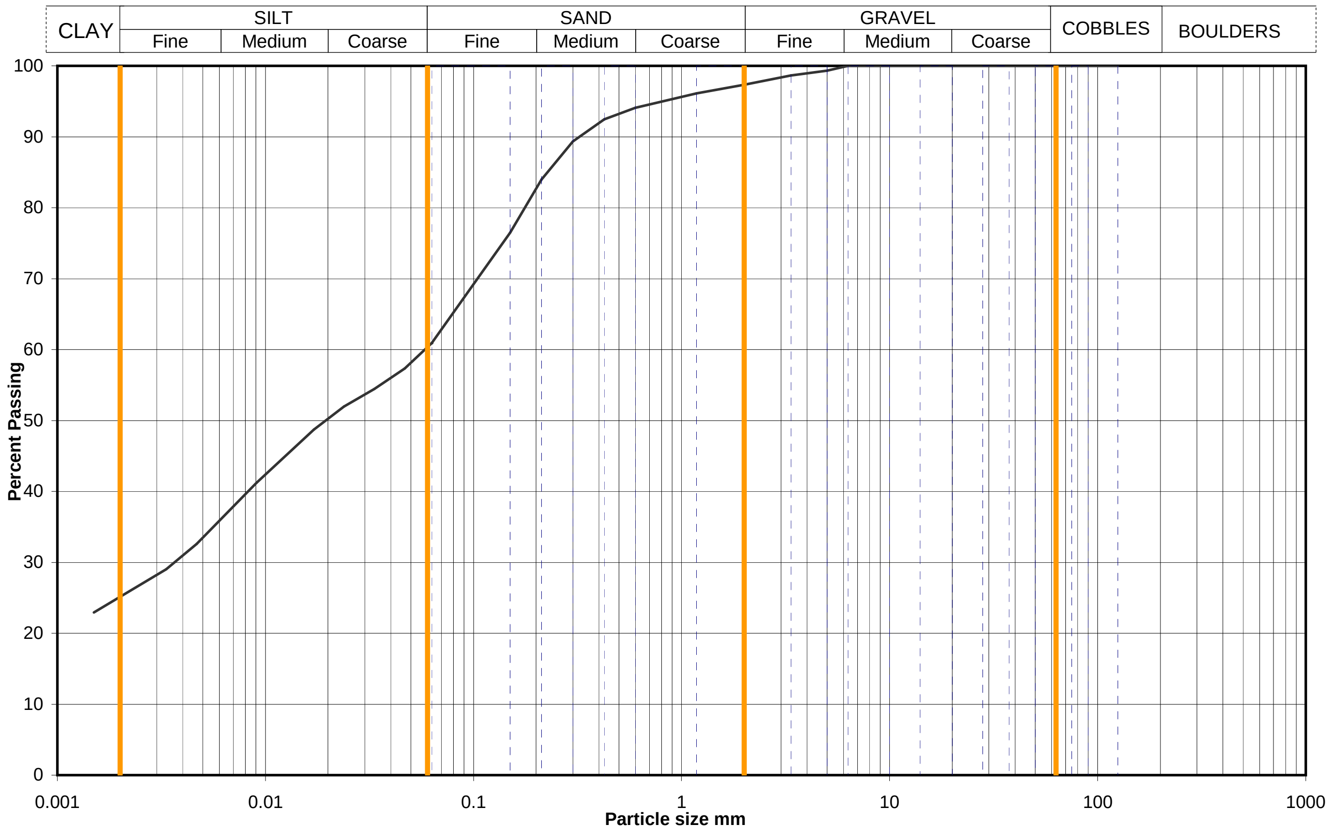
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.00		
			Samp No	36	Type	UT
			ID	A5085-1520160126100329		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	61
90	100	0.0467	57
75	100	0.0334	54
63	100	0.0238	52
50	100	0.0171	49
37.5	100	0.0091	41
28	100	0.0047	33
20	100	0.0033	29
14	100	0.0015	23
10	100		
6.3	100		
5.0	99		
3.35	99		
2.00	97		
1.18	96	Particle density, Mg/m3	
0.600	94		
0.425	92	2.65	assumed
0.300	89	Dry mass of sample, kg	
0.212	84		
0.150	76	5.6	
0.063	61		

Soil description	Firm to stiff greyish brown slightly gravelly sandy CLAY with chalk fragments.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	3	3
	Sand	37	37
	Silt	35	35
*<60mm values to aid description only	Clay	25	25

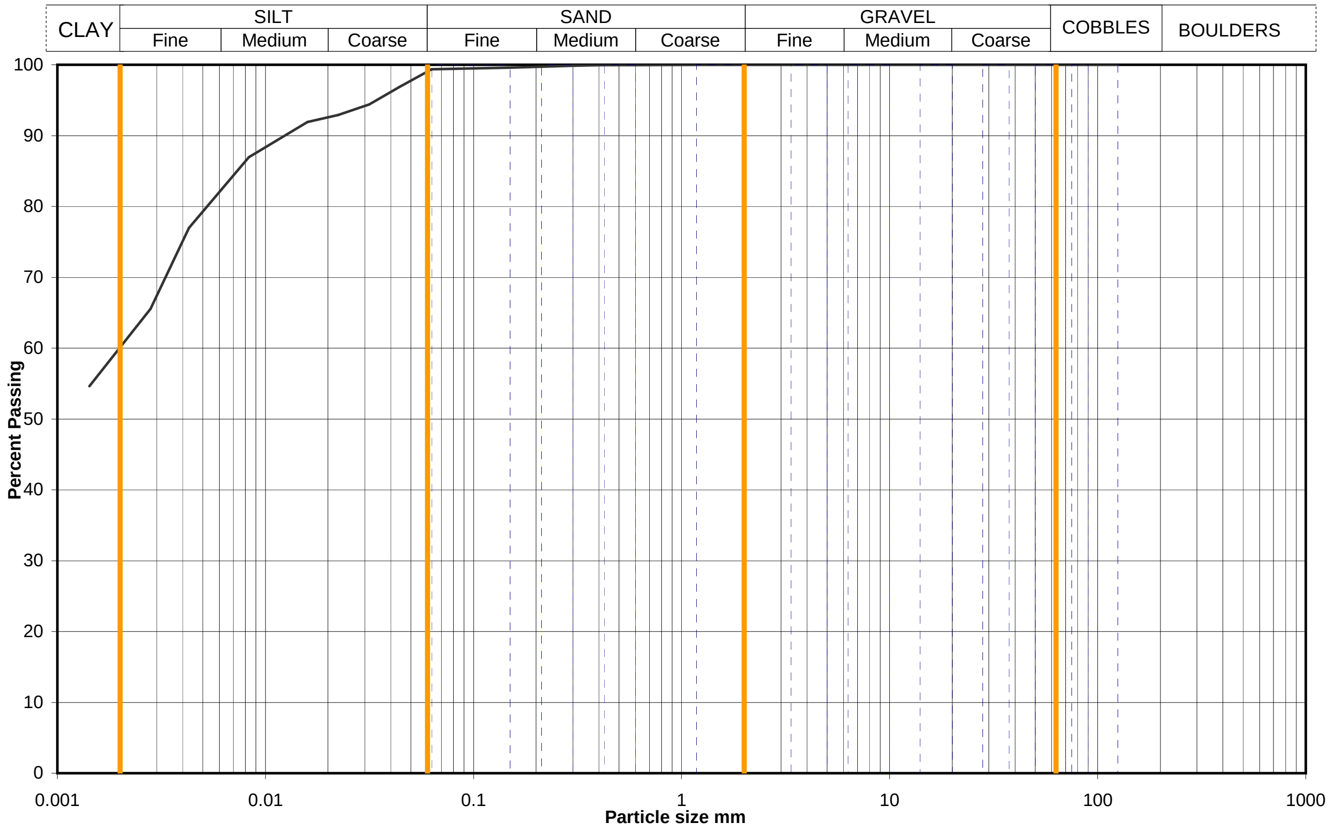
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404	
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.50	
			Samp No	46	Type: B
			ID	A5085-1520160126100732	
			Spec Ref		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	99
90	100	0.0442	97
75	100	0.0315	94
63	100	0.0224	93
50	100	0.0159	92
37.5	100	0.0083	87
28	100	0.0043	77
20	100	0.0028	66
14	100	0.0014	55
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	100	6.3	
0.063	99		

Soil description	Brownish grey slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	1	1
	Silt	39	39
	Clay	60	60

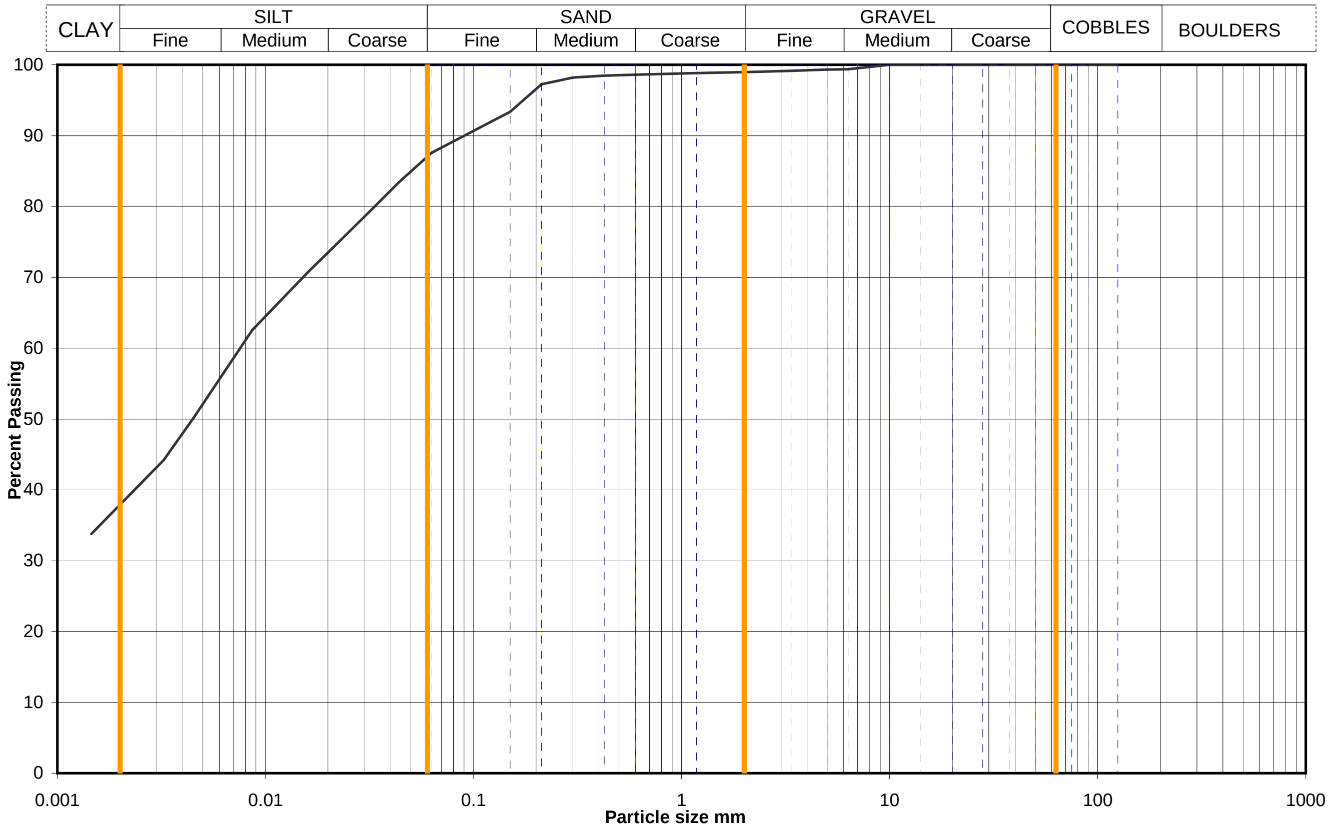
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	18.00		
			Samp No	52	Type	B
			ID	A5085-1520160126100940		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	88
90	100	0.0439	83
75	100	0.0315	79
63	100	0.0226	75
50	100	0.0163	71
37.5	100	0.0086	63
28	100	0.0045	50
20	100	0.0032	44
14	100	0.0015	34
10	100		
6.3	99		
5.0	99		
3.35	99		
2.00	99		
1.18	99	Particle density, Mg/m3	
0.600	99		
0.425	98	2.65	assumed
0.300	98	Dry mass of sample, kg	
0.212	97		
0.150	93	5.9	
0.063	88		

Soil description	Greyish brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	1	1
	Sand	12	12
	Silt	49	49
	Clay	38	38

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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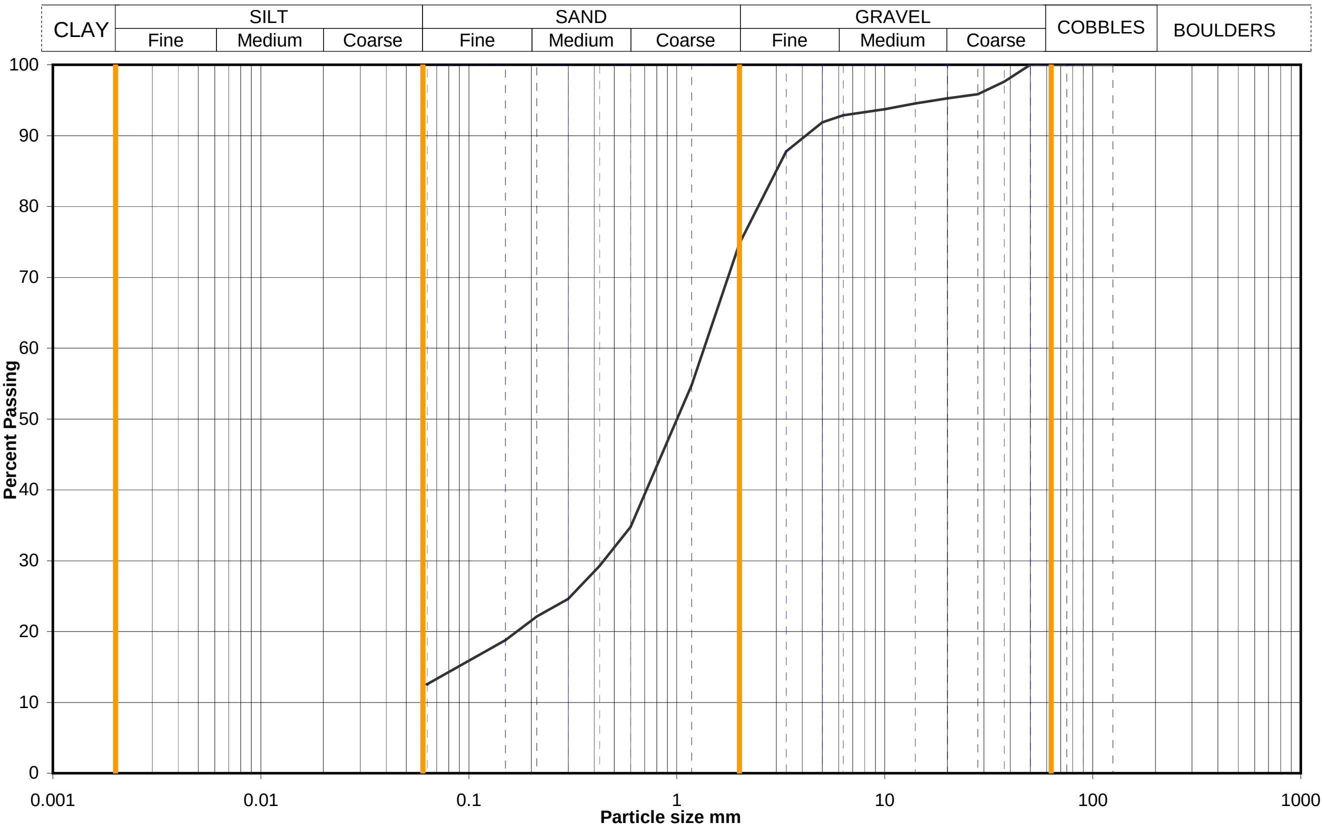
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH404			
Project Name	A63 CASTLE STREET		Depth (m BGL)	23.80			
			Samp No	71	Type	B	
			ID	A5085-1520160126101330			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	96		
20	95		
14	95		
10	94		
6.3	93		
5.0	92		
3.35	88		
2.00	75		
1.18	55		
0.600	35		
0.425	29		
0.300	25	Dry mass of sample, kg	
0.212	22		
0.150	19	4.8	
0.063	13		

Soil description	Brown very gravelly clayey SAND.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	25	25
	Sand	62	62
	Silt	silt+clay =	
	Clay	13	13

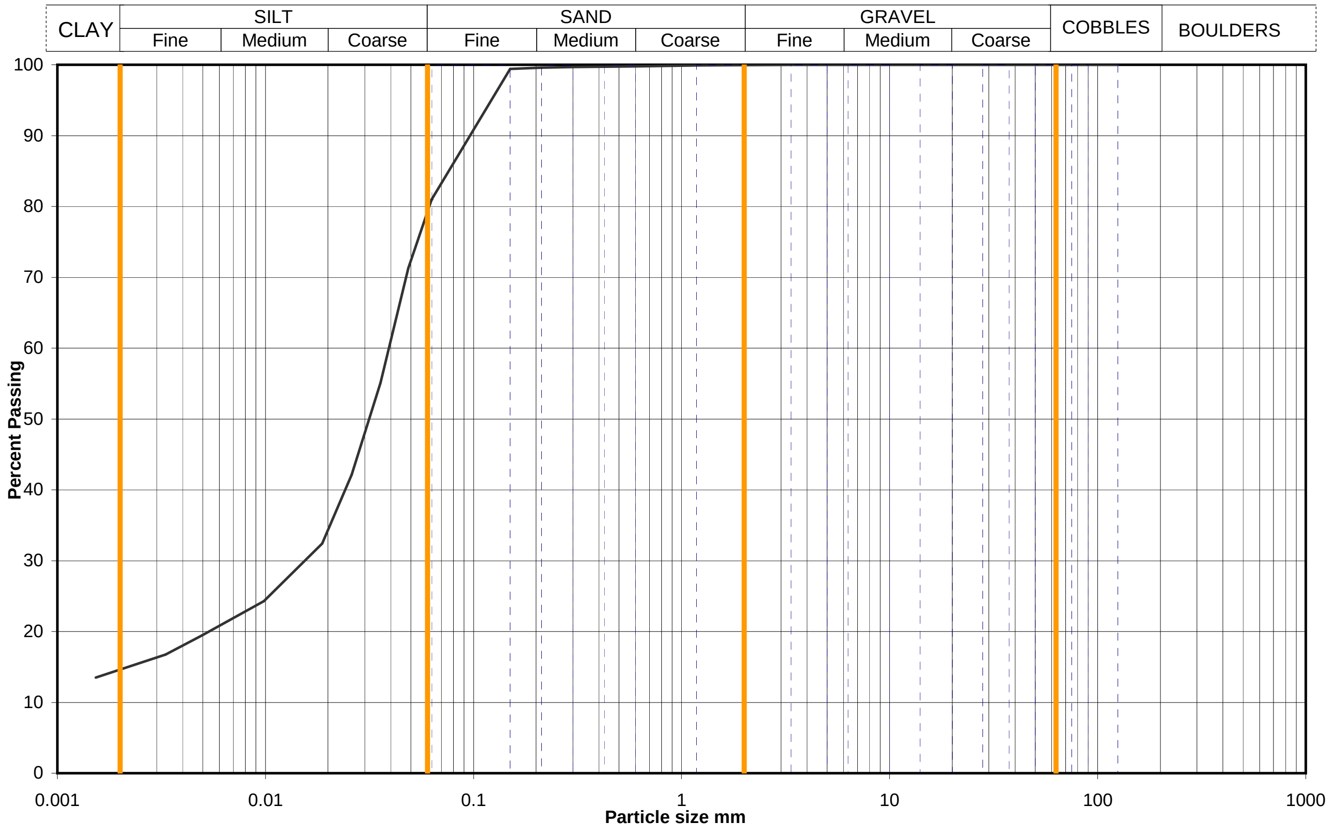
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.00		
			Samp No	7	Type	P
			ID	A5085-1520160119112456		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	81
90	100	0.0485	71
75	100	0.0357	55
63	100	0.0260	42
50	100	0.0187	32
37.5	100	0.0098	24
28	100	0.0050	19
20	100	0.0033	17
14	100	0.0015	13
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65 assumed	
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	99		
0.063	81	8.8	

Soil description	Dark grey slightly sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	21	21
	Silt	64	64
	Clay	15	15

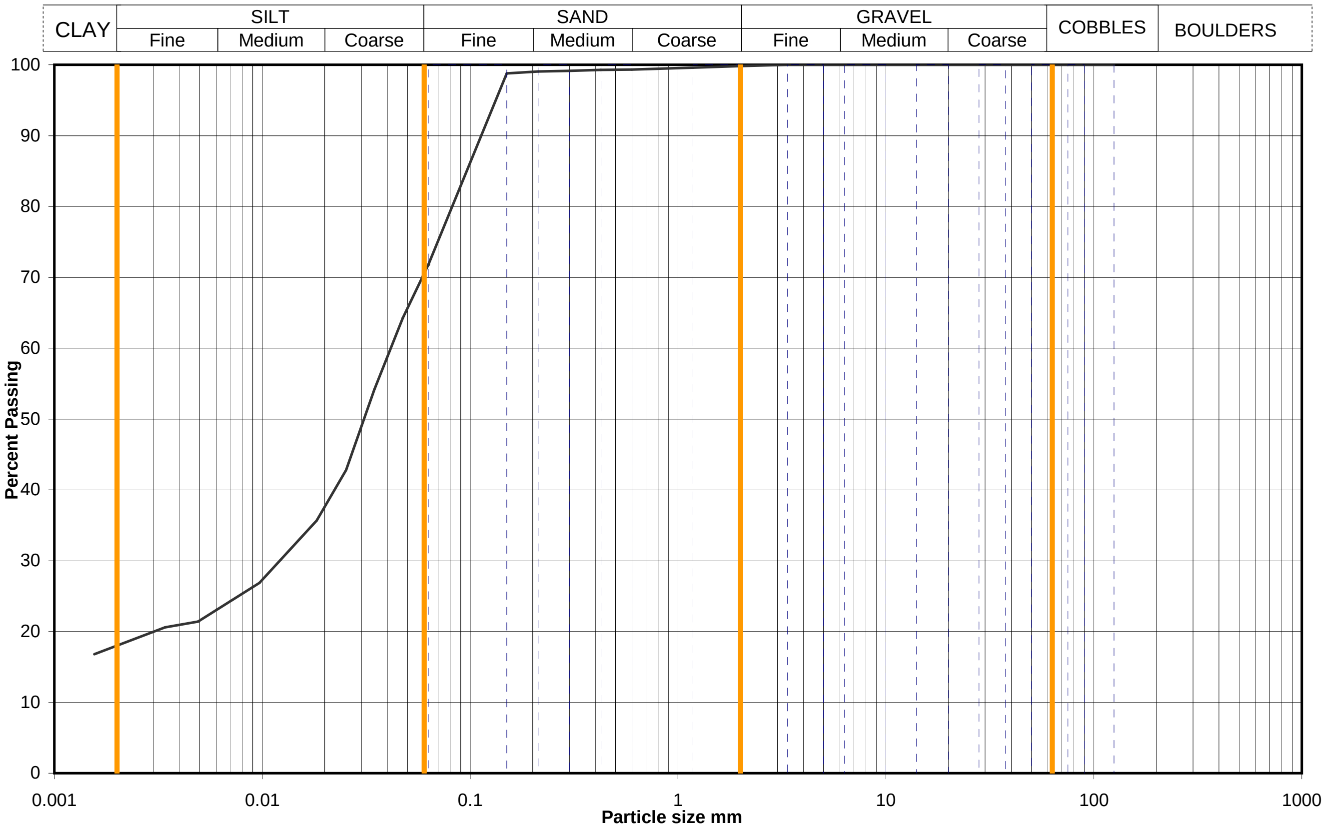
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Printed:18/03/2016 11:11	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.00		
			Samp No	8	Type	P
			ID	A5085-1520160119112519		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	72
90	100	0.0473	64
75	100	0.0346	54
63	100	0.0253	43
50	100	0.0183	36
37.5	100	0.0097	27
28	100	0.0049	21
20	100	0.0034	21
14	100	0.0016	17
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	25.8	
0.063	72		

Soil description	Very soft dark grey slightly sandy organic silty CLAY.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	29	29
*<60mm values to aid description only	Silt	53	53
	Clay	18	18

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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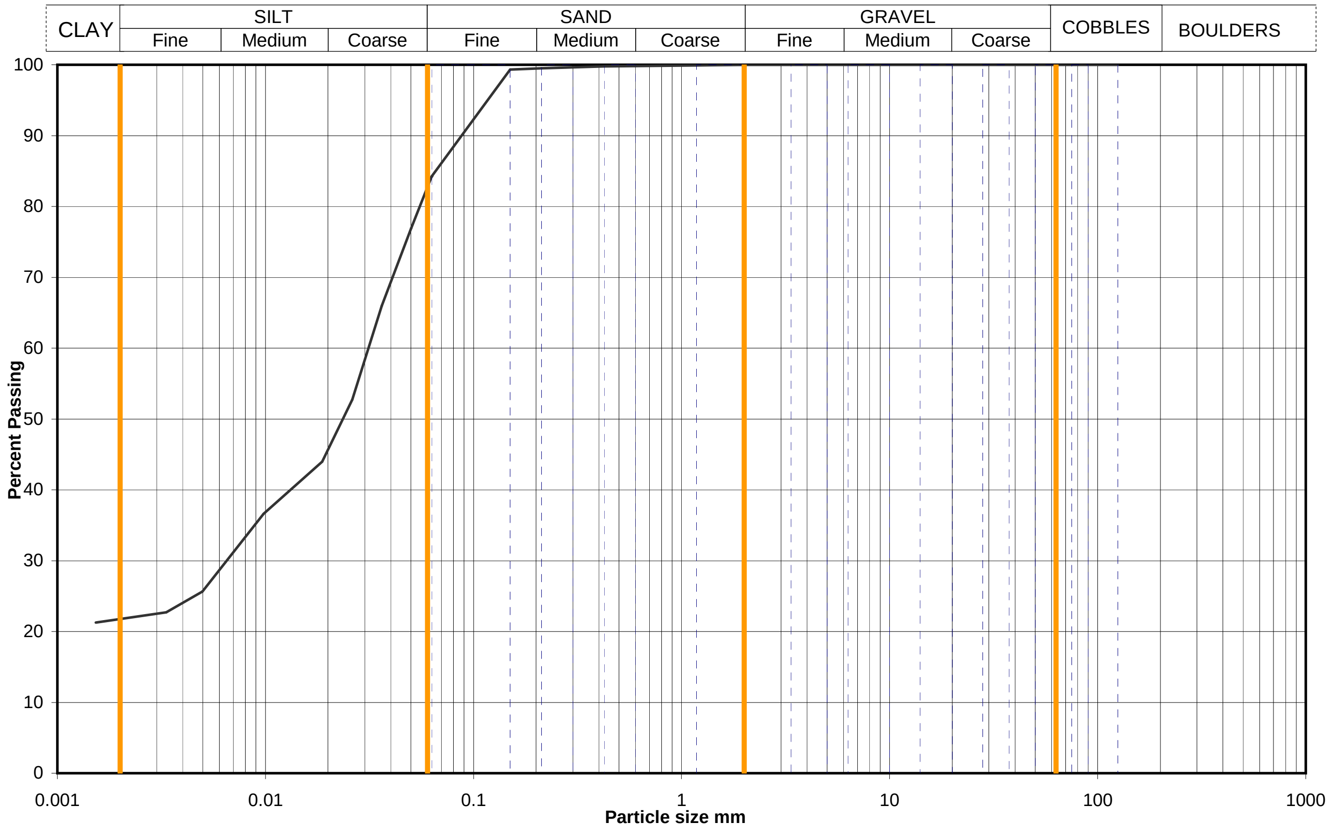
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00			
			Samp No	10	Type	P	
			ID	A5085-1520160119112551			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	84
90	100	0.0502	77
75	100	0.0362	66
63	100	0.0261	53
50	100	0.0187	44
37.5	100	0.0098	37
28	100	0.0050	26
20	100	0.0033	23
14	100	0.0015	21
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	99	7.2	
0.063	84		

Soil description	Dark grey slightly sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	17	17
	Silt	61	61
	Clay	22	22

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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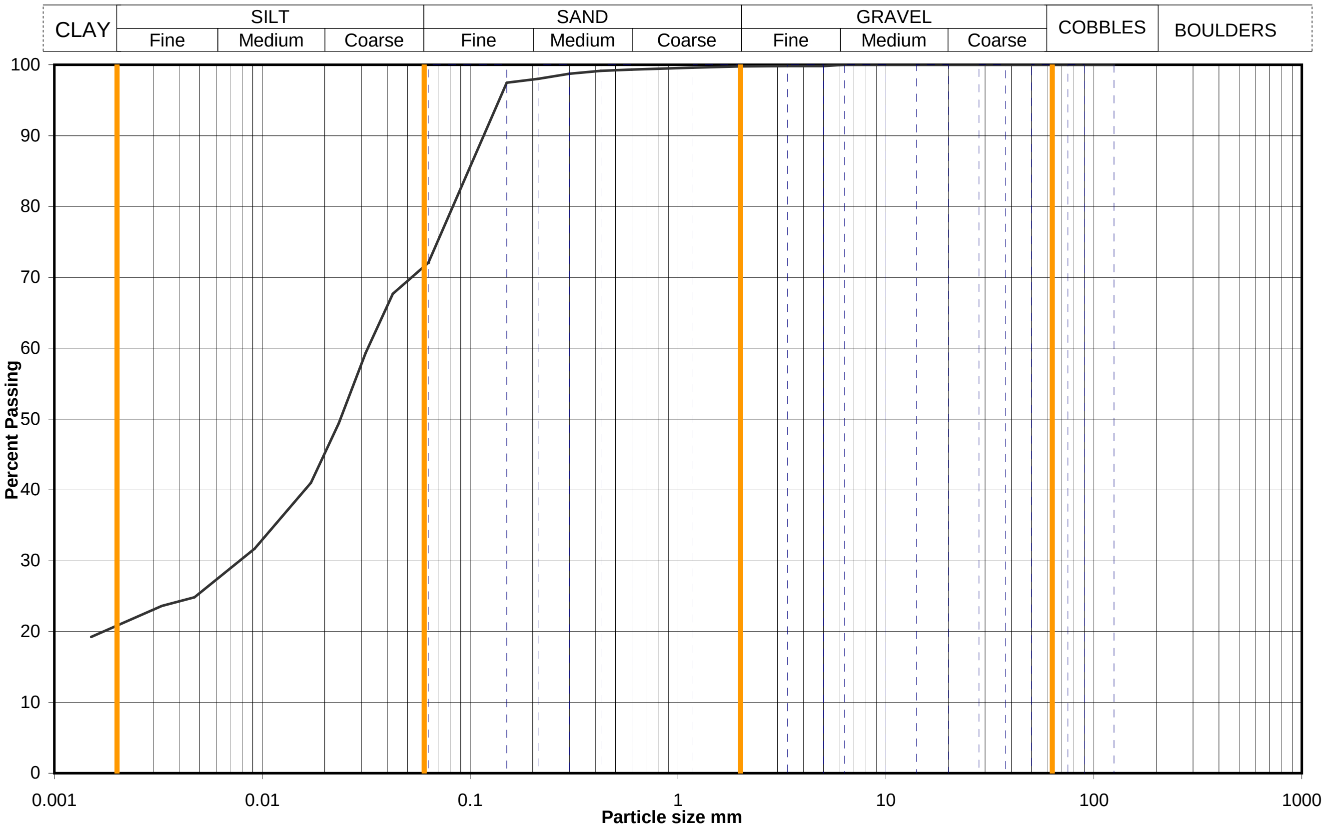
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00			
			Samp No	11	Type	P	
			ID	A5085-1520160119112610			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	72
90	100	0.0424	68
75	100	0.0314	59
63	100	0.0233	49
50	100	0.0171	41
37.5	100	0.0092	32
28	100	0.0047	25
20	100	0.0033	24
14	100	0.0015	19
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65 assumed	
0.300	99	Dry mass of sample, kg	
0.212	98		
0.150	97		
0.063	72	4.4	

Soil description	Soft dark brown slightly sandy silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	28	28
	Silt	51	51
	Clay	21	21

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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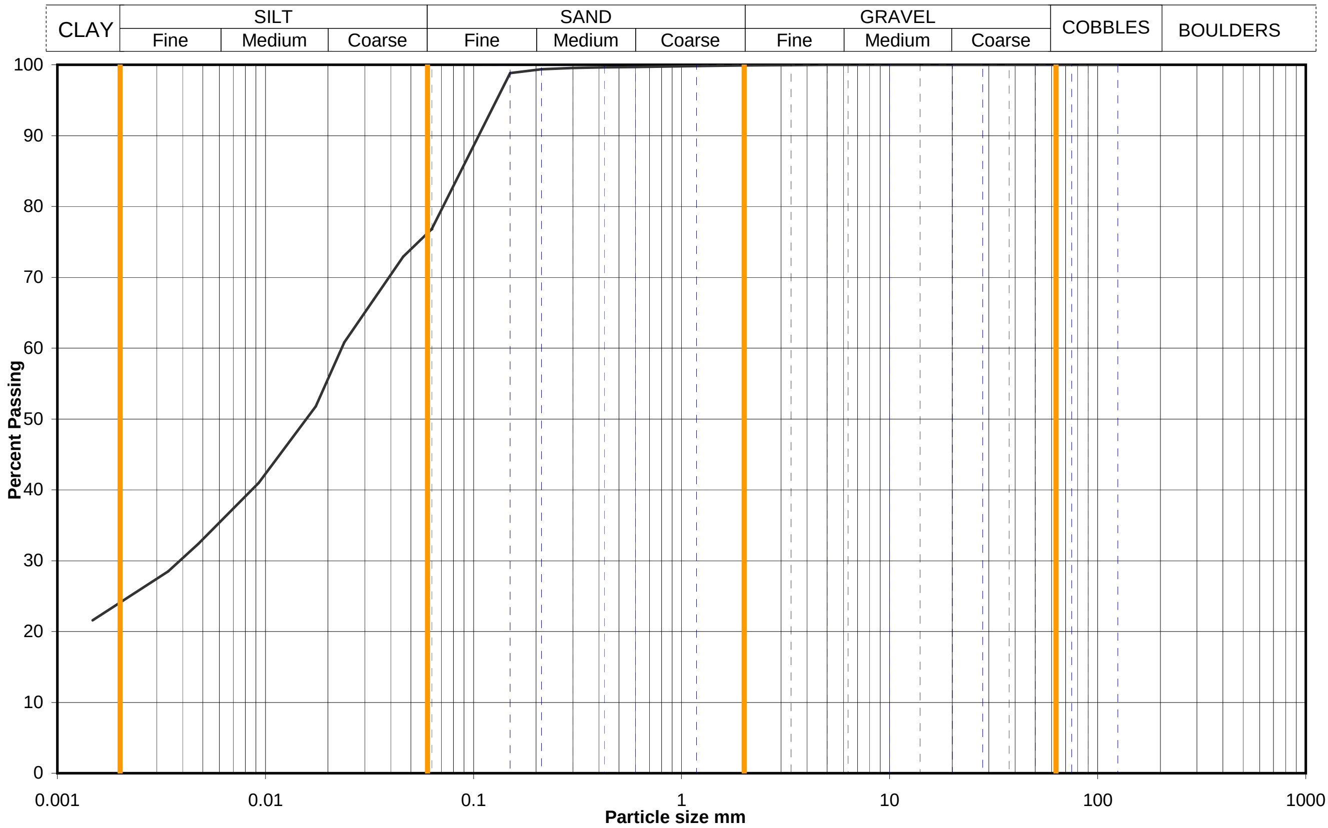
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.00			
			Samp No	13	Type	P	
			ID	A5085-1520160119112634			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	77
90	100	0.0460	73
75	100	0.0332	67
63	100	0.0240	61
50	100	0.0174	52
37.5	100	0.0093	41
28	100	0.0048	32
20	100	0.0034	28
14	100	0.0015	22
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	99		
0.150	99		
0.063	77	7.5	

Soil description	Very soft brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	24	24
	Silt	52	52
	Clay	24	24

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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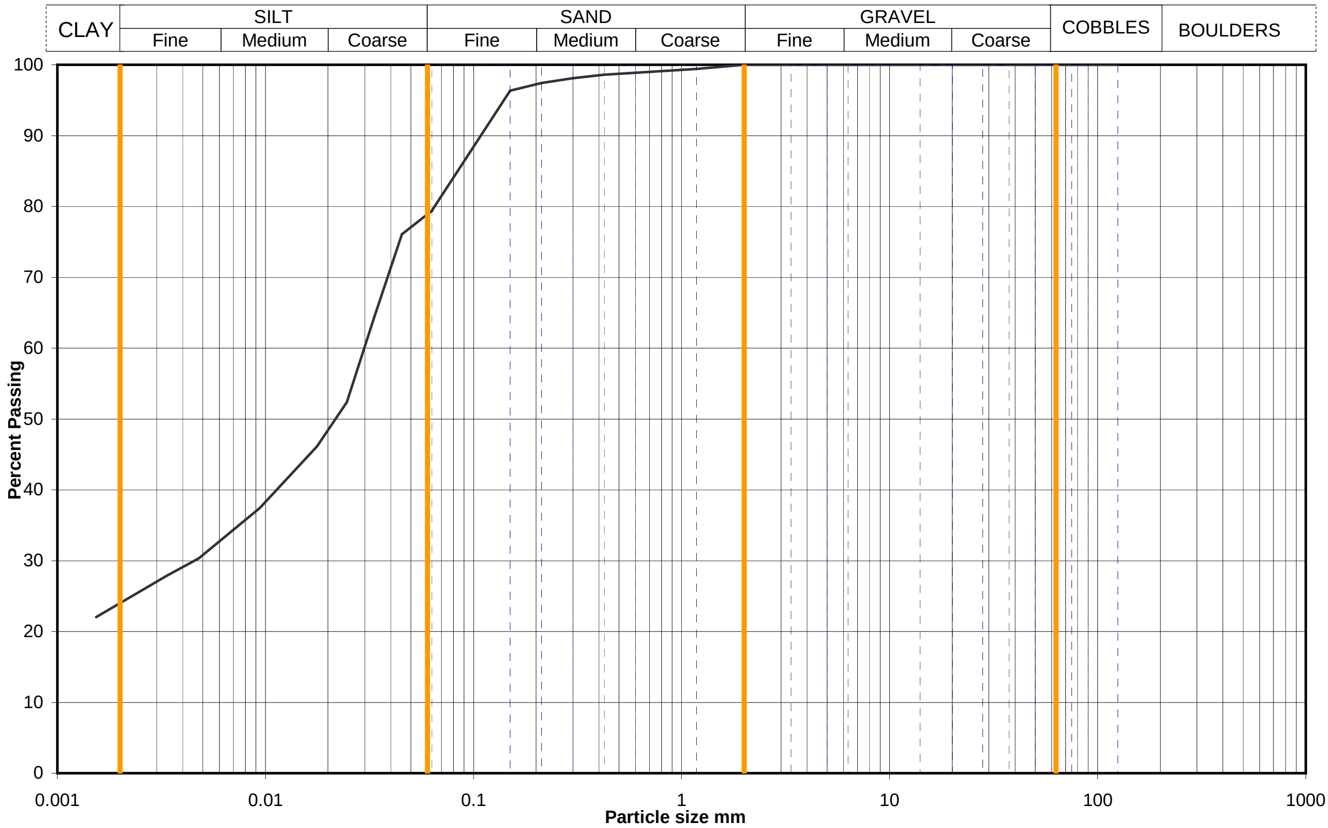
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00			
			Samp No	15	Type	P	
			ID	A5085-1520160119112703			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	79
90	100	0.0453	76
75	100	0.0334	64
63	100	0.0246	52
50	100	0.0177	46
37.5	100	0.0094	37
28	100	0.0048	30
20	100	0.0033	28
14	100	0.0015	22
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	99	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65 assumed	
0.300	98	Dry mass of sample, kg	
0.212	97		
0.150	96	4.2	
0.063	79		

Soil description	Soft to firm greyish brown slightly sandy silty CLAY becoming organic clayey SILT towards base.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	21	21
	Silt	55	55
	Clay	24	24

Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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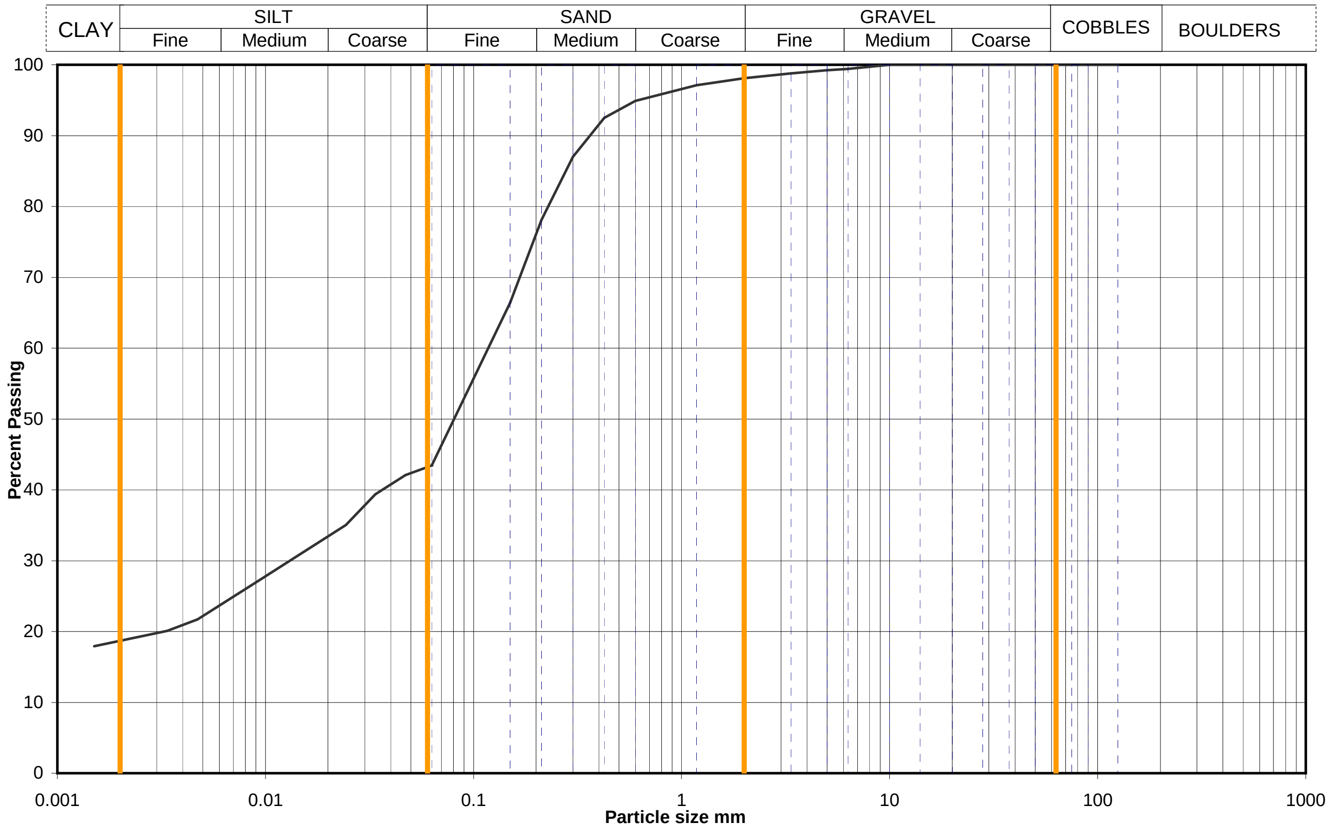
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.00			
			Samp No	19	Type	UT	
			ID	A5085-1520160119112827			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	43
90	100	0.0470	42
75	100	0.0337	39
63	100	0.0244	35
50	100	0.0175	32
37.5	100	0.0092	27
28	100	0.0047	22
20	100	0.0034	20
14	100	0.0015	18
10	100		
6.3	99		
5.0	99		
3.35	99		
2.00	98		
1.18	97	Particle density, Mg/m3	
0.600	95		
0.425	93	2.65	assumed
0.300	87	Dry mass of sample, kg	
0.212	78		
0.150	66	3.6	
0.063	43		

Soil description	Soft brownish dark grey slightly gravelly sandy CLAY.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<63mm
*<60mm values to aid description only	Cobbles / boulders	0	0
	Gravel	2	2
	Sand	55	55
	Silt	24	24
	Clay	19	19

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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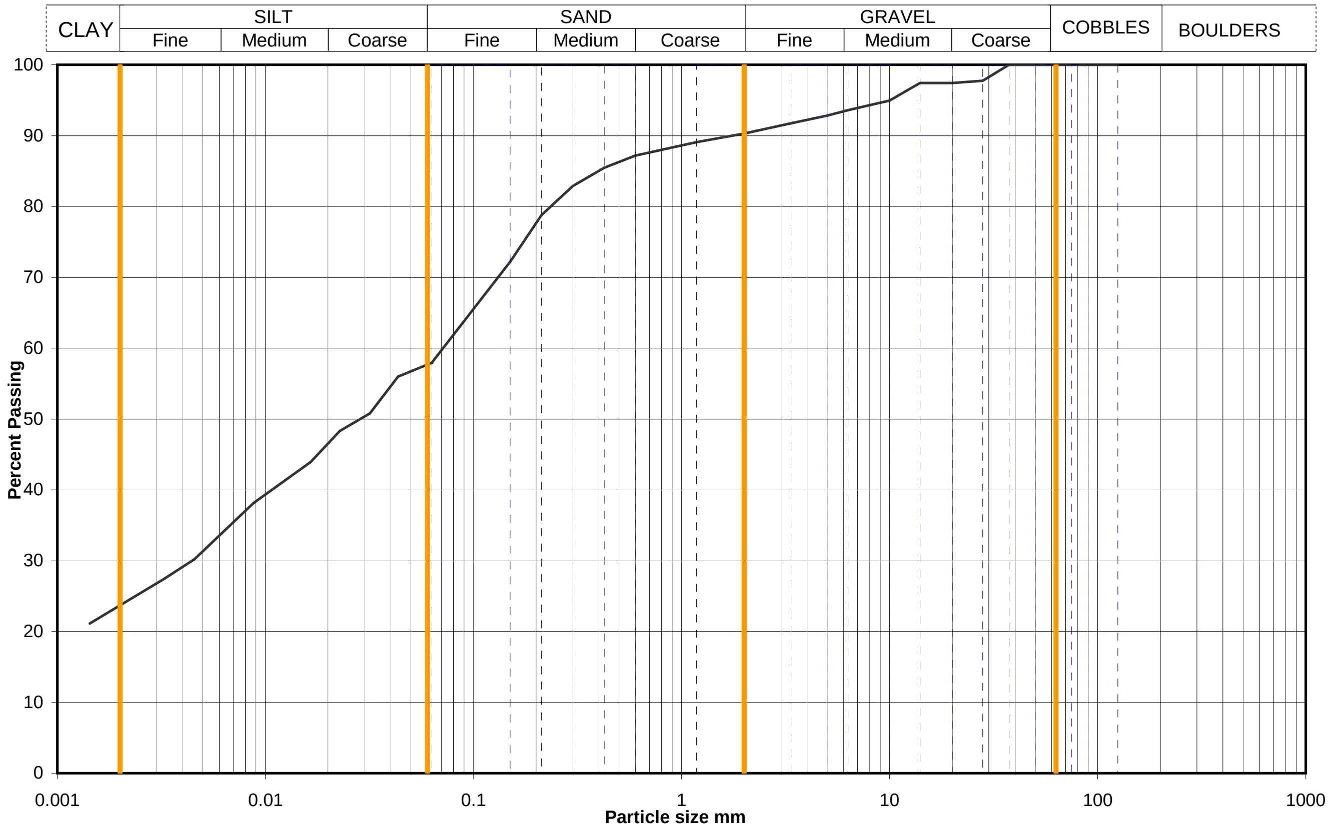
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	11.50		
			Samp No	25	Type	UT
			ID	A5085-1520160119113252		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	58
90	100	0.0435	56
75	100	0.0317	51
63	100	0.0227	48
50	100	0.0165	44
37.5	100	0.0088	38
28	98	0.0046	30
20	97	0.0033	27
14	97	0.0014	21
10	95		
6.3	94		
5.0	93		
3.35	92		
2.00	90		
1.18	89	Particle density, Mg/m3	
0.600	87		
0.425	85	2.65	assumed
0.300	83	Dry mass of sample, kg	
0.212	79		
0.150	72	4.1	
0.063	58		

Soil description	Firm brownish dark grey slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	10	10
	Sand	33	33
	Silt	34	34
	Clay	23	23

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref			Figure
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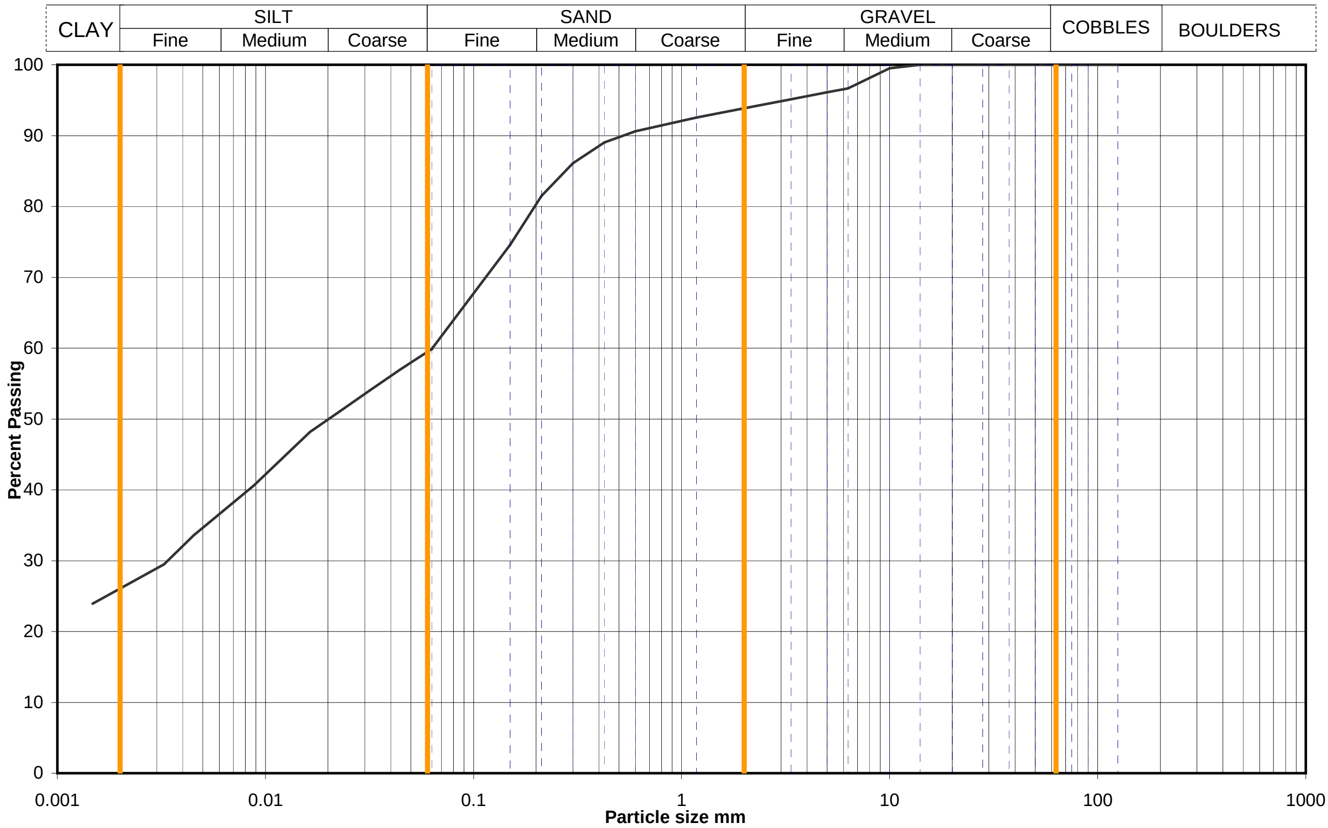
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.00		
			Samp No	34	Type	D
			ID	A5085-1520160119113547		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	60
90	100	0.0442	57
75	100	0.0318	54
63	100	0.0228	51
50	100	0.0164	48
37.5	100	0.0088	41
28	100	0.0045	34
20	100	0.0033	29
14	100	0.0015	24
10	100		
6.3	97		
5.0	96		
3.35	95		
2.00	94		
1.18	93	Particle density, Mg/m3	
0.600	91		
0.425	89	2.65 assumed	
0.300	86	Dry mass of sample, kg	
0.212	81		
0.150	75	0.9	
0.063	60		

Soil description	Dark brown slightly sandy slightly gravelly CLAY.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

		Whole	*<63mm
Sample Proportions *<60mm values to aid description only	Cobbles / boulders	0	0
	Gravel	6	6
	Sand	34	34
	Silt	34	34
	Clay	26	26

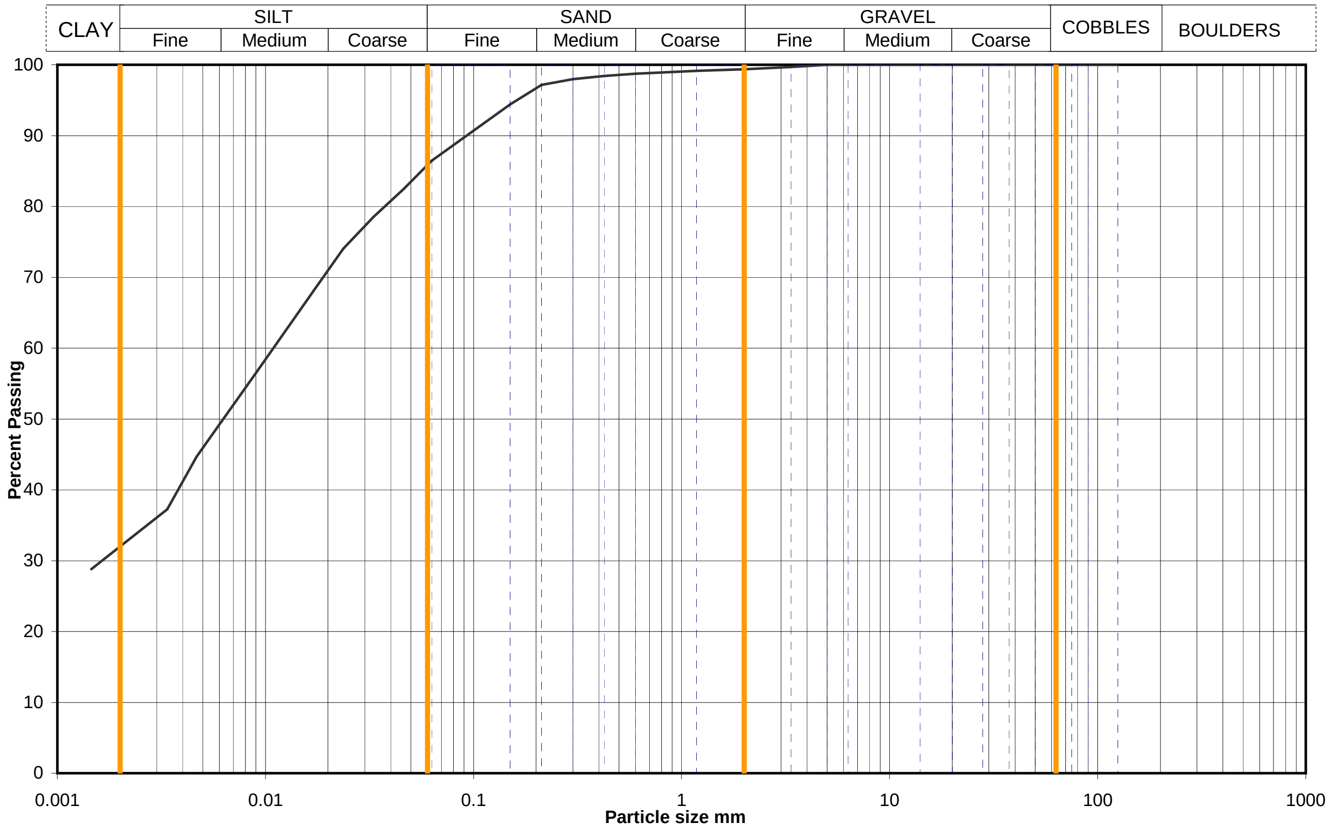
Uniformity Coefficient D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:12	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	19.00		
			Samp No	54	Type	B
			ID	A5085-1520160119115054		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	86
90	100	0.0462	82
75	100	0.0331	78
63	100	0.0237	74
50	100	0.0170	68
37.5	100	0.0091	57
28	100	0.0047	45
20	100	0.0034	37
14	100	0.0015	29
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	99		
1.18	99	Particle density, Mg/m3	
0.600	99		
0.425	98	2.65	assumed
0.300	98	Dry mass of sample, kg	
0.212	97		
0.150	94	8.2	
0.063	86		

Soil description	Brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	1	1
	Sand	14	14
	Silt	53	53
	Clay	32	32

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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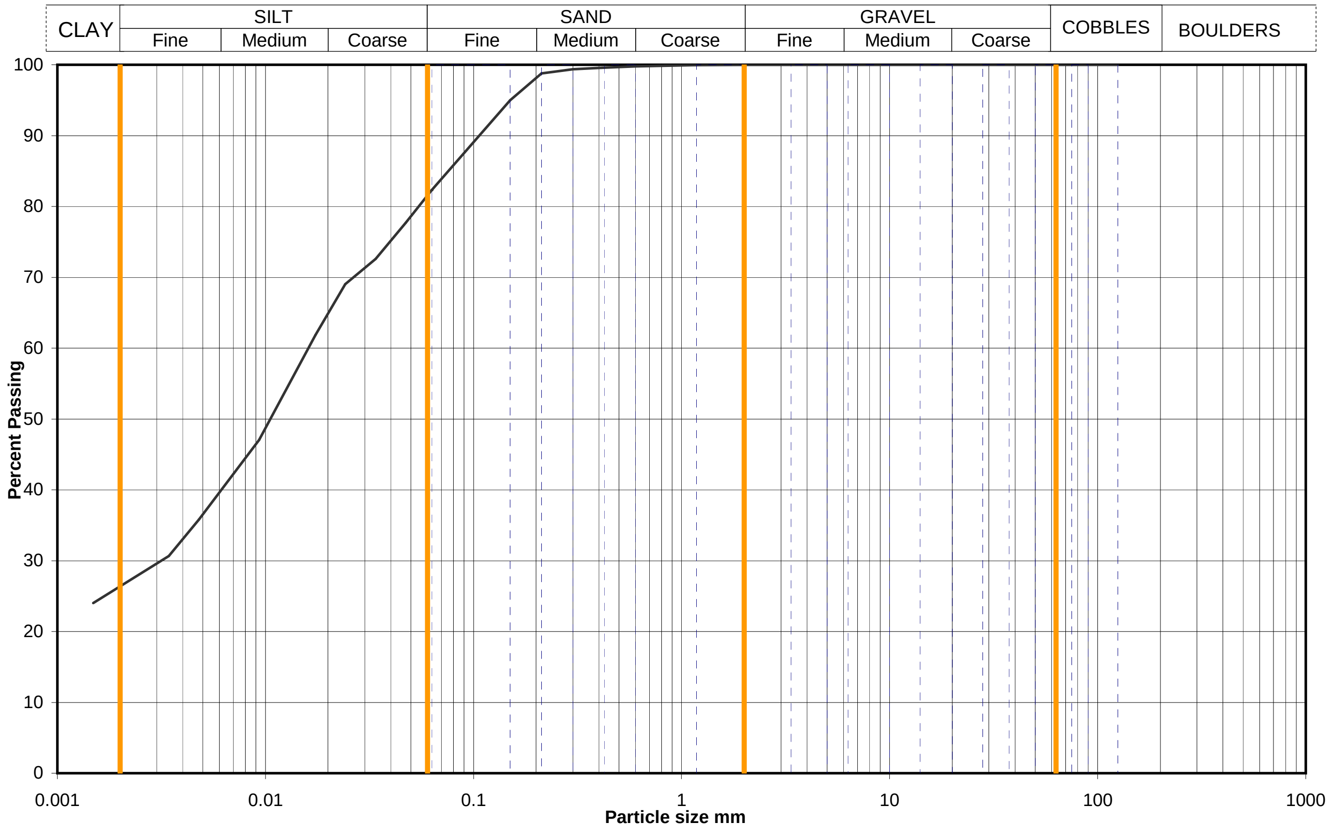
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405
Project Name	A63 CASTLE STREET		Depth (m BGL)	21.00
			Samp No	60 / Type: B
			ID	A5085-1520160119115219
			Spec Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	82
90	100	0.0472	78
75	100	0.0338	73
63	100	0.0242	69
50	100	0.0174	62
37.5	100	0.0093	47
28	100	0.0048	36
20	100	0.0034	31
14	100	0.0015	24
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	95	6.1	
0.063	82		

Soil description	Greyish brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
		Whole	*<63mm
Sample Proportions	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	18	18
	Silt	55	55
	Clay	27	27

Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.3 dry sieve
	Sedimentation	9.5 hydrometer

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Figure
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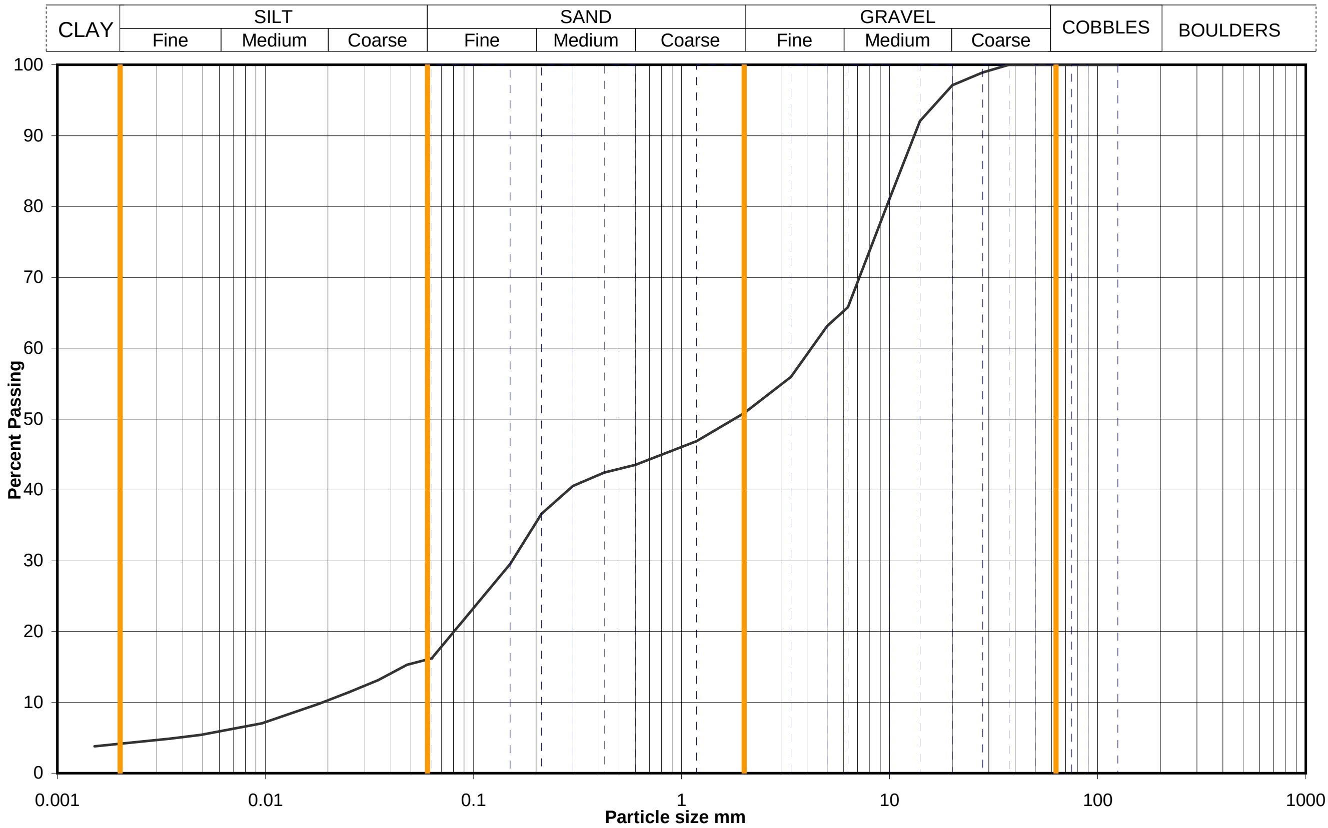
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	23.60			
			Samp No	67	Type	B	
			ID	A5085-1520160119115414			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	16
90	100	0.0479	15
75	100	0.0348	13
63	100	0.0251	11
50	100	0.0181	10
37.5	100	0.0096	7
28	99	0.0049	5
20	97	0.0035	5
14	92	0.0015	4
10	81		
6.3	66		
5.0	63		
3.35	56		
2.00	51		
1.18	47	Particle density, Mg/m3	
0.600	44		
0.425	42	2.65	assumed
0.300	41	Dry mass of sample, kg	
0.212	37		
0.150	30	12.0	
0.063	16		

Soil description	Brown very sandy clayey GRAVEL.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	49	49
	Sand	35	35
	Silt	12	12
	Clay	4	4

Uniformity Coefficient	D_{60} / D_{10}	222

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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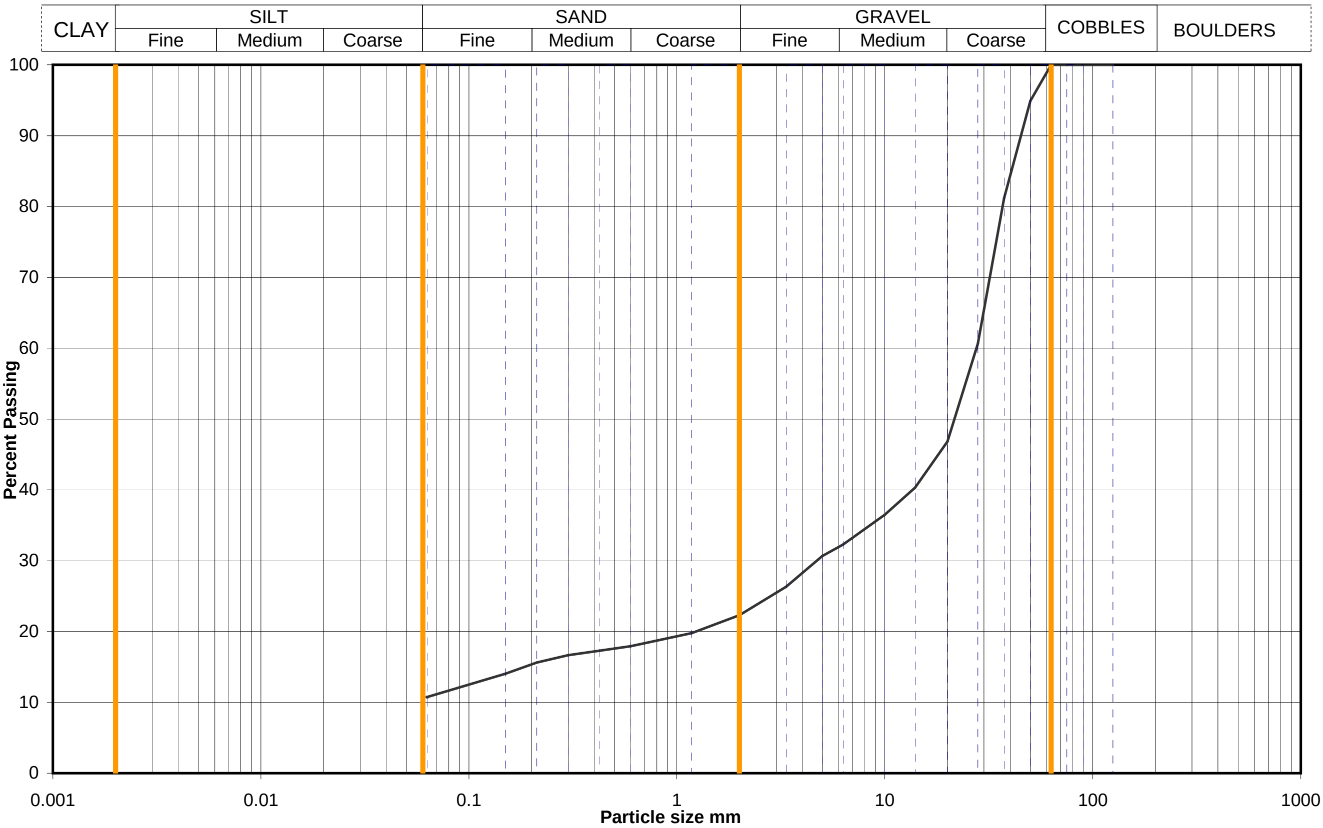
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	24.60		
			Samp No	69	Type	B
			ID	A5085-1520160119115434		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	81		
28	61		
20	47		
14	40		
10	36		
6.3	32		
5.0	31		
3.35	26		
2.00	22		
1.18	20		
0.600	18		
0.425	17		
0.300	17	Dry mass of sample, kg	
0.212	16		
0.150	14	14.0	
0.063	11		

Soil description	White and cream CHALK composed of sandy silty GRAVEL.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	78	78
*<60mm values to aid description only	Sand	12	12
	Silt	silt+clay =	
	Clay	10	10

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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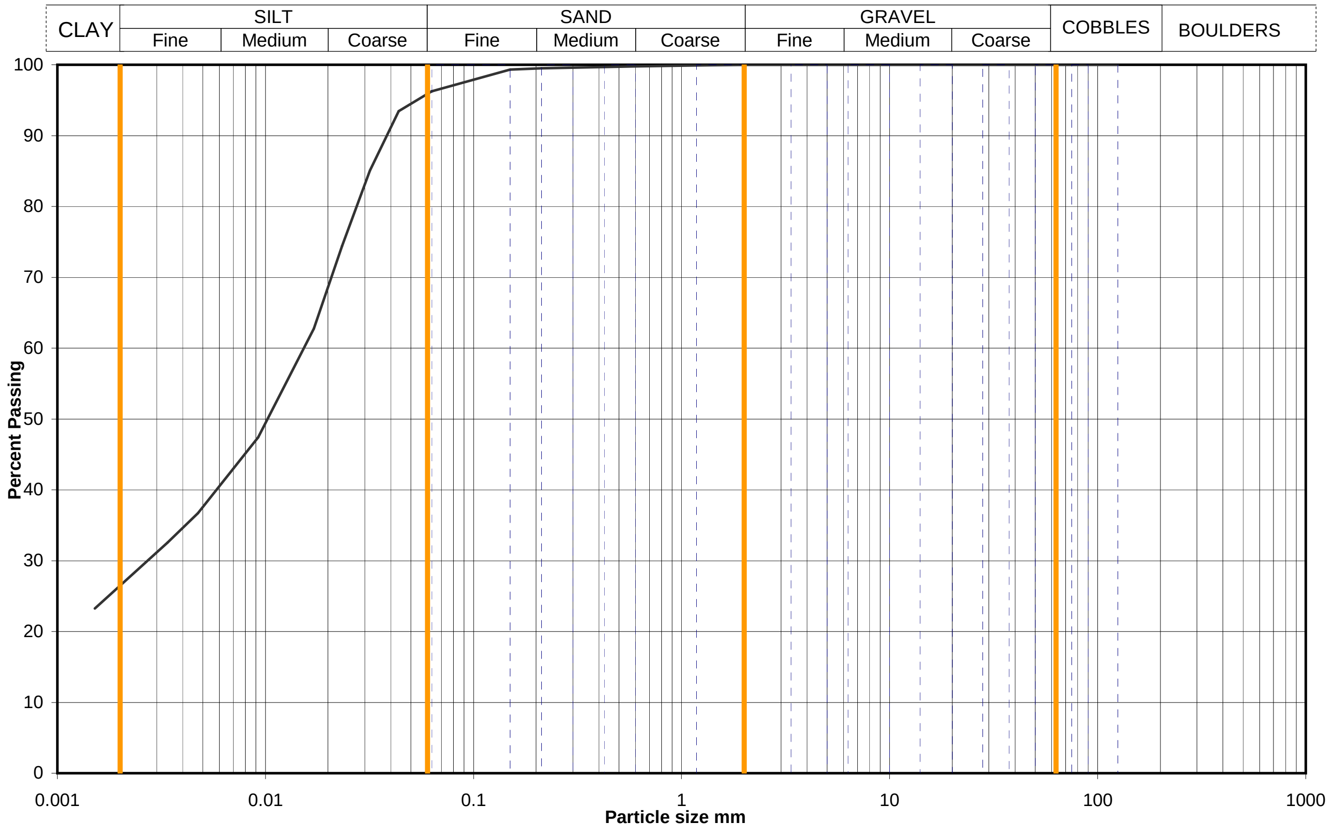
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406			
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.50			
			Samp No	13	Type	P	
			ID	A5085-1520151208041628			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	96
90	100	0.0437	93
75	100	0.0318	85
63	100	0.0233	74
50	100	0.0171	63
37.5	100	0.0092	47
28	100	0.0047	37
20	100	0.0034	33
14	100	0.0015	23
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	99		
0.150	99	1.9	
0.063	96		

Soil description	Brownish grey slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	4	4
	Silt	69	69
	Clay	27	27

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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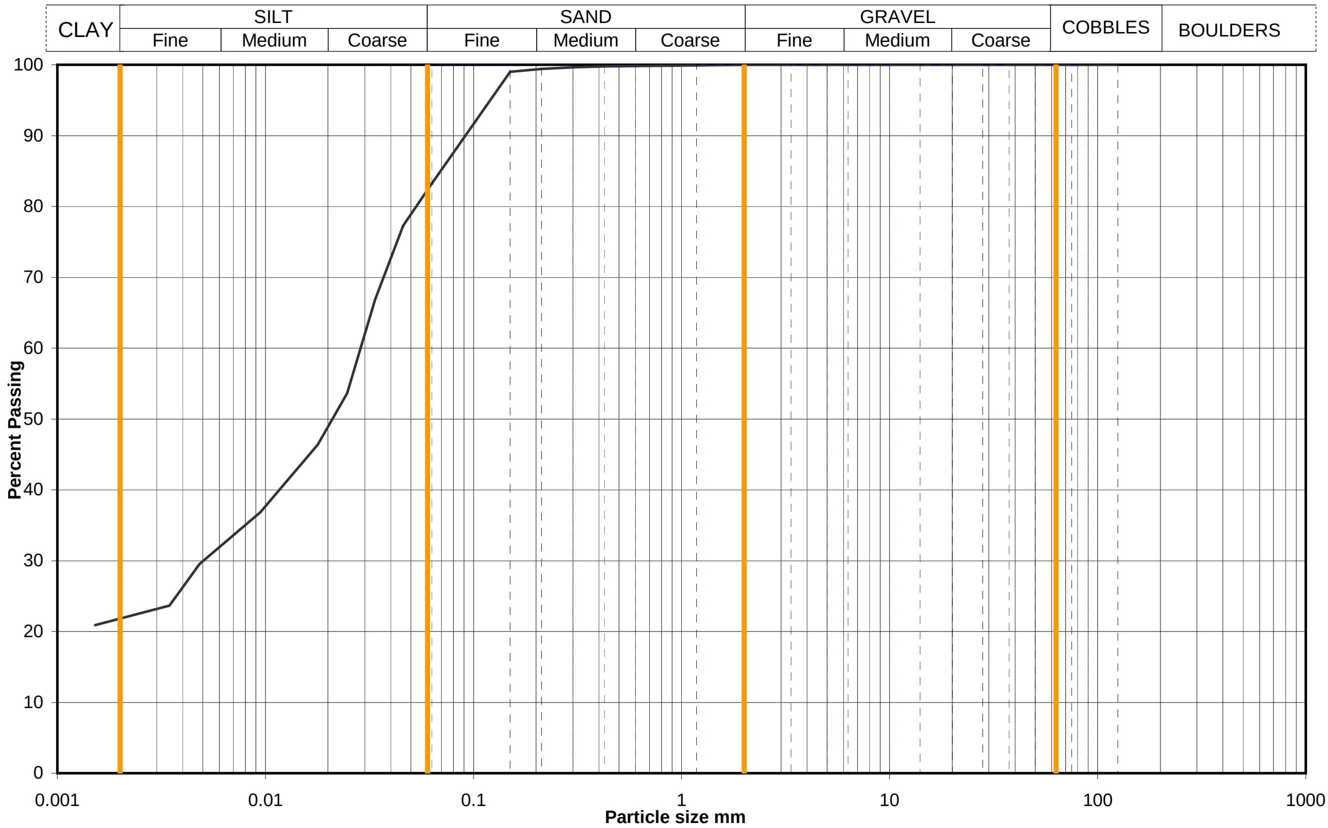
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00		
			Samp No	16	Type	UT
			ID	A5085-1520151208042145		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	83
90	100	0.0459	77
75	100	0.0336	67
63	100	0.0247	54
50	100	0.0178	46
37.5	100	0.0095	37
28	100	0.0048	30
20	100	0.0035	24
14	100	0.0015	21
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	99		
0.150	99	2.9	
0.063	83		

Soil description	Grey slightly sandy silty CLAY.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	18	18
	Silt	60	60
	Clay	22	22

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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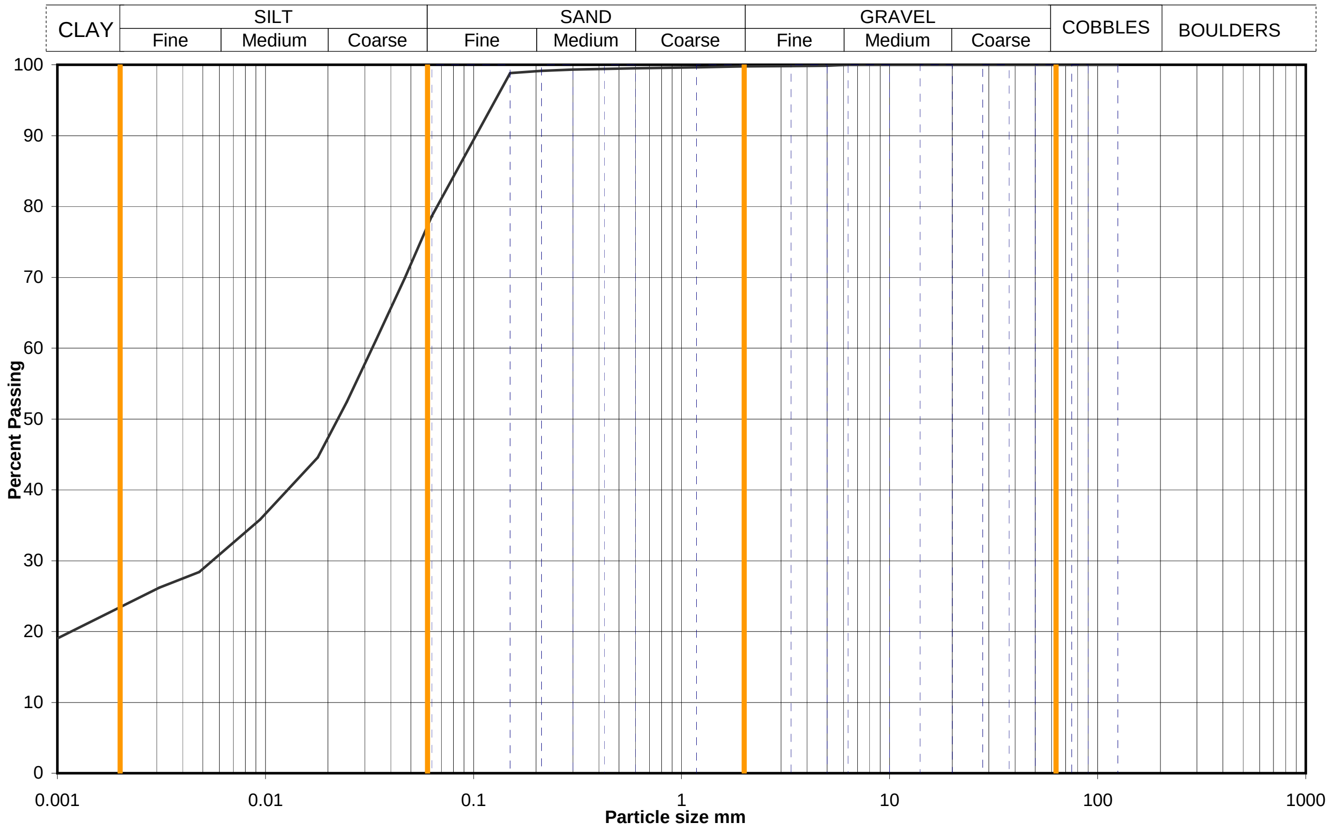
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.50		
			Samp No	18	Type	B
			ID	A5085-1520151208042257		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	79
90	100	0.0467	70
75	100	0.0339	61
63	100	0.0246	52
50	100	0.0178	45
37.5	100	0.0094	36
28	100	0.0048	28
20	100	0.0031	26
14	100	0.0008	18
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99		
0.063	79	12.4	

Soil description	Grey and brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	23	23
	Silt	54	54
	Clay	23	23

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Figure
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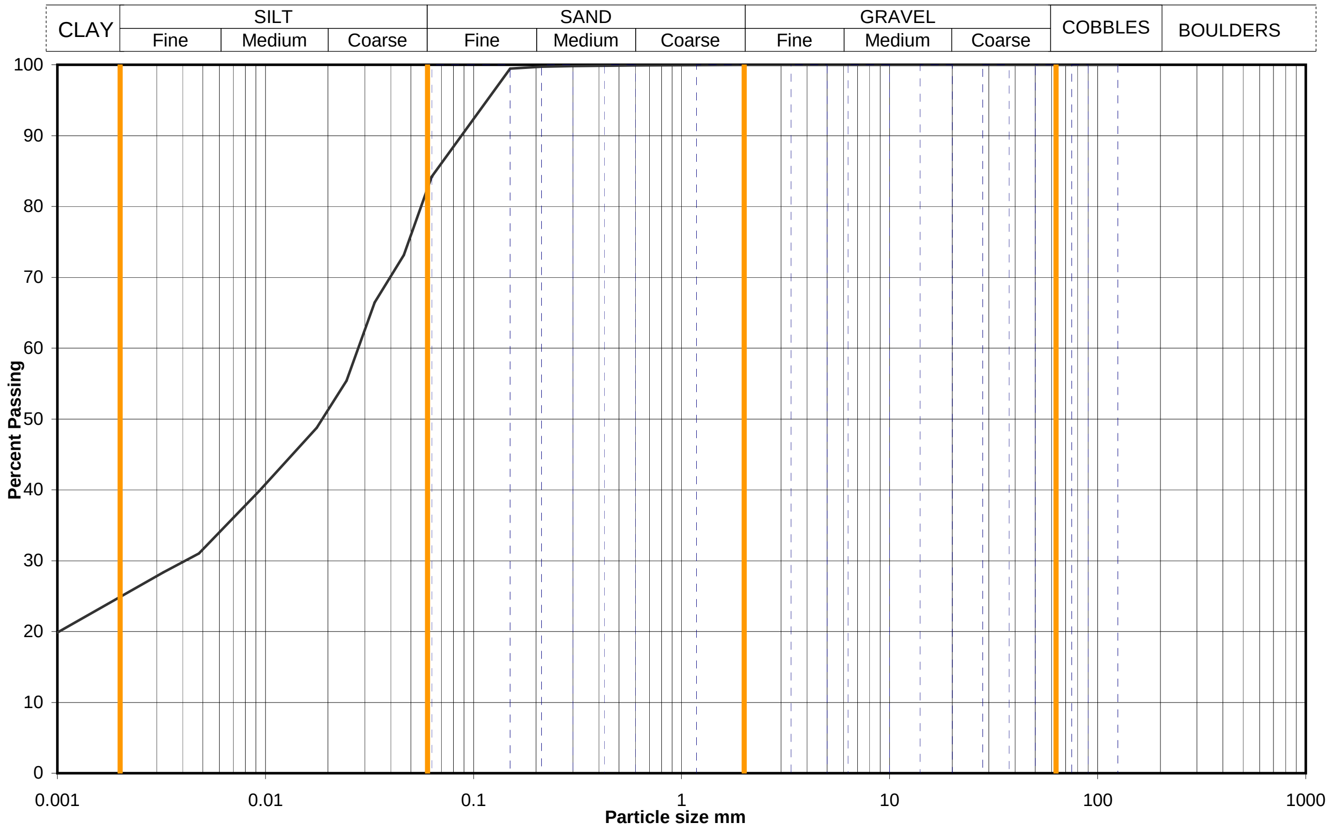
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.50		
			Samp No	23	Type	B
			ID	A5085-1520151209113442		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	84
90	100	0.0463	73
75	100	0.0335	66
63	100	0.0245	55
50	100	0.0177	49
37.5	100	0.0093	40
28	100	0.0048	31
20	100	0.0032	28
14	100	0.0008	19
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65 assumed	
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	99	7.0	
0.063	84		

Soil description	Greyish brown slightly sandy slightly gravelly SILT.
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377
Remarks	

		Whole	*<63mm
Sample Proportions	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	18	18
	Silt	57	57
	Clay	25	25

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.3 dry sieve
	Sedimentation	9.5 hydrometer

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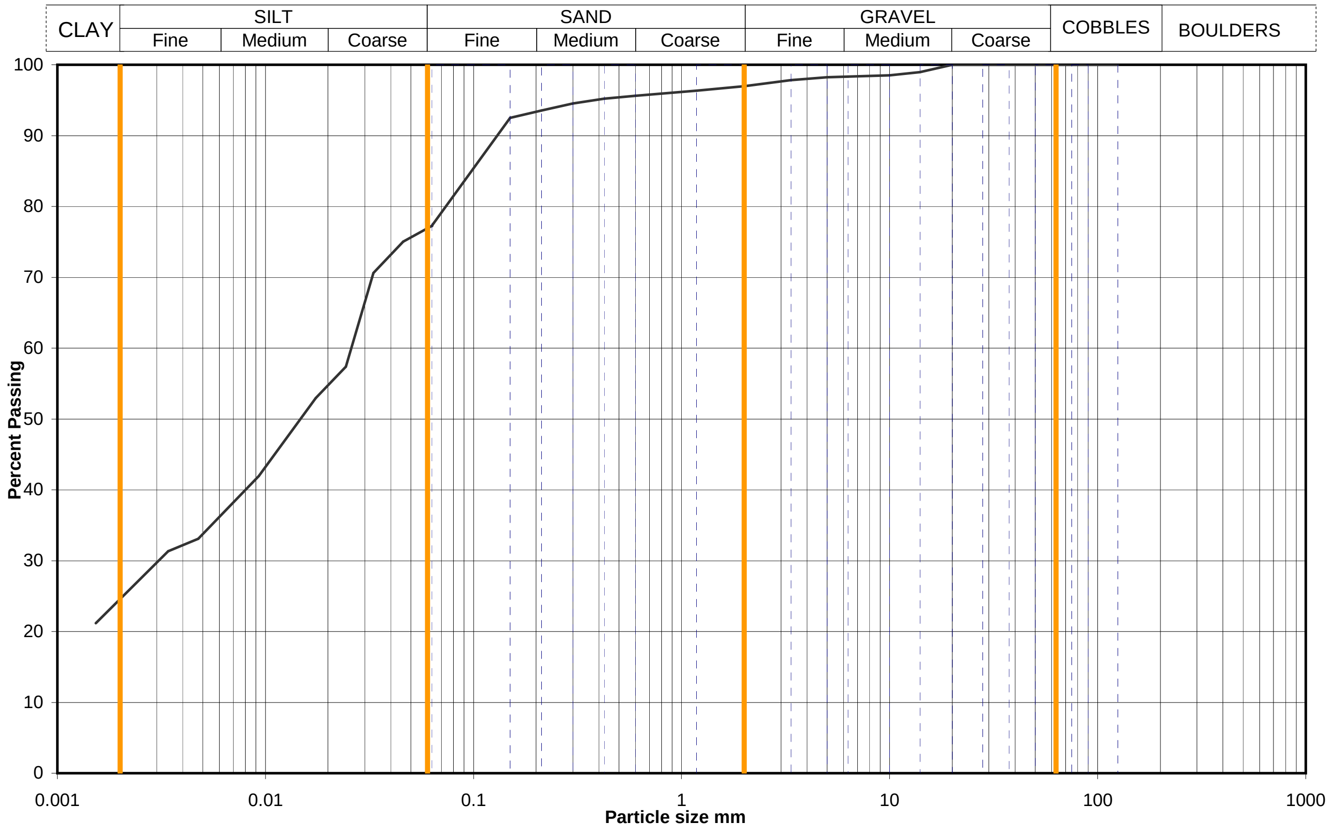
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00		
			Samp No	27	Type	B
			ID	A5085-1520151209113602		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	77
90	100	0.0460	75
75	100	0.0330	71
63	100	0.0243	57
50	100	0.0174	53
37.5	100	0.0093	42
28	100	0.0048	33
20	100	0.0034	31
14	99	0.0015	21
10	99		
6.3	98		
5.0	98		
3.35	98		
2.00	97		
1.18	96	Particle density, Mg/m3	
0.600	96		
0.425	95	2.65	assumed
0.300	95	Dry mass of sample, kg	
0.212	94		
0.150	93	6.4	
0.063	77		

Soil description	Grey slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	3	3
	Sand	20	20
	Silt	52	52
	Clay	25	25

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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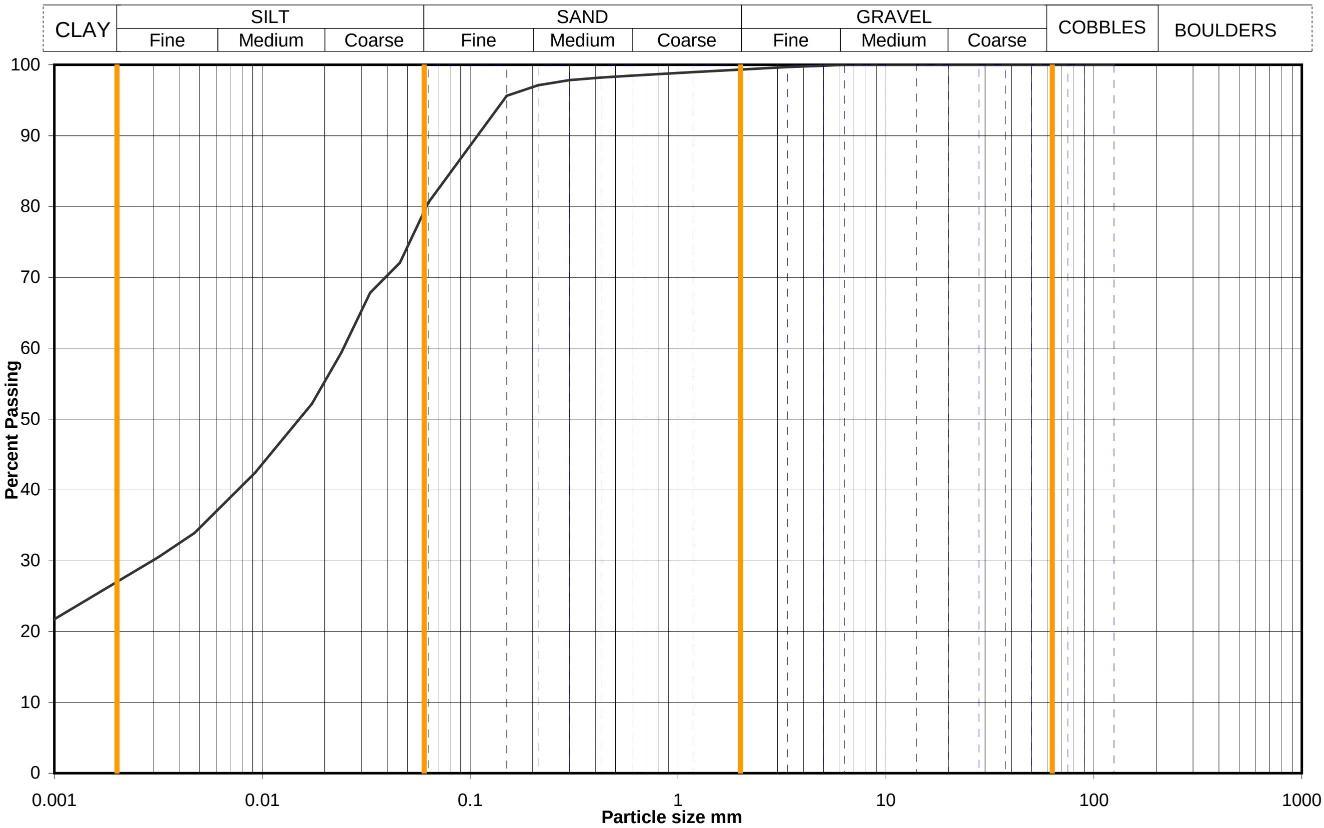
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.50
			Samp No	30
			Type	B
			ID	A5085-1520151209113910
			Spec Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	81
90	100	0.0460	72
75	100	0.0330	68
63	100	0.0240	59
50	100	0.0174	52
37.5	100	0.0092	42
28	100	0.0047	34
20	100	0.0032	31
14	100	0.0008	20
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	99		
1.18	99	Particle density, Mg/m3	
0.600	98		
0.425	98	2.65 assumed	
0.300	98	Dry mass of sample, kg	
0.212	97		
0.150	96	4.9	
0.063	81		

Soil description	Greyish brown slightly sandy slightly gravelly SILT.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	1	1
	Sand	20	20
	Silt	52	52
	Clay	27	27

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.3 dry sieve
	Sedimentation	9.5 hydrometer

QA Ref			Figure
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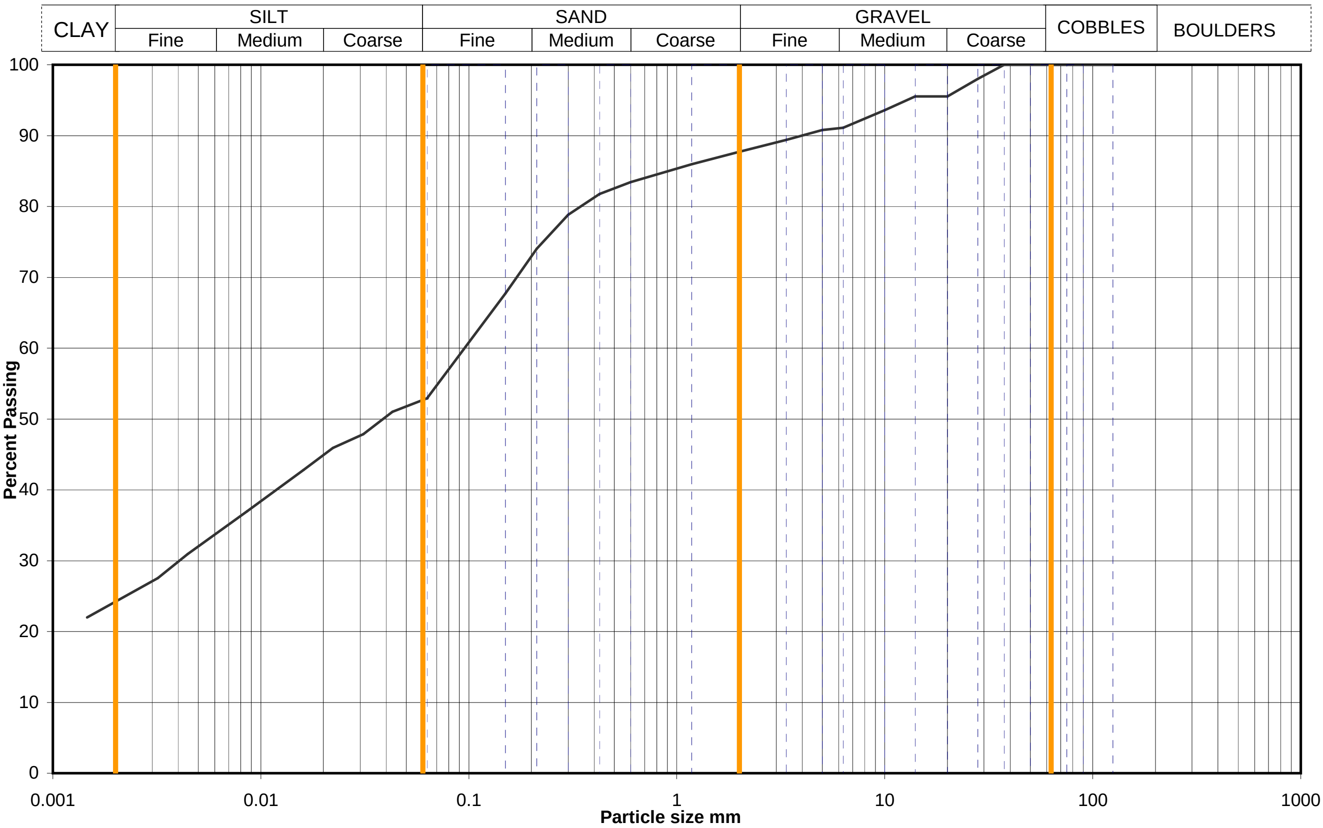
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406			
Project Name	A63 CASTLE STREET		Depth (m BGL)	13.00			
			Samp No	40	Type	UT	
			ID	A5085-1520151209114256			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	53
90	100	0.0430	51
75	100	0.0310	48
63	100	0.0222	46
50	100	0.0160	43
37.5	100	0.0086	37
28	98	0.0044	31
20	96	0.0032	28
14	96	0.0015	22
10	94		
6.3	91		
5.0	91		
3.35	89		
2.00	88		
1.18	86	Particle density, Mg/m3	
0.600	83		
0.425	82	2.65 assumed	
0.300	79	Dry mass of sample, kg	
0.212	74		
0.150	68		
0.063	53	5.2	

Soil description	Very stiff greyish brown slightly sandy slightly gravelly CLAY		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	12	12
	Sand	35	35
	Silt	29	29
	Clay	24	24

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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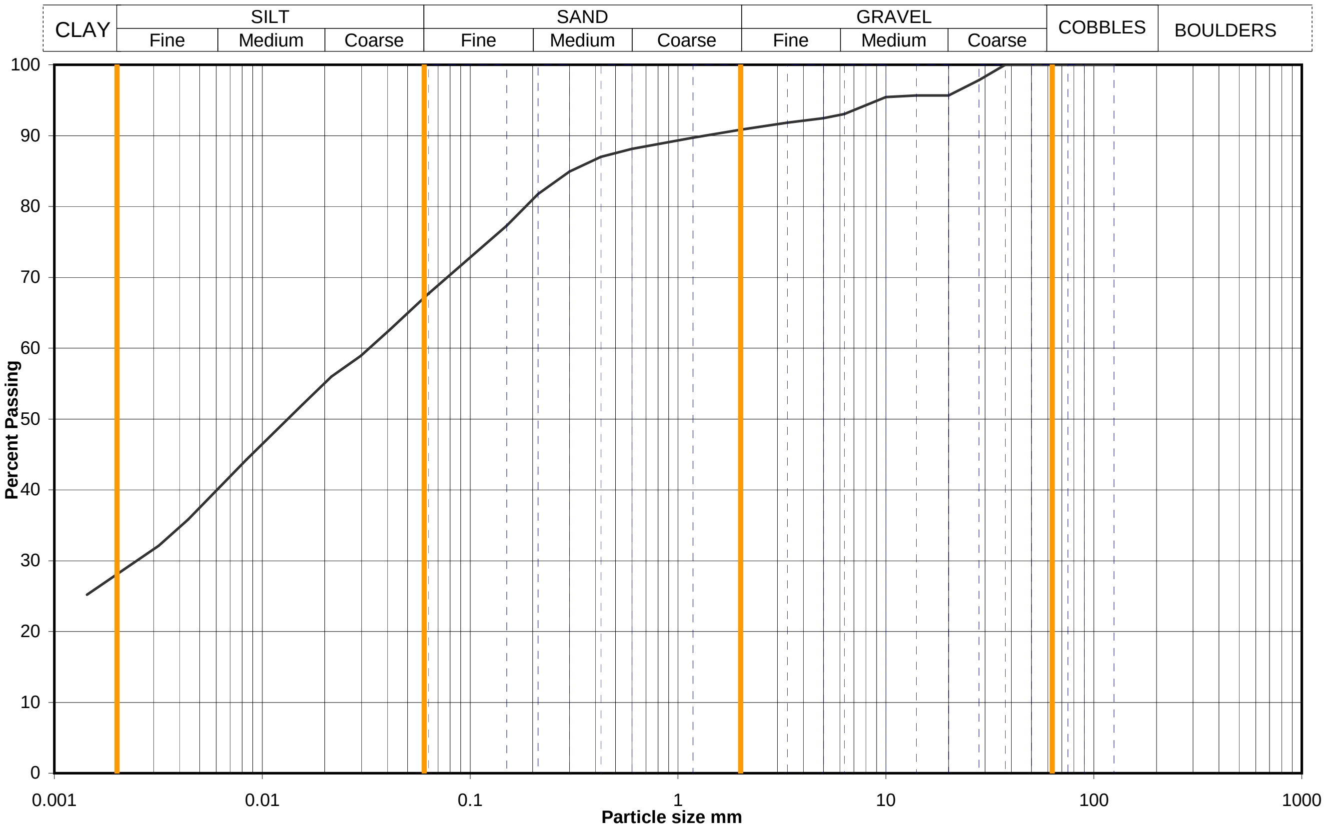
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.50		
			Samp No	47	Type	UT
			ID	A5085-1520151222102152		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	68
90	100	0.0411	63
75	100	0.0298	59
63	100	0.0215	56
50	100	0.0156	52
37.5	100	0.0084	44
28	98	0.0044	36
20	96	0.0032	32
14	96	0.0014	25
10	95		
6.3	93		
5.0	92		
3.35	92		
2.00	91		
1.18	90	Particle density, Mg/m3	
0.600	88		
0.425	87	2.65	assumed
0.300	85	Dry mass of sample, kg	
0.212	82		
0.150	77	3.8	
0.063	68		

Soil description	Firm to stiff greyish brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	9	9
	Sand	24	24
	Silt	39	39
	Clay	28	28

Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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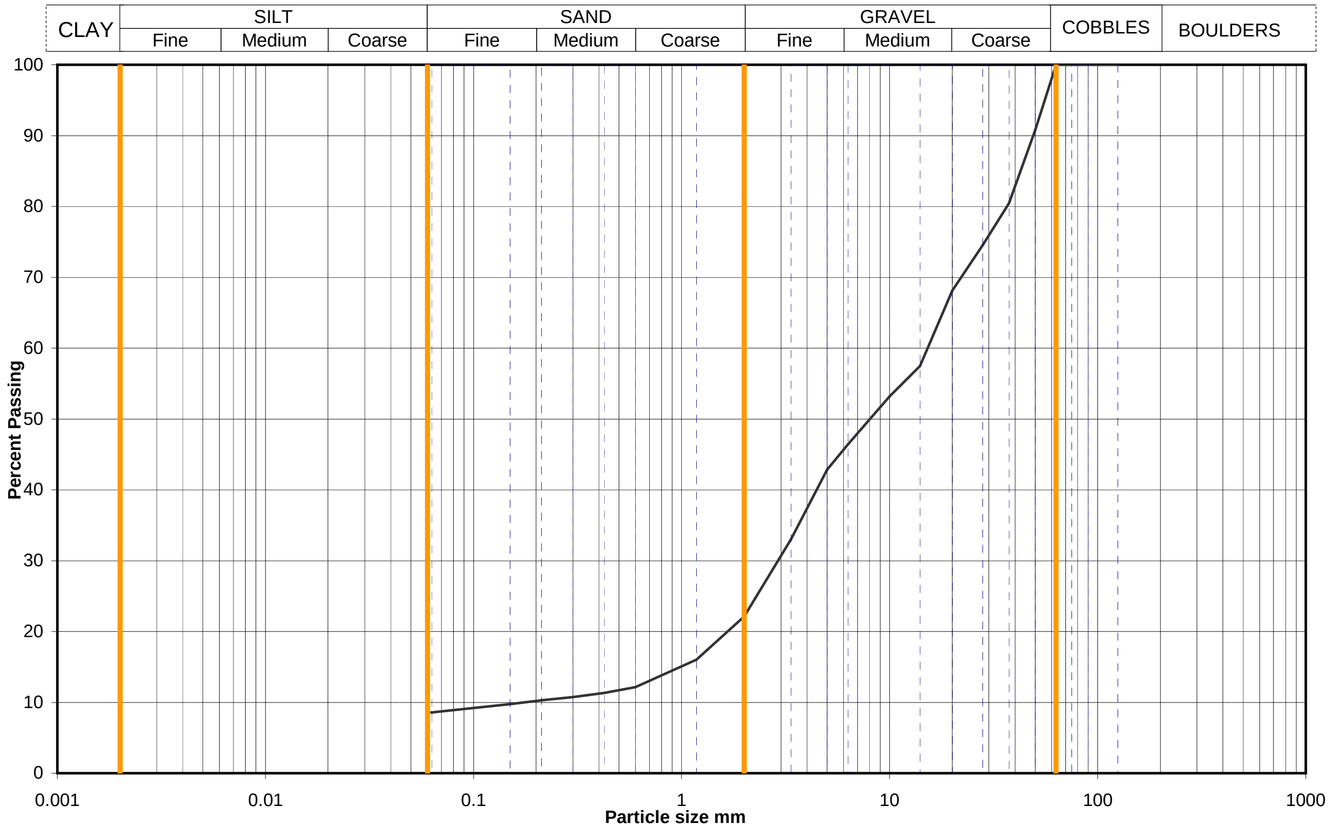
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	23.00		
			Samp No	82	Type	B
			ID	A5085-1520151222102956		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	91		
37.5	80		
28	75		
20	68		
14	57		
10	53		
6.3	46		
5.0	43		
3.35	33		
2.00	22		
1.18	16		
0.600	12		
0.425	11		
0.300	11	Dry mass of sample, kg	
0.212	10		
0.150	10	12.5	
0.063	9		

Soil description	Light brownish cream sandy clayey GRAVEL.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	78	78
	Sand	14	14
	Silt	silt+clay =	
	Clay	8	8

Uniformity Coefficient	D_{60} / D_{10}	87

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

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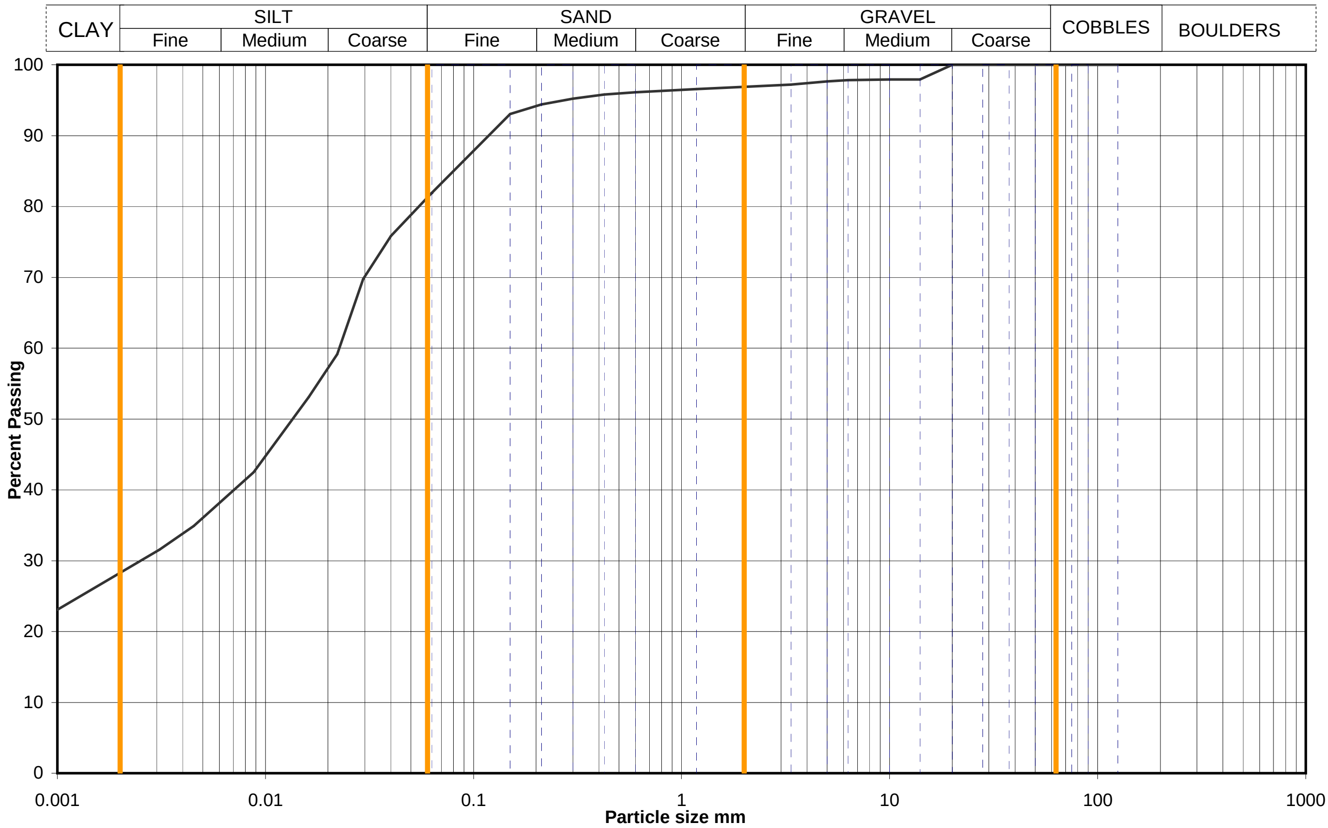
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.20		
			Samp No	4	Type	B
			ID	A5085-1520151208111339		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	82
90	100	0.0401	76
75	100	0.0295	70
63	100	0.0221	59
50	100	0.0161	53
37.5	100	0.0088	42
28	100	0.0045	35
20	100	0.0031	32
14	98	0.0008	22
10	98		
6.3	98		
5.0	98		
3.35	97		
2.00	97		
1.18	97	Particle density, Mg/m3	
0.600	96		
0.425	96	2.65	assumed
0.300	95	Dry mass of sample, kg	
0.212	94		
0.150	93	12.1	
0.063	82		

Soil description	Brownish grey slightly sandy slightly gravelly silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	3	3
	Sand	16	16
	Silt	53	53
	Clay	28	28

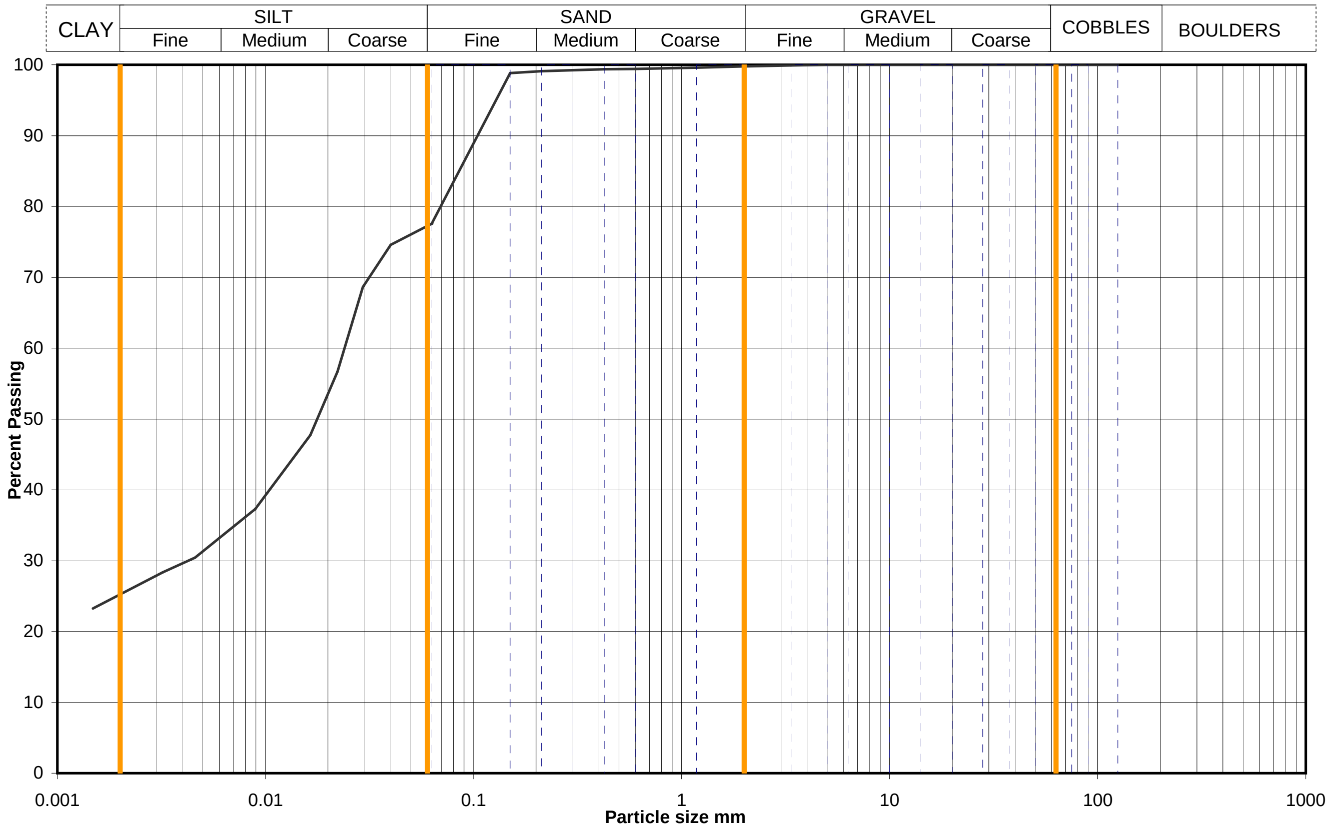
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Environmental Scientifics Group	Printed:18/03/2016 11:12	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.10		
			Samp No	9	Type	UT
			ID	A5085-1520151208112333		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	78
90	100	0.0400	75
75	100	0.0294	69
63	100	0.0222	57
50	100	0.0165	48
37.5	100	0.0089	37
28	100	0.0046	30
20	100	0.0032	28
14	100	0.0015	23
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	6.8	
0.063	78		

Soil description	Very soft brown slightly sandy silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	23	23
	Silt	52	52
	Clay	25	25

Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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Figure
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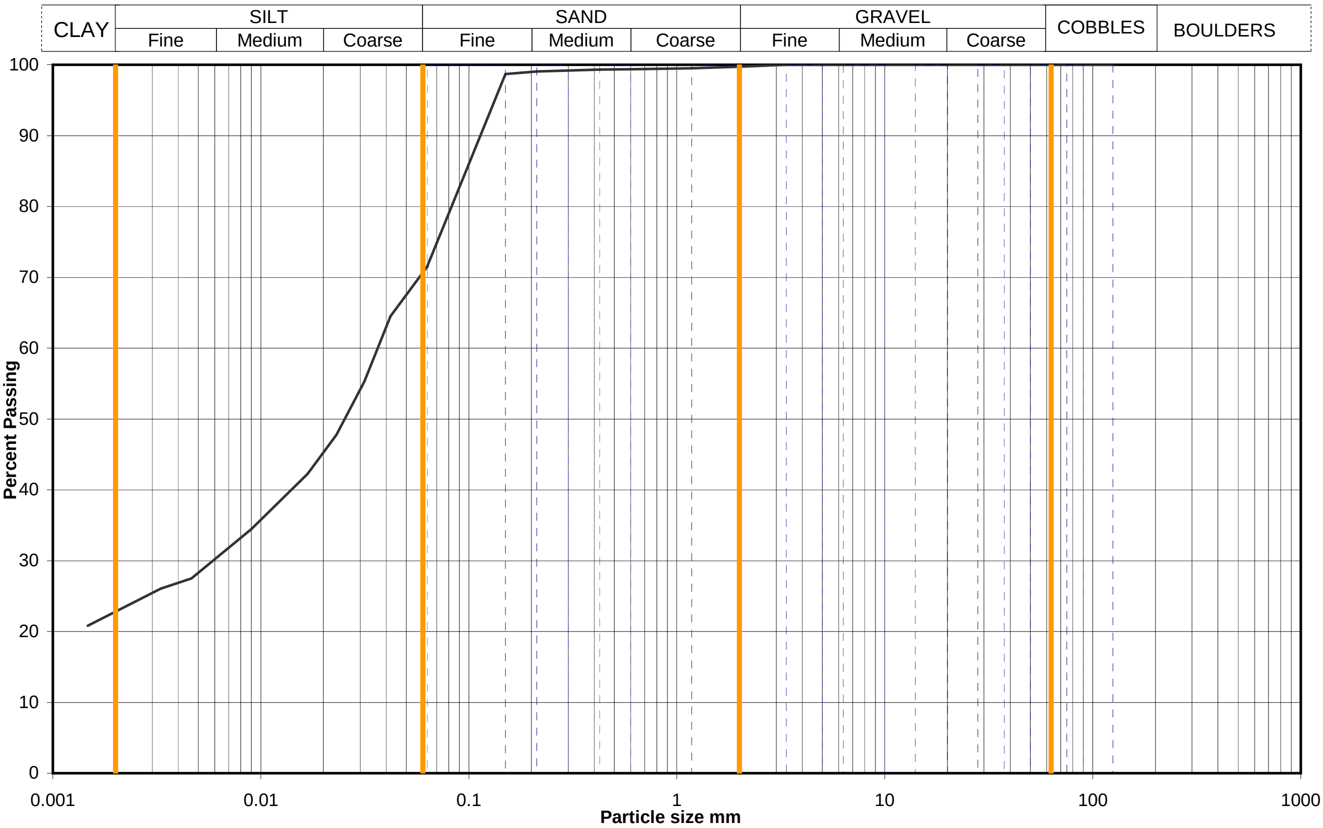
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.05		
			Samp No	15	Type	P
			ID	A5085-1520151222105857		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	71
90	100	0.0421	65
75	100	0.0314	55
63	100	0.0231	48
50	100	0.0168	42
37.5	100	0.0090	34
28	100	0.0046	27
20	100	0.0033	26
14	100	0.0015	21
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99		
0.063	71	7.7	

Soil description	Brown slightly sandy silty CLAY.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	29	29
	Silt	48	48
	Clay	23	23

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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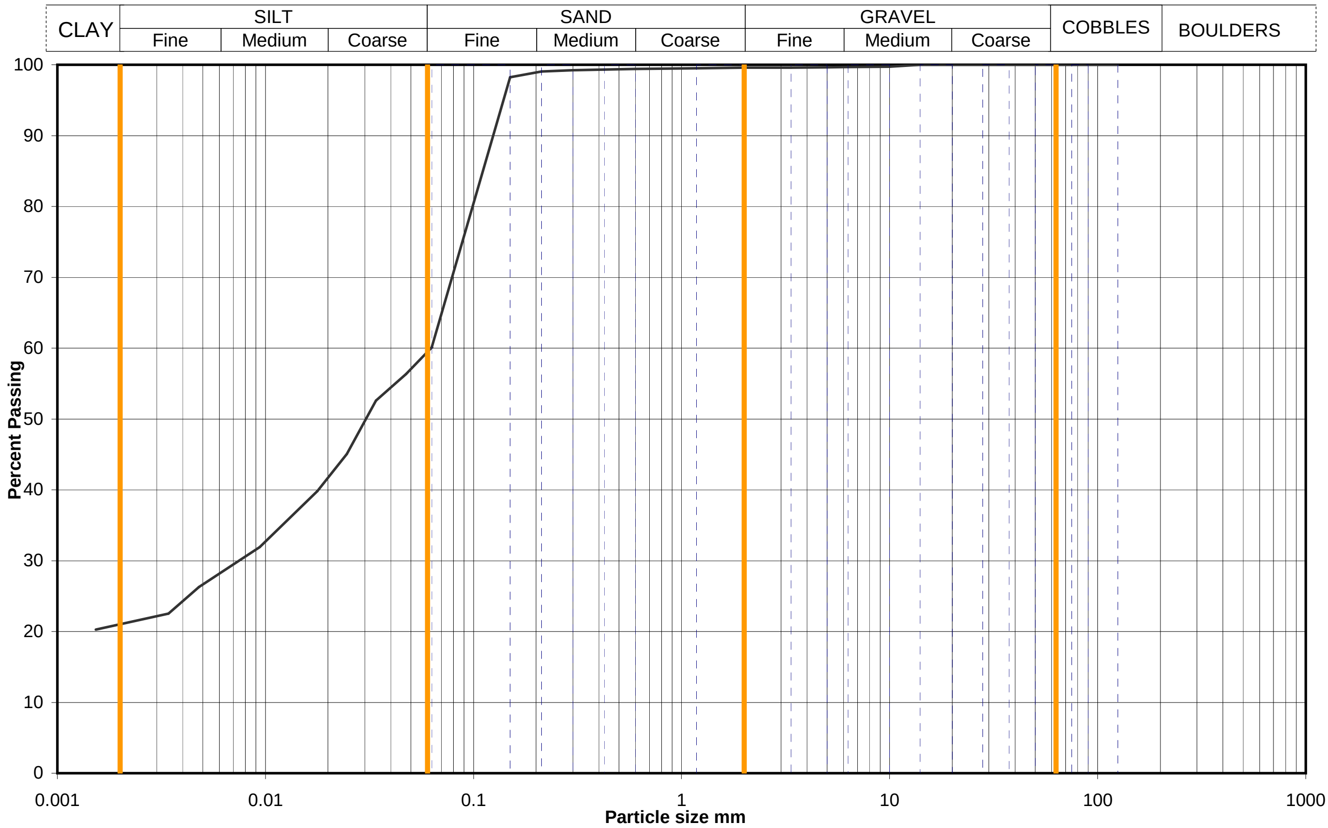
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.05			
			Samp No	20	Type	B	
			ID	A5085-1520151222105952			
			Spec Ref				



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	60
90	100	0.0473	56
75	100	0.0339	53
63	100	0.0246	45
50	100	0.0177	40
37.5	100	0.0094	32
28	100	0.0048	26
20	100	0.0034	23
14	100	0.0015	20
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	99		
0.425	99	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	98	10.0	
0.063	60		

Soil description	Grey sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	40	40
	Silt	39	39
	Clay	21	21

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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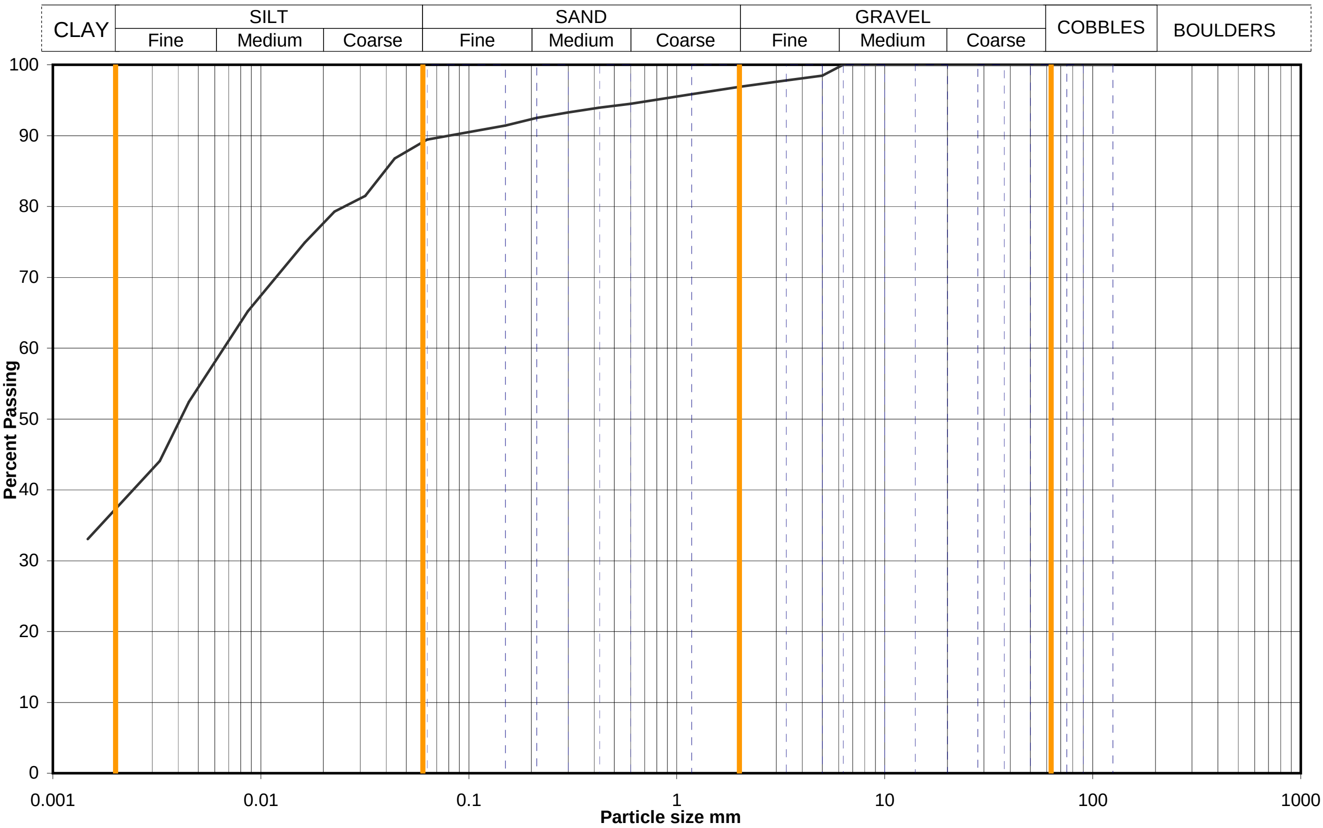
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.50		
			Samp No	25	Type	UT
			ID	A5085-1520151222110034		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	89
90	100	0.0440	87
75	100	0.0317	81
63	100	0.0226	79
50	100	0.0162	75
37.5	100	0.0087	65
28	100	0.0045	52
20	100	0.0033	44
14	100	0.0015	33
10	100		
6.3	100		
5.0	98		
3.35	98		
2.00	97		
1.18	96	Particle density, Mg/m3	
0.600	94		
0.425	94	2.65 assumed	
0.300	93	Dry mass of sample, kg	
0.212	92		
0.150	91	1.5	
0.063	89		

Soil description	Firm brownish grey slightly sandy slightly gravelly CLAY with wood fragments.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	3	3
	Sand	8	8
	Silt	52	52
	Clay	37	37

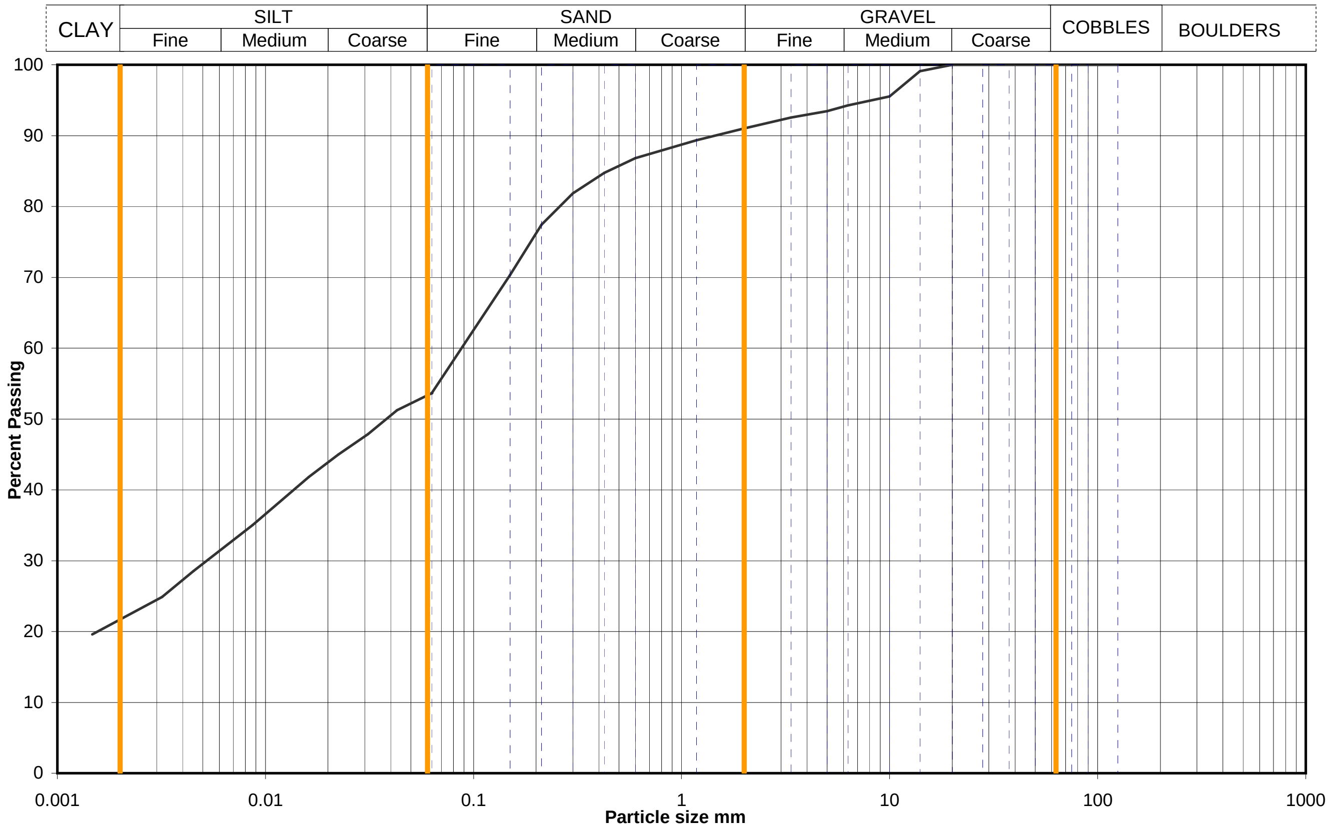
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:12	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	12.50		
			Samp No	33	Type	UT
			ID	A5085-1520151222110125		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	54
90	100	0.0429	51
75	100	0.0310	48
63	100	0.0224	45
50	100	0.0161	42
37.5	100	0.0087	35
28	100	0.0045	29
20	100	0.0032	25
14	99	0.0015	20
10	96		
6.3	94		
5.0	93		
3.35	93		
2.00	91		
1.18	89	Particle density, Mg/m3	
0.600	87		
0.425	85	2.65	assumed
0.300	82	Dry mass of sample, kg	
0.212	77		
0.150	70	3.1	
0.063	54		

Soil description	Soft to firm brownish grey slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	9	9
	Sand	38	38
	Silt	31	31
	Clay	22	22

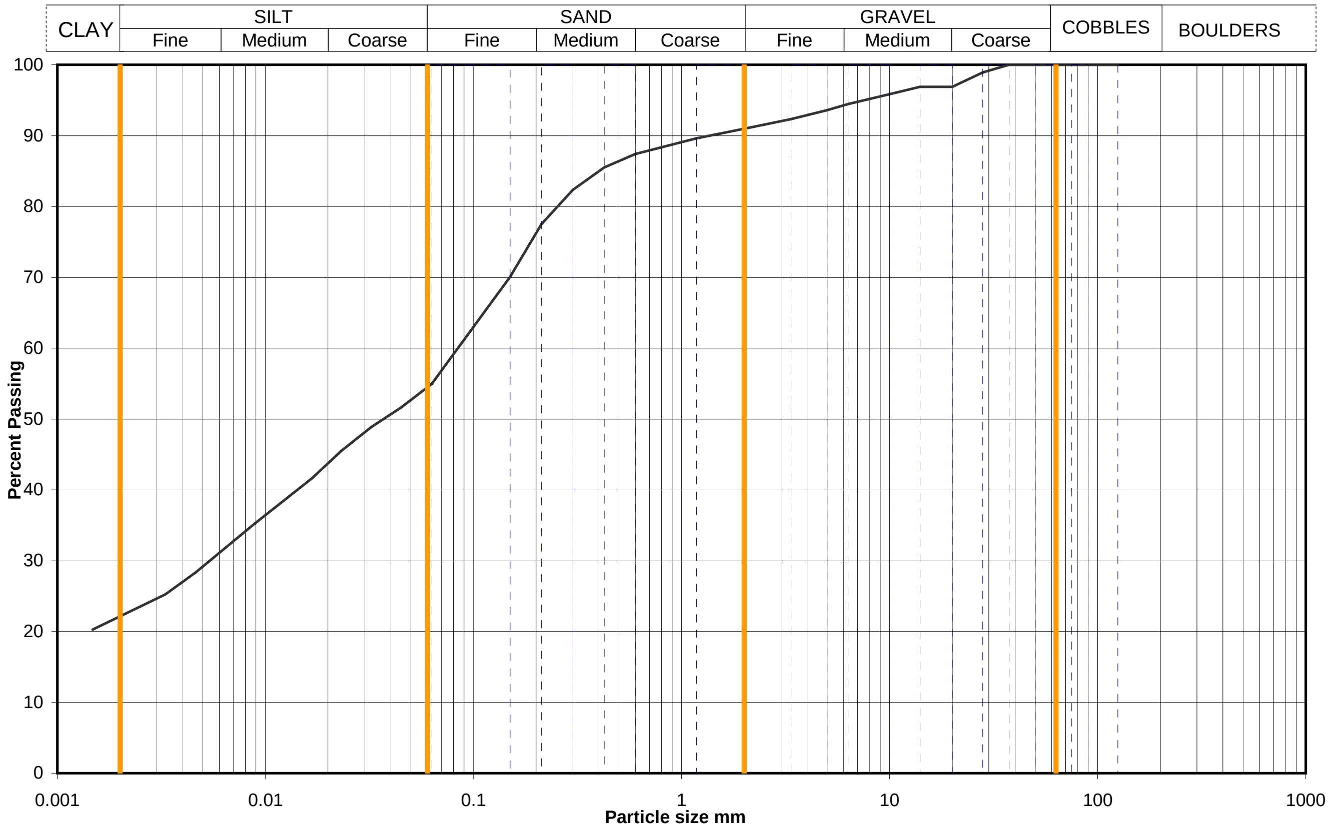
Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:13	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.50
			Samp No	41 Type UT
			ID	A5085-1520151222110217
			Spec Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	55
90	100	0.0448	52
75	100	0.0322	49
63	100	0.0232	46
50	100	0.0167	42
37.5	100	0.0089	35
28	99	0.0046	28
20	97	0.0033	25
14	97	0.0015	20
10	96		
6.3	94		
5.0	94		
3.35	92		
2.00	91		
1.18	90	Particle density, Mg/m3	
0.600	87		
0.425	86	2.65 assumed	
0.300	82	Dry mass of sample, kg	
0.212	78		
0.150	70	4.3	
0.063	55		

Soil description	Stiff brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	9	9
	Sand	37	37
	Silt	32	32
	Clay	22	22

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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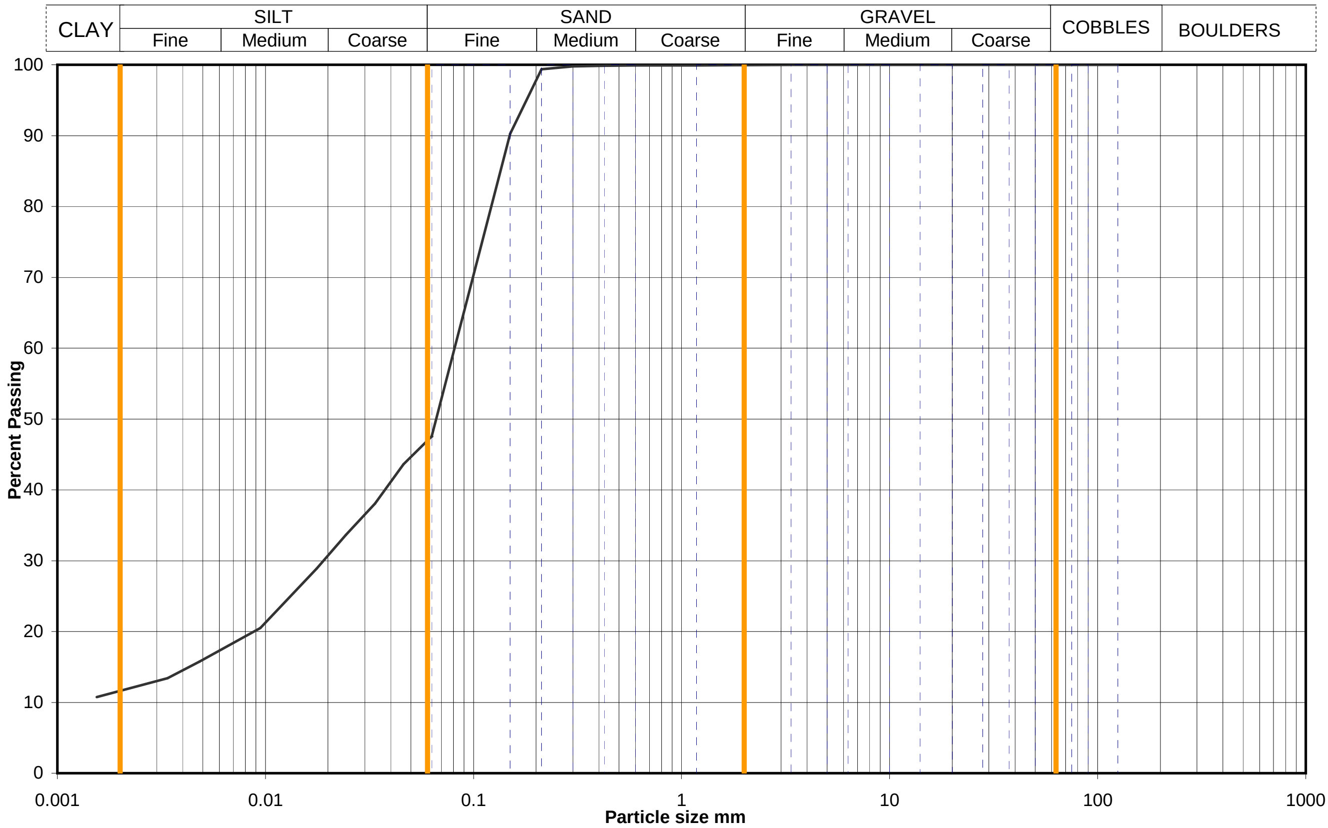
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.50		
			Samp No	49	Type	UT
			ID	A5085-1520151222110304		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	48
90	100	0.0461	44
75	100	0.0336	38
63	100	0.0243	34
50	100	0.0176	29
37.5	100	0.0095	20
28	100	0.0048	16
20	100	0.0034	13
14	100	0.0015	11
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	99		
0.150	90	5.0	
0.063	48		

Soil description	Brown sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	53	53
	Silt	35	35
	Clay	12	12

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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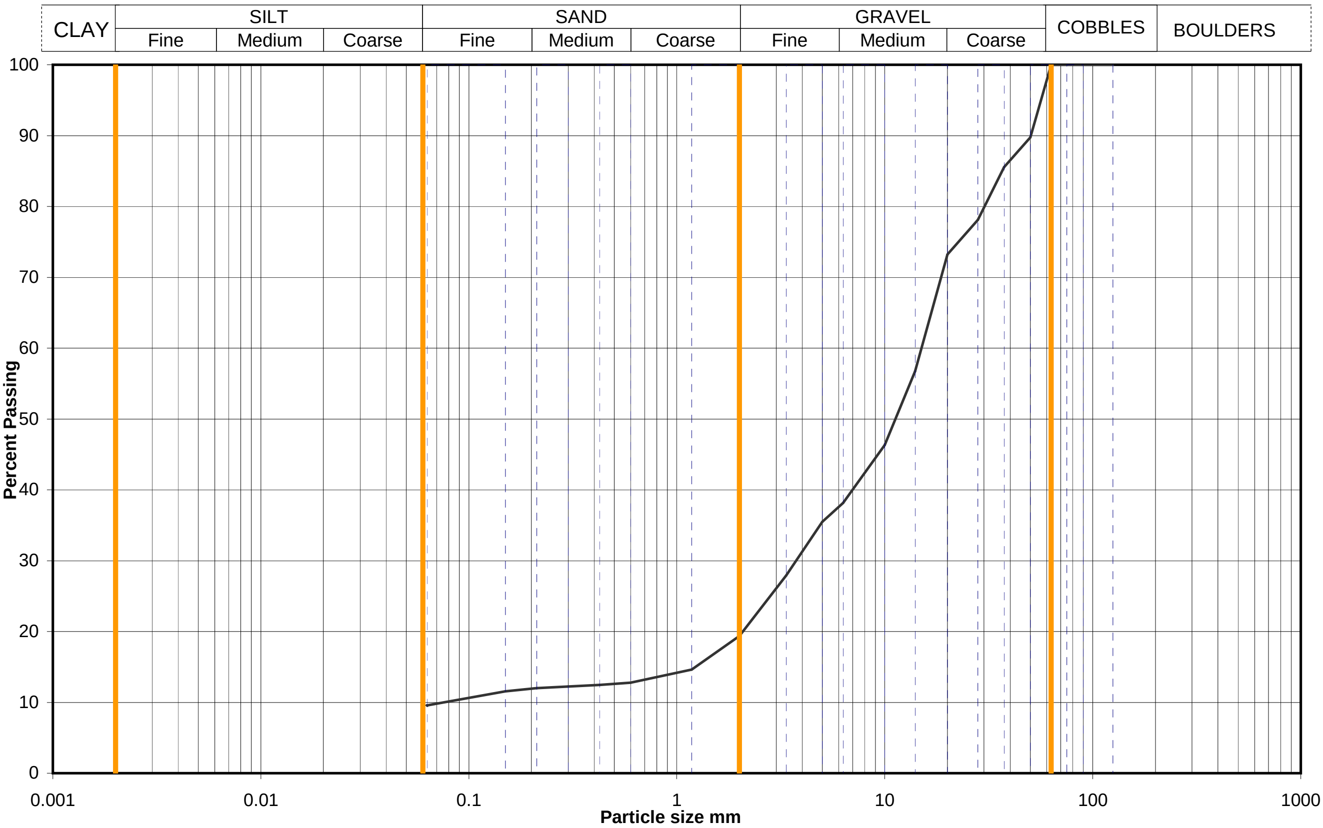
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	26.50		
			Samp No	85	Type	B
			ID	A5085-1520151222110835		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	90		
37.5	86		
28	78		
20	73		
14	57		
10	46		
6.3	38		
5.0	36		
3.35	28		
2.00	19		
1.18	15		
0.600	13		
0.425	12		
0.300	12	Dry mass of sample, kg	
0.212	12		
0.150	12	12.6	
0.063	10		

Soil description	White sandy silty GRAVEL. Gravel is chalk.		
Preparation / Pretreatment	Sieve: pre dried,		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	81	81
	Sand	10	10
	Silt	silt+clay =	
	Clay	9	9

Uniformity Coefficient	D_{60} / D_{10}	197

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.3 dry sieve
	Sedimentation	none

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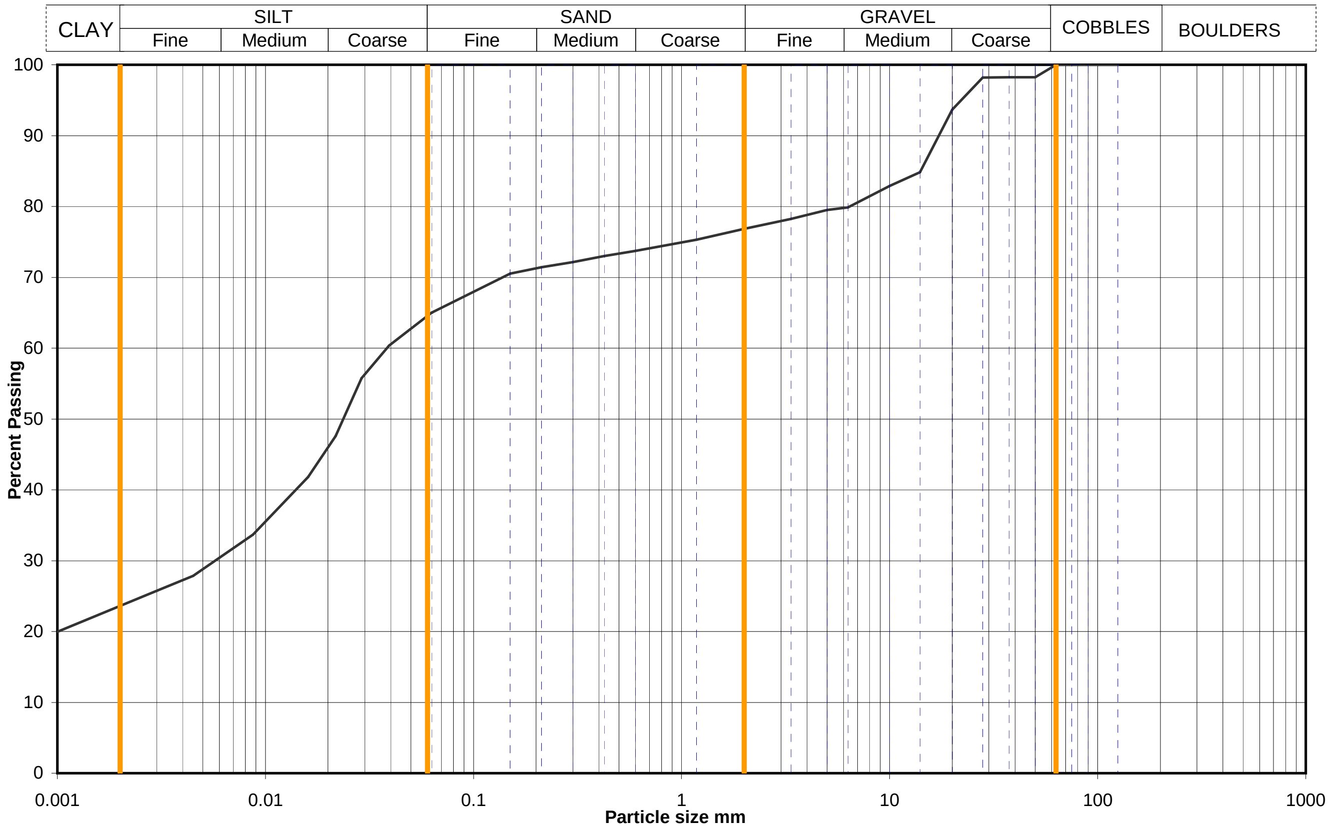
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.40		
			Samp No	2	Type	B
			ID	A5085-1520151209100759		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	65
90	100	0.0393	60
75	100	0.0289	56
63	100	0.0218	48
50	98	0.0160	42
37.5	98	0.0087	34
28	98	0.0045	28
20	94	0.0030	26
14	85	0.0008	19
10	83		
6.3	80		
5.0	80		
3.35	78		
2.00	77		
1.18	75	Particle density, Mg/m3	
0.600	74		
0.425	73	2.65 assumed	
0.300	72	Dry mass of sample, kg	
0.212	71		
0.150	71	12.2	
0.063	65		

Soil description	Light brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	23	23
	Sand	12	12
	Silt	41	41
	Clay	24	24

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref			Figure
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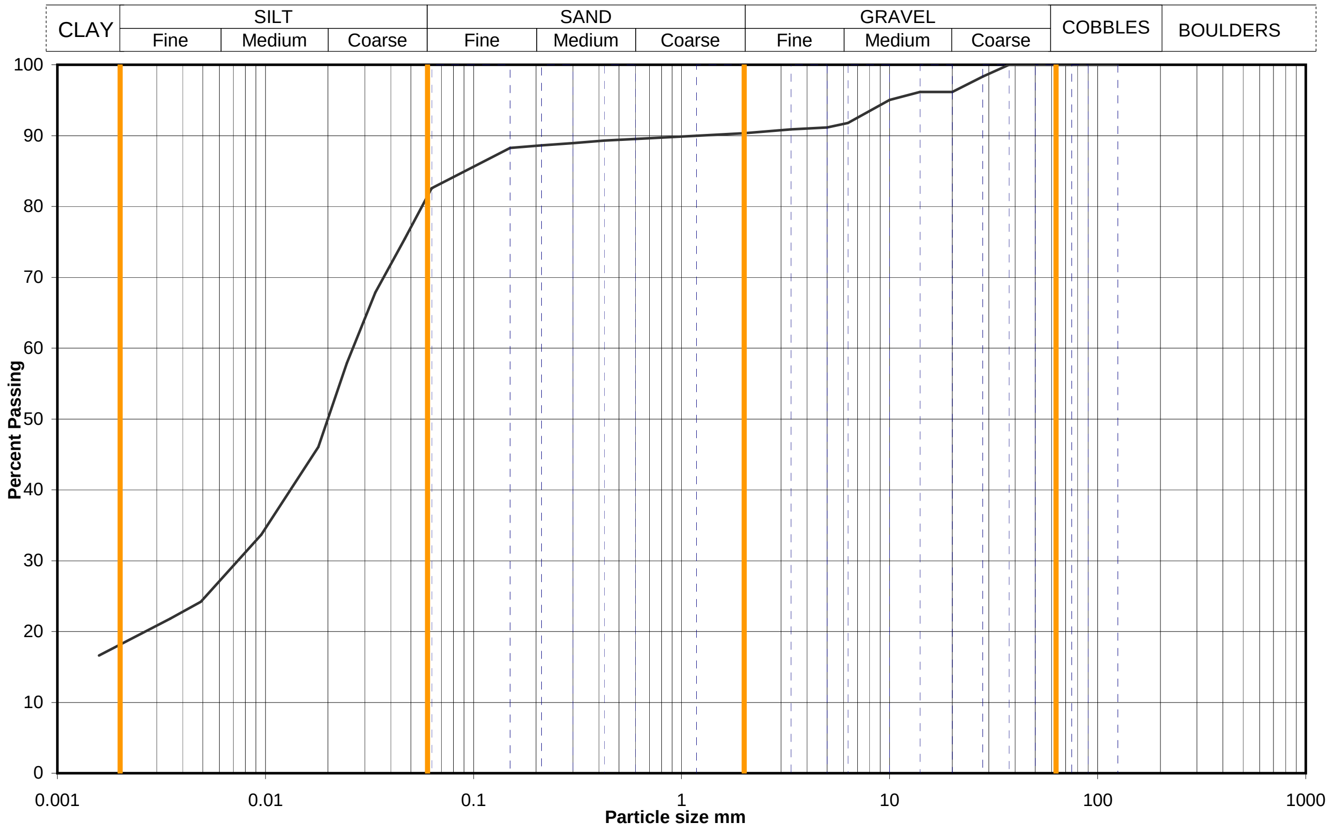
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.35		
			Samp No	7	Type	UT
			ID	A5085-1520151209102344		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	83
90	100	0.0467	75
75	100	0.0338	68
63	100	0.0246	58
50	100	0.0180	46
37.5	100	0.0096	34
28	98	0.0049	24
20	96	0.0035	22
14	96	0.0016	17
10	95		
6.3	92		
5.0	91		
3.35	91		
2.00	90		
1.18	90	Particle density, Mg/m3	
0.600	90		
0.425	89	2.65 assumed	
0.300	89	Dry mass of sample, kg	
0.212	89		
0.150	88		
0.063	83	4.3	

Soil description	Dark greyish brown slightly sandy slightly gravelly clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	10	10
	Sand	9	9
	Silt	63	63
	Clay	18	18

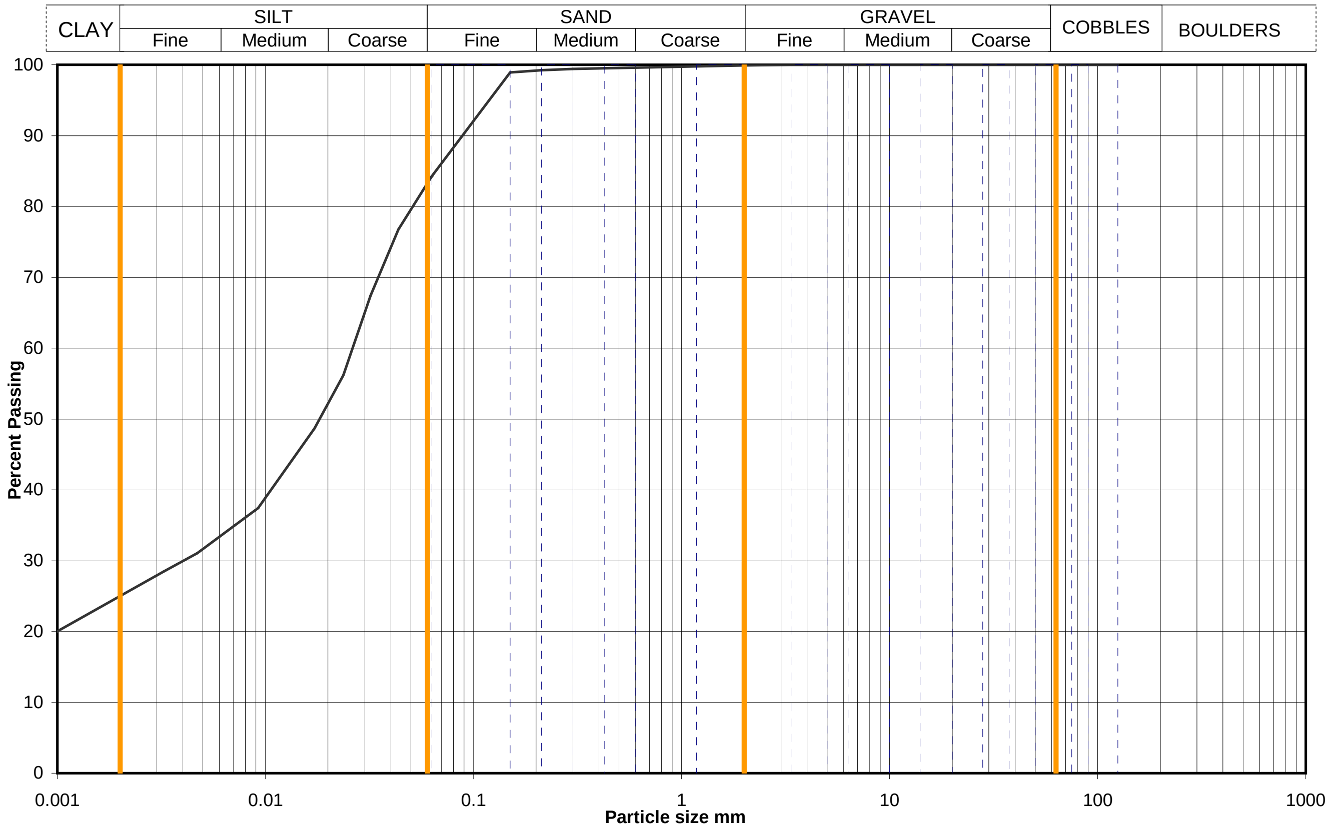
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Printed:18/03/2016 11:13	**Figure** PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90
			Samp No	11
			Type	P
			ID	A5085-1520151209102511
			Spec Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	84
90	100	0.0435	77
75	100	0.0320	67
63	100	0.0237	56
50	100	0.0172	49
37.5	100	0.0092	37
28	100	0.0047	31
20	100	0.0032	28
14	100	0.0008	19
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	99	2.65 assumed	
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	4.1	
0.063	84		

Soil description	Soft dark grey silty CLAY becoming firm dark grey slightly sandy silty CLAY with organic material towards base.
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377
Remarks	

Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	17	17
	Silt	58	58
	Clay	25	25

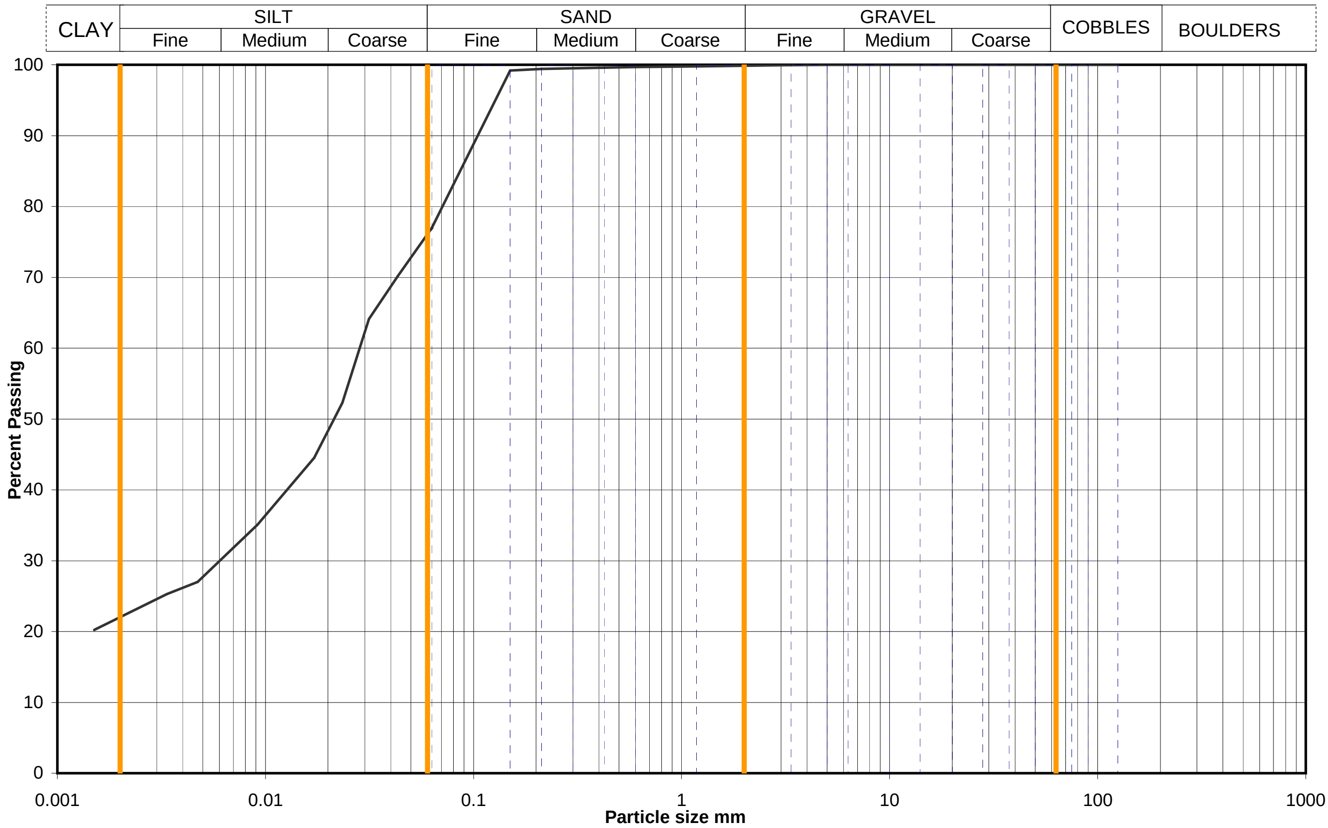
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref			Figure
SLR 2,9 Rev 88 Aug 11	Environmental Scientifics Group	Printed:18/03/2016 11:13	PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.70		
			Samp No	15	Type	UT
			ID	A5085-1520151209102618		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	77
90	100	0.0432	70
75	100	0.0314	64
63	100	0.0234	52
50	100	0.0171	45
37.5	100	0.0092	35
28	100	0.0047	27
20	100	0.0034	25
14	100	0.0015	20
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65 assumed	
0.300	100	Dry mass of sample, kg	
0.212	99		
0.150	99	3.2	
0.063	77		

Soil description	Very soft dark brown slightly sandy silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	24	24
	Silt	54	54
	Clay	22	22

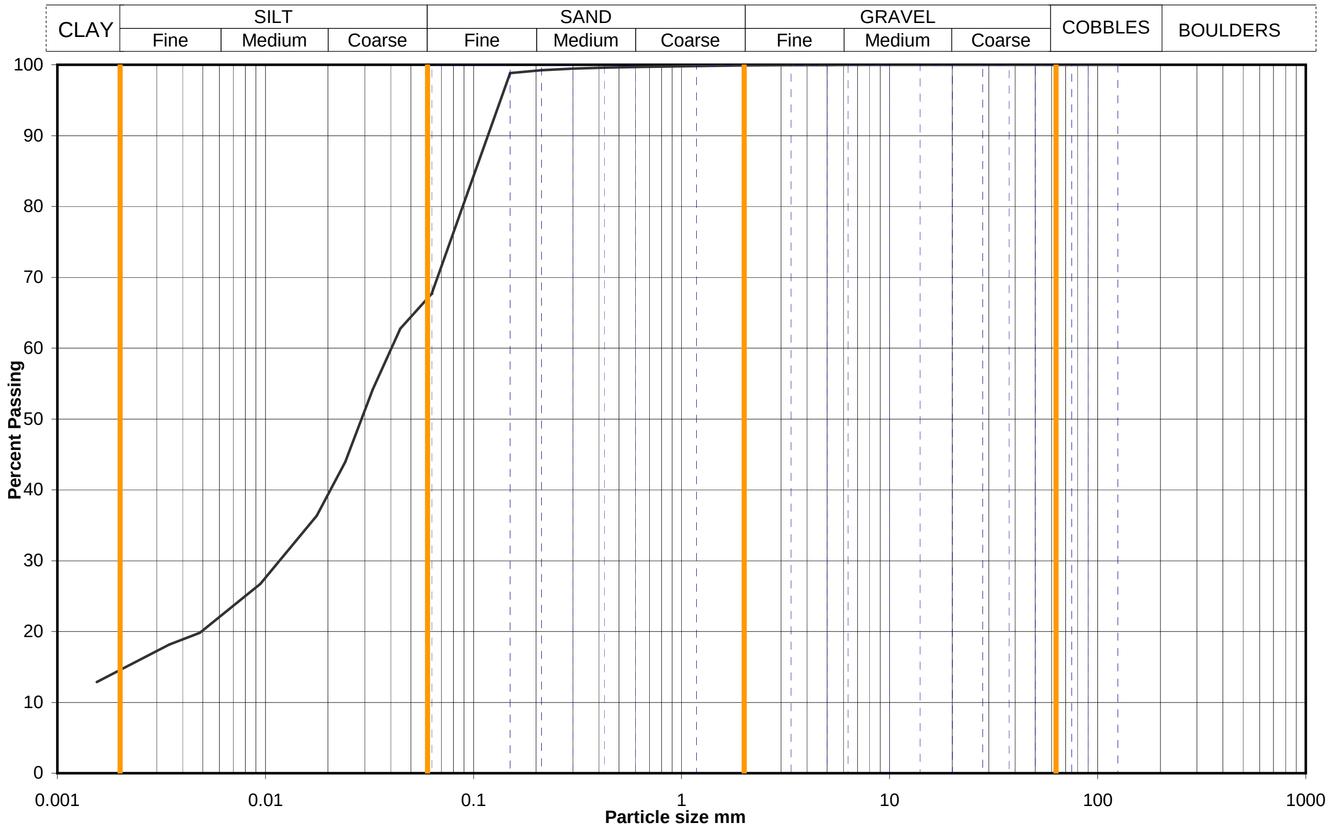
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Environmental Scientifics Group	Printed:18/03/2016 11:13	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.05		
			Samp No	19	Type	P
			ID	A5085-1520151209102743		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	68
90	100	0.0445	63
75	100	0.0328	54
63	100	0.0242	44
50	100	0.0177	36
37.5	100	0.0095	27
28	100	0.0048	20
20	100	0.0034	18
14	100	0.0015	13
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65 assumed	
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	7.9	
0.063	68		

Soil description	Brown slightly sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	33	33
	Silt	52	52
	Clay	15	15

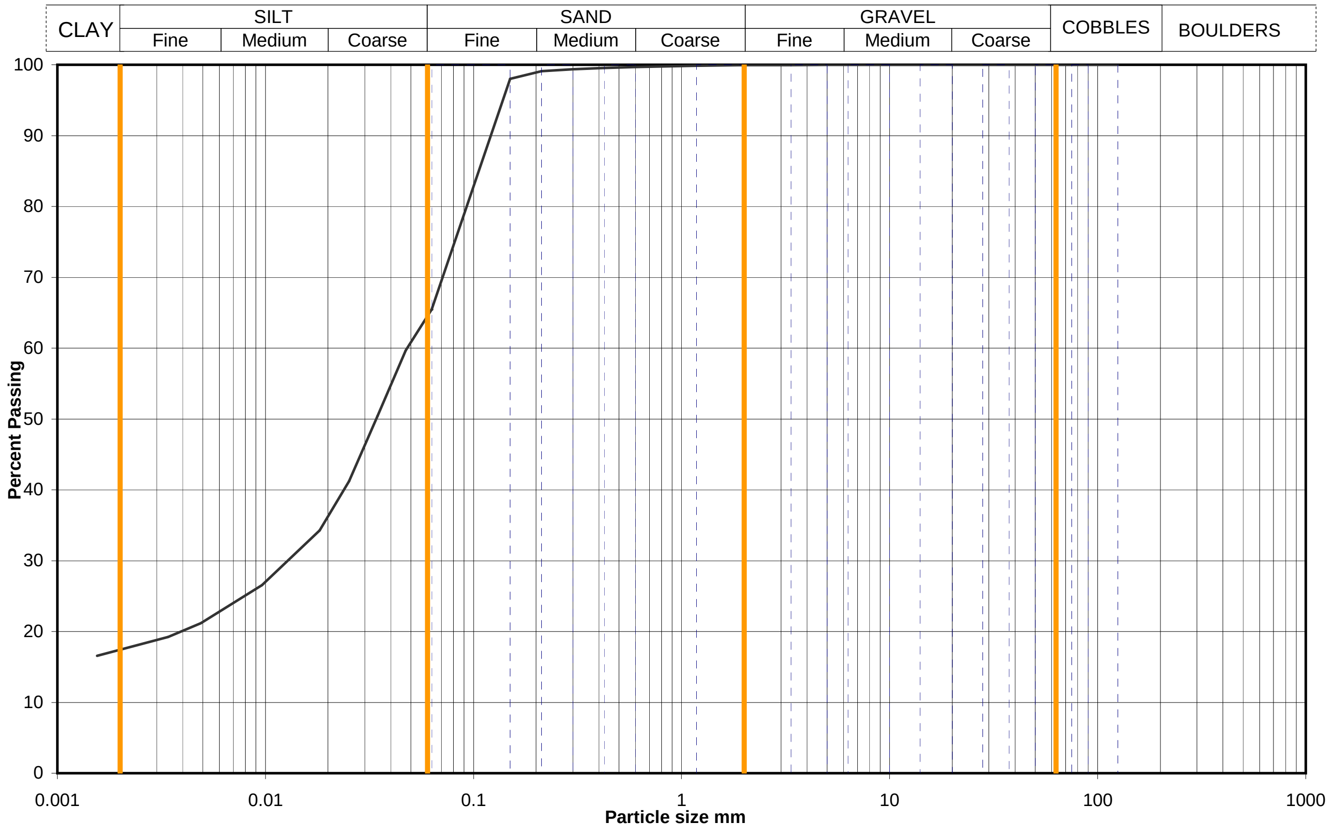
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:13	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05		
			Samp No	20	Type	P
			ID	A5085-1520151209104559		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	65
90	100	0.0472	60
75	100	0.0345	50
63	100	0.0252	41
50	100	0.0182	34
37.5	100	0.0096	27
28	100	0.0049	21
20	100	0.0034	19
14	100	0.0016	17
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	98	7.0	
0.063	65		

Soil description	Dark greyish brown sandy clayey SILT becoming very soft organic silty CLAY towards base.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	35	35
	Silt	47	47
	Clay	18	18

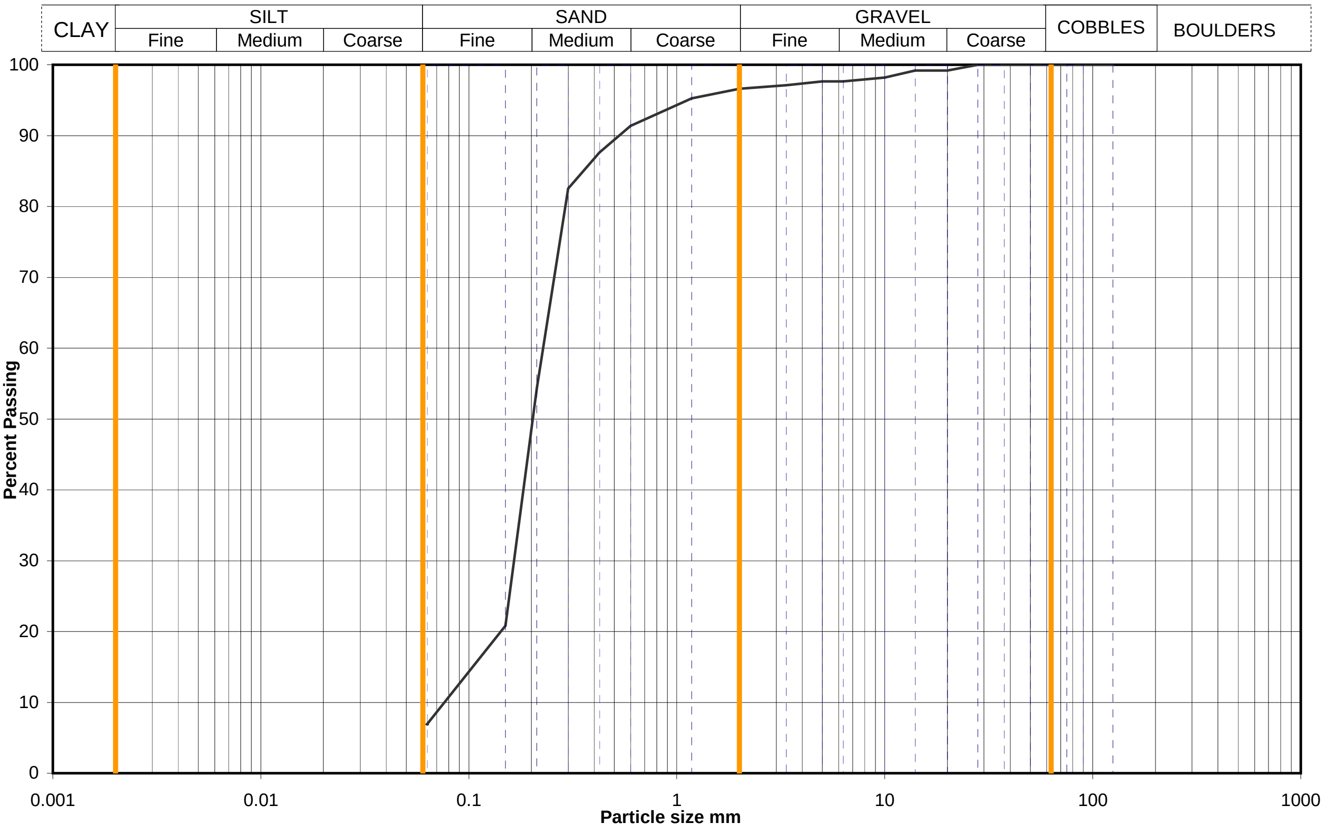
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Printed:18/03/2016 11:13	**Figure** PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	11.50		
			Samp No	25	Type	UT
			ID	A5085-1520151209105041		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	99		
14	99		
10	98		
6.3	98		
5.0	98		
3.35	97		
2.00	97		
1.18	95		
0.600	91		
0.425	88		
0.300	83	Dry mass of sample, kg	
0.212	54		
0.150	21	1.6	
0.063	7		

Soil description	Dark brown slightly gravelly slightly clayey SAND.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	3	3
	Sand	90	90
*<60mm values to aid description only	Silt	silt+clay =	
	Clay	7	7

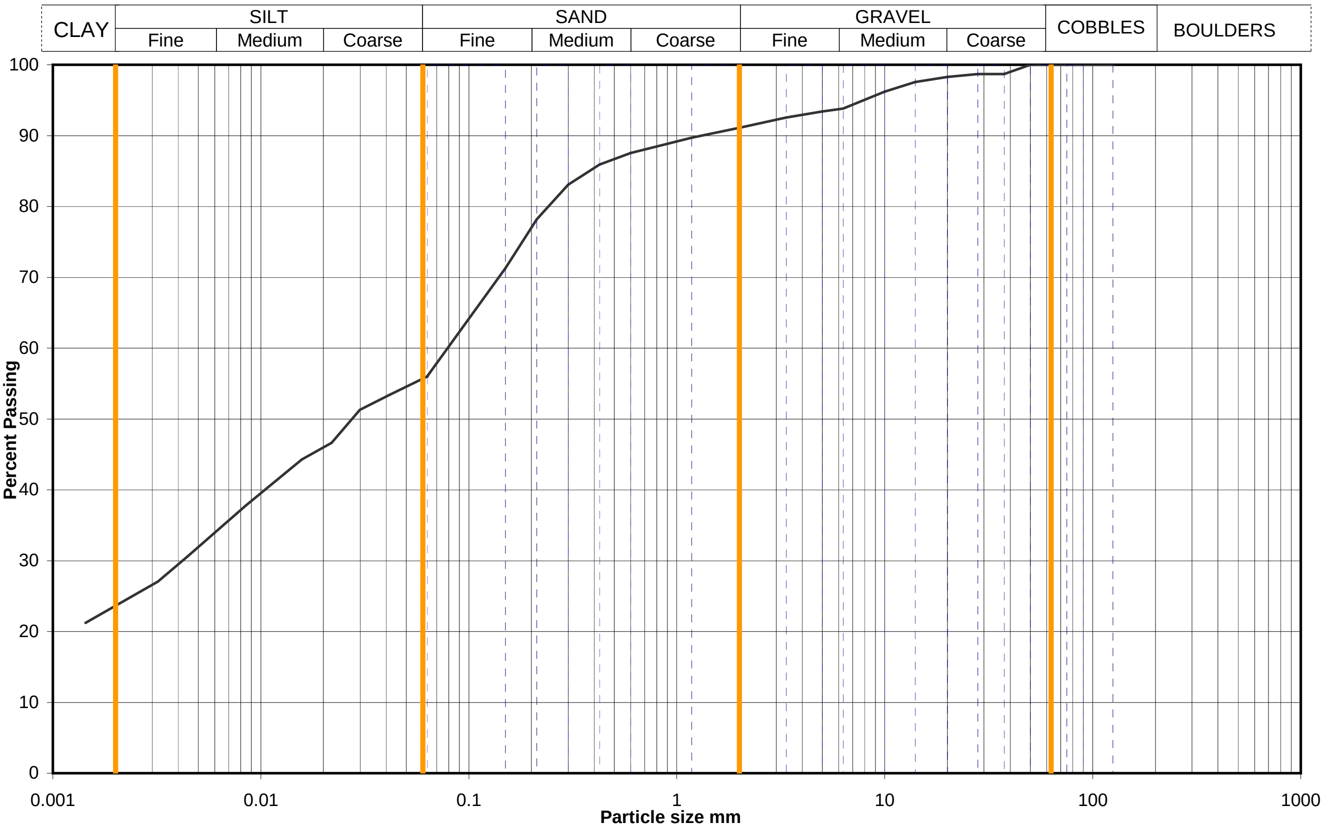
Uniformity Coefficient	D_{60} / D_{10}	3

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group UKAS TESTING 1157	Printed:18/03/2016 11:13	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.15		
			Samp No	35	Type	UT
			ID	A5085-1520151222123103		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	56
90	100	0.0416	53
75	100	0.0299	51
63	100	0.0219	47
50	100	0.0157	44
37.5	99	0.0085	38
28	99	0.0044	31
20	98	0.0032	27
14	98	0.0014	21
10	96		
6.3	94		
5.0	93		
3.35	93		
2.00	91		
1.18	90	Particle density, Mg/m3	
0.600	88		
0.425	86	2.65 assumed	
0.300	83	Dry mass of sample, kg	
0.212	78		
0.150	71		
0.063	56	6.8	

Soil description	Soft greyish brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	9	9
	Sand	35	35
	Silt	32	32
	Clay	24	24

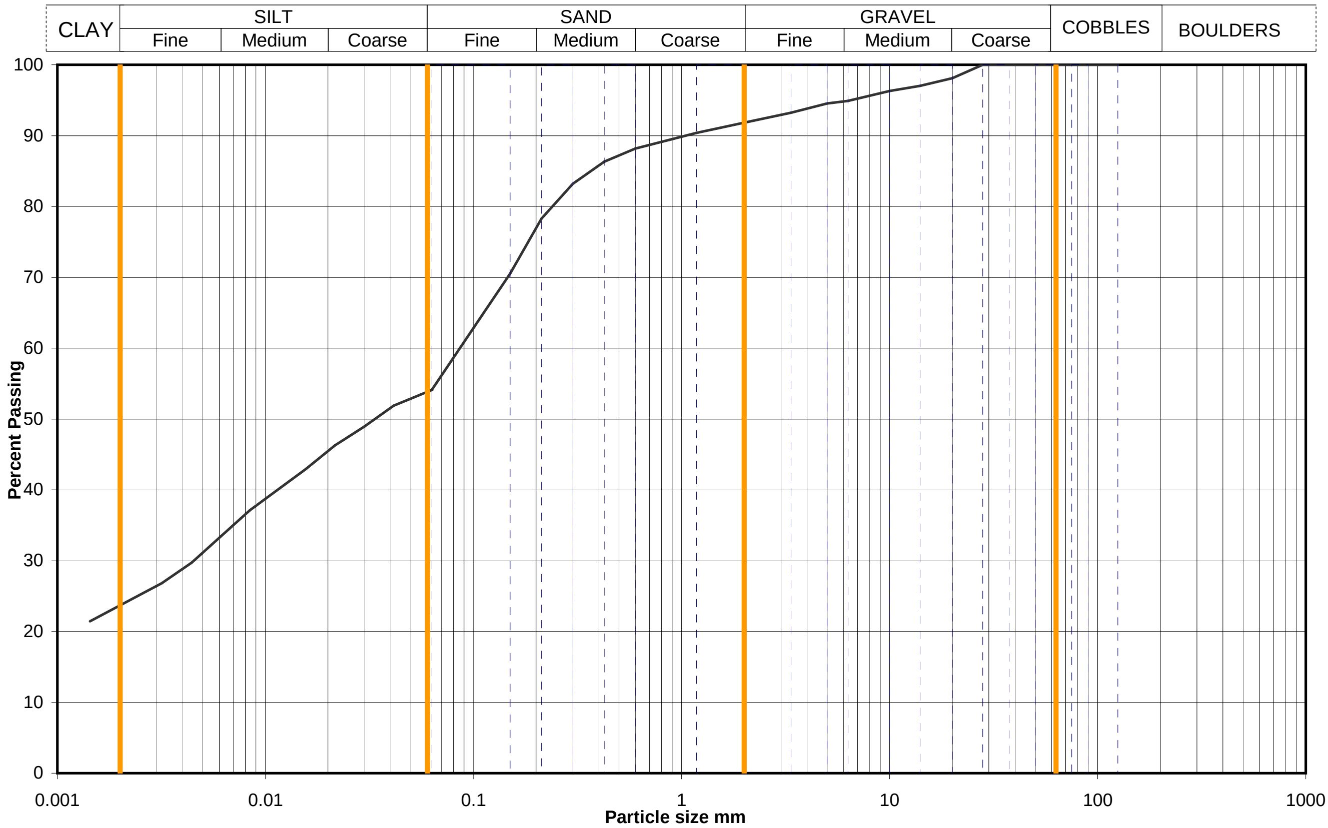
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:13	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.80		
			Samp No	37	Type	UT
			ID	A5085-1520151222123121		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	54
90	100	0.0413	52
75	100	0.0299	49
63	100	0.0216	46
50	100	0.0156	43
37.5	100	0.0084	37
28	100	0.0044	30
20	98	0.0032	27
14	97	0.0014	21
10	96		
6.3	95		
5.0	95		
3.35	93		
2.00	92		
1.18	90	Particle density, Mg/m3	
0.600	88		
0.425	86	2.65	assumed
0.300	83	Dry mass of sample, kg	
0.212	78		
0.150	71	5.4	
0.063	54		

Soil description	Firm to stiff greyish brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	8	8
*<60mm values to aid description only	Sand	38	38
	Silt	30	30
	Clay	24	24

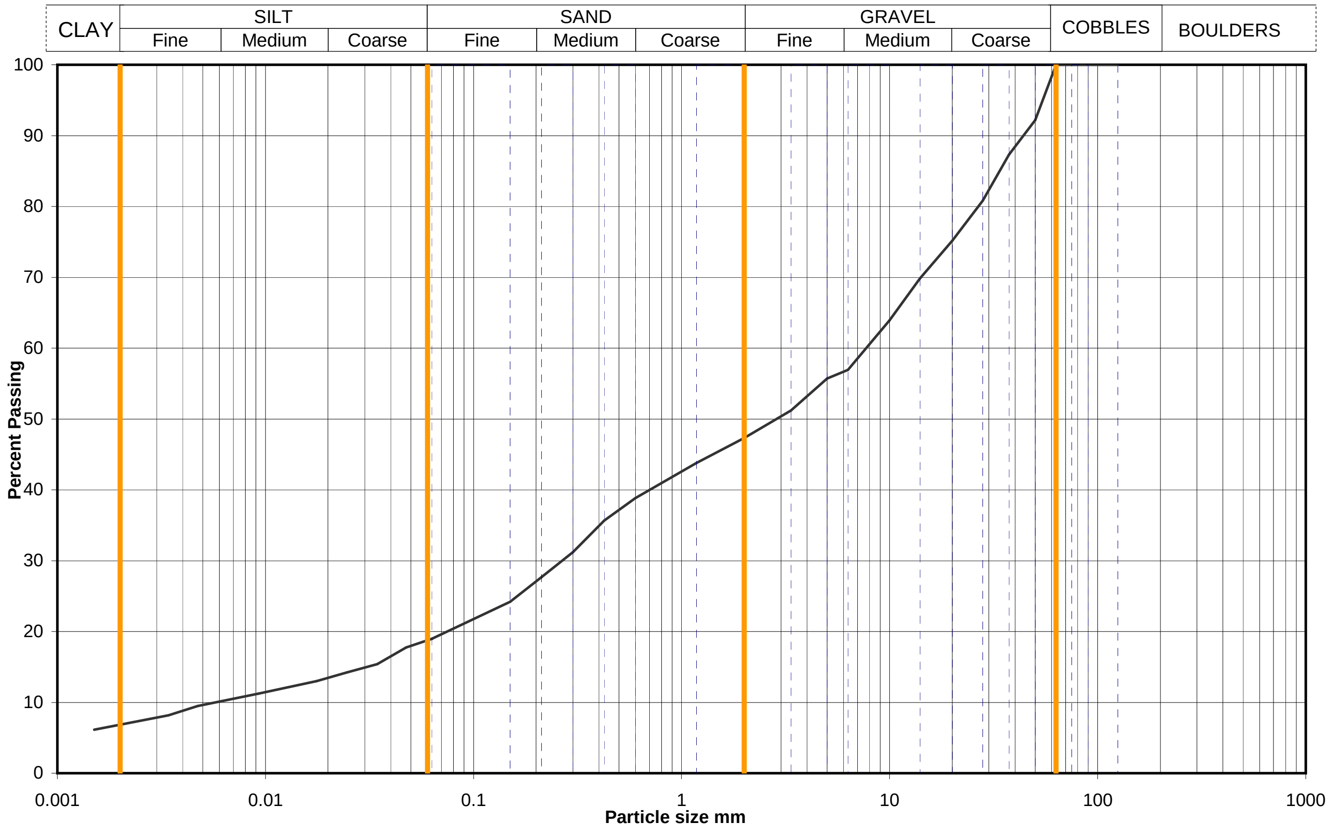
Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:13	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.20		
			Samp No	3	Type	B
			ID	A5085-1520151222015233		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	19
90	100	0.0473	18
75	100	0.0344	15
63	100	0.0246	14
50	92	0.0177	13
37.5	87	0.0093	11
28	81	0.0047	9
20	75	0.0034	8
14	70	0.0015	6
10	64		
6.3	57		
5.0	56		
3.35	51		
2.00	47		
1.18	44	Particle density, Mg/m3	
0.600	39		
0.425	36	2.65	assumed
0.300	31	Dry mass of sample, kg	
0.212	28		
0.150	24	7.9	
0.063	19		

Soil description	Greyish brown slightly sandy gravelly SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	53	53
	Sand	29	29
	Silt	12	12
	Clay	6	6

Uniformity Coefficient	D_{60} / D_{10}	1335

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref				Figure
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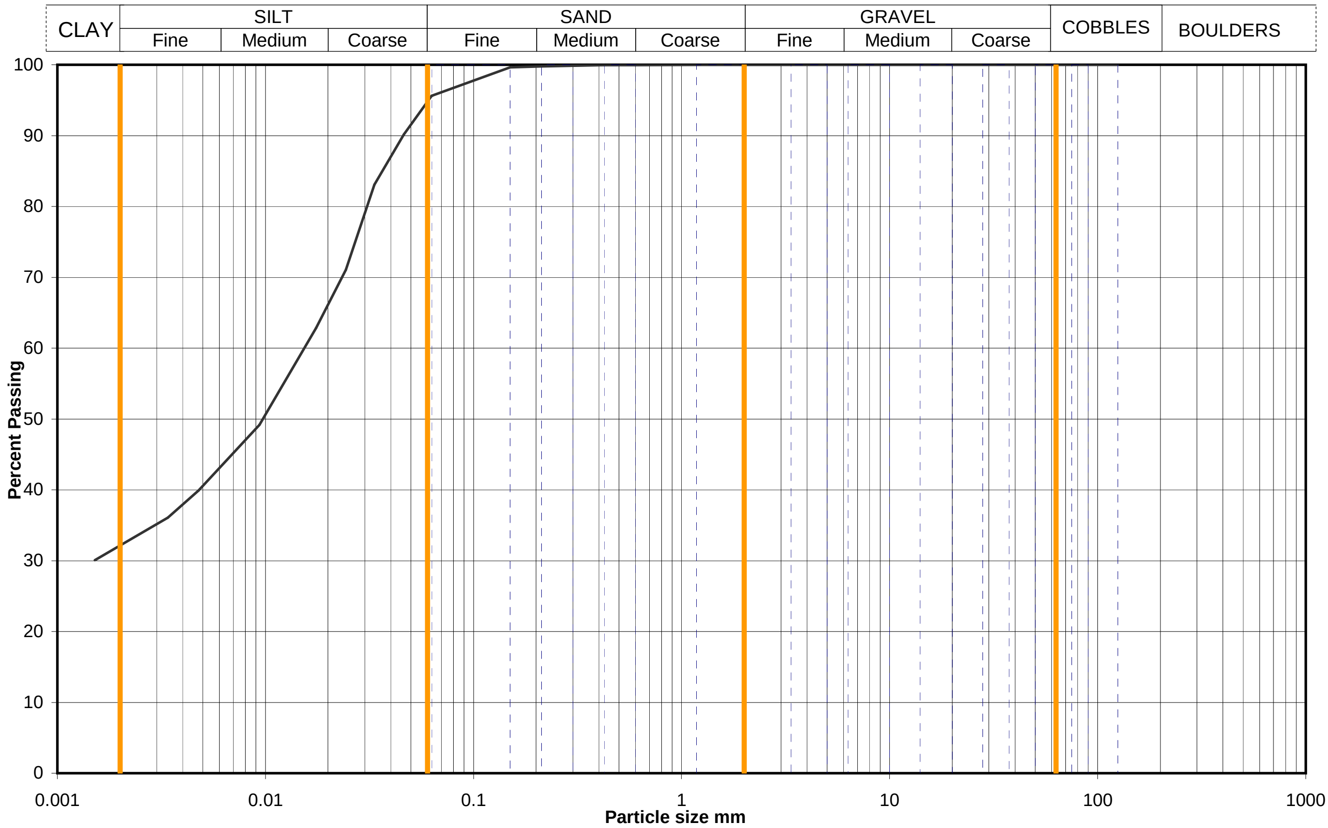
Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.55		
			Samp No	10	Type	UT
			ID	A5085-1520151222015310		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	96
90	100	0.0463	90
75	100	0.0334	83
63	100	0.0243	71
50	100	0.0175	63
37.5	100	0.0093	49
28	100	0.0048	40
20	100	0.0034	36
14	100	0.0015	30
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	100	Dry mass of sample, kg	
0.212	100		
0.150	100	4.2	
0.063	96		

Soil description	Soft brown mottled grey slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	5	5
	Silt	63	63
	Clay	32	32

Uniformity Coefficient	**D_{60} / D_{10}**	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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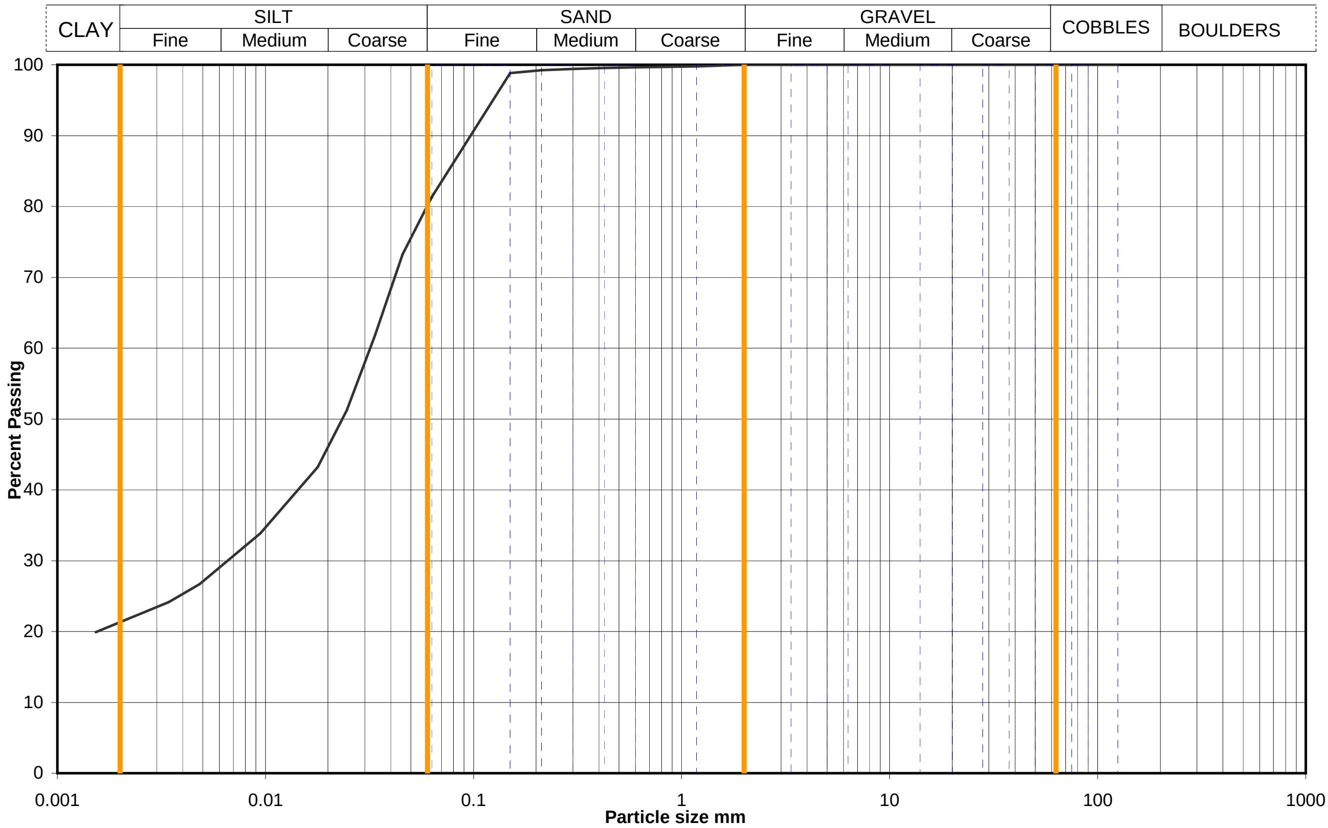
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00		
			Samp No	17	Type	P
			ID	A5085-1520151222015410		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	81
90	100	0.0457	73
75	100	0.0336	62
63	100	0.0246	51
50	100	0.0178	43
37.5	100	0.0094	34
28	100	0.0048	27
20	100	0.0034	24
14	100	0.0015	20
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65	assumed
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	7.9	
0.063	81		

Soil description	Very soft greyish brown slightly sandy silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
	Sand	20	20
	Silt	59	59
	Clay	21	21

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

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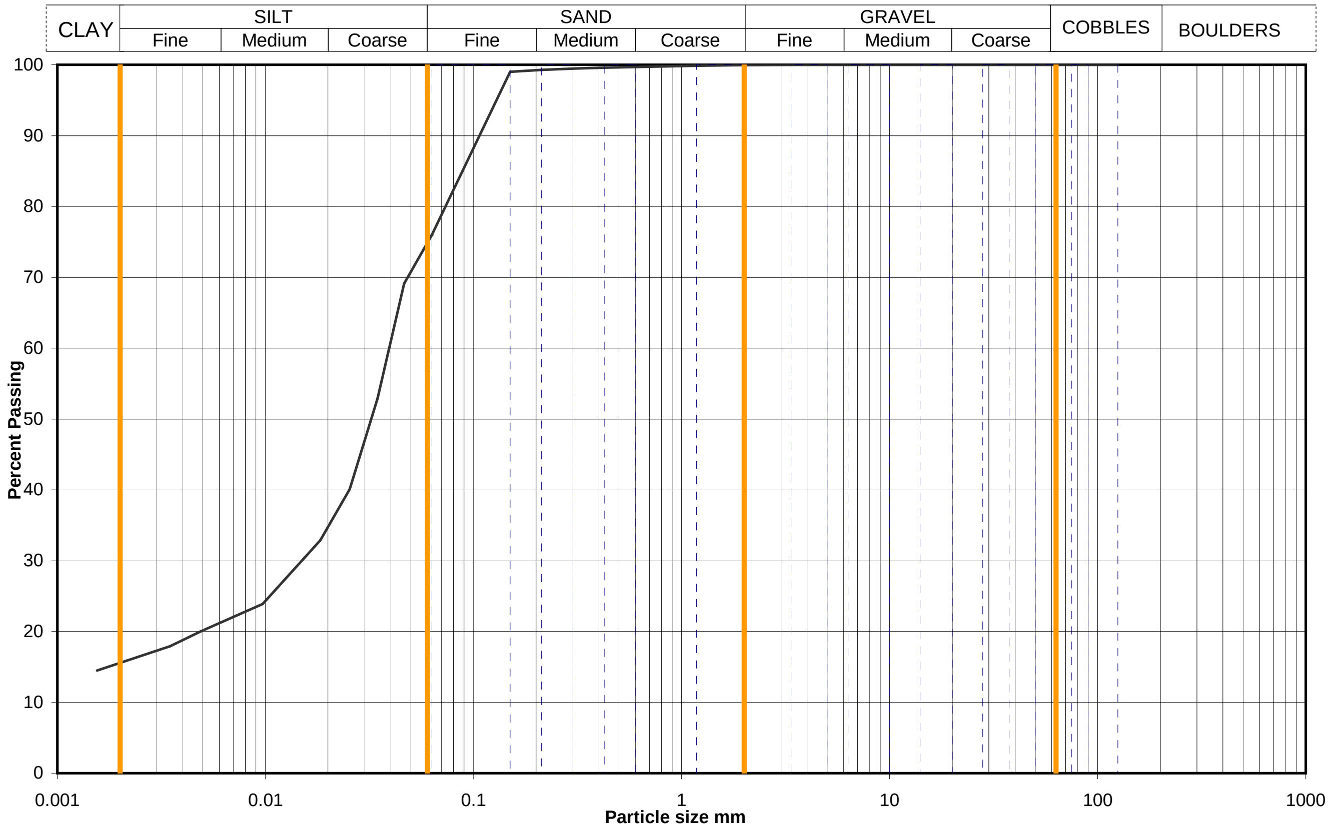
Figure
PSD

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.50		
			Samp No	22	Type	UT
			ID	A5085-1520151222015444		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	76
90	100	0.0464	69
75	100	0.0346	53
63	100	0.0254	40
50	100	0.0183	33
37.5	100	0.0097	24
28	100	0.0049	20
20	100	0.0035	18
14	100	0.0016	15
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	100		
1.18	100	Particle density, Mg/m3	
0.600	100		
0.425	100	2.65 assumed	
0.300	99	Dry mass of sample, kg	
0.212	99		
0.150	99	3.0	
0.063	76		

Soil description	Soft brown slightly sandy silty CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	0	0
*<60mm values to aid description only	Sand	25	25
	Silt	59	59
	Clay	16	16

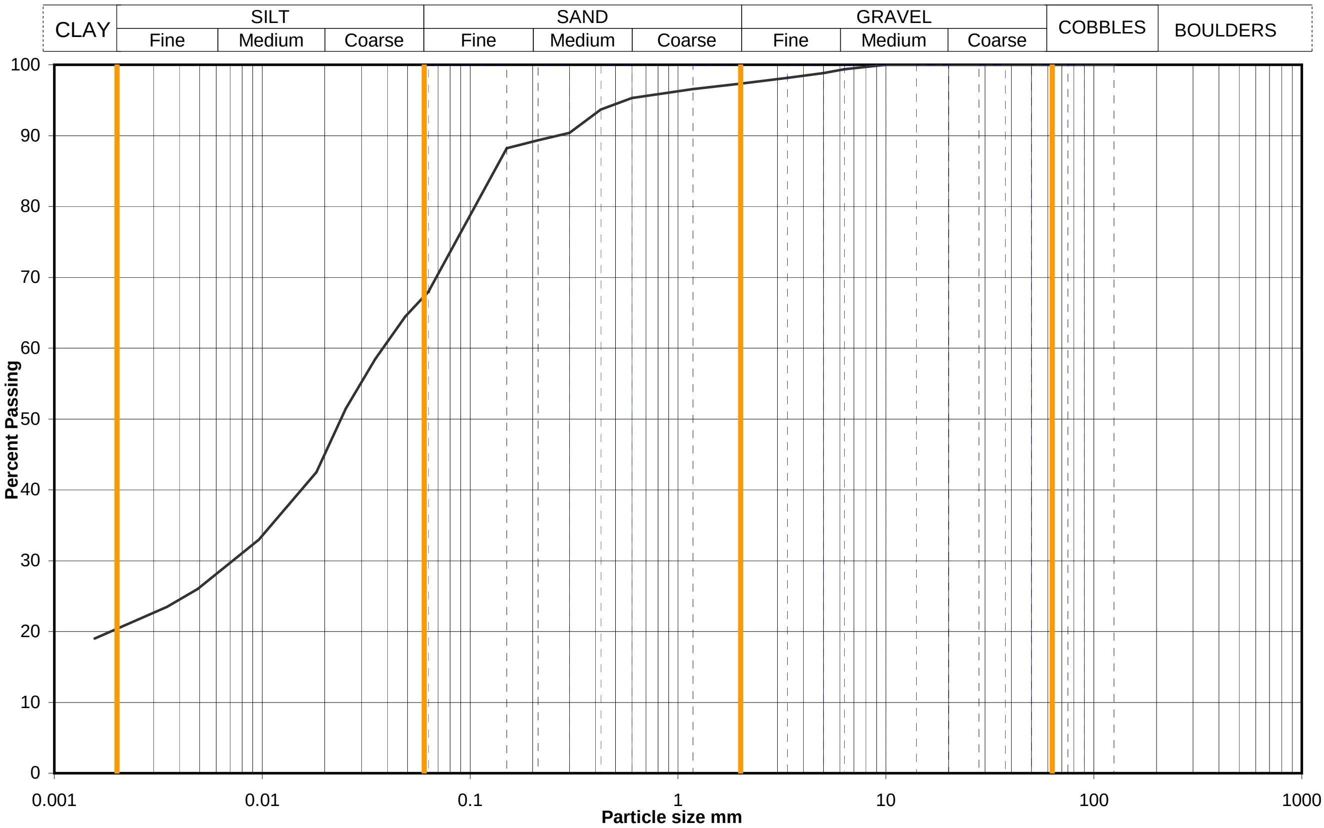
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 11:13	**Figure** **PSD**

Particle Size Distribution Analysis

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.50		
			Samp No	25	Type	UT
			ID	A5085-1520151222015515		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	68
90	100	0.0487	64
75	100	0.0350	58
63	100	0.0252	51
50	100	0.0182	42
37.5	100	0.0096	33
28	100	0.0049	26
20	100	0.0035	23
14	100	0.0016	19
10	100		
6.3	99		
5.0	99		
3.35	98		
2.00	97		
1.18	97	Particle density, Mg/m3	
0.600	95		
0.425	94	2.65	assumed
0.300	90	Dry mass of sample, kg	
0.212	89		
0.150	88	4.3	
0.063	68		

Soil description	Soft brownish dark grey slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<63mm
	Cobbles / boulders	0	0
	Gravel	3	3
	Sand	30	30
	Silt	47	47
	Clay	20	20

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	Environmental Scientifics Group	Printed:18/03/2016 11:13	**Figure** **PSD**

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS WITHOUT MEASUREMENT OF PORE PRESSURE - SUMMARY OF RESULTS

Project No	Project Name
A5085-15	A63 CASTLE STREET

Hole No.	Sample No.	Depth (m) from	Depth (m) to	Sample type	Soil Description	Density bulk (Mg/m^3)	Density dry (Mg/m^3)	w (%)	Test type	Dia. (mm)	ó$_3$ (kPa)	At failure / end of stage: Axial strain (%)	At failure / end of stage: ó$_1$ - ó$_3$ (kPa)	At failure / end of stage: c_u (kPa)	MODE	Remarks
BH402	16	8.40	9.05	UT	Firm to stiff greyish brown sandy CLAY.	2.07	1.70	22	UU	103.0	155	19.4	58	29	P	
BH402	24	10.95	11.40	UT	Very stiff greyish brown slightly gravelly sandy CLAY.	2.25	2.00	13	UU	103.7	205	19.8	576	288	P	
BH402	26	11.60	12.05	UT	Very stiff brown slightly sandy slightly gravelly silty CLAY.	2.14	1.79	20	UU	103.4	220	19.8	302	151	P	
BH402	30	13.30	13.75	UT	Stiff greyish brown slightly sandy slightly gravelly CLAY.	2.10	1.74	21	UU	103.6	250	15.4	162	81	C	
BH402	38	15.90	16.35	UT	Stiff laminated greyish brown slightly sandy CLAY.	1.96	1.51	30	UU	103.9	300	6.9	159	79	B	
BH402	46	18.50	18.95	UT	Stiff to very stiff brown slightly sandy silty CLAY.	2.07	1.69	23	UU	104.0	350	10.9	217	109	B	
BH402	50	19.75	20.20	UT	Stiff greyish brown slightly sandy slightly gravelly CLAY with sand partings and occasional shell	2.12	1.78	19	UU	103.9	370	9.9	249	124	B	
BH403	27	11.90	12.35	UT	Stiff brown slightly sandy slightly gravelly CLAY.	2.22	1.95	14	UU	103.7	220	18.8	396	198	P	
BH403	32	13.85	14.20	UT	Firm greyish brown slightly sandy slightly gravelly CLAY.	2.19	1.86	17	UU	102.4	260	19.9	149	74	P	
BH403	38	15.70	16.15	UT	Soft to firm brown slightly sandy CLAY.	2.01	1.59	26	UU	103.7	300	15.3	83	41	P	
BH403	48	18.95	19.40	UT	Firm greyish brown slightly sandy CLAY with sand partings.	1.99	1.56	28	UU	103.0	350	9.4	70	35	C	
BH404	17	9.00	10.00	P	Firm dark brown organic CLAY.	1.36	0.62	121	UU	97.7	105	20.1	75	37	P	
BH404	26	11.50	11.95	UT	Very stiff brown slightly sandy slightly gravelly CLAY.	2.22	1.97	13	UU	103.9	220	19.8	664	332	P	
BH404	30	12.50	12.95	UT	Very stiff greyish brown slightly gravelly sandy CLAY.	2.20	1.91	15	UU	103.8	235	15.3	400	200	C	
BH404	36	14.00	14.45	UT	Firm to stiff greyish brown slightly gravelly sandy CLAY with chalk fragments.	2.20	1.91	15	UU	103.7	262	19.7	188	94	P	
BH404	44	16.00	16.45	UT	Stiff laminated greyish brown slightly sandy CLAY.	1.96	1.51	30	UU	103.1	300	5.4	179	89	B	
BH404	54	18.50	18.95	UT	Firm greyish brown silty CLAY.	2.02	1.62	25	UU	103.1	350	11.4	119	60	B	
BH405	5	2.50	2.95	UT	Firm brown slightly sandy silty CLAY.	1.93	1.44	34	UU	102.6	50	19.0	71	36	P	
BH405	35	14.00	14.45	UT	Stiff greyish brown slightly sandy slightly gravelly CLAY with chalk fragments.	2.20	1.91	15	UU	103.6	260	19.8	258	129	P	
BH405	45	16.50	16.95	UT	Stiff laminated brown slightly sandy silty CLAY.	2.02	1.62	25	UU	103.1	310	7.9	200	100	B	
BH405	65	23.00	23.45	UT	Very stiff brown slightly sandy silty CLAY.	2.13	1.78	20	UU	103.1	430	18.7	625	313	P	
BH406	9	2.50	2.95	UT	Soft to firm laminated greyish brown slightly sandy CLAY.	1.87	1.35	38	UU	101.1	45	17.8	47	23	P	

General notes: Tests carried out in accordance with BS1377: Part 7: 1990, clause 8 for single stage, clause 9 for multistage tests. Specimens nominally 2:1 height diameter ratio and tested at a rate of strain of 2%/minute, unless annotated otherwise. See individual test reports for further details.

Legend				
UU - single stage test (may be in sets of specimens)	ó$_3$	cell pressure	Mode of failure P	plastic
UUM - multistage test on a single specimen	ó$_1$ - ó$_3$	deviator stress	B	brittle
suffix R - remoulded or recompacted	c_u	undrained shear strength	C	compound

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS WITHOUT MEASUREMENT OF PORE PRESSURE - SUMMARY OF RESULTS

Project No	Project Name
A5085-15	A63 CASTLE STREET

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	Density bulk Mg/m³	Density dry Mg/m³	w %	Test type	Dia. mm	ó₃ kPa	At failure / end of stage: Axial strain %	ó₁ - ó₃ kPa	c u kPa	MODE	Remarks
BH406	40	13.00	13.45	UT	Very stiff greyish brown slightly sandy slightly gravelly CLAY	2.22	1.96	13	UU	103.9	235	18.8	575	287	P	
BH406	47	14.50	14.95	UT	Firm to stiff greyish brown slightly sandy slightly gravelly CLAY.	2.22	1.91	16	UU	102.7	260	19.8	125	63	P	
BH406	69	20.00	20.45	UT	Firm laminated greyish brown slightly sandy CLAY.	1.96	1.54	27	UU	102.7	365	10.9	182	91	P	
BH407	5	1.70	2.15	UT	Firm to stiff brown slightly sandy silty CLAY with occasional partings of sand and silt.	1.88	1.54	22	UU	102.7	40	12.8	167	84	C	
BH407	27	11.00	11.45	UT	Firm brownish grey slightly sandy organic CLAY with wood fragments.	1.60	0.98	63	UU	103.5	110	10.9	53	26	P	
BH407	33	12.50	12.95	UT	Soft to firm brownish grey slightly sandy slightly gravelly CLAY.	2.18	1.85	18	UU	103.8	225	20.1	59	29	P	
BH407	62	20.00	20.45	UT	Stiff brown slightly sandy CLAY with occasional partings of sand.	2.06	1.69	22	UU	103.0	370	9.4	161	81	C	
BH408	3	2.00	2.45	UT	Firm to stiff brown slightly sandy CLAY with occasional partings of sand.	1.95	1.51	29	UU	103.4	40	11.4	127	64	C	
BH408	37	14.80	15.25	UT	Firm to stiff greyish brown slightly gravelly sandy CLAY.	2.21	1.91	16	UU	103.6	150	19.7	232	116	P	
BH408	57	21.35	21.80	UT	Firm brown slightly sandy CLAY.	1.97	1.54	28	UU	101.7	215	18.7	111	56	P	
BH417	12	4.20	4.65	UT	Firm brown slightly sandy CLAY.	1.91	1.44	33	UU	102.4	80	19.8	58	29	P	

General notes: Tests carried out in accordance with BS1377: Part 7: 1990, clause 8 for single stage, clause 9 for multistage tests. Specimens nominally 2:1 height diameter ratio and tested at a rate of strain of 2%/minute, unless annotated otherwise. See individual test reports for further details.

Legend

UU - single stage test (may be in sets of specimens)	$ó_3$	cell pressure	Mode of failure P	plastic
UUM - multistage test on a single specimen	$ó_1$ - $ó_3$	deviator stress	B	brittle
suffix R - remoulded or recompacted	c_u	undrained shear strength	C	compound

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

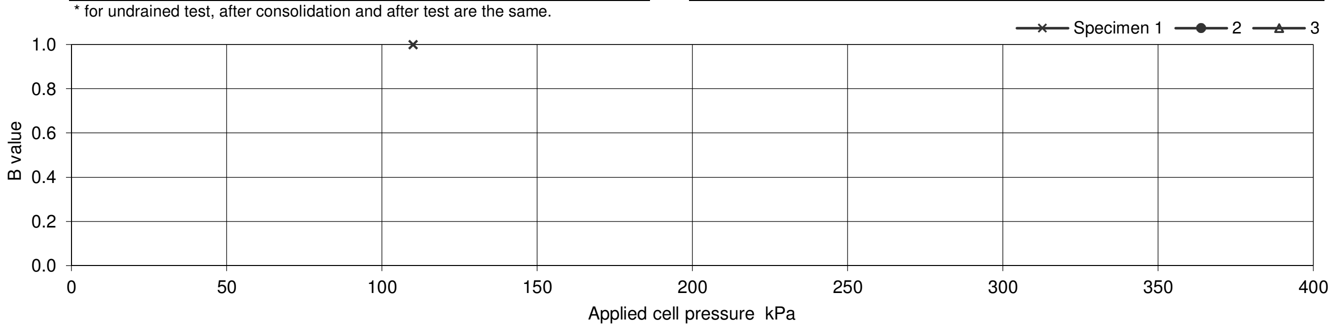
Project No	A5085-15	Sample Details:	Hole No	BH402
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.75-4.75
			No	9 Type P
			ID	
			Spec Ref	

	Specimen Details		1	2	3
Initial	Length	mm	190.62		
	Diameter	mm	97.62		
	Bulk Density	Mg/m³	1.79		
	Water Content	%	46		
	Dry density	Mg/m³	1.23		
After consolidation	Length	mm	186.62		
	Diameter	mm	95.55		
	Bulk Density*	Mg/m³	1.85		
	Water Content*	%	41		
	Dry density*	Mg/m³	1.31		

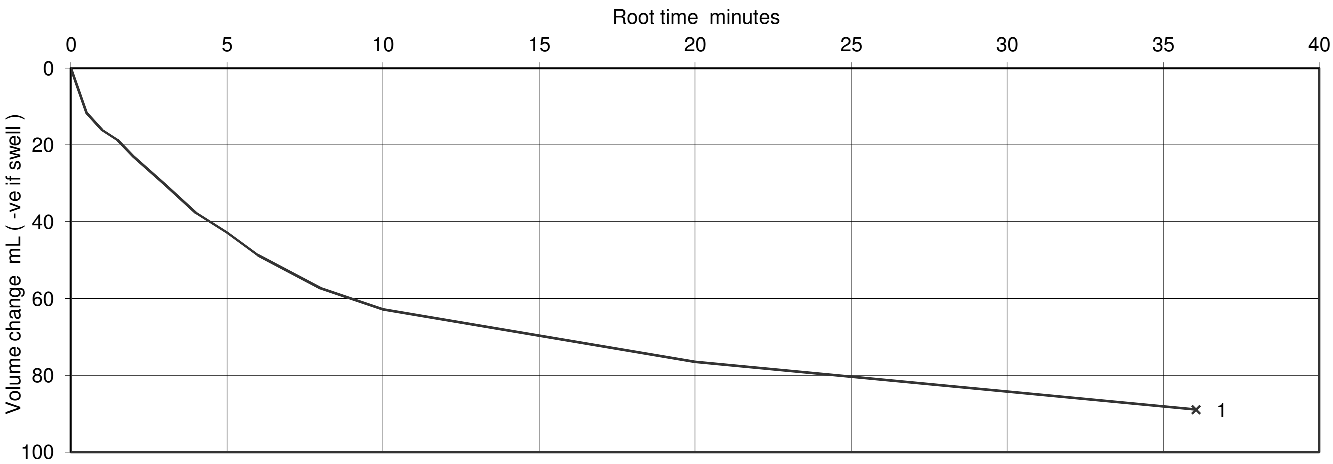
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft greyish brown sandy clayey SILT.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	208.6		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		365			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		65			kPa
	Pore pressure at start of consolidation		365			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.00			m^2/year
	Coefficient of Compressibility	M_{vi}	0.97			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	6.0E-10			m/s

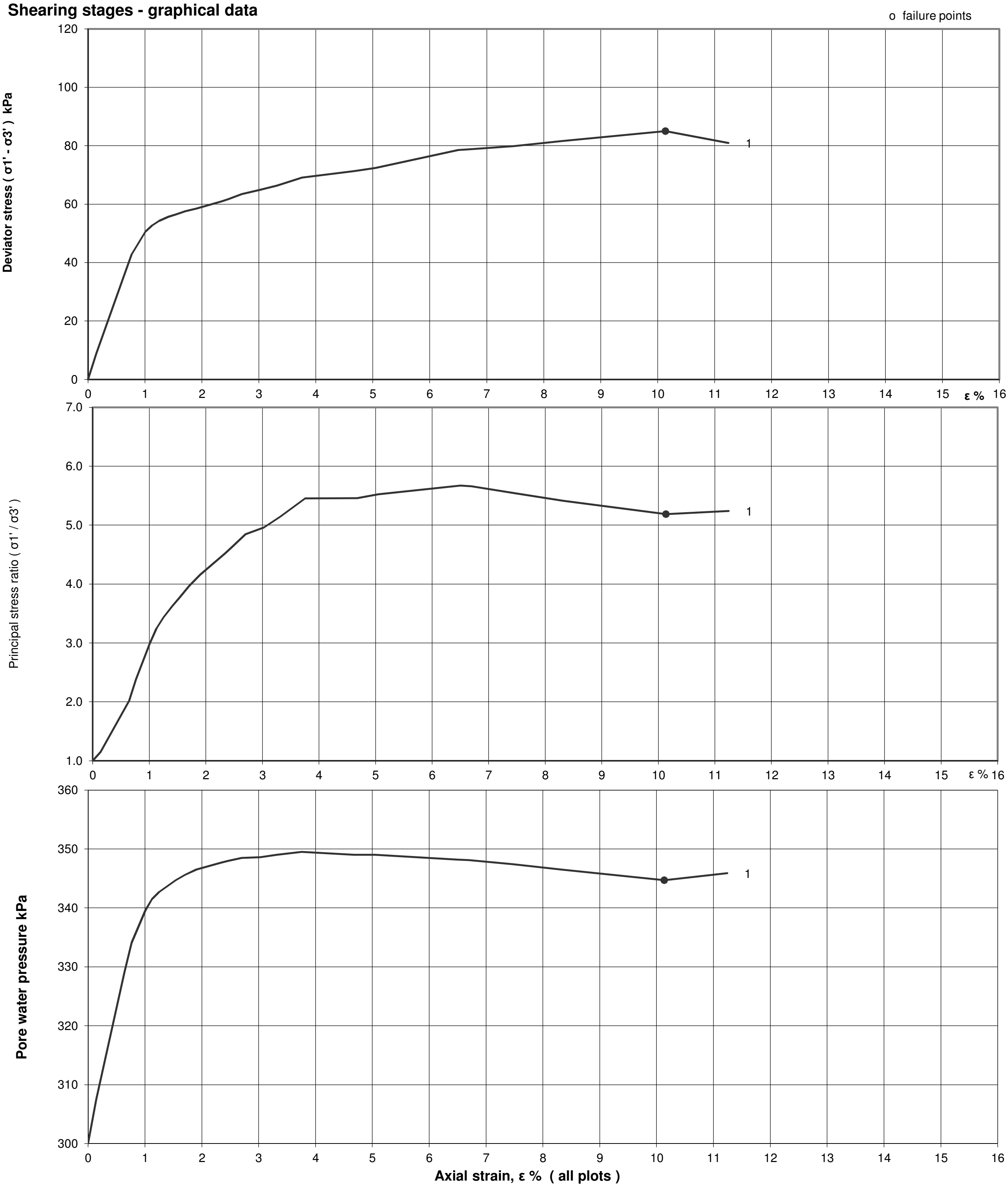


Ref			Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:01	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.75-4.75		
			No	9	Type	P
			ID			
			Spec Ref			

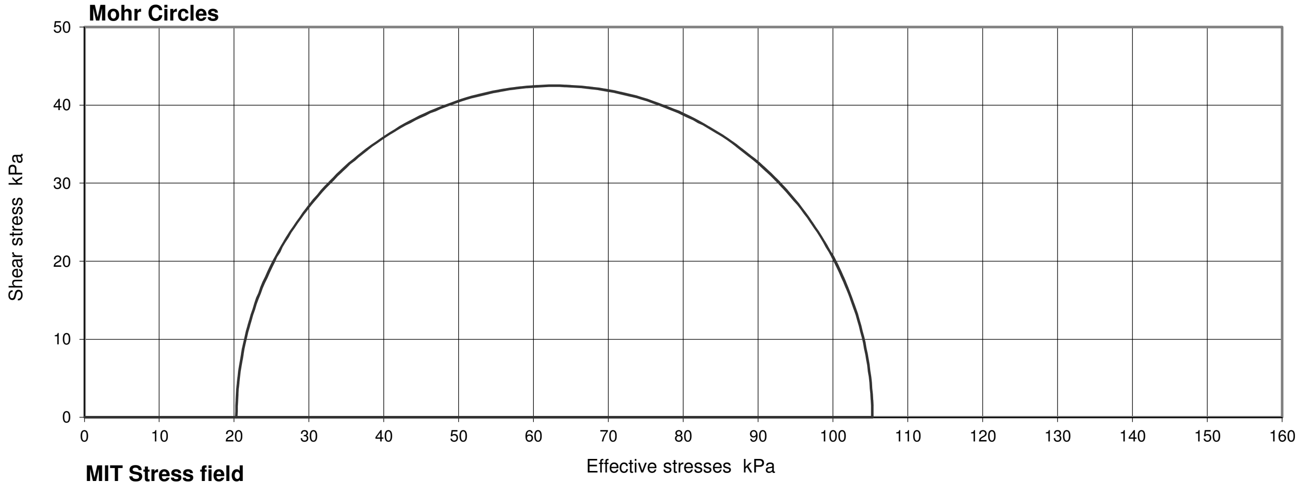
Shearing stages - graphical data



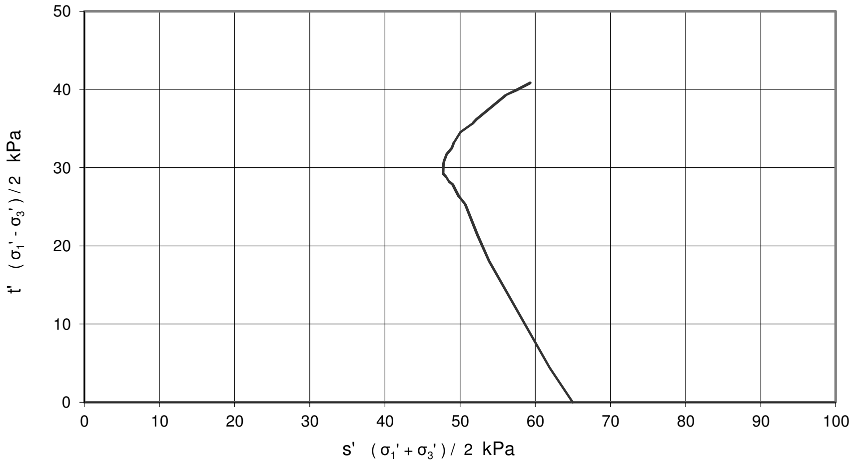
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.75-4.75		
			No	9	Type	P
			ID			
			Spec Ref			

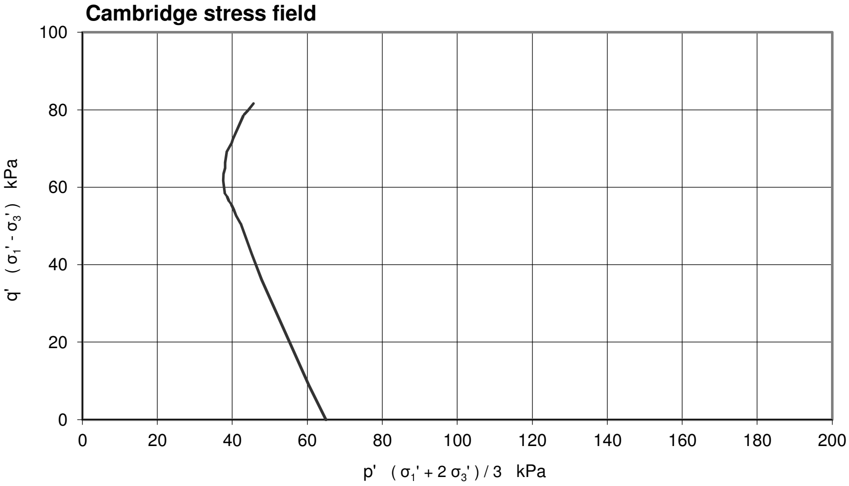
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	365			kPa
Initial pwp	300			kPa
Initial σ_3'	65			kPa
Rate of strain	1.63			%/hr

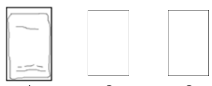
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	10.14			%
$(\sigma_1' / \sigma_3')_f$	5.186			
$(\sigma_1' - \sigma_3')_f$	85.0			kPa
u_f	345			kPa
$\sigma_3'{}_f$	20			kPa
$\sigma_1'{}_f$	105			kPa
A_f	0.53			
Time to failure	6.2			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:01	Figure **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

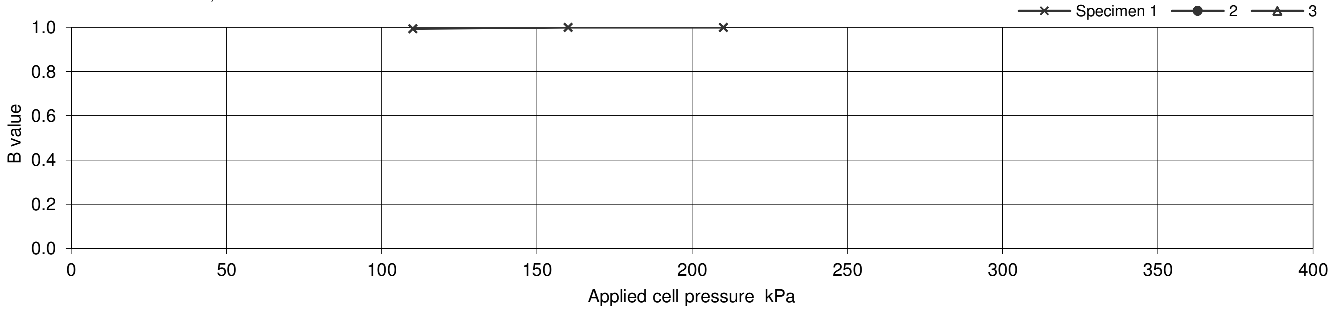
Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.40-7.40		
			No	13	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	170.54		
	Diameter	mm	100.78		
	Bulk Density	Mg/m³	2.04		
	Water Content	%	33		
	Dry density	Mg/m³	1.54		
After consolidation	Length	mm	163.09		
	Diameter	mm	96.28		
	Bulk Density*	Mg/m³	2.27		
	Water Content*	%	29		
	Dry density*	Mg/m³	1.76		

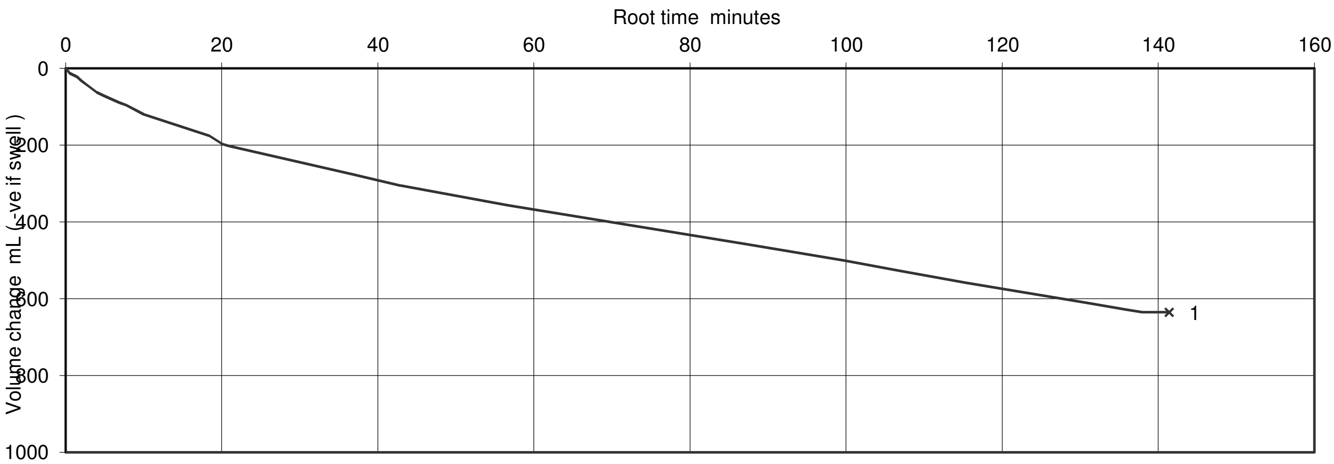
* for undrained test, after consolidation and after test are the same.

Soil Description	Very soft brown sandy silty CLAY.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	210.2		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		388			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		88			kPa
	Pore pressure at start of consolidation		388			kPa
	Pore pressure at end of consolidation		305			kPa
	Pore pressure dissipation at end of consolidation		94			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.10			m^2/year
	Coefficient of Compressibility	M_{vi}	4.15			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.3E-10			m/s



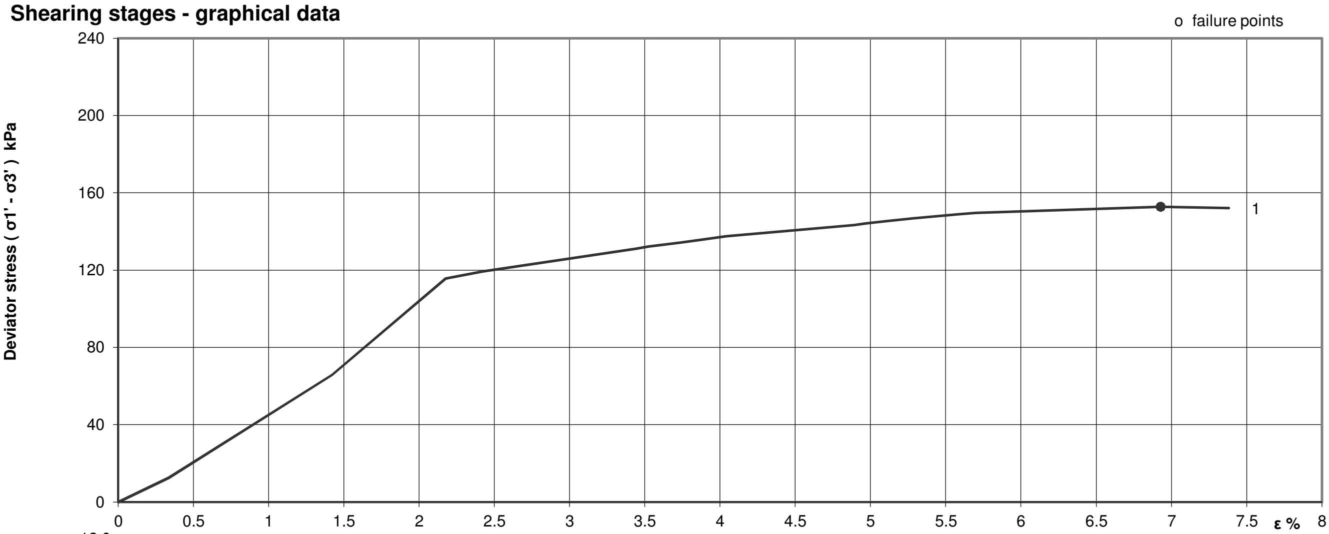
Ref			
SLR8.1 Rev 85 May 09	ESG	Printed:23/03/2016 12:22	Figure CU sheet 1 of 3

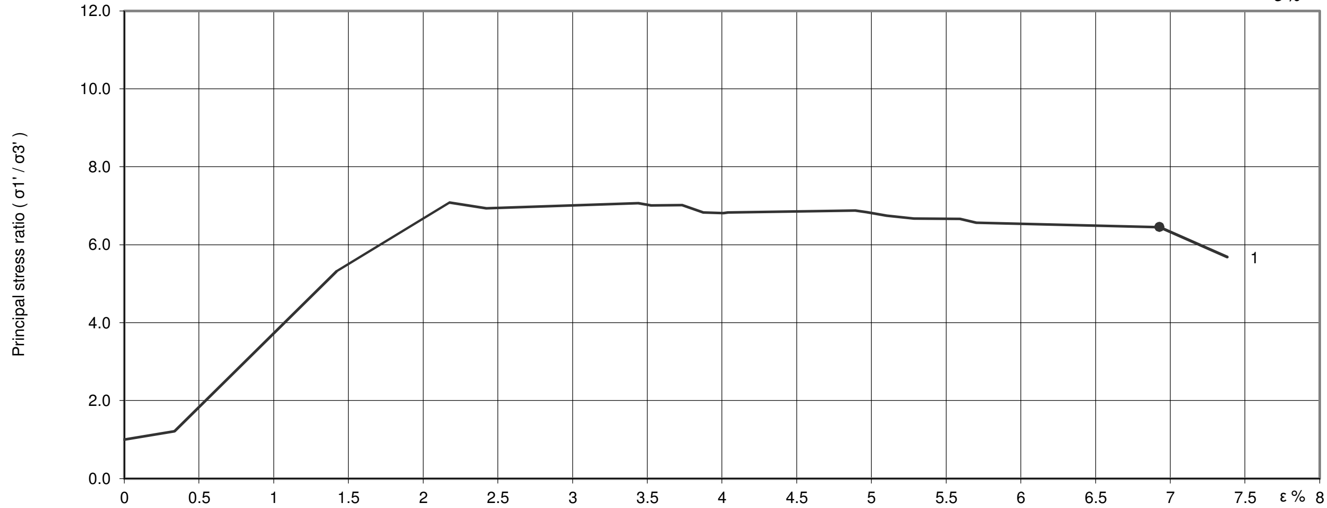
1157

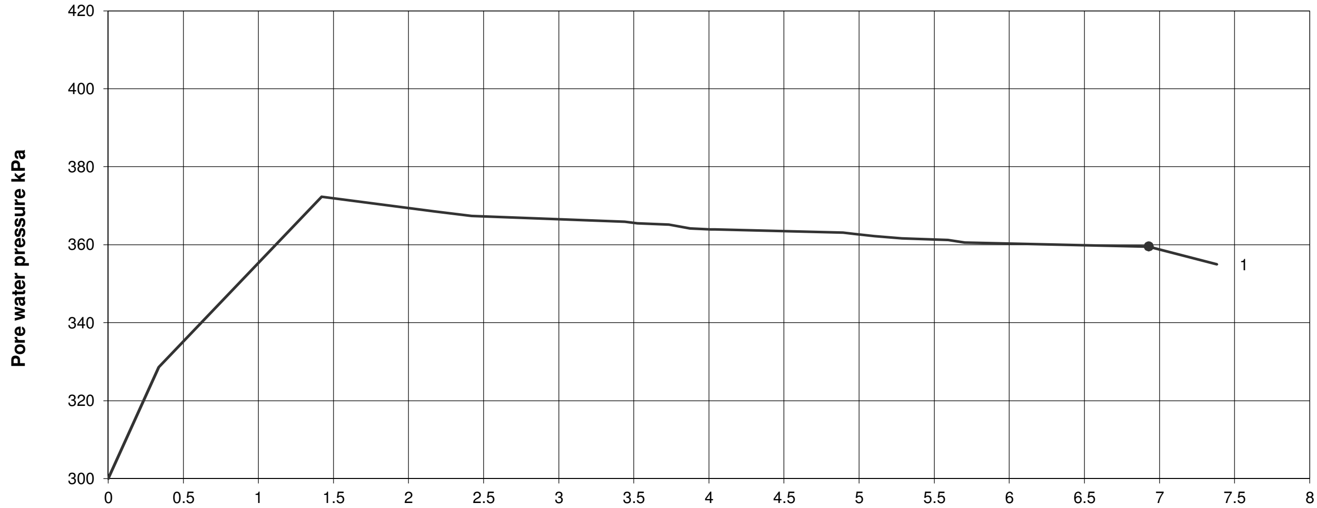
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH402		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.40-7.40		
			No	13	Type	P
			ID			
			Spec Ref			

Shearing stages - graphical data





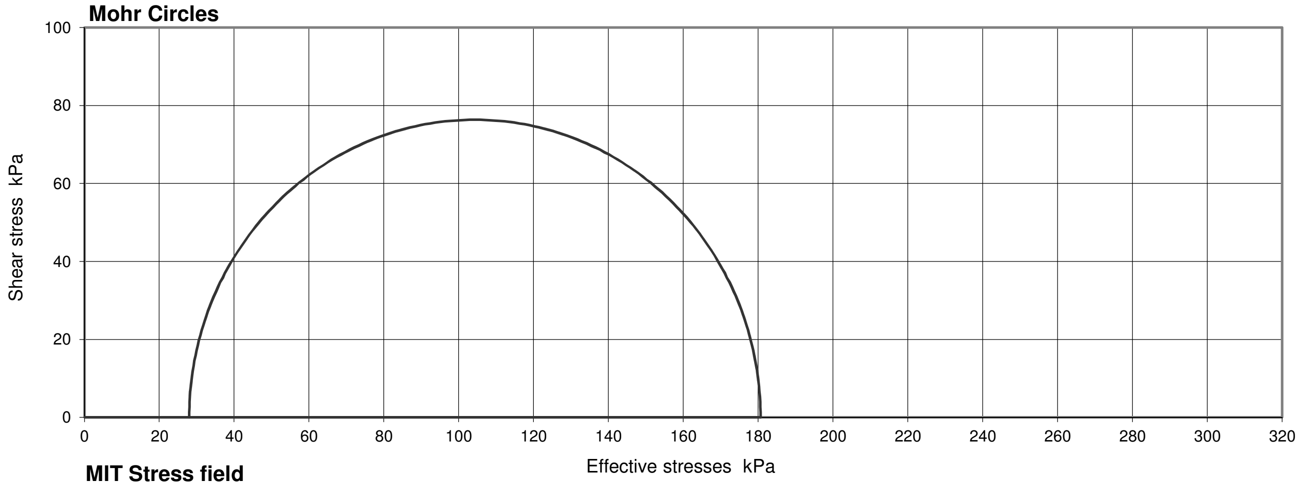


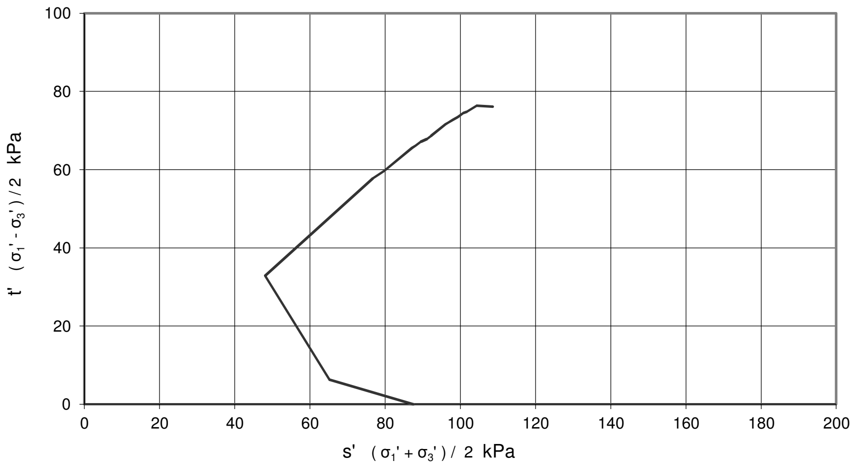
Axial strain, ε % (all plots)

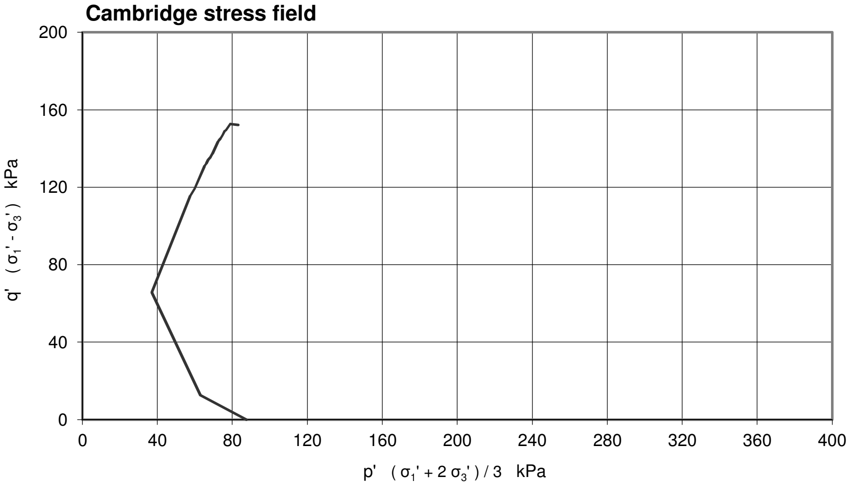
Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:23/03/2016 12:22	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH402
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.40-7.40
			No	13 · Type P
			ID	
			Spec Ref	







Compression stages

Specimen	1	2	3	
Cell pressure	387.5			kPa
Initial pwp	300			kPa
Initial σ_3'	88			kPa
Rate of strain	0.15			%/hr

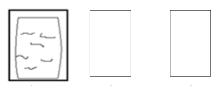
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	6.93			%
$(\sigma_1' / \sigma_3')_f$	6.453			
$(\sigma_1' - \sigma_3')_f$	152.7			kPa
u_f	360			kPa
$\sigma_3'_f$	28			kPa
$\sigma_1'_f$	181			kPa
A_f	0.39			
Time to failure	45.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:23/03/2016 12:22	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

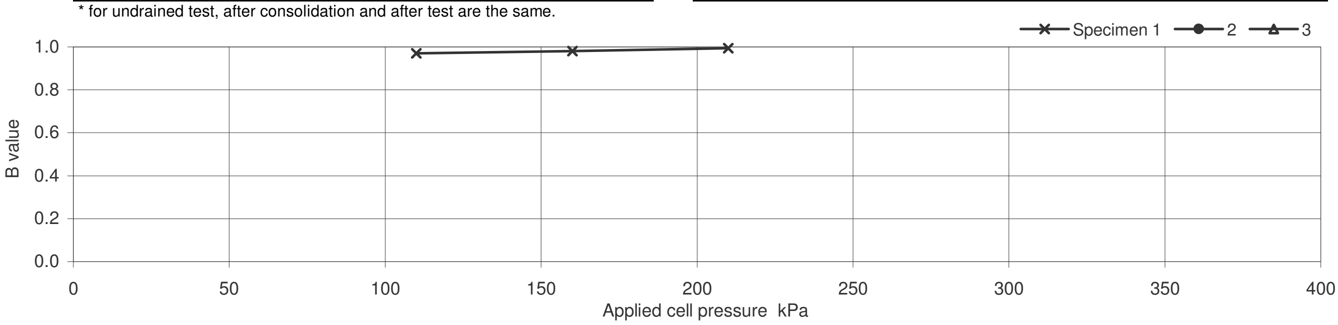
Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	2.30-2.75		
			No	6	Type	UT
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	203.20		
	Diameter	mm	103.12		
	Bulk Density	Mg/m³	1.90		
	Water Content	%	35		
	Dry density	Mg/m³	1.41		
After consolidation	Length	mm	200.27		
	Diameter	mm	101.63		
	Bulk Density*	Mg/m³	1.93		
	Water Content*	%	31		
	Dry density*	Mg/m³	1.47		

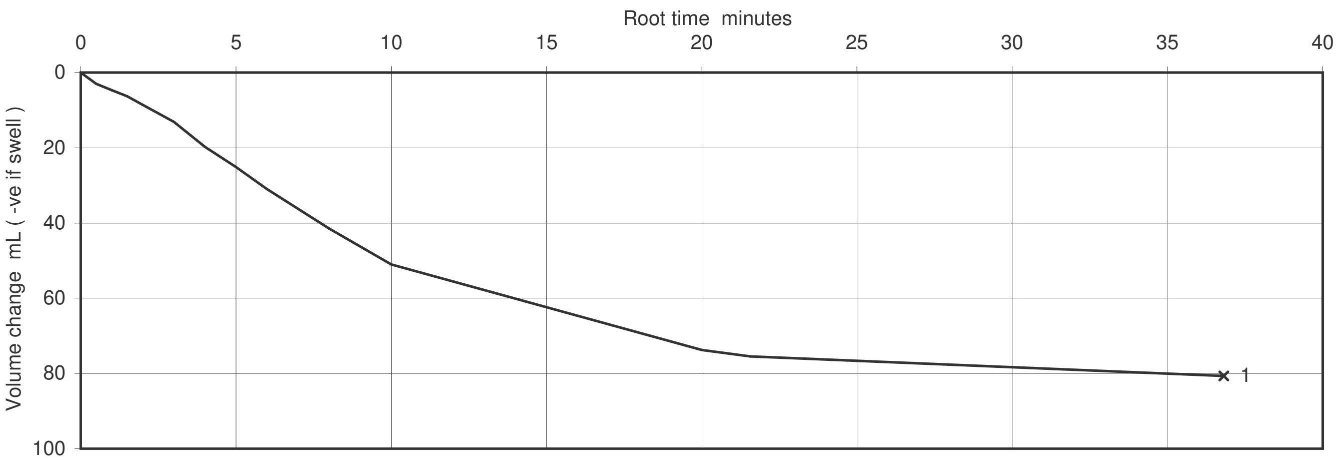
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown SILT.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	195.6		
Final B Value		0.99		



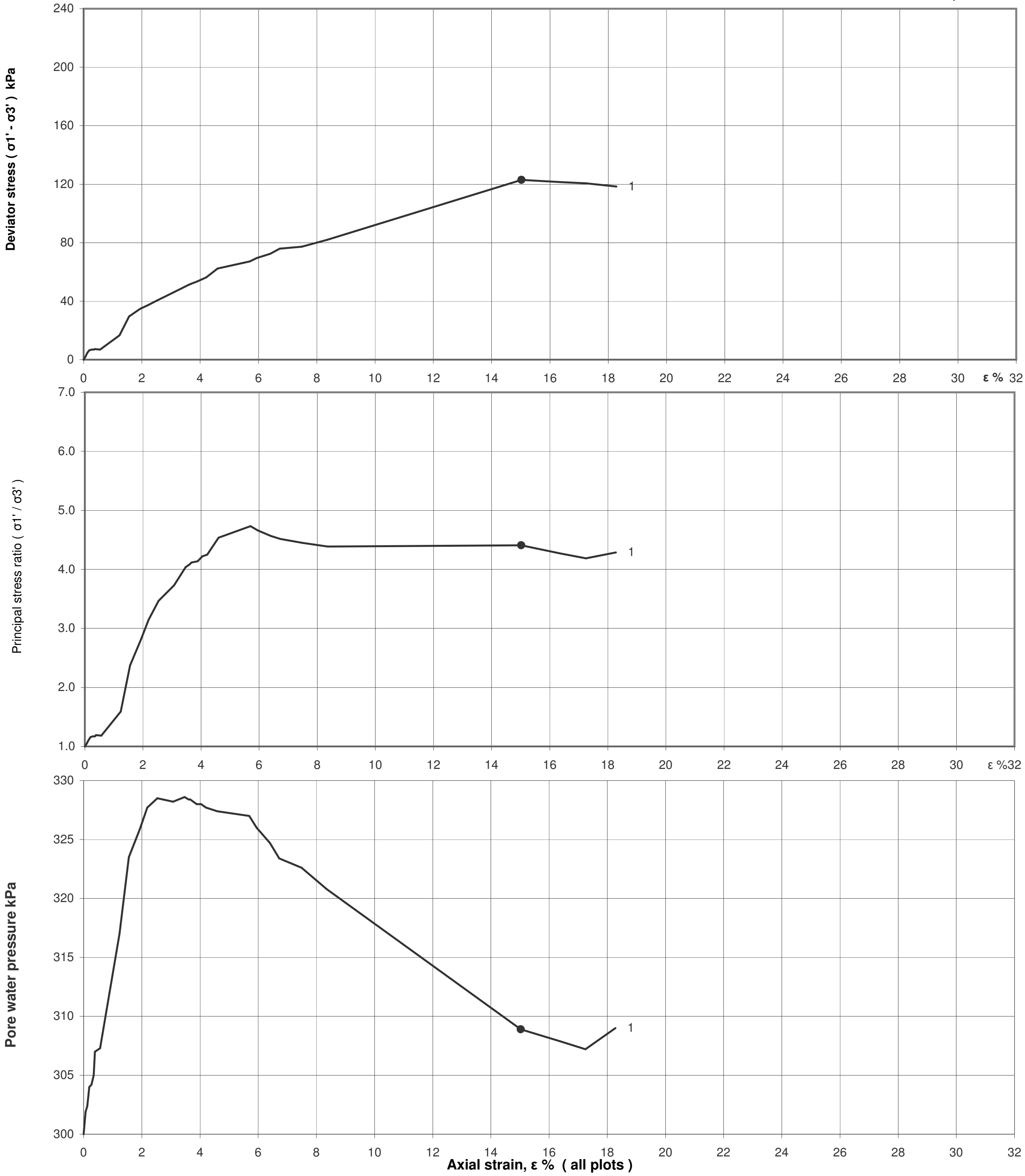
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		345			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		45			kPa
	Pore pressure at start of consolidation		344			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.97			m^2/year
	Coefficient of Compressibility	M_{vi}	1.08			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	3.3E-10			m/s



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	2.30-2.75		
			No	6	Type	UT
			ID			
			Spec Ref			

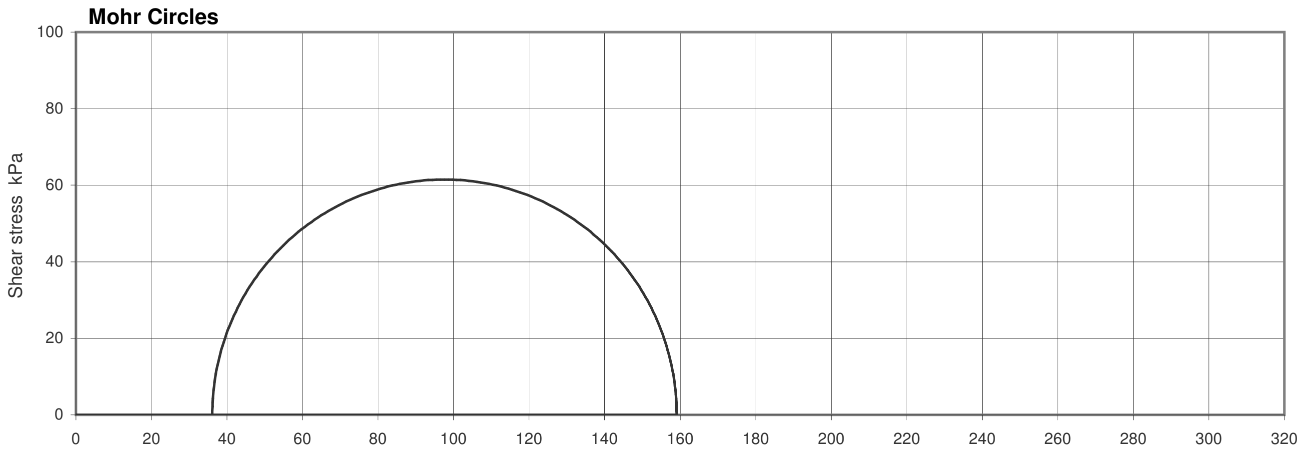
Shearing stages - graphical data



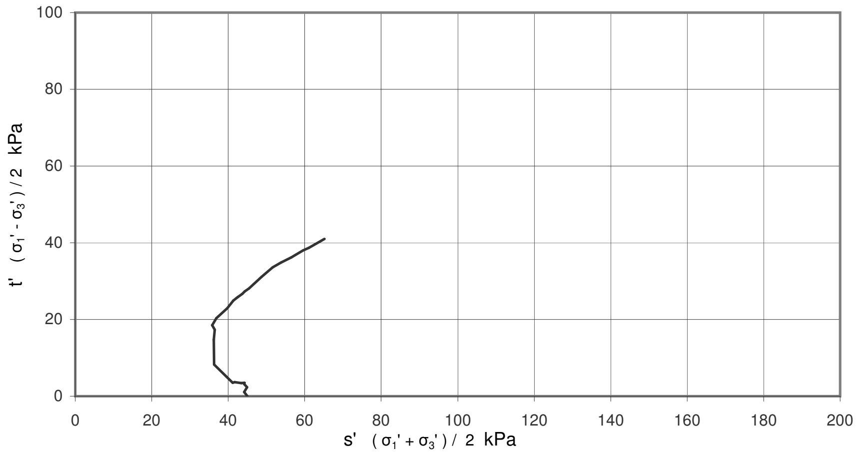
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:48	**Figure** **CU** sheet 2 of 3

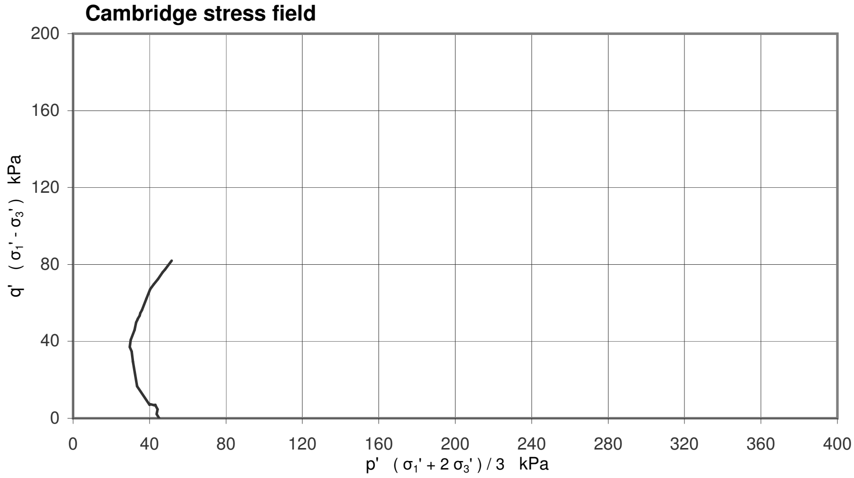
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	2.30-2.75			
			No	6	Type	UT	
			ID				
			Spec Ref				



Effective stresses kPa





Compression stages

Specimen	1	2	3	
Cell pressure	345			kPa
Initial pwp	300			kPa
Initial σ_3'	45			kPa
Rate of strain	0.72			%/hr

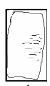
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	15.02			%
$(\sigma_1' / \sigma_3')_f$	4.407			
$(\sigma_1' - \sigma_3')_f$	123.0			kPa
u_f	309			kPa
$\sigma_3'{}_f$	36			kPa
$\sigma_1'{}_f$	159			kPa
A_f	0.07			
Time to failure	20.8			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.594 mm thick rubber membrane(s)

Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:48	**Figure** **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

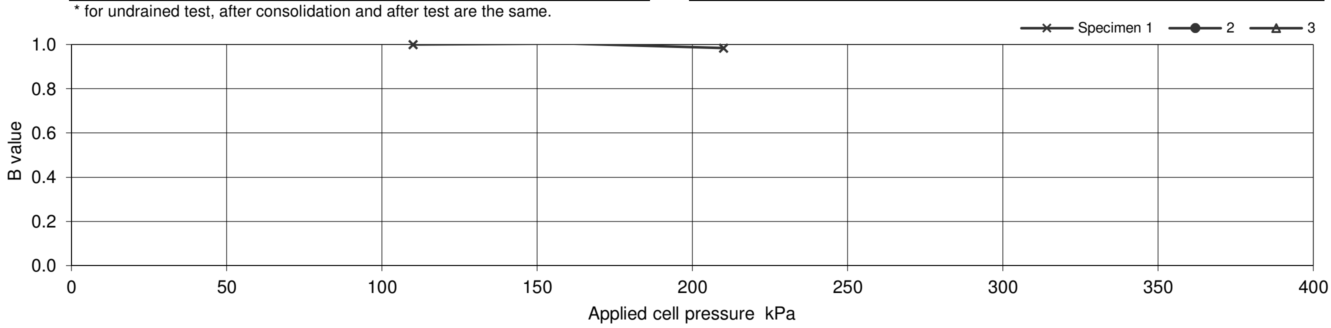
Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.60-4.60		
			No	10	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	191.05		
	Diameter	mm	97.38		
	Bulk Density	Mg/m³	1.81		
	Water Content	%	44		
	Dry density	Mg/m³	1.26		
After consolidation	Length	mm	187.46		
	Diameter	mm	95.54		
	Bulk Density*	Mg/m³	1.85		
	Water Content*	%	39		
	Dry density*	Mg/m³	1.33		

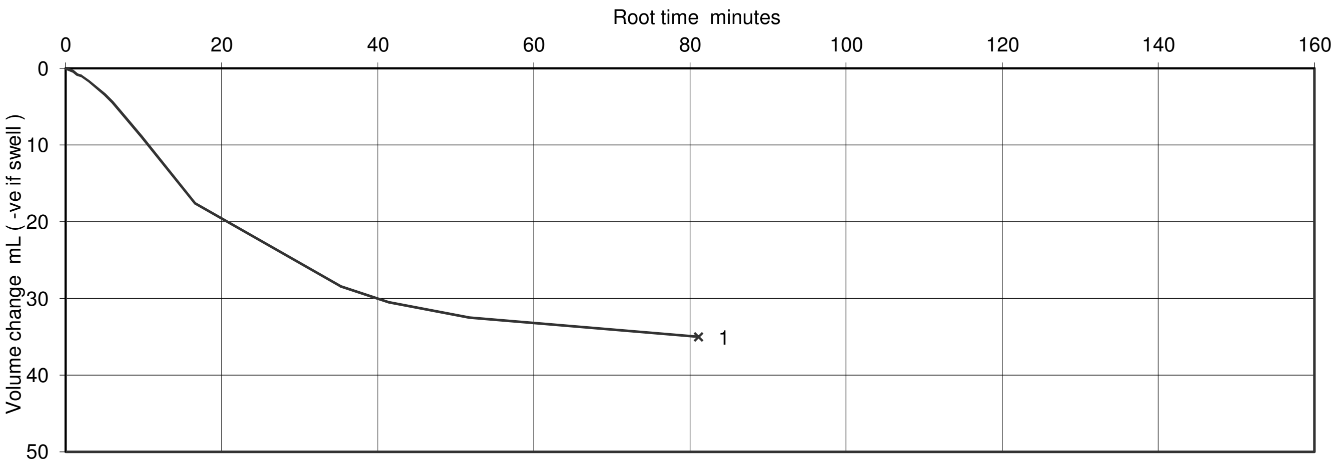
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm brown silty CLAY.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	209.4		
Final B Value		0.98		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		360			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		60			kPa
	Pore pressure at start of consolidation		350			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.25			m^2/year
	Coefficient of Compressibility	M_{vi}	0.51			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.0E-11			m/s

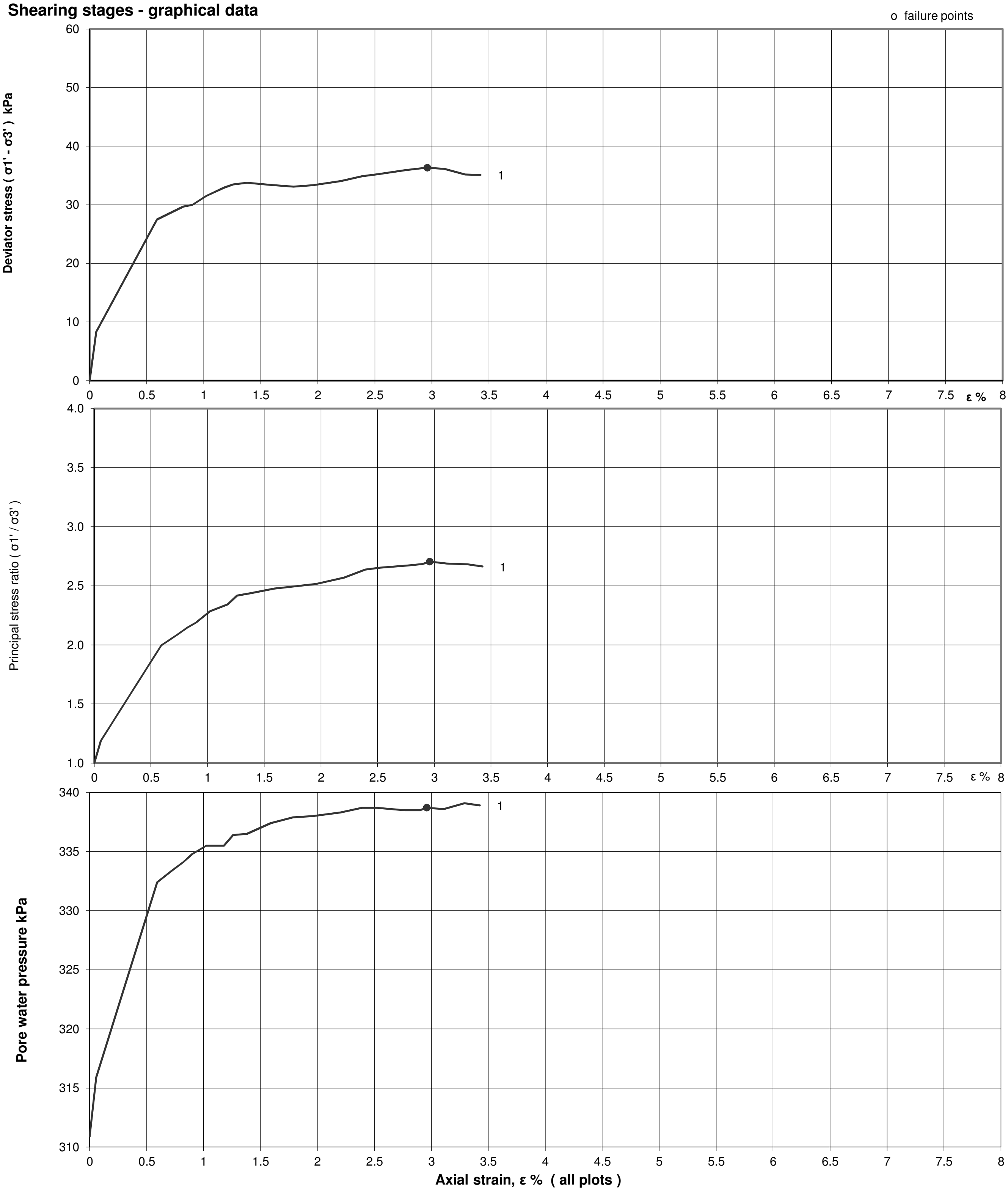


Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:18/03/2016 10:00	**Figure** **CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.60-4.60		
			No	10	Type	P
			ID			
			Spec Ref			

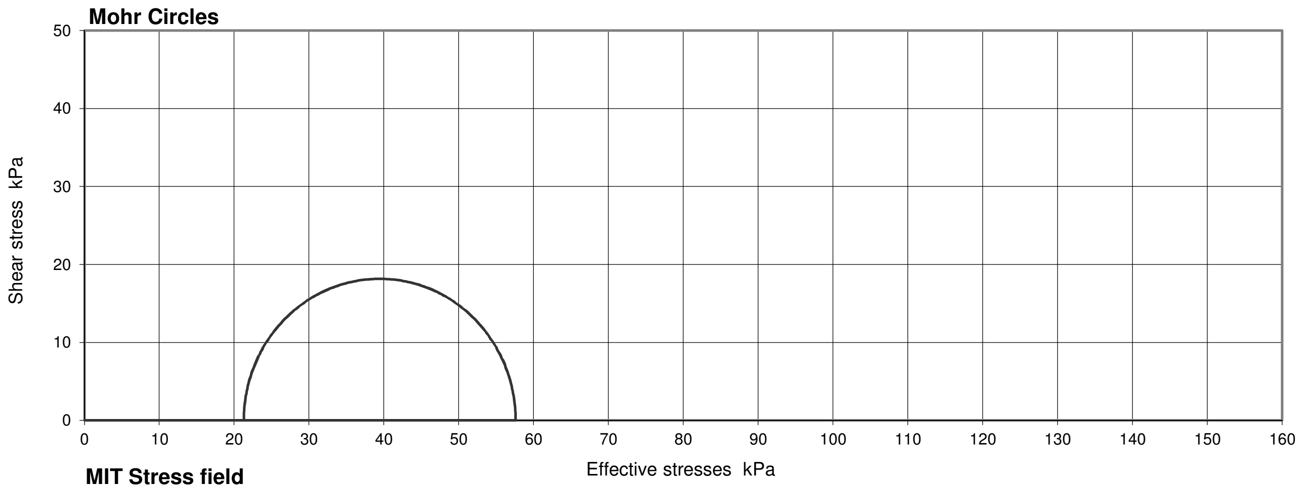
Shearing stages - graphical data

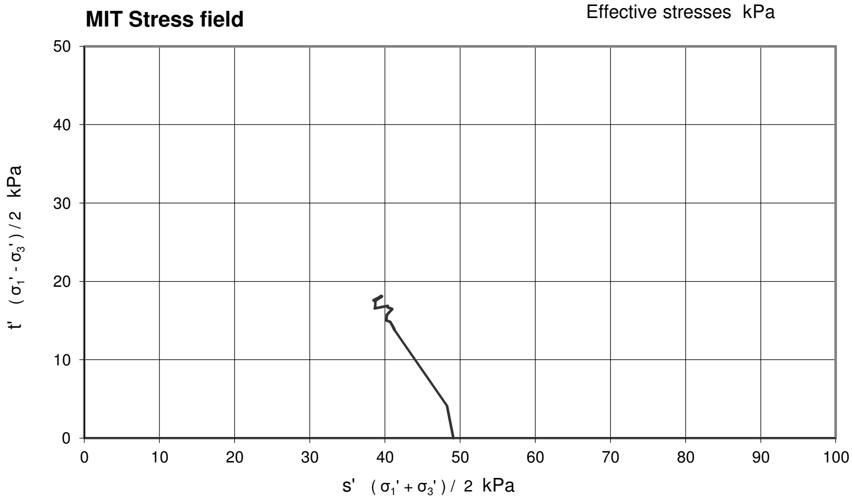


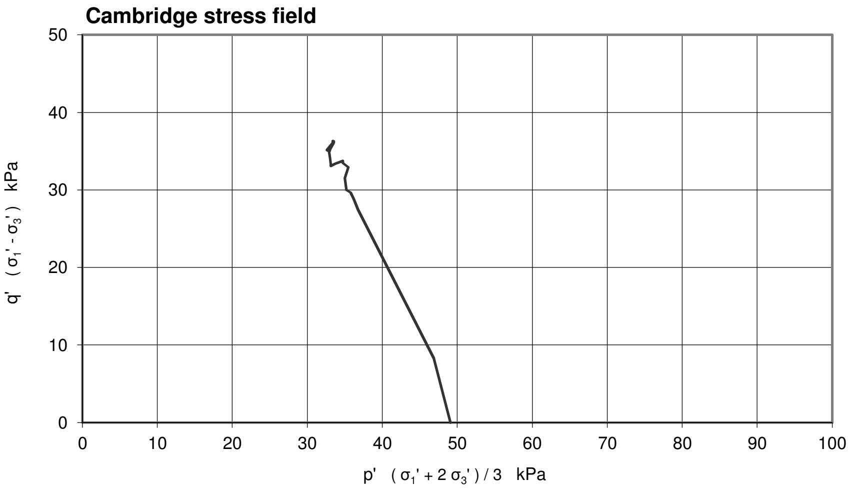
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:00	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.60-4.60			
			No	10	Type	P	
			ID				
			Spec Ref				







Compression stages

Specimen	1	2	3	
Cell pressure	360			kPa
Initial pwp	311			kPa
Initial σ_3'	49			kPa
Rate of strain	0.42			%/hr

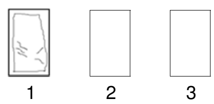
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	2.96			%
$(\sigma_1' / \sigma_3')_f$	2.705			
$(\sigma_1' - \sigma_3')_f$	36.3			kPa
u_f	339			kPa
$\sigma_3'{}_f$	21			kPa
$\sigma_1'{}_f$	58			kPa
A_f	0.77			
Time to failure	7.0			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:00	**CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

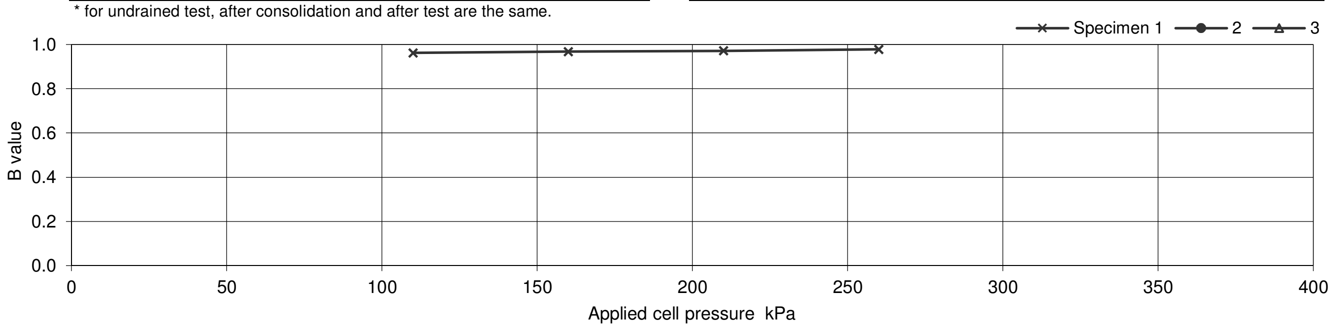
Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00-6.00			
			No	12	Type	P	
			ID	Top			
			Spec Ref	Sample 2			

Specimen Details			1	2	3
Initial	Length	mm	191.28		
	Diameter	mm	97.02		
	Bulk Density	Mg/m³	1.83		
	Water Content	%	41		
	Dry density	Mg/m³	1.30		
After consolidation	Length	mm	187.97		
	Diameter	mm	95.32		
	Bulk Density*	Mg/m³	1.88		
	Water Content*	%	37		
	Dry density*	Mg/m³	1.37		

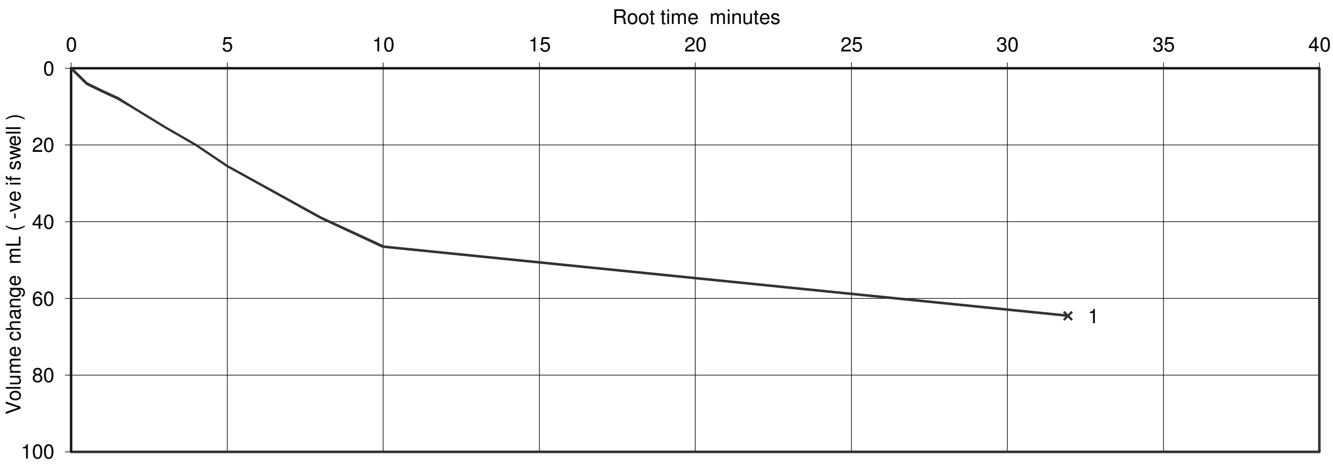
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm greyish brown clayey SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	256.4		
Final B Value		0.98		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		370			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		70			kPa
	Pore pressure at start of consolidation		361			kPa
	Pore pressure at end of consolidation		303			kPa
	Pore pressure dissipation at end of consolidation		96			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.13			m^2/year
	Coefficient of Compressibility	M_{vi}	0.79			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	2.8E-10			m/s

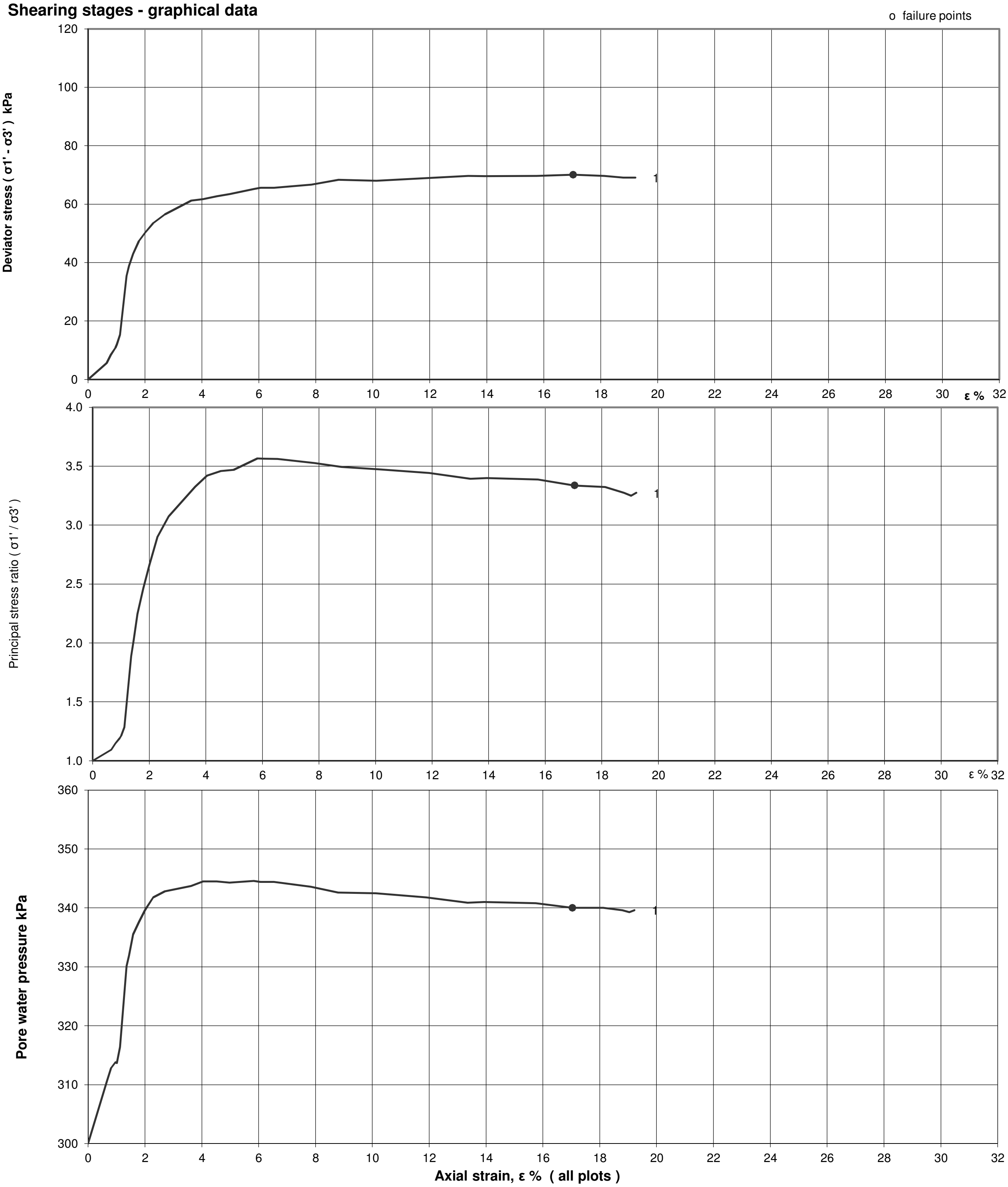


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 09:49	Figure **CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00-6.00		
			No	12	Type	P
			ID	Top		
			Spec Ref	Sample 2		

Shearing stages - graphical data

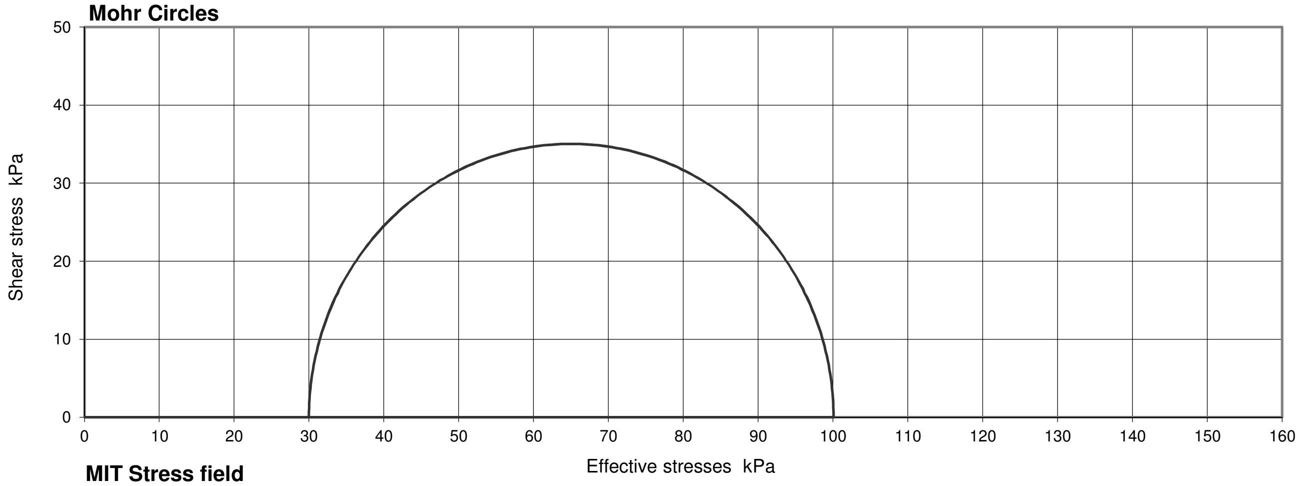


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 09:49	**Figure** **CU** sheet 2 of 3

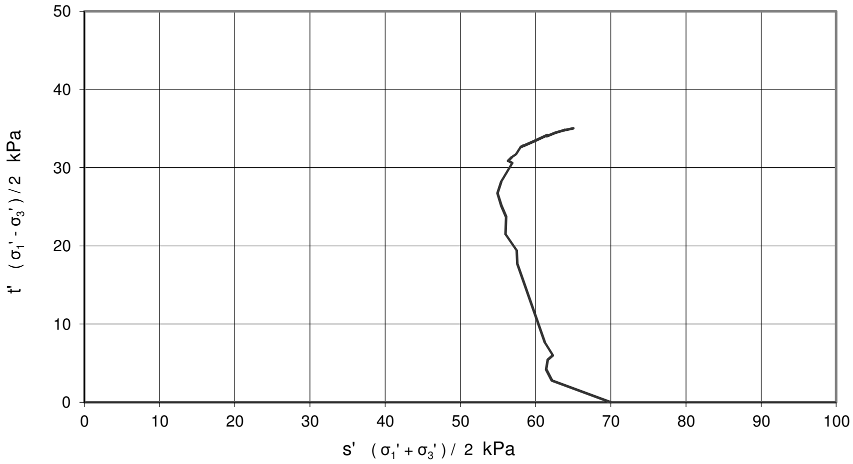
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00-6.00		
			No	12	Type	P
			ID	Top		
			Spec Ref	Sample 2		

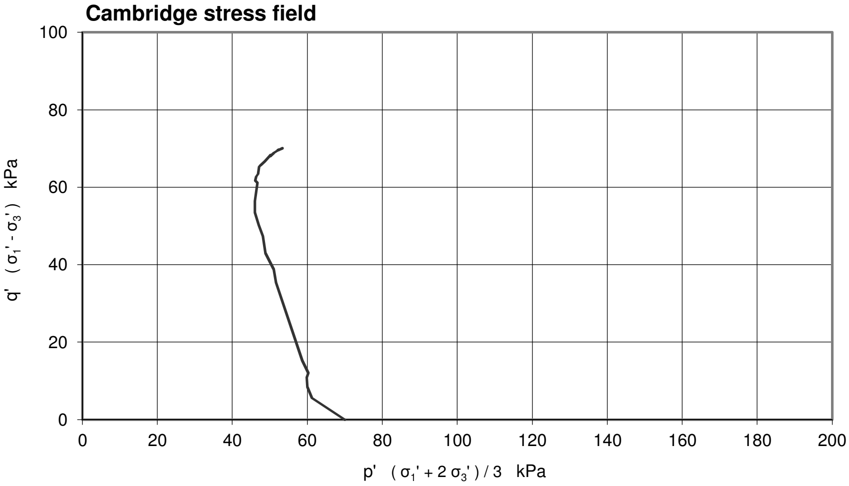
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	370			kPa
Initial pwp	300			kPa
Initial σ_3'	70			kPa
Rate of strain	0.95			%/hr

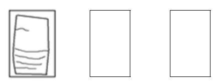
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	17.04			%
$(\sigma_1'/\sigma_3')_f$	3.336			
$(\sigma_1' - \sigma_3')_f$	70.1			kPa
u_f	340			kPa
$\sigma_3'{}_f$	30			kPa
$\sigma_1'{}_f$	100			kPa
A_f	0.57			
Time to failure	17.9			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.48 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 09:49	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

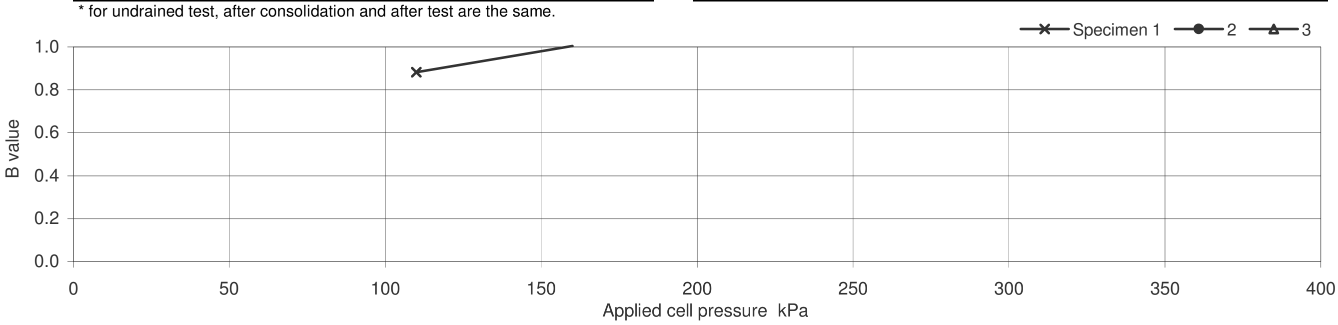
Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00-6.00			
			No	12	Type	P	
			ID	Base			
			Spec Ref	Sample 2			

	Specimen Details		1	2	3
Initial	Length	mm	190.21		
	Diameter	mm	97.24		
	Bulk Density	Mg/m³	1.82		
	Water Content	%	40		
	Dry density	Mg/m³	1.30		
After consolidation	Length	mm	185.44		
	Diameter	mm	94.77		
	Bulk Density*	Mg/m³	1.89		
	Water Content*	%	34		
	Dry density*	Mg/m³	1.41		

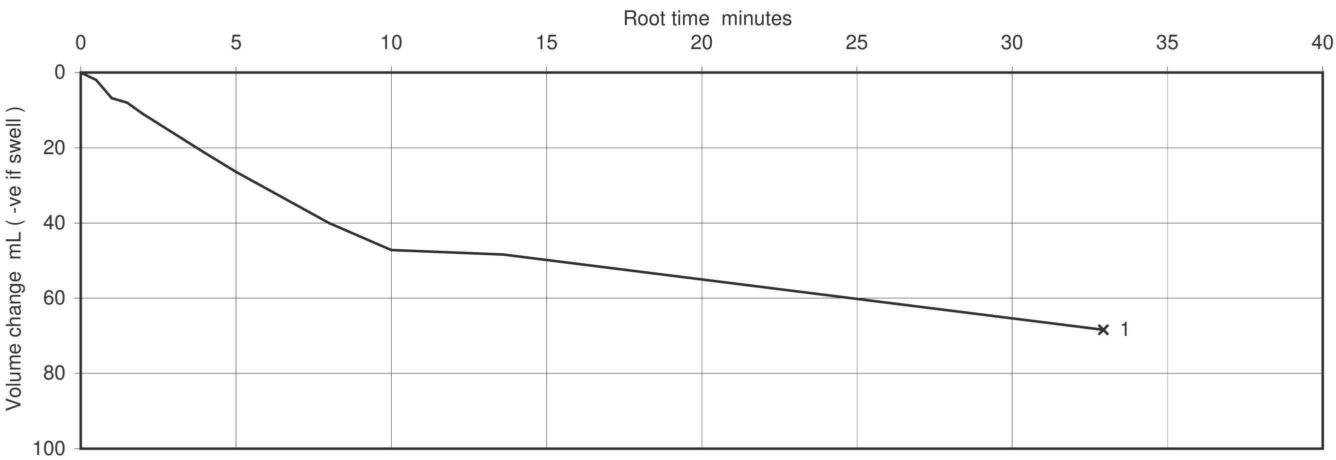
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown slightly sandy CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	160		
Final pore water pressure	kPa	148.2		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		440			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		140			kPa
	Pore pressure at start of consolidation		399			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.19			m^2/year
	Coefficient of Compressibility	M_{vi}	0.50			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.9E-10			m/s

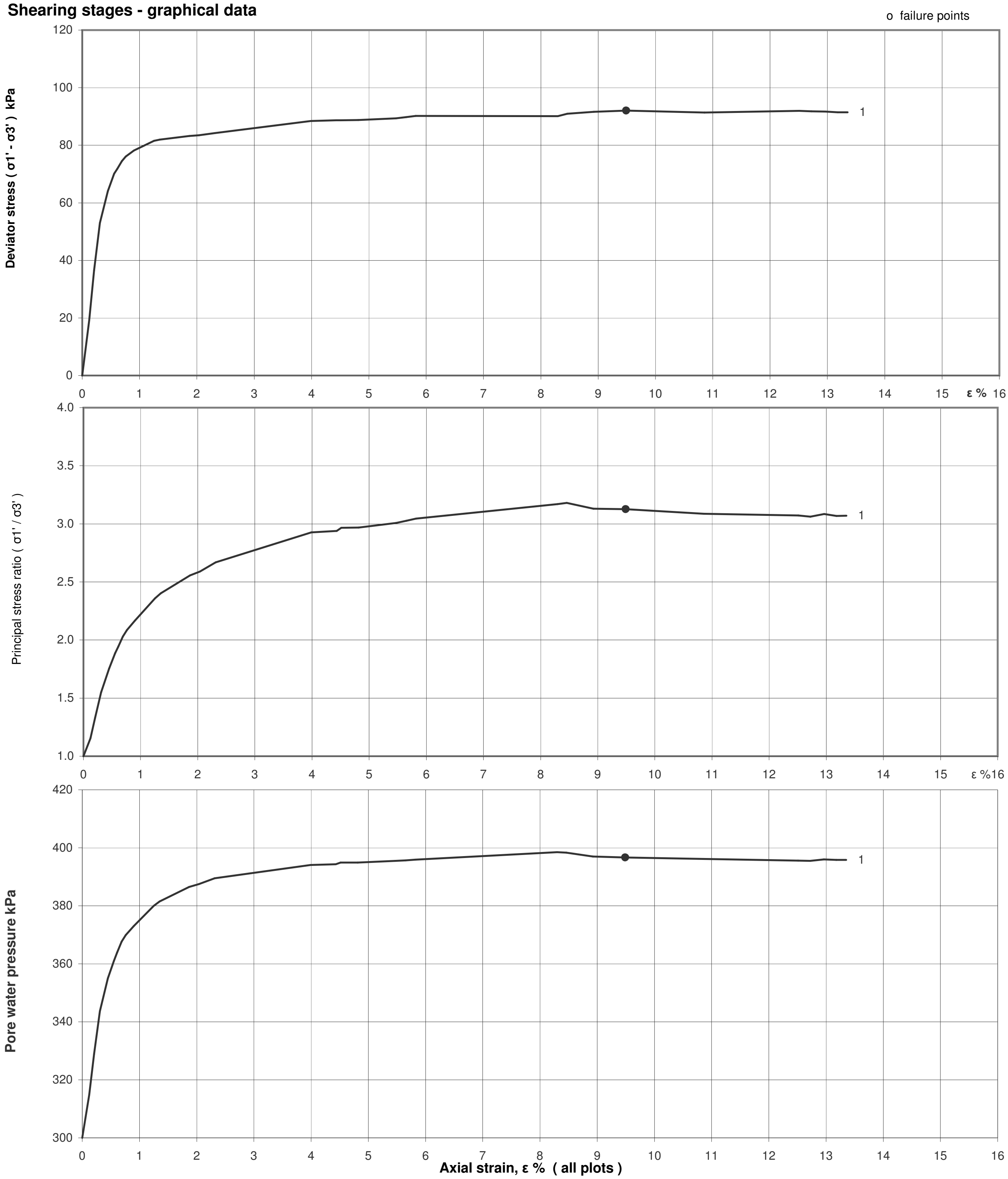


Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:46	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00-6.00		
			No	12	Type	P
			ID	Base		
			Spec Ref	Sample 2		

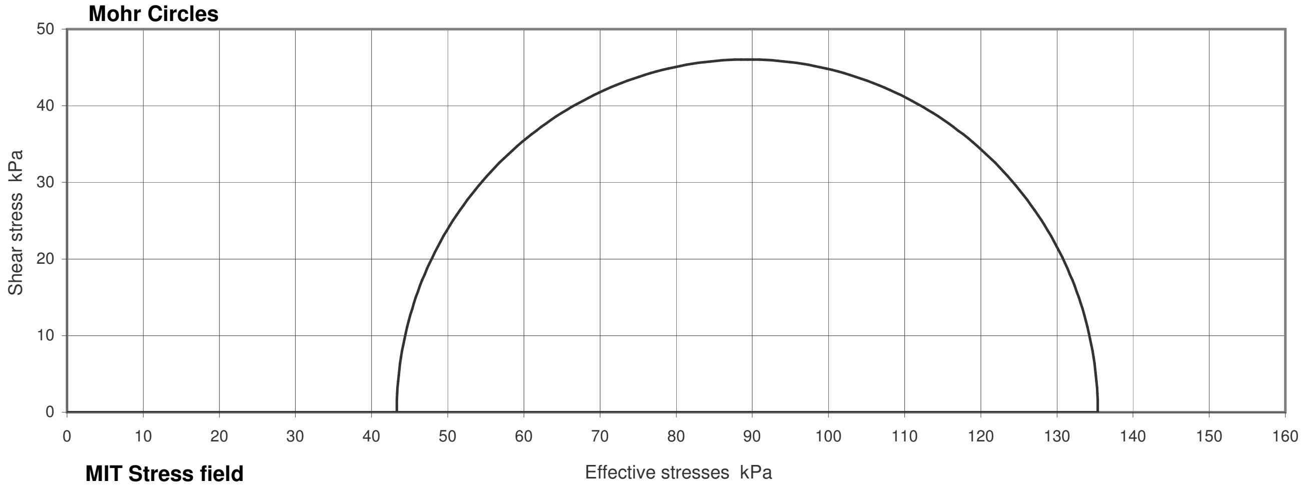
Shearing stages - graphical data

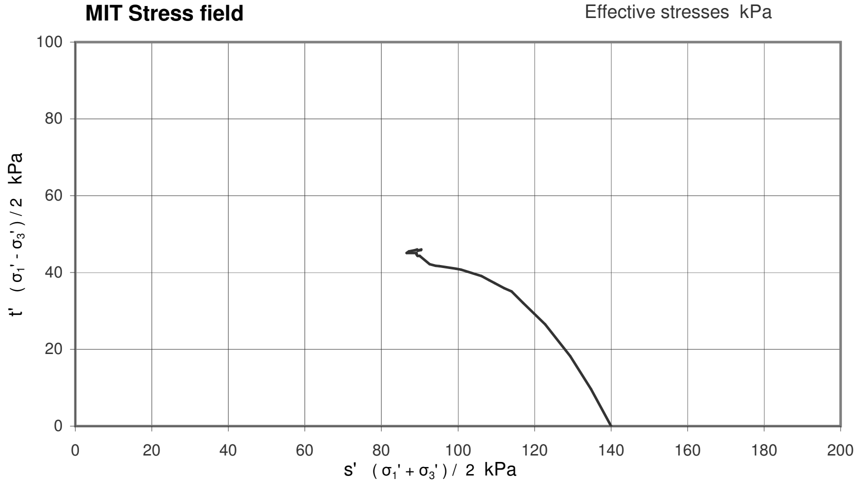


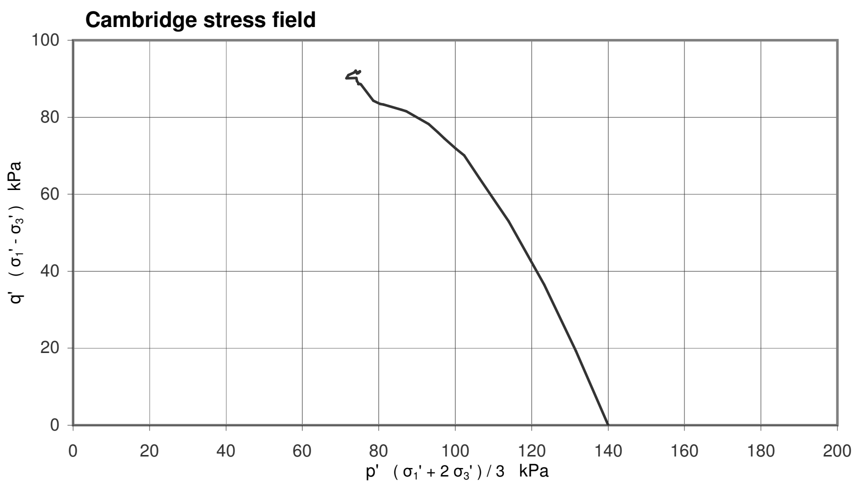
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:46	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00-6.00		
			No	12	Type	P
			ID	Base		
			Spec Ref	Sample 2		







Compression stages

Specimen	1	2	3	
Cell pressure	440			kPa
Initial pwp	300			kPa
Initial σ_3'	140			kPa
Rate of strain	1.00			%/hr

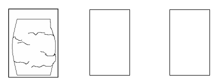
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	9.49			%
$(\sigma_1' / \sigma_3')_f$	3.126			
$(\sigma_1' - \sigma_3')_f$	92.1			kPa
u_f	397			kPa
$\sigma_3'_f$	43			kPa
$\sigma_1'_f$	135			kPa
A_f	1.05			
Time to failure	9.5			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.4 mm thick rubber membrane(s)

Ref		Printed:01/03/2016 10:46	Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157		CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

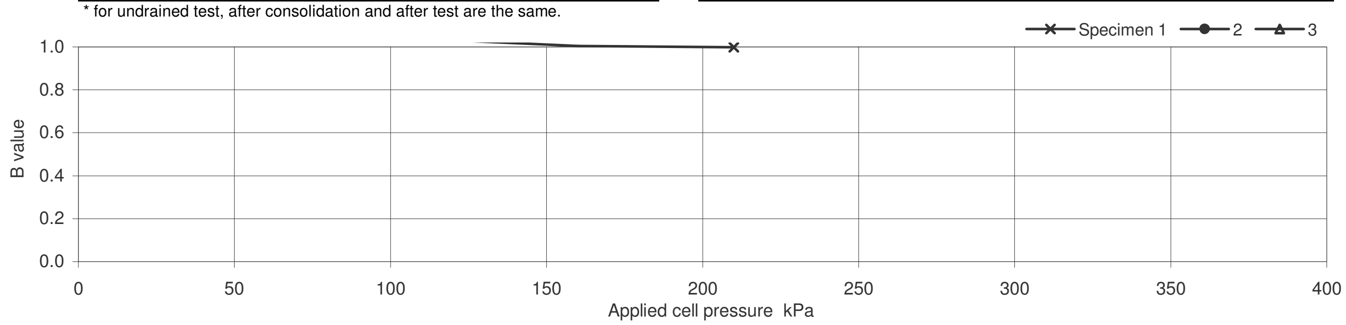
Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.00-8.00		
			No	14	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	190.22		
	Diameter	mm	98.04		
	Bulk Density	Mg/m³	1.81		
	Water Content	%	41		
	Dry density	Mg/m³	1.28		
After consolidation	Length	mm	186.00		
	Diameter	mm	95.84		
	Bulk Density*	Mg/m³	1.86		
	Water Content*	%	35		
	Dry density*	Mg/m³	1.37		

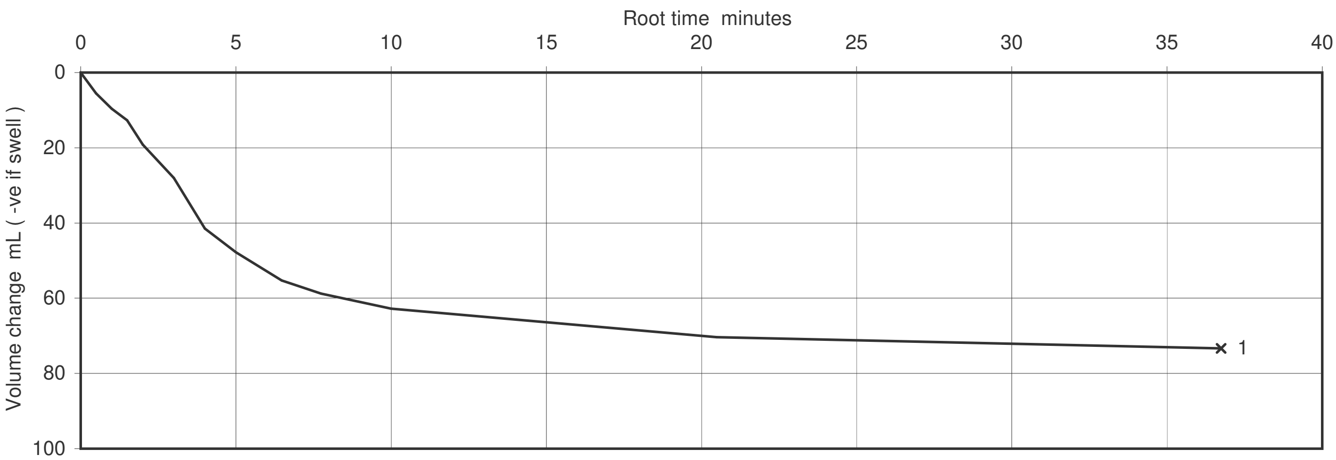
* for undrained test, after consolidation and after test are the same.

Soil Description	Firm brown sandy SILT.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	201.8		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		390			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		90			kPa
	Pore pressure at start of consolidation		376			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	4.20			m^2/year
	Coefficient of Compressibility	M_{vi}	0.68			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	8.9E-10			m/s

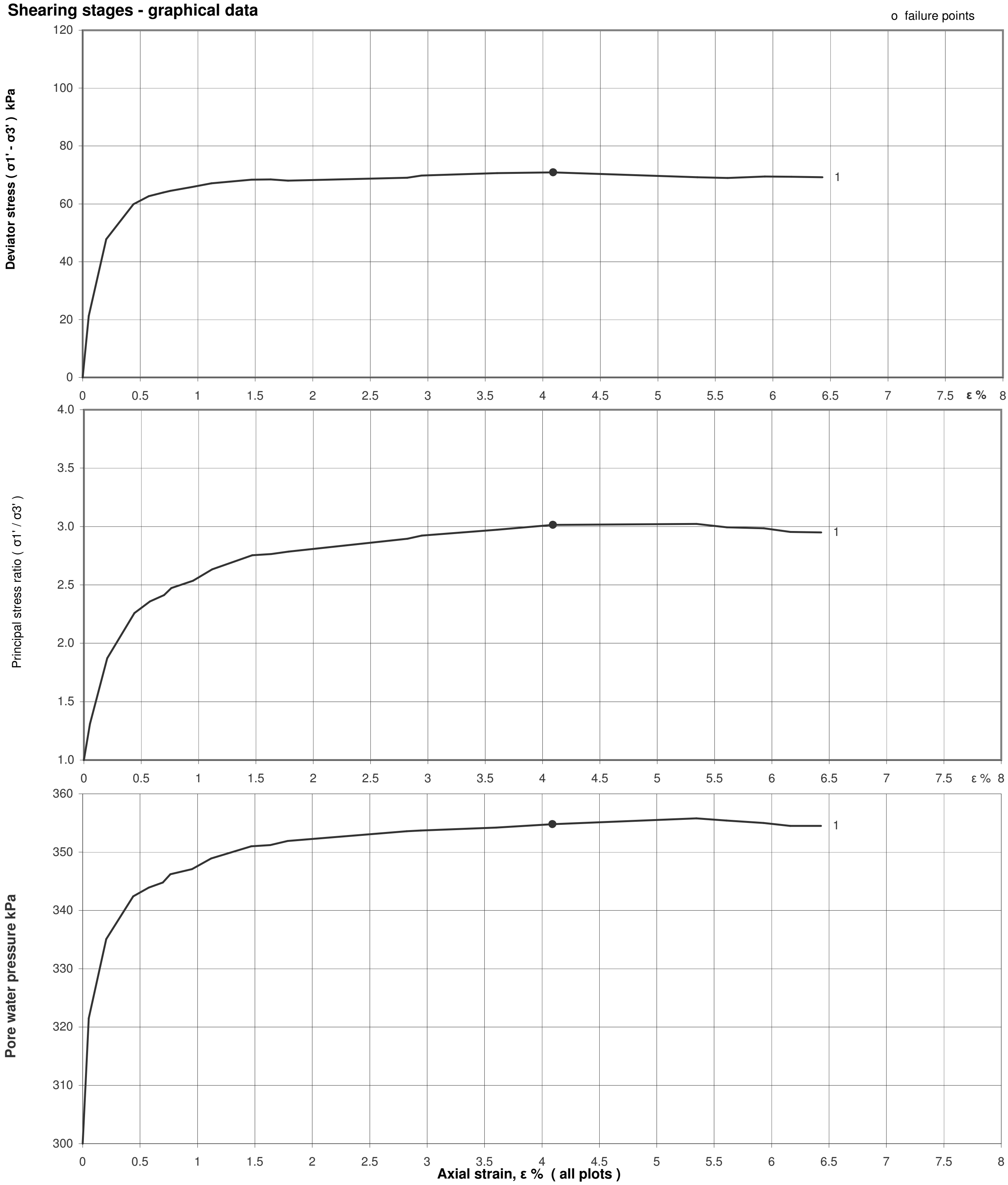


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:47	**Figure** **CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.00-8.00		
			No	14	Type	P
			ID			
			Spec Ref			

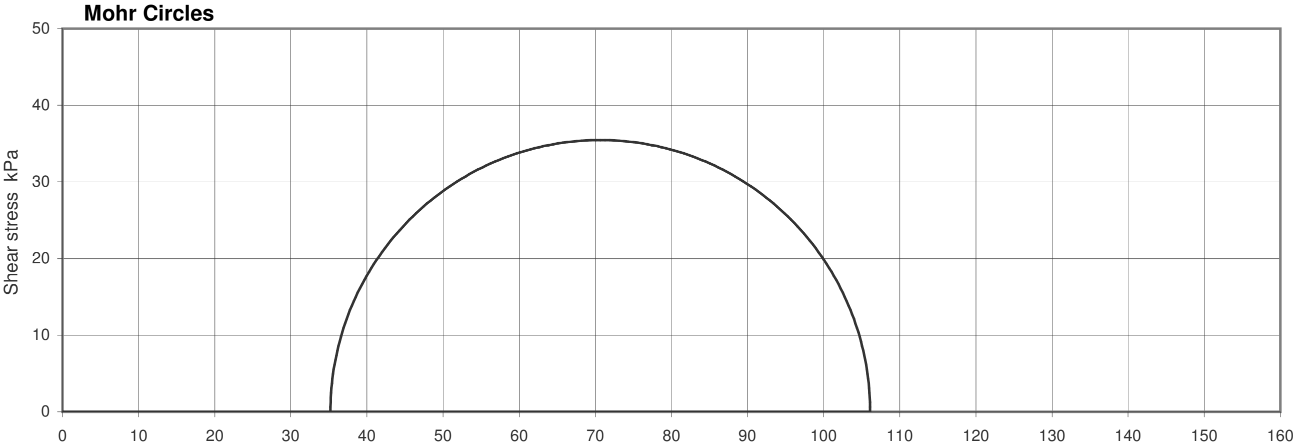
Shearing stages - graphical data

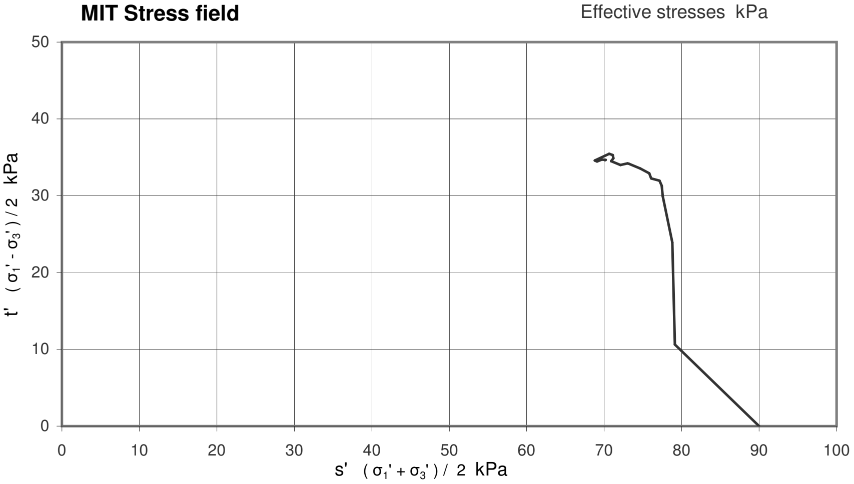


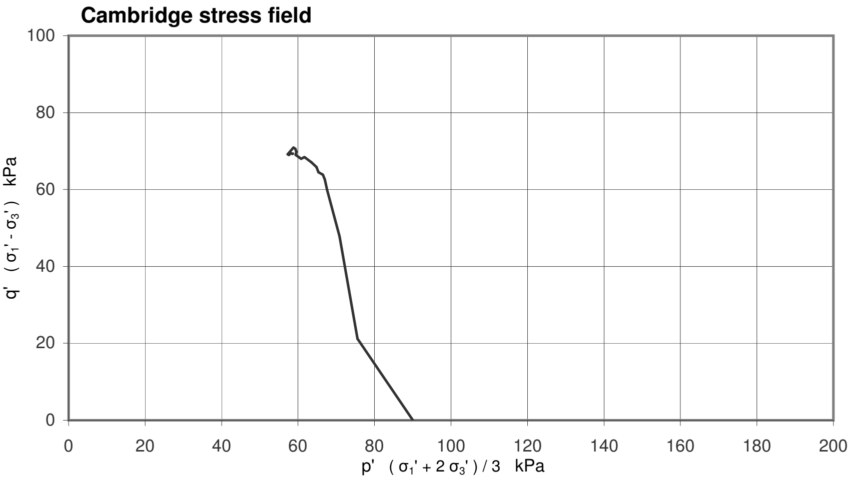
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:47	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.00-8.00		
			No	14	Type	P
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	390			kPa
Initial pwp	300			kPa
Initial σ_3'	90			kPa
Rate of strain	2.00			%/hr

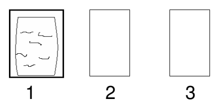
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	4.09			%
$(\sigma_1' / \sigma_3')_f$	3.014			
$(\sigma_1' - \sigma_3')_f$	70.9			kPa
u_f	355			kPa
$\sigma_3'_f$	35			kPa
$\sigma_1'_f$	106			kPa
A_f	0.77			
Time to failure	2.0			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:47	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

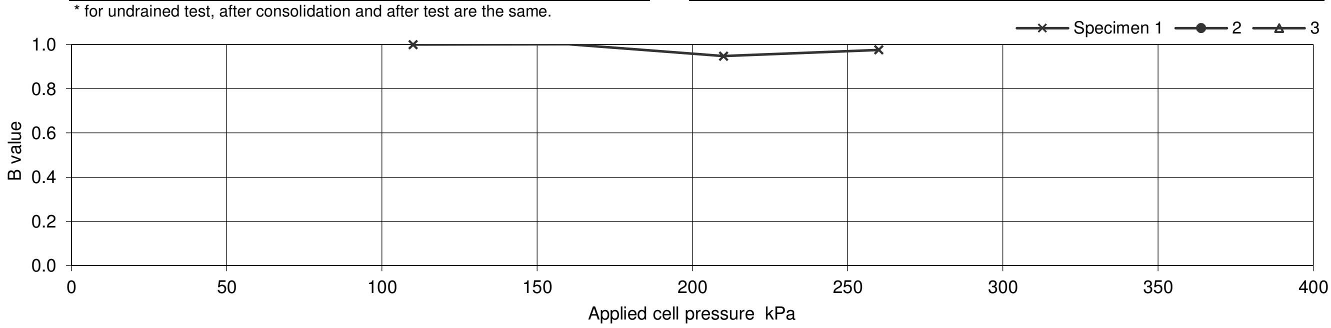
Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.65-9.30		
			No	18	Type	UT
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	201.64		
	Diameter	mm	102.59		
	Bulk Density	Mg/m³	1.82		
	Water Content	%	40		
	Dry density	Mg/m³	1.31		
After consolidation	Length	mm	194.31		
	Diameter	mm	98.79		
	Bulk Density*	Mg/m³	1.92		
	Water Content*	%	31		
	Dry density*	Mg/m³	1.46		

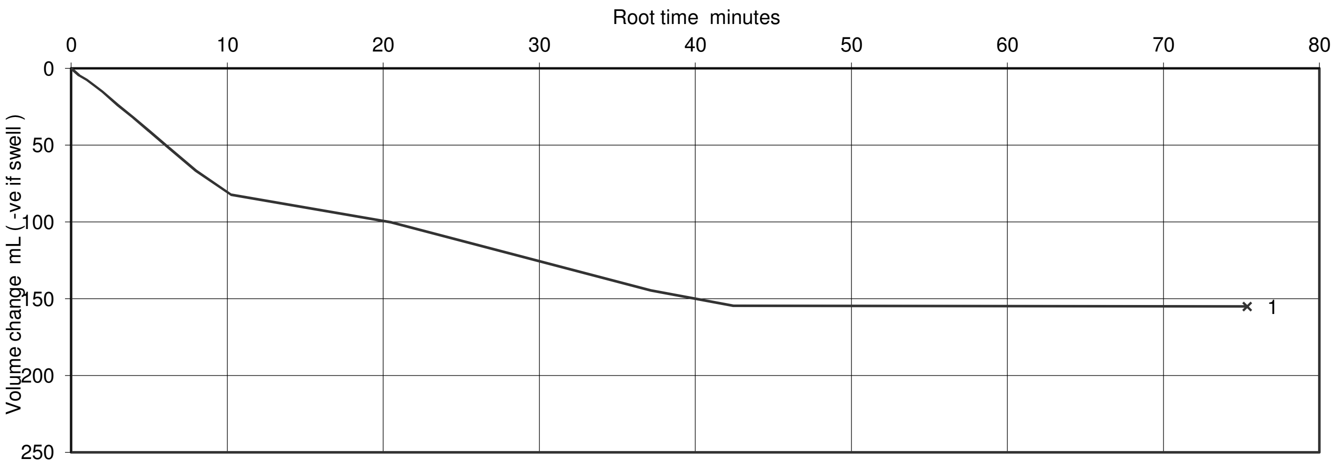
* for undrained test, after consolidation and after test are the same.

Soil Description	Very soft brown CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	255.7		
Final B Value		0.98		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		400			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		100			kPa
	Pore pressure at start of consolidation		398			kPa
	Pore pressure at end of consolidation		301			kPa
	Pore pressure dissipation at end of consolidation		99			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.61			m^2/year
	Coefficient of Compressibility	M_{vi}	0.97			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.8E-10			m/s

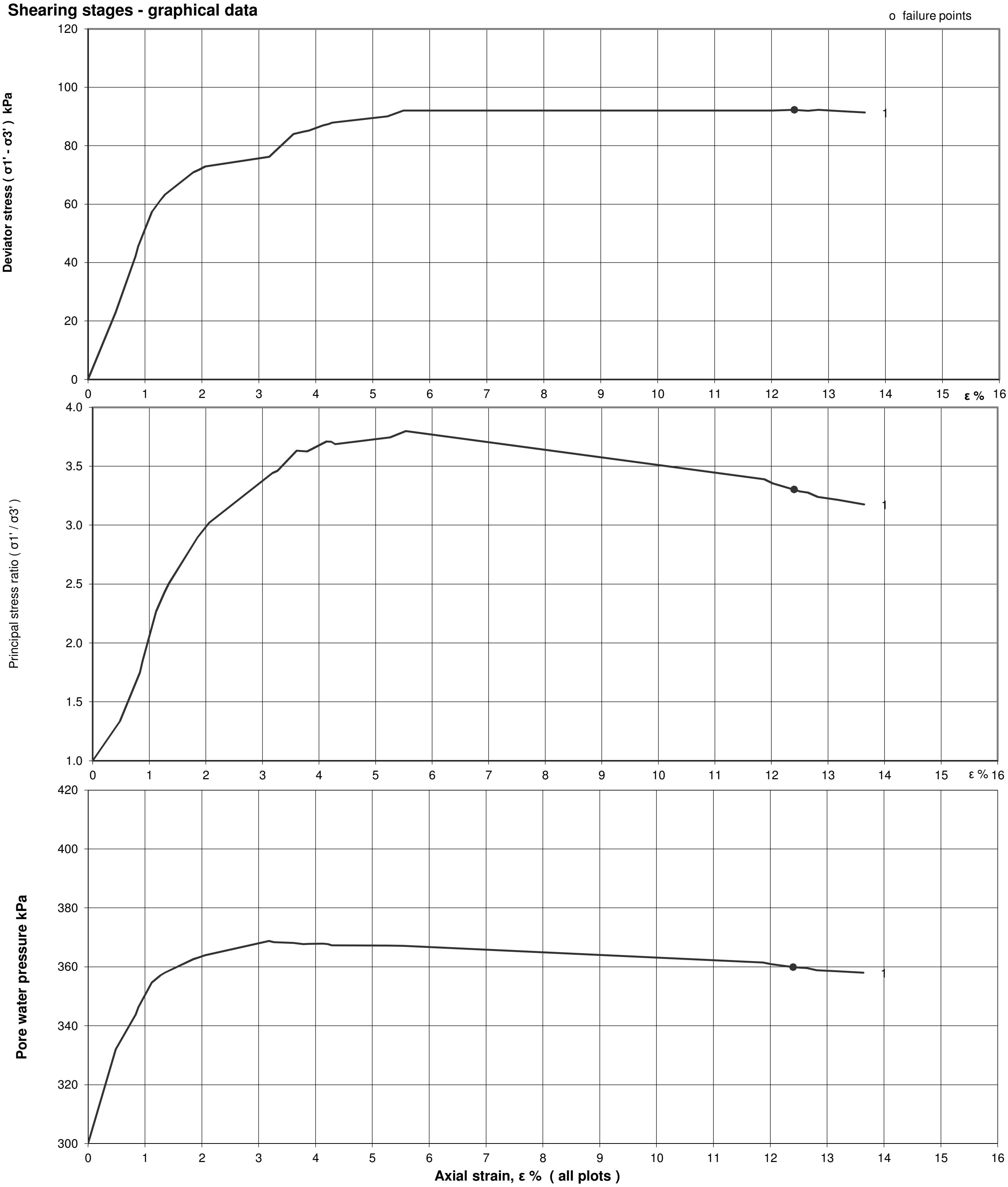


Ref			Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 09:50	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.65-9.30		
			No	18	Type	UT
			ID			
			Spec Ref			

Shearing stages - graphical data

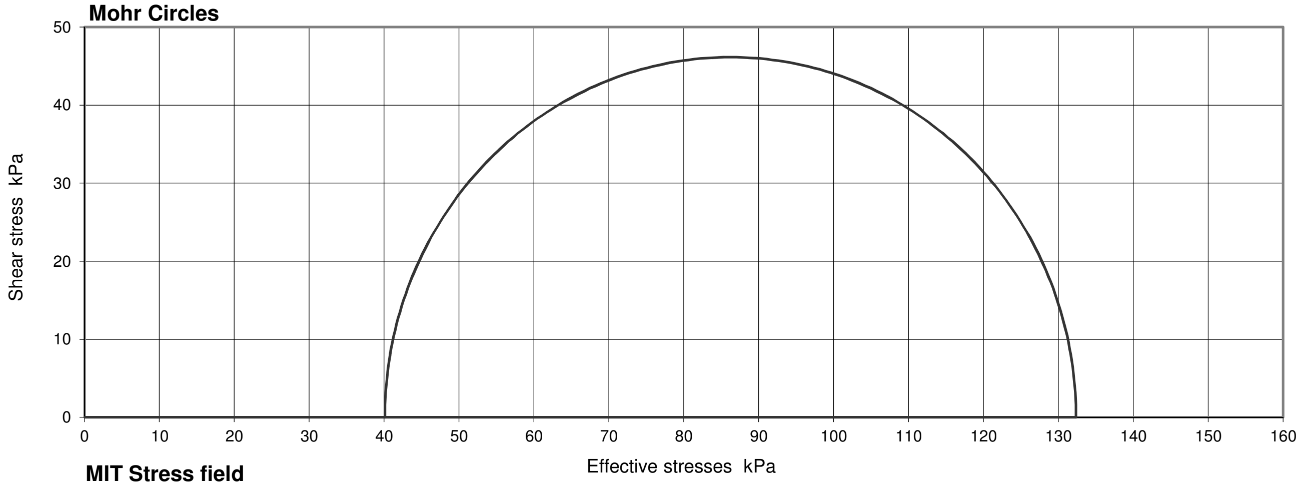


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 09:50	**Figure** **CU** sheet 2 of 3

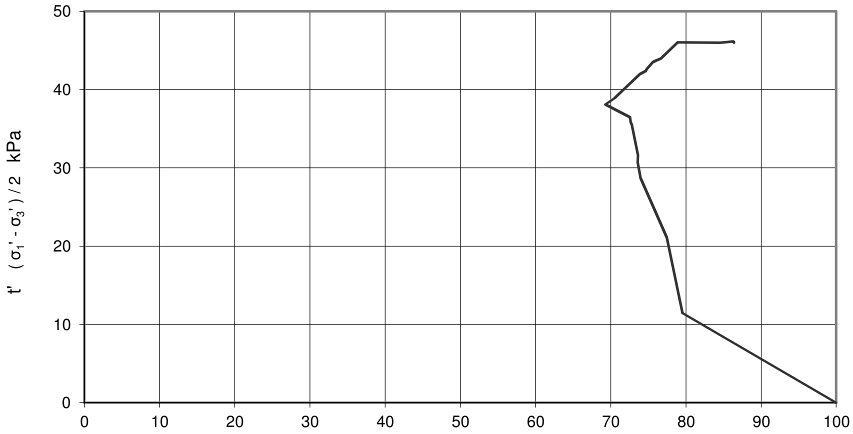
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.65-9.30		
			No	18	Type	UT
			ID			
			Spec Ref			

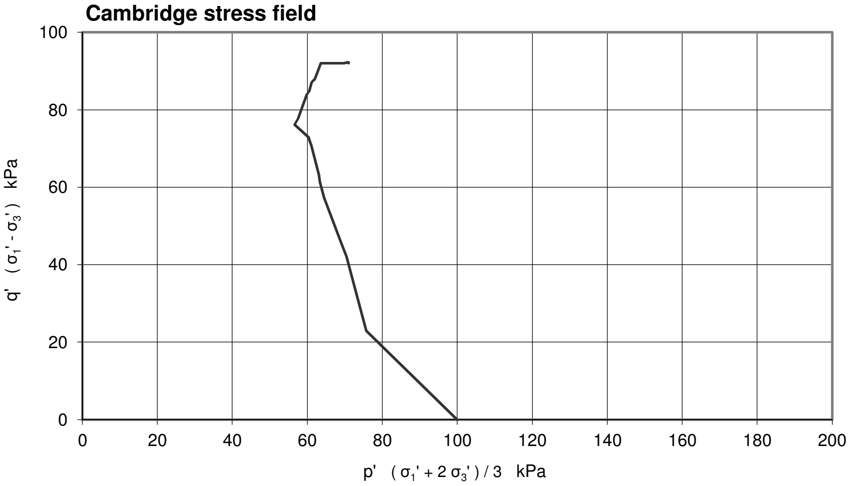
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	400			kPa
Initial pwp	300			kPa
Initial σ_3'	100			kPa
Rate of strain	0.46			%/hr

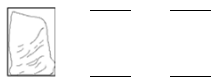
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	12.40			%
$(\sigma_1' / \sigma_3')_f$	3.301			
$(\sigma_1' - \sigma_3')_f$	92.3			kPa
u_f	360			kPa
$\sigma_3'{}_f$	40			kPa
$\sigma_1'{}_f$	132			kPa
A_f	0.65			
Time to failure	26.8			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 09:50	**Figure** **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

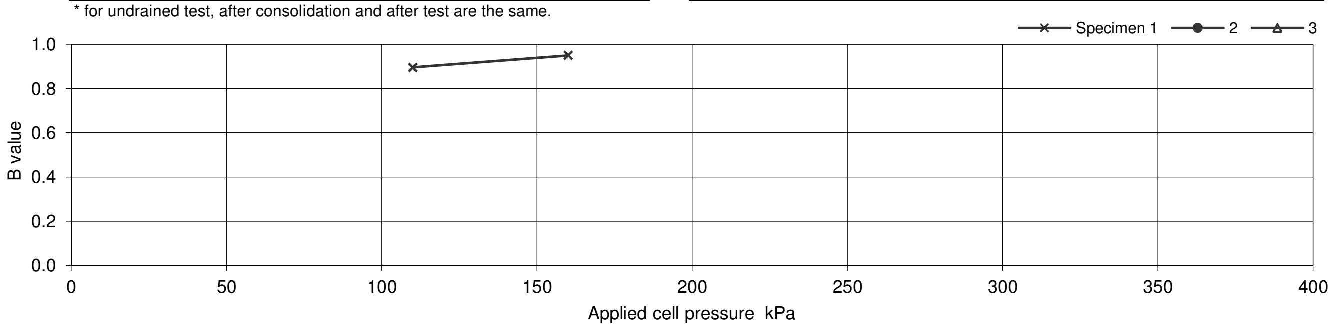
Project No	A5085-15	Sample Details:	Hole No	BH404			
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.50-1.95			
			No	3	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	205.17		
	Diameter	mm	104.23		
	Bulk Density	Mg/m³	1.96		
	Water Content	%	30		
	Dry density	Mg/m³	1.52		
After consolidation	Length	mm	205.09		
	Diameter	mm	104.18		
	Bulk Density*	Mg/m³	1.96		
	Water Content*	%	29		
	Dry density*	Mg/m³	1.52		

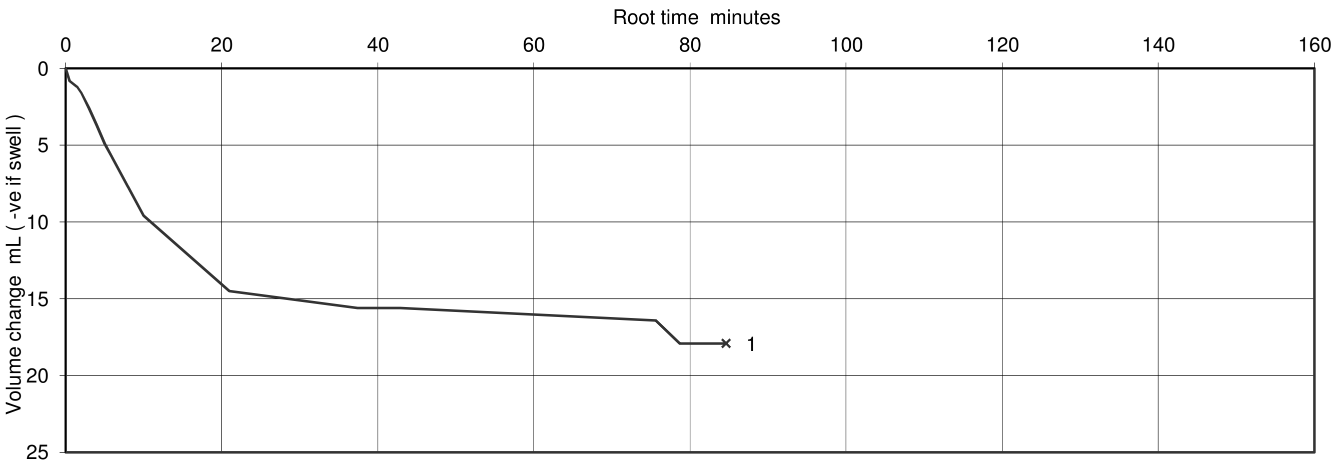
* for undrained test, after consolidation and after test are the same.

Soil Description	Firm brown slightly gravelly Silty CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	160		
Final pore water pressure	kPa	147.5		
Final B Value		0.95		



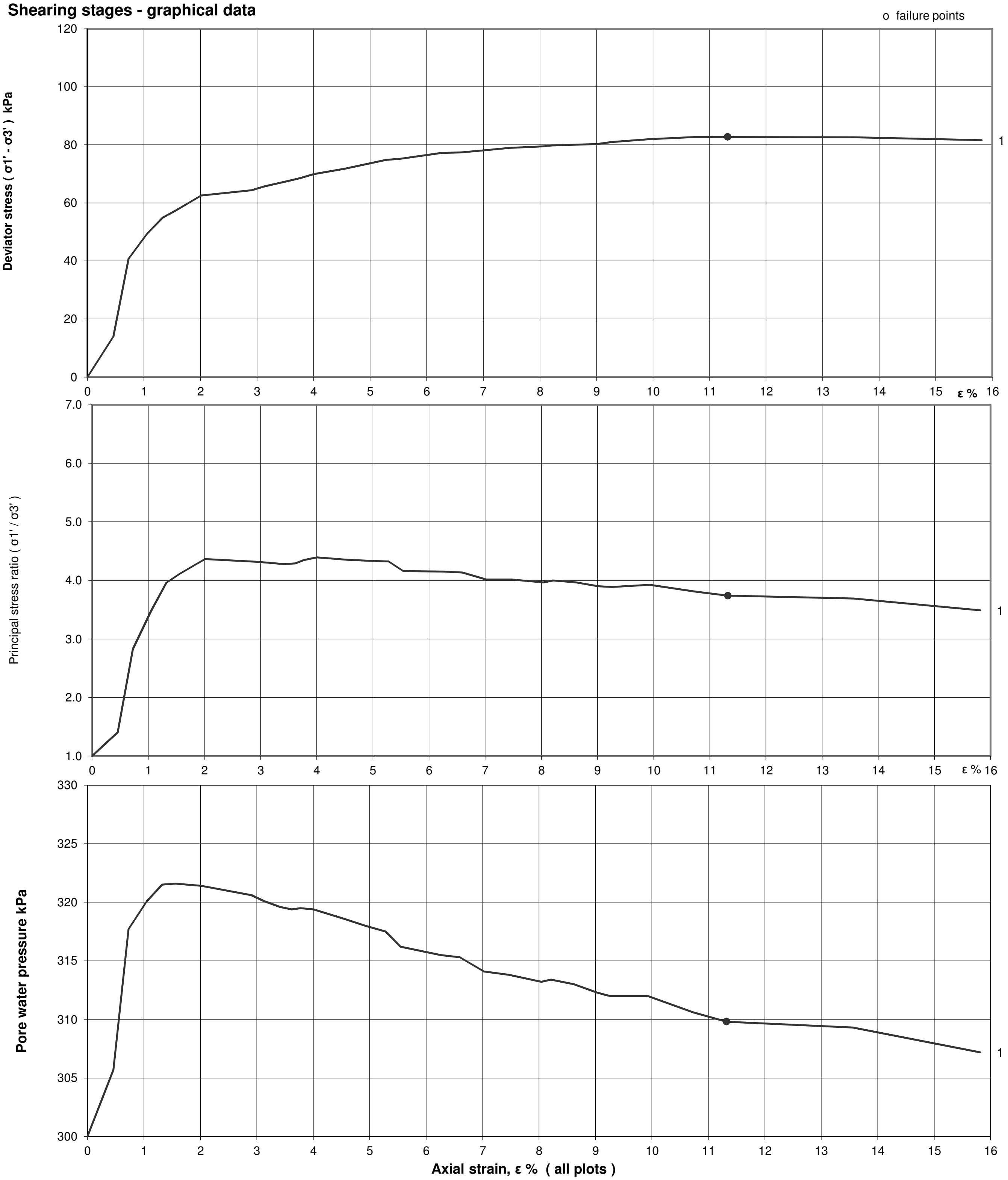
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		340			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		40			kPa
	Pore pressure at start of consolidation		325			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.76			m^2/year
	Coefficient of Compressibility	M_{vi}	0.40			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	9.4E-11			m/s



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.50-1.95		
			No	3	Type	UT
			ID			
			Spec Ref			

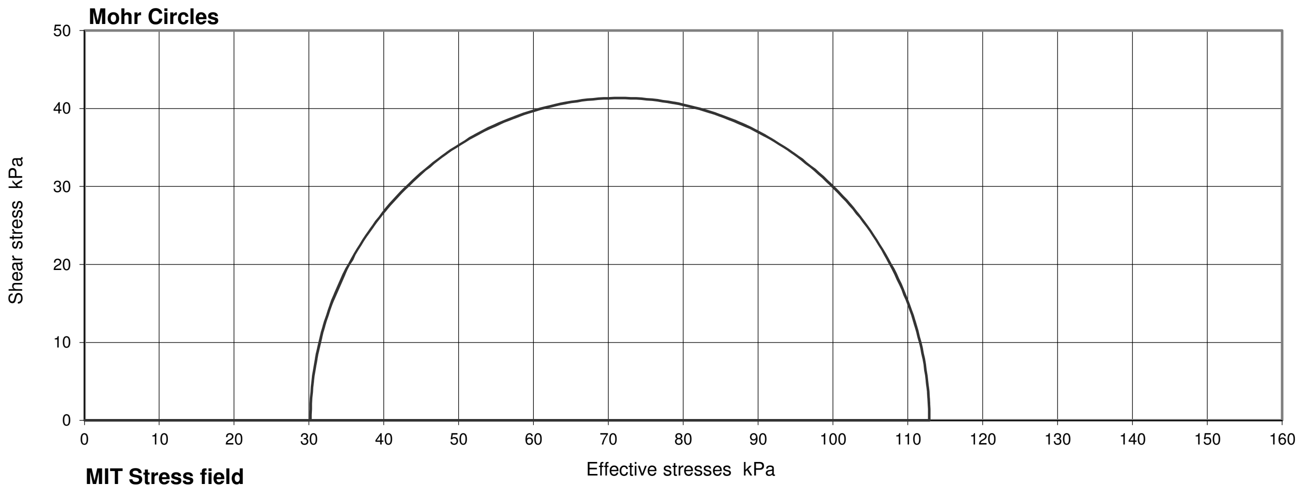
Shearing stages - graphical data

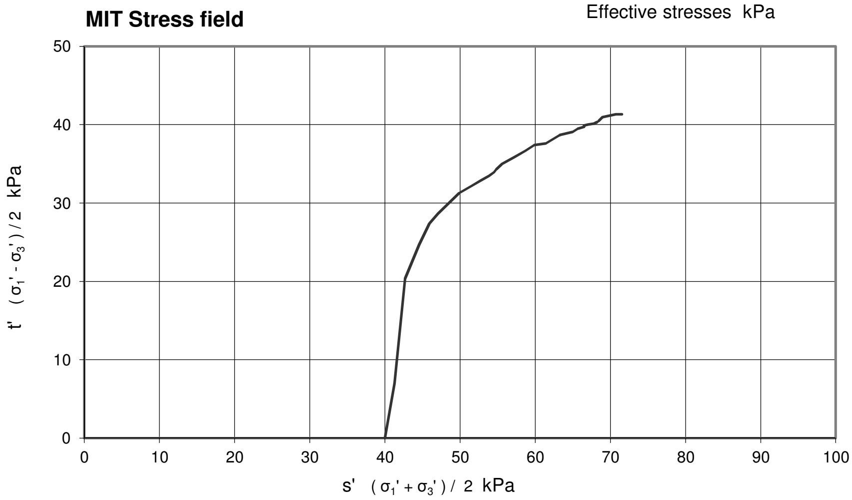


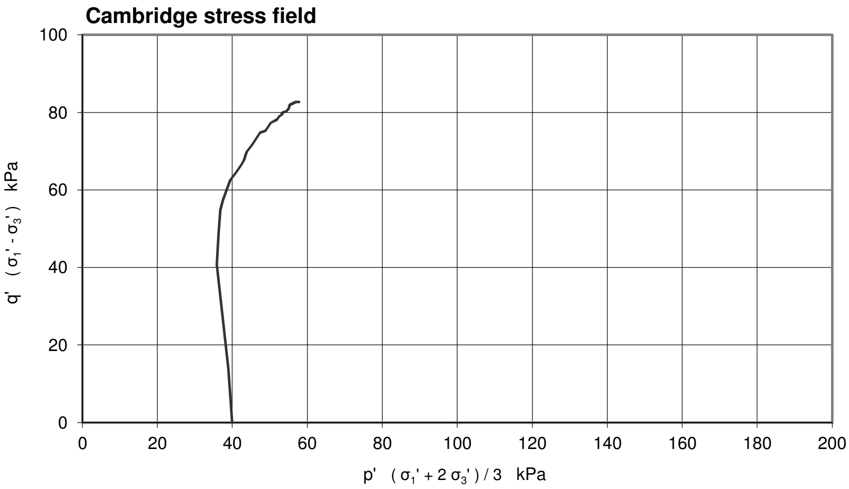
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:45	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.50-1.95		
			No	3	Type	UT
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	340			kPa
Initial pwp	300			kPa
Initial σ_3'	40			kPa
Rate of strain	0.55			%/hr

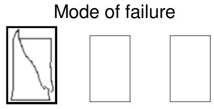
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	11.32			%
$(\sigma_1' / \sigma_3')_f$	3.738			
$(\sigma_1' - \sigma_3')_f$	82.7			kPa
u_f	310			kPa
$\sigma_3'{}_f$	30			kPa
$\sigma_1'{}_f$	113			kPa
A_f	0.12			
Time to failure	20.7			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.54 mm thick rubber membrane(s)
SPLIT AND DESCRIBE

Ref SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:45	**Figure** **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

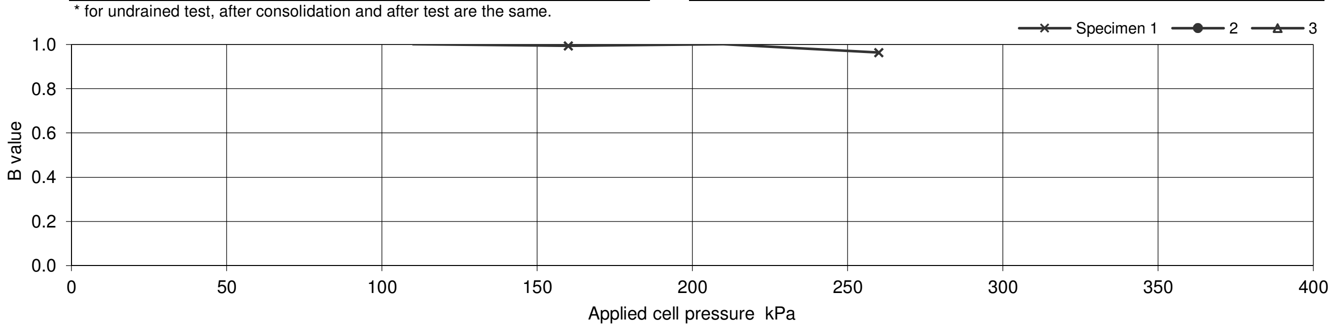
Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.00-4.00		
			No	7	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	191.03		
	Diameter	mm	97.52		
	Bulk Density	Mg/m³	1.80		
	Water Content	%	44		
	Dry density	Mg/m³	1.25		
After consolidation	Length	mm	187.41		
	Diameter	mm	95.66		
	Bulk Density*	Mg/m³	1.85		
	Water Content*	%	39		
	Dry density*	Mg/m³	1.32		

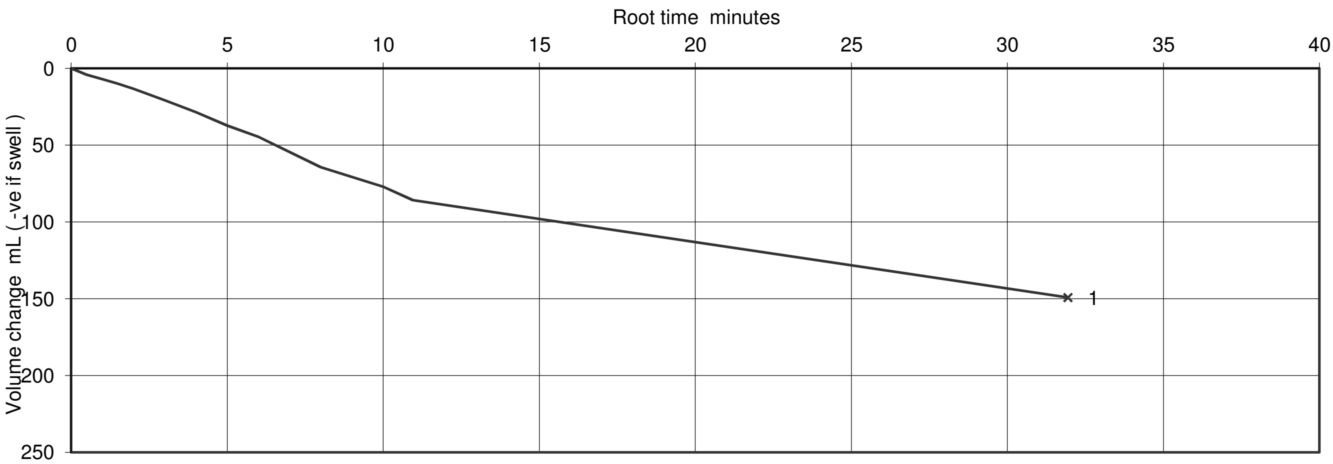
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft light brownish black organic clayey sandy SILT.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	246.2		
Final B Value		0.96		



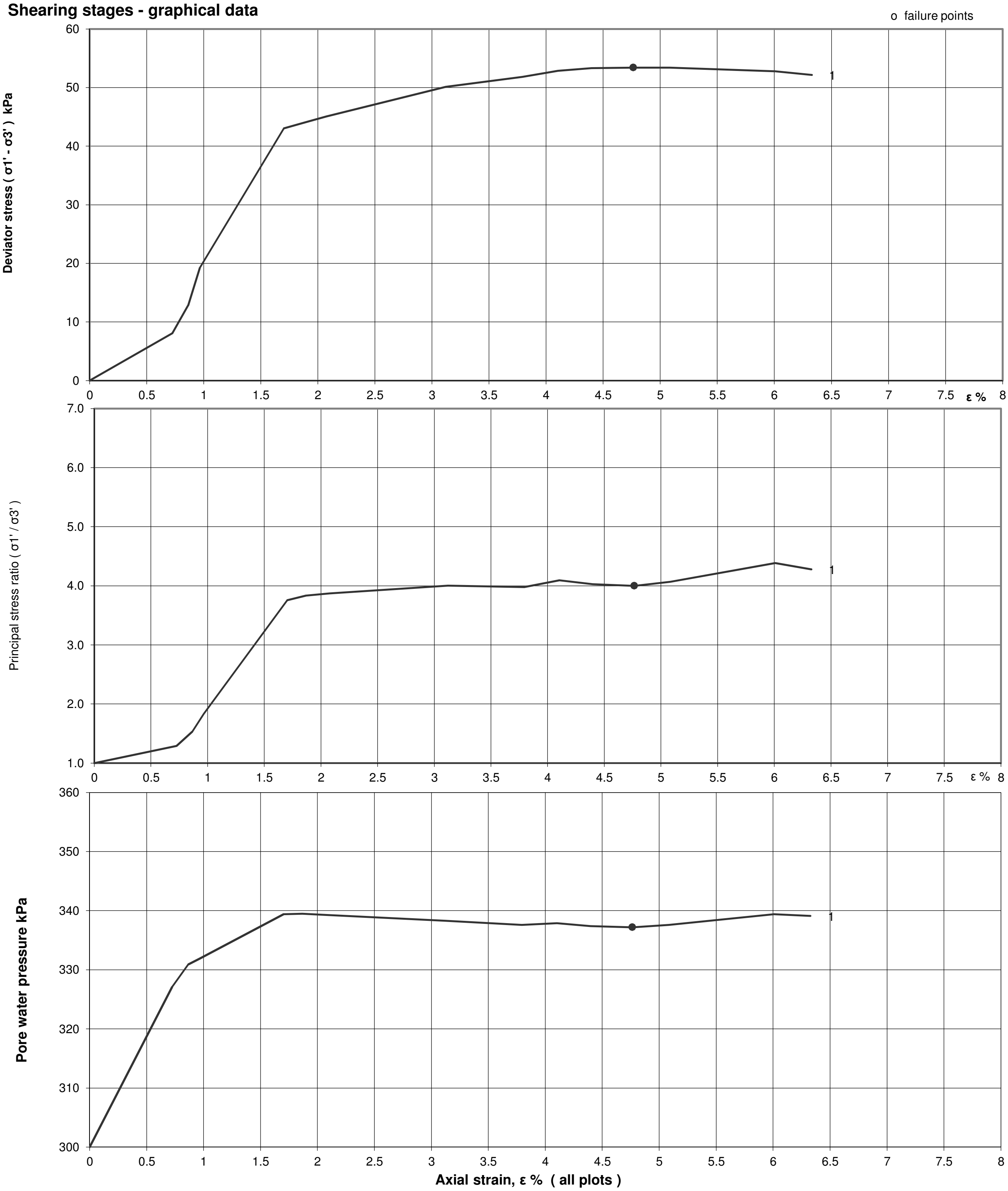
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		355			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		55			kPa
	Pore pressure at start of consolidation		346			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.60			m^2/year
	Coefficient of Compressibility	M_{vi}	2.15			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.0E-10			m/s



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.00-4.00		
			No	7	Type	P
			ID			
			Spec Ref			

Shearing stages - graphical data

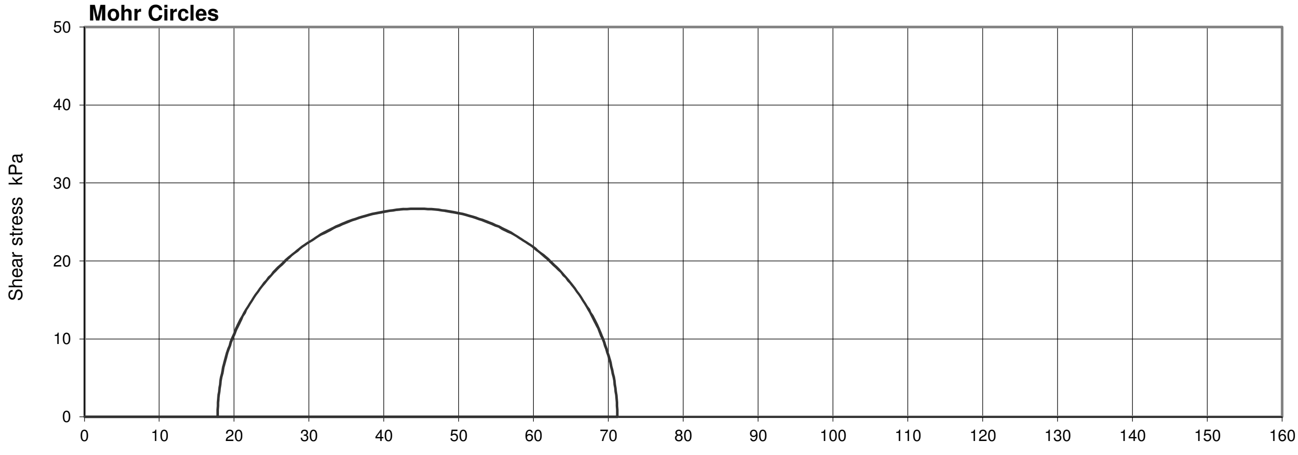


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 09:51	**Figure** **CU** sheet 2 of 3

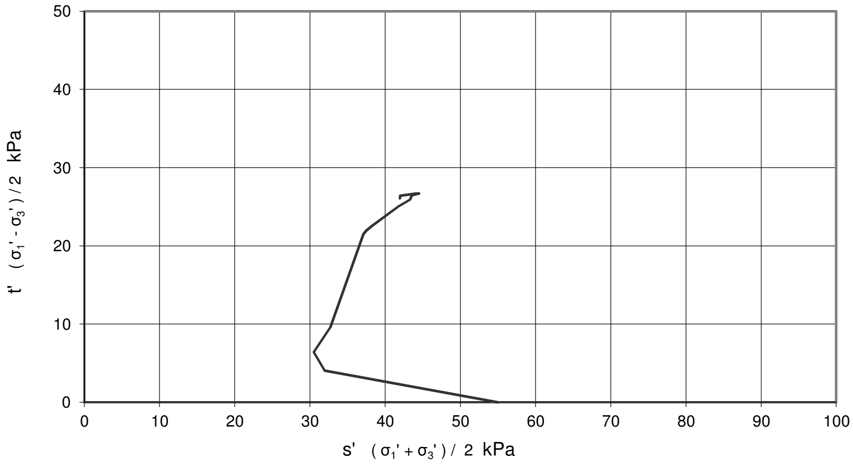
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.00-4.00		
			No	7	Type	P
			ID			
			Spec Ref			

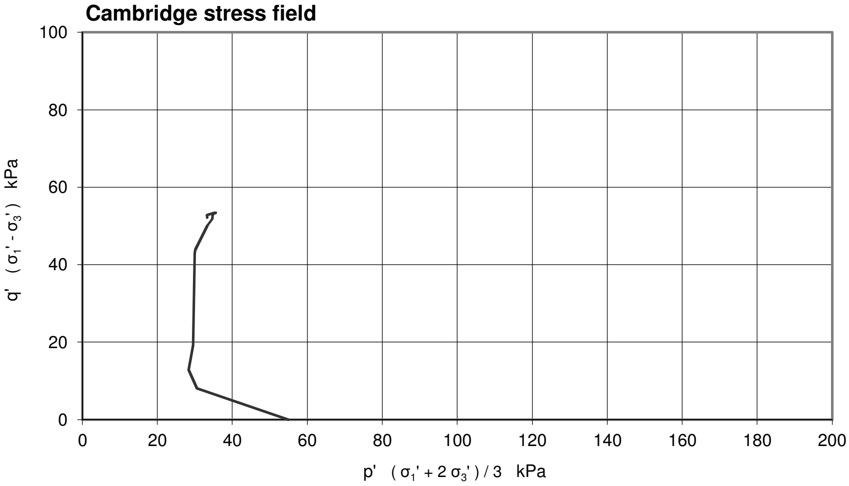
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	355			kPa
Initial pwp	300			kPa
Initial σ_3'	55			kPa
Rate of strain	0.48			%/hr

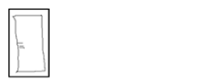
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	4.76			%
$(\sigma_1' / \sigma_3')_f$	4.000			
$(\sigma_1' - \sigma_3')_f$	53.4			kPa
u_f	337			kPa
$\sigma_3'{}_f$	18			kPa
$\sigma_1'{}_f$	71			kPa
A_f	0.70			
Time to failure	10.0			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 09:51	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

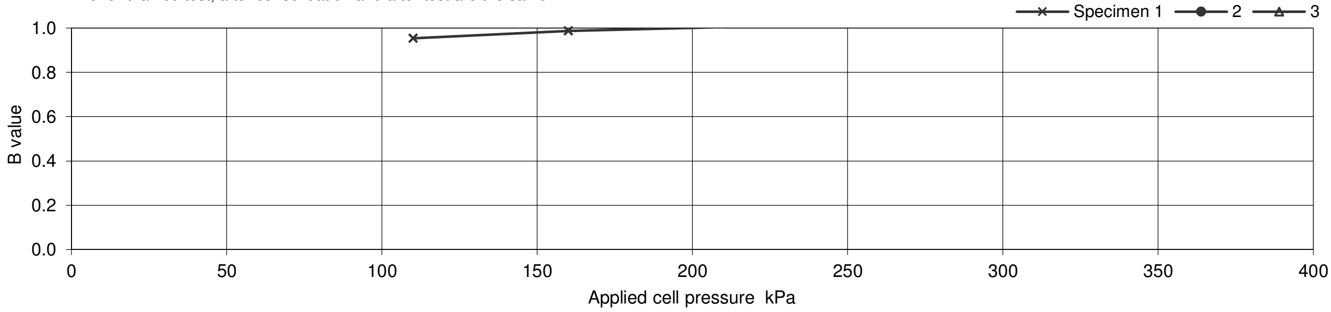
Project No	A5085-15	Sample Details:	Hole No	BH404			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00			
			No	10	Type	P	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	184.16		
	Diameter	mm	97.29		
	Bulk Density	Mg/m³	1.85		
	Water Content	%	40		
	Dry density	Mg/m³	1.32		
After consolidation	Length	mm	179.98		
	Diameter	mm	95.05		
	Bulk Density*	Mg/m³	1.91		
	Water Content*	%	35		
	Dry density*	Mg/m³	1.41		

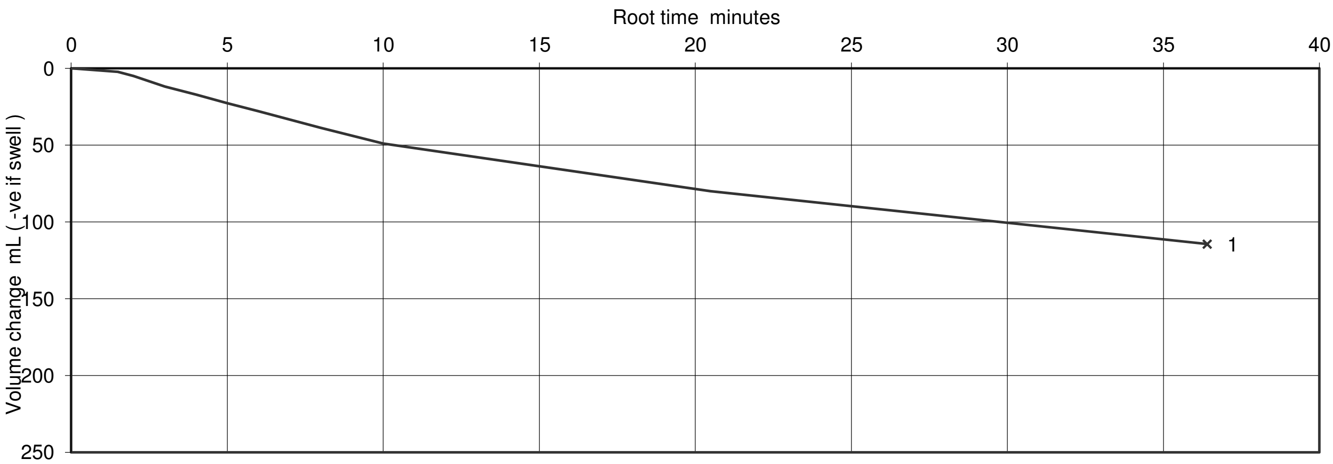
* for undrained test, after consolidation and after test are the same.

Soil Description	Very soft brown sandy clayey SILT.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	204.8		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		380			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		80			kPa
	Pore pressure at start of consolidation		378			kPa
	Pore pressure at end of consolidation		306			kPa
	Pore pressure dissipation at end of consolidation		93			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.53			m^2/year
	Coefficient of Compressibility	M_{vi}	1.13			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.8E-10			m/s

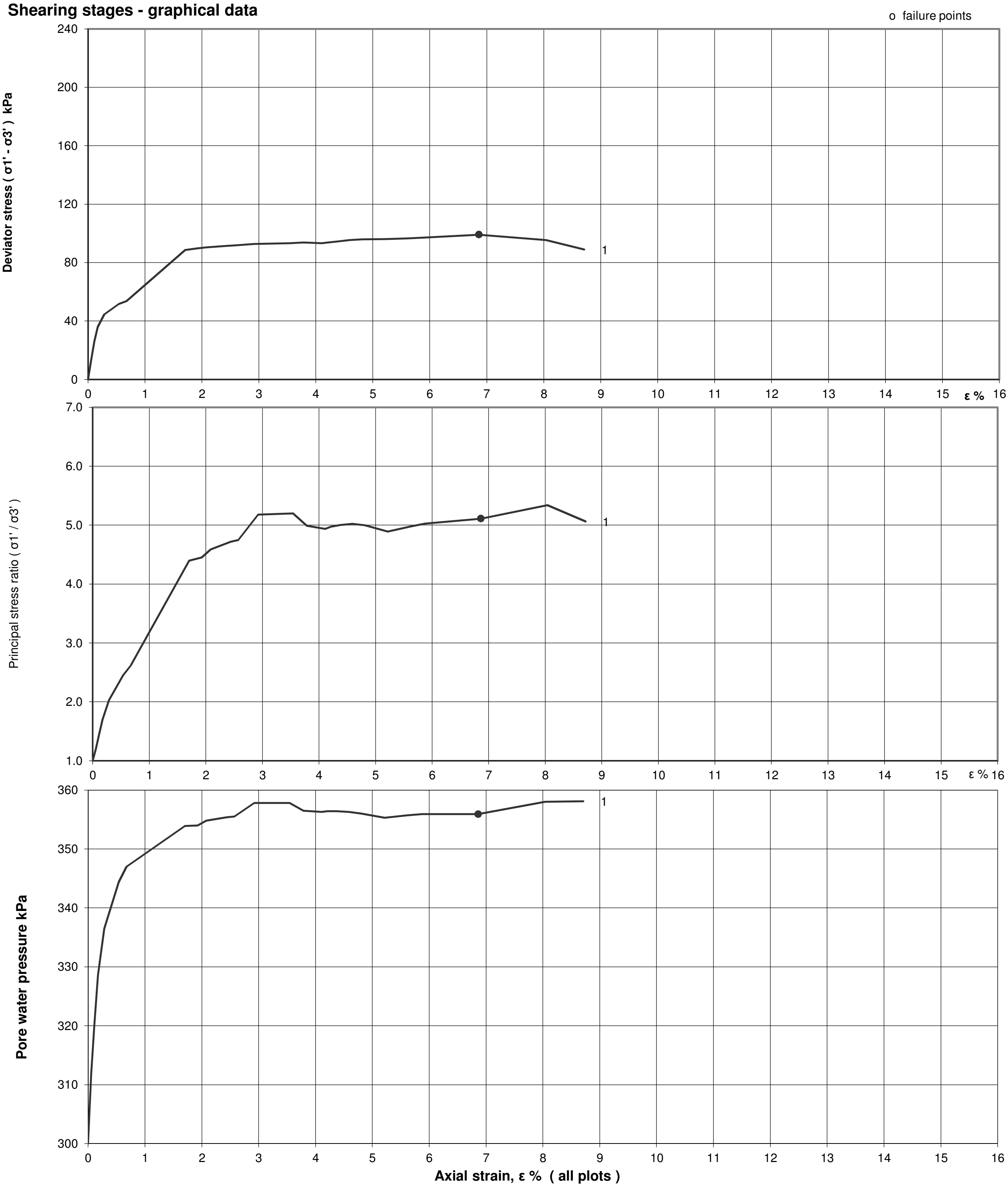


Ref			Figure
SLR8.1 Rev 85 May 09	ESG	1157	Printed:18/03/2016 09:51	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	10	Type	P
			ID			
			Spec Ref			

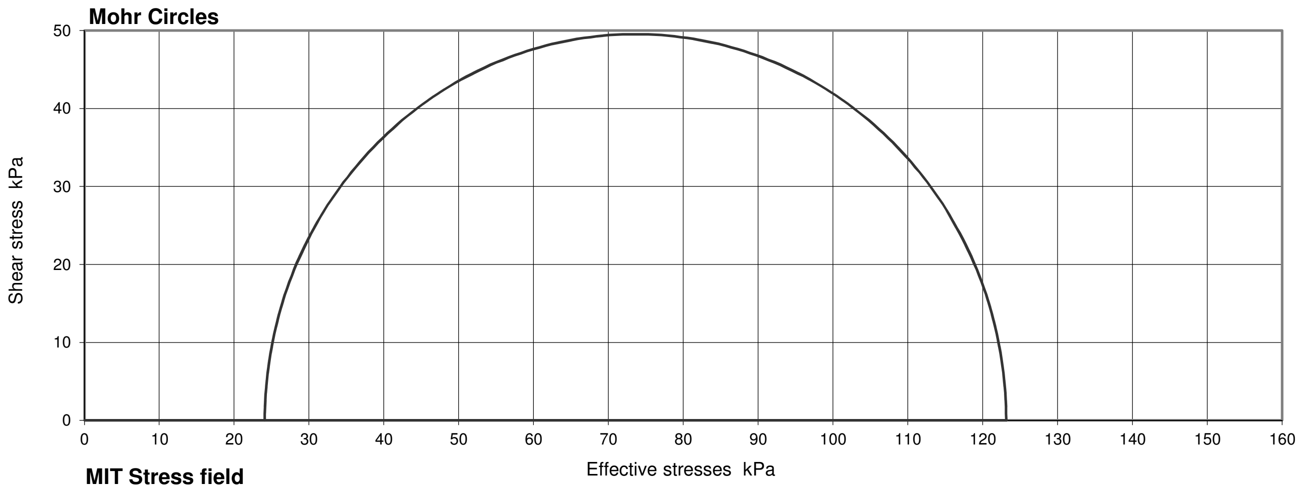
Shearing stages - graphical data

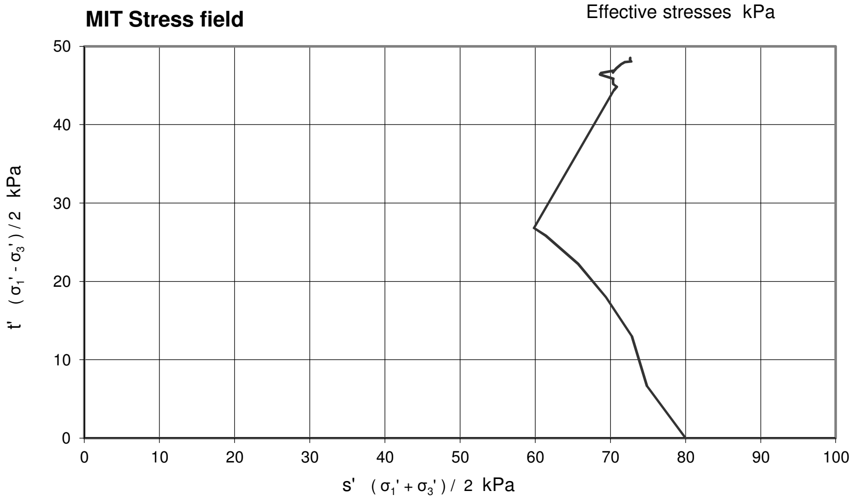


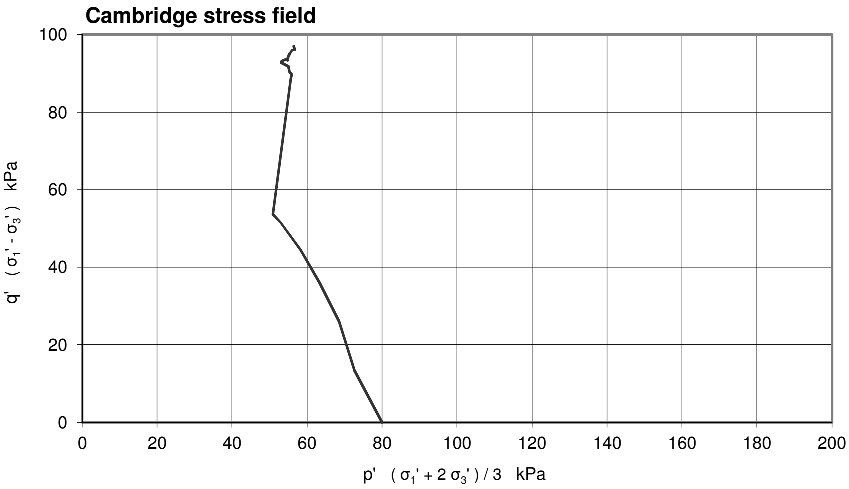
Ref			Figure
SLR8.1 Rev 85 May 09	ESG · UKAS TESTING 1157	Printed:18/03/2016 09:51	CU sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	10	Type	P
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	380			kPa
Initial pwp	300			kPa
Initial σ_3'	80			kPa
Rate of strain	0.41			%/hr

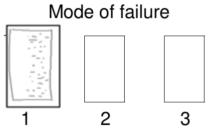
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	6.86			%
(σ_1' / σ_3') $_f$	5.110			
(σ_1' - σ_3') $_f$	99.1			kPa
u_f	356			kPa
σ_3' $_f$	24			kPa
σ_1' $_f$	123			kPa
A_f	0.56			
Time to failure	16.8			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.318 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 09:51	**Figure** **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

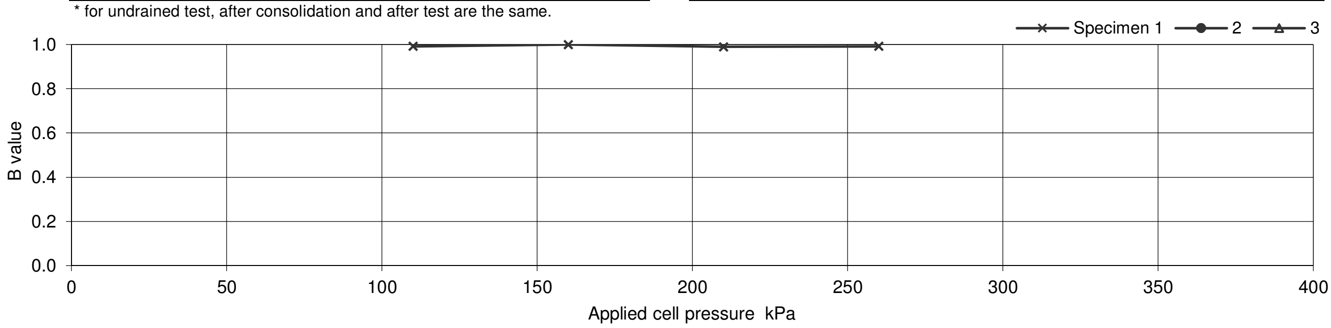
Project No	A5085-15	Sample Details:	Hole No	BH404
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00-9.00
			No	14 / Type P
			ID	
			Spec Ref	

	Specimen Details		1	2	3
Initial	Length	mm	192.71		
	Diameter	mm	97.62		
	Bulk Density	Mg/m³	1.75		
	Water Content	%	46		
	Dry density	Mg/m³	1.20		
After consolidation	Length	mm	187.02		
	Diameter	mm	94.69		
	Bulk Density*	Mg/m³	1.82		
	Water Content*	%	38		
	Dry density*	Mg/m³	1.32		

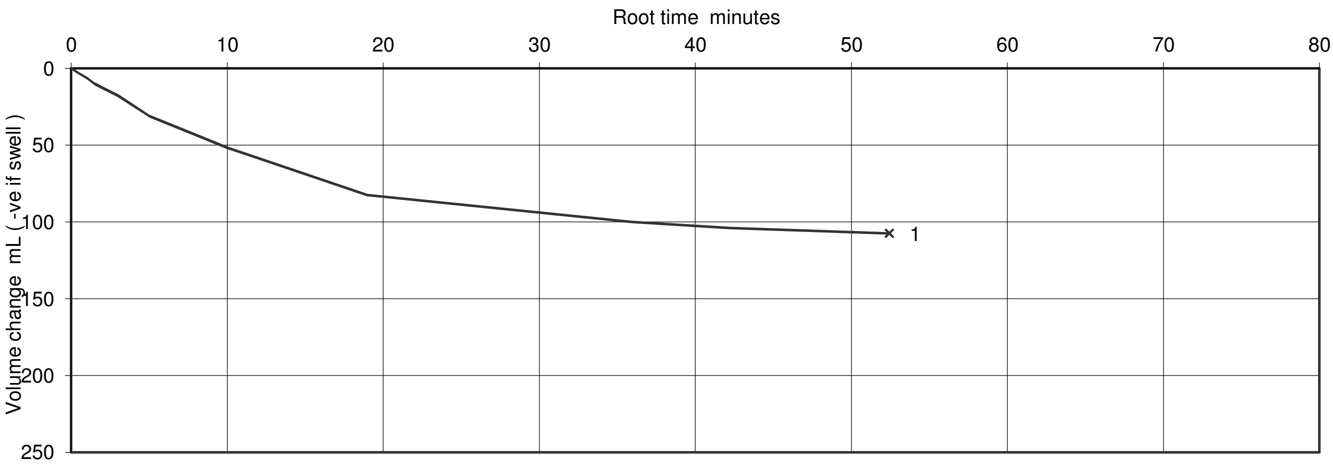
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown clayey SILT.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	251.1		
Final B Value		0.99		



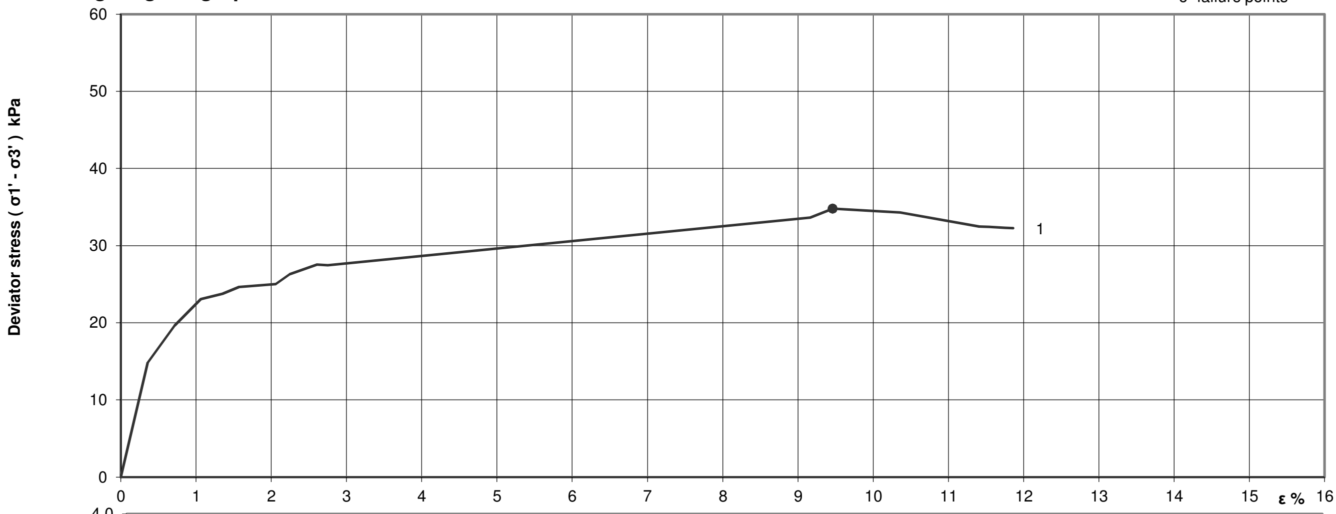
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		398			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		98			kPa
	Pore pressure at start of consolidation		390			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.64			m^2/year
	Coefficient of Compressibility	M_{vi}	0.84			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.7E-10			m/s

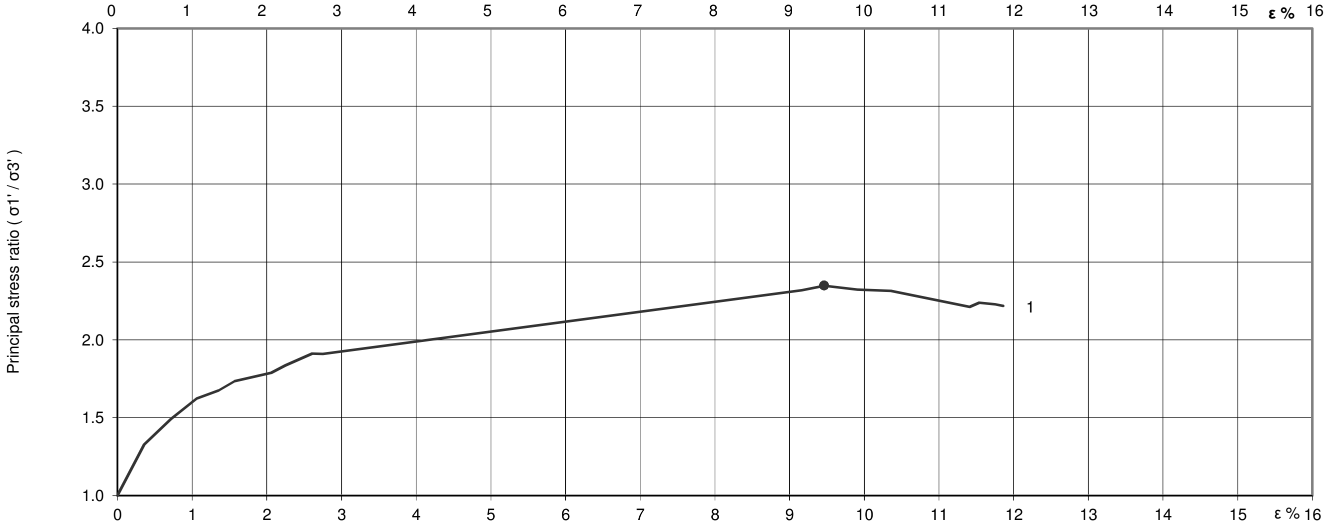


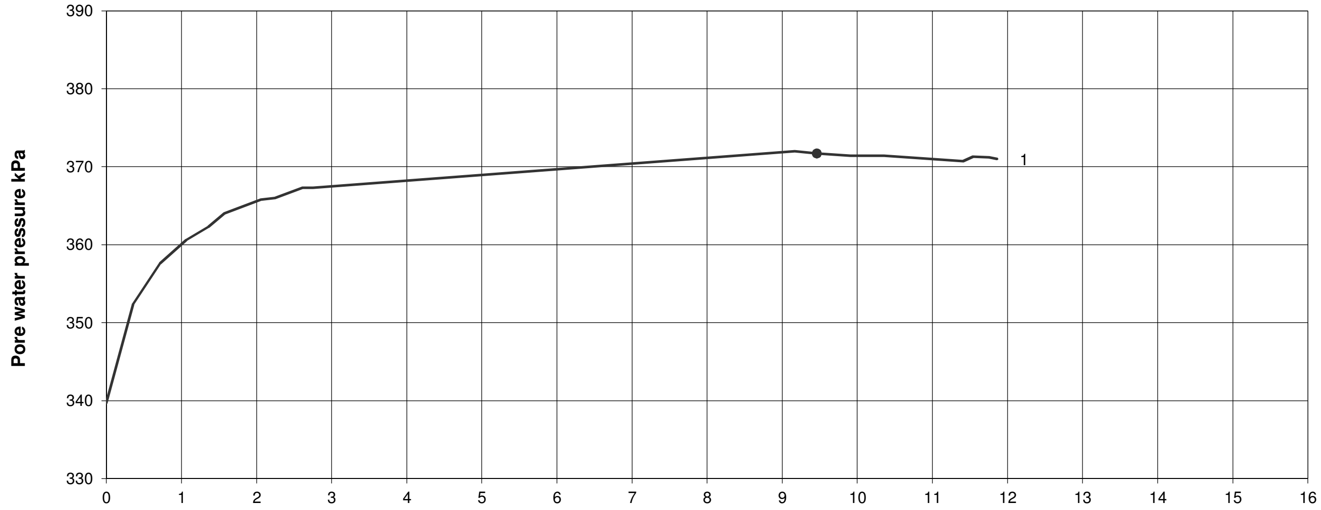
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00-9.00		
			No	14	Type	P
			ID			
			Spec Ref			

Shearing stages - graphical data







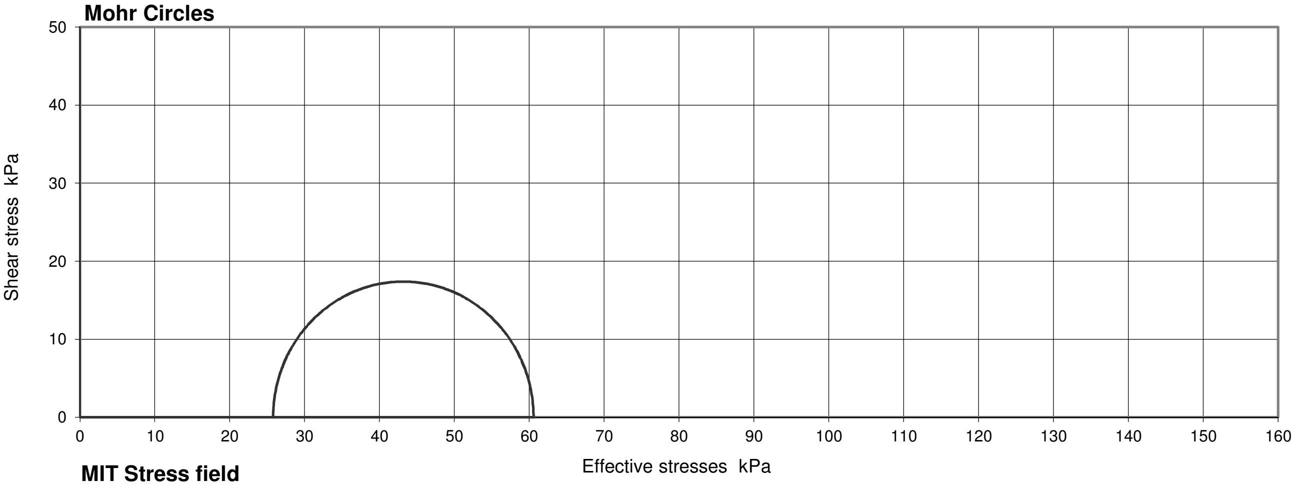
Axial strain, ε % (all plots)

Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:18/03/2016 09:53	**Figure** **CU** sheet 2 of 3

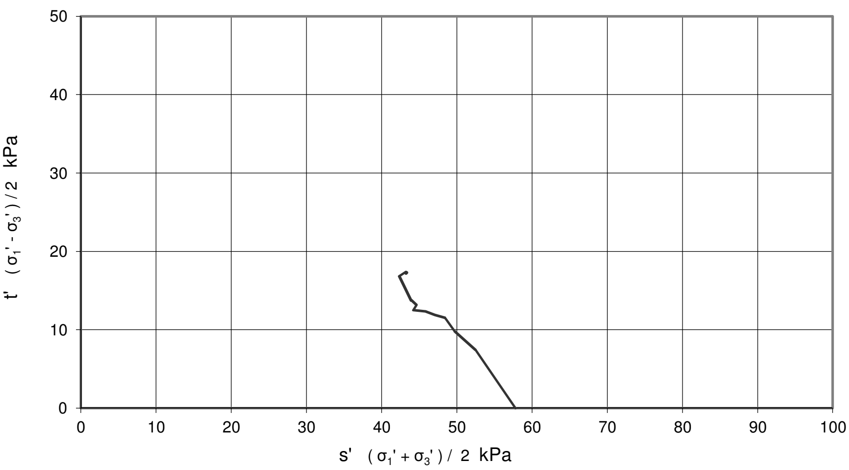
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00-9.00		
			No	14	Type	P
			ID			
			Spec Ref			

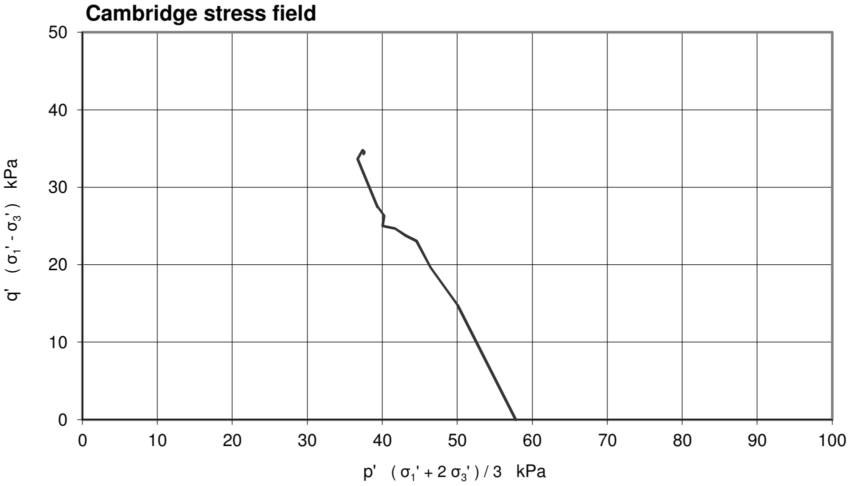
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	397.5			kPa
Initial pwp	340			kPa
Initial σ_3'	58			kPa
Rate of strain	0.54			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	9.46			%
$(\sigma_1' / \sigma_3')_f$	2.348			
$(\sigma_1' - \sigma_3')_f$	34.8			kPa
u_f	372			kPa
$\sigma_3'_f$	26			kPa
$\sigma_1'_f$	61			kPa
A_f	0.92			
Time to failure	17.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.54 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 09:53	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

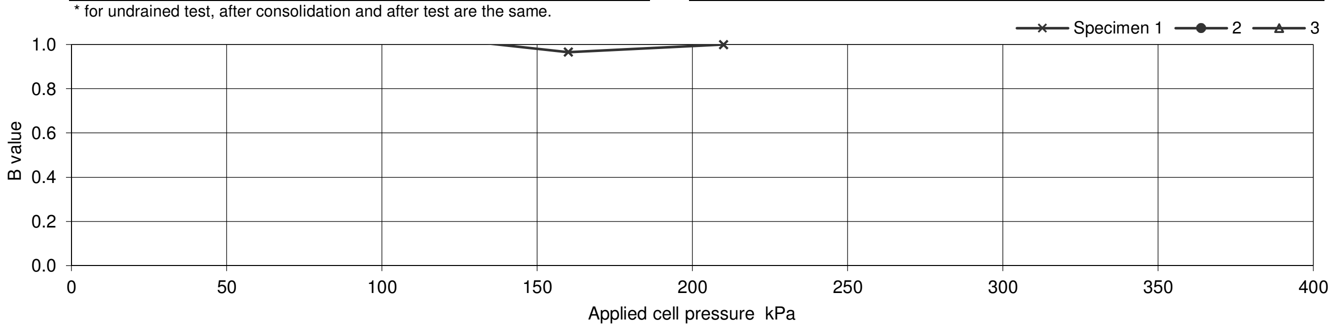
Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.00-5.00			
			No	8	Type	P	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	183.23		
	Diameter	mm	99.48		
	Bulk Density	Mg/m³	2.12		
	Water Content	%	55		
	Dry density	Mg/m³	1.37		
After consolidation	Length	mm	171.11		
	Diameter	mm	92.67		
	Bulk Density*	Mg/m³	2.27		
	Water Content*	%	34		
	Dry density*	Mg/m³	1.69		

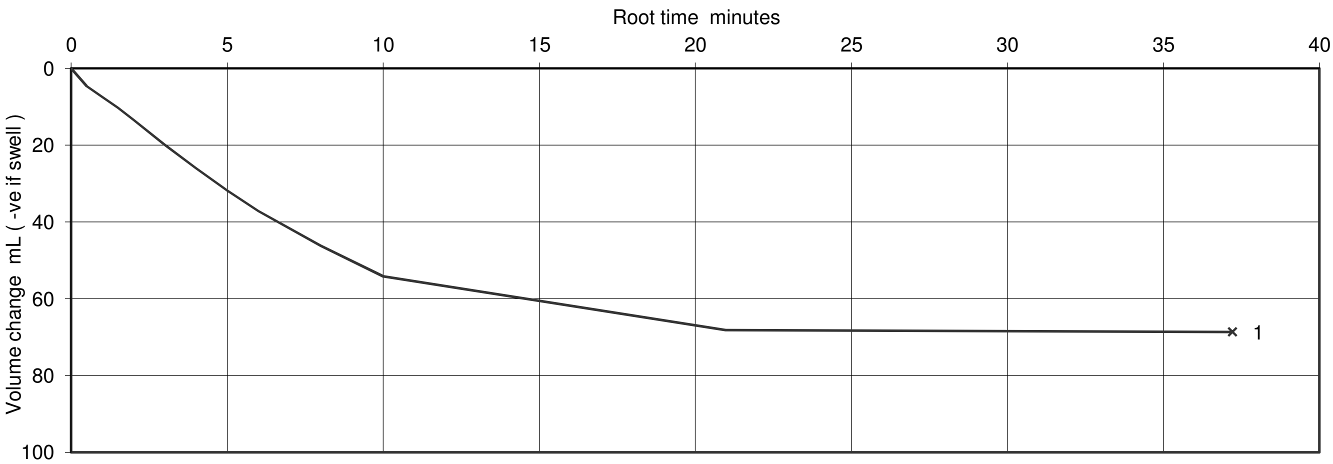
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft greyish brown slightly sandy silty CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	206.1		
Final B Value		1.00		



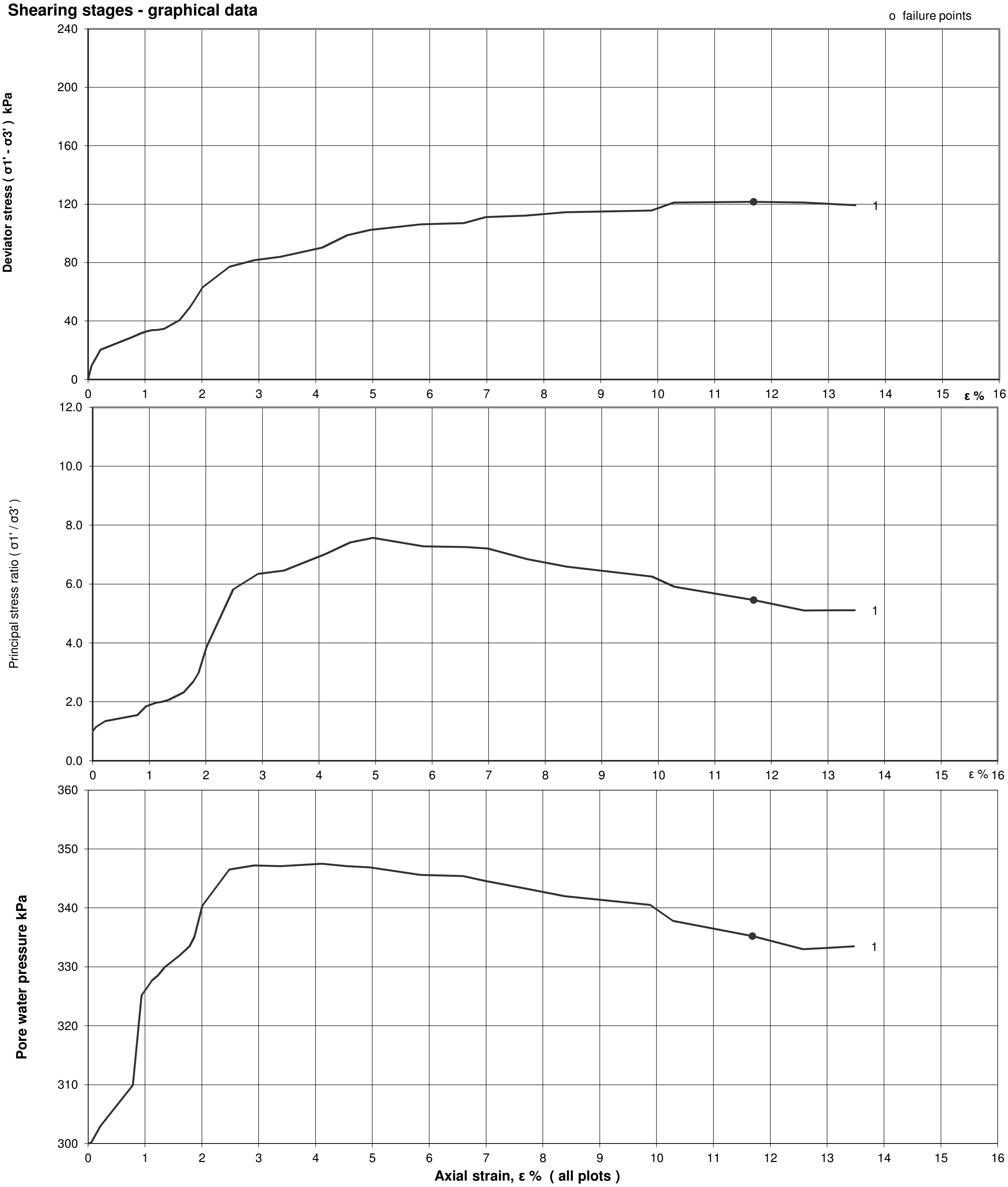
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		363			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		63			kPa
	Pore pressure at start of consolidation		362			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.58			m^2/year
	Coefficient of Compressibility	M_{vi}	0.90			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.4E-10			m/s



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.00-5.00		
			No	8	Type	P
			ID			
			Spec Ref			

Shearing stages - graphical data

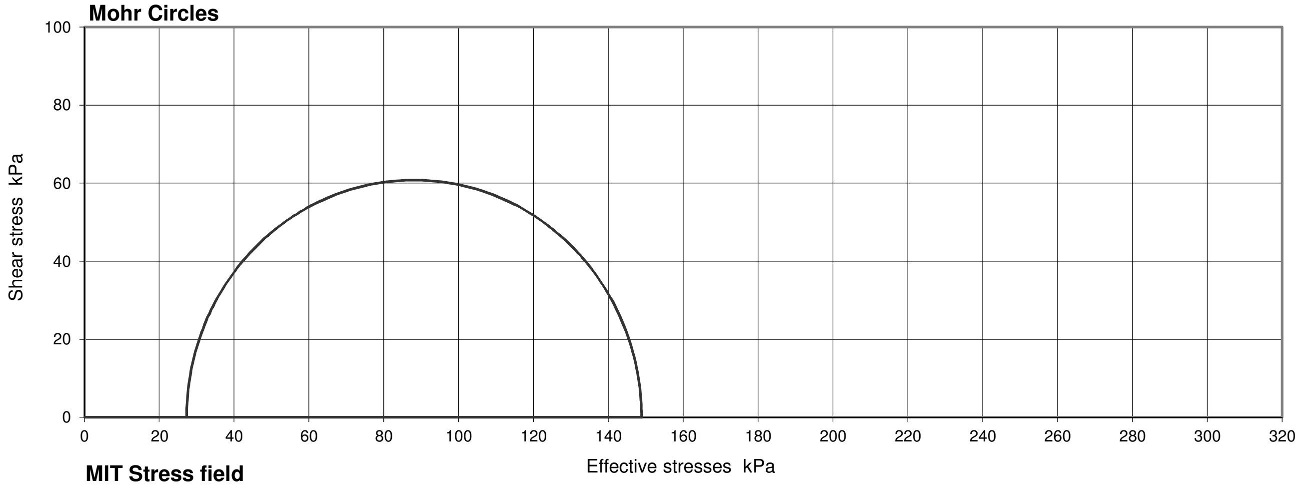


Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:18/03/2016 10:02	**Figure** **CU** sheet 2 of 3

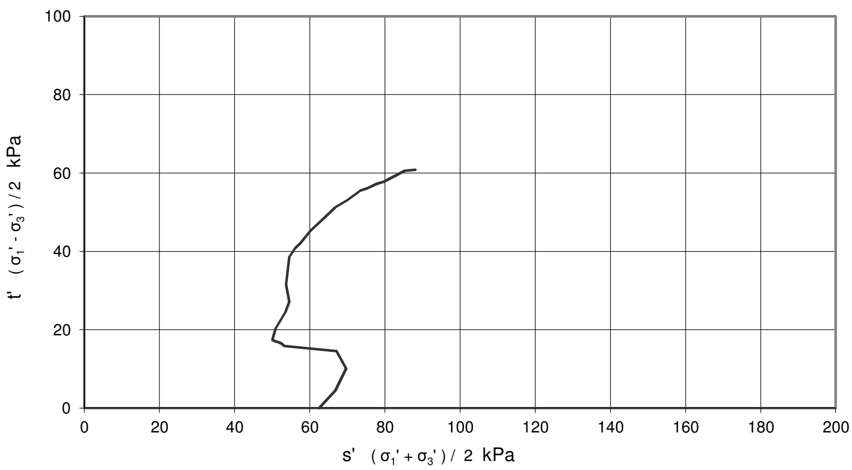
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.00-5.00		
			No	8	Type	P
			ID			
			Spec Ref			

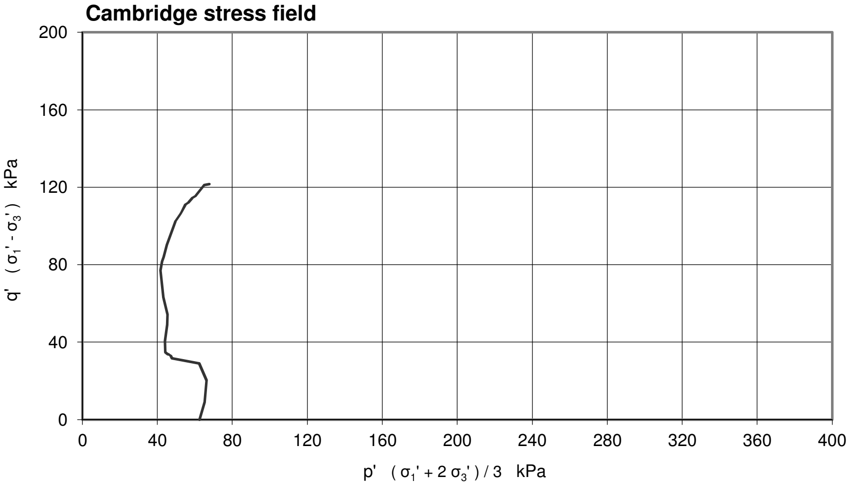
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	362.5			kPa
Initial pwp	300			kPa
Initial σ_3'	63			kPa
Rate of strain	2.00			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	11.69			%
$(\sigma_1' / \sigma_3')_f$	5.453			
$(\sigma_1' - \sigma_3')_f$	121.6			kPa
u_f	335			kPa
$\sigma_3'{}_f$	27			kPa
$\sigma_1'{}_f$	149			kPa
A_f	0.29			
Time to failure	5.8			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.504 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:02	**Figure** **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

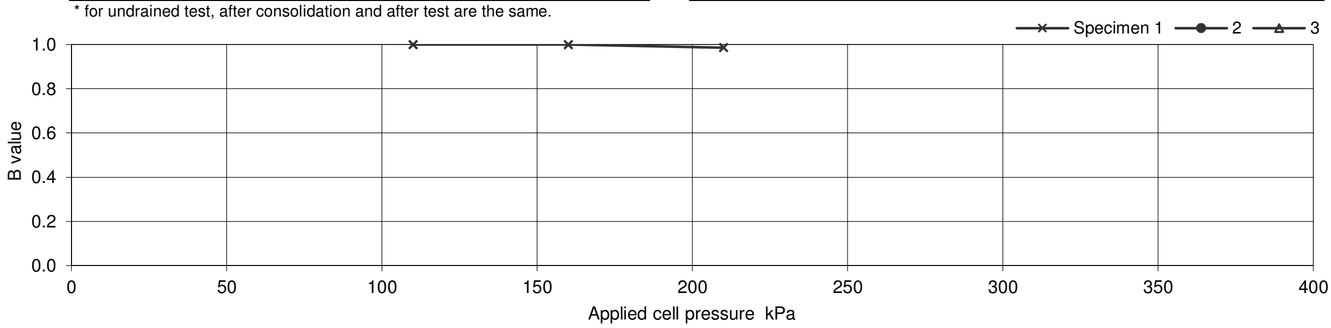
Project No	A5085-15	Sample Details:	Hole No	BH405
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00
			No	11 Type P
			ID	Top
			Spec Ref	Sample 1

	Specimen Details		1	2	3
Initial	Length	mm	189.80		
	Diameter	mm	97.07		
	Bulk Density	Mg/m³	1.85		
	Water Content	%	41		
	Dry density	Mg/m³	1.31		
After consolidation	Length	mm	185.11		
	Diameter	mm	94.64		
	Bulk Density*	Mg/m³	1.91		
	Water Content*	%	36		
	Dry density*	Mg/m³	1.41		

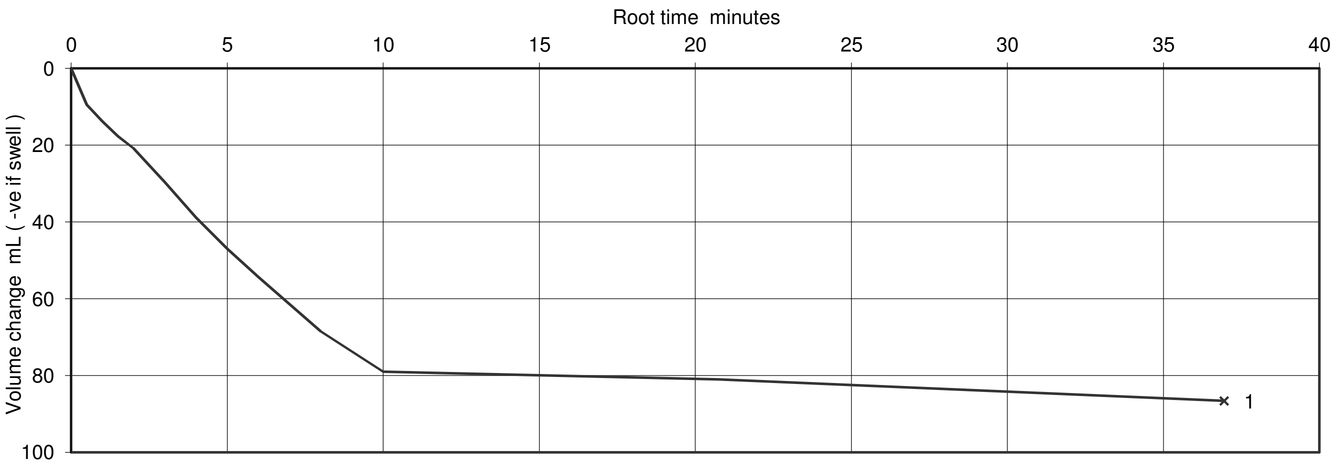
* for undrained test, after consolidation and after test are the same.

Soil Description	Very soft dark brown clayey SILT.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	200.5		
Final B Value		0.99		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		380			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		80			kPa
	Pore pressure at start of consolidation		370			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.21			m^2/year
	Coefficient of Compressibility	M_{vi}	0.89			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	6.1E-10			m/s

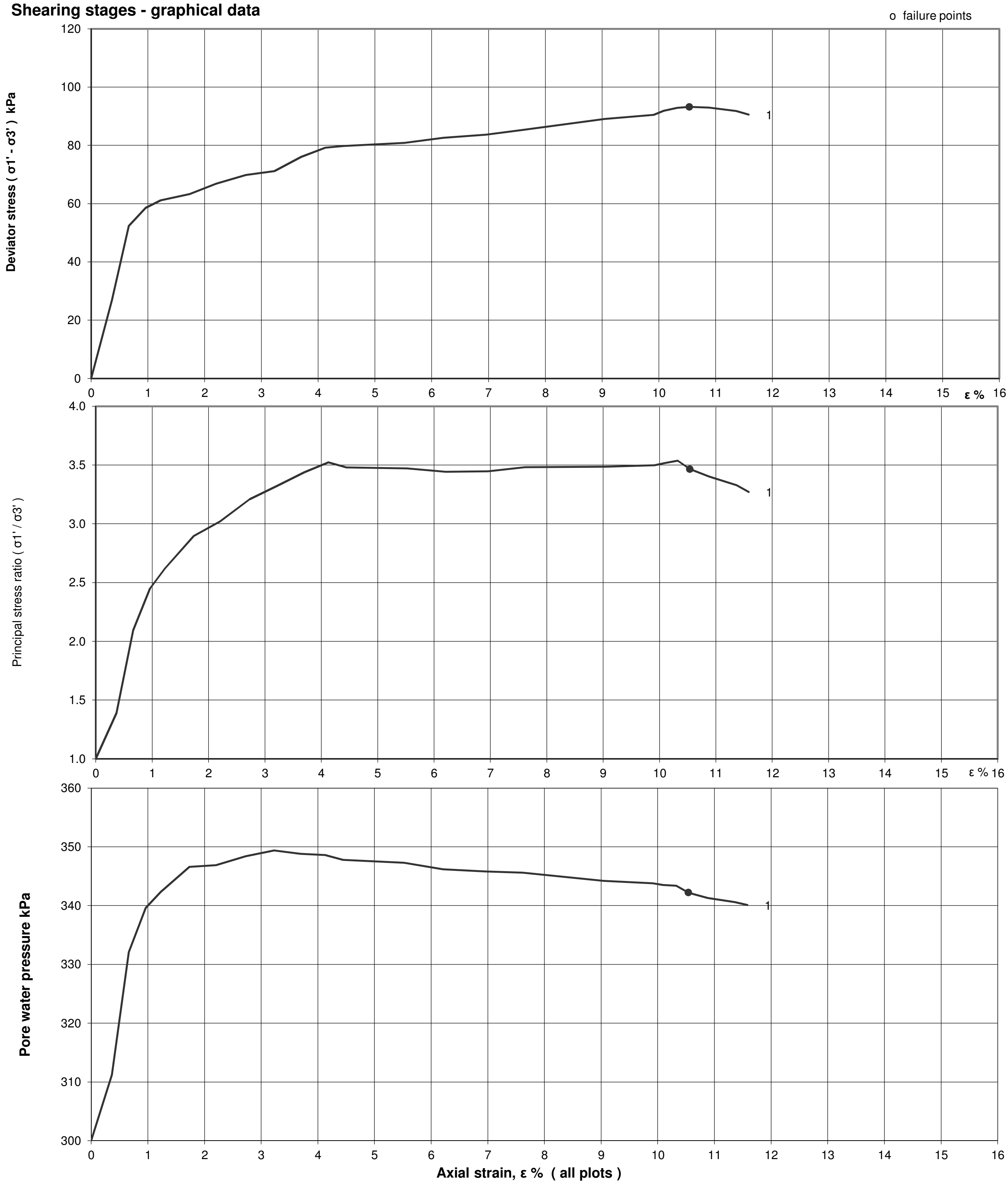


Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:18/03/2016 10:02	**Figure** **CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	11	Type	P
			ID	Top		
			Spec Ref	Sample 1		

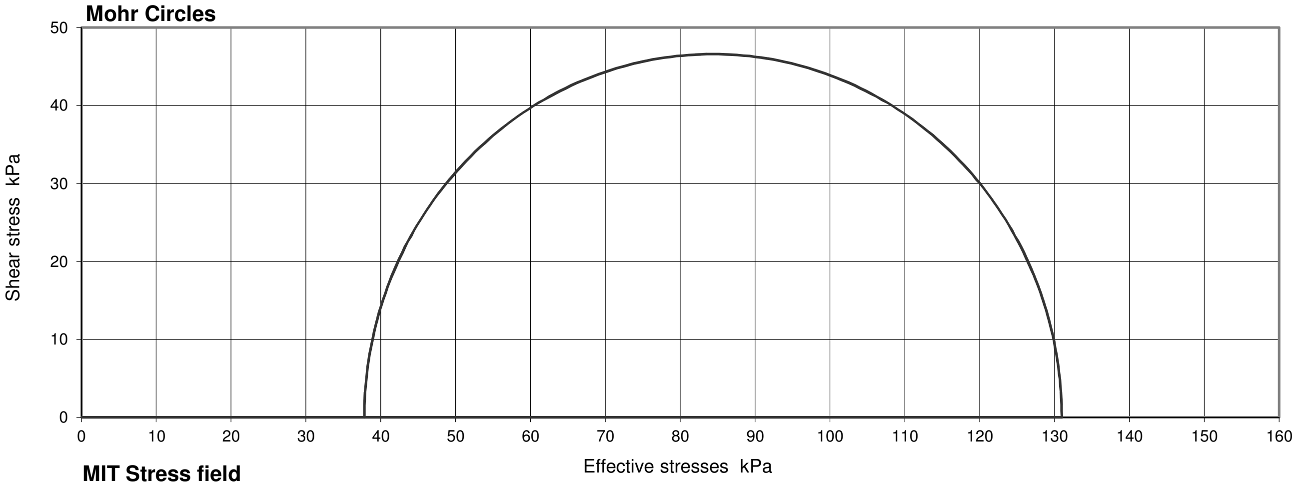
Shearing stages - graphical data

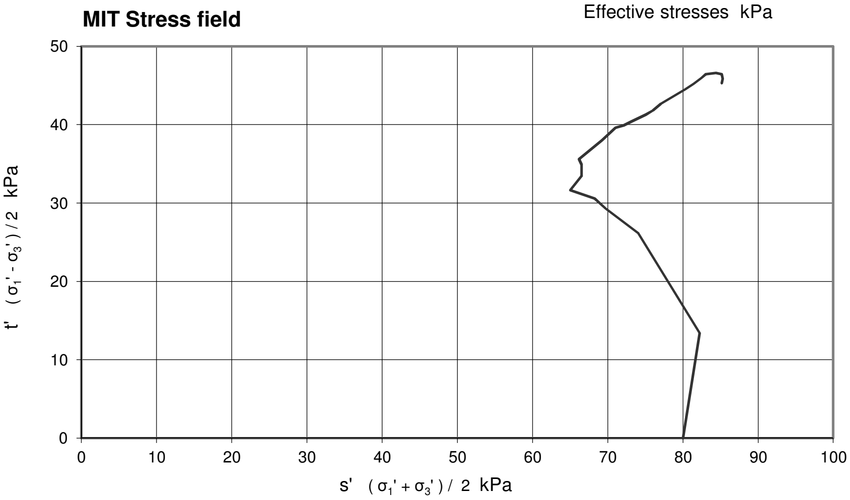


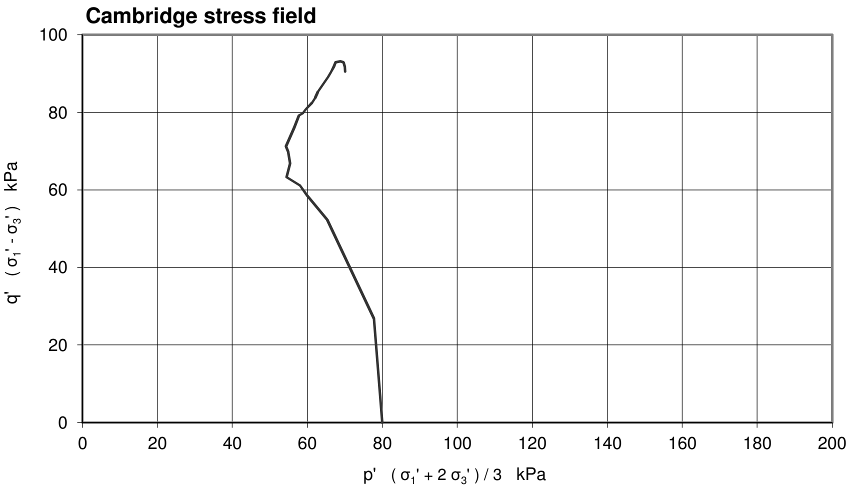
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:02	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00
			No	11 / Type: P
			ID	Top
			Spec Ref	Sample 1







Compression stages

Specimen	1	2	3	
Cell pressure	380			kPa
Initial pwp	300			kPa
Initial σ_3'	80			kPa
Rate of strain	1.85			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	10.54			%
$(\sigma_1' / \sigma_3')_f$	3.465			
$(\sigma_1' - \sigma_3')_f$	93.2			kPa
u_f	342			kPa
$\sigma_3'_f$	38			kPa
$\sigma_1'_f$	131			kPa
A_f	0.45			
Time to failure	5.7			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.34 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:02	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

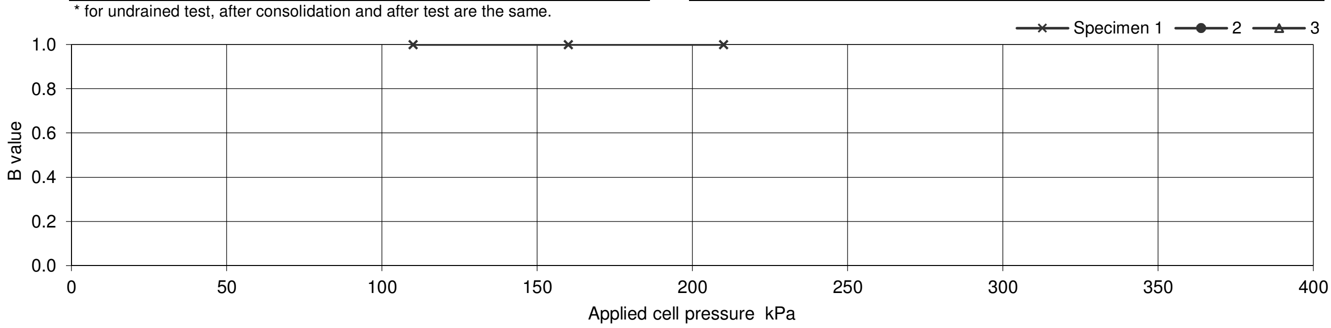
Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	11	Type	P
			ID	Base		
			Spec Ref	Sample 2		

	Specimen Details		1	2	3
Initial	Length	mm	204.01		
	Diameter	mm	101.81		
	Bulk Density	Mg/m³	1.76		
	Water Content	%	38		
	Dry density	Mg/m³	1.28		
After consolidation	Length	mm	199.26		
	Diameter	mm	99.41		
	Bulk Density*	Mg/m³	1.85		
	Water Content*	%	35		
	Dry density*	Mg/m³	1.37		

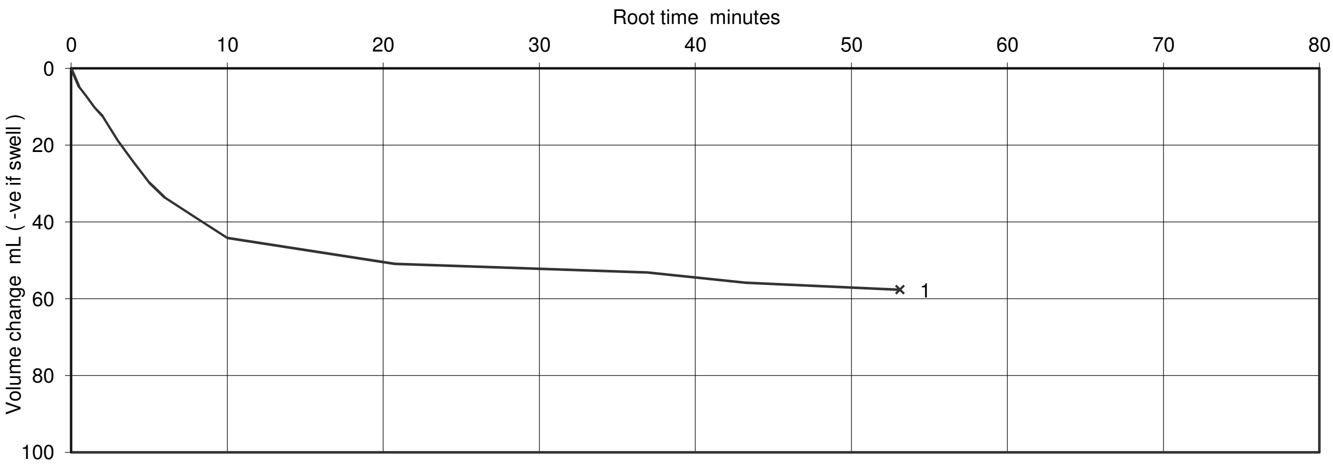
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown silty CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	207		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		340			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		40			kPa
	Pore pressure at start of consolidation		339			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.14			m^2/year
	Coefficient of Compressibility	M_{vi}	0.92			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	6.1E-10			m/s

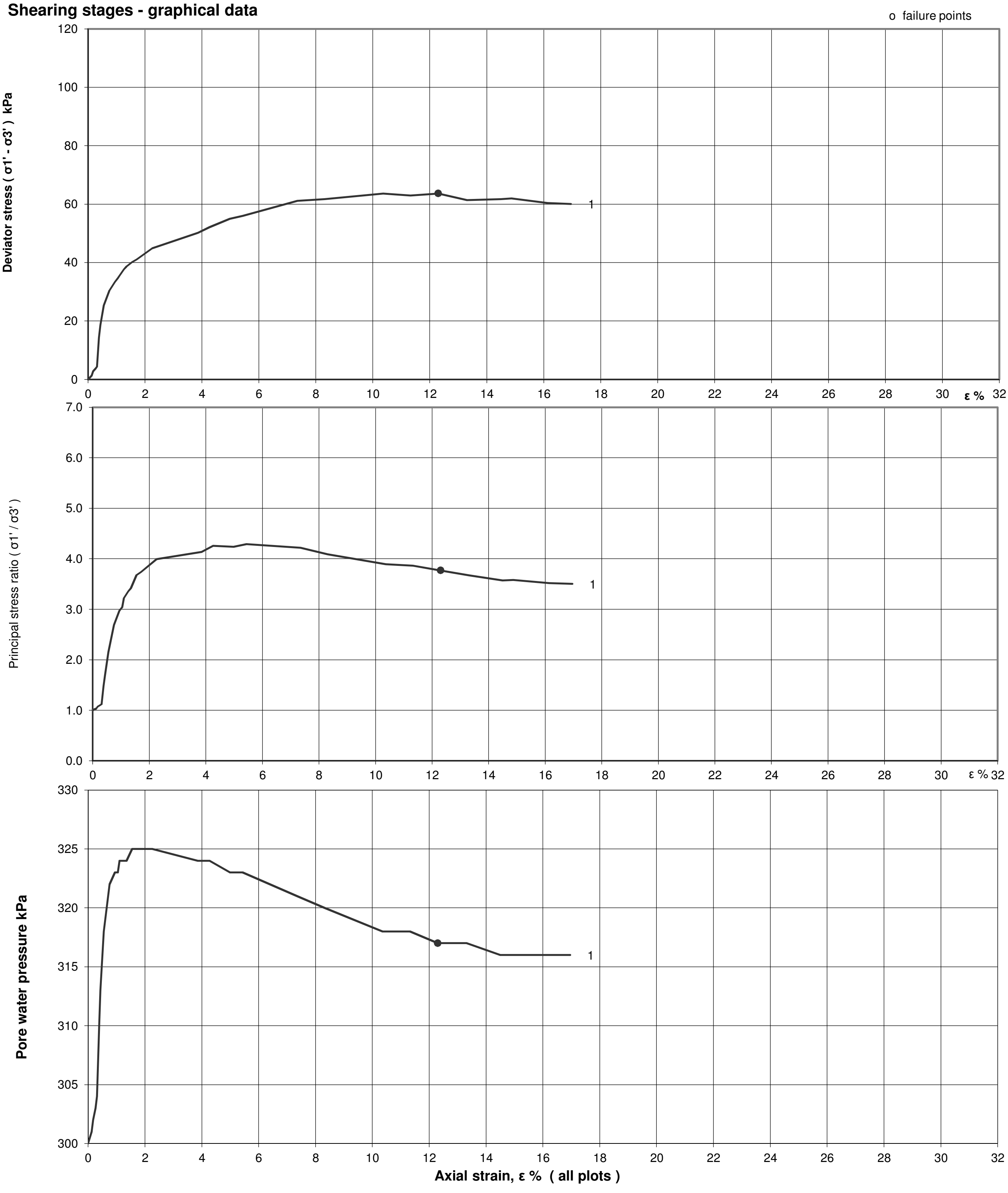


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:03	**Figure** **CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	11	Type	P
			ID	Base		
			Spec Ref	Sample 2		

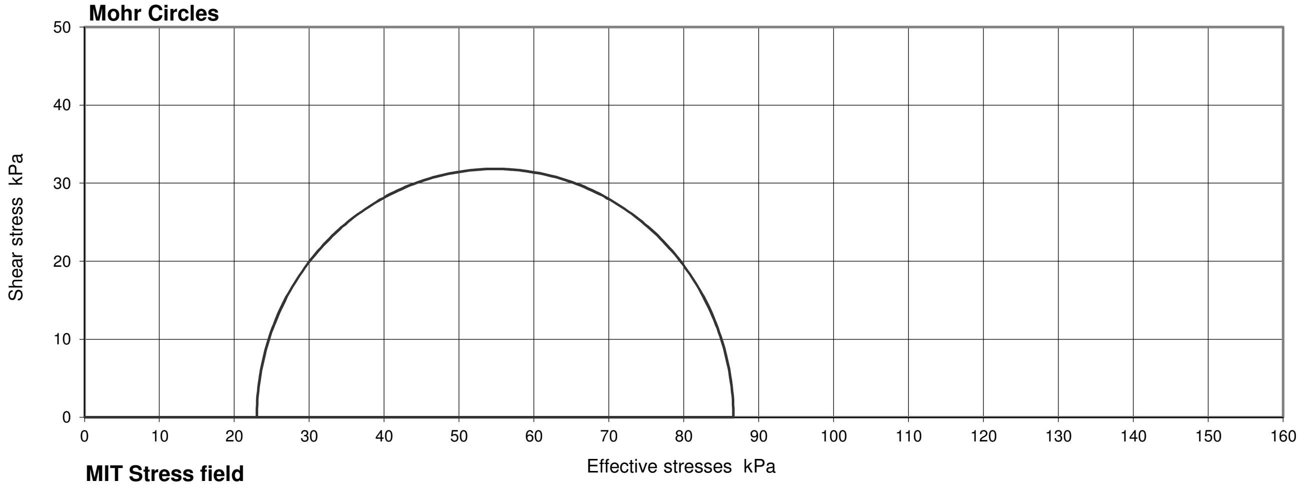
Shearing stages - graphical data

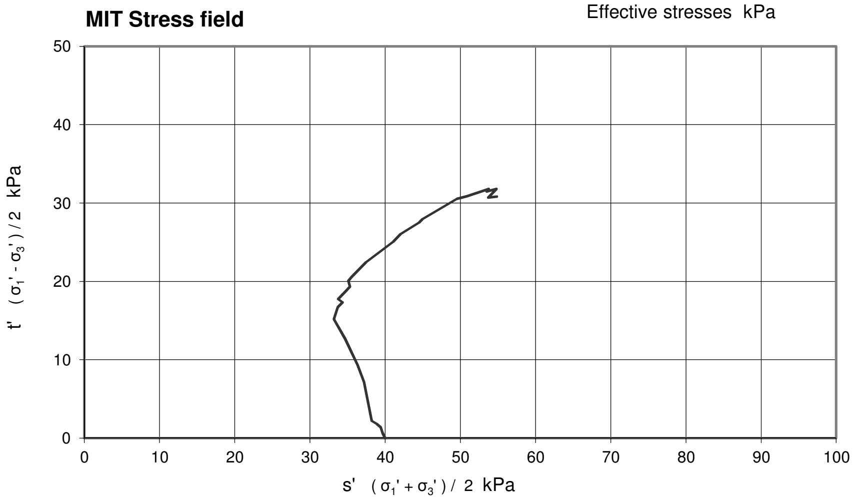


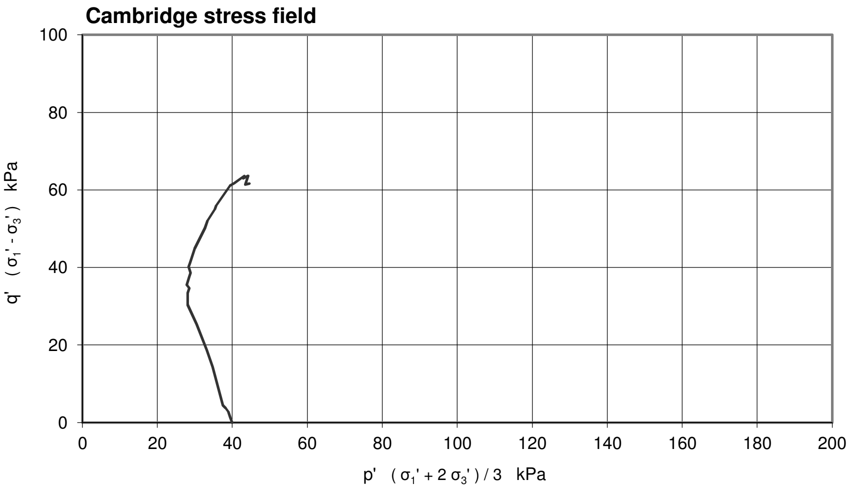
Ref SLR8.1 Rev 85 May 09	ESG	UKAS TESTING 1157	Printed:18/03/2016 10:03	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	11	Type	P
			ID	Base		
			Spec Ref	Sample 2		







Compression stages

Specimen	1	2	3	
Cell pressure	340			kPa
Initial pwp	300			kPa
Initial σ_3'	40			kPa
Rate of strain	1.71			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	12.30			%
$(\sigma_1' / \sigma_3')_f$	3.767			
$(\sigma_1' - \sigma_3')_f$	63.6			kPa
u_f	317			kPa
$\sigma_3'{}_f$	23			kPa
$\sigma_1'{}_f$	87			kPa
A_f	0.27			
Time to failure	7.2			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.485 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:03	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

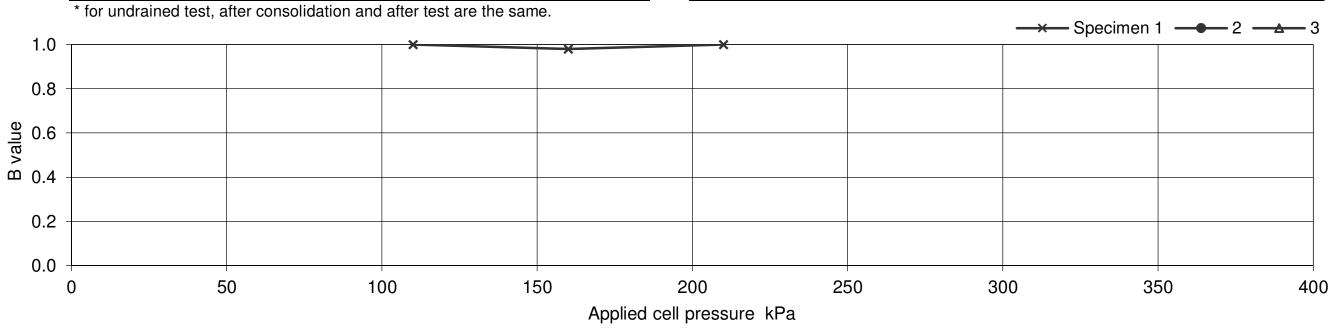
Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00-9.00		
			No	15	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	203.59		
	Diameter	mm	101.43		
	Bulk Density	Mg/m³	1.69		
	Water Content	%	45		
	Dry density	Mg/m³	1.16		
After consolidation	Length	mm	197.89		
	Diameter	mm	98.55		
	Bulk Density*	Mg/m³	1.79		
	Water Content*	%	41		
	Dry density*	Mg/m³	1.27		

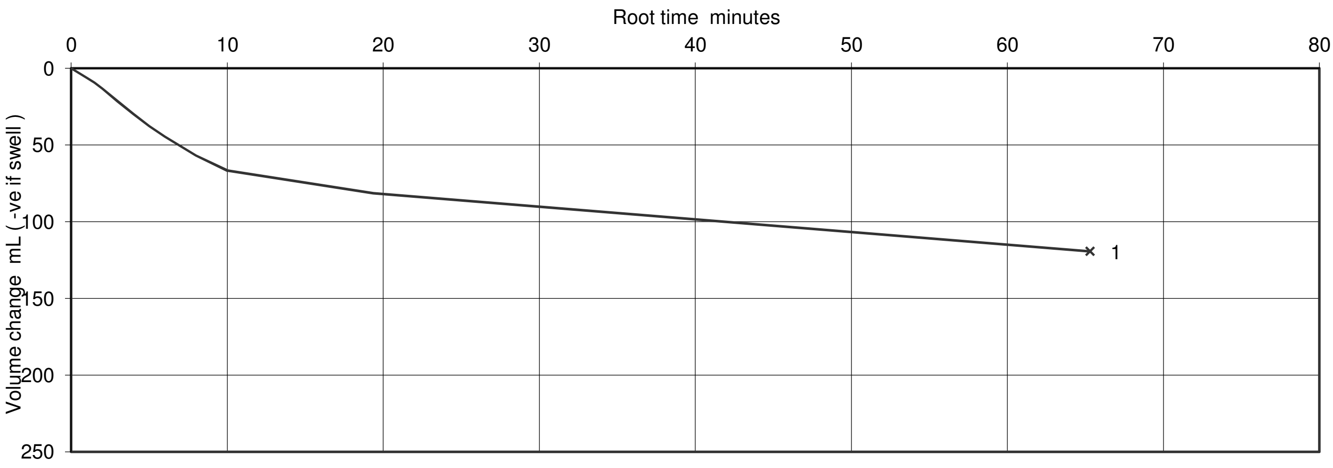
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm brownish grey clayey SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	205		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		398			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		98			kPa
	Pore pressure at start of consolidation		390			kPa
	Pore pressure at end of consolidation		304			kPa
	Pore pressure dissipation at end of consolidation		96			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.86			m^2/year
	Coefficient of Compressibility	M_{vi}	0.85			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	2.3E-10			m/s

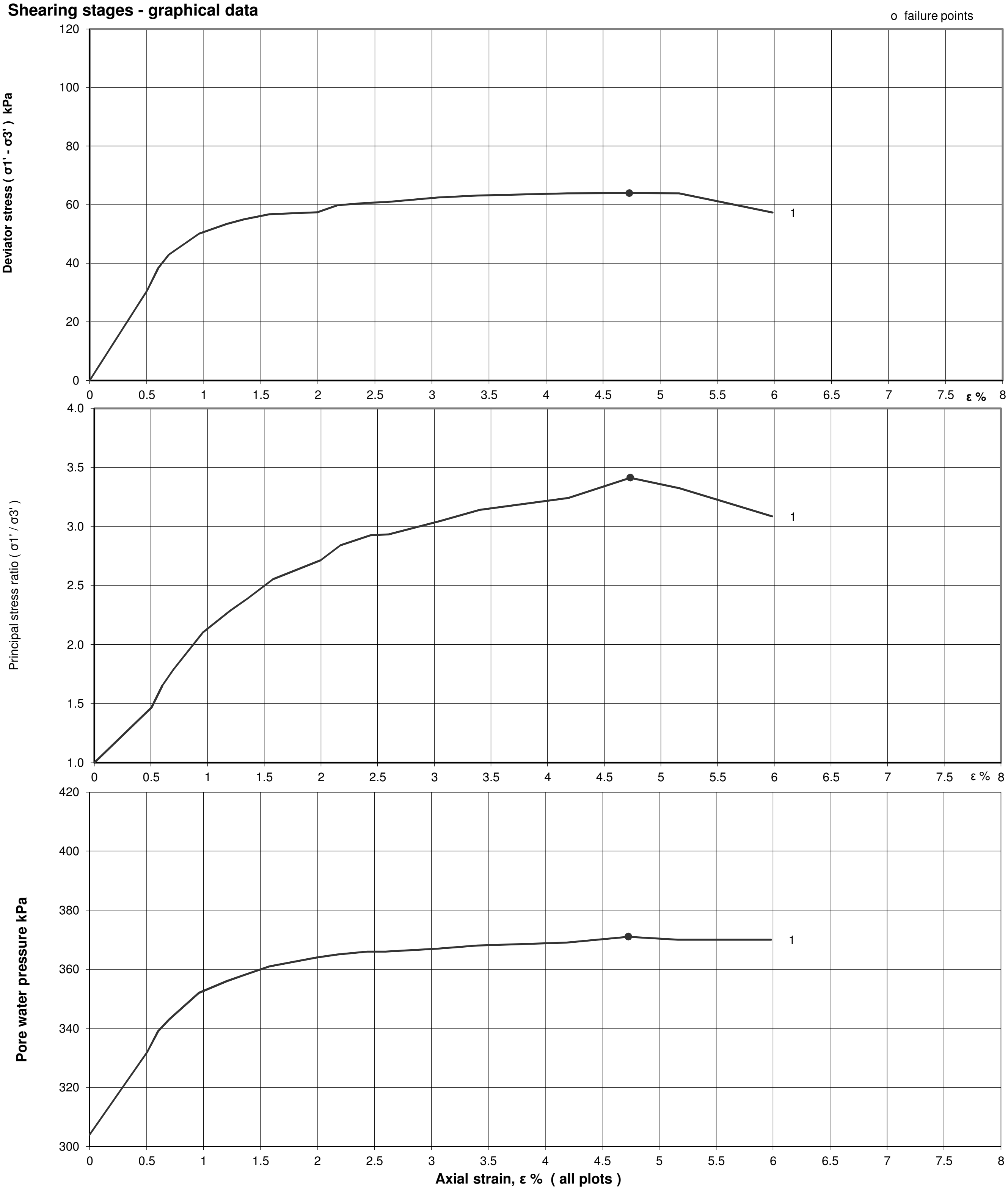


Ref			
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:04	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00-9.00		
			No	15	Type	P
			ID			
			Spec Ref			

Shearing stages - graphical data



Ref SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:04	**Figure** **CU** sheet 2 of 3

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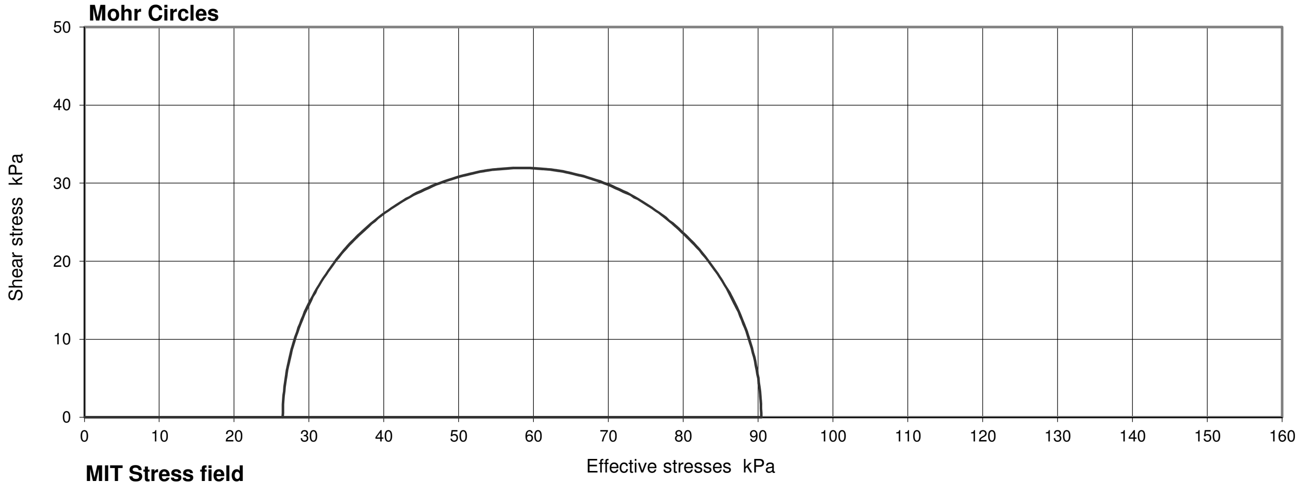
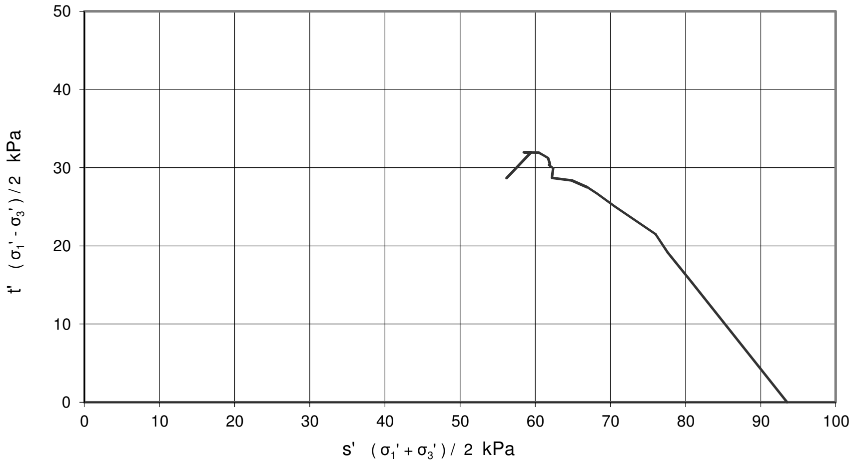
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00-9.00		
			No	15	Type	P
			ID			
			Spec Ref			

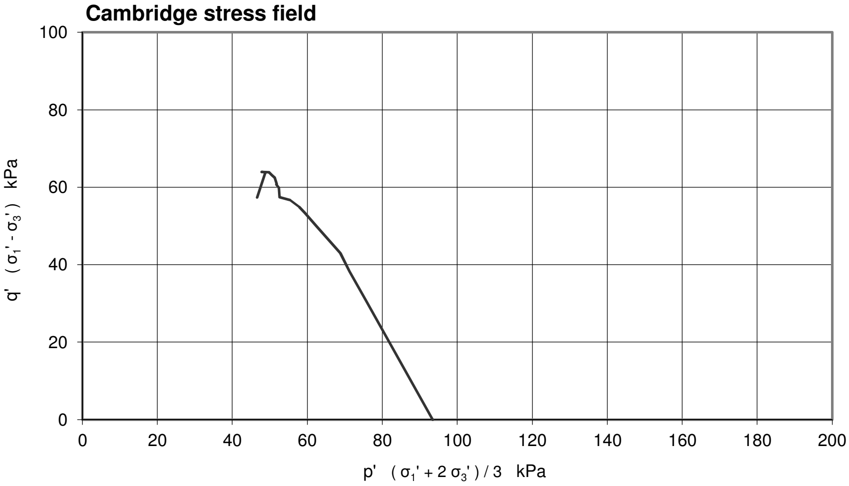
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	397.5			kPa
Initial pwp	304			kPa
Initial σ_3'	94			kPa
Rate of strain	0.68			%/hr

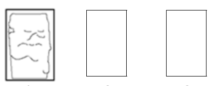
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	4.73			%
$(\sigma_1' / \sigma_3')_f$	3.412			
$(\sigma_1' - \sigma_3')_f$	63.9			kPa
u_f	371			kPa
$\sigma_3'{}_f$	27			kPa
$\sigma_1'{}_f$	90			kPa
A_f	1.05			
Time to failure	6.9			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.516 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:04	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

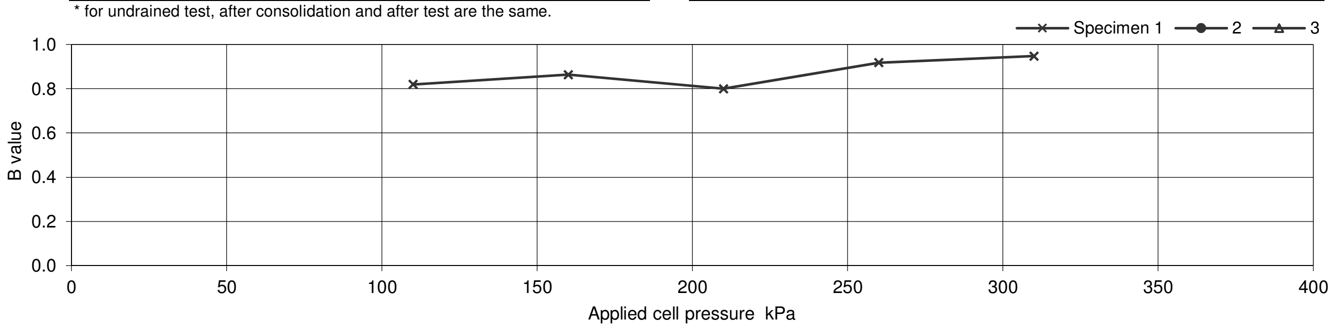
Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00			
			No	17	Type	P	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	193.94		
	Diameter	mm	98.85		
	Bulk Density	Mg/m³	1.28		
	Water Content	%	120		
	Dry density	Mg/m³	0.58		
After consolidation	Length	mm	187.29		
	Diameter	mm	95.40		
	Bulk Density*	Mg/m³	1.40		
	Water Content*	%	120		
	Dry density*	Mg/m³	0.64		

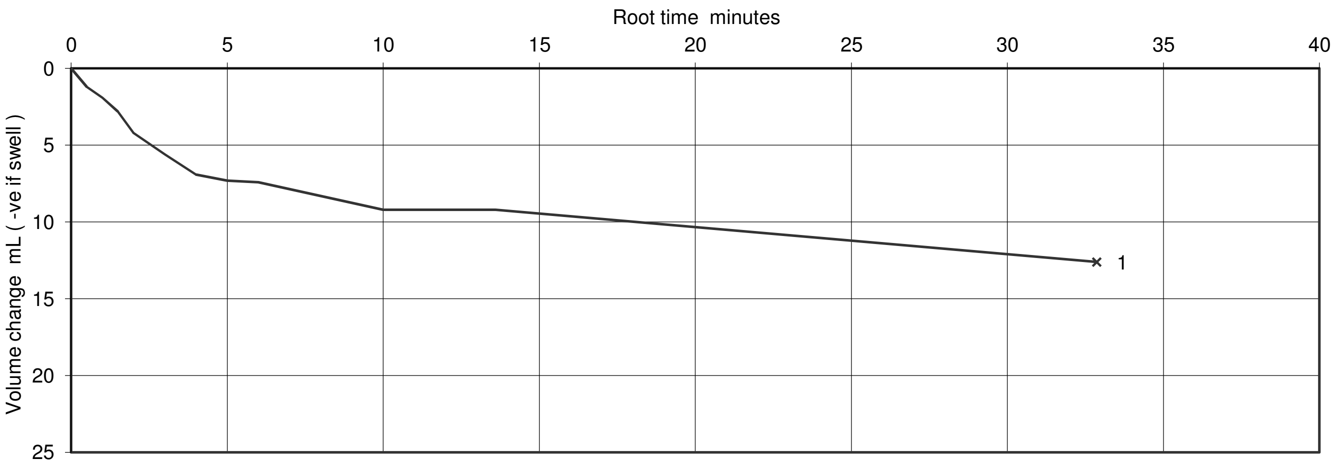
* for undrained test, after consolidation and after test are the same.

Soil Description	Firm dark brown silty peaty CLAY becoming firm dark brown clayey silty amorphous PEAT towards base of specimen. Contains FM gravel sized wood fragments.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	310		
Final pore water pressure	kPa	295.3		
Final B Value		0.95		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		405			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		105			kPa
	Pore pressure at start of consolidation		387			kPa
	Pore pressure at end of consolidation		303			kPa
	Pore pressure dissipation at end of consolidation		97			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	4.74			m^2/year
	Coefficient of Compressibility	M_{vi}	0.11			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.6E-10			m/s

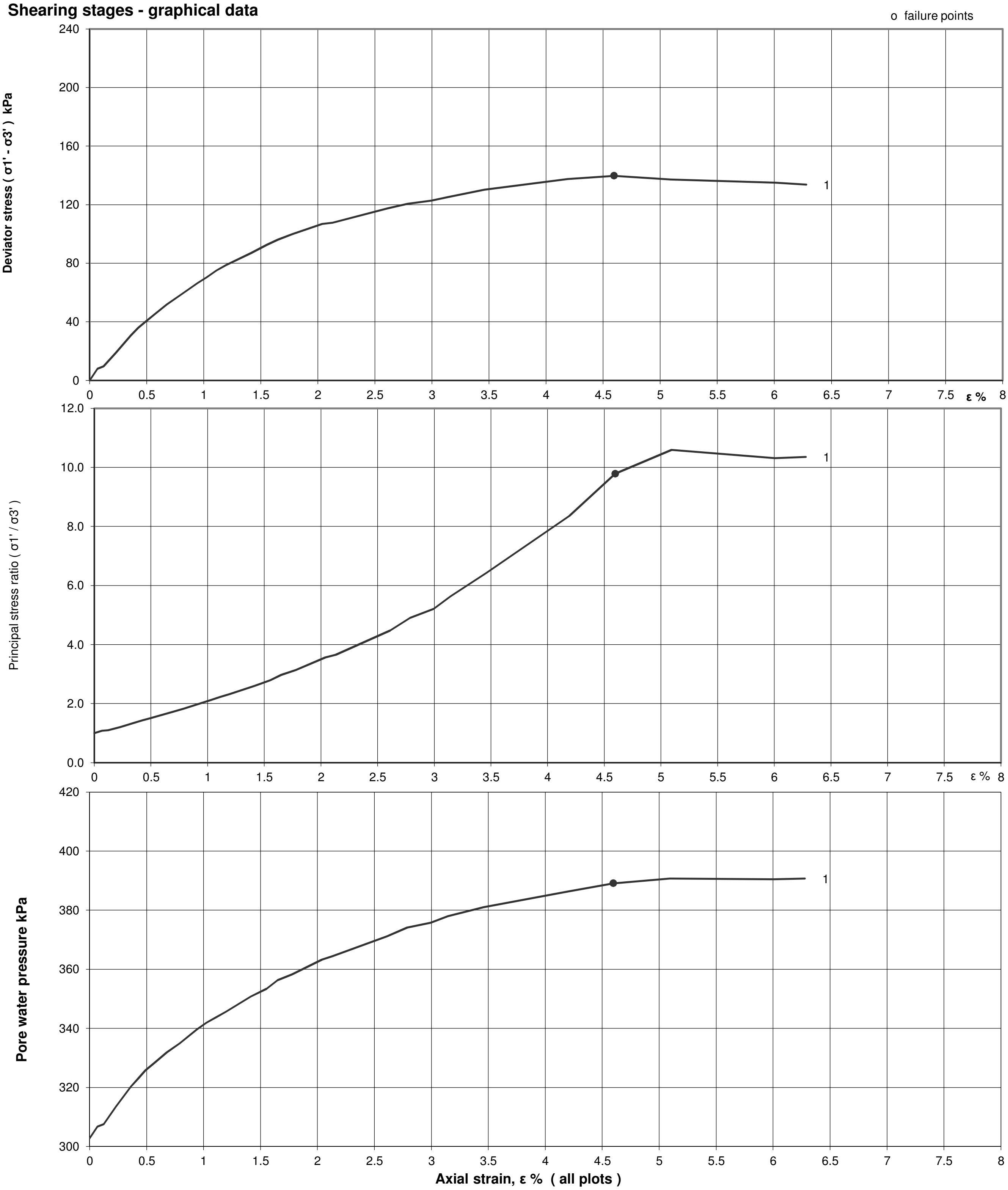


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:04	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00		
			No	17	Type	P
			ID			
			Spec Ref			

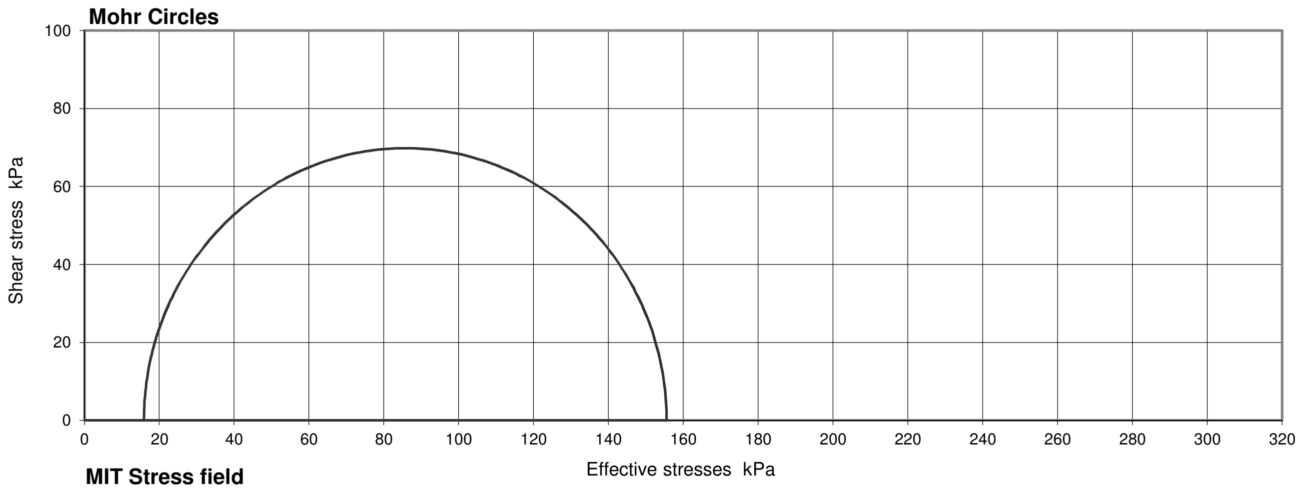
Shearing stages - graphical data

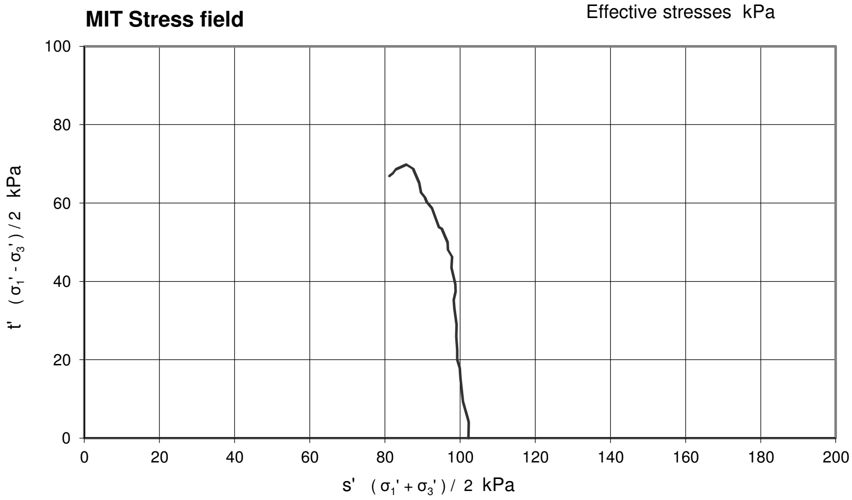


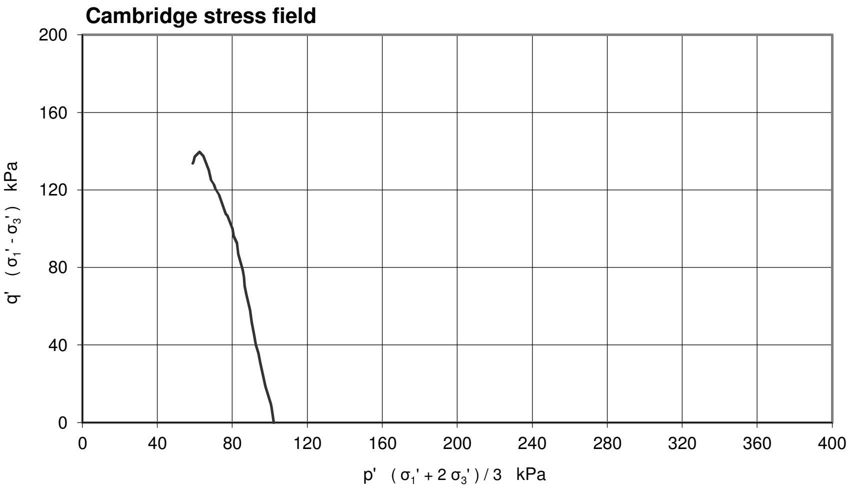
Ref			Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:04	CU sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00		
			No	17	Type	P
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	405			kPa
Initial pwp	303			kPa
Initial σ_3'	102			kPa
Rate of strain	2.00			%/hr

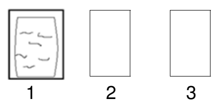
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	4.60			%
$(\sigma_1' / \sigma_3')_f$	9.784			
$(\sigma_1' - \sigma_3')_f$	139.7			kPa
u_f	389			kPa
$\sigma_3'{}_f$	16			kPa
$\sigma_1'{}_f$	156			kPa
A_f	0.62			
Time to failure	2.3			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.486 mm thick rubber membrane(s)

SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:04	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

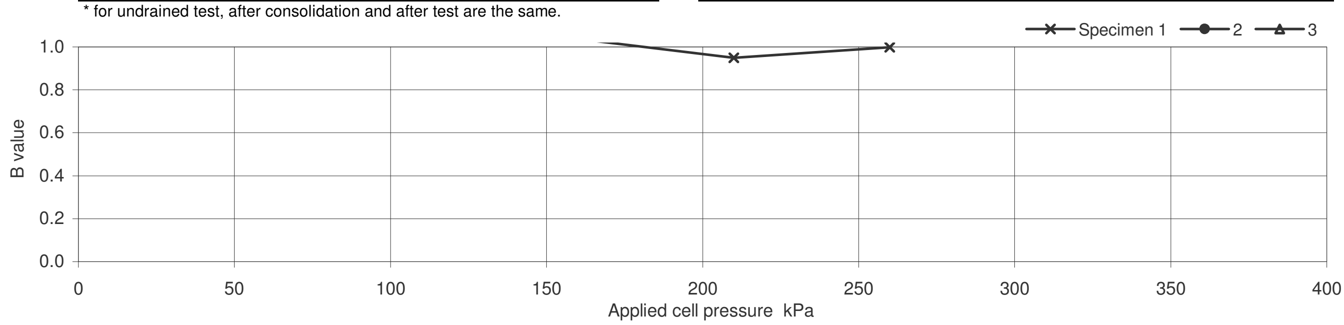
Project No	A5085-15	Sample Details: Hole No	BH406
Project Name	A63 CASTLE STREET	Depth (m BGL)	3.00 - 3.45
		No	11 — Type: UT
		ID	
		Spec Ref	

	Specimen Details		1	2	3
Initial	Length	mm	197.88		
	Diameter	mm	103.97		
	Bulk Density	Mg/m³	1.84		
	Water Content	%	85		
	Dry density	Mg/m³	0.99		
After consolidation	Length	mm	171.79		
	Diameter	mm	89.21		
	Bulk Density*	Mg/m³	2.06		
	Water Content*	%	33		
	Dry density*	Mg/m³	1.55		

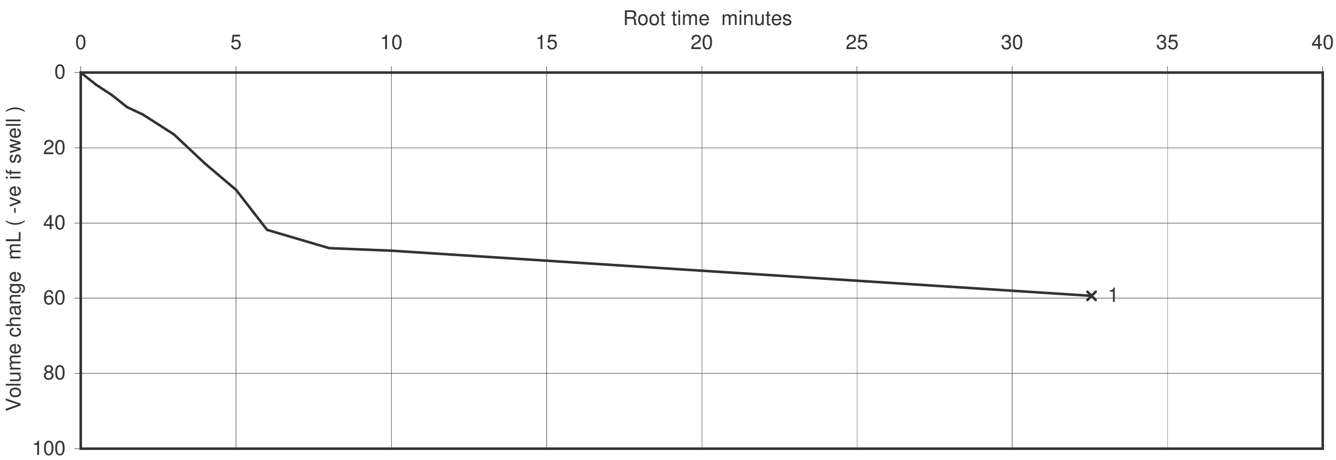
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown silty CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation: Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa			
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	260.7		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		350			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		50			kPa
	Pore pressure at start of consolidation		357			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.01			m^2/year
	Coefficient of Compressibility	M_{vi}	0.92			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	5.8E-10			m/s

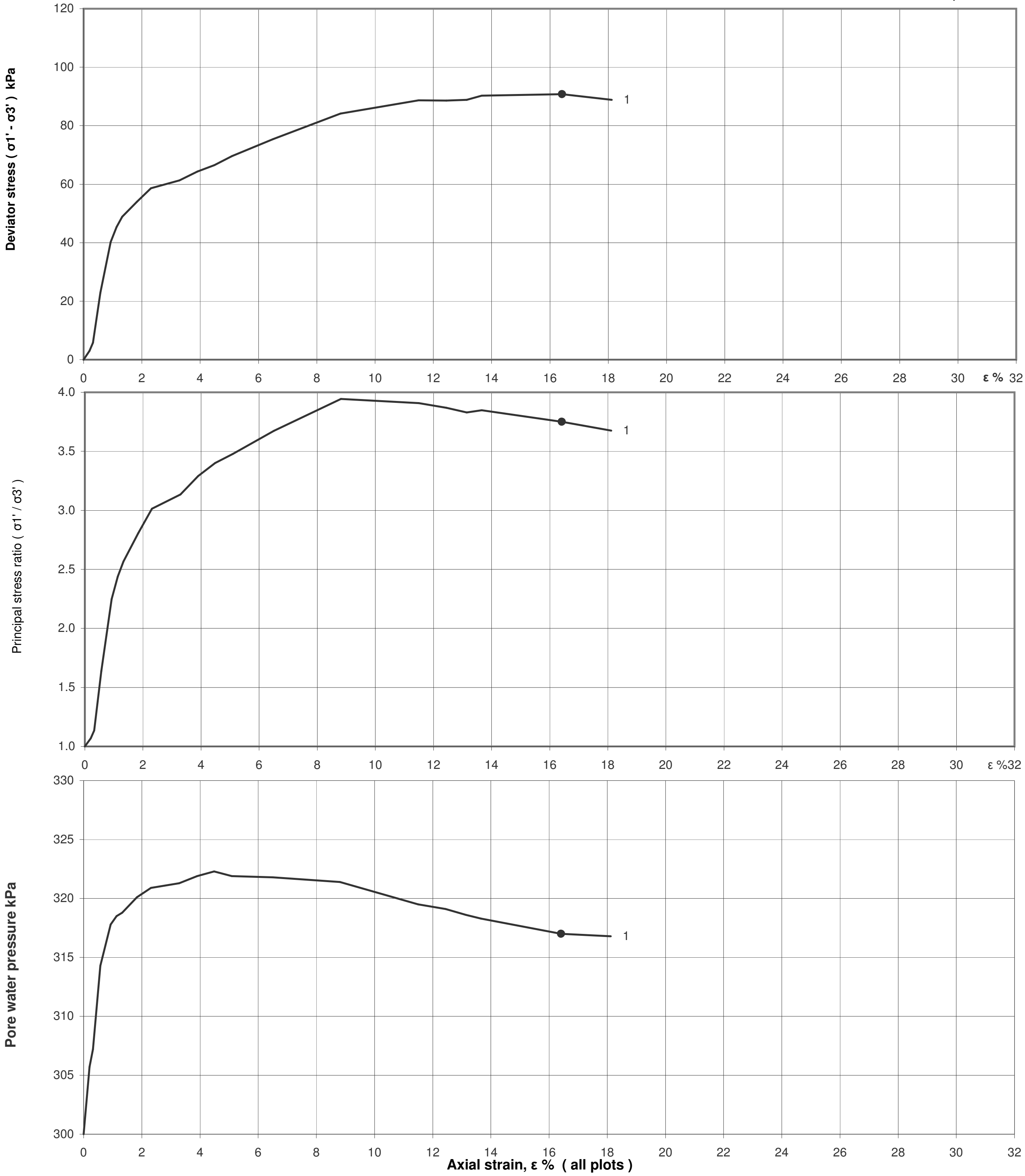


Ref: SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:01	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.00 - 3.45		
			No	11	Type	UT
			ID			
			Spec Ref			

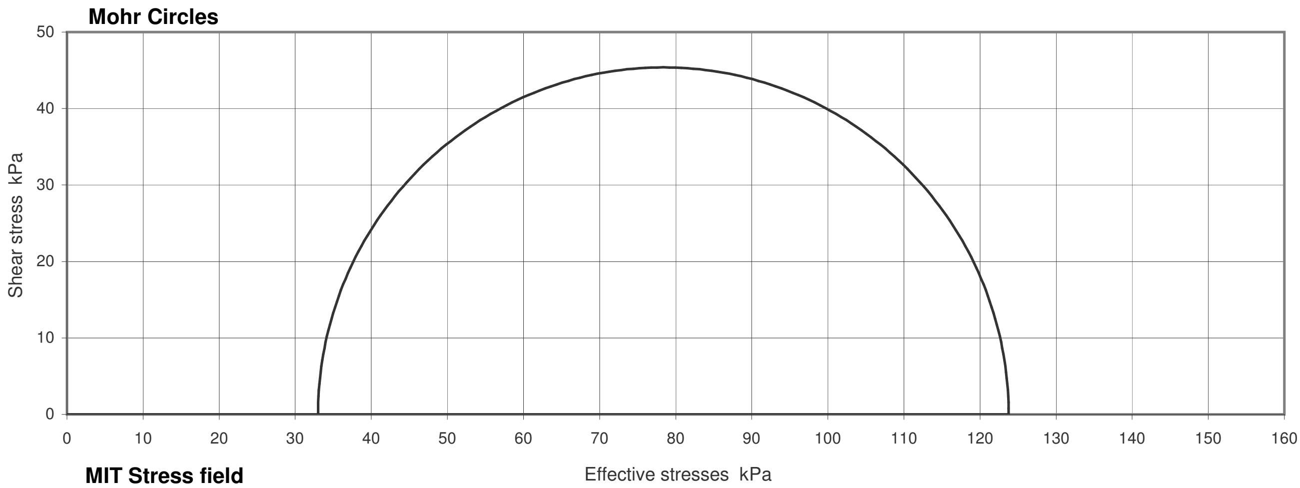
Shearing stages - graphical data

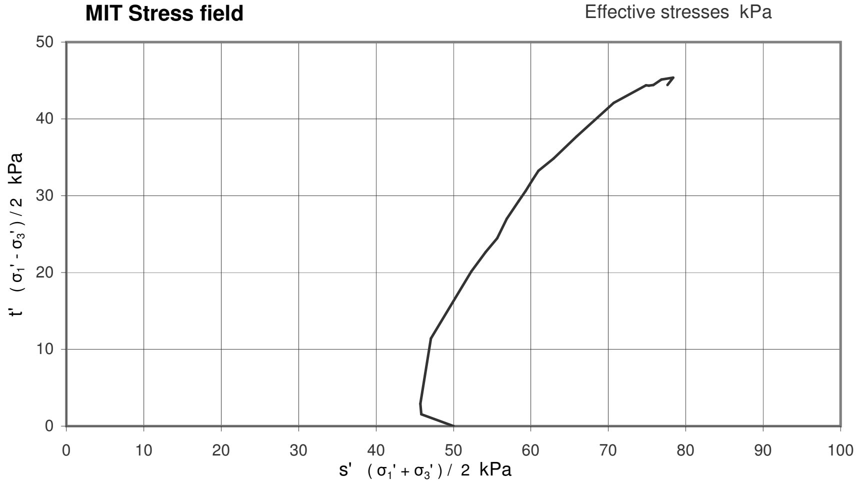


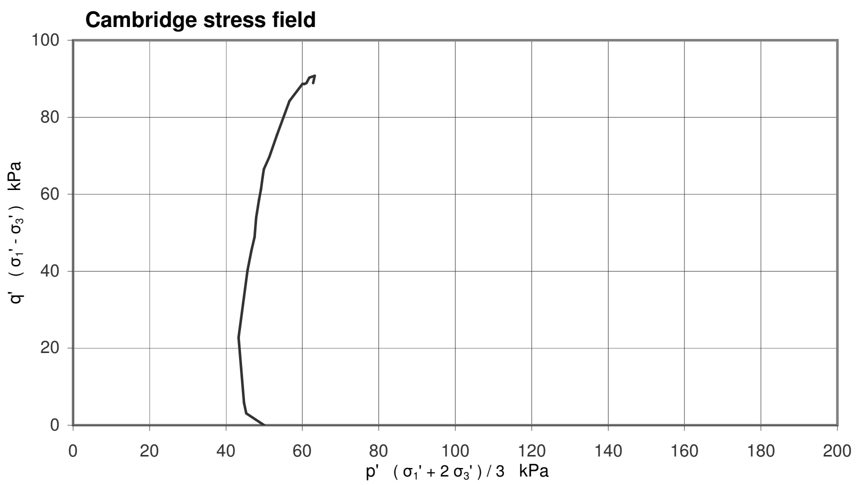
Ref SLR8.1 Rev 85 May 09	ESG	UKAS TESTING 1157	Printed:13/02/2016 11:01	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No		BH406	
Project Name	A63 CASTLE STREET		Depth (m BGL)		3.00 - 3.45	
			No	11	Type	UT
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	350			kPa
Initial pwp	300			kPa
Initial σ_3'	50			kPa
Rate of strain	1.86			%/hr

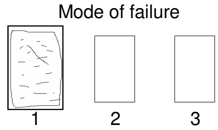
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	16.42			%
$(\sigma_1' / \sigma_3')_f$	3.750			
$(\sigma_1' - \sigma_3')_f$	90.8			kPa
u_f	317			kPa
$\sigma_3'{}_f$	33			kPa
$\sigma_1'{}_f$	124			kPa
A_f	0.19			
Time to failure	8.8			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.4 mm thick rubber membrane(s)

Split and Describe after testing.

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:01	CU 0 sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

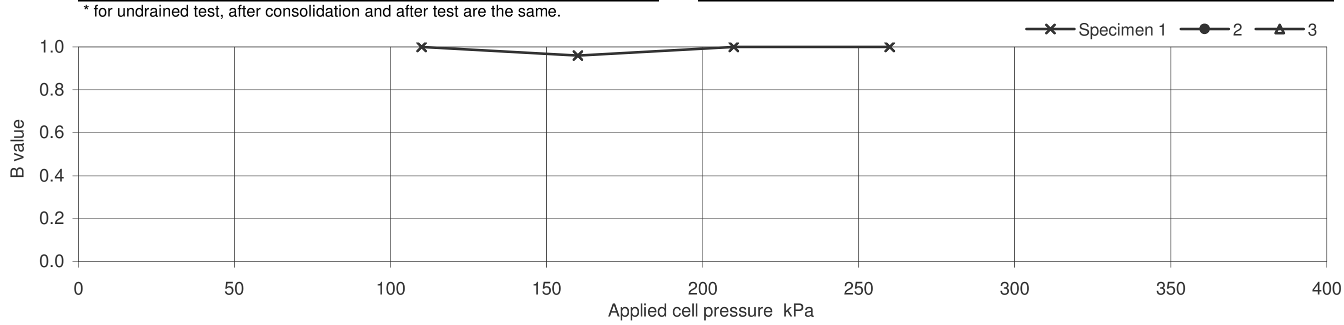
Project No	A5085-15	Sample Details:	Hole No	BH406
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.50 - 4.95
			No	14 — Type UT
			ID	
			Spec Ref	

	Specimen Details		1	2	3
Initial	Length	mm	198.34		
	Diameter	mm	104.69		
	Bulk Density	Mg/m³	1.87		
	Water Content	%	91		
	Dry density	Mg/m³	0.98		
After consolidation	Length	mm	168.92		
	Diameter	mm	87.80		
	Bulk Density*	Mg/m³	2.13		
	Water Content*	%	30		
	Dry density*	Mg/m³	1.63		

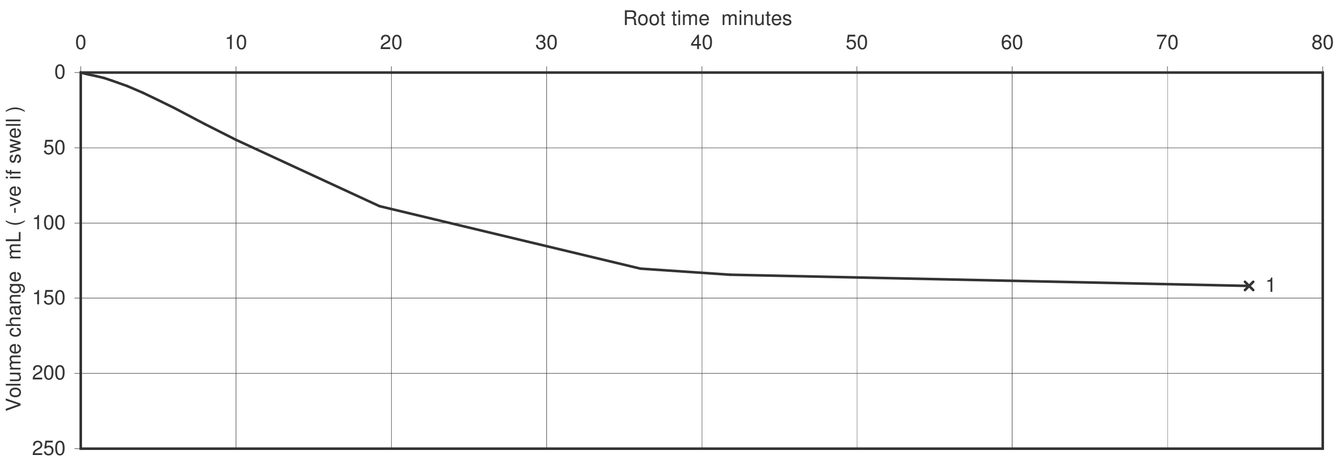
* for undrained test, after consolidation and after test are the same.

Soil Description	Very soft brown slightly sandy clayey SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	256		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		361			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		61			kPa
	Pore pressure at start of consolidation		362			kPa
	Pore pressure at end of consolidation		303			kPa
	Pore pressure dissipation at end of consolidation		95			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.22			m^2/year
	Coefficient of Compressibility	M_{vi}	2.11			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.4E-10			m/s

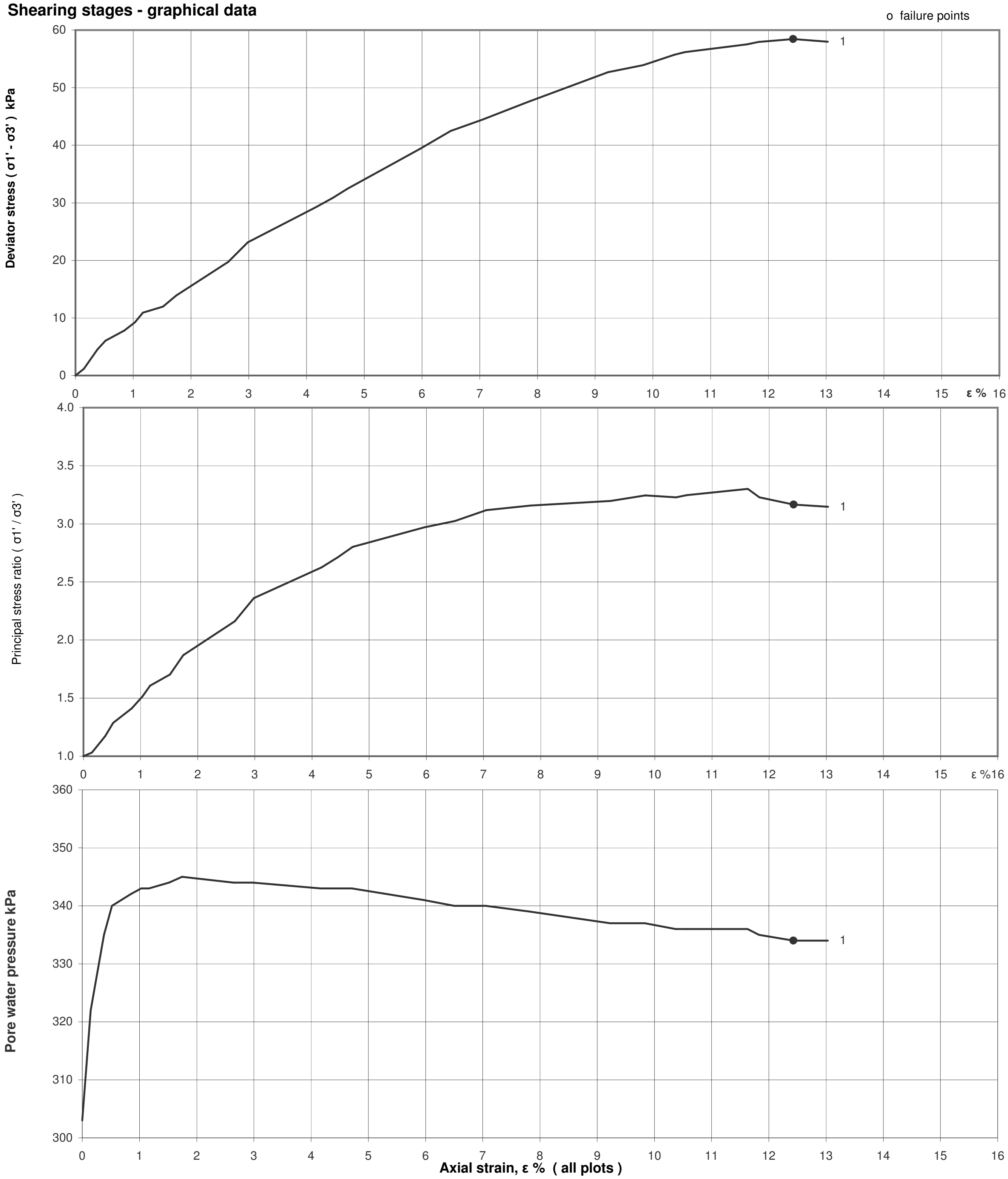


Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:54	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.50 - 4.95		
			No	14	Type	UT
			ID			
			Spec Ref			

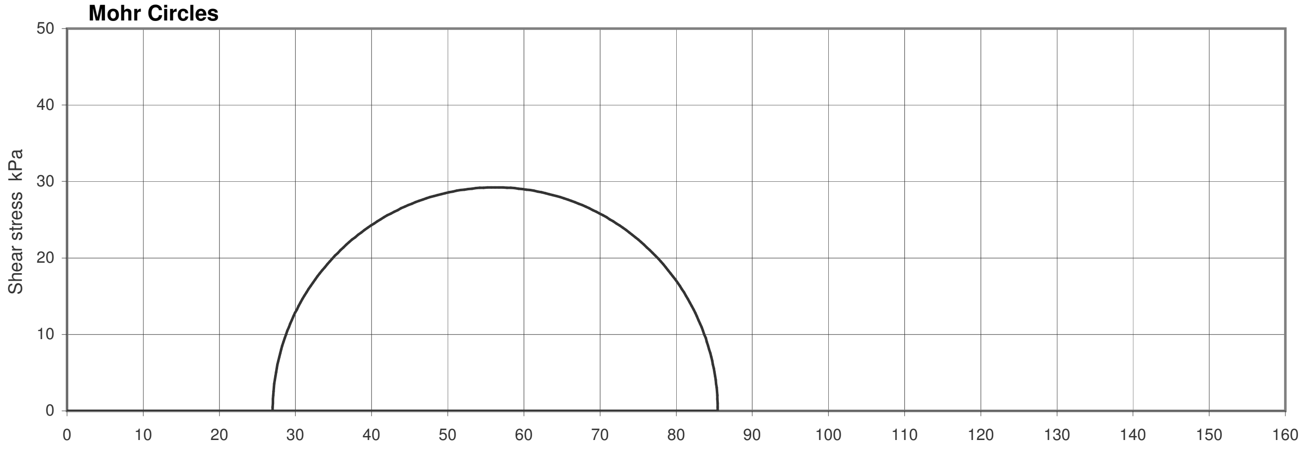
Shearing stages - graphical data

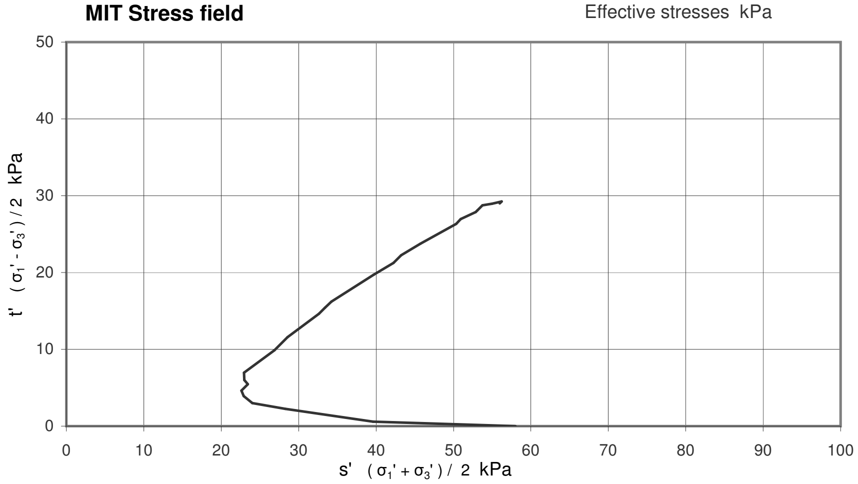


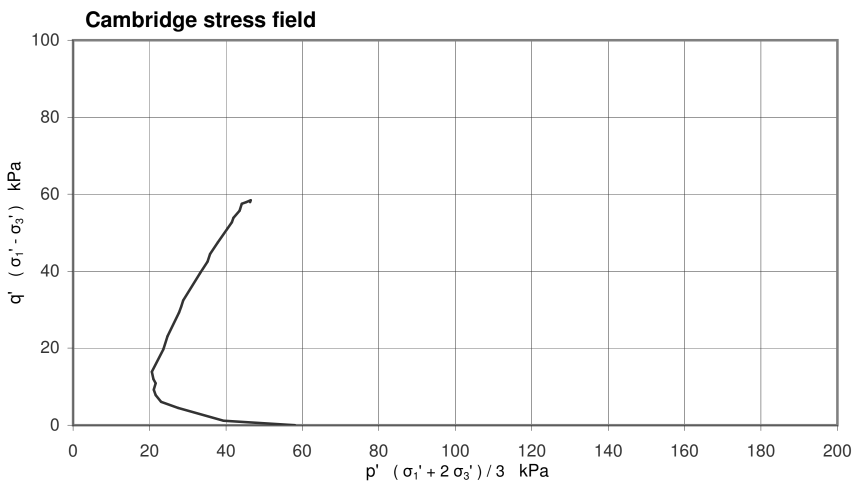
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:54	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.50 - 4.95
			No 14	Type UT
			ID	
			Spec Ref	







Compression stages

Specimen	1	2	3	
Cell pressure	361			kPa
Initial pwp	303			kPa
Initial σ_3'	58			kPa
Rate of strain	0.59			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	12.43			%
$(\sigma_1' / \sigma_3')_f$	3.165			
$(\sigma_1' - \sigma_3')_f$	58.5			kPa
u_f	334			kPa
$\sigma_3'{}_f$	27			kPa
$\sigma_1'{}_f$	85			kPa
A_f	0.53			
Time to failure	21.2			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG / UKAS TESTING 1157	Printed:01/03/2016 10:54	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

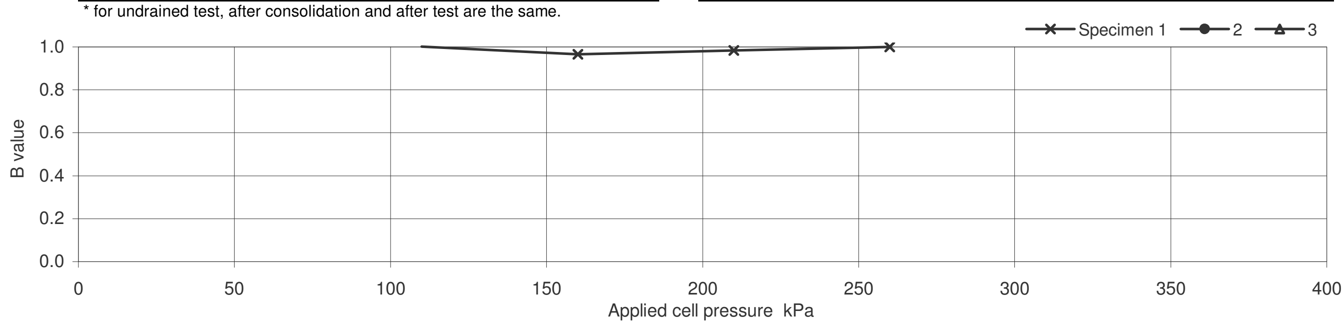
Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.50-7.50		
			No	21	Type	P
			ID	Sample 2		
			Spec Ref	Base		

	Specimen Details		1	2	3
Initial	Length	mm	191.94		
	Diameter	mm	97.71		
	Bulk Density	Mg/m³	1.80		
	Water Content	%	57		
	Dry density	Mg/m³	1.15		
After consolidation	Length	mm	190.76		
	Diameter	mm	97.11		
	Bulk Density*	Mg/m³	1.82		
	Water Content*	%	55		
	Dry density*	Mg/m³	1.17		

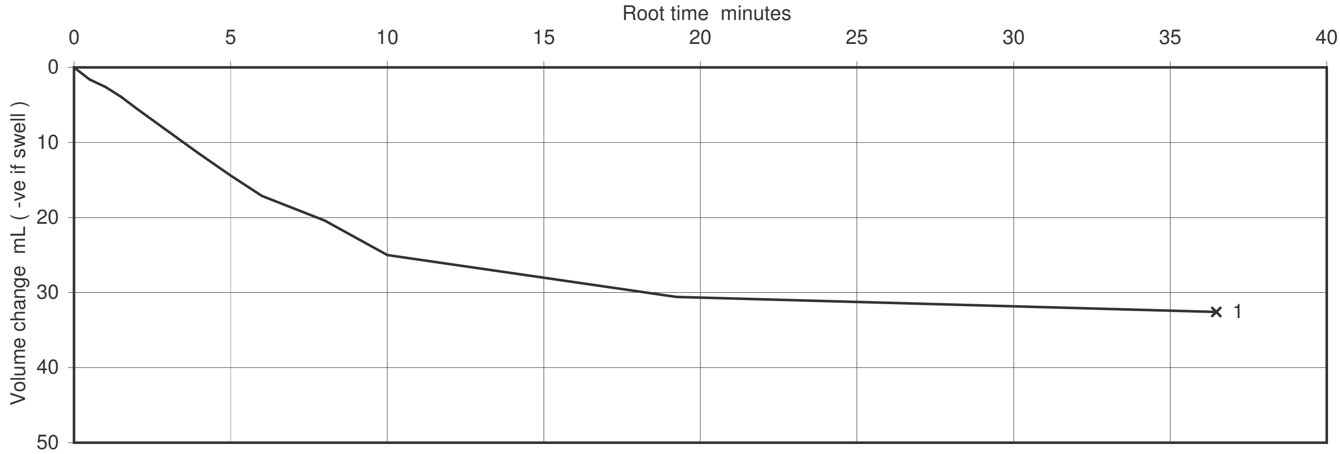
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown sandy SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	258		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		340			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		40			kPa
	Pore pressure at start of consolidation		330			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.56			m^2/year
	Coefficient of Compressibility	M_{vi}	0.76			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	3.7E-10			m/s

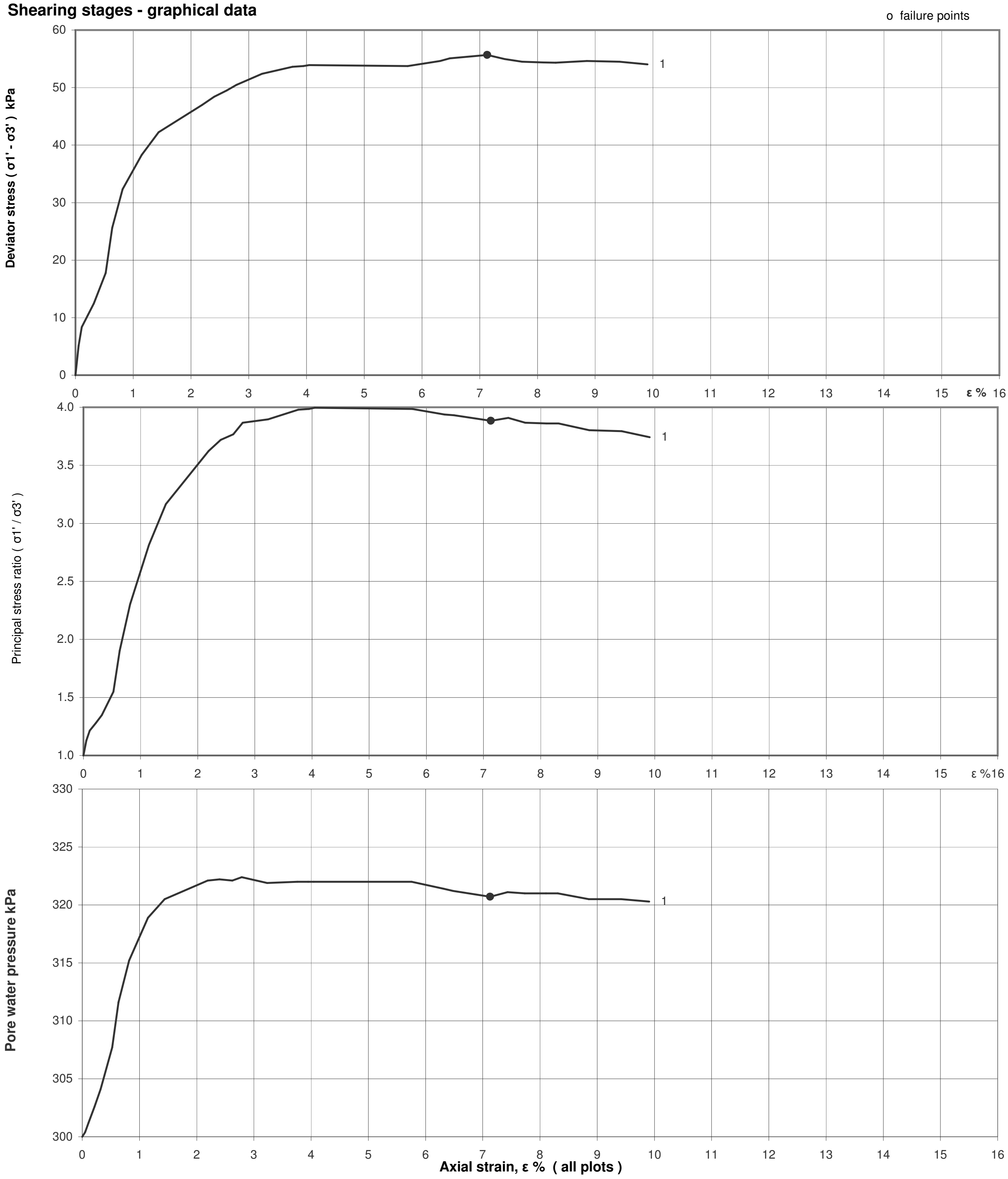


Ref			Figure
SLR8.1 Rev 85 May 09	UKAS TESTING 1157	Printed:01/03/2016 10:50	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.50-7.50		
			No	21	Type	P
			ID	Sample 2		
			Spec Ref	Base		

Shearing stages - graphical data

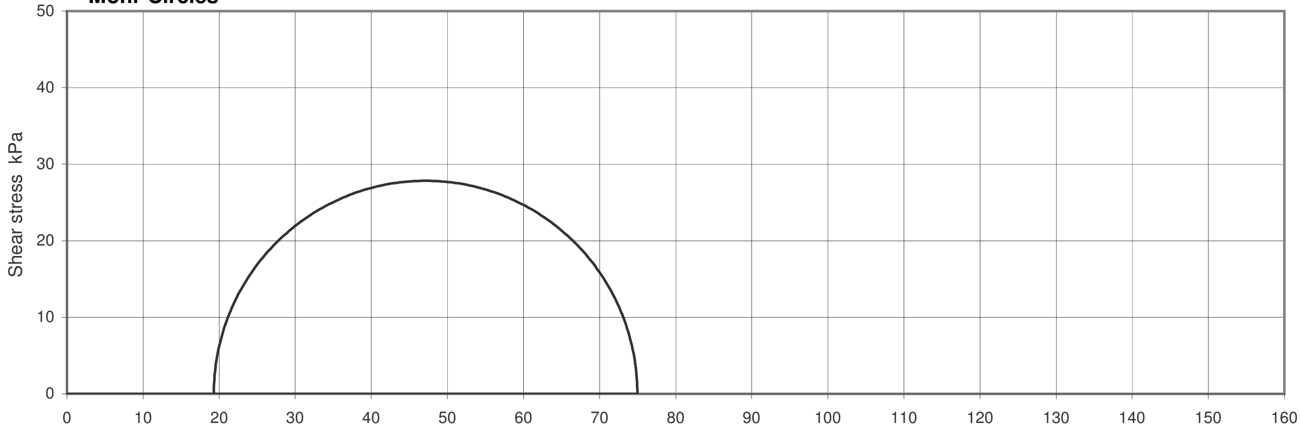


Ref			Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:01/03/2016 10:50	**CU** sheet 2 of 3

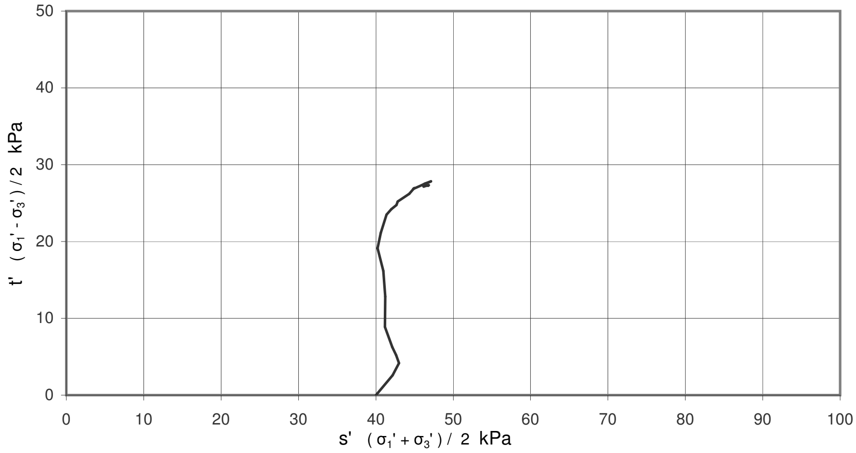
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.50-7.50		
			No	21	Type	P
			ID	Sample 2		
			Spec Ref	Base		

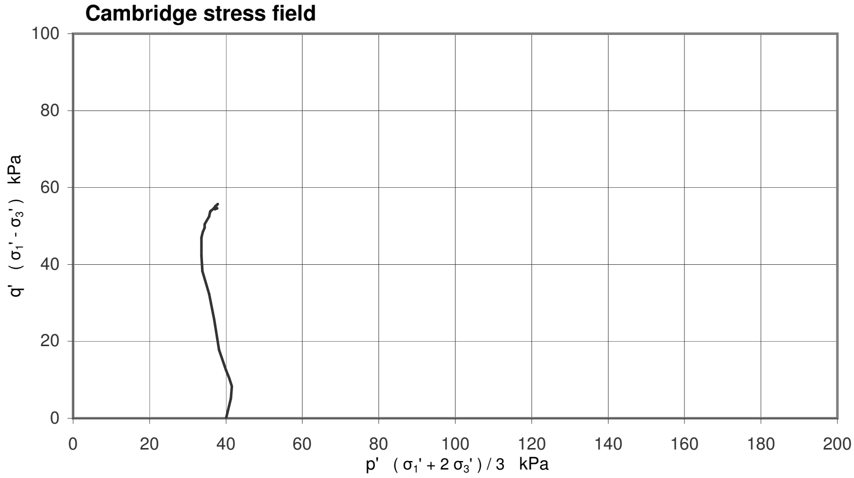
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	340			kPa
Initial pwp	300			kPa
Initial σ_3'	40			kPa
Rate of strain	1.28			%/hr

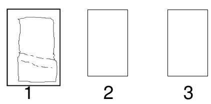
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	7.13			%
$(\sigma_1' / \sigma_3')_f$	3.884			
$(\sigma_1' - \sigma_3')_f$	55.7			kPa
u_f	321			kPa
$\sigma_3'{}_f$	19			kPa
$\sigma_1'{}_f$	75			kPa
A_f	0.37			
Time to failure	5.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.57 mm thick rubber membrane(s)

Ref		Printed:01/03/2016 10:50	Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157		**CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

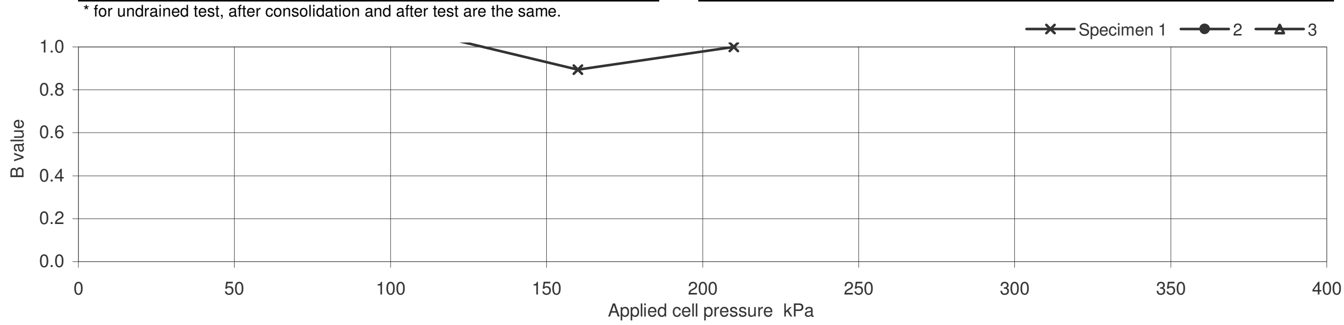
Project No	A5085-15	Sample Details:	Hole No	BH406			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.50-7.50			
			No	21	Type	P	
			ID	TOP			
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	192.85		
	Diameter	mm	96.81		
	Bulk Density	Mg/m³	1.77		
	Water Content	%	49		
	Dry density	Mg/m³	1.18		
After consolidation	Length	mm	189.62		
	Diameter	mm	95.17		
	Bulk Density*	Mg/m³	1.81		
	Water Content*	%	45		
	Dry density*	Mg/m³	1.25		

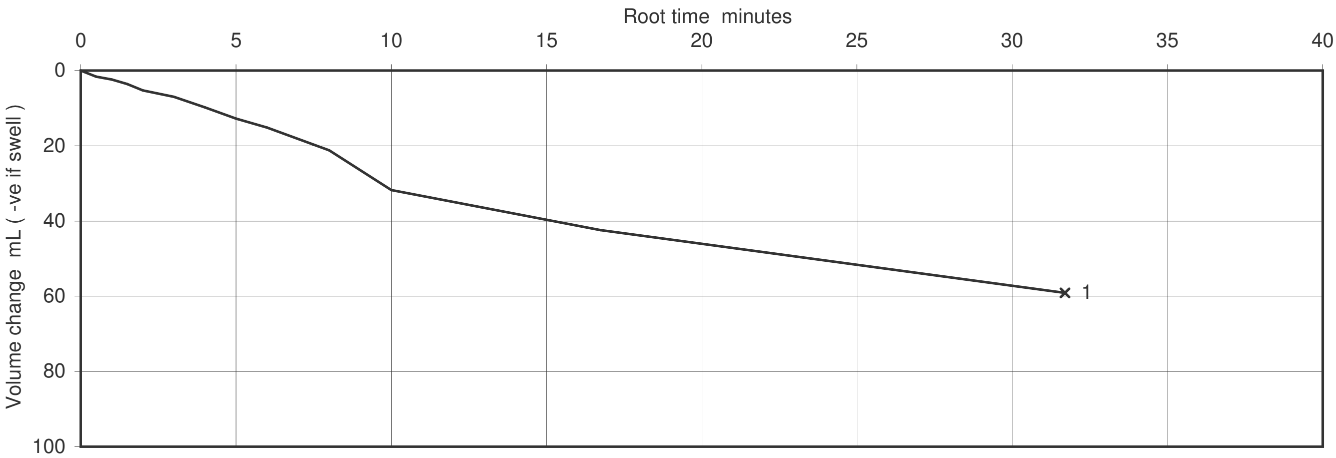
* for undrained test, after consolidation and after test are the same.

Soil Description	
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa			
Differential Pressure	kPa			
Final Cell Pressure	kPa			
Final pore water pressure	kPa			
Final B Value				



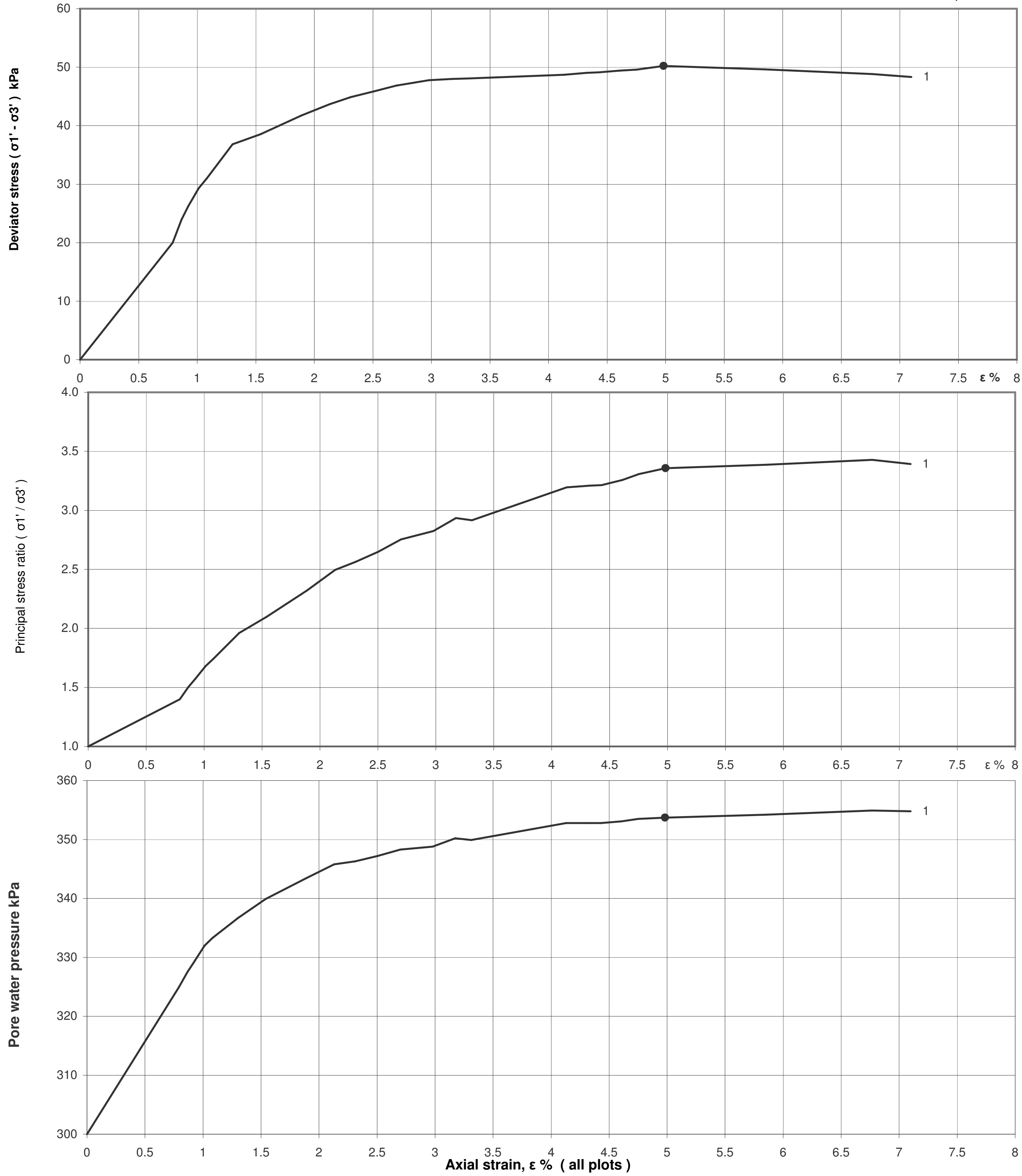
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		375			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		75			kPa
	Pore pressure at start of consolidation		364			kPa
	Pore pressure at end of consolidation		303			kPa
	Pore pressure dissipation at end of consolidation		96			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.58			m^2/year
	Coefficient of Compressibility	M_{vi}	0.68			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.2E-10			m/s



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.50-7.50		
			No	21	Type	P
			ID	TOP		
			Spec Ref			

Shearing stages - graphical data

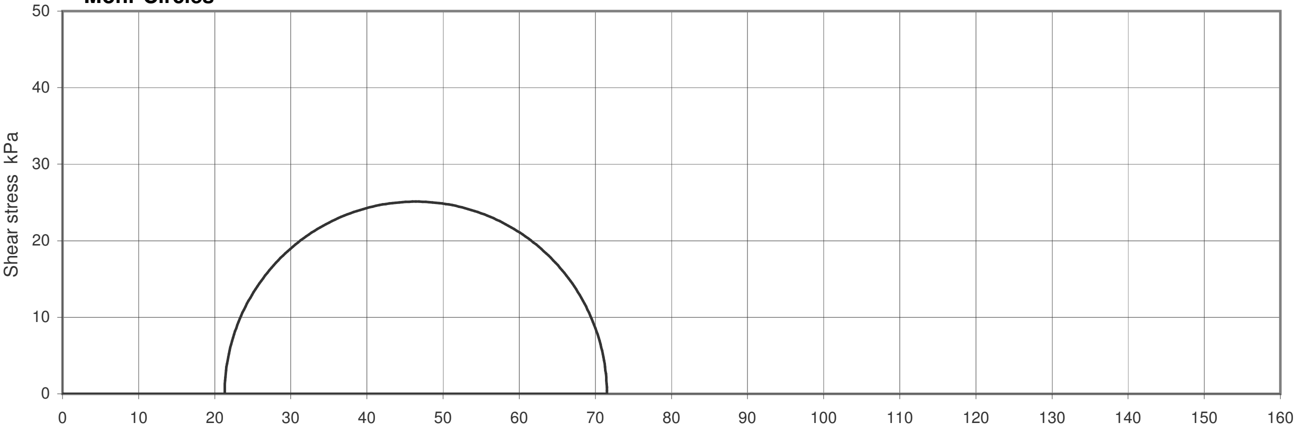


Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:04	CU sheet 2 of 3

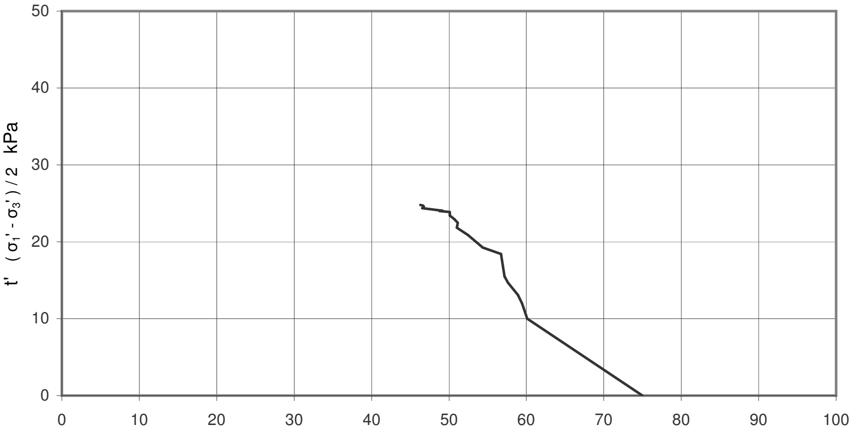
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.50-7.50		
			No	21	Type	P
			ID	TOP		
			Spec Ref			

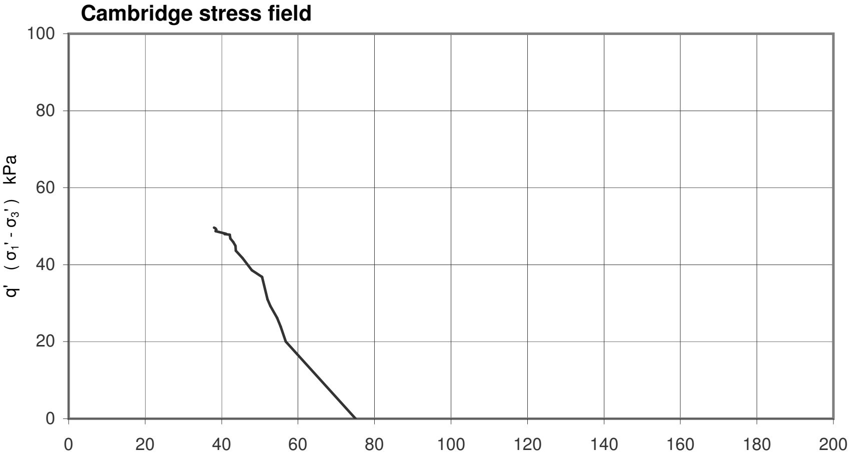
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	375			kPa
Initial pwp	300			kPa
Initial σ_3'	75			kPa
Rate of strain	0.50			%/hr

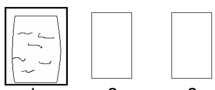
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	4.98			%
$(\sigma_1' / \sigma_3')_f$	3.358			
$(\sigma_1' - \sigma_3')_f$	50.2			kPa
u_f	354			kPa
$\sigma_3'{}_f$	21			kPa
$\sigma_1'{}_f$	72			kPa
A_f	1.07			
Time to failure	10.0			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.4 mm thick rubber membrane(s)

Ref SLR8.1 Rev 85 May 09	ESG / UKAS TESTING 1157	Printed:13/02/2016 11:04	**Figure** **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

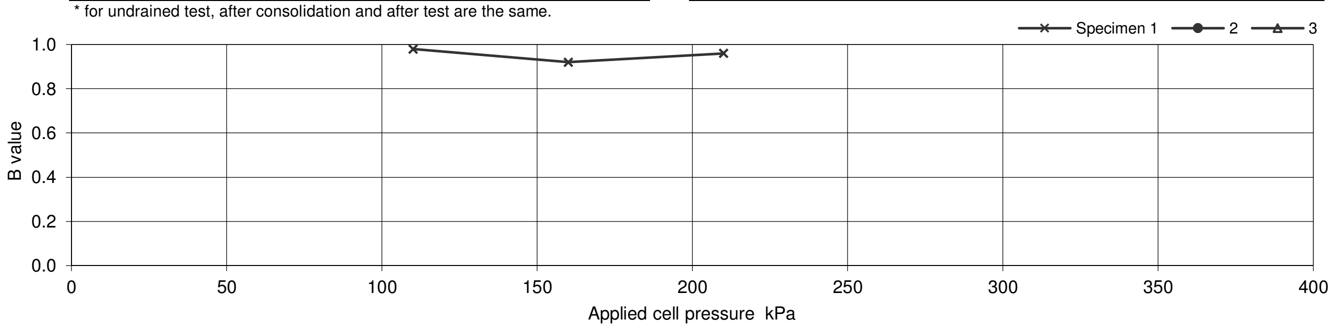
Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8-9.1		
			No	25	Type	P
			ID	BOTTOM		
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	193.22		
	Diameter	mm	97.32		
	Bulk Density	Mg/m³	1.54		
	Water Content	%	77		
	Dry density	Mg/m³	0.87		
After consolidation	Length	mm	190.73		
	Diameter	mm	96.06		
	Bulk Density*	Mg/m³	1.57		
	Water Content*	%	72		
	Dry density*	Mg/m³	0.91		

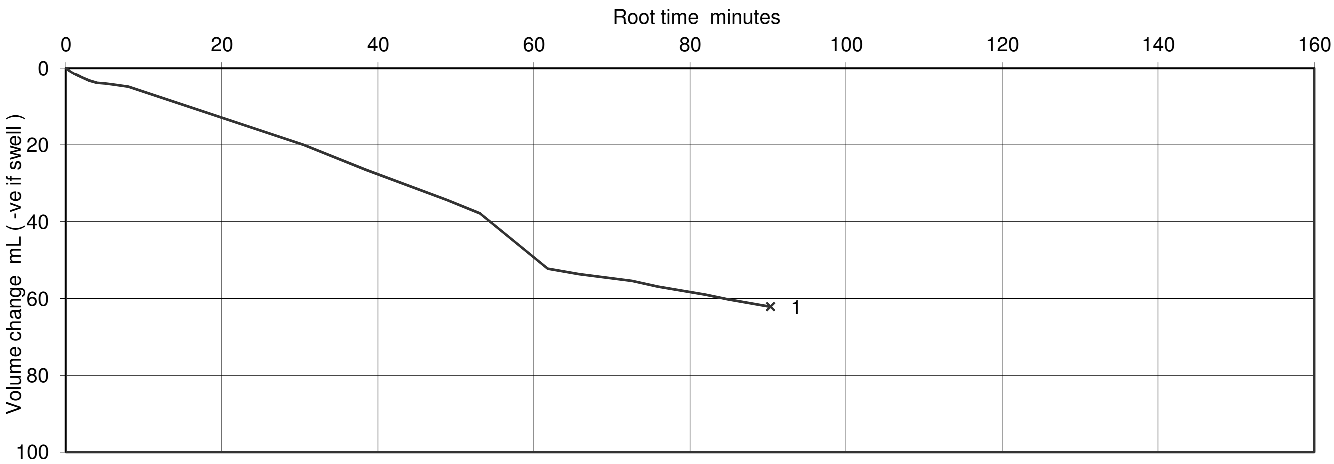
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm brown silty organic CLAY. Contains frequent wood fragments.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	197		
Final B Value		0.96		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		480			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		180			kPa
	Pore pressure at start of consolidation		364			kPa
	Pore pressure at end of consolidation		303			kPa
	Pore pressure dissipation at end of consolidation		95			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.03			m^2/year
	Coefficient of Compressibility	M_{vi}	0.71			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	5.8E-12			m/s

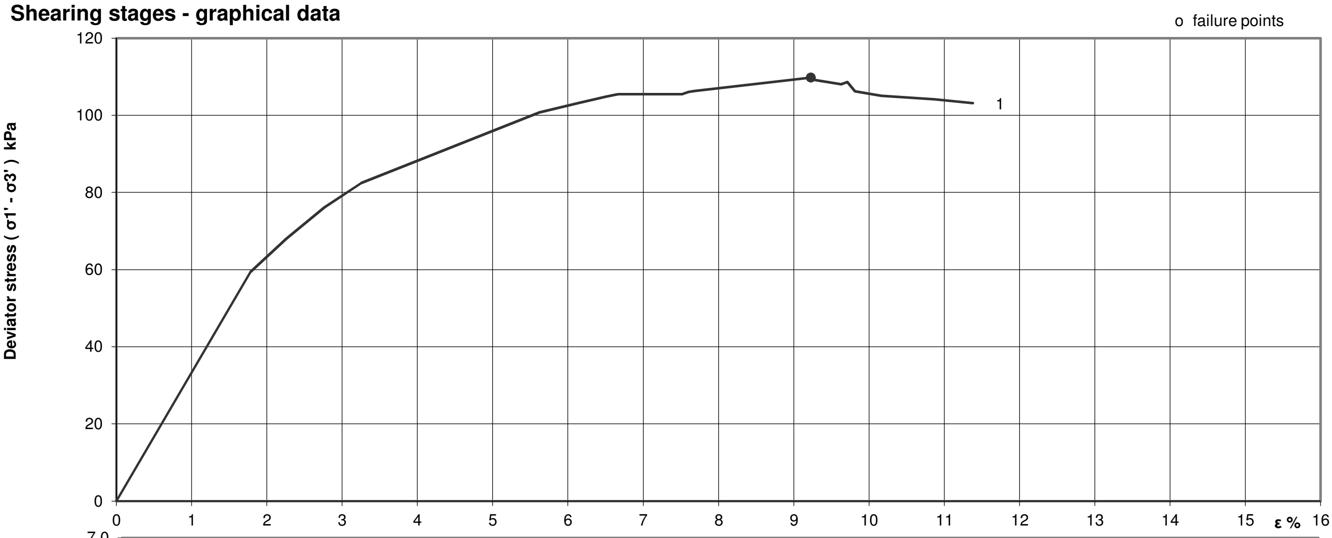


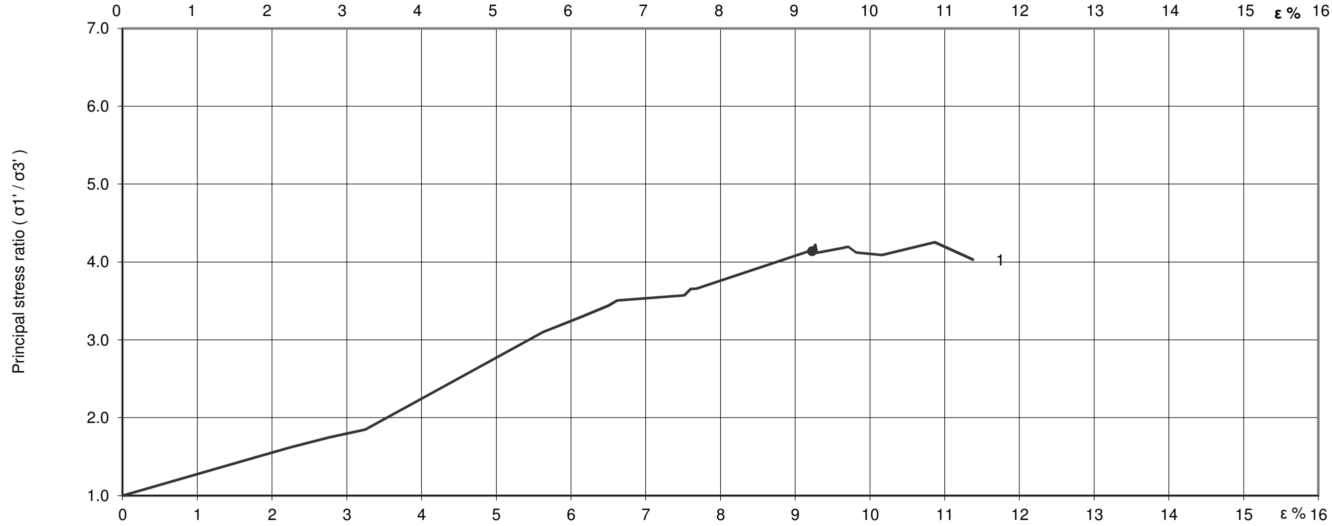
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:23/03/2016 11:48	**Figure** **CU** sheet 1 of 3

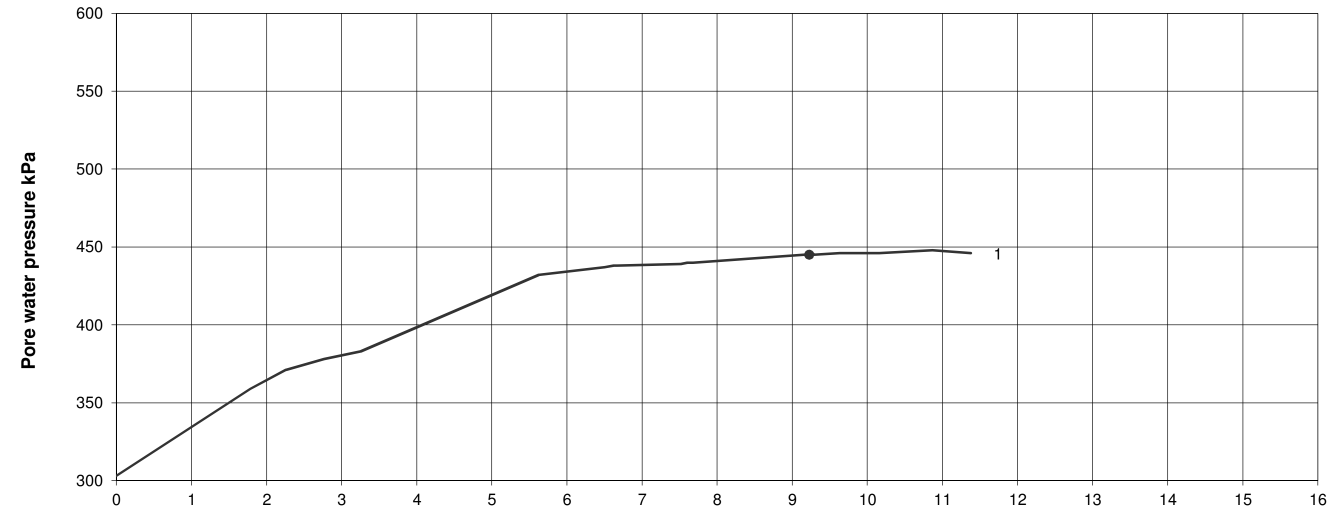
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8-9.1		
			No	25	Type	P
			ID	BOTTOM		
			Spec Ref			

Shearing stages - graphical data





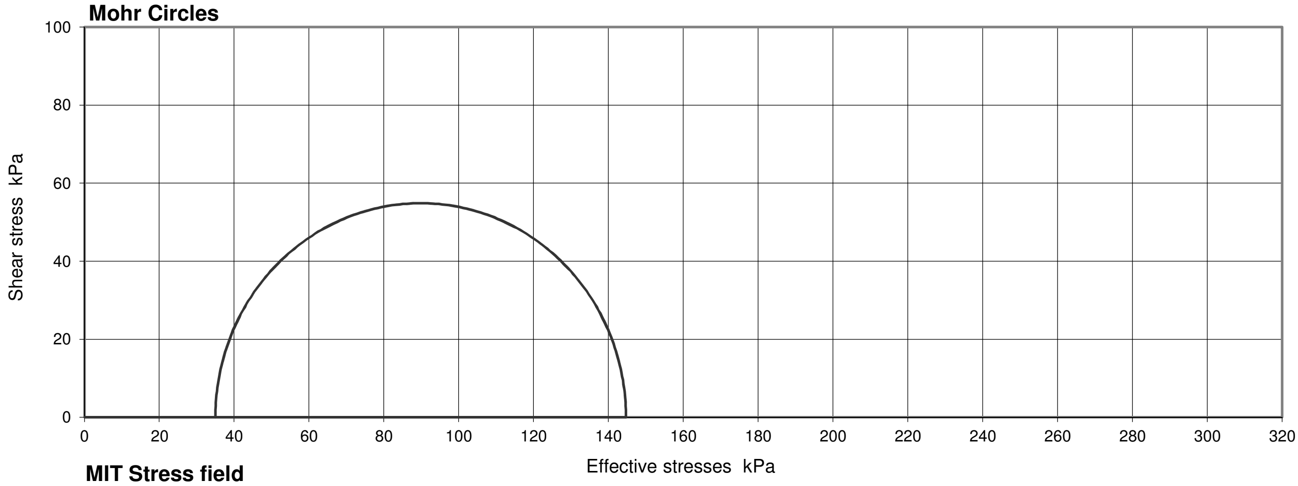


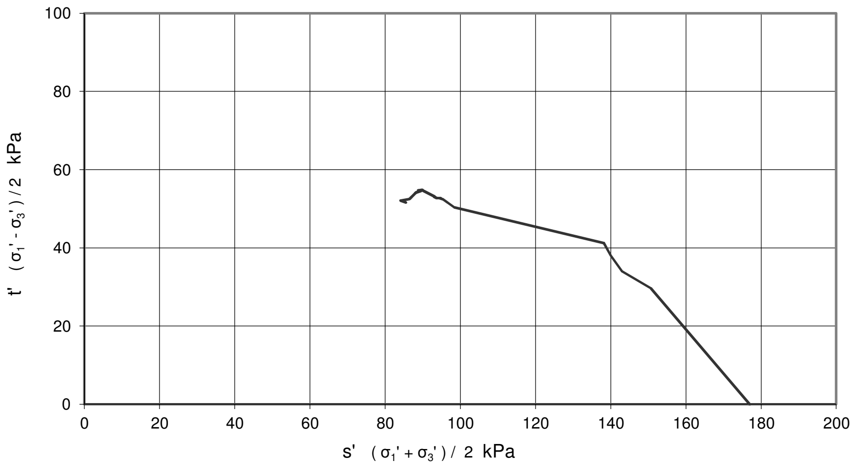
Axial strain, ε % (all plots)

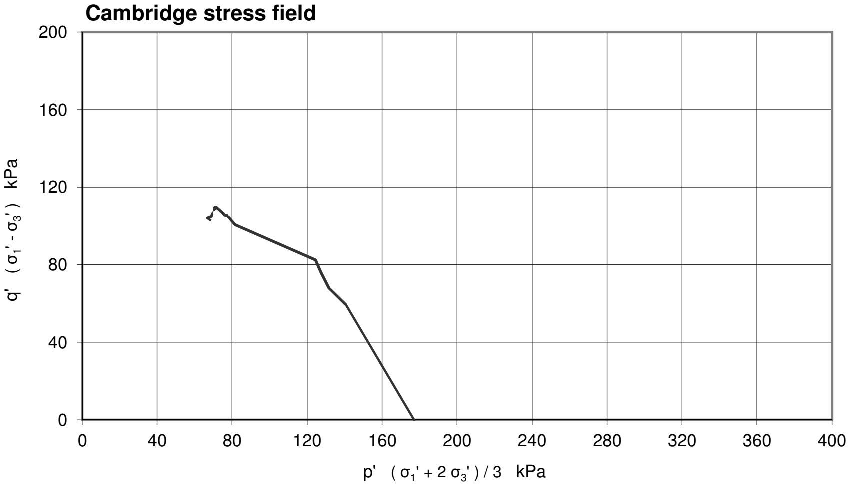
Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:23/03/2016 11:48	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8-9.1		
			No	25	Type	P
			ID	BOTTOM		
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	480			kPa
Initial pwp	303			kPa
Initial σ_3'	177			kPa
Rate of strain	0.02			%/hr

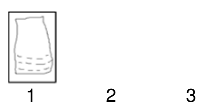
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	9.23			%
$(\sigma_1' / \sigma_3')_f$	4.135			
$(\sigma_1' - \sigma_3')_f$	109.7			kPa
u_f	445			kPa
$\sigma_3'{}_f$	35			kPa
$\sigma_1'{}_f$	145			kPa
A_f	1.29			
Time to failure	417.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.409 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:23/03/2016 11:48	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

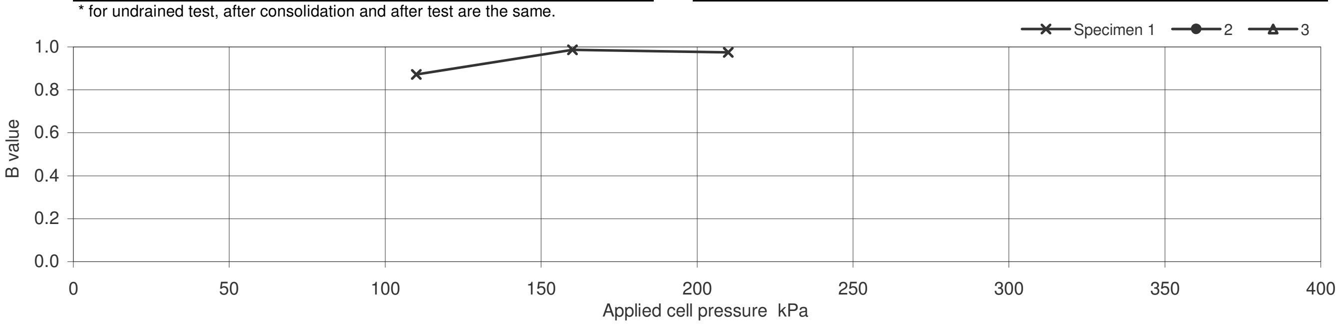
Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8-9.1		
			No	25	Type	P
			ID	TOP		
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	192.77		
	Diameter	mm	96.98		
	Bulk Density	Mg/m³	1.48		
	Water Content	%	230		
	Dry density	Mg/m³	0.44		
After consolidation	Length	mm	160.12		
	Diameter	mm	78.86		
	Bulk Density*	Mg/m³	1.56		
	Water Content*	%	94		
	Dry density*	Mg/m³	0.80		

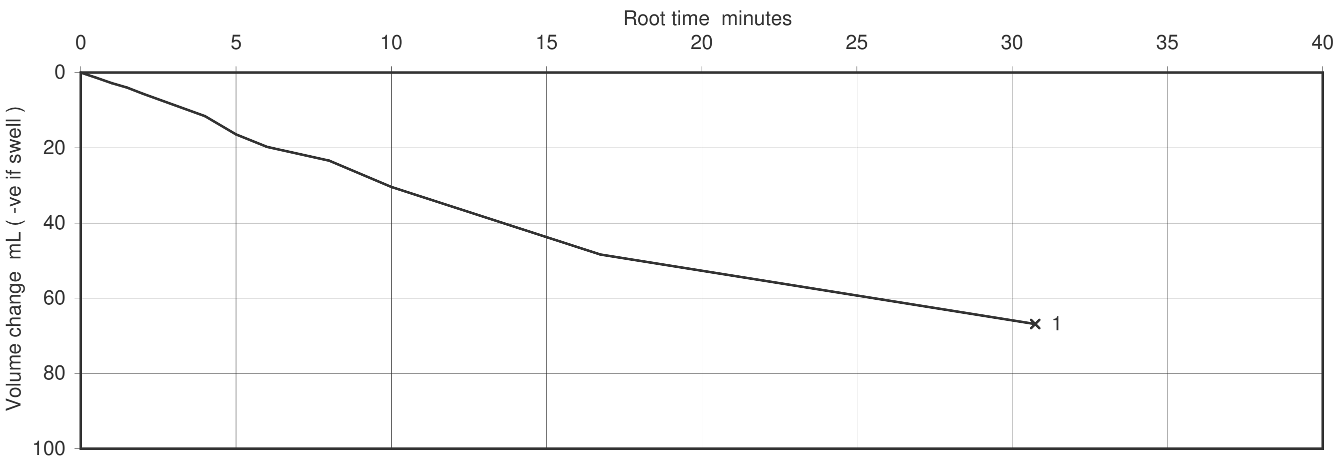
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm brown slightly sandy silty organic CLAY containing frequent wood fragments
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	150		
Final B Value		0.97		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		370			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		70			kPa
	Pore pressure at start of consolidation		353			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.30			m^2/year
	Coefficient of Compressibility	M_{vi}	1.50			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.4E-10			m/s



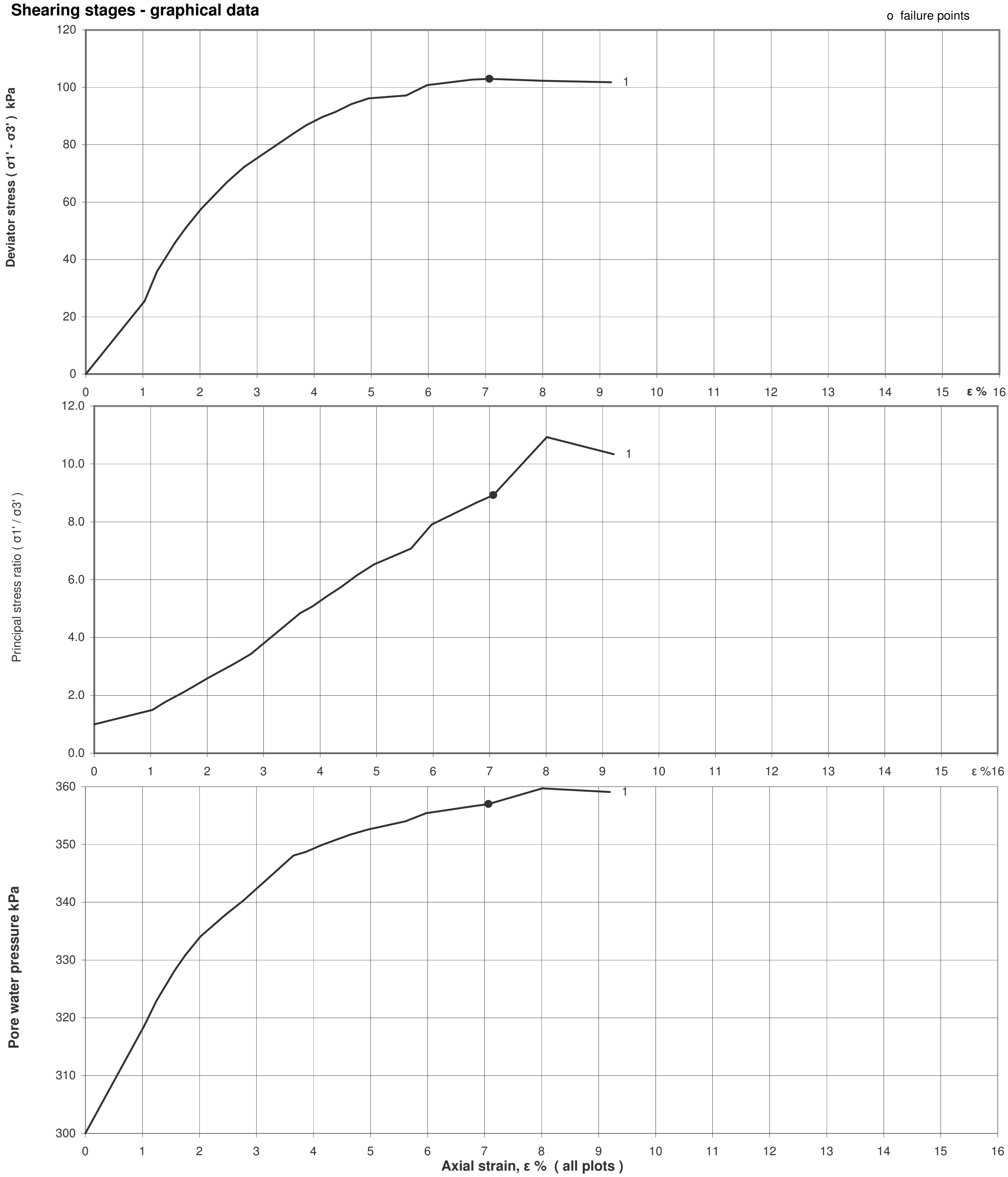
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:50	**Figure** **CU** sheet 1 of 3

UKAS TESTING 1157

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8-9.1		
			No	25	Type	P
			ID	TOP		
			Spec Ref			

Shearing stages - graphical data

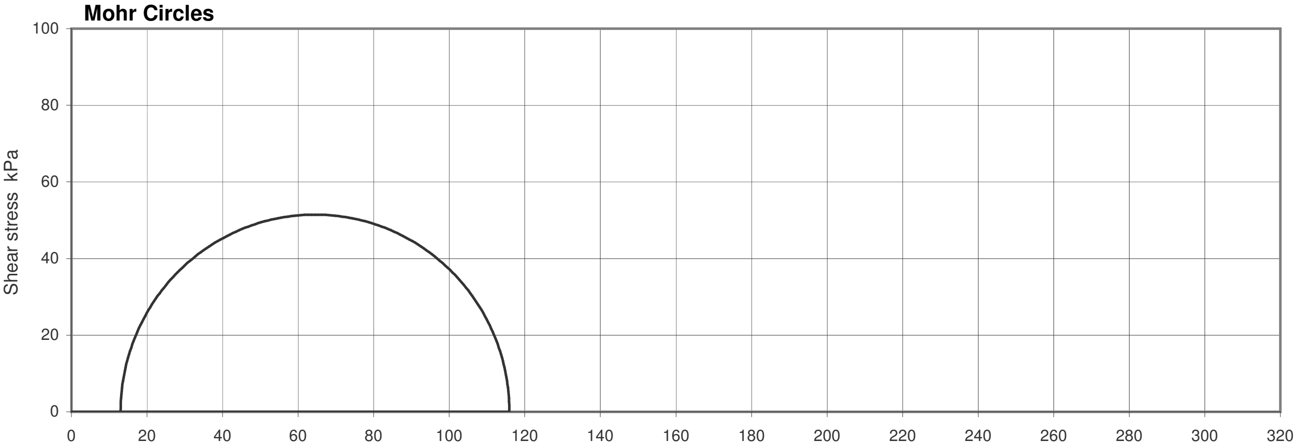


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:01/03/2016 10:50	**Figure** **CU** sheet 2 of 3

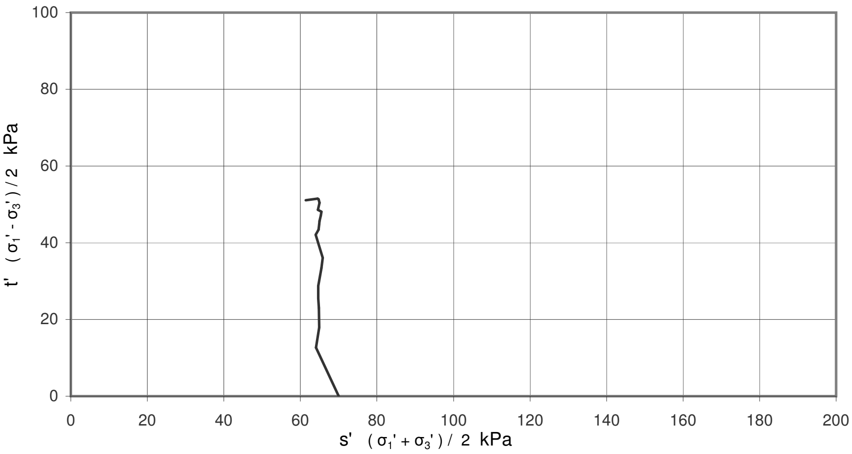
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8-9.1		
			No	25	Type	P
			ID	TOP		
			Spec Ref			

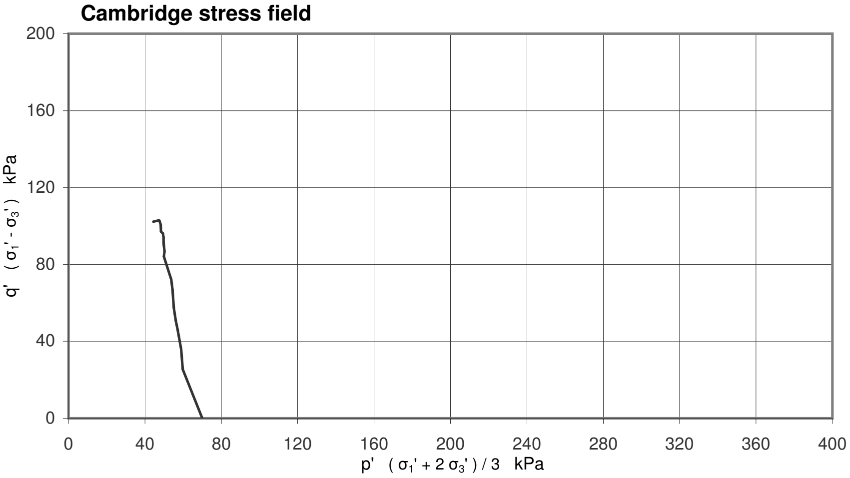
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	370			kPa
Initial pwp	300			kPa
Initial σ_3'	70			kPa
Rate of strain	0.38			%/hr

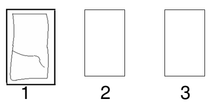
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	7.07			%
$(\sigma_1' / \sigma_3')_f$	8.917			
$(\sigma_1' - \sigma_3')_f$	102.9			kPa
u_f	357			kPa
$\sigma_3'_f$	13			kPa
$\sigma_1'_f$	116			kPa
A_f	0.55			
Time to failure	18.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.504 mm thick rubber membrane(s)

Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:50	**Figure** CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

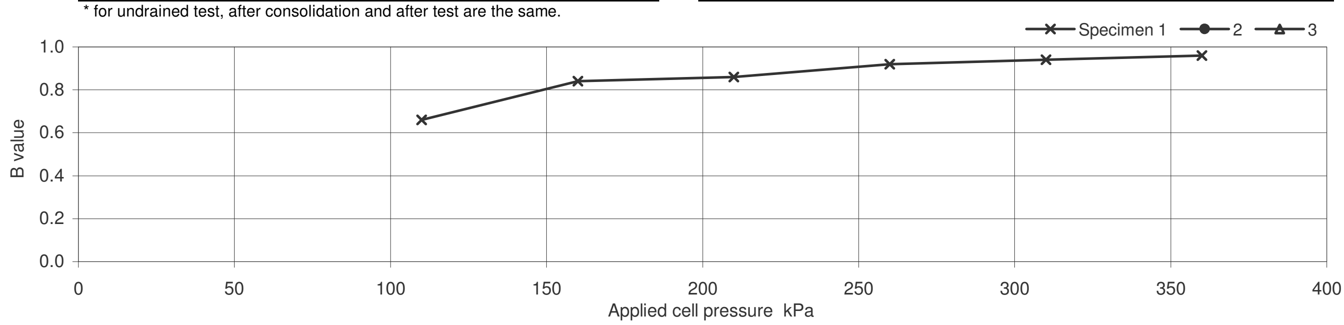
Project No	A5085-15	Sample Details:	Hole No	BH406			
Project Name	A63 CASTLE STREET		Depth (m BGL)	14-14.45			
			No	45	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	203.90		
	Diameter	mm	104.68		
	Bulk Density	Mg/m³	2.22		
	Water Content	%	13		
	Dry density	Mg/m³	1.96		
After consolidation	Length	mm	203.49		
	Diameter	mm	104.48		
	Bulk Density*	Mg/m³	2.22		
	Water Content*	%	13		
	Dry density*	Mg/m³	1.97		

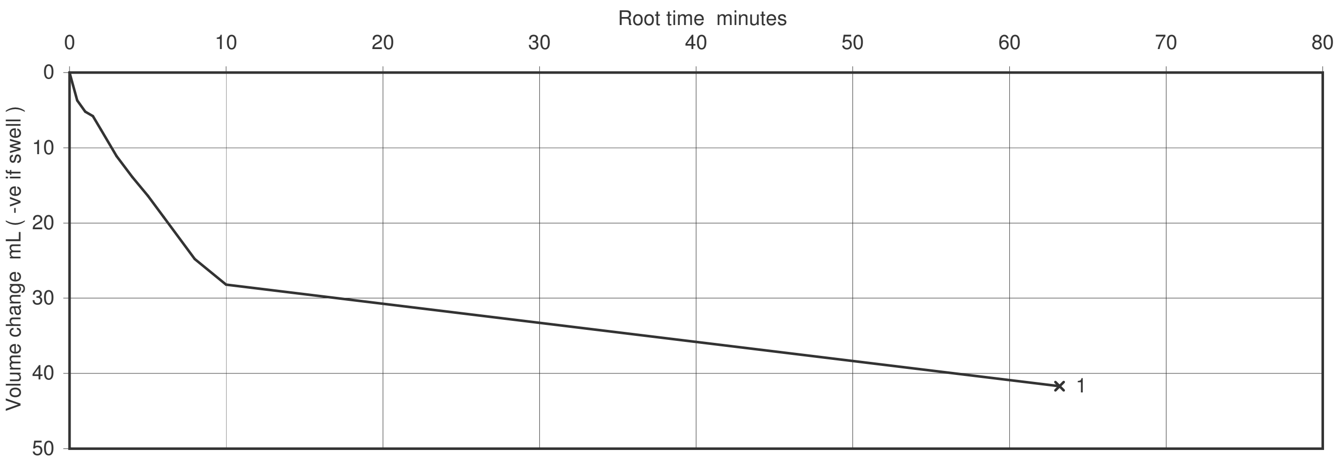
* for undrained test, after consolidation and after test are the same.

Soil Description	Firm to stiff brown slightly sandy slightly gravelly CLAY.Gravel FMC
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	360		
Final pore water pressure	kPa	342		
Final B Value		0.96		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		445			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		145			kPa
	Pore pressure at start of consolidation		430			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.27			m^2/year
	Coefficient of Compressibility	M_{vi}	0.18			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	7.1E-11			m/s

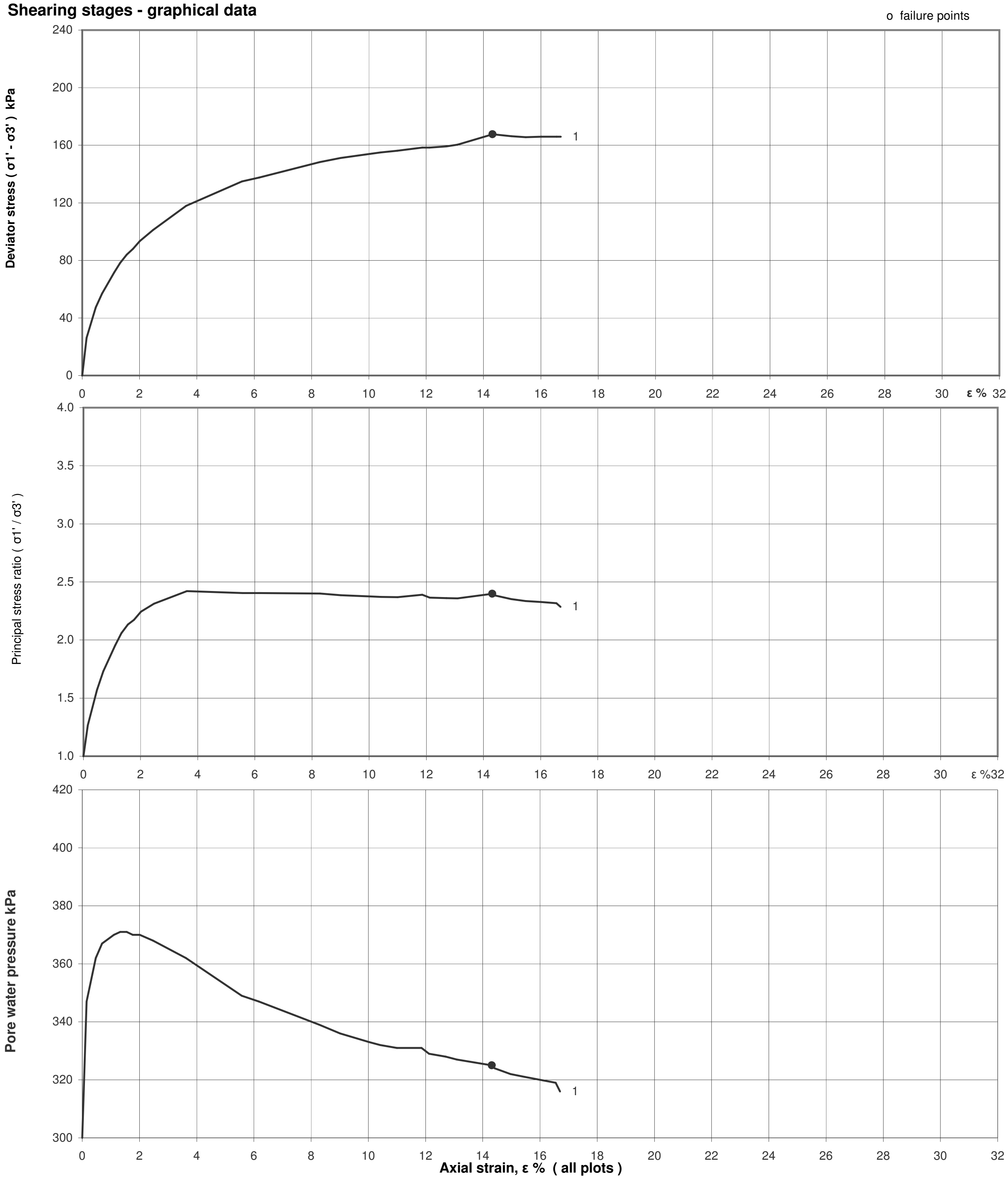


Ref SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:04	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14-14.45		
			No	45	Type	UT
			ID			
			Spec Ref			

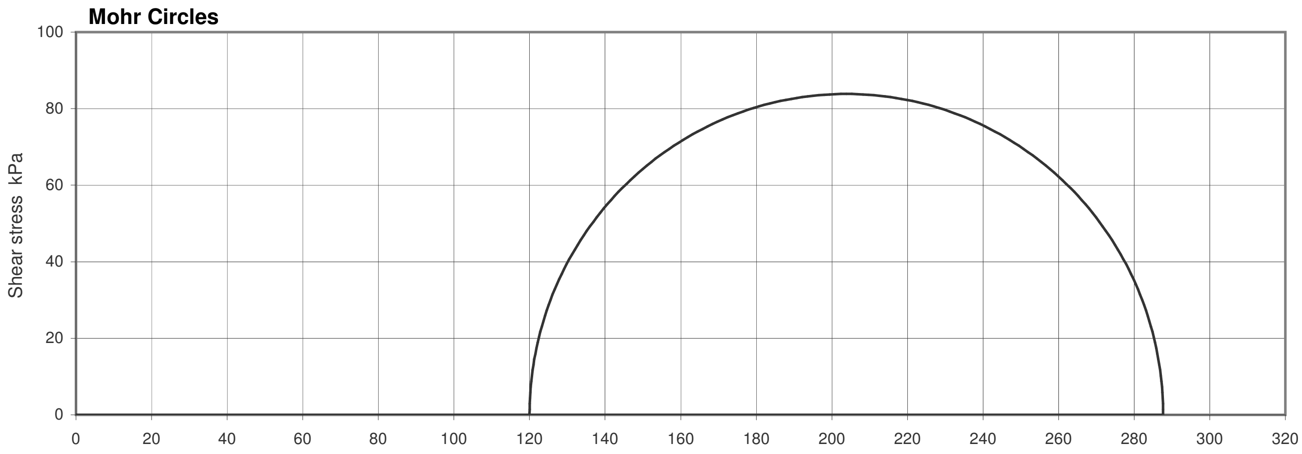
Shearing stages - graphical data

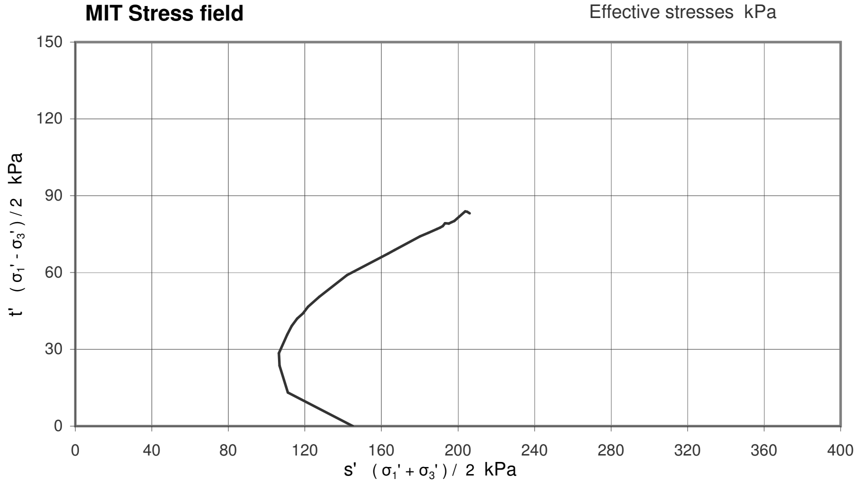


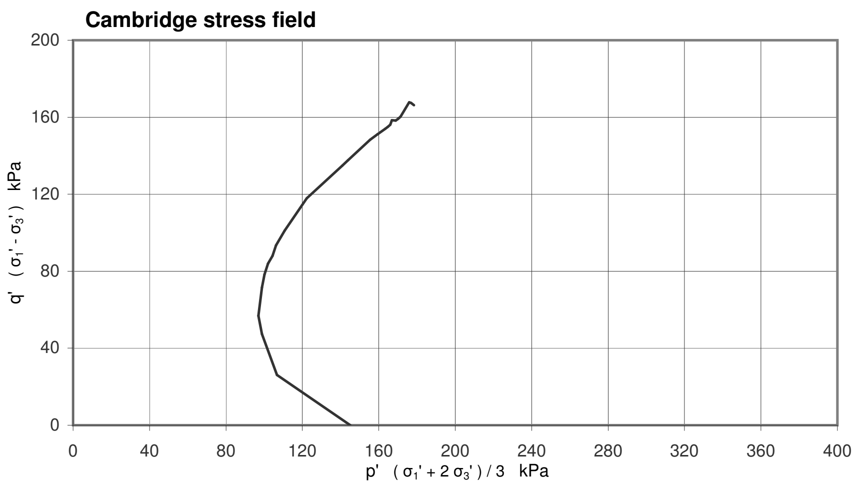
Ref SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:04	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406			
Project Name	A63 CASTLE STREET		Depth (m BGL)	14-14.45			
			No	45	Type	UT	
			ID				
			Spec Ref				







Compression stages

Specimen	1	2	3	
Cell pressure	445			kPa
Initial pwp	300			kPa
Initial σ_3'	145			kPa
Rate of strain	0.89			%/hr

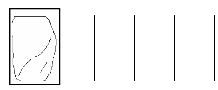
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	14.31			%
$(\sigma_1' / \sigma_3')_f$	2.397			
$(\sigma_1' - \sigma_3')_f$	167.7			kPa
u_f	325			kPa
$\sigma_3'{}_f$	120			kPa
$\sigma_1'{}_f$	288			kPa
A_f	0.15			
Time to failure	16.1			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.54 mm thick rubber membrane(s)

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

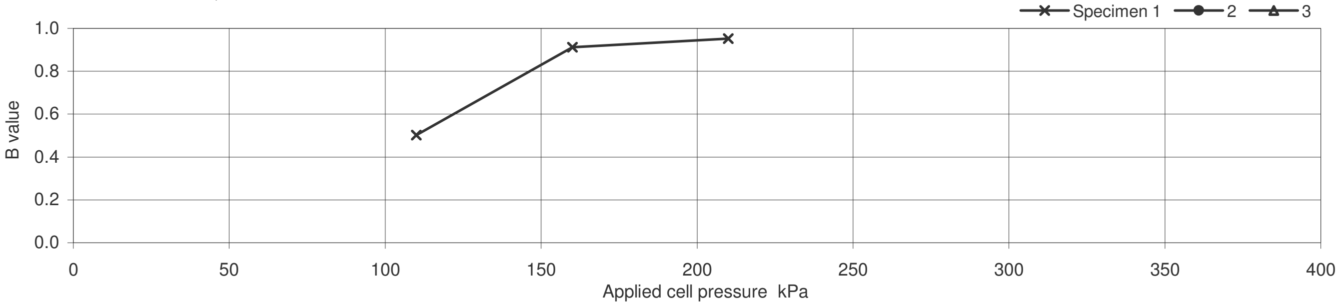
Project No	A5085-15	Sample Details:	Hole No	BH406			
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.00 - 16.45			
			No	53	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	203.30		
	Diameter	mm	102.98		
	Bulk Density	Mg/m³	2.07		
	Water Content	%	23		
	Dry density	Mg/m³	1.69		
After consolidation	Length	mm	203.99		
	Diameter	mm	103.33		
	Bulk Density*	Mg/m³	2.06		
	Water Content*	%	23		
	Dry density*	Mg/m³	1.67		

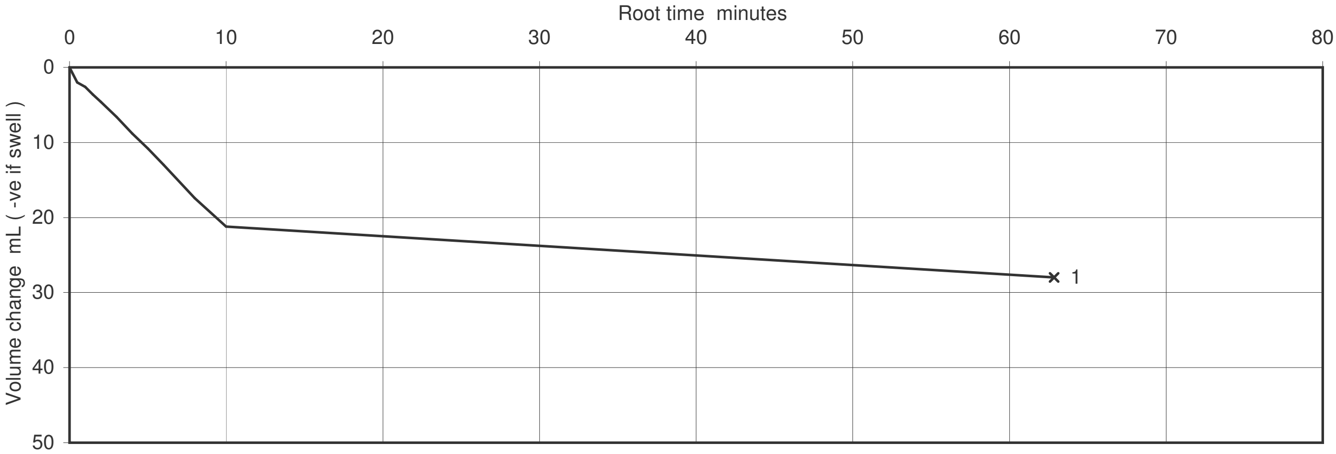
* for undrained test, after consolidation and after test are the same.

Soil Description	Stiff brown CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	199.8		
Final B Value		0.95		



Consolidation Details	Drainage Conditions		From radial boundary and one end				
	Specimen No.		1	2	3		
	Cell Pressure applied		370			kPa	
	Back Pressure applied		300			kPa	
	Effective Pressure		70			kPa	
	Pore pressure at start of consolidation		358			kPa	
	Pore pressure at end of consolidation		300			kPa	
	Pore pressure dissipation at end of consolidation		100			%	
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.30			m^2/year	
	Coefficient of Compressibility	M_{vi}	0.28			m^2/MN	
	Coefficient of Permeability (calculated)	k_{vi}	1.1E-10			m/s	

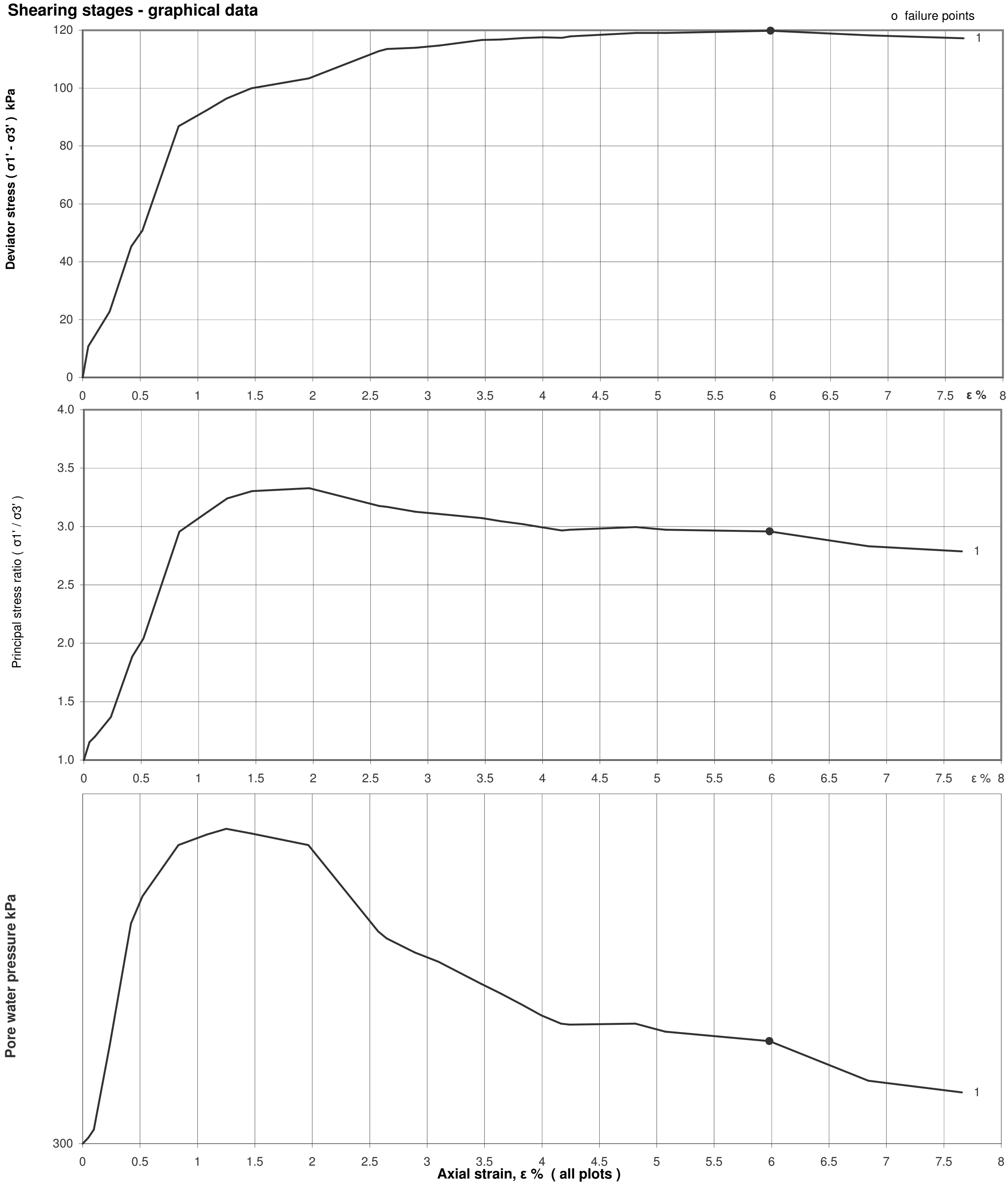


Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:06	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.00 - 16.45		
			No	53	Type	UT
			ID			
			Spec Ref			

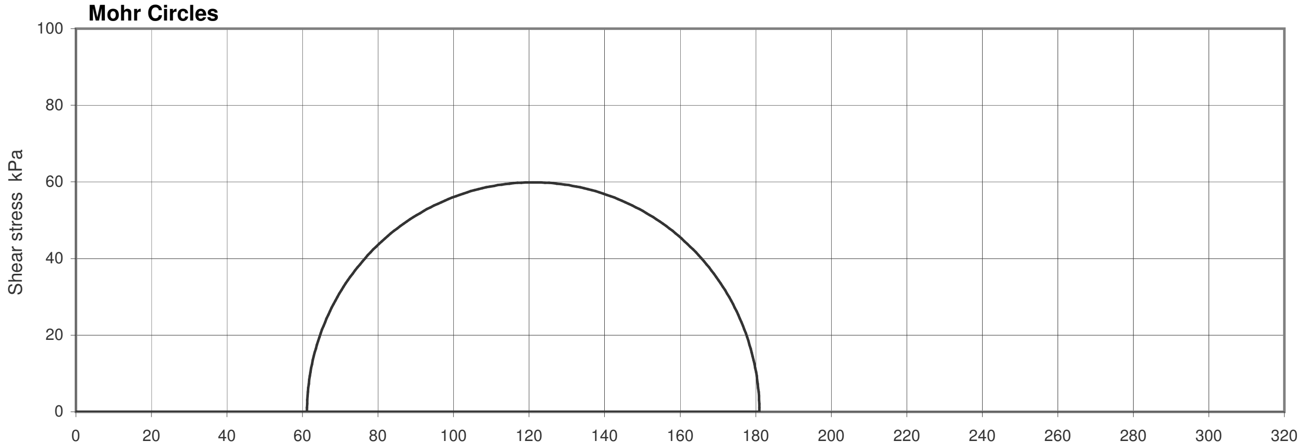
Shearing stages - graphical data

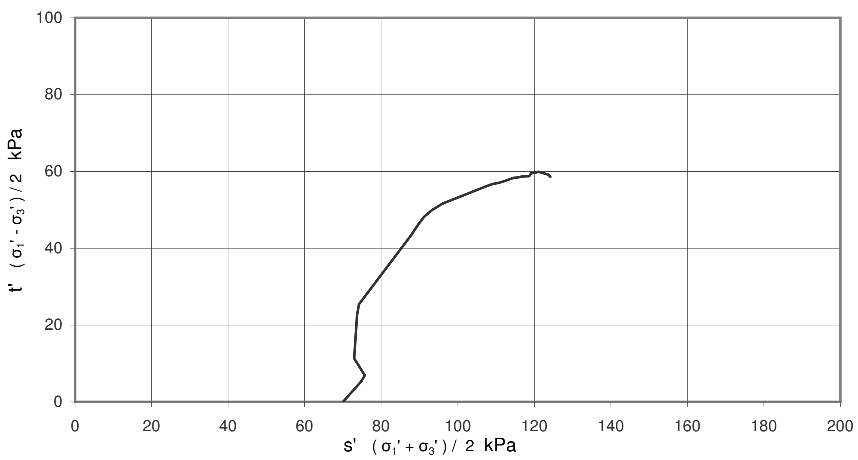


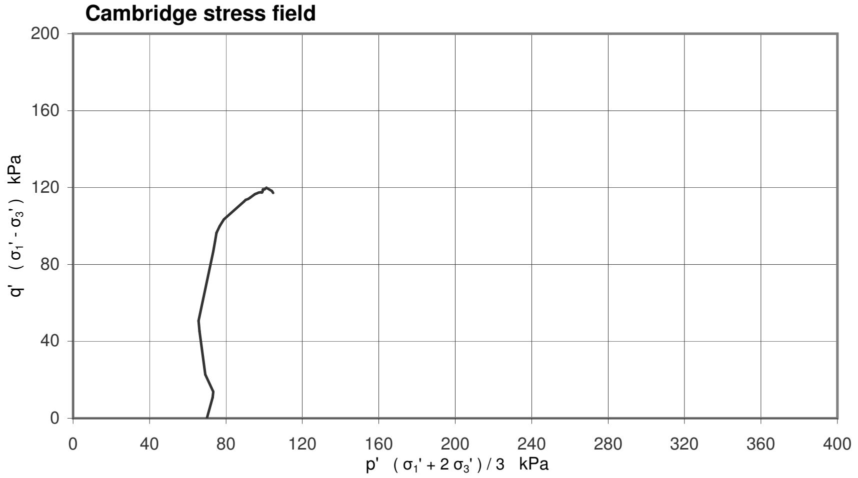
Ref SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:06	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.00 - 16.45		
			No	53	Type	UT
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	370			kPa
Initial pwp	300			kPa
Initial σ_3'	70			kPa
Rate of strain	0.95			%/hr

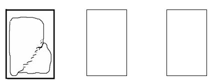
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	5.98			%
$(\sigma_1' / \sigma_3')_f$	2.957			
$(\sigma_1' - \sigma_3')_f$	119.8			kPa
u_f	309			kPa
$\sigma_3'{}_f$	61			kPa
$\sigma_1'{}_f$	181			kPa
A_f	0.07			
Time to failure	6.3			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.54 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:06	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

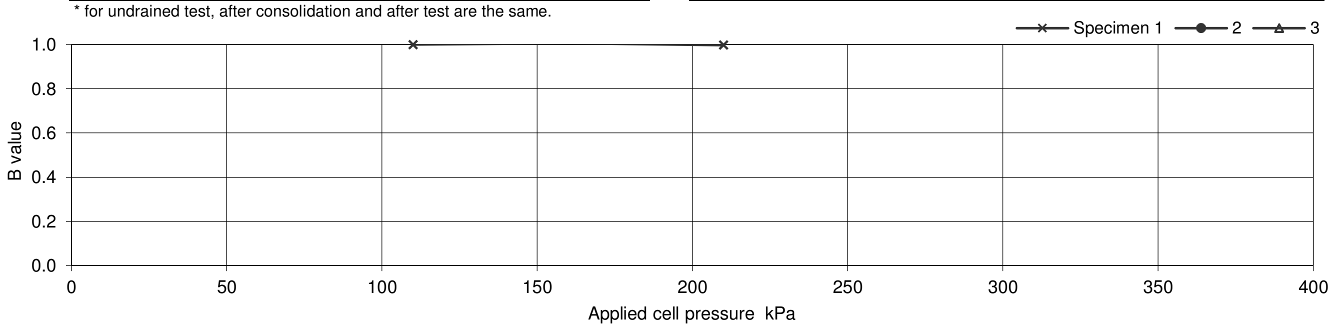
Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.10 - 3.55		
			No	9	Type	UT
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	199.83		
	Diameter	mm	103.86		
	Bulk Density	Mg/m³	1.90		
	Water Content	%	35		
	Dry density	Mg/m³	1.41		
After consolidation	Length	mm	195.71		
	Diameter	mm	101.69		
	Bulk Density*	Mg/m³	1.97		
	Water Content*	%	31		
	Dry density*	Mg/m³	1.50		

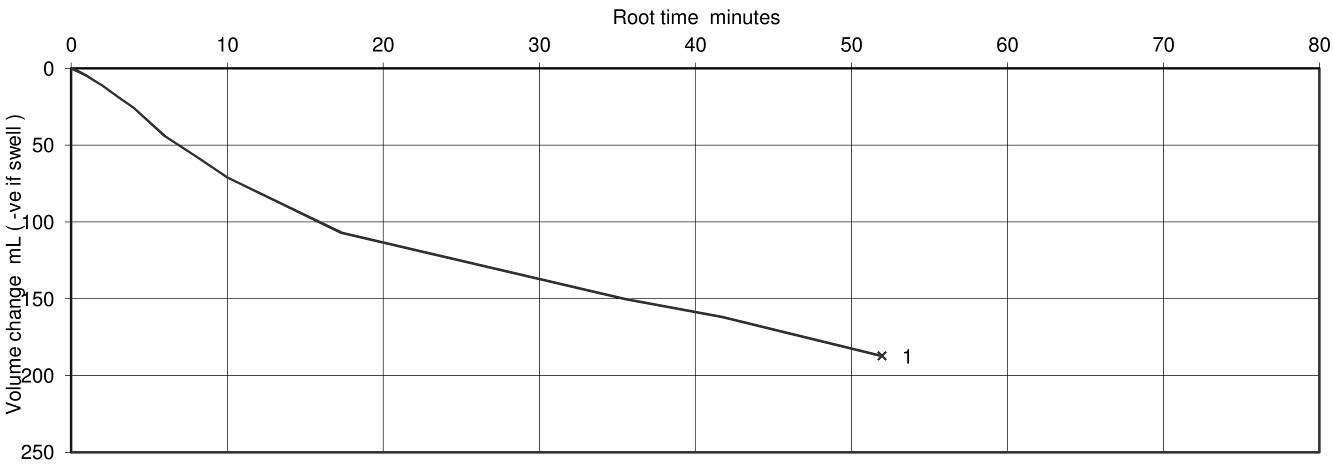
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft dark brown slightly sandy silty CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	204		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		350			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		50			kPa
	Pore pressure at start of consolidation		345			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.41			m^2/year
	Coefficient of Compressibility	M_{vi}	2.34			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	3.0E-10			m/s

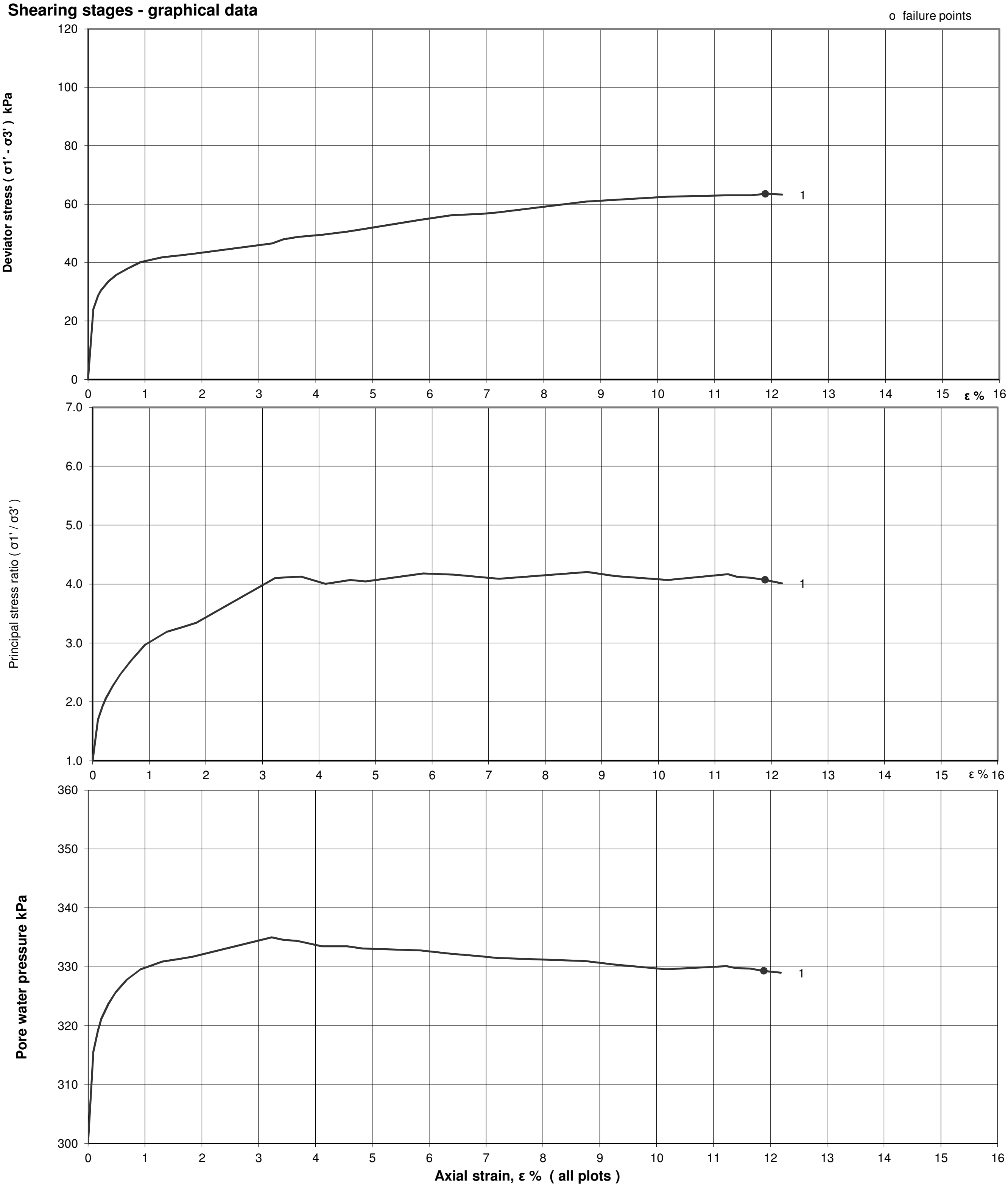


Ref			Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:05/04/2016 08:29	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.10 - 3.55		
			No	9	Type	UT
			ID			
			Spec Ref			

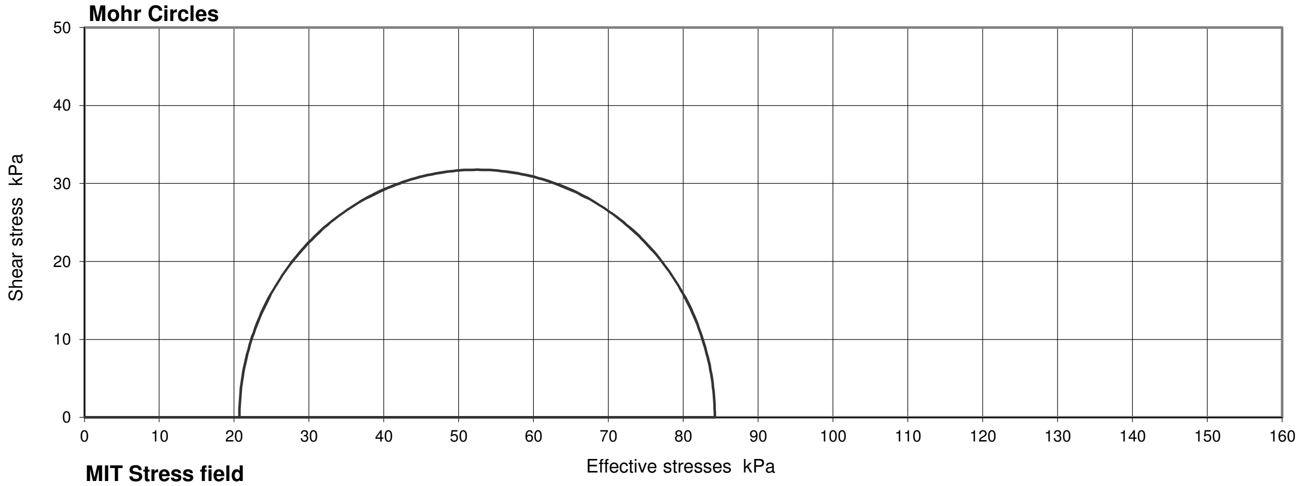
Shearing stages - graphical data

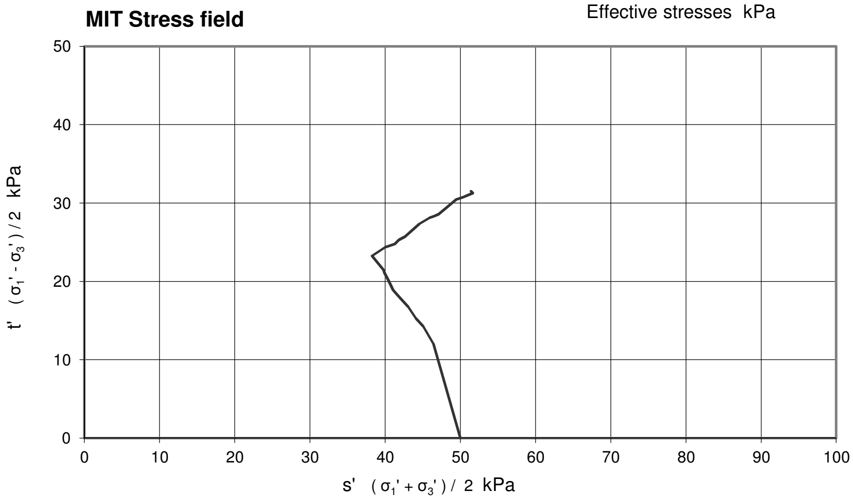


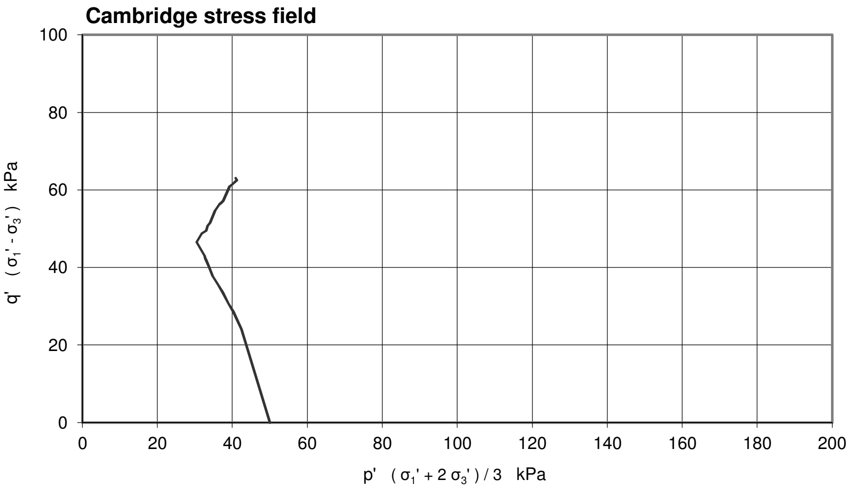
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:05/04/2016 08:29	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.10 - 3.55		
			No	9	Type	UT
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	350			kPa
Initial pwp	300			kPa
Initial σ_3'	50			kPa
Rate of strain	0.28			%/hr

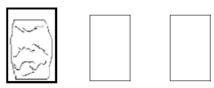
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	11.89			%
$(\sigma_1' / \sigma_3')_f$	4.069			
$(\sigma_1' - \sigma_3')_f$	63.5			kPa
u_f	329			kPa
$\sigma_3'_f$	21			kPa
$\sigma_1'_f$	84			kPa
A_f	0.46			
Time to failure	42.8			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.4 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:05/04/2016 08:29	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

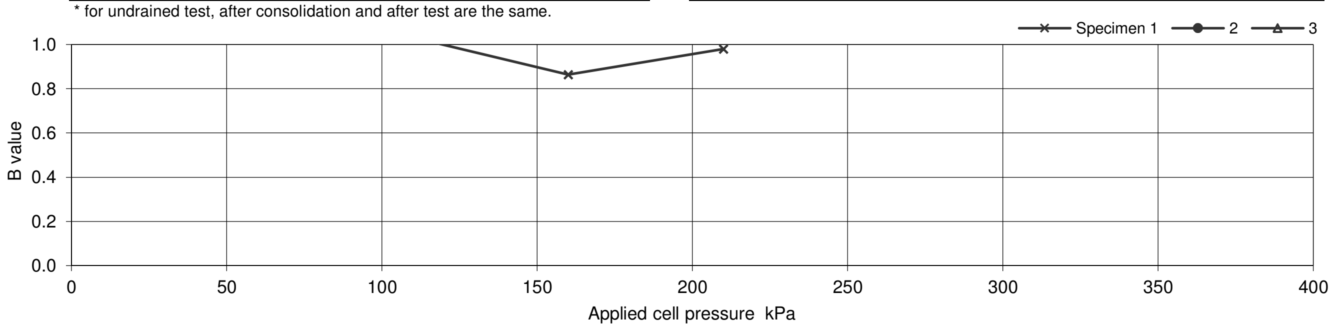
Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.05 - 7.05		
			No	15	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	191.58		
	Diameter	mm	96.50		
	Bulk Density	Mg/m³	1.84		
	Water Content	%	41		
	Dry density	Mg/m³	1.30		
After consolidation	Length	mm	189.13		
	Diameter	mm	95.25		
	Bulk Density*	Mg/m³	1.87		
	Water Content*	%	38		
	Dry density*	Mg/m³	1.35		

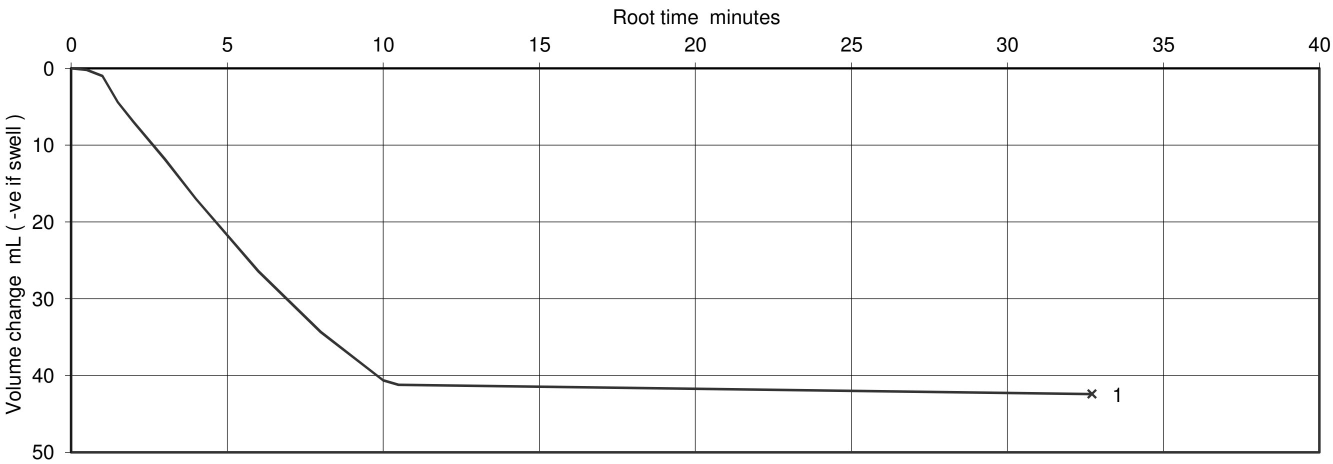
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown clayey SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	206.2		
Final B Value		0.98		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		360			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		60			kPa
	Pore pressure at start of consolidation		354			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.28			m^2/year
	Coefficient of Compressibility	M_{vi}	0.56			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.0E-10			m/s

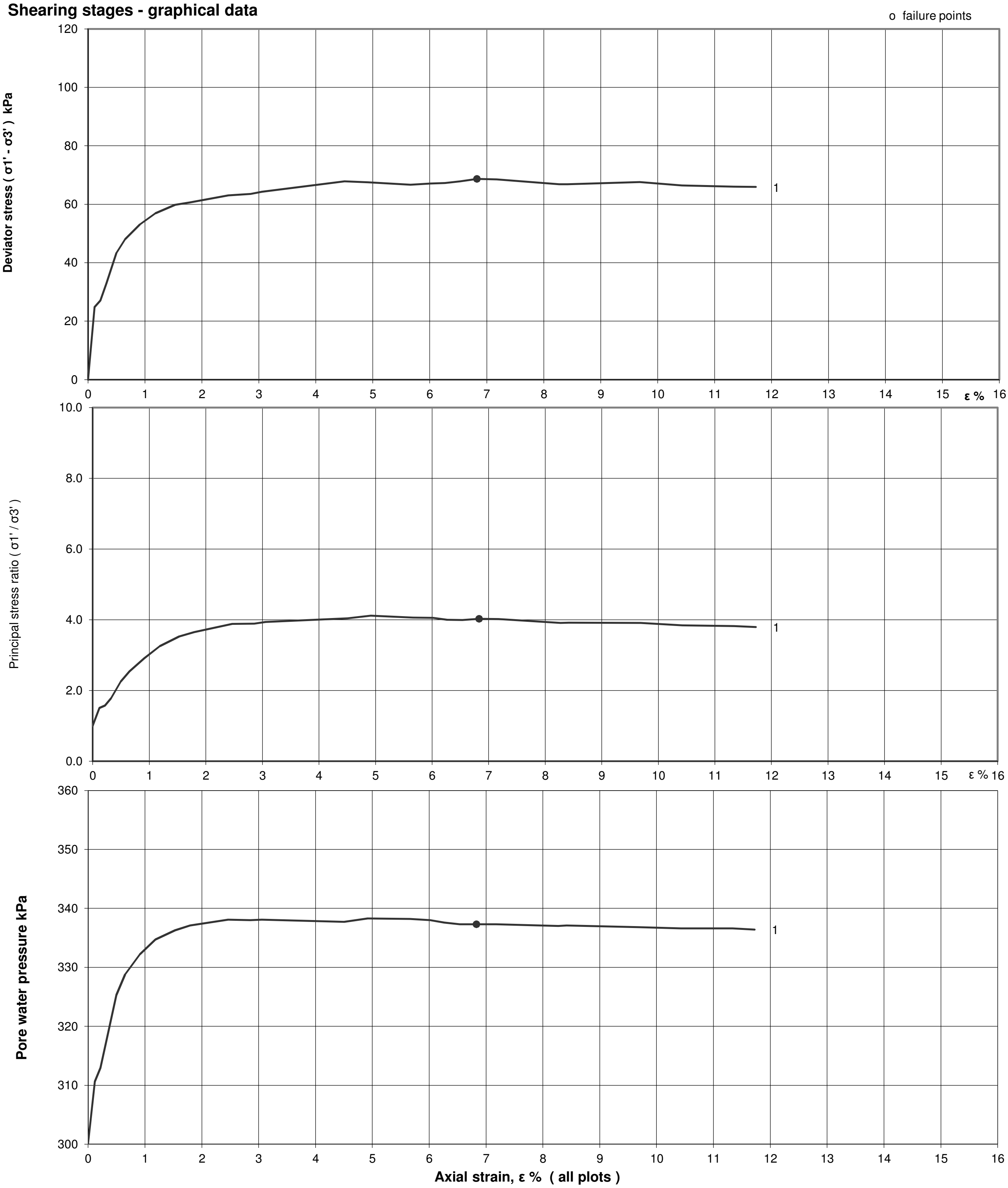


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:03/03/2016 09:44	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.05 - 7.05		
			No	15	Type	P
			ID			
			Spec Ref			

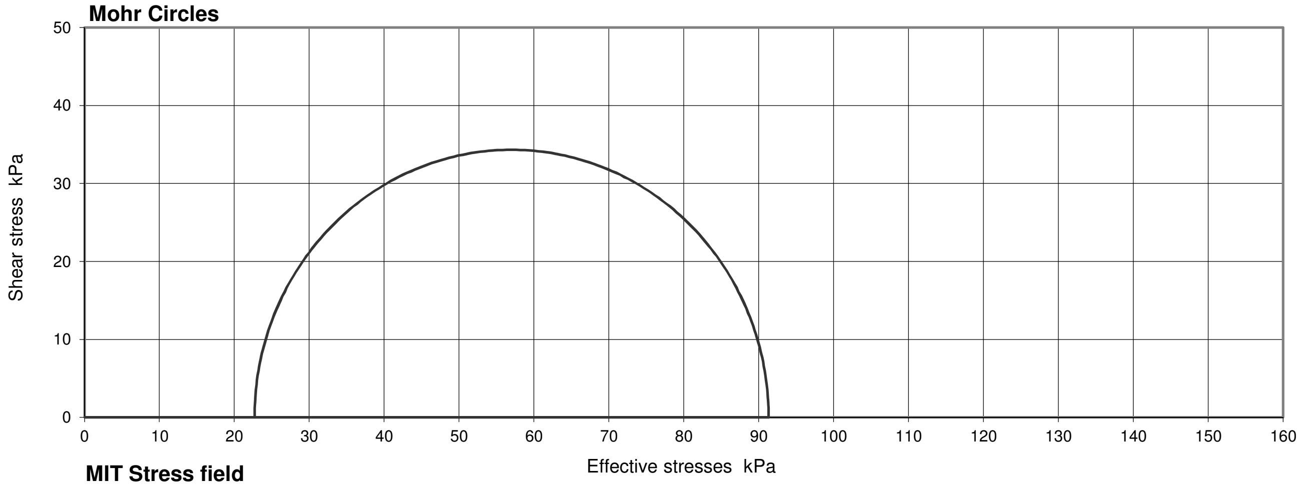
Shearing stages - graphical data

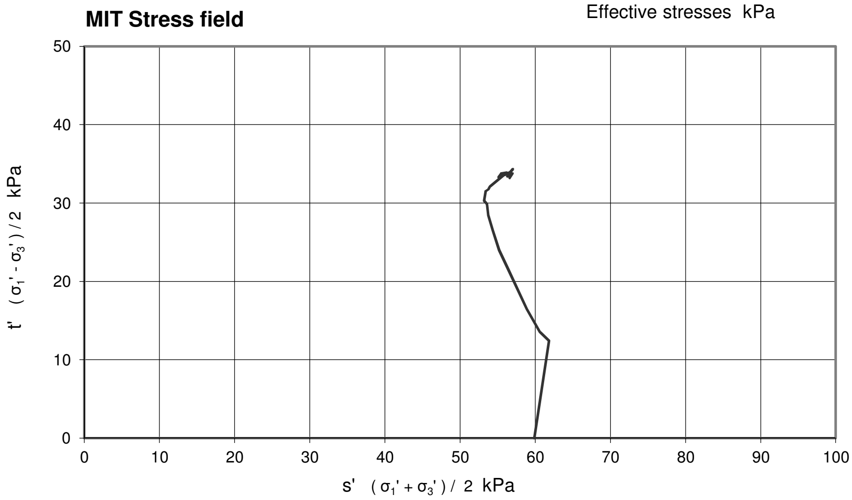


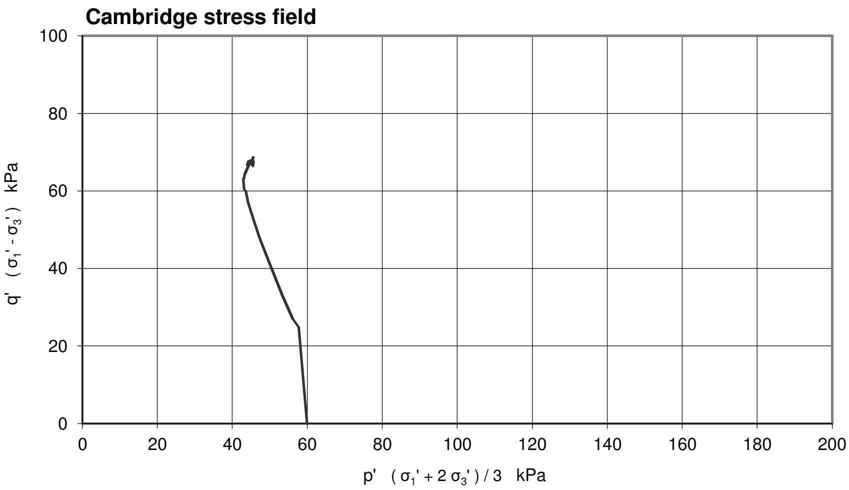
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:03/03/2016 09:44	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.05 - 7.05		
			No	15	Type	P
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	360			kPa
Initial pwp	300			kPa
Initial σ_3'	60			kPa
Rate of strain	2.00			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	6.83			%
$(\sigma_1' / \sigma_3')_f$	4.024			
$(\sigma_1' - \sigma_3')_f$	68.6			kPa
u_f	337			kPa
$\sigma_3'{}_f$	23			kPa
$\sigma_1'{}_f$	91			kPa
A_f	0.54			
Time to failure	3.4			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:03/03/2016 09:44	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

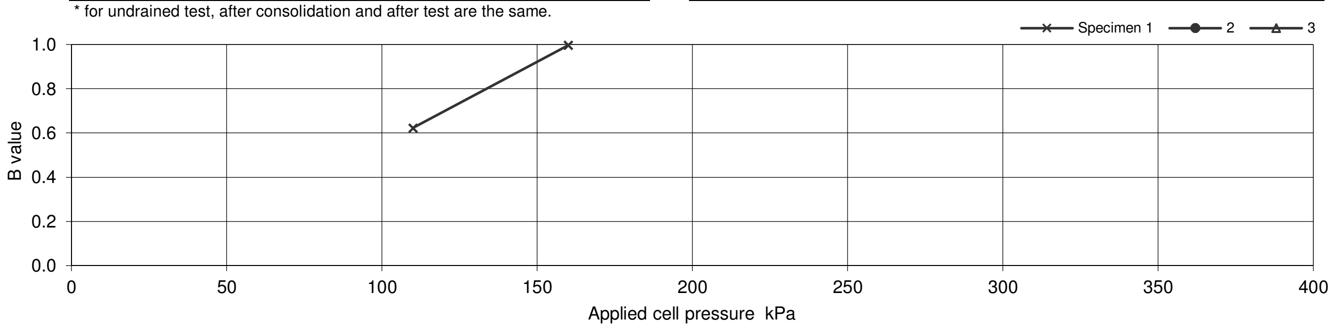
Project No	A5085-15	Sample Details:	Hole No		BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)		7.60 - 8.05		
			No	18	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	200.13		
	Diameter	mm	105.29		
	Bulk Density	Mg/m³	1.57		
	Water Content	%	53		
	Dry density	Mg/m³	1.03		
After consolidation	Length	mm	189.91		
	Diameter	mm	99.77		
	Bulk Density*	Mg/m³	1.74		
	Water Content*	%	45		
	Dry density*	Mg/m³	1.20		

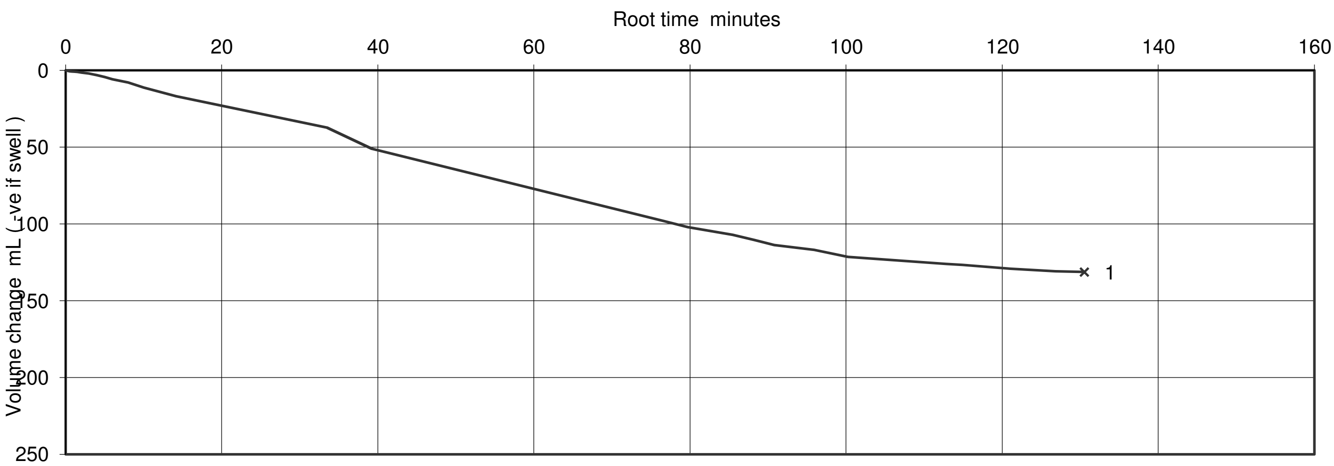
* for undrained test, after consolidation and after test are the same.

Soil Description	Very soft organic CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	160		
Final pore water pressure	kPa	150.7		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		376			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		76			kPa
	Pore pressure at start of consolidation		367			kPa
	Pore pressure at end of consolidation		302			kPa
	Pore pressure dissipation at end of consolidation		97			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.02			m^2/year
	Coefficient of Compressibility	M_{vi}	1.26			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	9.6E-12			m/s

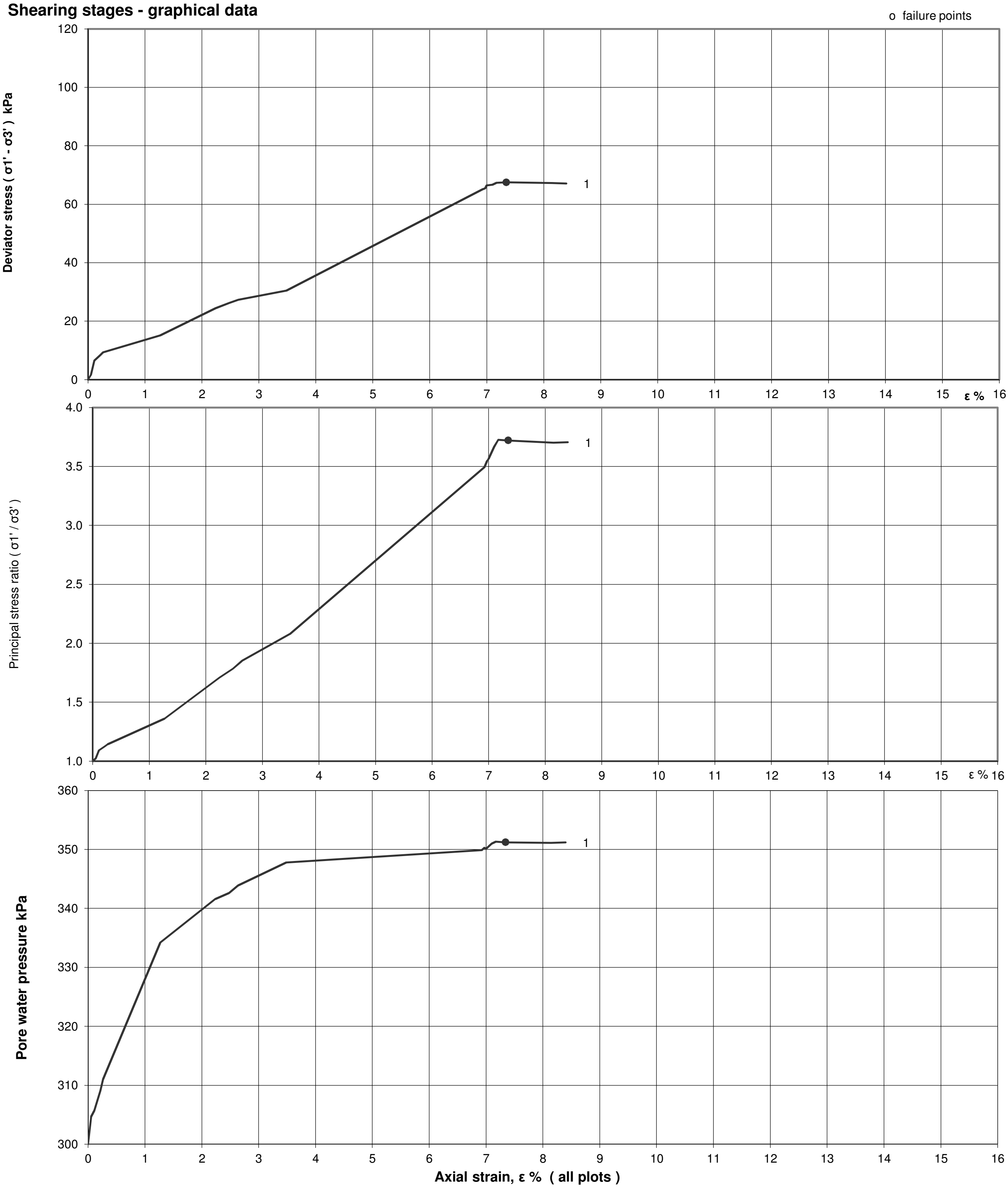


Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:18/03/2016 10:05	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.60 - 8.05		
			No	18	Type	UT
			ID			
			Spec Ref			

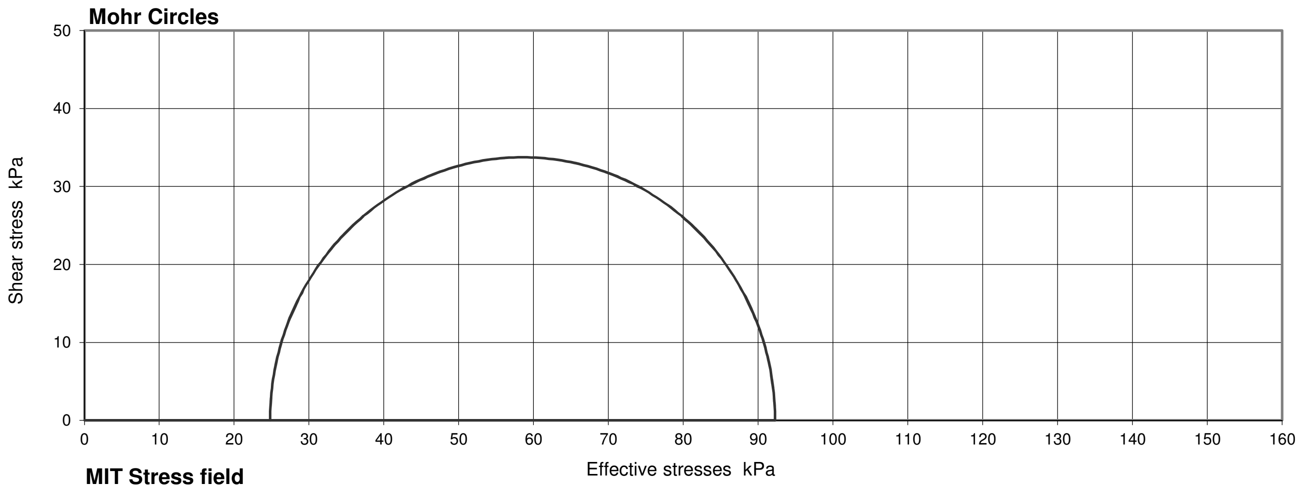
Shearing stages - graphical data

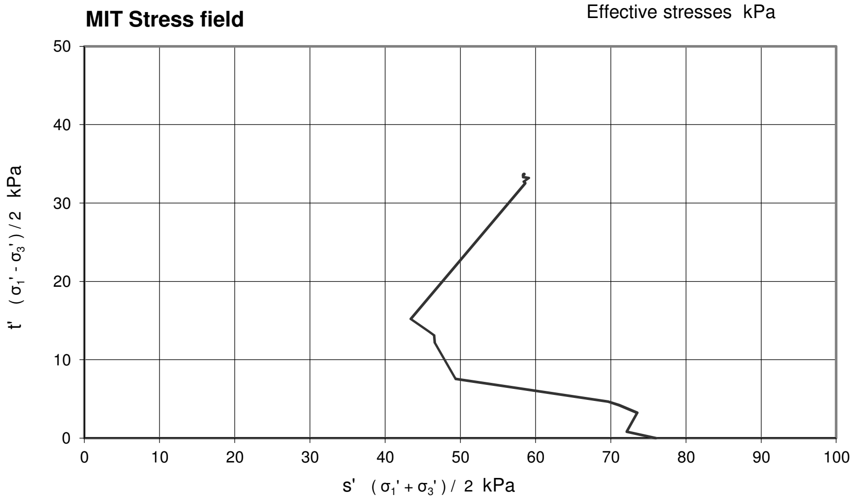


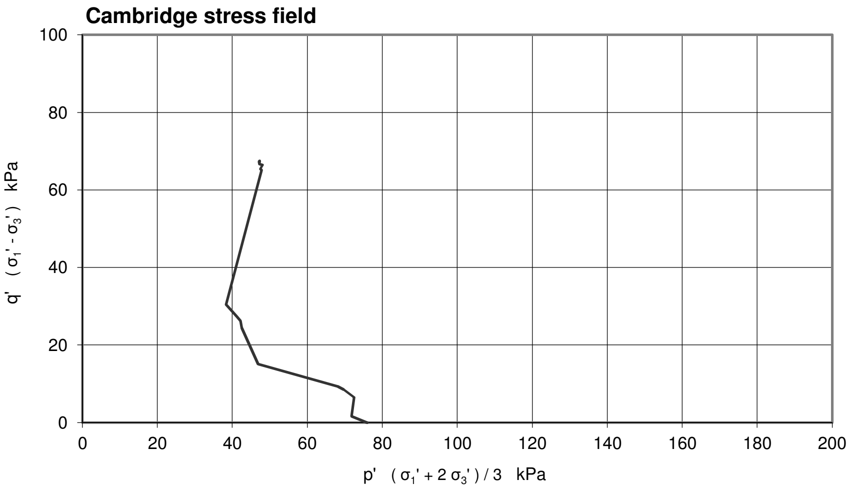
Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:18/03/2016 10:05	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.60 - 8.05		
			No	18	Type	UT
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	376			kPa
Initial pwp	300			kPa
Initial σ_3'	76			kPa
Rate of strain	0.05			%/hr

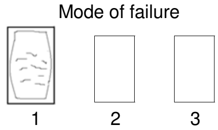
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	7.35			%
$(\sigma_1' / \sigma_3')_f$	3.721			
$(\sigma_1' - \sigma_3')_f$	67.5			kPa
u_f	351			kPa
$\sigma_3'_f$	25			kPa
$\sigma_1'_f$	92			kPa
A_f	0.76			
Time to failure	139.9			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:05	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

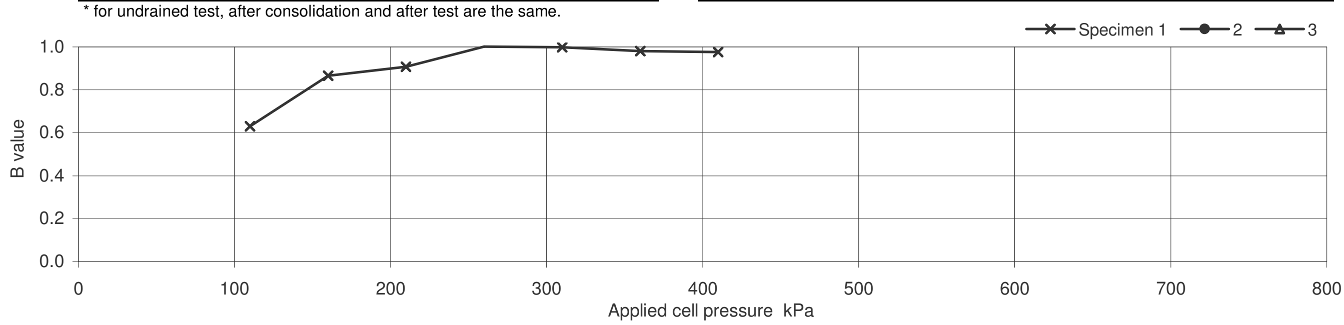
Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00		
			No	22	Type	P
			ID	BASE		
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	204.09		
	Diameter	mm	99.37		
	Bulk Density	Mg/m³	1.44		
	Water Content	%	80		
	Dry density	Mg/m³	0.80		
After consolidation	Length	mm	199.17		
	Diameter	mm	96.95		
	Bulk Density*	Mg/m³	1.53		
	Water Content*	%	79		
	Dry density*	Mg/m³	0.86		

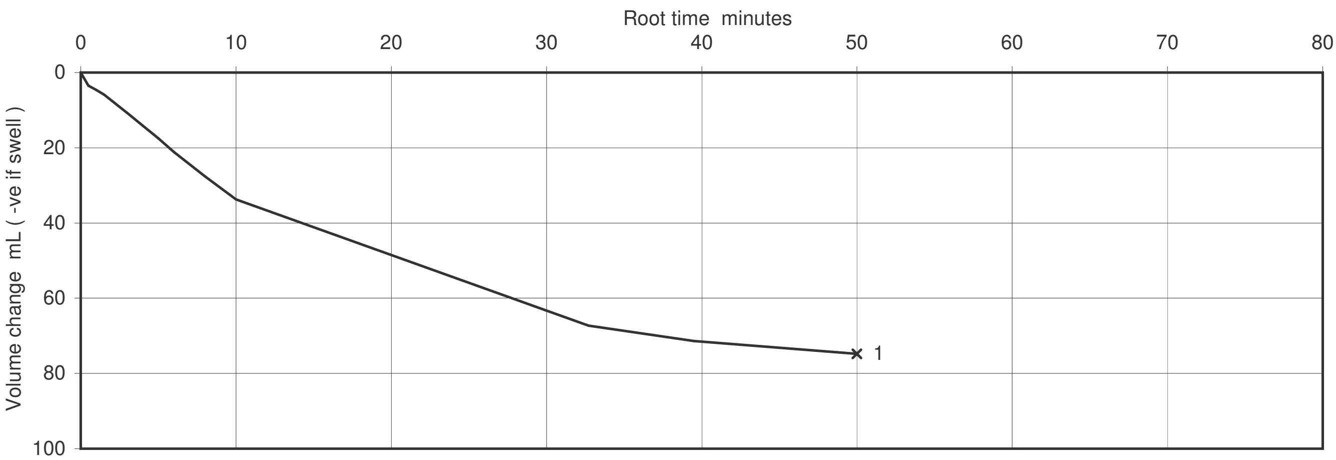
* for undrained test, after consolidation and after test are the same.

Soil Description	Firm dark brown silty CLAY. Contains frequent large wood fragments
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	410		
Final pore water pressure	kPa	396.1		
Final B Value		0.98		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		448			kPa
	Back Pressure applied		350			kPa
	Effective Pressure		98			kPa
	Pore pressure at start of consolidation		433			kPa
	Pore pressure at end of consolidation		352			kPa
	Pore pressure dissipation at end of consolidation		97			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.39			m^2/year
	Coefficient of Compressibility	M_{vi}	0.60			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	7.3E-11			m/s

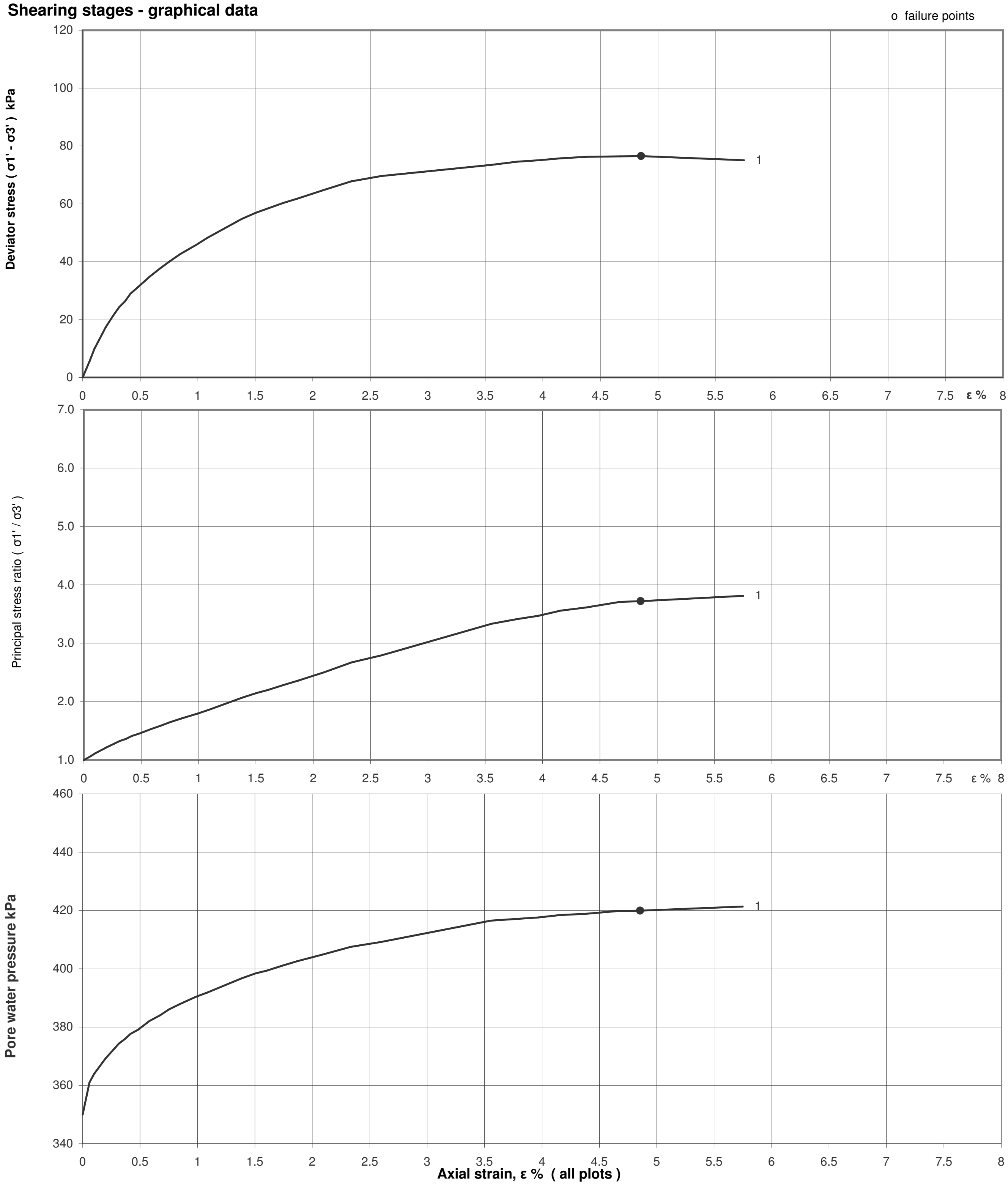


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:56	**Figure** CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00		
			No	22	Type	P
			ID	BASE		
			Spec Ref			

Shearing stages - graphical data

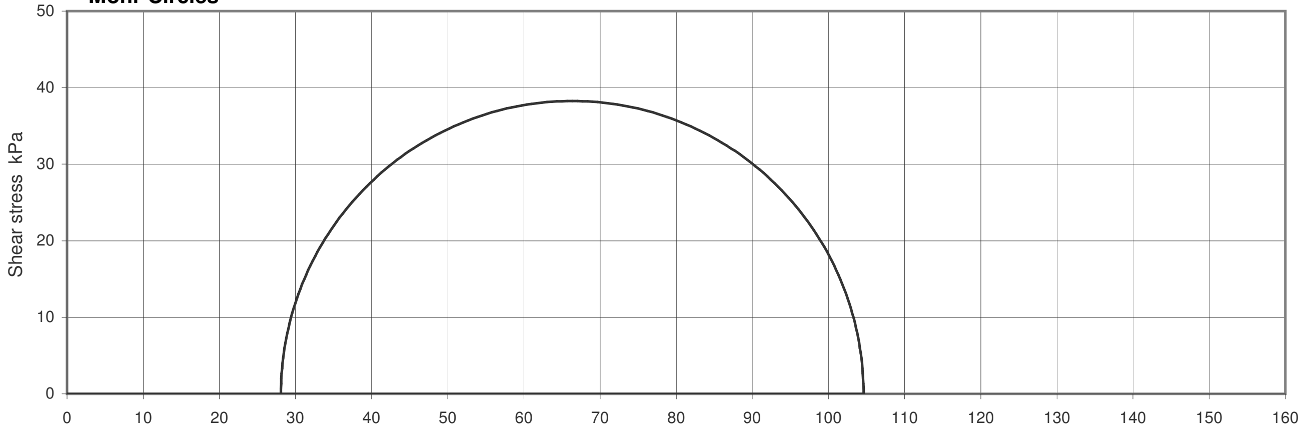


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:56	**Figure** **CU** sheet 2 of 3

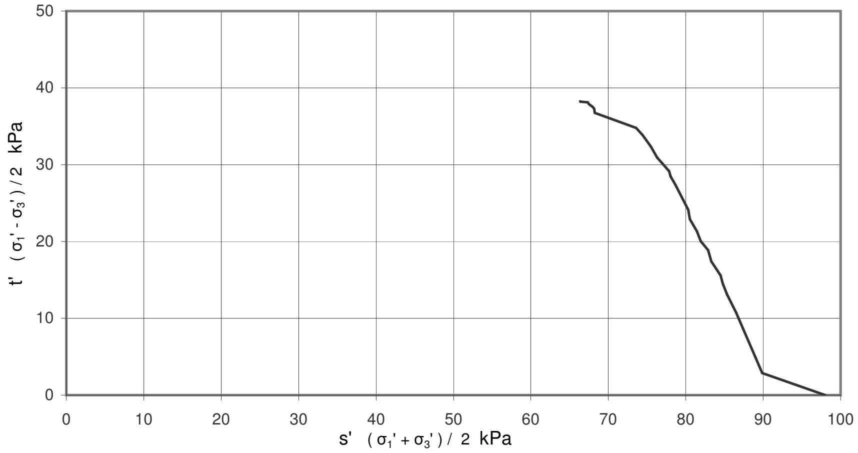
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00		
			No	22	Type	P
			ID	BASE		
			Spec Ref			

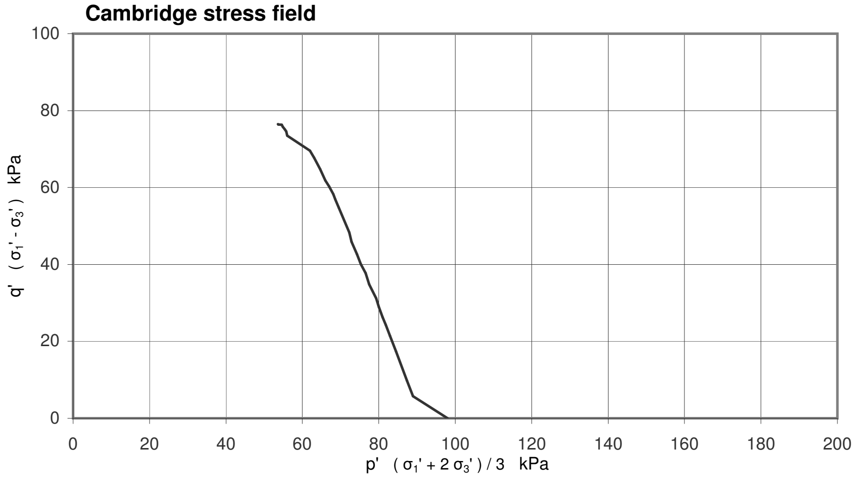
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	448			kPa
Initial pwp	350			kPa
Initial σ_3'	98			kPa
Rate of strain	0.34			%/hr

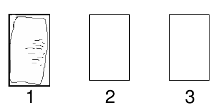
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	4.86			%
$(\sigma_1'/\sigma_3')_f$	3.723			
$(\sigma_1' - \sigma_3')_f$	76.5			kPa
u_f	420			kPa
$\sigma_3'{}_f$	28			kPa
$\sigma_1'{}_f$	105			kPa
A_f	0.91			
Time to failure	14.3			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.57 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:56	**CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

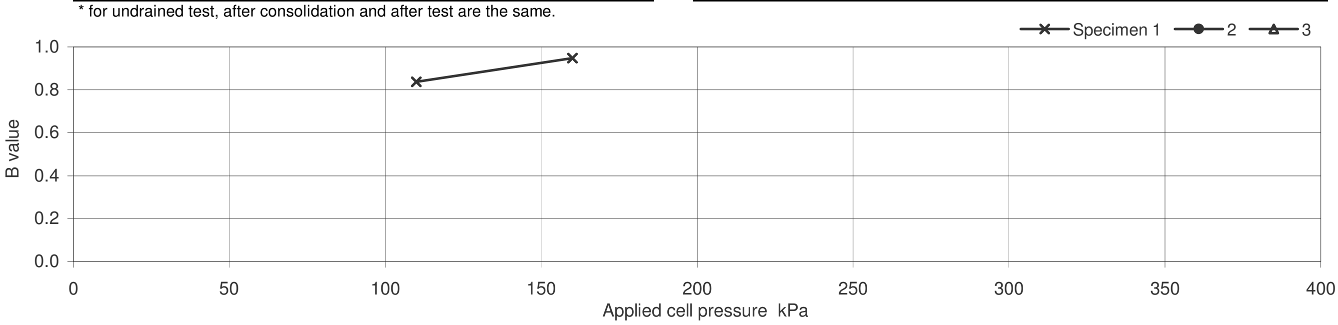
Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00			
			No	22	Type	P	
			ID	TOP			
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	192.65		
	Diameter	mm	97.23		
	Bulk Density	Mg/m³	1.54		
	Water Content	%	77		
	Dry density	Mg/m³	0.87		
After consolidation	Length	mm	192.09		
	Diameter	mm	96.95		
	Bulk Density*	Mg/m³	1.55		
	Water Content*	%	76		
	Dry density*	Mg/m³	0.88		

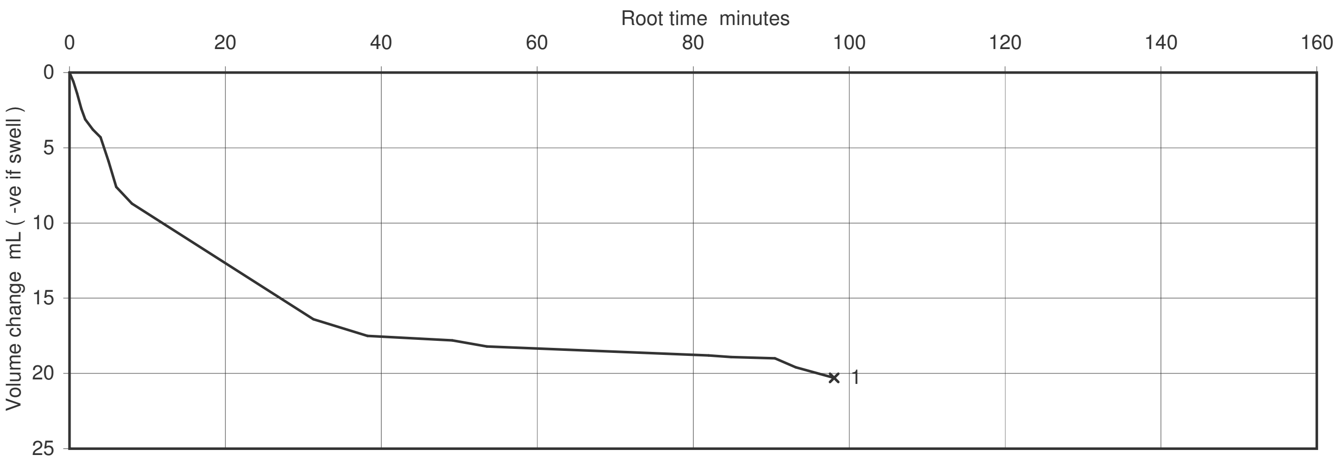
* for undrained test, after consolidation and after test are the same.

Soil Description	Firm dark brown peaty organic CLAY. Contains frequent wood fragments.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	160		
Final pore water pressure	kPa	146.1		
Final B Value		0.95		



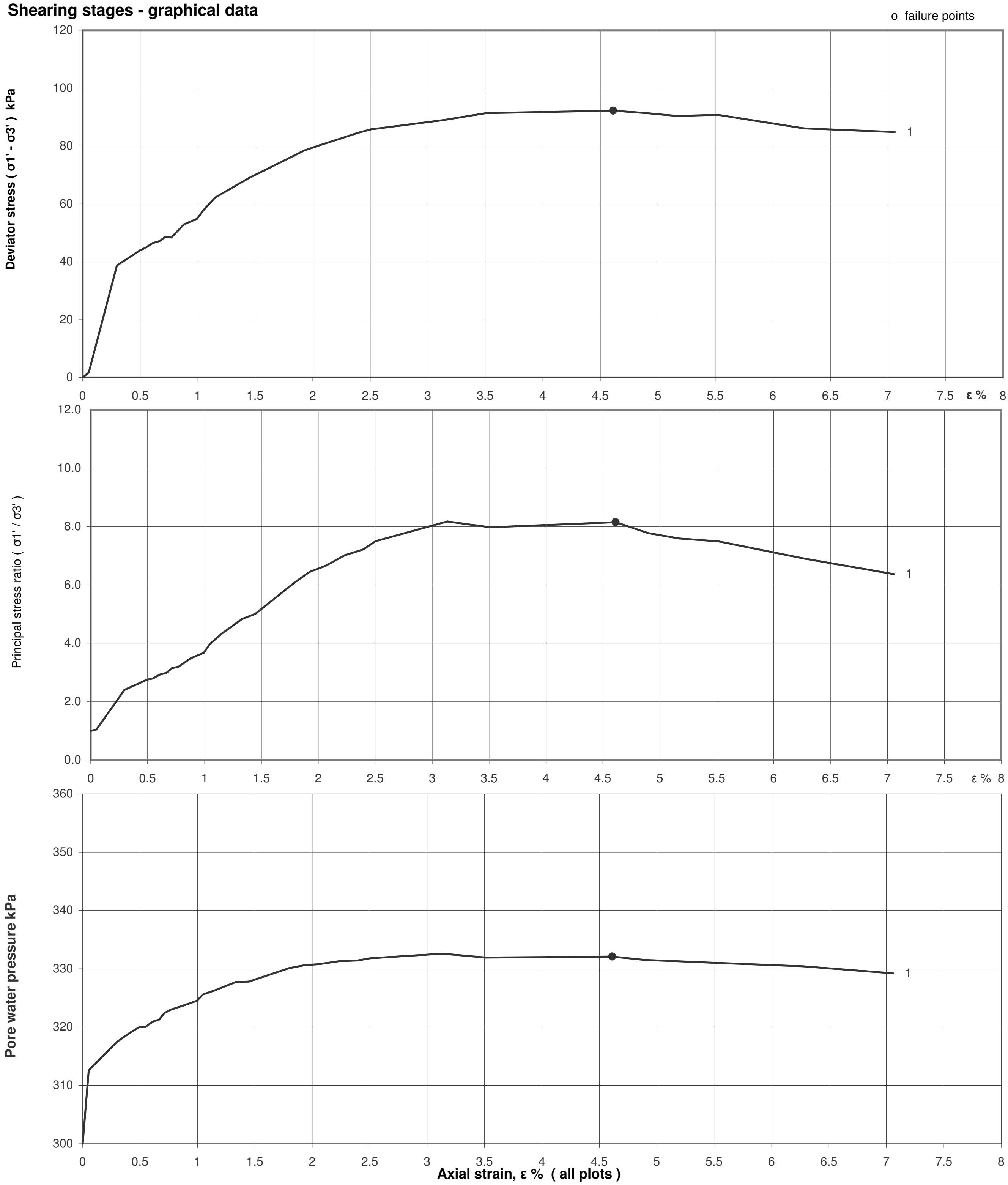
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		345			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		45			kPa
	Pore pressure at start of consolidation		328			kPa
	Pore pressure at end of consolidation		301			kPa
	Pore pressure dissipation at end of consolidation		95			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.72			m²/year
	Coefficient of Compressibility	M_{vi}	0.53			m²/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.2E-10			m/s



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00		
			No	22	Type	P
			ID	TOP		
			Spec Ref			

Shearing stages - graphical data

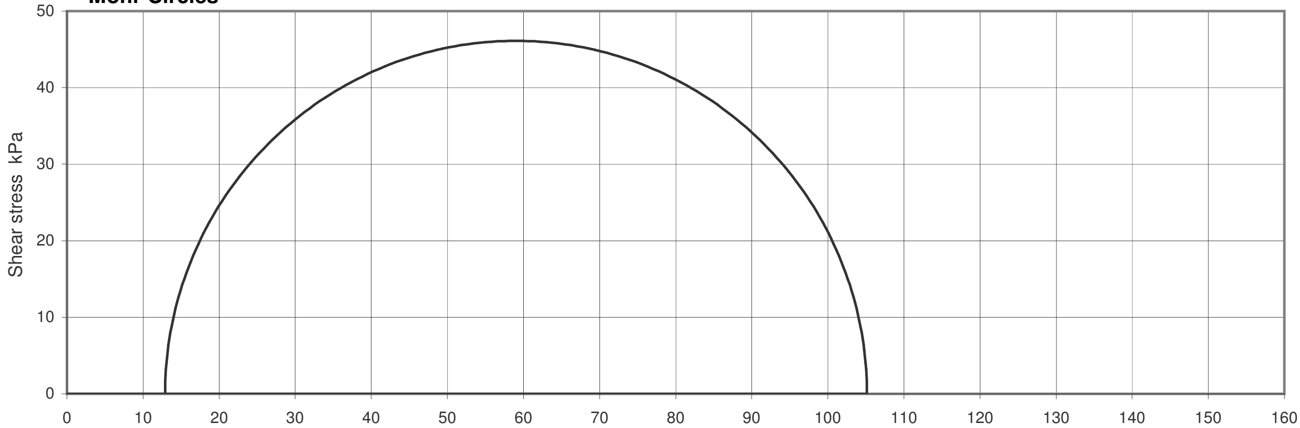


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:57	**Figure** **CU** sheet 2 of 3

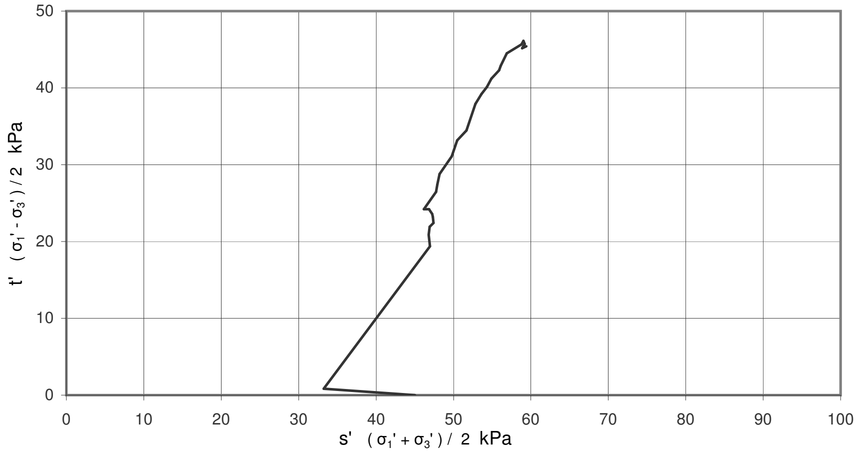
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00-10.00		
			No	22	Type	P
			ID	TOP		
			Spec Ref			

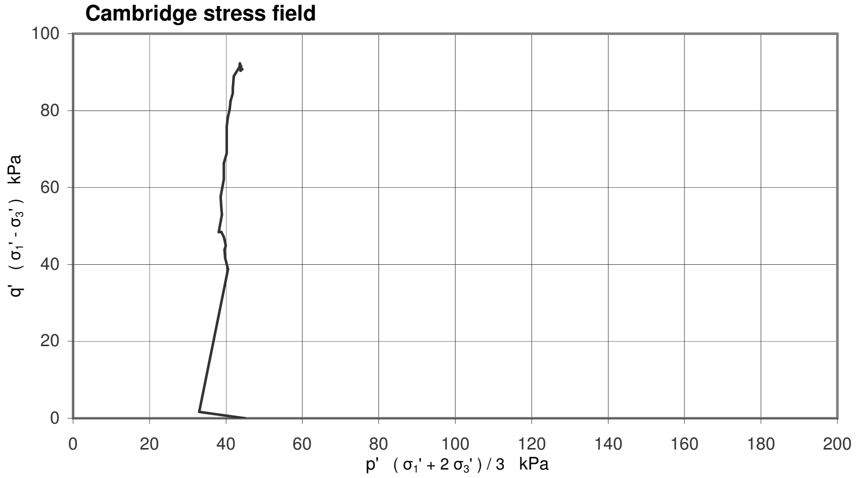
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	345			kPa
Initial pwp	300			kPa
Initial σ_3'	45			kPa
Rate of strain	0.60			%/hr

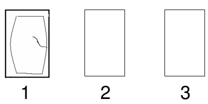
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	4.61			%
$(\sigma_1' / \sigma_3')_f$	8.150			
$(\sigma_1' - \sigma_3')_f$	92.2			kPa
u_f	332			kPa
$\sigma_3'{}_f$	13			kPa
$\sigma_1'{}_f$	105			kPa
A_f	0.35			
Time to failure	7.7			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:57	**CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

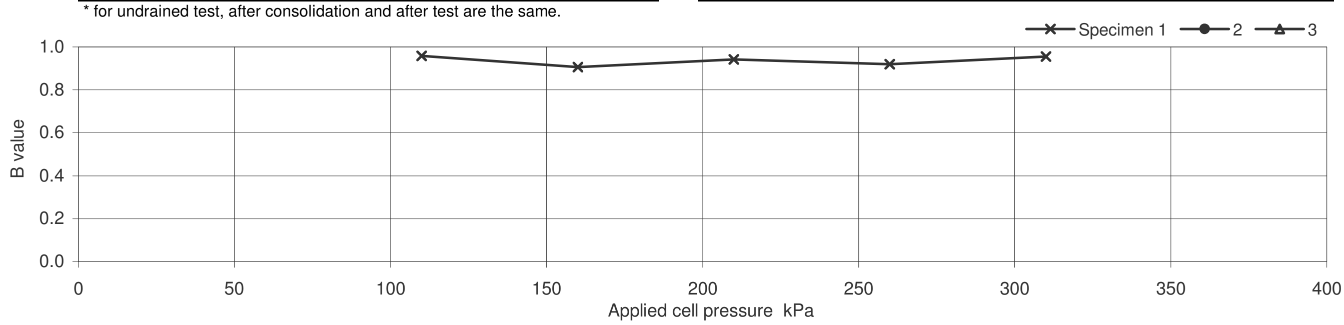
Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.5 - 10.85			
			No	25	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	203.43		
	Diameter	mm	102.85		
	Bulk Density	Mg/m³	1.39		
	Water Content	%	100		
	Dry density	Mg/m³	0.68		
After consolidation	Length	mm	199.34		
	Diameter	mm	100.76		
	Bulk Density*	Mg/m³	1.45		
	Water Content*	%	100		
	Dry density*	Mg/m³	0.73		

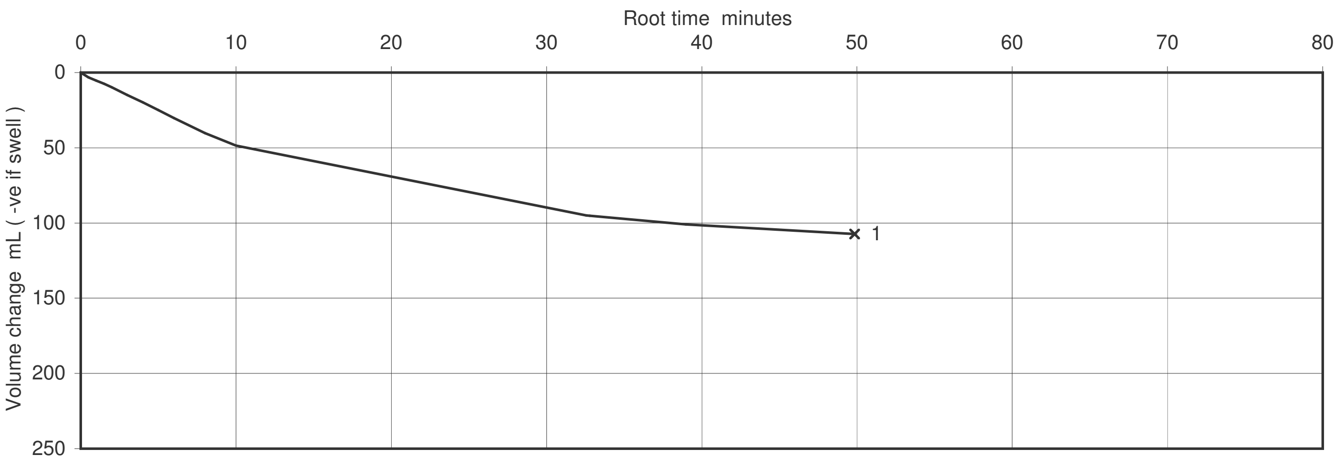
* for undrained test, after consolidation and after test are the same.

Soil Description	Firm brownish grey peaty organic CLAY containing regular wood fragments.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	310		
Final pore water pressure	kPa	302.5		
Final B Value		0.96		



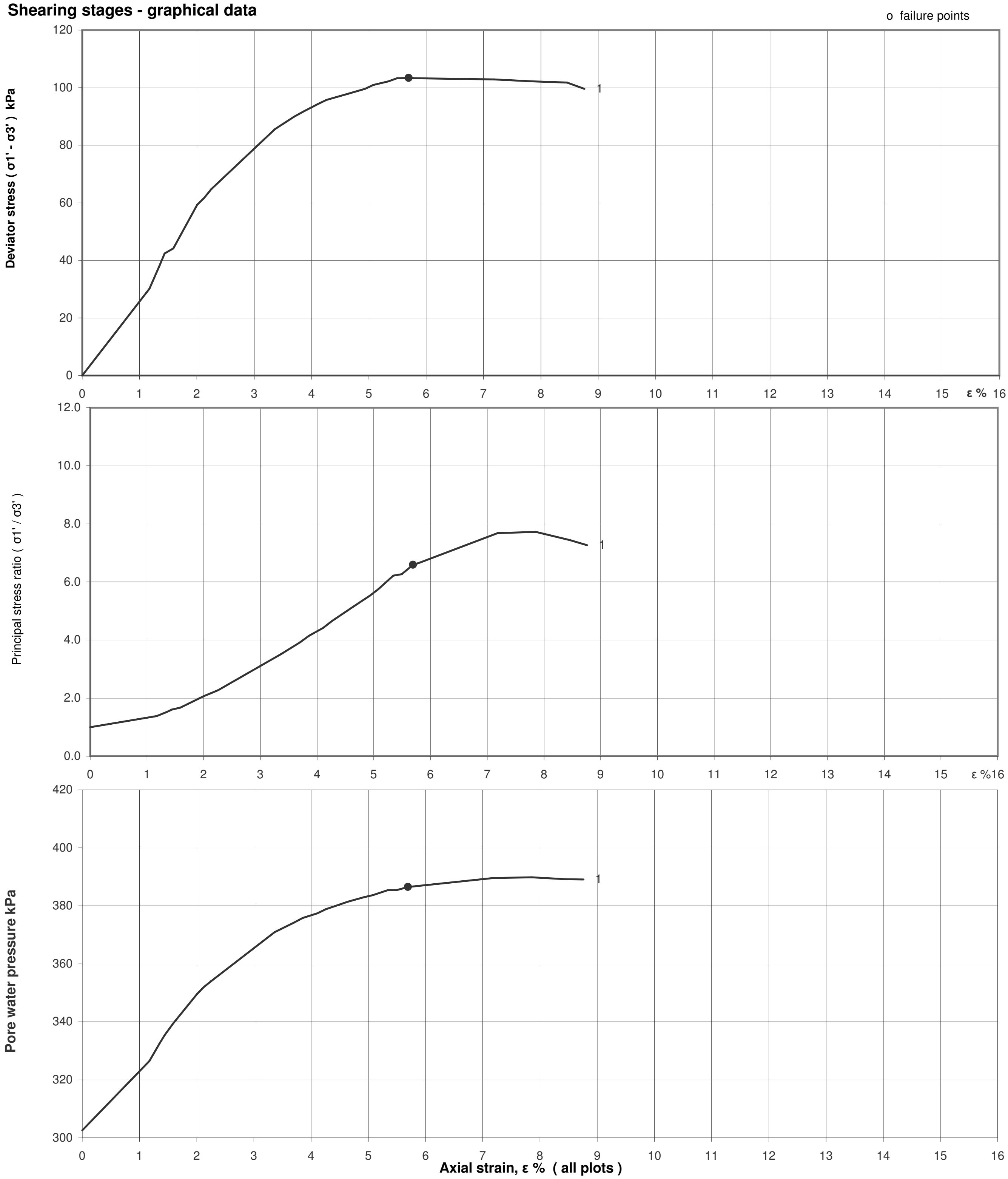
Consolidation Details	Drainage Conditions		From radial boundary and one end				
	Specimen No.		1	2	3		
	Cell Pressure applied		405			kPa	
	Back Pressure applied		300			kPa	
	Effective Pressure		105			kPa	
	Pore pressure at start of consolidation		332			kPa	
	Pore pressure at end of consolidation		303			kPa	
	Pore pressure dissipation at end of consolidation		92			%	
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.48			m^2/year	
	Coefficient of Compressibility	M_{vi}	0.71			m^2/MN	
	Coefficient of Permeability (calculated)	k_{vi}	1.1E-10			m/s	



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.5 - 10.85		
			No	25	Type	UT
			ID			
			Spec Ref			

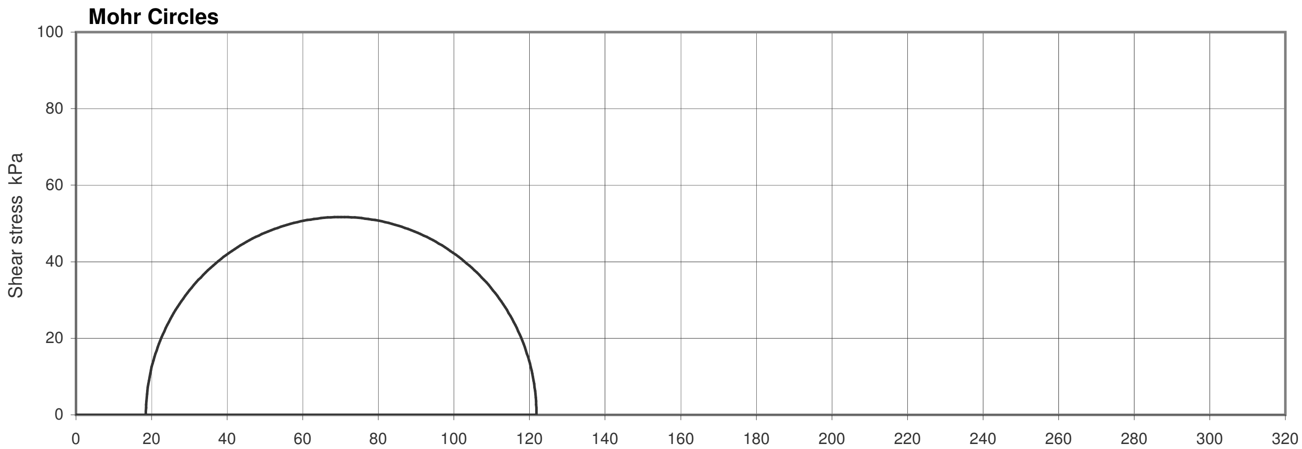
Shearing stages - graphical data

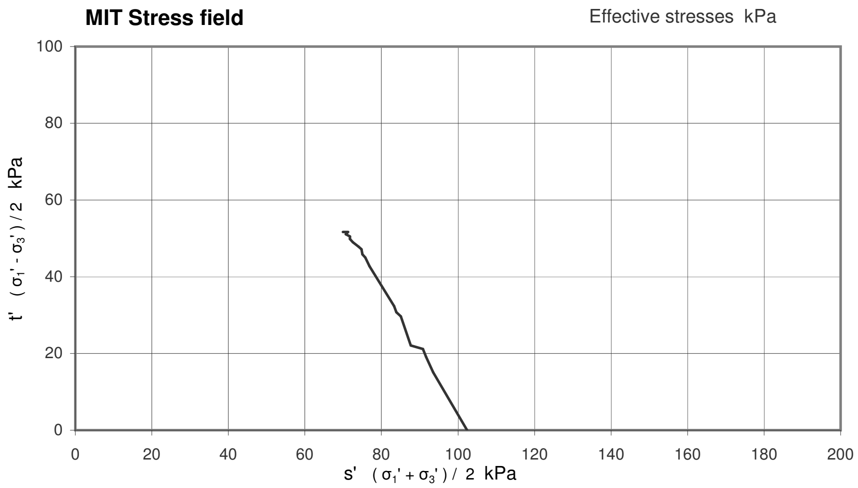


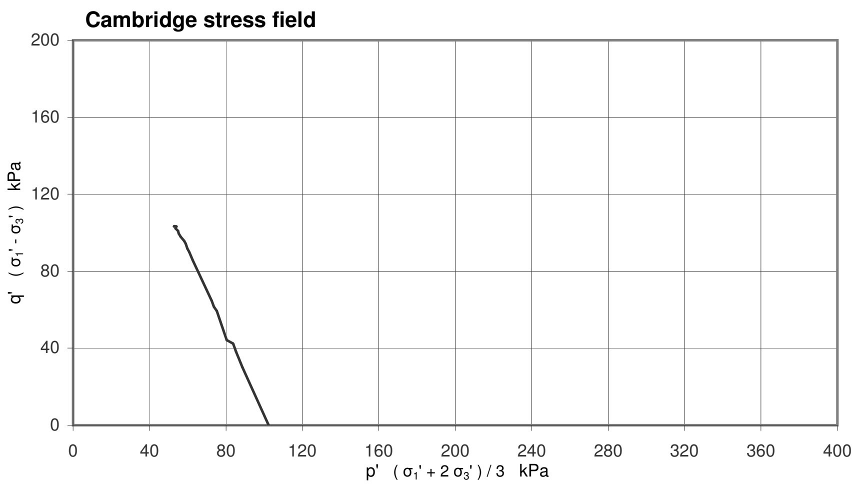
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 10:59	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	10.5 - 10.85			
			No	25	Type	UT	
			ID				
			Spec Ref				







Compression stages

Specimen	1	2	3	
Cell pressure	405			kPa
Initial pwp	303			kPa
Initial σ_3'	102			kPa
Rate of strain	0.36			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	5.69			%
$(\sigma_1' / \sigma_3')_f$	6.587			
$(\sigma_1' - \sigma_3')_f$	103.4			kPa
u_f	387			kPa
$\sigma_3'{}_f$	19			kPa
$\sigma_1'{}_f$	122			kPa
A_f	0.81			
Time to failure	15.8			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1	2	3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:01/03/2016 10:59	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

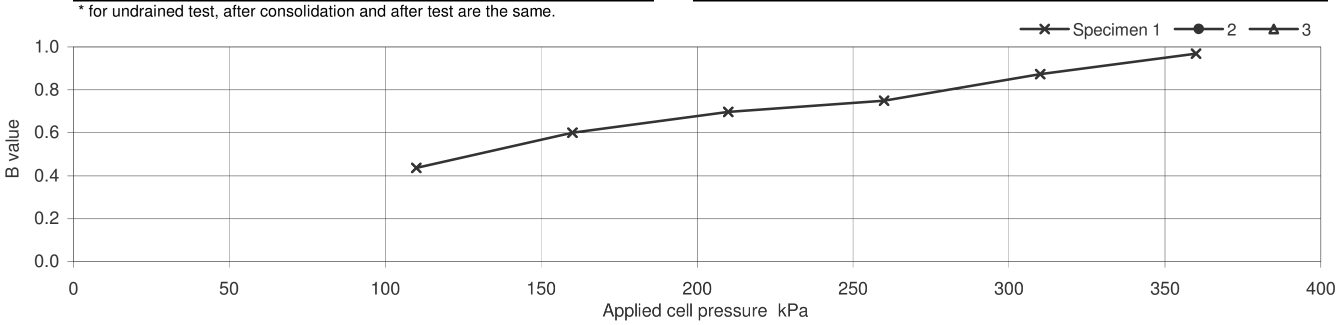
Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.00 - 14.45			
			No	39	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	203.45		
	Diameter	mm	103.87		
	Bulk Density	Mg/m³	2.23		
	Water Content	%	14		
	Dry density	Mg/m³	1.96		
After consolidation	Length	mm	203.34		
	Diameter	mm	103.81		
	Bulk Density*	Mg/m³	2.23		
	Water Content*	%	14		
	Dry density*	Mg/m³	1.96		

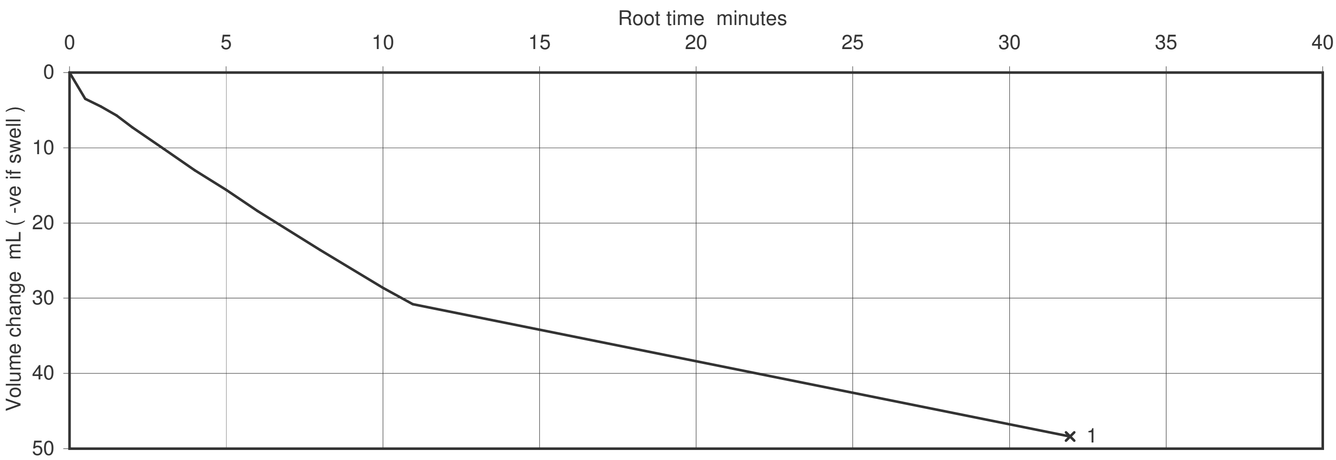
* for undrained test, after consolidation and after test are the same.

Soil Description	Stiff brown slightly gravelly slightly sandy CLAY. Gravel fine to medium.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	360		
Final pore water pressure	kPa	342.6		
Final B Value		0.97		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		445			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		145			kPa
	Pore pressure at start of consolidation		434			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.81			m^2/year
	Coefficient of Compressibility	M_{vi}	0.20			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	5.1E-11			m/s

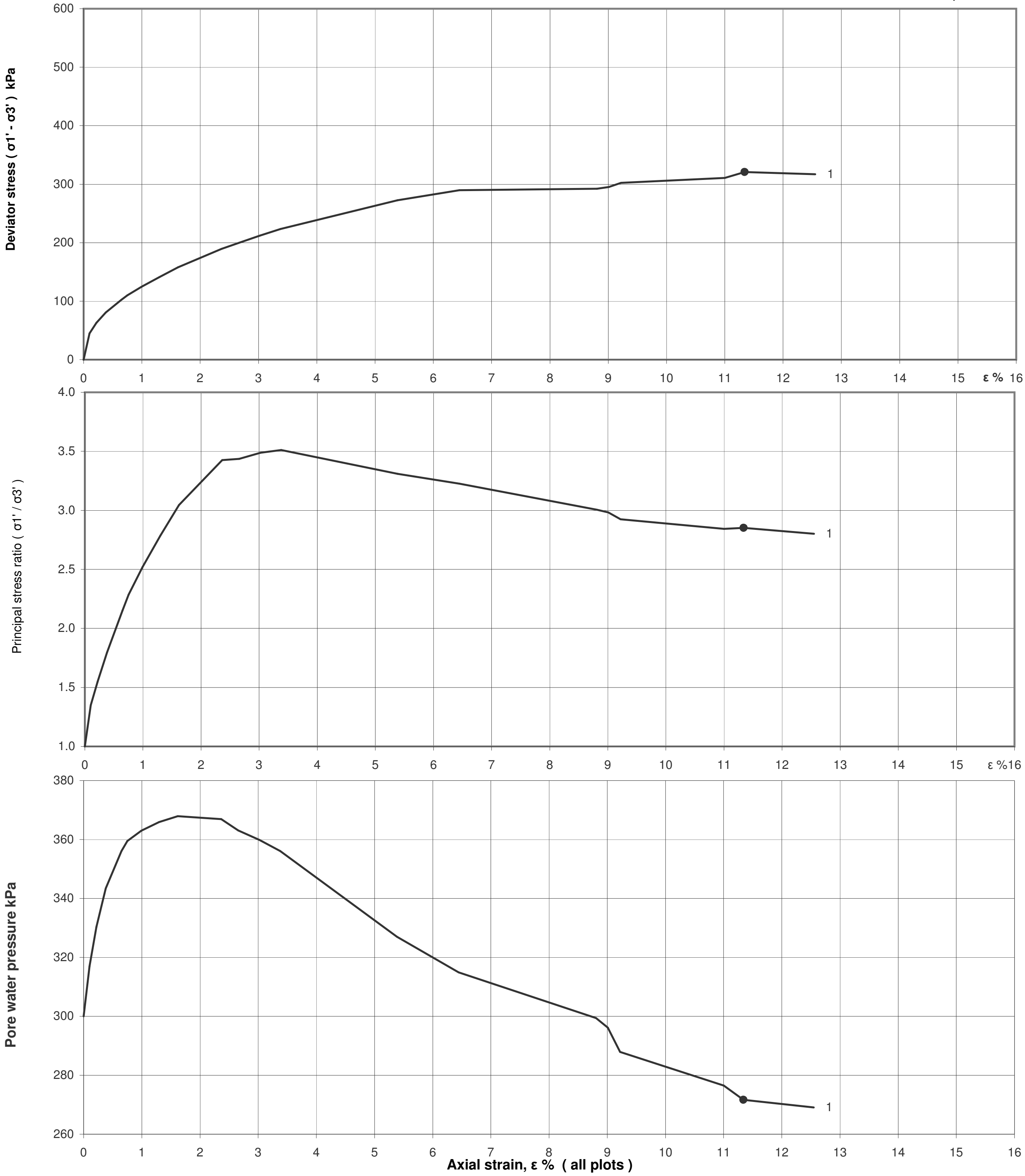


Ref				Figure
SLR8.1 Rev 85 May 09	ESG	UKAS TESTING 1157	Printed:01/03/2016 11:00	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.00 - 14.45		
			No	39	Type	UT
			ID			
			Spec Ref			

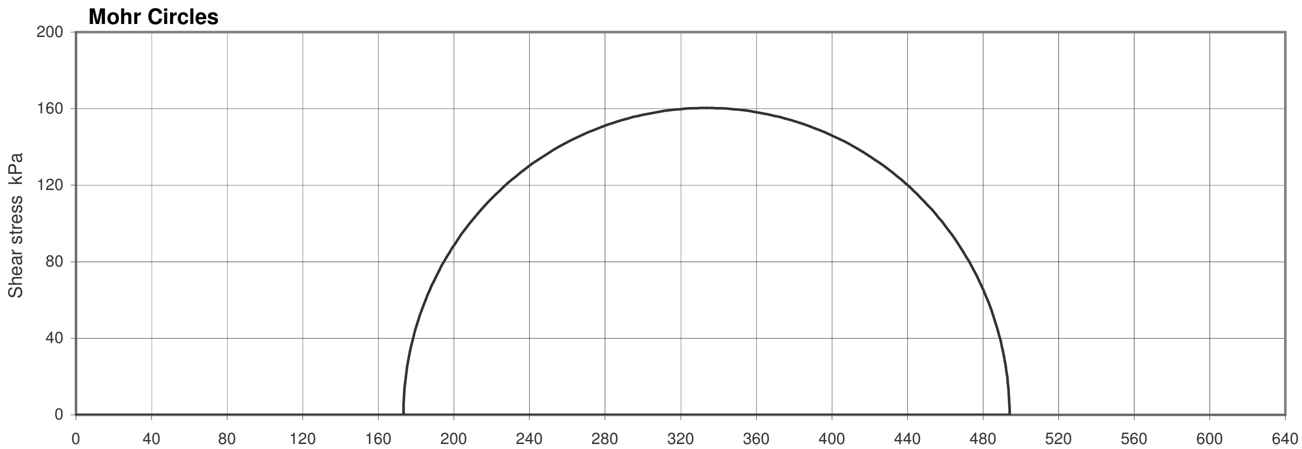
Shearing stages - graphical data

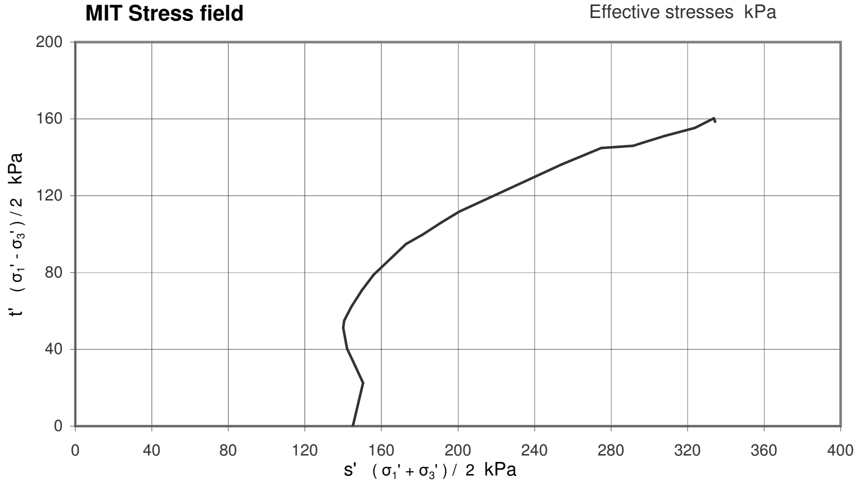


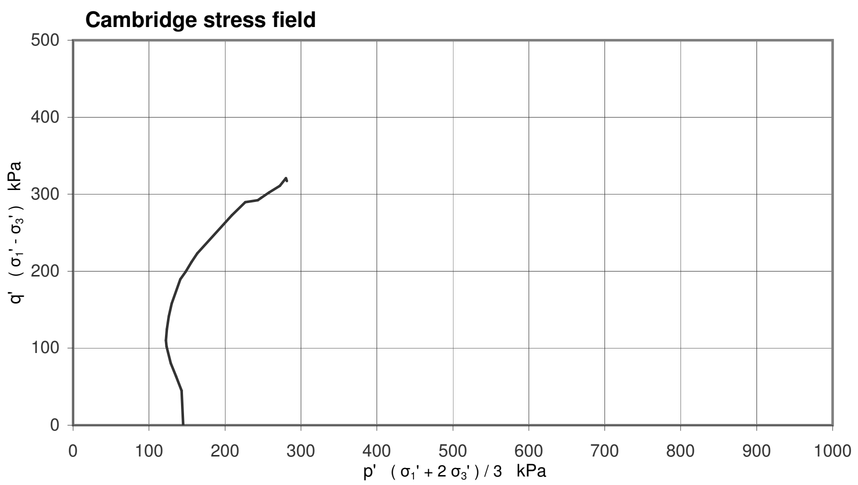
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:00	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.00 - 14.45
			No	39 / Type: UT
			ID	
			Spec Ref	







Compression stages

Specimen	1	2	3	
Cell pressure	445			kPa
Initial pwp	300			kPa
Initial σ_3'	145			kPa
Rate of strain	0.58			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	11.34			%
$(\sigma_1' / \sigma_3')_f$	2.851			
$(\sigma_1' - \sigma_3')_f$	320.8			kPa
u_f	272			kPa
$\sigma_3'{}_f$	173			kPa
$\sigma_1'{}_f$	494			kPa
A_f	-0.09			
Time to failure	19.7			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

Ref		Printed:01/03/2016 11:00	Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157		CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

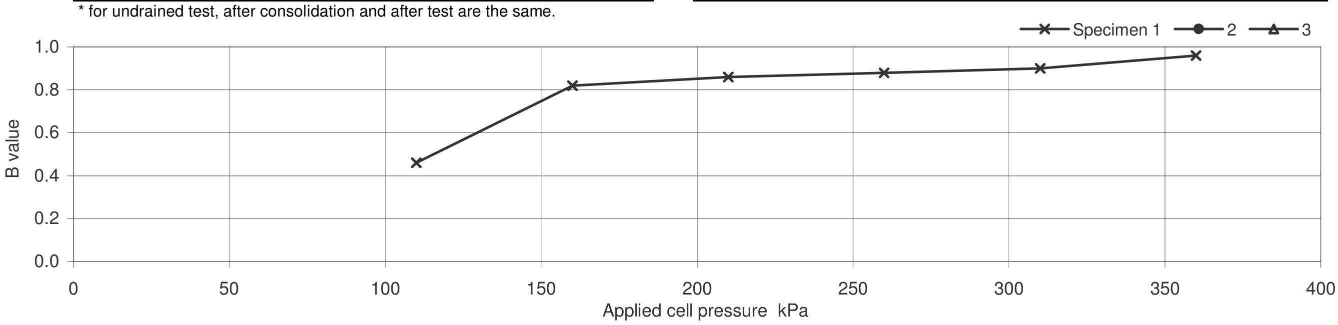
Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.5 - 14.95		
			No	41	Type	UT
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	203.59		
	Diameter	mm	103.33		
	Bulk Density	Mg/m³	2.21		
	Water Content	%	13		
	Dry density	Mg/m³	1.95		
After consolidation	Length	mm	203.37		
	Diameter	mm	103.22		
	Bulk Density*	Mg/m³	2.22		
	Water Content*	%	14		
	Dry density*	Mg/m³	1.95		

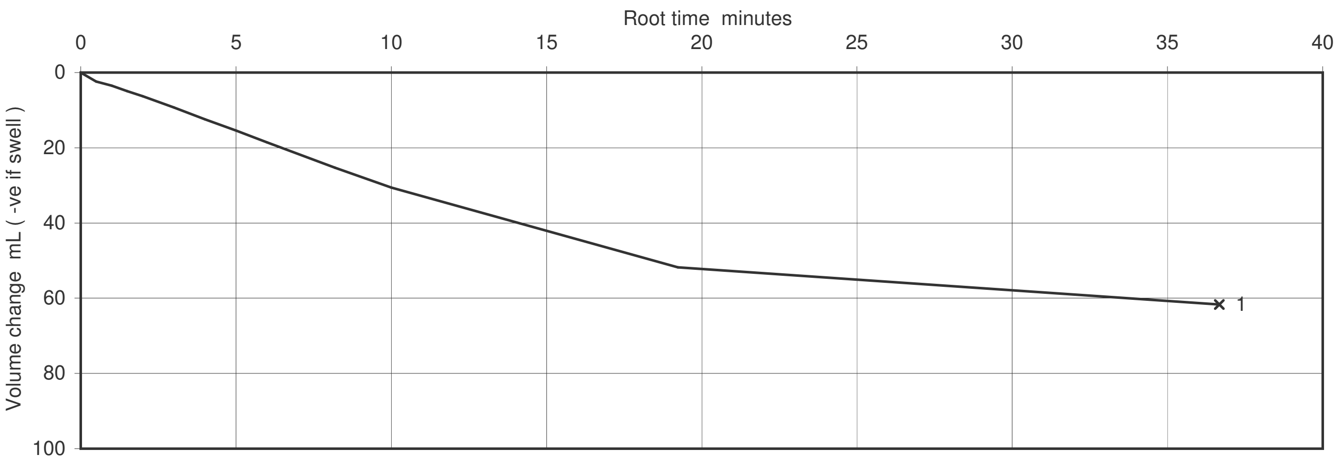
* for undrained test, after consolidation and after test are the same.

Soil Description	Stiff brown slightly sandy slightly gravelly CLAY. Gravel FM
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	360		
Final pore water pressure	kPa	351		
Final B Value		0.96		



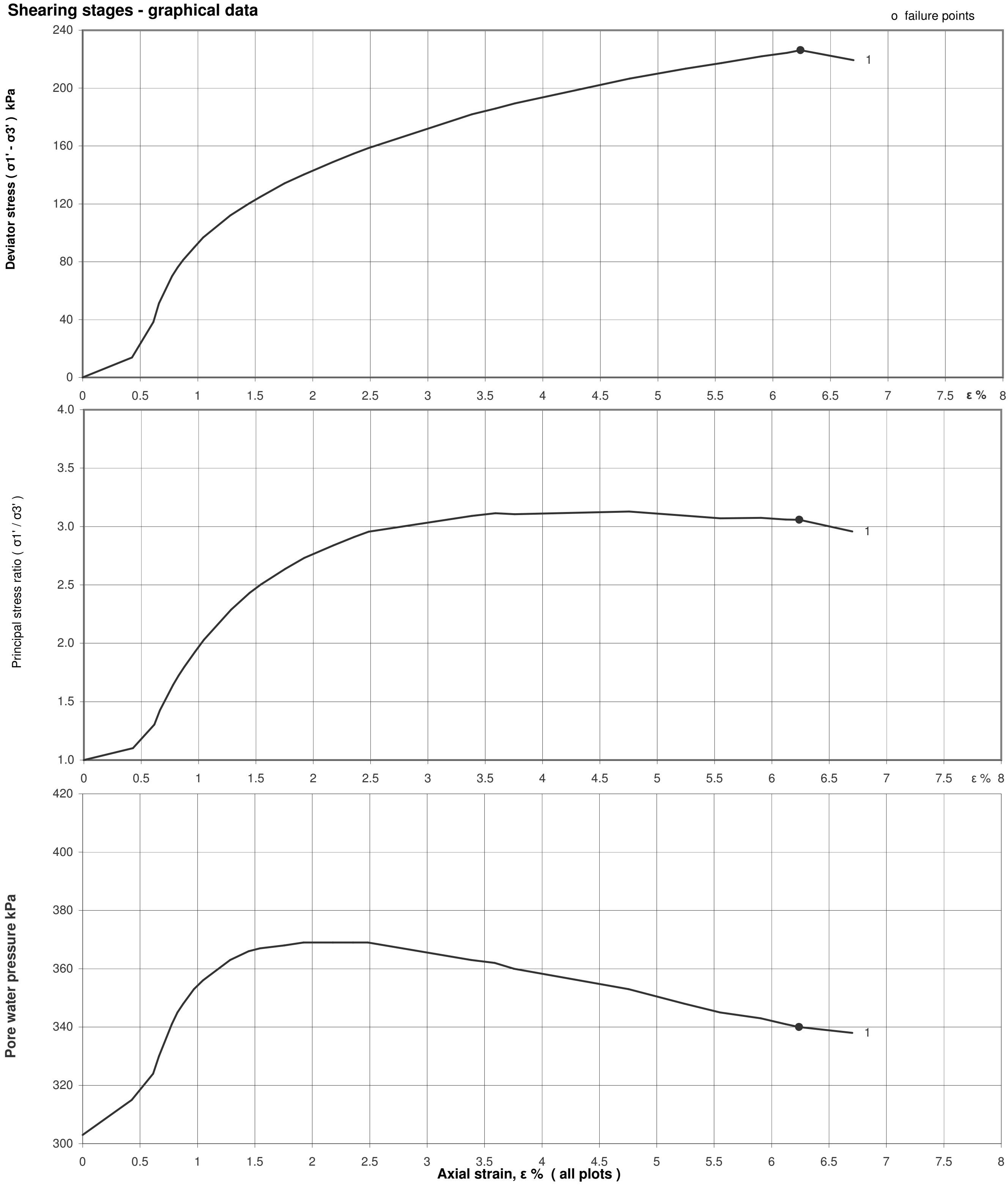
Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		450			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		150			kPa
	Pore pressure at start of consolidation		438			kPa
	Pore pressure at end of consolidation		303			kPa
	Pore pressure dissipation at end of consolidation		98			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.54			m^2/year
	Coefficient of Compressibility	M_{vi}	0.26			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.4E-11			m/s



Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.5 - 14.95		
			No	41	Type	UT
			ID			
			Spec Ref			

Shearing stages - graphical data

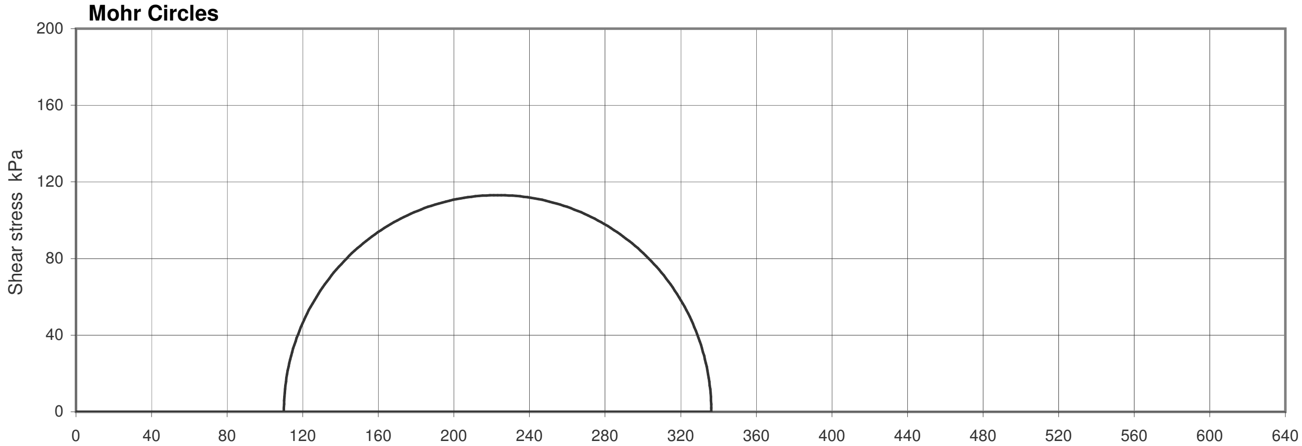


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:01/03/2016 11:02	**Figure** **CU** sheet 2 of 3

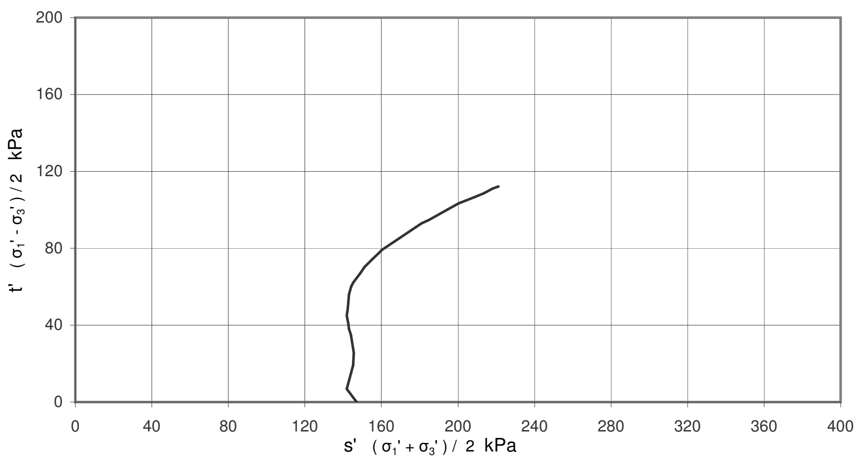
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	14.5 - 14.95			
			No	41	Type	UT	
			ID				
			Spec Ref				

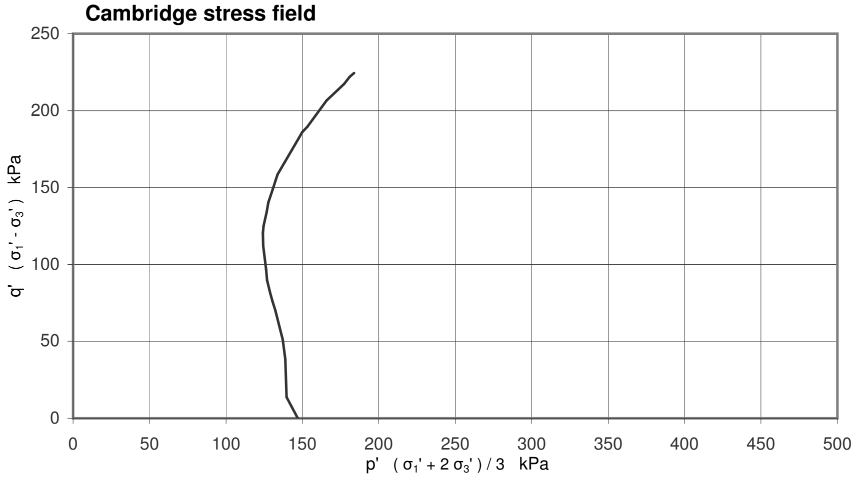
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	450			kPa
Initial pwp	303			kPa
Initial σ_3'	147			kPa
Rate of strain	0.39			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	6.24			%
$(\sigma_1' / \sigma_3')_f$	3.057			
$(\sigma_1' - \sigma_3')_f$	226.2			kPa
u_f	340			kPa
$\sigma_3'{}_f$	110			kPa
$\sigma_1'{}_f$	336			kPa
A_f	0.16			
Time to failure	15.9			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG / UKAS TESTING 1157	Printed:01/03/2016 11:02	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

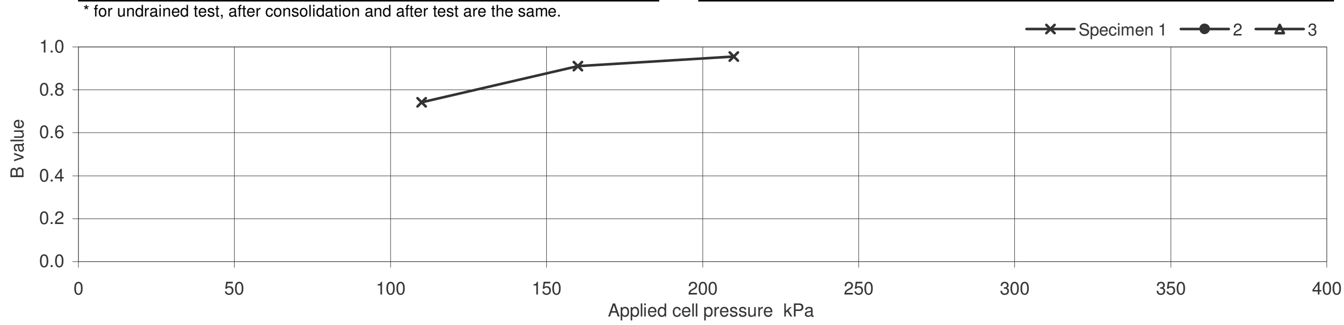
Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.00 - 16.45			
			No	47	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	203.45		
	Diameter	mm	103.55		
	Bulk Density	Mg/m³	2.06		
	Water Content	%	22		
	Dry density	Mg/m³	1.69		
After consolidation	Length	mm	203.08		
	Diameter	mm	103.36		
	Bulk Density*	Mg/m³	2.07		
	Water Content*	%	22		
	Dry density*	Mg/m³	1.70		

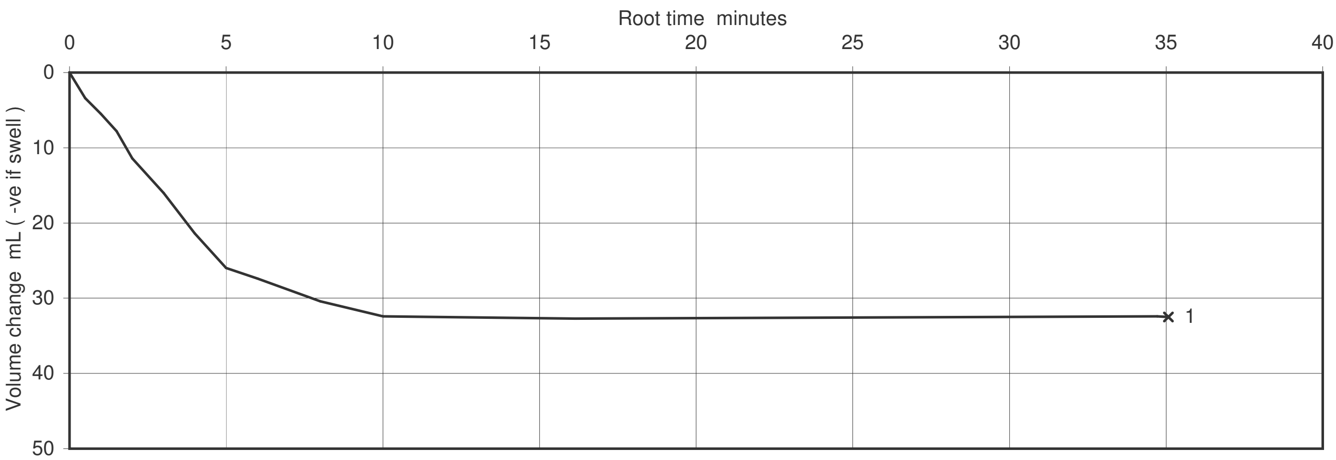
* for undrained test, after consolidation and after test are the same.

Soil Description	Stiff brown CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	195.2		
Final B Value		0.96		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		625			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		325			kPa
	Pore pressure at start of consolidation		602			kPa
	Pore pressure at end of consolidation		305			kPa
	Pore pressure dissipation at end of consolidation		98			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	6.13			m^2/year
	Coefficient of Compressibility	M_{vi}	0.06			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.2E-10			m/s

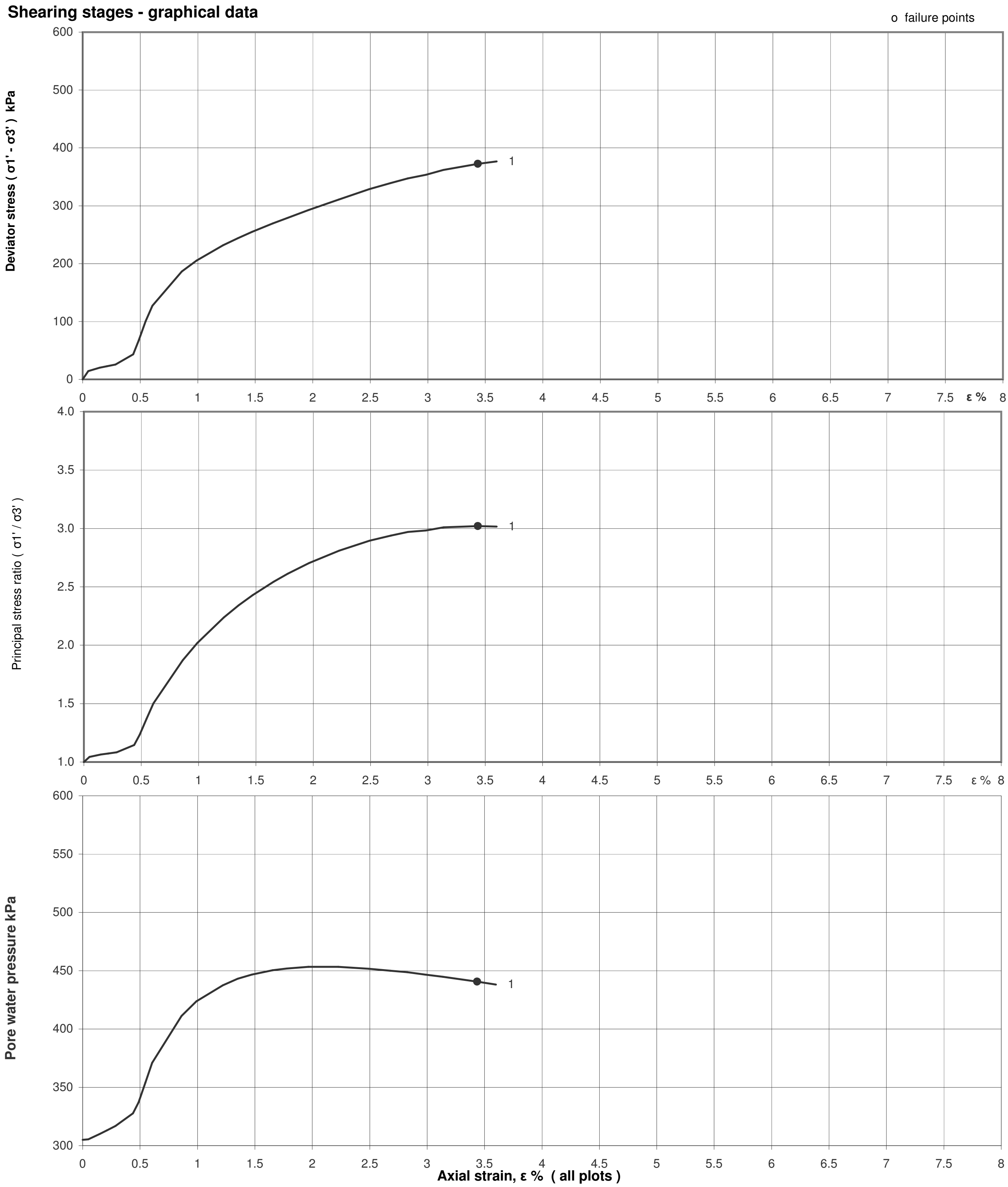


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:03	**Figure** **CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No		BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)		16.00 - 16.45		
			No	47	Type	UT	
			ID				
			Spec Ref				

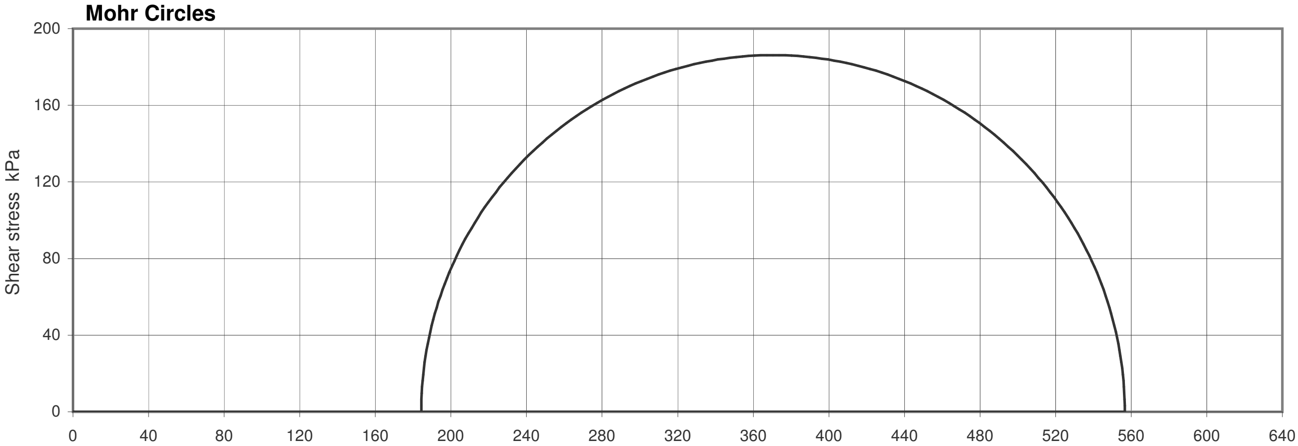
Shearing stages - graphical data

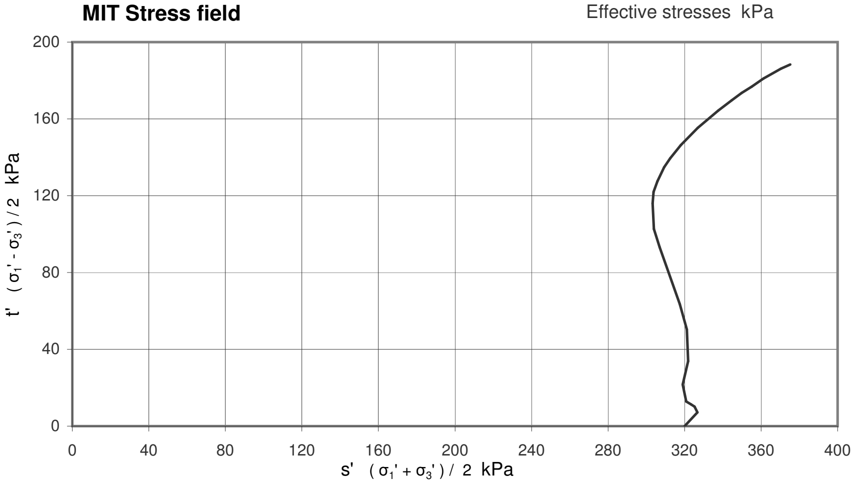


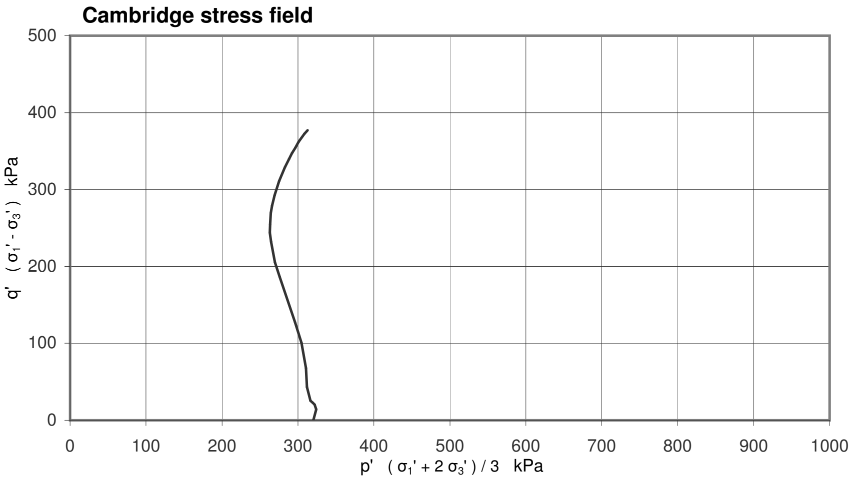
Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:03	CU sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH407			
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.00 - 16.45			
			No	47	Type	UT	
			ID				
			Spec Ref				







Compression stages

Specimen	1	2	3	
Cell pressure	625			kPa
Initial pwp	305			kPa
Initial σ_3'	320			kPa
Rate of strain	2.00			%/hr

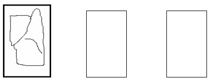
Failure conditions

Criterion				
Axial strain	3.44			%
$(\sigma_1'/\sigma_3')_f$	3.020			
$(\sigma_1' - \sigma_3')_f$	372.3			kPa
u_f	441			kPa
$\sigma_3'{}_f$	184			kPa
$\sigma_1'{}_f$	557			kPa
A_f	0.36			
Time to failure	1.7			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:03	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

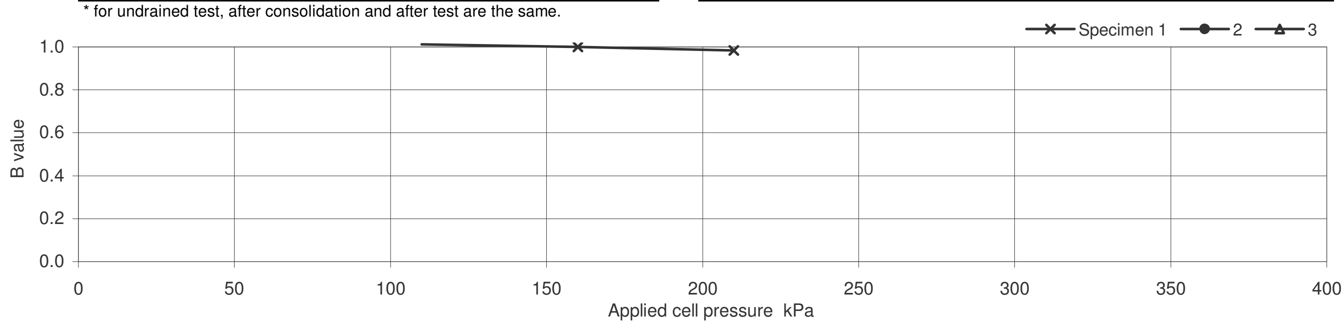
Project No	A5085-15	Sample Details:	Hole No	BH408			
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.35 - 3.80			
			No	7	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	203.87		
	Diameter	mm	103.18		
	Bulk Density	Mg/m³	1.86		
	Water Content	%	37		
	Dry density	Mg/m³	1.36		
After consolidation	Length	mm	200.04		
	Diameter	mm	101.22		
	Bulk Density*	Mg/m³	1.91		
	Water Content*	%	33		
	Dry density*	Mg/m³	1.44		

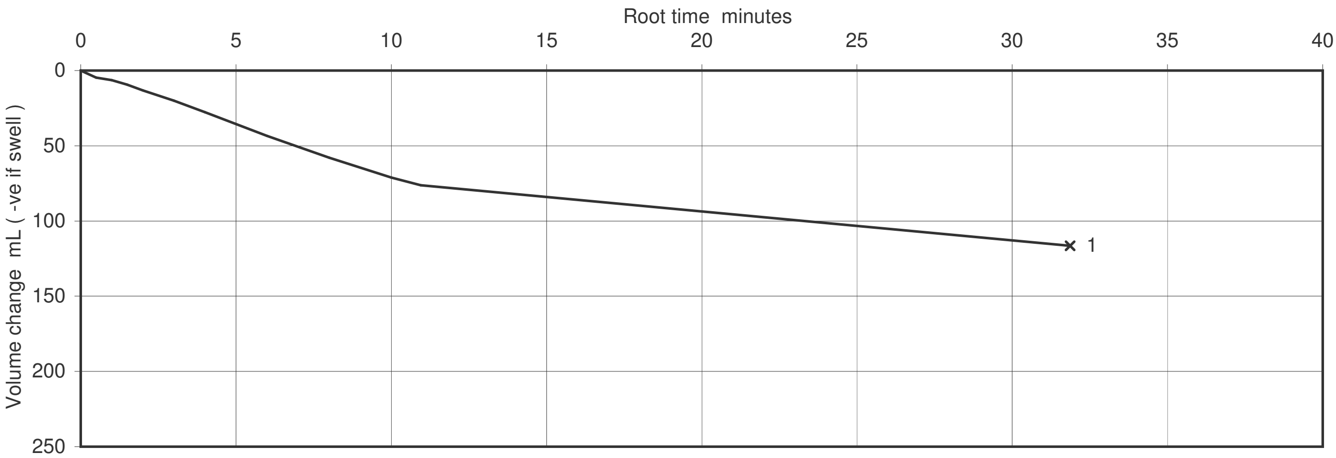
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm dark greyish brown gravelly clayey SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	197.9		
Final B Value		0.98		



Consolidation Details	Drainage Conditions		From radial boundary and one end				
	Specimen No.		1	2	3		
	Cell Pressure applied		350			kPa	
	Back Pressure applied		300			kPa	
	Effective Pressure		50			kPa	
	Pore pressure at start of consolidation		346			kPa	
	Pore pressure at end of consolidation		300			kPa	
	Pore pressure dissipation at end of consolidation		100			%	
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.87			m^2/year	
	Coefficient of Compressibility	M_{vi}	1.46			m^2/MN	
	Coefficient of Permeability (calculated)	k_{vi}	4.0E-10			m/s	

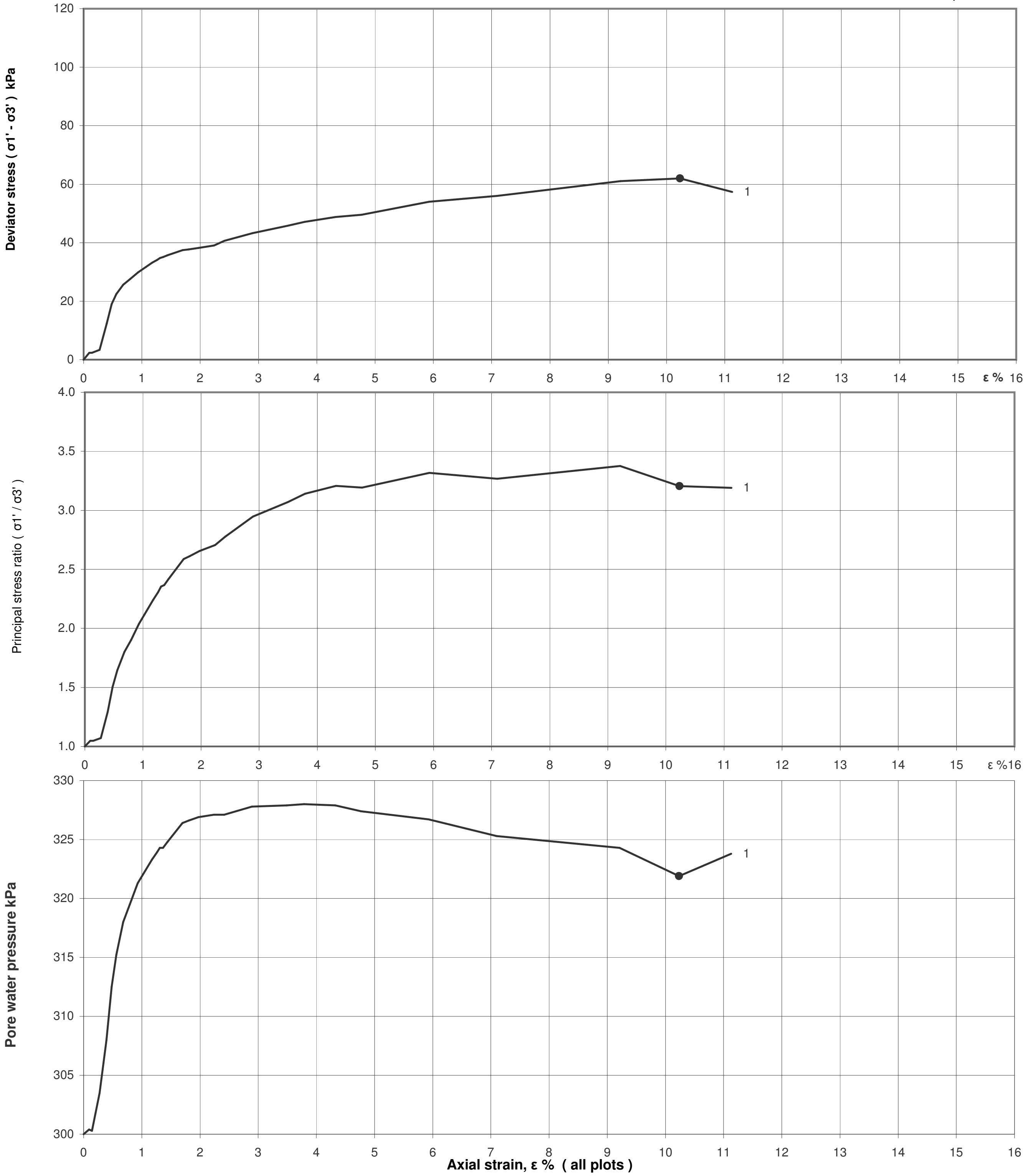


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:09	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.35 - 3.80		
			No	7	Type	UT
			ID			
			Spec Ref			

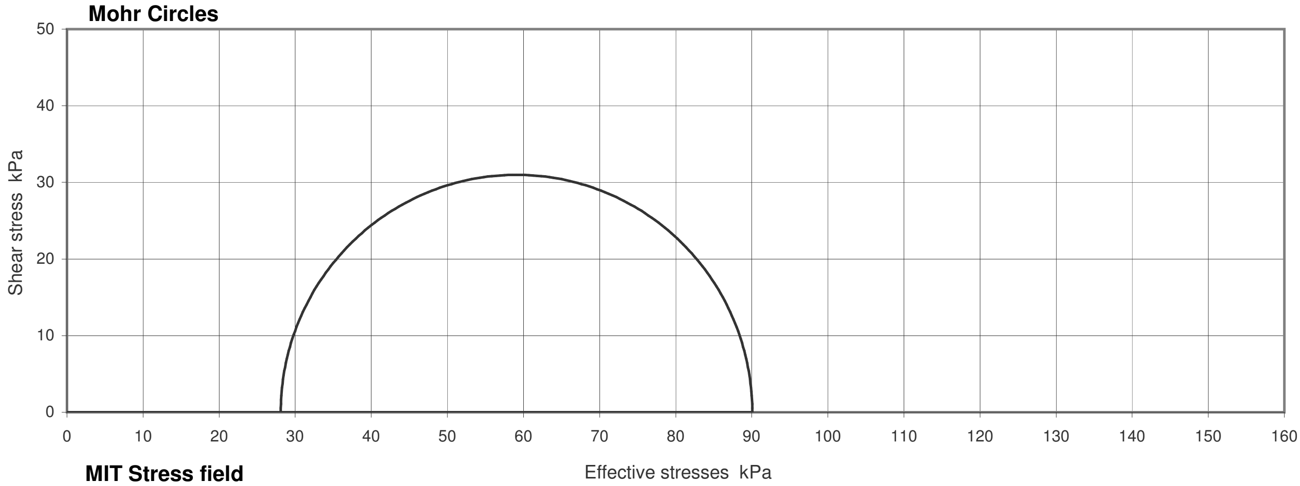
Shearing stages - graphical data

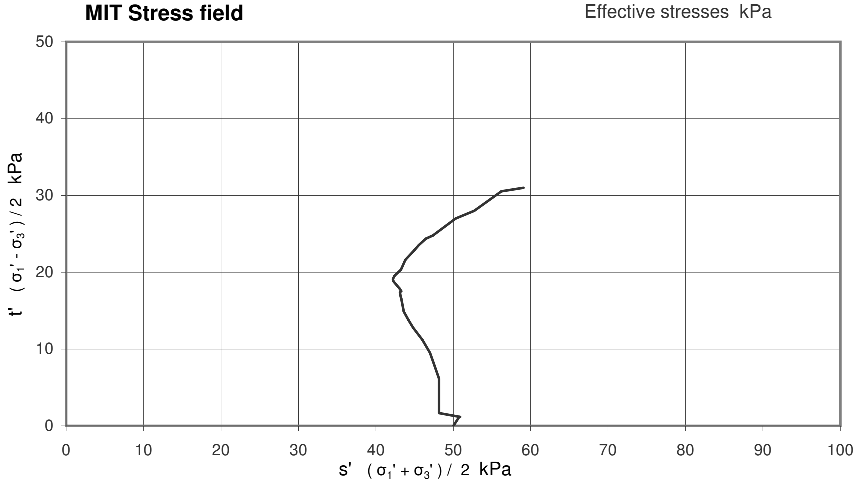


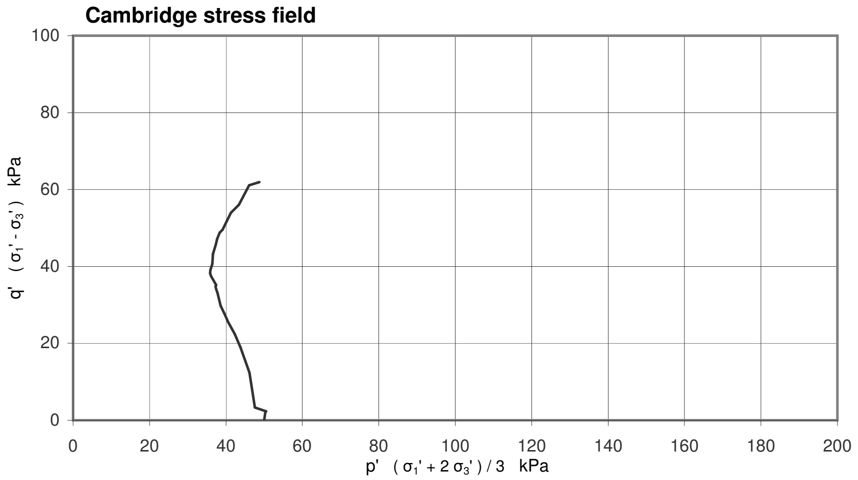
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:09	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.35 - 3.80
			No	7
			Type	UT
			ID	
			Spec Ref	







Compression stages

Specimen	1	2	3	
Cell pressure	350			kPa
Initial pwp	300			kPa
Initial σ_3'	50			kPa
Rate of strain	0.65			%/hr

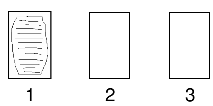
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	10.23			%
$(\sigma_1' / \sigma_3')_f$	3.205			
$(\sigma_1' - \sigma_3')_f$	62.0			kPa
u_f	322			kPa
$\sigma_3'{}_f$	28			kPa
$\sigma_1'{}_f$	90			kPa
A_f	0.35			
Time to failure	15.9			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:09	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

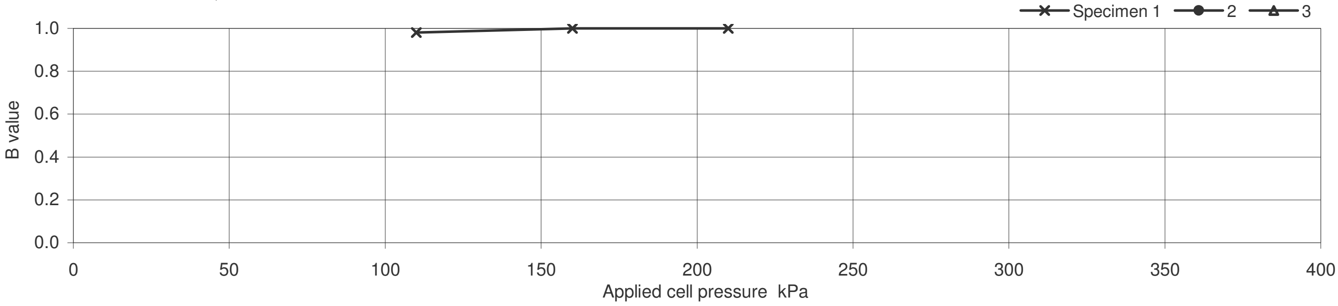
Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90 - 5.90		
			No	11	Type	P
			ID	Bottom		
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	192.37		
	Diameter	mm	96.88		
	Bulk Density	Mg/m³	1.84		
	Water Content	%	100		
	Dry density	Mg/m³	0.91		
After consolidation	Length	mm	160.38		
	Diameter	mm	79.15		
	Bulk Density*	Mg/m³	2.23		
	Water Content*	%	37		
	Dry density*	Mg/m³	1.63		

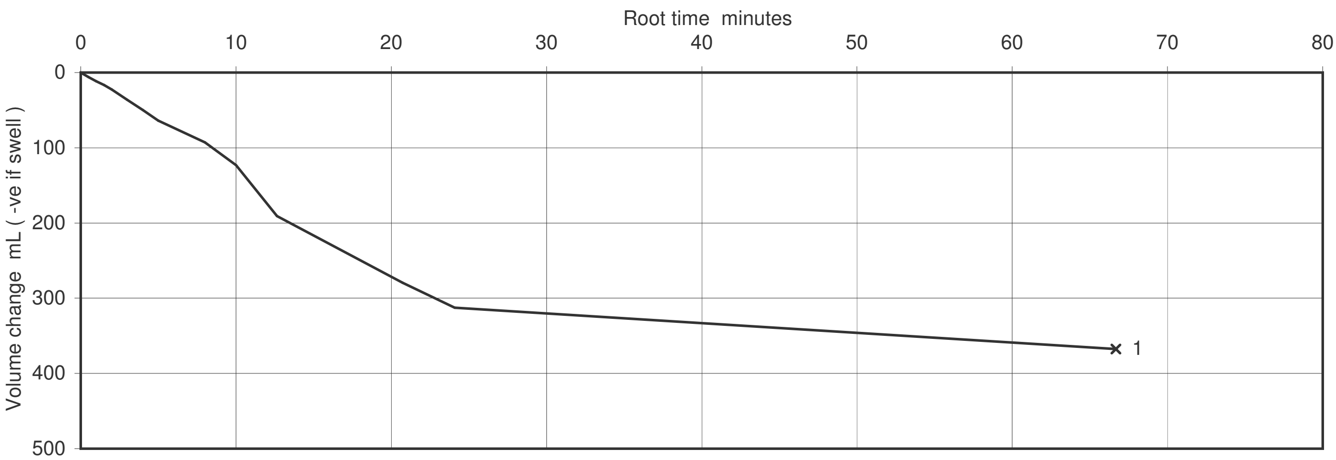
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft dark grey slightly sandy silty CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	203		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		368			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		68			kPa
	Pore pressure at start of consolidation		368			kPa
	Pore pressure at end of consolidation		302			kPa
	Pore pressure dissipation at end of consolidation		97			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.28			m^2/year
	Coefficient of Compressibility	M_{vi}	5.08			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.5E-10			m/s

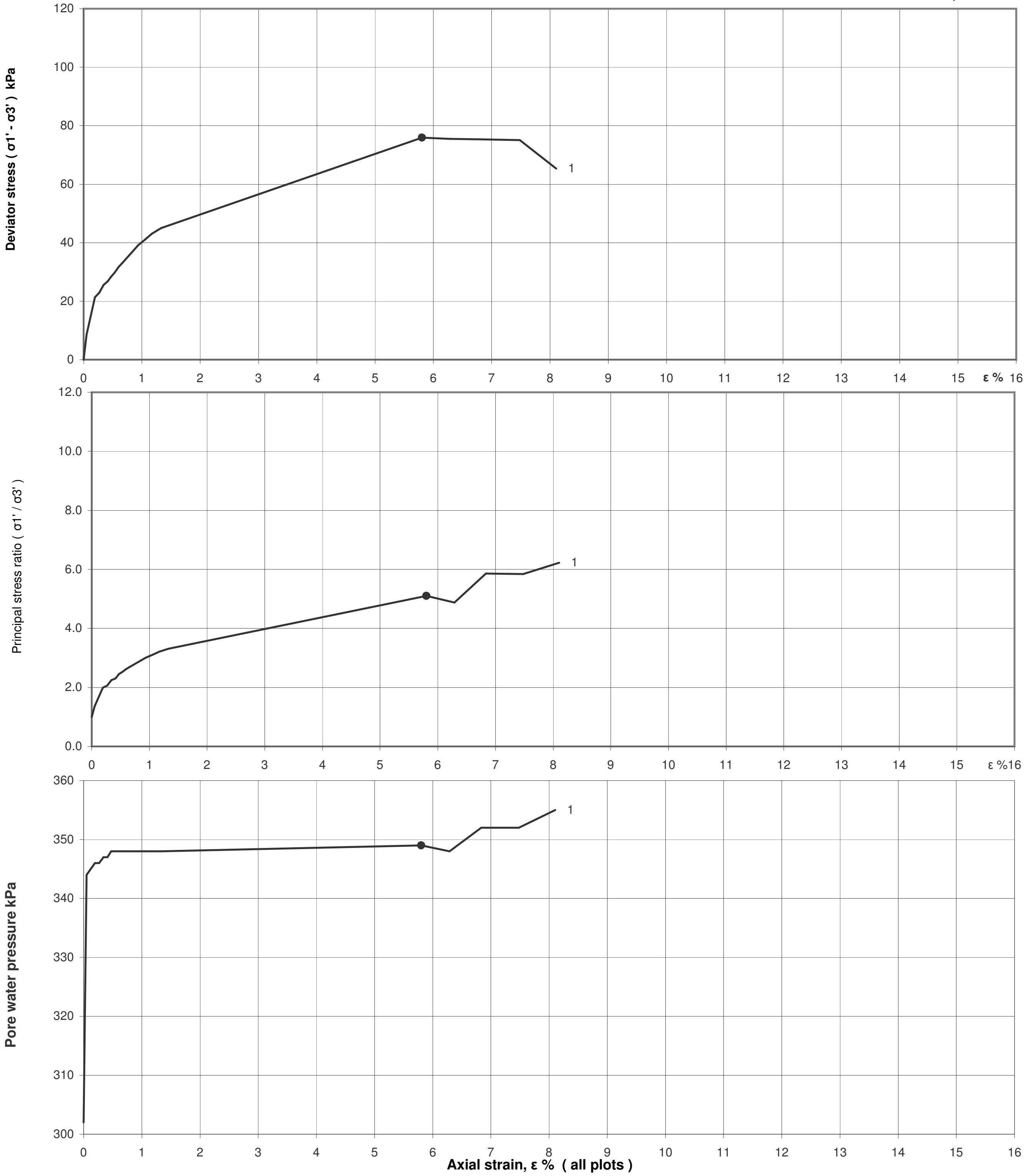


Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:02	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90 - 5.90		
			No	11	Type	P
			ID	Bottom		
			Spec Ref			

Shearing stages - graphical data

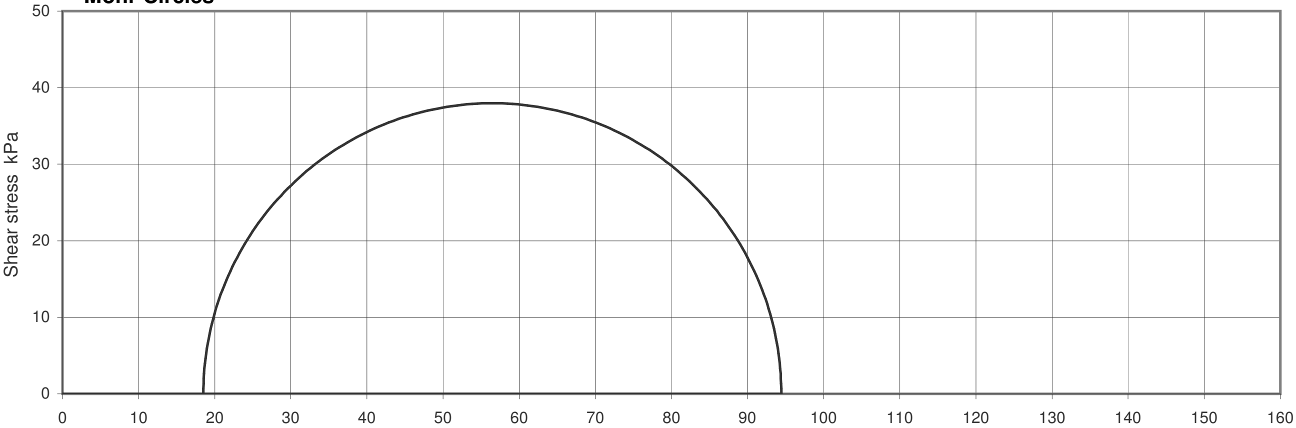


Ref SLR8.1 Rev 85 May 09		Printed:13/02/2016 11:02	**Figure** **CU** sheet 2 of 3

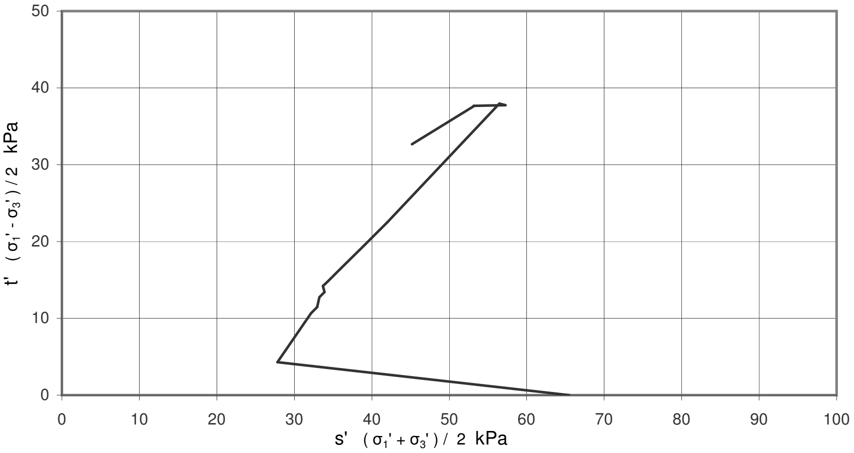
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90 - 5.90		
			No	11	Type	P
			ID	Bottom		
			Spec Ref			

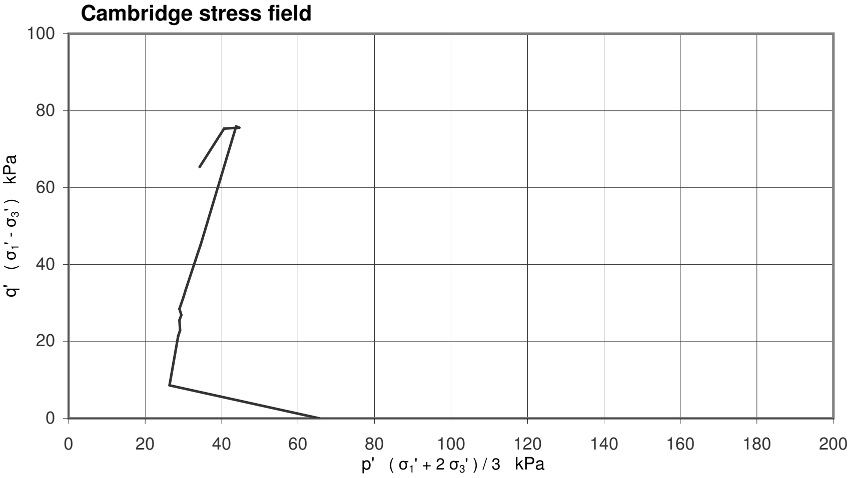
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	367.5			kPa
Initial pwp	302			kPa
Initial σ_3'	66			kPa
Rate of strain	0.29			%/hr

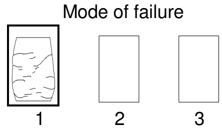
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	5.80			%
(σ_1' / σ_3')$_f$	5.104			
(σ_1' - σ_3')$_f$	75.9			kPa
u_f	349			kPa
$\sigma_3'_f$	19			kPa
$\sigma_1'_f$	94			kPa
A_f	0.62			
Time to failure	20.1			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.399 mm thick rubber membrane(s)

Ref SLR8.1 Rev 85 May 09	ESG	Printed:13/02/2016 11:02	**Figure** **CU** sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

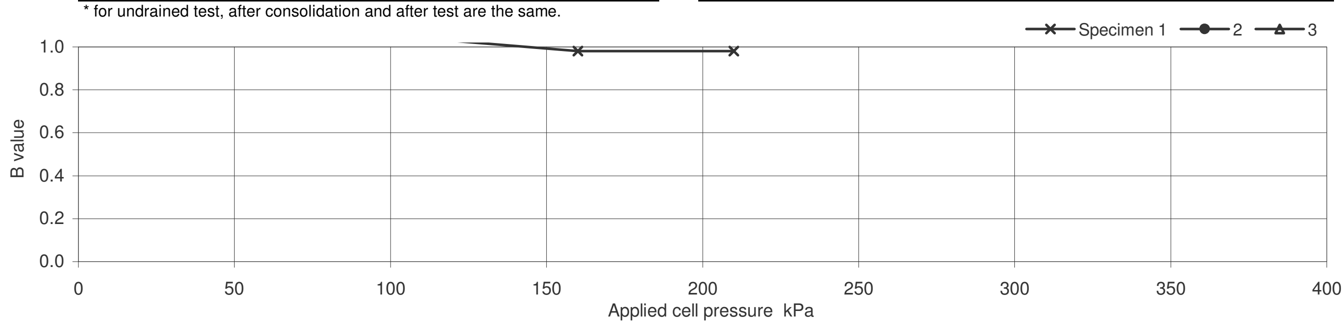
Project No	A5085-15	Sample Details:	Hole No	BH408			
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90 - 5.90			
			No	11	Type	P	
			ID	TOP			
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	182.79		
	Diameter	mm	100.23		
	Bulk Density	Mg/m³	1.95		
	Water Content	%	38		
	Dry density	Mg/m³	1.41		
After consolidation	Length	mm	177.10		
	Diameter	mm	97.06		
	Bulk Density*	Mg/m³	2.04		
	Water Content*	%	31		
	Dry density*	Mg/m³	1.55		

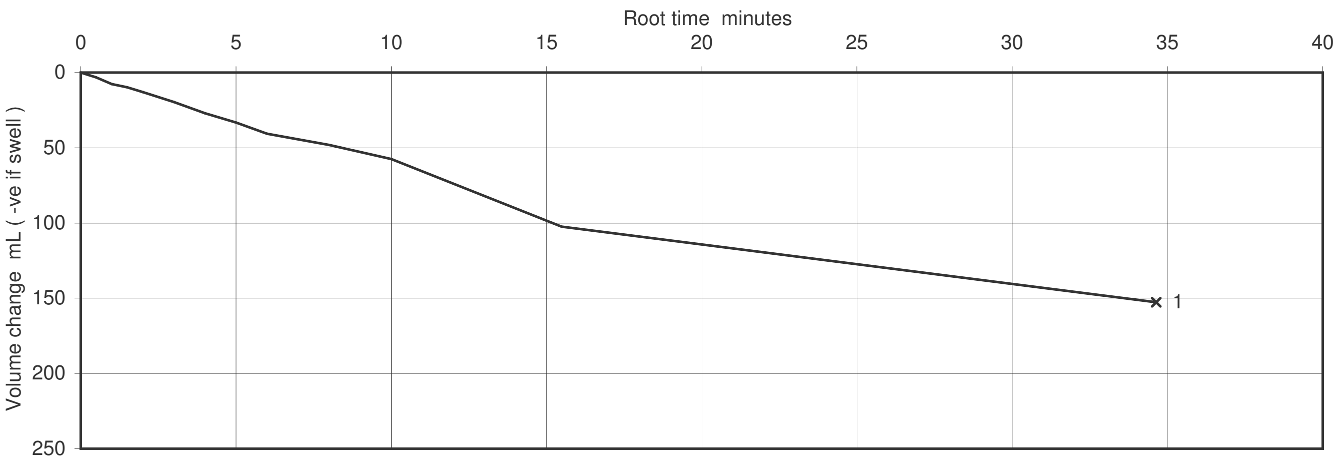
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft dark grey silty CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	204		
Final B Value		1.06		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		332			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		32			kPa
	Pore pressure at start of consolidation		330			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.46			m^2/year
	Coefficient of Compressibility	M_{vi}	3.48			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.9E-10			m/s

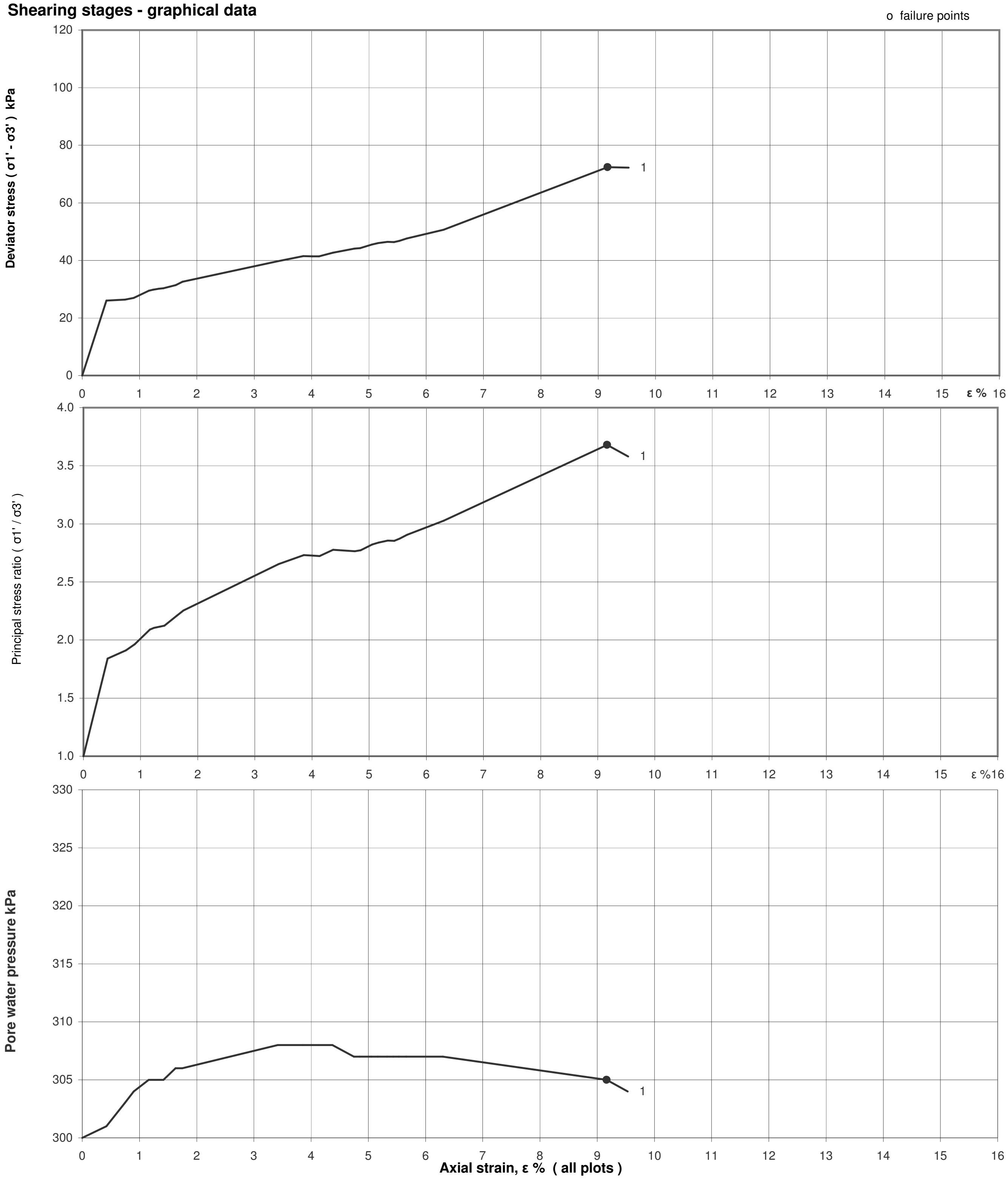


Ref			Figure
SLR8.1 Rev 85 May 09	ESG / UKAS TESTING 1157	Printed:08/02/2016 14:33	**CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90 - 5.90		
			No	11	Type	P
			ID	TOP		
			Spec Ref			

Shearing stages - graphical data

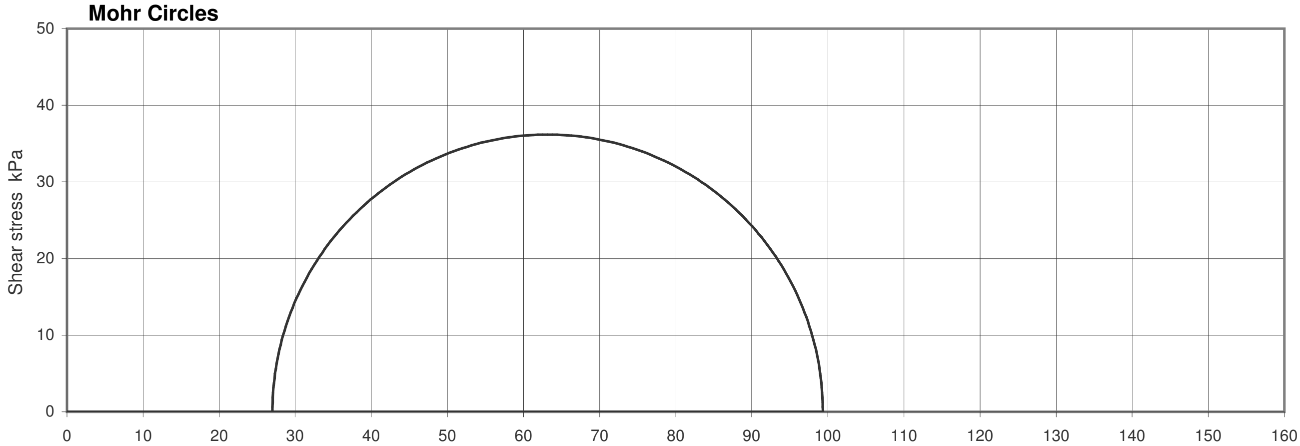


Ref SLR8.1 Rev 85 May 09	ESG	Printed:08/02/2016 14:33	**Figure** **CU 0** sheet 2 of 3

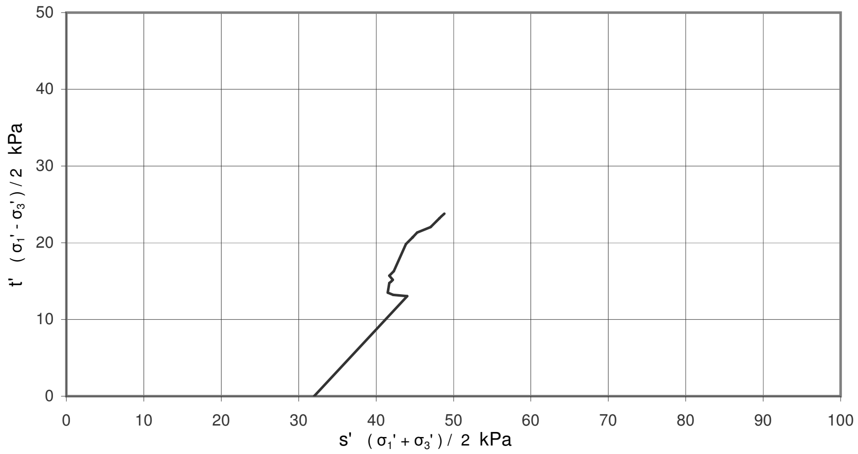
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90 - 5.90		
			No	11	Type	P
			ID	TOP		
			Spec Ref			

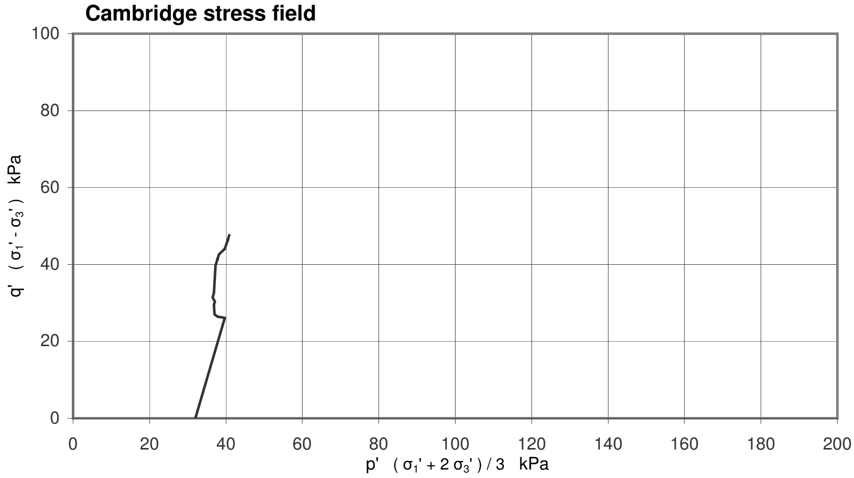
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	332			kPa
Initial pwp	300			kPa
Initial σ_3'	32			kPa
Rate of strain	0.32			%/hr

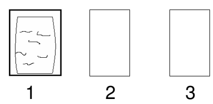
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	9.16			%
$(\sigma_1' / \sigma_3')_f$	3.680			
$(\sigma_1' - \sigma_3')_f$	72.3			kPa
u_f	305			kPa
$\sigma_3'_f$	27			kPa
$\sigma_1'_f$	99			kPa
A_f	0.07			
Time to failure	29.1			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.399 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:08/02/2016 14:33	CU 0 sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

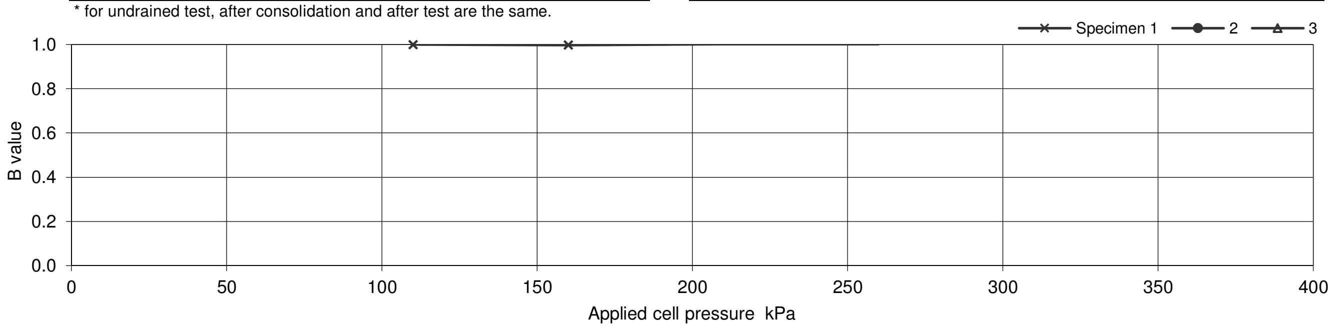
Project No	A5085-15	Sample Details:	Hole No	BH408			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.7 - 7.15			
			No	15	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	199.87		
	Diameter	mm	103.60		
	Bulk Density	Mg/m³	1.89		
	Water Content	%	38		
	Dry density	Mg/m³	1.38		
After consolidation	Length	mm	190.84		
	Diameter	mm	98.81		
	Bulk Density*	Mg/m³	2.02		
	Water Content*	%	28		
	Dry density*	Mg/m³	1.58		

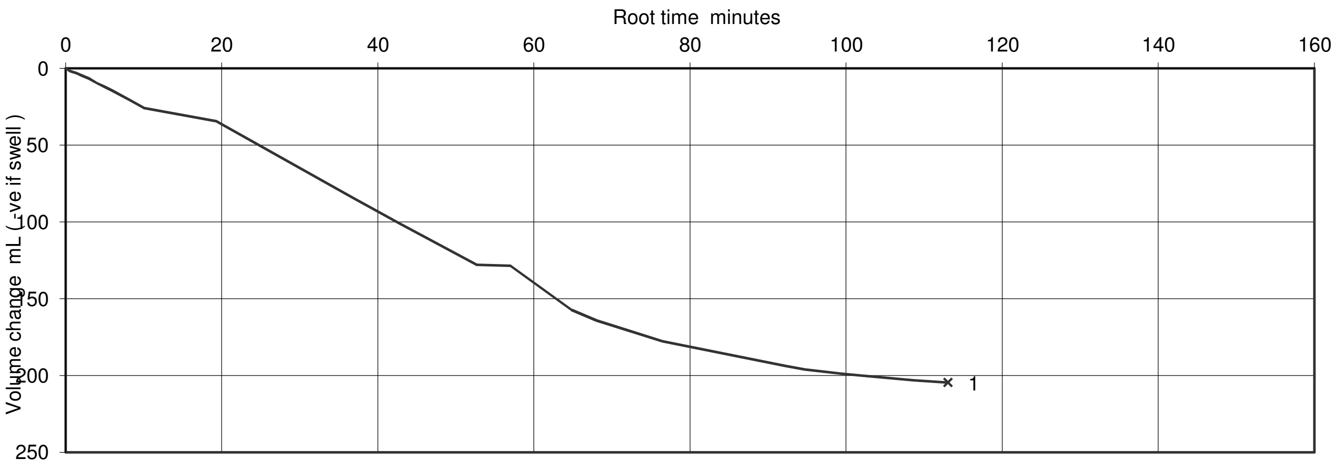
* for undrained test, after consolidation and after test are the same.

Soil Description	Very soft dark brown CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	252.2		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From one end				
	Specimen No.		1	2	3		
	Cell Pressure applied		450			kPa	
	Back Pressure applied		300			kPa	
	Effective Pressure		150			kPa	
	Pore pressure at start of consolidation		446			kPa	
	Pore pressure at end of consolidation		307			kPa	
	Pore pressure dissipation at end of consolidation		95			%	
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.82			m^2/year	
	Coefficient of Compressibility	M_{vi}	0.89			m^2/MN	
	Coefficient of Permeability (calculated)	k_{vi}	7.7E-10			m/s	



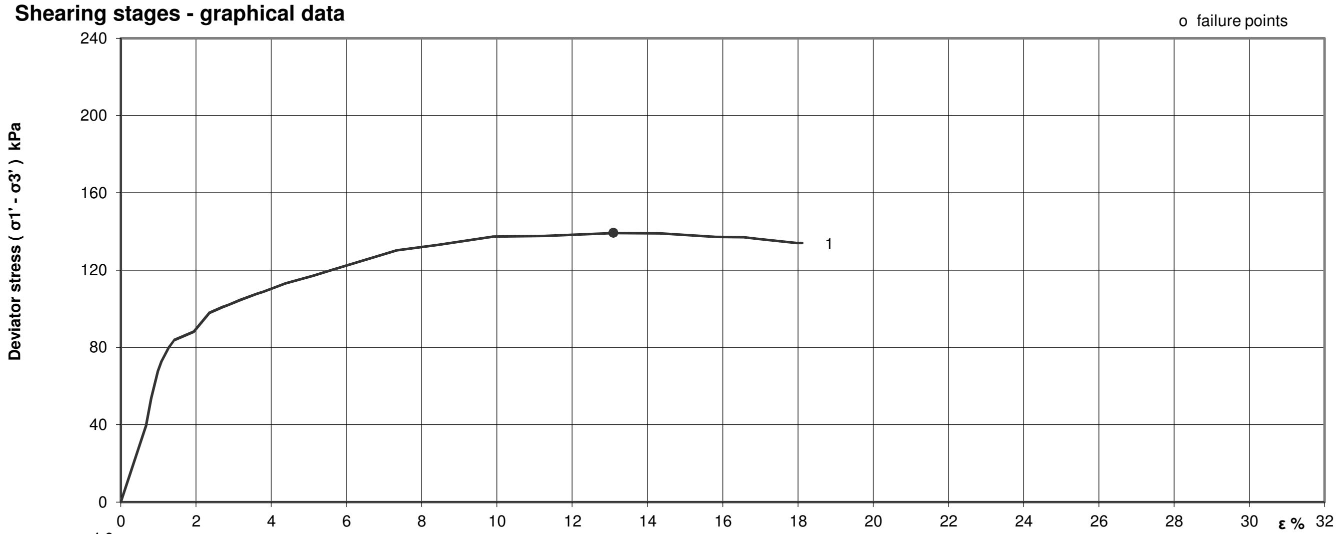
Ref SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:46	**Figure** **CU** sheet 1 of 3

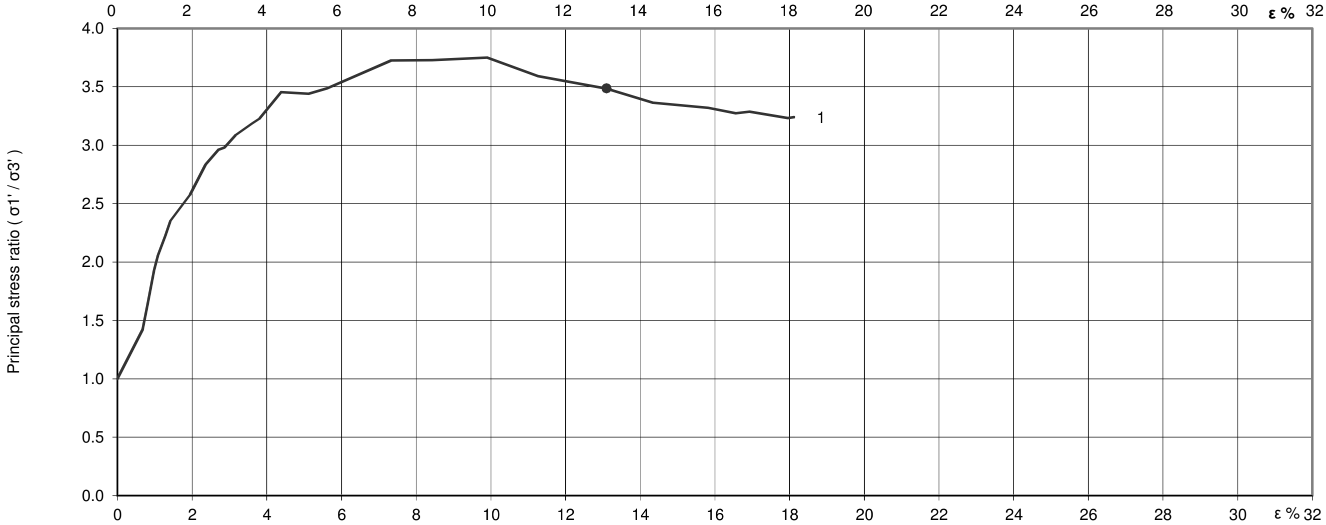
1157

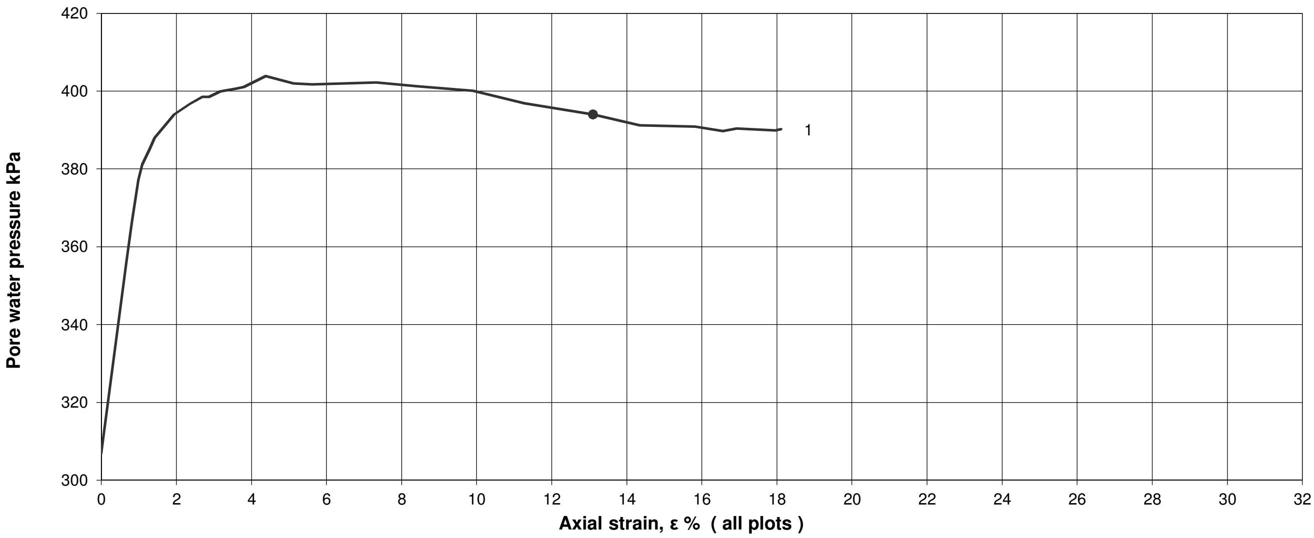
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.7 - 7.15		
			No	15	Type	UT
			ID			
			Spec Ref			

Shearing stages - graphical data





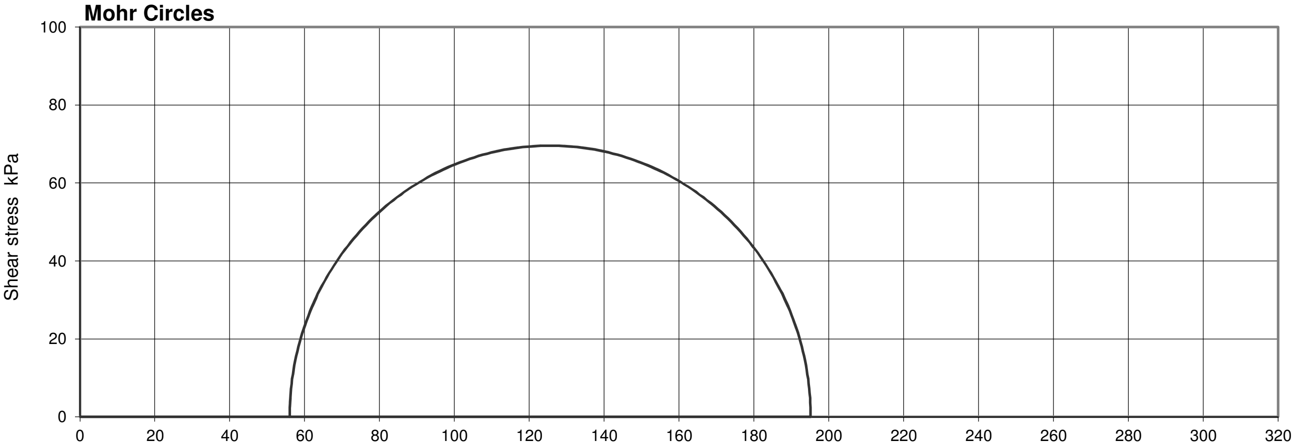


Ref SLR8.1 Rev 85 May 09	ESG 1157	Printed:18/03/2016 10:46	**Figure** **CU** sheet 2 of 3

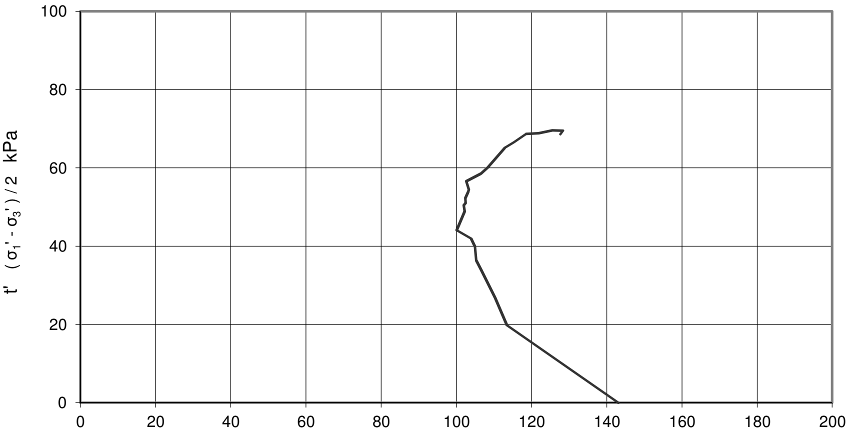
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.7 - 7.15		
			No	15	Type	UT
			ID			
			Spec Ref			

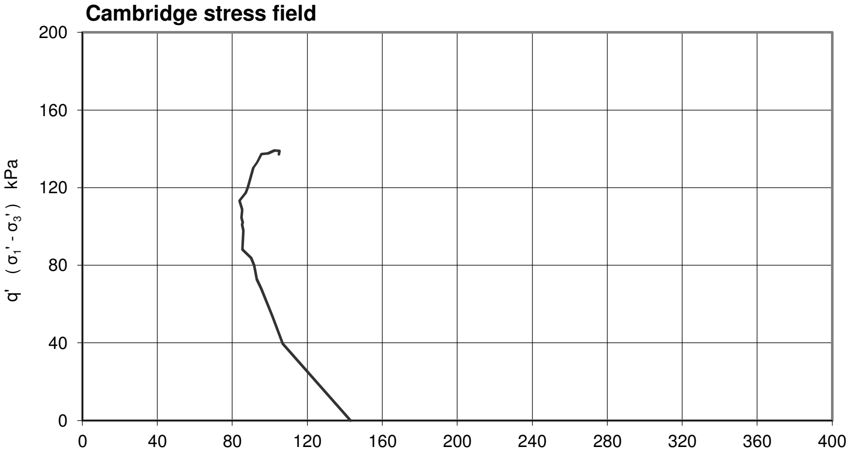
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	450			kPa
Initial pwp	307			kPa
Initial σ_3'	143			kPa
Rate of strain	0.25			%/hr

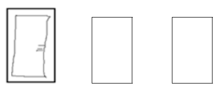
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	13.10			%
$(\sigma_1' / \sigma_3')_f$	3.485			
$(\sigma_1' - \sigma_3')_f$	139.2			kPa
u_f	394			kPa
$\sigma_3'_f$	56			kPa
$\sigma_1'_f$	195			kPa
A_f	0.63			
Time to failure	51.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, and 0.308 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:46	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

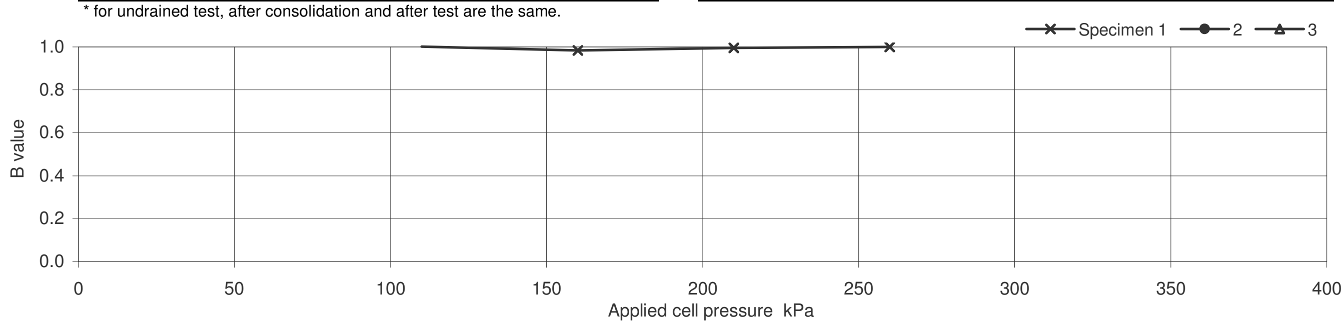
Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.05 - 9.05		
			No	19	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	191.74		
	Diameter	mm	97.67		
	Bulk Density	Mg/m³	1.83		
	Water Content	%	38		
	Dry density	Mg/m³	1.32		
After consolidation	Length	mm	191.88		
	Diameter	mm	97.74		
	Bulk Density*	Mg/m³	1.83		
	Water Content*	%	39		
	Dry density*	Mg/m³	1.32		

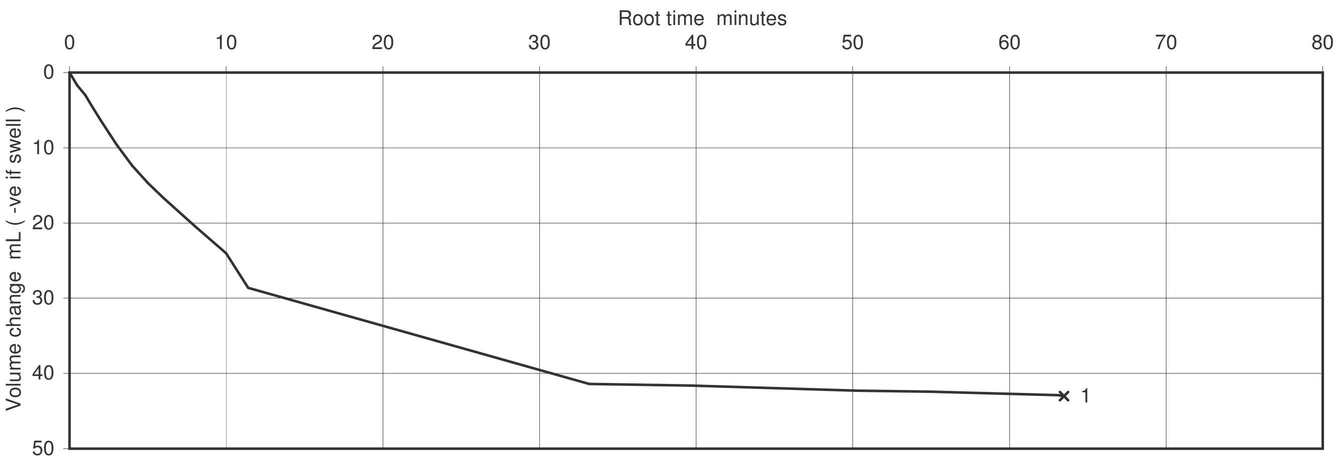
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown slightly sandy SILT with pockets of brownish grey clayey SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	260		
Final pore water pressure	kPa	261.5		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		345			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		45			kPa
	Pore pressure at start of consolidation		343			kPa
	Pore pressure at end of consolidation		302			kPa
	Pore pressure dissipation at end of consolidation		96			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.03			m^2/year
	Coefficient of Compressibility	M_{vi}	0.69			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	2.2E-10			m/s



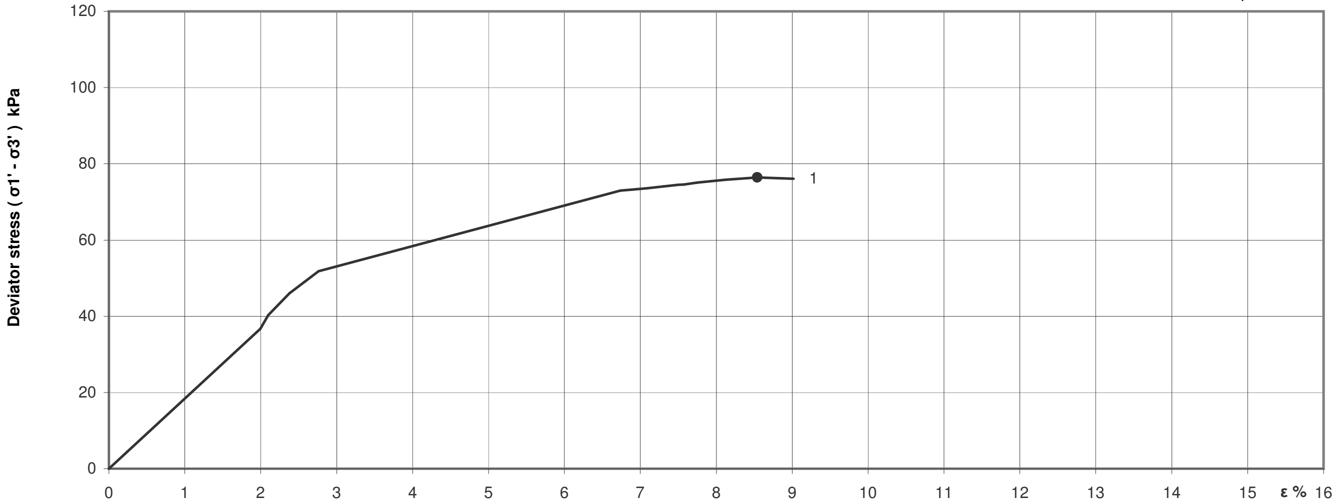
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:03	Figure CU sheet 1 of 3

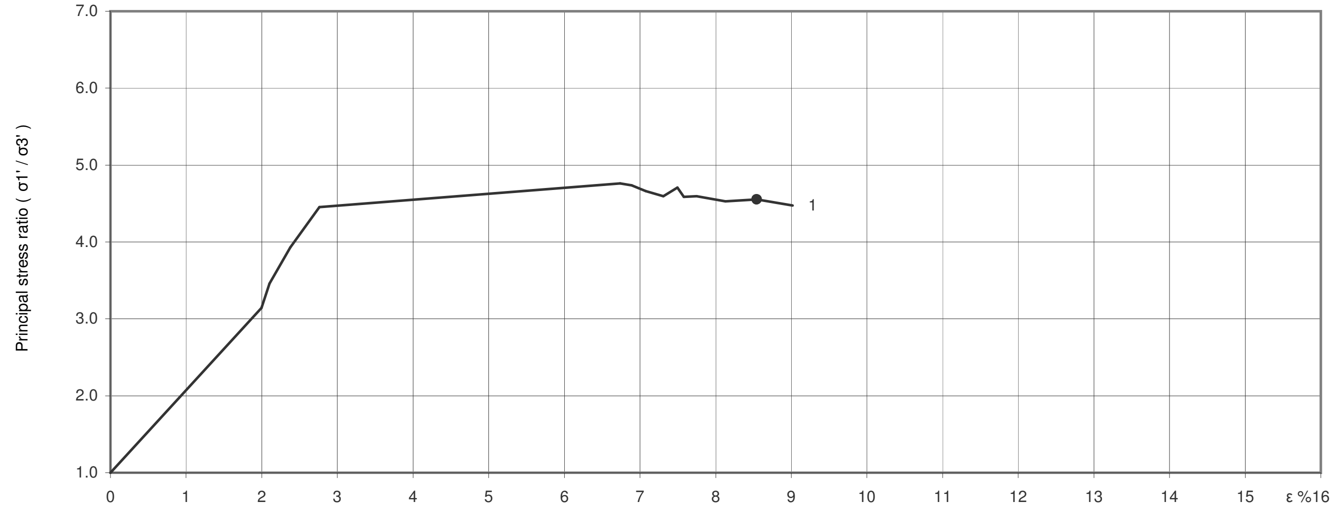
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

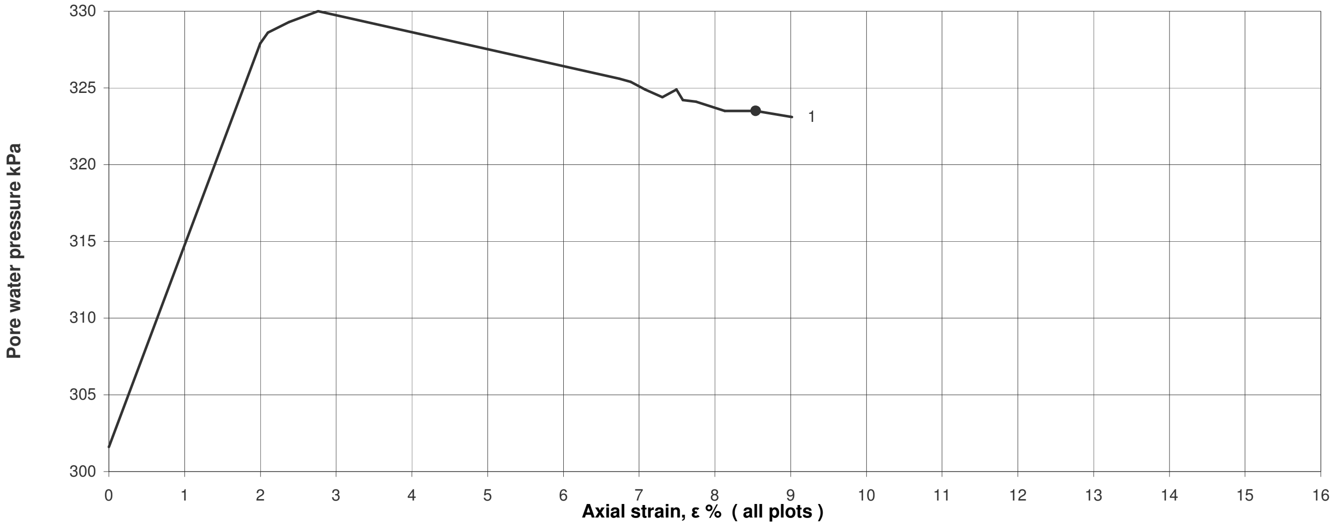
Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.05 - 9.05		
			No	19	Type	P
			ID			
			Spec Ref			

Shearing stages - graphical data

o failure points



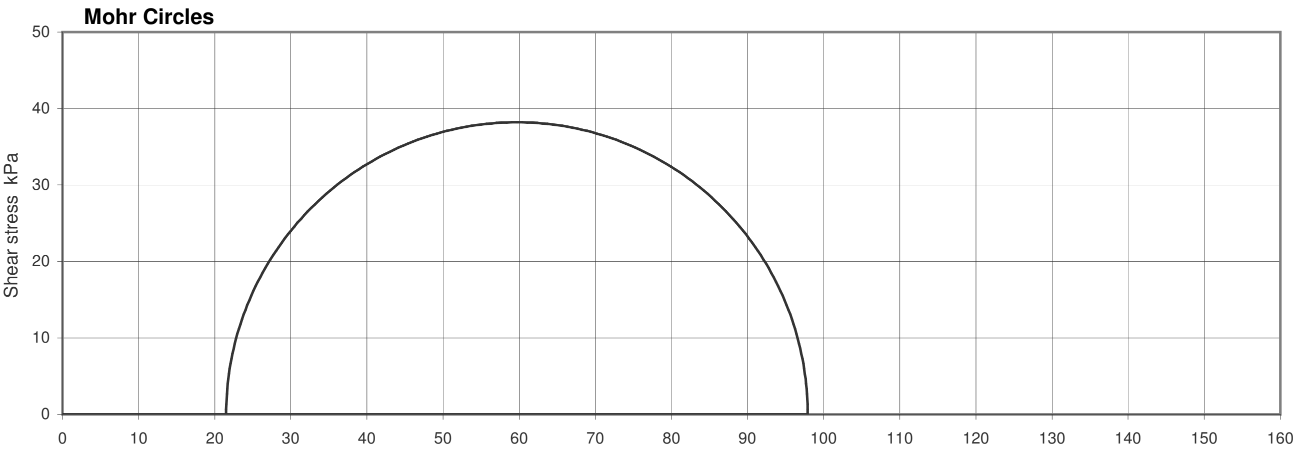


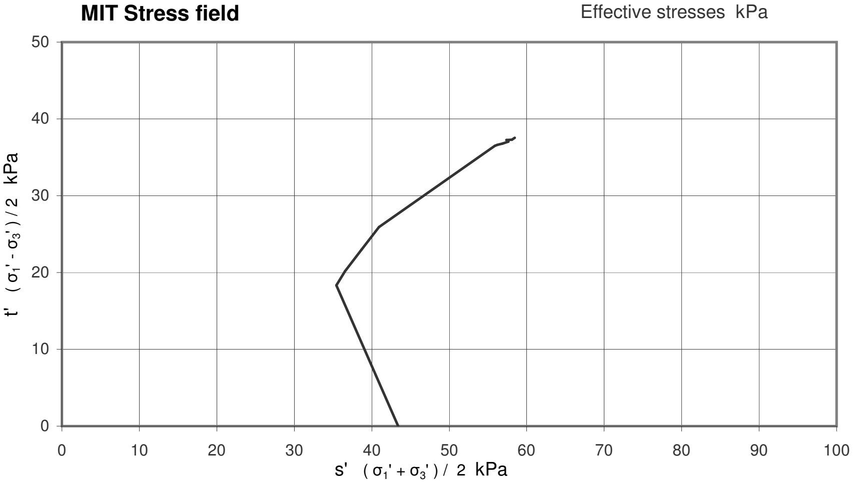


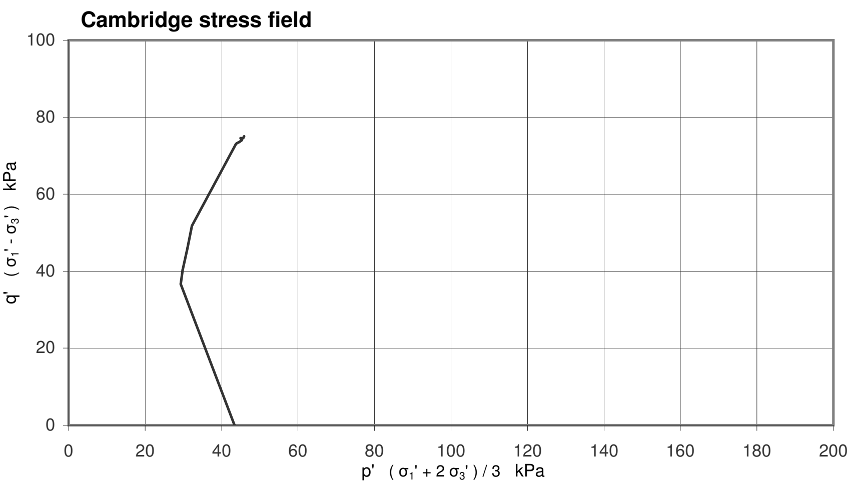
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:01/03/2016 11:03	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.05 - 9.05		
			No	19	Type	P
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	345			kPa
Initial pwp	302			kPa
Initial σ_3'	43			kPa
Rate of strain	0.83			%/hr

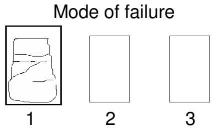
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	8.54			%
$(\sigma_1' / \sigma_3')_f$	4.554			
$(\sigma_1' - \sigma_3')_f$	76.4			kPa
u_f	324			kPa
$\sigma_3'_f$	22			kPa
$\sigma_1'_f$	98			kPa
A_f	0.29			
Time to failure	10.4			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.4 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:03	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

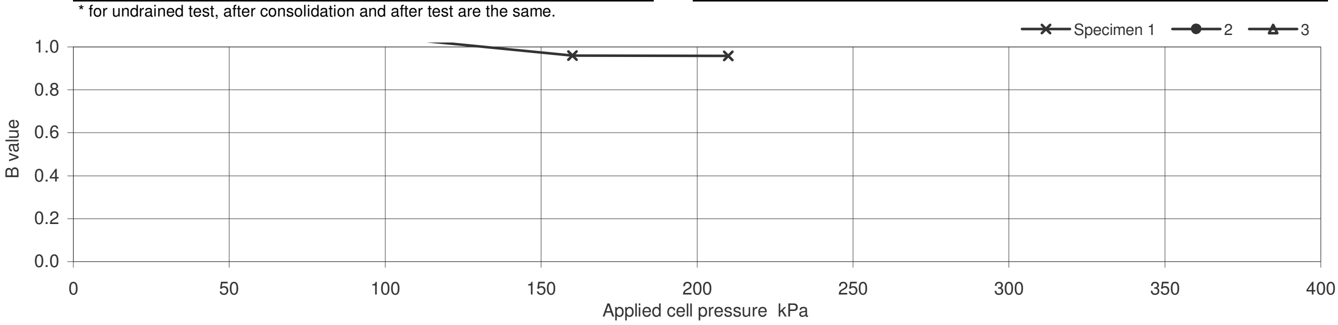
Project No	A5085-15	Sample Details:	Hole No	BH408			
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05 - 10.05			
			No	20	Type	P	
			ID	BASE			
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	192.15		
	Diameter	mm	97.04		
	Bulk Density	Mg/m³	1.79		
	Water Content	%	45		
	Dry density	Mg/m³	1.24		
After consolidation	Length	mm	186.44		
	Diameter	mm	94.12		
	Bulk Density*	Mg/m³	1.87		
	Water Content*	%	38		
	Dry density*	Mg/m³	1.36		

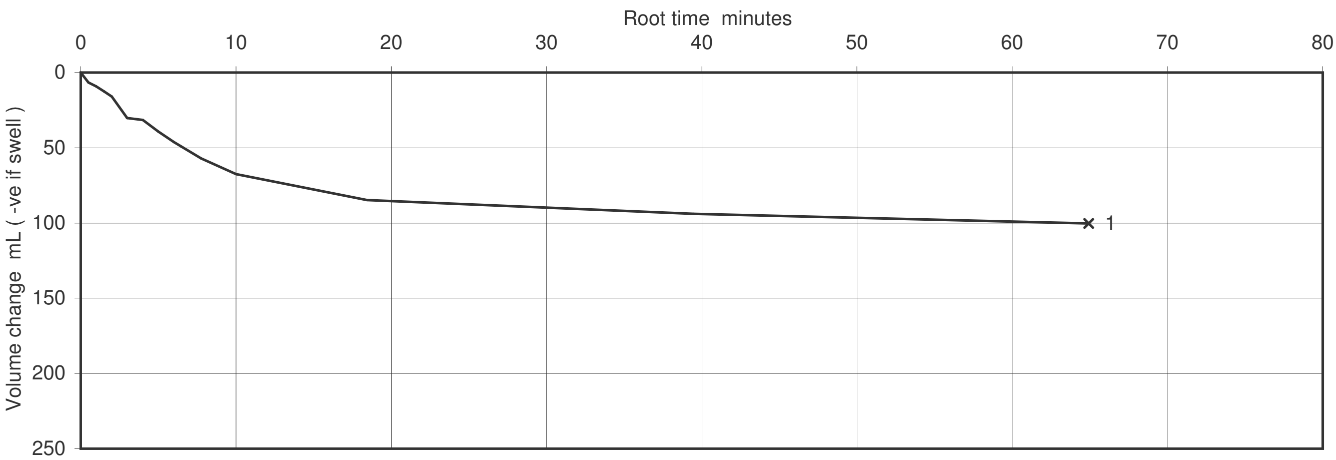
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm dark greyish brown slightly sandy clayey SILT. Specimen is also laminated.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	201.5		
Final B Value		0.96		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		500			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		200			kPa
	Pore pressure at start of consolidation		495			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.06			m^2/year
	Coefficient of Compressibility	M_{vi}	0.37			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.2E-10			m/s

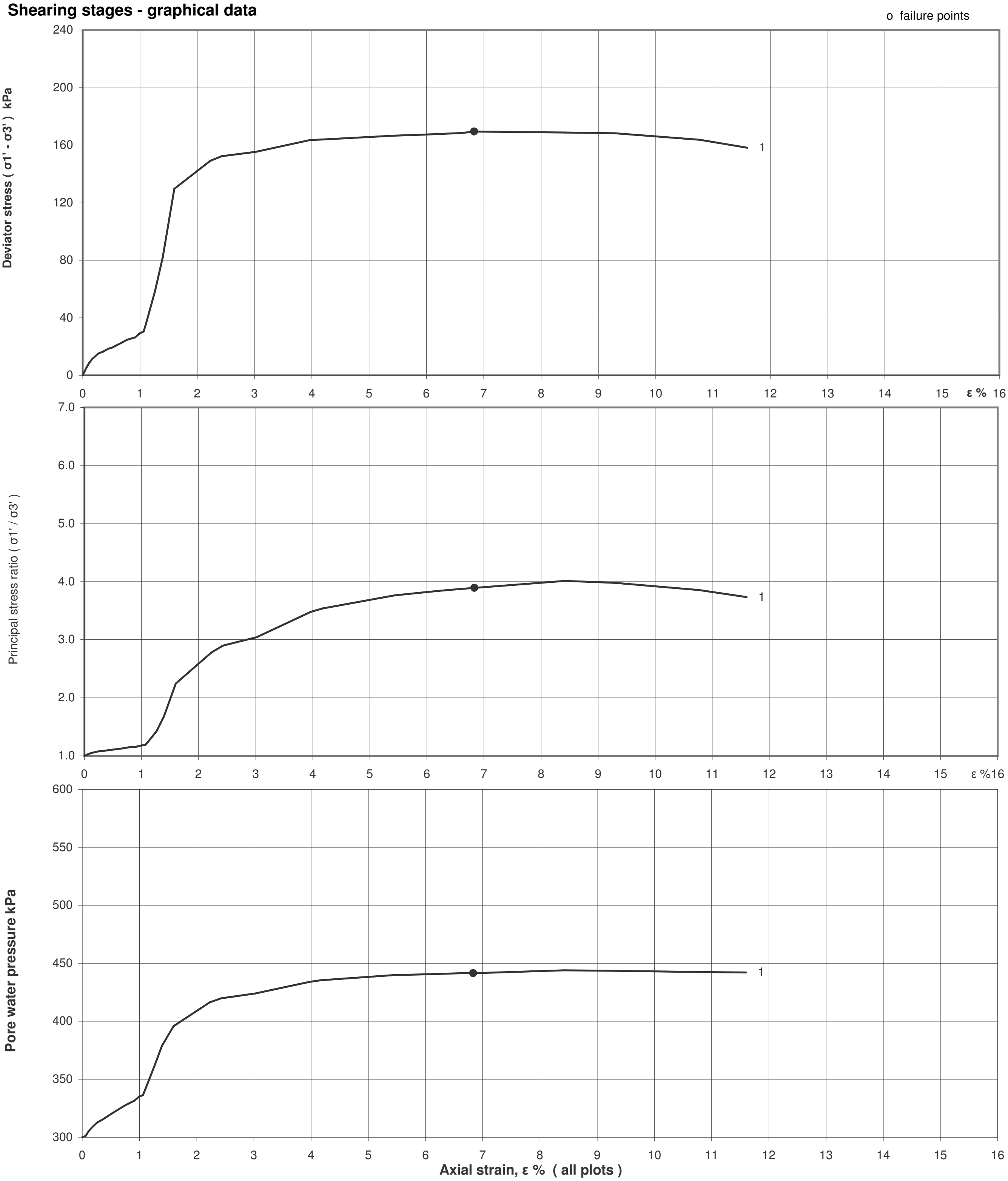


Ref			
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:04	Figure CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05 - 10.05		
			No	20	Type	P
			ID	BASE		
			Spec Ref			

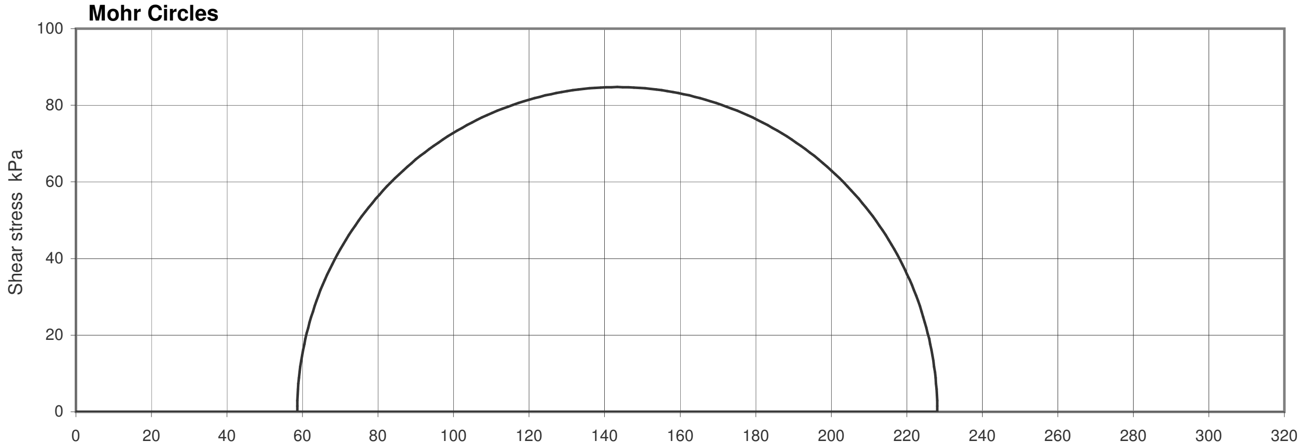
Shearing stages - graphical data

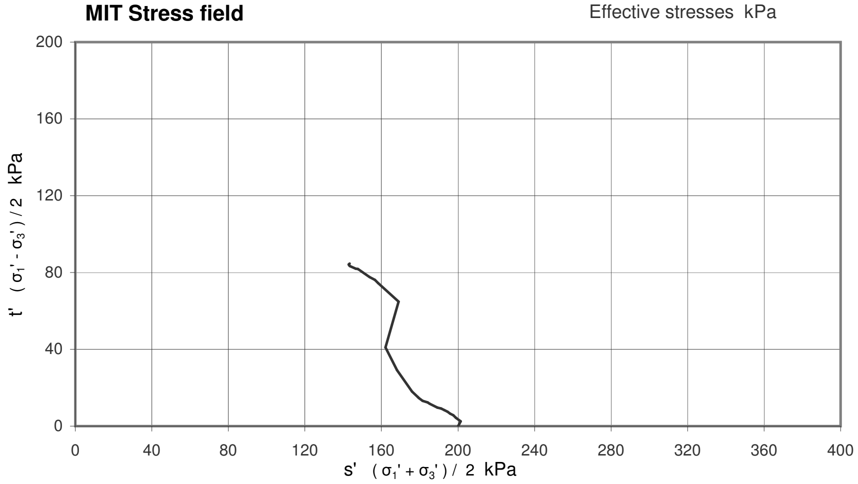


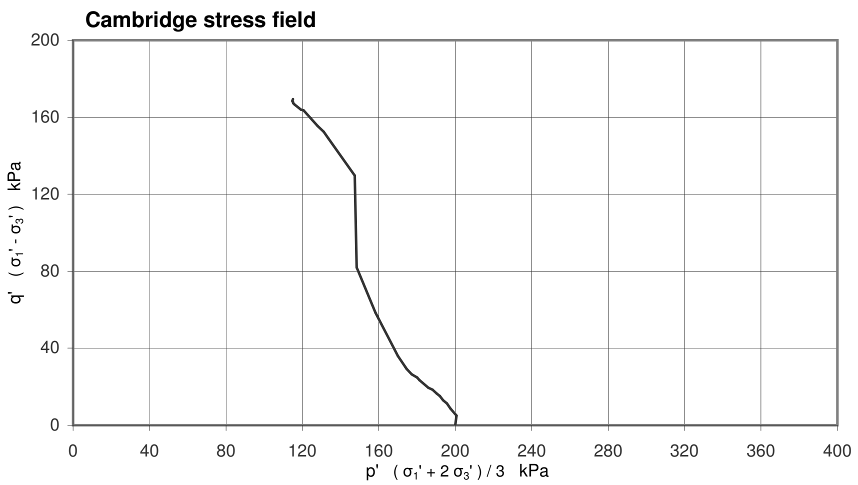
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:04	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05 - 10.05		
			No	20	Type	P
			ID	BASE		
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	500			kPa
Initial pwp	300			kPa
Initial σ_3'	200			kPa
Rate of strain	0.90			%/hr

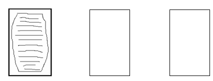
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	6.83			%
$(\sigma_1' / \sigma_3')_f$	3.892			
$(\sigma_1' - \sigma_3')_f$	169.5			kPa
u_f	441			kPa
$\sigma_3'{}_f$	59			kPa
$\sigma_1'{}_f$	228			kPa
A_f	0.83			
Time to failure	7.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



Notes : Deviator stresses corrected for area change, vertical side drains and 0.6 mm thick rubber membrane(s)

Ref		Printed:01/03/2016 11:04	Figure
SLR8.1 Rev 85 May 09	ESG / UKAS TESTING 1157		CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

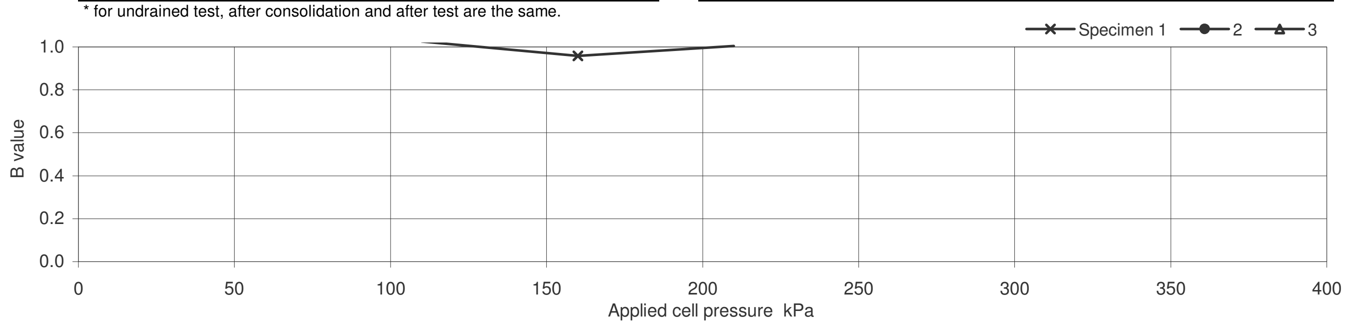
Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05 - 10.05		
			No	20	Type	P
			ID	TOP		
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	188.41		
	Diameter	mm	97.91		
	Bulk Density	Mg/m³	1.90		
	Water Content	%	36		
	Dry density	Mg/m³	1.40		
After consolidation	Length	mm	183.98		
	Diameter	mm	95.58		
	Bulk Density*	Mg/m³	1.98		
	Water Content*	%	32		
	Dry density*	Mg/m³	1.50		

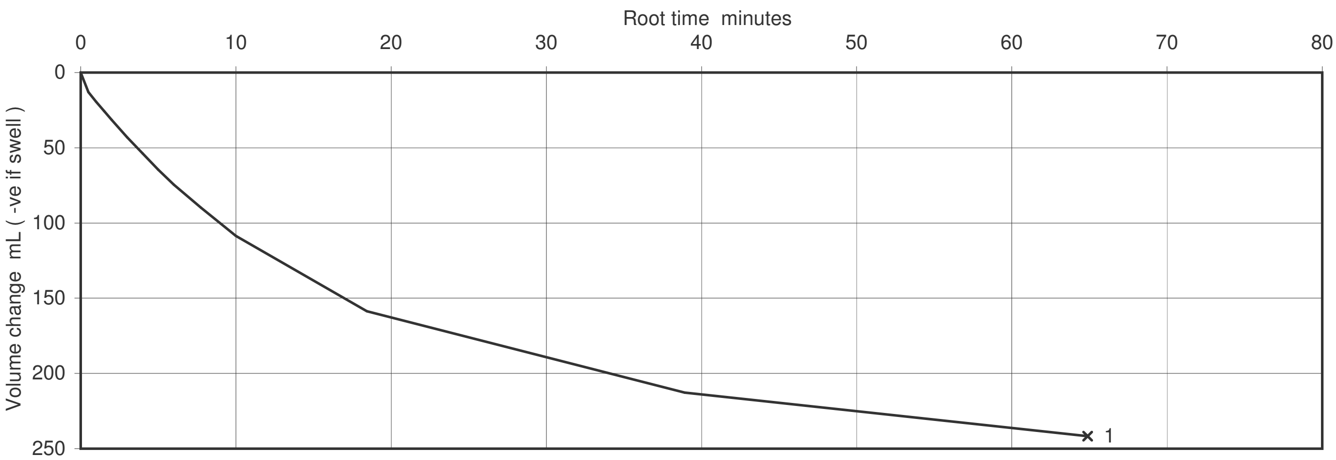
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft dark greyish brown slightly sandy SILT
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	197.1		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		395			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		95			kPa
	Pore pressure at start of consolidation		390			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	0.44			m^2/year
	Coefficient of Compressibility	M_{vi}	1.72			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	2.4E-10			m/s

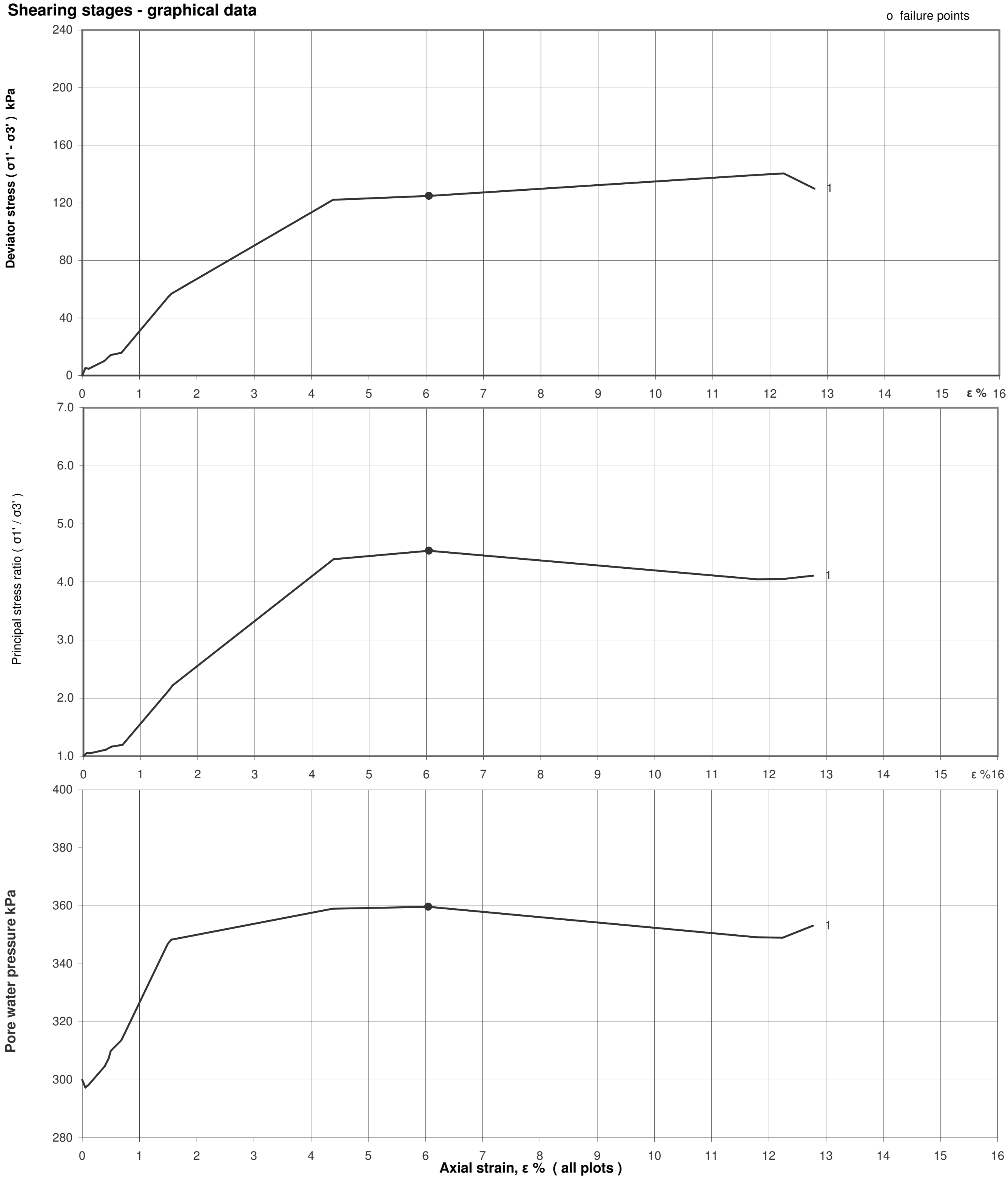


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:08	**Figure** CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05 - 10.05		
			No	20	Type	P
			ID	TOP		
			Spec Ref			

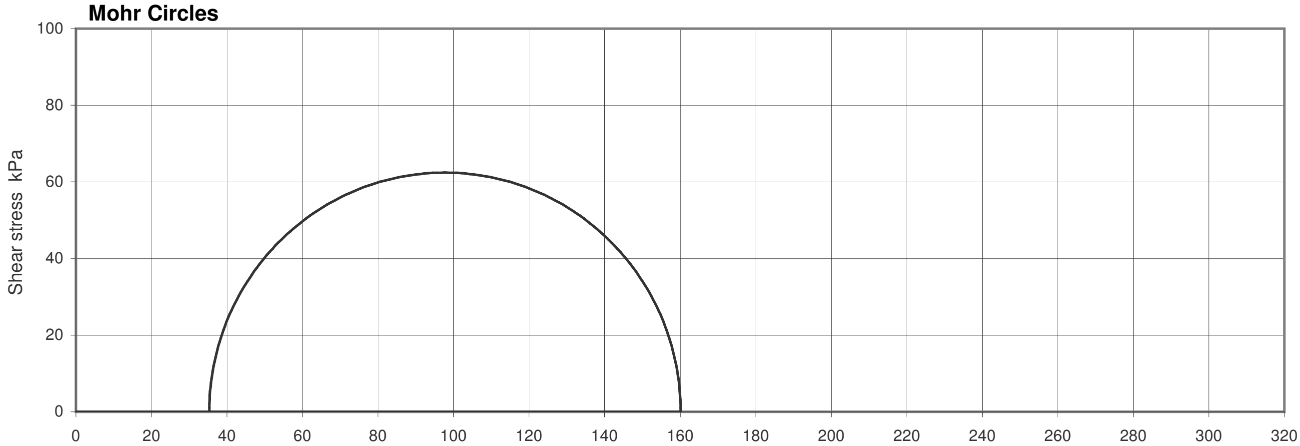
Shearing stages - graphical data

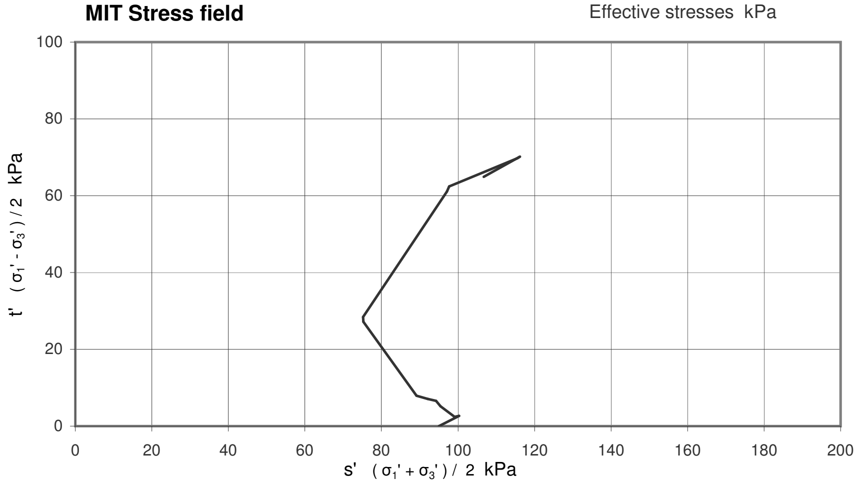


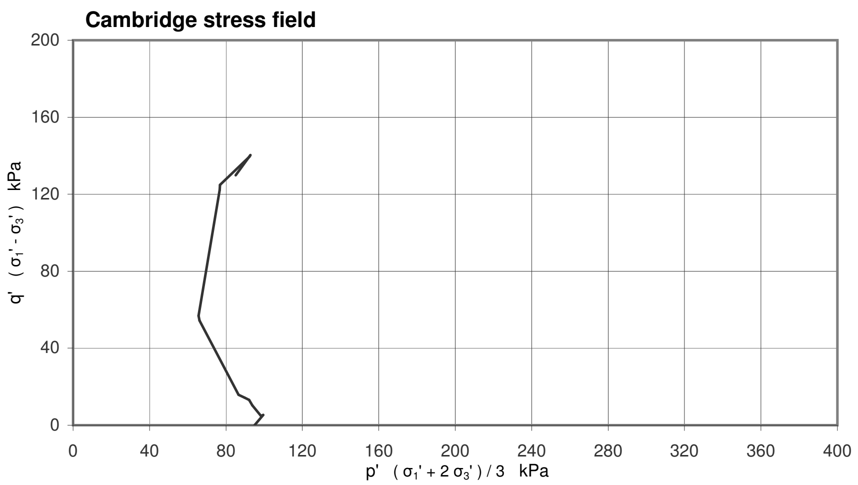
Ref SLR8.1 Rev 85 May 09	ESG	UKAS TESTING 1157	Printed:01/03/2016 11:08	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05 - 10.05		
			No	20	Type	P
			ID	TOP		
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	395			kPa
Initial pwp	300			kPa
Initial σ_3'	95			kPa
Rate of strain	0.33			%/hr

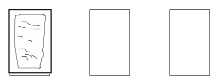
Failure conditions

Criterion				
Axial strain	6.05			%
$(\sigma_1' / \sigma_3')_f$	4.537			
$(\sigma_1' - \sigma_3')_f$	124.8			kPa
u_f	360			kPa
$\sigma_3'_f$	35			kPa
$\sigma_1'_f$	160			kPa
A_f	0.48			
Time to failure	18.4			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.616 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:08	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

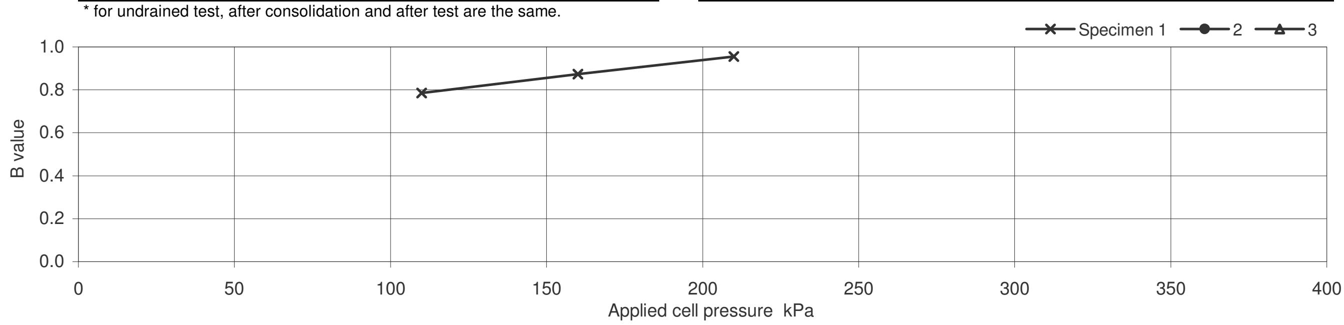
Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.75 - 17.2		
			No	43	Type	UT
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	202.96		
	Diameter	mm	103.34		
	Bulk Density	Mg/m³	2.04		
	Water Content	%	24		
	Dry density	Mg/m³	1.65		
After consolidation	Length	mm	201.95		
	Diameter	mm	102.83		
	Bulk Density*	Mg/m³	2.06		
	Water Content*	%	23		
	Dry density*	Mg/m³	1.67		

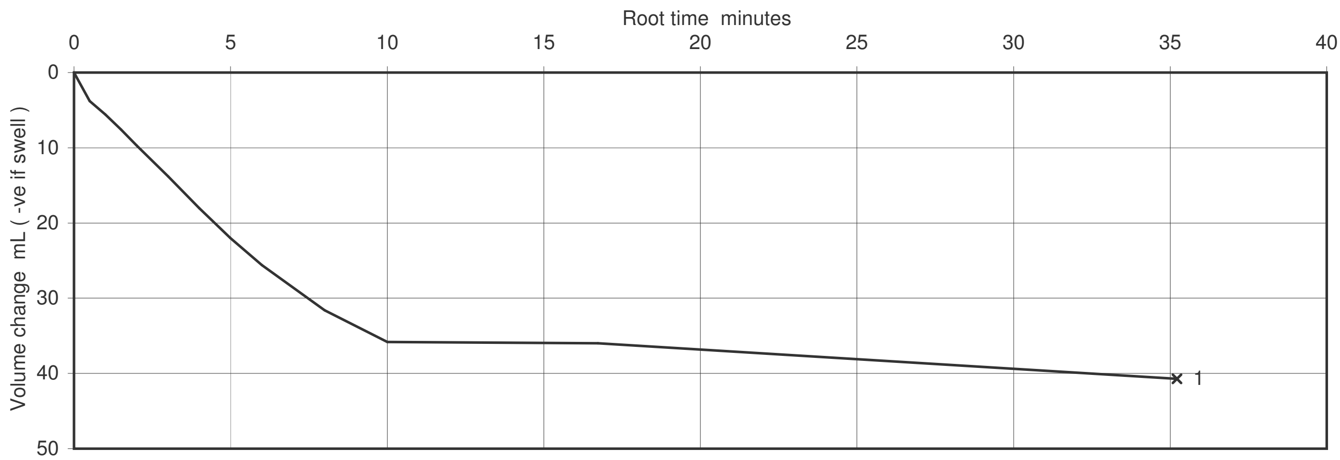
* for undrained test, after consolidation and after test are the same.

Soil Description	Stiff brown CLAY
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	10		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	201		
Final B Value		0.96		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		470			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		170			kPa
	Pore pressure at start of consolidation		461			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.53			m^2/year
	Coefficient of Compressibility	M_{vi}	0.15			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.2E-10			m/s

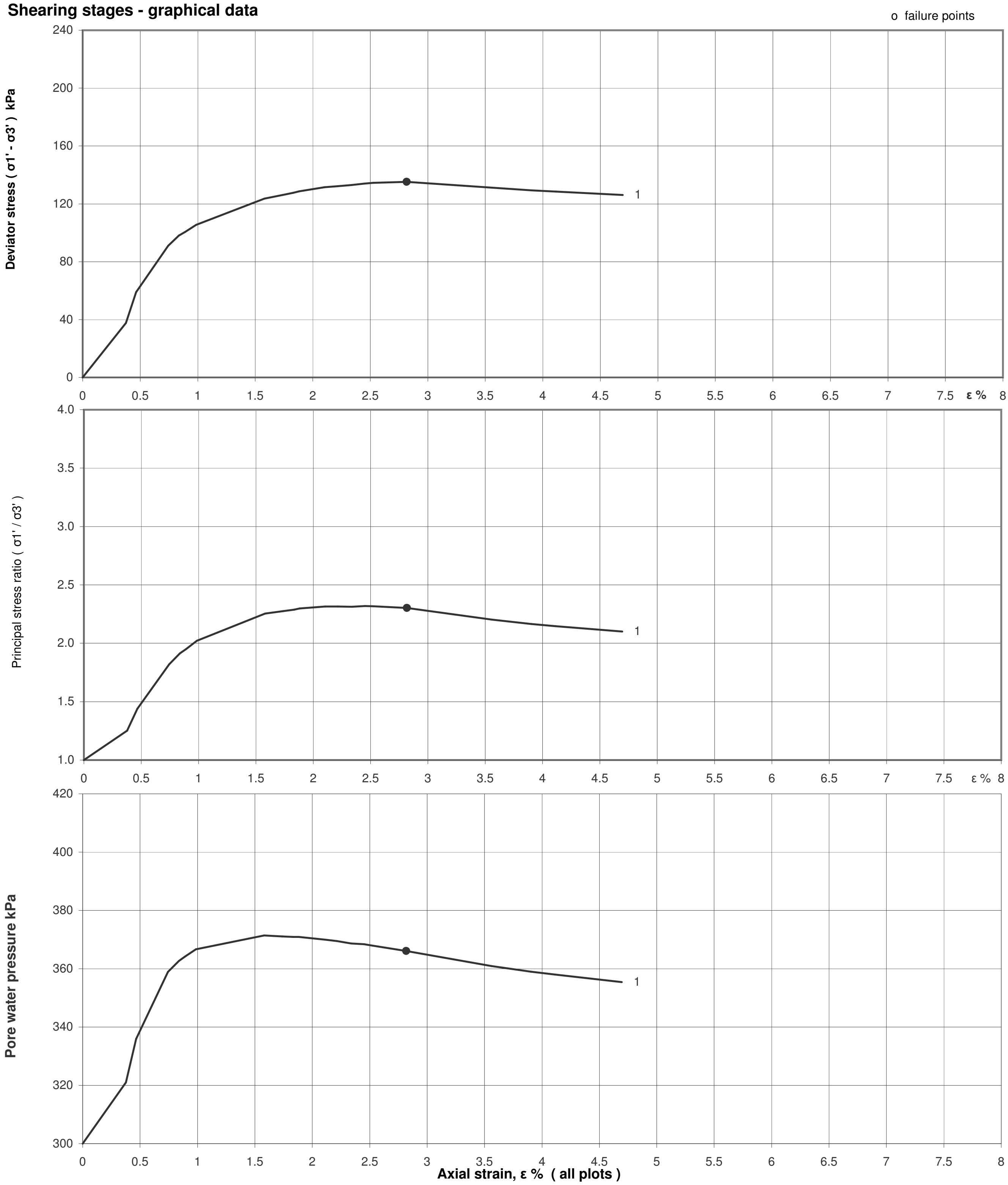


Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:10	Figure **CU** sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.75 - 17.2		
			No	43	Type	UT
			ID			
			Spec Ref			

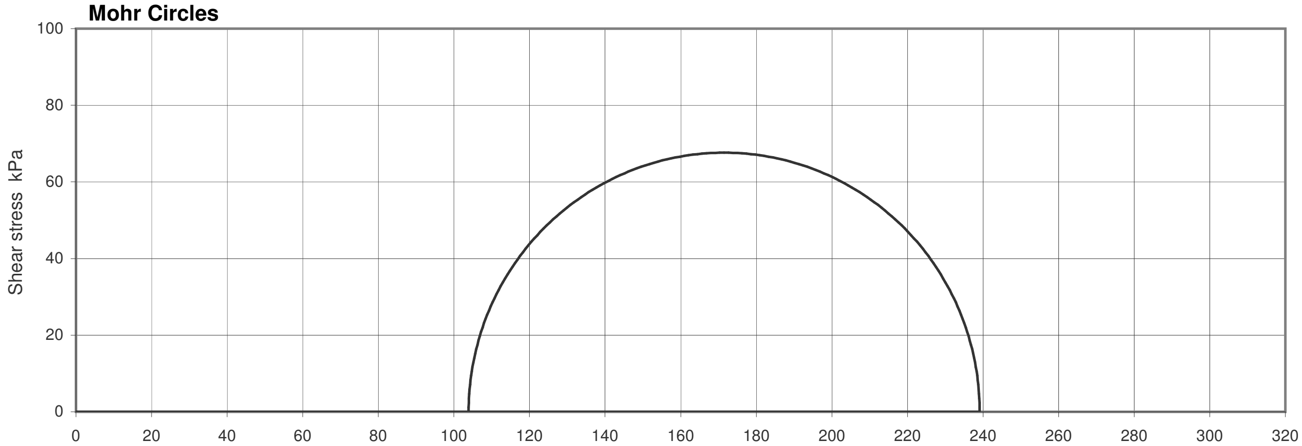
Shearing stages - graphical data

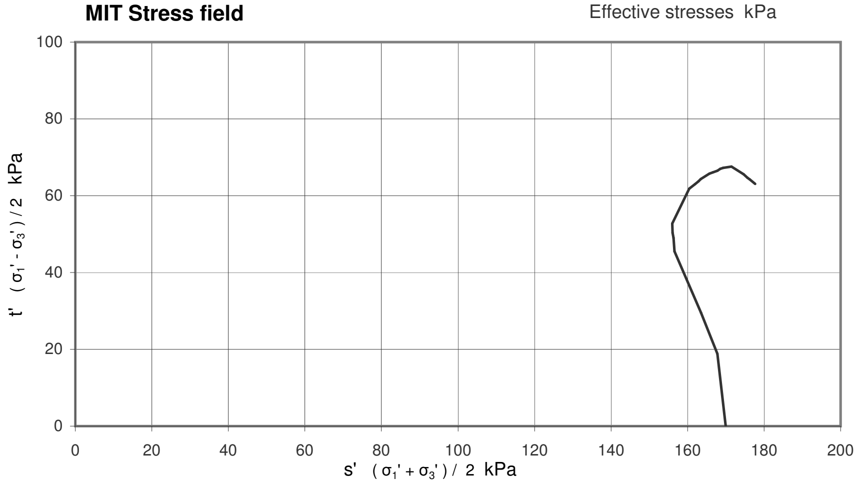


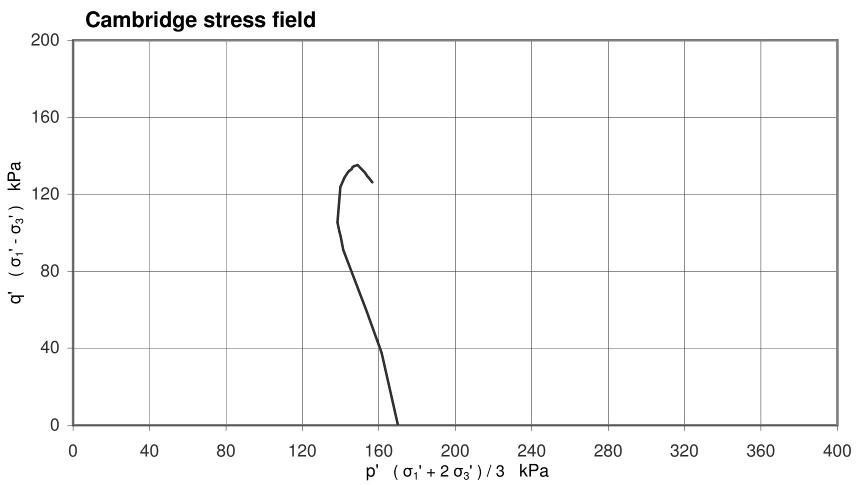
Ref SLR8.1 Rev 85 May 09	ESG	Printed:01/03/2016 11:10	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH408
Project Name	A63 CASTLE STREET		Depth (m BGL)	16.75 - 17.2
			No	43	Type UT
			ID	
			Spec Ref	







Compression stages

Specimen	1	2	3	
Cell pressure	470			kPa
Initial pwp	300			kPa
Initial σ_3'	170			kPa
Rate of strain	1.85			%/hr

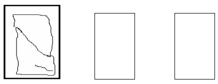
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	2.82			%
$(\sigma_1' / \sigma_3')_f$	2.301			
$(\sigma_1' - \sigma_3')_f$	135.2			kPa
u_f	366			kPa
$\sigma_3'{}_f$	104			kPa
$\sigma_1'{}_f$	239			kPa
A_f	0.49			
Time to failure	1.5			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.308 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:01/03/2016 11:10	CU sheet 3 of 3

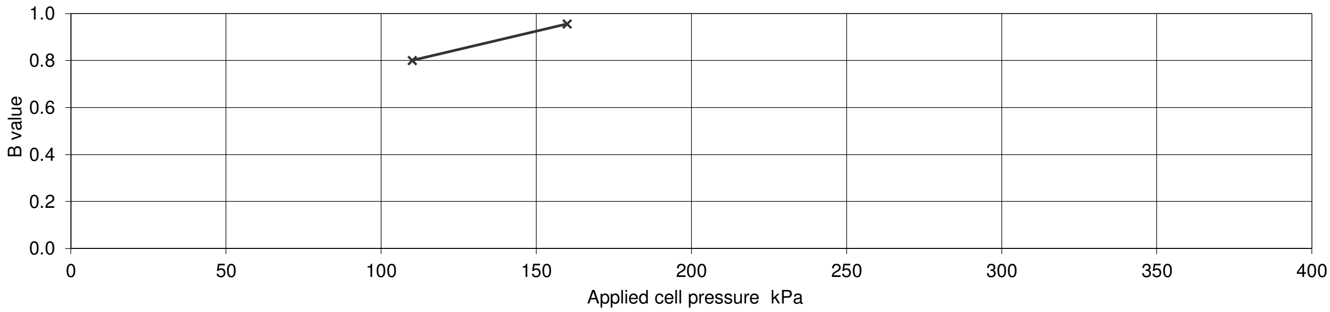
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure (BS1377 : Part 8 : 1990) - Multistage test on a single specimen

Project No	A5085-15	Sample Details:	Hole No	BH417
Project Name	A63 Castle Street		Depth (m BGL)	2.90-3.35
			No 8	Type UT
			ID	
			Spec Ref	

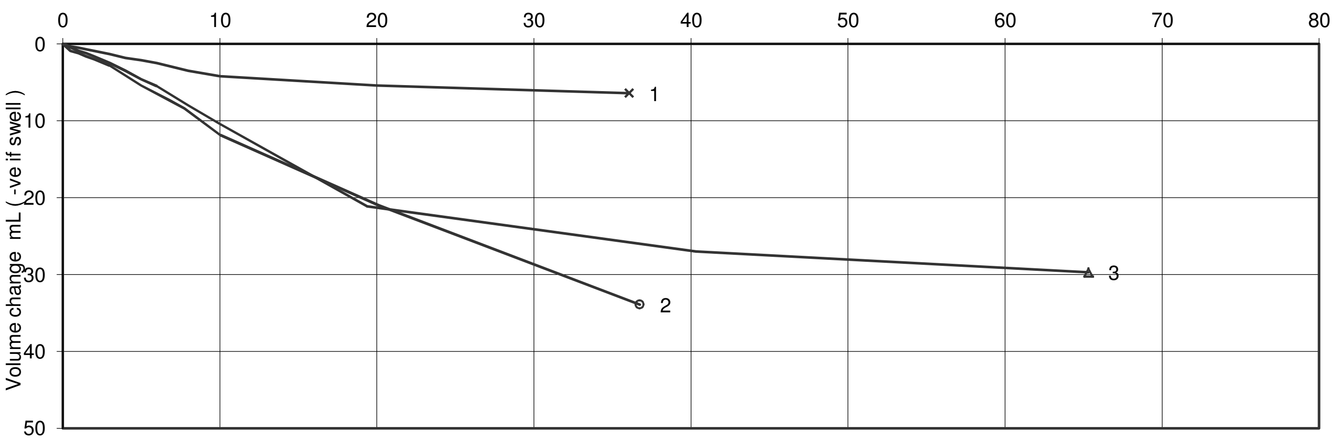
Specimen Details		
Initial		
Length	mm	202.96
Diameter	mm	104.18
Bulk Density	Mg/m³	1.95
Water Content	%	26
Dry density	Mg/m³	1.54
After test		
Bulk Density	Mg/m³	2.00
Water Content	%	25
Dry density	Mg/m³	1.60

Soil Description	Soft brown slightly sandy slightly gravelly CLAY. Gravel Fine
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation
		Increments of cell and back pressure
Cell pressure increments	kPa	50
Differential Pressure	kPa	10
Final Cell Pressure	kPa	160
Final pore water pressure	kPa	145.7
Final B Value		0.96



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Stage No.		1	2	3	
	Cell Pressure applied		330	360	420	kPa
	Back Pressure applied		300	300	300	kPa
	Effective Pressure		30	60	120	kPa
	Pore pressure at start of consolidation		312	342	381	kPa
	Pore pressure at end of consolidation		301	302	301	kPa
	Pore pressure dissipation at end of consolidation		96	94	99	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	1.10	0.31	0.33	m^2/year
	Coefficient of Compressibility	M_{vi}	0.32	0.50	0.22	m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	1.1E-10	4.8E-11	2.3E-11	m/s

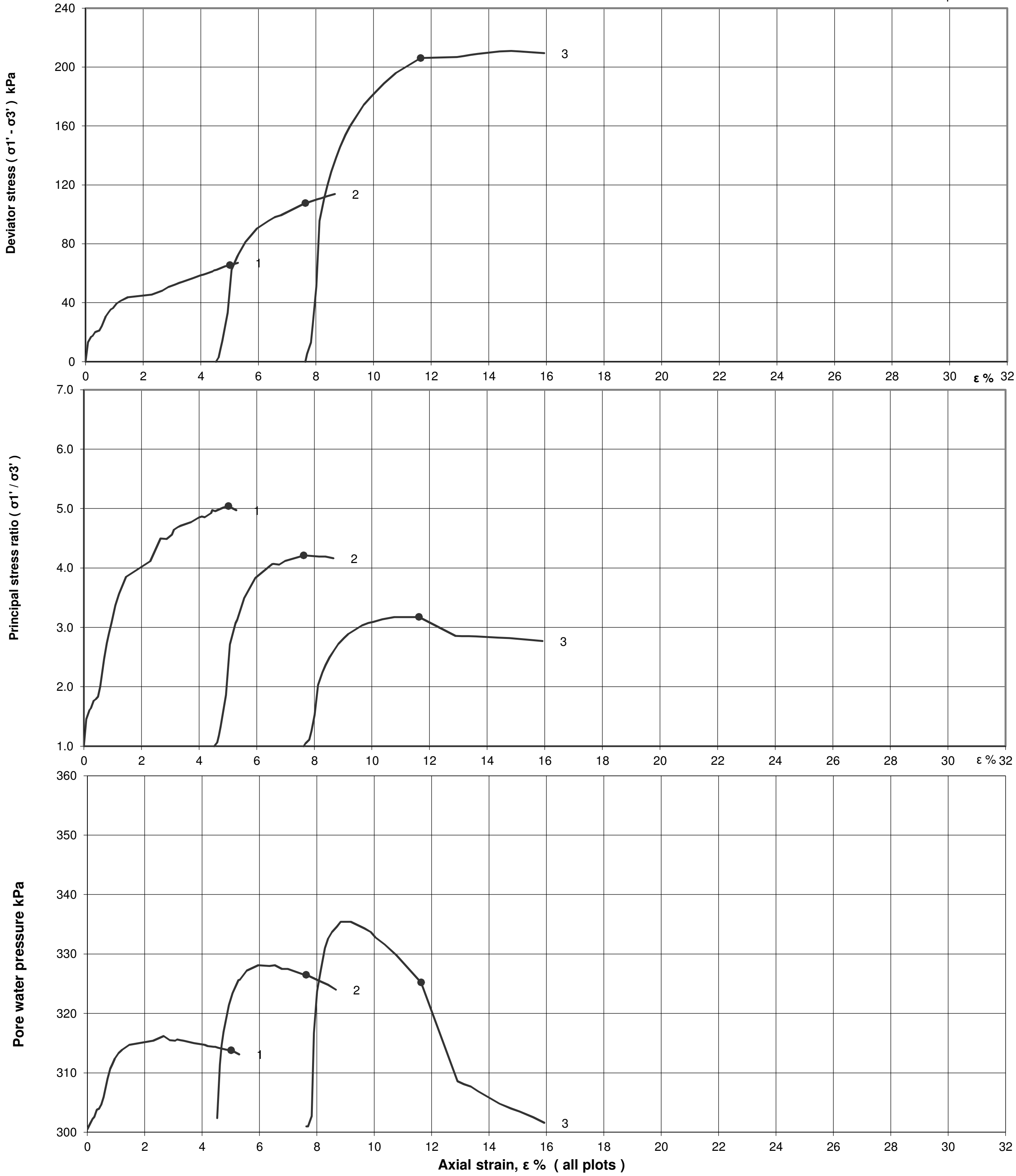


Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990) - Multistage test on a single specimen

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 Castle Street		Depth (m BGL)	2.90-3.35		
			No	8	Type	UT
			ID			
			Spec Ref			

Shearing stages - graphical data

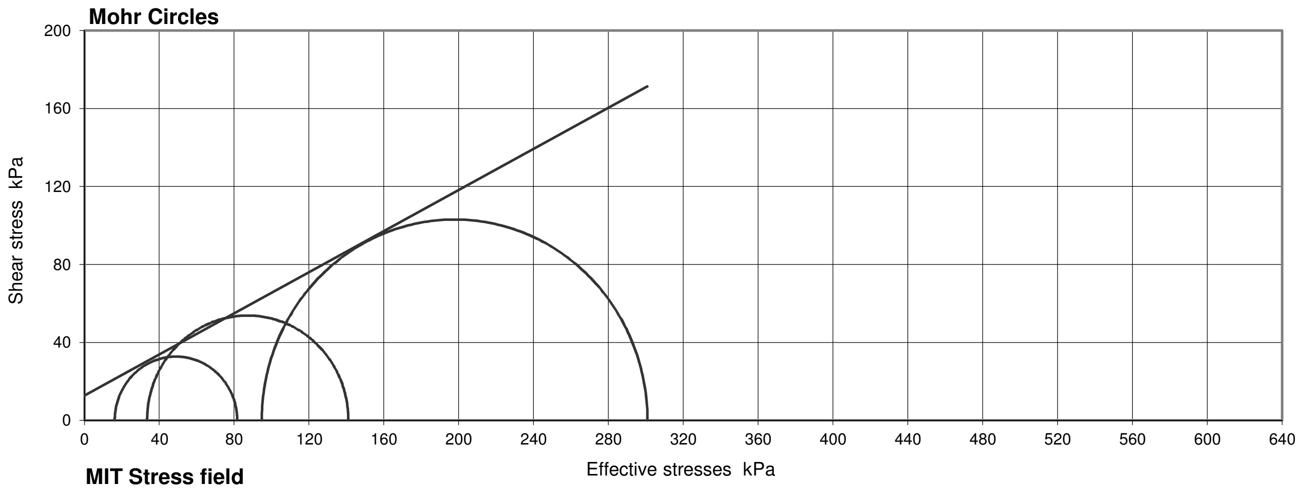
o failure points

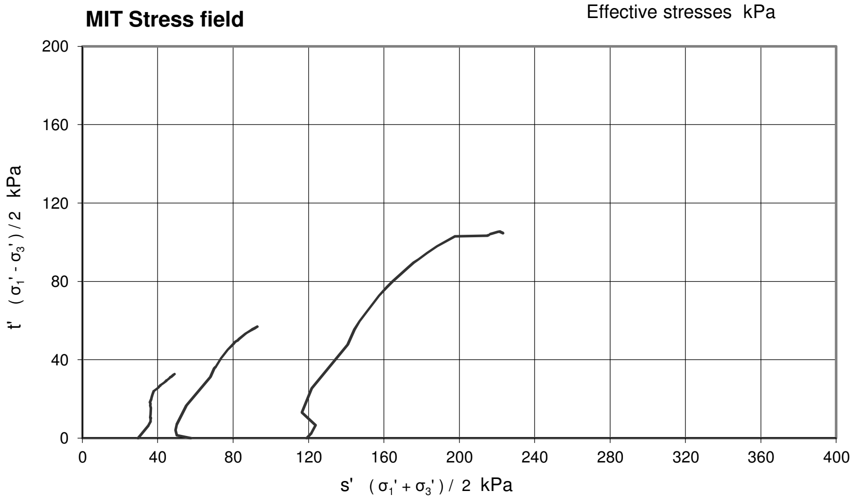


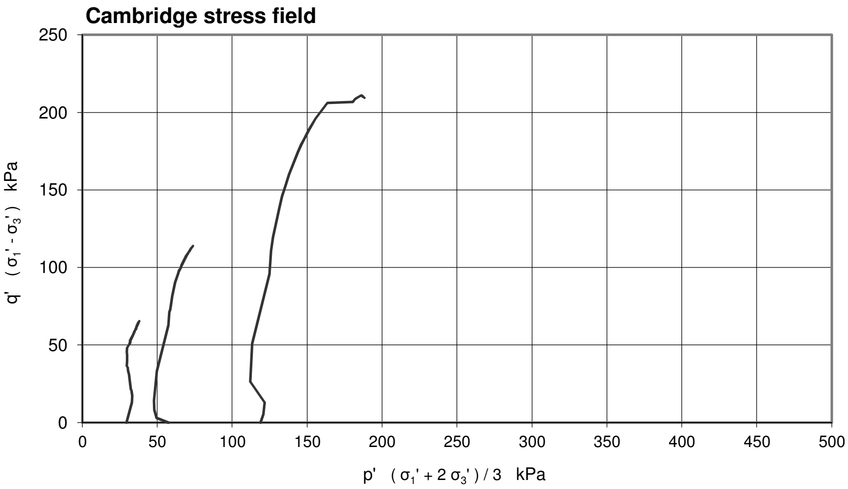
Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:07	**Figure** **CUM** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990) - Multistage test on a single specimen

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 Castle Street		Depth (m BGL)	2.90-3.35		
			No	8	Type	UT
			ID			
			Spec Ref			







Compression stages

Stage	1	2	3	
Cell pressure	330	360	420	kPa
Initial pwp	301	302	301	kPa
Initial σ_3'	30	58	119	kPa
Rate of strain	0.78	0.78	0.78	%/hr

Failure conditions

Criterion				
Axial strain	5.02	7.63	11.64	%
$(\sigma_1' / \sigma_3')_f$	5.040	4.211	3.174	
$(\sigma_1' - \sigma_3')_f$	65.5	107.6	206.1	kPa
u_f	314	327	325	kPa
$\sigma_3'_f$	16	34	95	kPa
$\sigma_1'_f$	82	141	301	kPa
A_f	0.20	0.22	0.12	
Time to failure	6.4	9.8	14.9	hrs

Shear Strength Parameters

		Linear regression
c '	kPa	12.7
Ø '	degrees	27.8
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

Notes : Deviator stresses corrected for area change, vertical side drains and 0.613 mm thick rubber membrane(s)

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:07	CUM sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

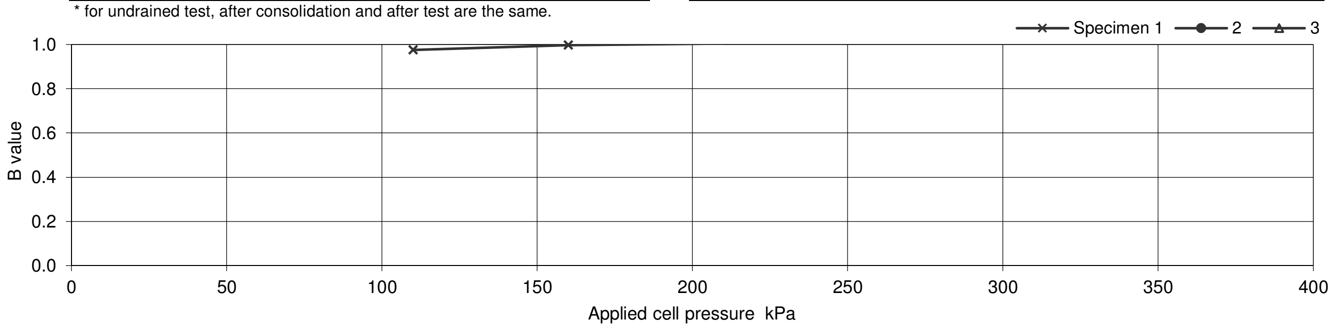
Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	17	Type	P
			ID			
			Spec Ref			

	Specimen Details		1	2	3
Initial	Length	mm	190.42		
	Diameter	mm	96.72		
	Bulk Density	Mg/m³	1.90		
	Water Content	%	36		
	Dry density	Mg/m³	1.39		
After consolidation	Length	mm	187.55		
	Diameter	mm	95.25		
	Bulk Density*	Mg/m³	1.94		
	Water Content*	%	33		
	Dry density*	Mg/m³	1.46		

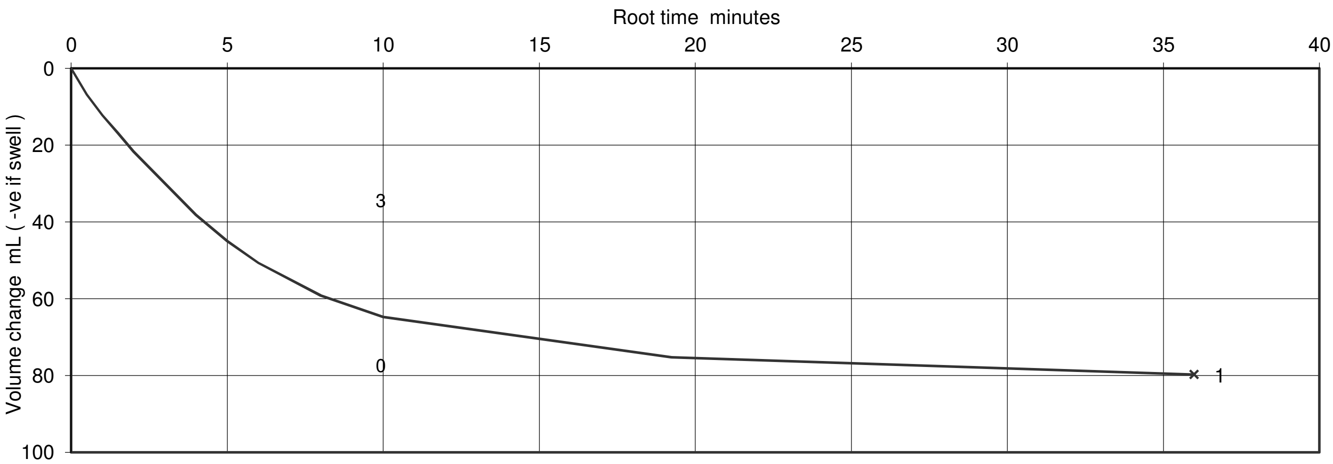
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft to firm greyish brown clayey SILT becoming CLAY towards the base.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell pressure only		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	198.5		
Final B Value		1.00		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		390			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		90			kPa
	Pore pressure at start of consolidation		388			kPa
	Pore pressure at end of consolidation		300			kPa
	Pore pressure dissipation at end of consolidation		100			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.70			m^2/year
	Coefficient of Compressibility	M_{vi}	0.64			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	5.4E-10			m/s

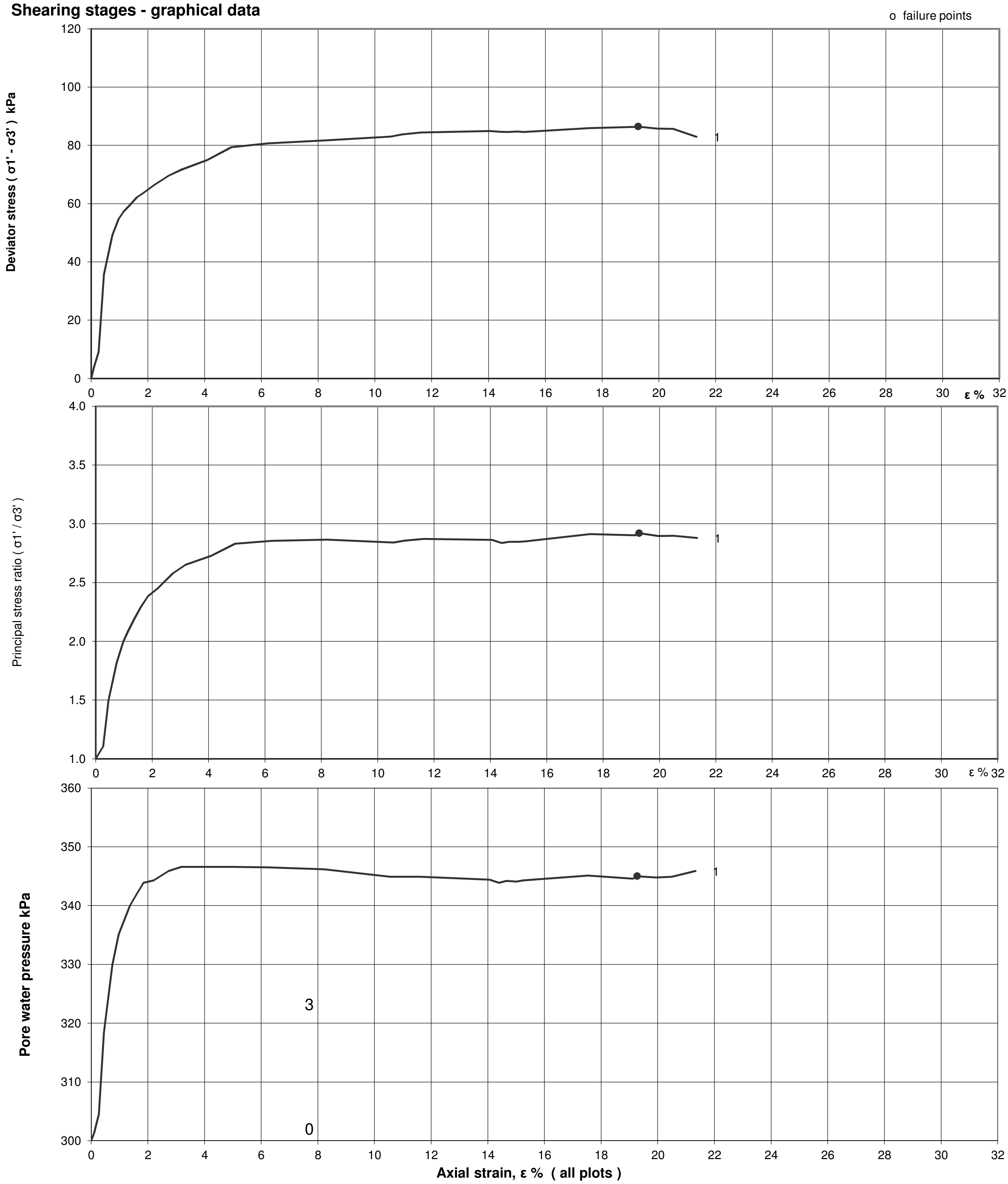


Ref			Figure
SLR8.1 Rev 85 May 09	ESG	UKAS TESTING 1157	Printed:18/03/2016 10:06	CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	17	Type	P
			ID			
			Spec Ref			

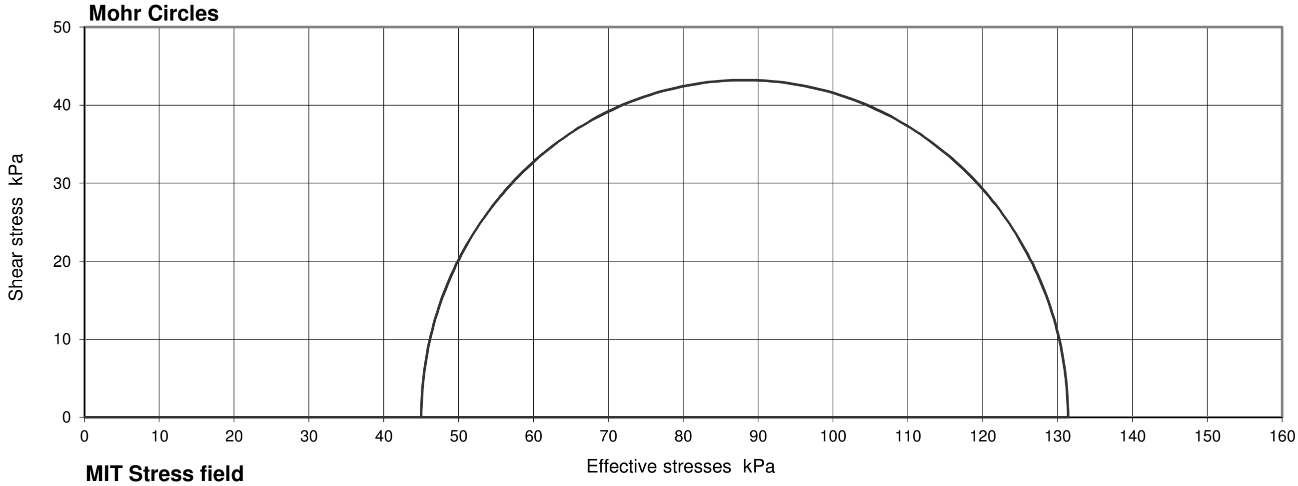
Shearing stages - graphical data

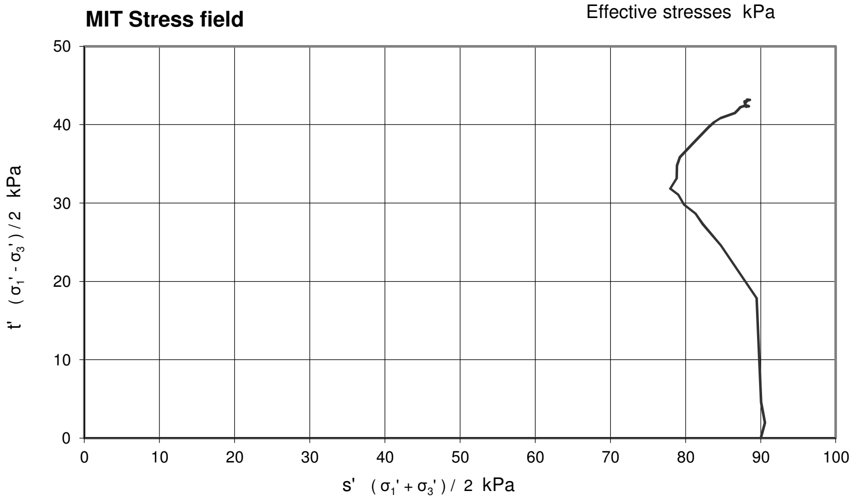


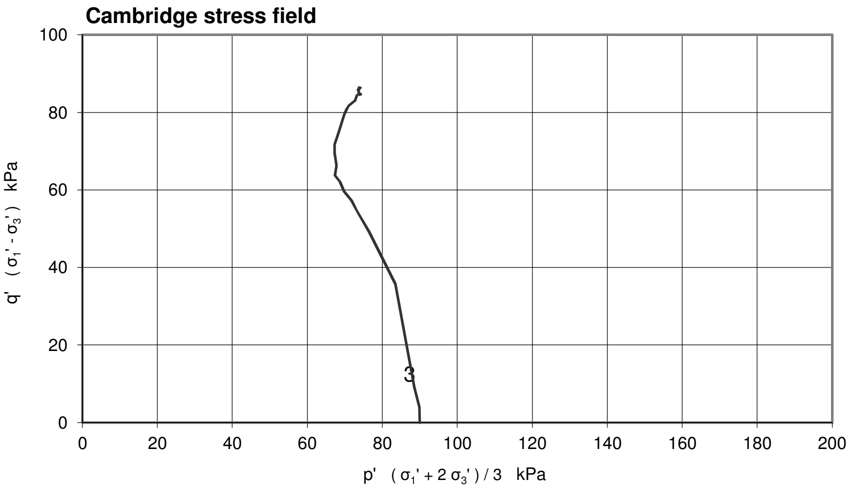
Ref SLR8.1 Rev 85 May 09	ESG	1157	Printed:18/03/2016 10:06	**Figure** **CU** sheet 2 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00-7.00		
			No	17	Type	P
			ID			
			Spec Ref			







Compression stages

Specimen	1	2	3	
Cell pressure	390			kPa
Initial pwp	300			kPa
Initial σ_3'	90			kPa
Rate of strain	2.00			%/hr

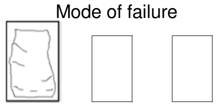
Failure conditions

Criterion	Maximum deviator stress			
Axial strain	19.28			%
$(\sigma_1' / \sigma_3')_f$	2.920			
$(\sigma_1' - \sigma_3')_f$	86.4			kPa
u_f	345			kPa
$\sigma_3'_f$	45			kPa
$\sigma_1'_f$	131			kPa
A_f	0.52			
Time to failure	9.6			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure



1 2 3

Notes : Deviator stresses corrected for area change, vertical side drains and 0.542 mm thick rubber membrane(s)

SPLIT AND DESCRIBE 0

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:06	CU sheet 3 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

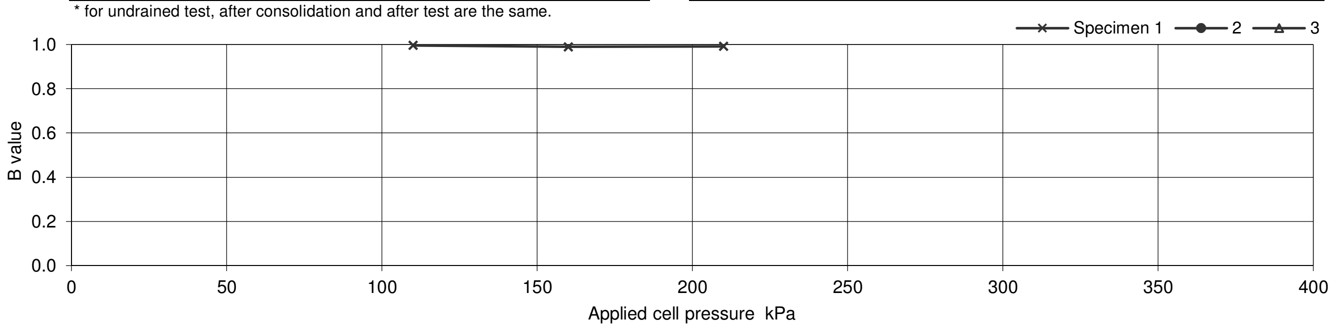
Project No	A5085-15	Sample Details:	Hole No	BH417			
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.50-8.95			
			No	22	Type	UT	
			ID				
			Spec Ref				

	Specimen Details		1	2	3
Initial	Length	mm	204.22		
	Diameter	mm	104.39		
	Bulk Density	Mg/m³	1.95		
	Water Content	%	33		
	Dry density	Mg/m³	1.47		
After consolidation	Length	mm	198.54		
	Diameter	mm	101.44		
	Bulk Density*	Mg/m³	2.04		
	Water Content*	%	27		
	Dry density*	Mg/m³	1.60		

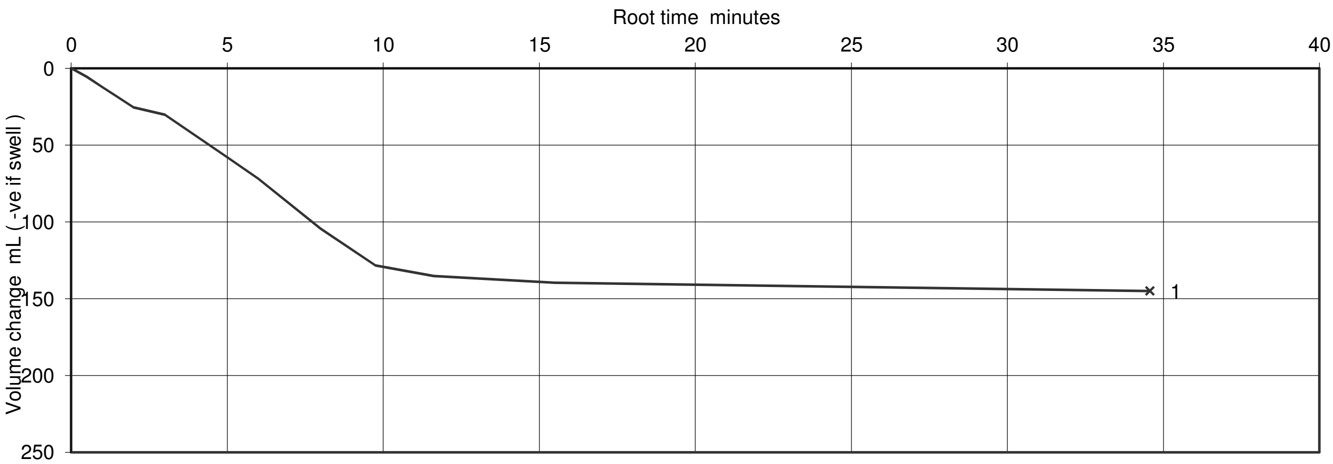
* for undrained test, after consolidation and after test are the same.

Soil Description	Soft brown silty CLAY.
Specimen Type /Preparation	UNDISTURBED

Saturation Details		Method of Saturation		
		Increments of cell and back pressure		
Cell pressure increments	kPa	50		
Differential Pressure	kPa	0		
Final Cell Pressure	kPa	210		
Final pore water pressure	kPa	201.5		
Final B Value		0.99		



Consolidation Details	Drainage Conditions		From radial boundary and one end			
	Specimen No.		1	2	3	
	Cell Pressure applied		410			kPa
	Back Pressure applied		300			kPa
	Effective Pressure		110			kPa
	Pore pressure at start of consolidation		407			kPa
	Pore pressure at end of consolidation		302			kPa
	Pore pressure dissipation at end of consolidation		98			%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	C_{vi}	2.00			m^2/year
	Coefficient of Compressibility	M_{vi}	0.79			m^2/MN
	Coefficient of Permeability (calculated)	k_{vi}	4.9E-10			m/s

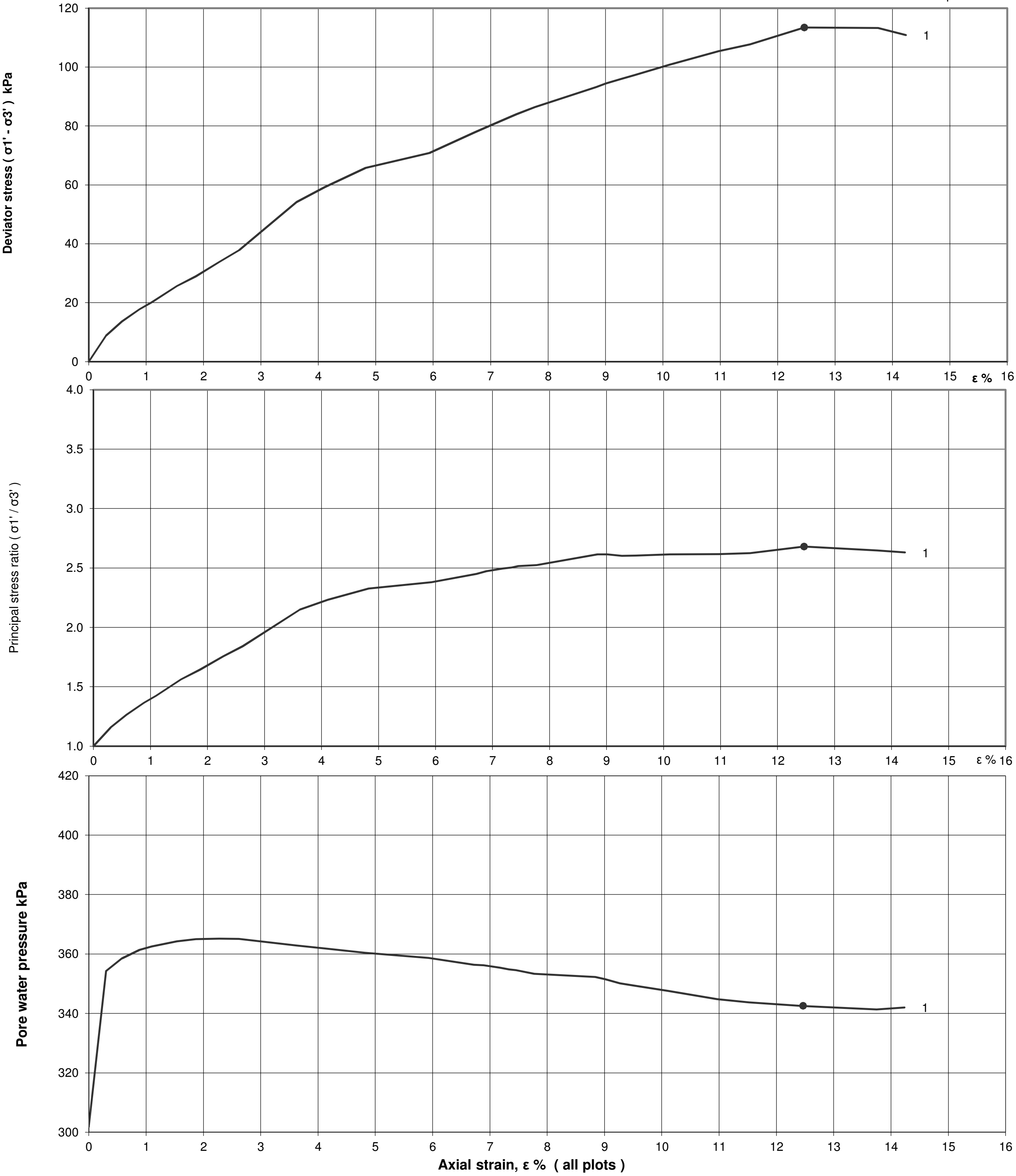


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:07	**Figure** CU sheet 1 of 3

Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No		BH417	
Project Name	A63 CASTLE STREET		Depth (m BGL)		8.50-8.95	
			No	22	Type	UT
			ID			
			Spec Ref			

Shearing stages - graphical data

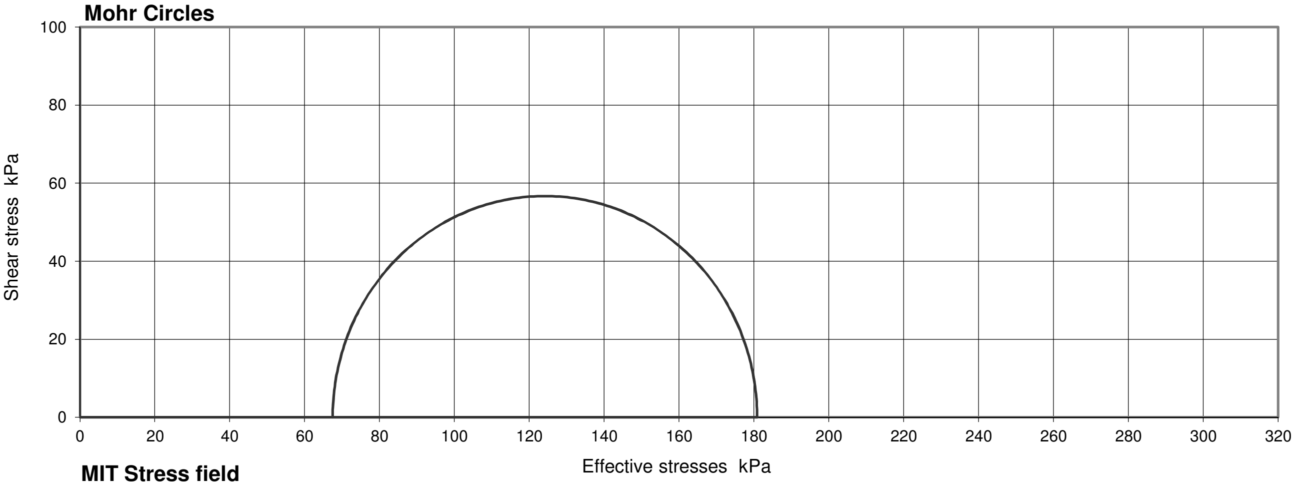


Ref SLR8.1 Rev 85 May 09	ESG UKAS TESTING 1157	Printed:18/03/2016 10:07	Figure **CU** sheet 2 of 3

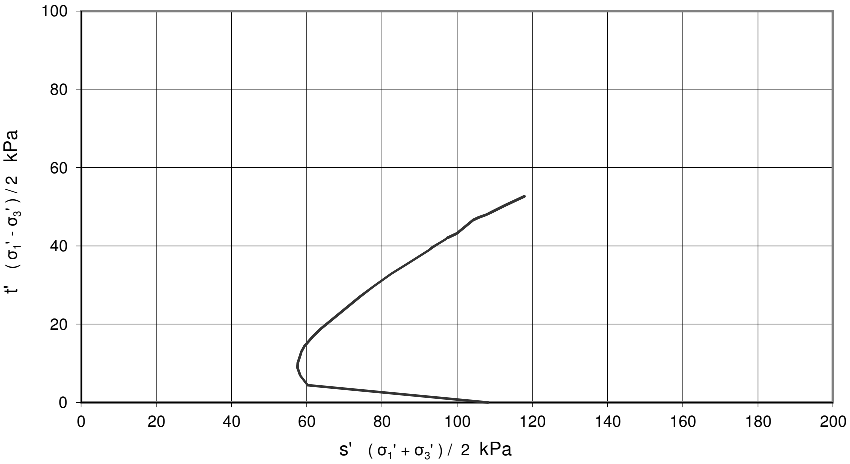
Consolidated Undrained Triaxial Compression test with Measurement of Pore Water Pressure
(BS1377 : Part 8 : 1990)

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.50-8.95		
			No	22	Type	UT
			ID			
			Spec Ref			

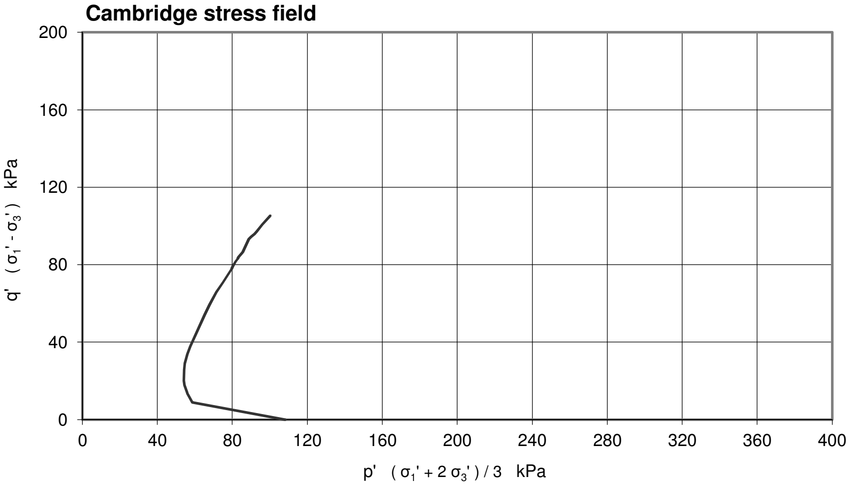
Mohr Circles



MIT Stress field



Cambridge stress field



Compression stages

Specimen	1	2	3	
Cell pressure	410			kPa
Initial pwp	302			kPa
Initial σ_3'	108			kPa
Rate of strain	1.43			%/hr

Failure conditions

Criterion	Maximum deviator stress			
Axial strain	12.47			%
$(\sigma_1' / \sigma_3')_f$	2.680			
$(\sigma_1' - \sigma_3')_f$	113.4			kPa
u_f	343			kPa
$\sigma_3'{}_f$	68			kPa
$\sigma_1'{}_f$	181			kPa
A_f	0.36			
Time to failure	8.7			hrs

Shear Strength Parameters

		Linear regression
c '	kPa	not assessed
Ø '	degrees	not assessed
		Manual re-assessment
c '	kPa	-
Ø '	degrees	-

Mode of failure

1 2 3

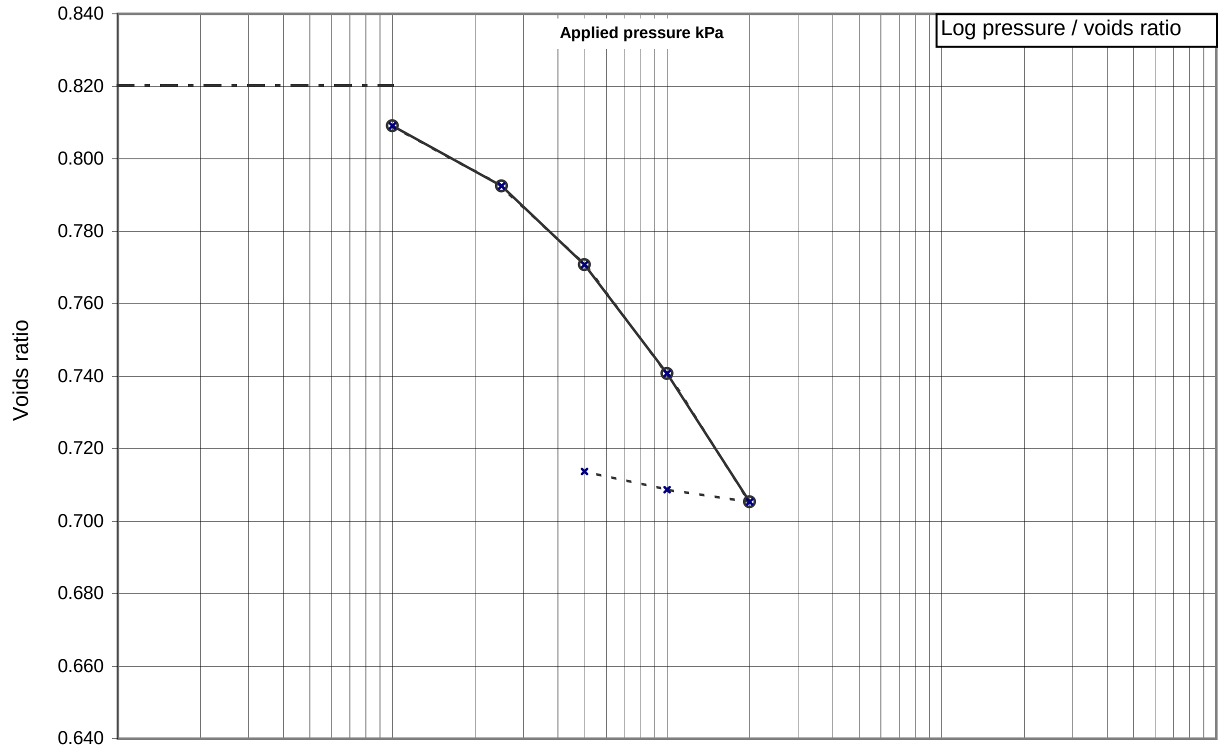
Notes : Deviator stresses corrected for area change, vertical side drains and 0.34 mm thick rubber membrane(s)

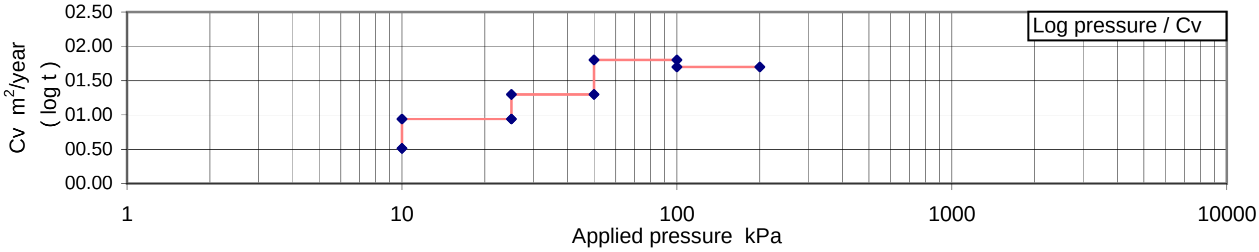
SPLIT AND DESCRIBE

Ref			Figure
SLR8.1 Rev 85 May 09	ESG	Printed:18/03/2016 10:07	CU sheet 3 of 3

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.65			
			Samp No	4	Type	UT	
			ID	A5085-1520160119124320			
			Spec Ref				





Soil description	Soft brown slightly sandy silty CLAY.				
Preparation	Undisturbed				
Index properties (if available)	Liquid limit %	45	Plastic limit %	25	

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m³
Diameter	74.99		mm
Height	19.13	18.01	mm
Voids ratio	0.820	0.714	
Moisture content	30	28	%
Bulk density	1.90	1.97	Mg/m³
Dry density	1.46	1.55	Mg/m³
Saturation	98	103	%
Average temperature for test	20		°C

Swelling pressure: not measured kPa

Notes :

Specimen taken 100 mm from base of sample

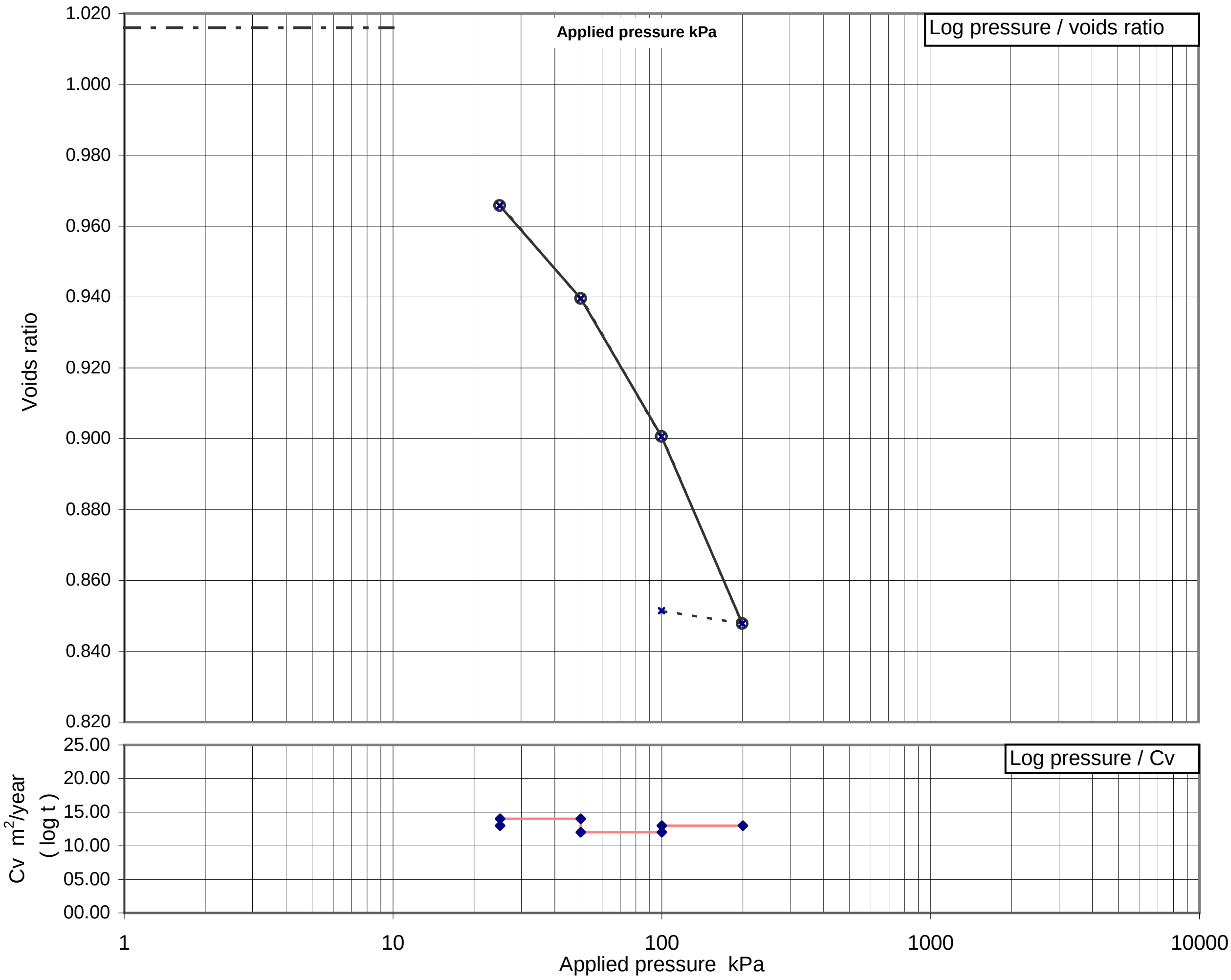
Applied Pressure kPa	Voids ratio	M_v m²/MN	C_v ($t_{50, log}$) m²/year	C_v ($t_{90, root}$) m²/year	
0	0.8202				
10	0.8091	0.612	0.51	0.55	
25	0.7925	0.610	0.94	1	
50	0.7708	0.484	1.3	1.4	
100	0.7407	0.340	1.8	1.9	
200	0.7054	0.203	1.7	1.8	
100	0.7087	0.020	-	-	
50	0.7137	0.059	-	-	

QA Ref			Figure
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	Printed:18/03/2016 10:13	OED

UKAS TESTING 1157

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH403			
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00			
			Samp No	12	Type	P	
			ID	A5085-1520160119124457			
			Spec Ref				



Soil description	Soft brown sandy silty CLAY.			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	36	Plastic limit %	22

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.04		mm
Height	19.04	17.49	mm
Voids ratio	1.016	0.851	
Moisture content	38	31	%
Bulk density	1.82	1.88	Mg/m^3
Dry density	1.31	1.43	Mg/m^3
Saturation	100	98	%
Average temperature for test	20		^{o}C

Swelling pressure: not measured kPa

Notes :

Specimen taken 10 mm from base of sample

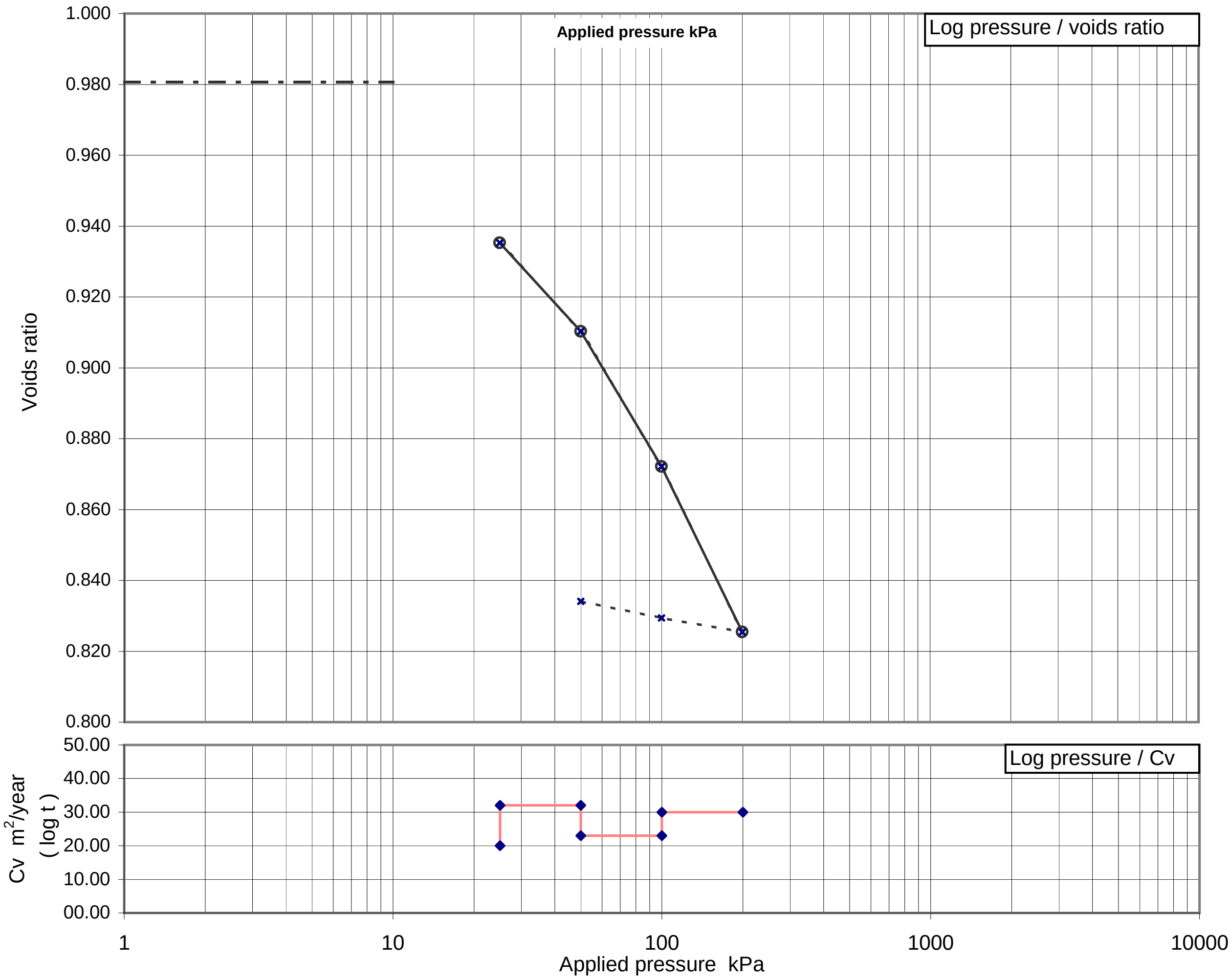
Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	1.0160				
25	0.9658	0.998	13	14	
50	0.9396	0.532	14	17	
100	0.9006	0.402	12	13	
200	0.8478	0.278	13	14	
100	0.8514	0.019	-	-	

QA Ref SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	Printed:18/03/2016 10:13	Figure **OED**

UKAS TESTING 1157

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH404			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00			
			Samp No	10	Type	P	
			ID	A5085-1520160126094851			
			Spec Ref				



Soil description	Dark brown sandy clayey SILT.			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	30	Plastic limit %	NP

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.06		mm
Height	20.06	18.58	mm
Voids ratio	0.981	0.834	
Moisture content	37	32	%
Bulk density	1.83	1.90	Mg/m^3
Dry density	1.34	1.44	Mg/m^3
Saturation	100	100	%
Average temperature for test	20		^{o}C

Swelling pressure: not measured kPa

Notes :

Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50,\ log}$) m^2/year	C_v ($t_{90,\ root}$) m^2/year	
0	0.9807				
25	0.9352	0.917	20	21	
50	0.9103	0.516	32	32	
100	0.8722	0.399	23	25	
200	0.8255	0.249	30	35	
100	0.8294	0.022	-	-	
50	0.8341	0.051	-	-	

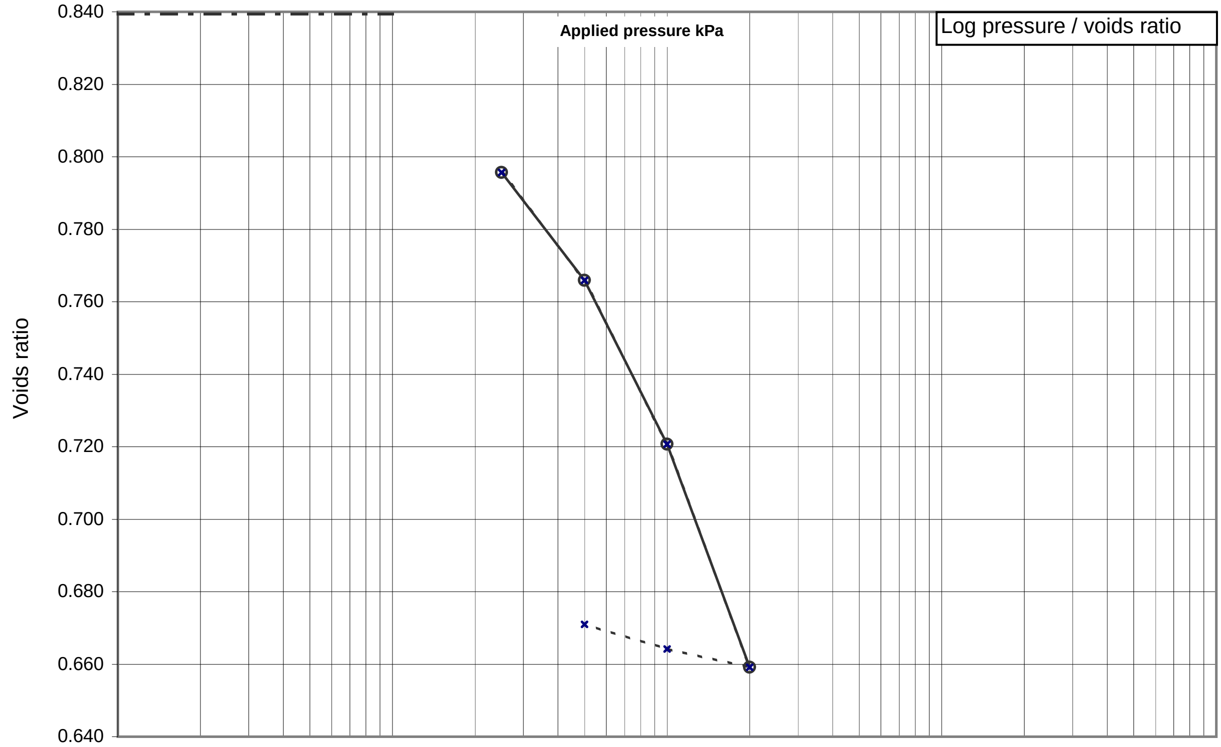
QA Ref		Figure
SLR 5.3 Rev 146 Nov 14	Printed:18/03/2016 10:14	OED

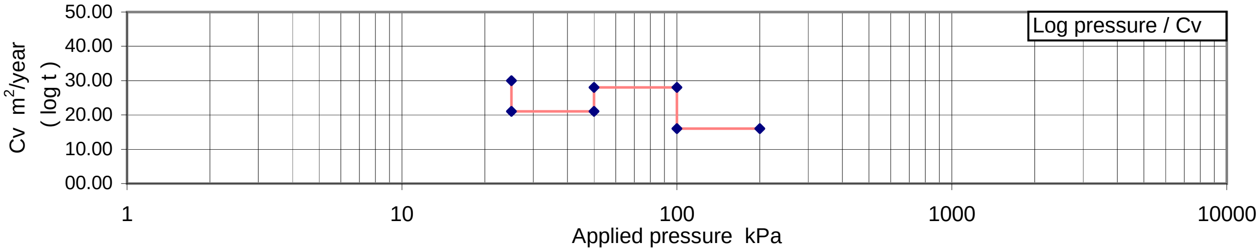
Environmental Scientifics Group

UKAS TESTING 1157

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH405
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.00
			Samp No	8 / Type: P
			ID	A5085-1520160119112519
			Spec Ref	





Soil description: Very soft dark grey slightly sandy organic silty CLAY.

Preparation: Undisturbed

Index properties (if available): Liquid limit % 42 | Plastic limit % 25

Specimen details	Initial	Final	
Particle density	2.65	measured	Mg/m^3
Diameter	75.04		mm
Height	19.06	17.31	mm
Voids ratio	0.839	0.671	
Moisture content	33	27	%
Bulk density	1.91	2.01	Mg/m^3
Dry density	1.44	1.59	Mg/m^3
Saturation	103	105	%
Average temperature for test	20		^{o}C

Swelling pressure: not measured kPa

Notes :

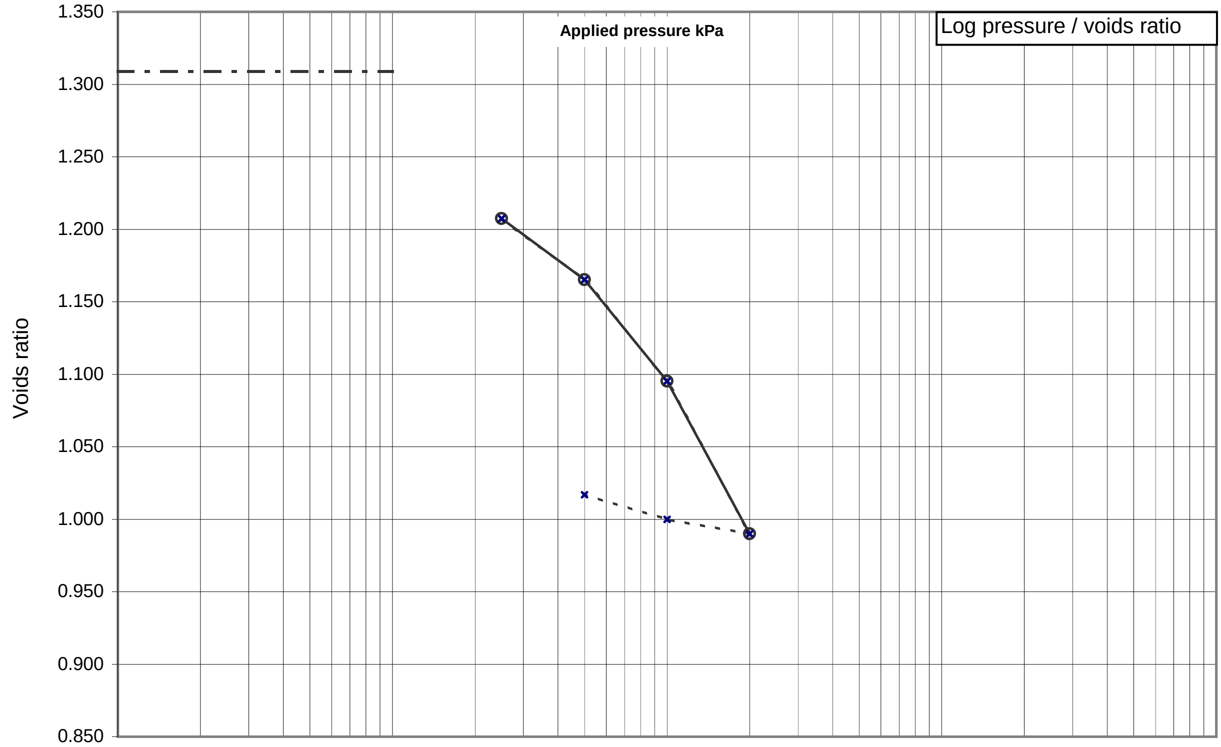
Specimen taken 10 mm from base of sample

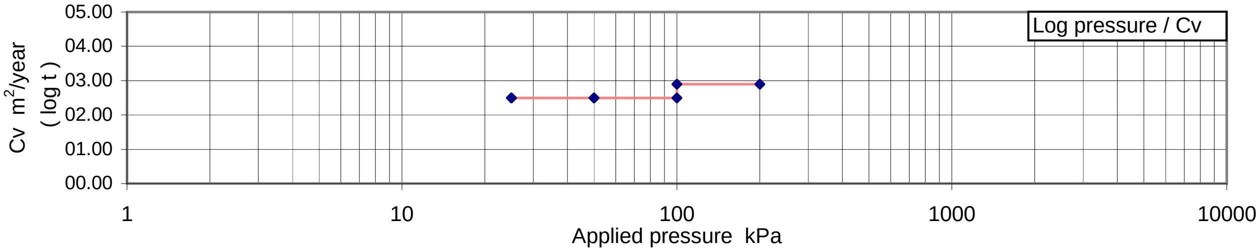
Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	0.8394				
25	0.7957	0.951	30	27	
50	0.7659	0.662	21	23	
100	0.7207	0.513	28	30	
200	0.6592	0.357	16	17	
100	0.6642	0.030	-	-	
50	0.6710	0.081	-	-	

QA Ref SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group · UKAS TESTING 1157	Printed:18/03/2016 10:14	Figure **OED**

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH405		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.00		
			Samp No	13	Type	P
			ID	A5085-1520160119112634		
			Spec Ref			





Soil description	Very soft brown slightly sandy CLAY.			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	43	Plastic limit %	22

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.00		mm
Height	19.05	16.64	mm
Voids ratio	1.309	1.017	
Moisture content	50	40	%
Bulk density	1.72	1.83	Mg/m^3
Dry density	1.15	1.31	Mg/m^3
Saturation	101	103	%
Average temperature for test	20		^oC

Swelling pressure: not measured kPa

Notes :

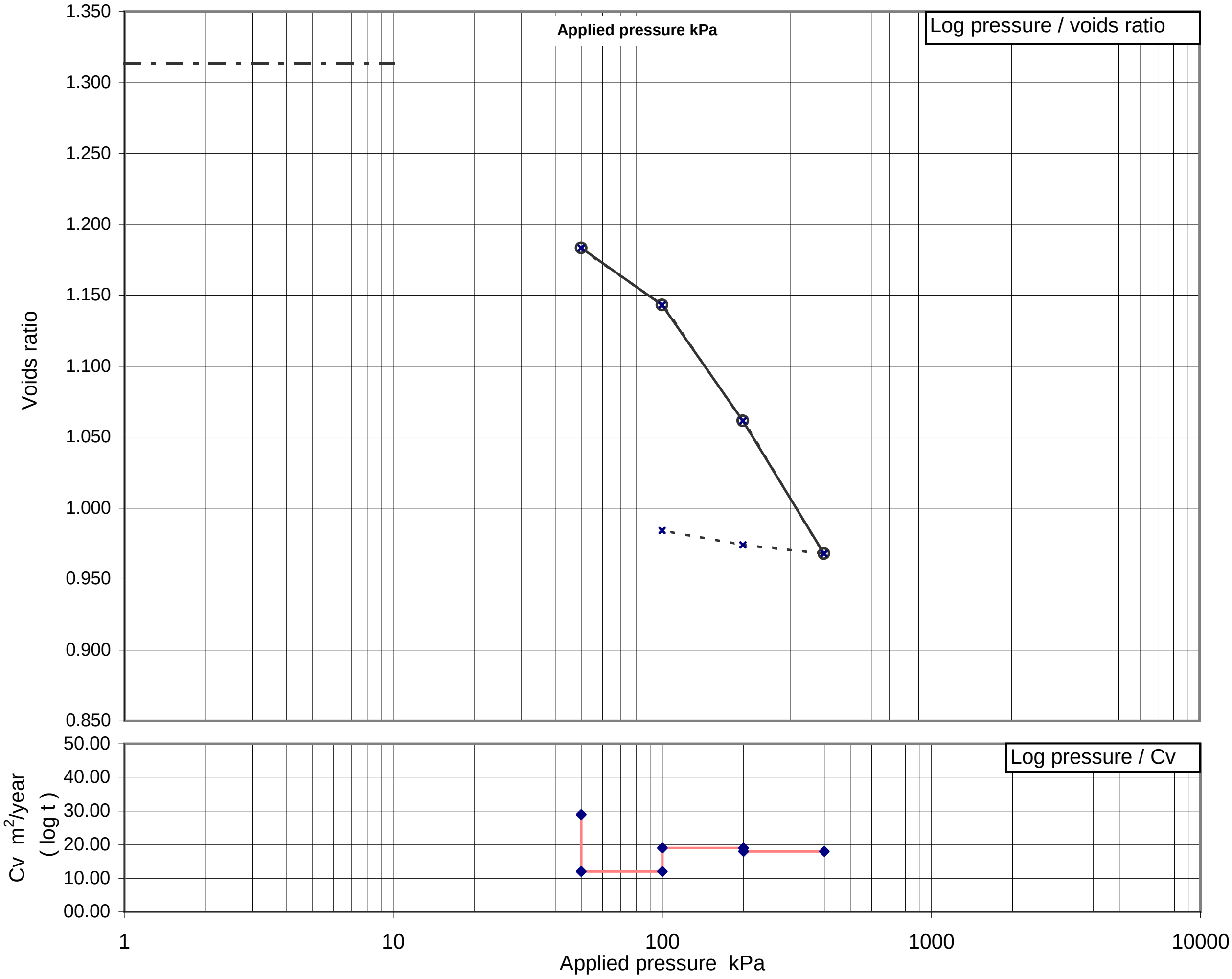
Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) $m^2/year$	C_v ($t_{90, root}$) $m^2/year$	
0	1.3087				
25	1.2074	1.755	2.5	2.8	
50	1.1653	0.764	2.5	2.8	
100	1.0953	0.646	2.5	2.7	
200	0.9900	0.503	2.9	3.1	
100	0.9999	0.050	-	-	
50	1.0168	0.168	-	-	

QA Ref			Figure
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	Printed:18/03/2016 10:14	OED

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH405			
Project Name	A63 CASTLE STREET		Depth (m BGL)	8.00			
			Samp No	15	Type	P	
			ID	A5085-1520160119112703			
			Spec Ref				



Soil description	Soft to firm greyish brown slightly sandy silty CLAY becoming organic clayey SILT towards			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	43	Plastic limit %	24

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.01		mm
Height	19.06	16.35	mm
Voids ratio	1.313	0.984	
Moisture content	49	37	%
Bulk density	1.70	1.83	Mg/m^3
Dry density	1.15	1.34	Mg/m^3
Saturation	98	100	%
Average temperature for test	20		^oC

Swelling pressure: not measured kPa

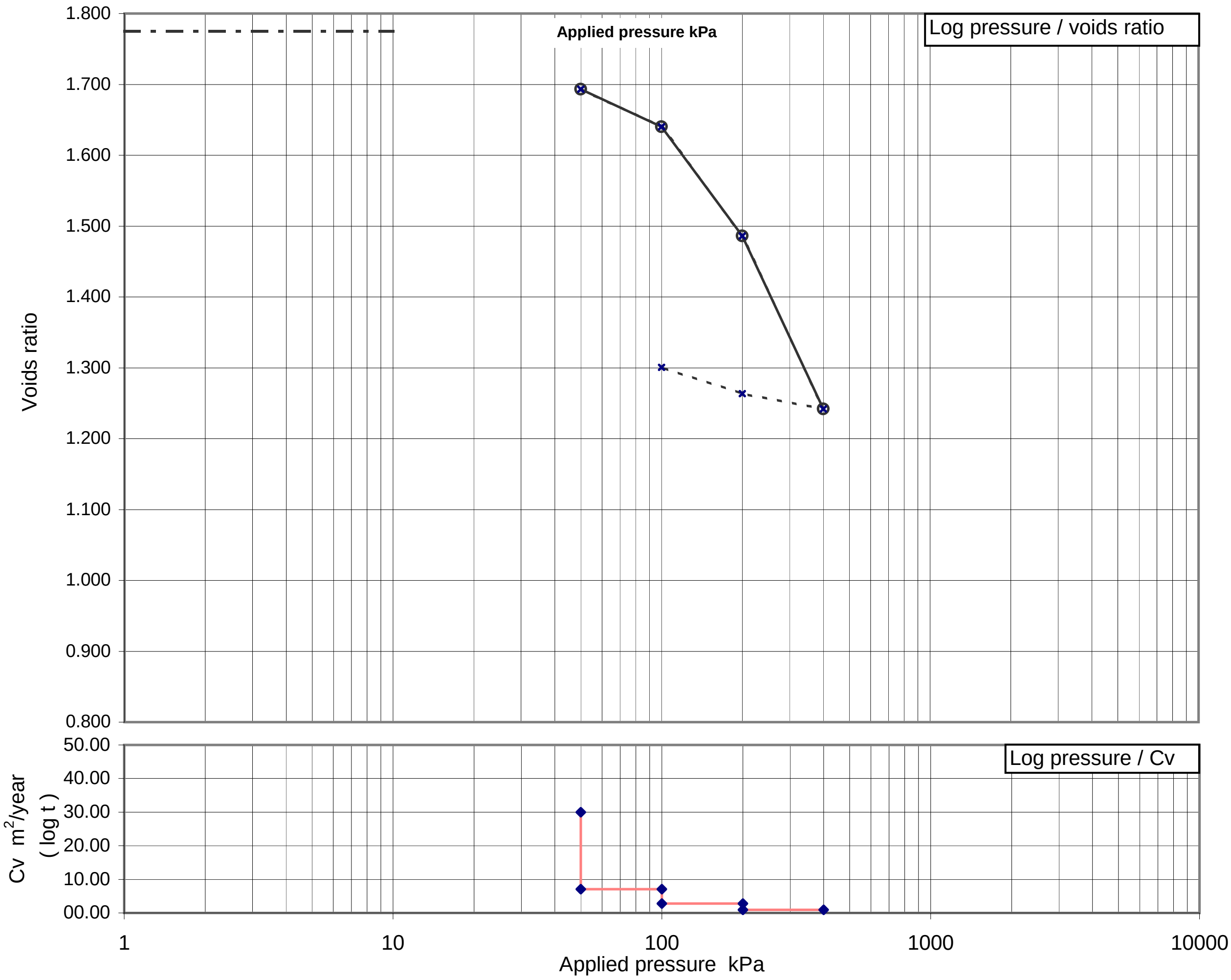
Notes :

Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	1.3133				
50	1.1834	1.123	29	34	
100	1.1431	0.369	12	13	
200	1.0615	0.381	19	19	
400	0.9679	0.227	18	19	
200	0.9741	0.016	-	-	
100	0.9843	0.052	-	-	

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH405
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00
			Samp No	17 — Type: P
			ID	A5085-1520160119112729
			Spec Ref	



Soil description	Firm dark brown organic silty CLAY becoming silty amotphous PEAT with frequent wood
Preparation	Undisturbed
Index properties (if available)	Liquid limit % 79 — Plastic limit % 61

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.06		mm
Height	19.07	15.81	mm
Voids ratio	1.775	1.301	
Moisture content	58	48	%
Bulk density	1.51	1.70	Mg/m^3
Dry density	0.96	1.15	Mg/m^3
Saturation	86	98	%
Average temperature for test	20		°C

Swelling pressure: not measured kPa

Notes :

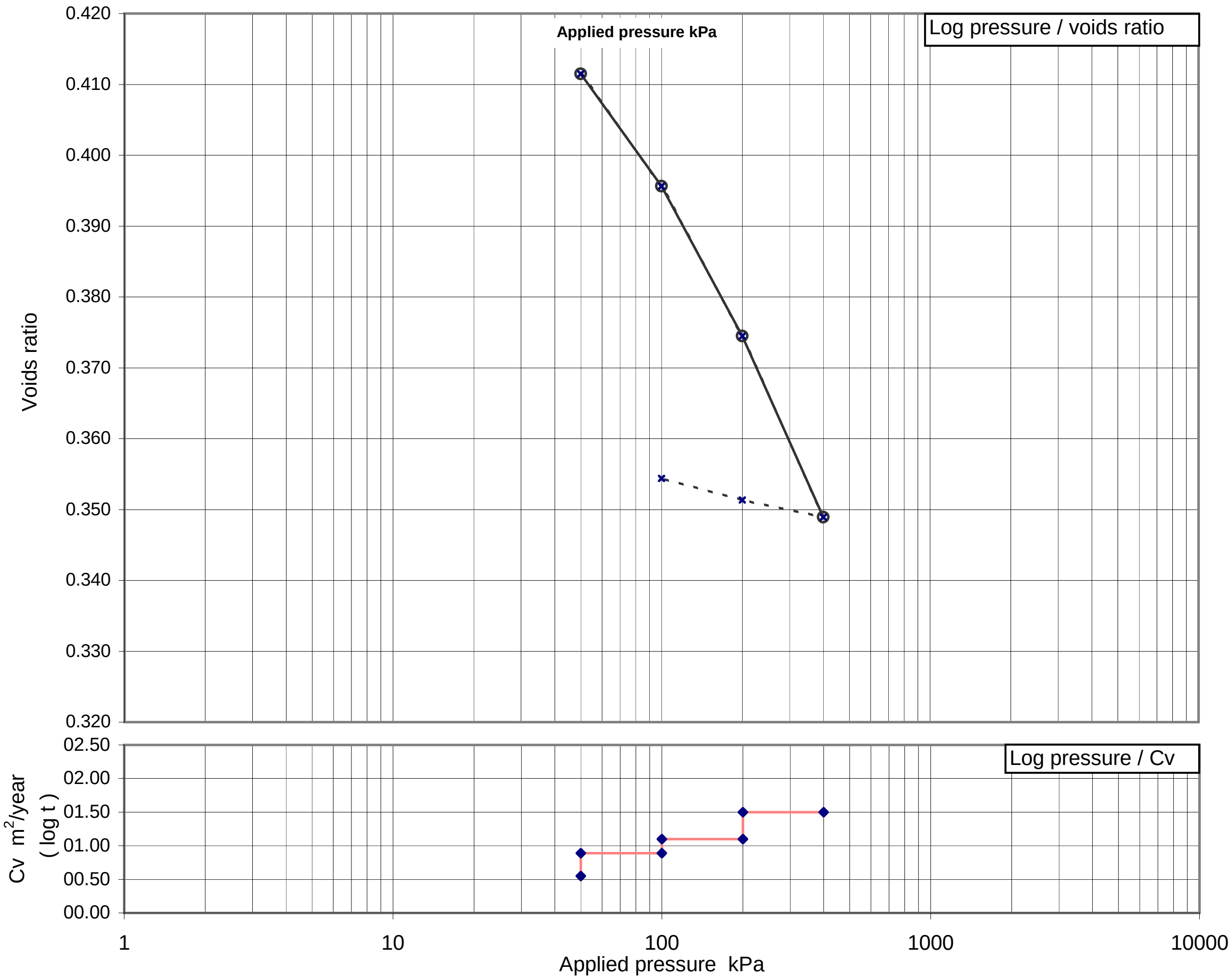
Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) $m^2/year$	C_v ($t_{90, root}$) $m^2/year$	
0	1.7747				
50	1.6934	0.586	30	27	
100	1.6401	0.395	7.1	7.4	
200	1.4863	0.583	2.8	3	
400	1.2420	0.491	0.9	0.93	
200	1.2634	0.048	-	-	
100	1.3008	0.165	-	-	

QA Ref		Printed	Figure
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group; UKAS TESTING 1157	Printed:18/03/2016 10:14	OED

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH405
Project Name	A63 CASTLE STREET		Depth (m BGL)	11.00
			Samp No	23 / Type: UT
			ID	A5085-1520160119113210
			Spec Ref	



Soil description	Soft brown slightly sandy slightly gravelly CLAY.		
Preparation	Undisturbed		
Index properties (if available)	Liquid limit % 33	Plastic limit % 19	

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.01		mm
Height	19.04	17.80	mm
Voids ratio	0.449	0.354	
Moisture content	18	14	%
Bulk density	2.15	2.23	Mg/m^3
Dry density	1.83	1.96	Mg/m^3
Saturation	105	105	%
Average temperature for test	20		^{o}C

Swelling pressure: not measured kPa

Notes :

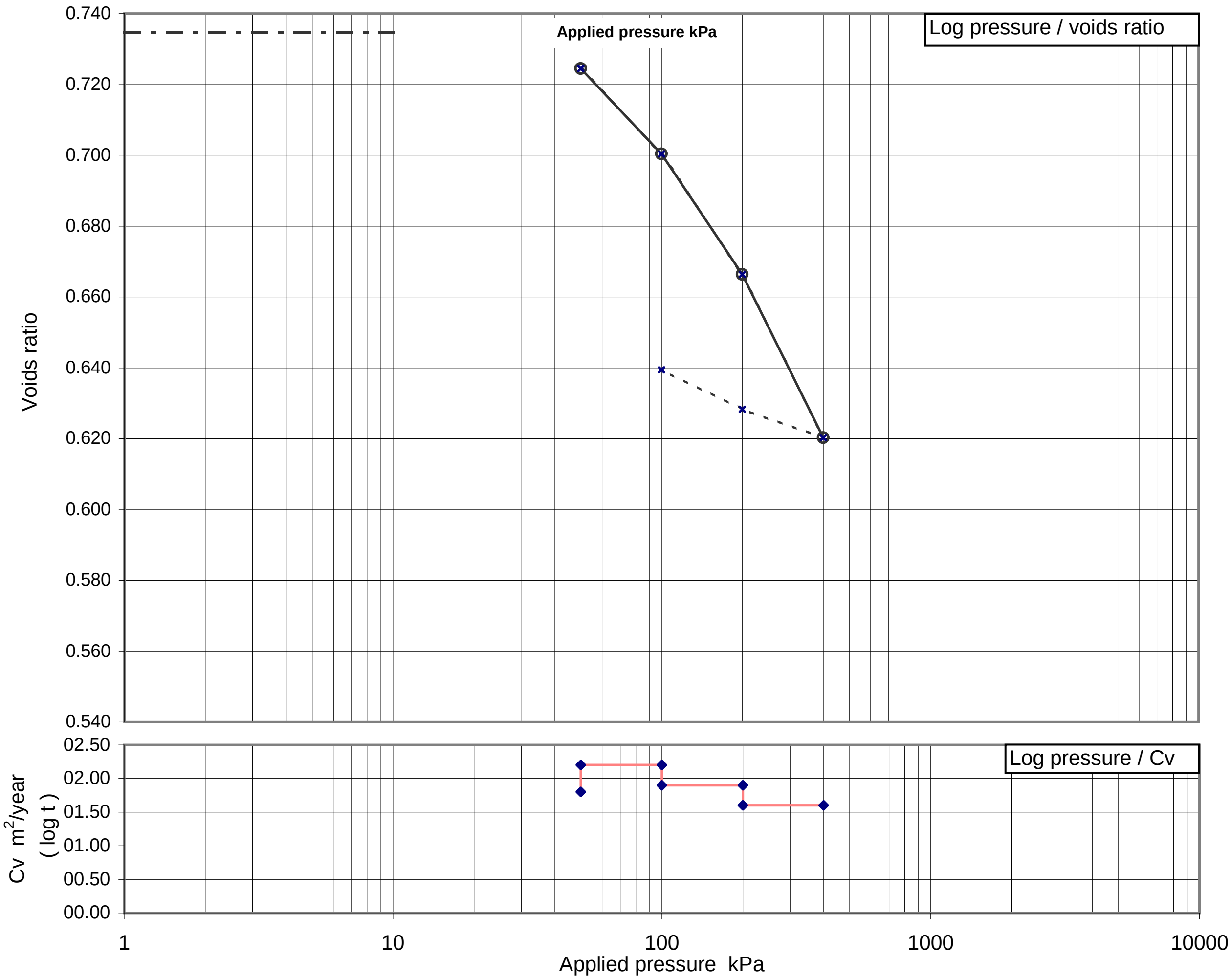
Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	0.4487				
50	0.4115	0.514	0.55	0.6	
100	0.3956	0.224	0.89	0.93	
200	0.3745	0.152	1.1	1.1	
400	0.3489	0.093	1.5	1.6	
200	0.3514	0.009	-	-	
100	0.3544	0.023	-	-	

QA Ref SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:18/03/2016 10:14	Figure **OED**

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.70		
			Samp No	5	Type	UT
			ID	A5085-1520151208111429		
			Spec Ref			



Soil description	Firm to stiff brown slightly sandy silty CLAY with occasional partings of sand and silt.				
Preparation	Undisturbed				
Index properties (if available)	Liquid limit %	53	Plastic limit %	25	

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.12		mm
Height	20.17	19.07	mm
Voids ratio	0.735	0.639	
Moisture content	28	25	%
Bulk density	1.95	2.03	Mg/m^3
Dry density	1.53	1.62	Mg/m^3
Saturation	100	105	%
Average temperature for test	21		^{o}C

Swelling pressure >25 kPa

Notes :

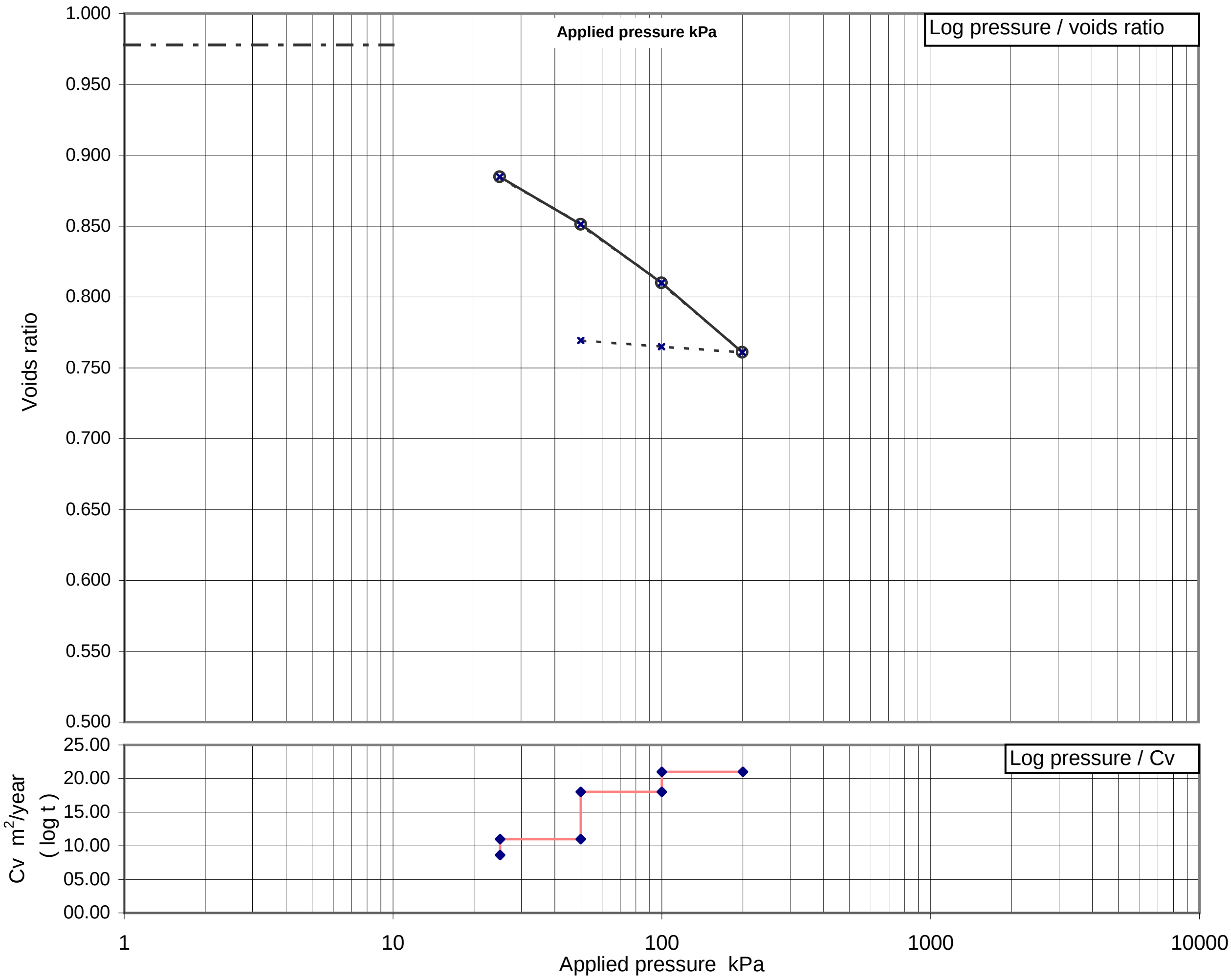
Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50,\ log}$) m^2/year	C_v ($t_{90,\ root}$) m^2/year	
25	0.7346				
50	0.7244	0.234	1.8	1.9	
100	0.7004	0.279	2.2	2.2	
200	0.6664	0.200	1.9	2	
400	0.6203	0.138	1.6	1.8	
200	0.6283	0.025	-	-	
100	0.6394	0.068	-	-	

Specimen taken 10 mm from base of sample

QA Ref			Figure
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	Printed:18/03/2016 10:14	OED

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.10		
			Samp No	9	Type	UT
			ID	A5085-1520151208112333		
			Spec Ref			



Soil description	Very soft brown slightly sandy silty CLAY.			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	38	Plastic limit %	23

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.16		mm
Height	20.22	18.09	mm
Voids ratio	0.978	0.769	
Moisture content	38	30	%
Bulk density	1.85	1.95	Mg/m^3
Dry density	1.34	1.50	Mg/m^3
Saturation	104	105	%
Average temperature for test	21		°C

Swelling pressure: not measured kPa

Notes :

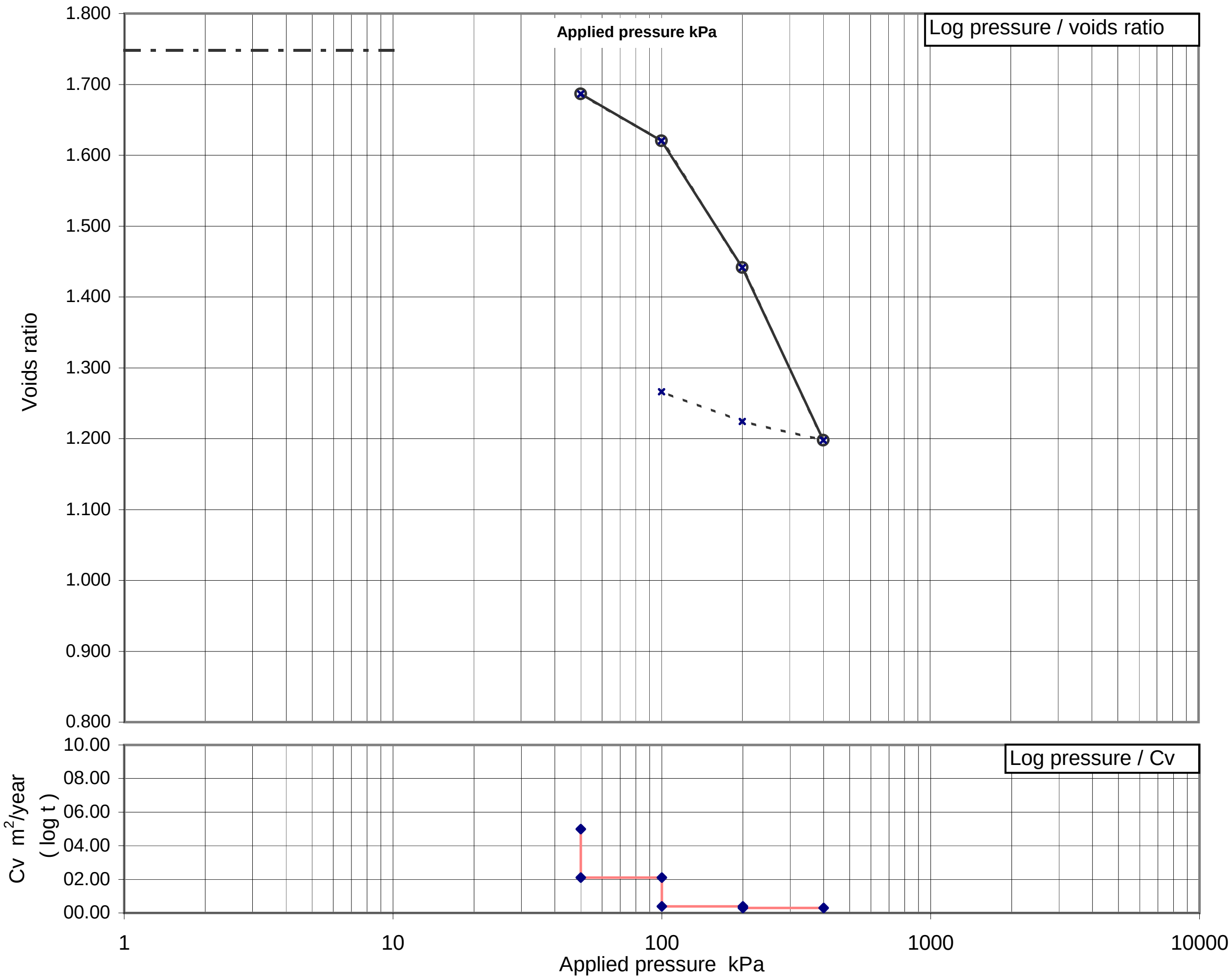
Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	0.9776				
25	0.8847	1.879	8.6	9.1	
50	0.8513	0.710	11	11	
100	0.8100	0.446	18	20	
200	0.7609	0.271	21	22	
100	0.7648	0.022	-	-	
50	0.7693	0.051	-	-	

QA Ref SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:18/03/2016 10:14	Figure **OED**

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH407
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.00
			Samp No	22 Type P
			ID	A5085-1520151222110003
			Spec Ref	



Soil description	Dark grey organic slightly sandy silty CLAY with frequent wood fragments.			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	98	Plastic limit %	49

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	74.99		mm
Height	18.98	15.65	mm
Voids ratio	1.748	1.266	
Moisture content	64	48	%
Bulk density	1.58	1.74	Mg/m^3
Dry density	0.96	1.17	Mg/m^3
Saturation	97	101	%
Average temperature for test	20		°C

Swelling pressure: not measured kPa

Notes :

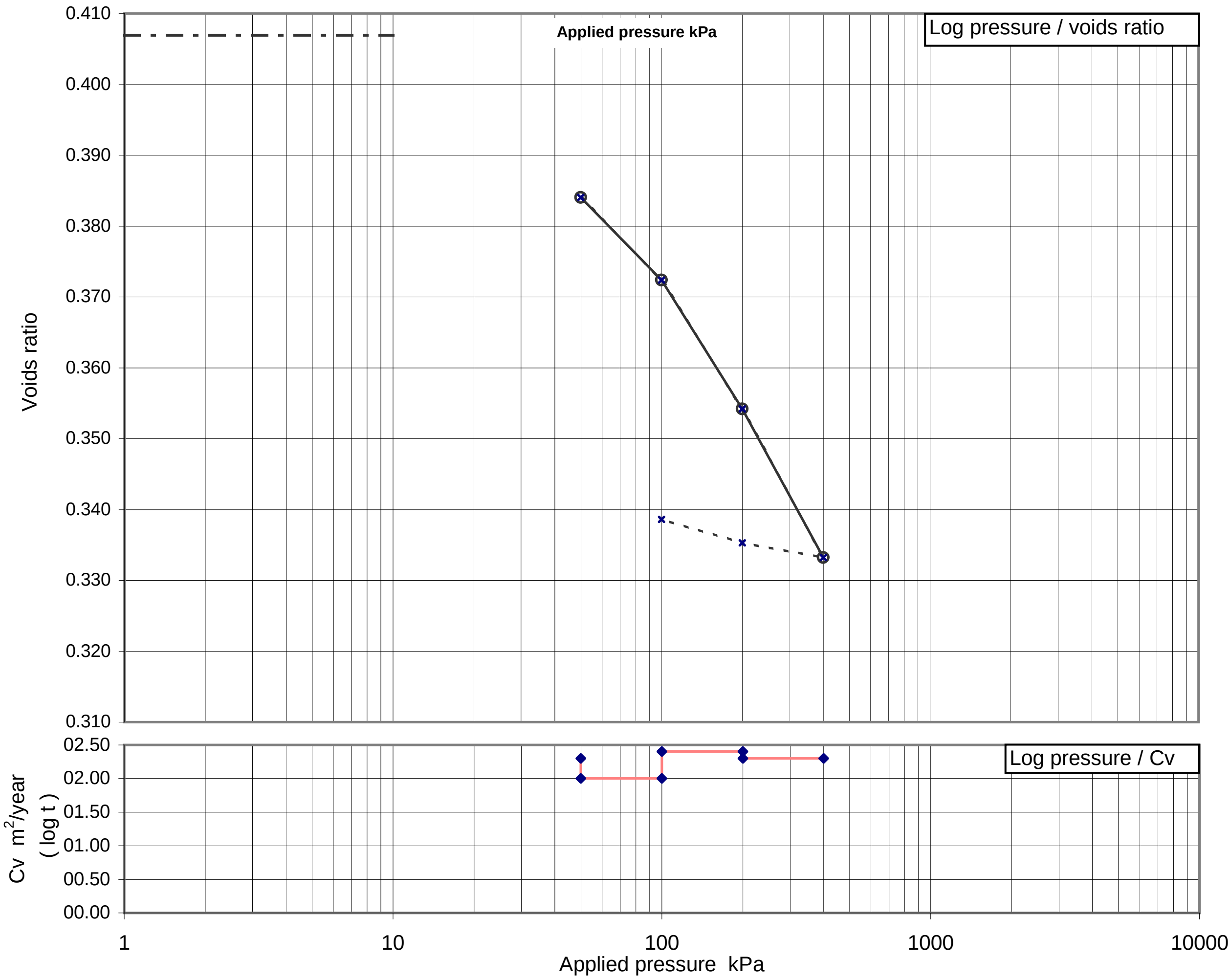
Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) $m^2/year$	C_v ($t_{90, root}$) $m^2/year$	
0	1.7483				
50	1.6864	0.451	5	5.4	
100	1.6202	0.493	2.1	2.2	
200	1.4414	0.682	0.4	0.43	
400	1.1979	0.499	0.29	0.32	
200	1.2241	0.060	-	-	
100	1.2662	0.189	-	-	

QA Ref			
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	Printed:18/03/2016 10:14	Figure OED

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH407
Project Name	A63 CASTLE STREET		Depth (m BGL)	12.50
			Samp No	33 / Type: UT
			ID	A5085-1520151222110125
			Spec Ref	



Soil description	Soft to firm brownish grey slightly sandy slightly gravelly CLAY.			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	27	Plastic limit %	15

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.01		mm
Height	19.05	18.13	mm
Voids ratio	0.407	0.339	
Moisture content	15	13	%
Bulk density	2.17	2.25	Mg/m^3
Dry density	1.88	1.98	Mg/m^3
Saturation	100	105	%
Average temperature for test	20		°C

Swelling pressure: not measured kPa

Notes :

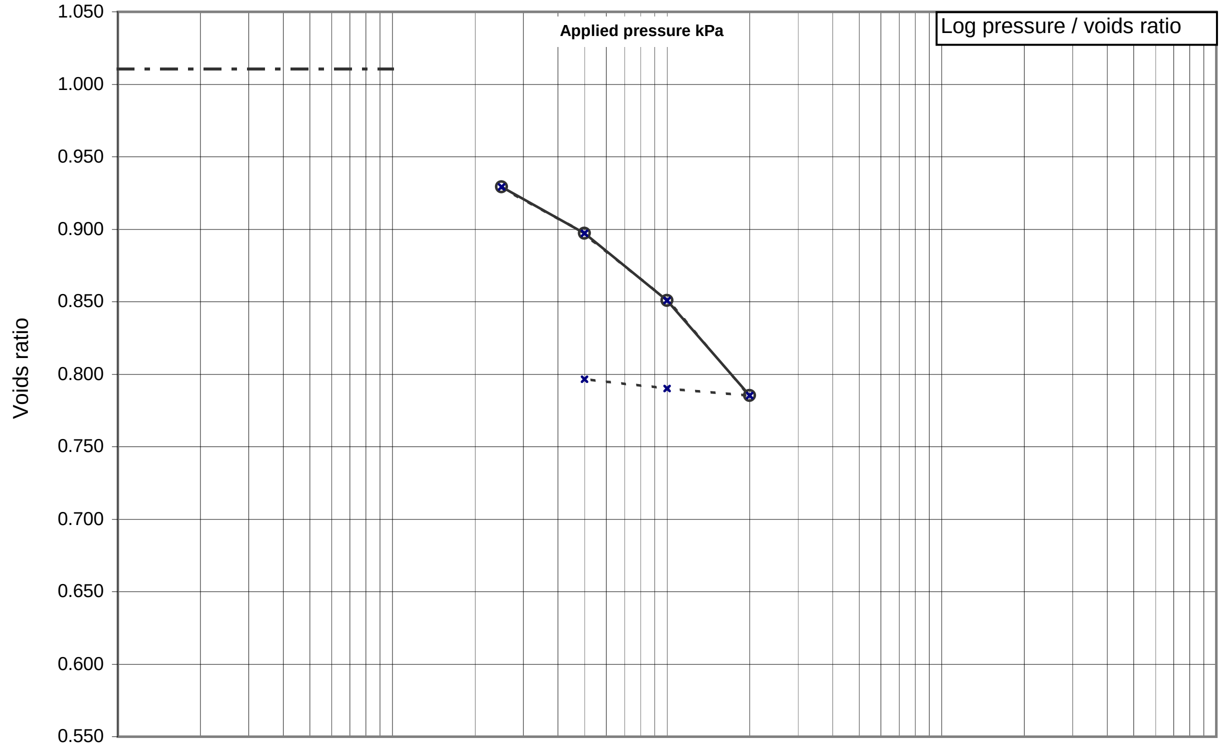
Specimen taken 10 mm from base of sample

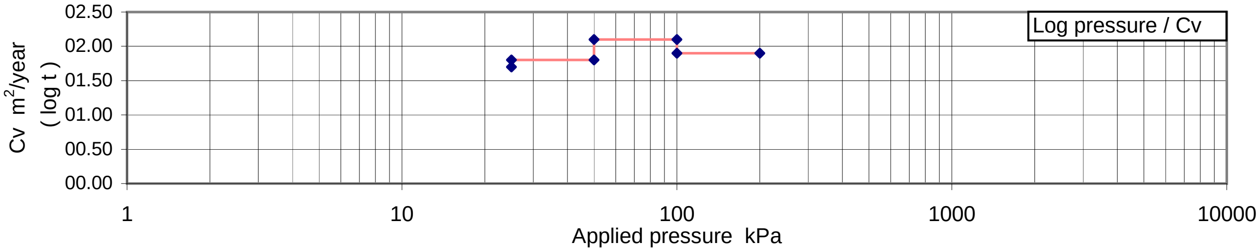
Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) $m^2/year$	C_v ($t_{90, root}$) $m^2/year$	
0	0.4069				
50	0.3840	0.325	2.3	2.5	
100	0.3724	0.169	2	2.1	
200	0.3542	0.132	2.4	2.4	
400	0.3332	0.077	2.3	2.5	
200	0.3353	0.008	-	-	
100	0.3386	0.025	-	-	

QA Ref SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	Printed:18/03/2016 10:14	Figure **OED**

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.90		
			Samp No	11	Type	P
			ID	A5085-1520151209102511		
			Spec Ref			





Soil description: Soft dark grey silty CLAY becoming firm dark grey slightly sandy silty CLAY with organic

Preparation: Undisturbed

Index properties (if available): Liquid limit % 42 | Plastic limit % 24

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	74.99		mm
Height	19.02	17.00	mm
Voids ratio	1.011	0.797	
Moisture content	39	32	%
Bulk density	1.83	1.94	Mg/m^3
Dry density	1.32	1.48	Mg/m^3
Saturation	102	105	%
Average temperature for test	21		°C

Swelling pressure: not measured kPa

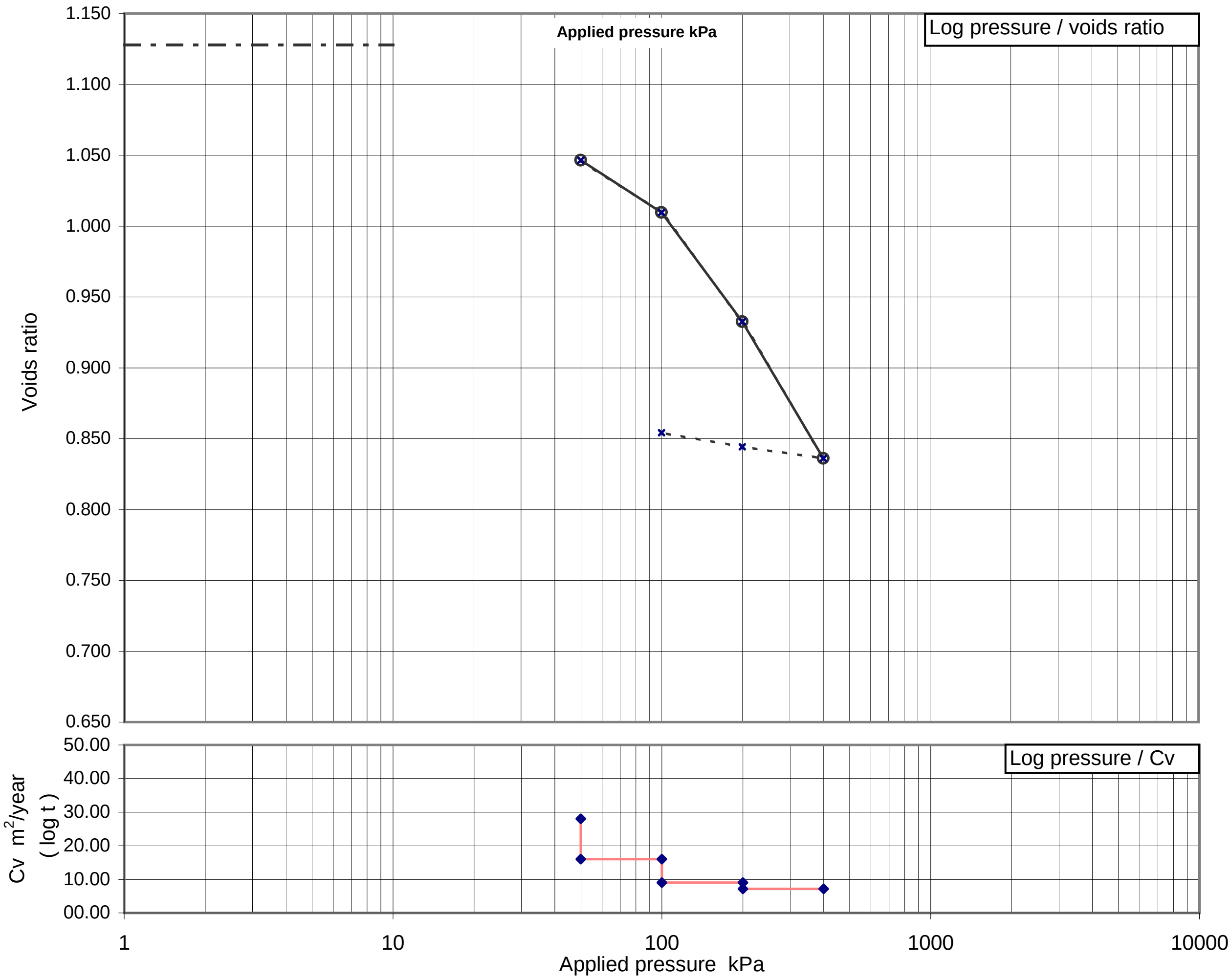
Notes :

Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	1.0106				
25	0.9293	1.617	1.7	1.8	
50	0.8973	0.664	1.8	2	
100	0.8509	0.489	2.1	2.2	
200	0.7853	0.355	1.9	1.9	
100	0.7901	0.027	-	-	
50	0.7966	0.072	-	-	

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH408
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05
			Samp No	20
			Type	P
			ID	A5085-1520151209104559
			Spec Ref	



Soil description	Dark greyish brown sandy clayey SILT becoming very soft organic silty CLAY towards base.			
Preparation	Undisturbed			
Index properties (if available)	Liquid limit %	37	Plastic limit %	22

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	74.96		mm
Height	19.03	16.58	mm
Voids ratio	1.128	0.854	
Moisture content	43	34	%
Bulk density	1.78	1.91	Mg/m^3
Dry density	1.25	1.43	Mg/m^3
Saturation	101	105	%
Average temperature for test	21		^{o}C

Swelling pressure: not measured kPa

Notes :

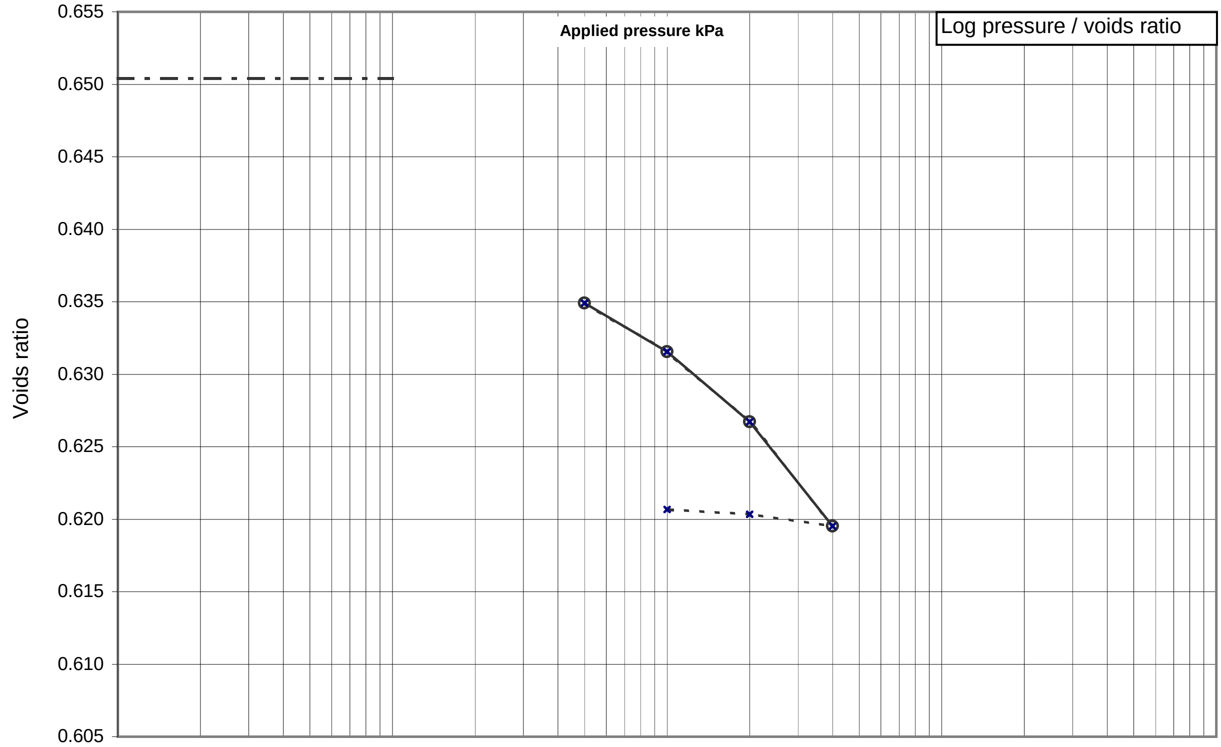
Specimen taken 10 mm from base of sample

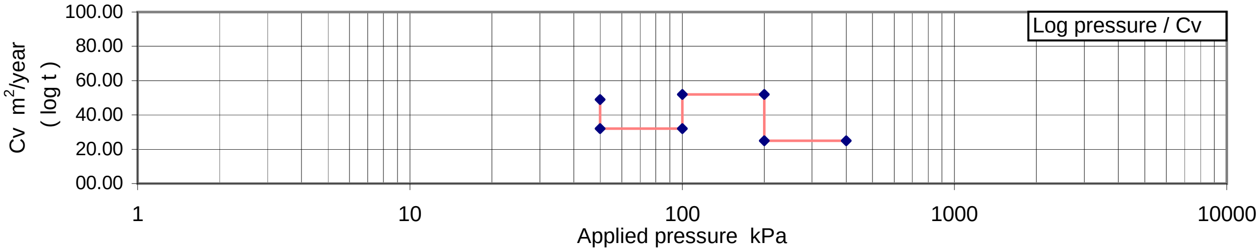
Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	1.1277				
50	1.0464	0.764	28	30	
100	1.0096	0.360	16	15	
200	0.9325	0.384	9	9.4	
400	0.8362	0.249	7.2	7.5	
200	0.8443	0.022	-	-	
100	0.8542	0.053	-	-	

QA Ref SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:18/03/2016 10:14	Figure OED

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	11.50		
			Samp No	25	Type	UT
			ID	A5085-1520151209105041		
			Spec Ref			





Soil description: Dark brown slightly gravelly slightly clayey SAND.

Preparation: Undisturbed

Index properties (if available): Liquid limit % 24 | Plastic limit % NP

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.02		mm
Height	20.17	19.80	mm
Voids ratio	0.650	0.621	
Moisture content	23	23	%
Bulk density	1.97	2.01	Mg/m^3
Dry density	1.61	1.64	Mg/m^3
Saturation	92	97	%
Average temperature for test	21		^{o}C

Swelling pressure: not measured kPa

Notes :

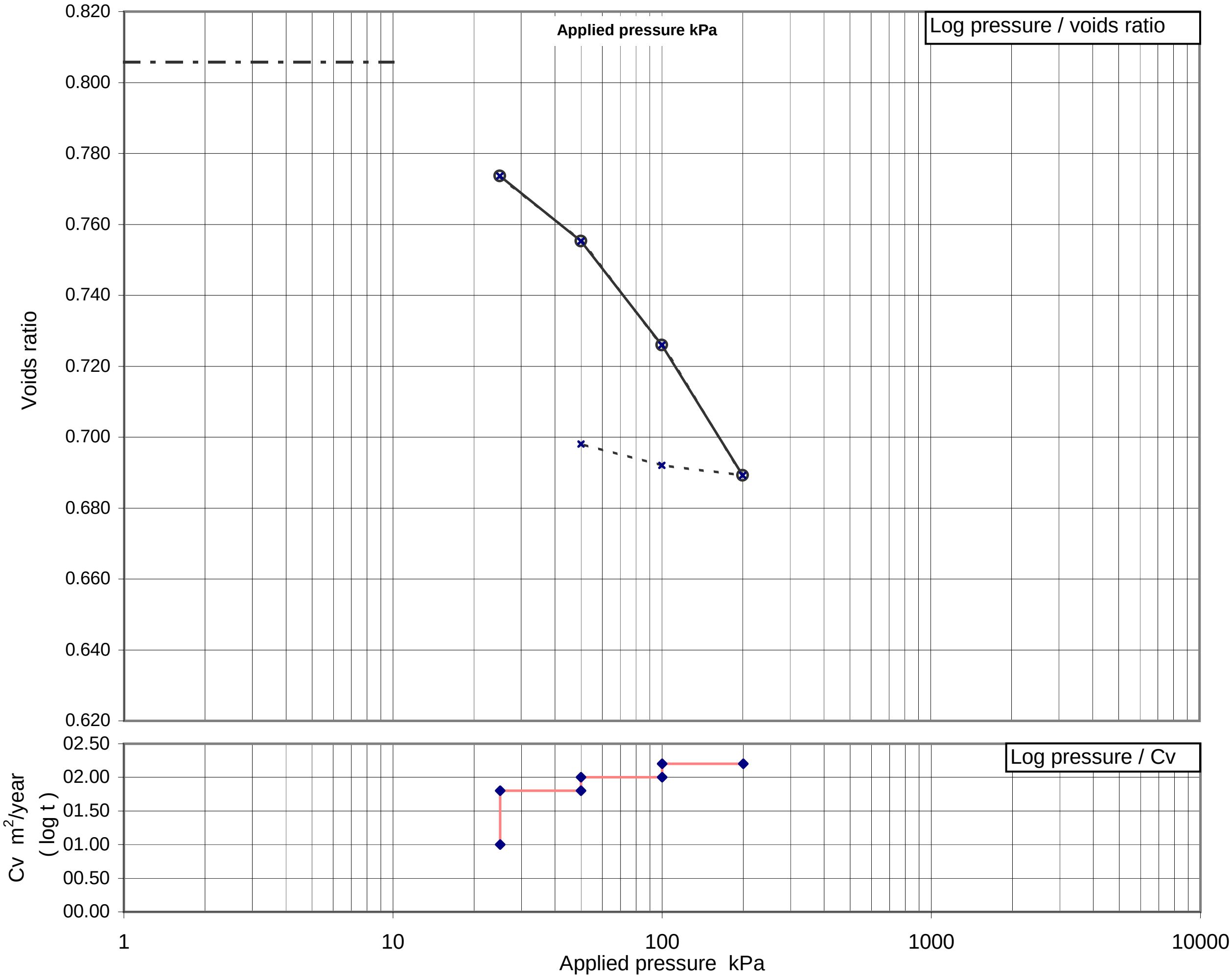
Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) m^2/year	C_v ($t_{90, root}$) m^2/year	
0	0.6504				
50	0.6349	0.187	49	59	
100	0.6316	0.041	32	41	
200	0.6267	0.030	52	55	
400	0.6195	0.022	25	33	
200	0.6203	0.003	-	-	
100	0.6207	0.002	-	-	

QA Ref				Figure
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:18/03/2016 10:14	OED

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH417			
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.55			
			Samp No	10	Type	UT	
			ID	A5085-1520151222015310			
			Spec Ref				



Soil description	Soft brown mottled grey slightly sandy CLAY.				
Preparation	Undisturbed				
Index properties (if available)	Liquid limit %	45	Plastic limit %	23	

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.03		mm
Height	19.06	17.92	mm
Voids ratio	0.806	0.698	
Moisture content	31	28	%
Bulk density	1.92	1.99	Mg/m^3
Dry density	1.47	1.56	Mg/m^3
Saturation	102	105	%
Average temperature for test	20		^oC

Swelling pressure: not measured kPa

Notes :

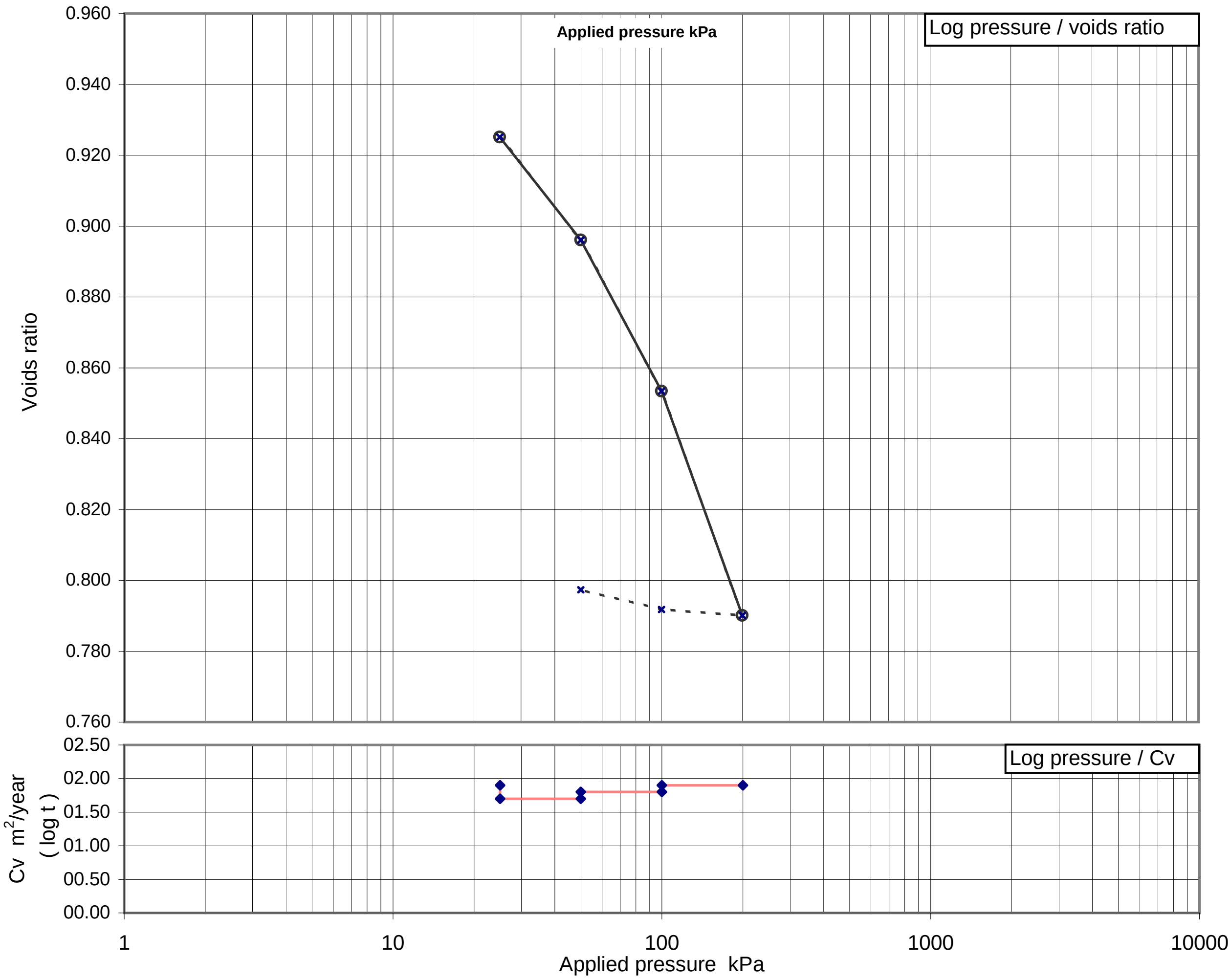
Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) $m^2/year$	C_v ($t_{90, root}$) $m^2/year$	
0	0.8057				
25	0.7737	0.709	1	1	
50	0.7553	0.415	1.8	1.9	
100	0.7260	0.334	2	2.1	
200	0.6892	0.213	2.2	2.4	
100	0.6921	0.017	-	-	
50	0.6981	0.071	-	-	

Specimen taken 10 mm from base of sample

QA Ref			Figure
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group	Printed:18/03/2016 10:14	OED

ONE DIMENSIONAL CONSOLIDATION TEST
BS 1377 : Part 5 : 1990 : clause 3

Project No	A5085-15	Sample Details:	Hole No	BH417			
Project Name	A63 CASTLE STREET		Depth (m BGL)	6.00			
			Samp No	17	Type	P	
			ID	A5085-1520151222015410			
			Spec Ref				



Soil description: Very soft greyish brown slightly sandy silty CLAY.

Preparation: Undisturbed

Index properties (if available): Liquid limit % 38 | Plastic limit % 24

Specimen details	Initial	Final	
Particle density	2.65	assumed	Mg/m^3
Diameter	75.11		mm
Height	19.07	17.27	mm
Voids ratio	0.985	0.797	
Moisture content	37	29	%
Bulk density	1.83	1.90	Mg/m^3
Dry density	1.33	1.47	Mg/m^3
Saturation	101	97	%
Average temperature for test	20		°C

Swelling pressure: not measured kPa

Notes :

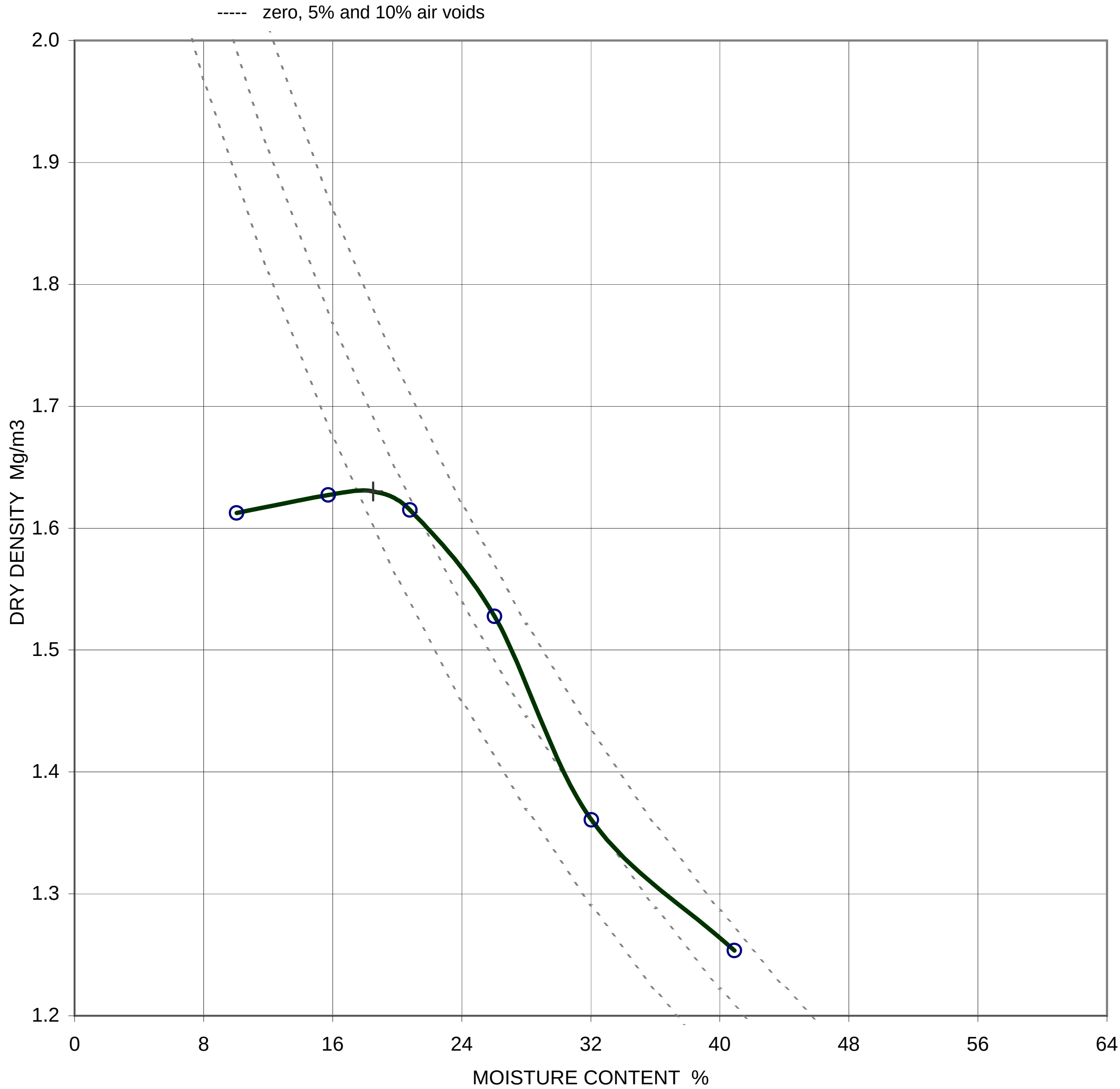
Specimen taken 10 mm from base of sample

Applied Pressure kPa	Voids ratio	M_v m^2/MN	C_v ($t_{50, log}$) $m^2/year$	C_v ($t_{90, root}$) $m^2/year$	
0	0.9851				
25	0.9251	1.208	1.9	2.1	
50	0.8961	0.603	1.7	1.8	
100	0.8534	0.450	1.8	1.9	
200	0.7901	0.341	1.9	2	
100	0.7918	0.009	-	-	
50	0.7974	0.063	-	-	

QA Ref			Figure
SLR 5.3 Rev 146 Nov 14	ESG Environmental Scientifics Group / UKAS TESTING 1157	Printed:18/03/2016 10:14	OED

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH403		
Project Name	A63 CASTLE STREET		Depth (m BGL)	4.60		
			Samp No	11	Type	B
			ID	A5085-1520160119124449		
			Spec Ref			



Soil description	Grey and brown slightly sandy slightly gravelly CLAY.		Derived Parameters +
Test method	BS 1377:part 4:1990: clause 3.3, 2.5 kg rammer in a 1 litre mould		Maximum dry density, Mg/m3
Preparation	Original material was natural, single sample tested		**1.63**
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	Optimum moisture content, %
Particle density, Mg/m^3	2.65	assumed	**19**
Remarks			

QA Ref SLD 4, 3.3/4 Rev 66 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 10:13	**Figure** **COMPL**

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

ESG

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	m/c	Depth from m	to m	Compaction Type BS 1377 Part 4	Test No. %	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH403	B11	40.9%	4.60	5.00	2.5kg	1	41	1.25	Too Soft	
BH403	B11	40.9%	4.60	5.00	2.5kg	2	32	1.36	4	
BH403	B11	40.9%	4.60	5.00	2.5kg	3	26	1.53	8	
BH403	B11	40.9%	4.60	5.00	2.5kg	4	21	1.62	24	
BH403	B11	40.9%	4.60	5.00	2.5kg	5	16	1.63	74	
BH403	B11	40.9%	4.60	5.00	2.5kg	6	10	1.61	Too Stiff	

Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

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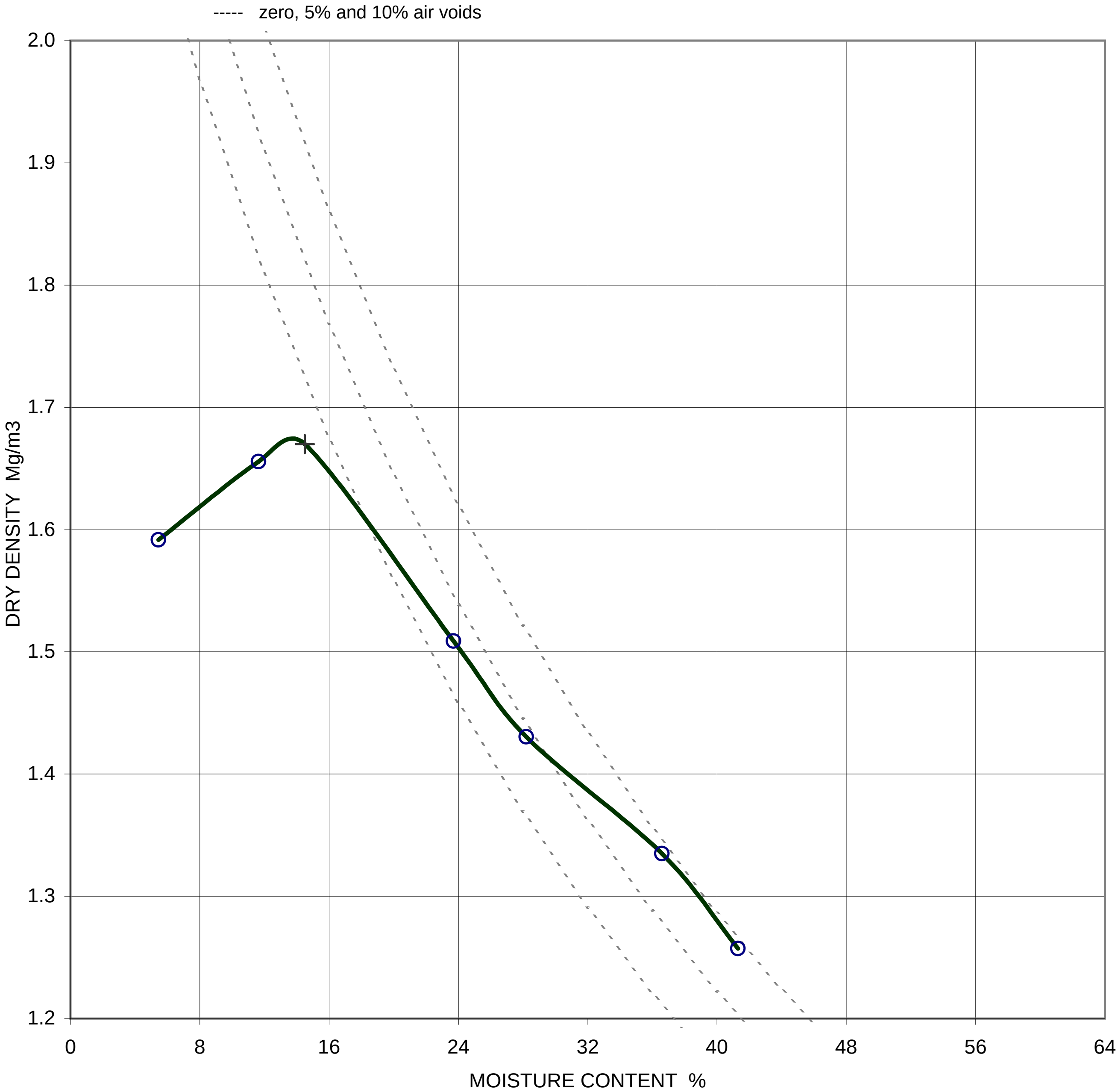
Loc No. A5085-15

Location A63 CASTLE STREET

TABLE

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH404		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00		
			Samp No	9	Type	P
			ID	A5085-1520160126094756		
			Spec Ref			



Soil description	Dark grey slightly sandy clayey SILT.	
Test method	BS 1377:part 4:1990: clause 3.3, 2.5 kg rammer in a 1 litre mould	
Preparation	Original material was natural, separate specimens tested	
Material > 37.5mm	0	%
Material < 37.5mm > 20mm	0	%
Particle density, Mg/m^3	2.65	assumed
Remarks		

Derived Parameters +

Maximum dry density, Mg/m3

1.67

Optimum moisture content, %

15

QA Ref SLD 4, 3.3/4 Rev 66 Aug 11	Printed:18/03/2016 10:13	**Figure** **COMPL**

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

ESG

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	m/c	Depth from m	to m	Compaction Type BS 1377 Part 4	Test No.	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH404	P9	41.3%	5.00	6.00	2.5kg	1	41	1.26	Too Soft	
BH404	P9	41.3%	5.00	6.00	2.5kg	2	37	1.34	Too Soft	
BH404	P9	41.3%	5.00	6.00	2.5kg	3	5.5	1.59	Too stiff	
BH404	P9	41.3%	5.00	6.00	2.5kg	4	24	1.51	40	
BH404	P9	41.3%	5.00	6.00	2.5kg	5	28	1.43	28	
BH404	P9	41.3%	5.00	6.00	2.5kg	6	12	1.66	86	

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Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

Loc No. A5085-15

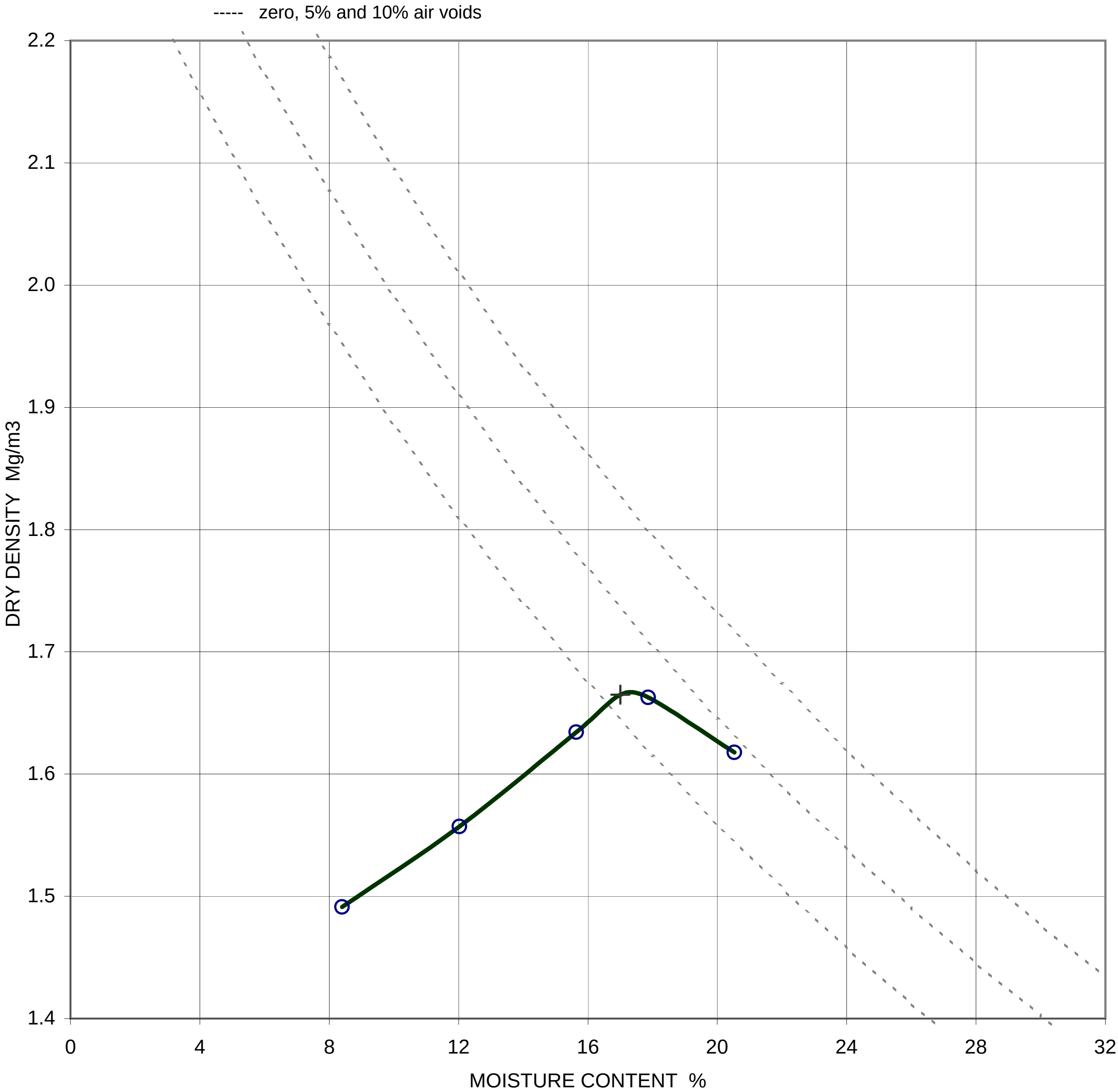
Location A63 CASTLE STREET

TABLE

Sheet 1 of 1

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	5.00		
			Samp No	16	Type	UT
			ID	A5085-1520151208042145		
			Spec Ref			



Soil description	Grey slightly sandy silty CLAY.		
Test method	BS 1377:part 4:1990: clause 3.3, 2.5 kg rammer in a 1 litre mould		
Preparation	Original material was natural, single sample tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	
Particle density, Mg/m^3	2.65	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

1.67

Optimum moisture content, %

17

QA Ref SLD 4, 3.3/4 Rev 66 Aug 11	Printed:18/03/2016 10:13	**Figure** **COMPL**

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	m/c	Depth from m	to m	Compaction Type BS 1377 Part 4	Test No. %	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH406	UT16	35.5%	5.00	5.45	2.5kg	1	8.4	1.49	Too Stiff	
BH406	UT16	35.5%	5.00	5.45	2.5kg	2	12	1.56	110	
BH406	UT16	35.5%	5.00	5.45	2.5kg	3	16	1.59	79	
BH406	UT16	35.5%	5.00	5.45	2.5kg	4	18	1.66	44	
BH406	UT16	35.5%	5.00	5.45	2.5kg	5	21	1.62	18	

Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

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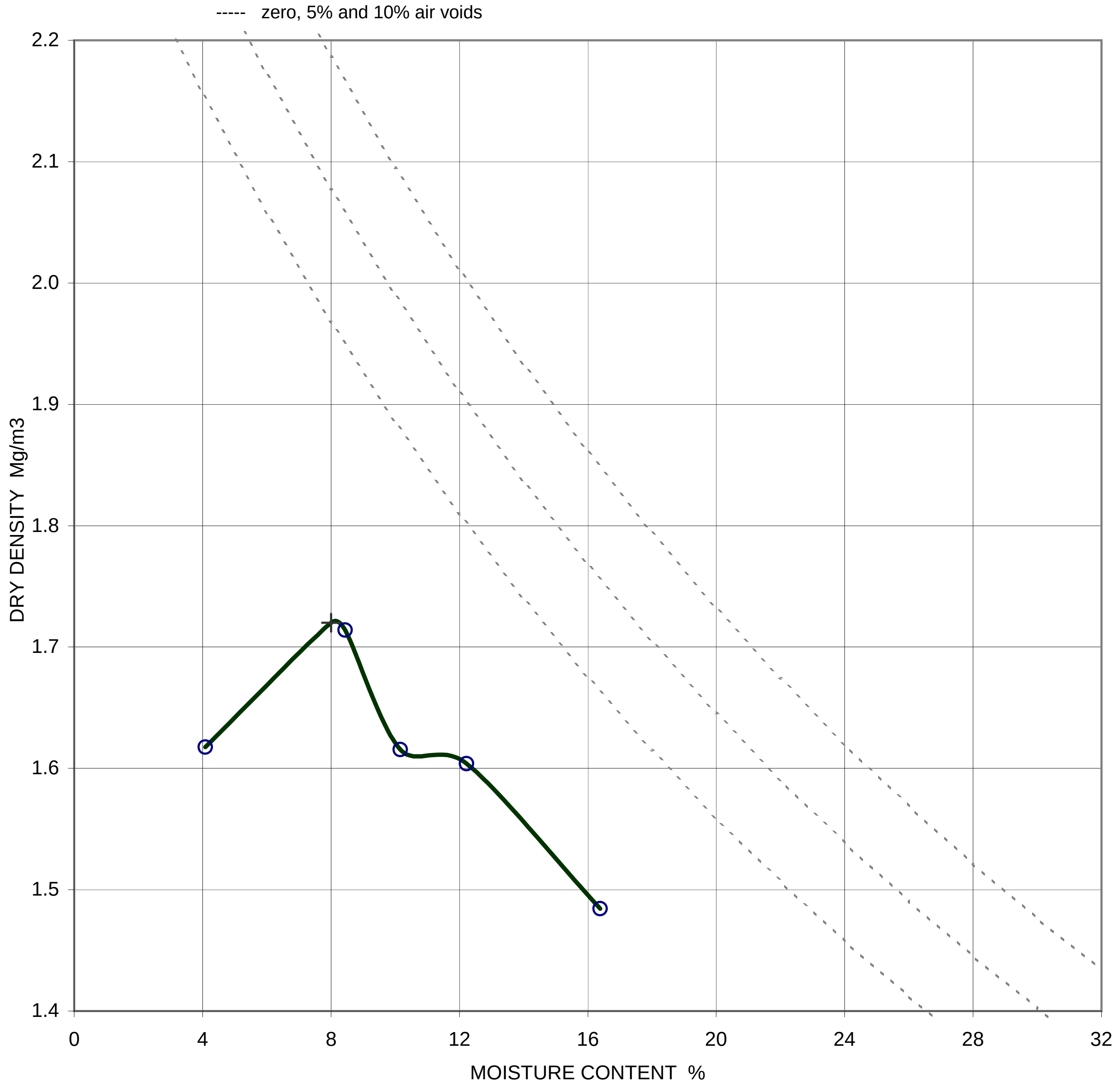
Loc No. A5085-15

Location A63 CASTLE STREET

TABLE

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH406		
Project Name	A63 CASTLE STREET		Depth (m BGL)	7.50		
			Samp No	23	Type	B
			ID	A5085-1520151209113442		
			Spec Ref			



Soil description	Greyish brown slightly sandy slightly gravelly SILT.		
Test method	BS 1377:part 4:1990: clause 3.3, 2.5 kg rammer in a 1 litre mould		
Preparation	Original material was natural, single sample tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	
Particle density, Mg/m^3	2.65	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

1.72

Optimum moisture content, %

8.0

QA Ref SLD 4, 3.3/4 Rev 66 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 10:13	**Figure** **COMPL**

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	m/c	Depth from m	to m	Compaction Type BS 1377 Part 4	Test No. %	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH406	B23	49.0%	7.50	8.00	2.5kg	1	4.1	1.62	Material unsuitable. Displaced on penetration.	
BH406	B23	49.0%	7.50	8.00	2.5kg	2	8.4	1.71		
BH406	B23	49.0%	7.50	8.00	2.5kg	3	12	1.60		
BH406	B23	49.0%	7.50	8.00	2.5kg	4	16	1.48		
BH406	B23	49.0%	7.50	8.00	2.5kg	5	10	1.62		

Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

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Loc No. A5085-15

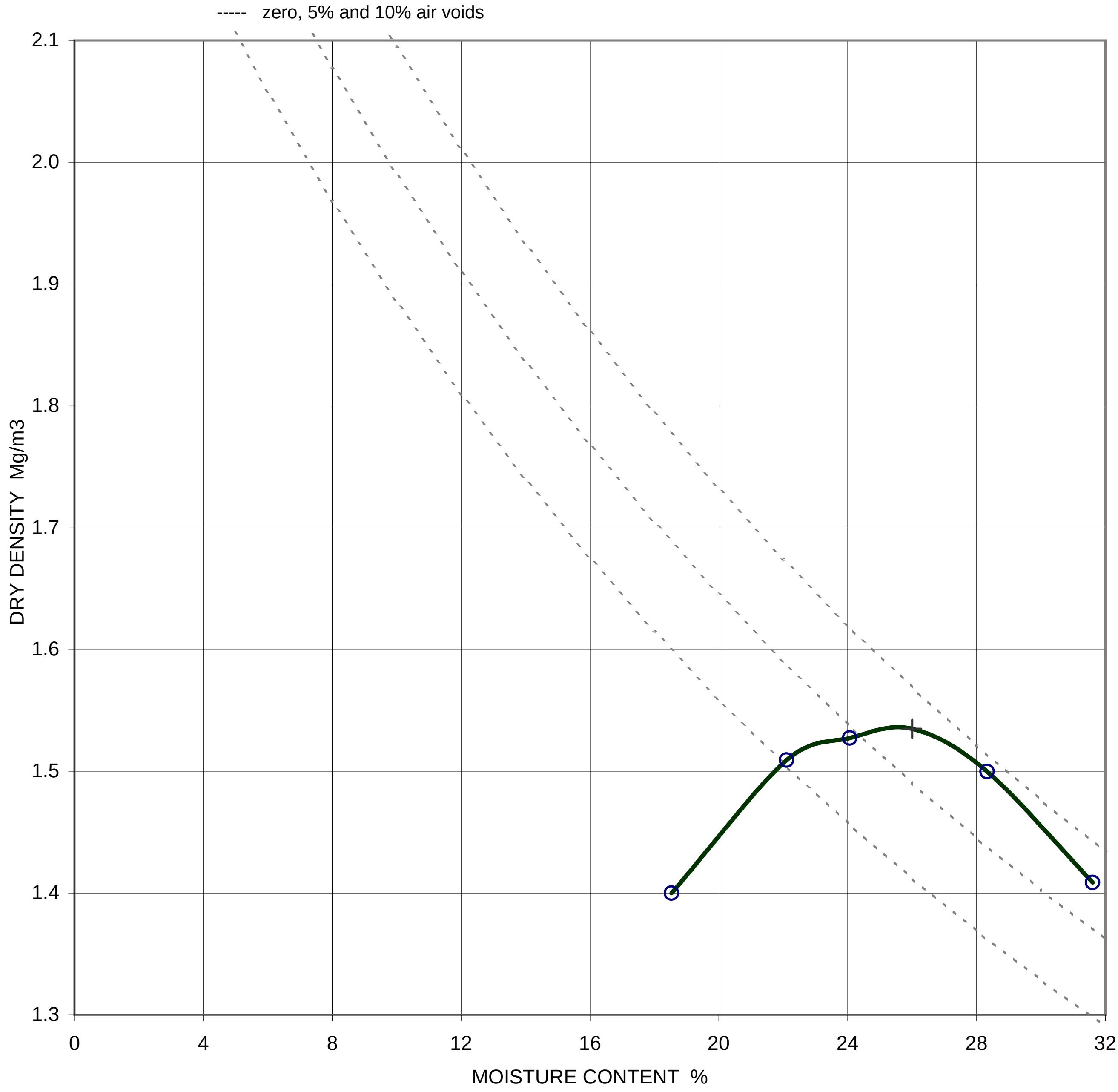
Location A63 CASTLE STREET

TABLE

Sheet 1 of 1

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH407		
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.10		
			Samp No	9	Type	UT
			ID	A5085-1520151208112333		
			Spec Ref			



Soil description	Very soft brown slightly sandy silty CLAY.		Derived Parameters +
Test method	BS 1377:part 4:1990: clause 3.3, 2.5 kg rammer in a 1 litre mould		Maximum dry density, Mg/m3
Preparation	Original material was natural, single sample tested		**1.54**
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	Optimum moisture content, %
Particle density, Mg/m^3	2.65	assumed	**26**
Remarks			

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ESG Environmental Scientifics Group

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Figure
COMPL

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

ESG

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	Sample m/c	Depth from m	Depth to m	Compaction Type BS 1377 Part 4	Test No. %	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH407	UT9	31.6%	3.10	2.55	2.5kg	1	32	1.41	10	
BH407	UT9	31.6%	3.10	2.55	2.5kg	2	28	1.50	28	
BH407	UT9	31.6%	3.10	2.55	2.5kg	3	22	1.51	72	
BH407	UT9	31.6%	3.10	2.55	2.5kg	4	24	1.53	55	
BH407	UT9	31.6%	3.10	2.55	2.5kg	5	19	1.40	105	

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Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

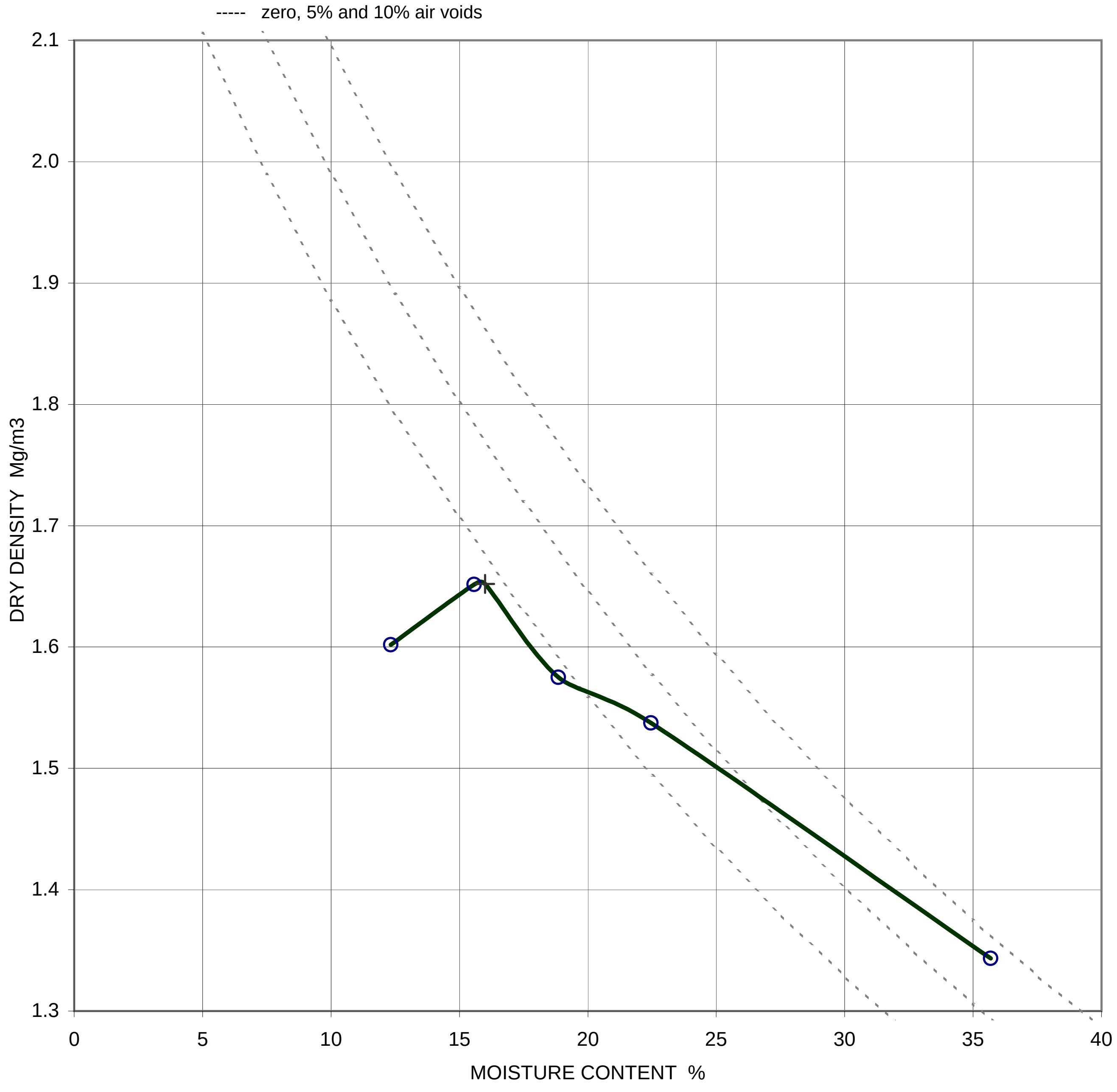
Loc No. A5085-15

Location A63 CASTLE STREET

TABLE

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH408		
Project Name	A63 CASTLE STREET		Depth (m BGL)	9.05		
			Samp No	20	Type	P
			ID	A5085-1520151209104559		
			Spec Ref			



Soil description	Dark greyish brown sandy clayey SILT becoming very soft organic silty CLAY towards base.		Derived Parameters +
Test method	BS 1377:part 4:1990: clause 3.3, 2.5 kg rammer in a 1 litre mould		Maximum dry density, Mg/m3
Preparation	Original material was natural, single sample tested		**1.65**
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	Optimum moisture content, %
Particle density, Mg/m^3	2.65	assumed	**16**
Remarks			

QA Ref SLD 4, 3.3/4 Rev 66 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 10:13	**Figure** **COMPL**

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	m/c	Depth from m	to m	Compaction Type BS 1377 Part 4	Test No.	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH408	P20	35.6%	9.05	1.05	2.5kg	1	36	1.34	6	
BH408	P20	35.6%	9.05	1.05	2.5kg	2	23	1.54	25	
BH408	P20	35.6%	9.05	1.05	2.5kg	3	19	1.58	38	
BH408	P20	35.6%	9.05	1.05	2.5kg	4	16	1.65	45	
BH408	P20	35.6%	9.05	1.05	2.5kg	5	12	1.60	62	

Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

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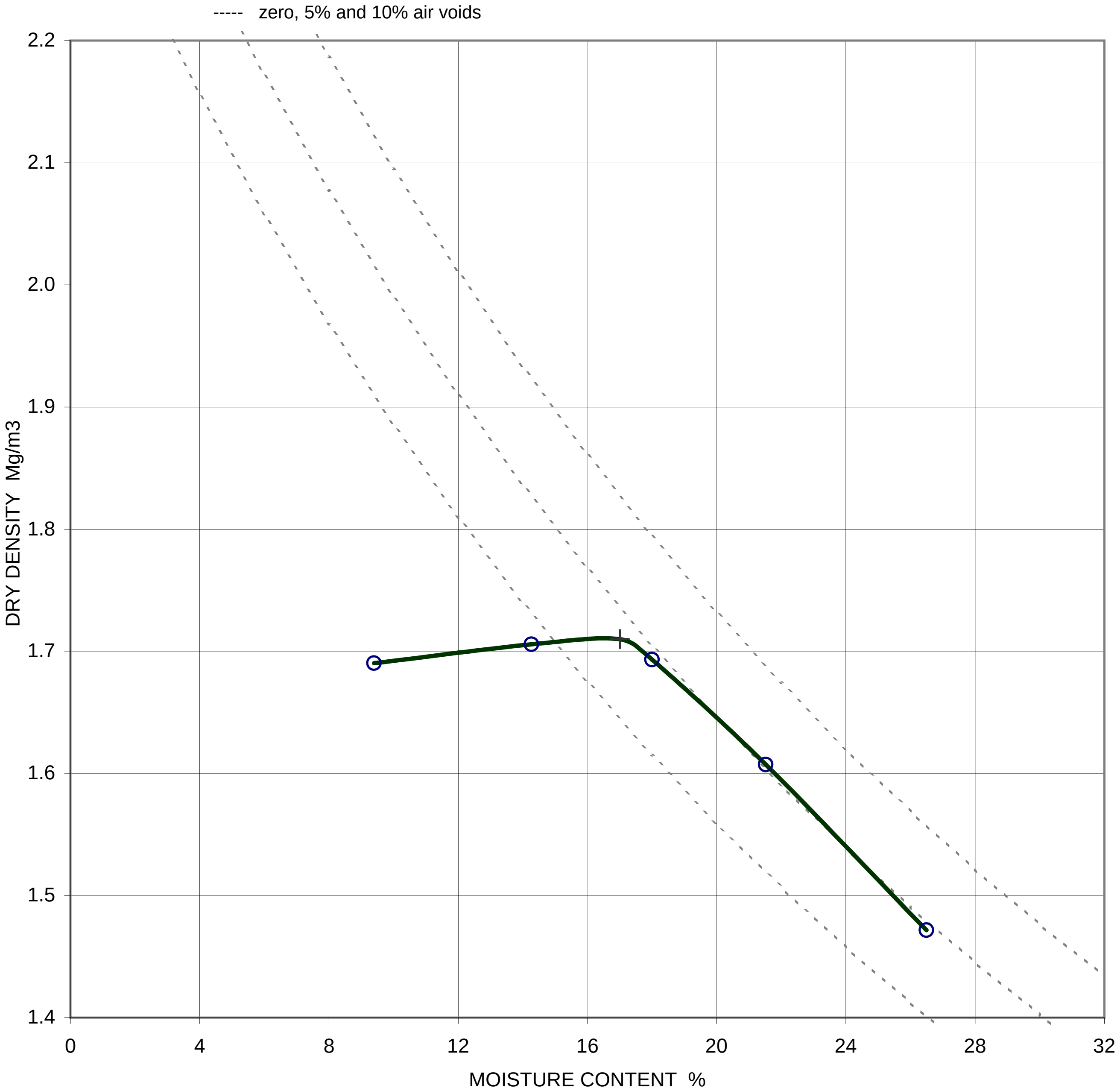
Loc No. A5085-15

Location A63 CASTLE STREET

TABLE

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH417		
Project Name	A63 CASTLE STREET		Depth (m BGL)	1.20		
			Samp No	3	Type	B
			ID	A5085-1520151222015233		
			Spec Ref			



Soil description	Greyish brown slightly sandy gravelly SILT.		Derived Parameters +
Test method	BS 1377:part 4:1990: clause 3.4, 2.5 kg rammer in a CBR mould		Maximum dry density, Mg/m3
Preparation	Original material was natural, single sample tested		**1.71**
Material > 37.5mm	13	%	
Material < 37.5mm > 20mm	12	%	Optimum moisture content, %
Particle density, Mg/m^3	2.65	assumed	**17**
Remarks			

QA Ref SLD 4, 3.3/4 Rev 66 Aug 11	ESG Environmental Scientifics Group	Printed:18/03/2016 10:13	**Figure** **COMPL**

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	Sample m/c	Depth from m	Depth to m	Compaction Type BS 1377 Part 4	Test No.	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH417	B3	20.7%	1.20	2.00	2.5kg	1	21	1.65	60	
BH417	B3	20.7%	1.20	2.00	2.5kg	2	18	1.69	88	
BH417	B3	20.7%	1.20	2.00	2.5kg	3	14	1.71	110	
BH417	B3	20.7%	1.20	2.00	2.5kg	4	21	1.54	52	
BH417	B3	20.7%	1.20	2.00	2.5kg	5	9.4	1.69	Too Stiff	

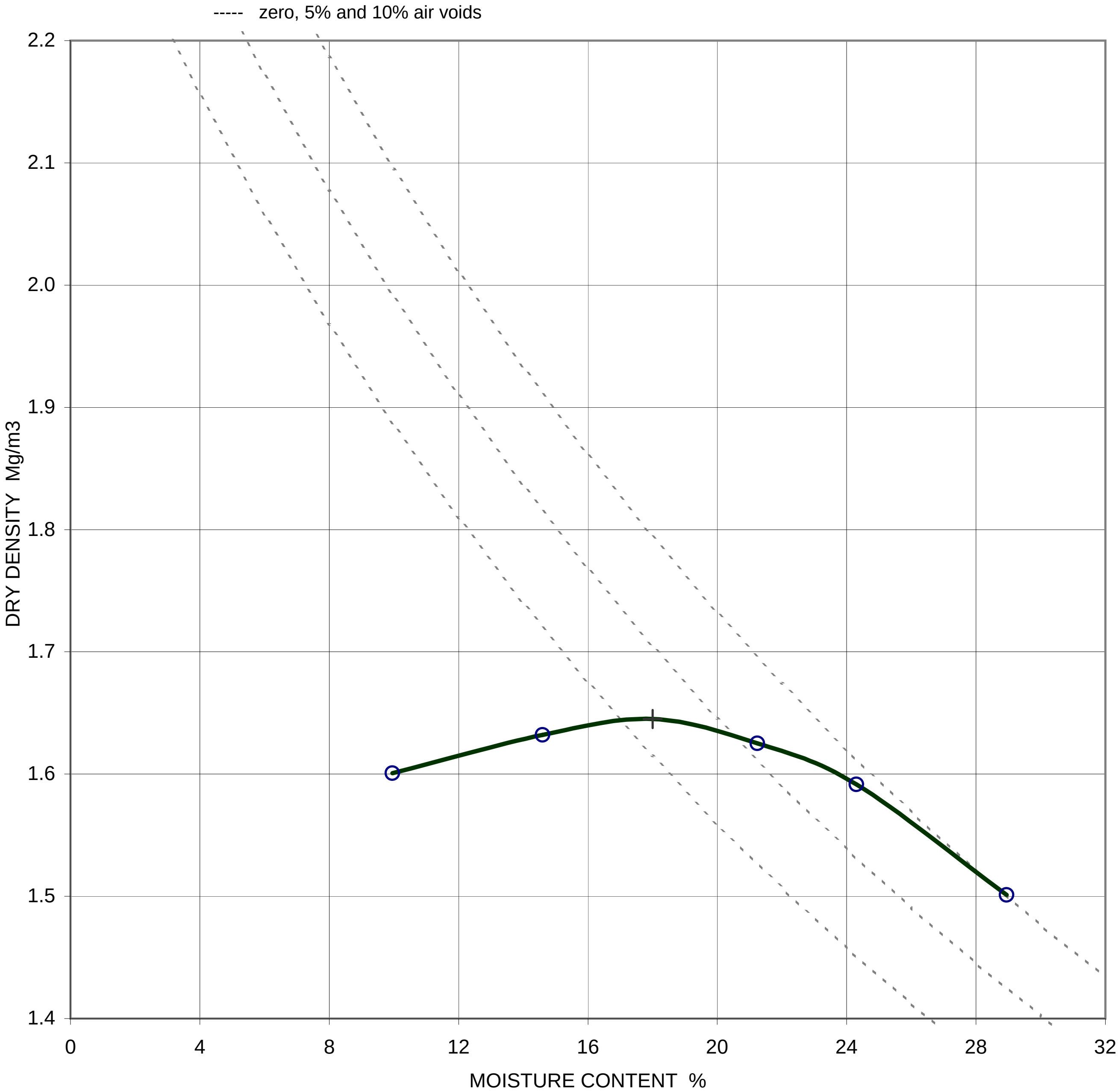
Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

SLR 4 Rev.0 Sept 99	Loc No. A5085-15	TABLE
	Location A63 CASTLE STREET	Sheet 1 of 1

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : LIGHT COMPACTION, 2.5 kg rammer

Project No	A5085-15	Sample Details:	Hole No	BH417
Project Name	A63 CASTLE STREET		Depth (m BGL)	3.55
			Samp No	10 / Type UT
			ID	A5085-1520151222015310
			Spec Ref	



Soil description	Soft brown mottled grey slightly sandy CLAY.		
Test method	BS 1377:part 4:1990: clause 3.3, 2.5 kg rammer in a 1 litre mould		
Preparation	Original material was natural, single sample tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	
Particle density, Mg/m^3	2.65	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

1.65

Optimum moisture content, %

18

QA Ref
SLD 4, 3.3/4
Rev 66
Aug 11

ESG Environmental Scientifics Group

UKAS TESTING 1157

Printed:18/03/2016 10:13

Figure
COMPL

SUMMARY OF VANE TEST ON COMPACTION SPECIMENS

SAMPLE SOURCE					Test Data					REMARKS
Hole No	Sample No.	m/c	Depth from m	to m	Compaction Type BS 1377 Part 4	Test No.	Moisture Content %	Dry Density Mg/m3	Hand Vane Shear Strength kN/m²	
BH417	UT10	28.9%	3.55	4.00	2.5kg	1	29	1.50	14	
BH417	UT10	28.9%	3.55	4.00	2.5kg	2	24	1.59	38	
BH417	UT10	28.9%	3.55	4.00	2.5kg	3	10	1.60	115	
BH417	UT10	28.9%	3.55	4.00	2.5kg	4	15	1.63	88	
BH417	UT10	28.9%	3.55	4.00	2.5kg	5	21	1.63	62	

Notes :

1 Hand vane tests carried out using Pilcon vane on recompacted specimen

Loc No. A5085-15

Location A63 CASTLE STREET

TABLE

CHEMICAL TESTS - SUMMARY OF RESULTS

Hole No.	Sample No.	Depth (m) from	Depth (m) to	Sample type	Soil Description	Org %	LOI %	pH	Preparation/test *	Sulphate as SO_4 2:1 water sol. g/L	Sulphate as SO_4 ground water g/L	Sulphate as SO_4 acid sol. %	SD1 options TS %	SD1 options Mg mg/L, NO_3 mg/L, NH_4	CO_2 %	Chloride, Cl water sol. %	Chloride, Cl acid sol. %	<2 mm %	Remarks
BH402	3	1.20		B				8.4		0.051		0.039	0.03						
BH402	9	3.75		P	Greyish brown slightly sandy clayey SILT.	1.90 s												99	
BH402	9	3.75		P				7.7		0.207		0.080	0.30						
BH402	11	5.75		UT	Brownish dark grey sandy slightly clayey SILT.	2.10 s												100	
BH402	13	6.40		P	Greyish brown sandy clayey SILT.	1.90 c												100	
BH402	13	6.40		P				8.0		0.089		0.053	0.17						
BH402	16	8.40		UT	Firm to stiff greyish brown sandy CLAY.	0.40 s												100	
BH402	16	8.40		UT				8.8		0.076		0.028	0.14						
BH402	24	10.95		UT	Very stiff greyish brown slightly gravelly sandy CLAY.	1.00												90	
BH402	24	10.95		UT				8.6		0.022		0.024	0.08						
BH402	38	15.90		UT				8.1		0.072		0.051	0.10						
BH402	55	22.00		D				8.8		0.088		0.050	0.03						
BH403	4	1.65		UT	Soft brown slightly sandy silty CLAY.	1.10												100	
BH403	12	5.00		P	Soft brown sandy silty CLAY.	1.70 c												100	
BH403	18	8.65		UT	Very soft brown CLAY.	1.00 s												100	
BH406	27	9.00		B	Grey slightly sandy slightly gravelly CLAY.	5.00 s c												97	
BH406	30	10.50		B	Greyish brown slightly sandy slightly gravelly SILT.	6.10 c												99	
BH407	3	1.20		D				7.8		0.442		0.106	0.08						
BH407	9	3.10		UT				7.6		0.636		0.187	0.39						
BH407	15	6.05		P				7.7		0.306		0.096	0.21						
BH407	18	7.60		UT	Very soft black organic slightly sandy slightly gravelly CLAY.	10.50 s												100	
BH407	21	8.50		UT				8.5		0.123		0.110	0.42						
BH407	25	10.50		UT	Firm brownish grey slightly sandy slightly gravelly CLAY with wood	17.60												97	
BH407	25	10.50		UT				6.7		1.760		0.544	2.83						
BH407	27	11.00		UT				6.3		3.600		0.911	4.50	0.545 - -					

BS 1377 : definitive method unless stated :
- Org Organic matter content (s-sulphides, c-chlorides identified)
- LOI Mass loss on ignition at 440°C
- CO_2 Carbonate content (rapid titration)
- Cl Chloride content

* Sulphate tests preparation / test methods :
1. BS 1377:Part 3:1990:clause 5.3
2. BS 1377:Part 3:1990:clause 5.4
3. BS 1377:Part 3:1990:clause 5.5
4. TRL447 - 1 water soluble sulphate
5. TRL447 - 2 acid soluble sulphate
6. BR279 - groundwater sulphate

< 2mm material passing 2mm sieve

BRE Special Digest SD1, dependent options :
- TS Total Sulphur to BR279 / EN ISO15178
- Mg Soluble Magnesium to BR279, colorimetric
- NO3 Soluble Nitrate to BR279, colorimetric
- NH_4 qualitative

CHEMICAL TESTS - SUMMARY OF RESULTS

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	Org %	LOI %	pH	Preparation/test *	Sulphate as SO_4 2:1 water sol. g/L	Sulphate as SO_4 ground water g/L	Sulphate as SO_4 acid sol. %	SD1 options TS %	SD1 options Mg mg/L, NO_3 mg/L, NH_4	CO_2 %	Chloride, Cl water sol. %	Chloride, Cl acid sol. %	<2 mm %	Remarks
BH407	33	12.50		UT				8.4		0.048		0.030	0.05						
BH407	44	15.50		D				8.3		0.607		0.037	0.16						
BH407	52	17.50		D				8.0		0.100		0.055	0.11						
BH407	60	19.50		UT				8.2		0.442		0.047	0.15						
BH407	75	23.50		UT				8.1		0.076		0.053	0.11						
BH407	85	26.50		B				8.6		0.124		0.062	0.05						
BH408	11	4.90		P	Soft dark grey silty CLAY becoming firm dark grey slightly sandy silty CLAY	1.70 s												100	
BH408	20	9.05		P	Dark greyish brown sandy clayey SILT becoming very soft organic silty	0.70 s												100	
BH408	25	11.50		UT	Dark brown slightly gravelly slightly clayey SAND.	0.50 s c												97	
BH408	30	12.60		UT	Firm organic black slightly sandy CLAY.		33											100	
BH417	3	1.20		B				8.3		0.123		0.138	0.08						
BH417	17	6.00		P				7.8		0.423		0.139	0.30						
BH417	22	8.50		UT	Soft brown slightly sandy silty CLAY.	1.80 s												100	
BH417	25	9.50		UT	Soft brownish dark grey slightly sandy slightly gravelly CLAY.	1.00 s												97	
BH417	25	9.50		UT				7.8		0.246		0.094	0.33						

BS 1377 : definitive method unless stated :
- Org: Organic matter content (s-sulphides, c-chlorides identified)
- LOI: Mass loss on ignition at 440°C
- CO_2: Carbonate content (rapid titration)
- Cl: Chloride content

* Sulphate tests preparation / test methods :
1. BS 1377:Part 3:1990:clause 5.3
2. BS 1377:Part 3:1990:clause 5.4
3. BS 1377:Part 3:1990:clause 5.5
4. TRL447 - 1 water soluble sulphate
5. TRL447 - 2 acid soluble sulphate
6. BR279 - groundwater sulphate

< 2mm material passing 2mm sieve

BRE Special Digest SD1, dependent options :
- TS: Total Sulphur to BR279 / EN ISO15178
- Mg: Soluble Magnesium to BR279, colorimetric
- NO3: Soluble Nitrate to BR279, colorimetric
- NH_4: qualitative

TEST REPORT

1252

Report No. EFS/160977 (Ver. 1)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 6 samples described in this report were registered for analysis by ESG on 08-Feb-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 12-Feb-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 12-Feb-2016

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected. ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

			Units :	mg/kg	mg/l	%	pH Units
			Method Codes :	ICPACIDS	ICPWSS	TSBRE1	WSLM50
			Method Reporting Limits :	20	10	0.005	
			UKAS Accredited :	Yes	Yes	No	No
LAB ID Number CL/	Client Sample Description	Sample Date		SO4-- (acid sol)	SO4-- (H2O sol) mg/l	Total Sulphur.	pH (BS1377)
1604377	BH407 D 53 17.50			553	100	0.106	8.0
1604378	BH407 D 4 1.20			1060	442	0.079	7.8
1604379	BH407 D 60 19.50			467	442	0.154	8.2
1604380	BH407 D 21 8.50			1100	123	0.420	8.5
1604381	BH407 D 45 15.50			372	607	0.162	8.3
1604382	BH407 D 75 23.50			525	76	0.114	8.1

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Client Name **ESG Doncaster**

Contact Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	**12-Feb-2016**
Report Number	**EFS/160977**
Table Number	**1**

Where individual results are flagged see report notes for status.

Sample Analysis

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

S160977

Customer ESG Doncaster
Site A63 Castle Street
Report No S160977

Consignment No S53437
Date Logged 08-Feb-2016

Report Due 15-Feb-2016

		MethodID	CustServ	Dep.Opt			ICPACIDS	ICPBRE	ICPWSS	KONECL	KoneNO3	TSBRE1	WSLM50
ID Number	Description	Sampled	REPORT A	DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	SO4-- (acid sol)	Magnesium (BRE)	SO4-- (H2O sol) mg/l	Chloride:(2:1)	Nitrate (BRE 2:1): mg/l	Total Sulphur.	pH (BS1377)
							✓		✓				
CL/1604377	BH407 17.50-17.95	D	D	D	D	D	D	D	D	D	D	D	D
CL/1604378	BH407 1.20-1.70	D	D				D	D	D	D	D	D	D
CL/1604379	BH407 19.50-19.95	D	D				D	D	D	D	D	D	D
CL/1604380	BH407 8.50-8.95	D	D				D	D	D	D	D	D	D
CL/1604381	BH407 15.50-15.95	D	D				D	D	D	D	D	D	D
CL/1604382	BH407 23.50-23.95	D	D				D	D	D	D	D	D	D

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile **TR** Denotes Tremolite
CR Denotes Crocidolite **AC** Denotes Actinolite
AM Denotes Amosite **AN** Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined **N.Det** Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : S16_0977

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1604377	BH407 D 53 17.50	CLAY
CL/1604378	BH407 D 4 1.20	SILT
CL/1604379	BH407 D 60 19.50	CLAY
CL/1604380	BH407 D 21 8.50	CLAY
CL/1604381	BH407 D 45 15.50	CLAY
CL/1604382	BH407 D 75 23.50	CLAY

TEST REPORT

Report No. EFS/161316 (Ver. 1)

ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 1 sample described in this report were registered for analysis by ESG on 19-Feb-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 25-Feb-2016

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 25-Feb-2016

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.

ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/l	%	pH Units
		Method Codes :	ICPACIDS	ICPWSS	TSBRE1	WSLM50
		Method Reporting Limits :	20	10	0.005	
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**SO4-- (acid sol)**	**SO4-- (H2O sol) mg/l**	**Total Sulphur.**	**pH (BS1377)**
1606109	BH407 B 85 26.50		618	124	0.049	8.6

ESG

Bretby Business Park, Ashby Road

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Fax +44 (0) 1283 554422

Client Name	**ESG Limited (Doncaster)**
Contact	Mr M Stanley

A63 Castle Street

Sample Analysis

Date Printed	**25-Feb-2016**
Report Number	**EFS/161316**
Table Number	**1**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer ESG Limited (Doncaster)
Site A63 Castle Street
Report No S161316

Consignment No S53621
Date Logged 19-Feb-2016

Report Due 26-Feb-2016

ID Number	Description	MethodID / Sampled	CustServ	Dep.Opt			ICPACIDS	ICPBRE	ICPWSS	KONECL	KoneNO3	TSBRE1	WSLM50
			REPORT A	DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	SO4-- (acid sol)	Magnesium (BRE)	SO4-- (H2O sol) mg/l	Chloride:(2:1)	Nitrate (BRE 2:1): mg/l	Total Sulphur.	pH (BS1377)
CL/1606109	BH407 26.50-27.00	D	D	D	D	D	D	D	D	D	D	D	D

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(white)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Limited (Doncaster)

Site : A63 Castle Street

Report Number : S16_1316

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1606109	BH407 B 85 26.50	CHALK

TEST REPORT

1252

Report No. EFS/161684 (Ver. 1)

ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 6 samples described in this report were registered for analysis by ESG on 02-Mar-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 08-Mar-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of
ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 08-Mar-2016

Tests marked '^' have been subcontracted to another laboratory.
Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/l	%	pH Units
		Method Codes :	ICPACIDS	ICPWSS	TSBRE1	WSLM50
		Method Reporting Limits :	20	10	0.005	
		UKAS Accredited :	Yes	Yes	No	No
LAB ID Number CL/	Client Sample Description	Sample Date	SO4-- (acid sol)	SO4-- (H2O sol) mg/l	Total Sulphur.	pH (BS1377)
1607344	BH402 B 3 1.20		391	51	0.029	8.4
1607345	BH402 P 9 3.75		804	207	0.304	7.7
1607346	BH402 UT 16 8.40		278	76	0.137	8.8
1607347	BH402 UT 24 10.95		236	22	0.082	8.6
1607348	BH402 UT 38 15.90		513	72	0.103	8.1
1607349	BH402 P 56 22.00		502 §	88 §	0.034	8.8

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Client Name ESG Limited (Doncaster)

Contact Mr M Stanley

A63 Castle Street

Sample Analysis

Date Printed	08-Mar-2016
Report Number	EFS/161684
Table Number	1

Where individual results are flagged see report notes for status.

Sample Analysis

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

S161684

Customer **ESG Limited (Doncaster)**
Site **A63 Castle Street**
Report No **S161684**

Consignment No S53621
Date Logged 02-Mar-2016

Report Due 09-Mar-2016

ID Number	Description	Sampled	CustServ REPORT A	Dep.Opt DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	ICPACIDS SO4-- (acid sol)	ICPBRE Magnesium (BRE)	ICPWSS SO4-- (H2O sol) mg/l	KONECL Chloride:(2:1)	KoneNO3 Nitrate (BRE 2:1): mg/l	TSBRE1 Total Sulphur.	WSLM50 pH (BS1377)
CL/1607344	BH402 1.20-2.00	D	D	D	D	D	D	D	D	D	D	D	D
CL/1607345	BH402 3.75-4.75	D	D				D	D	D	D	D	D	D
CL/1607346	BH402 8.40-9.05	D	D				D	D	D	D	D	D	D
CL/1607347	BH402 10.95-11.40	D	D				D	D	D	D	D	D	D
CL/1607348	BH402 15.90-16.35	D	D				D	D	D	D	D	D	D
CL/1607349	BH402 22.00-23.00	D	D				D	D	D	D	D	D	D

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key

A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key

(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Limited (Doncaster)

Site : A63 Castle Street

Report Number : S16_1684

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1607344	BH402 B 3 1.20	CLAY
CL/1607345	BH402 P 9 3.75	SILT
CL/1607346	BH402 UT 16 8.40	CLAY
CL/1607347	BH402 UT 24 10.95	CLAY
CL/1607348	BH402 UT 38 15.90	CLAY
CL/1607349	BH402 P 56 22.00	CHALK

TEST REPORT

1252

Report No. EFS/161698 (Ver. 1)

ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 1 sample described in this report were registered for analysis by ESG on 02-Mar-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 08-Mar-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 08-Mar-2016

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

			SO4-- (acid sol)	SO4-- (H2O sol) mg/l	Total Sulphur.	pH (BS1377)
		Units :	mg/kg	mg/l	%	pH Units
		Method Codes :	ICPACIDS	ICPWSS	TSBRE1	WSLM50
		Method Reporting Limits :	20	10	0.005	
		UKAS Accredited :	Yes	Yes	No	No
LAB ID Number CL/	Client Sample Description	Sample Date				
1607364	BH407 UT 25 10.50		5440	1760	2.83	6.7

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Client Name ESG Limited (Doncaster)

Contact Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	08-Mar-2016
Report Number	EFS/161698
Table Number	1

Where individual results are flagged see report notes for status.

Sample Analysis

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

S161698

Customer ESG Limited (Doncaster)
Site A63 Castle Street
Report No S161698

Consignment No S54040
Date Logged 02-Mar-2016

Report Due 09-Mar-2016

		MethodID	CustServ	Dep.Opt			ICPACIDS	ICPBRE	ICPWSS	KONECL	KoneNO3	TSBRE1	WSLM50
ID Number	Description	Sampled	REPORT A	DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	SO4-- (acid sol)	Magnesium (BRE)	SO4-- (H2O sol) mg/l	Chloride:(2:1)	Nitrate (BRE 2:1): mg/l	Total Sulphur.	pH (BS1377)
							✓		✓				
CL/1607364	BH407 10.50-10.85	D	D	D	D	D	D	D	D	D	D	D	D

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

 The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Limited (Doncaster)
Site : A63 Castle Street
Report Number : S16_1698

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1607364	BH407 UT 25 10.50	CLAY

TEST REPORT

1252

Report No. EFS/161702 (Ver. 1)

ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 2 samples described in this report were registered for analysis by ESG on 02-Mar-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 08-Mar-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns — Managing Director, Multi-Sector Services

Date of Issue: 08-Mar-2016

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

Units :	mg/kg	mg/l	%	pH Units
Method Codes :	ICPACIDS	ICPWSS	TSBRE1	WSLM50
Method Reporting Limits :	20	10	0.005	
UKAS Accredited :	Yes	Yes	No	No

LAB ID Number CL/	Client Sample Description	Sample Date	SO4-- (acid sol)	SO4-- (H2O sol) mg/l	Total Sulphur.	pH (BS1377)
1607374	BH417 B 3 1.20		1380	123	0.079	8.3
1607375	BH417 UT 25 9.50		944	246	0.334	7.8

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Client Name	**ESG Limited (Doncaster)**	**Sample Analysis**	
Contact	Mr N Cooke		
		Date Printed	**08-Mar-2016**
A63 Castle Street		**Report Number**	**EFS/161702**
		Table Number	**1**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer ESG Limited (Doncaster)
Site A63 Castle Street
Report No S161702

Consignment No S53621
Date Logged 02-Mar-2016
Report Due 09-Mar-2016

		MethodID	CustServ	Dep.Opt			ICPACIDS	ICPBRE	ICPWSS	KONECL	KoneNO3	TSBRE1	WSLM50
ID Number	Description	Sampled	REPORT A	DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	SO4-- (acid sol)	Magnesium (BRE)	SO4-- (H2O sol) mg/l	Chloride:(2:1)	Nitrate (BRE 2:1): mg/l	Total Sulphur.	pH (BS1377)
							✓		✓				
CL/1607374	BH417 1.20-2.00	D	D	D	D	D	D	D	D	D	D	D	D
CL/1607375	BH417 9.50-9.95	D	D				D	D	D	D	D	D	D

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key

A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key

(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^oC

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Limited (Doncaster)
Site : A63 Castle Street
Report Number : S16_1702

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1607374	BH417 B 3 1.20	MADE GROUND
CL/1607375	BH417 UT 25 9.50	CLAY

TEST REPORT

1252

Report No. EFS/162441 (Ver. 1)

ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 4 samples described in this report were registered for analysis by ESG on 29-Mar-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 01-Apr-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of [redacted]
ESG :
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 01-Apr-2016

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/l	%	pH Units
		Method Codes :	ICPACIDS	ICPWSS	TSBRE1	WSLM50
		Method Reporting Limits :	20	10	0.005	
		UKAS Accredited :	Yes	Yes	No	No
LAB ID Number CL/	Client Sample Description	Sample Date	SO4-- (acid sol)	SO4-- (H2O sol) mg/l	Total Sulphur.	pH (BS1377)
1610263	BH402 P 13 6.40		532	89	0.166	8.0
1610264	BH407 P 15 6.05		960	306	0.213	7.7
1610265	BH407 UT 33 12.50		298	48	0.046	8.4
1610266	BH417 P 17 6.00		1390	423	0.304	7.8

ESG

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Client Name ESG Limited (Doncaster)

Contact Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	01-Apr-2016
Report Number	EFS/162441
Table Number	1

Where individual results are flagged see report notes for status.

Sample Analysis | **ESG Environmental Chemistry** | **S162441**

Analytical and Deviating Sample Overview

Customer ESG Limited (Doncaster)
Site A63 Castle Street
Report No S162441

Consignment No S54712
Date Logged 29-Mar-2016

Report Due 04-Apr-2016

ID Number	Description	Sampled	REPORT A	DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	SO4-- (acid sol)	Magnesium (BRE)	SO4-- (H2O sol) mg/l	Chloride:(2:1)	Nitrate (BRE 2:1): mg/l	Total Sulphur.	pH (BS1377)
		MethodID	CustServ	Dep.Opt			ICPACIDS	ICPBRE	ICPWSS	KONECL	KoneNO3	TSBRE1	WSLM50
							✓		✓				
CL/1610263	BH402 6.40-7.40	D	D	D	D	D	D	D	D	D	D	D	D
CL/1610264	BH407 6.05-7.05	D	D				D	D	D	D	D	D	D
CL/1610265	BH407 12.50-12.95	D	D				D	D	D	D	D	D	D
CL/1610266	BH417 6.00-7.00	D	D				D	D	D	D	D	D	D

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

 The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^oC

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Limited (Doncaster)

Site : A63 Castle Street

Report Number : S16_2441

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1610263	BH402 P 13 6.40	SILT
CL/1610264	BH407 P 15 6.05	SILT
CL/1610265	BH407 UT 33 12.50	CLAY
CL/1610266	BH417 P 17 6.00	SILT

TEST REPORT

1252

Report No. EFS/162595 (Ver. 2)

ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

<u>Site: A63 Castle Street</u>

The 1 sample described in this report were registered for analysis by ESG on 01-Apr-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 14-Apr-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 14-Apr-2016

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

LAB ID Number CL/	Client Sample Description	Sample Date	SO4-- (acid sol)	SO4-- (H2O sol) mg/l	Total Sulphur.	pH (BS1377)
		Units :	mg/kg	mg/l	%	pH Units
		Method Codes :	ICPACIDS	ICPWSS	TSBRE1	WSLM50
		Method Reporting Limits :	20	10	0.005	
		UKAS Accredited :	Yes	Yes	No	No
1610949	BH407 UT 9 3.10		1870	636	0.392	7.6

Bretby Business Park, Ashby Road
Burton-on-Trent, Staffordshire, DE15 0YZ
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name	**ESG Limited (Doncaster)**
Contact	Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	**14-Apr-2016**
Report Number	**EFS/162595**
Table Number	**1**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer **ESG Limited (Doncaster)**
Site **A63 Castle Street**
Report No **S162595**

Consignment No S54040
Date Logged 01-Apr-2016
Report Due 08-Apr-2016

ID Number	Description	MethodID / Sampled	CustServ: REPORT A	Dep.Opt: DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	ICPACIDS: SO4-- (acid sol)	ICPBRE: Magnesium (BRE)	ICPWSS: SO4-- (H2O sol) mg/l	KONECL: Chloride:(2:1)	KoneNO3: Nitrate (BRE 2:1): mg/l	TSBRE1: Total Sulphur.	WSLM50: pH (BS1377)
Test Method Accredited to ISO17025							✓		✓				
CL/1610949	BH407 3.10-3.55												

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory. **In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.**

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,

- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis

Unless stated otherwise results are expressed as mg/l

Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,

- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^oC

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile — **TR** Denotes Tremolite
CR Denotes Crocidolite — **AC** Denotes Actinolite
AM Denotes Amosite — **AN** Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined — **N.Det** Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Limited (Doncaster)

Site : A63 Castle Street

Report Number : S16_2595

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1610949	BH407 UT 9 3.10	SILT

Our Ref: EFS/163059 (Ver. 1)
Your Ref: A5085-16

April 29, 2016

Environmental Chemistry
ESG
Bretby Business Park
Ashby Road
Burton-on-Trent
Staffordshire
DE15 0YZ

Telephone: 01283 554400
Facsimile: 01283 554422

Mr N Cooke
ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

For the attention of Mr N Cooke

Dear Mr Cooke

Sample Analysis - A63 Castle Street

Samples from the above site have been analysed in accordance with the schedule supplied.
The sample details and the results of analyses for these samples are given in the appended report.

An invoice for this work will follow under a separate cover.

Where appropriate the samples will be kept until 31/05/16 when they will be discarded. Please call 01283 554649 for an extension of this date.
Please be aware that our policy for the retention of paper based laboratory records and analysis reports is 6 years.

The work was carried out in accordance with Environmental Scientifics Group Ltd (Multi-Sector Services) Standard Terms and Conditions of Contract.

If I can be of any further assistance please do not hesitate to contact me.

Yours sincerely

for ESG
[redacted]

P Williams
Project Co-ordinator
01283 554649

TEST REPORT

1252

Report No. EFS/163059 (Ver. 1)

ESG Limited (Doncaster)
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

<u>Site: A63 Castle Street</u>

The 1 sample described in this report were registered for analysis by ESG on 19-Apr-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 29-Apr-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of
ESG :
Declan Burns [redacted]
Managing Director
Multi-Sector Services

Date of Issue: 29-Apr-2016

Tests marked '^' have been subcontracted to another laboratory.
Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/l	g/l	%	pH Units
		Method Codes :	ICPACIDS	ICPWSS	ICPBRE	TSBRE1	WSLM50
		Method Reporting Limits :	20	10	0.0001	0.005	
		UKAS Accredited :	Yes	Yes	No	No	No
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**SO4-- (acid sol)**	**SO4-- (H2O sol) mg/l**	**Magnesium (BRE)**	**Total Sulphur.**	**pH (BS1377)**
1613122	BH407 UT 27 11.00		9110	3600	0.545	4.501	6.3

ESG

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Fax +44 (0) 1283 554422

Client Name	**ESG Limited (Doncaster)**
Contact	Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	**29-Apr-2016**
Report Number	**EFS/163059**
Table Number	**1**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer ESG Limited (Doncaster)
Site A63 Castle Street
Report No S163059

Consignment No S55288
Date Logged 19-Apr-2016
Report Due 03-May-2016

ID Number	Description	Sampled	CustServ: REPORT A	Dep.Opt: DO Cl if pH<5.5	DO Mg if SO4(W)>3000	DO NO3 if pH<5.5	ICPACIDS: SO4-- (acid sol)	ICPBRE: Magnesium (BRE)	ICPWSS: SO4-- (H2O sol) mg/l	KONECL: Chloride:(2:1)	KoneNO3: Nitrate (BRE 2:1): mg/l	TSBRE1: Total Sulphur.	WSLM50: pH (BS1377)
							✓		✓				
CL/1613122	BH407 11.00-11.45												

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

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Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPBRE	Oven Dried @ < 35°C	Determination of Magnesium (BRE) in soil samples by water extraction followed by ICPOES detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	TSBRE1	Oven Dried @ < 35°C	Determination of Total Carbon and/or Total Sulphur in solid samples by high temperature combustion/infrared detection
Soil	WSLM50	Oven Dried @ < 35°C	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^oC

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
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‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

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Sample Descriptions

Client : ESG Limited (Doncaster)
Site : A63 Castle Street
Report Number : S16_3059

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1613122	BH407 UT 27 11.00	SILT

APPENDIX G

GEOENVIRONMENTAL LABORATORY TEST RESULTS

Test Reports	EFS/158452
	EFS/158453
	EFS/158466
	EFS/158661
	EFS/158711
	EFS/158776
	EFS/160146
	EXR/211674
	151215-53

TEST REPORT

1252

Report No. EFS/158452 (Ver. 2)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
DN6 8DG

Site: A63 Castle Street

The 1 sample described in this report were registered for analysis by ESG on 10-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 18-Dec-2015

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Pages 2 to 3)
Table of PAH (MS-SIM) (80) Results (Page 4)
Table of GRO Results (Page 5)
Table of TPH (Si) banding (UK-CWG) (Page 6)
GC-FID Chromatograms (Pages 7 to 8)
Table of VOC (HSA) Results (Page 9)
Subcontracted Analysis Reports (Pages 10 to 11)
The accreditation status of subcontracted analysis is displayed on the appended subcontracted analysis reports.
Analytical and Deviating Sample Overview (Pages 12 to 13)
Table of Method Descriptions (Page 14)
Table of Report Notes (Page 15)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 18-Dec-2015

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

LAB ID Number CL/	Client Sample Description	Sample Date	GRO (AA-UK) HSA-GCFID	Boron (H20 Soluble)	Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Manganese (MS)	Mercury (MS)	Molybdenum (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	Beryllium.	pH units (AR)
		Units :	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units
		Method Codes :	GROHSA	ICPBOR	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPSOIL	PHSOIL
		Method Reporting Limits :	0.2	0.5	0.1	0.3	0.1	0.5	0.5	0.5	1	0.1	0.5	0.5	0.5	3	0.1	
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1572259	BH407 ES 10 3.50	09-Dec-15	Req	2.4	0.4	9.3	0.18	31.2	16.4	18.1	597.3	<0.1	0.6	32.1	0.8	81	0.934	8.4

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

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Client Name ESG Doncaster

Contact Neil Cooke

Sample Analysis

A63 Castle Street

Date Printed	18-Dec-2015
Report Number	EFS/158452
Table Number	1

Where individual results are flagged see report notes for status.

			Units :	mg/kg	mg/kg		mg/kg	µg/kg	mg/kg	mg/kg	% M/M	µg/kg	µg/kg	ug/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg
			Method Codes :	SFAPI	SFAPI	Sub020	TPHUSSI	VOCHSAS	ICPMSS	KONECR	WSLM59	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	PAHMSUS
			Method Reporting Limits :	0.5	0.5		10		0.6	0.1	0.04	5	1	2	6	4	2		
			UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	Client Sample Description	Sample Date		Cyanide(Total) (AR)	Phenol Index.(AR)	^Asbestos ID & Quan	TPH by GCFID (Si-UKCWG)>44	VOC HSA-GCMS	Vanadium (MS)	Chromium vi:	Total Organic Carbon	Toluene	Benzene	Ethyl Benzene	Xylenes	m/p Xylenes	o Xylene	BTEX-HSA GCMS analysis	PAH (16) by GCMS
1572259	BH407 ES 10 3.50	09-Dec-15		<0.5	<0.5	NADIS	Req	Req	44	<0.1	0.92	<5	<1	<2	<6	<4	<2	Req	Req

ESG

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

Tel +44 (0) 1283 554400

Fax +44 (0) 1283 554422

Client Name	**ESG Doncaster**
Contact	Neil Cooke

A63 Castle Street

Sample Analysis

Date Printed	**18-Dec-2015**
Report Number	**EFS/158452**
Table Number	**1**

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	BH407 ES 10 3.50	**Job Number:**	S15_8452
LIMS ID Number:	CL1572259	**Date Booked in:**	10-Dec-15
QC Batch Number:	151265	**Date Extracted:**	11-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	15-Dec-15
Directory:	1415PAH.GC5\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	-	< 0.08	-
Pyrene	129-00-0	-	< 0.08	-
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.28	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	100
Acenaphthene-d10	99
Phenanthrene-d10	100
Chrysene-d12	107
Perylene-d12	113

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	96
Terphenyl-d14	80

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Gasoline Range Organics

(BTEX and Aromatic/Aliphatic Carbon Ranges)

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8452
Directory: E:\TES\DATA\2015\1215HSA_GC9\151215 2015-12-15 09-56-37\048F4801.D
Method: HEADSPACE GCFID

Matrix: Soil
Date Booked in: 10-Dec-15
Date extracted: 15-Dec-15
Date Analysed: 16-Dec-15, 00:44:
Units: mg/kg

*** Sample data with an asterisk are not UKAS accredited.**

		BTEX				Aromatics		Aliphatics		Total GRO
Sample ID	**Client ID**	**Benzene**	**Toluene**	**Ethyl benzene**	**Xylenes**	**C5 - C7**	**>C7 - C8**	**C5 - C6**	**>C6 - C8**	**C5 - C10**
CL1572259	BH407 ES 10 3.50	<0.010	<0.010	<0.010	<0.020	<0.01	<0.01	<0.2	<0.2	<0.2

Where individual results are flagged see report notes for status.

ALIPHATIC / AROMATIC FRACTION BY GC/FID

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8452
QC Batch Number: 151265
Directory: D:\TES\DATA\Y2015\121415TPH_GC4\121415 2015-12-14 10-37-09\083B4501.D
Method: Ultra Sonic

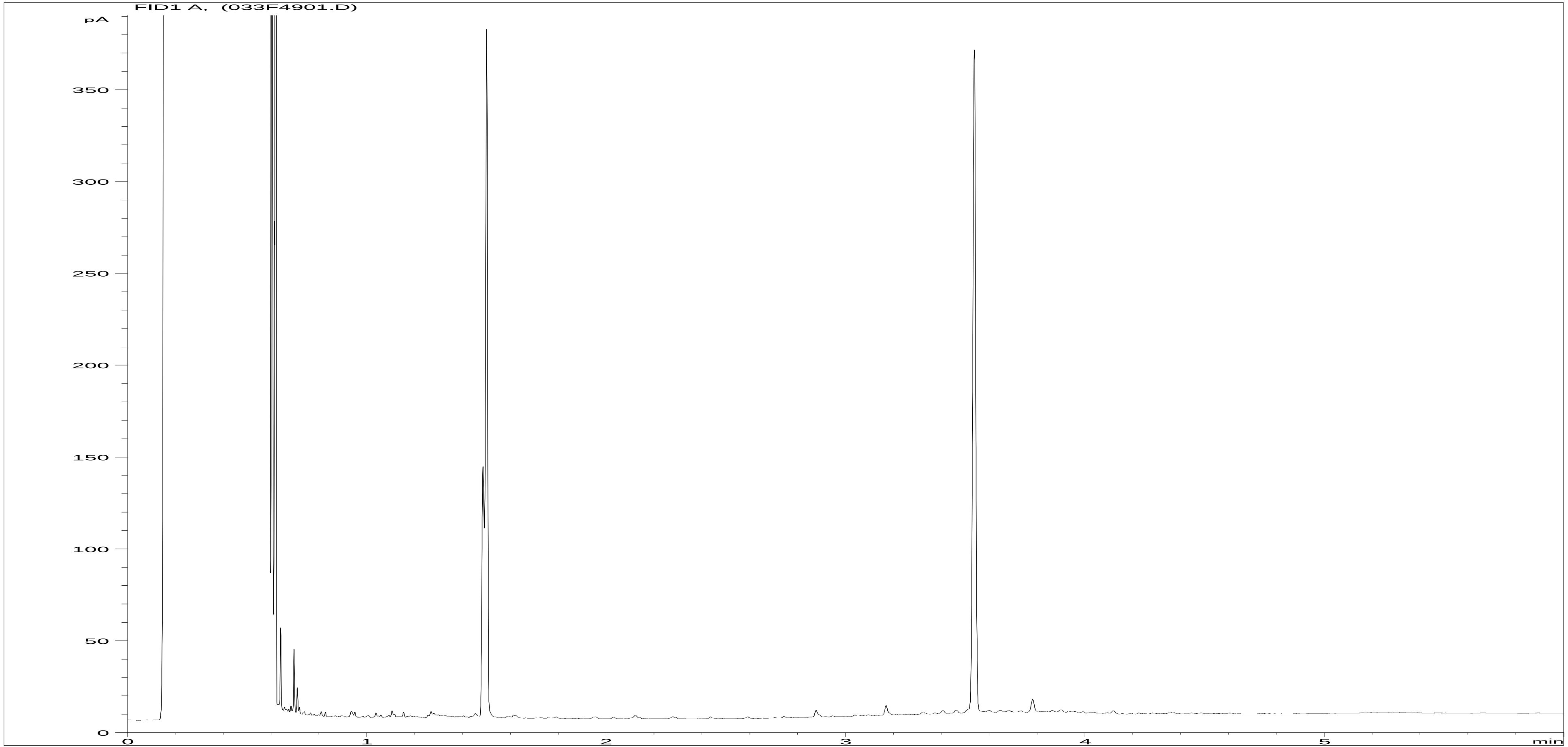
Separation: Silica gel
Eluents: Hexane, DCM

Matrix: Soil
Date Booked in: 10-Dec-15
Date Extracted: 12-Nov-15
Date Analysed: 15-Dec-15, 10:29:01

		Concentration, (mg/kg) - as wet weight												
Bands marked with a ' * ' are not UKAS Accredited		**>C8 - C10**	**>C8 - C10**	**>C10 - C12**	**>C10 - C12**	**>C12 - C16**	**>C12 - C16**	**>C16 - C35**	**>C16 - C21**	**>C35 - C44***	**>C21 - C35**	**>C35 - C44***	**>C8 - C44***	**>C8 - C44***
Sample ID	**Client ID**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aromatics**	**Aliphatics**	**Aromatics**
CL1572259	BH407 ES 10 3.50	<4.12	<4	<4.12	<4	<4.12	<4	43.5	<4	<5.79	15.5	6.28	52.5	28.2

Where individual results are flagged see report notes for status.

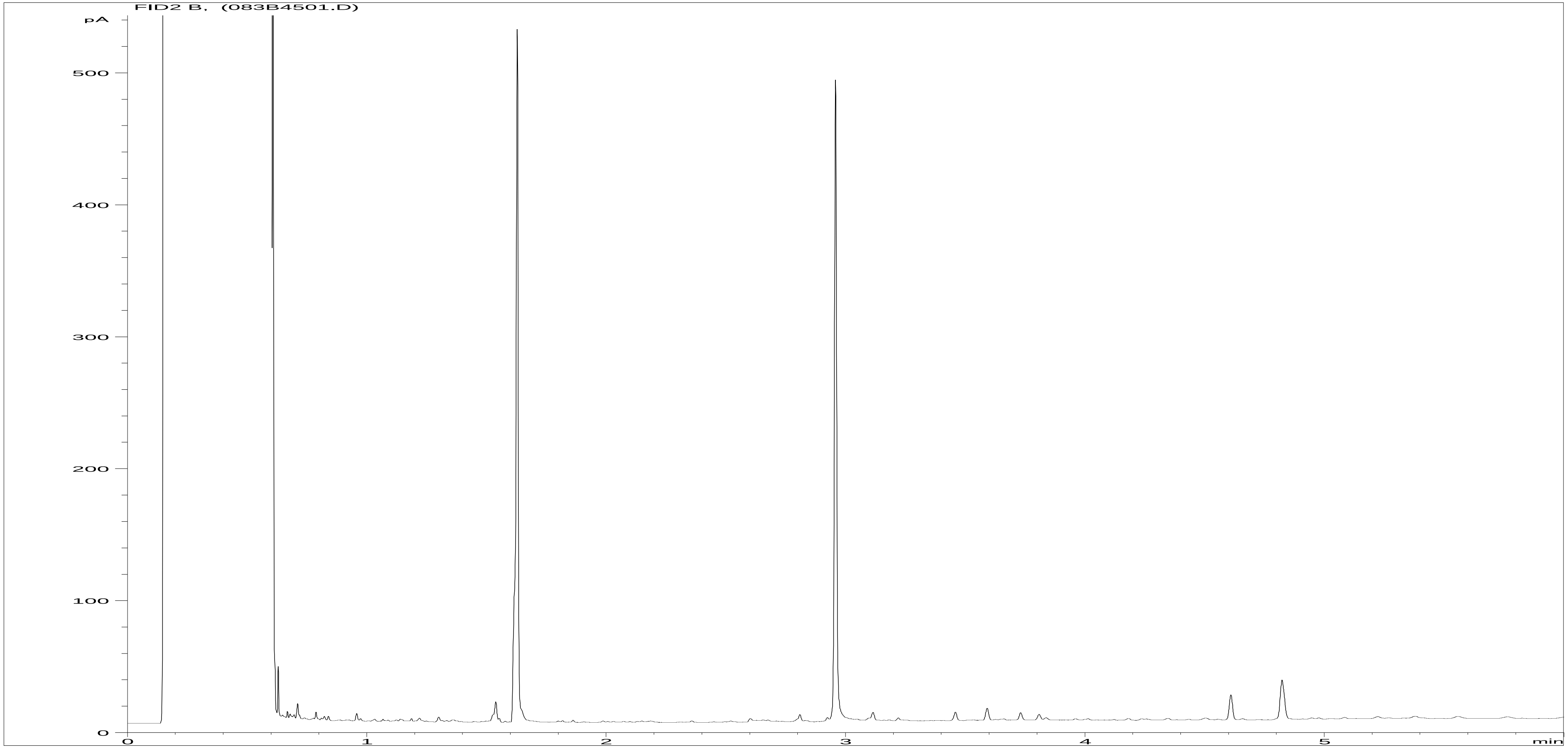
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1572259ALI	**Job Number:**	S15_8452
Multiplier:	16.48	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH407 ES 10 3.50
Acquisition Date/Time:	15-Dec-15, 11:21:15		
Datafile:	D:\TES\DATA\Y2015\121415TPH_GC4\121415 2015-12-14 10-37-09\033F4901.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1572259ARO	**Job Number:**	S15_8452
Multiplier:	11.36	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH407 ES 10 3.50
Acquisition Date/Time:	15-Dec-15, 10:29:01		
Datafile:	D:\TES\DATA\Y2015\121415TPH_GC4\121415 2015-12-14 10-37-09\083B4501.D		

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	215VOC.MS19\	Initial Calibration	**Matrix:**	Soil
Sample Details:	BH407 ES 10 3.50	**Date Booked in:**	10-Dec-15		**Method:**	Headspace
LIMS ID Number:	CL1572259	**Date Analysed:**	15-Dec-15		**Multiplier:**	0.97
Job Number:	S15_8452	**Operator:**	PR		**Position:**	11

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	87	Dibromofluoromethane	102
1,4-Difluorobenzene	4.35	87	Toluene-d8	93
Chlorobenzene-d5	5.46	74		
Bromofluorobenzene	5.86	57		
1,4-Dichlorobenzene-d4	6.26	44		
Naphthalene-d8	7.09	14		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

IOM

WORKING FOR A HEALTHIER FUTURE

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: ESG Environmental Chemistry
PO Box 100
Burton upon Trent
Staffordshire
DE15 0XD

CONTRACT NO: 46529-2

PROJECT NO: 610

DATE OF ISSUE: 18.12.15

DATE SAMPLES RECEIVED: 11.12.15

DATE SAMPLES ANALYSED: 18.12.15

SAMPLE DESCRIPTION: One soil/loose aggregate sample weighing approximately 0.9kg

ANALYSIS REQUESTED: Qualitative and quantitative analysis of a soil/loose aggregate sample for mass determination of asbestos.

METHODS:

Qualitative - The sample was analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative - The analysis was carried out using our documented in-house method based on HSE Contract Research Report No. 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies *et al*, 1996) and HSG 248. Our method includes initial examination of the entire sample, detailed analysis of a representative sub-sample and quantification by hand picking/weighing and/or fibre counting/sizing as appropriate.

RESULTS:

Initial Screening

No asbestos was detected in the soil sample by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.

www.iom-world.org
Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org
IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING 0374

CONTRACT NO: 46529-2
PROJECT NO: 610
DATE OF ISSUE: 18.12.15

RESULTS: (cont.)

Table 1: Qualitative Results

ESG Job I.D: S158452

IOM sample number	Client sample number	ACM type detected	PLM result
S36955	S1572259 BH407 3.50	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are outwith the scope of our UKAS accreditation.

AUTHORISED BY: [redacted] ……………………
J Simpson
Senior Scientific Technician

Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158452

Consignment No S52255
Date Logged 10-Dec-2015

Report Due 17-Dec-2015

ID Number	Description	MethodID / Sampled	CustServ	GROHSA	ICPBOR	ICPMSS													ICPSOIL	KONECR	PAHMSUS	PHSOIL	SFAPI		Sub020	TPHUSSI	VOCHSAS
			REPORT A	GRO (AA-UK) HSA-GCFID	Boron (H20 Soluble)	Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Manganese (MS)	Mercury (MS)	Molybdenum (MS)	Nickel (MS)	Selenium (MS)	Vanadium (MS)	Zinc (MS)	Beryllium.	Chromium vi:	PAH (16) by GCMS	pH units (AR)	Cyanide(Total) (AR)	Phenol Index.(AR)	^Asbestos ID & Quan	TPH by GCFID (Si-UKCWG)>44	BTEX-HSA GCMS analysis
				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
CL/1572259	BH407 3.50	09/12/15																									

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(white)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158452

Consignment No S52255
Date Logged 10-Dec-2015

Report Due 17-Dec-2015

		MethodID	VOCHSAS		WSLM59
ID Number	Description	Sampled	VOC HSA-GCMS	Ethyl Benzene (µg/kg)	Total Organic Carbon
			✓	✓	
CL/1572259	BH407 3.50	09/12/15			

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	GROHSA	As Received	Determination of Total Gasoline Range Organics Hydrocarbons (GRO) by Headspace GCFID
Soil	ICPBOR	Oven Dried @ < 35°C	Determination of Boron in soil samples by hot water extraction followed by ICPOES detection
Soil	ICPMSS	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPMS
Soil	ICPSOIL	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPOES detection
Soil	KONECR	Oven Dried @ < 35°C	Determination of Chromium vi in soil samples by water extraction followed by colorimetric detection
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Soil	SubCon*	*	Contact Laboratory for details of the methodology used by the sub-contractor.
Soil	TPHUSSI	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection including quantitation of Aromatic and Aliphatic fractions.
Soil	VOCHSAS	As Received	Determination of Volatile Organic Compounds (VOC) by Headspace GCMS
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table. All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^oC

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : S15_8452

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1572259	BH407 ES 10 3.50	CLAY

TEST REPORT

UKAS TESTING
1252

Report No. EFS/158453 (Ver. 2)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
DN6 8DG

Site: A63 Castle Street

The 1 sample described in this report were registered for analysis by ESG on 10-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 18-Dec-2015

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Pages 2 to 3)
Table of PAH (MS-SIM) (80) Results (Page 4)
Table of GRO Results (Page 5)
Table of TPH (Si) banding (UK-CWG) (Page 6)
GC-FID Chromatograms (Pages 7 to 8)
Table of VOC (HSA) Results (Page 9)
Subcontracted Analysis Reports (Pages 10 to 11)
The accreditation status of subcontracted analysis is displayed on the appended subcontracted analysis reports.
Analytical and Deviating Sample Overview (Pages 12 to 13)
Table of Method Descriptions (Page 14)
Table of Report Notes (Page 15)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 18-Dec-2015

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units
		Method Codes :	GROHSA	ICPBOR	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPSOIL	PHSOIL
		Method Reporting Limits :	0.2	0.5	0.1	0.3	0.1	0.5	0.5	0.5	1	0.1	0.5	0.5	0.5	3	0.1	
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	Client Sample Description	Sample Date	GRO (AA-UK) HSA-GCFID	Boron (H20 Soluble)	Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Manganese (MS)	Mercury (MS)	Molybdenum (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	Beryllium.	pH units (AR)
1572260	BH408 ES 12 4.90	09-Dec-15	Req	3.5	0.5	9.9	0.18	27.4	15.3	15.5	617.9	<0.1	0.8	27.4	0.6	75.9	0.758	8.4

ESG

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Burton-on-Trent, Staffordshire, DE15 0YZ

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Client Name ESG Doncaster

Contact Neil Cooke

A63 Castle Street

Sample Analysis

Date Printed	18-Dec-2015
Report Number	EFS/158453
Table Number	1

Where individual results are flagged see report notes for status.

LAB ID Number CL/	Client Sample Description	Sample Date	Cyanide(Total) (AR)	Phenol Index.(AR)	^Asbestos ID & Quan	TPH by GCFID (Si-UKCWG)>44	VOC HSA-GCMS	Vanadium (MS)	Chromium vi:	Total Organic Carbon	Toluene	Benzene	Ethyl Benzene	Xylenes	m/p Xylenes	o Xylene	BTEX-HSA GCMS analysis	PAH (16) by GCMS
		Units :	mg/kg	mg/kg		mg/kg	µg/kg	mg/kg	mg/kg	% M/M	µg/kg	µg/kg	ug/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg
		Method Codes :	SFAPI	SFAPI	Sub020	TPHUSSI	VOCHSAS	ICPMSS	KONECR	WSLM59	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	PAHMSUS
		Method Reporting Limits :	0.5	0.5		10		0.6	0.1	0.04	5	1	2	6	4	2		
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1572260	BH408 ES 12 4.90	09-Dec-15	<0.5	<0.5	NADIS	Req	Req	38.8	<0.1	0.99	<5	<1	<2	<6	<4	<2	Req	Req

Bretby Business Park, Ashby Road
Burton-on-Trent, Staffordshire, DE15 0YZ
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Fax +44 (0) 1283 554422

Client Name	**ESG Doncaster**	**Sample Analysis**	
Contact	Neil Cooke		
		Date Printed	**18-Dec-2015**
	A63 Castle Street	**Report Number**	**EFS/158453**
		Table Number	**1**

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	BH408 ES 12 4.90	**Job Number:**	S15_8453
LIMS ID Number:	CL1572260	**Date Booked in:**	10-Dec-15
QC Batch Number:	151262	**Date Extracted:**	11-Nov-15
Quantitation File:	Initial Calibration	**Date Analysed:**	12-Dec-15
Directory:	15AMS17.PAH\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	-	< 0.08	-
Pyrene	129-00-0	-	< 0.08	-
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.28	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	90
Acenaphthene-d10	92
Phenanthrene-d10	90
Chrysene-d12	94
Perylene-d12	99

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	108
Terphenyl-d14	83

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Gasoline Range Organics

(BTEX and Aromatic/Aliphatic Carbon Ranges)

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8453
Directory: C:\CHEM32\1\DATA\1214HSA_GC12\121415 2015-12-14 15-50-40\159B5901.D
Method: HEADSPACE GCFID

Matrix: Soil
Date Booked in: 10-Dec-15
Date extracted: 14-Dec-15
Date Analysed: 15-Dec-15, 10:33:
Units: mg/kg

*** Sample data with an asterisk are not UKAS accredited.**

		BTEX				Aromatics		Aliphatics		Total GRO
Sample ID	**Client ID**	**Benzene**	**Toluene**	**Ethyl benzene**	**Xylenes**	**C5 - C7**	**>C7 - C8**	**C5 - C6**	**>C6 - C8**	**C5 - C10**
CL1572260	BH408 ES 12 4.90	<0.010	<0.010	<0.010	<0.020	<0.01	<0.01	<0.2	<0.2	<0.2

Where individual results are flagged see report notes for status.

ALIPHATIC / AROMATIC FRACTION BY GC/FID

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8453
QC Batch Number: 151262
Directory: D:\TES\DATA\Y2015\121415TPH_GC4\121415 2015-12-14 10-37-09\074B3301.D
Method: Ultra Sonic

Separation: Silica gel
Eluents: Hexane, DCM

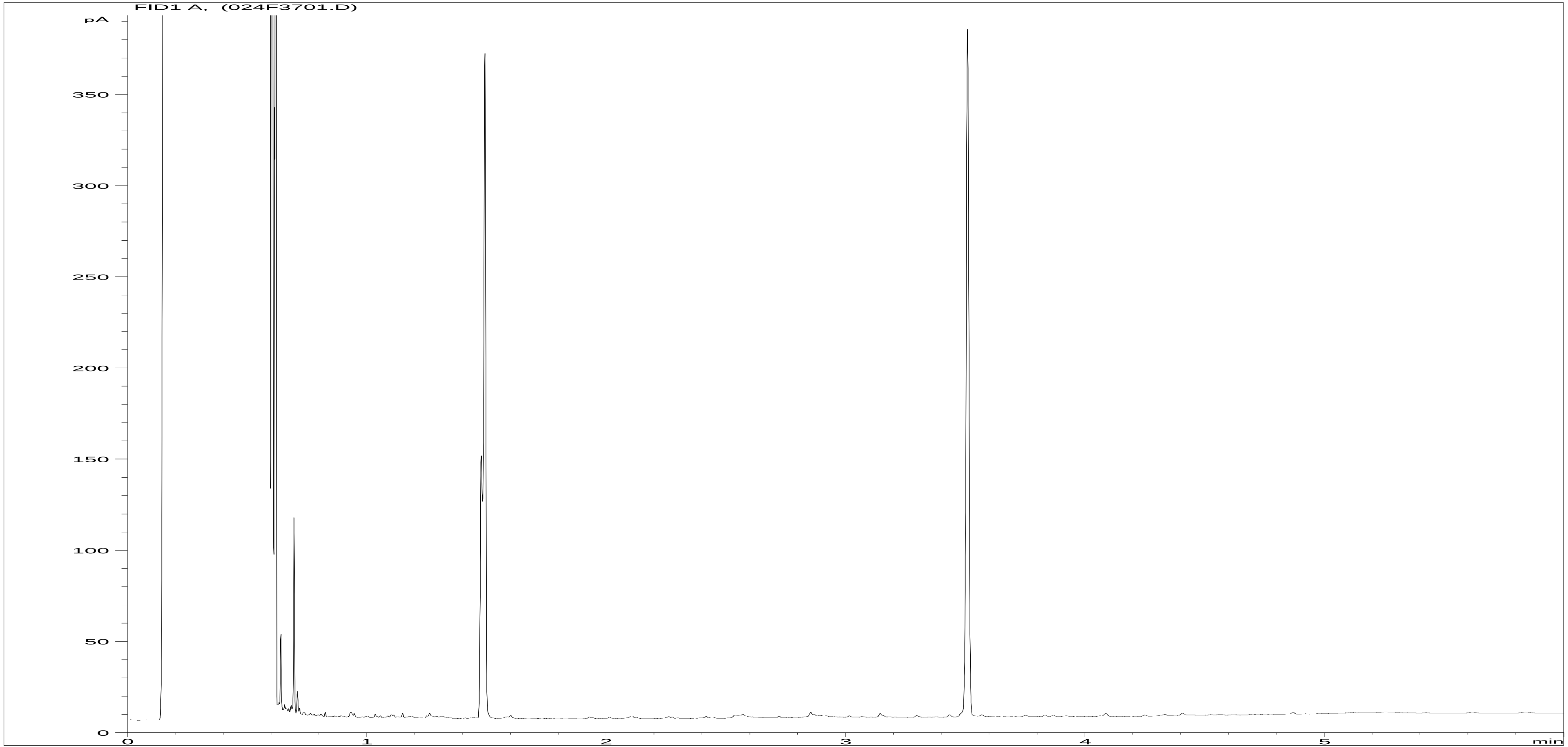
Matrix: Soil
Date Booked in: 10-Dec-15
Date Extracted: 11-Dec-15
Date Analysed: 15-Dec-15, 07:51:52

Bands marked with a ' * ' are not UKAS Accredited

		Concentration, (mg/kg) - as wet weight												
		>C8 - C10	>C8 - C10	>C10 - C12	>C10 - C12	>C12 - C16	>C12 - C16	>C16 - C35	>C16 - C21	>C35 - C44*	>C21 - C35	>C35 - C44*	>C8 - C44*	>C8 - C44*
Sample ID	**Client ID**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aromatics**	**Aliphatics**	**Aromatics**
CL1572260	BH408 ES 12 4.90	<4.28	<4	<4.28	<4	<4.28	<4	17.4	<4	<6.01	<8.76	7.99	22.9	20.7

Where individual results are flagged see report notes for status.

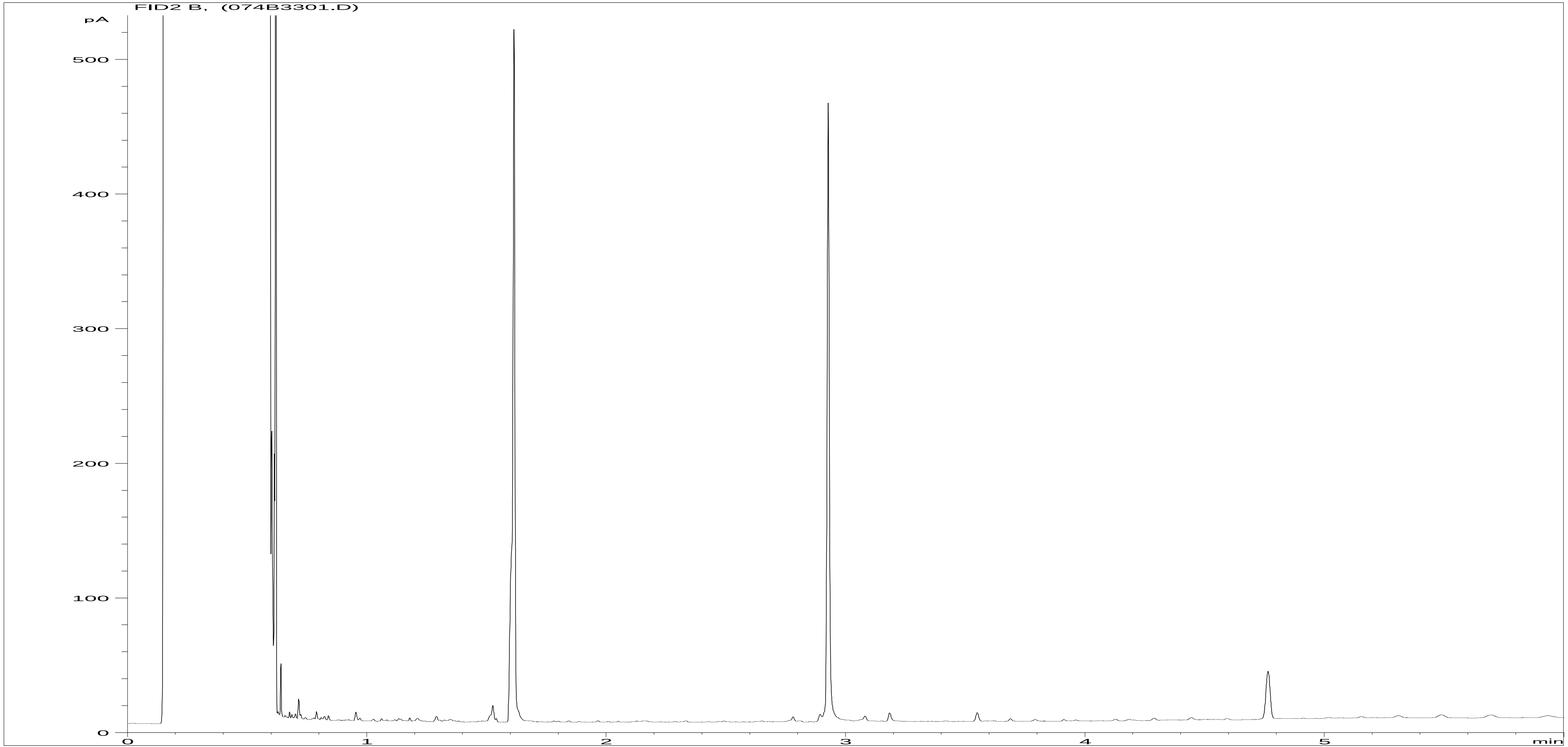
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1572260ALI	**Job Number:**	S15_8453
Multiplier:	17.12	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH408 ES 12 4.90
Acquisition Date/Time:	15-Dec-15, 08:44:20		
Datafile:	D:\TES\DATA\Y2015\121415TPH_GC4\121415 2015-12-14 10-37-09\024F3701.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1572260ARO	**Job Number:**	S15_8453
Multiplier:	10.72	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH408 ES 12 4.90
Acquisition Date/Time:	15-Dec-15, 07:51:52		
Datafile:	D:\TES\DATA\Y2015\121415TPH_GC4\121415 2015-12-14 10-37-09\074B3301.D		

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	211VOC.MS19\	Initial Calibration	**Matrix:**	Soil
Sample Details:	BH408 ES 12 4.90	**Date Booked in:**	10-Dec-15		**Method:**	Headspace
LIMS ID Number:	CL1572260	**Date Analysed:**	11-Dec-15		**Multiplier:**	1.08
Job Number:	S15_8453	**Operator:**	PR		**Position:**	20

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	6.11	23	86
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	100	Dibromofluoromethane	101
1,4-Difluorobenzene	4.35	97	Toluene-d8	98
Chlorobenzene-d5	5.46	85		
Bromofluorobenzene	5.86	69		
1,4-Dichlorobenzene-d4	6.26	56		
Naphthalene-d8	7.09	24		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

IOM

WORKING FOR A HEALTHIER FUTURE

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY:	ESG Environmental Chemistry PO Box 100 Burton upon Trent Staffordshire DE15 0XD	**CONTRACT NO:** **PROJECT NO:** **DATE OF ISSUE:**	46529-3 610 18.12.15

DATE SAMPLES RECEIVED: 11.12.15

DATE SAMPLES ANALYSED: 18.12.15

SAMPLE DESCRIPTION: One soil/loose aggregate sample weighing approximately 1.3kg

ANALYSIS REQUESTED: Qualitative and quantitative analysis of a soil/loose aggregate sample for mass determination of asbestos.

METHODS:

Qualitative - The sample was analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative - The analysis was carried out using our documented in-house method based on HSE Contract Research Report No. 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies *et al*, 1996) and HSG 248. Our method includes initial examination of the entire sample, detailed analysis of a representative sub-sample and quantification by hand picking/weighing and/or fibre counting/sizing as appropriate.

RESULTS:

Initial Screening

No asbestos was detected in the soil sample by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.

UKAS TESTING
0374

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8034 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

CONTRACT NO: 46529-3
PROJECT NO: 610
DATE OF ISSUE: 18.12.15

RESULTS: (cont.)

Table 1: Qualitative Results

ESG Job I.D: S158453

IOM sample number	Client sample number	ACM type detected	PLM result
S36956	S1572260 BH408 4.90	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are outwith the scope of our UKAS accreditation.

[redacted]

AUTHORISED BY: ……………………
J Simpson
Senior Scientific Technician

Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158453

Consignment No S52255
Date Logged 10-Dec-2015

Report Due 17-Dec-2015

ID Number	Description	MethodID / Sampled	CustServ: REPORT A	GROHSA: GRO (AA-UK) HSA-GCFID	ICPBOR: Boron (H20 Soluble)	ICPMSS: Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Manganese (MS)	Mercury (MS)	Molybdenum (MS)	Nickel (MS)	Selenium (MS)	Vanadium (MS)	Zinc (MS)	ICPSOIL: Beryllium.	KONECR: Chromium vi:	PAHMSUS: PAH (16) by GCMS	PHSOIL: pH units (AR)	SFAPI: Cyanide(Total) (AR)	Phenol Index.(AR)	Sub020: ^Asbestos ID & Quan	TPHUSSI: TPH by GCFID (Si-UKCWG)>44	VOCHSAS: BTEX-HSA GCMS analysis
				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
CL/1572260	BH408 4.90	09/12/15																									

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(white)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158453

Consignment No S52255
Date Logged 10-Dec-2015

Report Due 17-Dec-2015

ID Number	Description	Sampled	VOC HSA-GCMS	Ethyl Benzene (µg/kg)	Total Organic Carbon
		MethodID	VOCHSAS		WSLM59
			✓	✓	
CL/1572260	BH408 4.90	09/12/15			

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(blank)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	GROHSA	As Received	Determination of Total Gasoline Range Organics Hydrocarbons (GRO) by Headspace GCFID
Soil	ICPBOR	Oven Dried @ < 35°C	Determination of Boron in soil samples by hot water extraction followed by ICPOES detection
Soil	ICPMSS	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPMS
Soil	ICPSOIL	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPOES detection
Soil	KONECR	Oven Dried @ < 35°C	Determination of Chromium vi in soil samples by water extraction followed by colorimetric detection
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Soil	SubCon*	*	Contact Laboratory for details of the methodology used by the sub-contractor.
Soil	TPHUSSI	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection including quantitation of Aromatic and Aliphatic fractions.
Soil	VOCHSAS	As Received	Determination of Volatile Organic Compounds (VOC) by Headspace GCMS
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^oC

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile **TR** Denotes Tremolite
CR Denotes Crocidolite **AC** Denotes Actinolite
AM Denotes Amosite **AN** Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined **N.Det** Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : S15_8453

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1572260	BH408 ES 12 4.90	CLAY

TEST REPORT

1252

Report No. EFS/158466 (Ver. 2)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 1 sample described in this report were registered for analysis by ESG on 11-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 22-Dec-2015

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Pages 2 to 3)
Table of PAH (MS-SIM) (80) Results (Page 4)
Table of GRO Results (Page 5)
Table of TPH (Si) banding (UK-CWG) (Page 6)
GC-FID Chromatograms (Pages 7 to 8)
Table of VOC (HSA) Results (Page 9)
Subcontracted Analysis Reports (Pages 10 to 11)
The accreditation status of subcontracted analysis is displayed on the appended subcontracted analysis reports.
Analytical and Deviating Sample Overview (Pages 12 to 13)
Table of Method Descriptions (Page 14)
Table of Report Notes (Page 15)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns   Managing Director
Multi-Sector Services

Date of Issue: 22-Dec-2015

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected. ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units
		Method Codes :	GROHSA	ICPBOR	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPSOIL	PHSOIL
		Method Reporting Limits :	0.2	0.5	0.1	0.3	0.1	0.5	0.5	0.5	1	0.1	0.5	0.5	0.5	3	0.1	
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	Client Sample Description	Sample Date	GRO (AA-UK) HSA-GCFID	Boron (H20 Soluble)	Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Manganese (MS)	Mercury (MS)	Molybdenum (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	Beryllium.	pH units (AR)
1572325	BH406 ES 1 0.7	09-Dec-15	Req	1.4	13.7	22.3	0.39	26.8	102.3	394.7	784.8	<0.1	2.3	29.3	0.5	160.3	1.44	8.6

ESG

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

Tel +44 (0) 1283 554400

Fax +44 (0) 1283 554422

Client Name	**ESG Doncaster**	**Sample Analysis**	
Contact	Mr N Cooke		
A63 Castle Street		**Date Printed**	**22-Dec-2015**
		Report Number	**EFS/158466**
		Table Number	**1**

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/kg		mg/kg	µg/kg	mg/kg	mg/kg	% M/M	µg/kg	µg/kg	ug/kg	µg/kg	µg/kg	µg/kg	mg/kg	
		Method Codes :	SFAPI	SFAPI	Sub020	TPHUSSI	VOCHSAS	ICPMSS	KONECR	WSLM59	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	PAHMSUS	
		Method Reporting Limits :	0.5	0.5		10		0.6	0.1	0.04	5	1	2	6	4	2		
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**Cyanide(Total) (AR)**	**Phenol Index.(AR)**	**^Asbestos ID & Quan**	**TPH by GCFID (Si-UKCWG)>44**	**VOC HSA-GCMS**	**Vanadium (MS)**	**Chromium vi:**	**Total Organic Carbon**	**Toluene**	**Benzene**	**Ethyl Benzene**	**Xylenes**	**m/p Xylenes**	**o Xylene**	**PAH (16) by GCMS**	
1572325	BH406 ES 1 0.7	09-Dec-15	<0.5	<0.5	NADIS	Req	Req	47.5	<0.1	3.31	<5	<1	<2	<6	<4	<2	Req	

ESG	**Client Name**	**ESG Doncaster**	**Sample Analysis**
	Contact	Mr N Cooke	
Bretby Business Park, Ashby Road Burton-on-Trent, Staffordshire, DE15 0YZ Tel +44 (0) 1283 554400 Fax +44 (0) 1283 554422	**A63 Castle Street**		**Date Printed** 22-Dec-2015 **Report Number** EFS/158466 **Table Number** 1

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	BH406 ES 1 0.7	**Job Number:**	S15_8466
LIMS ID Number:	CL1572325	**Date Booked in:**	11-Dec-15
QC Batch Number:	151269	**Date Extracted:**	15-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	16-Dec-15
Directory:	1515PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	3.34	0.21	98
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	4.51	0.19	94
Fluorene	86-73-7	4.89	0.15	91
Phenanthrene	85-01-8	5.74	1.88	98
Anthracene	120-12-7	5.78	0.43	92
Fluoranthene	206-44-0	7.10	2.61	92
Pyrene	129-00-0	7.38	2.10	88
Benzo[a]anthracene	56-55-3	9.06	1.23	95
Chrysene	218-01-9	9.12	1.31	97
Benzo[b]fluoranthene	205-99-2	10.60	1.06	98
Benzo[k]fluoranthene	207-08-9	10.63	1.05	97
Benzo[a]pyrene	50-32-8	11.02	1.06	96
Indeno[1,2,3-cd]pyrene	193-39-5	12.41	0.58	90
Dibenzo[a,h]anthracene	53-70-3	12.43	0.10	58
Benzo[g,h,i]perylene	191-24-2	12.71	0.59	83
Total (USEPA16) PAHs	-	-	< 14.63	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	61
Acenaphthene-d10	61
Phenanthrene-d10	64
Chrysene-d12	75
Perylene-d12	80

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	115
Terphenyl-d14	92

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Gasoline Range Organics
(BTEX and Aromatic/Aliphatic Carbon Ranges)

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8466
Directory: C:\CHEM32\1\DATA\1215HSA_GC12\121515 2015-12-15 14-42-22\033F3301.D
Method: HEADSPACE GCFID

Matrix: Soil
Date Booked in: 11-Dec-15
Date extracted: 15-Dec-15
Date Analysed: 16-Dec-15, 01:11:
Units: mg/kg

*** Sample data with an asterisk are not UKAS accredited.**

		BTEX				Aromatics		Aliphatics		Total GRO
Sample ID	**Client ID**	**Benzene**	**Toluene**	**Ethyl benzene**	**Xylenes**	**C5 - C7**	**>C7 - C8**	**C5 - C6**	**>C6 - C8**	**C5 - C10**
CL1572325	BH406 ES 1 0.7	<0.010	<0.010	<0.010	<0.020	<0.01	<0.01	<0.2	<0.2	<0.2

Where individual results are flagged see report notes for status.

ALIPHATIC / AROMATIC FRACTION BY GC/FID

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8466
QC Batch Number: 151269
Directory: D:\TES\DATA\Y2015\121615TPH_GC4\121615 2015-12-16 13-09-52\064B1601.D
Method: Ultra Sonic

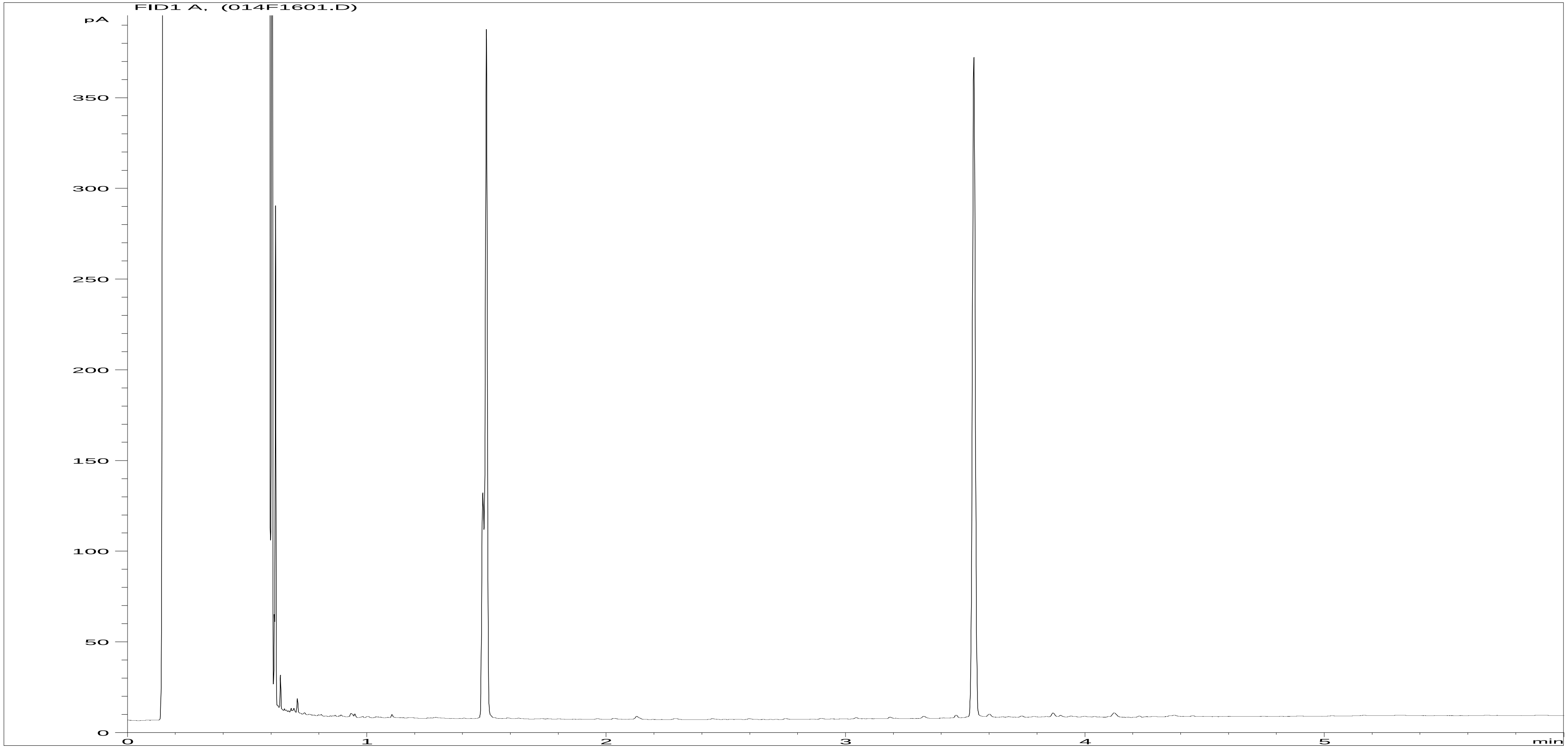
Separation: Silica gel
Eluents: Hexane, DCM

Matrix: Soil
Date Booked in: 11-Dec-15
Date Extracted: 15-Dec-15
Date Analysed: 16-Dec-15, 16:38:11

		Concentration, (mg/kg) - as wet weight												
Bands marked with a ' * ' are not UKAS Accredited		**>C8 - C10**	**>C8 - C10**	**>C10 - C12**	**>C10 - C12**	**>C12 - C16**	**>C12 - C16**	**>C16 - C35**	**>C16 - C21**	**>C35 - C44***	**>C21 - C35**	**>C35 - C44***	**>C8 - C44***	**>C8 - C44***
Sample ID	**Client ID**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aromatics**	**Aliphatics**	**Aromatics**
CL1572325	BH406 ES 1 0.7	<4.08	<4	<4.08	<4	<4.08	<4	14.2	11.2	<5.73	41.1	<5.62	<20.4	58.4

Where individual results are flagged see report notes for status.

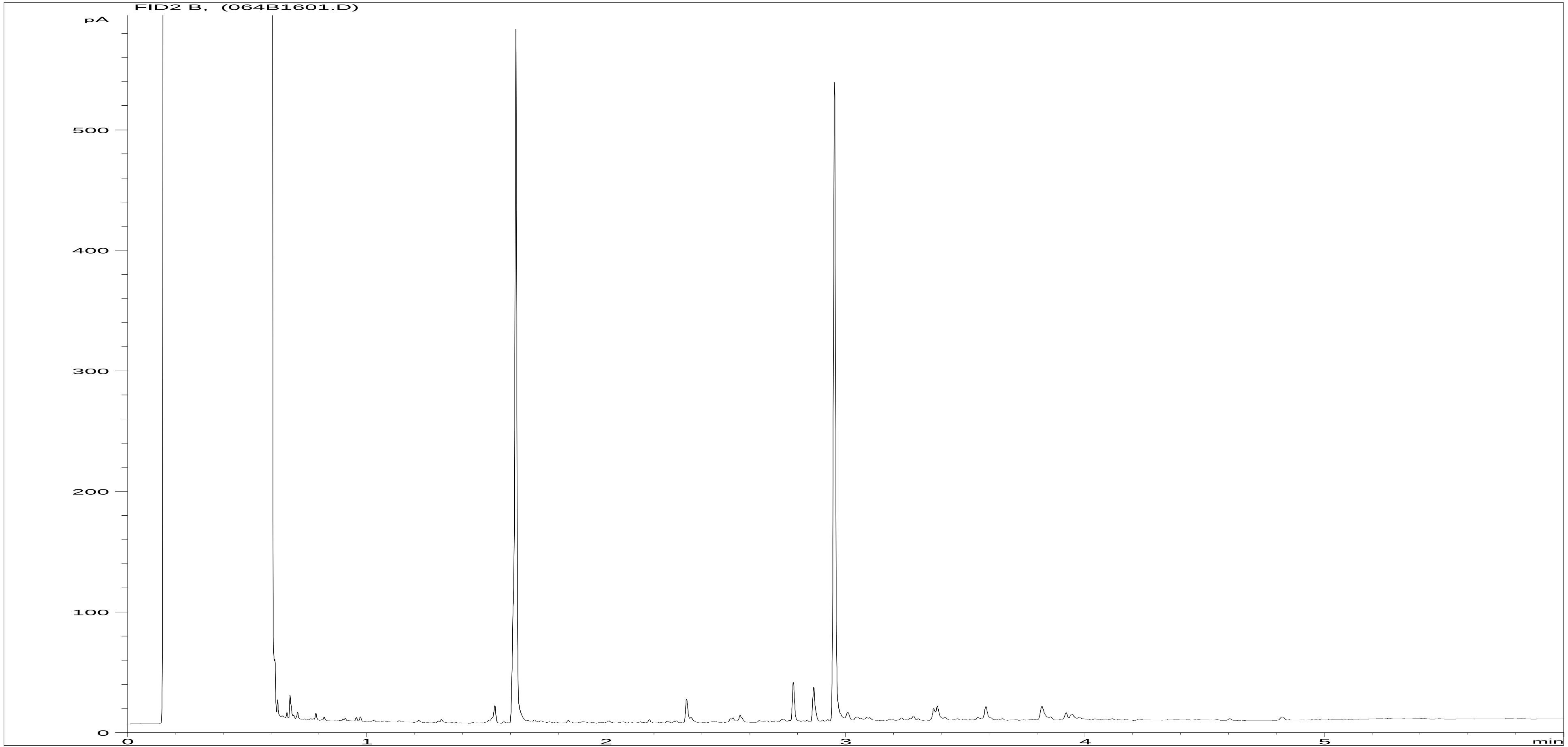
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1572325ALI	**Job Number:**	S15_8466
Multiplier:	16.32	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH406 ES 1 0.7
Acquisition Date/Time:	16-Dec-15, 16:38:11		
Datafile:	D:\TES\DATA\Y2015\121615TPH_GC4\121615 2015-12-16 13-09-52\014F1601.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1572325ARO	**Job Number:**	S15_8466
Multiplier:	11.68	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH406 ES 1 0.7
Acquisition Date/Time:	16-Dec-15, 16:38:11		
Datafile:	D:\TES\DATA\Y2015\121615TPH_GC4\121615 2015-12-16 13-09-52\064B1601.D		

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	215VOC.MS19\ Initial Calibration	**Matrix:**	Soil
Sample Details:	BH406 ES 1 0.7	**Date Booked in:**	11-Dec-15	**Method:**	Headspace
LIMS ID Number:	CL1572325	**Date Analysed:**	15-Dec-15	**Multiplier:**	1.03
Job Number:	S15_8466	**Operator:**	PR	**Position:**	12

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	7.11	46	71
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	75	Dibromofluoromethane	115
1,4-Difluorobenzene	4.35	72	Toluene-d8	95
Chlorobenzene-d5	5.46	58		
Bromofluorobenzene	5.86	44		
1,4-Dichlorobenzene-d4	6.26	32		
Naphthalene-d8	7.09	10		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

IOM

WORKING FOR A HEALTHIER FUTURE

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY:	ESG Environmental Chemistry PO Box 100 Burton upon Trent Staffordshire DE15 0XD	**CONTRACT NO:** **PROJECT NO:** **DATE OF ISSUE:**	46568 610 22.12.15

DATE SAMPLES RECEIVED: 15.12.15

DATE SAMPLES ANALYSED: 22.12.15

SAMPLE DESCRIPTION: One soil/loose aggregate sample weighing approximately 1.5kg

ANALYSIS REQUESTED: Qualitative and quantitative analysis of a soil/loose aggregate sample for mass determination of asbestos.

METHODS:

Qualitative - The sample was analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative - The analysis was carried out using our documented in-house method based on HSE Contract Research Report No. 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies *et al*, 1996) and HSG 248. Our method includes initial examination of the entire sample, detailed analysis of a representative sub-sample and quantification by hand picking/weighing and/or fibre counting/sizing as appropriate.

RESULTS:

Initial Screening

No asbestos was detected in the soil sample by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

CONTRACT NO: 46568
PROJECT NO: 610
DATE OF ISSUE: 22.12.15

RESULTS: (cont.)

Table 1: Qualitative Results

ESG Job I.D: S158466

IOM sample number	Client sample number	ACM type detected	PLM result
S36987	S1572325 BH406 0.7	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are outwith the scope of our UKAS accreditation.

[redacted]

AUTHORISED BY: ....
J Simpson
Senior Scientific Technician

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158466

Consignment No S52219
Date Logged 11-Dec-2015

Report Due 18-Dec-2015

		MethodID	CustServ	GROHSA	ICPBOR	ICPMSS												ICPSOIL	KONECR	PAHMSUS	PHSOIL	SFAPI		Sub020	TPHUSSI	VOCHSAS
ID Number	**Description**	**Sampled**	REPORT A	GRO (AA-UK) HSA-GCFID	Boron (H20 Soluble)	Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Manganese (MS)	Mercury (MS)	Molybdenum (MS)	Nickel (MS)	Selenium (MS)	Vanadium (MS)	Zinc (MS)	Beryllium.	Chromium vi:	PAH (16) by GCMS	pH units (AR)	Cyanide(Total) (AR)	Phenol Index.(AR)	^Asbestos ID & Quan	TPH by GCFID (Si-UKCWG)>44	BTEX-HSA GCMS analysis
				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
CL/1572325	BH406 0.7	09/12/15																									

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(white)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer **ESG Doncaster**
Site **A63 Castle Street**
Report No **S158466**

Consignment No S52219
Date Logged 11-Dec-2015

Report Due 18-Dec-2015

ID Number	Description	Sampled	VOC HSA-GCMS	Ethyl Benzene (µg/kg)	Total Organic Carbon
		MethodID	VOCHSAS		WSLM59
			✓	✓	
CL/1572325	BH406 0.7	09/12/15			

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(blank)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	GROHSA	As Received	Determination of Total Gasoline Range Organics Hydrocarbons (GRO) by Headspace GCFID
Soil	ICPBOR	Oven Dried @ < 35°C	Determination of Boron in soil samples by hot water extraction followed by ICPOES detection
Soil	ICPMSS	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPMS
Soil	ICPSOIL	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPOES detection
Soil	KONECR	Oven Dried @ < 35°C	Determination of Chromium vi in soil samples by water extraction followed by colorimetric detection
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Soil	SubCon*	*	Contact Laboratory for details of the methodology used by the sub-contractor.
Soil	TPHUSSI	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection including quantitation of Aromatic and Aliphatic fractions.
Soil	VOCHSAS	As Received	Determination of Volatile Organic Compounds (VOC) by Headspace GCMS
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : S15_8466

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1572325	BH406 ES 1 0.7	SILT

TEST REPORT

1252

Report No. EFS/158661 (Ver. 1)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

<u>Site: A63 Castle Street</u>

The 1 sample described in this report were registered for analysis by ESG on 17-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 30-Dec-2015

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Pages 2 to 3)
Table of PAH (MS-SIM) (80) Results (Page 4)
Table of GRO Results (Page 5)
Table of TPH (Si) banding (UK-CWG) (Page 6)
GC-FID Chromatograms (Pages 7 to 8)
Subcontracted Analysis Reports (Pages 9 to 11)
The accreditation status of subcontracted analysis is displayed on the appended subcontracted analysis reports.
Analytical and Deviating Sample Overview (Pages 12 to 13)
Table of Method Descriptions (Page 14)
Table of Report Notes (Page 15)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 30-Dec-2015

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units	mg/kg	
		Method Codes :	GROHSA	ICPBOR	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPSOIL	PHSOIL	SFAPI	Sub040
		Method Reporting Limits :	0.2	0.5	0.1	0.3	0.1	0.5	0.5	0.5	0.1	0.5	0.5	3	0.1		0.5	
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**GRO (AA-UK) HSA-GCFID**	**Boron (H20 Soluble)**	**Antimony (MS)**	**Arsenic (MS)**	**Cadmium (MS)**	**Chromium (MS)**	**Copper (MS)**	**Lead (MS)**	**Mercury (MS)**	**Nickel (MS)**	**Selenium (MS)**	**Zinc (MS)**	**Beryllium.**	**pH units (AR)**	**Cyanide(Total) (AR)**	**^Asbestos Screen DET**
1573122	BH417 ES 1 0.70	**16-Dec-15**	Req	26.8	23.8	13.9	7.28	21.5	65.7	659	0.98	18.4	<0.5	441	0.36	8.5	<0.5	NAIIS

ESG

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

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Client Name	**ESG Doncaster**	
Contact	Mr N Cooke	

Sample Analysis

A63 Castle Street

Date Printed	**30-Dec-2015**
Report Number	**EFS/158661**
Table Number	**1**

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/kg	mg/kg	% M/M	µg/kg	µg/kg	ug/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg				
		Method Codes :	TPHUSSI	ICPMSS	KONECR	WSLM59	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	PAHMSUS				
		Method Reporting Limits :	10	0.6	0.1	0.04	5	1	2	6	4	2						
		UKAS Accredited :	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
LAB ID Number CL/	Client Sample Description	Sample Date	TPH by GCFID (Si-UKCWG)>44	Vanadium (MS)	Chromium vi:	Total Organic Carbon	Toluene	Benzene	Ethyl Benzene	Xylenes	m/p Xylenes	o Xylene	BTEX-HSA GCMS analysis	PAH (16) by GCMS				
1573122	BH417 ES 1 0.70	16-Dec-15	Req	29.1	<0.1	2.28	<5	<1	<2	<6	<4	<2	Req	Req				

ESG

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Fax +44 (0) 1283 554422

Client Name	ESG Doncaster
Contact	Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	30-Dec-2015
Report Number	EFS/158661
Table Number	1

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	BH417 ES 1 0.70	**Job Number:**	S15_8661
LIMS ID Number:	CL1573122	**Date Booked in:**	17-Dec-15
QC Batch Number:	151292	**Date Extracted:**	21-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	22-Dec-15
Directory:	2115PAH.GC5\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	3.35	0.10	98
Acenaphthylene	208-96-8	4.40	0.09	96
Acenaphthene	83-32-9	4.52	0.16	98
Fluorene	86-73-7	4.91	0.11	96
Phenanthrene	85-01-8	5.77	1.23	99
Anthracene	120-12-7	5.83	0.34	98
Fluoranthene	206-44-0	7.14	2.08	94
Pyrene	129-00-0	7.43	1.80	94
Benzo[a]anthracene	56-55-3	9.14	1.05	94
Chrysene	218-01-9	9.19	1.05	99
Benzo[b]fluoranthene	205-99-2	10.68	1.32	98
Benzo[k]fluoranthene	207-08-9	10.71	0.50	98
Benzo[a]pyrene	50-32-8	11.11	1.01	97
Indeno[1,2,3-cd]pyrene	193-39-5	12.49	0.73	90
Dibenzo[a,h]anthracene	53-70-3	12.53	0.15	65
Benzo[g,h,i]perylene	191-24-2	12.81	0.69	83
Total (USEPA16) PAHs	-	-	12.41	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	92
Acenaphthene-d10	93
Phenanthrene-d10	89
Chrysene-d12	90
Perylene-d12	91

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	115
Terphenyl-d14	91

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Gasoline Range Organics
(BTEX and Aromatic/Aliphatic Carbon Ranges)

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8661
Directory: C:\CHEM32\1\DATA\1221HSA_GC12\122115 2015-12-21 09-42-07\017F1701.D
Method: HEADSPACE GCFID

Matrix: Soil
Date Booked in: 17-Dec-15
Date extracted: 21-Dec-15
Date Analysed: 21-Dec-15, 15:06:
Units: mg/kg

*** Sample data with an asterisk are not UKAS accredited.**

		BTEX				Aromatics		Aliphatics		Total GRO
Sample ID	**Client ID**	**Benzene**	**Toluene**	**Ethyl benzene**	**Xylenes**	**C5 - C7**	**>C7 - C8**	**C5 - C6**	**>C6 - C8**	**C5 - C10**
CL1573122	BH417 ES 1 0.70	<0.010	<0.010	<0.010	<0.020	<0.01	<0.01	<0.2	<0.2	<0.2

Where individual results are flagged see report notes for status.

ALIPHATIC / AROMATIC FRACTION BY GC/FID

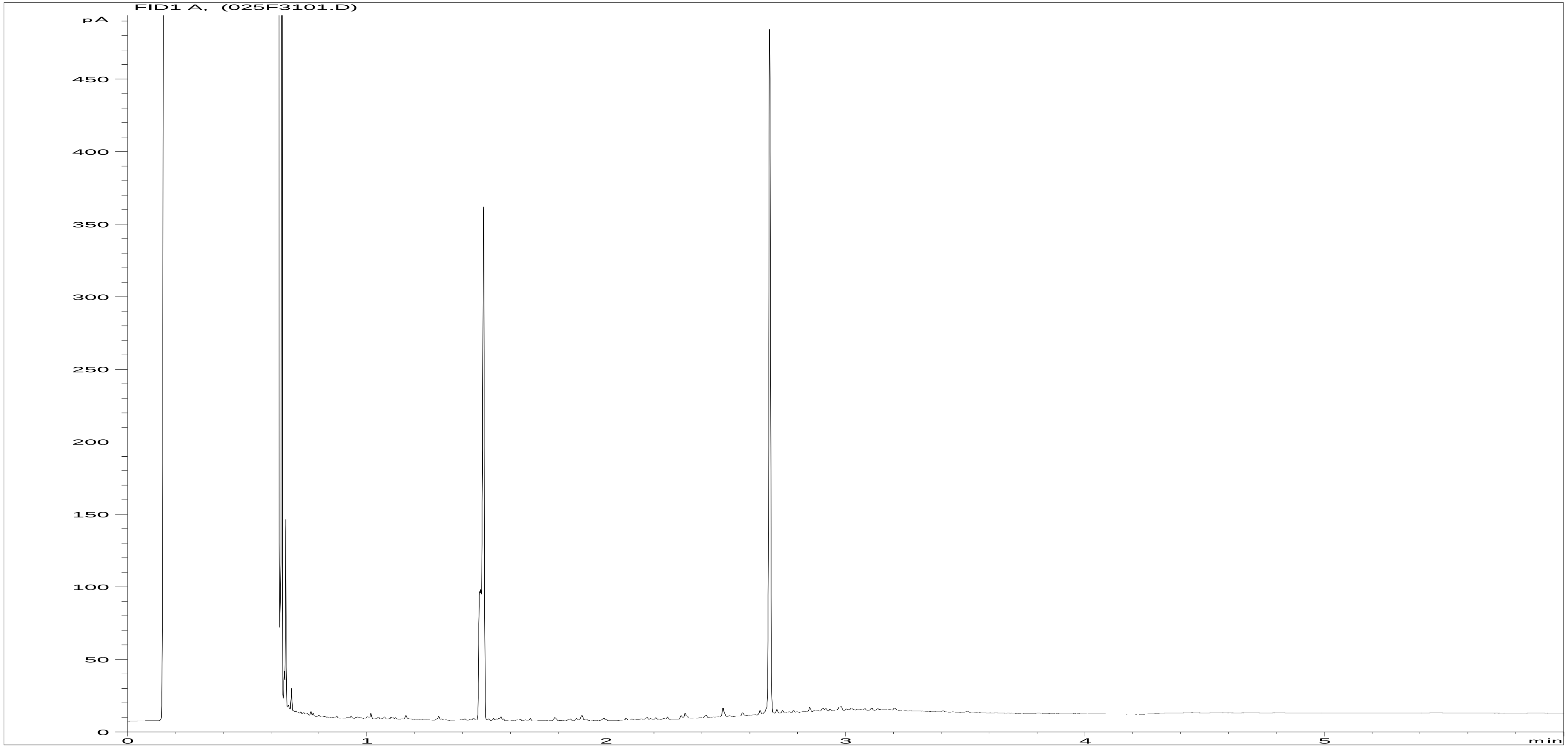
Customer and Site Details:	ESG Doncaster : A63 Castle Street		
Job Number:	S15_8661	**Separation:**	Silica gel
QC Batch Number:	151292	**Eluents:**	Hexane, DCM
Directory:	D:\TES\DATA\Y2013\02\122115TPH_GC3\122115 2015-12-21 18-23-19\075B3101.D		
Method:	Ultra Sonic		

Matrix:	Soil
Date Booked in:	17-Dec-15
Date Extracted:	21-Dec-15
Date Analysed:	22-Dec-15, 01:00:42

		Concentration, (mg/kg) - as wet weight												
Bands marked with a ' * ' are not UKAS Accredited		**>C8 - C10**	**>C8 - C10**	**>C10 - C12**	**>C10 - C12**	**>C12 - C16**	**>C12 - C16**	**>C16 - C35**	**>C16 - C21**	**>C35 - C44***	**>C21 - C35**	**>C35 - C44***	**>C8 - C44***	**>C8 - C44***
Sample ID	**Client ID**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aromatics**	**Aliphatics**	**Aromatics**
CL1573122	BH417 ES 1 0.70	<4.48	<4	<4.48	<4	<4.48	6.38	25.8	17.2	<6.29	71.2	14	29.6	113

Where individual results are flagged see report notes for status.

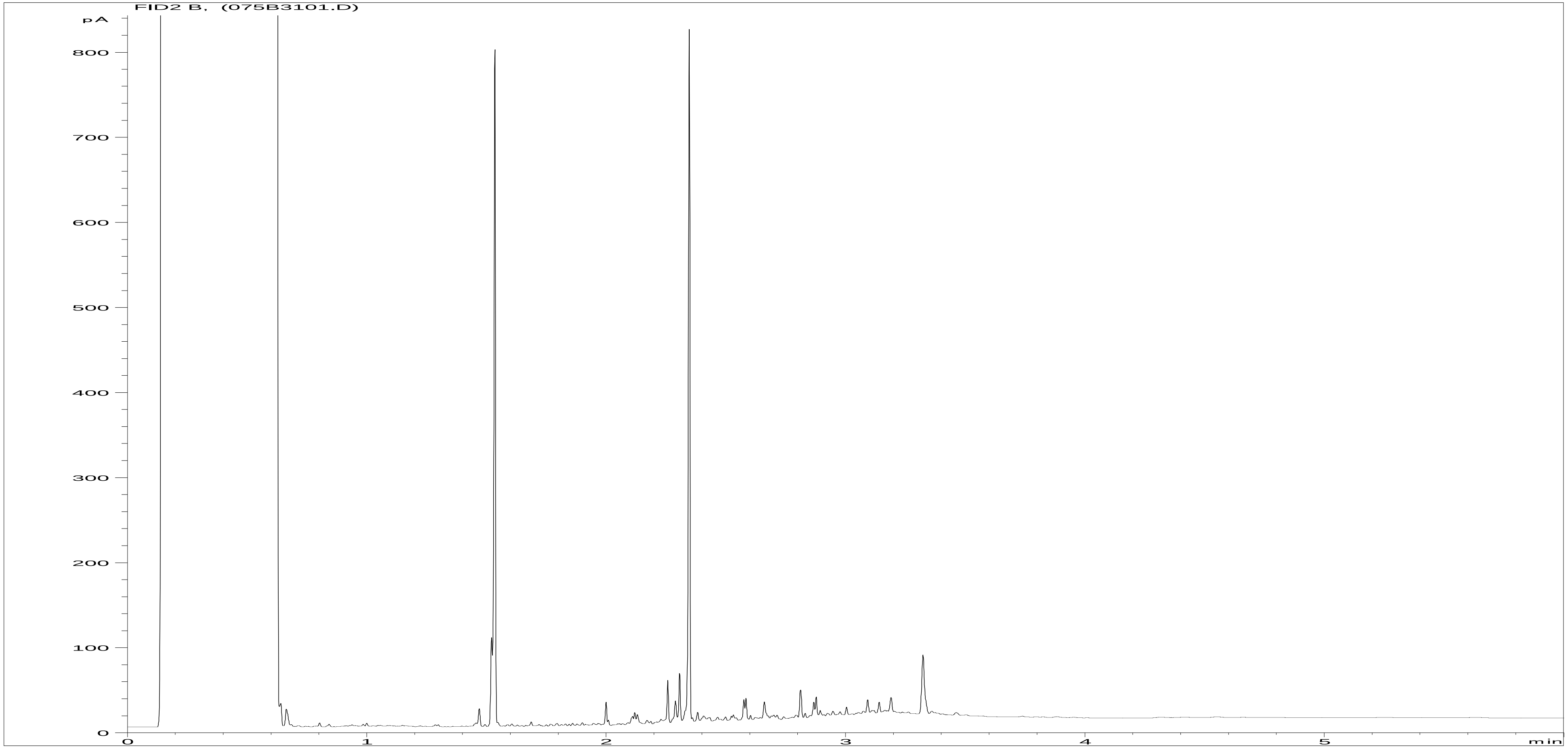
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573122ALI	**Job Number:**	S15_8661
Multiplier:	17.92	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH417 ES 1 0.70
Acquisition Date/Time:	22-Dec-15, 01:00:42		
Datafile:	D:\TES\DATA\Y2013\02\122115TPH_GC3\122115 2015-12-21 18-23-19\025F3101.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573122ARO	**Job Number:**	S15_8661
Multiplier:	11.04	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	BH417 ES 1 0.70
Acquisition Date/Time:	22-Dec-15, 01:00:42		
Datafile:	D:\TES\DATA\Y2013\02\122115TPH_GC3\122115 2015-12-21 18-23-19\075B3101.D		

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158661

Consignment No S52497
Date Logged 17-Dec-2015

Report Due 24-Dec-2015

ID Number	Description	Sampled	REPORT A	DO ID & Quant if ASB found	GRO (AA-UK) HSA-GCFID	Boron (H20 Soluble)	Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Mercury (MS)	Nickel (MS)	Selenium (MS)	Vanadium (MS)	Zinc (MS)	Beryllium.	Chromium vi:	PAH (16) by GCMS	pH units (AR)	Cyanide(Total) (AR)	^Asbestos ID and Quantification	^Asbestos Screen DET	TPH by GCFID (Si-UKCWG)>44	BTEX-HSA GCMS analysis	Ethyl Benzene (µg/kg)	Total Organic Carbon
		MethodID	CustServ	Dep.Opt	GROHSA	ICPBOR	ICPMSS											ICPSOIL	KONECR	PAHMSUS	PHSOIL	SFAPI	Sub002	Sub040	TPHUSSI	VOCHSAS		WSLM59
					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CL/1573122	BH417 0.70	16/12/15																										

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(white)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158661

Consignment No S52497
Date Logged 17-Dec-2015

Report Due 24-Dec-2015

ID Number	Description	Sampled	Total Organic Carbon (MethodID: WSLM59)
CL/1573122	BH417 0.70	16/12/15	

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	GROHSA	As Received	Determination of Total Gasoline Range Organics Hydrocarbons (GRO) by Headspace GCFID
Soil	ICPBOR	Oven Dried @ < 35°C	Determination of Boron in soil samples by hot water extraction followed by ICPOES detection
Soil	ICPMSS	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPMS
Soil	ICPSOIL	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPOES detection
Soil	KONECR	Oven Dried @ < 35°C	Determination of Chromium vi in soil samples by water extraction followed by colorimetric detection
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Soil	SubCon*	*	Contact Laboratory for details of the methodology used by the sub-contractor.
Soil	TPHUSSI	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection including quantitation of Aromatic and Aliphatic fractions.
Soil	VOCHSAS	As Received	Determination of Volatile Organic Compounds (VOC) by Headspace GCMS
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : S15_8661

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1573122	BH417 ES 1 0.70	MADE GROUND

TEST REPORT

1252

Report No. EFS/158711 (Ver. 1)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 4 samples described in this report were registered for analysis by ESG on 21-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 30-Dec-2015

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Table of PAH (MS-SIM) (80) Results (Pages 3 to 6)
Table of PCB Congener Results (Page 7)
GC-FID Chromatograms (Pages 8 to 11)
Table of WAC Analysis Results (Pages 12 to 15)
Analytical and Deviating Sample Overview (Page 16)
Table of Method Descriptions (Page 17)
Table of Report Notes (Page 18)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]

Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 30-Dec-2015

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

			pH units (AR)	Tot.Moisture @ 105C	TPH Band (>C10-C40)	TPH by GCFID (AR)	Acid Neut. Capacity	L.O.I. % @ 450C	PCB-7 Congeners Analysis	Total Organic Carbon	Benzene	Toluene	Ethyl Benzene	Xylenes	MTBE	m/p Xylenes	o Xylene	PAH (17) by GCMS
		Units :	pH Units	%	mg/kg	mg/kg	Mol/kg	%	µg/kg	% M/M	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg
		Method Codes :	PHSOIL	TMSS	TPHFIDUS	TPHFIDUS	ANC	LOI(%MM)	PCBUSECDAR	WSLM59	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	PAHMSUS
		Method Reporting Limits :		0.2	10	10	0.04	0.2		0.04	10	10	10	30	20	20	10	
		UKAS Accredited :	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
LAB ID Number CL/	**Client Sample Description**	**Sample Date**																
1573351	S4 D 0.30	17-Dec-15	8.3	23.1	97	97	2.56	7.2	Req	2.75	<10	<10	<10	<30	<20	<20	<10	Req
1573352	S4 D 0.50	17-Dec-15	8.4	22.1	104	104	2.24	7.1	Req	2.40	<10	<10	<10	<30	<20	<20	<10	Req
1573353	S7 D 0.30	17-Dec-15	8.2	27.1	165	166	1.92	9.6	Req	3.85	<10	<10	<10	<30	<20	<20	<10	Req
1573354	S7 D 0.50	17-Dec-15	8.3	24.7	116	117	2.08	7.3	Req	2.41	<10	<10	<10	<30	<20	<20	<10	Req

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

Tel +44 (0) 1283 554400

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Client Name	**ESG Doncaster**
Contact	Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	**30-Dec-2015**
Report Number	**EFS/158711**
Table Number	**1**

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	S4 D 0.30	**Job Number:**	S15_8711
LIMS ID Number:	CL1573351	**Date Booked in:**	21-Dec-15
QC Batch Number:	151307	**Date Extracted:**	23-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	24-Dec-15
Directory:	2415PAH.GC5\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	5.76	0.24	99
Anthracene	120-12-7	5.82	0.08	100
Fluoranthene	206-44-0	7.13	0.57	97
Pyrene	129-00-0	7.42	0.53	95
Benzo[a]anthracene	56-55-3	9.12	0.29	93
Chrysene	218-01-9	9.18	0.32	98
Benzo[b]fluoranthene	205-99-2	10.67	0.46	97
Benzo[k]fluoranthene	207-08-9	10.70	0.16	97
Benzo[a]pyrene	50-32-8	11.10	0.31	97
Indeno[1,2,3-cd]pyrene	193-39-5	12.48	0.26	98
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	12.80	0.24	93
Coronene	191-07-1 *	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 3.86	-

* Denotes compound is not UKAS accredited

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	86
Acenaphthene-d10	87
Phenanthrene-d10	85
Chrysene-d12	90
Perylene-d12	92

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	117
Terphenyl-d14	91

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	S4 D 0.50	**Job Number:**	S15_8711
LIMS ID Number:	CL1573352	**Date Booked in:**	21-Dec-15
QC Batch Number:	151307	**Date Extracted:**	23-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	24-Dec-15
Directory:	2415PAH.GC5\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	5.76	0.23	98
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	7.13	0.47	97
Pyrene	129-00-0	7.42	0.42	94
Benzo[a]anthracene	56-55-3	9.12	0.26	93
Chrysene	218-01-9	9.18	0.28	98
Benzo[b]fluoranthene	205-99-2	10.67	0.40	94
Benzo[k]fluoranthene	207-08-9	10.70	0.14	94
Benzo[a]pyrene	50-32-8	11.10	0.26	96
Indeno[1,2,3-cd]pyrene	193-39-5	12.49	0.21	93
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	12.80	0.20	89
Coronene	191-07-1 *	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 3.35	-

* Denotes compound is not UKAS accredited
"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	82
Acenaphthene-d10	83
Phenanthrene-d10	81
Chrysene-d12	86
Perylene-d12	87

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	119
Terphenyl-d14	92

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	S7 D 0.30	**Job Number:**	S15_8711
LIMS ID Number:	CL1573353	**Date Booked in:**	21-Dec-15
QC Batch Number:	151307	**Date Extracted:**	23-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	24-Dec-15
Directory:	2415PAH.GC5\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	3.34	0.11	97
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	5.76	0.73	99
Anthracene	120-12-7	5.82	0.21	99
Fluoranthene	206-44-0	7.13	1.36	97
Pyrene	129-00-0	7.42	1.16	94
Benzo[a]anthracene	56-55-3	9.12	0.64	94
Chrysene	218-01-9	9.18	0.68	99
Benzo[b]fluoranthene	205-99-2	10.67	0.88	78
Benzo[k]fluoranthene	207-08-9	10.70	0.31	94
Benzo[a]pyrene	50-32-8	11.10	0.61	97
Indeno[1,2,3-cd]pyrene	193-39-5	12.49	0.47	99
Dibenzo[a,h]anthracene	53-70-3	12.52	0.10	81
Benzo[g,h,i]perylene	191-24-2	12.80	0.44	93
Coronene	191-07-1 *	15.08	0.13	53
Total (USEPA16) PAHs	-	-	< 7.94	-

* Denotes compound is not UKAS accredited

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	83
Acenaphthene-d10	85
Phenanthrene-d10	83
Chrysene-d12	88
Perylene-d12	89

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	122
Terphenyl-d14	94

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	S7 D 0.50	**Job Number:**	S15_8711
LIMS ID Number:	CL1573354	**Date Booked in:**	21-Dec-15
QC Batch Number:	151307	**Date Extracted:**	23-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	24-Dec-15
Directory:	2415PAH.GC5\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	3.34	0.10	96
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	5.76	0.34	99
Anthracene	120-12-7	5.82	0.10	99
Fluoranthene	206-44-0	7.13	0.64	97
Pyrene	129-00-0	7.42	0.54	95
Benzo[a]anthracene	56-55-3	9.12	0.30	92
Chrysene	218-01-9	9.18	0.36	96
Benzo[b]fluoranthene	205-99-2	10.67	0.52	80
Benzo[k]fluoranthene	207-08-9	10.70	0.19	98
Benzo[a]pyrene	50-32-8	11.10	0.32	97
Indeno[1,2,3-cd]pyrene	193-39-5	12.48	0.27	92
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	12.80	0.25	85
Coronene	191-07-1 *	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 4.25	-

* Denotes compound is not UKAS accredited

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	82
Acenaphthene-d10	84
Phenanthrene-d10	81
Chrysene-d12	84
Perylene-d12	83

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	120
Terphenyl-d14	92

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polychlorinated Biphenyls (congeners)

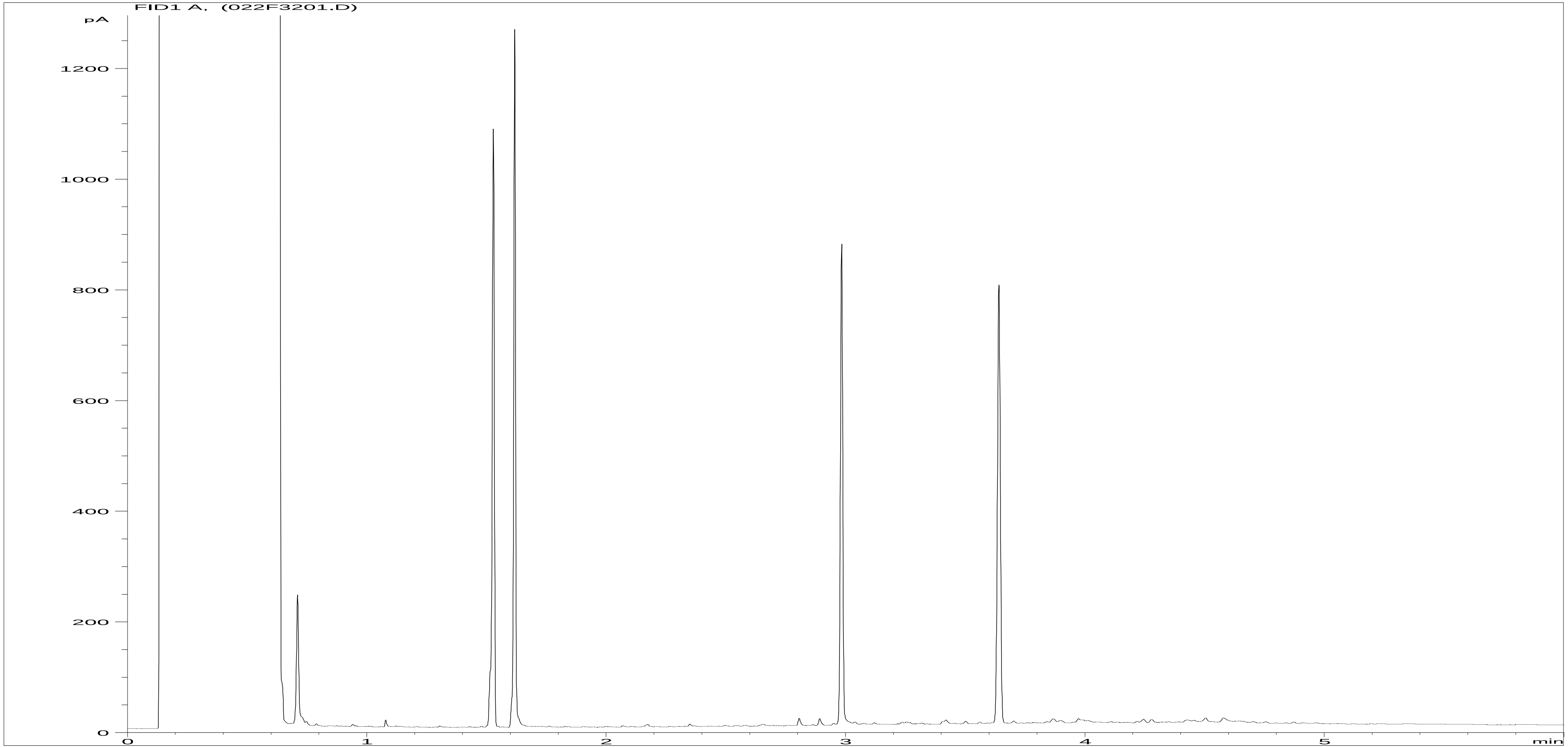
Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Matrix:**	SOIL
Job Number:	S15_8711	**Date Booked in:**	21-Dec-15
QC Batch Number:	151307	**Date Extracted:**	23-Dec-15
Directory:	1224PCB.GC8	**Date Analysed:**	24-Dec-15
Method:	Ultrasonic		

*** This sample data is not UKAS accredited.**

		Concentration, (µg/kg)						
Sample ID	**Customer ID**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB153**	**PCB138**	**PCB180**
* CL1573351	S4 D 0.30	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
CL1573352	S4 D 0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
CL1573353	S7 D 0.30	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
CL1573354	S7 D 0.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Where individual results are flagged see report notes for status.

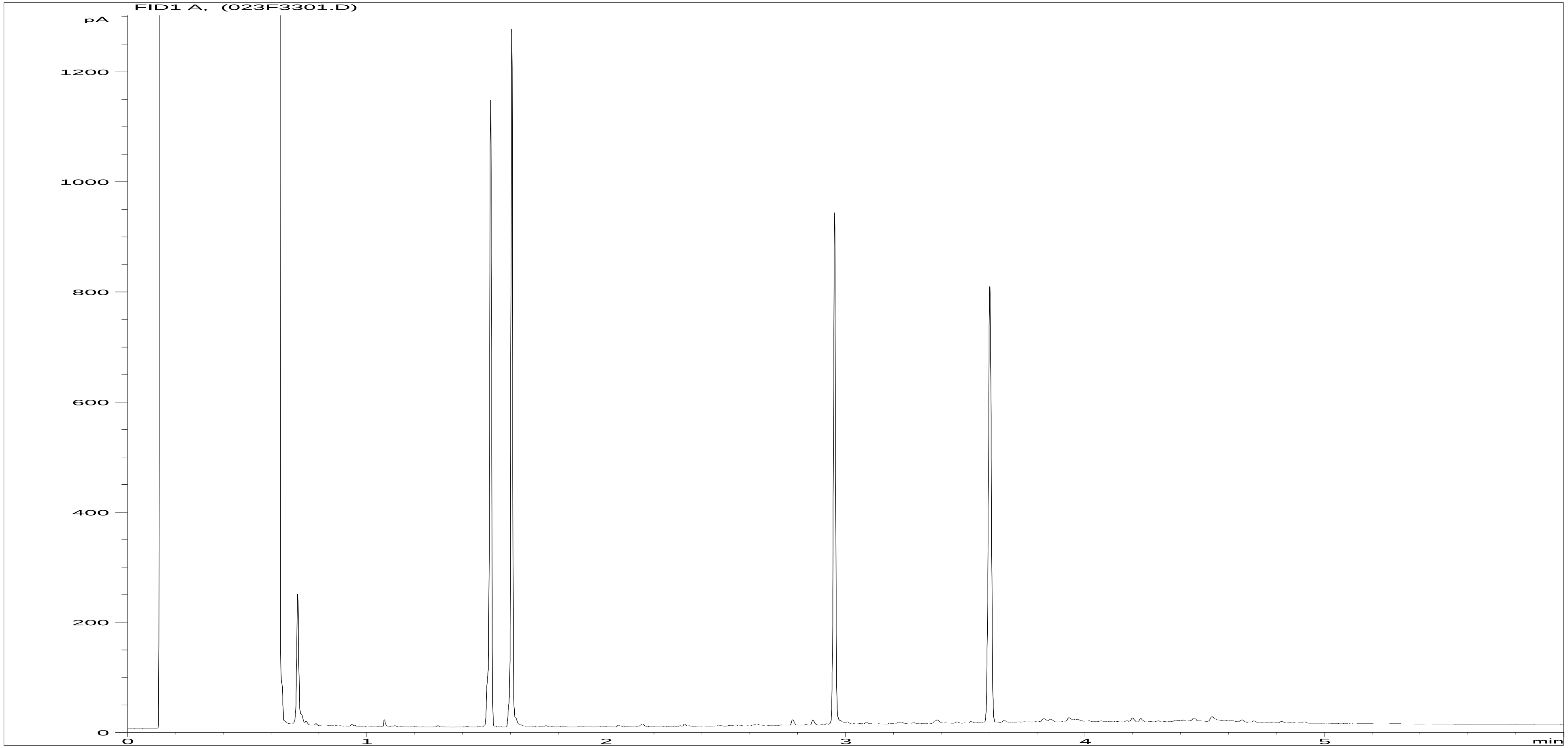
Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1573351	**Job Number:**	S15_8711
Multiplier:	8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	S4 D 0.30
Acquisition Date/Time:	23-Dec-15, 17:29:29		
Datafile:	D:\TES\DATA\Y2015\122315TPH_GC4\122315 2015-12-23 08-27-14\022F3201.D		

Where individual results are flagged see report notes for status.

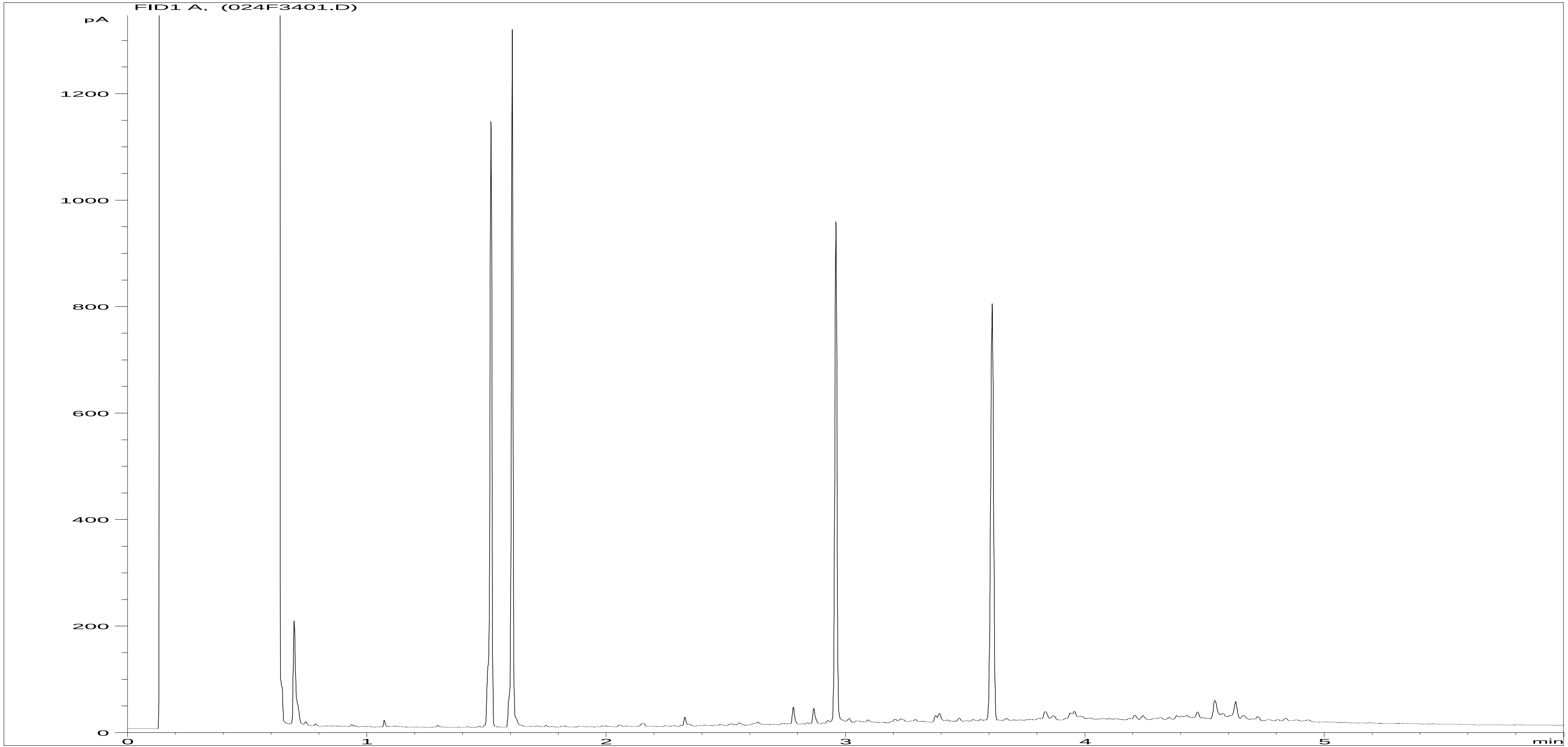
Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1573352	**Job Number:**	S15_8711
Multiplier:	8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	S4 D 0.50
Acquisition Date/Time:	23-Dec-15, 17:42:48		
Datafile:	D:\TES\DATA\Y2015\122315TPH_GC4\122315 2015-12-23 08-27-14\023F3301.D		

Where individual results are flagged see report notes for status.

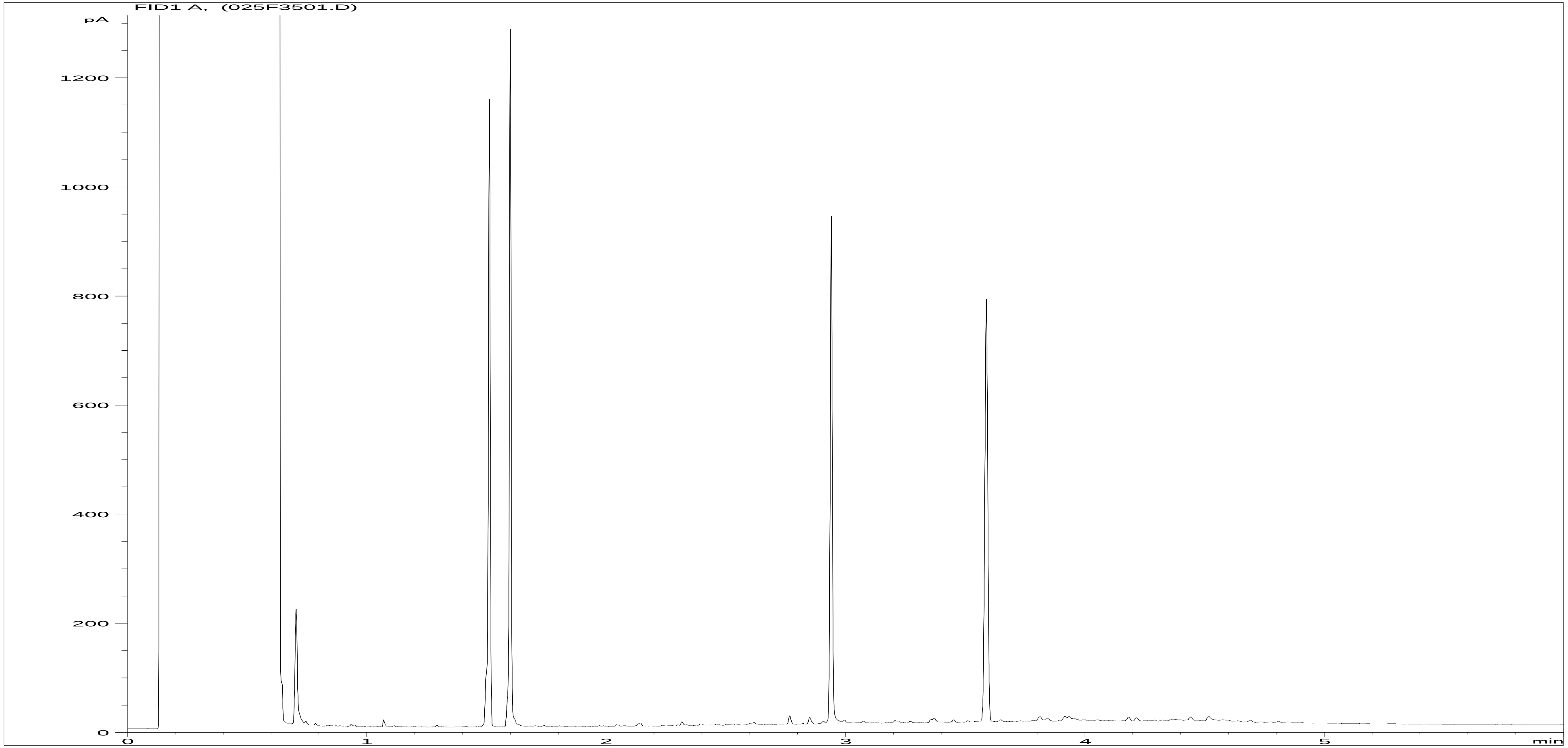
Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1573353	**Job Number:**	S15_8711
Multiplier:	8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	S7 D 0.30
Acquisition Date/Time:	23-Dec-15, 17:56:25		
Datafile:	D:\TES\DATA\Y2015\122315TPH_GC4\122315 2015-12-23 08-27-14\024F3401.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1573354	**Job Number:**	S15_8711
Multiplier:	8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	S7 D 0.50
Acquisition Date/Time:	23-Dec-15, 18:09:48		
Datafile:	D:\TES\DATA\Y2015\122315TPH_GC4\122315 2015-12-23 08-27-14\025F3501.D		

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING

					Leaching Data	
Client	ESG Doncaster				Weight of sample (kg)	0.296
					Moisture content @ 105°C (% of Wet Weight)	23.1
Contact	Mr N Cooke				Equivalent Weight based on drying at 105°C (kg)	0.225
					Volume of water required to carry out 2:1 stage (litres)	0.379
Site	A63 Castle Street				Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
S4 D 0.30		s15_8711	CL/1573351	30-Dec-15	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	2.87	3	5	6
N	LOI450	Loss on Ignition (%)	7.5			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.07	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	126	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<5.12	100		
U	PHSOIL	pH (pH units)	8.3		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	2.67		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.7	8.1	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	286	148					
U	ICPMSW	Arsenic	0.011	0.011	0.022	0.11	0.5	2	25
U	ICPWATVAR	Barium	0.14	0.17	0.28	1.7	20	100	300
U	ICPMSW	Cadmium	0.0004	0.0004	0.0008	0.004	0.04	1	5
U	ICPMSW	Chromium	0.017	0.015	0.034	0.15	0.5	10	70
U	ICPMSW	Copper	0.058	0.049	0.116	0.5	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.007	0.005	0.014	0.05	0.5	10	30
U	ICPMSW	Nickel	0.007	0.006	0.014	0.06	0.4	10	40
U	ICPMSW	Lead	0.124	0.138	0.248	1.36	0.5	10	50
U	ICPMSW	Antimony	0.003	0.002	0.006	0.02	0.06	0.7	5
U	ICPMSW	Selenium	0.001	<0.001	0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	0.123	0.15	0.246	1.46	4	50	200
U	KONENS	Chloride	20	22	40	217	800	15000	25000
U	ISEF	Fluoride	1.2	1.3	2.4	13	10	150	500
U	ICPWATVAR	Sulphate as SO4	8	4	16	45	1000	20000	50000
N	WSLM27	Total Dissolved Solids	223	116	446	1303	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	32	17	64	190	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

WASTE ACCEPTANCE CRITERIA TESTING

					Leaching Data	
Client	ESG Doncaster				Weight of sample (kg)	0.292
					Moisture content @ 105°C (% of Wet Weight)	22.1
Contact	Mr N Cooke				Equivalent Weight based on drying at 105°C (kg)	0.225
					Volume of water required to carry out 2:1 stage (litres)	0.383
Site	A63 Castle Street				Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
S4 D 0.50		s15_8711	CL/1573352	30-Dec-15	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	2.49	3	5	6
N	LOI450	Loss on Ignition (%)	7.4			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.07	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	134	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<4.40	100		
U	PHSOIL	pH (pH units)	8.4		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	2.32		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except °°		mg/kg (dry weight)				
U	WSLM3	pH (pH units) °°	7.7	8.2	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) °°	253	135					
U	ICPMSW	Arsenic	0.012	0.013	0.024	0.13	0.5	2	25
U	ICPWATVAR	Barium	0.14	0.29	0.28	2.7	20	100	300
U	ICPMSW	Cadmium	0.0005	0.0005	0.001	0.005	0.04	1	5
U	ICPMSW	Chromium	0.014	0.021	0.028	0.2	0.5	10	70
U	ICPMSW	Copper	0.047	0.054	0.094	0.53	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.013	0.006	0.026	0.07	0.5	10	30
U	ICPMSW	Nickel	0.008	0.009	0.016	0.09	0.4	10	40
U	ICPMSW	Lead	0.149	0.218	0.298	2.09	0.5	10	50
U	ICPMSW	Antimony	0.003	0.002	0.006	0.02	0.06	0.7	5
U	ICPMSW	Selenium	0.002	0.002	0.004	0.02	0.1	0.5	7
U	ICPMSW	Zinc	0.121	0.175	0.242	1.68	4	50	200
U	KONENS	Chloride	28	26	56	263	800	15000	25000
U	ISEF	Fluoride	1.8	1.3	3.6	14	10	150	500
U	ICPWATVAR	Sulphate as SO4	13	5	26	61	1000	20000	50000
N	WSLM27	Total Dissolved Solids	197	105	394	1173	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	24	23	48	231	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING

					Leaching Data	
Client	ESG Doncaster				Weight of sample (kg)	0.300
					Moisture content @ 105°C (% of Wet Weight)	27.1
Contact	Mr N Cooke				Equivalent Weight based on drying at 105°C (kg)	0.225
					Volume of water required to carry out 2:1 stage (litres)	0.375
Site	A63 Castle Street				Fraction of sample above 4 mm %	3.400
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
S7 D 0.30		s15_8711	CL/1573353	30-Dec-15	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

				Landfill Waste Acceptance Criteria Limit Values		
Accreditation	**Method Code**	**Solid Waste Analysis (Dry Basis)**	**Concentration in Solid (Dry Weight Basis)**	**Inert Waste Landfill**	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
N	WSLM59	Total Organic Carbon (% M/M)	4.1	3	5	6
N	LOI450	Loss on Ignition (%)	10.2			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.07	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	226	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<11.07	100		
U	PHSOIL	pH (pH units)	8.2		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	2.05		To be evaluated	To be evaluated

Accreditation	**Method Code**	**Leachate Analysis**	**2:1 Leachate**	**8:1 Leachate**	**Calculated amount leached @ 2:1**	**Calculated cumulative amount leached @ 10:1**	**Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)**		
			mg/l except ºº		**mg/kg (dry weight)**				
U	WSLM3	pH (pH units) ºº	7.9	8	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	271	146					
U	ICPMSW	Arsenic	0.008	0.011	0.016	0.11	0.5	2	25
U	ICPWATVAR	Barium	0.14	0.21	0.28	2	20	100	300
U	ICPMSW	Cadmium	0.0005	0.0004	0.001	0.004	0.04	1	5
U	ICPMSW	Chromium	0.008	0.019	0.016	0.18	0.5	10	70
U	ICPMSW	Copper	0.05	0.052	0.1	0.52	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.002	0.001	0.004	0.01	0.5	10	30
U	ICPMSW	Nickel	0.005	0.006	0.01	0.06	0.4	10	40
U	ICPMSW	Lead	0.097	0.189	0.194	1.77	0.5	10	50
U	ICPMSW	Antimony	0.003	0.002	0.006	0.02	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	0.12	0.149	0.24	1.45	4	50	200
U	KONENS	Chloride	18	22	36	215	800	15000	25000
U	ISEF	Fluoride	1.3	1	2.6	10	10	150	500
U	ICPWATVAR	Sulphate as SO4	7	3	14	35	1000	20000	50000
N	WSLM27	Total Dissolved Solids	211	114	422	1269	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	23	18	46	187	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING

					Leaching Data	
Client	ESG Doncaster				Weight of sample (kg)	0.292
					Moisture content @ 105°C (% of Wet Weight)	24.7
Contact	Mr N Cooke				Equivalent Weight based on drying at 105°C (kg)	0.225
					Volume of water required to carry out 2:1 stage (litres)	0.383
Site	A63 Castle Street				Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
S7 D 0.50		s15_8711	CL/1573354	30-Dec-15	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	2.52	3	5	6
N	LOI450	Loss on Ignition (%)	7.6			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.07	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	154	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<5.75	100		
U	PHSOIL	pH (pH units)	8.3		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	2.17		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.7	8.2	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	242	132					
U	ICPMSW	Arsenic	0.011	0.014	0.022	0.14	0.5	2	25
U	ICPWATVAR	Barium	0.17	0.22	0.34	2.1	20	100	300
U	ICPMSW	Cadmium	0.0003	0.0003	0.0006	0.003	0.04	1	5
U	ICPMSW	Chromium	0.023	0.04	0.046	0.38	0.5	10	70
U	ICPMSW	Copper	0.064	0.059	0.128	0.6	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.003	0.002	0.006	0.02	0.5	10	30
U	ICPMSW	Nickel	0.007	0.008	0.014	0.08	0.4	10	40
U	ICPMSW	Lead	0.191	0.16	0.382	1.64	0.5	10	50
U	ICPMSW	Antimony	0.002	0.001	0.004	0.01	0.06	0.7	5
U	ICPMSW	Selenium	0.002	0.001	0.004	0.01	0.1	0.5	7
U	ICPMSW	Zinc	0.142	0.17	0.284	1.66	4	50	200
U	KONENS	Chloride	25	21	50	215	800	15000	25000
U	ISEF	Fluoride	1.6	1.2	3.2	13	10	150	500
U	ICPWATVAR	Sulphate as SO4	11	4	22	49	1000	20000	50000
N	WSLM27	Total Dissolved Solids	189	103	378	1145	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	26	18	52	191	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer **ESG Doncaster**
Site **A63 Castle Street**
Report No **S158711**

Consignment No S52593
Date Logged 21-Dec-2015

Report Due 30-Dec-2015

		MethodID	**ANC**	**BTEXHSA**		**CEN Leachate**		**CustServ**	**LOI(%MM)**	**PAHMSUS**	**PCBUSECDAR**	**PHSOIL**	**TMSS**	**TPHFIDUS**		**WSLM59**
ID Number	**Description**	**Sampled**	**Acid Neut. Capacity**	**BTEX-HSA + MTBE analysis**	**MTBE (µg/kg)**	**CEN Leac(P)1**	**CEN Leac(P)2**	**REPORT A**	**L.O.I. % @ 450C**	**PAH (17) by GCMS**	**PCB-7 Congeners Analysis**	**pH units (AR)**	**Tot.Moisture @ 105C**	**TPH Band (>C10-C40)**	**TPH by GCFID (AR)**	**Total Organic Carbon**
				✓						✓		✓	✓	✓	✓	
CL/1573351	S4 0.30	17/12/15														
CL/1573352	S4 0.50	17/12/15														
CL/1573353	S7 0.30	17/12/15														
CL/1573354	S7 0.50	17/12/15														

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
(green)	Analysis Required
(yellow)	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
(white)	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ANC	Oven Dried @ < 35°C	Quantitative digestion with Hydrochloric Acid back titration with 1M Sodium Hydroxide to pH 7
Soil	BTEXHSA	As Received	Determination of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) by Headspace GCFID
Soil	LOI(%MM)	Oven Dried @ < 35°C	Determination of loss on ignition for soil samples at specified temperature by gravimetry
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PCBUSECDAR	As Received	Determination of Polychlorinated Biphenyl (PCB) congeners/aroclors by hexane/acetone extraction followed by GCECD detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	TMSS	As Received	Determination of the Total Moisture content at 105ºC by loss on oven drying gravimetric analysis (% based upon wet weight)
Soil	TPHFIDUS	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection.
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection
Water	ICPMSW	As Received	Direct quantitative determination of Metals in water samples using ICPMS
Water	ICPWATVAR	As Received	Direct determination of Metals and Sulphate in water samples using ICPOES
Water	ISEF	As Received	Determination of Fluoride in water samples by Ion Selective Electrode (ISE)
Water	KONENS	As Received	Direct analysis using discrete colorimetric analysis
Water	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Water	WSLM13	As Received	Instrumental analysis using acid/persulphate digestion and non-dispersive IR detection
Water	WSLM2	As Received	Determination of the Electrical Conductivity (µS/cm) by electrical conductivity probe.
Water	WSLM27	As Received	Gravimetric Determination
Water	WSLM3	As Received	Determination of the pH of water samples by pH probe

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table. All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile | **TR** Denotes Tremolite
CR Denotes Crocidolite | **AC** Denotes Actinolite
AM Denotes Amosite | **AN** Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols. This may have resulted in deterioration of the sample(s) during transit to the laboratory. Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined | **N.Det** Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : S15_8711

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1573351	S4 D 0.30	Brown MADE GROUND
CL/1573352	S4 D 0.50	Brown Stone SILT
CL/1573353	S7 D 0.30	Brown Stone SILT
CL/1573354	S7 D 0.50	Brown Clay SILT

TEST REPORT

UKAS TESTING
1252

Report No. EFS/158776 (Ver. 2)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 7 samples described in this report were registered for analysis by ESG on 22-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 18-Jan-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Pages 2 to 4)
Table of PAH (MS-SIM) (80) Results (Pages 5 to 11)
Table of PCB Congener (12) Results (Page 12)
Table of SVOC Results (Pages 13 to 19)
Table of GRO Results (Page 20)
Table of TPH (Si) banding (std) (Page 21)
GC-FID Chromatograms (Pages 22 to 35)
Table of VOC (HSA) Results (Pages 36 to 42)
Subcontracted Analysis Reports (Pages 43 to 44)
The accreditation status of subcontracted analysis is displayed on the appended subcontracted analysis reports.
Table of Asbestos Screening Results (Page 45)
Analytical and Deviating Sample Overview (Pages 46 to 47)
Table of Additional Report Notes (Page 48)
Table of Method Descriptions (Page 49)
Table of Report Notes (Page 50)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 18-Jan-2016

Tests marked '^' have been subcontracted to another laboratory.
Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units
		Method Codes :	GROHSA	ICPBOR	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPSOIL	PHSOIL
		Method Reporting Limits :	0.2	0.5	0.1	0.3	0.1	0.5	0.5	0.5	1	0.1	0.5	0.5	0.5	3	0.1	
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	Client Sample Description	Sample Date	GRO (AA) by HSA GC-FID	Boron (H20 Soluble)	Antimony (MS)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Manganese (MS)	Mercury (MS)	Molybdenum (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	Beryllium.	pH units (AR)
1573558	WS401 ES 1 0.30	18-Dec-15	Req §	2.2 §	0.9 §	9 §	0.3 §	20.1 §	18.1 §	69.5 §	210.1 §	<0.1 §	1.9 §	20 §	<0.5 §	63.5 §	0.33 §	11.2 §
1573559	WS401 ES 3 1.60	18-Dec-15	Req	2.4	1.8	16.8	0.26	18.4	54.1	329.5	470.9	0.25	1.4	17.7	0.6	73.2	0.647	9.2
1573560	WS402 ES 1 0.10	18-Dec-15	Req	1.2	0.8	10.5	1.2	16.2	24.4	103.7	412.2	0.16	1.5	15.3	<0.5	74.9	0.36	11.7
1573561	WS402 ES 2 1.20	18-Dec-15	Req	3	0.5	13.5	0.18	32.2	15.5	23.7	570.5	<0.1	1	30.5	<0.5	77.9	0.922	8.9
1573562	WS403 ES 2 1.25	18-Dec-15	Req	3	0.4	11.9	0.21	32.8	15	21.7	772.6	<0.1	0.7	32.6	0.6	81.6	0.908	8.9
1573563	WS404 ES 1 0.10	18-Dec-15	Req §	0.9 §	0.3 §	4.9 §	1.69 §	8.5 §	15.2 §	18.3 §	933.2 §	<0.1 §	1.2 §	6.5 §	<0.5 §	80.8 §	0.218 §	11.5 §
1573564	WS404 ES 2 1.10	18-Dec-15	Req	4.4	0.6	13	0.31	26.3	37.7	103.7	536	0.25	1.8	27.4	1.2	89.4	0.806	8.9

ESG

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Client Name	**ESG Doncaster**
Contact	Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	**18-Jan-2016**
Report Number	**EFS/158776**
Table Number	**1**

Where individual results are flagged see report notes for status.

LAB ID Number CL/	Client Sample Description	Sample Date	Cyanide(Total) (AR)	Phenol Index.(AR)	^Asbestos Screen	SVOC by GCMS (AR)	TPH by GCFID (AR/Si)	VOC HSA-GCMS	Fraction of non-crushable material %	Fraction of sample above 4 mm %	Vanadium (MS)	Chromium vi:	PCB-12 Congeners Analysis	^Dioxins & Furans MW	^Dioxins like PCBs	Total Organic Carbon	Toluene	Benzene
		Units :	mg/kg	mg/kg		mg/kg	mg/kg	µg/kg	%	%	mg/kg	mg/kg	µg/kg			% M/M	µg/kg	µg/kg
		Method Codes :	SFAPI	SFAPI	Sub002a	SVOCMSUS	TPHUSSI	VOCHSAS	CEN Leachate	CEN Leachate	ICPMSS	KONECR	PCBUSECDAR	Sub030	Sub030	WSLM59	VOCHSAS	VOCHSAS
		Method Reporting Limits :	0.5	0.5			20				0.6	0.1				0.04	5	1
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No			No	Yes	Yes
1573558	WS401 ES 1 0.30	18-Dec-15	<0.5 §	<0.5 §	NAIIS	Req §	Req §	Req §			16.2	<0.1				0.55	<5 §	<1 §
1573559	WS401 ES 3 1.60	18-Dec-15	<0.5	<0.5	NAIIS	Req	Req	Req	0	40	31	<0.1	Req			1.97	<5	<1
1573560	WS402 ES 1 0.10	18-Dec-15	<0.5	<0.5	NAIIS	Req	Req	Req	0	58	19.5	0.2	Req			0.92	<5	<1
1573561	WS402 ES 2 1.20	18-Dec-15	<0.5	<0.5	NAIIS	Req	Req	Req			49	<0.1				0.98	<5	<1
1573562	WS403 ES 2 1.25	18-Dec-15	<0.5	<0.5	NAIIS	Req	Req	Req			49.3	<0.1				1.23	<5	<1
1573563	WS404 ES 1 0.10	18-Dec-15	<0.5 §	<0.5 §	NAIIS	Req §	Req §	Req §			9.2	<0.1		Req	Req	1.39	<5 §	<1 §
1573564	WS404 ES 2 1.10	18-Dec-15	<0.5	<0.5	NAIIS	Req	Req	Req	0	36	45	<0.1				5.25	<5	<1

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Client Name **ESG Doncaster**

Contact Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	**18-Jan-2016**
Report Number	**EFS/158776**
Table Number	**1**

Where individual results are flagged see report notes for status.

		Units :	ug/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
		Method Codes :	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	VOCHSAS	PAHMSUS	PHEHPLC	PHEHPLC	PHEHPLC	PHEHPLC	PHEHPLC
		Method Reporting Limits :	2	6	4	2			0.3	0.3	0.3	0.3	
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**Ethyl Benzene**	**Xylenes**	**m/p Xylenes**	**o Xylene**	**BTEX-HSA GCMS analysis**	**PAH (16) by GCMS**	**Phenol**	**Cresols**	**Xylenols**	**Trimethylphenols**	**Total Phenols**
1573558	WS401 ES 1 0.30	18-Dec-15	<2 §	<6 §	<4 §	<2 §	Req §	Req §					
1573559	WS401 ES 3 1.60	18-Dec-15	<2	<6	<4	<2	Req	Req	<0.3	<0.3	<0.3	<0.3	<1.2
1573560	WS402 ES 1 0.10	18-Dec-15	<2	<6	<4	<2	Req	Req	<0.3	<0.3	<0.3	<0.3	<1.2
1573561	WS402 ES 2 1.20	18-Dec-15	<2	<6	<4	<2	Req	Req					
1573562	WS403 ES 2 1.25	18-Dec-15	<2	<6	<4	<2	Req	Req					
1573563	WS404 ES 1 0.10	18-Dec-15	<2 §	<6 §	<4 §	<2 §	Req §	Req §					
1573564	WS404 ES 2 1.10	18-Dec-15	<2	<6	<4	<2	Req	Req					

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Contact Mr N Cooke

Sample Analysis

A63 Castle Street

Date Printed	**18-Jan-2016**
Report Number	**EFS/158776**
Table Number	**1**

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS401 ES 1 0.30	**Job Number:**	S15_8776
LIMS ID Number:	CL1573558	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	29-Dec-15
Directory:	2915PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: No

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	6.97	0.09	90
Pyrene	129-00-0	-	< 0.08	-
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.29	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	98
Acenaphthene-d10	98
Phenanthrene-d10	98
Chrysene-d12	86
Perylene-d12	81

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	109
Terphenyl-d14	83

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS401 ES 3 1.60	**Job Number:**	S15_8776
LIMS ID Number:	CL1573559	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	29-Dec-15
Directory:	2915PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	3.26	0.14	97
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	5.63	0.19	100
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	6.96	0.21	91
Pyrene	129-00-0	7.24	0.17	88
Benzo[a]anthracene	56-55-3	8.91	0.13	96
Chrysene	218-01-9	8.97	0.12	99
Benzo[b]fluoranthene	205-99-2	10.45	0.11	96
Benzo[k]fluoranthene	207-08-9	10.48	0.08	97
Benzo[a]pyrene	50-32-8	10.87	0.10	90
Indeno[1,2,3-cd]pyrene	193-39-5	12.25	0.09	84
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	12.53	0.09	63
Total (USEPA16) PAHs	-	-	< 1.83	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	96
Acenaphthene-d10	95
Phenanthrene-d10	94
Chrysene-d12	89
Perylene-d12	90

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	107
Terphenyl-d14	82

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS402 ES 1 0.10	**Job Number:**	S15_8776
LIMS ID Number:	CL1573560	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	29-Dec-15
Directory:	2915PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	4.42	0.10	95
Fluorene	86-73-7	4.79	0.12	91
Phenanthrene	85-01-8	5.63	1.18	98
Anthracene	120-12-7	5.67	0.33	92
Fluoranthene	206-44-0	6.96	2.03	91
Pyrene	129-00-0	7.24	1.58	87
Benzo[a]anthracene	56-55-3	8.92	1.11	90
Chrysene	218-01-9	8.97	1.00	97
Benzo[b]fluoranthene	205-99-2	10.45	0.84	97
Benzo[k]fluoranthene	207-08-9	10.47	0.95	95
Benzo[a]pyrene	50-32-8	10.87	0.90	97
Indeno[1,2,3-cd]pyrene	193-39-5	12.25	0.55	89
Dibenzo[a,h]anthracene	53-70-3	12.27	0.09	58
Benzo[g,h,i]perylene	191-24-2	12.53	0.44	95
Total (USEPA16) PAHs	-	-	< 11.38	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	99
Acenaphthene-d10	97
Phenanthrene-d10	97
Chrysene-d12	89
Perylene-d12	87

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	103
Terphenyl-d14	79

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS402 ES 2 1.20	**Job Number:**	S15_8776
LIMS ID Number:	CL1573561	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	29-Dec-15
Directory:	2915PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	-	< 0.08	-
Pyrene	129-00-0	-	< 0.08	-
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.28	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	101
Acenaphthene-d10	99
Phenanthrene-d10	97
Chrysene-d12	87
Perylene-d12	83

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	106
Terphenyl-d14	80

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS403 ES 2 1.25	**Job Number:**	S15_8776
LIMS ID Number:	CL1573562	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	29-Dec-15
Directory:	2915PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	-	< 0.08	-
Pyrene	129-00-0	-	< 0.08	-
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.28	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	98
Acenaphthene-d10	96
Phenanthrene-d10	95
Chrysene-d12	80
Perylene-d12	74

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	111
Terphenyl-d14	83

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS404 ES 1 0.10	**Job Number:**	S15_8776
LIMS ID Number:	CL1573563	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	29-Dec-15
Directory:	2915PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: No

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	5.63	0.08	93
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	6.96	0.17	94
Pyrene	129-00-0	7.24	0.19	88
Benzo[a]anthracene	56-55-3	8.91	0.12	95
Chrysene	218-01-9	8.97	0.14	94
Benzo[b]fluoranthene	205-99-2	10.45	0.09	63
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	10.87	0.08	89
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.59	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	98
Acenaphthene-d10	98
Phenanthrene-d10	99
Chrysene-d12	92
Perylene-d12	102

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	107
Terphenyl-d14	82

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS404 ES 2 1.10	**Job Number:**	S15_8776
LIMS ID Number:	CL1573564	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	29-Dec-15
Directory:	2915PAHMS14\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	6.96	0.29	91
Pyrene	129-00-0	7.24	0.22	88
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.63	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	99
Acenaphthene-d10	98
Phenanthrene-d10	96
Chrysene-d12	91
Perylene-d12	97

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	105
Terphenyl-d14	81

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polychlorinated Biphenyls (congeners)

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Matrix:** Soil	Soil
Job Number:	S15_8776	**Date Booked in:**	22-Dec-15
QC Batch Number:	151315	**Date Extracted:**	29-Dec-15
Directory:	1230PCB.GC8	**Date Analysed:**	31-Dec-15
Method:	Ultrasonic		

*** This sample data is not UKAS accredited.**

		Concentration, (µg/kg)											
Sample ID	**Customer ID**	**PCB 81**	**PCB 77**	**PCB 123**	**PCB 118**	**PCB 114**	**PCB 105**	**PCB 126**	**PCB 167**	**PCB 156**	**PCB 157**	**PCB 169**	**PCB 189**
* CL1573559	WS401 ES 3 1.60	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
* CL1573560	WS402 ES 1 0.10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Where individual results are flagged see report notes for status.

Semi-Volatile Organic Compounds

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Soil	**QC Batch Number:**	258
Sample Details:	WS401 ES 1 0.30	**Date Booked in:**	22-Dec-15	**Ext Method:**	Ultrasonic	**Multiplier:**	0.2
LIMS ID Number:	CL1573558	**Date Extracted:**	29-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	S15_8776	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Phenol	108-95-2	-	< 0.1	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.1	-
2-Chlorophenol	95-57-8	-	< 0.1	-
1,3-Dichlorobenzene	541-73-1	-	< 0.1	-
1,4-Dichlorobenzene	106-46-7	-	< 0.1	-
Benzyl alcohol	100-51-6	-	< 0.5	-
1,2-Dichlorobenzene	95-50-1	-	< 0.1	-
2-Methylphenol	95-48-7	-	< 0.1	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.5	-
Hexachloroethane	67-72-1	-	< 0.1	-
N-Nitroso-di-n-propylamine	621-64-7	-	< 0.9	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.1	-
Nitrobenzene	98-95-3	-	< 0.5	-
Isophorone	78-59-1	-	< 0.1	-
2-Nitrophenol	88-75-5	-	< 0.1	-
2,4-Dimethylphenol	105-67-9	-	< 0.1	-
Benzoic Acid	65-85-0	-	< 0.5	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.1	-
2,4-Dichlorophenol	120-83-2	-	< 0.1	-
1,2,4-Trichlorobenzene	120-82-1	-	< 0.1	-
Naphthalene	91-20-3	-	< 0.1	-
4-Chlorophenol	106-48-9	-	< 0.5	-
4-Chloroaniline	106-47-8	-	< 0.5	-
Hexachlorobutadiene	87-68-3	-	< 0.1	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.1	-
2-Methylnaphthalene	91-57-6	-	< 0.1	-
1-Methylnaphthalene	90-12-0	-	< 0.1	-
Hexachlorocyclopentadiene	77-47-4	-	< 0.1	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.1	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.1	-
2-Chloronaphthalene	91-58-7	-	< 0.1	-
Biphenyl	92-52-4	-	< 0.1	-
Diphenyl ether	101-84-8	-	< 0.1	-
2-Nitroaniline	88-74-4	-	< 0.5	-
Acenaphthylene	208-96-8	-	< 0.1	-
Dimethylphthalate	131-11-3	-	< 0.1	-
2,6-Dinitrotoluene	606-20-2	-	< 0.5	-
Acenaphthene	83-32-9	-	< 0.1	-
3-Nitroaniline	99-09-2	-	< 14.5	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/kg	% Fit
2,4-Dinitrophenol	51-28-5	-	< 0.5	-
Dibenzofuran	132-64-9	-	< 0.1	-
4-Nitrophenol	100-02-7	-	< 0.5	-
2,4-Dinitrotoluene	121-14-2	-	< 0.2	-
Fluorene	86-73-7	-	< 0.1	-
Diethylphthalate	84-66-2	-	< 0.1	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.1	-
4,6-Dinitro-2-methylphenol	534-52-1	-	< 0.2	-
4-Nitroaniline	100-01-6	-	< 0.6	-
N-Nitrosodiphenylamine	86-30-6	-	< 0.1	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.1	-
Hexachlorobenzene	118-74-1	-	< 0.1	-
Pentachlorophenol	87-86-5	-	< 0.5	-
Phenanthrene	85-01-8	-	< 0.1	-
Anthracene	120-12-7	-	< 0.1	-
Di-n-butylphthalate	84-74-2	-	< 0.1	-
Fluoranthene	206-44-0	-	< 0.2	-
Pyrene	129-00-0	-	< 0.2	-
Butylbenzylphthalate	85-68-7	-	< 0.2	-
Benzo[a]anthracene	56-55-3	-	< 0.2	-
Chrysene	218-01-9	-	< 0.2	-
3,3'-Dichlorobenzidine	91-94-1	-	< 0.5	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.2	-
Di-n-octylphthalate	117-84-0	-	< 0.2	-
Benzo[b]fluoranthene	205-99-2	-	< 0.2	-
Benzo[k]fluoranthene	207-08-9	-	< 0.2	-
Benzo[a]pyrene	50-32-8	-	< 0.2	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.5	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.5	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.5	-
Coronene	191-07-1*	-	< 0.3	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	127
Naphthalene-d8	131
Acenaphthene-d10	133
Phenanthrene-d10	135
Chrysene-d12	153
Perylene-d12	168

"*" denotes compounds which are not UKAS accredited

Surrogates	% Rec
2-Fluorophenol	84
Phenol-d5	86
Nitrobenzene-d5	81
2-Fluorobiphenyl	87
2,4,6-Tribromophenol	27
Terphenyl-d14	93

Where individual results are flagged see report notes for status.

Semi-Volatile Organic Compounds

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Soil	**QC Batch Number:**	258
Sample Details:	WS401 ES 3 1.60	**Date Booked in:**	22-Dec-15	**Ext Method:**	Ultrasonic	**Multiplier:**	0.2
LIMS ID Number:	CL1573559	**Date Extracted:**	29-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	S15_8776	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Phenol	108-95-2	-	< 0.1	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.1	-
2-Chlorophenol	95-57-8	-	< 0.1	-
1,3-Dichlorobenzene	541-73-1	-	< 0.1	-
1,4-Dichlorobenzene	106-46-7	-	< 0.1	-
Benzyl alcohol	100-51-6	-	< 0.5	-
1,2-Dichlorobenzene	95-50-1	-	< 0.1	-
2-Methylphenol	95-48-7	-	< 0.1	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.5	-
Hexachloroethane	67-72-1	-	< 0.1	-
N-Nitroso-di-n-propylamine	621-64-7*	-	< 0.9	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.1	-
Nitrobenzene	98-95-3	-	< 0.5	-
Isophorone	78-59-1*	-	< 0.1	-
2-Nitrophenol	88-75-5	-	< 0.1	-
2,4-Dimethylphenol	105-67-9	-	< 0.1	-
Benzoic Acid	65-85-0*	-	< 0.5	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.1	-
2,4-Dichlorophenol	120-83-2	-	< 0.1	-
1,2,4-Trichlorobenzene	120-82-1*	-	< 0.1	-
Naphthalene	91-20-3	-	< 0.1	-
4-Chlorophenol	106-48-9	-	< 0.5	-
4-Chloroaniline	106-47-8*	-	< 0.5	-
Hexachlorobutadiene	87-68-3*	-	< 0.1	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.1	-
2-Methylnaphthalene	91-57-6*	-	< 0.1	-
1-Methylnaphthalene	90-12-0	-	< 0.1	-
Hexachlorocyclopentadiene	77-47-4*	-	< 0.1	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.1	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.1	-
2-Chloronaphthalene	91-58-7	-	< 0.1	-
Biphenyl	92-52-4	-	< 0.1	-
Diphenyl ether	101-84-8	-	< 0.1	-
2-Nitroaniline	88-74-4*	-	< 0.5	-
Acenaphthylene	208-96-8	-	< 0.1	-
Dimethylphthalate	131-11-3	-	< 0.1	-
2,6-Dinitrotoluene	606-20-2	-	< 0.5	-
Acenaphthene	83-32-9	-	< 0.1	-
3-Nitroaniline	99-09-2*	-	< 14.5	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/kg	% Fit
2,4-Dinitrophenol	51-28-5*	-	< 0.5	-
Dibenzofuran	132-64-9	-	< 0.1	-
4-Nitrophenol	100-02-7*	-	< 0.5	-
2,4-Dinitrotoluene	121-14-2	-	< 0.2	-
Fluorene	86-73-7	-	< 0.1	-
Diethylphthalate	84-66-2	-	< 0.1	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.1	-
4,6-Dinitro-2-methylphenol	534-52-1*	-	< 0.2	-
4-Nitroaniline	100-01-6*	-	< 0.6	-
N-Nitrosodiphenylamine	86-30-6*	-	< 0.1	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.1	-
Hexachlorobenzene	118-74-1	-	< 0.1	-
Pentachlorophenol	87-86-5*	-	< 0.5	-
Phenanthrene	85-01-8	5.91	0.3	99
Anthracene	120-12-7	5.95	0.1	98
Di-n-butylphthalate	84-74-2	-	< 0.1	-
Fluoranthene	206-44-0	6.73	0.4	97
Pyrene	129-00-0	6.92	0.3	99
Butylbenzylphthalate	85-68-7	-	< 0.2	-
Benzo[a]anthracene	56-55-3	8.23	0.2	90
Chrysene	218-01-9	-	< 0.2	-
3,3'-Dichlorobenzidine	91-94-1*	-	< 0.5	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.2	-
Di-n-octylphthalate	117-84-0	-	< 0.2	-
Benzo[b]fluoranthene	205-99-2	9.96	0.2	72
Benzo[k]fluoranthene	207-08-9	-	< 0.2	-
Benzo[a]pyrene	50-32-8	-	< 0.2	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.5	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.5	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.5	-
Coronene	191-07-1*	-	< 0.3	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	104
Naphthalene-d8	107
Acenaphthene-d10	107
Phenanthrene-d10	108
Chrysene-d12	127
Perylene-d12	147

Surrogates	% Rec
2-Fluorophenol	96
Phenol-d5	91
Nitrobenzene-d5	85
2-Fluorobiphenyl	87
2,4,6-Tribromophenol	101
Terphenyl-d14	88

"*" denotes compounds which are not UKAS accredited

Where individual results are flagged see report notes for status.

Semi-Volatile Organic Compounds

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Soil	**QC Batch Number:**	258
Sample Details:	WS402 ES 1 0.10	**Date Booked in:**	22-Dec-15	**Ext Method:**	Ultrasonic	**Multiplier:**	0.2
LIMS ID Number:	CL1573560	**Date Extracted:**	29-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	S15_8776	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Phenol	108-95-2	-	< 0.1	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.1	-
2-Chlorophenol	95-57-8	-	< 0.1	-
1,3-Dichlorobenzene	541-73-1	-	< 0.1	-
1,4-Dichlorobenzene	106-46-7	-	< 0.1	-
Benzyl alcohol	100-51-6	-	< 0.5	-
1,2-Dichlorobenzene	95-50-1	-	< 0.1	-
2-Methylphenol	95-48-7	-	< 0.1	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.5	-
Hexachloroethane	67-72-1	-	< 0.1	-
N-Nitroso-di-n-propylamine	621-64-7*	-	< 0.9	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.1	-
Nitrobenzene	98-95-3	-	< 0.5	-
Isophorone	78-59-1*	-	< 0.1	-
2-Nitrophenol	88-75-5	-	< 0.1	-
2,4-Dimethylphenol	105-67-9	-	< 0.1	-
Benzoic Acid	65-85-0*	-	< 0.5	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.1	-
2,4-Dichlorophenol	120-83-2	-	< 0.1	-
1,2,4-Trichlorobenzene	120-82-1*	-	< 0.1	-
Naphthalene	91-20-3	-	< 0.1	-
4-Chlorophenol	106-48-9	-	< 0.5	-
4-Chloroaniline	106-47-8*	-	< 0.5	-
Hexachlorobutadiene	87-68-3*	-	< 0.1	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.1	-
2-Methylnaphthalene	91-57-6*	-	< 0.1	-
1-Methylnaphthalene	90-12-0	-	< 0.1	-
Hexachlorocyclopentadiene	77-47-4*	-	< 0.1	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.1	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.1	-
2-Chloronaphthalene	91-58-7	-	< 0.1	-
Biphenyl	92-52-4	-	< 0.1	-
Diphenyl ether	101-84-8	-	< 0.1	-
2-Nitroaniline	88-74-4*	-	< 0.5	-
Acenaphthylene	208-96-8	-	< 0.1	-
Dimethylphthalate	131-11-3	-	< 0.1	-
2,6-Dinitrotoluene	606-20-2	-	< 0.5	-
Acenaphthene	83-32-9	-	< 0.1	-
3-Nitroaniline	99-09-2*	-	< 14.5	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/kg	% Fit
2,4-Dinitrophenol	51-28-5*	-	< 0.5	-
Dibenzofuran	132-64-9	-	< 0.1	-
4-Nitrophenol	100-02-7*	-	< 0.5	-
2,4-Dinitrotoluene	121-14-2	-	< 0.2	-
Fluorene	86-73-7	5.32	0.1	92
Diethylphthalate	84-66-2	-	< 0.1	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.1	-
4,6-Dinitro-2-methylphenol	534-52-1*	-	< 0.2	-
4-Nitroaniline	100-01-6*	-	< 0.6	-
N-Nitrosodiphenylamine	86-30-6*	-	< 0.1	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.1	-
Hexachlorobenzene	118-74-1	-	< 0.1	-
Pentachlorophenol	87-86-5*	-	< 0.5	-
Phenanthrene	85-01-8	5.91	1.1	99
Anthracene	120-12-7	5.95	0.4	94
Di-n-butylphthalate	84-74-2	-	< 0.1	-
Fluoranthene	206-44-0	6.73	1.5	98
Pyrene	129-00-0	6.93	1.2	99
Butylbenzylphthalate	85-68-7	-	< 0.2	-
Benzo[a]anthracene	56-55-3	8.24	0.8	88
Chrysene	218-01-9	8.29	0.7	94
3,3'-Dichlorobenzidine	91-94-1*	-	< 0.5	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.2	-
Di-n-octylphthalate	117-84-0	-	< 0.2	-
Benzo[b]fluoranthene	205-99-2	9.97	0.8	72
Benzo[k]fluoranthene	207-08-9	10.02	0.3	69
Benzo[a]pyrene	50-32-8	10.57	0.7	96
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.5	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.5	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.5	-
Coronene	191-07-1*	-	< 0.3	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	116
Naphthalene-d8	121
Acenaphthene-d10	121
Phenanthrene-d10	125
Chrysene-d12	152
Perylene-d12	180

Surrogates	% Rec
2-Fluorophenol	72
Phenol-d5	83
Nitrobenzene-d5	74
2-Fluorobiphenyl	84
2,4,6-Tribromophenol	31
Terphenyl-d14	85

"*" denotes compounds which are not UKAS accredited

Semi-Volatile Organic Compounds

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Soil	**QC Batch Number:**	258
Sample Details:	WS402 ES 2 1.20	**Date Booked in:**	22-Dec-15	**Ext Method:**	Ultrasonic	**Multiplier:**	0.2
LIMS ID Number:	CL1573561	**Date Extracted:**	29-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	S15_8776	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Phenol	108-95-2	-	< 0.1	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.1	-
2-Chlorophenol	95-57-8	-	< 0.1	-
1,3-Dichlorobenzene	541-73-1	-	< 0.1	-
1,4-Dichlorobenzene	106-46-7	-	< 0.1	-
Benzyl alcohol	100-51-6	-	< 0.5	-
1,2-Dichlorobenzene	95-50-1	-	< 0.1	-
2-Methylphenol	95-48-7	-	< 0.1	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.5	-
Hexachloroethane	67-72-1	-	< 0.1	-
N-Nitroso-di-n-propylamine	621-64-7*	-	< 0.9	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.1	-
Nitrobenzene	98-95-3	-	< 0.5	-
Isophorone	78-59-1*	-	< 0.1	-
2-Nitrophenol	88-75-5	-	< 0.1	-
2,4-Dimethylphenol	105-67-9	-	< 0.1	-
Benzoic Acid	65-85-0*	-	< 0.5	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.1	-
2,4-Dichlorophenol	120-83-2	-	< 0.1	-
1,2,4-Trichlorobenzene	120-82-1*	-	< 0.1	-
Naphthalene	91-20-3	-	< 0.1	-
4-Chlorophenol	106-48-9	-	< 0.5	-
4-Chloroaniline	106-47-8*	-	< 0.5	-
Hexachlorobutadiene	87-68-3*	-	< 0.1	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.1	-
2-Methylnaphthalene	91-57-6*	-	< 0.1	-
1-Methylnaphthalene	90-12-0	-	< 0.1	-
Hexachlorocyclopentadiene	77-47-4*	-	< 0.1	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.1	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.1	-
2-Chloronaphthalene	91-58-7	-	< 0.1	-
Biphenyl	92-52-4	-	< 0.1	-
Diphenyl ether	101-84-8	-	< 0.1	-
2-Nitroaniline	88-74-4*	-	< 0.5	-
Acenaphthylene	208-96-8	-	< 0.1	-
Dimethylphthalate	131-11-3	-	< 0.1	-
2,6-Dinitrotoluene	606-20-2	-	< 0.5	-
Acenaphthene	83-32-9	-	< 0.1	-
3-Nitroaniline	99-09-2*	-	< 14.5	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/kg	% Fit
2,4-Dinitrophenol	51-28-5*	-	< 0.5	-
Dibenzofuran	132-64-9	-	< 0.1	-
4-Nitrophenol	100-02-7*	-	< 0.5	-
2,4-Dinitrotoluene	121-14-2	-	< 0.2	-
Fluorene	86-73-7	-	< 0.1	-
Diethylphthalate	84-66-2	-	< 0.1	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.1	-
4,6-Dinitro-2-methylphenol	534-52-1*	-	< 0.2	-
4-Nitroaniline	100-01-6*	-	< 0.6	-
N-Nitrosodiphenylamine	86-30-6*	-	< 0.1	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.1	-
Hexachlorobenzene	118-74-1	-	< 0.1	-
Pentachlorophenol	87-86-5*	-	< 0.5	-
Phenanthrene	85-01-8	-	< 0.1	-
Anthracene	120-12-7	-	< 0.1	-
Di-n-butylphthalate	84-74-2	-	< 0.1	-
Fluoranthene	206-44-0	-	< 0.2	-
Pyrene	129-00-0	-	< 0.2	-
Butylbenzylphthalate	85-68-7	-	< 0.2	-
Benzo[a]anthracene	56-55-3	-	< 0.2	-
Chrysene	218-01-9	-	< 0.2	-
3,3'-Dichlorobenzidine	91-94-1*	-	< 0.5	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.2	-
Di-n-octylphthalate	117-84-0	-	< 0.2	-
Benzo[b]fluoranthene	205-99-2	-	< 0.2	-
Benzo[k]fluoranthene	207-08-9	-	< 0.2	-
Benzo[a]pyrene	50-32-8	-	< 0.2	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.5	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.5	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.5	-
Coronene	191-07-1*	-	< 0.3	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	128
Naphthalene-d8	132
Acenaphthene-d10	132
Phenanthrene-d10	136
Chrysene-d12	163
Perylene-d12	185

"*" denotes compounds which are not UKAS accredited

Surrogates	% Rec
2-Fluorophenol	97
Phenol-d5	91
Nitrobenzene-d5	82
2-Fluorobiphenyl	85
2,4,6-Tribromophenol	87
Terphenyl-d14	89

Where individual results are flagged see report notes for status.

Semi-Volatile Organic Compounds

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Soil	**QC Batch Number:**	258
Sample Details:	WS403 ES 2 1.25	**Date Booked in:**	22-Dec-15	**Ext Method:**	Ultrasonic	**Multiplier:**	0.2
LIMS ID Number:	CL1573562	**Date Extracted:**	29-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	S15_8776	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Phenol	108-95-2	-	< 0.1	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.1	-
2-Chlorophenol	95-57-8	-	< 0.1	-
1,3-Dichlorobenzene	541-73-1	-	< 0.1	-
1,4-Dichlorobenzene	106-46-7	-	< 0.1	-
Benzyl alcohol	100-51-6	-	< 0.5	-
1,2-Dichlorobenzene	95-50-1	-	< 0.1	-
2-Methylphenol	95-48-7	-	< 0.1	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.5	-
Hexachloroethane	67-72-1	-	< 0.1	-
N-Nitroso-di-n-propylamine	621-64-7*	-	< 0.9	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.1	-
Nitrobenzene	98-95-3	-	< 0.5	-
Isophorone	78-59-1*	-	< 0.1	-
2-Nitrophenol	88-75-5	-	< 0.1	-
2,4-Dimethylphenol	105-67-9	-	< 0.1	-
Benzoic Acid	65-85-0*	-	< 0.5	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.1	-
2,4-Dichlorophenol	120-83-2	-	< 0.1	-
1,2,4-Trichlorobenzene	120-82-1*	-	< 0.1	-
Naphthalene	91-20-3	-	< 0.1	-
4-Chlorophenol	106-48-9	-	< 0.5	-
4-Chloroaniline	106-47-8*	-	< 0.5	-
Hexachlorobutadiene	87-68-3*	-	< 0.1	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.1	-
2-Methylnaphthalene	91-57-6*	-	< 0.1	-
1-Methylnaphthalene	90-12-0	-	< 0.1	-
Hexachlorocyclopentadiene	77-47-4*	-	< 0.1	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.1	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.1	-
2-Chloronaphthalene	91-58-7	-	< 0.1	-
Biphenyl	92-52-4	-	< 0.1	-
Diphenyl ether	101-84-8	-	< 0.1	-
2-Nitroaniline	88-74-4*	-	< 0.5	-
Acenaphthylene	208-96-8	-	< 0.1	-
Dimethylphthalate	131-11-3	-	< 0.1	-
2,6-Dinitrotoluene	606-20-2	-	< 0.5	-
Acenaphthene	83-32-9	-	< 0.1	-
3-Nitroaniline	99-09-2*	-	< 14.5	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/kg	% Fit
2,4-Dinitrophenol	51-28-5*	-	< 0.5	-
Dibenzofuran	132-64-9	-	< 0.1	-
4-Nitrophenol	100-02-7*	-	< 0.5	-
2,4-Dinitrotoluene	121-14-2	-	< 0.2	-
Fluorene	86-73-7	-	< 0.1	-
Diethylphthalate	84-66-2	-	< 0.1	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.1	-
4,6-Dinitro-2-methylphenol	534-52-1*	-	< 0.2	-
4-Nitroaniline	100-01-6*	-	< 0.6	-
N-Nitrosodiphenylamine	86-30-6*	-	< 0.1	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.1	-
Hexachlorobenzene	118-74-1	-	< 0.1	-
Pentachlorophenol	87-86-5*	-	< 0.5	-
Phenanthrene	85-01-8	-	< 0.1	-
Anthracene	120-12-7	-	< 0.1	-
Di-n-butylphthalate	84-74-2	-	< 0.1	-
Fluoranthene	206-44-0	-	< 0.2	-
Pyrene	129-00-0	-	< 0.2	-
Butylbenzylphthalate	85-68-7	-	< 0.2	-
Benzo[a]anthracene	56-55-3	-	< 0.2	-
Chrysene	218-01-9	-	< 0.2	-
3,3'-Dichlorobenzidine	91-94-1*	-	< 0.5	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.2	-
Di-n-octylphthalate	117-84-0	-	< 0.2	-
Benzo[b]fluoranthene	205-99-2	-	< 0.2	-
Benzo[k]fluoranthene	207-08-9	-	< 0.2	-
Benzo[a]pyrene	50-32-8	-	< 0.2	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.5	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.5	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.5	-
Coronene	191-07-1*	-	< 0.3	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	122
Naphthalene-d8	123
Acenaphthene-d10	122
Phenanthrene-d10	126
Chrysene-d12	145
Perylene-d12	157

"*" denotes compounds which are not UKAS accredited

Surrogates	% Rec
2-Fluorophenol	97
Phenol-d5	89
Nitrobenzene-d5	80
2-Fluorobiphenyl	85
2,4,6-Tribromophenol	89
Terphenyl-d14	91

Semi-Volatile Organic Compounds

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Soil	**QC Batch Number:**	258
Sample Details:	WS404 ES 1 0.10	**Date Booked in:**	22-Dec-15	**Ext Method:**	Ultrasonic	**Multiplier:**	1
LIMS ID Number:	CL1573563	**Date Extracted:**	29-Dec-15	**Operator:**	JO	**Dilution Factor:**	5
Job Number:	S15_8776	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Phenol	108-95-2	-	< 0.5	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.5	-
2-Chlorophenol	95-57-8	-	< 0.5	-
1,3-Dichlorobenzene	541-73-1	-	< 0.5	-
1,4-Dichlorobenzene	106-46-7	-	< 0.5	-
Benzyl alcohol	100-51-6	-	< 2.5	-
1,2-Dichlorobenzene	95-50-1	-	< 0.5	-
2-Methylphenol	95-48-7	-	< 0.5	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 2.5	-
Hexachloroethane	67-72-1	-	< 0.5	-
N-Nitroso-di-n-propylamine	621-64-7	-	< 4.5	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.5	-
Nitrobenzene	98-95-3	-	< 2.5	-
Isophorone	78-59-1	-	< 0.5	-
2-Nitrophenol	88-75-5	-	< 0.5	-
2,4-Dimethylphenol	105-67-9	-	< 0.5	-
Benzoic Acid	65-85-0	-	< 2.5	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.5	-
2,4-Dichlorophenol	120-83-2	-	< 0.5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 0.5	-
Naphthalene	91-20-3	-	< 0.5	-
4-Chlorophenol	106-48-9	-	< 2.5	-
4-Chloroaniline	106-47-8	-	< 2.5	-
Hexachlorobutadiene	87-68-3	-	< 0.5	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.5	-
2-Methylnaphthalene	91-57-6	-	< 0.5	-
1-Methylnaphthalene	90-12-0	-	< 0.5	-
Hexachlorocyclopentadiene	77-47-4	-	< 0.5	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.5	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.5	-
2-Chloronaphthalene	91-58-7	-	< 0.5	-
Biphenyl	92-52-4	-	< 0.5	-
Diphenyl ether	101-84-8	-	< 0.5	-
2-Nitroaniline	88-74-4	-	< 2.5	-
Acenaphthylene	208-96-8	-	< 0.5	-
Dimethylphthalate	131-11-3	-	< 0.5	-
2,6-Dinitrotoluene	606-20-2	-	< 2.5	-
Acenaphthene	83-32-9	-	< 0.5	-
3-Nitroaniline	99-09-2	-	< 72.5	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/kg	% Fit
2,4-Dinitrophenol	51-28-5	-	< 2.5	-
Dibenzofuran	132-64-9	-	< 0.5	-
4-Nitrophenol	100-02-7	-	< 2.5	-
2,4-Dinitrotoluene	121-14-2	-	< 1.0	-
Fluorene	86-73-7	-	< 0.5	-
Diethylphthalate	84-66-2	-	< 0.5	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.5	-
4,6-Dinitro-2-methylphenol	534-52-1	-	< 1.0	-
4-Nitroaniline	100-01-6	-	< 3.0	-
N-Nitrosodiphenylamine	86-30-6	-	< 0.5	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.5	-
Hexachlorobenzene	118-74-1	-	< 0.5	-
Pentachlorophenol	87-86-5	-	< 2.5	-
Phenanthrene	85-01-8	-	< 0.5	-
Anthracene	120-12-7	-	< 0.5	-
Di-n-butylphthalate	84-74-2	-	< 0.5	-
Fluoranthene	206-44-0	-	< 1.0	-
Pyrene	129-00-0	-	< 1.0	-
Butylbenzylphthalate	85-68-7	-	< 1.0	-
Benzo[a]anthracene	56-55-3	-	< 1.0	-
Chrysene	218-01-9	-	< 1.0	-
3,3'-Dichlorobenzidine	91-94-1	-	< 2.5	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 1.0	-
Di-n-octylphthalate	117-84-0	-	< 1.0	-
Benzo[b]fluoranthene	205-99-2	-	< 1.0	-
Benzo[k]fluoranthene	207-08-9	-	< 1.0	-
Benzo[a]pyrene	50-32-8	-	< 1.0	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 2.5	-
Dibenzo[a,h]anthracene	53-70-3	-	< 2.5	-
Benzo[g,h,i]perylene	191-24-2	-	< 2.5	-
Coronene	191-07-1*	-	< 1.5	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	114
Naphthalene-d8	117
Acenaphthene-d10	116
Phenanthrene-d10	117
Chrysene-d12	134
Perylene-d12	155

"*" denotes compounds which are not UKAS accredited

Surrogates	% Rec
2-Fluorophenol	87
Phenol-d5	83
Nitrobenzene-d5	79
2-Fluorobiphenyl	89
2,4,6-Tribromophenol	56
Terphenyl-d14	92

Semi-Volatile Organic Compounds

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Soil	**QC Batch Number:**	258
Sample Details:	WS404 ES 2 1.10	**Date Booked in:**	22-Dec-15	**Ext Method:**	Ultrasonic	**Multiplier:**	0.2
LIMS ID Number:	CL1573564	**Date Extracted:**	31-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	S15_8776	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Phenol	108-95-2	-	< 0.1	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.1	-
2-Chlorophenol	95-57-8	-	< 0.1	-
1,3-Dichlorobenzene	541-73-1	-	< 0.1	-
1,4-Dichlorobenzene	106-46-7	-	< 0.1	-
Benzyl alcohol	100-51-6	-	< 0.5	-
1,2-Dichlorobenzene	95-50-1	-	< 0.1	-
2-Methylphenol	95-48-7	-	< 0.1	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.5	-
Hexachloroethane	67-72-1	-	< 0.1	-
N-Nitroso-di-n-propylamine	621-64-7*	-	< 0.9	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.1	-
Nitrobenzene	98-95-3	-	< 0.5	-
Isophorone	78-59-1*	-	< 0.1	-
2-Nitrophenol	88-75-5	-	< 0.1	-
2,4-Dimethylphenol	105-67-9	-	< 0.1	-
Benzoic Acid	65-85-0*	-	< 0.5	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.1	-
2,4-Dichlorophenol	120-83-2	-	< 0.1	-
1,2,4-Trichlorobenzene	120-82-1*	-	< 0.1	-
Naphthalene	91-20-3	-	< 0.1	-
4-Chlorophenol	106-48-9	-	< 0.5	-
4-Chloroaniline	106-47-8*	-	< 0.5	-
Hexachlorobutadiene	87-68-3*	-	< 0.1	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.1	-
2-Methylnaphthalene	91-57-6*	-	< 0.1	-
1-Methylnaphthalene	90-12-0	-	< 0.1	-
Hexachlorocyclopentadiene	77-47-4*	-	< 0.1	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.1	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.1	-
2-Chloronaphthalene	91-58-7	-	< 0.1	-
Biphenyl	92-52-4	-	< 0.1	-
Diphenyl ether	101-84-8	-	< 0.1	-
2-Nitroaniline	88-74-4*	-	< 0.5	-
Acenaphthylene	208-96-8	-	< 0.1	-
Dimethylphthalate	131-11-3	-	< 0.1	-
2,6-Dinitrotoluene	606-20-2	-	< 0.5	-
Acenaphthene	83-32-9	-	< 0.1	-
3-Nitroaniline	99-09-2*	-	< 14.5	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/kg	% Fit
2,4-Dinitrophenol	51-28-5*	-	< 0.5	-
Dibenzofuran	132-64-9	-	< 0.1	-
4-Nitrophenol	100-02-7*	-	< 0.5	-
2,4-Dinitrotoluene	121-14-2	-	< 0.2	-
Fluorene	86-73-7	-	< 0.1	-
Diethylphthalate	84-66-2	-	< 0.1	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.1	-
4,6-Dinitro-2-methylphenol	534-52-1*	-	< 0.2	-
4-Nitroaniline	100-01-6*	-	< 0.6	-
N-Nitrosodiphenylamine	86-30-6*	-	< 0.1	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.1	-
Hexachlorobenzene	118-74-1	-	< 0.1	-
Pentachlorophenol	87-86-5*	-	< 0.5	-
Phenanthrene	85-01-8	-	< 0.1	-
Anthracene	120-12-7	-	< 0.1	-
Di-n-butylphthalate	84-74-2	-	< 0.1	-
Fluoranthene	206-44-0	-	< 0.2	-
Pyrene	129-00-0	-	< 0.2	-
Butylbenzylphthalate	85-68-7	-	< 0.2	-
Benzo[a]anthracene	56-55-3	-	< 0.2	-
Chrysene	218-01-9	-	< 0.2	-
3,3'-Dichlorobenzidine	91-94-1*	-	< 0.5	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.2	-
Di-n-octylphthalate	117-84-0	-	< 0.2	-
Benzo[b]fluoranthene	205-99-2	-	< 0.2	-
Benzo[k]fluoranthene	207-08-9	-	< 0.2	-
Benzo[a]pyrene	50-32-8	-	< 0.2	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.5	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.5	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.5	-
Coronene	191-07-1*	-	< 0.3	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	114
Naphthalene-d8	115
Acenaphthene-d10	117
Phenanthrene-d10	118
Chrysene-d12	142
Perylene-d12	171

Surrogates	% Rec
2-Fluorophenol	98
Phenol-d5	91
Nitrobenzene-d5	84
2-Fluorobiphenyl	89
2,4,6-Tribromophenol	92
Terphenyl-d14	90

"*" denotes compounds which are not UKAS accredited

Where individual results are flagged see report notes for status.

Gasoline Range Organics
(BTEX and Aliphatic Carbon Ranges)

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8776
Directory: C:\CHEM32\1\DATA\1223HSA_GC12\122315 2015-12-23 11-00-19\144B4401.D
Method: Headspace GCFID

Matrix: Soil
Date Booked in: 22-Dec-15
Date extracted: 23-Dec-15
Date Analysed: 24-Dec-15, 01:0

*** Sample data with an asterisk are not UKAS accredited.**

		Concentration, (mg/kg) - as wet weight					Aliphatics				
Sample ID	**Client ID**	**Benzene**	**Toluene**	**Ethyl benzene**	**m/p-Xylene**	**o-Xylene**	**C5 - C6**	**>C6 - C7**	**>C7 - C8**	**>C8 - C10**	**Total GRO**
* CL1573558	WS401 ES 1 0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.2	<0.2	<0.2	<0.2	<0.2
CL1573559	WS401 ES 3 1.60	<0.010	<0.010	<0.010	<0.010	<0.010	<0.2	<0.2	<0.2	<0.2	<0.2
CL1573560	WS402 ES 1 0.10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.2	<0.2	<0.2	<0.2	<0.2
CL1573561	WS402 ES 2 1.20	<0.010	<0.010	<0.010	<0.010	<0.010	<0.2	<0.2	<0.2	<0.2	<0.2
CL1573562	WS403 ES 2 1.25	<0.010	<0.010	<0.010	<0.010	<0.010	<0.2	<0.2	<0.2	<0.2	<0.2
* CL1573563	WS404 ES 1 0.10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.2	<0.2	<0.2	<0.2	<0.2
CL1573564	WS404 ES 2 1.10	<0.010	<0.010	<0.010	<0.010	<0.010	<0.2	<0.2	<0.2	<0.2	<0.2

Where individual results are flagged see report notes for status.

ALIPHATIC / AROMATIC FRACTION BY GC/FID

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: S15_8776
QC Batch Number: 151314
Directory: D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\077B3601.D
Method: Ultra Sonic

Separation: Silica gel
Eluents: Hexane, DCM

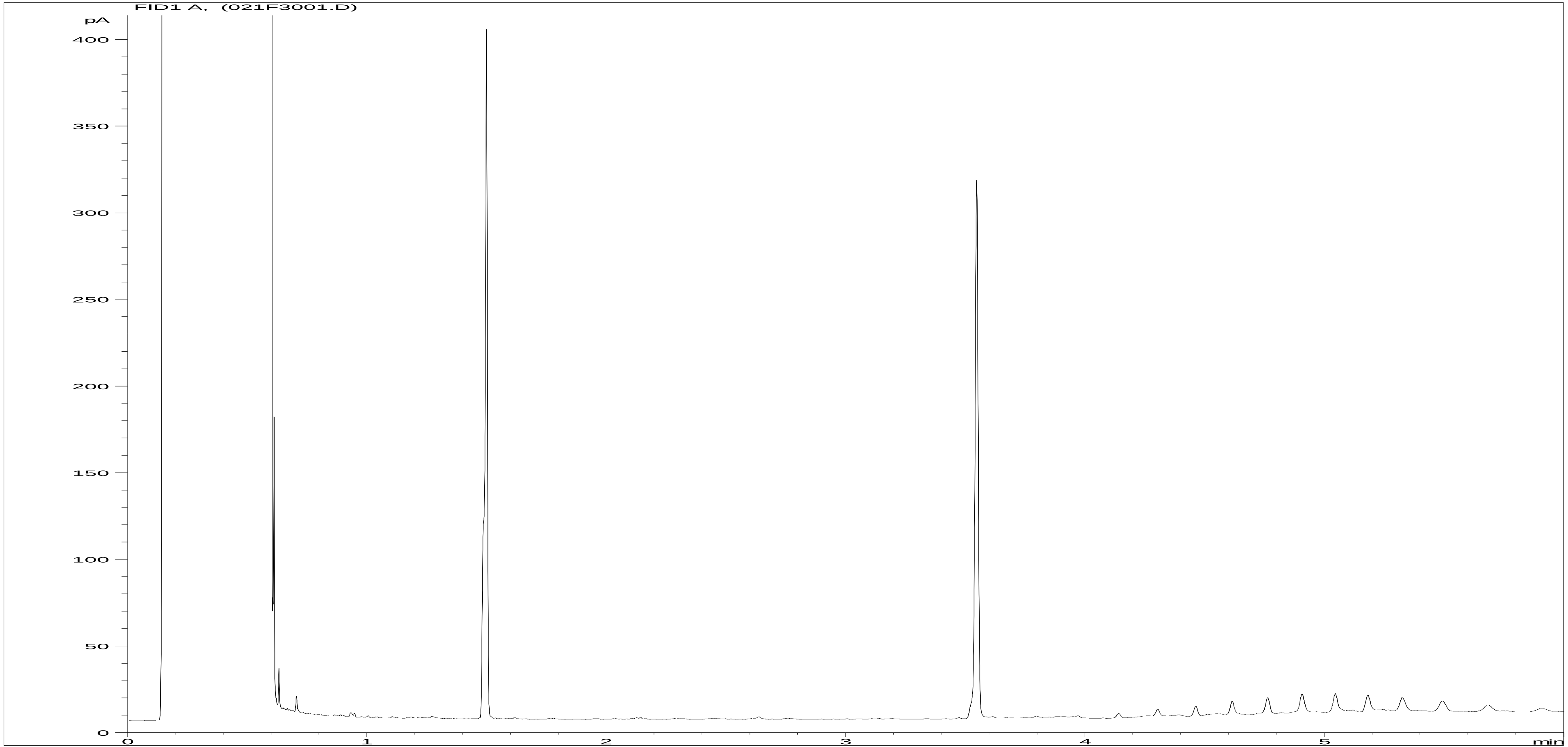
Matrix: Soil
Date Booked in: 22-Dec-15
Date Extracted: 29-Dec-15
Date Analysed: 30-Dec-15, 20:59:28

*** This sample data is not UKAS accredited.**

			Concentration, (mg/kg) - as wet weight											
			>C8 - C10		>C10 - C12		>C12 - C16		>C16 - C21		>C21 - C35		>C8 - C40	
	Sample ID	Client ID	Aliphatics	Aromatics	Aliphatics	Aromatics	Aliphatics	Aromatics	Aliphatics	Aromatics	Aliphatics	Aromatics	Aliphatics	Aromatics
*	CL1573558	WS401 ES 1 0.30	<4.2	<4	<4.2	<4	8	<4	<4.2	<4	10	<8.76	22.2	<20
	CL1573559	WS401 ES 3 1.60	<4.2	<4	<4.2	<4	8.13	<4	<4.2	<4	11.4	<8.76	21.1	<20
	CL1573560	WS402 ES 1 0.10	<4.12	<4	<4.12	<4	7.86	4.23	<4.12	4.9	14.9	26.4	25.4	42.6
	CL1573561	WS402 ES 2 1.20	<4.2	<4	<4.2	<4	7.76	6.09	<4.2	<4	9.5	<8.76	<21	<20
	CL1573562	WS403 ES 2 1.25	<4.24	<4	<4.24	<4	7.89	5.58	<4.24	<4	9.7	<8.76	<21.2	<20
*	CL1573563	WS404 ES 1 0.10	<4.12	<4	<4.12	<4	10.9	11.3	29.5	15.7	149	261	284	502
	CL1573564	WS404 ES 2 1.10	<4.28	<4	<4.28	<4	7.75	5.52	<4.28	<4	<9.4	30.7	<21.4	55

Where individual results are flagged see report notes for status.

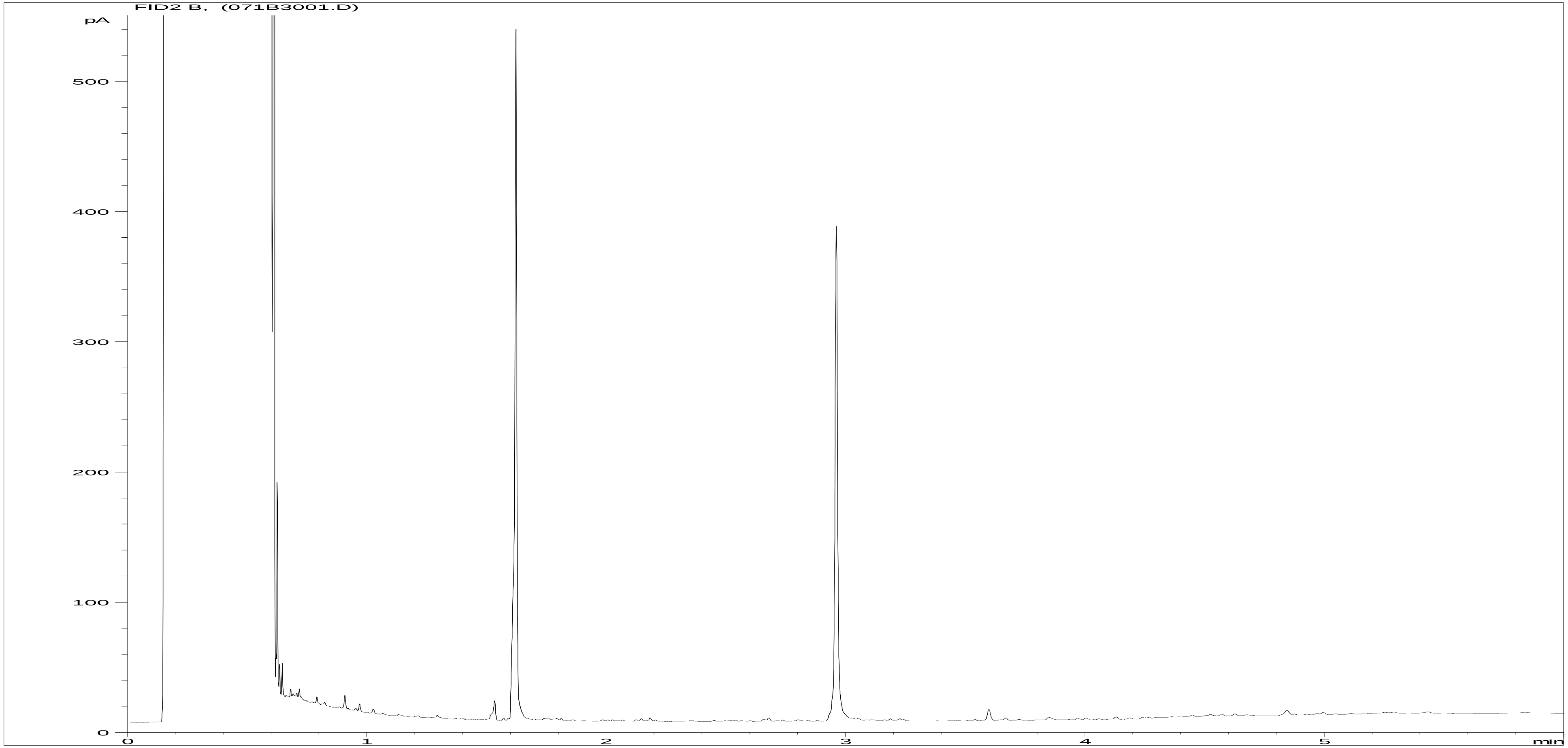
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573558ALI	**Job Number:**	S15_8776
Multiplier:	16.8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS401 ES 1 0.30
Acquisition Date/Time:	30-Dec-15, 19:38:03		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\021F3001.D		

Where individual results are flagged see report notes for status.

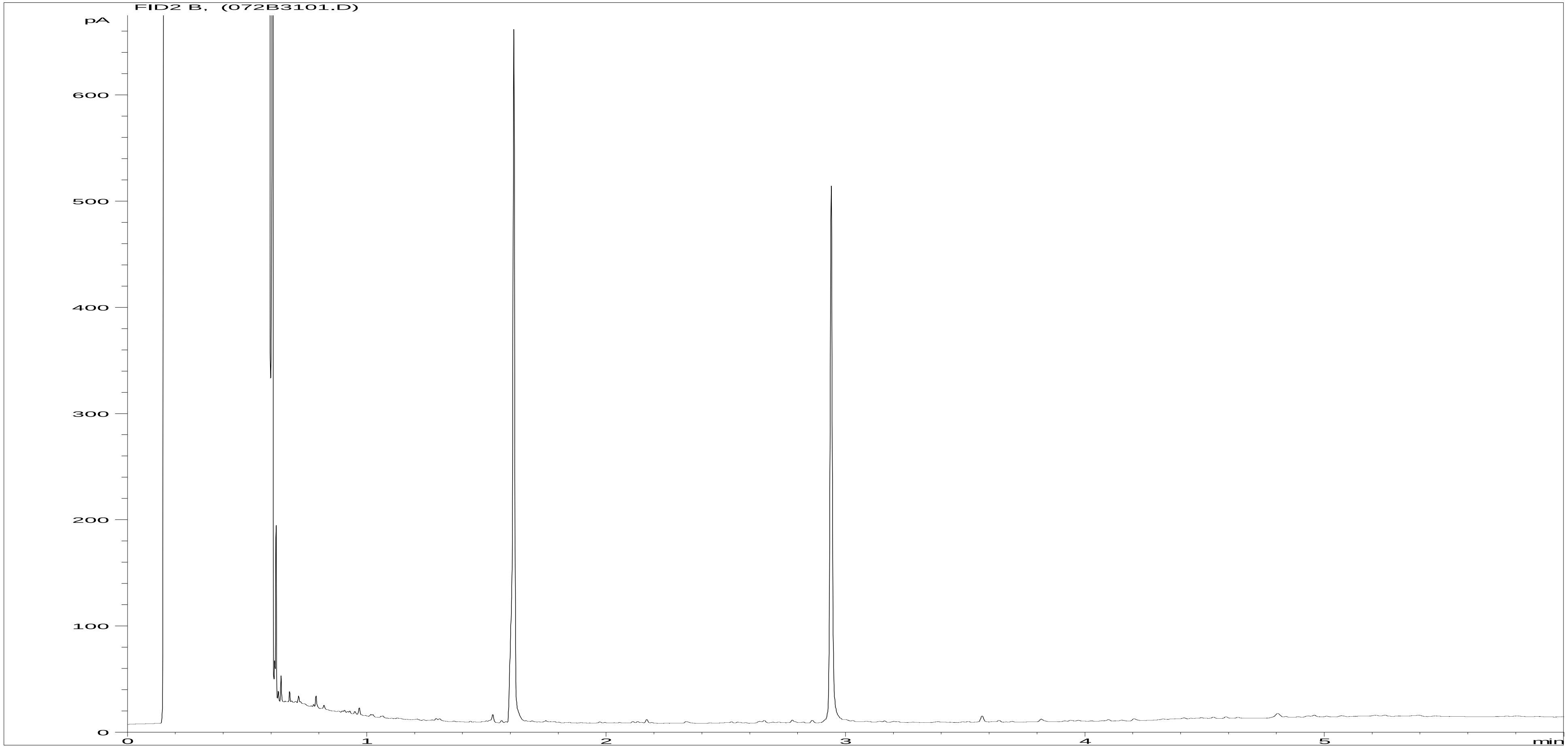
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573558ARO	**Job Number:**	S15_8776
Multiplier:	10.72	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS401 ES 1 0.30
Acquisition Date/Time:	30-Dec-15, 19:38:03		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\071B3001.D		

Where individual results are flagged see report notes for status.

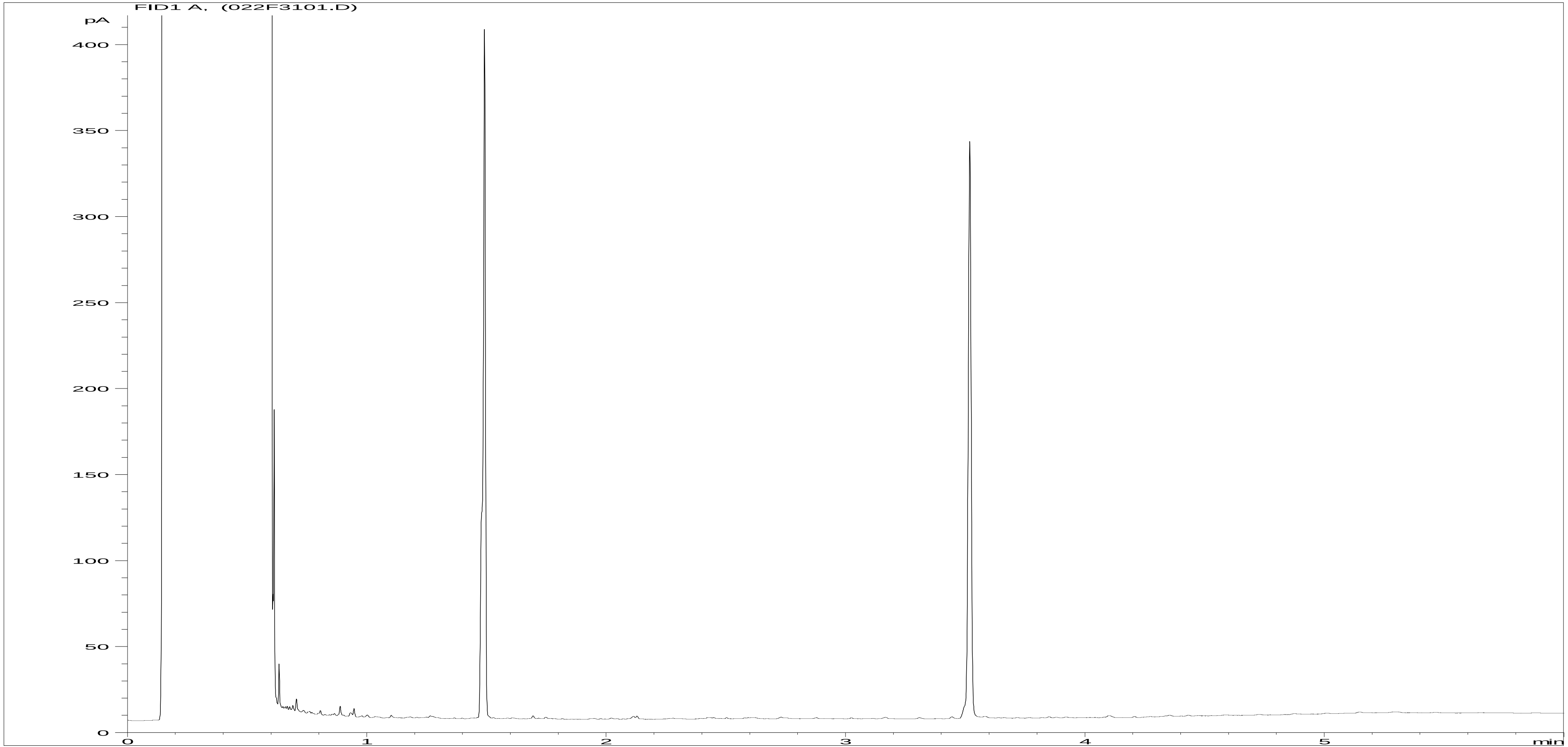
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573559ARO	**Job Number:**	S15_8776
Multiplier:	10.72	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS401 ES 3 1.60
Acquisition Date/Time:	30-Dec-15, 19:51:32		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\072B3101.D		

Where individual results are flagged see report notes for status.

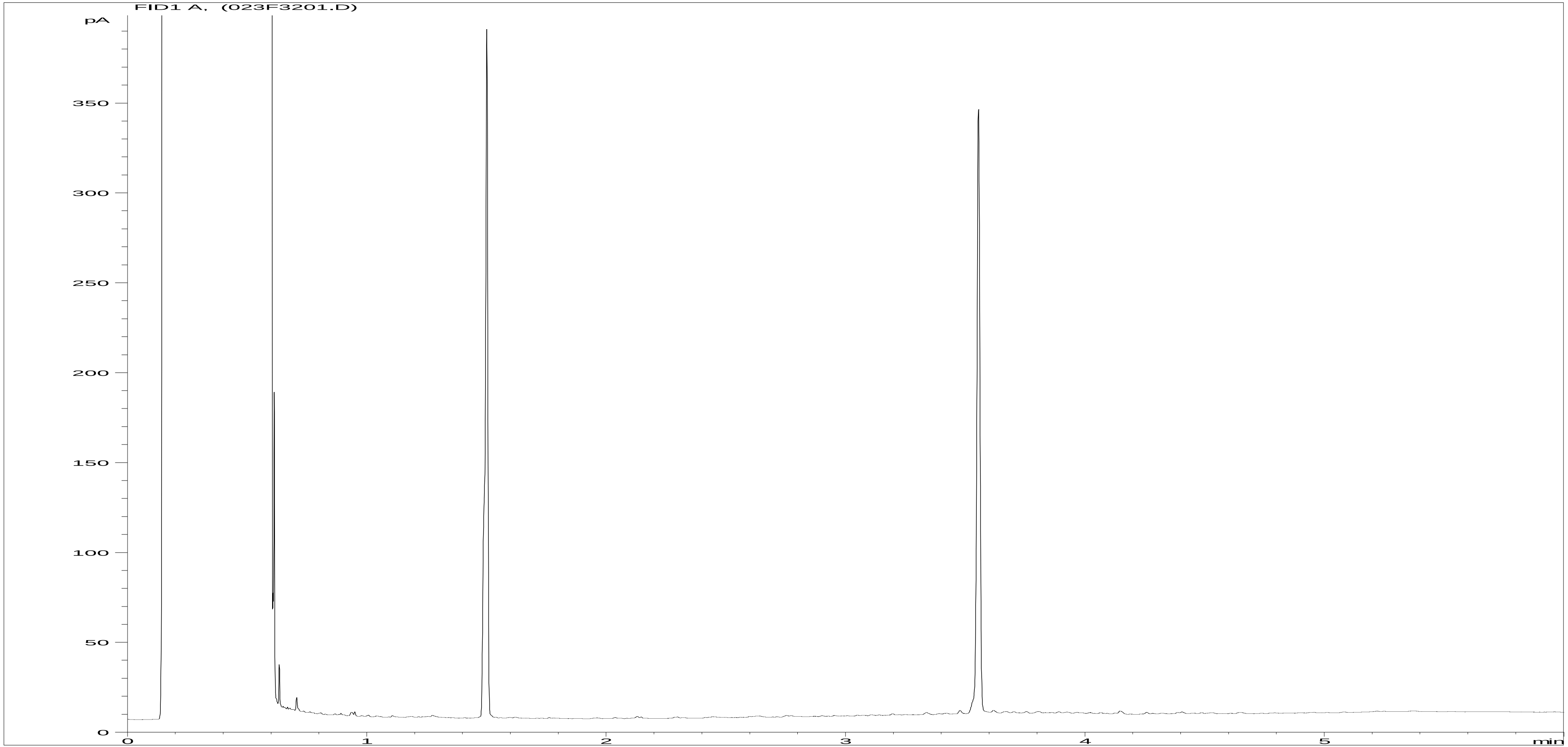
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573559ALI	**Job Number:**	S15_8776
Multiplier:	16.8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS401 ES 3 1.60
Acquisition Date/Time:	30-Dec-15, 19:51:32		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\022F3101.D		

Where individual results are flagged see report notes for status.

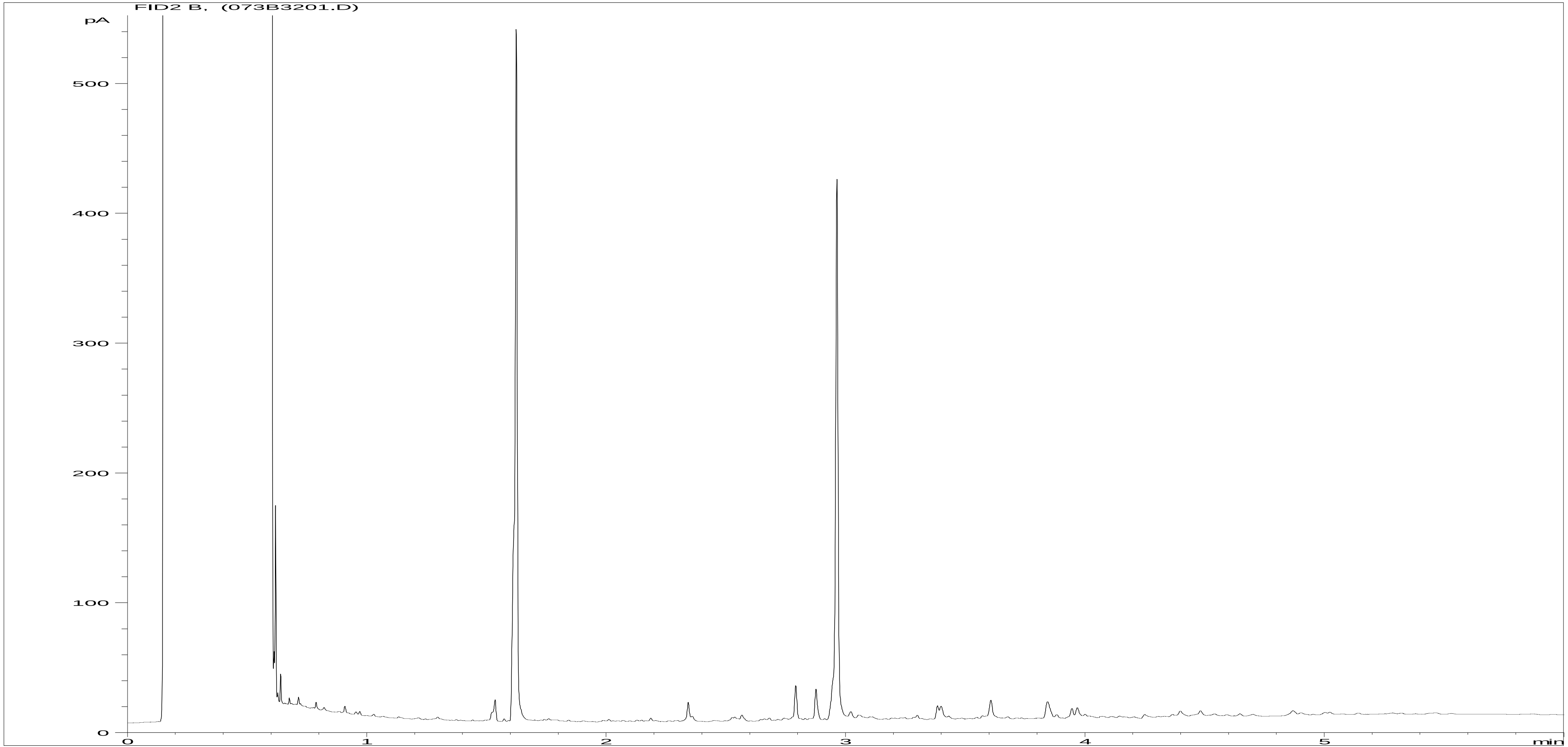
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573560ALI	**Job Number:**	S15_8776
Multiplier:	16.48	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS402 ES 1 0.10
Acquisition Date/Time:	30-Dec-15, 20:05:03		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\023F3201.D		

Where individual results are flagged see report notes for status.

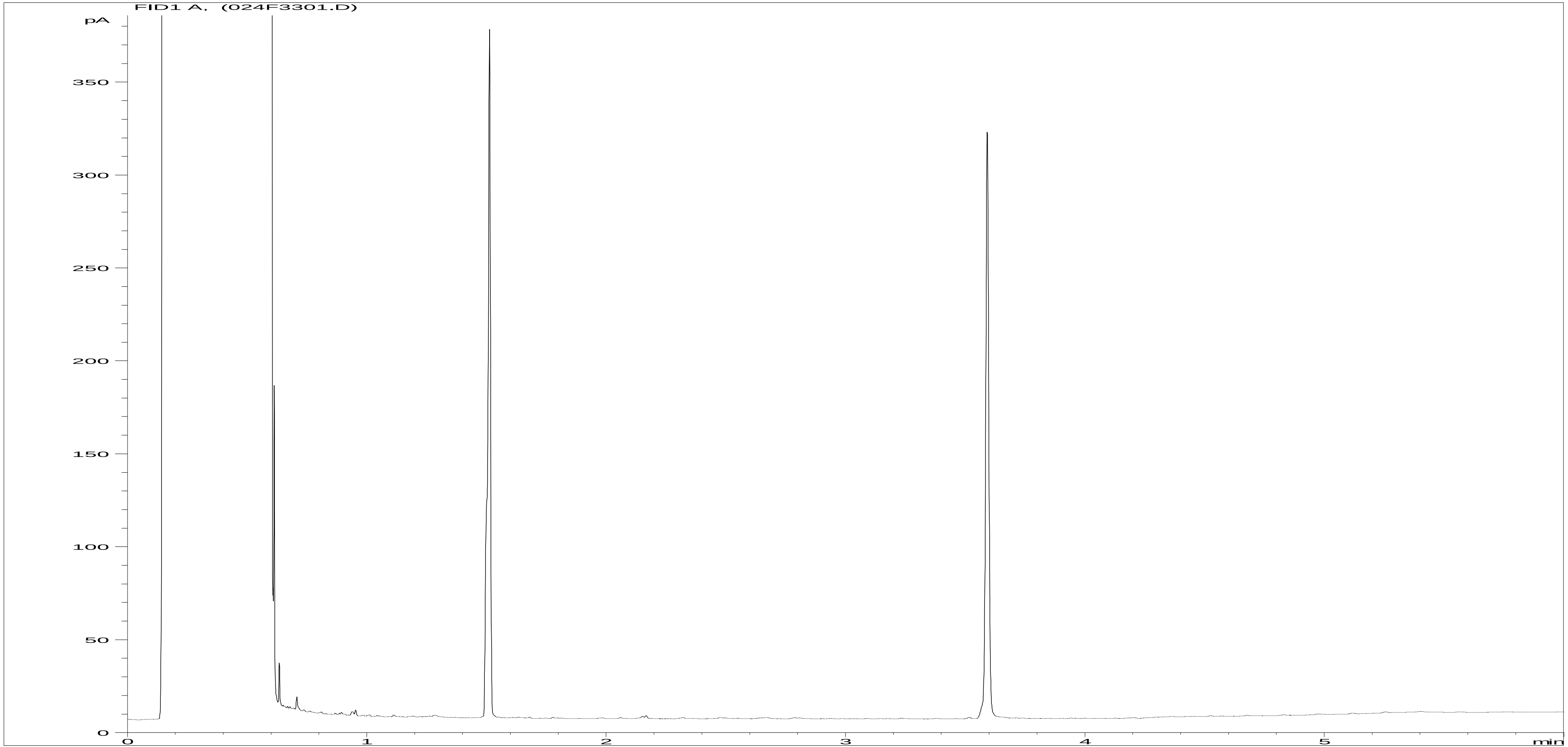
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573560ARO	**Job Number:**	S15_8776
Multiplier:	10.88	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS402 ES 1 0.10
Acquisition Date/Time:	30-Dec-15, 20:05:03		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\073B3201.D		

Where individual results are flagged see report notes for status.

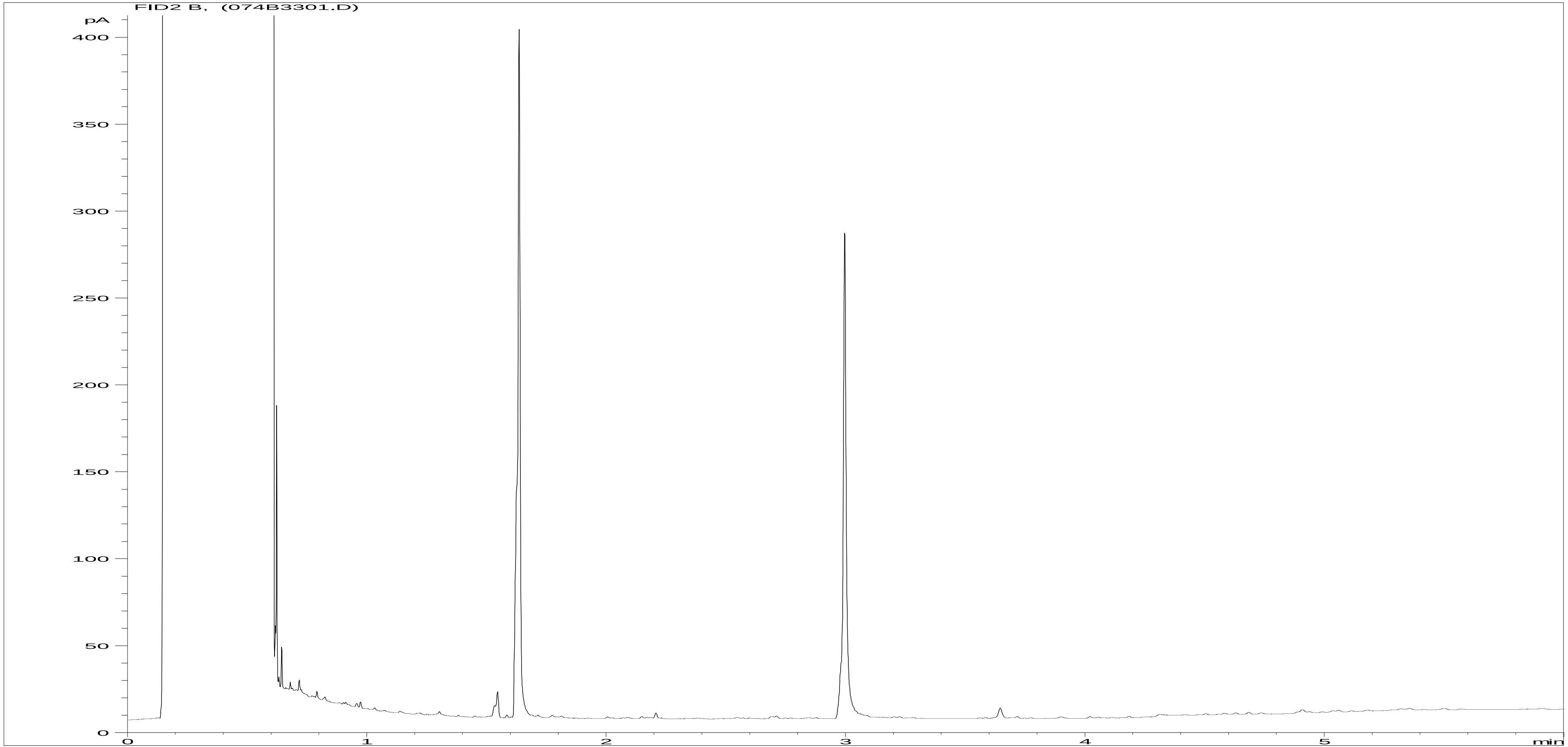
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573561ALI	**Job Number:**	S15_8776
Multiplier:	16.8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS402 ES 2 1.20
Acquisition Date/Time:	30-Dec-15, 20:18:35		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\024F3301.D		

Where individual results are flagged see report notes for status.

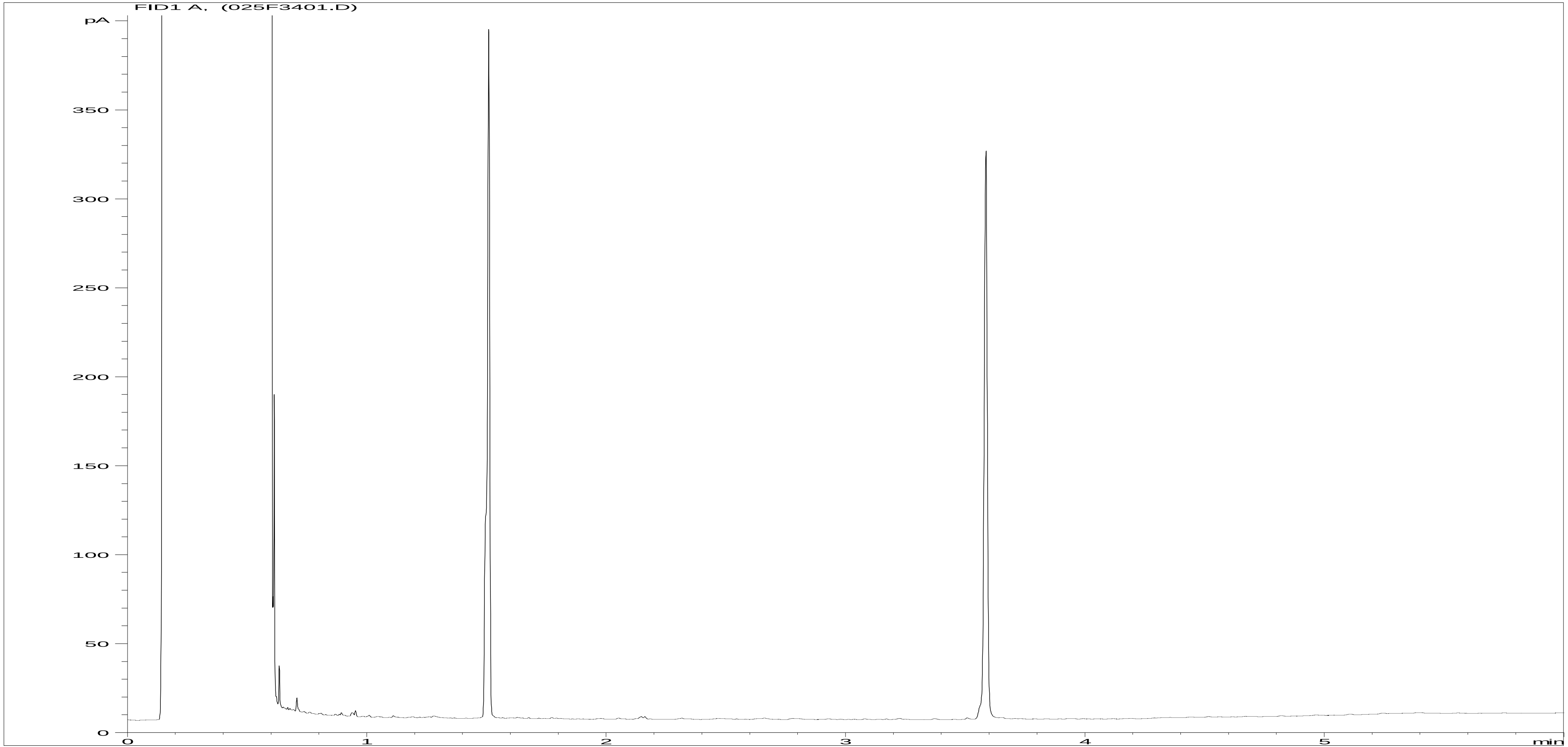
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573561ARO	**Job Number:**	S15_8776
Multiplier:	10.88	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS402 ES 2 1.20
Acquisition Date/Time:	30-Dec-15, 20:18:35		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\074B3301.D		

Where individual results are flagged see report notes for status.

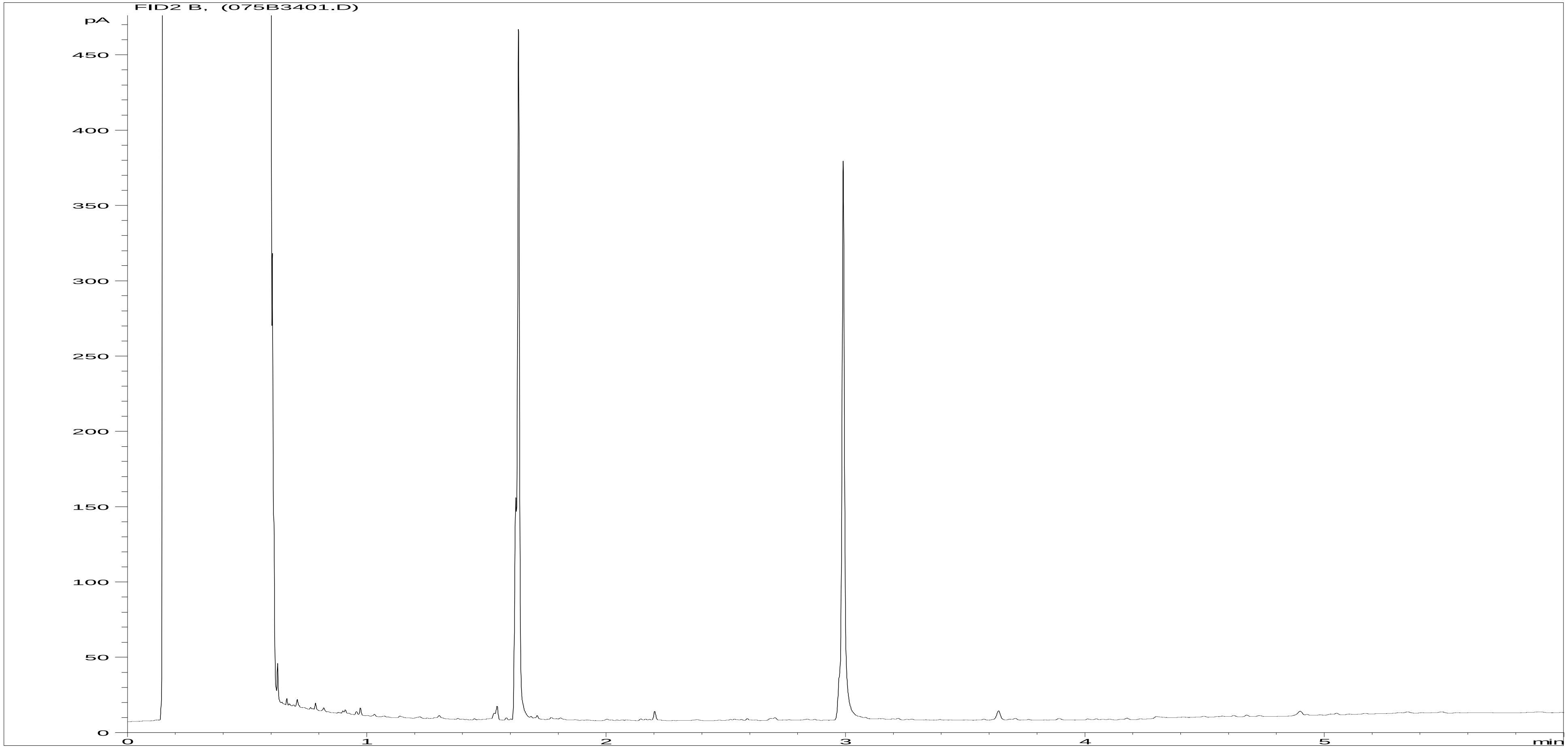
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573562ALI	**Job Number:**	S15_8776
Multiplier:	16.96	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS403 ES 2 1.25
Acquisition Date/Time:	30-Dec-15, 20:32:09		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\025F3401.D		

Where individual results are flagged see report notes for status.

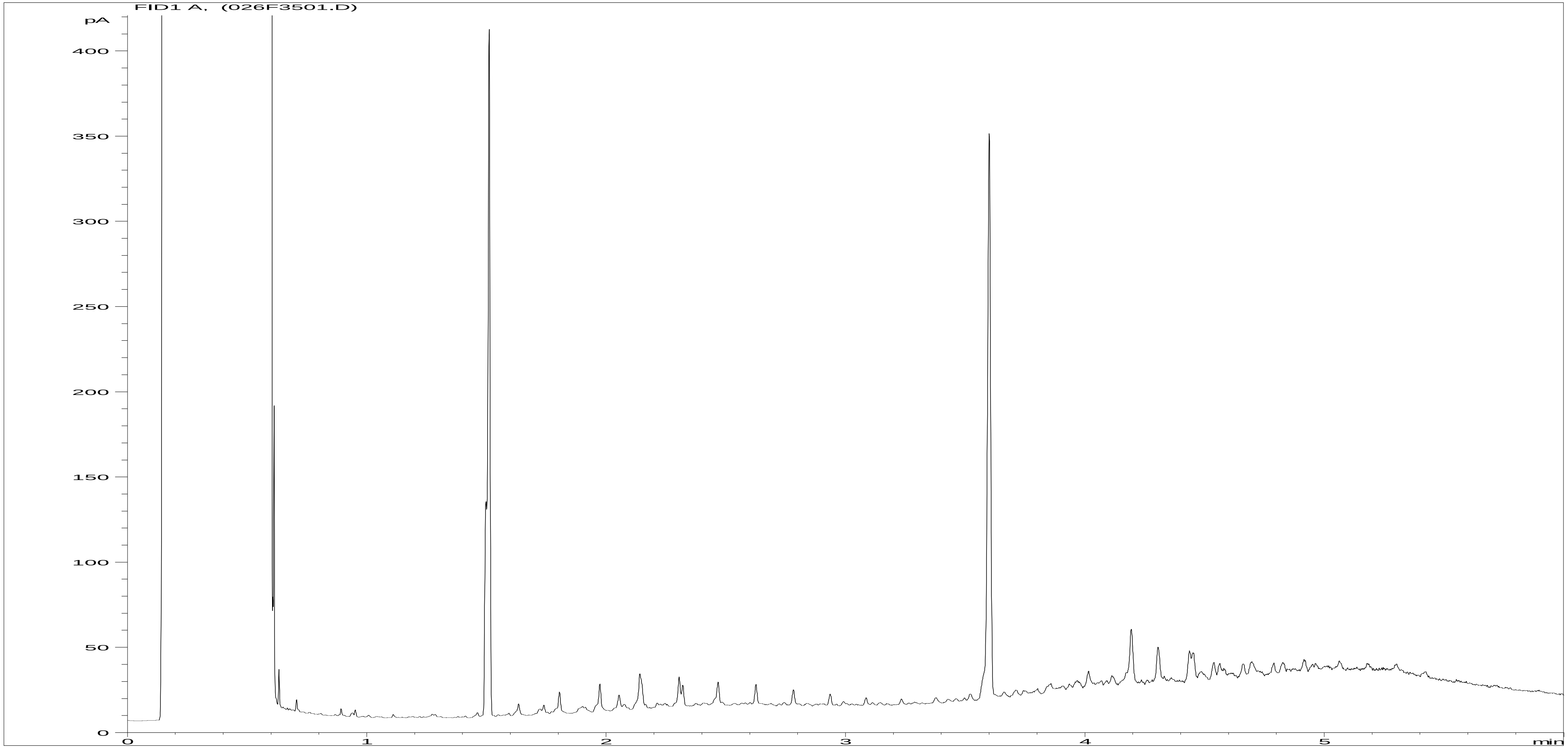
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573562ARO	**Job Number:**	S15_8776
Multiplier:	10.72	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS403 ES 2 1.25
Acquisition Date/Time:	30-Dec-15, 20:32:09		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\075B3401.D		

Where individual results are flagged see report notes for status.

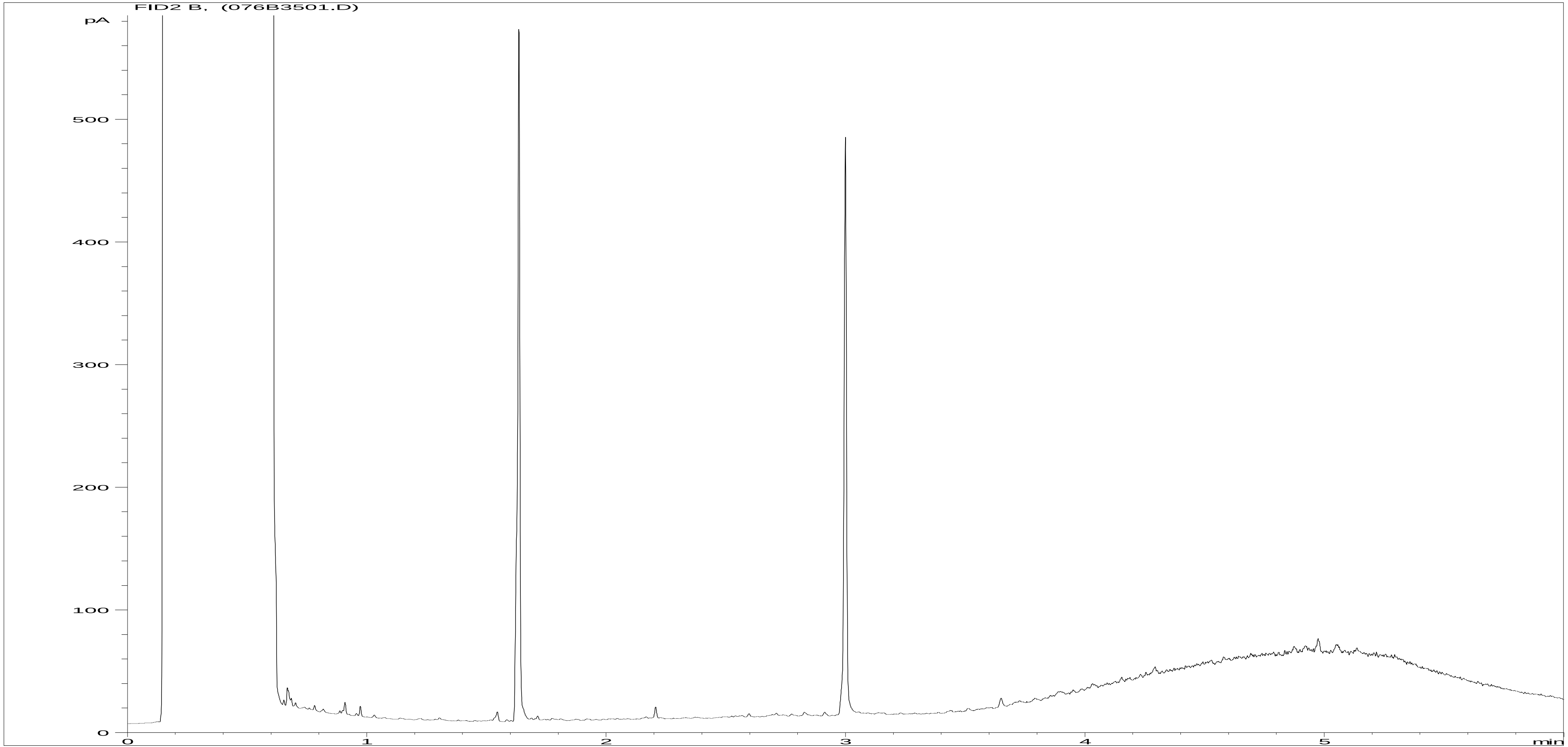
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573563ALI	**Job Number:**	S15_8776
Multiplier:	16.48	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS404 ES 1 0.10
Acquisition Date/Time:	30-Dec-15, 20:45:55		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\026F3501.D		

Where individual results are flagged see report notes for status.

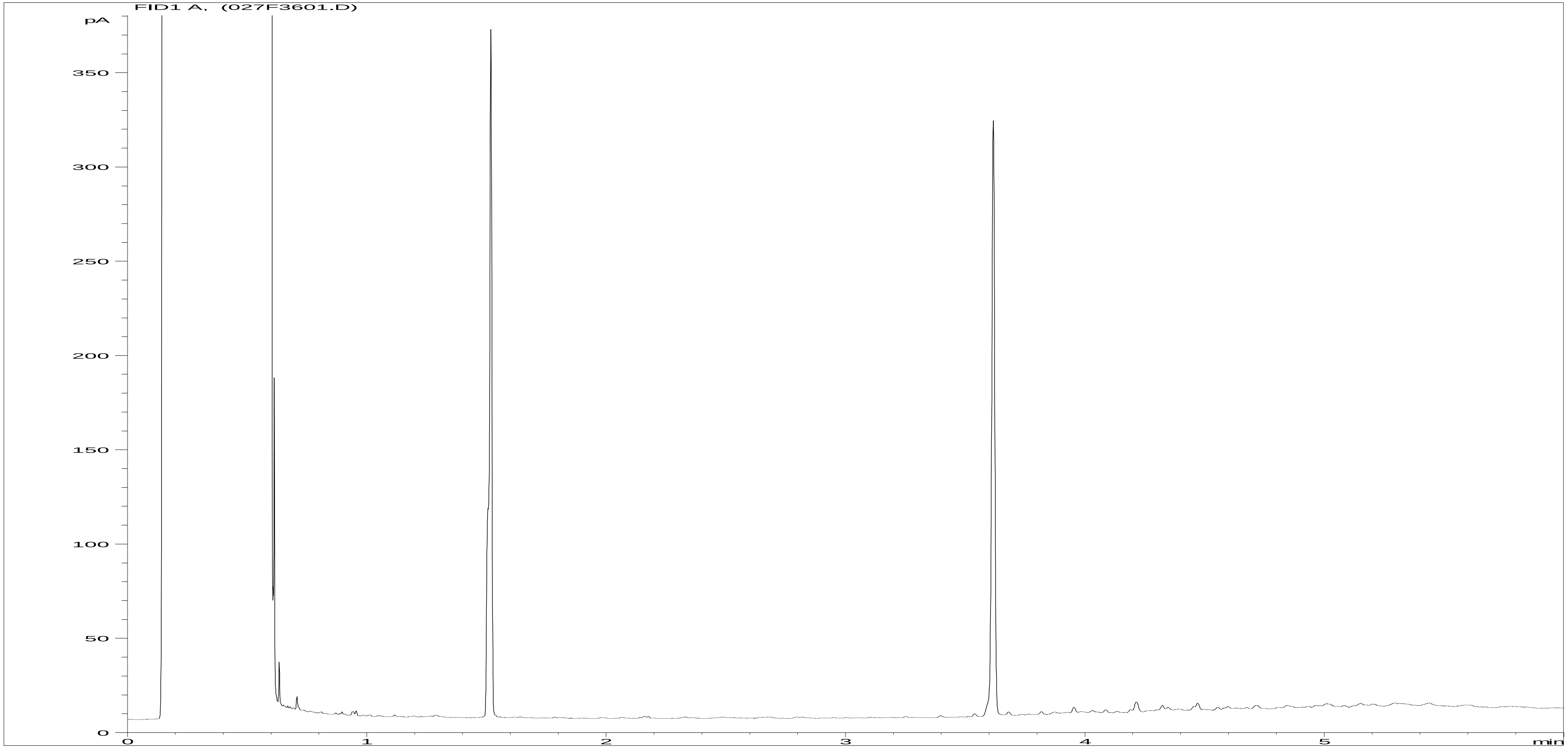
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573563ARO	**Job Number:**	S15_8776
Multiplier:	11.52	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS404 ES 1 0.10
Acquisition Date/Time:	30-Dec-15, 20:45:55		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\076B3501.D		

Where individual results are flagged see report notes for status.

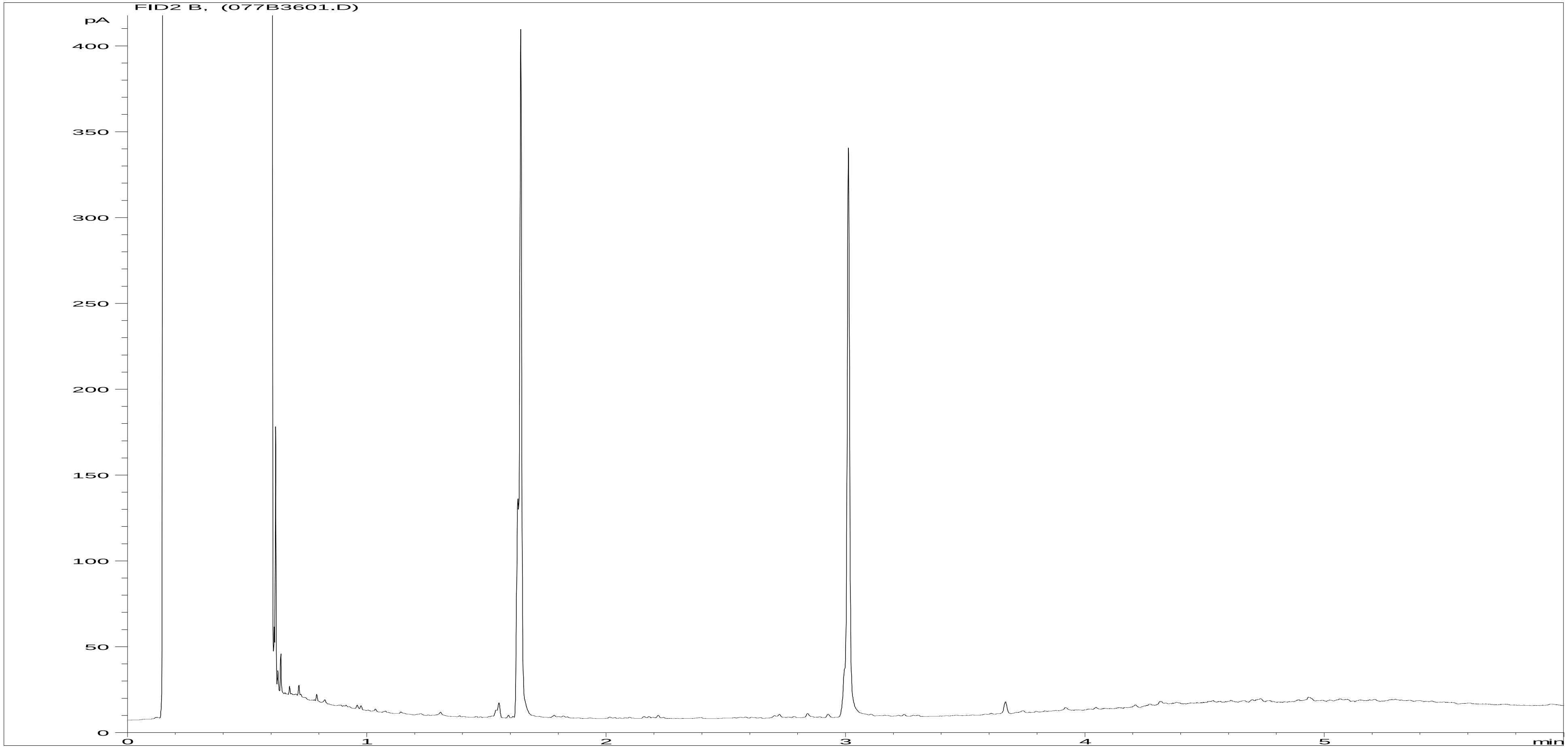
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	CL1573564ALI	**Job Number:**	S15_8776
Multiplier:	17.12	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS404 ES 2 1.10
Acquisition Date/Time:	30-Dec-15, 20:59:28		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\027F3601.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	CL1573564ARO	**Job Number:**	S15_8776
Multiplier:	10.56	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	WS404 ES 2 1.10
Acquisition Date/Time:	30-Dec-15, 20:59:28		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC4\123015 2015-12-30 12-56-11\077B3601.D		

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	223VOC.MS19\ Initial Calibration	**Matrix:**	Soil
Sample Details:	WS401 ES 1 0.30	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	CL1573558	**Date Analysed:**	24-Dec-15	**Multiplier:**	0.95
Job Number:	S15_8776	**Operator:**	TP	**Position:**	18

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8 **	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	7.11	6	M
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	96	Dibromofluoromethane	94
1,4-Difluorobenzene	4.35	99	Toluene-d8	96
Chlorobenzene-d5	5.46	86		
Bromofluorobenzene	5.86	73		
1,4-Dichlorobenzene-d4	6.26	56		
Naphthalene-d8	7.09	25		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	223VOC.MS19\ Initial Calibration	**Matrix:**	Soil
Sample Details:	WS401 ES 3 1.60	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	CL1573559	**Date Analysed:**	24-Dec-15	**Multiplier:**	1.03
Job Number:	S15_8776	**Operator:**	TP	**Position:**	19

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8 **	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	58	Dibromofluoromethane	107
1,4-Difluorobenzene	4.35	58	Toluene-d8	99
Chlorobenzene-d5	5.46	59		
Bromofluorobenzene	5.86	56		
1,4-Dichlorobenzene-d4	6.26	47		
Naphthalene-d8	7.09	24		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	223VOC.MS19\ Initial Calibration	**Matrix:**	Soil
Sample Details:	WS402 ES 1 0.10	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	CL1573560	**Date Analysed:**	24-Dec-15	**Multiplier:**	1.08
Job Number:	S15_8776	**Operator:**	TP	**Position:**	20

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	5.16	4	M
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8 **	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	92	Dibromofluoromethane	D
1,4-Difluorobenzene	4.35	94	Toluene-d8	100
Chlorobenzene-d5	5.46	89		
Bromofluorobenzene	5.86	77		
1,4-Dichlorobenzene-d4	6.26	67		
Naphthalene-d8	7.09	40		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	223VOC.MS19\	Initial Calibration	**Matrix:**	Soil
Sample Details:	WS402 ES 2 1.20	**Date Booked in:**	22-Dec-15		**Method:**	Headspace
LIMS ID Number:	CL1573561	**Date Analysed:**	24-Dec-15		**Multiplier:**	1.01
Job Number:	S15_8776	**Operator:**	TP		**Position:**	21

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8 **	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

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Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	78	Dibromofluoromethane	103
1,4-Difluorobenzene	4.35	78	Toluene-d8	97
Chlorobenzene-d5	5.46	74		
Bromofluorobenzene	5.86	65		
1,4-Dichlorobenzene-d4	6.26	51		
Naphthalene-d8	7.09	22		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	223VOC.MS19\ Initial Calibration	**Matrix:**	Soil
Sample Details:	WS403 ES 2 1.25	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	CL1573562	**Date Analysed:**	24-Dec-15	**Multiplier:**	1.02
Job Number:	S15_8776	**Operator:**	TP	**Position:**	22

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8 **	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	92	Dibromofluoromethane	100
1,4-Difluorobenzene	4.35	90	Toluene-d8	95
Chlorobenzene-d5	5.46	76		
Bromofluorobenzene	5.86	61		
1,4-Dichlorobenzene-d4	6.26	45		
Naphthalene-d8	7.09	16		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	223VOC.MS19\ Initial Calibration	**Matrix:**	Soil
Sample Details:	WS404 ES 1 0.10	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	CL1573563	**Date Analysed:**	24-Dec-15	**Multiplier:**	1.02
Job Number:	S15_8776	**Operator:**	TP	**Position:**	23

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8 **	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	92	Dibromofluoromethane	29
1,4-Difluorobenzene	4.35	97	Toluene-d8	95
Chlorobenzene-d5	5.46	88		
Bromofluorobenzene	5.86	78		
1,4-Dichlorobenzene-d4	6.26	67		
Naphthalene-d8	7.09	44		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: Yes

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	223VOC.MS19\	Initial Calibration	**Matrix:**	Soil
Sample Details:	WS404 ES 2 1.10	**Date Booked in:**	22-Dec-15		**Method:**	Headspace
LIMS ID Number:	CL1573564	**Date Analysed:**	24-Dec-15		**Multiplier:**	0.96
Job Number:	S15_8776	**Operator:**	TP		**Position:**	24

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8 **	-	< 1	-
Chloromethane	74-87-3 *	-	< 3	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 2	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-48 *	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
MTBE	1634-04-4	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6 **	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 3	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 2	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 4	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
o-Xylene	95-47-6	-	< 2	-
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 **	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8 *	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8 **	-	< 1	-
1,2,4-Trichlorobenzene	120-82-1 *	-	< 3	-
Hexachlorobutadiene	87-68-3 **	-	< 2	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 3	-

Compounds marked * are not MCERTS accredited
Compounds marked ** are not UKAS or Mcerts accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	4.01	60	Dibromofluoromethane	107
1,4-Difluorobenzene	4.35	57	Toluene-d8	97
Chlorobenzene-d5	5.46	53		
Bromofluorobenzene	5.86	46		
1,4-Dichlorobenzene-d4	6.26	38		
Naphthalene-d8	7.09	17		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

MSS
Marchwood Scientific Services

371 Millbrook Rd West
Southampton
SO15 0HW

Tel: 02380 786979

Name of Client : SG nvironmental Chemistry **Test Certificate No:** 116-17
Address : PO Box 100, Burton upon Trent, Staffordshire, D 15 0 D 0

ANALYSIS OF PCDDs and PCDFs

Job Reference: S158776
Sample Identifier : WS404 0.10, S1573563 **Date of Receipt :** 04 01 16
Sample No: 116-17 **Date of Analysis :** 14 01 16
Order No: B85551B C **Date of Report :** 14 01 16
Sample Type: Ash
Sample Condition : normal
Instrument : Micromass ltima NT **Test Method :** 2002
GC Column : DB5 **Blank :** 40116
Calibration File : 130116 **Sample Size :** 2.0

expressed as ng kg

Congener	Conc	DL	Rec %	Congener	Conc	DL	Rec %
2378-TCDF	0.127	0.118	78	**2378-TCDD**		0.137	76
12378-PCDF	0.319	0.147	82	**12378-PCDD**		0.162	83
23478-PCDF	0.211	0.132	87	**123478-HxCDD**	0.137	0.0588	85
123478-HxCDF	0.299	0.0588	91	**123678-HxCDD**	0.245	0.0637	86
123678-HxCDF	0.314	0.0539	91	**123789-HxCDD**	0.245	0.0588	
234678-HxCDF	0.23	0.0588	81	**1234678-HpCDD**	3.21	0.049	81
123789-HxCDF	0.191	0.0637	87	**OCDD**	16.4	0.172	55
1234678-HpCDF	2.17	0.0392	79				
1234789-HpCDF	0.211	0.0441	77				
OCDF	2.02	0.098					
Total 2,3,7,8-Furans	**6.09**			**Total 2,3,7,8-Dioxins**	**20.2**		
		TEQ[1]	**TEQ[2]**			**TEQ[1]**	**TEQ[2]**
TEQ (I-TEQ)		**0.593**	**0.375**	**TEQ (WHO)- Mammals**		**0.612**	**0.313**
				TEQ (WHO)- Fish		**0.631**	**0.332**
				TEQ (WHO)- Birds		**0.834**	**0.535**

*****	Isomer Not detected	Concentration of Non Detected Congeners at Detection Limit	**TEQ[1]**
TEQ	Toxic quivalent Value	Concentration of Non Detected Congeners at ero	**TEQ[2]**
TEF	Toxic quivalent Factor		
Conc	Concentration		
DL	Detection Value		

UKAS TESTING
1668

Reported by : Pettit Signature : [redacted]
Position : Technical Manager

MSS
Marchwood Scientific Services

371 Millbrook Rd West
Southampton
SO15 0HW

Tel: 02380 786979

Name of Client : SG nvironmental Chemistry **Test Certificate No:** 116-18
Address : PO Box 100, Burton upon Trent, Staffordshire, D 15 0 D
0

ANALYSIS OF PCBs

Sample Identifier :	WS404 0.10, S1573563	**Date of Receipt :**	04 01 16
Sample No:	116-18	**Date of Analysis :**	14 01 16
Order No:	B85551B C	**Date of Report :**	14 01 16
Sample Type:	Ash		
Sample Condition :	normal		
Instrument :	Micromass ltima NT	**Test Method :**	2002
GC Column :	DB5	**Blank :**	40116
Calibration File :	120116	**Sample Size :**	2.0

expressed as ng kg

Congener	Conc	DL	Rec %
PCB-81	0.221	0.132	100
PCB-77	3.3	0.127	110
PCB-123	0.608	0.147	85
PCB-118	33.1	0.147	85
PCB-114	0.946	0.147	86
PCB-105	14.2	0.172	81
PCB-126	0.299	0.172	90
PCB-167	2.17	0.103	86
PCB-156	5.4	0.098	83
PCB-157	1.19	0.0931	88
PCB-169	0.191	0.0833	95
PCB-189	1.01	0.221	87

	TEQ[1]	TEQ[2]
TEQ (WHO)- Mammals	**0.0378**	**0.0378**
TEQ (WHO)- Fish	**0.0022**	**0.0022**
TEQ (WHO)- Birds	**0.22**	**0.22**

*	Isomer Not detected	**TEQ1**	Concentration of Non Detected Congeners at Detection Limit
TEQ	Toxic quivalent Value		
TEF	Toxic quivalent Factor	**TEQ2**	Concentration of Non Detected Congeners at ero
Conc	Concentration		
DL	Detection Value		

UKAS TESTING
668

Reported by : Pettit **Signature :** [redacted]
Position : Technical Manager

ESG	ASBESTOS ANALYSIS RESULTS - SOIL ANALYSIS	UKAS TESTING 1089	Detection limit of Method SCI-ASB-020 is 0.001%
	ESG Asbestos Limited Certificate of Analysis for Asbestos in Soils		Sampling has been carried out by a third party
Client:	ESG Environmental Chemistry	**Page 1 of 1**	
Address:	Etwall House, Bretby Business Park, Ashby Road, Burton upon Trent	**Report No:**	**ANO-0488-11696**
For the attention of:	ESG Doncaster	**Report Date:**	**31/12/2015**
Site Address:	A63 Castle Street	**Project Number:**	**S158776**

Sample Number	Sample Date	Sample Location	Test Date	Total Sample Dry Weight (g)	Weight of <2mm Fraction (g)	Asbestos(g) in >8mm+>2mm	Asbestos(g) in <2mm	% Asbestos by weight of Total Dried Sample	Asbestos Fibre Types Identified
CL/1573558	18/12/15	WS401 0.30	31/12/2015					Screen Only	NAIIS
CL/1573559	18/12/15	WS401 1.60	31/12/2015					Screen Only	NAIIS
CL/1573560	18/12/15	WS402 0.10	31/12/2015					Screen Only	NAIIS
CL/1573561	18/12/15	WS402 1.20	31/12/2015					Screen Only	NAIIS
CL/1573562	18/12/15	WS403 1.25	31/12/2015					Screen Only	NAIIS
CL/1573563	18/12/15	WS404 0.10	31/12/2015					Screen Only	NAIIS
CL/1573564	18/12/15	WS404 1.10	31/12/2015					Screen Only	NAIIS

Keys			Name:	Stacey Innes	Authorised Signatory:
Keys	**NAACR = Not Analysed at Clients Request**	**NAIIS = No Asbestos Identified in Sample (Screens Only)**	Name:	Stacey Innes	Authorised Signatory:
	*** visible to naked eye**	**NADIS = No Asbestos Detected in Sample (ID & Quant Only)**	Position:	Lab Analyst	

The sample analysis for the above results was carried out using the procedures detailed in ESG Asbestos Limited in house method (SCI-ASB-020) based on HSE document MDHS 90 - Asbestos Contaminated Land - Draft 5 - November 1997 (withdrawn). Fibre identification was carried out using ESG Asbestos Limited in house method of transmitted/polarised light microscopy and centre stop dispersion staining (SCI-ASB-007), based on HSE's HSG 248. The analysis of fine fraction for asbestos content only includes fibres and does not discriminate non-asbestos fibres. All fibres are assumed, unless specified, to be amphiboles. All tests were carried out at ESG Asbestos Laboratory, Ashbourne House, Bretby Business Park, Ashby Road, Burton-upon-Trent, Staffordshire. DE15 0XD, UKAS Laboratory Number 1089.

Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158776

Consignment No S52596
Date Logged 22-Dec-2015

Report Due 31-Dec-2015

		MethodID	CEN Leachate			CustServ	GROHSA	ICPBOR	ICPMSS													ICPSOIL	KONECR	PAHMSUS	PCBUSECDAR	PHEHPLC	PHSOIL
ID Number	**Description**	**Sampled**	**CEN Leac(P)C**	**Fraction of non-crushable material %**	**Fraction of sample above 4 mm %**	**REPORT A**	**GRO (AA) by HSA GC-FID**	**Boron (H20 Soluble)**	**Antimony (MS)**	**Arsenic (MS)**	**Cadmium (MS)**	**Chromium (MS)**	**Copper (MS)**	**Lead (MS)**	**Manganese (MS)**	**Mercury (MS)**	**Molybdenum (MS)**	**Nickel (MS)**	**Selenium (MS)**	**Vanadium (MS)**	**Zinc (MS)**	**Beryllium.**	**Chromium vi:**	**PAH (16) by GCMS**	**PCB-12 Congeners Analysis**	**Phenol - HPLC**	**pH units (AR)**
							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓
CL/1573558	WS401 0.30	18/12/15																									
CL/1573559	WS401 1.60	18/12/15																									
CL/1573560	WS402 0.10	18/12/15																									
CL/1573561	WS402 1.20	18/12/15																									
CL/1573562	WS403 1.25	18/12/15																									
CL/1573563	WS404 0.10	18/12/15																									
CL/1573564	WS404 1.10	18/12/15																									

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

Customer ESG Doncaster
Site A63 Castle Street
Report No S158776

Consignment No S52596
Date Logged 22-Dec-2015

Report Due 31-Dec-2015

ID Number	Description	Sampled	SFAPI		Sub002a	Sub030		SVOCMSUS	TPHUSSI	VOCHSAS			WSLM59
			Cyanide(Total) (AR)	Phenol Index.(AR)	^Asbestos Screen	^Dioxins & Furans MW	^Dioxins like PCBs	SVOC by GCMS (AR)	TPH by GCFID (AR/Si)	BTEX-HSA GCMS analysis	VOC HSA-GCMS	Ethyl Benzene (µg/kg)	Total Organic Carbon
			✓	✓	✓			✓	✓	✓	✓	✓	
CL/1573558	WS401 0.30	18/12/15											
CL/1573559	WS401 1.60	18/12/15											
CL/1573560	WS402 0.10	18/12/15											
CL/1573561	WS402 1.20	18/12/15											
CL/1573562	WS403 1.25	18/12/15											
CL/1573563	WS404 0.10	18/12/15											
CL/1573564	WS404 1.10	18/12/15											

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
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C	Headspace present in the sample container
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E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
VOCHSAS	CL1573558 to CL1573564	The Primary process control result associated with this Test has not wholly met the requirements of the Laboratory Quality Management System (QMS). The Laboratory believes that the validity of the data has not been affected but in line with our QMS policy we have removed accreditation from the affected analytes (1,2-Dibromo-3-chloropropane). These circumstances should be taken into consideration when utilising the data.
VOCHSAS	CL1573562 CL153564	Due to matrix interference, the Internal Standard recovery for this Test is below the required QMS specification. This has been confirmed by historical data. All other Laboratory Process Controls meet the requirements of the QMS. These circumstances should be taken into consideration when utilising the data

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	CEN Leachate	As Received	Determination of Oversize and Inert Material Content prior to leaching sample
Soil	GROHSA	As Received	Determination of Total Gasoline Range Organics Hydrocarbons (GRO) by Headspace GCFID
Soil	ICPBOR	Oven Dried @ < 35°C	Determination of Boron in soil samples by hot water extraction followed by ICPOES detection
Soil	ICPMSS	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPMS
Soil	ICPSOIL	Oven Dried @ < 35°C	Determination of Metals in soil samples by aqua regia digestion followed by ICPOES detection
Soil	KONECR	Oven Dried @ < 35°C	Determination of Chromium vi in soil samples by water extraction followed by colorimetric detection
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PCBUSECDAR	As Received	Determination of Polychlorinated Biphenyl (PCB) congeners/aroclors by hexane/acetone extraction followed by GCECD detection
Soil	PHEHPLC	As Received	Determination of Phenols by methanol extraction followed by HPLC detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Soil	SubCon*	*	Contact Laboratory for details of the methodology used by the sub-contractor.
Soil	SVOCMSUS	As Received	Determination of Semi Volatile Organic Compounds in soil samples by Dichloromethane/Acetone extraction followed by GCMS detection
Soil	TPHUSSI	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection including quantitation of Aromatic and Aliphatic fractions.
Soil	VOCHSAS	As Received	Determination of Volatile Organic Compounds (VOC) by Headspace GCMS
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster

Site : A63 Castle Street

Report Number : S15_8776

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1573558	WS401 ES 1 0.30	STONE
CL/1573559	WS401 ES 3 1.60	MADE GROUND
CL/1573560	WS402 ES 1 0.10	MADE GROUND
CL/1573561	WS402 ES 2 1.20	CLAY
CL/1573562	WS403 ES 2 1.25	CLAY
CL/1573563	WS404 ES 1 0.10	STONE
CL/1573564	WS404 ES 2 1.10	CLAY

TEST REPORT

1252

Report No. EFS/160146 (Ver. 1)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 2 samples described in this report were registered for analysis by ESG on 11-Jan-2016. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 15-Jan-2016

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Table of PAH (MS-SIM) (80) Results (Pages 3 to 4)
Table of PCB Congener Results (Page 5)
GC-FID Chromatograms (Pages 6 to 7)
Table of WAC Analysis Results (Pages 8 to 9)
Analytical and Deviating Sample Overview (Page 10)
Table of Method Descriptions (Page 11)
Table of Report Notes (Page 12)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 15-Jan-2016

Tests marked '^' have been subcontracted to another laboratory.
Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	%	mg/kg	mg/kg	µg/kg	% M/M	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg			
		Method Codes :	TMSS	TPHFIDUS	TPHFIDUS	PCBUSECDAR	WSLM59	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	PAHMSUS			
		Method Reporting Limits :	0.2	10	10		0.04	10	10	10	30	20	20	10				
		UKAS Accredited :	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes			
LAB ID Number CL/	Client Sample Description	Sample Date	Tot.Moisture @ 105C	TPH Band (>C10-C40)	TPH by GCFID (AR)	PCB-7 Congeners Analysis	Total Organic Carbon	Benzene	Toluene	Ethyl Benzene	Xylenes	MTBE	m/p Xylenes	o Xylene	PAH (17) by GCMS			
1600681	Trench N5 Wac 1 D 0.90	06-Jan-16	11.4	192	193	Req	1.50	<10	<10	<10	<30	<20	<20	<10	Req			
1600682	Trench N2 Wac 2 D 1.00	07-Jan-16	20.8	416	417	Req	3.40	<10	<10	<10	<30	<20	<20	<10	Req			

ESG

Bretby Business Park, Ashby Road
Burton-on-Trent, Staffordshire, DE15 0YZ
Tel +44 (0) 1283 554400
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Client Name **ESG Doncaster**

Contact Mr N Cooke

A63 Castle Street

Sample Analysis

Date Printed	**15-Jan-2016**
Report Number	**EFS/160146**
Table Number	**1**

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	Trench N5 Wac 1 D 0.90	**Job Number:**	S16_0146
LIMS ID Number:	CL1600681	**Date Booked in:**	11-Jan-16
QC Batch Number:	160020	**Date Extracted:**	12-Jan-16
Quantitation File:	Initial Calibration	**Date Analysed:**	13-Jan-16
Directory:	316MS17.PAH\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	6.01	0.32	98
Anthracene	120-12-7	6.06	0.09	100
Fluoranthene	206-44-0	7.39	0.59	92
Pyrene	129-00-0	7.69	0.50	92
Benzo[a]anthracene	56-55-3	9.40	0.30	96
Chrysene	218-01-9	9.45	0.34	97
Benzo[b]fluoranthene	205-99-2	10.94	0.44	98
Benzo[k]fluoranthene	207-08-9	10.97	0.17	97
Benzo[a]pyrene	50-32-8	11.37	0.36	97
Indeno[1,2,3-cd]pyrene	193-39-5	12.76	0.30	97
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	13.10	0.31	94
Coronene	191-07-1 *	15.50	0.08	95
Total (USEPA16) PAHs	-	-	< 4.12	-

* Denotes compound is not UKAS accredited

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	88
Acenaphthene-d10	87
Phenanthrene-d10	88
Chrysene-d12	95
Perylene-d12	102

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	109
Terphenyl-d14	79

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	Trench N2 Wac 2 D 1.00	**Job Number:**	S16_0146
LIMS ID Number:	CL1600682	**Date Booked in:**	11-Jan-16
QC Batch Number:	160020	**Date Extracted:**	12-Jan-16
Quantitation File:	Initial Calibration	**Date Analysed:**	13-Jan-16
Directory:	316MS17.PAH\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	6.01	0.46	98
Anthracene	120-12-7	6.06	0.13	94
Fluoranthene	206-44-0	7.39	0.77	92
Pyrene	129-00-0	7.69	0.75	88
Benzo[a]anthracene	56-55-3	9.39	0.38	96
Chrysene	218-01-9	9.44	0.42	98
Benzo[b]fluoranthene	205-99-2	10.94	0.55	98
Benzo[k]fluoranthene	207-08-9	10.97	0.19	98
Benzo[a]pyrene	50-32-8	11.37	0.43	97
Indeno[1,2,3-cd]pyrene	193-39-5	12.77	0.36	98
Dibenzo[a,h]anthracene	53-70-3	12.79	0.10	94
Benzo[g,h,i]perylene	191-24-2	13.10	0.37	90
Coronene	191-07-1 *	15.50	0.09	91
Total (USEPA16) PAHs	-	-	< 5.23	-

* Denotes compound is not UKAS accredited
"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	84
Acenaphthene-d10	84
Phenanthrene-d10	85
Chrysene-d12	92
Perylene-d12	99

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	124
Terphenyl-d14	87

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Polychlorinated Biphenyls (congeners)

Customer and Site Details: ESG Doncaster: A63 Castle Street
Job Number: S16_0146
QC Batch Number: 160020
Directory: 0113PCB.GC8
Method: Ultrasonic

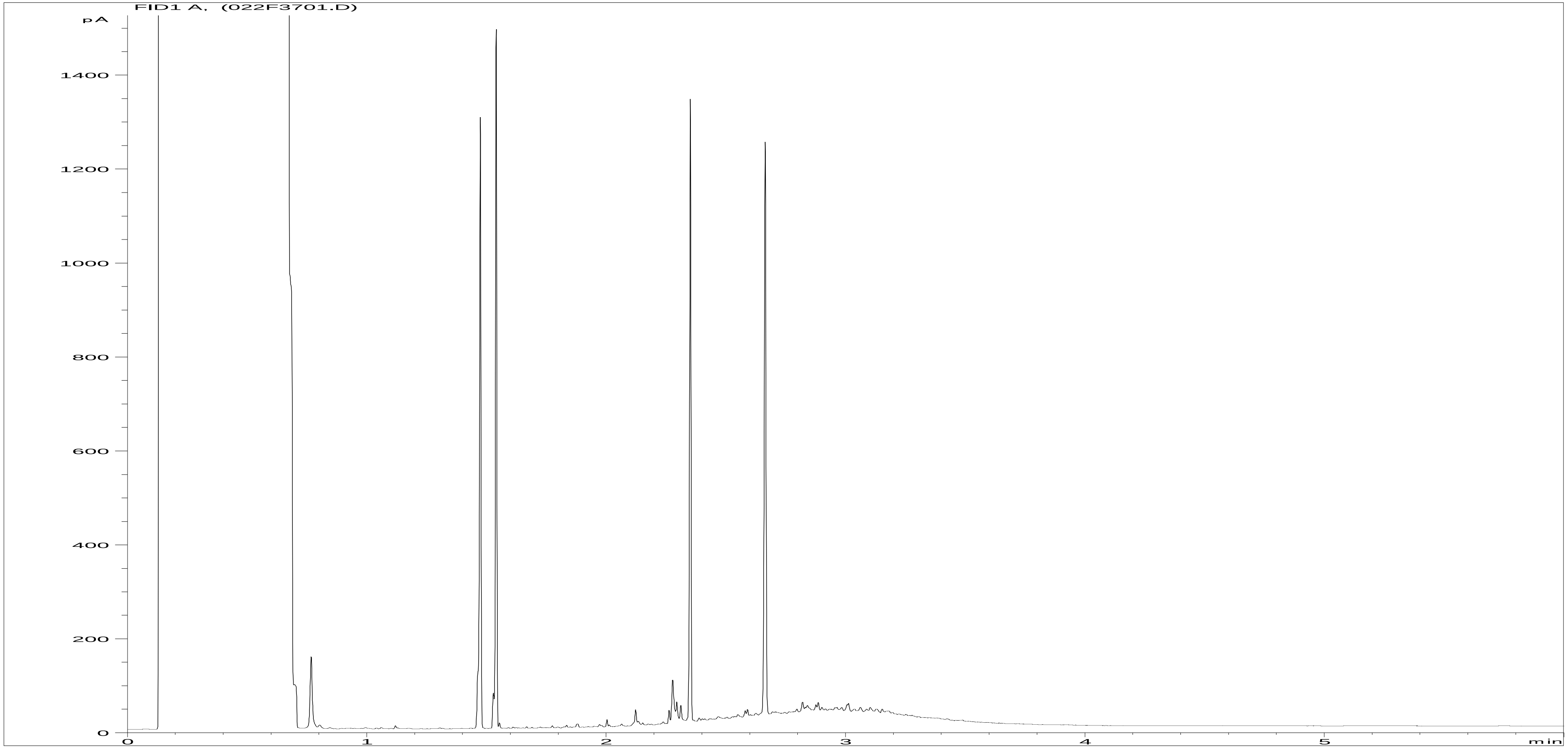
Matrix: SOIL
Date Booked in: 11-Jan-16
Date Extracted: 12-Jan-16
Date Analysed: 14-Jan-16

*** This sample data is not UKAS accredited.**

		Concentration, (µg/kg)						
Sample ID	**Customer ID**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB153**	**PCB138**	**PCB180**
* CL1600681	Trench N5 Wac 1 D 0.90	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
* CL1600682	Trench N2 Wac 2 D 1.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Where individual results are flagged see report notes for status.

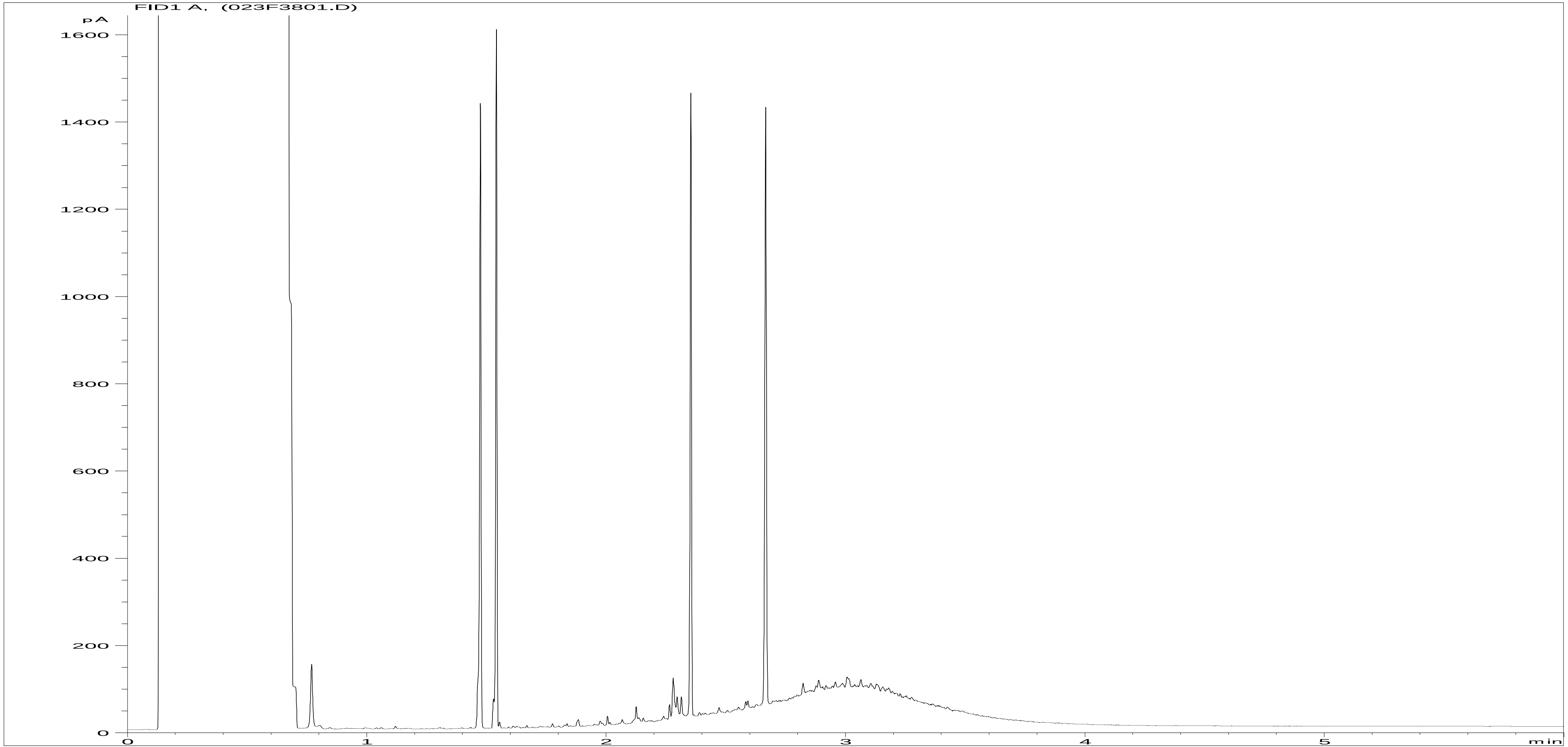
Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1600681	**Job Number:**	S16_0146
Multiplier:	8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	Trench N5 Wac 1 D 0.90
Acquisition Date/Time:	12-Jan-16, 19:00:30		
Datafile:	D:\TES\DATA\Y2016\011216TPH_GC3\011216 2016-01-12 10-58-44\022F3701.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1600682	**Job Number:**	S16_0146
Multiplier:	8	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	Trench N2 Wac 2 D 1.00
Acquisition Date/Time:	12-Jan-16, 19:13:40		
Datafile:	D:\TES\DATA\Y2016\011216TPH_GC3\011216 2016-01-12 10-58-44\023F3801.D		

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING

Client	ESG Doncaster				**Leaching Data**	
					Weight of sample (kg)	0.265
Contact	Mr N Cooke				Moisture content @ 105°C (% of Wet Weight)	11.4
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	A63 Castle Street				Volume of water required to carry out 2:1 stage (litres)	0.410
					Fraction of sample above 4 mm %	39.100
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
Trench N5 Wac 1 D 0.90		s16_0146	CL/1600681	15-Jan-16	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	1.5	3	5	6
	LOI450	Loss on Ignition (%)				10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.06	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	217	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<4.7	100		
	PHSOIL	pH (pH units)			>6	
	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7			To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8.2	8.5	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	349	136					
U	ICPMSW	Arsenic	0.013	0.016	0.026	0.16	0.5	2	25
U	ICPWATVAR	Barium	0.1	0.21	0.2	2	20	100	300
U	ICPMSW	Cadmium	0.0003	0.0005	0.0006	0.005	0.04	1	5
U	ICPMSW	Chromium	0.005	0.007	0.01	0.07	0.5	10	70
U	ICPMSW	Copper	0.041	0.05	0.082	0.49	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.011	0.003	0.022	0.04	0.5	10	30
U	ICPMSW	Nickel	0.004	0.006	0.008	0.06	0.4	10	40
U	ICPMSW	Lead	0.155	0.183	0.31	1.79	0.5	10	50
U	ICPMSW	Antimony	0.005	0.003	0.01	0.03	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	0.103	0.194	0.206	1.82	4	50	200
U	KONENS	Chloride	24	11	48	127	800	15000	25000
U	ISEF	Fluoride	0.8	0.4	1.6	5	10	150	500
U	ICPWATVAR	Sulphate as SO4	28	5	56	81	1000	20000	50000
N	WSLM27	Total Dissolved Solids	272	106	544	1281	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	21	16	42	167	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING

					Leaching Data	
Client	ESG Doncaster				Weight of sample (kg)	0.281
					Moisture content @ 105°C (% of Wet Weight)	20.8
Contact	Mr N Cooke				Equivalent Weight based on drying at 105°C (kg)	0.225
					Volume of water required to carry out 2:1 stage (litres)	0.394
Site	A63 Castle Street				Fraction of sample above 4 mm %	51.700
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
Trench N2 Wac 2 D 1.00		s16_0146	CL/1600682	15-Jan-16	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	3.51	3	5	6
	LOI450	Loss on Ignition (%)				10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.07	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	525	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<6.72	100		
	PHSOIL	pH (pH units)			>6	
	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7			To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8.2	8.4	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	459	163					
U	ICPMSW	Arsenic	0.004	0.01	0.008	0.09	0.5	2	25
U	ICPWATVAR	Barium	0.07	0.17	0.14	1.6	20	100	300
U	ICPMSW	Cadmium	0.0002	0.0006	0.0004	0.005	0.04	1	5
U	ICPMSW	Chromium	0.004	0.006	0.008	0.06	0.5	10	70
U	ICPMSW	Copper	0.015	0.03	0.03	0.28	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.009	0.003	0.018	0.04	0.5	10	30
U	ICPMSW	Nickel	0.002	0.005	0.004	0.05	0.4	10	40
U	ICPMSW	Lead	0.047	0.26	0.094	2.32	0.5	10	50
U	ICPMSW	Antimony	0.003	0.002	0.006	0.02	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	0.129	0.854	0.258	7.57	4	50	200
U	KONENS	Chloride	34	11	68	141	800	15000	25000
U	ISEF	Fluoride	1.1	0.7	2.2	8	10	150	500
U	ICPWATVAR	Sulphate as SO4	27	8	54	105	1000	20000	50000
N	WSLM27	Total Dissolved Solids	358	127	716	1578	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	17	17	34	170	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

Analytical and Deviating Sample Overview

Customer	**ESG Doncaster**	Consignment No S52796
Site	**A63 Castle Street**	Date Logged 11-Jan-2016
Report No	**S160146**	
		Report Due 18-Jan-2016

		MethodID	BTEXHSA		CEN Leachate		CustServ	PAHMSUS	PCBUSECDAR	TMSS	TPHFIDUS		WSLM59
ID Number	**Description**	**Sampled**	**BTEX-HSA + MTBE analysis**	**MTBE (µg/kg)**	**CEN Leac(P)1**	**CEN Leac(P)2**	**REPORT A**	**PAH (17) by GCMS**	**PCB-7 Congeners Analysis**	**Tot.Moisture @ 105C**	**TPH Band (>C10-C40)**	**TPH by GCFID (AR)**	**Total Organic Carbon**
			✓					✓		✓	✓	✓	
CL/1600681	Trench N5 Wac 1 0.90	06/01/16											
CL/1600682	Trench N2 Wac 2 1.00	07/01/16											

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	BTEXHSA	As Received	Determination of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) by Headspace GCFID
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PCBUSECDAR	As Received	Determination of Polychlorinated Biphenyl (PCB) congeners/aroclors by hexane/acetone extraction followed by GCECD detection
Soil	TMSS	As Received	Determination of the Total Moisture content at 105ºC by loss on oven drying gravimetric analysis (% based upon wet weight)
Soil	TPHFIDUS	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection.
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection
Water	ICPMSW	As Received	Direct quantitative determination of Metals in water samples using ICPMS
Water	ICPWATVAR	As Received	Direct determination of Metals and Sulphate in water samples using ICPOES
Water	ISEF	As Received	Determination of Fluoride in water samples by Ion Selective Electrode (ISE)
Water	KONENS	As Received	Direct analysis using discrete colorimetric analysis
Water	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Water	WSLM13	As Received	Instrumental analysis using acid/persulphate digestion and non-dispersive IR detection
Water	WSLM2	As Received	Determination of the Electrical Conductivity (µS/cm) by electrical conductivity probe.
Water	WSLM27	As Received	Gravimetric Determination
Water	WSLM3	As Received	Determination of the pH of water samples by pH probe

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile **TR** Denotes Tremolite
CR Denotes Crocidolite **AC** Denotes Actinolite
AM Denotes Amosite **AN** Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined **N.Det** Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : S16_0146

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1600681	Trench N5 Wac 1 D 0.90	Brown MADE GROUND
CL/1600682	Trench N2 Wac 2 D 1.00	Brown Stone SILT

TEST REPORT

1252

Report No. EXR/211674 (Ver. 1)

ESG Doncaster
ESG Doncaster
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Site: A63 Castle Street

The 3 samples described in this report were registered for analysis by ESG on 22-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 31-Dec-2015

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

Table 1 Main Analysis Results (Pages 2 to 4)
Table of PAH (MS-SIM) (10) Results (Pages 5 to 7)
Table of SVOC Results (Pages 8 to 10)
Table of GRO Results (Page 11)
Table of TPH (Si) banding (0.01) (Page 12)
GC-FID Chromatograms (Pages 13 to 18)
Table of VOC (HSA) Results (Pages 19 to 21)
Analytical and Deviating Sample Overview (Pages 22 to 23)
Table of Additional Report Notes (Page 24)
Table of Method Descriptions (Page 25)
Table of Report Notes (Page 26)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of
ESG : [redacted]
Declan Burns Managing Director
Multi-Sector Services

Date of Issue: 31-Dec-2015

Tests marked '^' have been subcontracted to another laboratory.
Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

LAB ID Number EX/	Client Sample Description	Sample Date	pH units w	Total Hardness as CaCO3	Chloride as Cl w	VOC HSA-GCMS o	Calcium as Ca (Dissolved) a	Magnesium as Mg (Dissolved) a	Nickel as Ni (Dissolved)	Chromium as Cr (Dissolved)	Cadmium as Cd (Dissolved)	PAH GC-MS (16) o	Copper as Cu (Dissolved)	Lead as Pb (Dissolved)	Zinc as Zn (Dissolved)	Arsenic as As (Dissolved)	Mercury as Hg (Dissolved)	Selenium as Se (Dissolved)
		Units :	pH units	mg/l	mg/l	µg/l	mg/l	mg/l	mg/l	mg/l	mg/l	µg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
		Method Codes :	WSLM3	Calc_HD	KONENS	VOCHSAW	ICPWATVAR	ICPWATVAR	ICPMSW	ICPMSW	ICPMSW	PAHMSW	ICPMSW	ICPMSW	ICPMSW	ICPMSW	ICPMSW	ICPMSW
		Method Reporting Limits :		7	1	1	1	1	0.001	0.001	0.0001		0.001	0.001	0.002	0.001	0.0001	0.001
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1649668	WS401 ES 3 1.60	22-Dec-15	7.7	78	10	Req §	23	5	0.005	0.006	<0.0001	Req §	0.024	0.075	0.041	0.006	<0.0001	<0.001
1649669	WS402 ES 1 0.10	22-Dec-15	11.9	<484	60	Req §	192	<1	0.003	0.02	0.0001	Req §	0.041	0.046	0.052	0.002	<0.0001	<0.001
1649670	WS404 ES 2 1.10	22-Dec-15	7.5	130	98	Req §	42	6	0.036	0.017	0.0008	Req §	0.201	0.42	0.349	0.031	<0.0001	0.003

ESG

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

Tel +44 (0) 1283 554400

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Client Name	**ESG Doncaster**
Contact	Mr N Cooke

A63 Castle Street

CEN Leachate 10:1

Date Printed	**31-Dec-2015**
Report Number	**EXR/211674**
Table Number	**1**

Where individual results are flagged see report notes for status.

		Units :	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
		Method Codes :	ICPMSW	ICPMSW	KONENS	KONENS	SFAPI	SFAPI	TPHFID-Si	ICPWATVAR	GROHSA	SVOCSW	VOCHSAW	VOCHSAW	VOCHSAW	VOCHSAW	VOCHSAW	VOCHSAW
		Method Reporting Limits :	0.001	0.001	0.01	0.01	0.02	0.05	0.01	0.01	0.1	0.002	1	1	1	2	1	1
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number EX/	**Client Sample Description**	**Sample Date**	**Vanadium as V (Dissolved)**	**Antimony as Sb (Dissolved)**	**Ammoniacal Nitrogen as N**	**Chromium VI as Cr**	**Cyanide (Total) as CN**	**Phenol Index as C6H5OH**	**TPH by GC(Si) o**	**Beryllium as Be (Dissolved) a**	**GRO-HSA (AA)**	**Semi Volatile Organic Compounds**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylenes**	**m/p Xylenes**	**o Xylene**
1649668	WS401 ES 3 1.60	22-Dec-15	0.013	0.002	0.02	<0.01	<0.02	<0.05	Req	<0.01	Req	Req	<1 §	<1 §	<1 §	<2 §	<1 §	<1 §
1649669	WS402 ES 1 0.10	22-Dec-15	0.005	0.001	0.08	0.01	<0.02	<0.05	Req	<0.01	Req	Req	<1 §	<1 §	<1 §	<2 §	<1 §	<1 §
1649670	WS404 ES 2 1.10	22-Dec-15	0.107	0.004	1.9	0.05	<0.02	<0.05	Req	<0.01	Req	Req	<1 §	<1 §	<1 §	<2 §	<1 §	<1 §

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Client Name	**ESG Doncaster**	**CEN Leachate 10:1**	
Contact	Mr N Cooke		
A63 Castle Street		**Date Printed**	**31-Dec-2015**
		Report Number	**EXR/211674**
		Table Number	**1**

Where individual results are flagged see report notes for status.

		Units :	mg/l	mg/l	mg/l	mg/l
		Method Codes :	PHEHPLCVL	PHEHPLCVL	PHEHPLCVL	PHEHPLCVL
		Method Reporting Limits :	0.0005	0.0005	0.0005	0.0005
		UKAS Accredited :	No	No	No	No
LAB ID Number EX/	Client Sample Description	Sample Date	Phenol	Cresols	Dimethylphenols	Trimethylphenols
1649668	WS401 ES 3 1.60	22-Dec-15	<0.0005	<0.0005	<0.0005	<0.0005
1649669	WS402 ES 1 0.10	22-Dec-15	0.0133	0.0007	<0.0005	<0.0005
1649670	WS404 ES 2 1.10	22-Dec-15				

Client Name	**ESG Doncaster**	**CEN Leachate 10:1**	
Contact	Mr N Cooke		
A63 Castle Street		**Date Printed**	**31-Dec-2015**
		Report Number	**EXR/211674**
		Table Number	**1**

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Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS401 ES 3 1.60	**Job Number:**	W21_1674
LIMS ID Number:	EX1649668	**Date Booked in:**	22-Dec-15
QC Batch Number:	150876	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	30-Dec-15
Directory:	915PAH.MS10\	**Matrix:**	Water
Dilution:	1.0	**Ext Method:**	Bottle

UKAS accredited?: No

Target Compounds	CAS #	R.T. (min)	Concentration ug/l	% Fit
Naphthalene	91-20-3	3.32	0.038	98
Acenaphthylene	208-96-8	4.37	0.013	M
Acenaphthene	83-32-9	4.49	0.118	91
Fluorene	86-73-7	4.87	0.123	85
Phenanthrene	85-01-8	5.72	0.109	94
Anthracene	120-12-7	5.77	0.044	93
Fluoranthene	206-44-0	7.07	0.134	94
Pyrene	129-00-0	7.35	0.131	73
Benzo[a]anthracene	56-55-3	-	< 0.010	-
Chrysene	218-01-9	9.09	0.038	94
Benzo[b]fluoranthene	205-99-2	10.58	0.029	78
Benzo[k]fluoranthene	207-08-9	10.62	0.017	81
Benzo[a]pyrene	50-32-8	11.01	0.021	86
Indeno[1,2,3-cd]pyrene	193-39-5	12.39	0.021	72
Dibenzo[a,h]anthracene	53-70-3	-	< 0.010	-
Benzo[g,h,i]perylene	191-24-2	12.69	0.025	56
Total (USEPA16) PAHs	-	-	< 0.881	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	105
Acenaphthene-d10	104
Phenanthrene-d10	109
Chrysene-d12	107
Perylene-d12	105

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	84
Terphenyl-d14	75

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS402 ES 1 0.10	**Job Number:**	W21_1674
LIMS ID Number:	EX1649669	**Date Booked in:**	22-Dec-15
QC Batch Number:	150876	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	30-Dec-15
Directory:	915PAH.MS10\	**Matrix:**	Water
Dilution:	1.0	**Ext Method:**	Bottle

UKAS accredited?: No

Target Compounds	CAS #	R.T. (min)	Concentration ug/l	% Fit
Naphthalene	91-20-3	3.32	0.145	94
Acenaphthylene	208-96-8	4.36	0.062	94
Acenaphthene	83-32-9	4.48	0.236	98
Fluorene	86-73-7	4.87	0.159	99
Phenanthrene	85-01-8	5.72	0.470	97
Anthracene	120-12-7	5.77	0.114	97
Fluoranthene	206-44-0	7.07	0.186	79
Pyrene	129-00-0	7.35	0.127	94
Benzo[a]anthracene	56-55-3	-	< 0.010	-
Chrysene	218-01-9	9.09	0.013	61
Benzo[b]fluoranthene	205-99-2	-	< 0.010	-
Benzo[k]fluoranthene	207-08-9	-	< 0.010	-
Benzo[a]pyrene	50-32-8	-	< 0.010	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.010	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.010	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.010	-
Total (USEPA16) PAHs	-	-	< 1.582	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	109
Acenaphthene-d10	109
Phenanthrene-d10	114
Chrysene-d12	108
Perylene-d12	105

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	84
Terphenyl-d14	75

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Doncaster: A63 Castle Street		
Sample Details:	WS404 ES 2 1.10	**Job Number:**	W21_1674
LIMS ID Number:	EX1649670	**Date Booked in:**	22-Dec-15
QC Batch Number:	150876	**Date Extracted:**	29-Dec-15
Quantitation File:	Initial Calibration	**Date Analysed:**	30-Dec-15
Directory:	915PAH.MS10\	**Matrix:**	Water
Dilution:	1.0	**Ext Method:**	Bottle

UKAS accredited?: No

Target Compounds	CAS #	R.T. (min)	Concentration ug/l	% Fit
Naphthalene	91-20-3	-	< 0.020	-
Acenaphthylene	208-96-8	-	< 0.010	-
Acenaphthene	83-32-9	4.48	0.029	95
Fluorene	86-73-7	-	< 0.010	-
Phenanthrene	85-01-8	-	< 0.010	-
Anthracene	120-12-7	5.77	0.012	65
Fluoranthene	206-44-0	7.06	0.124	75
Pyrene	129-00-0	7.35	0.113	95
Benzo[a]anthracene	56-55-3	-	< 0.010	-
Chrysene	218-01-9	9.09	0.030	60
Benzo[b]fluoranthene	205-99-2	10.59	0.019	62
Benzo[k]fluoranthene	207-08-9	-	< 0.010	-
Benzo[a]pyrene	50-32-8	11.01	0.014	79
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.010	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.010	-
Benzo[g,h,i]perylene	191-24-2	12.70	0.011	58
Total (USEPA16) PAHs	-	-	< 0.442	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	111
Acenaphthene-d10	110
Phenanthrene-d10	117
Chrysene-d12	115
Perylene-d12	114

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	84
Terphenyl-d14	75

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Where individual results are flagged see report notes for status.

Semi-Volatile Organic Compounds

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Leachate	**QC Batch Number:**	274
Sample Details:	WS401 ES 3 1.60	**Date Booked in:**	22-Dec-15	**Ext Method:**	Sep. Funnel	**Multiplier:**	0.005
LIMS ID Number:	EX1649668	**Date Extracted:**	30-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	W21_1674	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/l	% Fit
Phenol	108-95-2	-	< 0.020	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.005	-
2-Chlorophenol	95-57-8	-	< 0.020	-
1,3-Dichlorobenzene	541-73-1	-	< 0.005	-
1,4-Dichlorobenzene	106-46-7	-	< 0.005	-
Benzyl alcohol	100-51-6	-	< 0.005	-
1,2-Dichlorobenzene	95-50-1	-	< 0.005	-
2-Methylphenol	95-48-7	-	< 0.005	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.005	-
Hexachloroethane	67-72-1	-	< 0.005	-
N-Nitroso-di-n-propylamine	621-64-7	-	< 0.005	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.020	-
Nitrobenzene	98-95-3	-	< 0.005	-
Isophorone	78-59-1	-	< 0.005	-
2-Nitrophenol	88-75-5	-	< 0.020	-
2,4-Dimethylphenol	105-67-9	-	< 0.020	-
Benzoic Acid	65-85-0	-	< 0.100	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.005	-
2,4-Dichlorophenol	120-83-2	-	< 0.020	-
1,2,4-Trichlorobenzene	120-82-1	-	< 0.005	-
Naphthalene	91-20-3	-	< 0.002	-
4-Chlorophenol	106-48-9	-	< 0.020	-
4-Chloroaniline	106-47-8	-	< 0.005	-
Hexachlorobutadiene	87-68-3	-	< 0.005	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.005	-
2-Methylnaphthalene	91-57-6	-	< 0.002	-
1-Methylnaphthalene	90-12-0	-	< 0.002	-
Hexachlorocyclopentadiene	77-47-4	-	< 0.005	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.020	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.020	-
2-Chloronaphthalene	91-58-7	-	< 0.002	-
Biphenyl	92-52-4	-	< 0.002	-
Diphenyl ether	101-84-8	-	< 0.002	-
2-Nitroaniline	88-74-4	-	< 0.005	-
Acenaphthylene	208-96-8	-	< 0.002	-
Dimethylphthalate	131-11-3	-	< 0.005	-
2,6-Dinitrotoluene	606-20-2	-	< 0.005	-
Acenaphthene	83-32-9	-	< 0.002	-
3-Nitroaniline	99-09-2	-	< 0.005	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/l	% Fit
2,4-Dinitrophenol	51-28-5	-	< 0.010	-
Dibenzofuran	132-64-9	-	< 0.005	-
4-Nitrophenol	100-02-7	-	< 0.050	-
2,4-Dinitrotoluene	121-14-2	-	< 0.005	-
Fluorene	86-73-7	-	< 0.002	-
Diethylphthalate	84-66-2	-	< 0.005	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.005	-
4,6-Dinitro-2-methylphenol	534-52-1	-	< 0.050	-
4-Nitroaniline	100-01-6	-	< 0.005	-
N-Nitrosodiphenylamine	86-30-6	-	< 0.005	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.005	-
Hexachlorobenzene	118-74-1	-	< 0.005	-
Pentachlorophenol	87-86-5	-	< 0.050	-
Phenanthrene	85-01-8	-	< 0.002	-
Anthracene	120-12-7	-	< 0.002	-
Di-n-butylphthalate	84-74-2	-	< 0.005	-
Fluoranthene	206-44-0	-	< 0.002	-
Pyrene	129-00-0	-	< 0.002	-
Butylbenzylphthalate	85-68-7	-	< 0.005	-
Benzo[a]anthracene	56-55-3	-	< 0.002	-
Chrysene	218-01-9	-	< 0.002	-
3,3'-Dichlorobenzidine	91-94-1	-	< 0.020	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.005	-
Di-n-octylphthalate	117-84-0	-	< 0.002	-
Benzo[b]fluoranthene	205-99-2	-	< 0.002	-
Benzo[k]fluoranthene	207-08-9	-	< 0.002	-
Benzo[a]pyrene	50-32-8	-	< 0.002	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.002	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.002	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.002	-
Coronene	191-07-1	-	< 0.050	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	101
Naphthalene-d8	104
Acenaphthene-d10	107
Phenanthrene-d10	106
Chrysene-d12	119
Perylene-d12	135

Surrogates	% Rec
2-Fluorophenol	42
Phenol-d5	26
Nitrobenzene-d5	71
2-Fluorobiphenyl	79
2,4,6-Tribromophenol	74
Terphenyl-d14	64

Where individual results are flagged see report notes for status.

Semi-Volatile Organic Compounds

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Leachate	**QC Batch Number:**	274
Sample Details:	WS402 ES 1 0.10	**Date Booked in:**	22-Dec-15	**Ext Method:**	Sep. Funnel	**Multiplier:**	0.005
LIMS ID Number:	EX1649669	**Date Extracted:**	30-Dec-15	**Operator:**	JO	**Dilution Factor:**	1
Job Number:	W21_1674	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/l	% Fit
Phenol	108-95-2	-	< 0.020	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.005	-
2-Chlorophenol	95-57-8	-	< 0.020	-
1,3-Dichlorobenzene	541-73-1	-	< 0.005	-
1,4-Dichlorobenzene	106-46-7	-	< 0.005	-
Benzyl alcohol	100-51-6	-	< 0.005	-
1,2-Dichlorobenzene	95-50-1	-	< 0.005	-
2-Methylphenol	95-48-7	-	< 0.005	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.005	-
Hexachloroethane	67-72-1	-	< 0.005	-
N-Nitroso-di-n-propylamine	621-64-7	-	< 0.005	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.020	-
Nitrobenzene	98-95-3	-	< 0.005	-
Isophorone	78-59-1	-	< 0.005	-
2-Nitrophenol	88-75-5	-	< 0.020	-
2,4-Dimethylphenol	105-67-9	-	< 0.020	-
Benzoic Acid	65-85-0	-	< 0.100	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.005	-
2,4-Dichlorophenol	120-83-2	-	< 0.020	-
1,2,4-Trichlorobenzene	120-82-1	-	< 0.005	-
Naphthalene	91-20-3	-	< 0.002	-
4-Chlorophenol	106-48-9	-	< 0.020	-
4-Chloroaniline	106-47-8	-	< 0.005	-
Hexachlorobutadiene	87-68-3	-	< 0.005	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.005	-
2-Methylnaphthalene	91-57-6	-	< 0.002	-
1-Methylnaphthalene	90-12-0	-	< 0.002	-
Hexachlorocyclopentadiene	77-47-4	-	< 0.005	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.020	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.020	-
2-Chloronaphthalene	91-58-7	-	< 0.002	-
Biphenyl	92-52-4	-	< 0.002	-
Diphenyl ether	101-84-8	-	< 0.002	-
2-Nitroaniline	88-74-4	-	< 0.005	-
Acenaphthylene	208-96-8	-	< 0.002	-
Dimethylphthalate	131-11-3	-	< 0.005	-
2,6-Dinitrotoluene	606-20-2	-	< 0.005	-
Acenaphthene	83-32-9	-	< 0.002	-
3-Nitroaniline	99-09-2	-	< 0.005	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/l	% Fit
2,4-Dinitrophenol	51-28-5	-	< 0.010	-
Dibenzofuran	132-64-9	-	< 0.005	-
4-Nitrophenol	100-02-7	-	< 0.050	-
2,4-Dinitrotoluene	121-14-2	-	< 0.005	-
Fluorene	86-73-7	-	< 0.002	-
Diethylphthalate	84-66-2	-	< 0.005	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.005	-
4,6-Dinitro-2-methylphenol	534-52-1	-	< 0.050	-
4-Nitroaniline	100-01-6	-	< 0.005	-
N-Nitrosodiphenylamine	86-30-6	-	< 0.005	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.005	-
Hexachlorobenzene	118-74-1	-	< 0.005	-
Pentachlorophenol	87-86-5	-	< 0.050	-
Phenanthrene	85-01-8	-	< 0.002	-
Anthracene	120-12-7	-	< 0.002	-
Di-n-butylphthalate	84-74-2	-	< 0.005	-
Fluoranthene	206-44-0	-	< 0.002	-
Pyrene	129-00-0	-	< 0.002	-
Butylbenzylphthalate	85-68-7	-	< 0.005	-
Benzo[a]anthracene	56-55-3	-	< 0.002	-
Chrysene	218-01-9	-	< 0.002	-
3,3'-Dichlorobenzidine	91-94-1	-	< 0.020	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.005	-
Di-n-octylphthalate	117-84-0	-	< 0.002	-
Benzo[b]fluoranthene	205-99-2	-	< 0.002	-
Benzo[k]fluoranthene	207-08-9	-	< 0.002	-
Benzo[a]pyrene	50-32-8	-	< 0.002	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.002	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.002	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.002	-
Coronene	191-07-1	-	< 0.050	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	106
Naphthalene-d8	111
Acenaphthene-d10	113
Phenanthrene-d10	113
Chrysene-d12	125
Perylene-d12	140

Surrogates	% Rec
2-Fluorophenol	44
Phenol-d5	26
Nitrobenzene-d5	76
2-Fluorobiphenyl	85
2,4,6-Tribromophenol	96
Terphenyl-d14	89

Semi-Volatile Organic Compounds

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street			**Matrix:**	Leachate	**QC Batch Number:**	274
Sample Details:	WS404 ES 2 1.10	**Date Booked in:**	22-Dec-15	**Ext Method:**	Sep. Funnel	**Multiplier:**	0.05
LIMS ID Number:	EX1649670	**Date Extracted:**	30-Dec-15	**Operator:**	JO	**Dilution Factor:**	10
Job Number:	W21_1674	**Date Analysed:**	30-Dec-15	**Directory/Quant File:**	15SVOC.GC11\	**GPC (Y/N)**	N

Target Compounds	CAS #	R.T. (min)	Concentration mg/l	% Fit
Phenol	108-95-2	-	< 0.200	-
bis(2-Chloroethyl)ether	111-44-4	-	< 0.050	-
2-Chlorophenol	95-57-8	-	< 0.200	-
1,3-Dichlorobenzene	541-73-1	-	< 0.050	-
1,4-Dichlorobenzene	106-46-7	-	< 0.050	-
Benzyl alcohol	100-51-6	-	< 0.050	-
1,2-Dichlorobenzene	95-50-1	-	< 0.050	-
2-Methylphenol	95-48-7	-	< 0.050	-
bis(2-Chloroisopropyl)ether	108-60-1	-	< 0.050	-
Hexachloroethane	67-72-1	-	< 0.050	-
N-Nitroso-di-n-propylamine	621-64-7	-	< 0.050	-
3- & 4-Methylphenol	108-39-4/106-44-5	-	< 0.200	-
Nitrobenzene	98-95-3	-	< 0.050	-
Isophorone	78-59-1	-	< 0.050	-
2-Nitrophenol	88-75-5	-	< 0.200	-
2,4-Dimethylphenol	105-67-9	-	< 0.200	-
Benzoic Acid	65-85-0	-	< 1.000	-
bis(2-Chloroethoxy)methane	111-91-1	-	< 0.050	-
2,4-Dichlorophenol	120-83-2	-	< 0.200	-
1,2,4-Trichlorobenzene	120-82-1	-	< 0.050	-
Naphthalene	91-20-3	-	< 0.020	-
4-Chlorophenol	106-48-9	-	< 0.200	-
4-Chloroaniline	106-47-8	-	< 0.050	-
Hexachlorobutadiene	87-68-3	-	< 0.050	-
4-Chloro-3-methylphenol	59-50-7	-	< 0.050	-
2-Methylnaphthalene	91-57-6	-	< 0.020	-
1-Methylnaphthalene	90-12-0	-	< 0.020	-
Hexachlorocyclopentadiene	77-47-4	-	< 0.050	-
2,4,6-Trichlorophenol	88-06-2	-	< 0.200	-
2,4,5-Trichlorophenol	95-95-4	-	< 0.200	-
2-Chloronaphthalene	91-58-7	-	< 0.020	-
Biphenyl	92-52-4	-	< 0.020	-
Diphenyl ether	101-84-8	-	< 0.020	-
2-Nitroaniline	88-74-4	-	< 0.050	-
Acenaphthylene	208-96-8	-	< 0.020	-
Dimethylphthalate	131-11-3	-	< 0.050	-
2,6-Dinitrotoluene	606-20-2	-	< 0.050	-
Acenaphthene	83-32-9	-	< 0.020	-
3-Nitroaniline	99-09-2	-	< 0.050	-

Concentrations are reported on a wet weight basis.
"M" denotes that % fit has been manually interpreted

Target Compounds	CAS #	R.T.	Concentration mg/l	% Fit
2,4-Dinitrophenol	51-28-5	-	< 0.100	-
Dibenzofuran	132-64-9	-	< 0.050	-
4-Nitrophenol	100-02-7	-	< 0.500	-
2,4-Dinitrotoluene	121-14-2	-	< 0.050	-
Fluorene	86-73-7	-	< 0.020	-
Diethylphthalate	84-66-2	-	< 0.050	-
4-Chlorophenyl-phenylether	7005-72-3	-	< 0.050	-
4,6-Dinitro-2-methylphenol	534-52-1	-	< 0.500	-
4-Nitroaniline	100-01-6	-	< 0.050	-
N-Nitrosodiphenylamine	86-30-6	-	< 0.050	-
4-Bromophenyl-phenylether	101-55-3	-	< 0.050	-
Hexachlorobenzene	118-74-1	-	< 0.050	-
Pentachlorophenol	87-86-5	-	< 0.500	-
Phenanthrene	85-01-8	-	< 0.020	-
Anthracene	120-12-7	-	< 0.020	-
Di-n-butylphthalate	84-74-2	-	< 0.050	-
Fluoranthene	206-44-0	-	< 0.020	-
Pyrene	129-00-0	-	< 0.020	-
Butylbenzylphthalate	85-68-7	-	< 0.050	-
Benzo[a]anthracene	56-55-3	-	< 0.020	-
Chrysene	218-01-9	-	< 0.020	-
3,3'-Dichlorobenzidine	91-94-1	-	< 0.200	-
bis(2-Ethylhexyl)phthalate	117-81-7	-	< 0.050	-
Di-n-octylphthalate	117-84-0	-	< 0.020	-
Benzo[b]fluoranthene	205-99-2	-	< 0.020	-
Benzo[k]fluoranthene	207-08-9	-	< 0.020	-
Benzo[a]pyrene	50-32-8	-	< 0.020	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.020	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.020	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.020	-
Coronene	191-07-1	-	< 0.500	-

Internal Standards	% Area
1,4-Dichlorobenzene-d4	108
Naphthalene-d8	109
Acenaphthene-d10	110
Phenanthrene-d10	109
Chrysene-d12	123
Perylene-d12	134

Surrogates	% Rec
2-Fluorophenol	45
Phenol-d5	29
Nitrobenzene-d5	76
2-Fluorobiphenyl	82
2,4,6-Tribromophenol	60
Terphenyl-d14	58

Gasoline Range Organics
(BTEX and Aliphatic Carbon Ranges)

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: W21_1674
Directory: C:\CHEM32\1\DATA\1224HSA_GC12\122415 2015-12-24 09-47-49\141B4101.D
Method: Headspace GCFID

Matrix: Leachate
Date Booked in: 22-Dec-15
Date extracted: 24-Dec-15
Date Analysed: 24-Dec-15, 22:4

*** Sample data with an asterisk are not UKAS accredited.**

		Concentration, (mg/l)					Aliphatics				
Sample ID	**Client ID**	**Benzene**	**Toluene**	**Ethyl benzene**	**m/p-Xylene**	**o-Xylene**	**C5 - C6**	**>C6 - C7**	**>C7 - C8**	**>C8 - C10**	**Total GRO**
* EX1649668	WS401 ES 3 1.60	<0.005	<0.005	<0.005	<0.005	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1
* EX1649669	WS402 ES 1 0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1
* EX1649670	WS404 ES 2 1.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1

Where individual results are flagged see report notes for status.

ALIPHATIC / AROMATIC FRACTION BY GC/FID

Customer and Site Details: ESG Doncaster : A63 Castle Street
Job Number: W21_1674
Separation: Silica gel
QC Batch Number: 150876
Eluents: Hexane, DCM
Directory: D:\TES\DATA\Y2015\123015TPH_GC17\123015 2015-12-31 08-31-09\061B1401.D
Method: Bottle

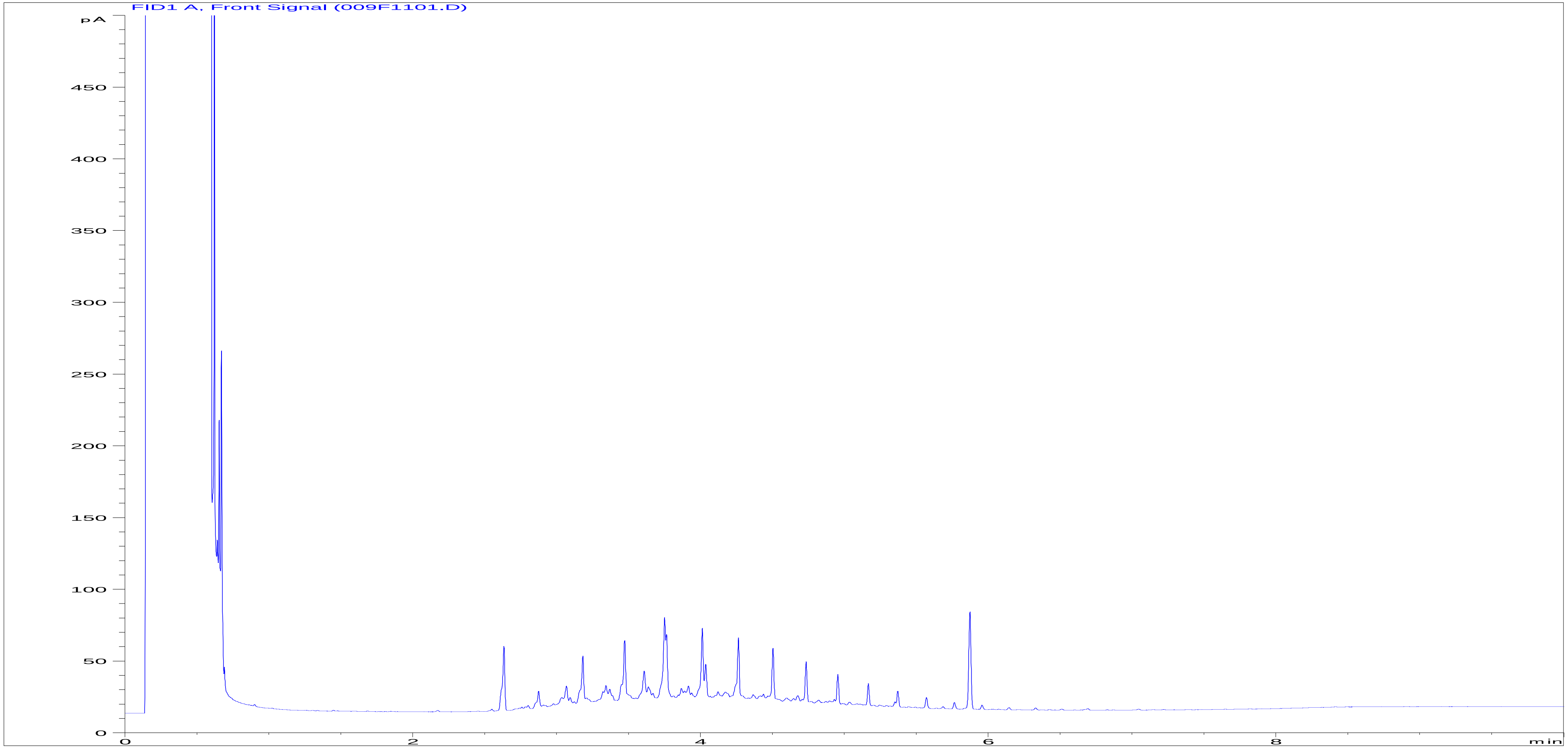
Matrix: Water
Date Booked ir 22-Dec-15
Date Extracted 29-Dec-15
Date Analysed 31-Dec-15, 12:38:41

*** This sample data is not UKAS accredited.**

		Concentration, (mg/l)											
		>C8 - C10		>C10 - C12		>C12 - C16		>C16 - C21		>C21 - C35		>C8 - C40	
Sample ID	**Client ID**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**	**Aliphatics**	**Aromatics**
EX1649668	WS401 ES 3 1.60	<0.01	<0.01	<0.01	<0.01	0.099	0.026	0.246	0.07	0.095	0.034	0.443	0.132
EX1649669	WS402 ES 1 0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EX1649670	WS404 ES 2 1.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.013	<0.01	<0.01	0.012	0.027	0.028

Where individual results are flagged see report notes for status.

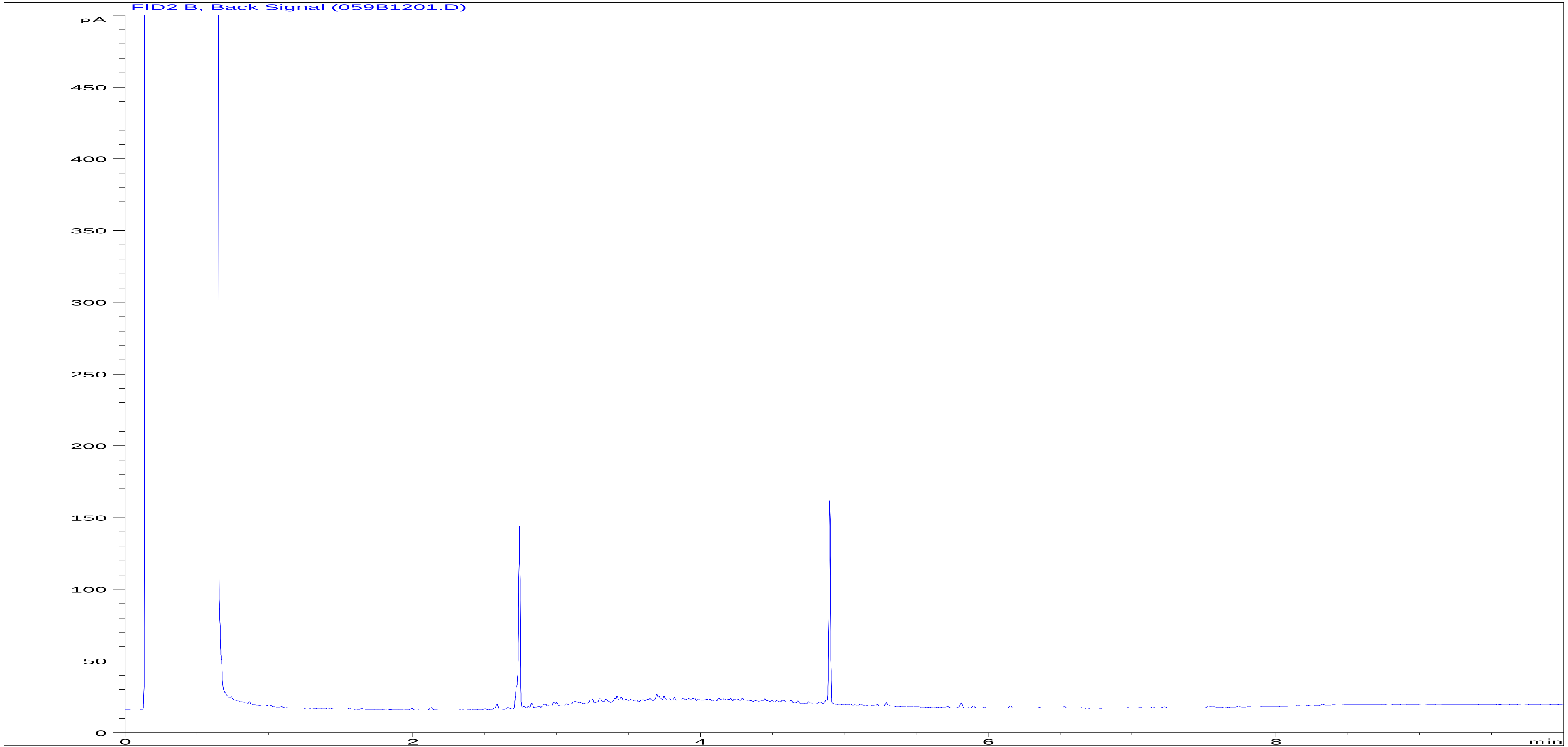
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	EX1649668ALI	**Job Number:**	W21_1674
Multiplier:	0.0198	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	TPH_RUNF.M	**Client Sample Ref:**	WS401 ES 3 1.60
Acquisition Date/Time:	31-Dec-15, 11:42:44		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC17\123015 2015-12-31 08-31-09\009F1101.D		

Where individual results are flagged see report notes for status.

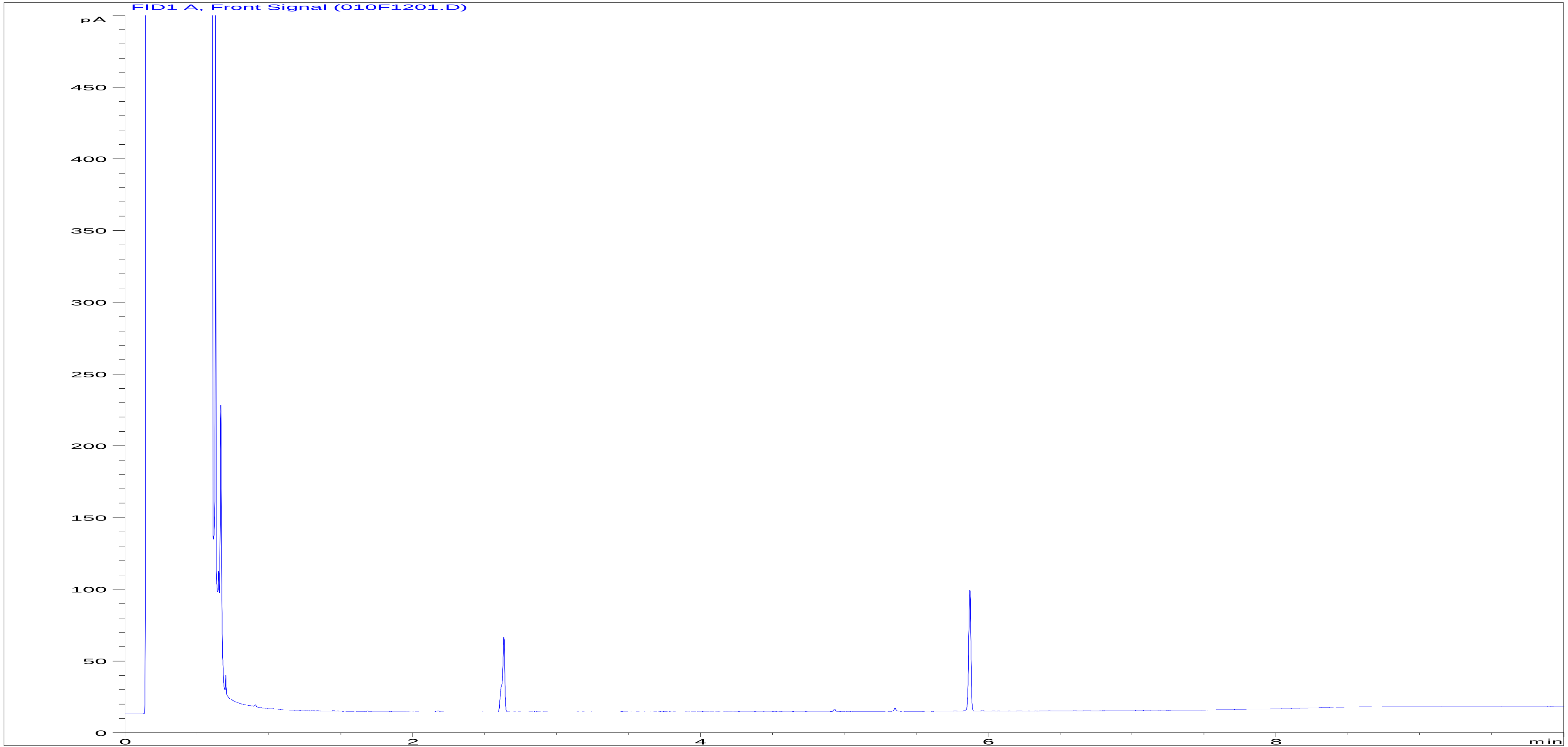
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	EX1649668ARO	**Job Number:**	W21_1674
Multiplier:	0.015	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	TPH_RUNF.M	**Client Sample Ref:**	WS401 ES 3 1.60
Acquisition Date/Time:	31-Dec-15, 12:01:18		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC17\123015 2015-12-31 08-31-09\059B1201.D		

Where individual results are flagged see report notes for status.

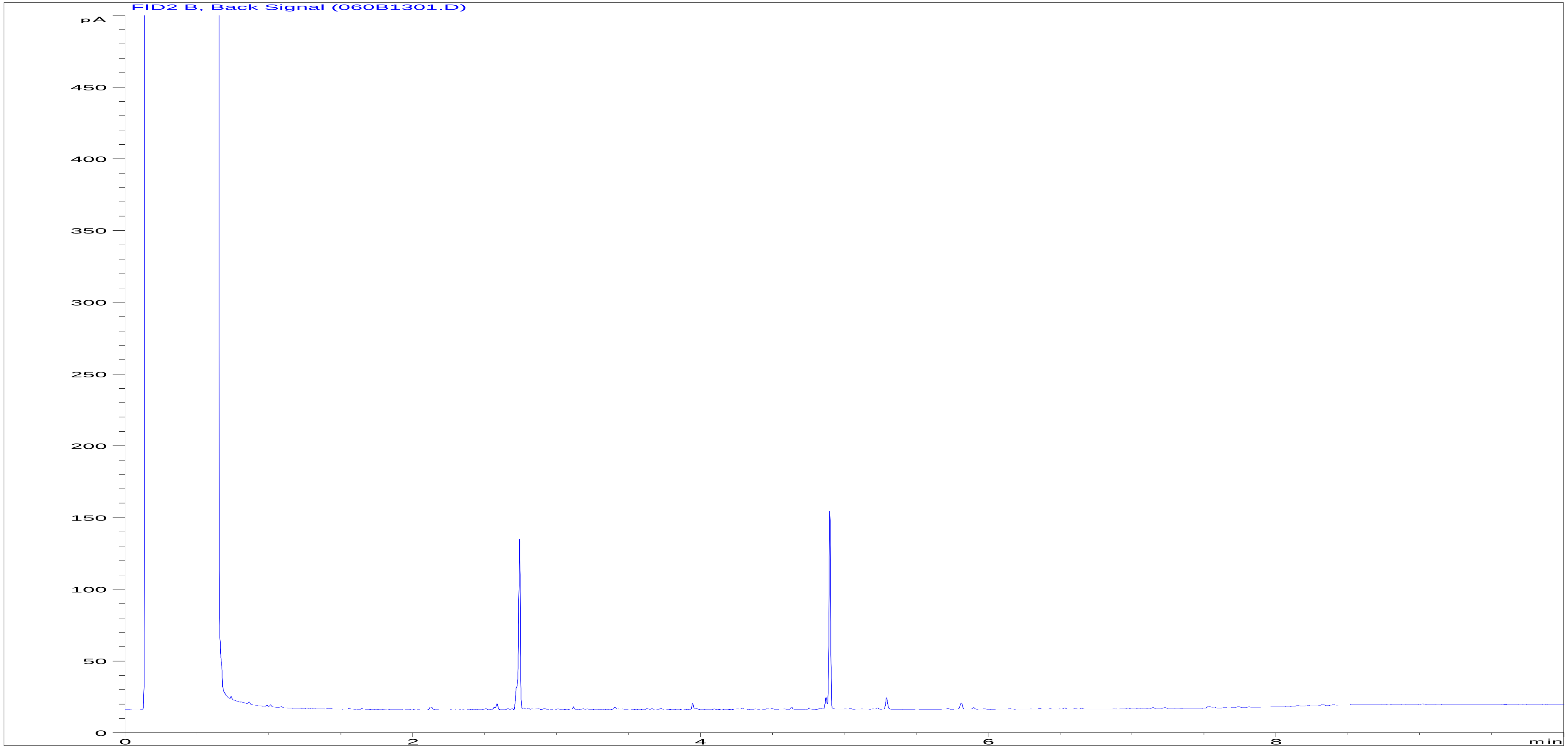
Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.



Sample ID:	EX1649669ALI	**Job Number:**	W21_1674
Multiplier:	0.0198	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	TPH_RUNF.M	**Client Sample Ref:**	WS402 ES 1 0.10
Acquisition Date/Time:	31-Dec-15, 12:01:18		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC17\123015 2015-12-31 08-31-09\010F1201.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	EX1649669ARO	**Job Number:**	W21_1674
Multiplier:	0.0148	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	TPH_RUNF.M	**Client Sample Ref:**	WS402 ES 1 0.10
Acquisition Date/Time:	31-Dec-15, 12:19:56		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC17\123015 2015-12-31 08-31-09\060B1301.D		

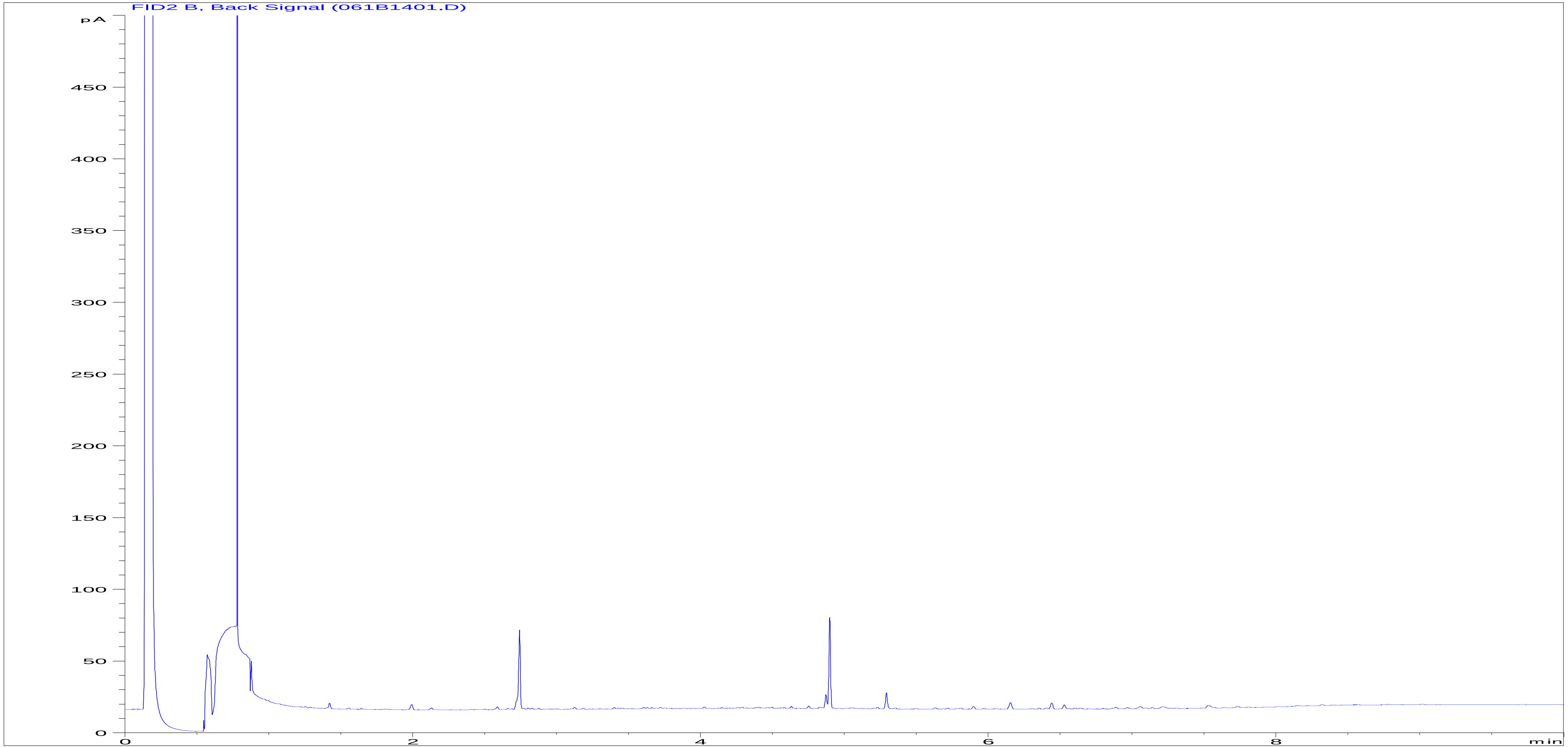
Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aliphatics Fraction.

Sample ID:	EX1649670ALI	**Job Number:**	W21_1674
Multiplier:	0.0198	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	TPH_RUNF.M	**Client Sample Ref:**	WS404 ES 2 1.10
Acquisition Date/Time:	31-Dec-15, 12:19:56		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC17\123015 2015-12-31 08-31-09\011F1301.D		

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID Aromatics Fraction.



Sample ID:	EX1649670ARO	**Job Number:**	W21_1674
Multiplier:	0.0148	**Client:**	ESG Doncaster
Dilution:	1	**Site:**	A63 Castle Street
Acquisition Method:	TPH_RUNF.M	**Client Sample Ref:**	WS404 ES 2 1.10
Acquisition Date/Time:	31-Dec-15, 12:38:41		
Datafile:	D:\TES\DATA\Y2015\123015TPH_GC17\123015 2015-12-31 08-31-09\061B1401.D		

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	1224VOC.MS8\ Initial Calibration	**Matrix:**	Leachate
Sample Details:	WS401 ES 3 1.60	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	EX1649668	**Date Analysed:**	24-Dec-15	**Multiplier:**	1
Job Number:	W21_1674	**Operator:**	PR	**Position:**	12

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-8 *	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9 *	-	< 5	-
Chloroethane	75-00-3	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-4	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7 *	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5 *	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropene	10061-02-6 *	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 5	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 *	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8 *	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorobutadiene	87-68-3	-	< 5	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Compounds marked * are not UKAS accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	3.32	107	Dibromofluoromethane	25
1,4-Difluorobenzene	3.69	105	Toluene-d8	101
Chlorobenzene-d5	4.85	108	Bromofluorobenzene	88
1,4-Dichlorobenzene-d4	5.65	86		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	1224VOC.MS8\ Initial Calibration	**Matrix:**	Water
Sample Details:	WS402 ES 1 0.10	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	EX1649669	**Date Analysed:**	24-Dec-15	**Multiplier:**	1
Job Number:	W21_1674	**Operator:**	PR	**Position:**	13

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 5	-
Chloroethane	75-00-3	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-4	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 5	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 *	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8 *	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorobutadiene	87-68-3	-	< 5	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Compounds marked * are not UKAS accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	3.32	106	Dibromofluoromethane	1
1,4-Difluorobenzene	3.69	103	Toluene-d8	101
Chlorobenzene-d5	4.85	107	Bromofluorobenzene	90
1,4-Dichlorobenzene-d4	5.65	89		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

Volatile Organic Compounds by HSA-GCMS

UKAS accredited?: No

Customer and Site Details:	ESG Doncaster: A63 Castle Street	**Directory/Quant file:**	1224VOC.MS8\ Initial Calibration	**Matrix:**	Water
Sample Details:	WS404 ES 2 1.10	**Date Booked in:**	22-Dec-15	**Method:**	Headspace
LIMS ID Number:	EX1649670	**Date Analysed:**	24-Dec-15	**Multiplier:**	1
Job Number:	W21_1674	**Operator:**	PR	**Position:**	14

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 5	-
Chloroethane	75-00-3	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-4	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 5	-
1,3-Dichloropropane	142-28-9	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5 *	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	98-06-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8 *	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorobutadiene	87-68-3	-	< 5	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Compounds marked * are not UKAS accredited
"M" denotes that % fit has been manually interpreted

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	3.32	96	Dibromofluoromethane	98
1,4-Difluorobenzene	3.69	92	Toluene-d8	100
Chlorobenzene-d5	4.85	95	Bromofluorobenzene	90
1,4-Dichlorobenzene-d4	5.65	80		

Note: Volatile compounds degrade with time, and this may affect the integrity of the data depending on the timescale between sampling and analysis. It is recommended that analysis takes place within 7 days of sampling.

Where individual results are flagged see report notes for status.

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

Customer **ESG Doncaster**
Site **A63 Castle Street**
Report No **W211674**

Consignment No S52596
Date Logged 22-Dec-2015

Report Due 31-Dec-2015

			MethodID	Calc_HD	CUSTSERV	GROHSA	ICPMSW											ICPWATVAR			KONENS
ID Number	**Description**	**Matrix Type**	**Sampled**	**Total Hardness as CaCO3 (CALC)**	**Report A (CEN)C**	**GRO-HSA GCFID (AA)**	**Nickel as Ni MS (Dissolved)**	**Chromium as Cr MS (Dissolved)**	**Cadmium as Cd MS (Dissolved)**	**Copper as Cu MS (Dissolved)**	**Lead as Pb MS (Dissolved)**	**Zinc as Zn MS (Dissolved)**	**Arsenic as As MS (Dissolved)**	**Mercury as Hg MS (Dissolved)**	**Selenium as Se MS (Dissolved)**	**Vanadium as V MS (Dissolved)**	**Antimony as Sb MS (Dissolved)**	**Calcium as Ca (Dissolved) VAR**	**Magnesium as Mg (Dissolved) VAR**	**Beryllium as Be (Dissolved) VAR**	**Chloride as Cl (Kone)**
				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
EX/1649668	WS401 1.60	Laboratory Produced Leachate	22/12/15																		
EX/1649669	WS402 0.10	Laboratory Produced Leachate	22/12/15																		
EX/1649670	WS404 1.10	Laboratory Produced Leachate	22/12/15																		

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

CEN Leachate 10:1 Analysis

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

W211674

Customer **ESG Doncaster**
Site **A63 Castle Street**
Report No **W211674**

Consignment No S52596
Date Logged 22-Dec-2015

Report Due 31-Dec-2015

ID Number	Description	Matrix Type	Sampled	Ammoniacal Nitrogen (Kone)	Chromium VI. as Cr (Kone)	Leachate Prep	PAH GC-MS (16)	Phenols by HPLC (Low Level)	Cyanide (Total) as CN SFA	Phenol Index SFA	SVOC	TPH by GC(Si)	BTEX Analysis HSA GC-MS	Benzene (µg/l)	Toluene (µg/l)	Ethyl Benzene (µg/l)	Xylenes (µg/l)	m/p Xylenes (µg/l)	o Xylene (µg/l)	VOC HSA-GCMS	pH units
			MethodID	KONENS		LeachPrep	PAHMSW	PHEHPLCVL	SFAPI		SVOCSW	TPHFID-Si	VOCHSAW								WSLM3
				✓	✓				✓	✓		✓									✓
EX/1649668	WS401 1.60	Laboratory Produced Leachate	22/12/15																		
EX/1649669	WS402 0.10	Laboratory Produced Leachate	22/12/15																		
EX/1649670	WS404 1.10	Laboratory Produced Leachate	22/12/15																		

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Report Number : W/EXR/211674

Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
VOCHSAW	EX1649668 EX164669	Due to matrix interference, the Surrogate (Dibromofluoromethane) recovery for this Test is below the required QMS specification. This has been confirmed by testing the pH of the sample which was above pH7.0. Surrogate is known to degrade in alkaline samples. All other Laboratory Process Controls meet the requirements of the QMS. These circumstances should be taken into consideration when utilising the data
PAHMSW	EX1649670	Due to matrix interference, the Surrogate recovery for this Test is below the required QMS specification. All other Laboratory Process Controls meet the requirements of the QMS. These circumstances should be taken into consideration when utilising the data.

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Water	Calc_HD	As Received	Calculation based on Dissolved metals analysis by ICPOES
Water	GROHSA	As Received	Determination of Total Gasoline Range Organics Hydrocarbons (GRO) by Headspace FID
Water	ICPMSW	As Received	Direct quantitative determination of Metals in water samples using ICPMS
Water	ICPWATVAR	As Received	Direct determination of Metals and Sulphate in water samples using ICPOES
Water	KONENS	As Received	Direct analysis using discrete colorimetric analysis
Water	PAHMSW	As Received	Determination of PolyAromatic Hydrocarbons in water by pentane extraction GCMS quantitation
Water	PHEHPLCVL	As Received	Determination of Phenols by HPLC
Water	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Water	SVOCSW	As Received	Determination of Semi Volatile Organic Compounds (SVOC) by DCM extraction followed by GCMS detection
Water	TPHFID-Si	As Received	Determination of speciated pentane extractable hydrocarbons in water by GCFID
Water	VOCHSAW	As Received	Determination of Volatile Organics Compounds by Headspace GCMS
Water	WSLM3	As Received	Determination of the pH of water samples by pH probe

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : ESG Doncaster
Site : A63 Castle Street
Report Number : W21_1674

Lab ID Number	Client ID	Description
EX/1649668	WS401 ES 3 1.60	Laboratory Produced Leachate
EX/1649669	WS402 ES 1 0.10	Laboratory Produced Leachate
EX/1649670	WS404 ES 2 1.10	Laboratory Produced Leachate

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Environmental Services Group Limited
Askern Road
Carcroft
Doncaster
South Yorkshire
DN6 8DG

Attention: Neil Cooke

CERTIFICATE OF ANALYSIS

Date:	31 December 2015
Customer:	H_ESG_DON
Sample Delivery Group (SDG):	151215-53
Your Reference:	A5085
Location:	A63 Castle Street GI
Report No:	343994

We received 2 samples on Tuesday December 15, 2015 and 2 of these samples were scheduled for analysis which was completed on Thursday December 31, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

[redacted]

Sonia McWhan

Operations Manager

MCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

ilac-MRA

UKAS TESTING 1291

Alcontrol Laboratories is a trading division of ALcontrol UK Limited
Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
12645683	BH402	ES1	0.60	09/12/2015
12645682	BH404	ES1	0.80	08/12/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

SOLID

Results Legend

- X Test
- N No Determination Possible

Lab Sample No(s)			12645683			12645682		
Customer Sample Reference			BH402			BH404		
AGS Reference			ES1			ES1		
Depth (m)			0.60			0.80		
Container			1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)
ANC at pH4 and ANC at pH 6	All	NDPs: 0 Tests: 2		X			X	
Anions by Kone (w)	All	NDPs: 0 Tests: 2	X			X		
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2	X			X		
Boron Water Soluble	All	NDPs: 0 Tests: 2		X			X	
CEN Readings	All	NDPs: 0 Tests: 2	X			X		
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 2	X			X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2	X			X		
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 2	X			X		
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 2		X			X	
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 2		X			X	
Fluoride	All	NDPs: 0 Tests: 2	X			X		
GRO by GC-FID (S)	All	NDPs: 0 Tests: 2			X			X
Loss on Ignition in soils	All	NDPs: 0 Tests: 2		X			X	
Mercury Dissolved	All	NDPs: 0 Tests: 2	X			X		
Metals in solid samples by OES	All	NDPs: 0 Tests: 2		X			X	

CERTIFICATE OF ANALYSIS

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

SOLID

Results Legend

- X — **Test**
- N — **No Determination Possible**

Lab Sample No(s)			12645683			12645682		
Customer Sample Reference			BH402			BH404		
AGS Reference			ES1			ES1		
Depth (m)			0.60			0.80		
Container			1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)
Mineral Oil	All	NDPs: 0 Tests: 2		X			X	
PAH Value of soil	All	NDPs: 0 Tests: 2		X			X	
PCBs by GCMS	All	NDPs: 0 Tests: 2		X			X	
pH	All	NDPs: 0 Tests: 2	X			X		
Phenols by HPLC (S)	All	NDPs: 0 Tests: 2	X			X		
Phenols by HPLC (W)	All	NDPs: 0 Tests: 2	X			X		
Sample description	All	NDPs: 0 Tests: 2		X			X	
Total Dissolved Solids	All	NDPs: 0 Tests: 2	X			X		
Total Organic Carbon	All	NDPs: 0 Tests: 2		X			X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 2		X			X	

Sample Descriptions

Grain Sizes

very fine	fine	medium	coarse	very coarse
<0.063mm	0.063mm - 0.1mm	0.1mm - 2mm	2mm - 10mm	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
12645683	BH402	0.60	Dark Brown	Sandy Loam	0.1 - 2 mm	Crushed Brick	Vegetation
12645682	BH404	0.80	Dark Brown	Sandy Clay Loam	0.063 - 0.1 mm	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

		Customer Sample R	BH402	BH404				
		Depth (m)	0.60	0.80				
		Sample Type	Soil/Solid	Soil/Solid				
		Date Sampled	09/12/2015	08/12/2015				
		Sample Time	.	.				
		Date Received	15/12/2015	15/12/2015				
		SDG Ref	151215-53	151215-53				
		Lab Sample No.(s)	12645683	12645682				
		AGS Reference	ES1	ES1				
Component	**LOD/Units**	**Method**						
Moisture Content Ratio (% of as received sample)	%	PM024	28	18				
Loss on ignition	<0.7 %	TM018	6.78 M	6.88 M				
Mineral oil >C10-C40	<1 mg/kg	TM061	12 @	7.57				
Mineral Oil Surrogate % recovery**	%	TM061	85.7 @	89				
Phenol	<0.01 mg/kg	TM062 (S)	<0.01 @ M	<0.01 @ M				
Cresols	<0.01 mg/kg	TM062 (S)	<0.01 @ M	<0.01 @ M				
Xylenols	<0.015 mg/kg	TM062 (S)	<0.015 @ M	<0.015 @ M				
Phenols, Total Detected monohydric	<0.035 mg/kg	TM062 (S)	<0.035 @ M	<0.035 @ M				
Organic Carbon, Total	<0.2 %	TM132	1.51 M	1.4 M				
pH	1 pH Units	TM133	8.79 M	8.28 M				
Cyanide, Total	<1 mg/kg	TM153	<1 M	<1 M				
PCB congener 28	<3 µg/kg	TM168	<3 M	<3 M				
PCB congener 52	<3 µg/kg	TM168	<3 M	<3 M				
PCB congener 101	<3 µg/kg	TM168	<3 M	<3 M				
PCB congener 118	<3 µg/kg	TM168	<3 M	<3 M				
PCB congener 138	<3 µg/kg	TM168	<3 M	<3 M				
PCB congener 153	<3 µg/kg	TM168	<3 M	<3 M				
PCB congener 180	<3 µg/kg	TM168	<3 M	<3 M				
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168	<21	<21				
Antimony	<0.6 mg/kg	TM181	2.26 #	1.57 #				
Arsenic	<0.6 mg/kg	TM181	18.6 M	16.1 M				
Beryllium	<0.01 mg/kg	TM181	1.43 M	1.41 M				
Cadmium	<0.02 mg/kg	TM181	0.237 M	0.4 M				
Chromium	<0.9 mg/kg	TM181	29.8 M	33.5 M				
Copper	<1.4 mg/kg	TM181	27.4 M	29.2 M				
Lead	<0.7 mg/kg	TM181	154 M	86.6 M				
Manganese	<0.13 mg/kg	TM181	700 M	807 M				
Mercury	<0.14 mg/kg	TM181	<0.14 M	<0.14 M				
Molybdenum	<0.1 mg/kg	TM181	1.09 #	0.808 #				
Nickel	<0.2 mg/kg	TM181	34.3 M	34.5 M				
Selenium	<1 mg/kg	TM181	<1 #	<1 #				
Vanadium	<0.2 mg/kg	TM181	50.7 #	48.8 #				

CERTIFICATE OF ANALYSIS

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

		Customer Sample R	BH402	BH404				
		Depth (m)	0.60	0.80				
		Sample Type	Soil/Solid	Soil/Solid				
		Date Sampled	09/12/2015	08/12/2015				
		Sample Time	.	.				
		Date Received	15/12/2015	15/12/2015				
		SDG Ref	151215-53	151215-53				
		Lab Sample No.(s)	12645683	12645682				
		AGS Reference	ES1	ES1				
Component	**LOD/Units**	**Method**						
Zinc	<1.9 mg/kg	TM181	108 M	122 M				
ANC @ pH 4	<0.03 mol/kg	TM182	1.07	0.351				
ANC @ pH 6	<0.03 mol/kg	TM182	0.252	0.109				
Polyaromatic hydrocarbons, Total 17	<10 mg/kg	TM213	<10	<10				
Boron, water soluble	<1 mg/kg	TM222	<1 M	<1 M				

CERTIFICATE OF ANALYSIS

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

		Customer Sample R	BH402	BH404				
		Depth (m)	0.60	0.80				
		Sample Type	Soil/Solid	Soil/Solid				
		Date Sampled	09/12/2015	08/12/2015				
		Sample Time	.	.				
		Date Received	15/12/2015	15/12/2015				
		SDG Ref	151215-53	151215-53				
		Lab Sample No.(s)	12645683	12645682				
		AGS Reference	ES1	ES1				
Component	**LOD/Units**	**Method**						
GRO Surrogate % recovery**	%	TM089	80	57				
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	<44 M	<44 M				
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #	<5 #				
Benzene	<10 µg/kg	TM089	<10 M	<10 M				
Toluene	<2 µg/kg	TM089	<2 M	<2 M				
Ethylbenzene	<3 µg/kg	TM089	<3 M	<3 M				
m,p-Xylene	<6 µg/kg	TM089	<6 M	<6 M				
o-Xylene	<3 µg/kg	TM089	<3 M	<3 M				
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9	<9				
sum of detected BTEX by GC	<24 µg/kg	TM089	<24	<24				
Aliphatics >C5-C6	<10 µg/kg	TM089	<10	<10				
Aliphatics >C6-C8	<10 µg/kg	TM089	<10	<10				
Aliphatics >C8-C10	<10 µg/kg	TM089	<10	<10				
Aliphatics >C10-C12	<10 µg/kg	TM089	<10	<10				
Aliphatics >C12-C16	<100 µg/kg	TM173	2500	598				
Aliphatics >C16-C21	<100 µg/kg	TM173	8950	163				
Aliphatics >C21-C35	<100 µg/kg	TM173	17700	7730				
Aliphatics >C35-C44	<100 µg/kg	TM173	2130	<100				
Total Aliphatics >C12-C44	<100 µg/kg	TM173	31300	8490				
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10	<10				
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10	<10				
Aromatics >EC8-EC10	<10 µg/kg	TM089	<10	<10				
Aromatics >EC10-EC12	<10 µg/kg	TM089	<10	<10				
Aromatics >EC12-EC16	<100 µg/kg	TM173	2420	<100				
Aromatics >EC16-EC21	<100 µg/kg	TM173	19600	209				
Aromatics >EC21-EC35	<100 µg/kg	TM173	62400	7190				
Aromatics >EC35-EC44	<100 µg/kg	TM173	17100	1010				
Aromatics >EC40-EC44	<100 µg/kg	TM173	6110	<100				
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	102000	8410				
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	133000	16900				

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH402 ES 1 0.60 SOLID 09/12/2015 00:00:00 21/12/2015 14:12:35 151215-53 12645683 TM048	29/12/2015	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH404 ES 1 0.80 SOLID 08/12/2015 00:00:00 21/12/2015 14:05:24 151215-53 12645682 TM048	29/12/2015	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	A63 Castle Street GI
Mass Sample taken (kg)	0.110	**Natural Moisture Content (%)**	22
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	82
Particle Size <4mm	>95%		

Case	
SDG	151215-53
Lab Sample Number(s)	12645682
Sampled Date	08-Dec-2015
Customer Sample Ref.	BH404 ES1
Depth (m)	0.80

Landfill Waste Acceptance Criteria Limits

Solid Waste Analysis	Result	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon (%)	1.27	3	5	6
Loss on Ignition (%)	6.88	-	-	10
Sum of BTEX (mg/kg)	<0.024	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg)	7.57	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	8.27	-	<6	-
ANC to pH 6 (mol/kg)	0.109	-	-	-
ANC to pH 4 (mol/kg)	0.351	-	-	-

Eluate Analysis	C_2 Conc^n in 10:1 eluate (mg/l)		A_2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.0141	<0.00012	0.141	<0.0012	0.5	2	25
Barium	0.00177	<0.00003	0.0177	<0.0003	20	100	300
Cadmium	<0.0001	<0.0001	<0.001	<0.001	0.04	1	5
Chromium	0.00115	<0.00022	0.0115	<0.0022	0.5	10	70
Copper	0.00295	<0.00085	0.0295	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00175	<0.00024	0.0175	<0.0024	0.5	10	30
Nickel	0.00125	<0.00015	0.0125	<0.0015	0.4	10	40
Lead	0.000273	<0.00002	0.00273	<0.0002	0.5	10	50
Antimony	0.000519	<0.00016	0.00519	<0.0016	0.06	0.7	5
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	0.1	0.5	7
Zinc	0.00236	<0.00041	0.0236	<0.0041	4	50	200
Chloride	12.2	<2	122	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	86	<5	860	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	3.09	<3	30.9	<30	500	800	1000

Leach Test Information

Date Prepared	18-Dec-2015
pH (pH Units)	8.95
Conductivity (µS/cm)	111.00
Temperature (°C)	19.30
Volume Leachant (Litres)	0.880

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
31/12/2015 13:27:03

13:26:56 31/12/2015

CERTIFICATE OF ANALYSIS

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	A63 Castle Street GI
Mass Sample taken (kg)	0.125	**Natural Moisture Content (%)**	38.9
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	72
Particle Size <4mm	>95%		

Case	
SDG	151215-53
Lab Sample Number(s)	12645683
Sampled Date	09-Dec-2015
Customer Sample Ref.	BH402 ES1
Depth (m)	0.60

Landfill Waste Acceptance Criteria Limits

Solid Waste Analysis	**Result**	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon (%)	1.51	3	5	6
Loss on Ignition (%)	6.78	-	-	10
Sum of BTEX (mg/kg)	<0.024	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg)	12	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	8.83	-	<6	-
ANC to pH 6 (mol/kg)	0.252	-	-	-
ANC to pH 4 (mol/kg)	1.07	-	-	-

Eluate Analysis	C_2 Conc^n in 10:1 eluate (mg/l)		A_2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.000971	<0.00012	0.00971	<0.0012	0.5	2	25
Barium	0.00797	<0.00003	0.0797	<0.0003	20	100	300
Cadmium	<0.0001	<0.0001	<0.001	<0.001	0.04	1	5
Chromium	0.00205	<0.00022	0.0205	<0.0022	0.5	10	70
Copper	0.00297	<0.00085	0.0297	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.0058	<0.00024	0.058	<0.0024	0.5	10	30
Nickel	0.000964	<0.00015	0.00964	<0.0015	0.4	10	40
Lead	0.000292	<0.00002	0.00292	<0.0002	0.5	10	50
Antimony	0.000365	<0.00016	0.00365	<0.0016	0.06	0.7	5
Selenium	0.00119	<0.00039	0.0119	<0.0039	0.1	0.5	7
Zinc	0.00164	<0.00041	0.0164	<0.0041	4	50	200
Chloride	23.6	<2	236	<20	800	15000	25000
Fluoride	0.704	<0.5	7.04	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	183	<5	1830	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	4.52	<3	45.2	<30	500	800	1000

Leach Test Information

Date Prepared	22-Dec-2015
pH (pH Units)	8.57
Conductivity (µS/cm)	228.00
Temperature (°C)	18.90
Volume Leachant (Litres)	0.865

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
31/12/2015 13:27:03

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM062 (S)	National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser		
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM182	CEN/TC 292 - WI 292046-chacterization of waste-leaching Behaviour Tests- Acid and Base Neutralization Capacity Test	Determination of Acid Neutralisation Capacity (ANC) Using Autotitration in Soils		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM213	In-house Method	Rapid Determination of PAHs by GC-FID		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	12645683	12645682
Customer Sample Ref.	BH402	BH404
AGS Ref.	ES1	ES1
Depth	0.60	0.80
Type	SOLID	SOLID
ANC at pH4 and ANC at pH 6	23-Dec-2015	23-Dec-2015
Anions by Kone (w)	29-Dec-2015	22-Dec-2015
Asbestos ID in Solid Samples	29-Dec-2015	29-Dec-2015
Boron Water Soluble	24-Dec-2015	24-Dec-2015
CEN 10:1 Leachate (1 Stage)	22-Dec-2015	18-Dec-2015
CEN Readings	23-Dec-2015	21-Dec-2015
Cyanide Comp/Free/Total/Thiocyanate	23-Dec-2015	23-Dec-2015
Dissolved Metals by ICP-MS	24-Dec-2015	23-Dec-2015
Dissolved Organic/Inorganic Carbon	24-Dec-2015	22-Dec-2015
EPH CWG (Aliphatic) GC (S)	23-Dec-2015	23-Dec-2015
EPH CWG (Aromatic) GC (S)	23-Dec-2015	23-Dec-2015
Fluoride	24-Dec-2015	24-Dec-2015
GRO by GC-FID (S)	22-Dec-2015	22-Dec-2015
Loss on Ignition in soils	30-Dec-2015	31-Dec-2015
Mercury Dissolved	29-Dec-2015	22-Dec-2015
Metals in solid samples by OES	23-Dec-2015	24-Dec-2015
Mineral Oil	24-Dec-2015	21-Dec-2015
PAH Value of soil	29-Dec-2015	29-Dec-2015
PCBs by GCMS	24-Dec-2015	20-Dec-2015
pH	30-Dec-2015	30-Dec-2015
Phenols by HPLC (S)	24-Dec-2015	24-Dec-2015
Phenols by HPLC (W)	29-Dec-2015	22-Dec-2015
Sample description	18-Dec-2015	17-Dec-2015
Total Dissolved Solids	24-Dec-2015	22-Dec-2015
Total Organic Carbon	24-Dec-2015	24-Dec-2015
TPH CWG GC (S)	30-Dec-2015	30-Dec-2015

SDG:	151215-53	**Location:**	A63 Castle Street GI	**Order Number:**	A17150
Job:	H_ESG_DON-2	**Customer:**	Environmental Services Group Limited	**Report Number:**	343994
Client Reference:	A5085	**Attention:**	Neil Cooke	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5 -C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
•	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
- Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

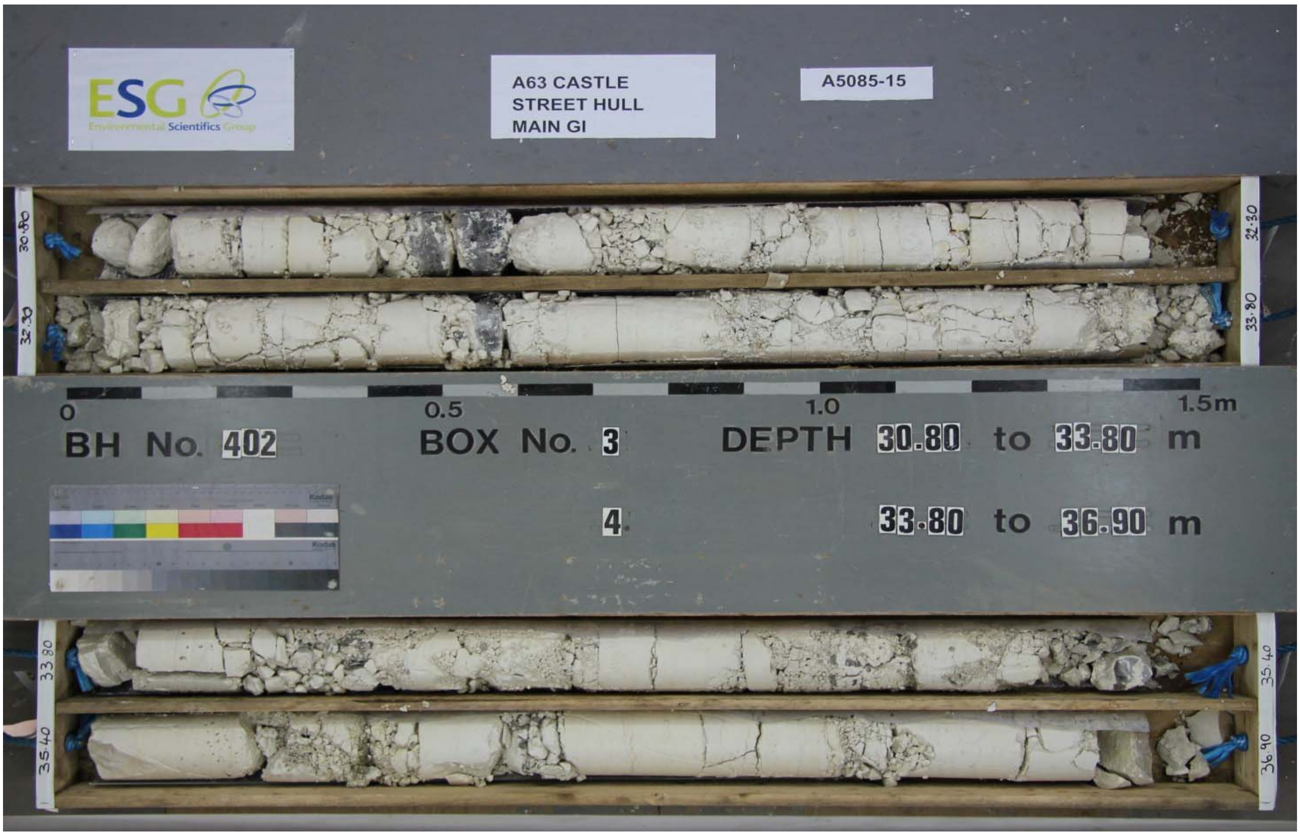
The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX H

PHOTOGRAPHS

Rotary Cores	Plate 1 and 2
Split and Described Samples	Photographs 1 to 173

Photographs



Notes:	Project	A63 CASTLE STREET IMPROVEMENT – MAIN GI	Plate
	Project No.	A5085-15	1
	Carried out for	Balfour Beatty	

Photographs

Notes:	Project	A63 CASTLE STREET IMPROVEMENT – MAIN GI	Plate
	Project No.	A5085-15	2
	Carried out for	Balfour Beatty	


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT6
2·45 To 2·90 M
TOP
TOP
BASE
BASE


TOP
BASE
A63 CASTLE
STREET HULL
MAIN GI A5085-15
BH No. 402 P9
3·75 To 4·75 M

TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402
P10
4.75 To 5.75 M
BASE


TOP
BASE
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402
P13
6-40 To 7-40 M


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402
P14
7·40 To 8·40 M
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT16
8.40
To
9.05
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT20
9·65 To 10·10 M
BASE
TOP
BASE
TOP


A63 CASTLE STREET HULL MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT22
10·30 To 10·75 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT24
10·95
To
11·40
M
TOP
BASE
TOP
BASE

A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT26
11-60 To 12-05 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT28
12.25 To 12.70 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT30
13-30
To
13-75
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT32
13·95 To 14·40 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT34
14·60 To 15·05 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT36
15·25 To 15·70 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT38
15·90
To
16·35
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT40
16-55 To 17-00 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT 42
17.20 To 17.65 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT44
17-85 To 18-30 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT46
18-50 To 18-95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 402 UT48
19-10 To 19-55 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
402
UT50
19.75
To
20.20
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT4
1·65 To 2·10 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Scientifics Group
BH No. 403 UT6
2·30 To 2·75 M
BASE
TOP
BASE
TOP


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT 8
2·95 To 3·40 M
TOP
BASE
TOP
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403
P10
3-60 To 4-60 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403
P12
5.00 To 6.00 M
TOP
BASE


TOP
BASE
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
ental Scientifics Group
BH No.
403
P14
7.00 To 8.00 M


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
403
UT18
8-65
To
9-30
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT22
9.95 To 10.40 M
TOP
BASE
TOP
BASE


A63 CASTLE STREET HULL MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT24
10-60 To 11-05 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
403
UT27
11·90 To 12·35 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT29
12·55 To 13·00 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT32
13-85 To 14-20 M
TOP
BASE
TOP
BASE


A63 CASTLE STREET HULL MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT34
14·40 To 14·85 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT36
15.05 To 15.50 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT38
15.70 To 16.15 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT40
16.35 To 16.80 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT42
17.00 To 17.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT44
17-65 To 18-10 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 403 UT46
18.30 To 18.75 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
403
UT48
18.95 To 19.40 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
403
UT54
20·75
To
21·10
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT3
1·50 To 1·95 M
TOP
BASE
TOP


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 P7
3.00 To 4.00 M
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
Environmental Scientifics Group
BH No.
404
P10
6.00
To
7.00
M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404
P11
7.00 To 8.00 M
TOP
BASE
TOP
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
Environmental Scientifics Group
BH No. 404 P14
8.00 To 9.00 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
P17
9.00 To 10.00 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT26
11·50
To
11·95
M
TOP
BASE
TOP


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT28
12·00 To 12·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT30
12.50 To 12.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT32
13·00 To 13·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT36
14·00 To 14·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT38
14.50 To 14.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT40
15-00 To 15-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT42
15.50 To 15.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT44
16.00
To
16.45
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT50
17.50 To 17.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT54
18.50 To 18.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT56
19.00 To 19.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT58
19.50 To 19.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
404
UT60
20.00 To 20.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT64
21.10 To 21.55 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 404 UT 68
22.20 To 22.65 M
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT5
2.50 To 2.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 P8
4.00 To 5.00 M
TOP
BASE
TOP
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
405
P11
6.00
TO
7.00
M
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 P 15
8.00 To 9.00 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405
P17
9.00 To 10.00 M
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT21
10.50 To 10.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405
UT 27
12.00 To 12.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT29
12·50 To 12·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT31
13.00 To 13.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT35
14-00 To 14-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT37
14.50 To 14.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT 39
15·00 To 15·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
405
UT41
15.50
To
15.95
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT43
16.00 To 16.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
405
UT45
16-50 To 16-95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405
UT48
17.00 To 17.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 405 UT52
18-50 To 18-95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
405
UT65
23.00
To
23.45
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
406
UT9
2·50
To
2·95
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT11
3-00 To 3-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No.
406
P13
3.50 To 4.50 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT14
4·50 To 4·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
406
UT16
5-00
To
5-45
M
TOP
BASE
TOP
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406
P21
6·50 To 7·50 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 P25
8-00 To 9-10 M
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406
UT38
12·50 To 12·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT40
13-00 To 13-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT43
13.50 To 13.95 M
TOP
BASE
TOP


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT45
14·00 To 14·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
406
UT47
14·50 To 14·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT49
15.00 To 15.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT51
15.50 To 15.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT53
16.00 To 16.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No. 406 UT55
16.50 To 16.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
406
UT57
17·00
To
17·45
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
406
UT59
17-50
To
17-95
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
406
UT61
18-00
To
18-45
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT63
18-50 To 18-95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT65
19·00 To 19·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT67
19·50 To 19·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT69
20.00 To 20.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 406 UT74
21·50 To 21·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT 5
1·70 To 2·15 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT9
2·55 To 3·10 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT12
5·00 To 5·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407
UT 14
5-60 To 6-05 M
TOP
BASE
TOP
BASE


TOP
BASE
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
BH No.
407
P15
6·05
To
7·05
M
ESG
Environmental Scientifics Group


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407
UT 17
7.10 To 7.55 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
407
UT18
7-60
To
8-05
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT21
8.50 To 8.95 M
TOP
BASE
TOP
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI A5085-15
FSG
BH No. 407 P22
9·00 To 10·00 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
407
UT23
10-00 To 10-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT25
10-50 To 10-95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT27
11-00 To 11-45 M
TOP
BASE
TOP
BASE


A63 CASTLE STREET HULL MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT29
11·50 To 11·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
407
UT31
12·00
To
12·45
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407
UT 33
12·50 To 12·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No. 407 UT35
13.00 To 13.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
407
UT37
13.50 To 13.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No. 407 UT39
14.00 To 14.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No. 407 UT41
14.50 To 14.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT43
15·00 To 15·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT45
15.50 To 15.95 M
TOP
BASE
TOP


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT47
16-00 To 16-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407
UT49
16·50 To 16·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT51
17.00 To 17.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT53
17.50 To 17.95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT55
18.00 To 18.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT57
18·50 To 18·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No. 407 UT60
19.50 To 19.95 M
TOP
BASE
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
407
UT62
20.00
To
20.45
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
Environmental Scientifics Group
BH No. 407 UT66
21.00 To 21.45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
407
UT70
22.00 To 22.45 M
TOP
BASE
TOP
BASE


A63 CASTLE STREET HULL MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407
UT75
23·50 To 23·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 407 UT79
24·50 To 24·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT3
2-00 To 2-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT5
2·70 To 3·15 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT7
3.35 To 3.80 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT9
4·00 To 4·45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 P11
4.90 To 5.90 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT13
6-00 To 6-45 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
408
UT15
6-70
To
7-15
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT17
7.40 To 7.85 M
TOP
BASE
TOP
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI A5085-15
FSG
ental Scientifics Group
BH No. 408 P19
8-05 To 9-05 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
BH No.
408
P20
9-05 To 10-05 M
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No.
408
UT21
10·10
To
10·55
M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT23
10.80 To 11.25 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT25
11-50 To 11-95 M
TOP
BASE
TOP
BASE


A63 CASTLE STREET HULL MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT30
12.60 To 13.05 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT34
13-70 To 14-15 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT35
14-15 To 14-60 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT37
14.80 To 15.25 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT39
15·45 To 15·90 M
TOP
BASE
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT41
16.10 To 16.55 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT43
16-75 To 17-20 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT45
17-40 To 17-85 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT47
18-05 To 18-50 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No. 408 UT49
18-70 To 19-15 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT51
19.35 To 19.80 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT57
21.35 To 21.80 M
TOP
BASE
TOP
BASE


A63 CASTLE STREET HULL MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408 UT60
22·45 To 22·90 M
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 408
UT 64
23.55 To 24.00 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 417 UT8
2.90 To 3.35 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
FSG
Scientifics Group
BH No. 417 UT12
4.20 To 4.65 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 417 UT14
4·85 To 5·25 M
Top
BASE
Top
BASE


TOP
A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 417 P17
6.00 To 7.00 M
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 417 UT19
7·50 To 7·95 M
TOP
BASE
TOP
BASE


A63 CASTLE
STREET HULL
MAIN GI
A5085-15
ESG
Environmental Scientifics Group
BH No. 417
UT22
8.50 To 8.95 M
TOP
BASE
TOP
BASE