

Ground Investigation



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STAR RADCLIFFE

Preliminary Ground Investigation
Report with Interpretive Chapter

for
Department for Education

Engineer : Mott MacDonald Limited

Project Number PN224390

August 2022

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We have prepared this report in our professional capacity using reasonable skill, care and diligence. The assessments, conclusions and recommendations within this report pertain to the study site defined herein, and the immediate area in continuity with the Site. They are based on the established historical uses, and information available at the time of writing and the proposed use of the Site. Where any information supplied by the client or other sources have been utilised, it has been assumed that the information is correct. No responsibility can be accepted by Geotechnics for inaccuracies in data supplied by any other party.

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Preliminary Ground Investigation Report with Interpretive Chapter at

STAR RADCLIFFE

Project No: PN224390
August 2022

1.0 INTRODUCTION

This Geo-environmental and Geotechnical Ground Investigation was carried out to the instruction of the Engineer, Mott McDonald Limited, on behalf of the Client, The Department for Education, with the purpose of providing design input with respect to Civil, Structural and Geo-Environmental engineering for the redevelopment of a secondary school in Radcliffe, Greater Manchester.

The proposed redevelopment consists of the demolition of the existing Spring Lane School and an adjacent Radcliffe Leisure Centre (also known as Coney Green Leisure Centre) which includes a swimming pool. Following these demolition works it is proposed to construct new school buildings including a Superblock and a Sports Hall, along with a new artificial grass pitch, a Multi-Use Games Area (MUGA), a grass pitch, new car parking areas and access roads.

A Desk Study has already been prepared by Geotechnics Limited to which reference should be made for full details of the site history and its environmental setting. It is advised that this report is read in conjunction with the Desk Study report (Ref: PC228400 Geo-environmental and Geotechnical Desk Study Report at Star Radcliffe dated 4th May 2022).

This report summarises the findings of the desk study and presents the findings of an intrusive geo-environmental and geotechnical survey undertaken in accordance with Stage 1 of RIBA Plan of Work 2020 Overview. The report aims to reduce uncertainty in geo-environmental and geotechnical risks identified in the previous Desk Study. It is intended to be used by the Client to aid in later stages of the design and construction of the proposed rebuild should that option be chosen. In addition, this report has been devised to generally comply with the relevant principles and requirements of a range of guidance including:

- Part IIA of the Environment Protection Act, 1990.
- Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, April 2012).
- National Planning Policy Framework (HCA, July 2021).
- BS EN 1997-1:2004+A1:2013: "Eurocode 7. Geotechnical Design".
- BS5930:2015+A1:2020: "Code of Practice for Ground Investigations".
- BS10175: 2011 +A2:2017 "Investigation of Potentially Contaminated Sites - Code of Practice".
- The Building Regulations 2010. Part C (HM Government 2013).
- Environment Agency (2020) "Land Contamination Risk Management".
- Environment Agency (2011) Report GPLCI "Guiding Principles for Land Contamination".
- Environment Agency (2017) "The Environment Agency's Approach to Groundwater Protection" November 2017 Version 1.1.
- Sustainable Remediation Forum UK (SuRF) Framework.

The purpose of this report is to gain a preliminary understanding of the ground conditions at the site and within the limitations of the scope of the Ground Investigation authorised by the Department for Education. The ground investigation was commissioned to help Contractors assess the ground related risks and make suitable cost allowances for the most likely design solution and undertake a preliminary assessment of the risks relating to identified source-pathway-receptor linkages.

Contractors for the scheme shall only use the factual data from this preliminary Ground Investigation Report. Contractors should obtain any additional investigation work that may be required to prepare their own detailed

Ground Investigation Report and Geotechnical Design Report to Eurocode 7 and to prepare their own contaminated land risk assessment in line with Land Contamination Risk Management (LCRM, 2020) guidance including further ground investigation and risk assessment, remediation options appraisal and remediation strategy and verification (if required), which are to be used as the basis of the contractors detailed design.

2.0 PRESENTATION

A description of the site and a summary of the procedures followed during the investigation process are presented in Sections 3 to 6. The factual data so obtained are presented in Appendices 2 to 22 of this report.

A Desk Study to seek information which may already exist about the site, its history, geology and ground conditions was carried out by Geotechnics Limited in May 2022.

An interpretation of the data obtained is presented in Section 7 and a geotechnical evaluation of its significance in relation to proposals available at the time of preparation of this report is presented in Section 8. A geo-environmental assessment is presented in Sections 9 and 10 with conclusions and recommendations in Section 11.

Attention is drawn to the General Notes and Investigation Procedures presented in Appendix 23 to aid an understanding of the procedures followed and the context in which the report should be read.

In addition, data in electronic format in accordance with “The Electronic Transfer of Geotechnical Data from Ground Investigations” published by the AGS (the AGS Format) are presented separately.

3.0 THE SITE

For full details of the site’s history, environmental setting and sensitive land use, reference should be made to the Desk Study mentioned in Section 1.0 above. A Site Location Plan can be found in Appendix 1 and the site location is summarised in the table below.

Location	Spring Lane School, Spring Lane, Radcliffe, Manchester.
Grid Reference	378700, 407630
Post Code	M26 2SZ
Site Area	Approximately 6.39 Ha
Site Shape	The site is roughly triangular-shaped, with truncated apices. The site fronts east-west onto the A6053 Spring Lane over a distance of 85m. The eastern side of the site runs broadly north-south over a distance of 330m along the base of the Metrolink embankment. The northern edge of the site curves east-west over 240m to its intersection with the northeast to southwest running Manchester, Bolton & Bury Canal. The north-western site boundary runs over 120m of the canal towpath. The western site boundary runs over a distance of 320m largely following a public footpath known as “Banana Path”.
Topography and Levels	The site generally slopes down from the Manchester, Bolton & Bury Canal towpath in the north at an elevation of 76.8m OD towards Spring Lane in the southeast at an elevation of 71.6m OD. The site is bifurcated by a sharp break in slope formed by the cutting of the southwest to northeast running former Lancashire & Yorkshire Railway’s Clifton, Accrington & Colne Line. To the northwest of this 3m to 4m high scarp, the ground slopes very gradually, whereas to the southeast of it the ground is relatively level. The steep embankment slopes of the L. & Y. R. Radcliffe East and West Forks lie immediately off-site. Steeper slopes and a low stone retaining wall exists along the site’s western boundary, where the ground rises up towards the former route of southeast to northwest running L. & Y. R. Prestwich Branch (near to the present-day Banana Path).

**Trees
and
Vegetation**

The higher, north-western part of the site is largely overgrown with rough grass. The lawns of Spring Lane School are well maintained. To the south and west of the existing school/leisure centre are landscaped areas including several tall, mature deciduous trees. The steep embankment slopes of the L. & Y. R. Radcliffe East and West Forks, which lie immediately off-site, are also lined with various mature deciduous trees along with various smaller bushes.

In places, along the western perimeter of the site and also adjacent to the embankment of the L. & Y. R. Radcliffe West Fork are areas of brambles, bracken and other weeds. The far western corner of the site is densely vegetated including several very tall deciduous trees.

During the site walkover undertaken as part of the desk study, it was initially thought that a stand of Japanese Knotweed may exist along the central part of the western perimeter of the site. Following closer inspection by the same personnel, during the fieldwork, the presence of Japanese Knotweed was discounted in this area.

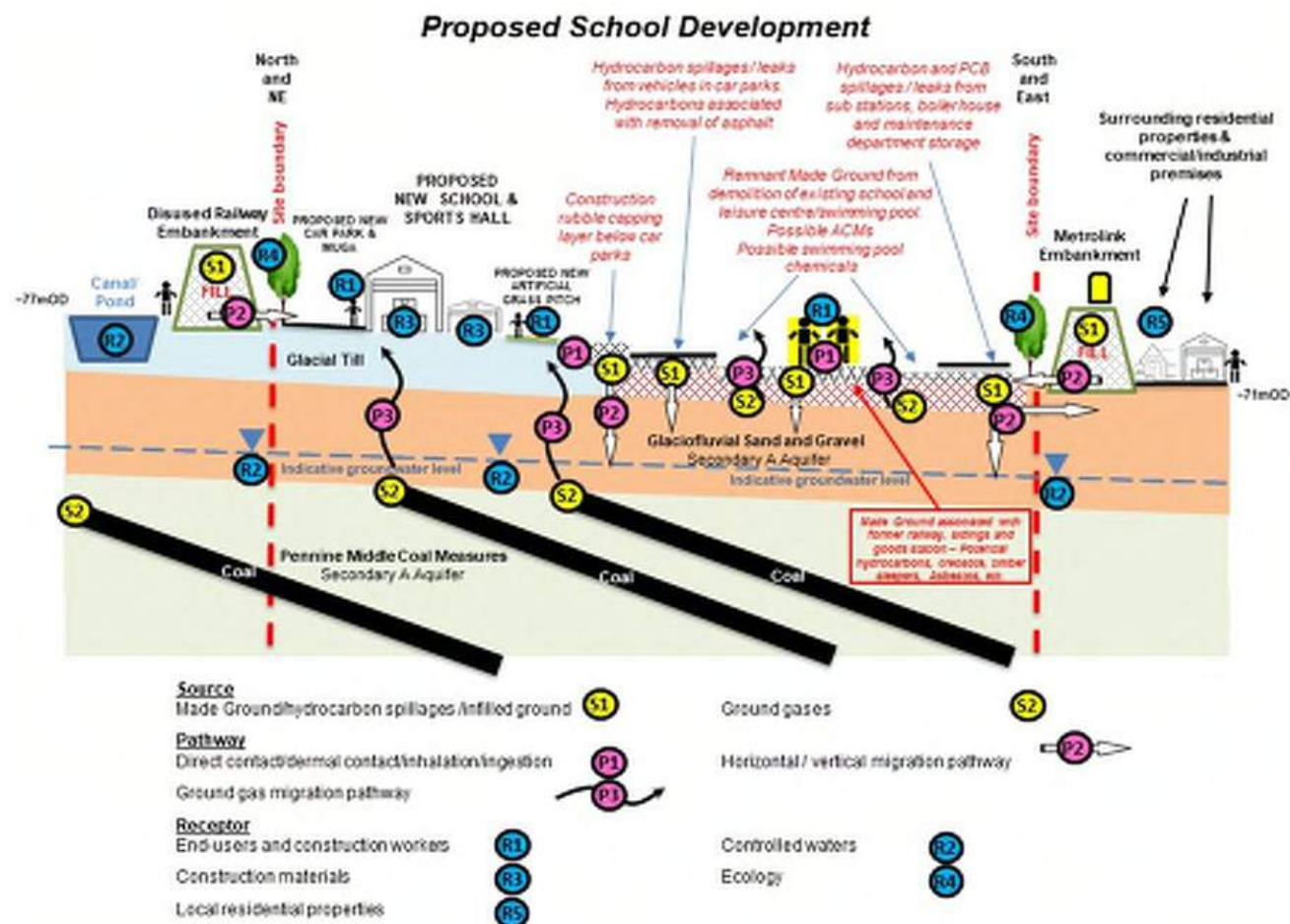
The “died-back” nature of the overgrown vegetation sometimes makes positive identification of particular plant species difficult. The presence/extent of any Japanese Knotweed should be confirmed by a suitable qualified and experienced ecologist.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL & CONTAMINANT LINKAGES

The Desk Study for the site (Ref: PC228400, May 2022) presented a preliminary conceptual site model based on publicly available information and on-site observations. The preliminary conceptual site model identified several potential contaminant linkages (source → pathway → receptor). Potential risks were assessed for these contaminant linkages, which identified where additional information was required. These are summarised below.

4.1 Preliminary Conceptual Site Model

In accordance with BS 10175 and LCRM, a schematic Initial Conceptual Site Model was developed, and this is shown below.



The ground model and proposed end use described above have been considered in relation to Nathaniel et al. 2015, The LQM/ClEH S4ULs for Human Health Risk Assessment. The proposed development generally does not conform to the conceptual models defined in Nathaniel et al. 2015 however for the purpose of this geo-environmental assessment, the site is closest to public open space (parkland) and residential without home grown produce.

4.2 Potential Contaminant Linkages Assessment

For each potential contaminant linkage, an assessment was made of the potential impact upon identified sensitive receptors. Potential contaminant linkages requiring further investigation are summarised below:

- Contaminants in soil and groundwater → Dermal contact, ingestion, inhalation → Construction workers
- Contaminants in soil and groundwater → Dermal contact, ingestion, inhalation → Future site workers, visitors and pupils
- Contaminants in soil and groundwater → Downward / lateral migration → Secondary A Aquifer

Further details of the potential contaminant linkage assessment are presented in the Desk Study (reference: PC228400, May2022).

There is the potential for gas generation from Made Ground below the site and there is also a limited potential for gas migration from historic landfills (e.g. Darbyshire Street infilled railway cutting to the southwest). There is also a potential for mine gases to migrate from coal outcrops and probable shallow workings below the site. Hence confirmatory monitoring has been undertaken as part of the scope of the works.

5.0 PROCEDURE

5.1 Commissioning

The intrusive ground investigation was awarded following submission of a proposal for ground investigation of the site in consultation with Mott MacDonald Limited.

5.2 General

The procedures followed in this site investigation are based on BS 5930:2015+A1:2020 – Code of Practice for Site Investigations and BS 10175:2011+A2:2017 - Investigation of Potentially Contaminated Sites. The soils and rocks encountered have been described in accordance with BS5930:2015+A1:2020 and BS EN ISO 14688-1:2018 and BS EN ISO 14689:2018. The positions of the exploratory holes are shown on the Exploratory Hole Location Plans in Appendix 22.

The exploratory hole locations were selected by Geotechnics Limited, and approved by Mott MacDonald Limited, to give general coverage of the site as well as focus on any targets identified in the Desk Study, within the constraints posed by buried and overhead services on the site. The number and type of exploratory holes was kept within the Client's financial limits, with the investigation being considered as a preliminary phase of investigation works.

The co-ordinates and levels shown on the Exploratory Hole Records were measured using a Leica SmartRover GPS survey device. The depths quoted on the exploratory hole records are in metres below ground level.

Prior to commencement of the intrusive investigative works, the available service drawings were consulted to check for the presence of buried services at the proposed exploratory hole locations.

Prior to breaking ground at each exploratory hole location, the location was scanned using a cable avoidance tool (CAT) by a suitably trained engineer. At each exploratory hole location (with the exception of the trial pits) an inspection pit was excavated using hand tools to a depth of 1.20m below ground level to also check for the presence of underground services. On completion of the excavation, the location was scanned again using a CAT.

5.3 Hand-dug Trial Pits

Five (5 No.) Hand-dug Trial Pits (numbered HD01 to HD05) were excavated to depths ranging between 0.60m (HD02) and 1.20m (HD05) below ground level using hand digging tools on 9th and 12th May 2022. This pitting work was supervised on site by a geotechnical / geo-environmental engineer.

The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. Representative disturbed (D and B) were taken, where appropriate, for laboratory examination and analysis and in addition, Environmental Soil samples (ES) were recovered at the depths indicated on the Hand-dug Trial Pit Records, presented in Appendix 2. Samples were taken directly from excavated materials deposited at the surface. Groundwater observations and trench stability notes are included on the Hand-dug Trial Pit Records. Photographs of the Hand-dug Trial Pits are presented in Appendix 3.

5.4 Machine-dug Trial Pits

Six (6 No.) Trial Pits (numbered TP01 to TP06) were excavated to a depth of 4.00m below ground level (except for TP02 which was excavated to 3.70m depth) using a JCB 3CX wheeled excavator between 23rd and 25th May 2022. This pitting work was supervised on site by a geotechnical / geo-environmental engineer.

The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. Representative disturbed (D and B) samples were taken, where appropriate, for laboratory examination and analysis and in addition, Environmental Soil samples (ES) were recovered at the depths indicated on the Machine-dug Trial Pit Records, presented in Appendix 4. Samples were taken directly from excavated materials deposited at the surface. Groundwater observations and trench stability notes are included on the Machine-dug Trial Pit Records.

Photographs of the Machine-dug Trial Pits are presented in Appendix 5.

5.5 Soakaway Tests

Three (3 No.) soakaway tests were carried out at the locations of Machine-dug Trial Pits TP01, TP02 and TP03 and numbered SA01, SA02 and SA03, respectively. The tests were carried out on 23rd to 25th May 2022. These tests were carried out in accordance with the method given in *BRE Digest 365 "Soakaway Design", 2016*.

Soakaway Test SA01 and SA02 were carried out adjacent to Machine-dug Trial Pits TP01 and TP02 following groundwater having been encountered at 1.50m depth (TP01) and 1.60m depth (TP02). Soakaway Test SA03 was carried out in Machine-dug Trial Pit TP03 prior to groundwater being encountered.

Following the test procedures in the Digest the tests were repeated three times at the locations of Soakaway Tests SA01 and SA02. The Digest requires the test to be repeated three times at each location, however, due to the slow soakage of the water from Machine-dug Trial Pit TP03, it was only possible to carry out a single test at this location in the time allowed for the test.

The results of the Soakaway Tests are presented in Appendix 6.

5.6 Dynamic Sample Boreholes

Seven (7 No.) Dynamic Sample Boreholes (numbered DS01 to DS07) were undertaken at the site to depths ranging between 3.45m (DS07) and 5.45m (DS01 and DS03) below ground level. This dynamic sampling work was carried out on 12th and 13th May 2022 and was supervised on site by a geotechnical/geo-environmental engineer.

The Dynamic Samples were taken using Super-Heavy Dynamic Probe apparatus which drives lined steel tubes into the ground in 1m lengths. The retrieved liners were split and the recovered soils described before being sub-sampled into ES, D and B samples as shown on the Dynamic Sample Borehole Records, presented in Appendix 7. The hole is not cased and progress depends on the nature of the strata penetrated.

Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata. The full details of the SPT results are presented on the SPT Results Summary Sheets, also included in Appendix 7, along with a copy of the relevant SPT Hammer Energy Test Report.

Photographs of the dynamic samples recovered are presented in Appendix 8.

Groundwater observations are included on the Dynamic Sample Borehole Records where appropriate and any rise in water level was recorded over 20 minutes whilst the dynamic sampling operations were suspended.

On completion, the Dynamic Sample Boreholes were backfilled with bentonite pellets to 0.20m below ground level and finished with arisings.

5.7 Cable Percussion with Rotary Follow-on Boreholes

Five (5 No.) Cable Percussion boreholes (numbered BH01 to BH04 including BH03A) were sunk using a combination of 200mm and 150mm diameter casing and tools to depths generally ranging between 15.10m (BH03A) and 21.66m (BH02) below ground level. Borehole BH03 was terminated at 2.45m below ground level for health and safety/environmental reasons following a strong hydrocarbon (petroleum) odour and an oily sheen on the gravel recovered being noted at 2.00m depth. This borehole was then backfilled with bentonite pellets to 0.20m below ground level and finished with arisings.

This boring work was carried out between 3rd and 18th May 2022.

Representative disturbed (D and B) and driven open-tube thin-walled (UT) samples of the soils encountered were obtained at regular intervals. Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata. The full details of the SPT results are presented on the SPT Results Summary Sheets, included in Appendix 9, along with the Borehole Records and a copy of the relevant SPT Hammer Energy Test Report. In addition, Environmental Soil samples (ES) were recovered at the depths indicated on the Borehole Records.

On completion of cable percussion boring, the boreholes were extended utilising 92mm diameter rotary coring techniques to depths ranging between 40.00m (BH04) and 42.50m (BH01) below ground level. The rotary coring commenced through the base of boreholes which had been left open and cased to facilitate coring.

The drilling equipment on this particular contract utilised water as the flushing medium.

Rock cores were extruded horizontally in transparent liners and placed into suitable core boxes. Photographs of the individual core boxes are included in Appendix 10.

On completion of rotary coring, the boreholes were extended further utilising 92mm diameter rotary open-hole drilling methods to depths ranging between 47.50m (BH01) and 51.50m (BH02) below ground level.

The strata descriptions in the open-hole sections of the Borehole Records are the Drilling Foreman's estimate based on sediment and chipping returns in the flushing medium. The rate of penetration is also used as an indicator of the type of material being drilled, particularly where there is loss of flush returns. Definitive classification in terms of geology or degree of disturbance is not usually possible from these sources.

The rotary drilling work was carried out during the period between 12th May and 26th May 2022.

Groundwater observations are included on the Borehole Records where appropriate and any rise in water level was recorded over 20 minutes whilst the drilling operations were suspended. It should be noted that the addition of water to the borehole as part of the drilling process may have masked the presence of groundwater in the borehole. Where water was added it has been noted on the Borehole Record.

On completion, 50mm diameter standpipes were installed the boreholes (see Section 5.9).

5.8 Dynamic Cone Penetration Tests

Dynamic Cone Penetration (DCP) Tests were carried out at fourteen (14 No.) locations marked on the Exploratory Hole Location Plan (see Appendix 22) and numbered DCP01 to DCP14. The tests were commenced from Ground Level and were performed to give an indication of CBR values at shallow depths to aid pavement design. At the locations of DCP01, DCP05, DCP07 and DCP08, prior to the commencement of any dynamic cone penetration testing, an inspection pit was excavated using hand tools to a depth of 1.20m below ground level to check for the presence of underground services. The remaining DCP test locations were adjacent to another exploratory hole and hence the corresponding inspection pit (or trial pit) was used to check for buried services. The relevant adjacent locations are as follows:

DCP Location	Tests (No.)	Adjacent Exploratory Hole Location
DCP01	1	Hand-dug Pit DCP01
DCP02	1	BH01
DCP03	1	DS03
DCP04	1	TP04
DCP05	2	Hand-dug Pit DCP05
DCP06	1	BH03A
DCP07	1	Hand-dug Pit DCP07
DCP08	1	Hand-dug Pit DCP08
DCP09	1	TP05
DCP10	1	TP06
DCP11	1	HD03
DCP12	1	TP03
DCP13	1	HD04
DCP14	1	HD05

The Dynamic Cone Penetration Tests were carried out between 11th and 26th May 2022.

The test comprises the measurement of increments of penetration of a 60° cone driven into the ground using an 8kg hammer falling a distance of 575mm. The CBR is obtained from the relationship between the CBR and the DCP readings;

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

as defined in the Design Manual for Roads and Bridges Document CS229 Revision 0, March 2020, published by Highways England. The test results are presented in Appendix 11.

5.9 Instrumentation and Monitoring

Long-term monitoring of the gas and groundwater levels was made possible by the installation of 50mm diameter standpipes as follows:

Exploratory Hole	Standpipe Slotted Pipe & Filter Zone (m)	Strata Monitored
BH01	1.00 to 4.00	Glacial Sand and Gravel
BH02	1.00 to 4.00	Granular Made Ground and Glacial Sand and Gravel
BH02	14.00 to 15.00.	Band of Glacial Sand/Gravel
BH03A	1.00 to 4.00	Granular Made Ground and Glacial Sand and Gravel
BH04	1.00 to 3.50	Granular Made Ground and Glacial Sand and Gravel

The site was initially classified as having a very high gas risk as the potential for ground gas generation from Made Ground below the site and also for migration of mine gases from coal seams and probable shallow workings via fissures in the Glacial Till and any permeable granular layers was identified during the desk study.

Monitoring of the gas and groundwater levels at the site commenced on 16th June 2022 with further visits on 24th and 30th June and 7th, 13th and 20th July 2022.

On each of the monitoring visits a record of the groundwater level in the standpipes was obtained where possible. All monitoring wells were dry for each monitoring visit. The following parameters were measured and recorded in each standpipe using a Geotechnical Instruments Limited GA5000 Gas Analyser:-

- Concentrations (% Vol) of CH₄, O₂, CO₂, along with (ppm) H₂S, CO.
- Flow Rate.
- Air Temperature
- Barometric Pressure.

The results of the monitoring are presented in Appendix I2.

5.10 Groundwater Purging and Sampling

In order to obtain representative groundwater samples, where groundwater was present within the standpipes, purging was carried out. The following parameters were recorded using a multi-parameter flow cell during purging which continued until such time as the parameters reached a steady level.

- Temperature (°C)
- Electrical Conductivity (mS/cm)
- Dissolved Oxygen Concentration (%)
- pH

Once the standpipe had been successfully purged, a groundwater sample was taken to enable subsequent chemical analyses to be carried out.

The groundwater purging work was carried out on 30th June 2022. Due to insufficient recharge of the groundwater into the standpipes, groundwater samples were taken on the following day, 1st July 2022.

Groundwater samples taken specifically for chemical analyses were contained within appropriate receptacles and stored alongside ice packs in a cool box to preclude any sample deterioration prior to immediate delivery to the testing laboratory.

6.0 LABORATORY TESTING

6.1 Geotechnical

The laboratory testing schedule was formulated by Geotechnics Limited, and approved by Mott MacDonald Limited, in order to relate to the proposed development plans available at the time of scheduling. The number and type of testing undertaken was constrained by the Client's financial limits, with the investigation being considered as a preliminary phase of investigation work. Unless otherwise stated, the tests were carried out in Professional Soils Laboratory Limited's UKAS accredited laboratory (Testing No. 4043) and were undertaken in accordance with the appropriate Standards as indicated below and on the Laboratory Test Certificate in Appendix I4. Any descriptions, opinions and interpretations are outside the scope of UKAS accreditation.

The tests undertaken can be summarised as follows:-

Soils

Standard	Test Description	Quantity
BS 1377:1990 Part 2: 3.2	Moisture Content Determination	30
BS 1377:1990 Part 2: 4.3 & 5.3	Liquid and Plastic Limit Determination	30
BS 1377:1990 Part 2: 8.3	Particle Density Determination	2
BS 1377:1990 Part 2: 9.2 & 9.3	Mechanical Analysis - Sieving	30
BS 1377:1990 Part 2: 9.4	Mechanical Analysis - Sedimentation	9
BS 1377:1990 Part 4: 3.3	Dry Density/Moisture Content relationship determination. Compaction Test - British Standard (2.5 kg Hammer)	4
BS 1377:1990 Part 4: 3.5	Dry Density/Moisture Content relationship determination. Compaction Test - Modified (4.5 kg Hammer).	2
BS 1377:1990 Part 4: 7	California Bearing Ratio (CBR) Measurement - recompactd	4
BS 1377:1990 Part 5: 3	One-Dimensional Consolidation Test	6
BS 1377:1990 Part 7: 3	Shear Strength Estimation using Laboratory Vane	5#
BS 1377:1990 Part 7: 4	Shear Strength Measurement - Shear Box Test – Drained	4
BS 1377:1990 Part 7: 8	Shear Strength Measurement - 100mm diameter (Single Stage) Quick Undrained Triaxial Compression Test	9
BS 1377:1990 Part 8: 7.1	Shear Strength Measurement - Consolidated Undrained Triaxial Compression Test with pore water pressure measurement.	2

- Laboratory Hand Vane Tests carried out on samples initially scheduled for 100mm diameter (Single Stage) Quick Undrained Triaxial Compression Tests but which on extrusion were found to be of insufficient length for triaxial testing.

The following testing was carried out at the laboratories of Chemtech Environmental Limited (UKAS Accredited Laboratory, Number 2531):

Standard	Test Description	Quantity
BS 1377:1990 Part 3: 3	Organic Matter Content	4
BRE Special Digest I Suite	Suites comprising:- Soluble Sulphate Acid Soluble Sulphate Total Sulphur Soluble Magnesium Ammonium Nitrate Chloride pH	10

The results of these geotechnical soil tests are presented in Appendix 14.

Rock

The following testing was carried out by Professional Soils Laboratory Limited (UKAS Accredited Laboratory, Number 4043):

Standard	Test Description	Quantity
ISRM Testing Methods	Point Load Determination (Axial)	43
ISRM Testing Methods	Point Load Determination (Diametral)	41
ISRM Testing Methods	Point Load Determination (Irregular)	1
ISRM Testing Methods	Unconfined Compressive Strength Determination	13

The results of these geotechnical rock tests are also presented in Appendix I4.

6.2 Contamination

Sixteen (16 No.) selected samples of soil and four (4 No.) samples of groundwater were tested at the laboratories of Derwentside Environmental Testing Services Limited for a number of determinands in order to allow assessment of potential site contamination. The determinands were specified by the Engineer and are detailed below and on the results sheets in Appendix I5 together with the test result as well as the test method, accreditation and detection limit. The laboratory testing schedule was formulated by Geotechnics Limited, and approved by Mott MacDonald Limited, in order to relate to the proposed development plans available at the time of scheduling. The number and type of testing undertaken was constrained by the Client's financial limits, with the investigation being considered as a preliminary phase of investigation work. The soil samples were tested for the following determinands:-

Metals

- Antimony
- Beryllium
- Chromium (Hexavalent)
- Lead
- Selenium
- Arsenic
- Boron (Water Soluble)
- Copper
- Molybdenum
- Vanadium
- Barium
- Chromium
- Iron
- Nickel
- Zinc

Inorganics

- pH
- Sulphate (Water Soluble)
- Cyanide (Free)
- Total Sulphur
- Total Organic Carbon

Other

- Petroleum Hydrocarbons (Aliphatic / Aromatic speciated)
- Volatile Organic Compounds (VOC)
- Polyaromatic Hydrocarbons (Speciated)
- MTBE
- Phenols
- Asbestos

The groundwater samples were analysed for the following determinands:

Metals

- Antimony
- Beryllium
- Chromium
- Copper
- Magnesium
- Nickel
- Zinc
- Arsenic
- Boron
- Chromium III
- Iron
- Manganese
- Selenium
- Barium
- Calcium
- Chromium (Hexavalent)
- Lead
- Molybdenum
- Vanadium

Inorganics

- pH
- Sulphate
- Fluoride
- Cyanide (Total & Free)
- Sulphide
- Total Hardness
- Ammoniacal Nitrogen
- Chloride

Other

- Petroleum Hydrocarbons (Aliphatic / Aromatic speciated)
- Polyaromatic Hydrocarbons (Speciated)

In addition, four (4 No.) leachate samples were prepared from selected soil samples in accordance with BS EN 12457 and analysed for the determinands detailed below and on the results sheets in Appendix 8.

Metals

- Antimony
- Beryllium
- Chromium
- Copper
- Magnesium
- Nickel
- Zinc
- Arsenic
- Boron
- Chromium III
- Iron
- Manganese
- Selenium
- Barium
- Calcium
- Chromium (Hexavalent)
- Lead
- Molybdenum
- Vanadium

Inorganics

- pH
- Sulphate (Water Soluble)
- Fluoride
- Cyanide (Total & Free)
- Sulphide
- Ammonical Nitrogen
- Chloride

Other

- Speciated Phenols

The results are presented in Appendix 15.

7.0 INTERPRETATION

7.1 Ground Conditions

On the basis of the expected geology discussed in Section 4.0 of the Phase I Desk Study Report and the findings of the exploratory holes it has been possible to classify the various strata proved in the investigation into the following divisions:-

- Pavement Construction Materials
- Topsoil
- Granular Made Ground
- Cohesive Made Ground
- Glacial Sand and Gravel
- Glacial Laminated Clay
- Glacial Till
- Pennine Middle Coal Measures Formation – Mudstone/Siltstone
- Pennine Middle Coal Measures – Sandstone
- Pennine Middle Coal Measures – Coal

It is noted that the BGS 1:50,000 scale Bedrock and Superficial Edition geological map (Sheet 85 Manchester) dated 2011 shows that over the lower, south-eastern half of the site, the superficial deposits comprise Glaciofluvial Deposits described as *undifferentiated sand and gravel with lenses of clay and stony clay*. However, such materials were generally not encountered in the exploratory holes sunk over this part of the site although they were revealed above the Glacial Till, in places across the upper, north-western half of the site.

Sections through the site are included in Appendix 13 to give an indication of the ground and groundwater conditions at the site. These sections are indicative only and reference should be made to the Exploratory Hole Records for detailed descriptions of the soils and the groundwater conditions encountered.

As part of the Phase I Desk Study, a Consultant's Coal Mining Report was obtained which stated that the conjectured outcrop of the Park Yard Coal runs southwest to northeast across the central part of the site. The Ince New Coal and another older coal seam are shown on the Coal Authority's Interactive Map outcropping 100m and 250m, respectively, to the northwest from the Park Yard Coal outcrop. Seams below 65m depth beneath the site are largely recorded as dipping at 9.5 degrees to the southeast.

Based on the Cross Sections in Appendix 13 tentative correlation of the coal seams is unclear, possibly as a result of unrecorded local faulting.

The ground profile exposed in the exploratory holes represents the conditions at discrete locations. The degree to which they represent conditions between or beyond the exploratory holes is a matter for conjecture and these can only be interpolated and hence, the uncertainties arising from this should be recognised. Where strata boundaries are shown on the sections between the exploratory holes they are conjectural and should be treated with caution.

A Rockhead Depth Diagram is presented in Appendix 13. This has been drawn up using data from the Geotechnics Limited Boreholes BH01, BH02, BH03A and BH04.

“Geological rockhead” is defined as the upper boundary of older consolidated rock formations which lie below unconsolidated deposits (generally of Pleistocene and Recent age). However, in this case the rockhead materials may be weathered to the condition of a residual soil (e.g. clay, silt, sand or gravel, etc).

“Engineering rockhead” is the level at which the rock has adequate bearing capacity for large structures (i.e. is less weathered, more intact, more competent and exhibiting the engineering behaviour of rock rather than soil).

For the Rockhead Depth Diagram it is “geological rockhead” that has been shown.

7.1.1 Pavement Construction Materials

Pavement construction materials were encountered across parts of the lower south-eastern parts of the site associated with the Radcliffe Leisure Centre car park (DS07), the Spring Lane School service yard (HD01) and the temporary Metrolink Park and Ride parking facility (BH04). Here tarmacadam up to 0.10m thick was found to be laid over a limestone gravel sub base layer up to 0.20m thick.

Concrete paving slabs were also encountered forming footpaths and other paved areas around the existing leisure centre and school sites. Between the Radcliffe Leisure Centre boiler-house and the temporary swimming pool building, near to the boiler-house chimney, in HD02, 50mm thick concrete paving slabs were noted laid over grey concrete and limestone gravel sub base extending to 0.25m depth.

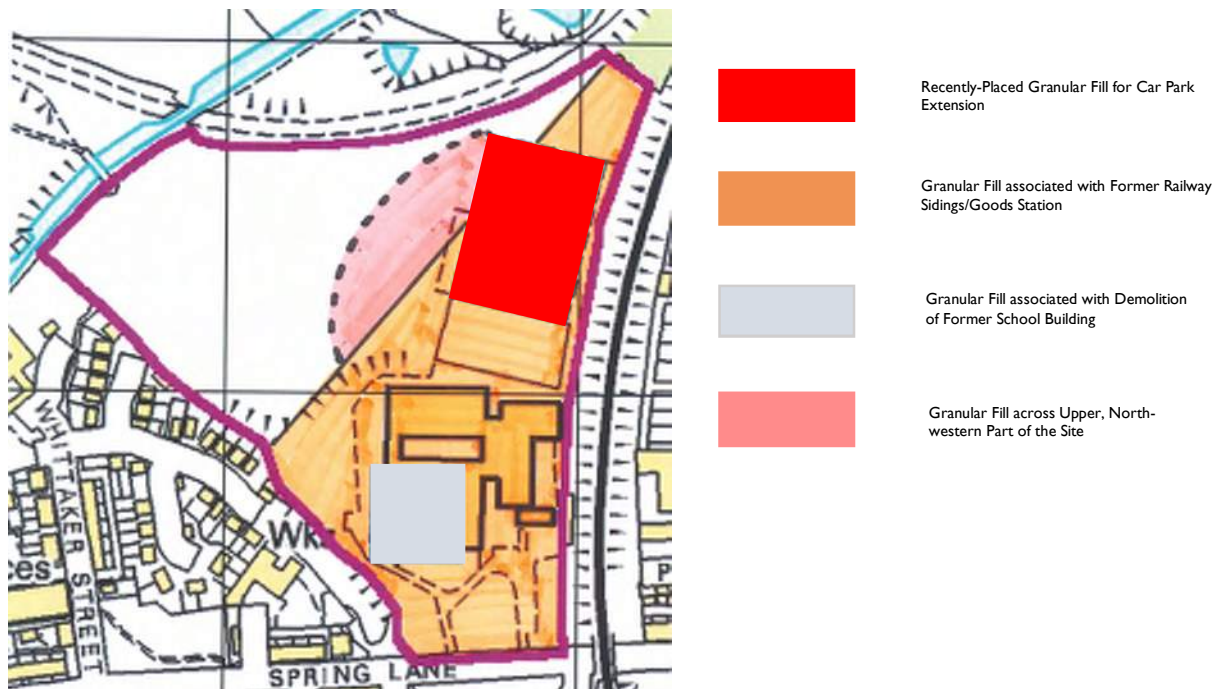
Along the eastern site boundary, near the base of the Metrolink embankment, the surfacing from the former goods station remains in place, with sandstone cobble setts extending to 0.20m depth. Similar, cobble setts were also noted at ground level behind the existing Spring Lane School Sports Hall, and also below the tarmacadam surfacing of the Radcliffe Leisure Centre car park (DS07).

7.1.2 Topsoil

The upper, north-western part of the site, and the north-eastern corner were covered by a topsoil layer typically ranging between 0.10m and 0.30 in thickness.

7.1.3 Granular Made Ground

The following sketch plan shows the general distribution of the various types of Granular Made Ground revealed across the site:



Recently-Placed Granular Fill for Car Park Extension

To the north of the temporary Metrolink Park and Ride parking facility, recently-placed granular fill exists as part of an on-going extension to the car park. Here, at TP01, a 0.10m thick surface layer of demolition rubble comprising light grey sandy gravel containing mudstone, limestone, slate, concrete, wood, plastic, metal and bricks overlies dark brown slightly clayey gravelly sand containing limestone. This recently-placed granular fill extends to 0.80m depth where it is found to lie on a Terram woven-geotextile.

Granular Fill associated with Former Railway Sidings/Goods Station

Below this recently-placed fill, and elsewhere across the lower, south-eastern part of the site, further granular fill was encountered probably associated with the former railway sidings/goods station. Here, this material typically comprises medium dense to dense dark brown and black sandy gravel containing mudstone, siltstone, sandstone, limestone and coal, along with ash, clinker, concrete, glass, wood, clayware pipe fragments and bricks. This material was proven to 2.20m depth at DS06 and 2.80m depth at DS07 where, in both cases, it was noted to be loose in terms of its relative density.

The Hand-dug Trial Pits HD01 to HD05 were all terminated within granular fill at depths ranging between 0.60m and 1.20m below ground level.

Granular Fill associated with Demolition of Former School Building

To the south of the existing lawns and MUGA of Spring Lane School, at HD04, granular fill was noted to extend to 0.90m depth where sandstone setts were encountered. Whilst similar to the granular fill encountered nearby, here this includes plastic fragments, suggesting some mixing with rubble from the relatively-recent demolition of former school buildings in 2015.

Granular Fill across Upper, North-western Part of the Site

In places, across the upper, north-western part of the site granular fill was encountered typically comprising medium dense dark brown and black gravelly clayey sand with a medium cobble content. Whilst generally not as coarse, this material was similar in composition to the granular fill associated with the former railway sidings/goods station to the south-east. This granular fill was thickest near to the crest of the south-west to north-east running scarp (former

railway cutting) where it extends to depths of between 1.75m and 2.40m below ground level at BH03, BH03A, DS04 and DS05.

At TP6, near to the crest of the scarp, the granular fill extended to 1.50m depth and was noted to include a metal frame, up to 1.20m in length.

Towards the centre of the site, within an area previously used as allotment gardens, the granular fill encountered in DCP05 and DS05 was noted to have a slight hydrocarbon odour. At BH03, a strong hydrocarbon (petroleum) odour and oily sheen was noted at 2.00m depth on encountering natural Glacial Sand and Gravel deposits, the contamination probably having percolated down through the overlying granular fill.

The Hand-dug Trial Pits DCP01 and DCP05 were both terminated within granular fill at 1.20m below ground level.

7.1.4 Cohesive Made Ground

Cohesive Fill across Upper, North-western Part of the Site

Underlying the Topsoil at DS01, DS02, DS04 and TP05 on the upper, northwestern part of the site, cohesive fill was encountered. This typically comprises very soft dark grey/black and brown slightly sandy slightly gravelly clay containing mudstone, siltstone, sandstone, coal and brick fragments. It extends up to 1.90m depth at DS01 (where the soils may possibly represent arisings derived from the excavation of the adjacent Manchester, Bolton & Bury Canal).

Part of a timber railway sleeper (up to 1.00m long) was encountered at the base of the cohesive fill at 1.10m depth within TP05.

Cohesive Fill across Lower, South-eastern Part of the Site

At DS7 underlying the granular fill at 2.80m depth, firm orangish brown sandy gravelly clay including ceramic fragments was encountered and proven to the base of this exploratory hole at 3.45m below ground level. Within TP3 below the granular fill at 1.70m depth, a 0.70m thickness of soft to firm dark grey slightly sandy slightly gravelly clay including brick fragments was noted. It is probable here that this cohesive fill comprises a re-worked, uppermost part of the natural Glacial Till.

7.1.5 Glacial Sand and Gravel

Over the lower, south-eastern part of the site, Glacial Sand and Gravel was revealed within BH04 where it exists as a 0.20m thick layer at 2.10m depth underlying the Granular Made Ground and also within DS6 where it exists as a layer contained within the Glacial Till, between 3.20m and 4.40m depth. It typically comprises medium dense brown gravelly clayey fine to coarse sand. In DS06 below 4.40m depth, these granular glacial deposits were noted to grade into dark grey sandy slightly silty fine to coarse gravel which was proven to the base of the exploratory hole at 5.00m below ground level. In DS06 at 4.00m depth, an SPT N-value of 9 was recorded in the granular glacial deposits. Here, the granular materials may have been disturbed by the “piping” effect of testing/sampling below the water table.

Across the upper, north-western part of the site, Glacial Sand and Gravel was encountered within BH01 and TP04 directly below the Topsoil, and also within BH02, BH03, BH03A, DS04 and DS05 where it lies below the Made Ground. It typically comprises medium dense brown slightly gravelly clayey fine to coarse sand and was proven to a maximum depth of 5.00m below ground level at DS05.

At the locations of the Dynamic Sample Boreholes, the Glacial Sand and Gravel contains subordinate layers of Glacial Till (DS2 and DS5) or exists as layers within the Glacial Till (DS1, DS3, DS4 and DS6).

Dynamic Sample Boreholes DS02 and DS05 were terminated within Glacial Sand and Gravel at depths of 4.00m and 5.00m, below ground level, respectively.

7.1.6 Glacial Laminated Clay

Towards the base of the Glacial Sand and Gravel deposits encountered in BH01, below 3.30m depth two 200mm thick layers of stiff laminated grey and brown clay with lenses of sand were revealed.

7.1.7 Glacial Till

Glacial Till was revealed below the Topsoil in DS3, beneath the Glacial Laminated Clay in BH01, and elsewhere underlying the Made Ground or Glacial Sand and Gravel. The Glacial Till typically comprises grey/brown slightly sandy slightly gravelly clay with a low to medium cobble content. It generally ranges from firm to very stiff in consistency with depth. In places, where it underlies Granular Made Ground (e.g. DS06) or Glacial Sand and Gravel (e.g. DS01) the Glacial Till may be water-softened to a very soft, or soft to firm consistency.

At the location of TP04, Glacial Till was encountered at 1.40m depth below the Glacial Sand and Gravel and was proven to the base of the Trial Pit at 4.00m below ground level. Here, in places, the till was noted to grade to a slightly sandy gravelly silt. Glacial Silt layers were also noted at TP03 below 3.70m depth and also between 17.60m and 18.10m depth within BH02. The Glacial Silt typically comprises stiff to very stiff light brownish grey slightly gravelly sandy silt.

The Hand-dug Trial Pits DCP07 and DCP08 were both terminated within Glacial Till at 1.20m below ground level. The Machine-dug Trial Pits TP01 to TP06 and the Dynamic Sample Boreholes DS01, DS03 and DS04 were also terminated within Glacial Till at depths ranging between 3.70m and 5.45m below ground level.

Within the Cable Percussion Boreholes, the Glacial Till was proven to “geological rockhead” (the top of the weathered bedrock) at the following depths below ground level:

Depth to base of Glacial Till / Geological Rockhead		
Borehole	Depth (m bgl)	Elevation (m AOD)
BH01	17.00	58.71
BH02	20.50	53.78
BH03A	13.10	61.13
BH04	12.60	58.44

7.1.8 Pennine Middle Coal Measures Formation – Mudstone/Siltstone

The bedrock encountered within the Cable Percussion with Rotary-Drilling Follow-on Boreholes comprises strata of the Pennine Coal Measures Formation. These strata largely consist of a rhythmic cyclothem sequence of interbedded mudstone and siltstone with subordinate layers of sandstone and coal seams which was proven to depths ranging between 47.00m (BH01) and 51.50m (BH02) below ground level.

Between “geological rockhead” and the depth at which rotary coring commenced, the interbedded mudstone and siltstone was notably weathered, such that in some cases the slightly stronger, more-intact siltstone was apparently seen to predominate over the weaker less-intact mudstone. This may simply be a feature of the boring process as the mudstone reduces to the condition of a clayey matrix, particularly with the addition of water flush to the borehole.

The mudstone layers are typically described as extremely weak to very weak thinly laminated to thinly bedded dark grey and grey mudstone with occasional laminae and thin beds of siltstone. In places, the extremely weak nature of the mudstone is marked by non-intact zones, particularly at shallower depths. In general, below coal seams the mudstone is noted to become black, carbonaceous and contains plant fossils (probably representative of seat-earths).

The siltstone layers are generally stronger and more-intact than the mudstone and are typically described as weak to moderately weak grey and light grey (occasionally red – BH04 below 40.00m depth) thickly laminated to thinly bedded siltstone with occasional laminae and thin beds of mudstone. With increasing depth, the siltstone becomes stronger and more intact becoming medium strong to strong in places and containing occasional quartz veins and

traces of bivalve fossils.

Discontinuities within the mudstone are typically described as subhorizontal. extremely closely to very closely spaced, planar and undulating, smooth and rough with minor clay infill or clay smear.

Discontinuities within the siltstone are typically described as subhorizontal. extremely closely to very closely spaced becoming closely to medium spaced with depth, undulating occasionally stepped, rough with occasional clay smear.

7.1.9 Pennine Middle Coal Measures Formation – Sandstone

In places, contained within the finer grained interbedded mudstone and siltstone sequence, occasional medium to thick beds of sandstone were encountered. These are listed in the following table.

BH01	BH03A	BH04
18.40m to 20.08m	27.05m to 28.30m	23.90m to 24.10m
	29.55m to 30.00m	34.65m to 37.78m

The sandstone typically comprises competent layers of medium strong to very strong laminated grey occasionally orangish brown fine to medium grained sandstone containing occasional quartz veins.

Discontinuities within the sandstone are typically described as subhorizontal, occasionally vertical, planar and undulating, rough with minor orangish brown iron staining.

7.1.10 Pennine Middle Coal Measures Formation – Coal

Various coal seams were also encountered within the interbedded mudstone and siltstone sequence. These are listed in the following table.

BH01	BH02	BH03A	BH04
27.86m to 28.37m	26.80m to 28.00m	16.40m to 16.75m	29.25m to 29.50m
40.50m to 42.08m	47.20m to 48.00m#	19.50m to 20.00m	30.50m to 30.80m
		20.20m to 20.40m	31.07m to 31.26m
		36.30m to 36.93m	
		40.35m to 40.50m	

#Probable coal seam based on colour of water flush becoming black.

The coal seams are typically described as extremely weak to very weak black coal which is generally non-intact (being recovered as gravel) or has extremely closely spaced discontinuities.

7.1.11 Coal Workings

As part of the Phase I Desk Study, a Consultant's Coal Mining Report was obtained which stated that there are probable unrecorded shallow workings below the site. The Summary of Findings Plan appended to the coal mining report shows the outcrop of the Park Yard Coal (also known as the Ashclough Coal) running southwest to northeast across the central part of the site. Further north on the site, near to the Manchester, Bolton & Bury Canal, the outcrop of the older Ince New Coal (also known as the Major Coal or Stonedolph Coal) is shown following a similar strike. It was therefore considered that potential mine entries or voids could be present associated with shallow workings within these two seams.

Based on the findings of the four (4 No.) cable percussion with rotary drilling follow-on boreholes, there appears to be no evidence of unrecorded past mine entries or coal workings on the exploratory hole records, with

- no voids (falling of the drill rods),
- no significant loss of drilling flush returns, and
- no “loose drilling” or “broken ground”

being reported by the drillers.

7.1.12 Ground Model

Based on the available exploratory holes, the ground profile over the lower, south-eastern part of the site is summarised as follows:-

Ground Profile – Lower, South-eastern Part of the Site				
Stratum	Typical Description	Depth to Top (m bgl)	Level of Top (m OD)	Thickness (m)
Topsoil	TOPSOIL: Black/dark brown slightly silty fine sand with many rootlets (Found in TP02, HD03 and HD05)	GL	71.53 to 70.30	0.20 to 0.30
Made Ground	Tarmacadam (Found in BH04, DS07 and HD01)	GL	71.04 to 70.31	0.05 to 0.10
Made Ground	Concrete (Found in BH02)	GL	70.39	0.10
Made Ground	Cobble Setts (Found in DS06)	GL	70.17	0.20
Made Ground	Limestone Gravel Sub base (Found in BH04, HD01 and HD02)	0.10	70.94 to 70.29	0.10 to 0.20
Granular Made Ground	MADE GROUND: Medium dense to dense dark brown and black sandy gravel containing mudstone, siltstone, sandstone, limestone and coal, along with ash, clinker, concrete, glass, wood, clayware pipe fragments and bricks.	GL to 0.30	71.95 to 69.97	1.20 to 2.60
Cohesive Made Ground	MADE GROUND: Soft to firm orangish brown/dark grey sandy gravelly clay including ceramic/brick fragments. (Found in DS07 and TP03)	1.70 to 2.80	68.72 to 67.51	0.70
Glacial Sand and Gravel	Medium dense brown gravelly clayey fine to coarse SAND / Dark grey sandy slightly silty fine to coarse GRAVEL. (Found in BH04 and DS06)	2.10 to 3.20	68.94 to 66.97	0.20 to 1.80
Glacial Till	Stiff to very stiff grey/brown slightly sandy slightly gravelly CLAY.	1.40 to 2.40	70.55 to 67.97	1.00 to 10.30
Weathered Pennine Middle Coal Measures	Extremely weak grey MUDSTONE with traces of coal. (Penetrated with cable percussion boring techniques – BH04)	12.60	58.44	3.10
Pennine Middle Coal Measures	Extremely weak to very weak dark grey and grey MUDSTONE, weak to moderately weak grey and light grey SILTSTONE, with subordinate beds of medium strong to strong grey/orangish brown SANDSTONE and occasional seams of extremely weak to very weak black COAL. (BH04)	15.70	55.34	> 29.30

Based on the available exploratory holes, the ground profile over the upper, north-western part of the site is summarised as follows:-

Ground Profile – Upper, North-western Part of the Site				
Stratum	Typical Description	Depth to Top (m bgl)	Level of Top (m OD)	Thickness (m)
Topsoil	TOPSOIL: Dark brown slightly silty fine to medium sand with many rootlets/ TOPSOIL: Very soft day brown slightly gravelly sandy clay with many rootlets.	GL	76.84 to 73.64	0.10 to 0.50
Granular Made Ground	MADE GROUND: Medium dense dark brown and black gravelly clayey sand with a medium cobble content.	0.10 to 1.30	76.00 to 72.47	0.40 to 1.70
Cohesive Made Ground	MADE GROUND: Very soft dark grey/black and brown slightly sandy slightly gravelly clay containing mudstone, siltstone, sandstone, coal and brick fragments.	0.10 to 0.50	76.64 to 73.67	0.30 to 1.70
Glacial Sand and Gravel	Medium dense brown slightly gravelly clayey fine to coarse SAND	0.10 to 2.80	75.61 to 70.97	0.90 to 3.20
Glacial Laminated Clay	Stiff laminated greyish brown slightly sandy CLAY with lenses of sand. (Found in BH01)	3.30	72.41	0.20
Glacial Till	Firm to very stiff grey/brown slightly sandy slightly gravelly CLAY with a low to medium cobble content. Grading to silt in places. Water-softened where it underlies granular layers.	0.25 to 4.00	74.86 to 69.74	0.10 to 18.7
Weathered Pennine Middle Coal Measures	Extremely weak dark grey MUDSTONE with thin beds of very weak grey SILTSTONE. (Penetrated with cable percussion boring techniques – BH01, BH02 and BH03A)	13.10 to 20.50	61.13 to 53.78	0.17 to 2.00
Pennine Middle Coal Measures	Extremely weak to very weak dark grey and grey MUDSTONE, weak to moderately weak grey and light grey SILTSTONE, with subordinate beds of medium strong to strong grey/orangish brown SANDSTONE and occasional seams of extremely weak to very weak black COAL. (BH01, BH02 and BH03A)	15.10 to 21.66	59.13 to 52.62	> 30.40

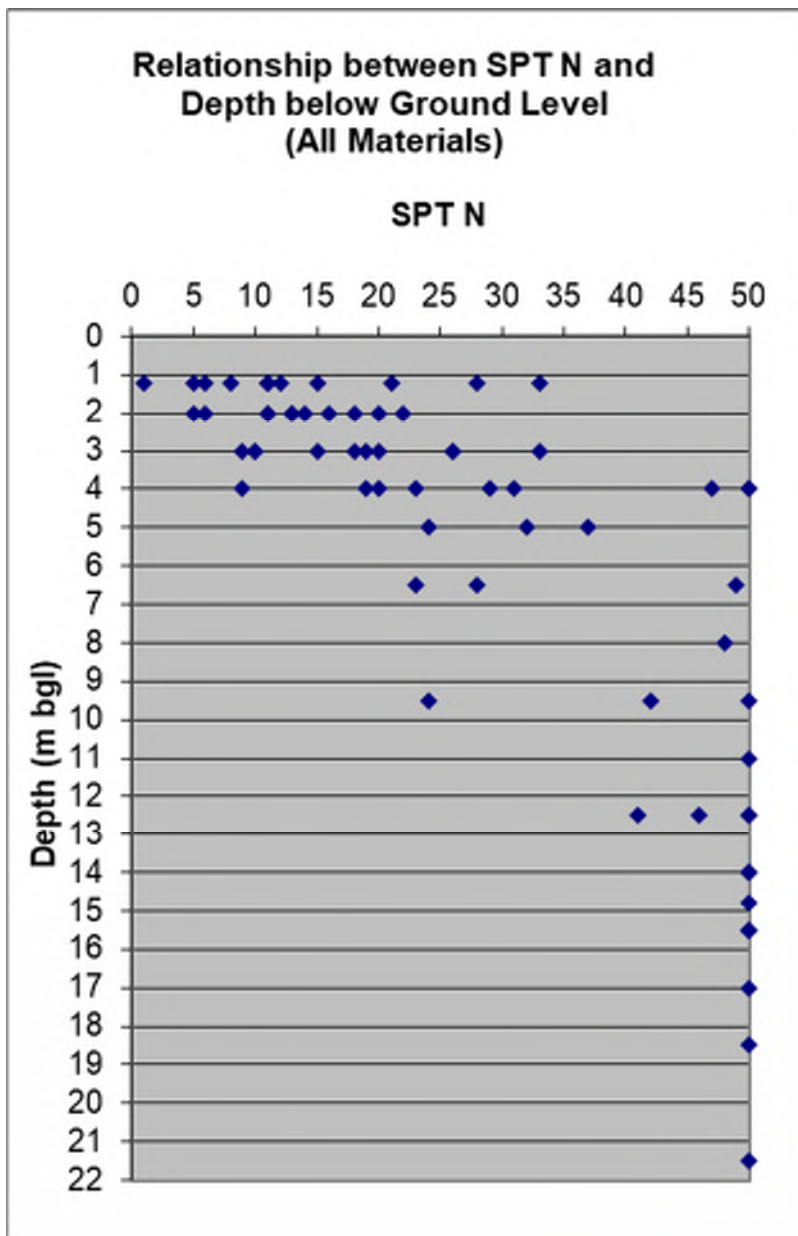
Geological cross sections across the site and a Rockhead Depth Diagram are presented in Appendix 13.

7.2 Soil and Rock Parameters

7.2.1 General

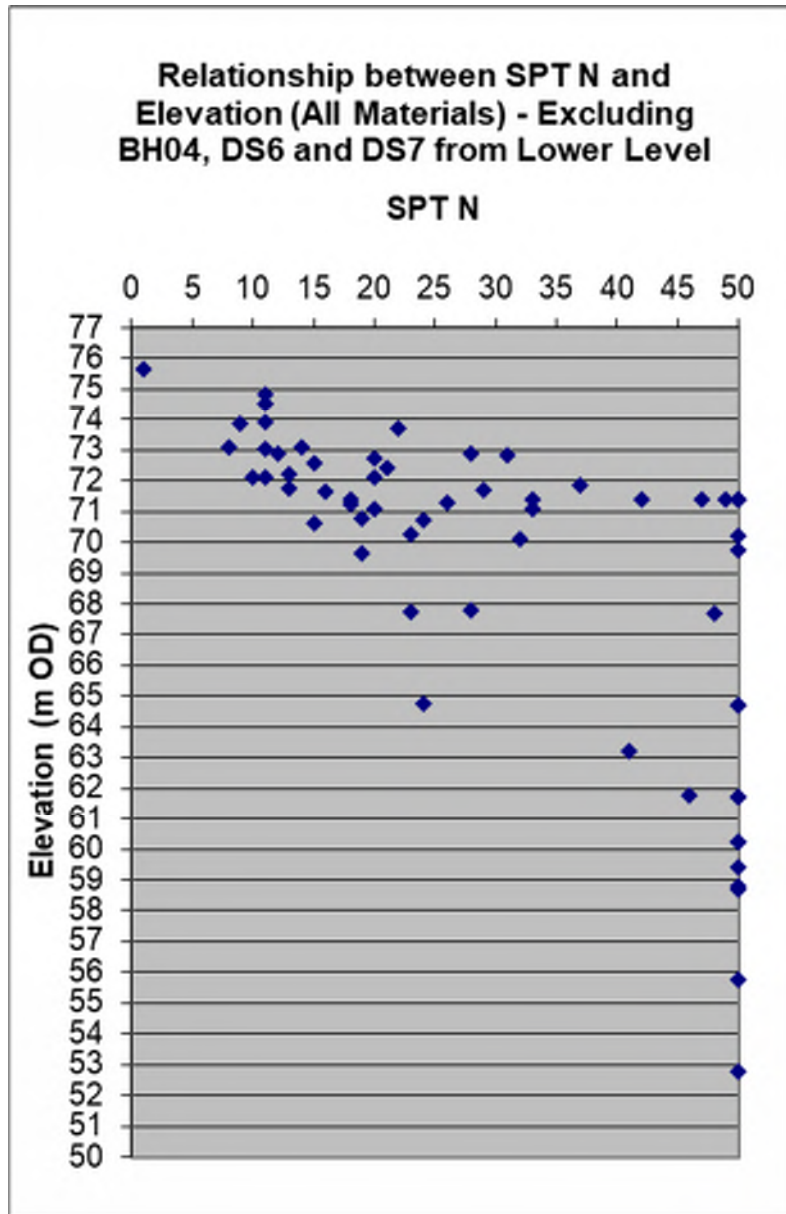
Geotechnical Soil and Rock Parameters Plots relating to all of the materials tested are presented in Appendix 16.

The following plot indicates the relationship between SPT N-values and depth for all of the materials tested within all of the exploratory holes sunk across the site. Where SPT N-values of 50 or above are shown on the plot these generally represent refusals upon cobbles/boulders or within the Pennine Middle Coal Measures bedrock.



The above SPT N-value versus depth plot highlights the particularly low SPT-N values recorded to 2m depth within the Made Ground of DS01, DS06 and DS07. The variations in depth of the refusals (shown as SPT-N = 50) generally reflects the presence of cobbles/boulders within the Glacial Deposits and refusals within the Pennine Middle Coal Measures bedrock (which was encountered at various levels across the site).

In an attempt to clarify the distribution of SPT N-values beneath the area of the proposed school buildings, they have been plotted against elevation with the data from the exploratory holes sunk from the lower, south-eastern part of the site (BH04, DS06 and DS07) excluded.



This plot still includes the very low SPT N-value ($N = 1$) recorded in the highest, far north-western corner of the site near to the Manchester, Bolton & Bury Canal.

At higher elevations (between about 75m and 70m OD) the typically medium dense relative density of the Granular Made Ground and Glacial Sand and Gravel is shown, whilst below this (between about 70m and 60m OD), the generally stiff to very stiff nature of the Glacial Till can be picked out.

Again, below about 60m OD, the refusals (shown as $N = 50$) may be due to cobbles/boulders in the Glacial Till or be due to the presence of the Pennine Middle Coal Measures bedrock.

7.2.2 Granular Made Ground

Geotechnical Soil Parameters Plots relating to Granular Made Ground are presented in Appendix 17.

The Granular Made Ground is of variable consistency/relative density and thickness. It is therefore heterogeneous and potentially compressible, with a potential for further degradation and could potentially be chemically aggressive in nature.

As previously mentioned in Section 7.1.3, where tested, the relative density of the Granular Made Ground encountered on the upper, north-western part of the site was generally medium dense. Whereas, similar material encountered on the lower south-eastern part of the site (DS06 and DS07) was loose (Refer to the following table).

Standard Penetration Test Results – Granular Made Ground			
Borehole	Depth (m bgl)	SPT – N Value	Relative Density
BH03	1.20-1.65	28	Medium dense
BH03A	1.20-1.65	11	Medium dense
BH04	1.20-1.65	33	Dense
DS04	1.20-1.65	15	Medium dense
DS04	2.00-2.45	13	Medium dense
DS05	1.20-1.65	21	Medium dense
DS06	1.20-1.65	6	Loose
DS06	2.00-2.45	6	Loose
DS07	1.20-1.65	5	Loose
DS07	2.00-2.45	5	Loose
Mean		14.3	Medium dense

Seventeen (17 No.) Particle Size Distribution Tests were carried out on samples of the Granular Made Ground. These gradings are plotted together as a PSD envelope on Figure 3 in Appendix 17 and show it to range between

Black/dark brown very sandy clayey fine to coarse gravel with a high cobble content, and

Brownish grey gravelly very clayey fine to coarse sand.

A representative typical description for the Granular Made Ground is

Black/dark brown very gravelly very clayey fine to coarse sand.

A single (1 No.) Compaction Test was carried out on a sample of Granular Made Ground recovered from 0.30-0.70m depth at DCP01. The results are summarised below:

Compaction Test Results – Granular Made Ground				
Sample	Method of Compaction	Initial Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (Mg/m ³)
DCP01 0.30-0.70m	2.5kg Rammer	17	14	1.83

In this case, for the Granular Made Ground the material tested is wetter than the optimum moisture content.

Two (2 No.) laboratory California Bearing Ratio (CBR) Tests were carried out on samples of the Granular Made Ground. These tests were carried out at their natural moisture content using a 2.5kg rammer.

California Bearing Ratio (CBR) Test Results – Granular Made Ground			
Sample	Moisture Content (%)	CBR Value - Sample Top (%)	CBR Value - Sample Bottom (%)
BH03 0.80-1.20m	12	18.8	24.4
BH04 0.60-1.20m	18	45.2	53.5

These test results reflect the potentially medium dense to dense relative density of the re-compacted Granular Made Ground over the upper, north-western part of the site, with the recorded CBR values being in excess of 20%. Comparison between these laboratory CBR results and in situ CBR results correlated from the Dynamic Cone Penetration Tests carried out in the Granular Made Ground can be made by referring to the table in Section 8.9. For the Granular Made Ground there appears to be a good correlation between the laboratory and in situ CBR results.

In the absence of reliable test data, the values of characteristic weight density (bulk unit weight) have been derived from charts of suggested values given in BS 8002: 2015, *Code of Practice for Earth Retaining Structures*.

Parameters derived from BS 8002: 2015, <i>Code of Practice for Earth Retaining Structures</i> – Granular Made Ground			
Relative Density	Weight Density (Bulk Unit Weight) γ_b (kN/m ³)	Effective Cohesion $c'_{cv,k}$ (kN/m ²)	Friction Angle $\phi'_{cv,k}$ (Degrees)
Loose to Medium Dense	18.0	0	38

BS 8002: 2015, *Code of Practice for Earth Retaining Structures* states that in the absence of reliable test data, for coarse soils, the characteristic constant volume (critical state or ultimate) angle of shearing resistance $\phi'_{cv,k}$ may be estimated, based on the following relationship:

$$\phi'_{cv,k} = 30^\circ + \phi'_{ang} + \phi'_{PSD}$$

Taking the sample from TP03 1.40-1.50m as the most representative of the Granular Made Ground tested, from the Particle Size Distribution test carried out the following Uniformity Coefficient is calculated:

Sample	D ₆₀ (mm)	D ₁₀ (mm)	Uniformity Coefficient C_u	ϕ'_{PSD} (Degrees)
TP03 1.40-1.50m	0.9	0.035	25.7	4

Given the largely angular to subangular nature of the Granular Made Ground, $\phi'_{ang} = 4^\circ$.

Hence, for the Granular Made Ground $\phi'_{cv,k} = 38^\circ$.

BS 8002: 2015, *Code of Practice for Earth Retaining Structures* states that where, in the absence of reliable laboratory test data, the characteristic constant volume angle of shearing resistance $\phi'_{cv,k}$ is used, then the characteristic constant volume effective cohesion ($c'_{cv,k}$) should be taken as zero.

The friction angle of the Granular Made Ground can also be derived from a correlation given by Peck, Hanson and Thorburn (1967). Hence, for an N value of 14, an approximate friction angle of 32 degrees is appropriate.

7.2.3 Cohesive Made Ground

The Cohesive Made Ground is also of variable consistency/relative density and thickness. It is also heterogeneous and potentially compressible, with a potential for further degradation and could potentially be chemically aggressive in nature.

Two (2 No.) Particle Size Distribution Tests were carried out on bulk disturbed samples of the Cohesive Made Ground, namely

DCP01 0.70-1.20m – Brown slightly sandy silty clay, and

HD03 0.80-1.20m – Firm dark brown slightly sandy slightly gravelly clay.

Two (2 No.) Plasticity Index Tests were carried out on samples of the Cohesive Made Ground. Using the Plasticity Index test results, the Consistency Index (I_c) has been calculated for the sample tested (Refer to the following table).

Plasticity Index Test Results – Cohesive Made Ground								
Sample	w (%)	PL (%)	LL (%)	PI (%)	Consistency Index I_c	Consistency (Based on I_c)	Plasticity Class	Passing 0.425mm Sieve (%)
TP03 2.00m	14	15	33	18	1.056	Very stiff	CL	71
TP05 0.50m	26	23	47	24	0.875	Stiff	CI	89

The Plasticity Index test results show the Cohesive Made Ground to be of low to intermediate plasticity (Refer to the Plasticity Charts for Casagrande Classification in Appendix 14 and Figure 9 in Appendix 17).

A single (1 No.) 60mm x 60mm Shear Box Test was carried out on a sample of Cohesive Made Ground yielding the following results:

60mm x 60mm Shear Box Test Results – Cohesive Made Ground			
Sample	Weight Density (Bulk Unit Weight) γ_b (kN/m ³)	Effective Cohesion c' (kN/m ²)	Friction Angle ϕ' (Degrees)
DCP01 0.70-1.20m	21.39	14	31

Values of characteristic weight density (bulk unit weight) have also been derived from charts of suggested values given in BS 8002: 2015, *Code of Practice for Earth Retaining Structures* (See table below).

Parameters derived from BS 8002: 2015, <i>Code of Practice for Earth Retaining Structures</i> – Cohesive Made Ground				
Sample	PI (%)	Weight Density (Bulk Unit Weight) γ_b (kN/m ³)	Effective Cohesion c' (kN/m ²)	Friction Angle ϕ' (Degrees)
TP03 2.00m	18	21.0	0	26.3
TP05 0.50m	24	20.0	0	24.7

The above friction angles have also been derived using BS 8002: 2015, *Code of Practice for Earth Retaining Structures*. This standard states that in the absence of reliable test data, for fine soils, the characteristic constant volume (critical state or ultimate) angle of shearing resistance $\phi'_{cv,k}$ may be used, based on the following relationship:

$$\phi'_{cv,k} = (42^\circ - 12.5 \log_{10} I_p) \text{ for } 5\% \leq I_p \leq 100\%$$

where I_p is the soil's plasticity index (%).

BS 8002: 2015, *Code of Practice for Earth Retaining Structures* states that where, in the absence of reliable laboratory test data, the characteristic constant volume angle of shearing resistance $\phi'_{cv,k}$ is used, then the characteristic constant volume effective cohesion ($c'_{cv,k}$) should be taken as zero.

7.2.4 Glacial Sand and Gravel

Geotechnical Soil Parameters Plots relating to Glacial Sand and Gravel are presented in Appendix 18.

As previously mentioned in Section 7.1.5, where tested, the relative density of the Glacial Sand and Gravel was generally medium dense. The plot shown on Figure 1 in Appendix 18 suggests a general trend of increasing relative density with depth within the Glacial Sand and Gravel.

Standard Penetration Test Results – Glacial Sand and Gravel			
Borehole	Depth (m bgl)	SPT – N Value	Relative Density
BH01	1.20-1.65	11	Medium dense
BH01	2.00-2.45	22	Medium dense
BH01	3.00-3.45	20	Medium dense
BH02	1.20-1.65	8	Loose
BH03	2.00-2.45	20	Medium dense
BH03A	2.00-2.45	13	Medium dense
BH03A	3.00-3.45	18	Medium dense
BH04	2.00-2.45	18	Medium dense
DS01	3.00-3.45	9	Loose
DS02	1.20-1.65	12	Medium dense
DS02	3.00-3.45	33	Dense
DS03	1.20-1.65	11	Medium dense
DS04	3.00-3.45	19	Medium dense
DS05	2.00-2.45	16	Medium dense
DS05	3.00-3.45	15	Medium dense
DS05	4.00-4.45	19	Medium dense
DS06	3.00-3.45	26	Medium dense
DS06	4.00-4.45	9	Loose
Mean		16.6	Medium dense

Eleven (11 No.) Particle Size Distribution Tests were carried out on samples of the Glacial Sand and Gravel. These gradings are plotted together as a PSD envelope on Figure 3 in Appendix 18 and show it to range between

Brown silty fine to coarse SAND and fine to coarse GRAVEL with a high cobble content, and

Brown very silty fine to medium SAND with traces of fine gravel.

A representative typical description for the Glacial Sand and Gravel is

Brown very sandy very clayey fine to coarse GRAVEL.

Two (2 No.) Compaction Tests were carried out on samples of Glacial Sand and Gravel. The results are summarised below:

Compaction Test Results – Glacial Sand and Gravel				
Sample	Method of Compaction	Initial Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (Mg/m ³)
BH02 0.50-1.20m	2.5kg Rammer	24	18	1.71
BH02 1.20-1.65m	4.5kg Rammer	17	14	1.91

For the Glacial Sand and Gravel the material tested is wetter than the optimum moisture content.

Three (3 No.) 60mm x 60mm Shear Box Tests were carried out on samples of Glacial Sand and Gravel yielding the following results:

60mm x 60mm Shear Box Test Results – Glacial Sand and Gravel			
Sample	Weight Density (Bulk Unit Weight) γ_b (kN/m ³)	Effective Cohesion c' (kN/m ²)	Friction Angle ϕ' (Degrees)
BH01 0.50-1.20m	19.13	30	33
DS02 1.20-2.00m	18.84	16	35
TP04 0.40-0.60	19.93	10	38

The shear box tests results show values of Effective Cohesion c' ranging between 10 and 30kN/m² reflecting a significant fines content as a secondary constituent within the Glacial Sand and Gravel samples tested. It is also noted that the particle size of the material tested in the 60mm x 60mm Shear Box Tests is not representative of much of the Glacial Sand and Gravel as the gravel and coarser fractions were not tested. However, the results could be considered to provide lower bound values of friction angle, as the inclusion of coarser fractions in the soil would be likely to lead to increased friction angles.

The friction angle of the Glacial Sand and Gravel can also be derived from a correlation given by Peck, Hanson and Thorburn (1967). Hence, for an N value of 17, an approximate friction angle of 32 degrees is appropriate.

7.2.5 Glacial Laminated Clay

Glacial Laminated Clay was only encountered as thin layers (up to 200mm thick) within BH01 and here a single (1 No.) Plasticity Index Test was carried out on a sample recovered from 3.80m depth. Using the Plasticity Index test results, the Consistency Index (I_c) has been calculated for the sample tested (Refer to the following table).

Plasticity Index Test Results – Glacial Laminated Clay								
Sample	w (%)	PL (%)	LL (%)	PI (%)	Consistency Index I_c	Consistency (Based on I_c)	Plasticity Class	Passing 0.425mm Sieve (%)
BH01 3.80m	17	15	31	16	0.875	Stiff	CL	98

The Plasticity Index test results show the Glacial Laminated Clay to be of low plasticity (Refer to the Plasticity Chart for Casagrande Classification in Appendix 14).

7.2.6 Glacial Till

Geotechnical Soil Parameters Plots relating to Glacial Till are presented in Appendix 19.

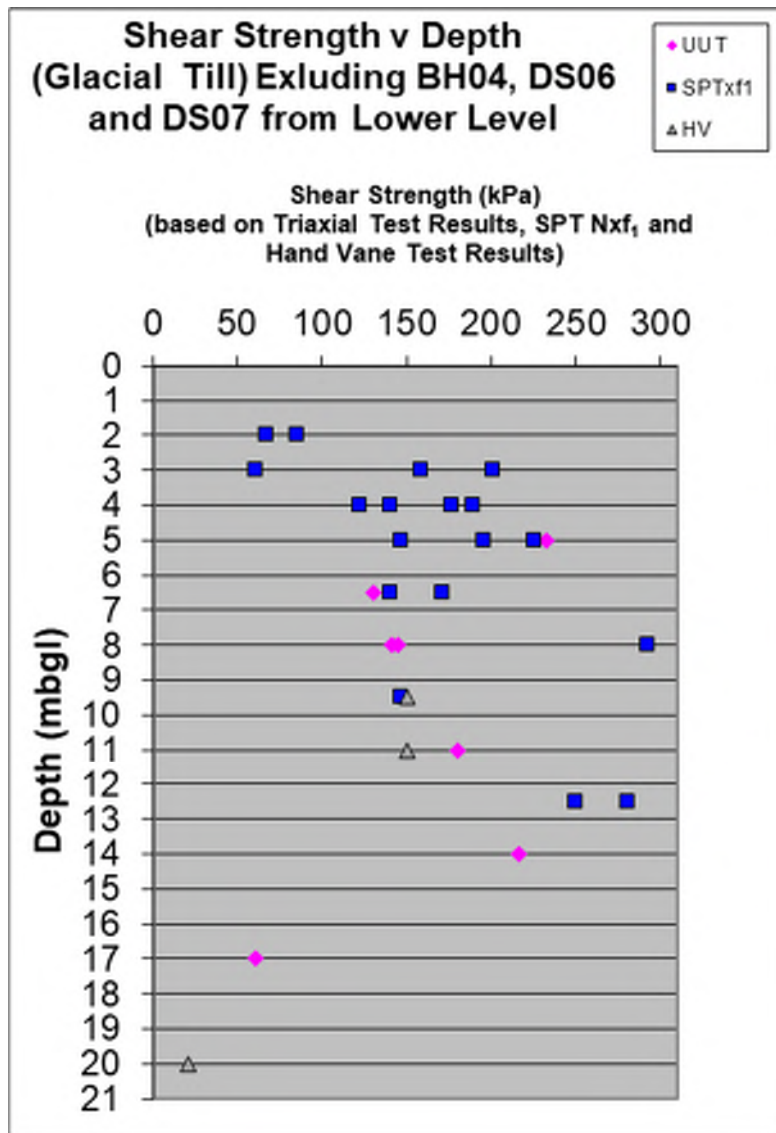
Standard Penetration Tests were performed in situ and Plasticity Index Tests have been carried out on samples of the Glacial Till in the laboratory. Hence, it has been possible to derive values of the undrained shear strength using a correlation proposed by Stroud (1975):

$$\text{Undrained Shear Strength } (c_u) = f_i \times \text{SPT } N$$

where f_i is dependent upon the Plasticity Index of the soil.

Based on the Plasticity Index data tabulated below, typically, for the Glacial Till $PI = 15.5\%$, hence for this material $f_i = 6.1$

Tentatively correlated values of undrained shear strength (c_u) have been plotted against depth on the following plot:



The results of the undrained triaxial strength tests and the laboratory hand vane tests, along with the SPT-N values recorded in the Glacial Till are generally consistent with a medium to very high strength clay. The lower-bound undrained shear strength values show a steady increase with depth.

The UT100 samples recovered from Borehole BH02 at 17.00-17.45m and at 20.00-20.45m yielded undrained shear strengths much lower than expected. For the former sample, an undrained triaxial strength test yielded an undrained shear strength of 61kN/m² which is thought likely to be due it failing along a band of silt. For the latter sample, the presence of pockets of silt is thought likely to be the reason for a low undrained shear strength of 21kN/m² being recorded using the laboratory hand vane tester.

It should be noted that the above plot excludes data from the exploratory holes sunk over the lower, south-eastern part of the site whereas the plots presented in Appendix 19 include data for all of the Glacial Till tested across the site.

Plasticity Index tests were carried out on twenty-seven (27 No.) samples of the Glacial Till. Using the Plasticity Index test results, the Consistency Index (I_c) has been calculated for each of the samples tested (Refer to the following table).

Plasticity Index Test Results – Glacial Till							
Sample	w (%)	LL (%)	PI (%)	Consistency Index I_c	Consistency (Based on I_c)	Plasticity Class	Passing 0.425mm Sieve (%)
BH01 4.00-4.45m	10	27	14	1.214	Very stiff	CL	73
BH01 5.00-5.45m	13	30	16	1.063	Very stiff	CL	75
BH02 1.80m	15	29	16	1.143	Very stiff	CL	67
BH02 3.00-3.45m	15	26	14	0.786	Stiff	CL	85
BH02 6.50-6.95m	11	32	17	1.176	Very stiff	CL	71
BH02 9.50-9.95m	12	30	15	1.200	Very stiff	CL	80
BH03A 4.00-4.43m	12	25	13	1.00	Stiff to Very stiff	CL	74
BH03A 6.50-6.95m	12	34	17	1.294	Very stiff	CL	69
BH04 3.50m	13	31	15	1.20	Very stiff	CL	62
BH04 4.00-4.45m	13	28	15	1.00	Stiff to Very stiff	CL	65
DCP07 0.90-1.20m	20	36	17	0.941	Stiff	CI	81
DCP08 1.00m	26	42	21	0.762	Stiff	CI	96
DS02 2.00-2.45m	13	27	14	1.00	Stiff to Very stiff	CL	82
DS03 2.00-3.00m	16	28	13	0.923	Stiff	CL	79
DS03 3.80-4.00m	16	-	NP	Non-Plastic	Non-Plastic	Non-Plastic	-
DS03 4.80-5.00m	14	-	NP	Non-Plastic	Non-Plastic	Non-Plastic	-
DS04 2.40-2.80m	12	31	17	1.118	Very stiff	CL	68
DS04 3.70-4.00m	10	27	14	1.214	Very stiff	CL	72
TP01 1.50m	15	28	14	0.929	Stiff	CL	86
TP02 1.60m	13	31	16	1.125	Very stiff	CL	78
TP03 3.00m	19	32	14	0.929	Stiff	CL	67
TP04 1.40-1.60m	16	28	14	0.857	Stiff	CL	90
TP04 3.00m	20	26	14	0.429	Soft	CL	86
TP05 1.20m	26	43	22	0.772	Stiff	CI	91
TP05 2.50m	15	30	16	0.938	Stiff	CL	82
TP06 1.50-1.60m	22	29	14	0.500	Soft to Firm	CL	91
TP06 2.80m	11	-	NP	Non-Plastic	Non-Plastic	Non-Plastic	-
Mean Average	15.2	30.4	15.5				

The Plasticity Index test results show the Glacial Till to be generally of low to intermediate plasticity (Refer to the Plasticity Charts for Casagrande Classification in Appendix 14 and Figure 9 in Appendix 19). Based on the tests carried out, the mean Plasticity Index for the Glacial Till is 15.5%.

Nine (9 No.) single-stage undrained triaxial strength tests were carried out on selected undisturbed samples of the Glacial Till. A further five (5 No.) UT100 samples were found to have insufficient specimen length to be suitable for single-stage undrained triaxial strength tests to be carried out and so laboratory hand vane tests were undertaken instead. The results are tabulated as follows:

Single Stage Undrained Triaxial Compressive Strength Test Results – Glacial Till (including Laboratory Hand Vane Test Results)			
Sample	Bulk Density (Mg/m³)	c_u (kN/m²)	Strength Classification
BH01 6.50-6.95m	2.18	130	High Strength
BH01 9.50-9.95m	Laboratory Hand Vane Test	>150	Very High Strength
BH02 5.00-5.45m	2.22	233	Very High Strength
BH02 8.00-8.45m	2.05	141	High Strength
BH02 11.00-11.45m	Laboratory Hand Vane Test	>150	Very High Strength
BH02 14.00-14.45m	2.27	216	Very High Strength
BH02 17.00-17.45m	2.22	61	Medium Strength
BH02 20.00-20.45m	Laboratory Hand Vane Test	21	Low Strength
BH03A 8.00-8.45m	2.17	145	High Strength
BH03A 11.00-11.45m	2.17	180	Very High Strength
BH04 3.00-3.45m	2.20	233	Very High Strength
BH04 5.00-5.45m	Laboratory Hand Vane Test	>150	Very High Strength
BH04 8.00-8.45m	2.27	92	High Strength
BH04 11.00-11.45m	Laboratory Hand Vane Test	>150	Very High Strength

The recorded undrained shear strength (c_u) values from the triaxial tests carried out on the Glacial Till typically range between 92kN/m² (i.e. high strength) and 233kN/m² (i.e. very high strength).

The UT100 samples recovered from Borehole BH02 at 17.00-17.45m and at 20.00-20.45m yielded undrained shear strengths much lower than expected. It is likely that the presence of bands and/or pockets of silt within these materials may have created local lines of weakness within the specimens tested.

Two (2 No.) consolidated undrained triaxial strength tests were carried out on selected undisturbed samples of the Glacial Till yielding the following results:

Consolidated Undrained Triaxial Compressive Strength Test Results – Glacial Till			
Sample	Bulk Density (Mg/m³)	Apparent Cohesion c' (kN/m²)	Angle of Friction – φ' (Degrees)
BH02 2.00-2.45m	2.12	0	29.9
BH03A 5.00-5.45m	2.20	0	30.9

Six (6 No.) One-dimensional Consolidation (Oedometer) tests were carried out on undisturbed samples of the Glacial Till to obtain a measure of their consolidation characteristics, as summarised in the table below:

One-dimensional Consolidation (Oedometer) Test Results – Glacial Till		
Sample	Measured Bulk Density (Mg/m³)	m_v (m²/MN) [Pressure Range]
BH01 6.50-6.95	2.14	0.141 [100-200kPa]
BH02 2.00-2.45m	2.17	0.165 [100-200kPa]
BH2 8.00-8.45m	2.01	0.041 [100-200kPa]
BH03A 5.00-5.45m	2.16	0.112 [100-200kPa]
BH03A 8.00-8.45m	2.19	0.072 [100-200kPa]
BH04 3.00-3.45m	2.18	0.105 [100-200kPa]

The Coefficient of Volume Compressibility (m_v) can also be estimated using the results of the Atterberg Limit tests and SPT N-values using the below relationship given by Stroud (1975),

$$m_v (m^2/MN) = \frac{1}{f_2 N}$$

Correlated Coefficient of Volume Compressibility – Glacial Till			
Mean SPT N Value	Mean Plasticity Index (I_p)	f_2 value	Mean Estimated m_v (m^2/MN)
35.42	15.5	0.68	0.042

For “Weathered Boulder Clays”, the coefficient of volume compressibility would be expected to be in the “medium compressibility” range (i.e. $0.10m^2/MN$ to $0.30m^2/MN$).

For “Boulder Clays”, the coefficient of volume compressibility would be expected to be in the “low compressibility” range (i.e. $0.05m^2/MN$ to $0.10m^2/MN$).

For “Heavily over-consolidated Boulder Clays”, the coefficient of volume compressibility would be expected to be in the “very low compressibility” range (i.e. below $0.05m^2/MN$).

Whilst samples selected for oedometer testing were carried out on specimens cut from “undisturbed” samples, such tests are susceptible to any disturbance derived either from sampling or specimen preparation.

A total of three (3 No.) compaction tests were carried out on samples of the Glacial Till. The results are summarised below:

Compaction Test Results – Glacial Till				
Sample	Method of Compaction	Initial Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (Mg/m^3)
DCP07 0.90-1.20m	4.5kg Rammer	20	14	1.82
TP04 1.40-1.60m	2.5kg Rammer	16	13	1.84
TP06 1.50-1.60m	2.5kg Rammer	22	13	1.88

In all cases for the Glacial Till the material tested is wetter than the optimum moisture content.

Two (2 No.) laboratory California Bearing Ratio (CBR) Tests were carried out on samples of the Glacial Till. These tests were carried out at their natural moisture content using a 2.5kg rammer.

California Bearing Ratio (CBR) Test Results – Glacial Till			
Sample	Moisture Content (%)	CBR Value - Sample Top (%)	CBR Value - Sample Bottom (%)
BH02 3.00-3.45m	15	0.6	0.6
TP06 1.50-1.60m	22	0.4	0.4

Comparison between these laboratory CBR results and in situ CBR results correlated from the Dynamic Cone Penetration Tests carried out in the Glacial Till can be made by referring to the table in Section 8.9. For the Glacial Till there appears to be no correlation between the laboratory and in situ CBR results. The laboratory test results reflect the potential low strength of the re-compacted Glacial Till, with the recorded CBR values falling below 2%.

7.2.7 Pennine Middle Coal Measures Formation

Plots of Unconfined Compressive Strength against Depth (Figure 11) and Unconfined Compressive Strength against Elevation (Figure 12) relating to specimens tested from the Pennine Middle Coal Measures Formation are presented in Appendix 16. Here, the Is_{50} value recorded from the Point Load Index Tests has been multiplied by a factor of 24 to obtain an approximation of the Unconfined Compressive Strength value.

Other data presented on the Boreholes Records, recorded during the mechanical logging of the rock cores, such as Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality Designation (RQD) and Fracture Index (FI) can also be important considerations in the design process when assessing the mass characteristics of the rock strata beneath the site.

Mudstone/Siltstone

The extremely weak nature of the upper weathered rock strata is evidenced by the progress of the cable percussion rig, which in places (e.g. BH04) was able to penetrate up to 3.10m beneath geological rockhead level without chiselling. The weathered bedrock through which the cable percussion boring rig can penetrate is deemed to be broadly equivalent to a highly to completely weathered rock mass, where the strength of the material is anticipated to be at best very weak, more likely extremely weak.

Where rock core are not available for strength testing it is possible to calculate extrapolated SPT N-values and use the tentative correlation between Rock Strength and SPT N-value:

$$UCS \text{ (MPa)} = 0.6154N^{1.67}/1000$$

(after Turner and Grose: Tunnel Construction & Piling, 1999).

Using the above correlation, Unconfined Compressive Strengths for the strata at the base of the available boreholes are tabulated as follows:

Borehole	Depth (m bgl)	Ext. SPT N Value	UCS (MPa)	Strength	Lithology
BH01	17.00	217.4	4.92	Very weak	Siltstone
BH02	21.50	238.1	5.73	Weak	Siltstone
BH03A	14.00	104.2	1.44	Very weak	Siltstone
BH03A	15.00	312.5	9.03	Weak	Siltstone
BH04	12.50	119.0	1.80	Very weak	Mudstone
BH04	14.00	84.7	1.02	Very weak	Mudstone
BH04	15.50	147.1	2.56	Very weak	Mudstone

Point Load Index Tests were attempted on thirty-two (32 No.) specimens of the Mudstone and seven (7 No.) specimens of the Siltstone.

Unconfined Compressive Strength Tests were attempted on three (3 No.) specimens of the Mudstone and five (5 No.) specimens of the Siltstone.

Point Load Index and UCS Test Results - Mudstone		
Point Load Index (Axial) (Is_{50})	Unconfined Compressive Strength (MPa)	Strength Range
0.01 to 0.76	2.4 to 34.9	Extremely weak to Medium strong

Point Load Index and UCS Test Results - Siltstone		
Point Load Index (Axial) (Is_{50})	Unconfined Compressive Strength (MPa)	Strength Range
0.05 to 0.77	15.0 to 43.7	Very weak to Medium strong

Sandstone

Point Load Index Tests were attempted on three (3 No.) specimens of the Sandstone. Five (5 No.) specimens of the Sandstone were also selected for Unconfined Compressive Strength Tests.

The majority of the specimens selected for Unconfined Compressive Strength Tests were from depths in excess of 10m or so below rockhead. Only a couple of specimens at shallower depths were deemed to be of suitable length due to the high Fracture Index or non-intact nature of the rock.

Point Load Index and UCS Test Results - Sandstone		
Point Load Index (Axial and Irregular) (IS_{50})	Unconfined Compressive Strength (MPa)	Strength Range
1.01 to 1.10	35.6 to 71.6	Moderately weak to Strong

Coal

Coal seams were generally extremely weak to very weak and non-intact (recovered as gravel) or with extremely closely spaced discontinuities generally rendering specimens unsuitable for either Point Load Index or Unconfined Compressive Strength Tests. However, for the seam encountered in BH02 between 26.80-28.00m, Point Load Index Tests were attempted on two (2 No.) specimens of Coal.

Point Load Index Test Results - Coal	
Point Load Index (Axial) (IS_{50})	Strength Range
0.09	Very weak

The following soil and rock parameters have been assessed:

- Moisture Content
- Plasticity Index
- Organic Matter Content
- Weight Density
- Optimum Moisture Content
- Maximum Dry Density
- Undrained Shear Strength
- Friction Angle
- Apparent Cohesion
- Point Load Index
- Unconfined Compressive Strength

Geotechnical Soil and Rock Parameters Plots relating to All Strata, Granular Made Ground, Glacial Sand and Gravel, and Glacial Till are presented in Appendices 16, 17, 18 and 19, respectively.

7.3 Groundwater

The following table lists the groundwater observations recorded during the sinking of the exploratory holes across the site:

Groundwater Inflows			
Hole	Depth (m bgl)	Elevation (m OD)	Remarks
BH01	1.60	74.11	Fast inflow, rose to 1.30m below ground level in 20 minutes, emanating from Glacial Sand and Gravel and sealed off with casing at 2.00m depth.
BH02	2.30	71.98	Slow inflow, rose to 1.70m below ground level in 20 minutes, emanating from sand lens in Glacial Till. Sealed off with casing at 5.00m depth within Glacial Till.
	14.40	59.88	Slow inflow, rose to 14.10m below ground level in 20 minutes, emanating from band of sand/gravel in Glacial Till. Sealed off with casing at 15.00m depth within Glacial Till.
BH03A	2.30	71.93	Slow inflow, rose to 1.80m below ground level in 20 minutes, emanating from Glacial Sand and Gravel. Sealed off with casing at 3.00m depth.
BH04	2.00	69.04	Seepage, no rise, emanating from base of Granular Made Ground. Sealed off with casing at 3.00m depth within Glacial Till.
	14.30	56.74	Fast inflow, rose to 12.80m below ground level in 20 minutes, emanating from Mudstone with traces of coal.
DS01	2.10	74.74	Seepage, no rise, emanating from near to base of Cohesive Made Ground.
	3.00	73.84	Slow inflow, rose to 1.90m below ground level in 20 minutes, emanating from Glacial Sand and Gravel.
DS02	1.30	72.80	Slow inflow, rose to 0.95m below ground level in 20 minutes, emanating from Glacial Sand and Gravel.
DS03	2.10	73.01	Slow inflow, rose to 1.70m below ground level in 20 minutes, emanating from near to base of Glacial Sand and Gravel.
DS04	3.00	70.77	Seepage, no rise, emanating from Glacial Sand and Gravel.
DS05	3.00	70.64	Medium inflow, rose to 1.80m below ground level in 20 minutes, emanating from Glacial Sand and Gravel.
DS06	2.00	68.17	Seepage, no rise, emanating from base of Granular Made Ground.
	3.00	67.17	Slow inflow, rose to 2.10m below ground level in 20 minutes, emanating from near to top of Glacial Sand and Gravel.
TP01	1.50	70.45	Slow inflow, rose to 1.40m below ground level in 20 minutes, emanating from near to base of Granular Made Ground.
TP02	1.60	69.96	Fast inflow, rose to 1.30m below ground level in 20 minutes, emanating from near to base of Granular Made Ground.
TP03	1.60	68.82	Slow inflow, emanating from base of Granular Made Ground.
	2.70	67.72	Medium inflow, emanating from lens of sand/gravel in Glacial Till.
TP5	2.20	72.46	Seepage, emanating from lens of sand/gravel in Glacial Till.
TP6	3.00	70.70	Slow inflow, rose to 2.90m below ground level in 20 minutes, emanating from lens of sand/gravel in Glacial Till.

The exploratory holes not listed in the table above remained dry throughout their excavation.

Standpipes were installed in Boreholes BH01, BH02, BH03A and BH04, and all recorded the presence of groundwater during the monitoring visits. The results can be summarised as follows:

Borehole	Strata covered by Filter Zone	Groundwater Level		Remarks
		Depth (m bgl)	Level (m OD)	
BH01	Glacial Sand and Gravel	1.52 – 1.96	74.19 – 73.75	Fall over monitoring visits.
BH02	Granular Made Ground and Glacial Sand and Gravel	0.88 – 1.32	73.40 – 72.96	Fall over monitoring visits.
BH02	Band of Glacial Sand/Gravel	1.75 – 8.50	72.53 – 65.78	Major fall between 5 th and 6 th monitoring visits.
BH03A	Granular Made Ground and Glacial Sand and Gravel	2.18 – 2.32	72.05 – 71.91	Fall over monitoring visits.
BH04	Granular Made Ground and Glacial Sand and Gravel	DRY (Visit 1) 1.74-1.80	69.30-69.24	Initially dry then fairly static over monitoring visits.

It should be noted that groundwater levels can vary both seasonally and after prolonged periods of wet or dry weather.

The groundwater levels recorded at the site are generally show a fall over the period of the monitoring visits with notable high groundwater levels initially recorded in the shallow standpipe in Borehole BH02. A major fall in the groundwater level in the deep standpipe in Borehole BH02 occurred between 13th and 20th July 2020, when the level fell from 1.95m to 8.50m below ground level (coinciding with a short period of hot, dry weather). Borehole BH04 was initially dry on 16th July 2022 but its water level remained static at about 1.80m below ground level on the following five visits.

The results of the groundwater monitoring are presented in Appendix 12.

8.0 GEOTECHNICAL EVALUATION

8.1 Proposals

It is understood that proposals for the site include the construction of a new secondary school comprising a three-storey “Superblock” school building and single-storey Sports Hall, along with associated infrastructure, car parking and soft landscaping. A plan showing the proposed rebuild location option at the time of preparation of this report is presented in Appendix 21. The following structural loadings have been provided by the Engineer, for a three-storey steel-framed building:

Three-Storey Steel-framed Superblock	SLS (kN)	ULS (kN)
Internal	2125.0	2975.0
Edge	1200.0	1650.0
Corner	650.0	900.0

In addition, for a single-storey Sports Hall, the following structural loadings have been provided by the engineer:

Single-Storey Sports Hall	SLS (kN)	ULS (kN)
Internal	-	-
Edge	575.0	800.0
Corner	325.0	425.0

Details of proposed finished levels had not been made available at the time of preparation of this report. Given the sloping nature of the site it is anticipated that a significant cut and fill operation will be required to create level platforms upon which the proposed new Superblock, Sports Hall, Multi-Use Games Area (MUGA), Sports Pitches and Car Parks will be constructed.

It is anticipated that the proposed Superblock, Sports Hall and Southern Car Park Area will be constructed at the same level (potentially at an elevation slightly lower than the existing ground level).

The Northern Car Park Area will be constructed at a slightly higher elevation to the Southern Car Park Area.

The new Sports Pitches are likely to be constructed at a similar elevation to the existing ground level in these areas, with the new MUGA constructed at the same level as the adjacent Sports Pitch.

8.2 Earthworks

Where the proposed scheme requires the raising of ground levels it is understood that this will be (at least partly) achieved using material won from areas of cut with any shortfall in material being made up using imported granular fill. In general terms the basic requirements for materials used in earthworks are as follows:

- low compressibility
- adequate shear strength following compaction
- contain materials which are not prone to volume and moisture content changes,

In addition, the fill materials must be:

- inert (unreactive, insoluble),
- unfrozen (since thawing releases excess water),
- non-degradable (not containing wood or perishable materials),
- non-hazardous (not chemically or physically harmful) and
- not susceptible to spontaneous combustion (e.g. not containing unburnt colliery waste)

Notwithstanding its chemical suitability, re-use of excavated material for earthworks would require the removal of any boulders and larger cobbles, in order to meet the various classifications given in the Specification for Highway Works.

For a fill material to be deemed acceptable it has to have the required properties to enable it to be incorporated into the permanent works. For certain specific purposes fills may be required to be free-draining, non-crushable or impermeable. However, general fills typically comprise the bulk of earthworks construction. The criteria for the acceptability of a general fill material depend on three factors:

- nature of the works,
- earthmoving efficiency and
- compactability

For the areas of fill at the site, sufficient strength is required to provide an adequate subgrade stiffness to support the pavement and, on its flanks, to prevent slope instability. Self-weight settlements within the fill must also be limited, therefore soils with low compressibility should be used. For adequate trafficability of earthmoving plant and

compactability beneath a roller, the soils traversed must have sufficient strength in order to prevent rutting or bogging down. Soils should be compacted at a moisture content near to their optimum moisture content in order to achieve a high dry density.

If a soil is compacted at moisture contents too dry of optimum then the resulting high air voids content would make the soil compressible and initially brittle. Increased infiltration of surface water into the voids would lead to a loss of strength, particularly if the soil is clayey and becomes softened.

If soils are compacted too wet of optimum then there is a risk of inducing high pore water pressures during construction which could cause slope instability during construction and excessive settlements following construction. If a material is considered to be of poor quality then it could be improved, such as by drying or lime stabilisation.

The recorded natural moisture contents in the materials likely to be 'cut' (i.e. the Granular Made Ground, Glacial Sand and Gravel and Glacial Till) are somewhat wetter than the measured optimum moisture contents (See following table).

Compaction Test Results				
Material	Sample	Method of Compaction	Initial Moisture Content (%)	Optimum Moisture Content (%)
Granular Made Ground	DCP01 0.30-0.70m	2.5kg Rammer	17	14
Glacial Sand and Gravel	BH02 0.50-1.20m	2.5kg Rammer	24	18
Glacial Sand and Gravel	BH02 1.20-1.65m	4.5kg Rammer	17	14
Glacial Till	DCP07 0.90-1.20m	4.5kg Rammer	20	14
Glacial Till	TP04 1.40-1.60m	2.5kg Rammer	16	13
Glacial Till	TP06 1.50-1.60m	2.5kg Rammer	22	13

It is anticipated that some form of modification, e.g. drying, lime stabilisation etc. will be required if these materials are to be re-used as fill material. It is recommended that the specialist stabilisation contractors are approached for guidance on the suitability of their proprietary stabilisation techniques to the soils expected to be 'cut' during the earthworks at this site.

An additional consideration with the proposed earthworks is the ability of the existing soils below the proposed fill areas to support the overlying newly-placed fill materials. Any soils having 'soft' consistencies are expected to be of low strength and of high compressibility. Care will need to be taken to ensure that the surcharge load from the proposed earthworks does not overstress such low strength soils.

Any embankment edge slopes should not be oversteepened, in order to minimise the risk of any slope instability. It may be necessary to limit the speed with which the ground is raised and to monitor pore water pressures in order to allow the founding soils to stiffen as the embankment loads are applied to the foundation soils. Long-term consolidation settlements would be expected to occur due to loading from the fill materials placed above the foundation soils.

8.3 Foundation Solutions

Based on the assumption that the site can be considered stable with respect to subsidence related to past coal mining, the approach to design and selection of suitable foundation options for this site is based on a hierarchy of complexity and expense. If the simplest and cheapest solution case can be shown to be appropriate, then further discussion is considered superfluous. Where such simple and proven techniques are not expected to be suitable, then other options are examined in more detail. It should be noted that the following comments on foundation solutions are based on the proposals discussed in Section 8.1 above; if proposals for the site are changed, it may be necessary to reconsider the foundation solutions. The following options have been considered:

- Traditional strip/pad foundations at shallow depth.
- Traditional strip/pad foundations, but using trench fill to transfer loads to soils at greater depths.
- Reinforced concrete raft foundation to reduce the intensity of loading.
- Ground improvement.
- Piled foundations.

8.3.1 Strip/Pad Foundations

The Made Ground is too weak and variable to support the proposed buildings on traditional strip/pad foundations without the risk of excessive and unacceptable settlements occurring. Whilst following the regrading of the site, natural soils are likely to present at shallow depth, some of these are of low strength or low relative density and therefore unable to support the loadings from the proposed buildings. Furthermore where soils of greater strength or greater relative density are met, given the relatively high proposed column loads for the three-storey Superblock building, the sizes of foundation bases that would be required to accommodate these would be so large as to be uneconomic. In addition, following the regrading of the site, the proposed Sports Hall will be constructed partly over natural ground and partly over placed fill. Excessive differential settlements are likely to result between foundations constructed within these different materials. The use of strip/pad foundations therefore appears to be precluded.

8.3.2 Trench Fill Foundations

For the proposed three-storey Superblock building, taking foundation excavations deeper into soils of greater strength or greater relative density, would still not resolve the problem of the uneconomic foundation base sizes required to accommodate the proposed column loads. For the proposed Sports Hall, over the part of its footprint over placed fill, the depth to a suitable natural foundation stratum is likely to be excessive. Concrete trench fill foundations are generally not considered practical to depths exceeding about 3m and may be considered uneconomical even at depths shallower than 3m. The use of concrete trench fill foundations therefore also appears to be precluded.

8.3.3 Raft Foundation

Consideration has been given to the use of a reinforced concrete raft foundation in order to reduce the intensity of loading. However, given the relatively high column loads for the three-storey Superblock, it is considered unlikely that a raft could be economically constructed with sufficient stiffness to mitigate the effect of the differential settlements that variations in loading would inevitably cause. For the proposed Sports Hall, to be constructed partly over natural ground and partly over placed fill, again would mean that excessive differential settlements are likely to result across these different materials. The use of a reinforced concrete raft therefore also appears to be precluded.

8.3.4 Ground Improvement

Consideration has also been given to the possibility of using the 'vibro' ground improvement process to increase the load-bearing capacity of the ground. However, in places, the exploratory holes encountered some soft cohesive soils and problems can arise with the lack of lateral support to the 'vibro' columns in such soils. Furthermore, where medium dense Glacial Sand and Gravel or firm or stiffer Glacial Till is met, the degree of improvement that 'vibro' techniques could achieve in such soils is somewhat limited. Specialist advice would need to be sought from the ground improvement contractors if 'vibro' ground improvement is to be considered further.

8.3.5 Piled Foundations

The most suitable foundation solution for this site would appear to be the adoption of piled foundations to carry all structural loads down to the Pennine Middle Coal Measures bedrock.

Following regrading of the site to create the building platforms, piles should be taken down through any superficial deposits and socketed to an appropriate depth within the Pennine Middle Coal Measures strata. These piles will

generate working loads from a combination of end-bearing resistance and skin friction.

Piles of either the driven or Continuous Flight Auger (CFA) bored type would be suited to the ground conditions but the latter possibly have the advantage of lower noise and vibration levels during installation. Driven (displacement) piles would have the advantage of there being no spoil created requiring disposal. However, pile installation (particularly driven piles) could be hindered by obstructions e.g. boulders in the Glacial Till and zones of more-intact, less-weathered bedrock.

It is recommended that the specialist piling contractors should be approached for advice on the suitability of their proprietary piling systems to this site and for guidance on the pile size/length/load capacity relationship. Such specialists should also be consulted to advise on a method of working during pile installation that would preclude (or reduce to acceptable levels) the potential downward migration of any contaminants into the underlying Secondary A aquifer.

Such piling is likely to be hindered by the presence of obstructions in the Made Ground (particularly over the lower south-eastern part of the site) or boulders in the Glacial Till and this may necessitate pre-excavation of pile positions.

The design of piles will depend on such factors as the required working load and foundation layout (in particular, the number of piles below each pile cap carrying the individual column loads).

The carrying capacity of piles is fundamentally related to their method of emplacement and individual piling contractors have their own formulae specific to their individual techniques. As previously stated, it is recommended that early discussions are held with experienced specialist contractors for advice on the applicability of their own particular proprietary techniques to these specific site conditions, nevertheless it is possible to use general formulae to give a first approximation.

In this case the ground profile below Borehole BH02 has been examined, as here the depth to rockhead was the greatest.

Following excavation of the site to achieve the appropriate building platform level for the proposed Superblock building, a general profile for the superficial deposits remaining over the western part of the site would typically be a 1.8m thickness of medium dense Glacial Sand and Gravel over about 10.7m of stiff to very stiff Glacial Till. Preliminary calculations suggest that a 450mm diameter pile taken down through these superficial deposits, so as to be socketed 2m into extremely weak to very weak Mudstone ($UCS = 1\text{ MPa}$) could carry a safe working load of the order of 2000kN. For a 600mm diameter pile, the safe working load increases to about 2750kN. The safe working load given was derived using a factor of safety of 2.5 on combined end-bearing resistance and skin friction. However, although such working loads can be calculated for the ground materials, a pile's capacity would be limited by the strength of the concrete used in the pile, i.e. consideration needs to be given to the failure of the pile as a structural member.

Whilst still limited by the strength of the concrete used in the construction of the piles, greater working loads could be achieved by increasing the pile diameter or extending the rock socket deeper into the Pennine Middle Coal Measures strata.

The use of bored piles in granular soils, particularly below the water table, may be problematic if the sides of the bore are not supported. Continuous flight auger techniques should overcome this problem, provided that the particular system/operator can prevent any necking and waisting in the pile shaft.

The various available combinations of pile diameter and rock socket length will produce a variety of different safe pile capacities. It is therefore recommended that the specialist piling contractors are approached for guidance on the most economical combination of pile diameter/socket length for their particular piling equipment.

However, although such working loads can be calculated for the ground materials, the pile capacity would be limited by the strength of the concrete used in the pile and the geometry of the pile. Consideration therefore needs to be given to the failure of the pile as a structural member. The specialist contractors should be able to advise further on this matter.

Further settlement of any Made Ground/placed fill can result in negative skin friction on the pile shaft. It is therefore recommended that measures are taken to accommodate such negative skin friction in the pile design.

On completion of pile installation, reinforced concrete pile caps should be constructed to support the structural columns. Walls should be supported on reinforced concrete ground beams, these being designed to span between the pile caps.

Consideration should be given to any possible adverse effects that piling may have on any neighbouring structures. For example excessive vibrations could directly damage structures or lead to the differential settlement of any loose materials beneath them.

Allowances should be made for pile load and integrity testing.

8.3.6 Building near Trees

Several mature / semi-mature trees are present along the northern site boundary. The three-storey Superblock building may fall within the zone of influence of these trees, which may thereby impact its foundation design.

Tree root systems in clay soils can cause shrinkage and swelling movements due to moisture extraction by the trees. NHBC Standards Chapter 4.2, 'Building near Trees' (2022) gives guidance on foundation depths and precautions against heave where foundations are to be constructed within influencing distance of trees. It should be noted that special precautions may be required relating to heave where trees have been or are to be removed.

The volume change potential of the soils found during the investigation are based on the Modified Plasticity Index, I_p , which is calculated as follows:

$$I_p = \frac{I_p \times \% \text{ less than } 425\mu\text{m}}{100}$$

Atterberg limit (plasticity index) tests have been carried out on samples of the Glacial Laminated Clay and Glacial Till. These test results can be used to determine the volume change potential in accordance with NHBC Chapter 4.2. The results from exploratory holes sunk in this part of the site are summarised in the following table:

Sample	PI (%)	% less than 425µm	Modified Plasticity Index I_p (%)	Volume Change Potential
Glacial Laminated Clay				
BH01 3.80m	16	98	15.68	Low
Glacial Till				
BH01 4.00-4.45m	14	73	10.22	Low
BH01 5.00-5.45m	16	75	12.00	Low
BH02 1.80m	16	67	10.72	Low
BH02 3.00-3.45m	14	85	11.90	Low
BH02 6.50-6.95m	17	71	12.07	Low
BH02 9.50-9.95m	15	80	12.00	Low
BH03A 4.00-4.43m	13	74	9.62	Non-Shrinkable
BH03A 6.50-6.95m	17	69	11.73	Low
DS03 2.00-3.00m	13	79	10.27	Low
DS03 3.80-4.00m	Non-Plastic	-	Non-Plastic	Non-Shrinkable
DS03 4.80-5.00m	Non-Plastic	-	Non-Plastic	Non-Shrinkable
DS04 2.40-2.80m	17	68	11.56	Low
DS04 3.70-4.00m	14	72	10.08	Low

On the basis of these results it is recommended that a Low Volume Change Potential is adopted when determining minimum foundation depths in relation to trees and the requirements for compressible materials/ voids adjacent to foundations or below floor slabs.

For Low Volume Change Potential soils the NHBC state that no void is required against the sides of foundations or ground beams constructed within the zone of influence of trees.

8.4 Ground Floor Slabs

Given that structural loads for the three-storey Superblock building and Sports Hall are to be supported on piles, it is recommended that a fully suspended floor construction is adopted with all loads carried on the main column foundations. Such a measure should prevent potential differential settlement problems between floor slabs and external walls.

Furthermore, an adequate void or compressible layer should be provided below the suspended floor construction. In accordance with NHBC Chapter 4.2, 'Building near Trees', special precautions may also be required relating to heave on ground slabs, where trees have been, or are to be removed. As previously stated in Section 8.3.6 above, the Glacial Till can generally be taken as having a Low Volume Change Potential based on NHBC Chapter 4.2.

For Low Volume Change Potential soils, the NHBC recommend a 200mm minimum void dimension below suspended precast concrete floors constructed within the zone of influence of trees.

8.5 Retaining Walls and Slopes

Retaining walls may be required and new slopes cut in order to create the level platforms on which the proposed three-storey Superblock building and Sports Hall, and the adjacent proposed car parks are to be constructed.

The following geotechnical parameters are appropriate for the design of such retaining structures, constructed in accordance with BS 8002: 2015 Code of Practice for Earth Retaining Structures.

Soil Parameters for Retaining Structures			
Material	Cohesion c' (kN/m ²)	Friction Angle ϕ' (Degrees)	Bulk Unit Weight γ_b (kN/m ³)
Cohesive Made Ground	0	25	21.0
Granular Made Ground	0	32	18.0
Glacial Sand and Gravel	0	32	19.9
Glacial Till	0	30	21.6

It is anticipated that such retaining walls could be supported on spread foundations. Appropriate drainage measures should be incorporated in the retaining wall design to allow for any increase in porewater pressure behind the walls.

The geotechnical parameters given in the table above can also be used in the safe design of any new slopes cut into these materials to ensure slope stability.

8.6 Excavations and Support

Following demolition works, over the footprints of the existing Radcliffe Leisure Centre and Spring Lane School on the lower, south-eastern part of the site, it is possible that remnant concrete floor slabs, old foundations and other sub structure remains may be present below the surface which could require removal using hydraulic breakers. Similarly, the presence of obstructions within the wider Made Ground, or boulders within the Glacial Till, cannot be discounted.

Otherwise, the Made Ground, Glacial Sand and Gravel and Glacial Till encountered on this site would be considered as "easy digging" for normal backhoe excavation plant.

For excavations, the sides should be constructed to a batter no steeper than the safe angle of repose for the ground materials encountered. For excavations in granular soils above the water table, excavation sides should be no steeper

than 1 (vertical) to 1.5 (horizontal) where space permits. Where cohesive soils are encountered above the water table, excavation sides should be no steeper than 1 (vertical) to 3 (horizontal) if left for a relatively long term.

Excavation sides can stand vertically in cohesive soils and in damp granular soils in the short term but instability of these sides can be sudden and unpredictable. Entry into any such excavations by personnel carries a significant risk of injury or death and hence processes to avoid the necessity to do this should be devised wherever possible.

Close-boarded support will be required for excavations in excess of 1.20m depth within granular materials or soft cohesive deposits. For excavations below 1.20m depth in firm clay, half-boarded support will be required. The particular requirements will need to be evaluated under the CDM Regulations.

All plant and machinery will need to maintain an appropriate stand off from the crest of all open excavations.

All formations should be protected from mechanical disturbance and assumed to be frost-susceptible.

8.7 Groundwater Control

On the basis of the information obtained during this investigation, any minor, localised groundwater or surface water ingresses within foundation excavations should be adequately controlled using conventional filtered pumping from sumps.

Clearly, any excavations below the water table will require dewatering. This may require the installation of a wellpoint dewatering system or alternatively, steel sheet piles could be driven to an appropriate depth in order to form a cut off or sufficiently extend groundwater flowpaths and then sump pumping used within. However, in such cases, careful monitoring should be carried out to ensure that excessive amounts of fines are not removed during dewatering since this could lead to the unpredictable settlement of the surrounding ground. Further advice should be sought from specialist groundwater control contractors.

8.8 Chemical Attack on Buried Concrete

The available chemical parameters for concrete mix design are summarised below:

Granular Made Ground (3 No. Samples)

pH	5.7 to 6.9
Water Soluble Sulphate	133 to 298 mg/l
Total Sulphate	0.04 to 0.07 %
Total Sulphur	0.01 to 0.05 %
Total Potential Sulphate	0.03 to 0.15 %
Oxidisable Sulphides	<0.3 %

Cohesive Made Ground (1 No. Sample)

pH	5.8
Water Soluble Sulphate	94 mg/l
Total Sulphate	0.05 %
Total Sulphur	0.01 %
Total Potential Sulphate	0.03 %
Oxidisable Sulphides	<0.3 %

Glacial Sand and Gravel (2 No. Samples)

pH	5.2 to 5.8
Water Soluble Sulphate	26 to 33 mg/l
Total Sulphate	0.01 to 0.02 %
Total Sulphur	0.01 %
Total Potential Sulphate	0.03 %
Oxidisable Sulphides	<0.3 %

Glacial Till (4 No. Samples)

pH	5.7 to 6.8
Water Soluble Sulphate	17 to 102 mg/l
Total Sulphate	0.01 to 0.03 %
Total Sulphur	0.01 to 0.11 %
Total Potential Sulphate	0.03 to 0.33 %
Oxidisable Sulphides	<0.3 %

Pennine Middle Coal Measures Strata (4 No. Samples)

pH	7.4 to 8.7
Water Soluble Sulphate	16 to 480 mg/l
Total Sulphate	0.02 to 0.10 %
Total Sulphur	0.01 to 3.2 %
Total Potential Sulphate	0.03 to 9.6 %
Oxidisable Sulphides	0.01 to 9.50 %

Groundwater (4 No. Samples)

(from the standpipes)

Water Soluble Sulphate	73 to 140 mg/l
pH	7.3 to 7.8

On the basis that at least part of the site (previously used as railway land) has been subject to industrial development, storage of chemicals and deposition of waste, and which may contain aggressive chemicals in residual surface materials or in ground penetrated by leachates, the site is classed as a brownfield location. There is a possibility that ground materials may contain oxidisable sulphides (e.g. within Made Ground containing colliery spoil) that can oxidise to form sulphates. Hence, a check for their presence has been undertaken.

The Oxidisable Sulphide Content (OS) has been determined from the Total Potential Sulphate Content (TPS) and Total Sulphate content (AS). The Oxidisable Sulphide content was not found to be above the threshold value of 0.3% (considered to indicate pyritic ground conditions) for a significant number of samples.

(NB: Only the sample of mudstone tested from Borehole BH04 at 14.00-14.45m depth recorded an Oxidisable Sulphide content in excess of 0.3% with 9.5% being measured).

Based on the procedures outlined in BRE Special Digest 1: 2005 and the test results, the Design Sulphate Class for the site is DS-I. The site is considered to be a "brownfield location", groundwater is conservatively considered to be mobile and the soils are unlikely to be pyritic. Hence, for the Made Ground, Glacial Sand and Gravel and Glacial Till the corresponding ACEC Class is taken as AC-2z. It is noted that due to the higher pH values recorded in the samples of the Pennine Middle Coal Measures Strata, here the corresponding ACEC Class is AC-I.

Strata Type	Design Sulphate Class	ACEC Class
Granular Made Ground	DS-I	AC-2z
Cohesive Made Ground	DS-I	AC-2z
Glacial Sand and Gravel	DS-I	AC-2z
Glacial Till	DS-I	AC-2z
Pennine Middle Coal Measures Strata	DS-I	AC-I
Based on Groundwater	DS-I	AC-I

NB: It should be noted that due to the low pH value of 5.2 recorded for the sample of Glacial Sand and Gravel recovered from Borehole BH01 at 2.00-2.45m depth, here the corresponding ACEC Class is AC-3z.

Only concrete meeting the requirements of BRE SD1, Special Digest 1: 2005 should be used for sub-surface work across the site.

8.9 Pavement Design

The conditions prevailing at the time of construction will affect the CBR of the subgrade soil and its strength.

Research has shown the importance of the equilibrium moisture content of the subgrade. The relationship between soil suction and the moisture content shows that a soil that becomes wet during construction will retain water and will therefore be weaker under the pavement in the equilibrium condition than a foundation that has remained dry, particularly for soils of low to medium plasticity.

The Plasticity Indices (PI) obtained from the cohesive materials likely to be exposed at formation level are likely to range between 13% and 24%.

The following equilibrium CBR values are indicated for thin and thick layered construction in the TRRL Laboratory Report 1132, *The structural design of bituminous roads* (1984):

Estimation of Equilibrium Subgrade CBR (%)		
Plasticity Index (%)	Thin Layered Construction (i.e. depth to subgrade of 300mm)	Thick Layered Construction (i.e. depth to subgrade of 1200mm)
10	3	6
20	4	5
30	3	4

These CBR values assume average construction conditions and a high water table and that the pavement formations may be wetted by groundwater during their lifetime.

Where encountered at sub grade level, TRRL Laboratory Report 1132 suggests that for poorly graded sand (e.g. Granular Made Ground and Glacial Sand), an equilibrium CBR in excess of 20% is indicated.

New pavements are required for the both a Southern Car Park (constructed at the same level as the proposed Superblock and Sports Hall) and a Northern Car Park (constructed at a slightly higher elevation to the Southern Car Park). In addition, a new access road is to be constructed, running along the south-western margin of the site (near to Banana Path) linking the proposed new school to Spring Lane.

An artificial grass pitch and a new Multi-Use Games Area (MUGA) are also proposed over the lower south-eastern part of the site.

The results of four (4 No.) CBR tests carried out in the laboratory on samples of Granular Made Ground and Glacial Till re-compacted at their natural moisture contents are presented in the following tables. These tables also include CBR values correlated from the Dynamic Cone Penetration Tests.

To enable a comparison of CBR values at potential formation levels across the site, where the DCP results allow, CBR values have been taken as those recorded at the following elevations:

- Northern Car Park Area – 74.40m OD
- Southern Car Park Area – 73.40m OD
- Access Road – Elevation at 0.60m below existing ground level.
-

California Bearing Ratio (CBR) Test Results – Northern Car Park Area				
Location	Elevation	Test Type	Material	CBR Value (%)
DCP01 1.18m	75.12	In Situ DCP	Granular Made Ground	25.8
DCP02 1.13m	74.58	In Situ DCP	Glacial Sand and Gravel	36.6
DCP03 0.71m	74.4	In Situ DCP	Glacial Sand and Gravel	8.3

California Bearing Ratio (CBR) Test Results – Southern Car Park Area				
Location	Elevation	Test Type	Material	CBR Value (%)
DCP04 1.17m	74.05	In Situ DCP	Glacial Sand and Gravel	27.4
DCP05 1.18m (Test 2)	73.41	In Situ DCP	Granular Made Ground	14.6
DCP06 0.71m	73.40	In Situ DCP	Granular Made Ground	10.1
DCP07 0.90m	73.40	In Situ DCP	Granular Made Ground	11.0
DCP08 0.46m	73.40	In Situ DCP	Granular Made Ground	18.8
DCP10 0.30m	73.40	In Situ DCP	Granular Made Ground	9.6
BH03 0.80-1.20m	73.31	Laboratory CBR	Granular Made Ground	18.8

California Bearing Ratio (CBR) Test Results – Access Road				
Location	Elevation	Test Type	Material	CBR Value (%)
DCP09 0.60m	74.06	In Situ DCP	Cohesive Made Ground	14.4
DCP11 0.62m	69.68	In Situ DCP	Granular Made Ground	15.8
DCP12 0.60m	69.82	In Situ DCP	Granular Made Ground	33.6
DCP13 0.41m	70.23	In Situ DCP	Granular Made Ground	Obstruction
DCP14 0.60m	70.61	In Situ DCP	Granular Made Ground	17.9
TP06 1.50-1.60m	72.2	Laboratory CBR	Glacial Till	0.4

California Bearing Ratio (CBR) Test Results – Artificial Grass Pitch				
Location	Elevation	Test Type	Material	CBR Value (%)
BH04 0.60-1.20m	70.44	Laboratory CBR	Granular Made Ground	45.2

California Bearing Ratio (CBR) Test Results – MUGA				
Location	Elevation	Test Type	Material	CBR Value (%)
BH02 3.00-3.45m	71.28	Laboratory CBR	Glacial Till	0.6

In the first instance, it would be considered reasonable to adopt a CBR value of 10% as a preliminary design value where the subgrade is comprised of granular materials and where the subgrade material is cohesive, a CBR value of 3% should be adopted. It would be prudent to undertake further testing to confirm this.

Whilst materials with a higher CBR value may be locally available, taking a lower value would allow for a more uniform approach to pavement design and reduce the possibility of design changes being required. Capping and sub base layer thicknesses should be designed to suit.

Should materials with CBR values of 2% or less be met at formation level, specialist design measures regarding the use of thickened sub bases, sub-grade geosynthetics or lime stabilisation will need to be considered.

The formation should be inspected for any loose/soft spots and proof-rolled. Unacceptable areas should be removed and replaced with suitably compacted granular fill.

Plasticity Index tests carried out on samples of the Cohesive Made Ground and Glacial Till from across the site recorded plasticity indices of less than 20%. In addition, particle size distribution tests carried out on samples of the Granular Made Ground and Glacial Sand and Gravel show it to contain a percentage of material passing the 75µm BS sieve in excess of 10%. In accordance with Road Note 29, “A Guide to the Structural Design of Pavements for New Roads”, 1970, these sub-grade materials are considered to be frost susceptible.

It should be noted that materials likely to be exposed at formation level will be susceptible to softening / loosening in the presence of water and should be promptly protected by a capping layer following exposure and inspection. Where this is not practicable it should be cut with a cross-fall and drainage provided. The materials exposed at formation level should be treated as frost susceptible.

For the proposed new access road, dependent on the nature of the earthworks operations, part of the road may be constructed upon newly placed fill materials. It is generally recommended that further in situ testing of the proposed formation is carried out prior to finalising pavement construction details. Furthermore, in situ testing should provide a more accurate measurement of the CBR value of the soil as it would not subject the soil to the disturbance involved when testing bulk samples in the laboratory.

8.10 Site Drainage and Soakaway Design

CIRIA Report 113 – *Control of groundwater for temporary works*, 1986 provides the following typical permeability ranges of soils:

Soil Type	Typical Permeability k (after CIRIA 113, 1986)
Clean Gravel	$>10^{-3}$ m/s
Clean Sand and Gravel Mixtures	10^{-3} to 10^{-5} m/s
Very fine Sand	10^{-5} to 10^{-7} m/s
Silt and mixtures of Sand and Clay	10^{-7} to 10^{-9} m/s
Clay	$<10^{-9}$ m/s

As stated in Section 7.1, it is noted that the BGS 1:50,000 scale Bedrock and Superficial Edition geological map (Sheet 85 Manchester) dated 2011 shows that over the lower, south-eastern half of the site, the superficial deposits comprise Glaciofluvial Deposits described as *undifferentiated sand and gravel with lenses of clay and stony clay*. Hence, it was initially proposed to investigate the Soil Infiltration Rate of these natural, granular materials beneath this part of the site to assess their suitability for the use of soakaways in site drainage (particularly with regard to the proposed artificial sports pitch).

In reality, the expected Glaciofluvial Deposits beneath the lower, south-eastern half of the site failed to materialise, and given the presence of groundwater at about 1.5m below ground level, soakaway tests were carried out in the Granular Made Ground between about 0.60m to 1.20m depth.

In situ soakaway tests carried out in accordance with the method given in BRE Digest 365 “Soakaway Design”, 2016 yielded the following results:

Soakaway Test	Wetted Depth (m bgl)	Test	Soil Type	Soil Infiltration Rate (m/s)
SA01	0.60 to 1.20	1	Granular Made Ground	1.13×10^{-4}
SA01	0.60 to 1.20	2	Granular Made Ground	9.88×10^{-5}
SA01	0.60 to 1.20	3	Granular Made Ground	7.50×10^{-5}
SA02	0.60 to 1.20	1	Granular Made Ground	8.93×10^{-5}
SA02	0.60 to 1.20	2	Granular Made Ground	4.85×10^{-5}
SA02	0.60 to 1.20	3	Granular Made Ground	1.68×10^{-5}
SA03	0.58 to 1.20	1	Granular Made Ground	4.78×10^{-6} #

Unable to carry out further tests due to slow soakage rate and time constraints.

For soakaways located within the Granular Made Ground in the areas of SA01 and SA01, a Soil Infiltration Rate of 1×10^{-5} m/s⁻¹ is considered appropriate for use in the design calculations.

Where the Granular Made Ground becomes more clayey (e.g. Soakaway Test SA03A), then the Soil Infiltration Rate falls to 1×10^{-6} m/s⁻¹.

It should be noted that it is a requirement of *BRE Digest 365 "Soakaway Design", 2016* that a soakaway should discharge from full to half volume in 24 hours.

Laboratory chemical leaching tests have shown some minor exceedances of Environmental Quality Standards for chromium, copper, iron and lead. However, the magnitude of the exceedances is not assessed to be significant. In addition, the methodology often over estimates soil leaching *in situ* due to sample preparation.

8.11 Updated Geotechnical Risk Register

A preliminary geotechnical risk register for the site was presented in the Desk Study (reference: PC228400, May 2022). The geotechnical risk register has been updated to reflect the findings of this investigation and above recommendations, as follows:

	Condition	Hazard	Potential Impact	Before Control			Comments / Proposed Mitigation	After Control		
				Probability	Impact	Risk		Probability	Impact	Risk
R1	Compressible Ground	Insufficient bearing capacity leading to potential increased total and differential settlement problems. The Glacial Till and Glaciofluvial Sand and Gravel Deposits could include soft clay and silt layers.	Failure / excessive movement of the foundations / ground bearing floor slabs leading to cracking of buildings. Potential for differential settlement.	3 (P)	4 (H)	12 (Md)	Piled foundations installed into stiff/very stiff Glacial Till or socketed into the Pennine Middle Coal Measures bedrock are recommended in order to accommodate the relatively high column loads of the proposed three-storey Superblock building and to cater for the footprint of the proposed Sports Hall being partly over natural ground and partly over placed fill. Piles should transfer loads onto competent strata below the level of any compressible layers. (See Section 8.3).	1 (VU)	4 (H)	4 (N)
R2	Made Ground	Variable behaviour and thickness leading to variable bearing capacities and unpredictable total and differential settlements.	Failure / excessive movement of the foundations / ground bearing floor slabs leading to cracking of buildings. Potential for differential settlement.	4 (L)	4 (H)	16 (Sb)	As piled foundations are recommended (See above) such piles should transfer loads onto competent strata below any Made Ground. Settlement of Made Ground will lead to negative skin friction against pile shafts which will need to be accommodated in the pile design (See Section 8.3).	1 (VU)	4 (H)	4 (N)
R3	Swelling / Shrinking Soils	Shallow foundation movement due to seasonal shrinkage / swelling of clay soils associated with trees and bushes. Trees and bushes are present adjacent to the site.	Excessive movement of the foundations / ground bearing floor slabs leading to cracking of buildings.	4 (L)	4 (H)	16 (Sb)	As piled foundations are recommended (See above) the effect of the shrinkage or swelling of clay soils due to trees will require the use of a void or compressible material below ground beams / suspended floor slabs following the guidance in NHBC Chapter 4.2 'Building Near Trees'. (See Section 8.3)	1 (VU)	4 (H)	4 (N)

R4	Obstruction / Hard Strata	Affecting excavations during construction works and potential hard spots below foundations / floor slabs.	Differential movement of the foundations / ground bearing floor slabs leading to cracking of buildings. Delays to excavations during construction .	3 (P)	4 (H)	12 (Md)	Use backhoe excavation plant but have hydraulic breakers available to assist with the removal of remnant concrete floor slabs, old foundations or other substructure remains from the previous school development or boulders within the Glacial Till. Pile installation (particularly driven piles) could be hindered by obstructions e.g. boulders in the Glacial Till and zones of more-intact, less-weathered bedrock. The use of piled foundations and suspended floor slabs should mean that problems associated with hard spots do not arise.	1 (VU)	4 (H)	4 (N)
R5	High Groundwater	Instability of foundation excavations and problems with foundation, floor slab and road / hardstanding formations.	Excessive movement of the foundations / ground bearing floor slabs leading to cracking of buildings and subsidence of roads / hardstanding areas.	3 (P)	4 (H)	12 (Md)	Based on ground investigation, significant groundwater is not expected in excavations (particularly in the area of the proposed new buildings) However, there may be localised groundwater perched within the Granular Made Ground and Glacial Sand and Gravel above the Glacial Till and this may necessitate the use of filtered sump pumping or well-points.	1 (VU)	4 (H)	4 (N)
R6	Chemically Aggressive Soil	Corrosive attack of buried concrete.	Degradation of concrete foundation and buried concrete structures leading to failure.	3 (P)	3 (M)	9 (Md)	Use concrete meeting the requirements of BRE SD1 (2005) for all subsurface concrete. For Made Ground and Glacial Deposits use ACEC class AC-2z, for Bedrock AC-I is appropriate.	1 (VU)	3 (M)	3 (N)
R7	Buried Services	Damage during ground investigation and construction works posing risk to Health and Safety of site personnel and public. Evidence of the presence of buried services noted during site walkover.	Increased cost and delay for unplanned diversions, protection or repair.	2 (U)	5 (VH)	10 (Md)	All Statutory Service Plans and the results of the GPR Survey to be provided to the Specialist Contractors prior to works taking place. Vigilance throughout any excavation work for any indications of unrecorded buried services.	1 (VU)	5 (VH)	5 (Mn)

R8	Slopes	Failure of existing slopes and slopes created during development and separating the different construction platform areas.	Local slope instability / failure.	2 (U)	4 (H)	8 (Mn)	Use appropriate soil parameters (See Section 8.5) in the safe design of any new slopes cut into these materials to ensure slope stability. Undertake further testing if required particularly where slopes are comprised of placed fill.	1 (VU)	4 (H)	4 (N)
R9	Retaining Walls	Failure of proposed new low retaining structures created during development and separating the different construction platform areas.	Local retaining wall instability / failure.	2 (U)	4 (H)	8 (Mn)	Use appropriate soil parameters (See Section 8.5) in the safe design of the proposed retaining structures.	1 (VU)	4 (H)	4 (N)
R10	Solution Features	Potential collapse or settlement of ground affecting buildings, hardstanding and infrastructure.	Not expected.	1 (VU)	5 (VH)	5 (Mn)	No mitigation controls required.	1 (VU)	5 (VH)	5 (Mn)
R11	Mining Activities	Potential collapse or settlement of ground affecting buildings, hardstanding and infrastructure.	Increased costs and delay to the project and potential serious injury or death.	3 (P)	5 (VH)	15 (Sb)	The ground investigation carried out did not find any evidence for any shallow coal workings in the vicinity of the proposed new school buildings. (See Section 7.1.1.1)	1 (VU)	5 (VH)	5 (Mn)
R12	Frost Susceptibility	Affecting the subgrade of roads and areas of hardstanding. The Made Ground, Glacial Till and Glaciofluvial Sand and Gravel Deposits may be frost-susceptible.	Subsidence and cracking of roads and areas for hardstanding and increased maintenance and management costs.	3 (P)	3 (P)	9 (Mn)	Based on the geotechnical testing carried out to assess frost-susceptibility of formation soils, all formations should be treated as frost-susceptible and new pavements should be designed accordingly.	1 (VU)	3 (M)	3 (N)
R13	UXO	Affecting investigation and construction works and posing risk to Health and Safety of site personnel and the public.	Increased costs and delay to the project and potential serious injury or death.	2 (U)	5 (VH)	10 (Md)	Preliminary UXO Threat Assessment indicates that the potential for a UXO hazard to occur at this site is assessed as UNLIKELY and NO FURTHER ACTION is required to address the UXO risk at this site.	1 (VU)	5 (VH)	5 (Mn)

9.0 GENERIC QUANTITATIVE RISK ASSESSMENT

9.1 Introduction

The UK approach to the assessment of contaminated land is based upon the principles of risk assessment, which is founded on the use of 'source-pathway-receptor' principles in order to establish the potential presence of 'pollutant linkage' as detailed in the LCRM.

Geotechnics Limited adopts a tiered approach to risk assessment in accordance with current UK guidance and good practice. The initial step of this process, known as Tier 1 or Generic Quantitative Risk Assessment (GQRA), is the comparison of site-derived data with relevant guideline levels.

Should the adopted criteria be exceeded, then two courses of action are available. The first is to break the pollutant linkage by undertaking remedial works such as removing or treating the contaminated soil. Alternatively, a more detailed risk assessment (DQRA) can be carried out to determine whether a contamination risk exists.

The UK approach to the assessment of human health risk from contaminated land is set out in the CLEA (Contaminated Land Exposure Assessment) framework, which was first published in 2002 by the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA). The original guidance was withdrawn, and revised guidance issued in 2009, which is set out in the following documents published by the EA:

'Human Health Toxicological Assessment of Contaminants in Soil', Science Report SC050021/SR2; and

'Updated Technical Background to the CLEA Model', Science Report SC050021/SR3.

The CLEA model uses generic assumptions about the fate and transport of chemicals in the environment and a generic conceptual model for site conditions together with human behaviour to estimate long term human exposure to soil contaminants. Soil Guideline Values (SGV) were previously derived using the CLEA Model by comparing estimated exposure with 'Health Criteria Values' (HCV) that represent a tolerable risk to health from chronic exposure.

The CLEA model has also been used to determine other generic assessment criteria (GACs), including those used within this assessment.

9.2 Risk Assessment Methodology

Based on site size, homogeneous ground conditions and site history, the site has been considered as one averaging zone. Relevant guidance issued by the Chartered Institute of Environmental Health (CIEH), in association with LQM, published November 2015 (with publication of the LQM Suitable for Use Levels (S4UL) has been adopted.

Laboratory testing results were directly compared to the adopted GAC for residential without home grown produce / public open space (parkland), and results are shown in full in Appendix 20.

9.3 Risk Assessment for Human Health

Heavy metals

Of the sixteen samples analysed, only one sample exceeded the relevant SGV/GAC for one contaminant. Arsenic in DS01 at 0.50m depth was detected at a concentration of 130mg/kg, exceeded the S4UL for residential without home grown produce (40mg/kg), but the concentration did not exceed the S4UL for public open space (park). Arsenic is therefore not considered to pose a significant risk to human health.

Other inorganic contaminants

No other inorganic contaminants were found to be above the relevant SGV/GAC.

PAHs

Of the sixteen (16 No.) samples tested, one sample exceeded the relevant SGV/GAC for five PAHs. This was a soil sample taken from location DS05 at 0.50m depth. The stratum is described as being black fine to coarse gravel, with the gravel including asphalt. A slight hydrocarbon odour was noted.

A summary of the S4UL exceedances is shown below:

- Naphthalene – 21 mg/kg – Exceeds residential without home grown produce (5.6mg/kg) but is below public open space (park) (1900mg/kg);
- Benzo(a)anthracene – 23 mg/kg – Exceeds residential without home grown produce (14mg/kg) but is below

- public open space (park) (56mg/kg);
- Benzo(b)fluoranthene – 23 mg/kg – Exceeds residential without home grown produce (4mg/kg) and public open space (park) (14mg/kg);
- Benzo(a)pyrene – 19 mg/kg – Exceeds residential without home grown produce (3.2mg/kg) and public open space (park) (12mg/kg); and
- Dibenzo(ah)anthracene – 2.1 mg/kg – Exceeds residential without home grown produce (0.32mg/kg) and public open space (park) (1.3mg/kg).

Volatile Organic Compounds

No VOCs were detected above the laboratory limit of detection

Mineralogical

The sixteen (16 No.) samples were laboratory screened for asbestos; and asbestos was not detected in any of the samples.

9.4 Risk Assessment for Phytotoxic Effects

Concentrations of the phytotoxic metals copper, nickel and zinc nickel do not exceed the guideline values for the protection of plants as presented in the [Defra Sewage Sludge Code of Practice](#). Concentrations of arsenic exceed the guideline value in one sample from DS01. Any risks to plants are assessed as being low. Mercury and cadmium were not included in the analytical suite. The results of the phytotoxic screening are presented in the tables below.

Determinand	Number of samples	GAC (mg/kg)	Results Exceeding GAC (mg/kg)	Exceeds GAC (Y/N)
Arsenic	12	All pH - 50	DS01 0.50m	Y
Copper	12	pH>7 - 200	-	N
Cadmium	-	All pH - 3	Not analysed for	-
Chromium	12	All pH - 400	-	N
Nickel	12	pH>7 - 110	-	N
Mercury	-	All pH - 1	Not analysed for	-
Lead	12	All pH - 300	-	N
Zinc	12	pH>7 - 300	-	N
Selenium	12	All pH - 3	-	N

9.5 Assessment for the Protection of Controlled Waters

The risks to controlled waters (groundwater and surface waters) from contaminants on-site have been assessed in accordance with the Environment Agency (EA) documents (The Environment Agency's Approach to Groundwater Protection, 2017 and Remedial Targets Methodology, 2006). Pollutant inputs from contaminated land sites are considered as passive inputs under the European Water Framework Directive (2000/60/EC) (WFD) and its daughter directives, and as such are regulated under the Environment Agency's 'limit' pollution objective. Acceptable water quality targets (WQT) are defined for protection of human health (based on Drinking Water Standards (DWS)) and for protection of aquatic ecosystems (Environmental Quality Standards (EQS)).

Groundwater was encountered during progression of exploratory holes, although not in all exploratory holes. Groundwater was encountered within Made Ground, granular lenses within the Glacial Till and Glacial Sand and Gravel deposits at various depths and upon encountering rockhead. During the six (6 No.) rounds of monitoring all monitoring wells have recorded groundwater. Groundwater gauging shows that groundwater levels are relatively shallow with depths ranging between approximately 0.85m and 2.22m in shallow deposits. One monitoring well was installed deeper, to intercept a band of sand/gravel contained within the Glacial Till (screened between 14.00m and 15.00m below ground level). Resting groundwater levels were between 1.75m and 1.90m below ground level, and approximately 0.85m below the resting groundwater level of a second monitoring well in the same borehole installed within the shallow deposits. This shows that there is a downward hydraulic gradient from shallow groundwater in the drift towards the groundwater contained within deeper strata including the bedrock.

Recovered water samples from the third monitoring visit, as well as soil samples selected for soil leaching analysis with the leaching aliquot, were analysed and screened against Environmental Quality Standards (EQS) rather than the Drinking Water Standards (DWS). EQS are considered the most appropriate screening criteria as there are no groundwater abstractions in the vicinity of the site and groundwater will form base flow to local rivers. There are no groundwater abstractions in the vicinity of the site, and base flow to surface water courses is the most appropriate receptor to consider.

Exceedances of the relevant guidance criteria are summarised in the table below.

Determinand	Unadjusted EQS GAC (µg/l)	DWS GAC (µg/l)	Results Exceeding EQS (µg/l)	Results Exceeding DWS (µg/l)
Chromium (VI)	3.4	50	HD03 – Soil Leachate – 7.4	N/A
Copper	1	2000	DCP05 – Soil Leachate – 2.5 BH03 – Soil Leachate – 3.7 HD01 – Soil Leachate – 1.7 HD03 – Soil leachate – 2.3 WS02 – Soil Leachate – 1.4 BH01 – Groundwater – 2.0 BH02 (Deep) – Groundwater – 1.6 BH04 – Groundwater – 1.5	N/A
Iron	1000	200	BH03 – Soil Leachate – 2,300 HD03 – Soil leachate – 1,400	BH03 – Soil Leachate – 2,300 HD03 – Soil leachate – 1,400
Lead	1.2	10	BH03 – Soil Leachate – 3.0	N/A
Manganese	123	50	BH01 – Groundwater – 1,500 BH02 (Shallow) Groundwater – 300 BH04 – Groundwater – 360	BH02 (Deep) – Groundwater – 58 BH01 – Groundwater – 1,500 BH02 (Shallow) Groundwater – 300 BH04 – Groundwater – 360
Selenium	-	10	N/A	CP01 – Groundwater – 29 CP03 – Groundwater – 37
Zinc	10.9	3000	BH01 – Groundwater – 37 BH02 (Shallow) – 15 BH02 (Deep) – Groundwater – 32 BH04 – Groundwater – 59	N/A
Aliphatic TPH >C5-C6	10	10	BH02 (Shallow) – 14	BH02 (Shallow) – 14
Fluoranthene	0.0063	-	BH01 – Groundwater – 0.01 BH02 (Shallow) – 0.01 BH02 (Deep) – 0.04 Groundwater – 32 BH04 – Groundwater – 0.02	N/A
Benzo(a)pyrene	0.00017	0.01	BH02 (Deep) – Groundwater – 0.02	BH02 (Deep) – Groundwater – 0.02
Benzo(b)fluoranthene	0.00017 (BaP value)	0.10	BH02 (Deep) – Groundwater – 0.03	N/A
Benzo(ghi)perylene	0.00017 (BaP value)	-	BH02 (Deep) – Groundwater – 0.03 BH04 – Groundwater – 0.01	N/A

The results above show that there are some exceedances of EQS and DWS values for some heavy metals and TPH and PAHs. The results show that at least some of the contaminants are representative of natural background concentrations in groundwater. For example, zinc exceeds the EQS value for all groundwater samples, including groundwater in drift and bedrock samples and no significant sources are present in soil leachate samples. Concentrations of manganese in groundwater are significantly higher than in soil leaching samples. This is probably due to biogeochemical reduction of Manganese oxides resulting in manganese being reduced to a soluble form.

The highest concentrations of PAH compounds were found in the groundwater sample from BH02 (Deep) which is screened to intercept a band of sand/gravel contained within the Glacial Till. The combination of the concentrations present, and the likely derivation of most contaminants in groundwater from natural or off-site sources is assessed to not present a significant risk to sensitive receptors.

9.6 Ground Gas Risk Assessment

The six (6 No.) rounds of ground gas monitoring results obtained are presented in Appendix 12. One round of monitoring were undertaken when atmospheric pressure was less than 1000mbar (990mbar on 24th June 2022).

The conceptual model has shown two potential sources of ground gas to be present. These are Made Ground deposits associated with historical site usage and potentially worked coal seams within the bedrock.

Assessment of the site prior to undertaking the intrusive investigation shows the site to be potentially classified as 'High Risk Zone' using Wilson et al. (2021). Following the findings of the investigation, the following additional information has been obtained:

- Measured concentrations of methane and carbon dioxide are low (<0.1% and up to 2.7% respectively) with negligible flow rates (typically <0.1 l/hr with a maximum of 0.7 l/hr), including monitoring wells screened within shallow deposits and within bedrock¹;
- Groundwater was present within shallow deposits and at rockhead, suggesting if any shallow coal mine workings are present they will be flooded;
- No shallow coal workings, or related phenomena (for example loss of drilling flush) were encountered during the progression of rotary boreholes; and
- Shallow deposits (Glacial deposits and Made Ground) are typically between approximately 13m and 18m thick, comprised mostly of relatively low permeability Glacial Till with layers (up to 4.00m thick in total) of Glacial Sand and Gravel, and Made Ground above.

9.7 Detailed Mine Gas Risk Assessment

In accordance with Wilson et al (2021), a detailed mine gas risk assessment (DMGRA) is required for sites that are classified as 'High Risk Zone'. The information obtained from the intrusive investigation will be incorporated onto the DMGA as part of a multiple lines of evidence risk assessment approach.

Strata Encountered

The intrusive investigation has shown that bedrock is covered by at least 10m of Glacial Till. No evidence of shallow workings was encountered in shallow coal seams intercepted by boreholes. Some minor granular lenses were observed within the Glacial Till. Over the Glacial Till, Glacial Sand and Gravel deposits were encountered.

Assessment: The Glacial Till is relatively thick and of a generally low permeability do to only being localised lenses of granular materials being encountered. There is no evidence for the presence of shallow coal workings and therefore limited opportunity for the release of ground gases into voids.

Hydrogeology

The Sand and Gravel deposits contained groundwater resting on top of the relatively low permeability Glacial Till below.

Groundwater was encountered at rockhead, although not in all exploratory holes. This implies that groundwater in bedrock is shallow.

Assessment: As groundwater is present at a shallow level in bedrock deposits if there are any shallow mineworkings, they will be flooded, which will limit the production of methane and limit / prevent release of methane in line with Wilson et al (2009).

Gas Monitoring Data

Six (6 No.) rounds of ground gas monitoring were undertaken of the monitoring wells installed within the Made Ground and/or Glacial Deposits; none were screened in bedrock or encountered coal seams. Gas risk assessment was also required to assess risks from shallow Made Ground deposits.

¹ It should be noted that traditional ways of assessing ground gas conditions as described in BS8485 are not suitable for coal mine derived ground gases. However, the information is useful for refining the Conceptual Site Model.

The findings of the ground gas monitoring has shown no methane concentrations above the limit of detection (<0.1%) and low carbon dioxide concentrations (maximum concentration of 2.7%). Flow rates were typically <0.1 l/hr with a maximum flow rate of 0.7 l/hr

Assessment: There is no evidence for the presence of significant quantities of ground gases being produced by Made Ground deposits or geogenic ground gases being released from bedrock deposits.

Other Considerations

Details of the proposed structures are unknown, however, it is recommended that the designers are mindful of the geological setting of the site. It is unknown if any significant earthworks will be undertaken that may influence the findings of this DMGRA.

The DMGRA may need to be reviewed when further specific development information becomes available.

Findings of the DMGRA

The assessment has shown that there is limited potential for there to be a significant source of mine ground gases as no evidence of shallow mines workings has been encountered. In addition, groundwater is present within bedrock at shallow depth and if there are any shallow mine workings, then they will be flooded which will reduce the opportunity for release of ground gases.

There is a significant thickness of Glacial Till above bedrock which will retard the vertical migration of any ground gases that may be released due to the low permeability. Although some granular lenses are present, these seem to be localised and are unlikely to be in hydraulic continuity. There are Sand and Gravel deposits above the Glacial Till, which contains groundwater. This will also act to retard any ground gases that may vertically migrate.

On the basis of the above there are unlikely to be any significant sources of mine related ground gases. The pathway for any ground gases to migrate to structures and buildings associated with the proposed development will be tortuous and the migration of ground gases will be retarded by the low permeability Glacial Till.

Risks to the development from mine gases are assessed as being low. However, the DMGRA should be reviewed once the details of any required earthworks, foundations and location of soakaways / drainages have been received.

10.0 REVISED CONTAMINANT LINKAGE ASSESSMENT

An updated assessment of pollutant linkages has been made following the completion of a ground investigation and generic quantitative risk assessment to assess potential sources.

Hazard Identification				Hazard Assessment			
Link	Contaminant	Pathway	Receptor	Probability	Consequence	Risk	Contaminant Linkage Assessment
I	Contaminated Soil / Groundwater	Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	A- Humans using the site during construction.	Low/ Unlikely	Medium	Medium/ Low Risk	NAR

Hazard Identification				Hazard Assessment			
Link	Contaminant	Pathway	Receptor	Probability	Consequence	Risk	Contaminant Linkage Assessment
2		Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	B- Humans using the site after development completion.	Negligible	Medium	Low Risk	NAR – With mitigation measures in place to break pathway.
3		Downward / Lateral Migration	C – Secondary A Aquifers (Glaciofluvial Sand and Gravel, Pennine Middle Coal Measures Formation) D – Surface water	Low / Unlikely	Medium	Medium / Low Risk	NAR: No significant sources identified.
4		Direct contact.	E- Building Structures	Negligible / not credible	Medium	Low Risk	NAR: Analysis undertaken
5	Gas – Methane & Carbon Dioxide	Ingestion, inhalation, dermal / direct contact	A- Humans using the site during construction.	Negligible / not credible	Severe	Medium / Low Risk	NAR: Not significant sources identified. Atmospheric monitoring within excavations should be carried out in accordance with health and safety requirements.
6		Ingestion, inhalation, dermal / direct contact	B - Humans using the site after development completion.	DMGRA following additional information		Low / Medium Risk	NAR: DMGRA has assessed there are minimal sources and the pathway for vertical transmission of ground gases is tortuous and provides retardation of any ground gases.
7		Gas migration from coal outcrops and shallow workings via fissures in Glacial Till and permeable Glaciofluvial Sand and Gravel Deposits	E- Building Structures				
8		Ingestion, inhalation, dermal / direct contact	F- Ecology (Flora/Fauna)	Low/ Unlikely	Negligible	Low Risk	NAR

Hazard Identification				Hazard Assessment			
Link	Contaminant	Pathway	Receptor	Probability	Consequence	Risk	Contaminant Linkage Assessment
9	Contaminated Soil / Waste / Groundwater	Secondary Aquifer	F- Ecology (Flora/Fauna)	Low/ Unlikely	Mild	Low Risk	NAR

11.0 CONCLUSIONS

11.1 Geotechnical

The site comprises an upper, north-western part and a lower, south-eastern part bifurcated by a SE-NW scarp (the remnant cut slope of the former Lancashire & Yorkshire Railway's Clifton, Accrington & Colne Line). The lower area is level and includes the current Radcliffe Leisure Centre, Spring Lane School and Metrolink Park and Ride Facility built over an area previously occupied by a goods station and railway sidings. The upper area slopes up to the northwest towards the Manchester, Bolton & Bury Canal. Near to the former railway, the land was previously used as allotment gardens, whereas a cricket pitch occupied the land between the former allotments and the canal.

This preliminary ground investigation has shown that the lower, south-eastern part of the site is largely underlain by Granular Made Ground (associated with its past railway usage) to about 2m depth overlying Glacial Till. Further, Granular Made Ground exists over the upper, north-western part of the site but this is largely restricted to the area of former allotments near to the former railway slope. This in turn overlies Glacial Sand and Gravel and together these granular materials extend up to 4m depth resting upon Glacial Till.

The depth to the Pennine Middle Coal Measures bedrock varies in the boreholes sunk across the site from 12.60m to 20.50m depth (53.78m AOD to 61.13m AOD) but this ground investigation did not find any evidence for any shallow coal workings in the vicinity of the proposed new school buildings.

The topography dominates this site which will be suitably regraded via substantial cut and fill operations to achieve the required formation levels for the proposed development scheme.

Piled foundations installed into stiff/very stiff Glacial Till or socketed into the Pennine Middle Coal Measures bedrock are recommended in order to accommodate the relatively high column loads of the proposed three-storey Superblock building and to cater for the footprint of the proposed Sports Hall being partly over natural ground and partly over placed fill.

Several mature / semi-mature trees are present along the northern site boundary. The three-storey Superblock building may fall within the zone of influence of these trees, which may thereby impact its foundation design. As piled foundations are recommended the effect of the shrinkage or swelling of clay soils due to trees will require the use of a void or compressible material below ground beams / suspended floor slabs following guidance in NHBC Chapter 4.2 'Building Near Trees'.

Testing carried out during this preliminary investigation indicates that subsurface concrete should be designed to comply with the AC-2z classification of BRE Special Digest 1, though it may be prudent to raise the ACEC class to AC-3z to cater for low pH values noted in the Glacial Sand and Gravel.

It would be prudent to adopt a conservative approach to pavement design, with the adoption of a preliminary design CBR value of 10% where the subgrade is comprised of granular materials and where the subgrade material is cohesive, a CBR value of 3% should be adopted. It would be prudent to undertake further testing to confirm this.

Where weaker zones are present at formation level, the exposed surface should be proof-rolled and any soft spots that depress unduly should be removed and replaced with clean crushed stone or similar suitable granular fill. Further CBR testing of the likely formation surface is advised prior to final design/construction.

The extent of granular natural materials across the site was found to be largely limited to sections of the upper, north-western part of the site. Soakaway testing carried out in accordance with BRE Digest 365 'Soakaway Design', of the Granular Made Ground across the lower, south-eastern part of the site yielded favourable soil infiltration rates. However, here, the use of soakaways will be dependent on the contaminative state of the ground.

In order to achieve the required formation levels for the proposed development scheme, new slopes (associated with the regrading of the site) and retaining walls will be required. Appropriate soil parameters should be used in the safe design of new slopes and retaining walls.

Potential abnormal geotechnical costs may arise from the following:

- A negative cut-fill balance. Details of proposed finished levels have not yet been made available. Ideally, cut and fill operations should be designed such that the volume of suitable soils won from areas of proposed cut is broadly equivalent to the volume required in areas of fill. If there is a deficit, then costs would be incurred in importing additional suitable fill materials to the site.
- The requirement of a piled foundation.
- The requirement of suspended ground floor slabs.
- Some materials won from areas of cut may be deemed unsuitable geotechnically for re-use below areas of proposed infill. Where such materials can be improved/stabilised to allow them to be used as fill then this improvement/stabilisation will incur additional costs.
- Some materials won from areas of cut may be deemed unsuitable geotechnically for re-use below areas of proposed infill. If these materials cannot be improved or used in landscaped mounds, etc then they may need to be removed off-site.
- As a precaution against heave in the underlying clay soils there are requirements for compressible materials/voids adjacent to foundations/below floor slabs in accordance with NHBC guidelines.
- Potential weaker zones at pavement formation surface requiring removal and replacement.

Further investigative works could include

- Further in situ CBR testing at the formation surface following the earthworks operations.

11.2 Updated Environmental Risk Assessment

A preliminary risk assessment has been carried out based on the contaminant-pathway-receptor model as defined in Statutory Guidance to Part IIA of the Environment Protection Act, 1990, in accordance with BS 10175: 2011 +A2 2017 "Investigation of Potentially Contaminated Sites – Code of Practice" and LCRM. In order to make a more detailed assessment of the potential hazards, a preliminary Phase 2 intrusive investigation was carried out to reduce uncertainty and produce a more comprehensive conceptual site model of the site. This detailed the characteristic ground conditions and elements of the surrounding environment and has assisted with identifying contaminant linkages.

No significant risks to controlled water receptors or human health receptors have been identified from contaminants in soil, soil leaching or groundwater samples. The DGMRA has confirmed that there are no significant sources of ground gases from Made Ground or the underlying coal-bearing bedrock deposits due to any shallow workings likely to be flooded with groundwater, and no evidence of shallow mine workings being present. Following the finalisation of development and earthworks requirements the DGMRA may need to be reassessed, for example if piled foundations are required.

Based on the scope of the works undertaken during this preliminary investigation, there are no anticipated abnormal costs relating to geo-environmental conditions. However, there may be special conditions appertaining to the site which were not revealed by this investigation and which have not been taken into account in this report.

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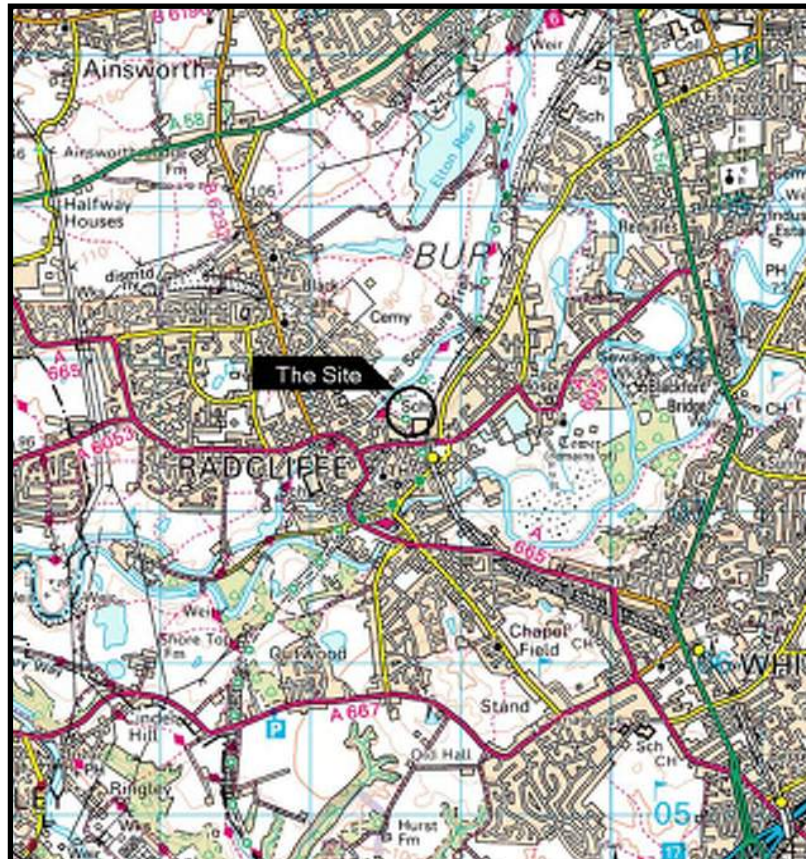
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APPENDIX I

Site Location Plan

SITE LOCATION PLAN



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Ground Investigation
for
STAR RADCLIFFE
for
Department for Education

GEOTECHNICS
geotechnical and geoenvironmental specialists

APPENDIX 2

Hand-dug Trial Pit Records

DATA SHEET - Symbols and Abbreviations used on Records



Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecon Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content
(All other strengths from undrained triaxial testing)	
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
()	Extrapolated value

Groundwater

Water Strike	
Depth Water Rose To	

Instrumentation

Seal

Filter

Seal

Strata

Made Ground Granular
Made Ground Cohesive
Topsoil
Cobbles and Boulders
Gravel
Sand
Silt
Clay
Peat

Note: Composite soil types shown by combined symbols

Chalk

Limestone

Sandstone

Coal

Strata, Continued

Mudstone

Siltstone

Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock

Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD Rock Quality Designation (% of intact core >100mm)

FRACTURE INDEX Fractures/metre

FRACTURE SPACING (m) Maximum Minimum

NI Non-intact core

NR No core recovery

AZCL Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

TRIAL PIT RECORD

Inspection Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

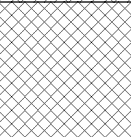
Trial Pit
Project No

DCP01
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates 378615.9 E
407729.7 N

Ground Level 76.30 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.00- 0.30	B			Rough grass over TOPSOIL: Dark brown slightly silty fine to coarse sand with many rootlets. [TOPSOIL]	G.L.		76.30
0.10	D						
0.20	ES			MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subrounded fine to coarse of mudstone, siltstone, coal and brick fragments. [GRANULAR MADE GROUND]	0.30		76.00
0.00- 1.17	DCP						
0.30- 0.70	B						
0.50	D						
0.50	ES			Below 0.70m, grading to slightly sandy silty clay.			
0.70- 1.20	B						
1.00	D			End of Excavation	1.20		75.10
1.00	ES						

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	09/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	09/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks	Inspection pit hand excavated to 1.20m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP01 located immediately adjacent to Hand-dug Trial Pit DCP01.	Logged by WH Checked by JK Figure 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020	geotechnics

TRIAL PIT RECORD

Inspection Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit

Project No

DCP05

PN224390

Client DEPARTMENT FOR EDUCATION

National Grid Coordinates 378634.6 E
407650.4 N

Ground Level 74.59 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.20- 0.80	B			Rough grass over TOPSOIL: Dark brown slightly silty fine to coarse sand with many rootlets. [TOPSOIL]	G.L.		74.59
0.00- 0.41	DCP				0.10		74.49
0.20	D			MADE GROUND: Black and dark brown clayey fine to coarse sand and angular fine to coarse gravel of various lithologies, ceramic and brick fragments. [GRANULAR MADE GROUND]	0.80		73.79
0.20	ES						
0.50	D				1.20		73.39
0.50	ES						
0.00- 1.18	DCP			MADE GROUND: Black mottled dark brown organic very gravelly very clayey fine to coarse sand. Gravel is angular to subrounded fine to coarse of mudstone, siltstone, coal and brick fragments. Occasional glass and wood fragments. Slight hydrocarbon odour. [GRANULAR MADE GROUND]			
0.80- 1.20	B						
1.00	D						
1.00	ES			End of Excavation			

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	12/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	12/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks	Inspection pit hand excavated to 1.20m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP05 (Tests 1 and 2) located immediately adjacent to Hand-dug Trial Pit DCP05.	Logged by WH Checked by JK Figure 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020	geotechnics

TRIAL PIT RECORD

Inspection Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit
Project NoDCP07
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates 378631.6 E
407618.6 N

Ground Level 74.30 m OD

Samples and Tests				Strata		Scale 1:50	
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.20- 0.80	B			Rough grass over TOPSOIL: Dark brown slightly silty fine to coarse sand with many rootlets. [TOPSOIL] MADE GROUND: Black and dark brown very gravelly very clayey fine to coarse sand. Gravel is angular fine to coarse of various lithologies, ceramic and brick fragments. [GRANULAR MADE GROUND] Firm to stiff yellowish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone. [GLACIAL TILL] End of Excavation	G.L.		74.30
0.20	D				0.10		74.20
0.00- 1.15	DCP						
0.20	ES						
0.50	D						
0.50	ES				0.90		73.40
0.90- 1.20	B						
1.00	D				1.20		73.10
1.00	ES						

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	11/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	11/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks		Logged by	
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.	Inspection pit hand excavated to 1.20m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP07 located immediately adjacent to Hand-dug Trial Pit DCP07.	Checked by Figure	WH JK 1 of 1 07/08/2022

geotechnics

Logged in accordance with BS5930:2015 + A1:2020

TRIAL PIT RECORD

Inspection Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit

Project No

DCP08

PN224390

Client DEPARTMENT FOR EDUCATION

National Grid Coordinates 378654.1 E
407604.7 N

Ground Level 73.86 m OD

Samples and Tests				Strata		Scale 1:50	
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.20- 0.80	B			Rough grass over TOPSOIL: Dark brown slightly silty fine to coarse sand with many rootlets.	G.L.		73.86
0.20	D			[TOPSOIL]	0.10		73.76
0.00- 1.15	DCP			MADE GROUND: Black and dark brown very clayey fine to coarse sand and angular fine to coarse gravel of various lithologies, ceramic and brick fragments.			
0.20	ES			Medium cobble content.	0.90		72.96
0.50	D			[GRANULAR MADE GROUND]			
0.50	ES			Firm yellowish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone.	1.20		72.66
0.90- 1.20	B			[GLACIAL TILL]			
1.00	D						
1.00	ES			End of Excavation			

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	11/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	11/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks		Logged by	
Inspection pit hand excavated to 1.20m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP08 located immediately adjacent to Hand-dug Trial Pit DCP08.	Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.	Logged by Checked by Figure	WH JK 1 of 1 07/08/2022

geotechnics

TRIAL PIT RECORD

Hand-dug Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit
Project No

HD01
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates 378756.6 E
407609.8 N

Ground Level 70.43 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.00 - 0.10	D			MADE GROUND: Black tarmacadam.	G.L.		70.43
0.10 - 0.30	B			[TARMACADAM]	0.10		70.33
0.20	D				0.30		70.13
0.20	ES			MADE GROUND: Greyish brown very sandy angular to subangular fine to coarse gravel of limestone (Sub base).			
0.30 - 0.60	B			[GRANULAR MADE GROUND]			
0.50	D						
0.50	ES			MADE GROUND: Dark grey and black mottled reddish brown very sandy silty angular to subangular fine to coarse gravel of various lithologies, ash and glass fragments. Medium cobble content. Grading to gravelly slightly silty sand in places.	1.10		69.33
0.60 - 1.20	B			[GRANULAR MADE GROUND]			
1.00	D						
1.00	ES			Below 0.60m, black mottled reddish brown.			
				At 1.10m, cobble/boulder obstruction.			
				End of Excavation			

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	12/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	12/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks	Trial Pit HD01 hand excavated to 1.10m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Hand-dug Trial Pit HD01 terminated at 1.10m depth on encountering a cobble/boulder obstruction.					Logged by WH
Symbols and abbreviations are explained on the accompanying key sheet.						Checked by JK
All dimensions are in metres.						Figure 1 of 1
						07/08/2022
						geotechnics

TRIAL PIT RECORD

Hand-dug Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit

HD02

Project No

PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates

378777.7 E
407534.6 N

Ground Level 70.39 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.00 - 0.25	B			MADE GROUND: Grey concrete paving flag. [CONCRETE]	G.L.		70.39
0.20	ES				0.05		70.34
0.25 - 0.60	B			MADE GROUND: Grey concrete. [CONCRETE]	0.10		70.29
0.50	ES				0.25		70.14
					0.60		69.79
1.00	ES			MADE GROUND: Reddish brown very sandy angular to subangular fine to coarse gravel of limestone (Sub base). [GRANULAR MADE GROUND]			
				MADE GROUND: Dark brown and black very gravelly fine to coarse sand of ash. Gravel is angular to subangular fine to coarse of mudstone, siltstone and sandstone. [GRANULAR MADE GROUND]			
				At 0.60m, obstruction.			
				End of Excavation			

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	12/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	13/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks	Trial Pit HD02 hand excavated to 0.60m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Hand-dug Trial Pit HD02 terminated at 0.60m depth on encountering a cobble/boulder obstruction.					Logged by WH Checked by JK Figure 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet.						geotechnics
All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020					

TRIAL PIT RECORD

Hand-dug Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit

HD03

Project No

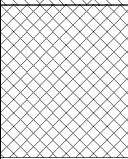
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates

378681.7 E
407533.1 N

Ground Level 70.30 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.00- 0.20	B			Rough vegetation over TOPSOIL: Dark brown and black slightly silty fine sand with many rootlets. [TOPSOIL] MADE GROUND: Dark brown mottled dark grey slightly gravelly slightly silty fine to coarse sand with some rootlets. Gravel is angular to subrounded fine to coarse of mudstone, siltstone, sandstone, brick fragments and traces of glass. [GRANULAR MADE GROUND] Below 0.80m, grading to firm brown slightly sandy slightly gravelly clay. End of Excavation	G.L.		70.30
0.10	ES				0.20		70.10
0.20- 0.80	B						
0.50	ES						
0.80- 1.20	B				1.20		69.10
1.00	ES						

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	09/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	09/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks	Trial Pit HD03 hand excavated to 1.20m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP11 located immediately adjacent to Hand-dug Trial Pit HD03.					Logged by WH Checked by JK Figure 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020					

Hand-dug Pit

Project **STAR RADCLIFFE**

Engineer

MOTT MACDONALD LIMITED

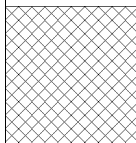
Trial Pit
Project No

HD04
PN224390

Client **DEPARTMENT FOR EDUCATION**

National Grid	378721.1	E
Coordinates	407509.6	N

Ground Level **70.64** m OD

Samples and Tests				Strata		Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD	
0.00- 0.40 0.20 0.20 0.40- 0.80 0.50 0.50	B D ES B D ES			MADE GROUND: Black mottled dark brown very sandy silty angular to subangular fine to coarse gravel of mudstone, siltstone and brick fragments. Some glass and plastic fragments. Grading to gravelly slightly silty sand in places. [GRANULAR MADE GROUND]	G.L.		70.64	
0.90 0.90	D ES			At 0.90m, obstruction - sandstone setts. End of Excavation	0.90		69.74	

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	12/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	12/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks	AGS	Logged by	Checked by	Figure	WH
Trial Pit HD04 hand excavated to 0.90m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Hand-dug Trial Pit HD04 terminated at 0.90m depth on encountering obstruction - sandstone setts. Dynamic Cone Penetration Test DCP13 located immediately adjacent to Hand-dug Trial Pit HD04.		JK	JK	1 of 1	07/08/2022

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020



TRIAL PIT RECORD

Hand-dug Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

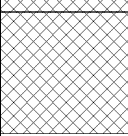
Trial Pit
Project No

HD05
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates 378712.5 E
407468.7 N

Ground Level 71.21 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.10- 0.40	B			Grass over TOPSOIL: Black mottled dark brown slightly silty fine sand with many rootlets. [TOPSOIL]	G.L.		71.21
0.10	ES				0.20		71.01
0.20	D				0.40		70.81
0.40- 0.80	B						
0.50	B						
0.50	D			MADE GROUND: Black mottled dark brown gravelly slightly silty fine to coarse sand. Gravel is angular to subangular fine to coarse of mudstone, siltstone, sandstone and glass fragments. [GRANULAR MADE GROUND]			
0.50	ES						
0.80- 1.20	B				1.20		70.01
1.00	D			MADE GROUND: Black very sandy silty angular fine to coarse gravel of mudstone, siltstone, sandstone and coal. Occasional clayware pipe fragments. Grading to gravelly sand in places. [GRANULAR MADE GROUND]			
1.00	ES						
				Below 0.80m, occasional wood fragments.			
				End of Excavation			

Excavation				Groundwater		
Plant	Hand digging tools.	Width (B)	0.50	Depth Observed	Depth of Pit	Details
Date	09/05/2022	Length (C)	0.50			
Shoring	None.	Date Backfilled	09/05/2022			None encountered.
Stability	Stable during excavation.					

Remarks	Trial Pit HD05 hand excavated to 1.20m depth and no services were found. ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP14 located immediately adjacent to Hand-dug Trial Pit HD05.					Logged by Checked by Figure	WH JK 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet.							
All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020						

APPENDIX 3

Hand-dug Trial Pit Photographs

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit DCP01

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit DCP05

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit DCP07

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit DCP08

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



PROJECT NAME	STAR RADCLIFFE		
PROJECT NO.	PN224390	HOLE ID	HD01
DATE	05 2022	BOX NO.	
NOTES			

Hand-dug Trial Pit HD01

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit HD02

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit HD03

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit HD04

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Hand-dug Trial Pit HD05

APPENDIX 4

Machine-dug Trial Pit Records

DATA SHEET - Symbols and Abbreviations used on Records



Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecon Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content
(All other strengths from undrained triaxial testing)	
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
()	Extrapolated value

Groundwater

Water Strike	
Depth Water Rose To	

Instrumentation

Seal

Filter

Seal

Strata

Made Ground Granular
Made Ground Cohesive
Topsoil
Cobbles and Boulders
Gravel
Sand
Silt
Clay
Peat

Note: Composite soil types shown by combined symbols

Chalk

Limestone

Sandstone

Coal

Strata, Continued

Mudstone

Siltstone

Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock

Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD Rock Quality Designation (% of intact core >100mm)

FRACTURE INDEX Fractures/metre

FRACTURE SPACING (m) Maximum Minimum

NI Non-intact core

NR No core recovery

AZCL Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

TRIAL PIT RECORD

Trial Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit

TP01

Project No

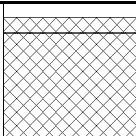
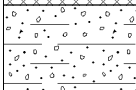
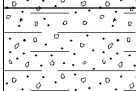
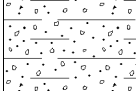
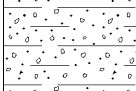
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates

378789.1 E
407703.1 N

Ground Level 71.95 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.25	D			MADE GROUND: Light grey sandy angular to subangular fine to coarse gravel of mudstone, limestone, slate, concrete and brick fragments. Some wood, plastic and metal fragments. Low cobble content of bricks. [GRANULAR MADE GROUND]	G.L.		71.95
0.25	ES				0.10		71.85
0.60 - 0.90	B						
0.80	D			MADE GROUND: Dark brown very sandy clayey subangular fine to coarse gravel of limestone. [GRANULAR MADE GROUND]	0.80		71.15
0.80	ES						
1.00	D						
1.00	ES			At 0.80m, Terram woven geo-membrane.	1.40		70.55
1.40 - 1.50	B			MADE GROUND: Dark brownish grey slightly sandy angular to subangular fine to coarse gravel of limestone, coal, concrete, clinker and brick fragments. [GRANULAR MADE GROUND]			
1.50	D						
1.50	ES				2.00		69.95
1.90 - 2.10	B			Firm to stiff greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of siltstone. [GLACIAL TILL]			
2.50	D						
2.50	ES						
2.90 - 3.10	B			Stiff to very stiff dark brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subangular fine to coarse of siltstone. [GLACIAL TILL]			
3.50	D						
3.80 - 4.00	B				4.00		67.95
				Below 3.00m, low cobble content of siltstone.			
				End of Excavation			

Excavation				Groundwater		
Plant	JCB 3CX	Width (B)	0.60	Depth Observed	Depth of Pit	Details
Date	24/05/2022	Length (C)	2.00	1.50	1.50	Rose to 1.40 in 20 mins, Slow inflow.
Shoring	None.	Date Backfilled	24/05/2022			
Stability	Stable during excavation.					

Remarks	ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Soakaway Test SA01 carried out in accordance with BRE Digest 365 (2016) adjacent to Machine-dug Trial Pit TP01.					Logged by	RW
Symbols and abbreviations are explained on the accompanying key sheet.						Checked by	JK
All dimensions are in metres.						Figure	1 of 1
							07/08/2022
						geotechnics	

Project **STAR RADCLIFFE**

Engineer

MOTT MACDONALD LIMITED

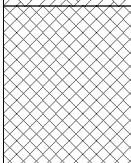
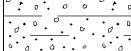
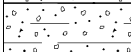
Trial Pit
Project No

TP02
PN224390

Client **DEPARTMENT FOR EDUCATION**

National Grid	378811.4	E
Coordinates	407742.0	N

Ground Level **71.53** m OD

Samples and Tests				Strata		Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD	
0.20 0.20 0.40- 0.60 0.50 0.50	D ES B D ES			Grass over TOPSOIL: Dark greyish brown slightly clayey fine to medium sand with many rootlets. [TOPSOIL]	G.L. 0.30	 	71.53 71.23	
1.20 1.20 1.50- 1.60 1.60 1.60	D ES B D ES			MADE GROUND: Dark grey very sandy slightly clayey subangular to subrounded fine to coarse gravel of mudstone, siltstone, coal, clinker and brick fragments. [GRANULAR MADE GROUND]	1.50		70.03	
1.90- 2.00	B			Firm to stiff brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of mudstone and siltstone. [GLACIAL TILL]	2.00		69.53	
2.50 2.50	D ES			Stiff to very stiff dark brownish grey slightly sandy slightly gravelly CLAY with a low cobble content. Gravel is subangular to subrounded fine to coarse of siltstone. [GLACIAL TILL]	3.70		67.83	
2.90- 3.10	B							
3.50 3.60- 3.70	D B							
				End of Excavation				

Excavation				Groundwater		
Plant	JCB 3CX	Width (B)	0.60	Depth Observed	Depth of Pit	Details
Date	23/05/2022	Length (C)	2.50	1.60	1.60	Rose to 1.30 in 20 mins, Fast inflow.
Shoring	None.	Date Backfilled	23/05/2022			
Stability	Stable during excavation.					

Remarks

 ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Soakaway Test SA02 carried out in accordance with BRE Digest 365 (2016) adjacent to Machine-dug Trial Pit TP02.

Logged by
Checked by
Figure

RW
JK
1 of 1
07/08/2022

Symbols and abbreviations are explained on the accompanying key sheet.

geotechnics

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Project **STAR RADCLIFFE**

Engineer

MOTT MACDONALD LIMITED

Trial Pit
Project No

TP03
PN224390

Client **DEPARTMENT FOR EDUCATION**

National Grid	378695.8	E
Coordinates	407519.9	N

Ground Level **70.42** m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.20 0.20 0.50 0.50	D ES D ES			MADE GROUND: Light grey sandy angular to subangular fine to coarse of mudstone, slate, limestone. and brick fragments. Low cobble content of bricks. [GRANULAR MADE GROUND]	G.L. 0.30		70.42 70.12
1.00 1.00	D ES			MADE GROUND: Black very gravelly very clayey fine to coarse sand of ash. Gravel is angular to subangular fine to coarse gravel of coal and clinker. Grading to sandy slightly clayey gravel in places. [GRANULAR MADE GROUND]			
1.40- 1.50	B				1.70		68.72
2.00 2.00	D ES			MADE GROUND: Soft to firm dark grey slightly sandy slightly gravelly clay. Gravel is subangular to subrounded fine to coarse of siltstone, sandstone and brick fragments. [COHESIVE MADE GROUND]	2.40		68.02
2.30- 2.40	B						
3.00 3.00	D ES			Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse mudstone and siltstone. [GLACIAL TILL] At 2.70m, lens of sand/gravel.	3.70 4.00		66.72 66.42
3.40- 3.50	B						
3.80- 4.00 4.00 4.00	B D ES			Stiff to very stiff light grey slightly sandy slightly gravelly SILT. Gravel is subrounded fine to medium of siltstone. [GLACIAL SILT]			
				End of Excavation			
Excavation					Groundwater		
Plant	JCB 3CX	Width (B)	0.60	Depth Observed	Depth of Pit	Details	
Date	25/05/2022	Length (C)	2.40	1.60	1.80	Slow inflow.	
Shoring	None.	Date Backfilled	25/05/2022	2.70	3.00	Medium inflow.	
Stability	Stable during excavation.						
Remarks	ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Soakaway Test SA03 carried out in accordance with BRE Digest 365 (2016) within Machine-dug Trial Pit TP03. Dynamic Cone Penetration Test DCP12 located immediately adjacent to Machine-dug Trial Pit TP03.						Logged by Checked by Figure
Symbols and abbreviations are explained on the accompanying key sheet.							RW JK 1 of 1 07/08/2022
All dimensions are in metres.							geotechnics
Logged in accordance with BS5930:2015 + A1:2020							

TRIAL PIT RECORD

Trial Pit

Project **STAR RADCLIFFE**

Engineer

MOTT MACDONALD LIMITED

Trial Pit
Project No

TP04
PN224390

Client **DEPARTMENT FOR EDUCATION**

National Grid
Coordinates **378613.0 E**
407664.1 N

Ground Level **75.22** m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.25	D			Grass over TOPSOIL: Brown slightly clayey fine to medium sand with many rootlets.	G.L.		75.22
0.25	ES			[TOPSOIL]	0.25		74.97
0.40- 0.60	B			Light brown silty fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of siltstone, sandstone and coal.			
0.50	D			[GLACIAL SAND AND GRAVEL]	1.00		74.22
0.50	ES						
1.00	D			Light brownish grey slightly gravelly slightly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of siltstone and sandstone.	1.40		73.82
1.00	ES			[GLACIAL SAND AND GRAVEL]			
1.40- 1.60	B						
1.50	D			Firm light brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of siltstone.			
1.50	ES			[GLACIAL TILL]			
2.00	D						
2.40- 2.60	B						
3.00	D			At 3.00m, Soft. Grading to slightly gravelly sandy silt in places.			
3.40- 3.60	B						
4.00	D			End of Excavation	4.00		71.22

Excavation				Groundwater		
Plant	JCB 3CX	Width (B)	0.60	Depth Observed	Depth of Pit	Details
Date	23/05/2022	Length (C)	2.50			
Shoring	None.	Date Backfilled	23/05/2022			None encountered.
Stability	Unstable below 1.40m.					

Remarks	ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP04 located immediately adjacent to Machine-dug Trial Pit TP04.	Logged by Checked by Figure	RW JK 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet.			
All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020		

geotechnics

TRIAL PIT RECORD

Trial Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit
Project No

TP05
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates 378608.5 E
407614.2 N

Ground Level 74.66 m OD

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
0.20	D			Grass over TOPSOIL: Brown slightly clayey fine to medium sand with many rootlets.	G.L.		74.66
0.20	ES			[TOPSOIL]	0.30		74.36
0.50	D			MADE GROUND: Soft to firm dark grey/black slightly sandy slightly gravelly clay. Gravel is subangular to subrounded fine to medium of siltstone and brick fragments.	1.10		73.56
0.50	ES			[COHESIVE MADE GROUND]	1.50		73.16
0.90- 1.00	B			At 1.10m, timber railway sleeper (up to 1.00m x 0.40m).	2.10		72.56
1.20- 1.40	B			Soft to firm light brown slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to medium of siltstone.	2.50		72.16
1.20	D			[GLACIAL TILL]			
1.20	ES			Soft to firm reddish brown sandy CLAY.			
1.50	D			[GLACIAL TILL]			
1.50	ES			Soft to firm brownish grey slightly sandy gravelly CLAY. Gravel is subrounded fine to coarse of siltstone.			
1.90- 2.10	B			[GLACIAL TILL]			
2.50	D			At 2.20m, lens of sand/gravel.			
2.50	ES			Stiff to very stiff brownish grey slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of siltstone.			
2.60- 2.70	B			[GLACIAL TILL]			
3.50	D			End of Excavation	4.00		70.66
3.80- 4.00	B						

Excavation				Groundwater		
Plant	JCB 3CX	Width (B)	0.60	Depth Observed	Depth of Pit	Details
Date	24/05/2022	Length (C)	2.50	2.20	2.30	Seepage, no rise.
Shoring	None.	Date Backfilled	24/05/2022			
Stability	Stable during excavation.					

Remarks	ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP09 located immediately adjacent to Machine-dug Trial Pit TP05.	Logged by Checked by Figure	RW JK 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet.		geotechnics	
All dimensions are in metres.		Logged in accordance with BS5930:2015 + A1:2020	

TRIAL PIT RECORD

Trial Pit

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Trial Pit

TP06

Project No

PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates

378654.4 E
407600.8 N

Ground Level 73.70

Samples and Tests				Strata	Scale 1:50		
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level
0.20	D			Grass over TOPSOIL: Brown slightly clayey fine to medium sand with many rootlets.	G.L.		73.70
0.20	ES			[TOPSOIL]	0.30		73.40
0.40- 0.60	B			MADE GROUND: Dark blackish brown slightly gravelly slightly clayey fine to medium sand with a medium cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, sandstone, coal, concrete and brick fragments. Occasional wood and metal fragments including a twisted metal frame (up to 1.20m long).			
0.50	D			[GRANULAR MADE GROUND]	1.50		72.20
1.00	D			Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to medium of siltstone.			
1.00	ES			[GLACIAL TILL]			
1.50- 1.60	B			Below 2.20m, slightly sandy gravelly.			
1.80	D			Between 2.80-3.00m, lens of brown very gravelly slightly silty fine to coarse sand.			
1.80	ES						
2.50- 2.60	B						
2.80	D						
2.80	ES						
3.50- 3.60	B						
3.80	D						
3.80	ES				4.00		69.70
				End of Excavation			

Excavation				Groundwater		
Plant	JCB 3CX	Width (B)	0.60	Depth Observed	Depth of Pit	Details
Date	25/05/2022	Length (C)	2.50	3.00	3.10	Rose to 2.90 in 20 mins, Slow inflow.
Shoring	None.	Date Backfilled	25/05/2022			
Stability	Stable during excavation.					

Remarks	ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial. Dynamic Cone Penetration Test DCP10 located immediately adjacent to Machine-dug Trial Pit TP06.	Logged by Checked by Figure	RW JK 1 of 1 07/08/2022
Symbols and abbreviations are explained on the accompanying key sheet.			
All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020		

APPENDIX 5

Machine-dug Trial Pit Photographs

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP01 (I)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP01 (2)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP01 (3) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP01 (4)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP01 (5) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP02 (I) during Soakaway Test

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP02 (2) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP02 (3)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP02 (4)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP02 (5) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP03 (I)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP03 (2)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP03 (3) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP04 (I)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP04 (2)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP04 (3) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP05 (I)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP05 (2)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP05 (3) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP06 (I)

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP06 (2) Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Machine-dug Trial Pit TP06 (3) Arsings

APPENDIX 6

Soakaway Test Results

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA01

Test No I

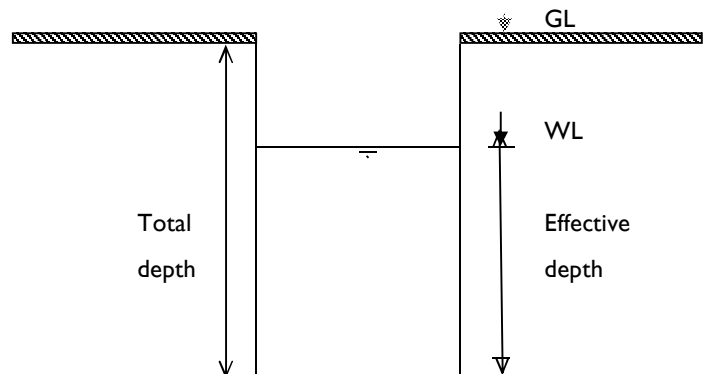
Project No PN224390

Client MOTT MACDONALD LIMITED

Date 24/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	0.60	0.60	100.00
0.50	0.64	0.56	93.33
1.00	0.67	0.53	88.33
1.50	0.70	0.50	83.33
2.00	0.72	0.48	80.00
2.50	0.74	0.46	76.67
3.00	0.75	0.45	75.00
3.50	0.77	0.43	71.67
4.00	0.77	0.43	71.67
4.50	0.78	0.42	70.00
5.00	0.79	0.41	68.33
5.50	0.79	0.41	68.33
6.00	0.80	0.40	66.67
6.50	0.80	0.40	66.67
7.00	0.81	0.39	65.00
7.50	0.82	0.38	63.33
8.00	0.82	0.38	63.33
8.50	0.83	0.37	61.67
9.00	0.85	0.35	58.33
9.50	0.85	0.35	58.33
10.00	0.86	0.34	56.67
11.00	0.87	0.33	55.00
12.00	0.88	0.32	53.33
13.00	0.89	0.31	51.67
14.00	0.91	0.29	48.33
15.00	0.94	0.26	43.33
16.00	0.96	0.24	40.00

TRIAL PIT SOAKAWAY



Trial pit length = 2.000 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	3.00
25%	0.150	1.050	19.60
Vp75-25	=	0.360	m3
ap50	=	2.760	m2
tp75-25	=	16.600	min
Soil Infiltration, f	=	1.31E-04	m/sec

Sheet 1

Remarks Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.

GEOTECHNICS

Form INS009 Rev 6

Date 24/05/2022

Date 24/05/2022

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

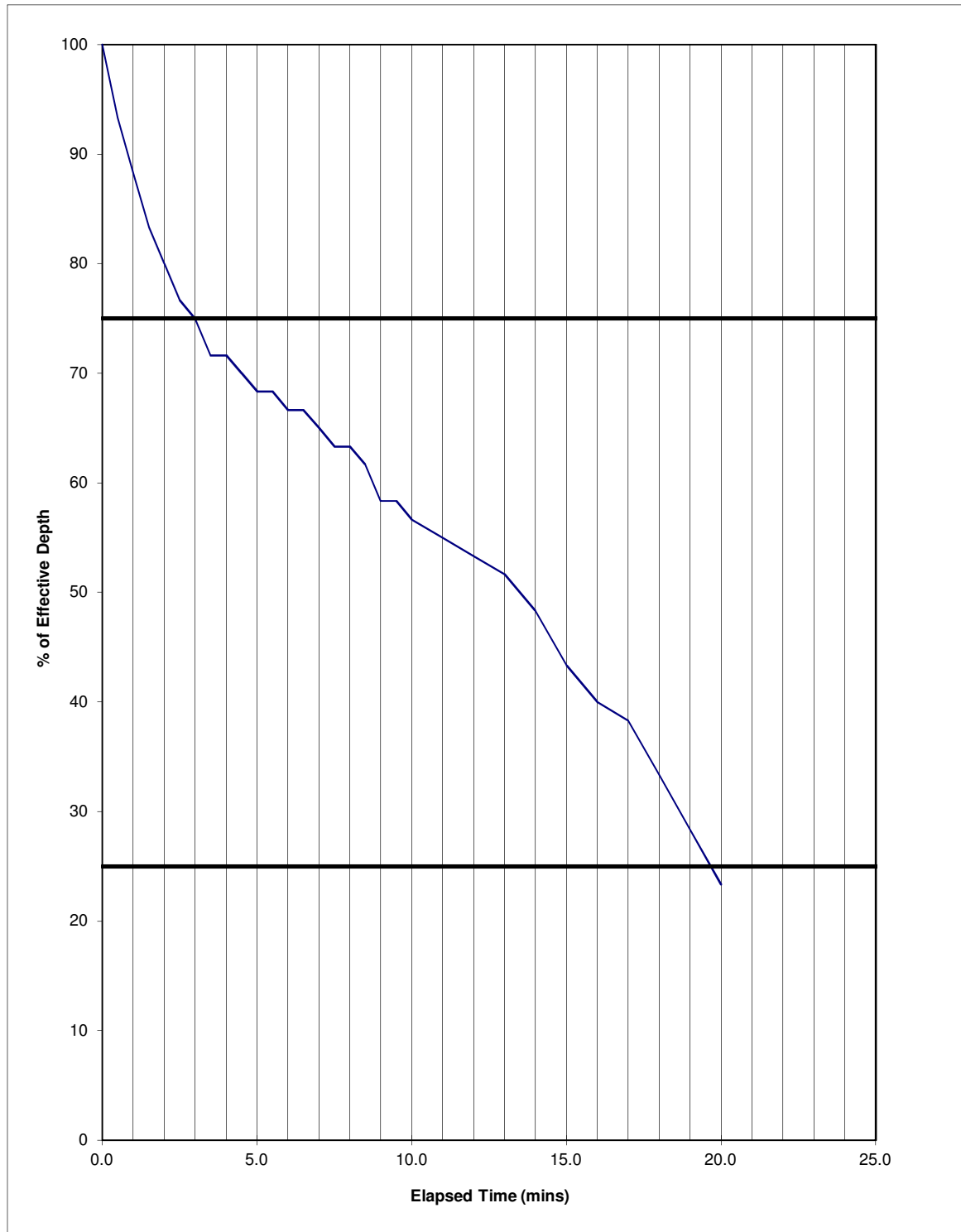
Trial Pit SA01

Test No I

Client MOTT MACDONALD LIMITED

Project No PN224390

Date 24/05/2022



tp75	=	3.00
tp25	=	19.60

Remarks Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.

Sheet 3

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA01

Test No 2

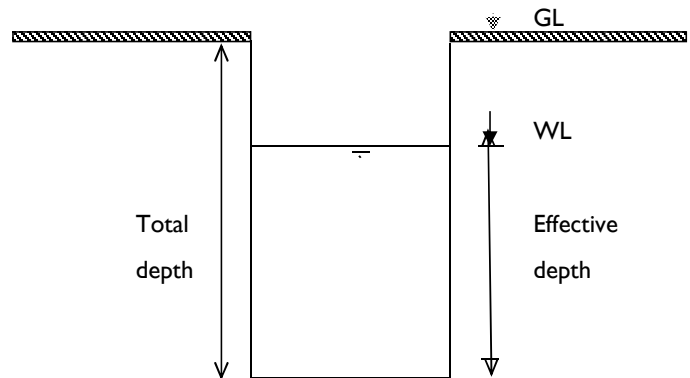
Project No PN224390

Client MOTT MACDONALD LIMITED

Date 24/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	0.60	0.60	100.00
0.50	0.64	0.56	93.33
1.00	0.66	0.54	90.00
1.50	0.68	0.52	86.67
2.00	0.70	0.50	83.33
2.50	0.70	0.50	83.33
3.00	0.71	0.49	81.67
3.50	0.71	0.49	81.67
4.00	0.72	0.48	80.00
4.50	0.73	0.47	78.33
5.00	0.74	0.46	76.67
5.50	0.74	0.46	76.67
6.00	0.75	0.45	75.00
6.50	0.76	0.44	73.33
7.00	0.77	0.43	71.67
7.50	0.78	0.42	70.00
8.00	0.78	0.42	70.00
8.50	0.79	0.41	68.33
9.00	0.80	0.40	66.67
9.50	0.81	0.39	65.00
10.00	0.81	0.39	65.00
11.00	0.82	0.38	63.33
12.00	0.82	0.38	63.33
13.00	0.83	0.37	61.67
14.00	0.84	0.36	60.00
15.00	0.85	0.35	58.33
16.00	0.85	0.35	58.33

TRIAL PIT SOAKAWAY



Trial pit length = 2.000 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

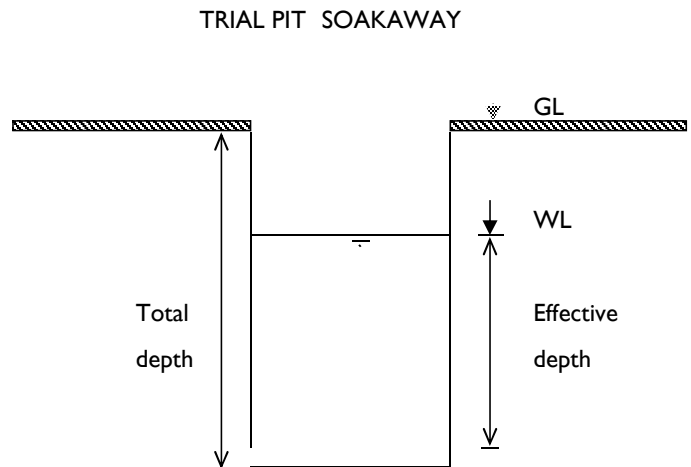
Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	6.00
25%	0.150	1.050	28.00
Vp75-25	=	0.360	m3
ap50	=	2.760	m2
tp75-25	=	22.000	min
Soil Infiltration, f	=	9.88E-05	m/sec

Sheet 1

Remarks Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.

Form INS009 Rev 6

Date 24/05/2022

[illegible]

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	6.00
25%	0.150	1.050	28.00
Vp75-25	=	0.360	m3
ap50	=	2.760	m2
tp75-25	=	0.000	min
Soil Infiltration, f	=	9.88E-05	m/sec

Remarks	Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.
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INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit

SA01

Test No

2

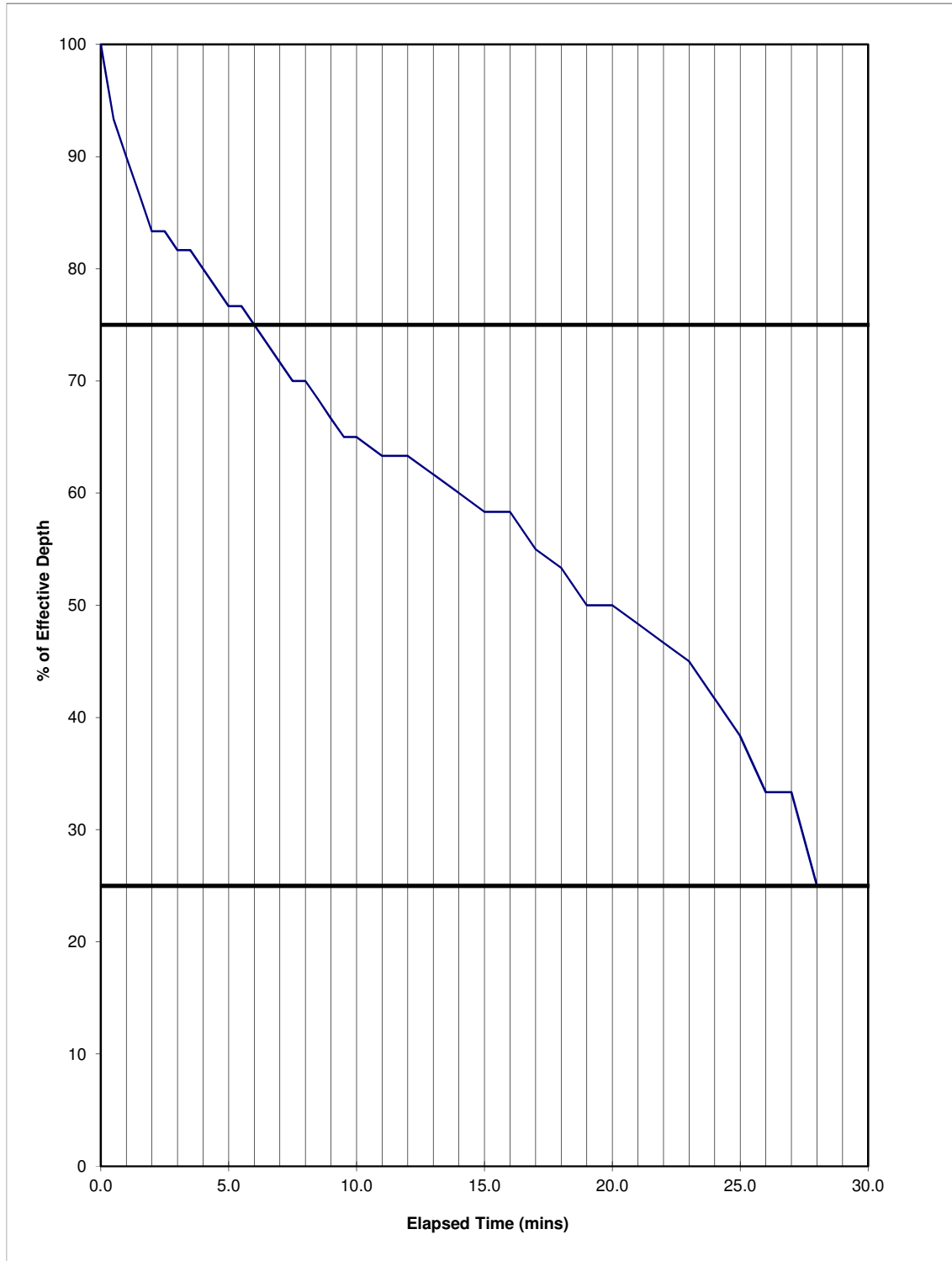
Project No

PN224390

Client MOTT MACDONALD LIMITED

Date

24/05/2022



tp75	=	6.00
tp25	=	28.00

Remarks Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.

Sheet 3

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA01

Test No 3

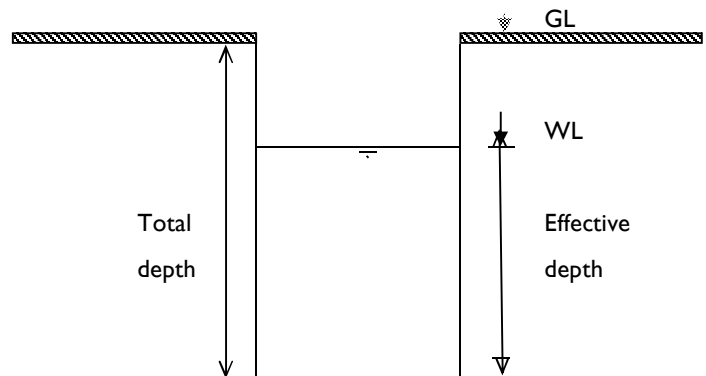
Project No PN224390

Client MOTT MACDONALD LIMITED

Date 24/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	0.60	0.60	100.00
0.50	0.62	0.58	96.67
1.00	0.64	0.56	93.33
1.50	0.65	0.55	91.67
2.00	0.67	0.53	88.33
2.50	0.68	0.52	86.67
3.00	0.69	0.51	85.00
3.50	0.70	0.50	83.33
4.00	0.71	0.49	81.67
4.50	0.72	0.48	80.00
5.00	0.73	0.47	78.33
5.50	0.75	0.45	75.00
6.00	0.75	0.45	75.00
6.50	0.76	0.44	73.33
7.00	0.77	0.43	71.67
7.50	0.78	0.42	70.00
8.00	0.79	0.41	68.33
8.50	0.80	0.40	66.67
9.00	0.80	0.40	66.67
9.50	0.80	0.40	66.67
10.00	0.81	0.39	65.00
11.00	0.81	0.39	65.00
12.00	0.82	0.38	63.33
13.00	0.82	0.38	63.33
14.00	0.83	0.37	61.67
15.00	0.83	0.37	61.67
16.00	0.83	0.37	61.67

TRIAL PIT SOAKAWAY



Trial pit length = 2.000 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	6.00
25%	0.150	1.050	35.00
Vp75-25	=	0.360	m3
ap50	=	2.760	m2
tp75-25	=	29.000	min
Soil Infiltration, f	=	7.50E-05	m/sec

Sheet 1

Remarks Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA01

Test No 3

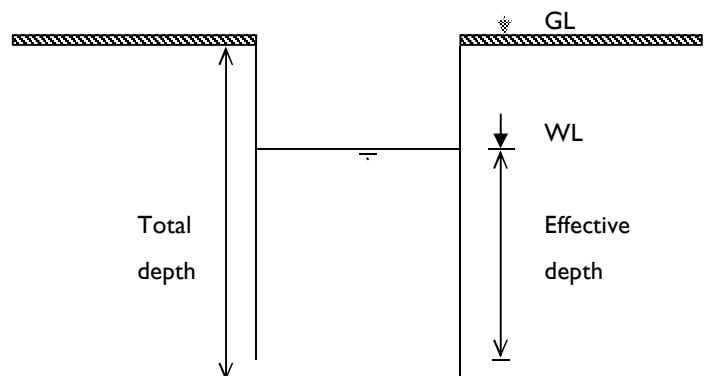
Project No PN224390

Client MOTT MACDONALD LIMITED

Date 24/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
17.00	0.84	0.360	60.0
18.00	0.84	0.360	60.0
19.00	0.86	0.340	56.7
20.00	0.86	0.340	56.7
21.00	0.87	0.330	55.0
22.00	0.87	0.330	55.0
23.00	0.89	0.310	51.7
24.00	0.89	0.310	51.7
25.00	0.89	0.310	51.7
26.00	0.90	0.300	50.0
27.00	0.91	0.290	48.3
28.00	0.92	0.280	46.7
29.00	0.94	0.260	43.3
30.00	0.96	0.240	40.0
31.00	0.96	0.240	40.0
32.00	0.97	0.230	38.3
33.00	0.98	0.220	36.7
34.00	1.00	0.200	33.3
35.00	1.06	0.140	23.3
36.00	1.06	0.140	23.3

TRIAL PIT SOAKAWAY



Trial pit length = 2.000 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	6.00
25%	0.150	1.050	35.00
Vp75-25	=	0.360	m3
ap50	=	2.760	m2
tp75-25	=	0.000	min
Soil Infiltration, f	=	7.50E-05	m/sec

Sheet 2

Remarks Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

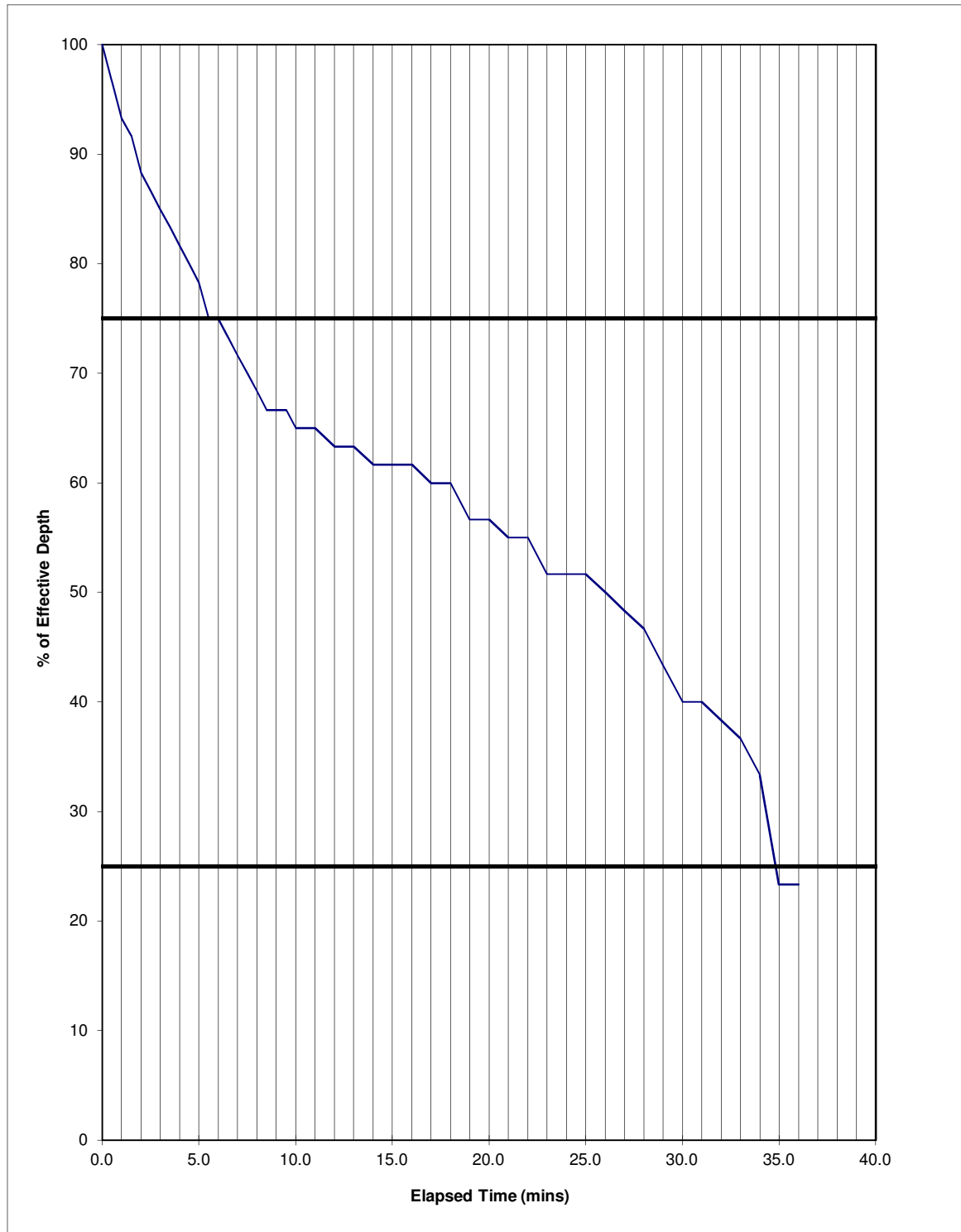
Trial Pit SA01

Test No 3

Client MOTT MACDONALD LIMITED

Project No PN224390

Date 24/05/2022



tp75	=	6.00
tp25	=	35.00

Remarks Soakaway Test SA01 carried out adjacent to Machine-dug Trial Pit TP01.

Sheet 3

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA02

Test No I

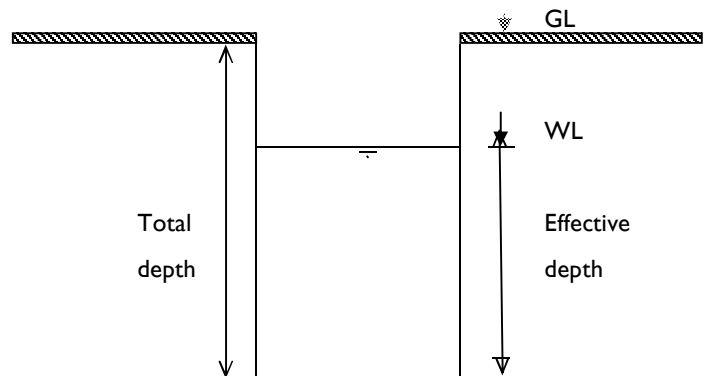
Project No PN224390

Client MOTT MACDONALD LIMITED

Date 23/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	0.60	0.60	100.00
0.50	0.64	0.56	93.33
1.00	0.69	0.51	85.00
1.50	0.69	0.51	85.00
2.00	0.70	0.50	83.33
2.50	0.72	0.48	80.00
3.00	0.73	0.47	78.33
3.50	0.74	0.46	76.67
4.00	0.75	0.45	75.00
4.50	0.76	0.44	73.33
5.00	0.78	0.42	70.00
5.50	0.78	0.42	70.00
6.00	0.79	0.41	68.33
6.50	0.80	0.40	66.67
7.00	0.82	0.38	63.33
7.50	0.83	0.37	61.67
8.00	0.84	0.36	60.00
8.50	0.85	0.35	58.33
9.00	0.86	0.34	56.67
9.50	0.87	0.33	55.00
10.00	0.87	0.33	55.00
10.50	0.88	0.32	53.33
11.00	0.88	0.32	53.33
11.50	0.88	0.32	53.33
12.00	0.89	0.31	51.67
12.50	0.90	0.30	50.00
13.00	0.90	0.30	50.00

TRIAL PIT SOAKAWAY



Trial pit length = 2.500 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	4.00
25%	0.150	1.050	29.00
Vp75-25	=	0.450 m3	
ap50	=	3.360 m2	
tp75-25	=	25.000 min	
Soil Infiltration, f	=	8.93E-05 m/sec	

Sheet I

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA02

Test No I

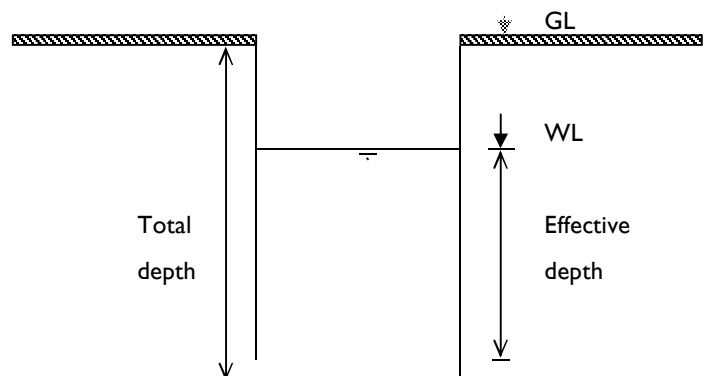
Client MOTT MACDONALD LIMITED

Project No PN224390

Date 23/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
13.50	0.91	0.290	48.3
14.00	0.92	0.280	46.7
14.50	0.92	0.280	46.7
15.00	0.93	0.270	45.0
16.00	0.94	0.260	43.3
17.00	0.95	0.250	41.7
18.00	0.96	0.240	40.0
19.00	0.97	0.230	38.3
20.00	0.98	0.220	36.7
21.00	0.99	0.210	35.0
22.00	1.00	0.200	33.3
23.00	1.00	0.200	33.3
24.00	1.01	0.190	31.7
25.00	1.02	0.180	30.0
26.00	1.03	0.170	28.3
27.00	1.03	0.170	28.3
28.00	1.04	0.160	26.7
29.00	1.05	0.150	25.0
30.00	1.05	0.150	25.0
31.00	1.06	0.140	23.3

TRIAL PIT SOAKAWAY



Trial pit length = 2.500 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	4.00
25%	0.150	1.050	29.00
Vp75-25	=	0.450 m3	
ap50	=	3.360 m2	
tp75-25	=	0.000 min	
Soil Infiltration, f	=	8.93E-05 m/sec	

Sheet 2

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

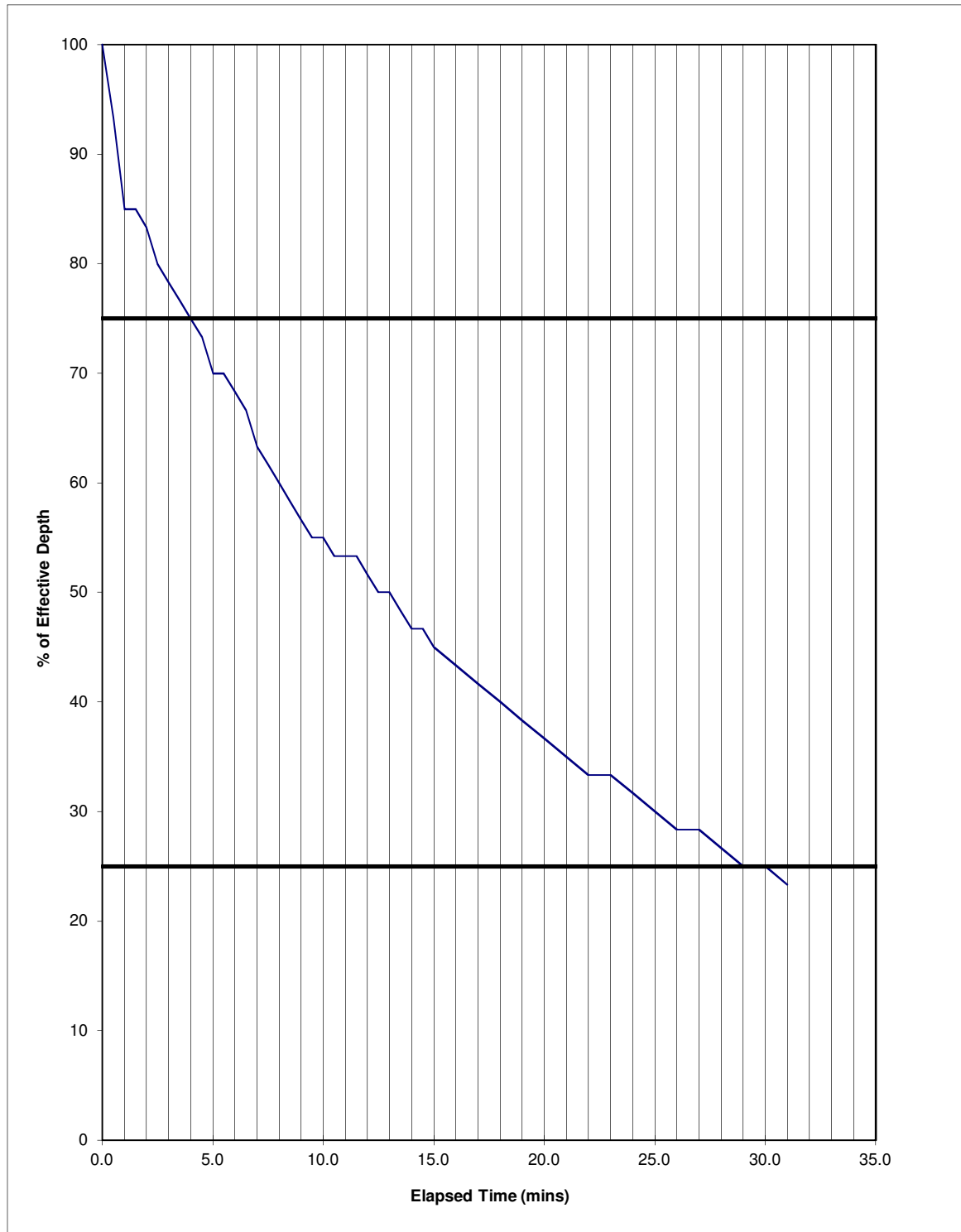
Trial Pit SA02

Test No I

Client MOTT MACDONALD LIMITED

Project No PN224390

Date 23/05/2022



tp75 = 4.00

tp25 = 29.00

Sheet 3

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA02

Test No 2

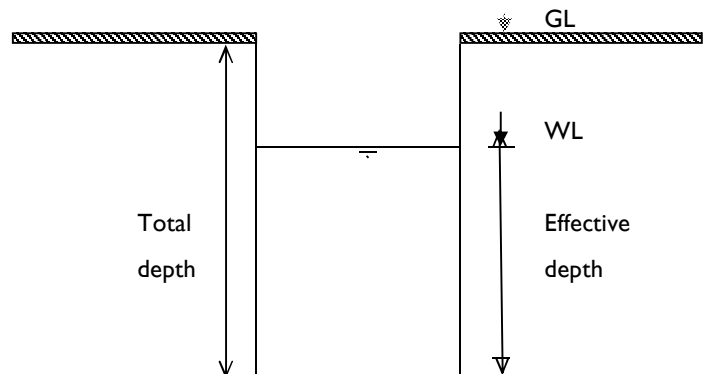
Client MOTT MACDONALD LIMITED

Project No PN224390

Date 23/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	0.60	0.60	100.00
0.50	0.61	0.59	98.33
1.00	0.63	0.57	95.00
1.50	0.64	0.56	93.33
2.00	0.64	0.56	93.33
2.50	0.65	0.55	91.67
3.00	0.66	0.54	90.00
3.50	0.66	0.54	90.00
4.00	0.67	0.53	88.33
4.50	0.68	0.52	86.67
5.00	0.69	0.51	85.00
5.50	0.70	0.50	83.33
6.00	0.71	0.49	81.67
6.50	0.71	0.49	81.67
7.00	0.72	0.48	80.00
7.50	0.72	0.48	80.00
8.00	0.73	0.47	78.33
8.50	0.74	0.46	76.67
9.00	0.74	0.46	76.67
9.50	0.75	0.45	75.00
10.00	0.75	0.45	75.00
10.50	0.76	0.44	73.33
11.00	0.77	0.43	71.67
11.50	0.77	0.43	71.67
12.00	0.77	0.43	71.67
12.50	0.78	0.42	70.00
13.00	0.78	0.42	70.00

TRIAL PIT SOAKAWAY



Trial pit length = 2.500 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	10.00
25%	0.150	1.050	56.00
Vp75-25	=	0.450 m3	
ap50	=	3.360 m2	
tp75-25	=	46.000 min	
Soil Infiltration, f	=	4.85E-05 m/sec	

Sheet 1

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA02

Test No 2

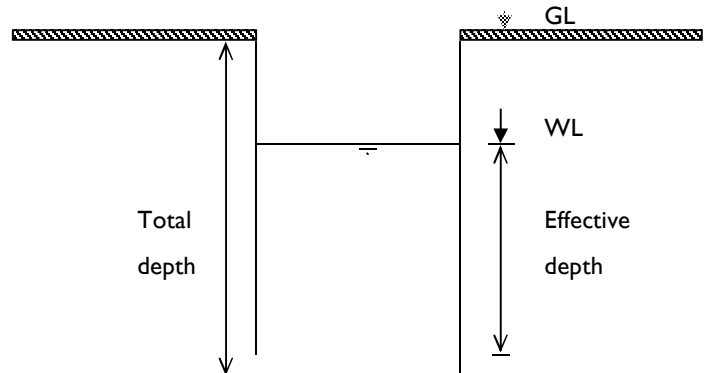
Project No PN224390

Client MOTT MACDONALD LIMITED

Date 23/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
13.50	0.79	0.410	68.3
14.00	0.80	0.400	66.7
14.50	0.80	0.400	66.7
15.00	0.81	0.390	65.0
16.00	0.82	0.380	63.3
17.00	0.83	0.370	61.7
18.00	0.83	0.370	61.7
19.00	0.83	0.370	61.7
20.00	0.85	0.350	58.3
21.00	0.86	0.340	56.7
22.00	0.87	0.330	55.0
23.00	0.87	0.330	55.0
24.00	0.88	0.320	53.3
25.00	0.89	0.310	51.7
26.00	0.89	0.310	51.7
27.00	0.90	0.300	50.0
28.00	0.91	0.290	48.3
29.00	0.91	0.290	48.3
30.00	0.92	0.280	46.7
31.00	0.93	0.270	45.0
32.00	0.93	0.270	45.0
33.00	0.94	0.260	43.3
34.00	0.94	0.260	43.3
35.00	0.950	0.250	41.7
36.00	0.950	0.250	41.7
37.00	0.960	0.240	40.0
38.00	0.960	0.240	40.0

TRIAL PIT SOAKAWAY



Trial pit length = 2.500 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	10.00
25%	0.150	1.050	56.00
Vp75-25	=	0.450 m3	
ap50	=	3.360 m2	
tp75-25	=	0.000 min	
Soil Infiltration, f	=	4.85E-05 m/sec	

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA02

Test No 2

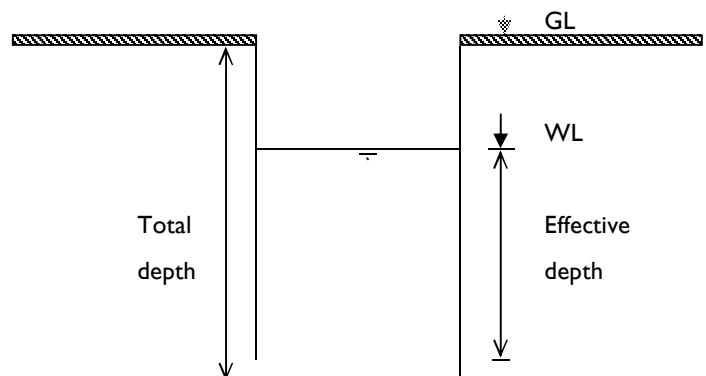
Client MOTT MACDONALD LIMITED

Project No PN224390

Date 23/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
39.00	0.97	0.230	38.3
40.00	0.97	0.230	38.3
41.00	0.98	0.220	36.7
42.00	0.98	0.220	36.7
43.00	0.98	0.220	36.7
44.00	0.99	0.210	35.0
45.00	0.99	0.210	35.0
46.00	1.00	0.200	33.3
47.00	1.00	0.200	33.3
48.00	1.00	0.200	33.3
49.00	1.01	0.190	31.7
50.00	1.02	0.180	30.0
51.00	1.02	0.180	30.0
52.00	1.03	0.170	28.3
53.00	1.03	0.170	28.3
54.00	1.04	0.160	26.7
55.00	1.04	0.160	26.7
56.00	1.05	0.150	25.0
57.00	1.05	0.150	25.0
58.00	1.05	0.150	25.0
59.00	1.05	0.150	25.0
60.00	1.06	0.140	23.3

TRIAL PIT SOAKAWAY



Trial pit length = 2.500 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	10.00
25%	0.150	1.050	56.00
Vp75-25	=	0.450 m3	
ap50	=	3.360 m2	
tp75-25	=	0.000 min	
Soil Infiltration, f	=	4.85E-05 m/sec	

Sheet 3

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

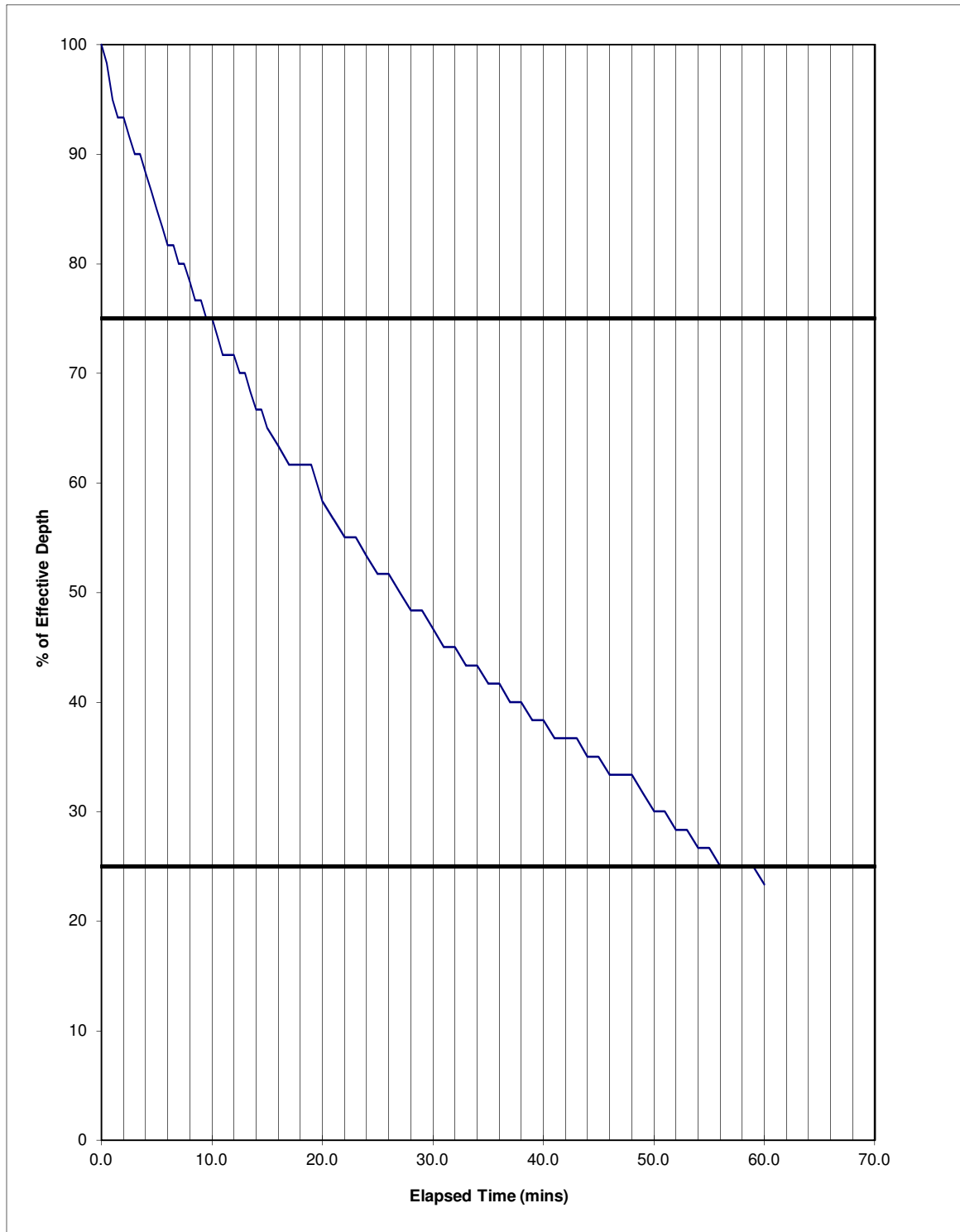
Trial Pit SA02

Test No 2

Client MOTT MACDONALD LIMITED

Project No PN224390

Date 23/05/2022



tp75	=	10.00
tp25	=	56.00

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

Sheet 3

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA02

Test No 3

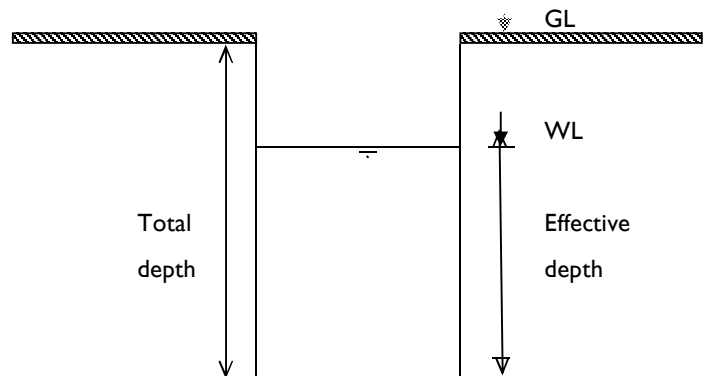
Project No PN224390

Client MOTT MACDONALD LIMITED

Date 23/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	0.60	0.60	100.00
0.50	0.64	0.56	93.33
1.00	0.65	0.55	91.67
1.50	0.65	0.55	91.67
2.00	0.65	0.55	91.67
2.50	0.66	0.54	90.00
3.00	0.67	0.53	88.33
3.50	0.67	0.53	88.33
4.00	0.67	0.53	88.33
4.50	0.67	0.53	88.33
5.00	0.67	0.53	88.33
6.00	0.68	0.52	86.67
7.00	0.69	0.51	85.00
8.00	0.70	0.50	83.33
10.00	0.72	0.48	80.00
12.00	0.73	0.47	78.33
14.00	0.74	0.46	76.67
16.00	0.74	0.46	76.67
18.00	0.76	0.44	73.33
20.00	0.77	0.43	71.67
25.00	0.80	0.40	66.67
30.00	0.84	0.36	60.00
35.00	0.84	0.36	60.00
40.00	0.86	0.34	56.67
50.00	0.89	0.31	51.67
60.00	0.90	0.30	50.00
75.00	0.90	0.30	50.00

TRIAL PIT SOAKAWAY



Trial pit length = 2.500 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.600 m

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	17.00
25%	0.150	1.050	150.00
Vp75-25	=	0.450 m3	
ap50	=	3.360 m2	
tp75-25	=	133.000 min	
Soil Infiltration, f	=	1.68E-05 m/sec	

Sheet 1

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

GEOTECHNICS

Form INS009 Rev 6

Date 23/05/2022

Initial depth from GL	=	0.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.450	0.750	17.00
25%	0.150	1.050	150.00
Vp75-25	=	0.450	m3
ap50	=	3.360	m2
tp75-25	=	0.000	min
Soil Infiltration, f	=	1.68E-05	m/sec

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

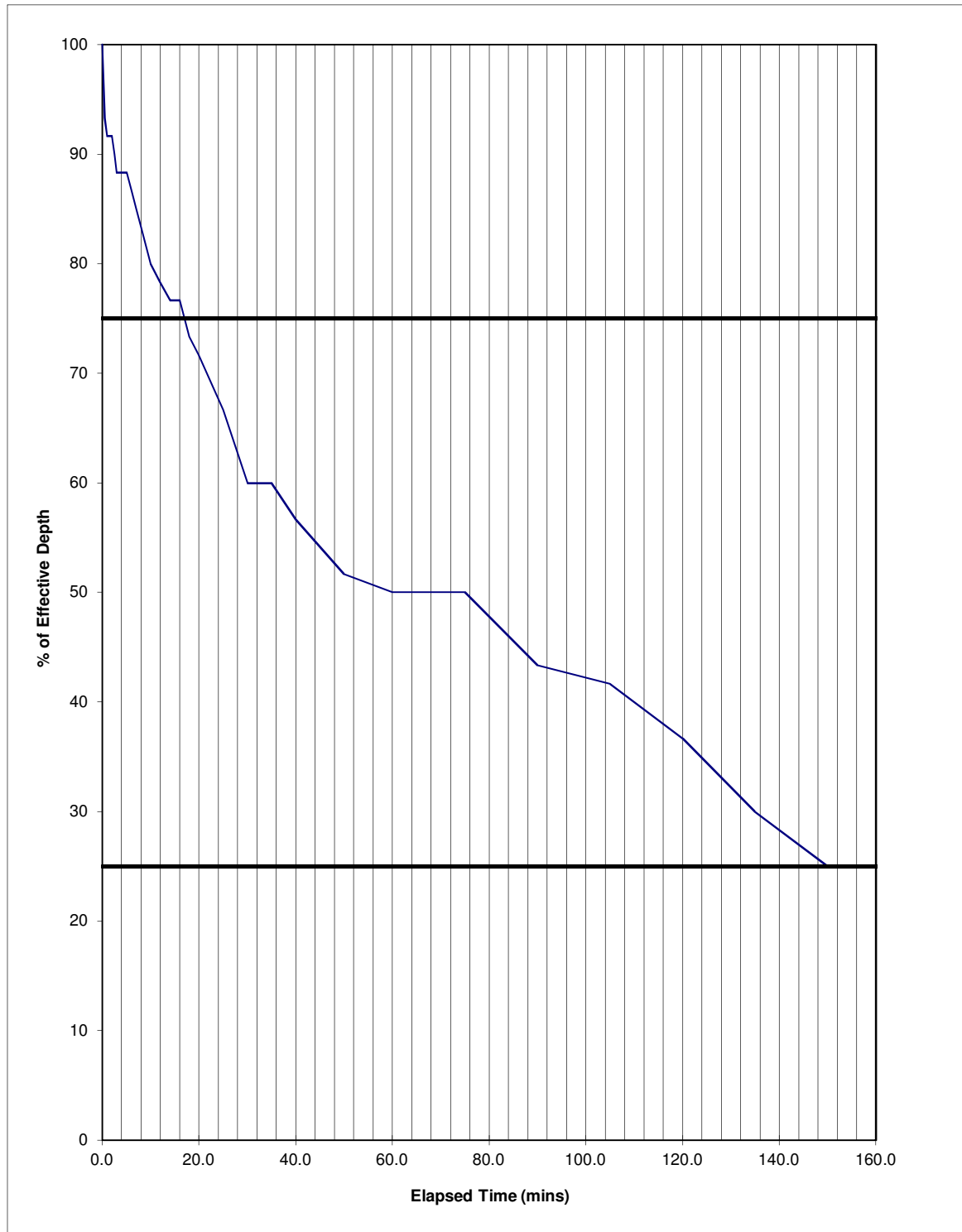
Trial Pit SA02

Test No 3

Client MOTT MACDONALD LIMITED

Project No PN224390

Date 23/05/2022



tp75 = 17.00

tp25 = 150.00

Sheet 3

Remarks Soakaway Test SA02 carried out adjacent to Machine-dug Trial Pit TP02.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA03

Test No I

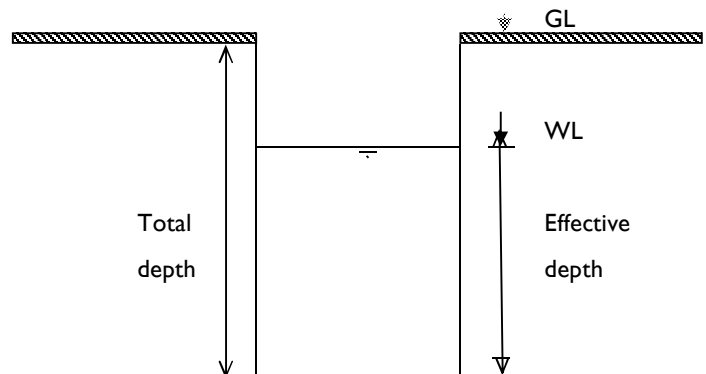
Client MOTT MACDONALD LIMITED

Project No PN224390

Date 25/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	0.58	0.62	100.00
0.50	0.58	0.62	100.00
1.00	0.58	0.62	100.00
1.50	0.59	0.61	98.39
2.00	0.60	0.60	96.77
2.50	0.60	0.60	96.77
3.00	0.61	0.59	95.16
3.50	0.61	0.59	95.16
4.00	0.61	0.59	95.16
4.50	0.61	0.59	95.16
5.00	0.61	0.59	95.16
5.50	0.61	0.59	95.16
6.00	0.62	0.58	93.55
6.50	0.62	0.58	93.55
7.00	0.62	0.58	93.55
7.50	0.62	0.58	93.55
8.00	0.63	0.57	91.94
8.50	0.63	0.57	91.94
9.00	0.63	0.57	91.94
9.50	0.64	0.56	90.32
10.00	0.64	0.56	90.32
11.00	0.65	0.55	88.71
12.00	0.65	0.55	88.71
13.00	0.66	0.54	87.10
14.00	0.66	0.54	87.10
15.00	0.67	0.53	85.48
20.00	0.68	0.52	83.87

TRIAL PIT SOAKAWAY



Trial pit length = 2.400 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.620 m

Initial depth from GL	=	0.580m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.465	0.735	40.00
25%	0.155	1.045	492.50
Vp75-25	=	0.446	m3
ap50	=	3.300	m2
tp75-25	=	452.500	min
Soil Infiltration, f	=	4.98E-06	m/sec

Sheet I

Remarks Soakaway Test SA03 carried out within Machine-dug Trial Pit TP03.
Due to time constraints the Soil Infiltration, f was extrapolated using the readings at 160 and 180 minutes.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

Trial Pit SA03

Test No I

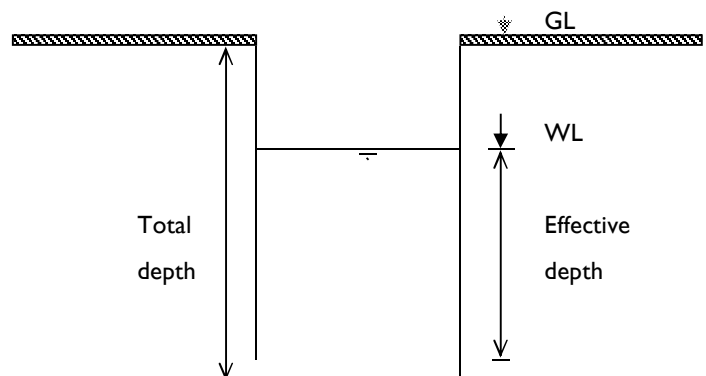
Client MOTT MACDONALD LIMITED

Project No PN224390

Date 25/05/2022

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
25.00	0.69	0.510	82.3
30.00	0.71	0.490	79.0
35.00	0.72	0.480	77.4
40.00	0.74	0.460	74.2
45.00	0.75	0.450	72.6
50.00	0.77	0.430	69.4
60.00	0.78	0.420	67.7
70.00	0.81	0.390	62.9
80.00	0.82	0.380	61.3
90.00	0.83	0.370	59.7
100.00	0.84	0.360	58.1
110.00	0.84	0.360	58.1
120.00	0.85	0.350	56.5
130.00	0.85	0.350	56.5
140.00	0.86	0.340	54.8
150.00	0.87	0.330	53.2
160.00	0.88	0.320	51.6
180.00	0.89	0.310	50.0
492.50	1.05	0.155	25.0

TRIAL PIT SOAKAWAY



Trial pit length = 2.400 m

Trial pit width = 0.600 m

Trial pit depth = 1.200 m

Effective depth (Head of Water) = 0.620 m

Initial depth from GL	=	0.580m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.465	0.735	40.00
25%	0.155	1.045	492.50
Vp75-25	=	0.446	m3
ap50	=	3.300	m2
tp75-25	=	0.000	min
Soil Infiltration, f	=	4.98E-06	m/sec

Sheet 2

Remarks Soakaway Test SA03 carried out within Machine-dug Trial Pit TP03.
Due to time constraints the Soil Infiltration, f was extrapolated using the readings at 160 and 180 minutes.

GEOTECHNICS

INSITU TESTING - Soakaway Test

Form INS009 Rev 6

Project STAR RADCLIFFE

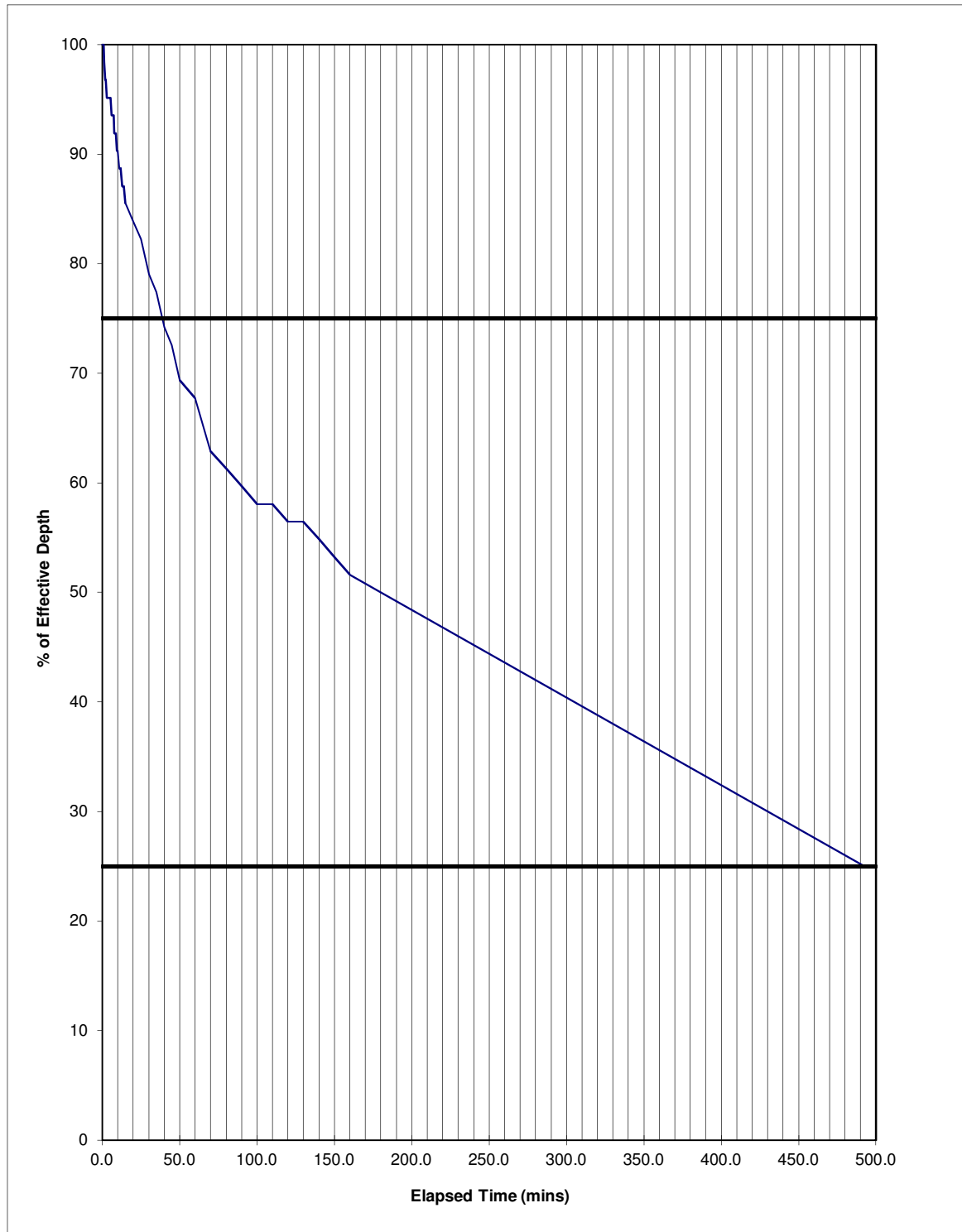
Trial Pit SA03

Test No I

Client MOTT MACDONALD LIMITED

Project No PN224390

Date 25/05/2022



tp75	=	40.00
tp25	=	492.50

Sheet 3

Remarks Soakaway Test SA03 carried out within Machine-dug Trial Pit TP03.
Due to time constraints the Soil Infiltration, f was extrapolated using the readings at 160 and 180 minutes.

GEOTECHNICS

APPENDIX 7

Dynamic Sample Borehole Records, SPT Results Summary Sheets and SPT Hammer Energy Test Report

DATA SHEET - Symbols and Abbreviations used on Records



Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecon Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content
(All other strengths from undrained triaxial testing)	
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
()	Extrapolated value

Groundwater

Water Strike	
Depth Water Rose To	

Instrumentation

Seal

Filter

Seal

Strata

Made Ground Granular
Made Ground Cohesive
Topsoil
Cobbles and Boulders
Gravel
Sand
Silt
Clay
Peat

Note: Composite soil types shown by combined symbols

Chalk

Limestone

Sandstone

Coal

Strata, Continued

Mudstone

Siltstone

Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock

Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD Rock Quality Designation (% of intact core >100mm)

FRACTURE INDEX Fractures/metre

FRACTURE SPACING (m) Maximum

NI Non-intact core

NR No core recovery

AZCL Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD - Dynamic Sampler

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **DS01**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378578.9 E 407738.5 N** Ground Level **76.84 m OD**
PN224390

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD		
0.00- 0.20	B					Rough grass over TOPSOIL: Very soft dark brown slightly gravelly sandy clay with some rootlets. Gravel is angular to subangular fine to coarse of sandstone and brick fragments. [TOPSOIL]	G.L.		76.84		
0.20- 0.50	B						0.20		76.64		
0.50- 0.70	ES						0.50		76.34		
0.70- 1.20	B						0.70		76.14		
1.00	ES						1.20		75.64		
1.20- 1.65	D	(DRY)			S1	MADE GROUND: Very soft brownish dark grey slightly gravelly sandy clay with occasional rootlets. Gravel is angular to subangular fine to coarse of sandstone and concrete. [COHESIVE MADE GROUND]	1.20		75.64		
1.25- 1.40	D						1.90		74.94		
1.40- 1.90	B						2.50		74.34		
1.90- 2.00	D				S11		3.70		73.14		
2.00- 2.45	D	(DRY)					5.45		71.39		
2.05- 2.30	D					MADE GROUND: Very soft black sandy gravelly clay. Gravel is angular to subangular fine to coarse of ash, sandstone and coal. [COHESIVE MADE GROUND]					
2.30- 2.50	D										
2.50- 3.50	B										
3.00- 3.45	#	(1.90)			S9						
3.50	ES										
3.70- 4.00	D				S31	Firm yellowish brown slightly gravelly sandy CLAY. Gravel is angular of sandstone (Possible Made Ground). [GLACIAL TILL] Between 2.00-2.30m, mottled dark grey. Loose dark brown gravelly clayey fine to medium SAND. Gravel is angular to subrounded fine to coarse of siltstone and sandstone. [GLACIAL SAND AND GRAVEL] Soft to firm greyish dark brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse of sandstone. [GLACIAL TILL] Below 4.00m, very stiff.					
4.00- 4.45	D	(1.90)									
5.00- 5.45		(1.90)			S37						
						End of Borehole					

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit Dynamic Sampler	NS/SW NS/SW	G.L.			12/05/22	08:00	2.10					Seepage, no rise. Slow inflow.
5.45	0.10			5.45		DRY	12/05/22	10:00	3.00		1.90	20		

Remarks **Inspection pit hand excavated to 1.20m depth and no services were found.**
AGS sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
Backfill details from base of hole: bentonite seal up to 0.20m, arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by **HM**
 Checked by **JK**
 Figure **1 of 1**
 07/08/2022

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BOREHOLE RECORD - Dynamic Sampler

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **DS02**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378736.1 E 407737.5 N** Ground Level **74.10 m OD**

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD		
0.00- 0.50	B					Rough grass over TOPSOIL: Very soft dark brown slightly gravelly sandy clay with some rootlets. Gravel is angular to subangular fine to coarse of siltstone, sandstone and coal. [TOPSOIL]	G.L.		74.10		
0.20	ES										
0.50- 0.80	B						0.50		73.60		
0.50	ES										
0.80- 1.20	B					MADE GROUND: Very soft orangish brown organic sandy gravelly clay with traces of rootlets. Gravel is subangular to subrounded fine to coarse of siltstone and coal. [COHESIVE MADE GROUND]	0.80		73.30		
1.00	ES										
1.20- 2.00	B										
1.20- 1.65	D	(0.95)			S12						
2.00- 2.50	B					Medium dense orangish brown very sandy clayey subangular to subrounded fine to coarse GRAVEL of mudstone, siltstone, sandstone and coal (Possible Made Ground). Grading to slightly gravelly slightly clayey sand in places. [GLACIAL SAND AND GRAVEL]	2.00		72.10		
2.00- 2.45	D	(0.95)			S11						
2.50- 3.00	D						2.50		71.60		
3.00- 3.45	D	(0.95)			S33	Firm dark grey slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of sandstone and coal (Possible Made Ground). [GLACIAL TILL]					
3.05- 4.00	D										
						Dark brown slightly clayey gravelly fine to medium SAND. Gravel is subangular to subrounded of mudstone, siltstone and sandstone. [GLACIAL SAND AND GRAVEL]					
						Below 3.00m, dense. Between 3.00-4.00m, poor recovery.					
						End of Borehole	4.00		70.10		

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit	NS/SW	G.L.			13/05/22	08:00	1.30		0.95	20		Slow inflow.
4.00	0.10	Dynamic Sampler	NS/SW	4.00		DRY	13/05/22	18:00						

Remarks **Inspection pit hand excavated to 1.20m depth and no services were found.**
AGS sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
Dynamic Sample Borehole DS02 collapsed to 3.50m depth on completion.
Backfill details from base of hole: bentonite seal up to 0.20m, arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by **HM**
 Checked by **JK**
 Figure **1 of 1**
 07/08/2022

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BOREHOLE RECORD - Dynamic Sampler

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **DS03**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378635.8 E 407687.7 N** Ground Level **75.11 m OD**
 Scale **1:50**

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD		
0.00- 0.25	B					Rough grass over TOPSOIL: Very soft dark brown slightly gravelly sandy clay with many roots and rootlets. Gravel is subangular to rounded fine to medium of siltstone and sandstone. [TOPSOIL]	G.L.		75.11		
0.20- 0.60	ES						0.25		74.86		
0.50- 1.20	B						0.60		74.51		
1.00- 1.65	ES						1.40		73.71		
1.20- 1.65	D	(1.70)			S11	Soft to firm grey mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of sandstone and coal (Possible Made Ground). [GLACIAL TILL]	1.90		73.21		
1.40- 1.90	B					Medium dense dark brown very gravelly clayey fine to coarse SAND with a high cobble content of sandstone. Gravel is subangular to subrounded fine to coarse of siltstone and sandstone (Possible Made Ground). [GLACIAL SAND AND GRAVEL]	2.00		73.11		
1.90- 2.00	D						2.00				
2.00- 2.45	B				S14	Medium dense dark brown clayey fine to coarse SAND (Possible Made Ground). [GLACIAL SAND AND GRAVEL]					
2.00- 2.45	D	(DRY)				Firm black mottled dark brown slightly sandy CLAY (Possible Made Ground). [GLACIAL TILL]					
3.00- 3.45	#	(1.70)			S10						
3.80- 4.00	D					Firm dark brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse of siltstone, sandstone and coal. [GLACIAL TILL]					
4.00- 4.45	D	(1.70)			S20						
4.80- 5.00	D					Between 3.00-4.00m, poor recovery. Below 3.80m, stiff, grading to slightly gravelly sandy silt in places. Between 4.00-5.00m, poor recovery.					
5.00- 5.45	D	(1.70)			S32						
						Below 4.80m, very stiff.					
						End of Borehole	5.45		69.66		

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit Dynamic Sampler	NS/SW	G.L.			12/05/22	10:00	2.10		1.70	20		Slow inflow.
5.45	0.10		NS/SW	5.45		1.70	12/05/22	12:00						

Remarks **Inspection pit hand excavated to 1.20m depth and no services were found.**
AGS sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
Dynamic Cone Penetration Test DCP03 located immediately adjacent to Dynamic Sample Borehole DS03.
Backfill details from base of hole: bentonite seal up to 0.20m, arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by
 Checked by
 Figure
 HM
 JK
 1 of 1
 07/08/2022

geotechnics

BOREHOLE RECORD - Dynamic Sampler

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **DS04**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378706.0 E 407679.4 N** Ground Level **73.77 m OD**
 Scale **1:50**

Sampling			Properties			Strata	Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
0.00- 0.10	D					Rough grass over TOPSOIL: Very soft dark brown slightly sandy slightly gravelly clay with many roots and rootlets. Gravel is angular to subrounded fine to coarse of siltstone, sandstone, coal and brick fragments. [TOPSOIL]	G.L.		73.77
0.10- 1.20	B						0.10		73.67
0.20	ES								
0.50	ES								
1.00	ES	(DRY)			S15	MADE GROUND: Very soft orangish grey and dark brown sandy gravelly clay with some roots and rootlets. Gravel is angular to subrounded fine to coarse of siltstone, sandstone, coal and brick fragments. [COHESIVE MADE GROUND]	1.30		72.47
1.20- 1.30	D								
1.20- 1.65	D								
1.25- 1.65	D								
1.30- 2.00	B								
2.00- 2.45	D	(DRY)			S13	MADE GROUND: Medium dense brownish grey slightly gravelly very clayey fine to coarse sand. Gravel is angular to subrounded fine to coarse of sandstone, coal and brick fragments. Grading to slightly gravelly sandy clay in places. [GRANULAR MADE GROUND]	2.40		71.37
2.05- 2.40	D								
2.40- 2.80	B								
2.80- 3.70	B	(3.00)			S19	Firm to stiff dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and coal (Possible Made Ground). [GLACIAL TILL]	2.80		70.97
3.00- 3.45	D								
3.70- 4.00	D	(3.00)			S50/275	Medium dense dark brown gravelly very clayey fine to coarse SAND. Gravel is subrounded fine to medium of sandstone and coal (Possible Made Ground). Grading to slightly gravelly sandy clay in places. [GLACIAL SAND AND GRAVEL]	3.70		70.07
4.00- 4.43	D								
						Firm to stiff dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone and coal. [GLACIAL TILL]	4.43		69.34
						At 4.43m, obstruction - probable cobble/boulder.			
						End of Borehole			

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit	NS/SW	G.L.			13/05/22	10:00	3.00	2.00				Seepage, no rise.
4.43	0.10	Dynamic Sampler	NS/SW	4.43		3.00	13/05/22	12:00						

Remarks **INS** Inspection pit hand excavated to 1.20m depth and no services were found.
AGS sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
 Dynamic Sample Borehole DS04 terminated at 4.43m depth upon encountering an obstruction - probable cobble/boulder.
 Backfill details from base of hole: bentonite seal up to 0.20m, arisings up to ground level.

Logged by **HM**
 Checked by **JK**
 Figure **1 of 1**
 07/08/2022

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BOREHOLE RECORD - Dynamic Sampler

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **DS05**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378675.8 E 407631.0 N** Ground Level **73.64 m OD**

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD		
0.00- 0.30	B					Rough grass over TOPSOIL: Very soft dark brown slightly sandy slightly gravelly clay with some roots and rootlets. Gravel is subangular to subrounded fine to coarse of siltstone, sandstone and coal. [TOPSOIL]	G.L.		73.64		
0.20	ES										
0.30- 1.20	B						0.30		73.34		
0.50	ES										
1.00	ES					MADE GROUND: Black very sandy silty angular to subangular fine to coarse gravel of siltstone, sandstone, limestone, concrete, tarmacadam and brick fragments. Slight hydrocarbon odour. [GRANULAR MADE GROUND] Below 1.20m, medium dense. Below 1.20m, organic.					
1.20- 1.75	B				S21						
1.20- 1.65	D	(DRY)									
1.75- 2.00	D						1.75		71.89		
2.00- 2.70	B					Medium dense yellow and black mottled dark grey clayey fine to coarse SAND and angular to subangular fine to coarse GRAVEL of sandstone and coal (Possible Made Ground). [GLACIAL SAND AND GRAVEL]					
2.00- 2.45	D	(DRY)			S16						
2.70- 3.00	D					Medium dense brownish grey clayey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of siltstone and sandstone. [GLACIAL SAND AND GRAVEL]	2.70		70.94		
3.00- 3.90	B				S15						
3.00- 3.45	D	(1.80)									
3.90- 4.00	D					Stiff brownish grey slightly sandy CLAY. [GLACIAL TILL] Medium dense brown slightly silty fine to coarse SAND. [GLACIAL SAND AND GRAVEL] Between 4.00-5.00m, poor recovery.	3.90		69.74		
4.00- 4.45	D	(1.80)			S19		4.00		69.64		
						End of Borehole	5.00		68.64		

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit Dynamic Sampler	NS/SW	G.L.			12/05/22	13:00	3.00		1.80	20		Medium inflow.
5.00	0.10		NS/SW	5.00		1.80	12/05/22	15:00						

Remarks **INS** Inspection pit hand excavated to 1.20m depth and no services were found.
AGS sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
 Dynamic Sample Borehole DS05 collapsed to 3.50m depth on completion.
 Backfill details from base of hole: collapsed material up to 3.50m, bentonite seal up to 0.20m, arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by **HM**
 Checked by **JK**
 Figure **1 of 1**
 07/08/2022

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BOREHOLE RECORD - Dynamic Sampler

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **DS06**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378785.4 E**
407604.4 N Ground Level **70.17 m OD**

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD		
0.20- 0.60	B					MADE GROUND: Grey sandstone cobble setts. [GRANULAR MADE GROUND]	G.L.		70.17		
0.20	ES						0.20		69.97		
0.50	ES										
0.60- 1.20	B					MADE GROUND: Dark grey gravelly slightly silty fine to medium sand. Gravel is angular to subangular fine to coarse of ash, sandstone, coal and concrete. Some metal fragments. [GRANULAR MADE GROUND]	0.60		69.57		
1.00	ES					Below 0.40m, high cobble content of sandstone.					
1.20- 2.00	B										
1.20- 1.65	D	(DRY)			S6	MADE GROUND: Dark grey very sandy slightly silty angular to subangular fine to coarse gravel of ash, sandstone and coal. [GRANULAR MADE GROUND]					
						Below 1.20m, loose.					
2.00- 2.45	D	(DRY)			S6						
2.05- 2.20	D						2.20		67.97		
2.20- 2.55	B					Very soft dark grey slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium of sandstone. [GLACIAL TILL]	2.55		67.62		
2.55- 2.95	B										
2.95- 3.00	D	(2.10)			S26	Stiff yellowish brown slightly gravelly sandy CLAY. Gravel is angular fine to medium of sandstone. [GLACIAL TILL]	2.95		67.22		
3.00- 3.45	D						3.20		66.97		
3.20- 4.00	B					Very soft light grey slightly sandy CLAY. [GLACIAL TILL]					
4.00- 4.45	D	(2.10)			S9	Medium dense yellowish brown gravelly clayey fine to coarse SAND. Gravel is angular to subangular fine to coarse of siltstone and sandstone. [GLACIAL SAND AND GRAVEL]	4.40		65.77		
4.05- 4.40	D					Below 4.00m, loose.					
4.40- 5.00	B					Dark grey sandy slightly silty subangular to rounded fine to coarse GRAVEL of mudstone, siltstone and sandstone. [GLACIAL SAND AND GRAVEL]	5.00		65.17		
						End of Borehole					

Boring				Progress					Groundwater				
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed
1.20	0.40	Inspection Pit	NS/SW	G.L.			12/05/22	15:00	2.00				
5.00	0.10	Dynamic Sampler	NS/SW	5.00		DRY	12/05/22	17:00	3.00		2.10	20	
													Remarks on Groundwater
													Seepage, no rise. Slow inflow.

Remarks **Inspection pit hand excavated to 1.20m depth and no services were found.**
AGS sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
Dynamic Sample Borehole DS06 collapsed to 3.50m depth on completion.
Backfill details from base of hole: bentonite seal up to 0.20m, arisings up to ground level.

Logged by **HM**
 Checked by **JK**
 Figure **1 of 1**
 07/08/2022

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BOREHOLE RECORD - Dynamic Sampler

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **DS07**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378778.2 E 407514.7 N** Ground Level **70.31 m OD**
PN224390

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD		
0.05- 0.20	B					MADE GROUND: Black tarmacadam. [TARMACADAM]	G.L.		70.31		
0.20- 0.40	B						0.05		70.26		
0.20	ES						0.20		70.11		
0.40- 1.20	B					MADE GROUND: Light grey sandstone cobble setts. [GRANULAR MADE GROUND]	0.40		69.91		
0.50	ES										
1.00	ES					MADE GROUND: Grey and reddish brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of sandstone and coal. [GRANULAR MADE GROUND]					
1.20- 2.00	B						1.20		69.11		
1.20- 1.65	D	(DRY)			S5	MADE GROUND: Dark grey gravelly slightly silty fine to coarse sand. Gravel is angular to subangular fine to coarse of sandstone and coal. [GRANULAR MADE GROUND]					
2.00- 2.45	D	(DRY)			S5	MADE GROUND: Loose dark grey sandy angular to subangular fine to coarse gravel of sandstone and coal. Sand is of ash. [GRANULAR MADE GROUND]					
2.30- 2.80	D					Between 2.00-3.00m, poor recovery.					
2.80- 3.00	D						2.80		67.51		
3.00- 3.45		(DRY)			S10	MADE GROUND: Firm orangish brown sandy gravelly clay. Gravel is angular to subangular fine to coarse of mudstone, siltstone, sandstone and traces of ceramic fragments. [COHESIVE MADE GROUND]					
						At 3.00m, no recovery.	3.45		66.86		
						End of Borehole					

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit	NS/SW	G.L.			13/05/22	08:00						None encountered.
3.45	0.10	Dynamic Sampler	NS/SW	3.45		DRY	13/05/22	10:00						

Remarks **INS** Inspection pit hand excavated to 1.20m depth and no services were found.
AGS sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
 Dynamic Sample Borehole DS07 collapsed to 2.80 depth on completion.
 Backfill details from base of hole: bentonite seal up to 0.20m, arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by **HM**
 Checked by **JK**
 Figure **1 of 1**
 07/08/2022

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Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'					
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50	
DS01	1.20	75.64	S	-	-	-	-	-	1	-	1	*					
DS01	2.00	74.84	S	-	1	1	2	2	3	4	11	*					
DS01	3.00	73.84	S	-	2	1	-	2	3	4	9	*					
DS01	4.00	72.84	S	-	5	6	5	7	8	11	31			*			
DS01	5.00	71.84	S	-	4	5	7	9	10	11	37				*		
Driller			Niki Stantan				Remarks										
Hammer No.			DART534														
Energy Ratio, Er (%)			70.00														
Calibration Date			07/04/2022														

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'				
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50
DS03	1.20	73.91	S	-	3	3	2	3	2	4	11	*				
DS03	2.00	73.11	S	-	13	8	4	4	3	3	14	*				
DS03	3.00	72.11	S	-	2	2	1	2	3	4	10	*				
DS03	4.00	71.11	S	-	3	3	2	5	6	7	20		*			
DS03	5.00	70.11	S	-	4	4	11	7	7	7	32			*		
Driller			Niki Stantan			Remarks										
Hammer No.			DART534													
Energy Ratio, Er (%)			70.00													
Calibration Date			07/04/2022													

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'					
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50	
DS04	1.20	72.57	S	-	3	4	4	4	3	4	15		*				
DS04	2.00	71.77	S	-	4	3	3	3	4	3	13		*				
DS04	3.00	70.77	S	-	2	3	2	4	5	8	19			*			
DS04	4.00	69.77	S	-	3	10	13	17	13	7/50	50/275						>
Driller			Niki Stantan				Remarks										
Hammer No.			DART534														
Energy Ratio, Er (%)			70.00														
Calibration Date			07/04/2022														

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'					
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50	
DS06	1.20	68.97	S	-	3	2	3	1	1	1	6	*					
DS06	2.00	68.17	S	-	1	1	2	3	1	-	6	*					
DS06	3.00	67.17	S	-	5	5	7	6	6	7	26			*			
DS06	4.00	66.17	S	-	2	2	1	3	2	3	9	*					
Driller			Niki Stantan			Remarks											
Hammer No.			DART534														
Energy Ratio, Er (%)			70.00														
Calibration Date			07/04/2022														

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

SPT Hammer Energy Test Report

in accordance with BS EN ISO 22476-3:2005

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

SPT Hammer Ref: DART534
Test Date: 24/11/2021
Report Date: 26/11/2021
File Name: DART534.spt
Test Operator: JL

Instrumented Rod Data

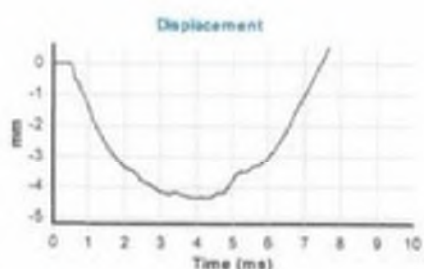
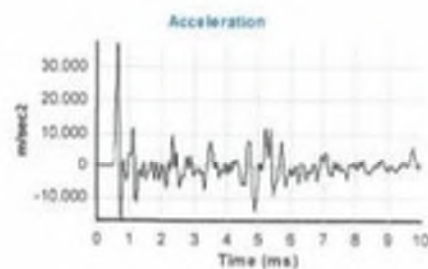
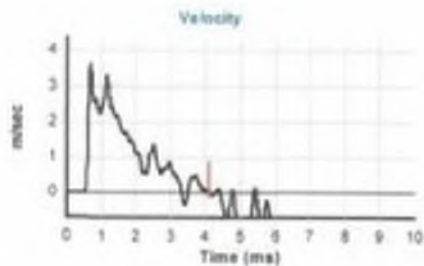
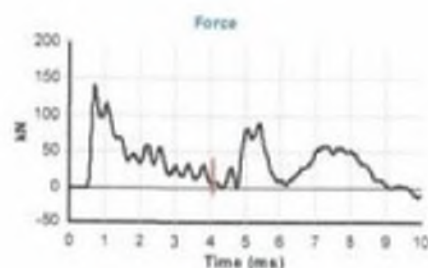
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_R (GPa): 200
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

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

Comments / Location

D & I DRILLING - 76885



Calculations

Area of Rod A (mm²): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 329

Energy Ratio E_r (%): **70**

The recommended calibration interval is 12 months

Signed: J. LOCK
Title: FITTER



APPENDIX 8

Dynamic Sample Photographs

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



I) Inspection Pit DS01 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



2) Inspection Pit DS01 (Close-up) 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



3) Dynamic Sample Borehole DS01 1.20m-2.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



4) Dynamic Sample Borehole DS01 2.00m-3.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



5) Dynamic Sample Borehole DS01 3.00m-4.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



6) Dynamic Sample Borehole DS01 4.00m-5.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



7) Inspection Pit DS02 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



8) Dynamic Sample Borehole DS02 1.20m-2.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



9) Dynamic Sample Borehole DS02 2.00m-3.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



I0) Dynamic Sample Borehole DS02 3.00m-4.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



11) Inspection Pit DS03 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



I2) Inspection Pit DS03 (Close-up) 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



I3) Dynamic Sample Borehole DS03 1.20m-2.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



I4) Dynamic Sample Borehole DS03 2.00m-3.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



I5) Dynamic Sample Borehole DS03 3.00m-4.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



I6) Dynamic Sample Borehole DS03 4.00m-5.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



17) Inspection Pit DS04 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

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18) Dynamic Sample Borehole DS04 1.20m-2.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



19) Dynamic Sample Borehole DS04 2.00m-3.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



20) Dynamic Sample Borehole DS04 3.00m-4.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



21) Dynamic Sample Borehole DS05 1.20m-2.00m

PHOTOGRAPHS

Project Number : PN224390

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22) Dynamic Sample Borehole DS05 2.00m-3.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



23) Dynamic Sample Borehole DS05 3.00m-4.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



24) Dynamic Sample Borehole DS05 4.00-5.00m

PHOTOGRAPHS

Project Number : PN224390

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25) Inspection Pit DS06 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



26) Inspection Pit DS06 (Close-up) 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



27) Dynamic Sample Borehole DS06 1.20m-2.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



28) Dynamic Sample Borehole DS06 2.00m-3.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



29) Dynamic Sample Borehole DS06 3.00m-4.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE

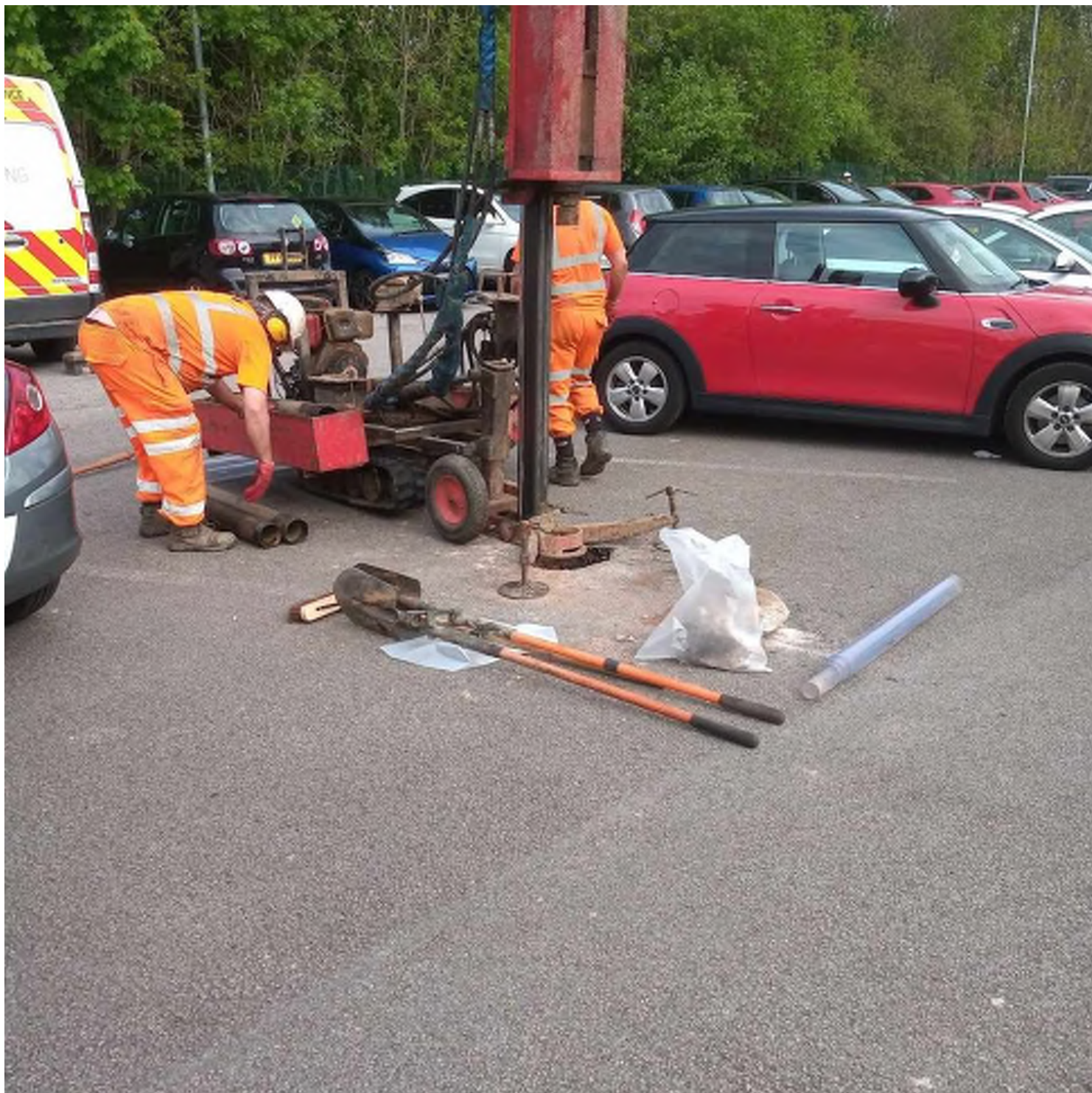


30) Dynamic Sample Borehole DS06 4.00m-5.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



31) Location of Dynamic Sample Borehole DS07

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



32) Dynamic Sample Borehole DS07 1.20m-2.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



33) Dynamic Sample Borehole DS07 2.00m-3.00m

APPENDIX 9

Cable Percussion with Rotary Follow-on Borehole Records, SPT Results Summary Sheets and SPT Hammer Energy Test Report

DATA SHEET - Symbols and Abbreviations used on Records



Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecon Probe Test
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content
(All other strengths from undrained triaxial testing)	
S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
()	Extrapolated value

Groundwater

Water Strike	
Depth Water Rose To	

Instrumentation

Seal

Filter

Seal

Strata

Made Ground Granular
Made Ground Cohesive
Topsoil
Cobbles and Boulders
Gravel
Sand
Silt
Clay
Peat

Note: Composite soil types shown by combined symbols

Chalk

Limestone

Sandstone

Coal

Strata, Continued

Mudstone

Siltstone

Metamorphic Rock

Fine Grained

Medium Grained

Coarse Grained

Igneous Rock

Fine Grained

Medium Grained

Coarse Grained

Backfill Materials

Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD Rock Quality Designation (% of intact core >100mm)

FRACTURE INDEX Fractures/metre

FRACTURE SPACING (m) Maximum

NI Non-intact core

NR No core recovery

AZCL Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **BH01**
PN224390
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378631.0 E**
407721.9 N Ground Level **75.71 m OD**

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description	Depth	Legend	Level m OD		
0.00- 0.50	B					Rough grass over TOPSOIL: Dark brown slightly silty fine to medium sand with some rootlets. [TOPSOIL]	G.L.		75.71		
0.20	D						0.10		75.61		
0.20	ES										
0.50- 1.20	B					Brown gravelly fine to coarse SAND with a low to medium cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone (Possible Made Ground). [GLACIAL SAND]	0.90		74.81		
0.50	D										
0.50	ES										
1.00	D										
1.00	ES										
1.20- 1.65	B										
1.20- 1.65	D	(DRY)			S11	Medium dense brown gravelly slightly silty fine to medium SAND with a medium to high cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone. [GLACIAL SAND]					
1.80	D										
2.00- 2.45	B										
2.00- 2.45	D	1.80 (DRY)			S22	Below 1.65m, slightly clayey to clayey. Occasional pockets of clay.	2.10		73.61		
						Medium dense brown slightly silty fine to medium SAND. [GLACIAL SAND]					
2.80	D										
3.00- 3.45	B										
3.00- 3.45	D	3.00 (DRY)			S20		3.30		72.41		
						Stiff laminated grey CLAY with occasional lenses of fine sand. [GLACIAL LAMINATED CLAY]	3.50		72.21		
3.80	D										
4.00- 4.45	B										
4.00- 4.45	D	4.00 (DRY)			S29	Grey slightly silty fine SAND. [GLACIAL SAND]	3.80		71.91		
						Stiff laminated brown mottled greyish brown slightly sandy CLAY with occasional lenses of fine to coarse sand. [GLACIAL LAMINATED CLAY]	4.00		71.71		
4.80	D										
5.00- 5.45	B										
5.00- 5.45	D	4.70 (DRY)			S24	Stiff brown occasionally mottled yellowish brown and reddish brown sandy gravelly CLAY with a medium cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone. [GLACIAL TILL]					
6.00	D										
6.50- 6.95	UT100	6.00 (DRY)									
7.00	D					Below 7.00m, gravel includes coal.					
7.50	D										
8.00- 8.45	B										
8.00- 8.45	D	7.50 (DRY)			S48	Below 8.00m, very stiff.					
9.00	D										
9.50- 9.95	UT100	9.00 (DRY)									
10.00	D										

Boring				Progress					Groundwater				
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed
1.20	0.50	Inspection Pit	SL/JL	G.L.			03/05/22	08:00	1.60		1.30	20	2.00
17.17	0.15	Cable Percussion	SL/JL	10.00	9.00	DRY	03/05/22	18:00					
42.50	0.09	Rotary Core	SG/CC	10.00	10.00	9.80	04/05/22	08:00					
47.50	0.09	Rotary Open Hole	SG/CC	16.00	16.00	DRY	04/05/22	18:00					
				16.00	16.00	DRY	05/05/22	08:00					
				17.17	16.50	DRY	05/05/22	18:00					

Remarks **AS** Inspection pit hand excavated to 1.20m depth and no services were found.
 ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
 Dynamic Cone Penetration Test DCP02 located immediately adjacent to Borehole BH01.
 ** Drillers description.
 A 50mm standpipe was installed to 4.00m with a geowrapped slotted section from 1.00m to 4.00m with upright lockable protective cover. Backfill details from base of hole: bentonite seal up to 4.00m, gravel filter up to 1.00m, bentonite seal up to 0.20m, concrete up to ground level.
 Symbols and abbreviations are explained on the accompanying key sheet.
 All dimensions are in metres.
 Logged in accordance with BS5930:2015 + A1:2020
 Logged by **WH**
 Checked by **JK**
 Figure **1 of 5**
 23/06/2022
geotechnics

Sampling			Properties			Strata								Scale 1:50				
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description							Depth	Legend	Level m OD			
10.50	D	10.50 (DRY)			S50/272													
11.00-11.45	B																	
11.00-11.42	D																	
12.00	D	12.00 (DRY)			S41													
12.50-12.95	B																	
12.50-12.95	D																	
13.50	D	13.50 (DRY)			S50/269													
14.00-14.45	B																	
14.00-14.42	D																	
15.00	D	15.00 (DRY)			S50/255	Very stiff brown occasionally mottled reddish brown sandy gravelly CLAY with a high cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone, sandstone and traces of coal. Occasional lenses of gravel. [GLACIAL TILL]							14.90		60.81			
15.50-15.95	B																	
15.50-15.91	D																	
16.50	D	16.50 (DRY)			S50/69	Very dense reddish brown and dark grey slightly sandy angular to subangular fine to coarse GRAVEL of siltstone and mudstone (Weathered siltstone and mudstone). [PENNINE MIDDLE CMF - WEATHERED SILTSTONE]							17.00		58.71			
17.00-17.45	B																	
17.00-17.17	D																	
Core Run/Depth (Core Dia/Time)		Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General					Detail		17.80		57.91		
17.17-18.50 (92mm) (40mins)		17.00 (3.60)	97 82	0.07 0.01	0	(25)	Extremely weak to very weak dark grey to grey SILTSTONE with many thick laminae of mudstone (up to 20mm thick). Many non-intact zones (Recovered as gravelly clay).					Discontinuities are subhorizontal, extremely closely to very closely spaced, planar and rough with clay infill (up to 10mm thick).		18.40		57.31		
18.50-20.00 (92mm) (40mins)		17.00 (3.70)	97 84	0.42 0.03	41	(NI)	[PENNINE MIDDLE CMF - SILTSTONE]											
					(28)													
					(NI)													
					(10)													
						(NI)	Weak to moderately weak grey SILTSTONE with occasional lenses and laminae of mudstone (up											
						(2)												
Boring					Progress					Groundwater								
Depth	Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater			
					17.17	17.00	13.20	18/05/22	11:30									
					26.00	17.00	3.70	18/05/22	16:00									
					26.00	17.00	3.80	19/05/22	09:00									
					36.50	17.00	3.80	19/05/22	16:00									
					36.50	17.00	3.80	20/05/22	09:00									
					47.50	17.00	3.80	20/05/22	16:00									
Remarks		Chiselling: 4.50-4.80m for 40 minutes and 7.30-7.50m for 35 minutes and 9.10-9.50m for 55 minutes and 11.40-11.70m for 45 minutes and 14.50-14.90m for 95 minutes and 15.10-15.50m for 110 minutes and 16.00-17.40m for 180 minutes. Flush: 17.00-20.00m, Water, 100% returns; 17.00-42.50m, Water, 75% returns; 42.50-47.50m, Water, Grey, 75% return.													Logged by Checked by Figure		WH JK 2 of 5 23/06/2022	
Symbols and abbreviations are explained on the accompanying key sheet.																		
All dimensions are in metres.		Logged in accordance with BS5930:2015 + A1:2020																

BOREHOLE RECORD - Cable Percussion and Rotary

Project	STAR RADCLIFFE	Engineer	MOTT MACDONALD LIMITED	Borehole Project No	BH01 PN224390
Client	DEPARTMENT FOR EDUCATION	National Grid Coordinates	378631.0 E 407721.9 N	Ground Level	75.71 m OD

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (F)	Description General	Description Detail	Depth	Legend	Level m OD
20.00-21.50 (92mm) (40mins)	17.00 (3.80)	100 60	0.08 0.01	0	(NI)	to 15mm thick). Many non-intact zones (Recovered as gravelly clay).	Discontinuities are subvertical and subhorizontal, extremely closely to very closely spaced, planar and stepped, rough.	20.08		55.63
					(25)	[PENNINE MIDDLE CMF - SILTSTONE]				
					(NI)	Strong to very strong grey fine to medium grained SANDSTONE with occasional quartz veins. Some non-intact zones (Recovered as gravel).	Between 18.50-19.00m, closely spaced discontinuities. Between 18.55-18.70m, quartz vein with pyrite.	21.20	xxxxx	54.51
21.50-23.00 (92mm) (40mins)	17.00 (3.70)	97 67	0.30 0.01	33	(5)	Discontinuities are subvertical and subhorizontal, medium spaced, undulating and stepped, rough.		22.00	xxxxx	53.71
					(28)	[PENNINE MIDDLE CMF - SANDSTONE]				
					(NI)					
					(25)					
23.00-24.50 (92mm) (40mins)	17.00 (3.70)	97 52	0.02 0.01	0	(25)	Extremely weak to very weak thickly laminated to very thinly bedded dark grey and reddish brown MUDSTONE with occasional laminae of siltstone (up to 5mm thick). Many non-intact zones (Recovered as gravelly clay).	Discontinuities are subhorizontal, extremely closely to very closely spaced, smooth with clay smear (up to 2mm thick). Between 20.60-20.85m, vertical, planar, smooth discontinuity.			
					(NI)					
					(25)	[PENNINE MIDDLE CMF - MUDSTONE]				
24.50-26.00 (92mm) (40mins)	17.00 (3.70)	100 60	0.03 0.01	0	(NI)	Strong grey SILTSTONE with lenses of mudstone (up to 15mm thick).	Discontinuities are subhorizontal, medium spaced, undulating and rough.			
					(25)	[PENNINE MIDDLE CMF - SILTSTONE]				
					(10)	Extremely weak to very weak thickly laminated to thinly bedded dark grey and reddish brown MUDSTONE with occasional laminae of siltstone (up to 5mm thick). Many non-intact zones (Recovered as gravelly clay).	Between 23.30-23.60m, siltstone laminae up to 15mm thick.	25.70	xxxxx	50.01
26.00-27.50 (92mm)	17.00 (3.80)	98 83	0.08 0.01	0	(NI)			26.00	xxxxx	49.71
					(25)	Discontinuities are subhorizontal, extremely closely to very closely spaced, smooth with clay smear (up to 2mm thick).				
					(NI)	[PENNINE MIDDLE CMF - MUDSTONE]				
					(25)					
27.50-29.00 (92mm)	17.00 (3.80)	97 70	0.02 0.01	0	(NI)	Moderately weak to medium strong thickly laminated to very thinly bedded grey and light grey SILTSTONE interbedded with mudstone	Discontinuities are subhorizontal, very closely spaced, undulating and rough.	27.60	xxxxx	48.11
					(25)			27.86		47.85
					(NI)					
					(25)			28.37		47.34
					(NI)	[PENNINE MIDDLE CMF - SILTSTONE]				
29.00-30.50 (92mm)	17.00 (3.80)	99 92	0.37 0.01	31	(28)	Moderately weak to medium strong dark grey occasionally reddish brown SILTSTONE with lenses of mudstone (up to 15mm thick).	Occasional subvertical, very closely to closely spaced, planar and undulating, rough discontinuities.	29.40	xxxxx	46.31
					(NI)	Discontinuities are subhorizontal, extremely closely to very closely				
					(25)					
					(NI)					

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

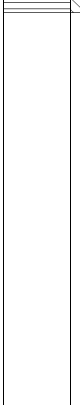
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Checked by
Figure
WH
JK
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BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **BH01**
PN224390
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378631.0 E**
407721.9 N Ground Level **75.71 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(28)	Extremely weak to very weak grey MUDSTONE. [PENNINE MIDDLE CMF - MUDSTONE]	Discontinuities are subhorizontal to subvertical, extremely closely to very closely spaced, undulating and planar, smooth with clay infill (up to 2mm thick).	40.50		35.21
					(NI)					
41.00-42.50 (92mm) (45mins)	17.00 (3.80)	95 89	0.25 0.01	23	(AZCL)	Extremely weak black COAL. Non-intact (Recovered as clayey gravel). Discontinuities are randomly-orientated, extremely closely spaced. [PENNINE MIDDLE CMF - COAL]	Below 41.00m, extremely weak to very weak. Discontinuities are subhorizontal, extremely closely to very closely spaced, planar and undulating, rough. Between 41.23-41.31m, subvertical, planar, rough discontinuity.	42.08		33.63
					(25)					
					(NI)					
					(22)					
					(6)	Medium strong to strong grey and light grey SILTSTONE with laminae of dark grey/black mudstone. [PENNINE MIDDLE CMF - SILTSTONE]	Discontinuities are subhorizontal, very closely to medium spaced, undulating, rough with occasional clay smear.	42.50		33.21
						** Grey MUDSTONE. [PENNINE MIDDLE CMF - MUDSTONE]	Between 42.50-47.00m, borehole advanced using rotary open-hole techniques. (** Colour of water flush stayed grey.)	47.50		28.21
						End of Borehole				

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by
Checked by
Figure
WH
JK
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BOREHOLE RECORD - Cable Percussion and Rotary

Project	STAR RADCLIFFE	Engineer	MOTT MACDONALD LIMITED	Borehole Project No	BH02 PN224390
Client	DEPARTMENT FOR EDUCATION	National Grid Coordinates	378711.1 E 407717.7 N	Ground Level	74.28 m OD

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description	Depth	Legend	Level m OD		
0.00- 0.50	B					Rough grass over TOPSOIL: Dark brown and black slightly silty fine to medium sand with some rootlets. [TOPSOIL]	G.L.		74.28		
0.20	D						0.10		74.18		
0.20	ES										
0.50- 1.20	B						0.50		73.78		
0.50	D										
0.50	ES					MADE GROUND: Dark brown and black gravelly slightly silty fine to coarse sand with a low cobble content. Gravel is angular to subangular fine to coarse of mudstone, siltstone and sandstone and brick fragments. [GRANULAR MADE GROUND]					
1.00	D										
1.00	ES										
1.20- 1.65	B										
1.20- 1.65	D	(DRY)			S8						
1.80	D					Brown mottled light grey gravelly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone. [GLACIAL SAND] Below 1.20m, loose.					
2.00	ES						1.80		72.48		
2.00- 2.45	UT83	1.70 (DRY)									
2.50	D										
2.80	D										
3.00- 3.45	#	3.00 (DAMP)			S26	Stiff brownish grey slightly gravelly sandy CLAY with a medium to high cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone. Occasional lenses of fine to coarse sand. [GLACIAL TILL]					
3.00- 3.45	B										
3.80	D					Stiff to very stiff brown mottled reddish brown and yellow sandy gravelly CLAY with a low cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone, sandstone and traces of coal. [GLACIAL TILL]					
4.00- 4.45	B										
4.00- 4.45	D	4.00 (DAMP)			S23						
4.80	D										
5.00- 5.45	UT100	4.70 (DRY)					4.40		69.88		
5.50	D										
6.00	D										
6.50- 6.95	B										
6.50- 6.95	D	6.00 (DRY)			S28						
7.50	D										
8.00- 8.45	UT100	7.50 (DRY)									
8.50	D										
9.00	D										
9.50- 9.95	B										
9.50- 9.95	D	9.00 (DRY)			S24						

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit	SL/JL	G.L.			10/05/22	08:00	2.30	1.70	1.70	20	5.00	Slow inflow.
6.00	0.20	Cable Percussion	SL/JL	8.50	7.50	DRY	10/05/22	18:00	14.40	13.50	14.10	20	15.00	Slow inflow.
21.66	0.15	Cable Percussion	SL/JL	8.50	7.50	DRY	11/05/22	08:00						
41.00	0.09	Rotary Core	SG/CC	20.00	18.00	DRY	11/05/22	18:00						
51.00	0.09	Rotary Open Hole	SG/CC	20.00	18.00	11.30	12/05/22	08:00						
				21.66	18.00	16.90	12/05/22	18:00						

Remarks  Inspection pit hand excavated to 1.20m depth and no services were found.
 ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
**** Drillers description.**
 A 50mm standpipe was installed to 4.00m with a geowrapped slotted section from 1.00m to 4.00m with upright lockable protective cover and a 50mm standpipe was installed to 15.00m with a geowrapped slotted section from 14.00m to 15.00m with upright lockable protective cover. Backfill details from base of hole: bentonite seal up to 15.00m, gravel filter up to 14.00m, bentonite seal up to 4.00m, gravel filter up to 1.00m, bentonite seal up to 0.20m,
 All dimensions are in metres. Logged in accordance with BS5930:2015 + A1:2020

Logged by WH
 Checked by JK
 Figure 1 of 6
 23/06/2022



Remarks	AGS concrete up to ground level. Chiselling: 4.60-4.80m for 35 minutes and 5.80-6.00m for 50 minutes and 11.50-11.70m for 40 minutes and 15.50-16.00m for 95 minutes and 18.90-19.30m for 75 minutes and 20.50-21.50m for 180 minutes. Flush: 21.00-28.00m, Water, 100% returns; 28.00-41.00m, Water, 75% returns; 41.00-47.20m, Water, Grey, 75% returns; 47.20-48.00m, Water, Black, 75% returns; 48.00-51.50m, Water, Grey, 75% return.	Logged by Checked by Figure	WH JK 2 of 6 23/06/2022
Symbols and abbreviations are explained on the accompanying key sheet.			
All dimensions are in metres.	Logged in accordance with BS5930:2015 + A1:2020		

BOREHOLE RECORD - Cable Percussion and Rotary

Project STAR RADCLIFFE

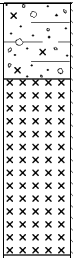
Engineer MOTT MACDONALD LIMITED

Borehole BH02
Project No PN224390

Client DEPARTMENT FOR EDUCATION

National Grid Coordinates 378711.1 E
407717.7 N

Ground Level 74.28 m OD

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description		Depth	Legend	Level m OD					
20.50	D							20.50		53.78					
21.00	D					Extremely weak grey SILTSTONE (Recovered as gravel). [PENNINE MIDDLE CMF - WEATHERED SILTSTONE]									
21.50 21.50-21.66	D	18.00 (16.90)			C50/63			21.66		52.62					
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (F)	Continued by Rotary techniques General									
21.66-22.00 (92mm)	18.00 (3.60)	65 38	0.02 0.01	0	(NI) (25)	Extremely weak to very weak dark grey and grey MUDSTONE with occasional very thin beds of siltstone (up to 40mm thick).									
22.00-23.50 (92mm)	18.00 (3.80)	97 56	0.03 0.01	0	(NI) (22) (NI)	[PENNINE MIDDLE CMF - MUDSTONE]									
23.50-25.00 (92mm)	18.00 (3.80)	93 33	0.02 0.01	0	(AZCL) (NI) (25) (NI) (22) (NI)	Below 23.50m, mainly subhorizontal discontinuities.									
25.00-26.50 (92mm)	18.00 (3.80)	98 57	0.02 0.01	0	(NI) (26) (NI) (25)										
26.50-28.00 (92mm)	18.00 (3.90)	99 17	0.01 0.01	0	(NI) (25)	Extremely weak to very weak black COAL. [PENNINE MIDDLE CMF - COAL]		26.80		47.48					
28.00-29.00 (92mm)	18.00 (3.90)	95 20	0.02 0.01	0	(NI) (28)	Extremely weak to very weak grey MUDSTONE with occasional very thin beds of dark grey mudstone and black coal (up to 30mm thick). [PENNINE MIDDLE CMF - MUDSTONE]		28.00		46.28					
29.00-30.50 (92mm)	18.00 (3.90)	97 77	0.03 0.01	0	(NI) (25) (NI) (28)	Extremely weak to very weak dark grey and grey MUDSTONE with occasional very thin beds of siltstone (up to 40mm thick).		29.00		45.28					
Boring					Progress					Groundwater					
Depth	Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					45.50 51.50	21.00 21.00	3.90 3.90	26/05/22 26/05/22	09:00 16:00						

Boring				Progress					Groundwater					
Depth	Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
				45.50 51.50	21.00 21.00	3.90 3.90	26/05/22 26/05/22	09:00 16:00						

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by WH
Checked by JK
Figure 3 of 6
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BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole **BH02**
 Project No **PN224390**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378711.1 E**
407717.7 N Ground Level **74.28 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50							
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (F)	Description General	Description Detail	Depth	Legend	Level m OD					
						[PENNINE MIDDLE CMF - MUDSTONE]									
30.50-32.00 (92mm)	18.00 (3.90)	83 67	0.05 0.01	0	(AZCL) (18) (NI) (NI) (>30)		Between 30.70-30.90m, very weak with closely to medium spaced discontinuities. At 30.80m, stepped and smooth discontinuity.								
32.00-33.50 (92mm)	18.00 (3.90)	100 67	0.05 0.01	0	(NI) (25)		Between 33.10-33.15m, very thin bed of very weak to moderately weak siltstone with very closely spaced, undulating and rough discontinuities.								
33.50-35.00 (92mm)	18.00 (3.90)	98 71	0.03 0.01	0	(NI) (28)		Below 34.87m, becomes interlaminated with siltstone.								
35.00-36.50 (92mm)	18.00 (3.90)	99 97	0.08 0.01	0	(25)		Between 35.32-35.38m, thin bed of moderately weak to medium strong light grey siltstone. Subhorizontal, closely spaced, undulating and rough discontinuities.								
36.50-38.00 (92mm)	18.00 (3.90)	93 67	0.07 0.01	0	(AZCL) (NI) (20) (8)	Weak to medium strong dark grey MUDSTONE with thin beds of medium strong to strong grey siltstone with quartz veins and bivalve fossils (up to 35mm).	Discontinuities are subhorizontal, extremely closely spaced, planar and undulating, smooth with occasional clay smearing.	36.34		37.94					
						[PENNINE MIDDLE CMF - MUDSTONE]									
38.00-39.50 (92mm)	18.00 (3.90)	99 97	0.02 0.01	0	(22)	Strong grey SILTSTONE with quartz veins. Discontinuities are subhorizontal, closely spaced, undulating and rough.	Discontinuities are subhorizontal, closely spaced, undulating and rough.	37.40	XXXXXX XXXXXX XXXXXX	36.88					
						[PENNINE MIDDLE CMF - SILTSTONE]									
39.50-41.00 (92mm)	18.00 (3.90)	93 83	0.09 0.01	0	(AZCL) (10)	Weak to medium strong dark grey MUDSTONE with thin beds of medium strong to strong grey siltstone with quartz veins and bivalve fossils (up to 35mm).	Discontinuities are subhorizontal, extremely closely spaced, planar and undulating, smooth with occasional clay smearing. Between 39.60-40.02m, medium strong, discontinuities become closely spaced.	37.60		36.68					
						[PENNINE MIDDLE CMF -									
Drilling						Progress				Groundwater					
Depth	Hole Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
Remarks 															
Symbols and abbreviations are explained on the accompanying key sheet. All dimensions are in metres.										Logged by WH Checked by JK Figure 4 of 6 23/06/2022 					
Logged in accordance with BS5930:2015 + A1:2020															

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **BH02 PN224390**

Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378711.1 E 407717.7 N** Ground Level **74.28 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
					(20)	MUDSTONE]				
						** Grey MUDSTONE. [PENNINE MIDDLE CMF - MUDSTONE]	Between 41.00-51.50m, borehole advanced using rotary open-hole techniques. Between 41.00-47.20m, ** Colour of water flush stayed grey.	41.00		33.28
						PROBABLE Black COAL. [PENNINE MIDDLE CMF - COAL]	Between 47.20-48.00m, ** Colour of water flush changed to black and very quick to drill. (No loss of flush).	47.20		27.08
						** Grey MUDSTONE. [PENNINE MIDDLE CMF - MUDSTONE]	Between 48.00m-51.50m, **Colour of water flush changed back to grey and began to drill slow.	48.00		26.28

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

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Figure
WH
JK
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23/06/2022



Remarks		Logged by	WH
		Checked by	JK
Symbols and abbreviations are explained on the accompanying key sheet.	All dimensions are in metres.	Figure	6 of 6
		23/06/2022	
Logged in accordance with BS5930:2015 + A1:2020			

BOREHOLE RECORD - Cable Percussion

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole **BH03**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378669.7 E 407660.3 N** Project No **PN224390**
 Ground Level **74.11 m OD**

Sampling			Properties			Strata	Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
0.00- 0.80	B					Rough grass over TOPSOIL: Dark brown and black slightly silty fine to medium sand with some rootlets. [TOPSOIL]	G.L.		74.11
0.20	D						0.10		74.01
0.20	ES								
0.50	D								
0.50	ES								
0.80- 1.20	B					MADE GROUND: Dark brown gravelly fine to coarse sand with a low cobble content. Gravel is angular to subangular fine to coarse of mudstone, siltstone, sandstone and brick fragments. Rare glass fragments. [GRANULAR MADE GROUND]	0.80		73.31
1.00	D								
1.00	ES								
1.20- 1.65	B								
1.20- 1.65	D	(DRY)			S28				
1.80	D					MADE GROUND: Medium dense dark brown and black gravelly clayey fine to coarse sand with a medium cobble content. Gravel is angular to subrounded fine to coarse of ash, mudstone, siltstone and sandstone. Traces of glass fragments. [GRANULAR MADE GROUND]	1.80		72.31
2.00- 2.45	#	1.70			S20				
2.00	ES	(DRY)							
						Brown gravelly clayey fine to coarse SAND with a medium cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone. [GLACIAL SAND] At 2.00m, strong hydrocarbon (petroleum) odour with oily sheen noted on gravel.	2.45		71.66
						End of Borehole			

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit Cable Percussion	SL/JL SL/JL	G.L.			05/05/22	08:00						None encountered.
2.00	0.20			2.00	1.70	DRY	05/05/22	18:00						
				2.00	1.70	DRY	06/05/22	08:00						
				2.45	2.00	DRY	06/05/22	18:00						

Remarks **AS** Inspection pit hand excavated to 1.20m depth and no services were found.
 ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
 Borehole terminated at 2.45m depth on encountering hydrocarbon contaminated layer and cable percussion rig moved 4m to the northeast to the location of Borehole BH03A.
 Backfill details from base of hole: bentonite seal up to 0.20m, arisings up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres. Logged in accordance with BS5930:2015 + A1:2020

Logged by **WH**
 Checked by **JK**
 Figure **1 of 1**
 23/06/2022

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BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole **BH03A**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378672.7 E 407665.2 N** Project No **PN224390**
 Ground Level **74.23 m OD**

Sampling			Properties			Strata			Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description	Depth	Legend	Level m OD		
0.00- 0.50	B					Rough grass over TOPSOIL: Dark brown and black slightly silty fine to medium sand with some rootlets. [TOPSOIL]	G.L.		74.23		
0.20	D						0.10		74.13		
0.50- 1.20	ES										
0.50	B										
0.50	D										
0.50	ES										
1.00	D					MADE GROUND: Dark brown and black gravelly slightly silty fine to coarse sand with a low cobble content. Gravel is angular to subangular fine to coarse of mudstone, siltstone and sandstone and brick fragments. [GRANULAR MADE GROUND]	0.80		73.43		
1.00	ES										
1.20- 1.65	B										
1.20- 1.65	D	(DRY)			S11						
1.80	D					MADE GROUND: Dark brown and black gravelly clayey fine to coarse sand. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone, sandstone and brick fragments. [GRANULAR MADE GROUND] Below 1.20m, medium dense.	1.80		72.43		
2.00- 2.45	B										
2.00- 2.45	D	1.70 (DRY)			S13						
2.00	ES										
2.80	D					Medium dense dark brown gravelly silty fine to medium SAND with a medium cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone and sandstone. [GLACIAL SAND]					
3.00- 3.45	#	3.00 (DRY)			S18						
3.00- 3.45	B										
3.80	D										
4.00- 4.45	B										
4.00- 4.43	D	4.00 (3.90)			S50/283	Stiff to very stiff brown occasionally mottled reddish brown sandy gravelly CLAY with a low cobble content. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone, sandstone and traces of coal. [GLACIAL TILL]	4.00		70.23		
4.80	D										
5.00- 5.45	UT100	4.50 (DRY)									
5.50	D										
6.00	D					Below 6.00m, medium to high cobble content.					
6.50- 6.95	B										
6.50- 6.95	D	6.00 (DRY)			S23						
7.50	D										
8.00- 8.45	UT100	7.50 (DRY)									
8.50	D										
9.00	D										
9.50- 9.95	B										
9.50- 9.94	D	9.00 (DRY)			S50/288						

Boring				Progress					Groundwater				
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed
1.20	0.40	Inspection Pit	SL/JL	G.L.			06/05/22	08:00	2.30	1.70	1.80	20	3.00
4.50	0.20	Cable Percussion	SL/JL	8.50	8.50	DRY	06/05/22	18:00					
15.10	0.15	Cable Percussion	SL/JL	8.50	8.50	8.10	09/05/22	08:00					
42.00	0.09	Rotary Core	SG/CC	15.10	15.00	DRY	09/05/22	18:00					
45.50	0.09	Rotary Open Hole	SG/CC	15.10	15.00	DRY	12/05/22	14:45					
				18.00	15.00	2.40	12/05/22	16:00					

Remarks **INS** Inspection pit hand excavated to 1.20m depth and no services were found.
 ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
 ** Drillers description.
 Dynamic Cone Penetration Test DCP06 located immediately adjacent to Borehole BH03A.
 A 50mm standpipe was installed to 4.00m with a geowrapped slotted section from 1.00m to 4.00m with upright lockable protective cover. Backfill details from base of hole: bentonite seal up to 4.00m, gravel filter up to 1.00m, bentonite seal up to 0.20m, concrete up to ground level.
 Symbols and abbreviations are explained on the accompanying key sheet.
 All dimensions are in metres.
 Logged in accordance with BS5930:2015 + A1:2020

Logged by **WH**
 Checked by **JK**
 Figure **1 of 5**
 23/06/2022

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Ground Level **74.23** m OD

WH
JK
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23/06/2022

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole **BH03A**
 Project No **PN224390**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378672.7 E 407665.2 N** Ground Level **74.23 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCF%	Length Max/Min	RQD %	SPT N (F)	Description General	Description Detail	Depth	Legend	Level m OD
					(25)	Extremely weak grey and light grey MUDSTONE with black carbonaceous plant fossils.	Discontinuities are subhorizontal, undulating, rough and smooth with clay infill (up to 2mm thick).	20.00		54.23
					(NI)	[PENNINE MIDDLE CMF - MUDSTONE]		20.20		54.03
					(25)			20.40		53.83
21.00-22.50 (92mm)	15.00 (3.00)	87 73	0.05 0.01	0	(NI)	Extremely weak black COAL.	Non-intact (Recovered as clayey gravel).			
					(25)	[PENNINE MIDDLE CMF - COAL]				
					(NI)	Extremely weak grey and light grey MUDSTONE with black carbonaceous plant fossils.	Between 20.50-21.00m, non-intact (Recovered as slightly gravelly clay).			
					(25)	Discontinuities are subhorizontal, extremely closely to very closely spaced, planar and rough.	Between 21.48-21.72m, generally non-intact.			
					(NI)		Between 21.62-21.85m, very thin and thin beds of very weak black coal (up to 130mm thick).			
22.50-24.00 (92mm)	15.00 (3.00)	95 55	0.06 0.01	0	(20)	[PENNINE MIDDLE CMF - MUDSTONE]		22.70		51.53
					(18)					
					(AZCL)	Very weak dark grey and reddish brown carbonaceous MUDSTONE with many non-intact zones (Recovered as gravel).				
					(20)	Discontinuities are subhorizontal, planar, rough and smooth with occasional clay infill (up to 2mm thick).	Between 24.08-24.70m, some very thin beds (up to 50mm thick) of coal.			
24.00-25.50 (92mm)	15.00 (3.00)	100 53	0.06 0.01	0	(NI)	[PENNINE MIDDLE CMF - MUDSTONE]	Non-intact (Recovered as gravelly clay)			
					(18)	Very weak to weak thickly laminated to thinly bedded grey and reddish brown MUDSTONE with interbeds of siltstone.	Discontinuities are subhorizontal, extremely closely to very closely spaced, planar and stepped, rough with minor clay infill.	25.00		49.23
25.50-27.00 (92mm)	15.00 (3.00)	100 93	0.25 0.01	43	(15)	[PENNINE MIDDLE CMF - MUDSTONE]		25.90		48.33
					(25)					
					(20)	Weak to moderately weak laminated grey mottled black SILTSTONE with interbeds and lenses of mudstone.	Below 26.30m, weak to medium strong. Closely to medium spaced discontinuities.			
						Discontinuities are subhorizontal, closely spaced, planar and undulating, rough.	Between 26.65-26.75m, subvertical, stepped, rough discontinuity.			
27.00-28.50 (92mm)	15.00 (3.20)	100 92	0.32 0.01	67	(4)	[PENNINE MIDDLE CMF - SILTSTONE]		27.05		47.18
						Medium strong to strong thinly laminated grey occasionally orangish brown fine to medium grained SANDSTONE.	Between 27.05-27.15m, subvertical, undulating and rough discontinuity.			
					(NI)	[PENNINE MIDDLE CMF - SANDSTONE]	Discontinuities are subhorizontal, closely to medium spaced, planar and undulating, rough with minor orangish brown staining (1mm penetration).	28.30		45.93
28.50-30.00 (92mm)	15.00 (3.20)	100 90	0.26 0.01	31	(25)					
					(NI)	Extremely weak to very weak laminated dark grey and grey MUDSTONE interbedded with siltstone. Many non-intact zones (Recovered as clayey gravel).	Discontinuities are subhorizontal, extremely closely to very closely spaced, planar and stepped, rough and smooth.	29.55		44.68
					(4)	[PENNINE MIDDLE CMF -		30.00		44.23

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by **WH**
 Checked by **JK**
 Figure **3 of 5**
 23/06/2022



BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole **BH03A**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378672.7 E 407665.2 N** Project No **PN224390**
 Ground Level **74.23 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
30.00-31.50 (92mm)	15.00 (3.20)	98 93	0.06 0.01	0	(25)	MUDSTONE]		30.00	xxxxxx	44.23
					(NI)	Medium strong to strong thinly laminated grey occasionally orangish brown fine to medium grained SANDSTONE. [PENNINE MIDDLE CMF - SANDSTONE]	Discontinuities are subhorizontal, closely to medium spaced, planar and undulating, rough with minor orangish brown staining (1mm penetration).	30.75	xxxxxx	43.48
31.50-33.00 (92mm)	15.00 (3.20)	100 87	0.04 0.01	0	(25)	Very weak to weak dark grey and grey SILTSTONE with mudstone laminae (up to 20mm thick). Discontinuities are subhorizontal, extremely closely to closely spaced, planar, rough and smooth. [PENNINE MIDDLE CMF - SILTSTONE]	Between 30.25-30.45m, vertical, undulating, rough discontinuity with yellowish brown staining (10mm penetration).			
					(NI)					
33.00-34.50 (92mm)	15.00 (3.20)	100 93	0.07 0.01	0		Extremely weak to weak thinly laminated dark grey MUDSTONE with many non-intact zones (Recovered as clayey gravel). [PENNINE MIDDLE CMF - MUDSTONE]	Discontinuities are subhorizontal, extremely closely to very closely spaced, undulating and planar, smooth and rough.			
					(20)	Weak to medium strong dark grey and grey SILTSTONE with interbeds of mudstone with carbonaceous plant fossils. Discontinuities are subhorizontal, extremely closely to closely spaced, undulating, rough and smooth with occasional clay smear. [PENNINE MIDDLE CMF - SILTSTONE]	Between 34.38-34.45m, vertical, stepped and rough discontinuity.	33.85	xxxxxx	40.38
34.50-36.00 (92mm)	15.00 (3.20)	100 60	0.10 0.01	7	(15)			34.50	xxxxxx	39.73
					(NI)					
36.00-37.50 (92mm)	15.00 (3.20)	91 20	0.03 0.01	0	(25)	Extremely weak to very weak grey MUDSTONE with many non-intact zones. Recovered as gravel. Discontinuities are subhorizontal, extremely closely to very closely spaced, undulating and stepped, smooth with occasional clay infill (up to 2mm thick). [PENNINE MIDDLE CMF - MUDSTONE]	Between 34.65-34.78m, vertical, undulating and smooth discontinuity. Between 35.07-35.20m, thin bed of medium strong light grey siltstone with some lenses of mudstone. Between 36.00-36.30, non-intact. (Recovered as clayey gravel).	36.30		37.93
					(NI)			36.93		37.30
37.50-39.00 (92mm)	15.00 (3.20)	100 98	0.25 0.01	25	(NR)	Extremely weak black COAL. [PENNINE MIDDLE CMF - COAL]	Non-intact (Recovered as gravel).	37.75	xxxxxx	36.48
					(2)					
39.00-40.50 (92mm)	15.00 (3.80)	100 83	0.18 0.01	20	(15)	Extremely weak to very weak grey MUDSTONE with many non-intact zones. Recovered as gravel. Discontinuities are subhorizontal, extremely closely to very closely spaced, undulating and stepped, smooth with occasional clay infill (up to 2mm thick). [PENNINE MIDDLE CMF - MUDSTONE]	Discontinuities are subhorizontal, extremely closely to very closely spaced, undulating and stepped, smooth with occasional clay infill (up to 2mm thick).		xxxxxx	
					(NI)					
					(16)	Weak to medium strong	Between 38.25-38.45m, vertical discontinuity.		xxxxxx	

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and
abbreviations are
explained on the
accompanying
key sheet.

All dimensions
are in metres. Logged in accordance with BS5930:2015 + A1:2020

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BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole **BH03A**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378672.7 E 407665.2 N** Project No **PN224390**
 Ground Level **74.23 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
40.50-42.00 (92mm)	15.00 (3.80)	93 87	0.03 0.01	0	(NI)	grey SILTSTONE with some laminae of dark grey mudstone. Discontinuities are subhorizontal, closely to medium spaced, undulating and rough. [PENNINE MIDDLE CMF - SILTSTONE]		40.35	xxxxx	33.88
					(AZCL)			40.50	xxxxx	33.73
					(25)	Extremely weak black COAL. [PENNINE MIDDLE CMF - COAL]	Non-intact (Recovered as gravel).			
					(NI)	Very weak to weak dark grey mottled black carbonaceous MUDSTONE with black plant fossils. [PENNINE MIDDLE CMF - MUDSTONE]	Discontinuities are subhorizontal, extremely closely to very closely spaced, undulating, smooth and rough.	42.00		32.23
					(>30)					
						** Grey MUDSTONE. [PENNINE MIDDLE CMF - MUDSTONE]	Between 42.00-45.50m, borehole advanced using rotary open-hole techniques. (** Colour of water flush stayed grey).			
						End of Borehole		45.50		28.73

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks 

Symbols and
abbreviations are
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key sheet.

All dimensions
are in metres.

Logged in accordance with BS5930:2015 + A1:2020

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23/06/2022



BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole **BH04**
 Project No **PN224390**
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378737.5 E**
407649.3 N Ground Level **71.04 m OD**

Sampling			Properties			Strata		Scale 1:50		
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (F)	Description	Depth	Legend	Level m OD	
0.10- 0.60	B					MADE GROUND: Black tarmacadam. [TARMACADAM]	G.L.		71.04	
0.20	D						0.10		70.94	
0.20	ES						0.20		70.84	
0.50	D					MADE GROUND: Light brown sandy angular fine to coarse gravel of limestone and concrete (Sub base). [GRANULAR MADE GROUND]				
0.50	ES									
0.60- 1.20	B									
1.00	D					MADE GROUND: Black and dark brown gravelly fine to coarse sand with a high cobble content. Gravel is angular to subangular fine to coarse of ash, sandstone and brick fragments. [GRANULAR MADE GROUND]				
1.00	ES					Between 1.20-1.65m, dense.				
1.20- 1.65	#	(DRY)			S33					
1.20- 1.65	B									
1.80	D									
2.00- 2.45	#	1.80			S18		2.10		68.94	
2.00- 2.45	B	(DRY)				Medium dense dark brown mottled light brown gravelly clayey fine to coarse SAND. Gravel is subangular fine to coarse of mudstone and siltstone. [GLACIAL SAND]	2.30		68.74	
2.00	ES									
2.80	D									
3.00	ES					Stiff brown mottled reddish and yellowish brown sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone, siltstone, sandstone and traces of coal. [GLACIAL TILL]				
3.00- 3.45	UT100	3.00 (DRY)								
3.50	D									
3.80	D									
4.00- 4.45	B					Below 4.00m, very stiff.				
4.00- 4.45	D	3.00 (DRY)			S47					
4.80	D									
5.00- 5.45	UT100	3.00 (DRY)								
5.50	D									
6.00	D									
6.50- 6.95	B									
6.50- 6.95	D	6.00 (DRY)			S49					
7.50	D									
8.00- 8.45	UT100	7.50 (7.90)								
8.50	D									
9.00- 9.45	B									
9.00	D									
9.50- 9.95	D	9.00 (DRY)			S42					

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.40	Inspection Pit	SL/JL	G.L.			17/05/22	08:00	2.00	1.80			3.00	Seepage, no rise.
5.50	0.20	Cable Percussion	SL/JL	8.00	8.00	DRY	17/05/22	18:00						Fast inflow.
15.70	0.15	Cable Percussion	SL/JL	8.00	7.50	7.90	18/05/22	08:00	14.30	13.50	12.80	20		
40.00	0.09	Rotary Core	SG/CH	15.70	15.00	14.30	18/05/22	18:00						
45.00	0.09	Rotary Open Hole	SG/CH	15.70	15.00	4.00	31/05/22	11:30						
				25.00	15.00	3.80	31/05/22	16:30						

Remarks **AS** Inspection pit hand excavated to 1.20m depth and no services were found.
 ES sample = 1 x 1litre plastic tub, 2 x 258ml amber glass jars and 1 x 60ml VOC vial.
 ** Drillers description.
 A 50mm standpipe was installed to 2.50m with a geowrapped slotted section from 1.00m to 3.50m with flush lockable protective cover. Backfill details from base of hole: bentonite seal up to 3.50m, gravel filter up to 1.00m, bentonite seal up to 0.20m, concrete up to 0.10m, tarmacadam up to ground level.
 Chiselling: 1.20-1.70m for 125 minutes and 4.40-4.70m for 50 minutes and 7.10-7.40m for 70 minutes.
 All dimensions are in metres. Logged in accordance with BS5930:2015 + A1:2020

Logged by **WH**
 Checked by **JK**
 Figure **1 of 5**
 23/06/2022

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BOREHOLE RECORD - Cable Percussion and Rotary

Project STAR RADCLIFFE

Engineer

MOTT MACDONALD LIMITED

Borehole
Project No

BH04
PN224390

Client DEPARTMENT FOR EDUCATION

National Grid
Coordinates 378737.5 E
407649.3 N

Ground Level 71.04 m OD

Sampling			Properties			Strata		Scale 1:50							
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description		Depth	Legend	Level m OD					
10.50	D														
11.00-11.45	UT100	10.50 (DRY)													
11.50	D														
12.00	D														
12.50-12.95	B														
12.50-12.78	D	12.00 (DRY)			S50/126	Extremely weak grey MUDSTONE with traces of coal (Recovered as clayey gravel). [PENNINE MIDDLE CMF - WEATHERED MUDSTONE]		12.60		58.44					
13.50	D														
14.00-14.45	B														
14.00-14.29	D	13.50 (DRY)			S50/177										
15.00	D														
15.50-15.70		13.50 (14.30)			C50/102										
Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General		15.70		55.34					
						Detail									
15.70-16.00 (92mm)	15.00 (3.80)	78 50	0.20 0.03	20	(12) (NI)	Weak to medium strong grey and light grey SILTSTONE with laminae and lenses of mudstone and occasional black plant fossils. Discontinuities are subhorizontal, very closely to closely spaced, undulating, smooth and rough with occasional clay smear. [PENNINE MIDDLE CMF - SILTSTONE]									
16.00-17.50 (92mm)	15.00 (3.80)	97 75	0.15 0.02	23	(14) (NI) (20) (NI)	Between 16.44-16.50m, vertical, undulating and smooth discontinuity. Between 16.70-16.75m, very thin bed of moderately strong greyish brown fine to coarse grained sandstone. Between 16.72-17.00m, thin bed of weak to moderately weak mudstone.		16.75		54.29					
17.50-19.00 (92mm)	15.00 (3.80)	98 75	0.04 0.02	0	(12) (NI) (15) (AZCL) (17) (NI)	Extremely weak to very weak dark grey and grey MUDSTONE with occasional laminae and very thin beds (up to 50mm thick) of greyish brown sandstone and light grey siltstone. Becoming moderately weak to strong. Discontinuities are horizontal to inclined (60 deg.), planar and undulating, smooth with clay infill (up to 2mm thick).									
19.00-20.50 (92mm)	15.00 (3.80)	93 77	0.04 0.01	0	(22) (NI) (25) (NI) (25)										
Boring					Progress			Groundwater							
Depth	Dia	Technique		Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
					25.00	15.00	3.80	01/06/22	09:00						
					35.50	15.00	3.80	01/06/22	16:00						
					35.50	15.00	3.70	06/06/22	09:00						
					45.00	15.00	3.70	06/06/22	17:00						
Remarks															
minutes and 9.20-9.40m for 50 minutes and 11.80-12.20m for 160 minutes and 15.00-15.50m for 70 minutes. Flush: 15.70-22.00m, Water, 100% returns; 22.00-45.00m, Water, Red, 75% return.															
Symbols and abbreviations are explained on the accompanying key sheet.															
All dimensions are in metres.															
Logged in accordance with BS5930:2015 + A1:2020															
Logged by Checked by Figure															
WH JK 2 of 5 23/06/2022															
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geotechnics

BOREHOLE RECORD - Cable Percussion and Rotary

Project STAR RADCLIFFE					Engineer MOTT MACDONALD LIMITED					Borehole BH04						
Client DEPARTMENT FOR EDUCATION					National Grid Coordinates 378737.5 E 407649.3 N					Project No PN224390						
										Ground Level 71.04 m OD						
Drilling		Properties/Sampling			Strata										Scale 1:50	
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD						
20.50-22.00 (92mm)	15.00 (3.80)	98 67	0.12 0.01	0	(NI)	[PENNINE MIDDLE CMF - MUDSTONE]										
					(28)											
					(AZCL)											
					(20)											
					(NI)											
					(28)											
					(NI)											
					(25)											
					(NI)											
					(25)											
22.00-23.50 (92mm)	15.00 (3.80)	93 70	0.02 0.01	0	(NI)											
					(24)											
					(NI)											
					(25)											
					(NI)											
					(10)											
					(NI)											
					(23.05)											
					(47.99)											
					(47.14)											
23.50-25.00 (92mm)	15.00 (3.80)	97 91	0.08 0.01	0	(AZCL)	[PENNINE MIDDLE CMF - MUDSTONE]	Discontinuities are subhorizontal, extremely closely spaced, undulating, smooth and rough with minor clay smear. Occasional vertical, stepped, tight discontinuities.									
					(25)											
					(NI)											
					(25)											
					(NI)											
					(22)											
					(NI)											
					(25)											
					(NI)											
					(25)											
25.00-26.50 (92mm)	15.00 (3.80)	93 87	0.02 0.01	0	(NI)	[PENNINE MIDDLE CMF - SANDSTONE]	Discontinuities are subvertical, closely spaced, planar and rough.									
					(28)											
					(NI)											
					(28)											
					(6)											
					(25)											
					(NI)											
					(25)											
					(NI)											
					(28)											
26.50-28.00 (92mm)	15.00 (3.80)	97 85	0.02 0.01	0	(NI)	[PENNINE MIDDLE CMF - MUDSTONE]										
					(25)											
					(NI)											
					(28)											
					(NI)											
					(28)											
					(NI)											
					(28)											
					(NI)											
					(28)											
28.00-29.50 (92mm)	15.00 (3.80)	97 87	0.02 0.01	0	(28)											
					(NI)											
					(28)											
					(NI)											
					(28)											
					(NI)											
					(28)											
					(NI)											
					(28)											
					(NI)											
29.50-31.00 (92mm)	15.00 (3.80)	97 83	0.02 0.01	0	(28)	[PENNINE MIDDLE CMF - COAL]	Discontinuities are randomly-orientated and extremely closely spaced.									
					(NI)											
					(25)											
					(29.25)											
					(41.79)											
					(41.54)											
					(29.50)											
					(29.50)											
					(29.50)											
					(29.50)											
					(25)	Very weak to weak thinly										
					(25)											
					(25)											
					(25)											
					(25)											
					(25)											
					(25)											
					(25)											
					(25)											
					(25)											

Drilling					Progress					Groundwater					
Depth	Hole Dia	Technique	Crew		Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015 + A1:2020

Logged by **WH**
Checked by **JK**
Figure **3 of 5**
23/06/2022

BOREHOLE RECORD - Cable Percussion and Rotary

Project **STAR RADCLIFFE** Engineer **MOTT MACDONALD LIMITED** Borehole Project No **BH04**
PN224390
 Client **DEPARTMENT FOR EDUCATION** National Grid Coordinates **378737.5 E**
407649.3 N Ground Level **71.04 m OD**

Drilling		Properties/Sampling				Strata		Scale 1:50		
Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCF%	Length Max/Min	RQD %	SPT N (F)	Description General	Description Detail	Depth	Legend	Level m OD
31.00-32.50 (92mm)	15.00 (3.80)	93 75	0.03 0.01	0	(26)	to thickly laminated dark grey and grey MUDSTONE.	Discontinuities are subhorizontal, extremely closely spaced, undulating, smooth and rough with minor clay smear. Occasional vertical, stepped, tight discontinuities.	30.50 30.80 31.07 31.26		40.54 40.24 39.97 39.78
					(NI)	[PENNINE MIDDLE CMF - MUDSTONE]				
					(25)	Extremely weak to very weak black COAL.				
					(AZCL)	[PENNINE MIDDLE CMF - COAL]				
32.50-34.00 (92mm)	15.00 (3.80)	90 27	0.04 0.01	0	(NI)	Very weak to weak thinly to thickly laminated dark grey and grey MUDSTONE.	Discontinuities are randomly-orientated and extremely closely spaced.	33.00		38.04
					(25)	[PENNINE MIDDLE CMF - MUDSTONE]				
					(16)	Extremely weak to very weak black COAL.				
					(NI)	[PENNINE MIDDLE CMF - COAL]				
34.00-35.50 (92mm)	15.00 (3.80)	100 99	0.50 0.02	70	(14)	Very weak to weak thinly to thickly laminated dark grey and grey MUDSTONE.	Discontinuities are subhorizontal, extremely closely spaced, undulating, smooth and rough with minor clay smear. Occasional vertical, stepped, tight discontinuities.	34.65		36.39
					(20)	[PENNINE MIDDLE CMF - MUDSTONE]				
					(5)	Moderately weak to medium strong grey mottled dark grey and black SILTSTONE with occasional laminae and lenses (up to 20mm thick) of mudstone.				
					(3)	Discontinuities are subhorizontal, extremely closely spaced, undulating, rough occasionally smooth, with occasional clay infill (up to 2mm thick).				
35.50-37.00 (92mm)	15.00 (3.70)	97 97	0.45 0.03	77	(3)	[PENNINE MIDDLE CMF - SILTSTONE]	Between 34.35-34.46m, vertical, undulating and rough discontinuity.	37.78		33.26
					(NI)	Very strong light grey fine to medium grained SANDSTONE with occasional laminae and lenses (up to 25mm thick) of mudstone and siltstone.				
					(22)	Discontinuities are subhorizontal, closely to medium spaced, undulating and rough.				
					(6)	[PENNINE MIDDLE CMF - SANDSTONE]				
37.00-38.50 (92mm)	15.00 (3.80)	97 90	0.25 0.02	40	(20)	Weak to medium strong dark grey and grey MUDSTONE with occasional laminae and lenses of siltstone.	Between 36.00-36.15m, thin bed of moderately weak to medium strong grey siltstone. Between 37.00-37.78m, thin bed of moderately weak to medium strong grey siltstone with laminae of dark grey mudstone.	39.55		31.49
					(NI)	Discontinuities are subhorizontal, very closely to closely spaced, planar and undulating, smooth and rough with minor clay smear.				
					(20)	[PENNINE MIDDLE CMF - MUDSTONE]				
					(>30)	Extremely weak to very				
38.50-40.00 (92mm)	15.00 (3.80)	92 90	0.20 0.01	13				40.00		31.04

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres. Logged in accordance with BS5930:2015 + A1:2020

Logged by **WH**
 Checked by **JK**
 Figure **4 of 5**
 23/06/2022

Remarks			Logged by Checked by Figure
Symbols and abbreviations are explained on the accompanying key sheet.			WH JK 5 of 5
All dimensions are in metres.		Logged in accordance with BS5930:2015 + A1:2020	

Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'				
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50
BH01	1.20	74.51	S	-	2	2	1	2	3	5	11	*				
BH01	2.00	73.71	S	-	3	4	5	6	5	6	22		*			
BH01	3.00	72.71	S	-	2	3	4	5	5	6	20		*			
BH01	4.00	71.71	S	-	6	10	6	5	8	10	29			*		
BH01	5.00	70.71	S	-	3	5	5	6	6	7	24		*			
BH01	8.00	67.71	S	-	5	7	10	10	12	16	48					*
BH01	11.00	64.71	S	-	4	7	10	11	16	13/47	50/272					>
BH01	12.50	63.21	S	-	3	5	6	10	11	14	41				*	
BH01	14.00	61.71	S	-	6	7	9	13	16	12/44	50/269					>
BH01	15.50	60.21	S	-	4	9	10	15	17	8/30	50/255					>
BH01	17.00	58.71	S	-	14	11/22	50/69				50/69					>
Driller			Steve Lowery				Remarks									
Hammer No.			AR2636													
Energy Ratio, Er (%)			60.00													
Calibration Date			07/01/2022													

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'				
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50
BH02	1.20	73.08	S	-	2	2	2	2	2	2	8	*				
BH02	3.00	71.28	S	-	3	5	9	5	6	6	26			*		
BH02	4.00	70.28	S	-	3	4	5	5	6	7	23			*		
BH02	6.50	67.78	S	-	3	5	5	6	7	10	28			*		
BH02	9.50	64.78	S	-	3	4	5	5	6	8	24			*		
BH02	12.50	61.78	S	-	5	7	9	11	12	14	46				*	
BH02	15.50	58.78	S	-	25/67		50/53				50/53					>
BH02	18.50	55.78	S	-	10	11	15	17	18/70		50/220					>
BH02	21.50	52.78	C	-	17	8/23	50/63				50/63					>
Driller			Steve Lowery				Remarks									
Hammer No.			AR2636													
Energy Ratio, Er (%)			60.00													
Calibration Date			07/01/2022													

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'				
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50
BH03A	1.20	73.03	S	0	1	1	2	3	3	3	11	*				
BH03A	2.00	72.23	S	0	2	3	4	3	3	3	13	*				
BH03A	3.00	71.23	S	-	2	3	5	3	8	2	18	*				
BH03A	4.00	70.23	S	-	3	5	11	13	16	10/58	50/283					>
BH03A	6.50	67.73	S	-	2	3	5	5	5	8	23		*			
BH03A	9.50	64.73	S	-	3	5	7	11	16	16/63	50/288					>
BH03A	12.50	61.73	S	-	5	20/22	50/27				50/27					>
BH03A	14.00	60.23	S	-	5	12	21	29/69			50/144					>
BH03A	15.00	59.23	C	-	25/53		50/48				50/48					>
Driller			Steve Lowery				Remarks									
Hammer No.			AR2636													
Energy Ratio, Er (%)			60.00													
Calibration Date			07/01/2022													

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project STAR RADCLIFFE

Project No PN224390

Client DEPARTMENT FOR EDUCATION

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'					
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10	20	30	40	50	
BH04	1.20	69.84	S	-	7	11	6	5	9	13	33				*		
BH04	2.00	69.04	S	-	11	5	4	3	4	7	18		*				
BH04	4.00	67.04	S	-	6	7	7	11	13	16	47					*	
BH04	6.50	64.54	S	-	8	8	9	11	14	15	49					*	
BH04	9.50	61.54	S	-	2	6	6	7	11	18	42					*	
BH04	12.50	58.54	S	-	4	7	28	22/51			50/126						>
BH04	14.00	57.04	S	-	17	8/37	17	18	15/27		50/177						>
BH04	15.50	55.54	C	-	18	7/23	33	17/27			50/102						>
Driller			Steve Lowery				Remarks										
Hammer No.			AR2636														
Energy Ratio, Er (%)			60.00														
Calibration Date			07/01/2022														

-/- Blows/penetration (mm) after seating

-*/- Total blows/penetration (mm)

SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)

C - SPT with cone

L - Split Spoon with liner used

GEOTECHNICS

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

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

SPT Hammer Ref: AR2636
Test Date: 07/01/2022
Report Date: 07/01/2022
File Name: AR2636.spt
Test Operator: JL

Instrumented Rod Data

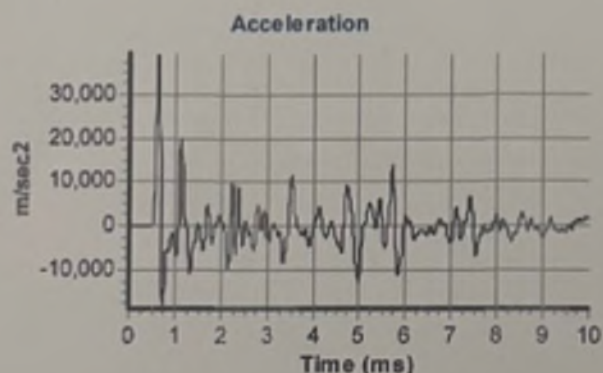
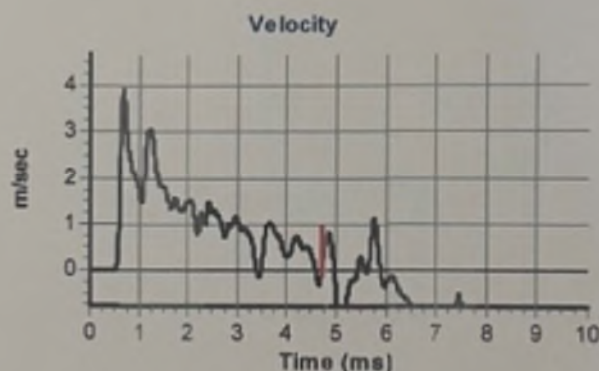
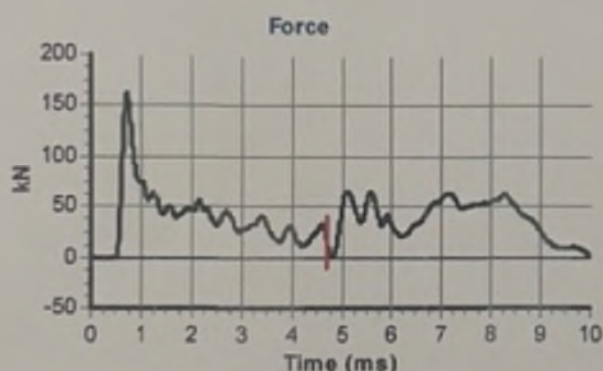
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 200
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

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

Comments / Location

STEVE LOWRY DRILLING LTD - 78630



Calculations

Area of Rod A (mm^2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 329

Energy Ratio E_r (%): **70**

Signed: J. LOCK
Title: FITTER

The recommended calibration interval is 12 months

APPENDIX 10

**Rock Core Photographs
(including Borehole Inspection Pit Photographs)**

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH01 Inspection Pit 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH01 Inspection Pit 0.00m-1.20m Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH01 Box 1 of 9 17.00m-20.00m



Borehole BH01 Box 1 of 9 18.55m-18.70m Quartz vein with pyrite

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH01 Box 2 of 9 20.00m-23.00m



Borehole BH01 Box 3 of 9 23.00m-26.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH01 Box 4 of 9 26.00m-29.00m



Borehole BH01 Box 5 of 9 29.00m-32.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH01 Box 6 of 9 32.00m-35.00m



Borehole BH01 Box 7 of 9 35.00m-38.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH01 Box 8 of 9 38.00m-41.00m



Borehole BH01 Box 9 of 9 41.00m-42.50m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH02 Inspection Pit 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH02 Inspection Pit 0.00m-1.20m Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH02 Box 1 of 7 21.00m-23.50m



Borehole BH02 Box 2 of 7 23.50m-26.50m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH02 Box 3 of 7 26.50m-29.50m



Borehole BH02 Box 4 of 7 29.50m-32.50m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH02 Box 5 of 7 32.50m-35.50m



Borehole BH02 Box 6 of 7 35.50m-38.50m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH02 Box 7 of 7 38.50m-41.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03 Inspection Pit 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03 Inspection Pit 0.00m-1.20m Arisings

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03A Inspection Pit 0.00m-1.20m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03A Box 1 of 9 15.00m-18.00m



Borehole BH03A Box 2 of 9 18.00m-21.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03A Box 3 of 9 21.00m-24.00m



Borehole BH03A Box 4 of 9 24.00m-27.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03A Box 5 of 9 27.00m-30.00m



Borehole BH03A Box 6 of 9 30.00m-33.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03A Box 7 of 9 33.00m-36.00m



Borehole BH03A Box 8 of 9 36.00m-39.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH03A Box 9 of 9 39.00m-42.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH04 Box 1 of 9 15.00m-18.00m



Borehole BH04 Box 2 of 9 18.00m-21.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH04 Box 3 of 9 21.00m-24.00m



Borehole BH04 Box 4 of 9 24.00m-27.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH04 Box 5 of 9 27.00m-30.00m



Borehole BH04 Box 6 of 9 30.00m-33.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH04 Box 7 of 9 33.00m-36.00m



Borehole BH04 Box 8 of 9 36.00m-39.00m

PHOTOGRAPHS

Project Number : PN224390

Project : STAR RADCLIFFE



Borehole BH04 Box 9 of 9 39.00m-40.00m

APPENDIX II

Dynamic Cone Penetration Tests

In Situ Testing - Dynamic Cone Penetration Test

Project STAR RADCLIFFE

Location No. DCP03

Client DEPARTMENT FOR EDUCATION

Project No. PN224390

Coordinates 378635.8 E, 407687.7 N

Ground Level 75.11 m OD

Test No. 1

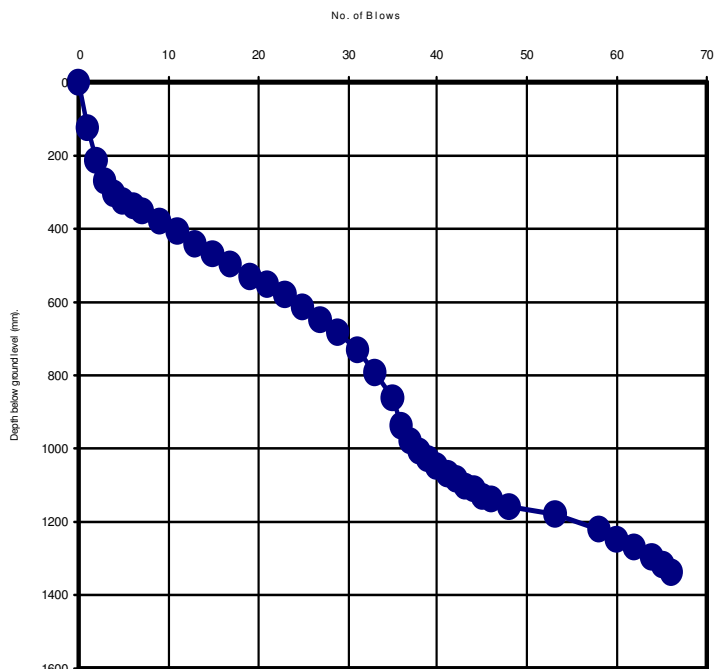
Test Date 13/05/2022

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	40	0	2	35	1	900	860
1	1	1	165	125	1	36	2	140	940
1	2	1	252	212	1	37	2	180	980
1	3	1	310	270	1	38	2	210	1010
1	4	1	340	300	1	39	2	230	1030
1	5	1	362	322	1	40	2	250	1050
1	6	1	380	340	1	41	2	270	1070
1	7	1	392	352	1	42	2	285	1085
2	9	1	420	380	1	43	2	300	1100
2	11	1	450	410	1	44	2	310	1110
2	13	1	480	440	1	45	2	330	1130
2	15	1	510	470	1	46	2	340	1140
2	17	1	536	496	2	48	2	360	1160
2	19	1	568	528	5	53	2	382	1182
2	21	1	592	552	5	58	2	420	1220
2	23	1	620	580	2	60	2	445	1245
2	25	1	656	616	2	62	2	472	1272
2	27	1	685	645	2	64	2	499	1299
2	29	1	720	680	1	65	2	519	1319
2	31	1	770	730	1	66	2	539	1339
2	33	1	830	790					

Test Started at	0.00	m
Operator	WH	
Checked by	JK	

Rod No.	Zero Reading (mm)
1	40
2	60

Depth bgl (mm)		Blows No.		DCP mm/blow	CBR %
Top	Base	Top	Base		
0	270	0	3	90	2.6
270	680	3	29	16	16.4
680	860	29	35	30	8.3
860	980	35	37	60	4.0
980	1140	37	46	18	14.4
1140	1220	46	58	7	40.7
1220	1339	58	66	15	17.4



Remarks

Printed: 09/06/2022

CBR estimated using the correlation in the HA Manual for Roads and Bridges, CS229, Rev. 0, 2020
 Dynamic Cone Penetration Test DCP03 located immediately adjacent to Dynamic Sample Borehole DS03.
 Co-ordinates - 378635.8mE, 407687.7mN. Ground Level - 75.11m OD.

GEOTECHNICS



In Situ Testing - Dynamic Cone Penetration Test

Project STAR RADCLIFFE

Location No. DCP05

Client DEPARTMENT FOR EDUCATION

Project No. PN224390

Coordinates 378634.6 E, 407650.4 N

Ground Level 74.59 m OD

Test No. 1

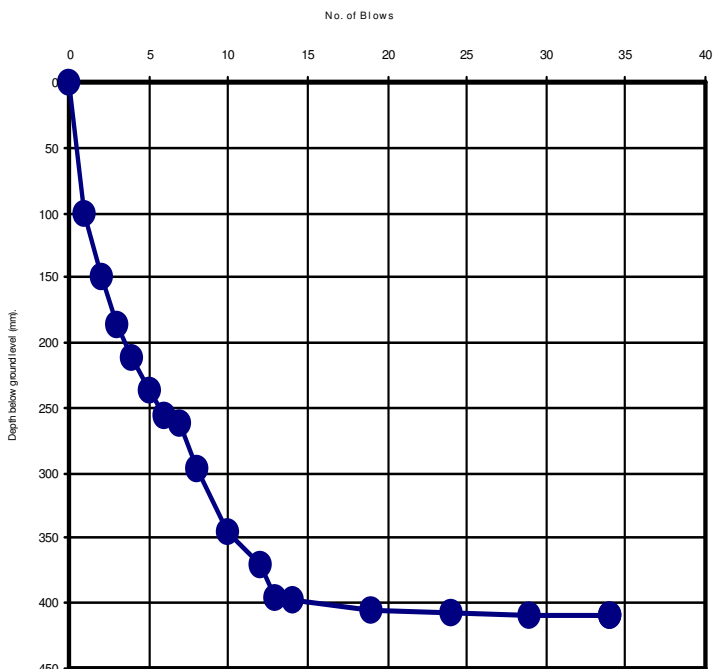
Test Date 12/05/2022

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	64	0
1	1	1	165	101
1	2	1	214	150
1	3	1	250	186
1	4	1	276	212
1	5	1	300	236
1	6	1	320	256
1	7	1	325	261
1	8	1	360	296
2	10	1	410	346
2	12	1	435	371
1	13	1	460	396
1	14	1	462	398
5	19	1	470	406
5	24	1	472	408
5	29	1	473	409
5	34	1	473	409
0	34	1	473	409

Test Started at	0.00 m
Operator	WH
Checked by	JK

Rod No.	Zero Reading (mm)
1	64

Depth bgl (mm)		Blows No.		DCP mm/blow	CBR %
Top	Base	Top	Base		
0	150	0	2	75	3.1
150	256	2	6	27	9.5
256	261	6	7	5	55.1
261	396	7	13	23	11.2
396	408	13	24	1	275.5
408	409	24	29	0	1655.1
409	409	29	39		



Remarks

Printed: 09/06/2022

CBR estimated using the correlation in the HA Manual for Roads and Bridges, CS229, Rev. 0, 2020
Dynamic Cone Penetration Test DCP05 (Test 1) located immediately adjacent to Hand-dug Trial Pit DCP05.
Dynamic Cone Penetration Test DCP05 (Test 1) terminated at 0.41m depth upon obstruction.
Co-ordinates - 378634.6mE, 407650.4mN. Ground Level - 74.59m OD.

GEOTECHNICS



In Situ Testing - Dynamic Cone Penetration Test

Project STAR RADCLIFFE

Location No. DCP06

Client DEPARTMENT FOR EDUCATION

Project No. PN224390

Coordinates 378669.7 E, 407660.3 N

Ground Level 74.11 m OD

Test No. 1

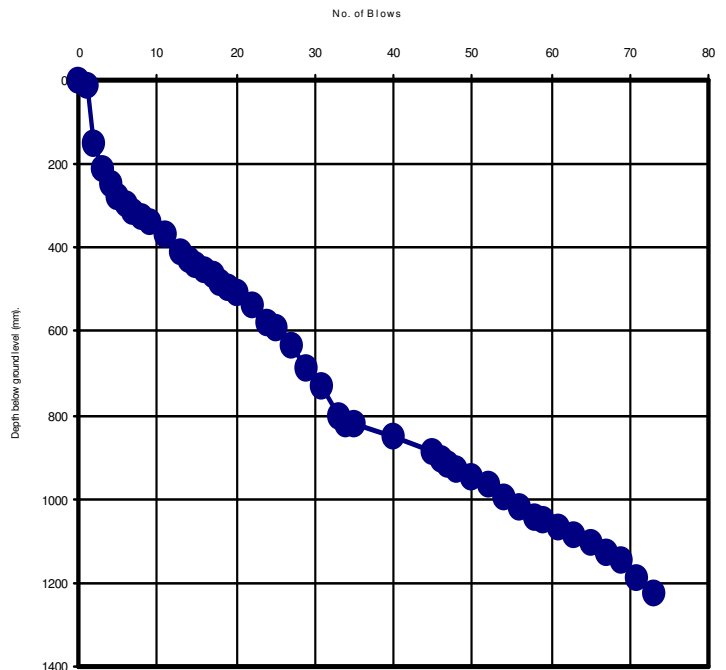
Test Date 26/05/2022

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	60	0	1	25	1	653	593	2	67	2	350	1128
1	1	1	70	10	2	27	1	694	634	2	69	2	370	1148
1	2	1	210	150	2	29	1	745	685	2	71	2	410	1188
1	3	1	274	214	2	31	1	792	732	2	73	2	450	1228
1	4	1	308	248	2	33	1	864	804					
1	5	1	340	280	1	34	2	40	818					
1	6	1	358	298	1	35	2	45	823					
1	7	1	372	312	5	40	2	70	848					
1	8	1	385	325	5	45	2	110	888					
1	9	1	396	336	1	46	2	127	905					
2	11	1	430	370	1	47	2	140	918					
2	13	1	470	410	1	48	2	150	928					
1	14	1	490	430	2	50	2	172	950					
1	15	1	503	443	2	52	2	190	968					
1	16	1	515	455	2	54	2	215	993					
1	17	1	526	466	2	56	2	240	1018					
1	18	1	540	480	2	58	2	267	1045					
1	19	1	556	496	1	59	2	274	1052					
1	20	1	567	507	2	61	2	290	1068					
2	22	1	598	538	2	63	2	310	1088					
2	24	1	640	580	2	65	2	325	1103					

Test Started at	0.00	m
Operator	WH	
Checked by	JK	

Rod No.	Zero Reading (mm)
1	60
2	26

Depth bgl (mm)		Blows No.		DCP	CBR %
Top	Base	Top	Base	mm/blow	
0	150	0	2	75	3.1
150	280	2	5	43	5.6
280	593	5	25	16	16.5
593	818	25	34	25	10.1
818	888	34	45	6	42.7
888	1148	45	69	11	24.3
1148	1228	69	73	20	12.7



Remarks

CBR estimated using the correlation in the HA Manual for Roads and Bridges, CS229, Rev. 0, 2020
 Dynamic Cone Penetration Test DCP06 located immediately adjacent to Borehole BH03A.
 Co-ordinates - 378672.7mE, 407665.2mN. Ground Level - 74.23m OD.

Printed: 09/06/2022

GEOTECHNICS



In Situ Testing - Dynamic Cone Penetration Test

Project STAR RADCLIFFE

Location No. DCP09

Client DEPARTMENT FOR EDUCATION

Project No. PN224390

Coordinates 378608.5 E, 407614.2 N

Ground Level 74.66 m OD

Test No. 1

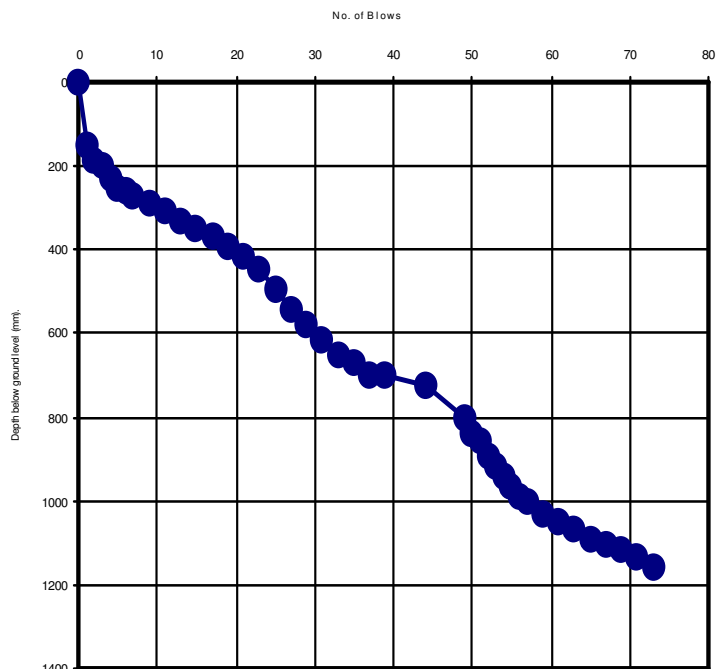
Test Date 26/05/2022

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	60	0	2	35	1	729	669
1	1	1	212	152	2	37	1	760	700
1	2	1	250	190	2	39	1	760	700
1	3	1	260	200	5	44	1	786	726
1	4	1	290	230	5	49	1	864	804
1	5	1	312	252	1	50	2	80	836
1	6	1	320	260	1	51	2	102	858
1	7	1	330	270	1	52	2	135	891
2	9	1	348	288	1	53	2	164	920
2	11	1	370	310	1	54	2	188	944
2	13	1	393	333	1	55	2	210	966
2	15	1	411	351	1	56	2	235	991
2	17	1	429	369	1	57	2	246	1002
2	19	1	452	392	2	59	2	276	1032
2	21	1	475	415	2	61	2	297	1053
2	23	1	506	446	2	63	2	314	1070
2	25	1	554	494	2	65	2	334	1090
2	27	1	605	545	2	67	2	347	1103
2	29	1	637	577	2	69	2	363	1119
2	31	1	675	615	2	71	2	380	1136
2	33	1	710	650	2	73	2	404	1160

Test Started at	0.00	m
Operator	WH	
Checked by	JK	

Rod No.	Zero Reading (mm)
1	60
2	48

Depth bgl (mm)		Blows No.		DCP mm/blow	CBR %
Top	Base	Top	Base		
0	152	0	1	152	1.5
152	252	1	5	25	10.1
252	415	5	21	10	26.0
415	700	21	37	18	14.4
700	726	37	44	4	75.4
726	991	44	56	22	11.5
991	1160	56	73	10	26.7



Remarks

CBR estimated using the correlation in the HA Manual for Roads and Bridges, CS229, Rev. 0, 2020
 Dynamic Cone Penetration Test DCP09 located immediately adjacent to Machine-dug Trial Pit TP05.
 Co-ordinates - 378608.5mE, 407614.2mN. Ground Level - 74.66m OD.

Printed: 09/06/2022

GEOTECHNICS



In Situ Testing - Dynamic Cone Penetration Test

Project STAR RADCLIFFE

Location No. DCP11

Client DEPARTMENT FOR EDUCATION

Project No. PN224390

Coordinates 378681.7 E, 407533.1 N

Ground Level 70.30 m OD

Test No. 1

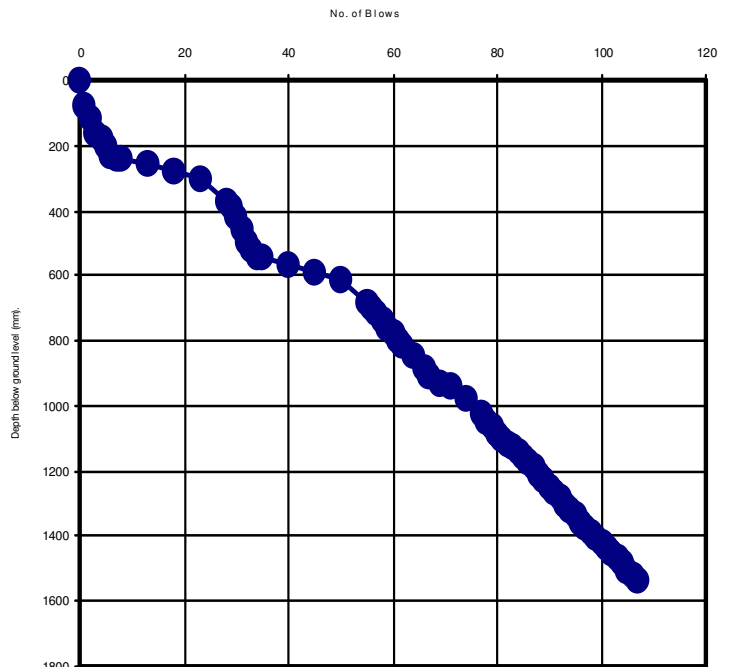
Test Date 13/05/2022

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)	Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	70	0	5	45	1	660	590	1	82	2	378	1116
1	1	1	150	80	5	50	1	680	610	1	83	2	390	1128
1	2	1	190	120	5	55	1	750	680	1	84	2	402	1140
1	3	1	230	160	1	56	1	770	700	1	85	2	415	1153
1	4	1	250	180	1	57	1	786	716	1	86	2	430	1168
1	5	1	272	202	1	58	1	808	738	1	87	2	450	1188
1	6	1	300	230	1	59	2	20	758	1	88	2	470	1208
1	7	1	310	240	1	60	2	40	778	1	89	2	490	1228
1	8	1	312	242	1	61	2	60	798	1	90	2	510	1248
5	13	1	325	255	1	62	2	75	813	1	91	2	526	1264
5	18	1	350	280	2	64	2	108	846	1	92	2	545	1283
5	23	1	372	302	2	66	2	150	888	1	93	2	566	1304
5	28	1	440	370	1	67	2	166	904	1	94	2	582	1320
1	29	1	460	390	2	69	2	190	928	1	95	2	600	1338
1	30	1	490	420	2	71	2	202	940	1	96	2	620	1358
1	31	1	530	460	3	74	2	240	978	1	97	2	638	1376
1	32	1	570	500	3	77	2	290	1028	1	98	2	650	1388
1	33	1	590	520	1	78	2	310	1048	1	99	2	668	1406
1	34	1	610	540	1	79	2	325	1063	1	100	2	680	1418
1	35	1	614	544	1	80	2	345	1083	1	101	2	694	1432
5	40	1	635	565	1	81	2	362	1100	1	102	2	710	1448

Test Started at	0.00	m
Operator	WH	
Checked by	JK	

Rod No.	Zero Reading (mm)
1	70
2	0

Depth bgl (mm)		Blows No.		DCP	CBR %
Top	Base	Top	Base	mm/blow	
0	230	0	6	38	6.4
230	302	6	23	4	65.7
302	370	23	28	14	19.1
370	540	28	34	28	8.8
540	610	34	50	4	63.5
610	1538	50	107	16	15.8



Remarks

CBR estimated using the correlation in the HA Manual for Roads and Bridges, CS229, Rev. 0, 2020
 Dynamic Cone Penetration Test DCP11 located immediately adjacent to Hand-dug Trial Pit HD03.
 Co-ordinates - 378681.7mE, 407533.1mN. Ground Level - 70.30m OD.

Printed: 09/06/2022

GEOTECHNICS



In Situ Testing - Dynamic Cone Penetration Test

Project STAR RADCLIFFE

Location No. DCP11

Client DEPARTMENT FOR EDUCATION

Project No. PN224390

Coordinates 378681.7 E, 407533.1 N

Ground Level 70.30 m OD

Test No. 1

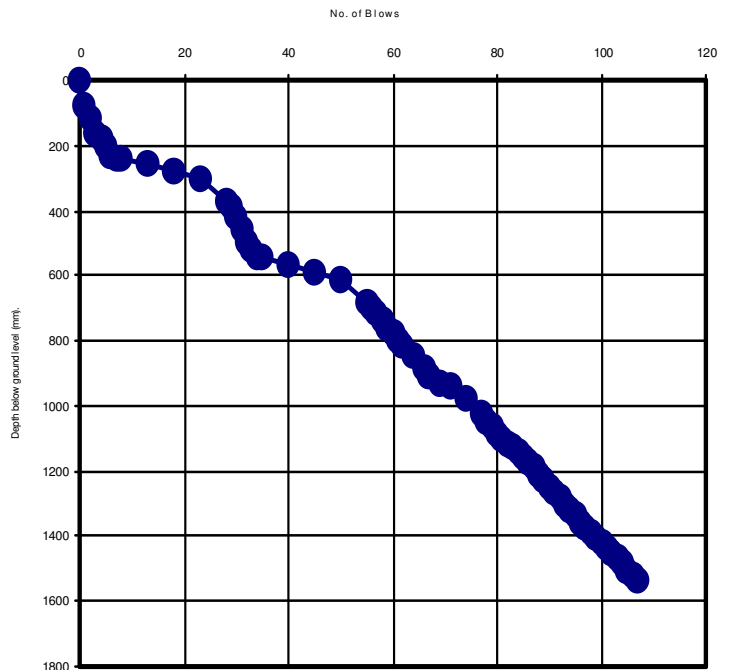
Test Date 13/05/2022

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
1	103	2	730	1468
1	104	2	746	1484
1	105	2	765	1503
1	106	2	780	1518
1	107	2	800	1538

Test Started at	0.00 m
Operator	WH
Checked by	JK

Rod No.	Zero Reading (mm)
1	70
2	0

Depth bgl (mm)		Blows No.		DCP mm/blow	CBR %
Top	Base	Top	Base		
0	230	0	6	38	6.4
230	302	6	23	4	65.7
302	370	23	28	14	19.1
370	540	28	34	28	8.8
540	610	34	50	4	63.5
610	1538	50	107	16	15.8



Remarks

Printed: 09/06/2022

CBR estimated using the correlation in the HA Manual for Roads and Bridges, CS229, Rev. 0, 2020
 Dynamic Cone Penetration Test DCP11 located immediately adjacent to Hand-dug Trial Pit HD03.
 Co-ordinates - 378681.7mE, 407533.1mN. Ground Level - 70.30m OD.

GEOTECHNICS



In Situ Testing - Dynamic Cone Penetration Test

Project STAR RADCLIFFE

Location No. DCP13

Client DEPARTMENT FOR EDUCATION

Project No. PN224390

Coordinates 378721.1 E, 407509.6 N

Ground Level 70.64 m OD

Test No. 1

Test Date 25/05/2022

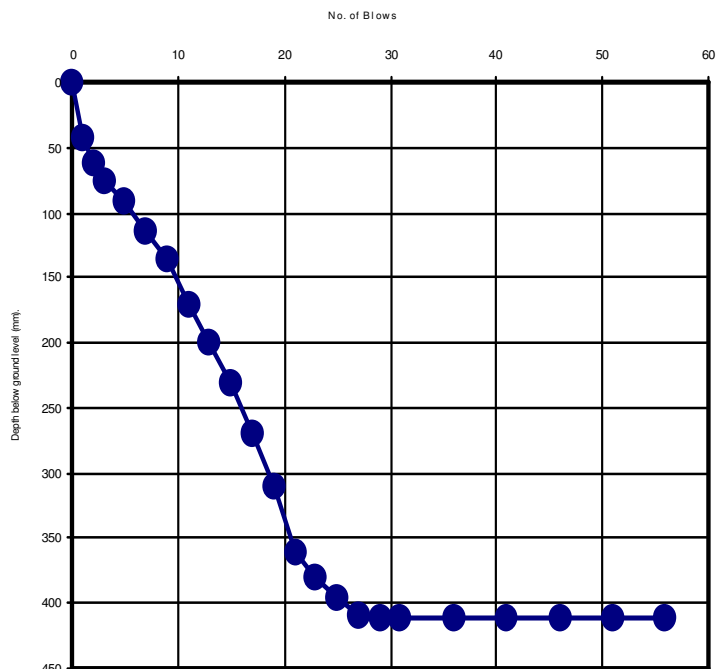
Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
0	0	1	40	0
1	1	1	82	42
1	2	1	102	62
1	3	1	116	76
2	5	1	132	92
2	7	1	155	115
2	9	1	176	136
2	11	1	210	170
2	13	1	240	200
2	15	1	270	230
2	17	1	310	270
2	19	1	350	310
2	21	1	400	360
2	23	1	420	380
2	25	1	436	396
2	27	1	450	410
2	29	1	451	411
2	31	1	452	412
5	36	1	452	412
5	41	1	452	412
5	46	1	452	412

Blows No.	Blows Total	Rod No.	Reading (mm)	Corrected Depth (mm)
5	51	1	452	412
5	56	1	452	412

Test Started at	0.00	m
Operator	WH	
Checked by	JK	

Rod No.	Zero Reading (mm)
1	40

Depth bgl (mm)		Blows No.		DCP mm/blow	CBR %
Top	Base	Top	Base		
0	62	0	2	31	8.0
62	136	2	9	11	25.0
136	360	9	21	22	11.3
360	412	21	31	5	52.9
412	412	31	56		



Remarks

Printed: 09/06/2022

CBR estimated using the correlation in the HA Manual for Roads and Bridges, CS229, Rev. 0, 2020
 Dynamic Cone Penetration Test DCP13 located immediately adjacent to Hand-dug Trial Pit HD04.
 Co-ordinates - 378721.1mE, 407509.6mN. Ground Level - 70.64m OD.

GEOTECHNICS



APPENDIX 12

Monitoring Results

FIELDWORK – Water Level Monitoring

ProjectSTAR RADCLIFFE

Project NoPN224390

ClientDEPARTMENT FOR EDUCATION

Sheet No1

Borehole		BH01		BH02		BH02		BH03A		BH04			
Instrument (dia. mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)		S (50mm)			
Depth to Base (m)		4.00		4.00		15.00		4.00		2.50			
Filter Zone (m)		1.00-4.00		1.00-4.00		14.00-15.00		1.00-4.00		1.00-3.50			
Level		75.71 m OD		74.28 m OD		74.28 m OD		74.23 m OD		71.04 m OD			
Date	Time	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level	Depth (m)	Level
16 Jun 2022		1.52	74.19	0.88	73.40	1.75	72.53	2.18	72.05	DRY			
24 Jun 2022		1.62	74.09	0.85	73.43	1.75	72.53	2.15	72.08	1.78	69.26		
30 Jun 2022		1.71	74.00	1.03	73.25	1.90	72.38	2.22	72.01	1.77	69.27		
7 Jul 2022		1.78	73.93	1.08	73.20	1.84	72.44	2.20	72.03	1.74	69.30		
13 Jul 2022		1.88	73.83	1.30	72.98	1.95	72.33	2.28	71.95	1.78	69.26		
20 Jul 2022		1.96	73.75	1.32	72.96	8.50	65.78	2.32	71.91	1.80	69.24		

Remarks

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

16/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (1 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☒

Slight ☐

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Water Sample Taken (Yes/No)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Carbon Dioxide (Peak) (% VOL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak) (% VOL)	Remarks
BH01	4.00	1.52	No	0.0	0.0	0.1	0.1	20.3	
BH02	(P1) 4.00	0.88	No	0.0	0.0	0.1	0.1	20.2	
BH02	(P2) 15.00		No	0.0	0.0	0.1	0.1	20.3	
BH03A	4.00	2.18	No	0.1	0.0	2.4	2.4	17.2	
BH04	2.50	DRY	No	0.0	0.0	0.0	0.0	20.2	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

16/06/2022

Client **DEPARTMENT FOR EDUCATION**

1 (2 of 3)

Equipment Used

MK1 ☐MK2 ☐GA2000 ☐

Other GA5000;

Weather / Site Conditions

Still ☐

Light

x

Moderate ☐

Strong ☐

None ☒ x

Slight ☐

Cloudy ☐

Overcast ☐

Dry x

Slight ☐

Moderate ☐Heavy ☐

Borehole	Depth to Base (m)	Oxygen (Steady) (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mbar)	Air Temp. (DegC)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH01	4.00	20.3	0	0	1014	20.00	0.0	0.0	
BH02	(P1) 4.00	20.2	0	0	1014	20.00	0.1	0.1	
BH02	(P2) 15.00	20.3	0	0	1014	20.00	0.0	0.0	
BH03A	4.00	17.2	0	1	1014	20.00	0.1	0.0	
BH04	2.50	20.2	0	0	1014	20.00	0.0	0.0	

Remarks

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

16/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (3 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☒

Slight ☐

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Wind ()	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
BH01	4.00	Light	None	Dry	GA5000	BT	
BH02	(P1) 4.00	Light	None	Dry	GA5000	BT	
BH02	(P2) 15.00	Light	None	Dry	GA5000	BT	
BH03A	4.00	Light	None	Dry	GA5000	BT	
BH04	2.50	Light	None	Dry	GA5000	BT	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

16/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (1 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☒

Slight ☐

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Water Sample Taken (Yes/No)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Carbon Dioxide (Peak) (% VOL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak) (% VOL)	Remarks
BH01	4.00	1.52	No	0.0	0.0	0.1	0.1	20.3	
BH02	(P1) 4.00	0.88	No	0.0	0.0	0.1	0.1	20.2	
BH02	(P2) 15.00		No	0.0	0.0	0.1	0.1	20.3	
BH03A	4.00	2.18	No	0.1	0.0	2.4	2.4	17.2	
BH04	2.50	DRY	No	0.0	0.0	0.0	0.0	20.2	

Remarks

geotechnics

Form 002/3

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

16/06/2022

Client **DEPARTMENT FOR EDUCATION**

Sheet No.

1 (2 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐MK2 ☐GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☒

Slight ☐

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐Heavy ☐

Borehole	Depth to Base (m)	Oxygen (Steady) (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mbar)	Air Temp. (DegC)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH01	4.00	20.3	0	0	1014	20.00	0.0	0.0	
BH02	(P1) 4.00	20.2	0	0	1014	20.00	0.1	0.1	
BH02	(P2) 15.00	20.3	0	0	1014	20.00	0.0	0.0	
BH03A	4.00	17.2	0	1	1014	20.00	0.1	0.0	
BH04	2.50	20.2	0	0	1014	20.00	0.0	0.0	

Remarks



Form 002/3

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

16/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (3 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☒

Slight ☐

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Wind ()	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
BH01	4.00	Light	None	Dry	GA5000	BT	
BH02	(P1) 4.00	Light	None	Dry	GA5000	BT	
BH02	(P2) 15.00	Light	None	Dry	GA5000	BT	
BH03A	4.00	Light	None	Dry	GA5000	BT	
BH04	2.50	Light	None	Dry	GA5000	BT	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

24/06/2022

Client **DEPARTMENT FOR EDUCATION**

1 (1 of 3)

Equipment Used

MK1 ☐MK2 ☐GA2000 ☐

Other **GFM436;**

Weather / Site Conditions

Still ☐

Light ☒

Moderate ☐

Strong ☐

None ☐

Slight ☐

Cloudy ☒

Overcast ☐

Dry ☐ x

Slight ☐

Moderate ☐Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Water Sample Taken (Yes/No)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Carbon Dioxide (Peak) (% VOL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak) (% VOL)	Remarks
BH01	4.00	1.62	No	0.0	0.0	0.1	0.1	19.3	
BH02	(P1) 4.00	0.85	No	0.0	0.0	0.0	0.0	19.7	
BH02	(P2) 15.00	1.75	No	0.0	0.0	0.0	0.0	19.8	
BH03A	4.00	2.15	No	0.0	0.0	1.0	1.0	18.8	
BH04	2.50	1.78	No	0.0	0.0	0.7	0.7	19.1	

Remarks

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

24/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (2 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GFM436;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☐

Slight ☐

Cloudy ☒

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Oxygen (Steady) (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mbar)	Air Temp. (DegC)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH01	4.00	19.3	0	0	990	20.00	0.0	0.0	
BH02	(P1) 4.00	19.7	0	0	990	20.00	0.0	0.0	
BH02	(P2) 15.00	19.8	0	0	990	20.00	0.0	0.0	
BH03A	4.00	18.8	0	0	990	20.00	0.0	0.0	
BH04	2.50	19.1	0	0	990	20.00	0.0	0.0	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

24/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (3 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GFM436;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☐

Slight ☐

Cloudy ☒

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Wind ()	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
BH01	4.00	Light	Cloudy	Dry	GFM436	WH	
BH02	(P1) 4.00	Light	Cloudy	Dry	GFM436	WH	
BH02	(P2) 15.00	Light	Cloudy	Dry	GFM436	WH	
BH03A	4.00	Light	Cloudy	Dry	GFM436	WH	
BH04	2.50	Light	Cloudy	Dry	GFM436	WH	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

30/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (1 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GFM436;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☒

Slight ☐

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Water Sample Taken (Yes/No)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Carbon Dioxide (Peak) (% VOL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak) (% VOL)	Remarks
BH01	4.00	1.71	Yes	0.0	0.0	0.3	0.3	19.9	Water samples taken on 01.07.2022 as insufficient recharge on 30.06.2022 following low flow purging.
BH02	(P1) 4.00	1.03	Yes	0.0	0.0	0.1	0.1	19.9	
BH02	(P2) 15.00	1.90	Yes	0.0	0.0	0.1	0.1	19.8	
BH03A	4.00	2.22	Yes	0.0	0.0	2.7	2.7	18.2	
BH04	2.50	1.77	Yes	0.0	0.0	1.7	1.7	19.3	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

30/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (2 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GFM436;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☒

Slight ☐

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Oxygen (Steady) (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mbar)	Air Temp. (DegC)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH01	4.00	19.9	0	0	1002	20.00	-0.3	0.0	Water samples taken on 01.07.2022 as insufficient recharge on 30.06.2022 following low flow purging.
BH02	(P1) 4.00	19.9	0	0	1002	20.00	0.5	0.5	
BH02	(P2) 15.00	19.8	0	0	1002	20.00	0.4	0.4	
BH03A	4.00	18.2	0	1	1002	20.00	0.3	0.3	
BH04	2.50	19.3	0	0	1002	20.00	0.7	0.7	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

30/06/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (3 of 3)

Equipment Used							
GI Infra Red Gas Analyser		MK1	☐	MK2	☐	GA2000	☐
Other GFM436;							
Weather / Site Conditions							
Wind		Still	☐	Light	☒	Moderate	☐
Cloud Cover		None	☒	Slight	☐	Cloudy	☐
Precipitation		Dry	☒	Slight	☐	Moderate	☐
Heavy		☐					
Borehole	Depth to Base (m)	Wind	Cloud	Rain	Equipment Used	Monitored by	Remarks
BH01	4.00	Light	None	Dry	GFM436	JG	Water samples taken on 01.07.2022 as insufficient recharge on 30.06.2022 following low flow purging.
BH02	(P1) 4.00	Light	None	Dry	GFM436	JG	
BH02	(P2) 15.00	Light	None	Dry	GFM436	JG	
BH03A	4.00	Light	None	Dry	GFM436	JG	
BH04	2.50	Light	None	Dry	GFM436	JG	

Remarks

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

07/07/2022

Client **DEPARTMENT FOR EDUCATION**

1 (1 of 3)

Equipment Used

MK1 ☐MK2 ☐GA2000 ☐

Other GA5000;

Weather / Site Conditions

Still ☐

Light ☒Moderate ☐

Strong ☐

None ☐

Slight ☒

Cloudy ☐

Overcast ☐

Dry x

Slight ☐

Moderate ☐Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Water Sample Taken (Yes/No)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Carbon Dioxide (Peak) (% VOL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak) (% VOL)	Remarks
BH01	4.00	1.78	No	0.0	0.0	1.2	1.1	10.6	
BH02	(P1) 4.00	1.08	No	0.0	0.0	0.3	0.2	19.2	
BH02	(P2) 15.00	1.84	No	0.0	0.0	0.1	0.1	19.8	
BH03A	4.00	2.20	No	0.0	0.0	2.6	2.6	18.0	
BH04	2.50	1.74	No	0.0	0.0	1.7	1.7	18.7	

Remarks

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

07/07/2022

Client **DEPARTMENT FOR EDUCATION**

1 (2 of 3)

Equipment Used

MK1 ☐MK2 ☐GA2000 ☐

Other GA5000;

Weather / Site Conditions

Still ☐

Light ☒

Moderate ☐

Strong ☐

None ☐

Slight ☒

Cloudy ☐

Overcast ☐

Dry ☐

Slight ☐

Moderate ☐Heavy ☐

Borehole	Depth to Base (m)	Oxygen (Steady) (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mbar)	Air Temp. (DegC)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH01	4.00	10.6	0	3	1025	19.00	-17.5	-9.7	
BH02	(P1) 4.00	19.0	0	0	1025	19.00	0.4	0.4	
BH02	(P2) 15.00	19.7	0	1	1025	19.00	0.4	0.4	
BH03A	4.00	18.0	0	1	1025	19.00	0.2	0.1	
BH04	2.50	18.7	0	0	1025	19.00	0.4	0.3	

Remarks

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

07/07/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (3 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☐

Slight ☒

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Wind ()	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
BH01	4.00	Light	Slight	Dry	GA5000	AC	
BH02	(P1) 4.00	Light	Slight	Dry	GA5000	AC	
BH02	(P2) 15.00	Light	Slight	Dry	GA5000	AC	
BH03A	4.00	Light	Slight	Dry	GA5000	AC	
BH04	2.50	Light	Slight	Dry	GA5000	AC	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

13/07/2022

Client **DEPARTMENT FOR EDUCATION**

1 (1 of 3)

Equipment Used

MK1 ☐MK2 ☐GA2000 ☐

Other GA5000;

Weather / Site Conditions

Still ☐

Light ☒

Moderate ☐

Strong ☐

None ☐

Slight ☒

Cloudy ☐

Overcast ☐

Dry ☐

Slight ☐

Moderate ☐Heavy ☐[illegible]

Remarks

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

13/07/2022

Client **DEPARTMENT FOR EDUCATION**

1 (2 of 3)

Equipment Used

GA2000 ☐

Other **GA5000;**

Weather / Site Conditions

Strong ☐

Overcast ☐Heavy ☐

Borehole	Depth to Base (m)	Oxygen (Steady) (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Barometric Pressure (mbar)	Air Temp. (DegC)	Flow Rate (Peak) (l/hr)	Flow Rate (Steady) (l/hr)	Remarks
BH01	4.00	19.5	0	0	1014	18.00	0.0	0.0	
BH02	(P1) 4.00	15.3	0	0	1014	18.00	0.0	0.0	
BH02	(P2) 15.00	19.9	0	0	1014	18.00	0.0	0.0	
BH03A	4.00	18.9	0	0	1014	18.00	0.0	0.0	
BH04	2.50	16.4	0	0	1014	18.00	0.0	0.0	

Remarks



Form 002/3

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

13/07/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (3 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☐

Slight ☒

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

Borehole	Depth to Base (m)	Wind ()	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
BH01	4.00	Light	Slight	Dry	GA5000	BT	
BH02	(P1) 4.00	Light	Slight	Dry	GA5000	BT	
BH02	(P2) 15.00	Light	Slight	Dry	GA5000	BT	
BH03A	4.00	Light	Slight	Dry	GA5000	BT	
BH04	2.50	Light			GA5000	BT	

Remarks

geotechnics

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

1 (1 of 3)

Client **DEPARTMENT FOR EDUCATION**

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐MK2 ☐GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light	x
-------	---

Moderate

Strong ☐

Cloud Cover

None ☐

Slight	x
--------	---

Cloudy ☐

Overcast	
----------	--

Precipitation

Dry	x
-----	---

Slight ☐

Moderate ☐Heavy ☐

Borehole	Depth to Base (m)	Depth to Water (m bgl)	Water Sample Taken (Yes/No)	Methane (Peak) CH4 (% VOL)	Methane (Steady) CH4 (% VOL)	Carbon Dioxide (Peak) (% VOL)	Carbon Dioxide (Steady) (% VOL)	Oxygen (Peak) (% VOL)	Remarks
BH01	4.00	1.96	No	0.0	0.0	2.4	2.4	6.1	
BH02	(P1) 4.00	1.32	No	0.0	0.0	0.8	0.7	19.4	
BH02	(P2) 15.00	8.50	No	0.0	0.0	0.2	0.2	20.1	
BH03A	4.00	2.32	No	0.0	0.0	4.0	4.0	15.4	
BH04	2.50	1.80	No	0.0	0.0	2.9	2.9	17.9	

Remarks



Form 002/3

FIELDWORK - Insitu Gas Monitoring - Daily Record

Project STAR RADCLIFFE

Project No

PN224390

Date

20/07/2022

Client DEPARTMENT FOR EDUCATION

Sheet No.

1 (3 of 3)

Equipment Used

GI Infra Red Gas Analyser

MK1 ☐

MK2 ☐

GA2000 ☐

Other GA5000;

Weather / Site Conditions

Wind

Still ☐

Light ☒

Moderate ☐

Strong ☐

Cloud Cover

None ☐

Slight ☒

Cloudy ☐

Overcast ☐

Precipitation

Dry ☒

Slight ☐

Moderate ☐

Heavy ☐

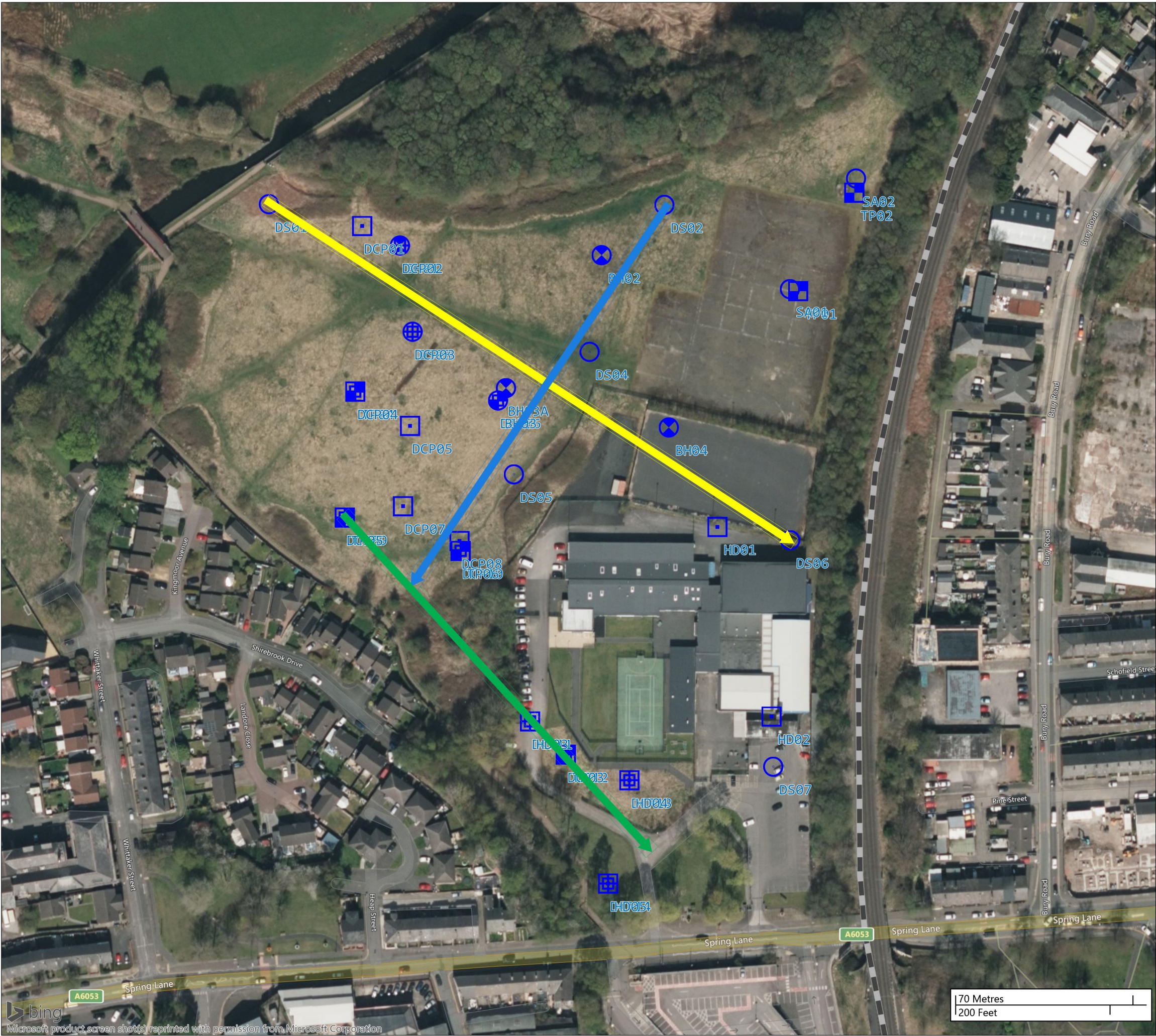
Borehole	Depth to Base (m)	Wind ()	Cloud ()	Rain ()	Equipment Used ()	Monitored by ()	Remarks
BH01	4.00	Light	Slight	Dry	GA5000	BT	
BH02	(P1) 4.00	Light	Slight	Dry	GA5000	BT	
BH02	(P2) 15.00	Light	Slight	Dry	GA5000	BT	
BH03A	4.00	Light	Slight	Dry	GA5000	BT	
BH04	2.50	Light	Slight		GA5000	BT	

Remarks

geotechnics

APPENDIX 13

Ground Model Cross Sections and Rockhead Depth Diagram



Legend

- Sections - A - A'
- Sections - B - B'
- Sections - C - C'
- Locations By Type - CP
- Locations By Type - CP+RC
- Locations By Type - DCP
- Locations By Type - DS
- Locations By Type - HP
- Locations By Type - IP
- Locations By Type - SOAK
- Locations By Type - TP

GEOTECHNICS
geotechnical and geoenvironmental specialists

Unit 1B Borders Industrial Park
River Lane
Saltney
Chester CH4 8RJ

Phone: 01244 671117
Email: mail@geotechnics.co.uk
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Engineer:
MOTT MACDONALD LIMITED

Client:
DEPARTMENT FOR EDUCATION

Project:
STAR RADCLIFFE

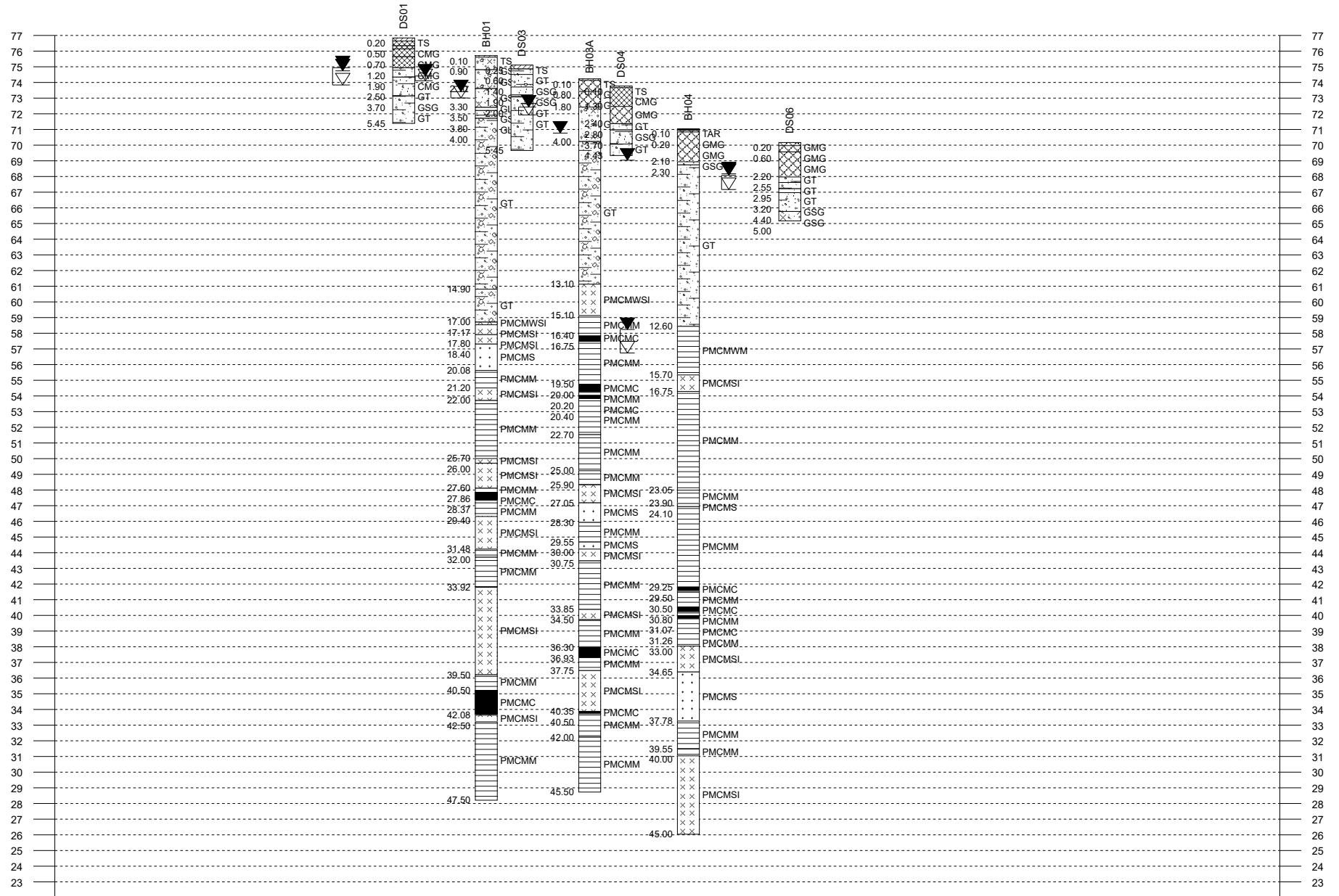
Drawing Title:
Exploratory Hole Location Plan

Scale: 1:1500 at A3	Date: 13/06/2022
Project No.: PN224390	Exploratory Hole Location Plan

Project: STAR RADCLIFFE	Title: Section A - A'	Unit 1B Borders Industrial Park River Lane Saltney Chester CH4 8RJ	Phone: 01244 671117 Email: mail@geotechnics.co.uk www.geotechnics.co.uk	 geotechnical and geoenvironmental specialists
	Vertical Scale: 1:350			
Project No.: PN224390	Horizontal Scale: 1:3500			
Client: DEPARTMENT FOR EDUCATION	Engineer: MOTT MACDONALD LIMITED			

Legend Key

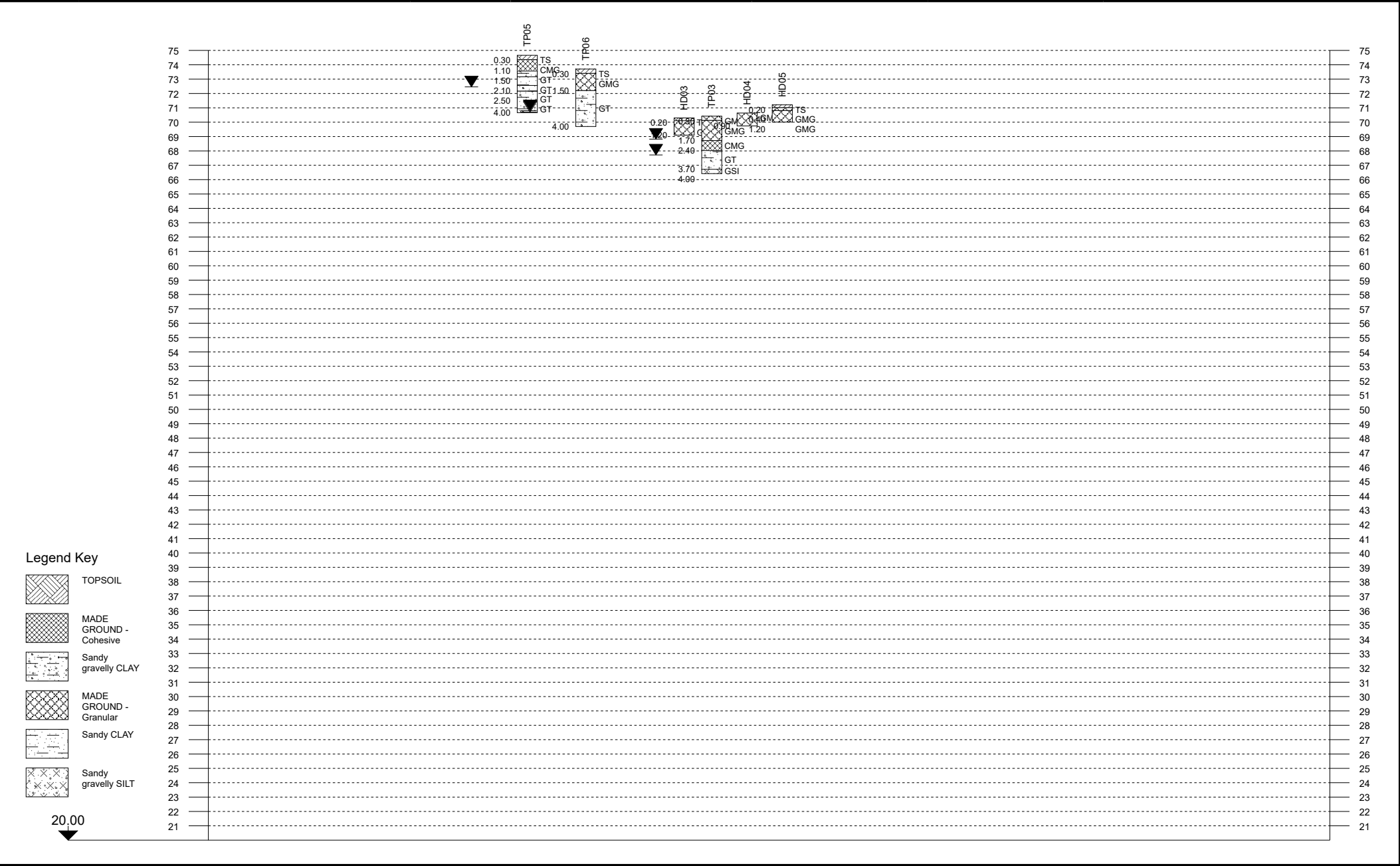
	TOPSOIL
	MADE GROUND - Cohesive
	Silty sandy cobbly GRAVEL
	Sandy gravelly CLAY
	Clayey gravelly cobbly SAND
	Clayey gravelly SAND
	MADE GROUND - Granular
	Clayey SAND
	Silty SAND
	Sandy CLAY
	CLAY
	Silty sandy gravelly cobbly CLAY
	Asphalt
	Silty sandy GRAVEL
	SILTSTONE
	MUDSTONE
	COAL
	SANDSTONE

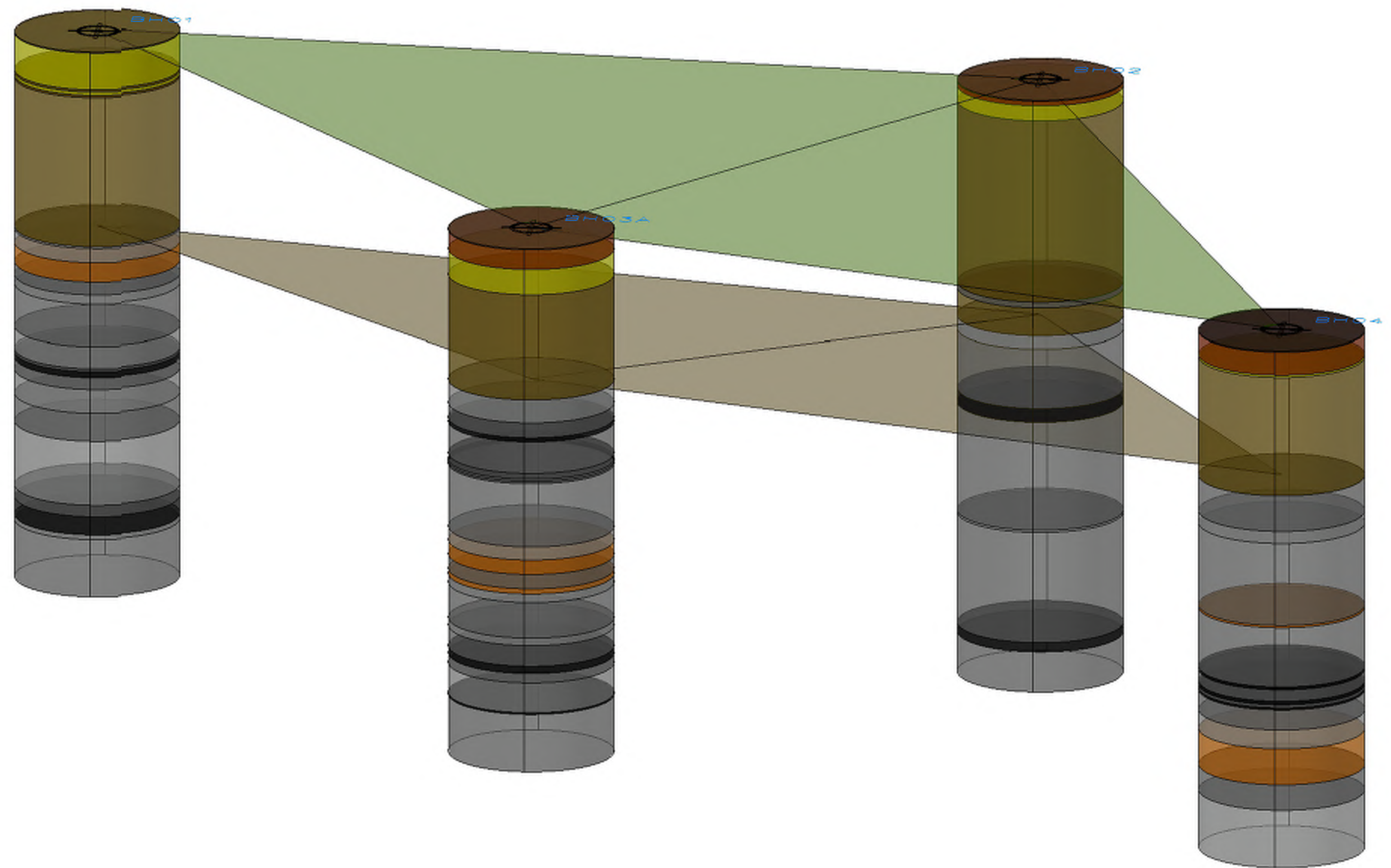


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Project:	STAR RADCLIFFE	Title:	Section C - C'	Unit 1B Borders Industrial Park River Lane Saltney Chester CH4 8RJ	Phone:	01244 671117		
		Vertical Scale:	1:350					
Project No.:	PN224390	Horizontal Scale:	1:3500			Email:		mail@geotechnics.co.uk
Client:	DEPARTMENT FOR EDUCATION	Engineer:	MOTT MACDONALD LIMITED					www.geotechnics.co.uk





Legend		
	CMG	COHESIVE MADE GROUND
	CONC	CONCRETE
	GG	GLACIAL GRAVEL
	GLC	GLACIAL LAMINATED CLAY
	GMG	GRANULAR MADE GROUND
	GSG	GLACIAL SAND AND GRAVEL
	GSI	GLACIAL SILT
	GT	GLACIAL TILL
	PMCMC	PENNINE MIDDLE CMF - COAL
	PMCM	PENNINE MIDDLE CMF - MUDSTONE
	PMCMS	PENNINE MIDDLE CMF - SANDSTONE
	PMCMSI	PENNINE MIDDLE CMF - SILTSTONE
	PMCMWM	PENNINE MIDDLE CMF - WEATHERED MUDSTONE
	PMCMWSI	PENNINE MIDDLE CMF - WEATHERED SILTSTONE
	TAR	TARMACADAM
	TS	TOPSOIL

GEOTECHNICS
geotechnical and geoenvironmental specialists

The Geotechnical Centre, Unit 1, Borders Industrial Park, River Lane, Saltness, Chester CH4 8RJ	Phone: 01244 671117 Fax: 01224 671122 Email: mail@geotechnics.co.uk www.geotechnics.co.uk
---	--

Engineer:
MOTT MACDONALD LIMITED

Client:
DEPARTMENT FOR EDUCATION

Project:
STAR RADCLIFFE

Drawing Title:
Rockhead Depth Diagram

Scale: 1:250@A1	Date: June 2022
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Project No: PN224390	File Name: Geo-PN224390-RH001
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APPENDIX I4

Laboratory Test Results - Geotechnical



LABORATORY REPORT



4043

Contract Number: PSL22/3908

Report Date: 30 June 2022

Client's Reference: PN224390

Client Name: Geotechnics Chester
The Geotechnical Centre
Unit 1 Borders Industrial Park
River Lane, Saltney
Chester
CH4 8RJ

For the attention of: John Knowles

Contract Title: Star Radcliffe

Date Received: 6/6/2022

Date Commenced: 6/6/2022

Date Completed: 30/6/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH01		B	0.50	1.20	Brown silty fine to coarse SAND and fine to coarse GRAVEL with a high cobble content.
BH01		B	1.20	1.65	Brown very sandy very silty fine to coarse GRAVEL with a medium cobble content.
BH01		B	2.00	2.45	Brown very silty fine to medium SAND with traces of fine gravel.
BH01		D	3.80		Stiff laminated brown mottled greyish brown slightly sandy CLAY with occasional lenses of sand.
BH01		D	4.00	4.45	Stiff brown slightly sandy slightly gravelly CLAY.
BH01		D	5.00	5.45	Stiff brown slightly sandy slightly gravelly CLAY.
BH01		UT	6.50	6.95	Stiff high strength brown slightly sandy slightly gravelly CLAY.
BH01		UT	9.50	9.95	Very stiff very high strength brown slightly sandy slightly gravelly CLAY.
BH02		B	0.50	1.20	Brown mottled light grey gravelly very clayey fine to coarse SAND.
BH02		B	1.20	1.65	Brown mottled light grey gravelly very clayey fine to coarse SAND.
BH02		D	1.80		Stiff brownish grey slightly gravelly sandy CLAY.
BH02		UT	2.00	2.45	Stiff brownish grey slightly gravelly sandy CLAY.
BH02		B	3.00	3.45	Stiff brownish grey slightly sandy slightly gravelly CLAY.
BH02		UT	5.00	5.45	Very stiff very high strength brown mottled red and yellow slightly sandy slightly gravelly CLAY.
BH02		D	6.50	6.95	Stiff brown slightly sandy slightly gravelly CLAY.
BH02		UT	8.00	8.45	Stiff high strength brown slightly sandy slightly gravelly CLAY.
BH02		D	9.50	9.95	Stiff brown slightly sandy slightly gravelly CLAY.
BH02		UT	11.00	11.45	Very stiff very high strength brown slightly sandy slightly gravelly CLAY.
BH02		UT	14.00	14.45	Very stiff very high strength brown slightly sandy slightly gravelly CLAY.



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Professional Soils Laboratory

Star Radcliffe

Contract No:

PSL22/3908

Client Ref:

PN224390

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH02		UT	17.00	17.45	Very stiff medium strength brown slightly sandy slightly gravelly CLAY with occasional band of silt.
BH02		UT	20.00	20.45	Very stiff low strength brown slightly sandy slightly gravelly CLAY with occasional pockets of silt.
BH03		B	0.80	1.20	MADE GROUND: Dark brown/black very sandy very clayey gravel of ash, mudstone and sandstone.
BH03A		B	1.20	1.65	MADE GROUND: Dark brown/black very gravelly very clayey sand of mudstone and brick fragments.
BH03A		B	2.00	2.45	Dark brown very sandy clayey fine to coarse GRAVEL of mudstone, siltstone and sandstone.
BH03A		D	4.00	4.43	Stiff brown occasionally mottled reddish brown slightly sandy slightly gravelly CLAY.
BH03A		UT	5.00	5.45	Stiff brown occasionally mottled reddish brown slightly sandy slightly gravelly CLAY.
BH03A		D	6.50	6.95	Stiff brown slightly sandy slightly gravelly CLAY.
BH03A		UT	8.00	8.45	Stiff high strength brown slightly sandy slightly gravelly CLAY.
BH03A		UT	11.00	11.45	Very stiff very high strength brown slightly sandy slightly gravelly CLAY.
BH04		B	0.60	1.20	MADE GROUND: Black/dark brown sandy clayey gravel of ash, sandstone and brick fragments.
BH04		B	1.20	1.65	MADE GROUND: Black/dark brown very sandy clayey gravel of ash and brick. High cobble content.
BH04		UT	3.00	3.45	Stiff brown mottled reddish brown and yellow slightly sandy slightly gravelly CLAY.
BH04		D	3.50		Stiff brown mottled reddish brown and yellow slightly sandy slightly gravelly CLAY.
BH04		D	4.00	4.45	Very stiff brown slightly sandy slightly gravelly CLAY.
BH04		UT	5.00	5.45	Very stiff very high strength brown slightly sandy slightly gravelly CLAY.
BH04		UT	8.00	8.45	Stiff high strength brown slightly sandy slightly gravelly CLAY.
BH04		UT	11.00	11.45	Very stiff very high strength brown slightly sandy slightly gravelly CLAY.
DCP01		B	0.30	0.70	MADE GROUND: Brown gravelly fine to coarse sand including mudstone, coal and brick fragments.



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Client Ref:

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
DCP01		B	0.70	1.20	MADE GROUND: Brown slightly sandy silty clay.
DCP05		B	0.20	0.80	MADE GROUND: Black/dark brown sand and gravel including ceramic and brick fragments.
DCP05		B	0.80	1.20	MADE GROUND: Black/dark brown organic very gravelly very clayey sand with brick fragments.
DCP07		B	0.20	0.80	MADE GROUND: Black/dark brown very gravelly very clayey sand with ceramic and brick fragments.
DCP07		B	0.90	1.20	Firm to stiff yellowish brown slightly sandy slightly gravelly CLAY.
DCP08		B	0.20	0.80	MADE GROUND: Black/dark brown very clayey sand and gravel with brick. Medium cobble content.
DCP08		D	1.00		Firm yellowish brown slightly sandy slightly gravelly CLAY.
DS02		B	1.20	2.00	Orangish brown very sandy clayey fine to coarse GRAVEL (Possible Made Ground).
DS02		D	2.00	2.45	Firm dark grey slightly sandy slightly gravelly CLAY.
DS03		B	0.60	1.20	Dark brown very gravelly clayey fine to coarse SAND. High cobble content (Possible Made Ground).
DS03		B	2.00	3.00	Firm dark brown slightly gravelly sandy CLAY.
DS03		D	3.80	4.00	Dark brown slightly gravelly sandy SILT.
DS03		D	4.80	5.00	Dark brown slightly gravelly sandy SILT.
DS04		B	1.30	2.00	MADE GROUND: Brownish grey gravelly very clayey fine to coarse sand including brick fragments.
DS04		B	2.40	2.80	Firm to stiff dark brown slightly sandy slightly gravelly CLAY (Possible Made Ground).
DS04		B	2.80	3.70	Dark brown gravelly very clayey fine to coarse SAND including coal (Possible Made Ground).
DS04		D	3.70	4.00	Firm to stiff dark brown slightly sandy slightly gravelly CLAY.
DS05		B	0.30	1.20	MADE GROUND: Black very sandy silty fine to coarse gravel with concrete and brick fragments.
DS05		B	2.00	2.70	Yellow and black clayey fine to coarse SAND and fine to coarse GRAVEL (Possible Made Ground).



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Contract No:

PSL22/3908

Client Ref:

PN224390

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
DS05		B	3.00	3.90	Brownish grey clayey fine to coarse SAND and fine to coarse GRAVEL.
DS06		B	0.60	1.20	MADE GROUND: Dark grey very sandy slightly silty fine to coarse gravel of ash, sandstone and coal.
HD01		B	0.60	1.20	MADE GROUND: Black very sandy silty gravel with ash and glass. Medium cobble content.
HD03		B	0.80	1.20	MADE GROUND: Firm dark brown slightly sandy slightly gravelly clay.
HD04		B	0.40	0.80	MADE GROUND: Black/dark brown very sandy silty fine to coarse gravel with brick fragments.
HD05		B	0.80	1.20	MADE GROUND: Black very sandy silty fine to coarse gravel with occasional wood fragments.
TP01		B	0.60	0.90	MADE GROUND: Dark brown very sandy clayey fine to coarse gravel of limestone.
TP01		D	1.50		Firm to stiff greyish brown slightly sandy slightly gravelly CLAY.
TP02		B	0.40	0.60	MADE GROUND: Dark grey very sandy clayey gravel with clinker and brick fragments.
TP02		D	1.60		Firm to stiff brownish grey slightly sandy slightly gravelly CLAY.
TP03		B	1.40	1.50	MADE GROUND: Black very gravelly very clayey fine to coarse sand of ash, with coal and clinker.
TP03		D	2.00		MADE GROUND: Firm dark grey slightly sandy slightly gravelly clay including brick fragments.
TP03		D	3.00		Firm light brown slightly sandy slightly gravelly CLAY.
TP04		B	0.40	0.60	Light brown silty fine to coarse SAND and fine to coarse GRAVEL.
TP04		B	1.40	1.60	Firm light brownish grey slightly sandy slightly gravelly CLAY.
TP04		D	3.00		Soft light brownish grey slightly sandy slightly gravelly CLAY.
TP05		D	0.50		MADE GROUND: Firm dark grey/black slightly sandy slightly gravelly clay with brick fragments.
TP05		D	1.20		Firm light brown slightly sandy slightly gravelly CLAY.
TP05		D	2.50		Stiff brownish grey slightly sandy slightly gravelly CLAY.



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Contract No:

PSL22/3908

Client Ref:

PN224390

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

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Star Radcliffe

Contract No:

PSL22/3908

Client Ref:**PN224390**

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BH01		D	3.80		17			31	15	16	98	Low Plasticity CL
BH01		D	4.00	4.45	10			27	13	14	73	Low Plasticity CL
BH01		D	5.00	5.45	13			30	14	16	75	Low Plasticity CL
BH02		D	1.80		15			29	13	16	67	Low Plasticity CL
BH02		UT	2.00	2.45			2.64					
BH02		B	3.00	3.45	15			26	12	14	85	Low Plasticity CL
BH02		D	6.50	6.95	11			32	15	17	71	Low Plasticity CL
BH02		D	9.50	9.95	12			30	15	15	80	Low Plasticity CL
BH03A		D	4.00	4.43	12			25	12	13	74	Low Plasticity CL
BH03A		UT	5.00	5.45			2.66					
BH03A		D	6.50	6.95	12			34	17	17	69	Low Plasticity CL
BH04		D	3.50		13			31	16	15	62	Low Plasticity CL
BH04		D	4.00	4.45	13			28	13	15	65	Low Plasticity CL
DCP07		B	0.90	1.20	20			36	19	17	81	Intermediate Plasticity CI
DCP08		D	1.00		26			42	21	21	96	Intermediate Plasticity CI
DS02		D	2.00	2.45	13			27	13	14	82	Low Plasticity CL
DS03		B	2.00	3.00	16			28	15	13	79	Low Plasticity CL
DS03		D	3.80	4.00	16				NP			
DS03		D	4.80	5.00	14				NP			

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



4043

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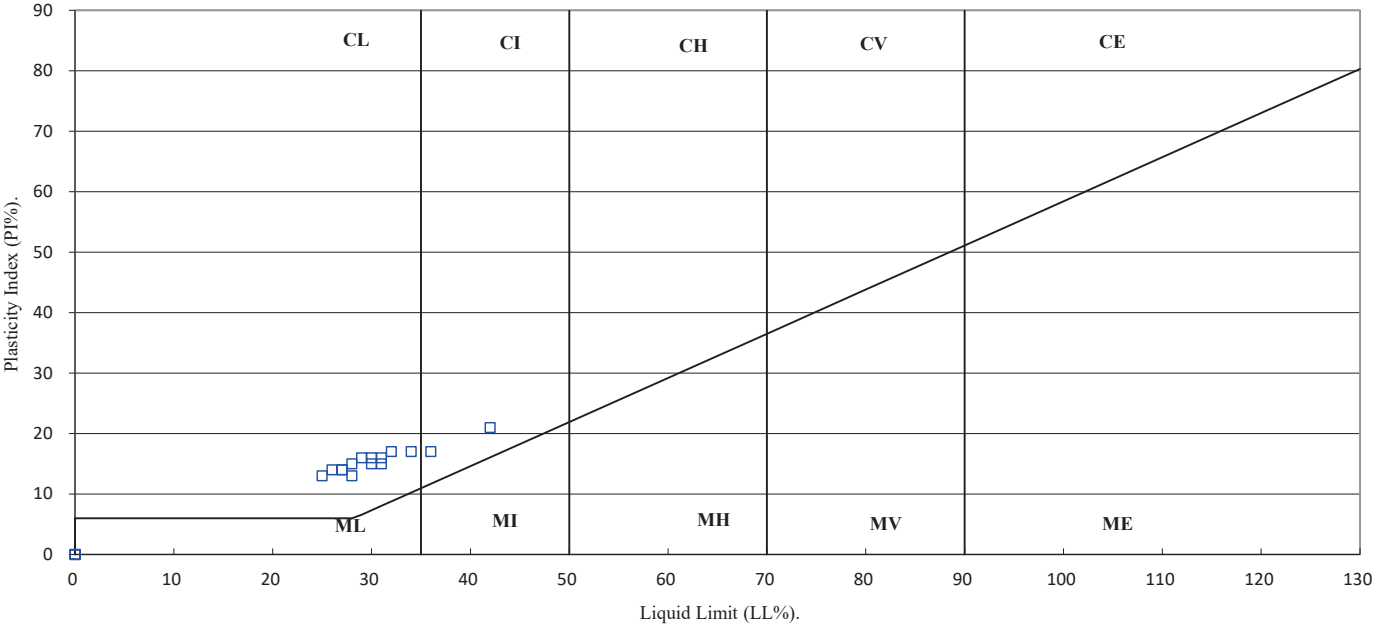
Contract No:

PSL22/3908

Client Ref:

PN224390

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

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Contract No:

PSL22/3908

Client Ref:

PN224390

SUMMARY OF SOIL CLASSIFICATION TESTS

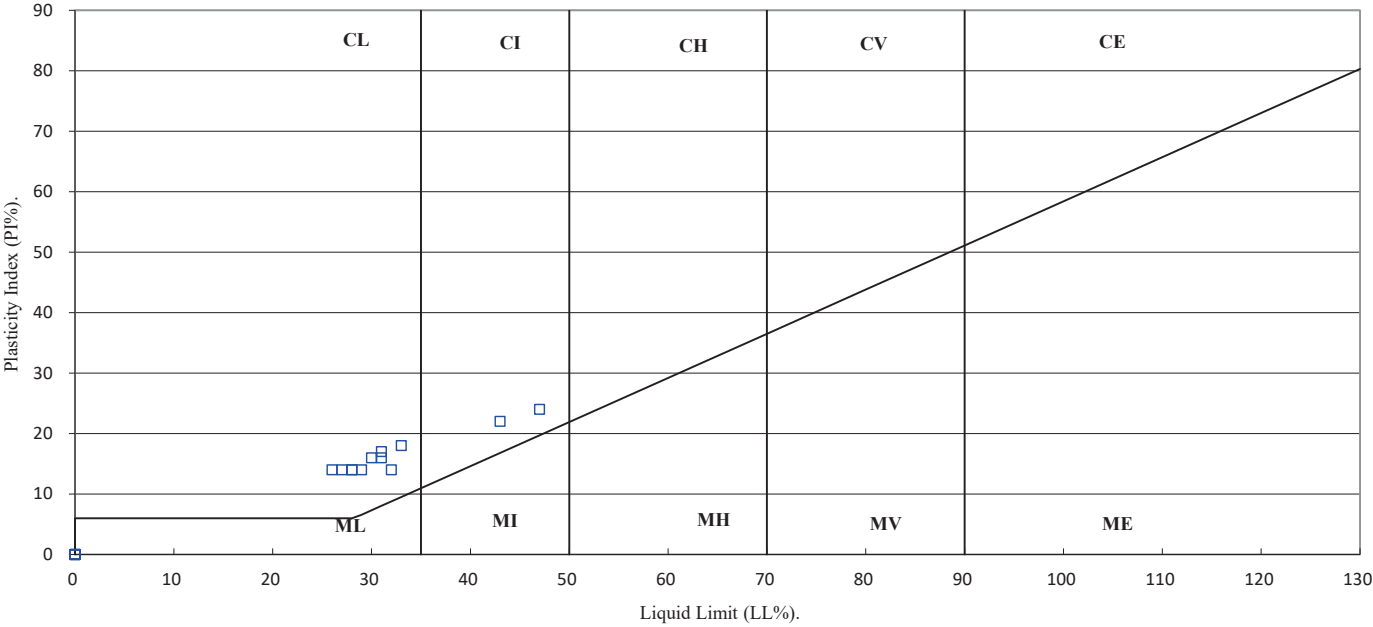
(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
DS04		B	2.40	2.80	12			31	14	17	68	Low Plasticity CL
DS04		D	3.70	4.00	10			27	13	14	72	Low Plasticity CL
TP01		D	1.50		15			28	14	14	86	Low Plasticity CL
TP02		D	1.60		13			31	15	16	78	Low Plasticity CL
TP03		D	2.00		14			33	15	18	71	Low Plasticity CL
TP03		D	3.00		19			32	18	14	67	Low Plasticity CL
TP04		B	1.40	1.60	16			28	14	14	90	Low Plasticity CL
TP04		D	3.00		20			26	12	14	86	Low Plasticity CL
TP05		D	0.50		26			47	23	24	89	Intermediate Plasticity CI
TP05		D	1.20		26			43	21	22	91	Intermediate Plasticity CI
TP05		D	2.50		15			30	14	16	82	Low Plasticity CL
TP06		B	1.50	1.60	22			29	15	14	91	Low Plasticity CL
TP06		D	2.80		11				NP			

SYMBOLS : NP : Non Plastic * : Liquid Limit and Plastic Limit Wet Sieved.

 4043		Star Radcliffe	Contract No:
			PSL22/3908
			Client Ref:
			PN224390

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Star Radcliffe

Contract No:

PSL22/3908

Client Ref:

PN224390

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

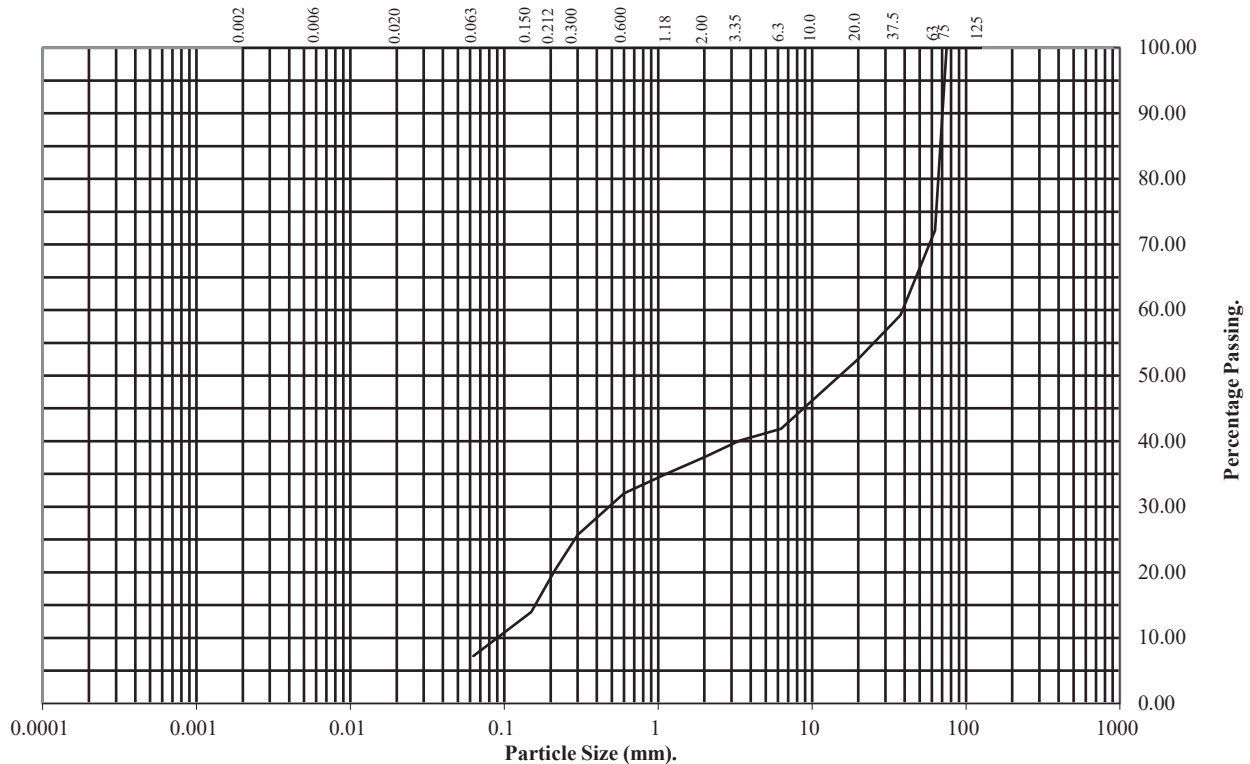
Hole Number: BH01

Top Depth (m): 0.50

Sample Number:

Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	72
37.5	59
20	53
10	46
6.3	42
3.35	40
2	38
1.18	35
0.6	32
0.3	26
0.212	20
0.15	14
0.063	7

Soil Fraction	Total Percentage
Cobbles	28
Gravel	34
Sand	31
Silt/Clay	7

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

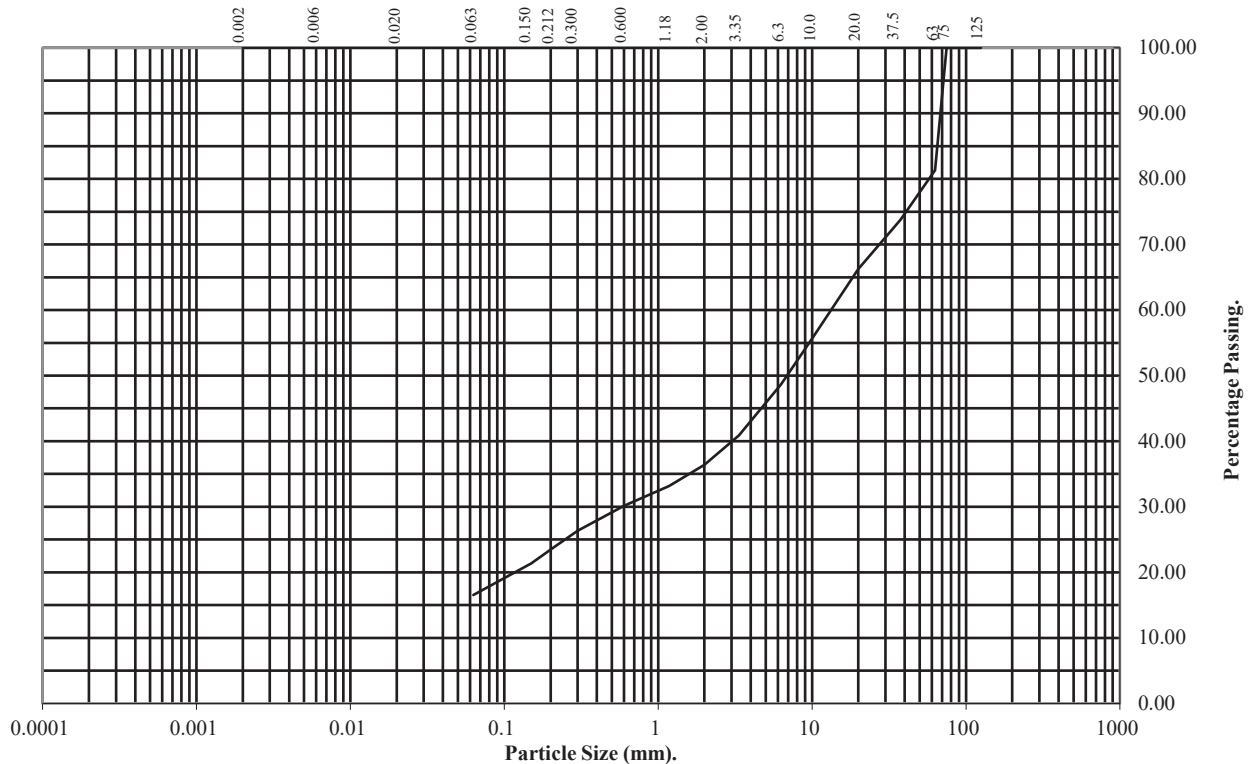
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH01 Top Depth (m): 1.20

Sample Number: Base Depth(m): 1.65

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	81
37.5	74
20	66
10	56
6.3	49
3.35	41
2	36
1.18	33
0.6	30
0.3	26
0.212	24
0.15	21
0.063	17

Soil Fraction	Total Percentage
Cobbles	19
Gravel	45
Sand	19
Silt/Clay	17

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
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Client Ref:
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PARTICLE SIZE DISTRIBUTION TEST

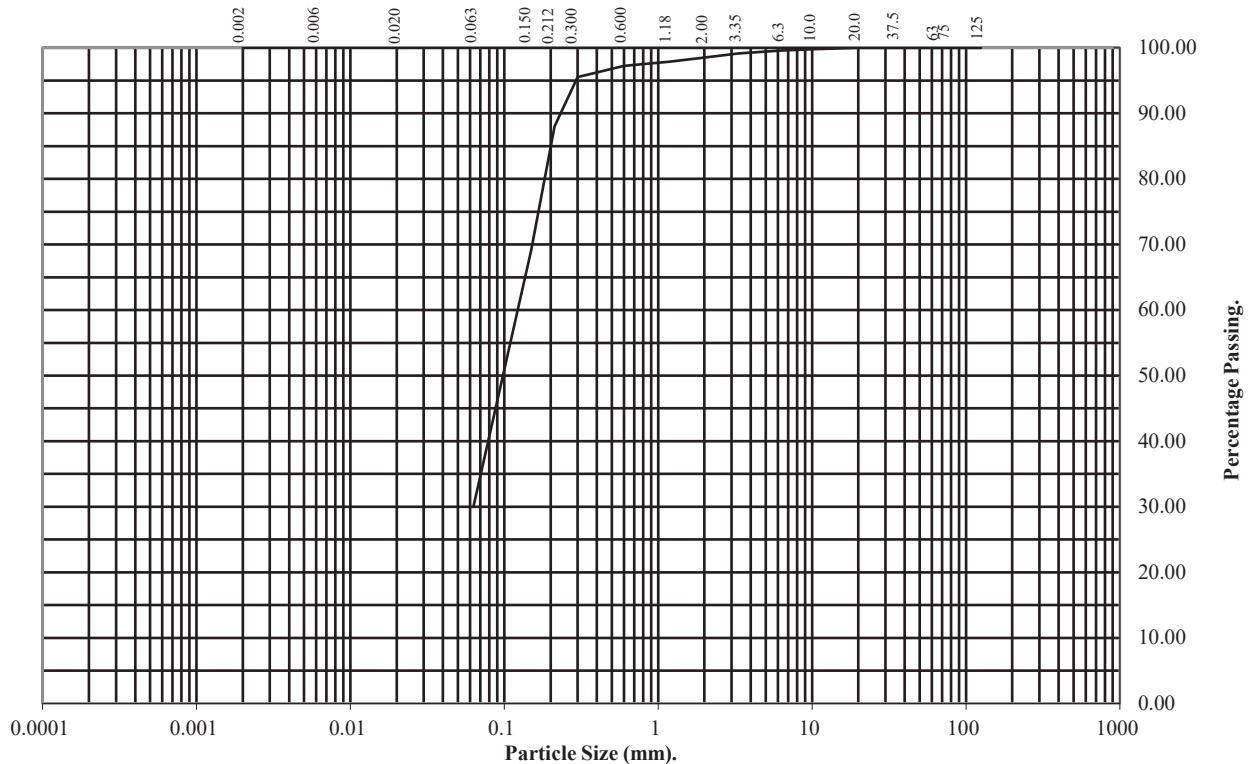
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH01 Top Depth (m): 2.00

Sample Number: Base Depth(m): 2.45

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	98
0.6	97
0.3	96
0.212	88
0.15	69
0.063	30

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	69
Silt/Clay	30

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

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PSL22/3908
Client Ref:
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PARTICLE SIZE DISTRIBUTION TEST

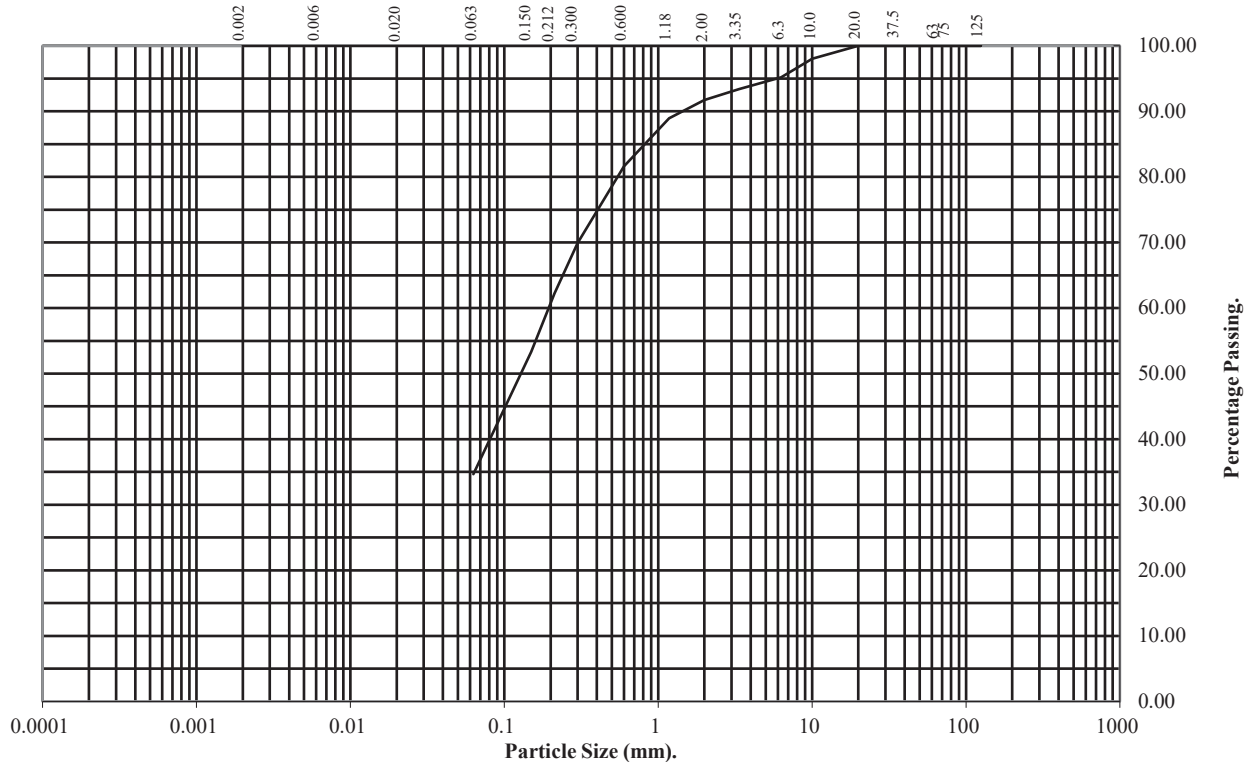
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH02 Top Depth (m): 0.50

Sample Number: Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	98
6.3	95
3.35	93
2	92
1.18	89
0.6	82
0.3	70
0.212	62
0.15	53
0.063	35

Soil Fraction	Total Percentage
Cobbles	0
Gravel	8
Sand	57
Silt/Clay	35

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

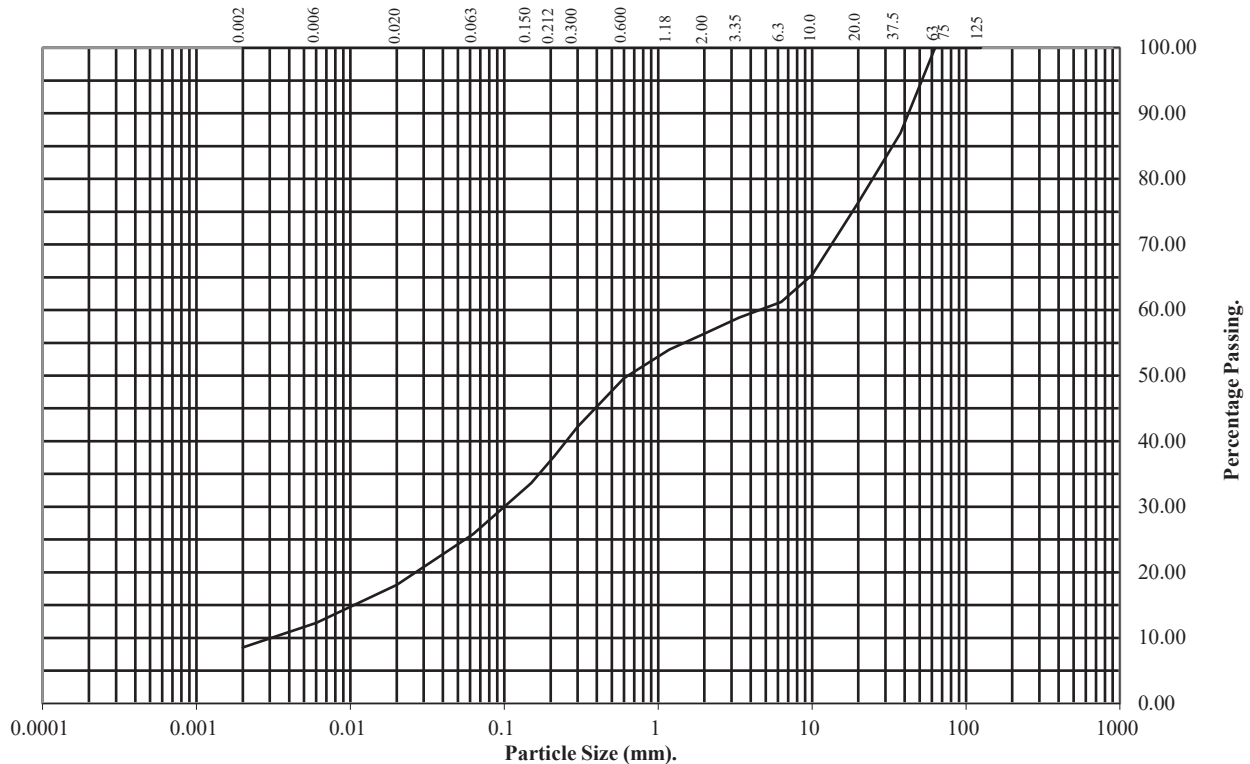
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: BH03 Top Depth (m): 0.80

Sample Number: Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	87
20	76
10	65
6.3	61
3.35	59
2	56
1.18	54
0.6	50
0.3	42
0.212	38
0.15	34
0.063	26

Particle Diameter	Percentage Passing
0.02	18
0.006	12
0.002	9

Soil Fraction	Total Percentage
Cobbles	0
Gravel	44
Sand	30
Silt	17
Clay	9

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

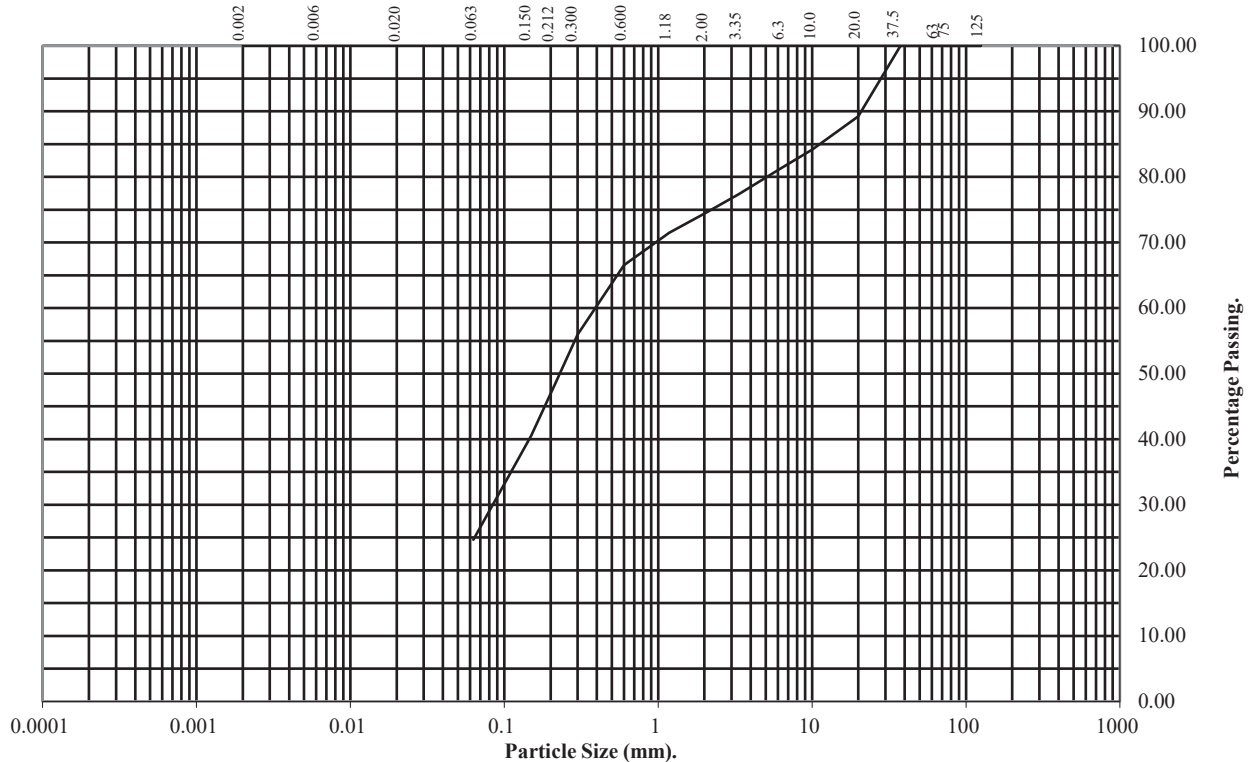
Hole Number: BH03A

Top Depth (m): 1.20

Sample Number:

Base Depth(m): 1.65

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	89
10	84
6.3	81
3.35	77
2	74
1.18	71
0.6	67
0.3	56
0.212	48
0.15	41
0.063	25

Soil Fraction	Total Percentage
Cobbles	0
Gravel	26
Sand	49
Silt/Clay	25

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

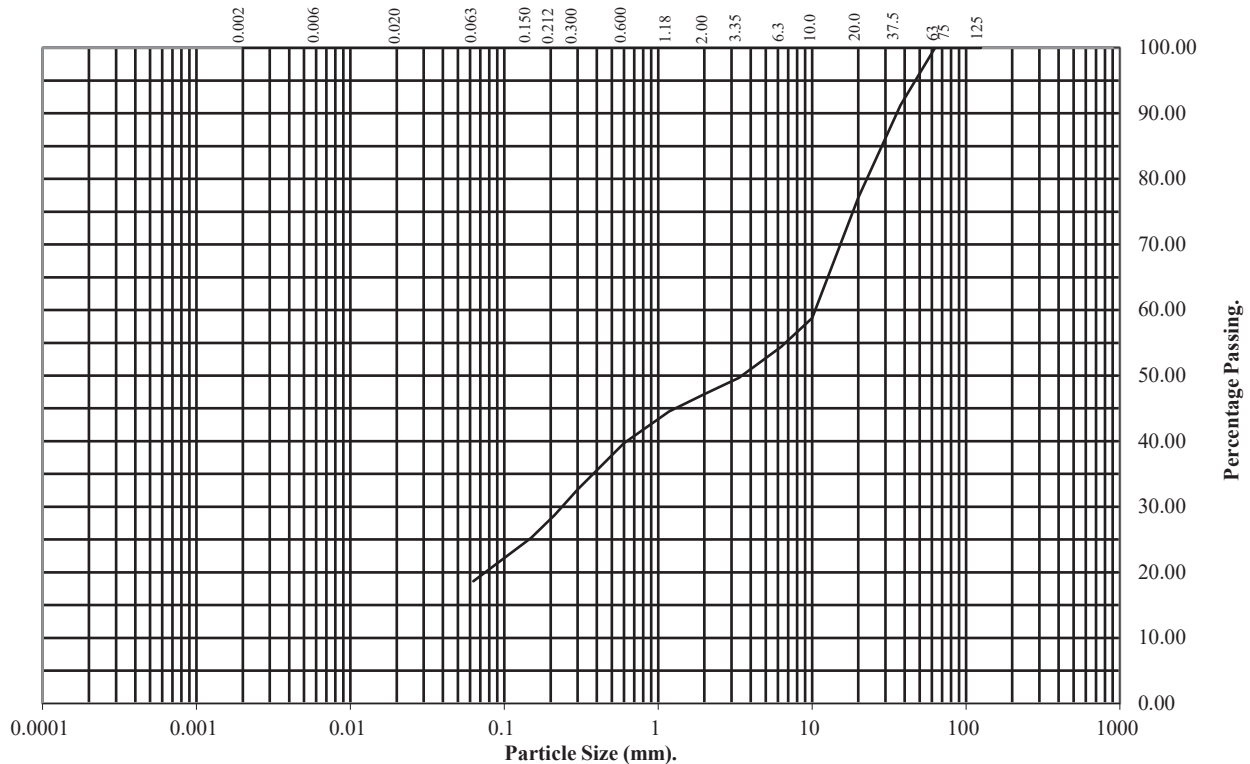
Hole Number: BH03A

Top Depth (m): 2.00

Sample Number:

Base Depth(m): 2.45

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	91
20	77
10	59
6.3	54
3.35	50
2	47
1.18	45
0.6	40
0.3	33
0.212	29
0.15	25
0.063	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	53
Sand	28
Silt/Clay	19

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

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Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

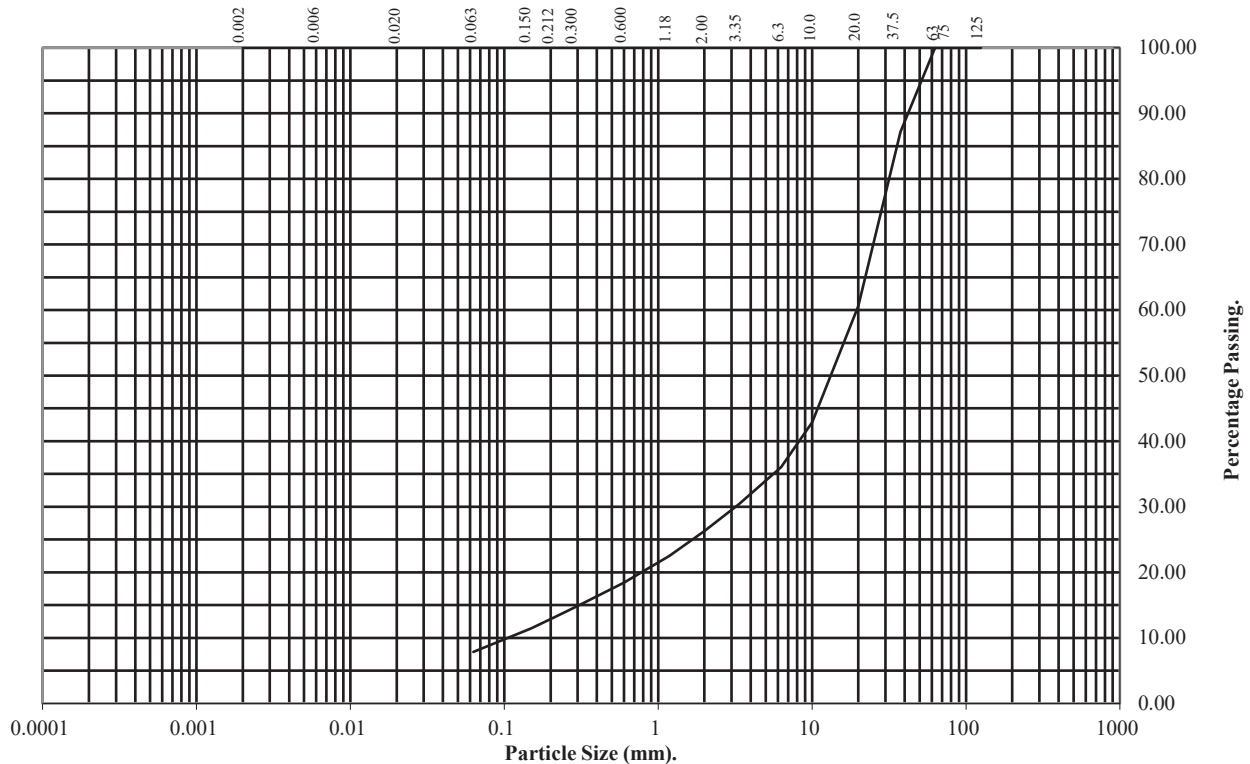
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH04 Top Depth (m): 0.60

Sample Number: Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	87
20	61
10	43
6.3	36
3.35	30
2	26
1.18	22
0.6	18
0.3	15
0.212	13
0.15	11
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	74
Sand	18
Silt/Clay	8

Remarks:
See Summary of Soil Descriptions



Star Radcliffe

Contract No:
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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

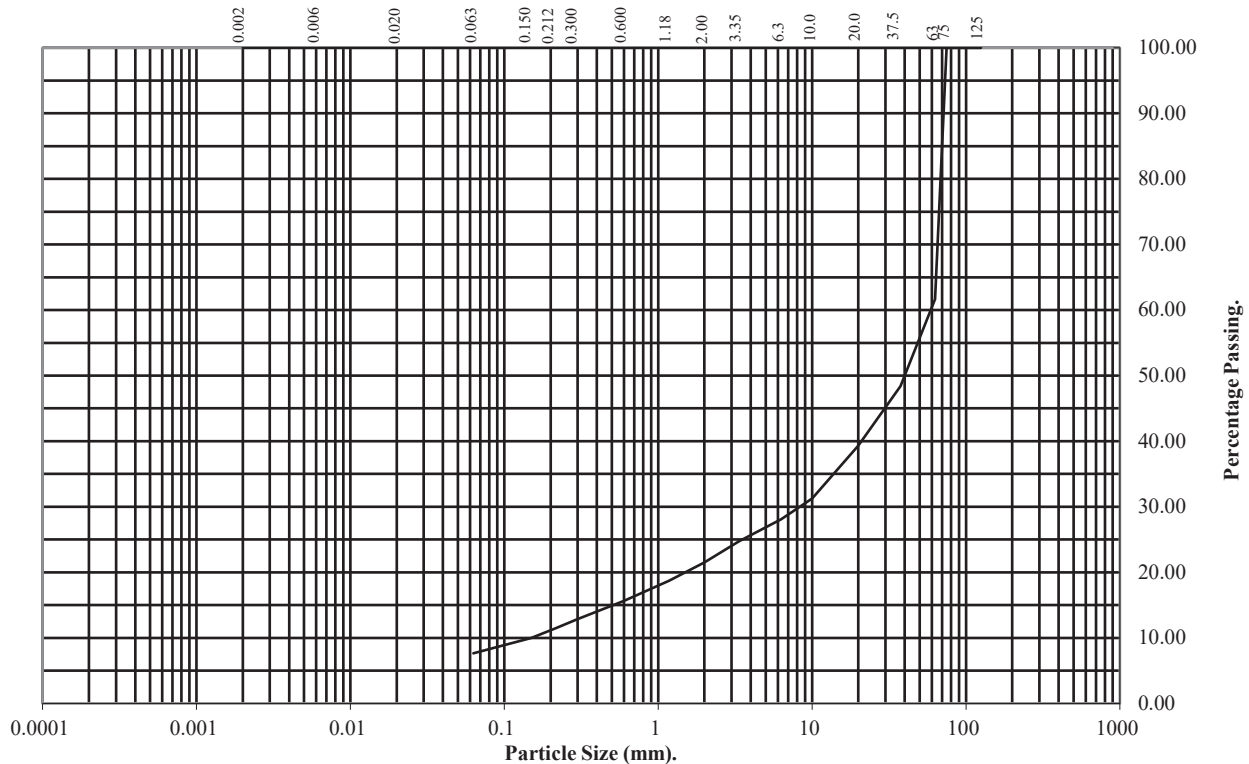
Hole Number: BH04

Top Depth (m): 1.20

Sample Number:

Base Depth(m): 1.65

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	62
37.5	48
20	39
10	31
6.3	28
3.35	25
2	22
1.18	19
0.6	16
0.3	13
0.212	11
0.15	10
0.063	8

Soil Fraction	Total Percentage
Cobbles	38
Gravel	40
Sand	14
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
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Client Ref:
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PARTICLE SIZE DISTRIBUTION TEST

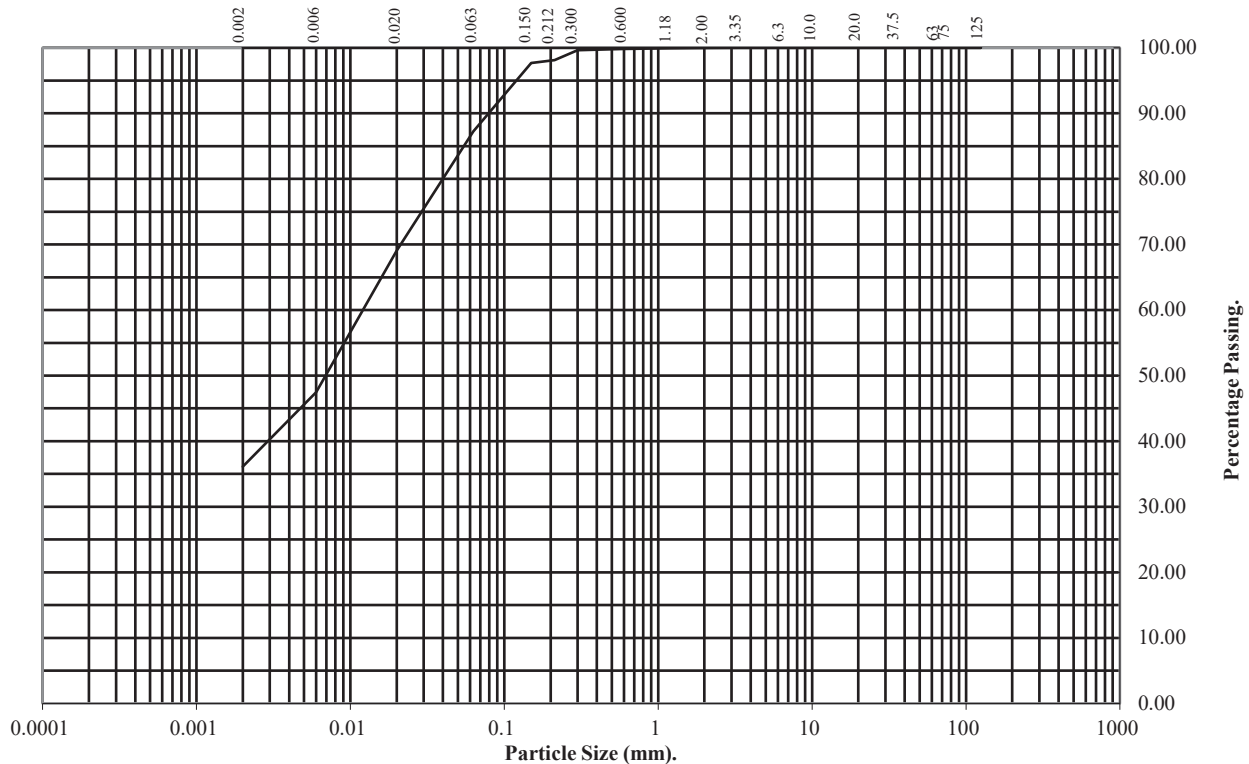
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: DCP01 Top Depth (m): 0.70

Sample Number: Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	100
0.3	100
0.212	98
0.15	98
0.063	87

Particle Diameter	Percentage Passing
0.02	69
0.006	47
0.002	36

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	13
Silt	51
Clay	36

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

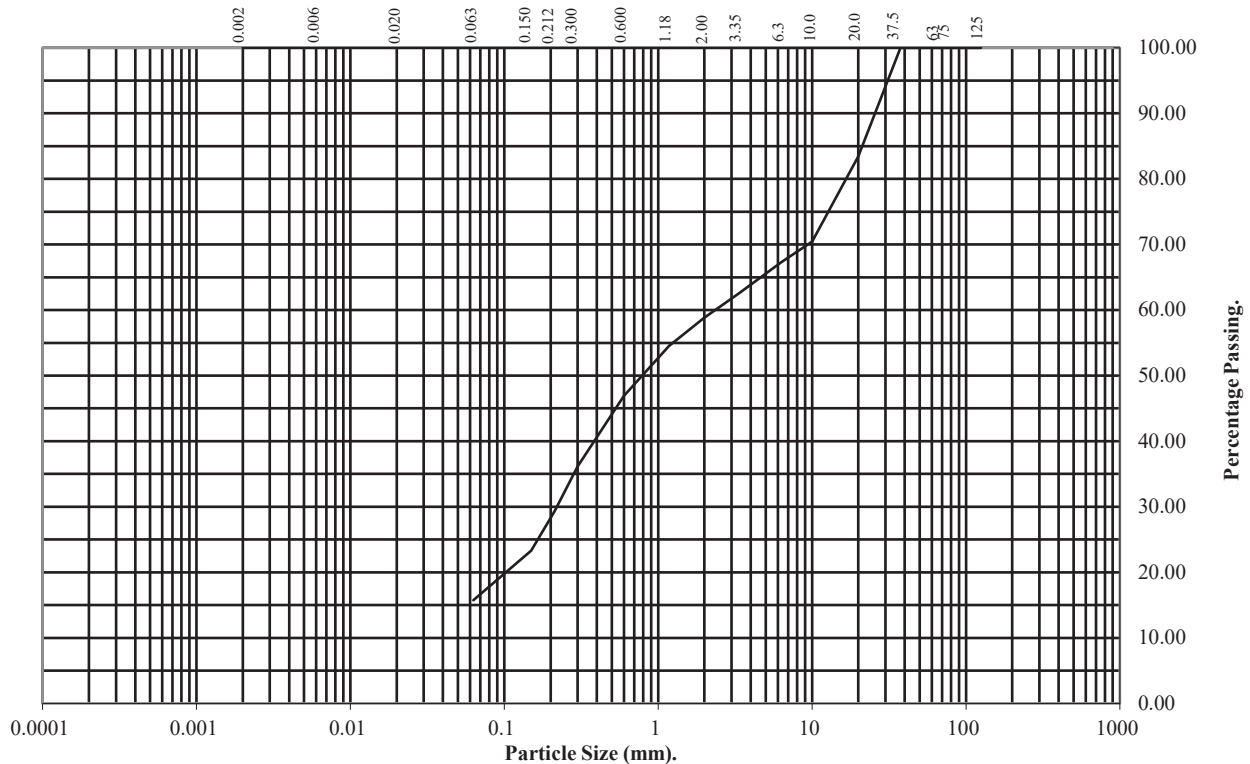
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: DCP05 Top Depth (m): 0.20

Sample Number: Base Depth(m): 0.80

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	83
10	70
6.3	67
3.35	63
2	59
1.18	55
0.6	47
0.3	36
0.212	29
0.15	23
0.063	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	41
Sand	43
Silt/Clay	16

Remarks:
See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

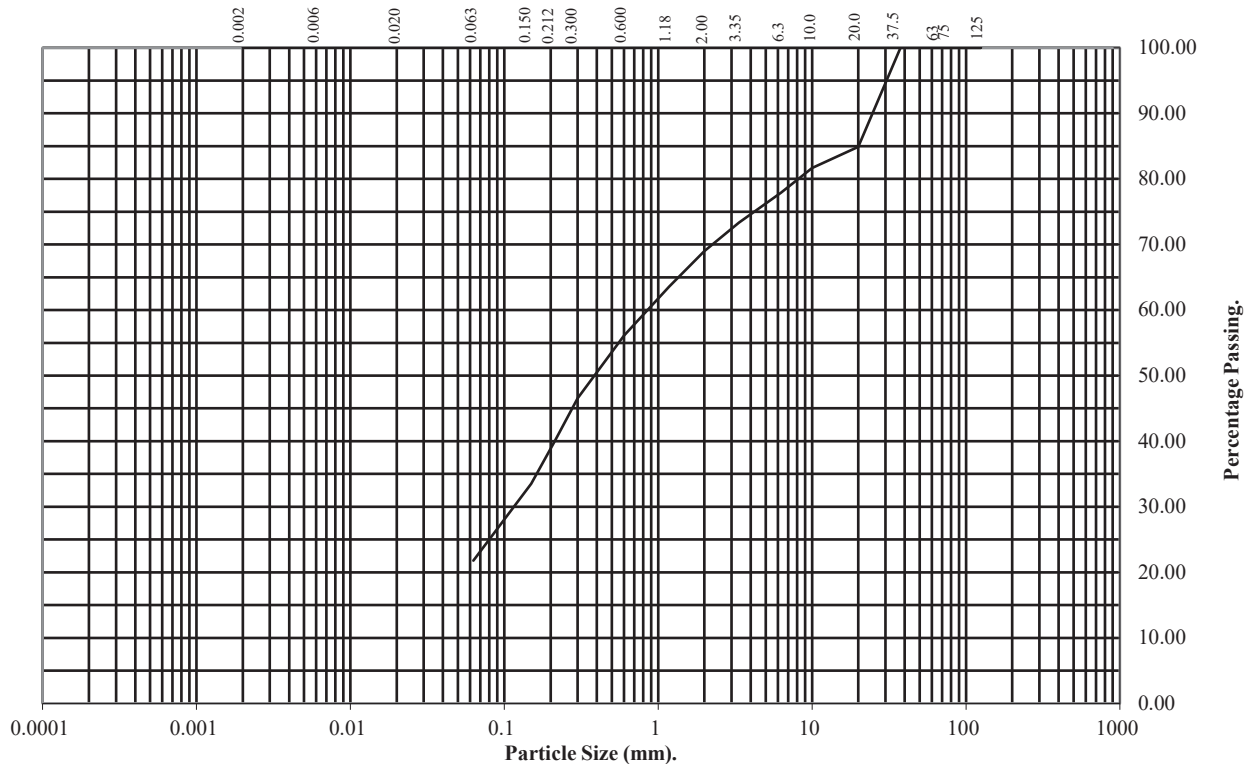
Hole Number: DCP05

Top Depth (m): 0.80

Sample Number:

Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	85
10	82
6.3	78
3.35	73
2	69
1.18	64
0.6	56
0.3	47
0.212	40
0.15	33
0.063	22

Soil Fraction	Total Percentage
Cobbles	0
Gravel	31
Sand	47
Silt/Clay	22

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

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PSL22/3908
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PN224390

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

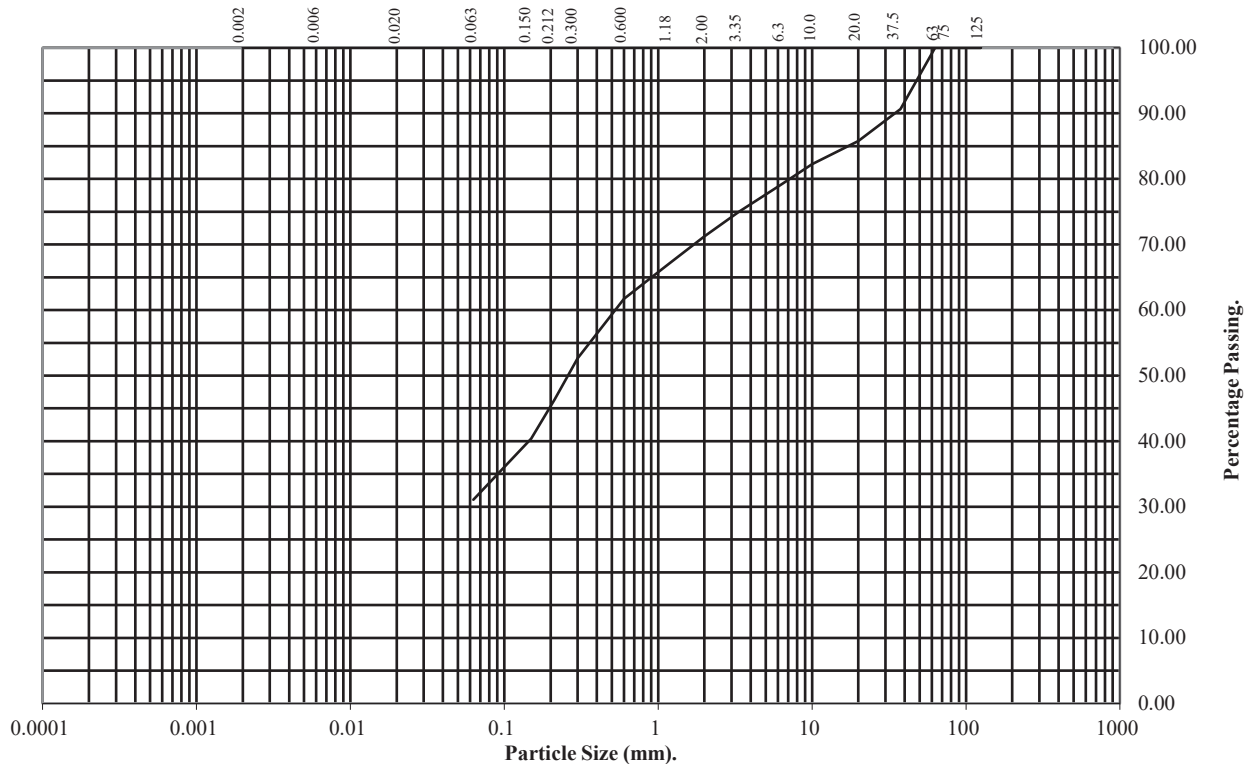
Hole Number: DCP07

Top Depth (m): 0.20

Sample Number:

Base Depth(m): 0.80

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	91
20	86
10	82
6.3	79
3.35	75
2	71
1.18	67
0.6	62
0.3	53
0.212	46
0.15	40
0.063	31

Soil Fraction	Total Percentage
Cobbles	0
Gravel	29
Sand	40
Silt/Clay	31

Remarks:

See Summary of Soil Descriptions



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PN224390

PARTICLE SIZE DISTRIBUTION TEST

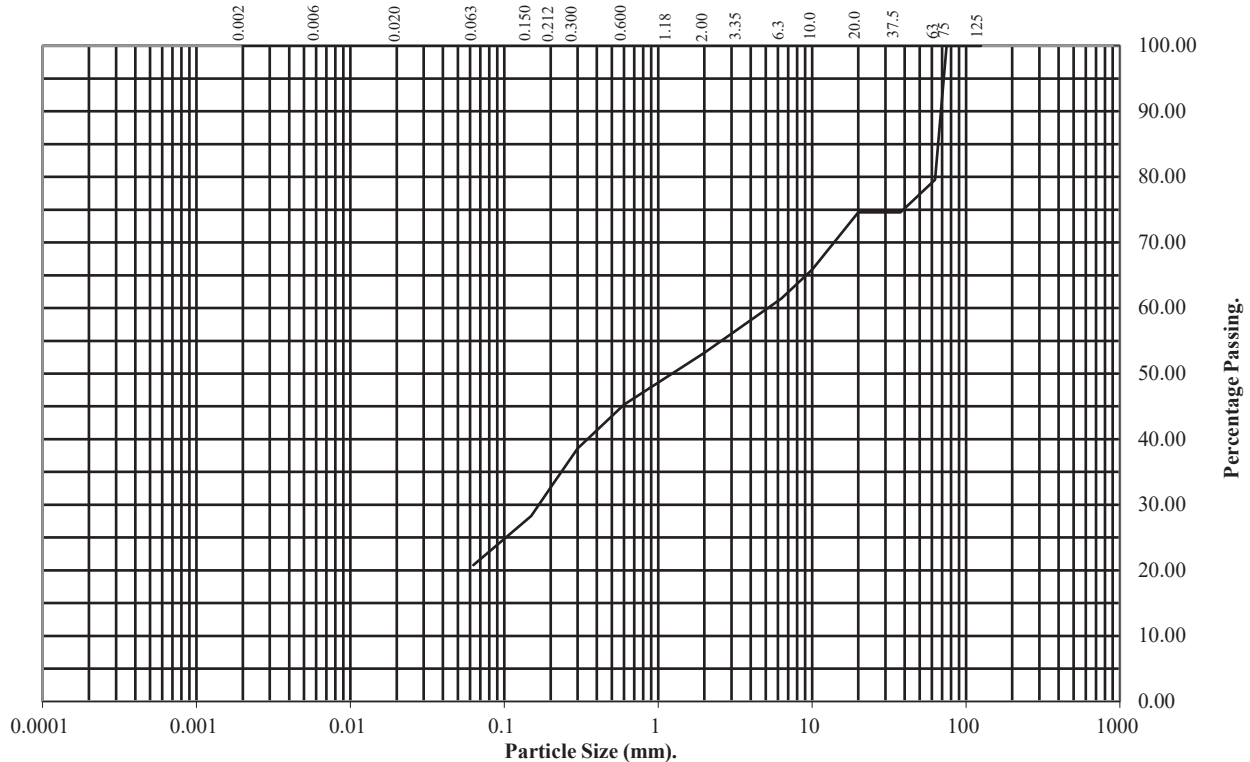
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: DCP08 Top Depth (m): 0.20

Sample Number: Base Depth(m): 0.80

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	80
37.5	75
20	75
10	66
6.3	61
3.35	57
2	53
1.18	50
0.6	45
0.3	39
0.212	34
0.15	28
0.063	21

Soil Fraction	Total Percentage
Cobbles	20
Gravel	27
Sand	32
Silt/Clay	21

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

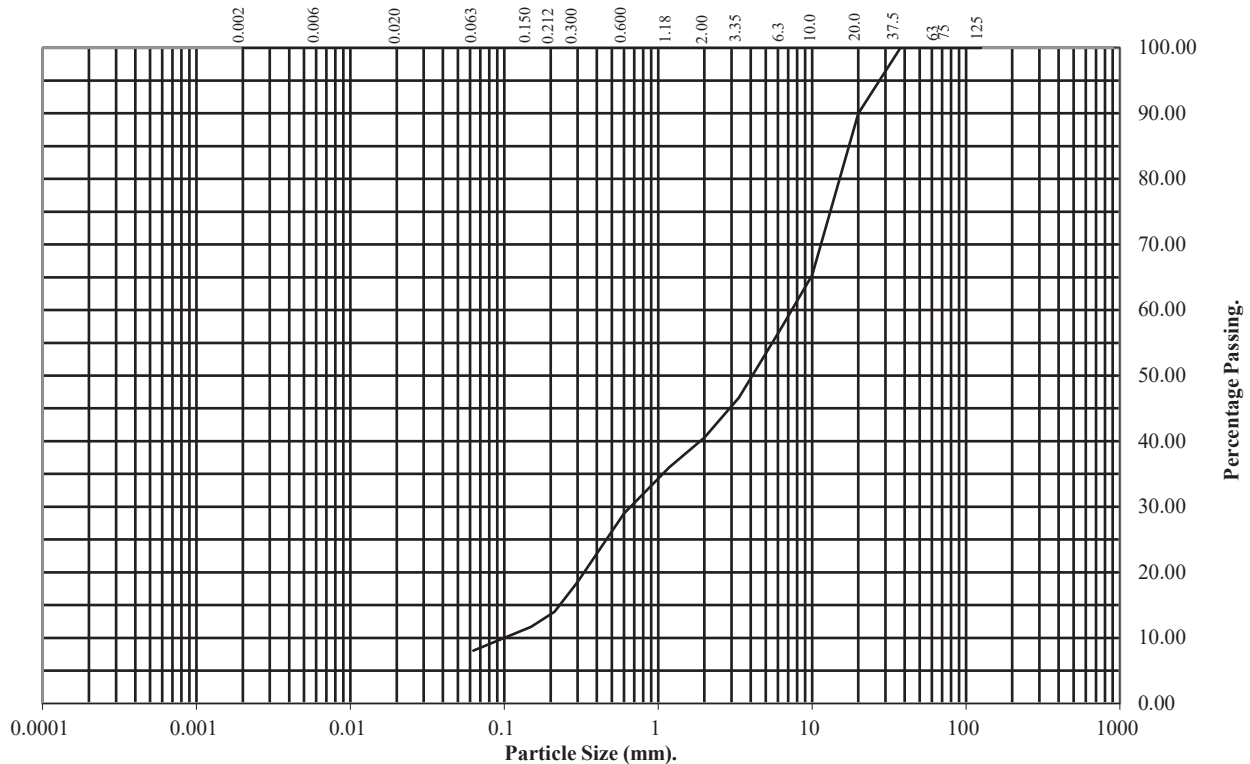
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: DS02 Top Depth (m): 1.20

Sample Number: Base Depth(m): 2.00

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	90
10	65
6.3	57
3.35	47
2	41
1.18	36
0.6	29
0.3	19
0.212	14
0.15	12
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	59
Sand	33
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

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Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

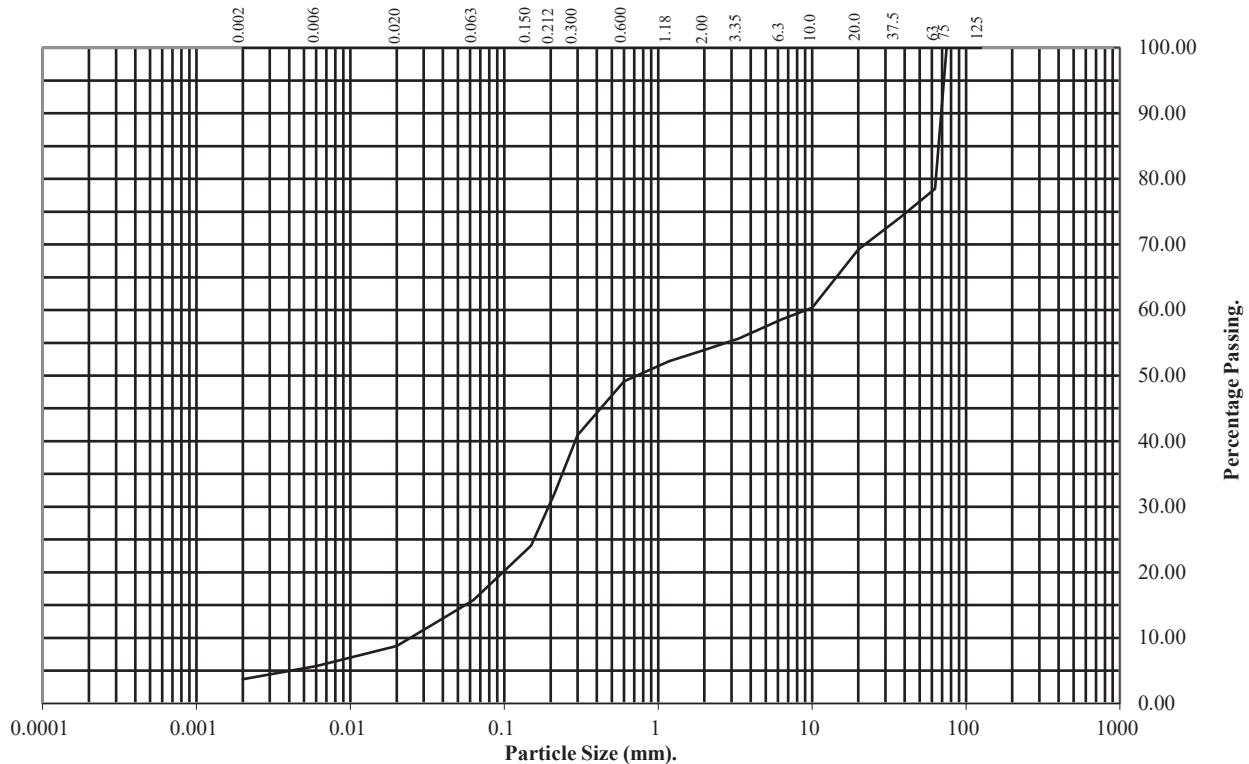
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **DS03** Top Depth (m): **0.60**

Sample Number: Base Depth(m): **1.20**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	78
37.5	74
20	69
10	60
6.3	59
3.35	56
2	54
1.18	52
0.6	49
0.3	41
0.212	32
0.15	24
0.063	16

Particle Diameter	Percentage Passing
0.02	9
0.006	6
0.002	4

Soil Fraction	Total Percentage
Cobbles	22
Gravel	24
Sand	38
Silt	12
Clay	4

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

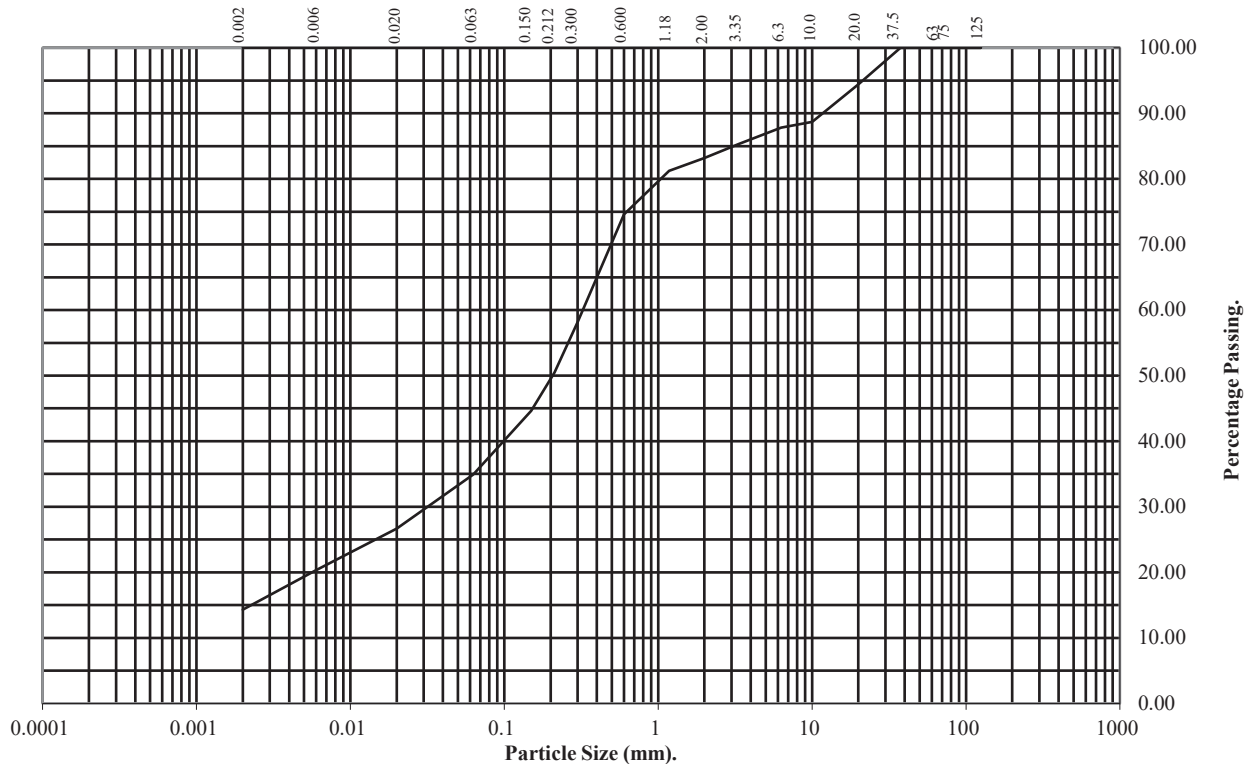
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **DS04** Top Depth (m): **1.30**

Sample Number: Base Depth(m): **2.00**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	89
6.3	88
3.35	85
2	83
1.18	81
0.6	75
0.3	58
0.212	51
0.15	45
0.063	35

Particle Diameter	Percentage Passing
0.02	27
0.006	20
0.002	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	17
Sand	48
Silt	21
Clay	14

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

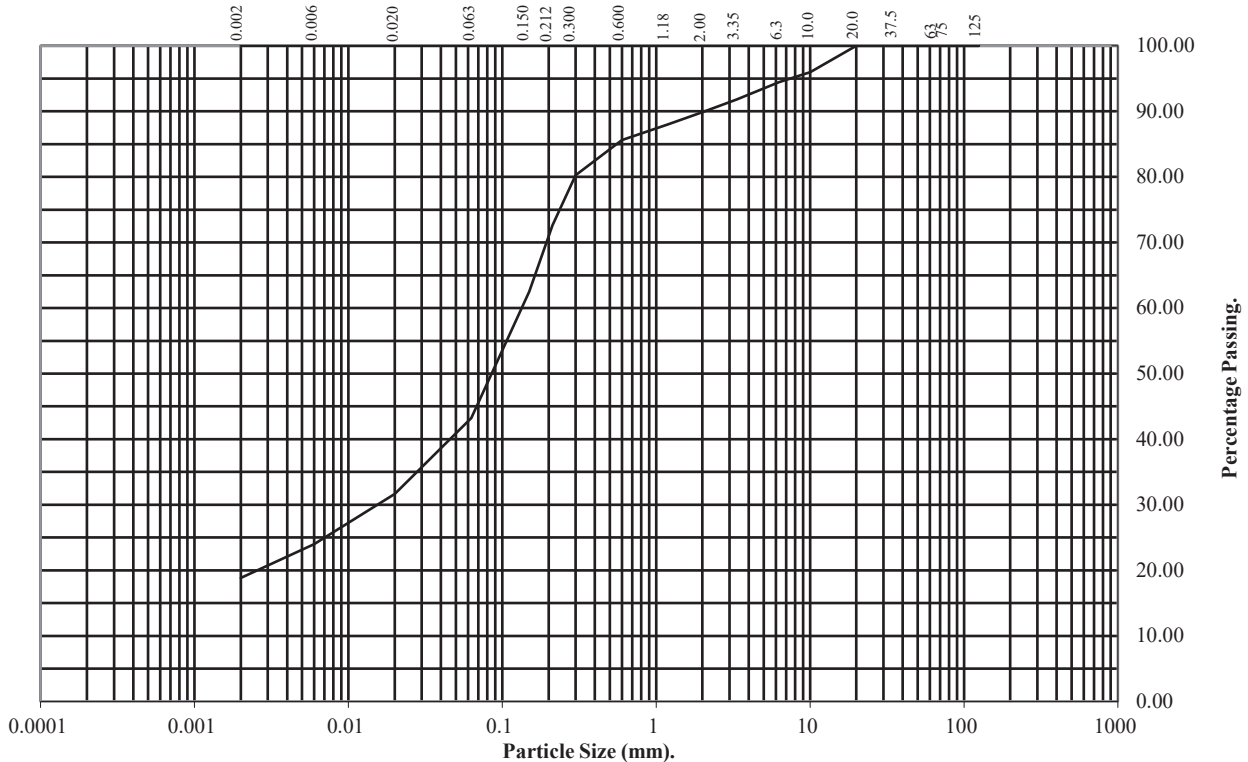
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **DS04** Top Depth (m): **2.80**

Sample Number: Base Depth(m): **3.70**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	96
6.3	94
3.35	92
2	90
1.18	88
0.6	86
0.3	80
0.212	73
0.15	62
0.063	43

Particle Diameter	Percentage Passing
0.02	32
0.006	24
0.002	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	10
Sand	47
Silt	24
Clay	19

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

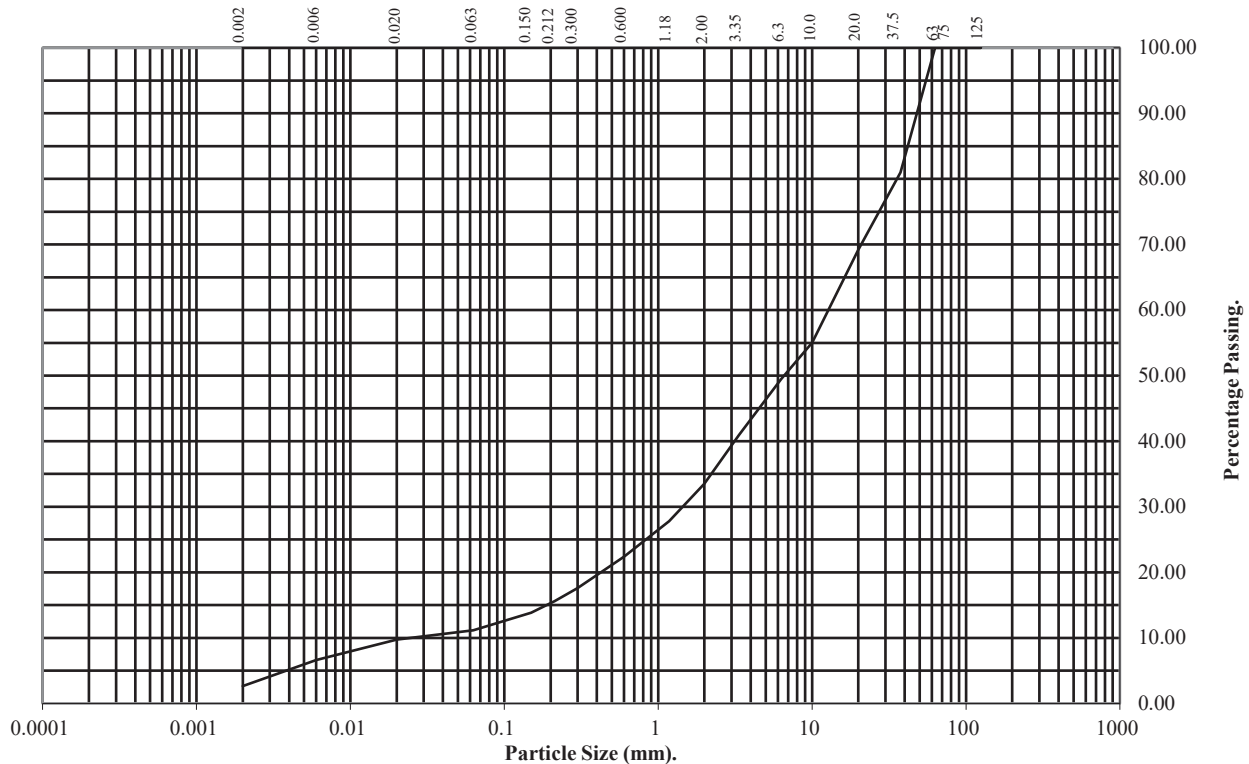
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **DS05** Top Depth (m): **0.30**

Sample Number: Base Depth(m): **1.20**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	81
20	69
10	55
6.3	49
3.35	41
2	33
1.18	28
0.6	22
0.3	18
0.212	16
0.15	14
0.063	11

Particle Diameter	Percentage Passing
0.02	10
0.006	7
0.002	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	67
Sand	22
Silt	8
Clay	3

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

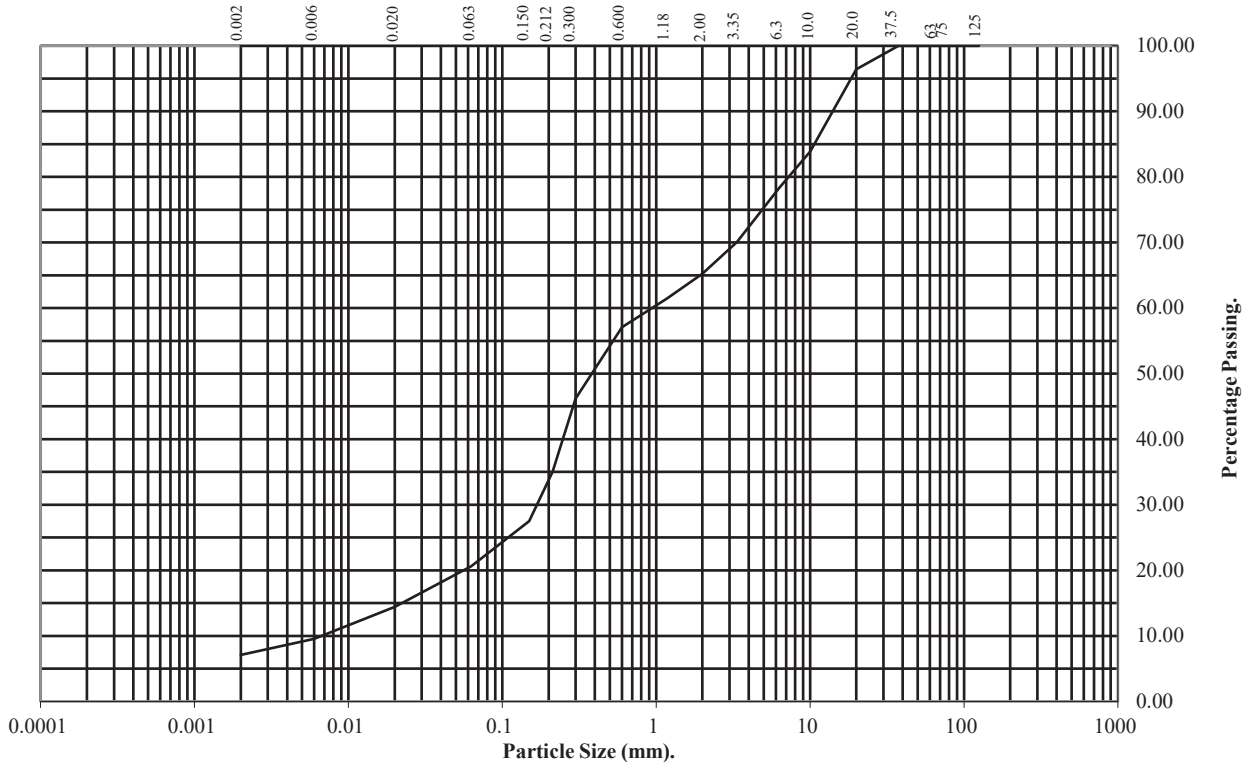
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **DS05** Top Depth (m): **2.00**

Sample Number: Base Depth(m): **2.70**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	84
6.3	78
3.35	70
2	65
1.18	61
0.6	57
0.3	46
0.212	35
0.15	28
0.063	21

Particle Diameter	Percentage Passing
0.02	14
0.006	10
0.002	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	35
Sand	44
Silt	14
Clay	7

Remarks:

See Summary of Soil Descriptions



Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

PARTICLE SIZE DISTRIBUTION TEST

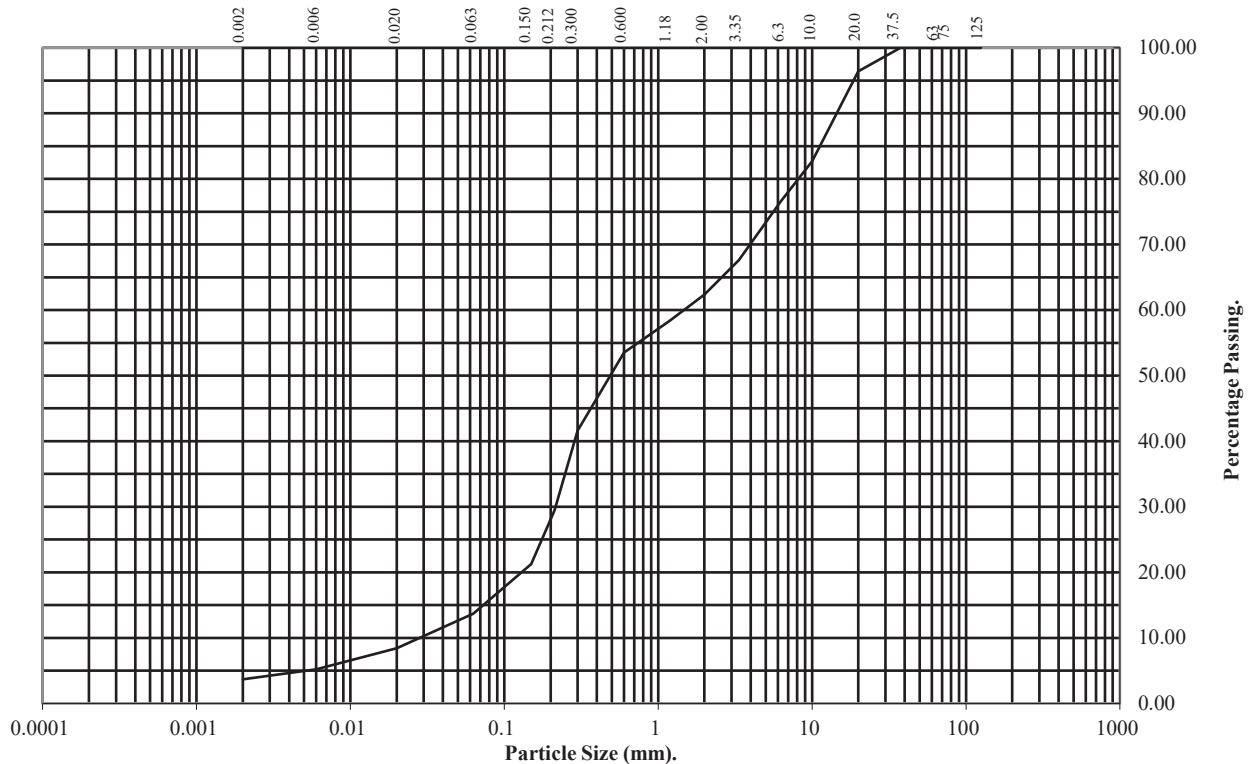
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **DS05** Top Depth (m): **3.00**

Sample Number: Base Depth(m): **3.90**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	83
6.3	77
3.35	68
2	62
1.18	58
0.6	54
0.3	42
0.212	29
0.15	21
0.063	14

Particle Diameter	Percentage Passing
0.02	8
0.006	5
0.002	4

Soil Fraction	Total Percentage
Cobbles	0
Gravel	38
Sand	48
Silt	10
Clay	4

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

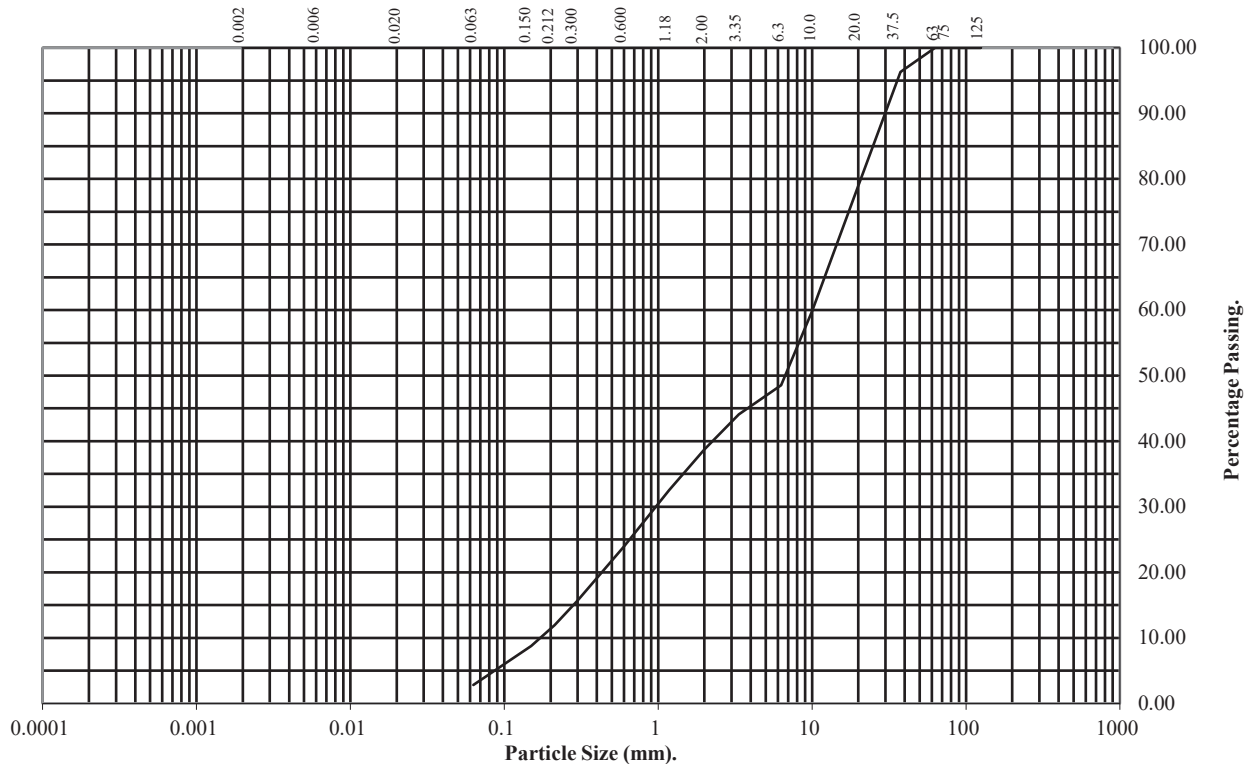
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: DS06 Top Depth (m): 0.60

Sample Number: Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	96
20	79
10	60
6.3	49
3.35	44
2	39
1.18	33
0.6	24
0.3	16
0.212	12
0.15	9
0.063	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	61
Sand	36
Silt/Clay	3

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

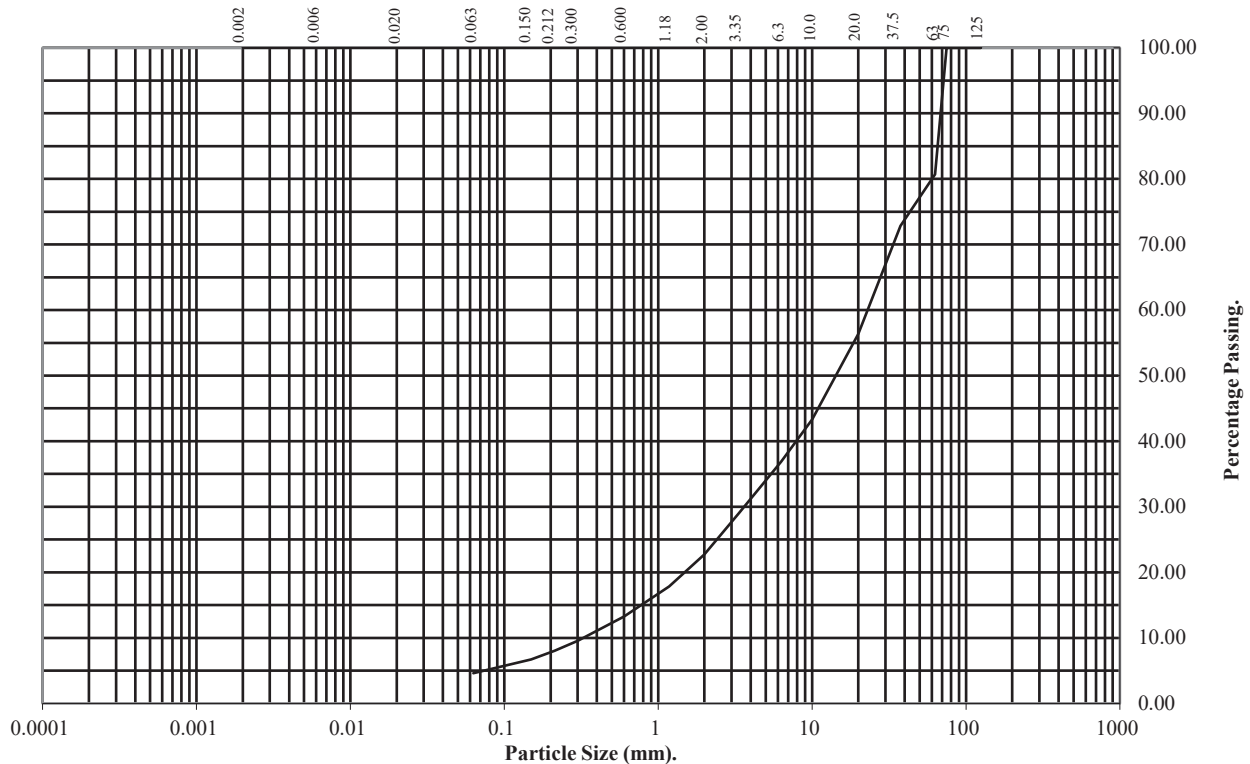
Hole Number: HD01

Top Depth (m): 0.60

Sample Number:

Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	81
37.5	73
20	56
10	43
6.3	37
3.35	29
2	23
1.18	18
0.6	13
0.3	10
0.212	8
0.15	7
0.063	5

Soil Fraction	Total Percentage
Cobbles	19
Gravel	58
Sand	18
Silt/Clay	5

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

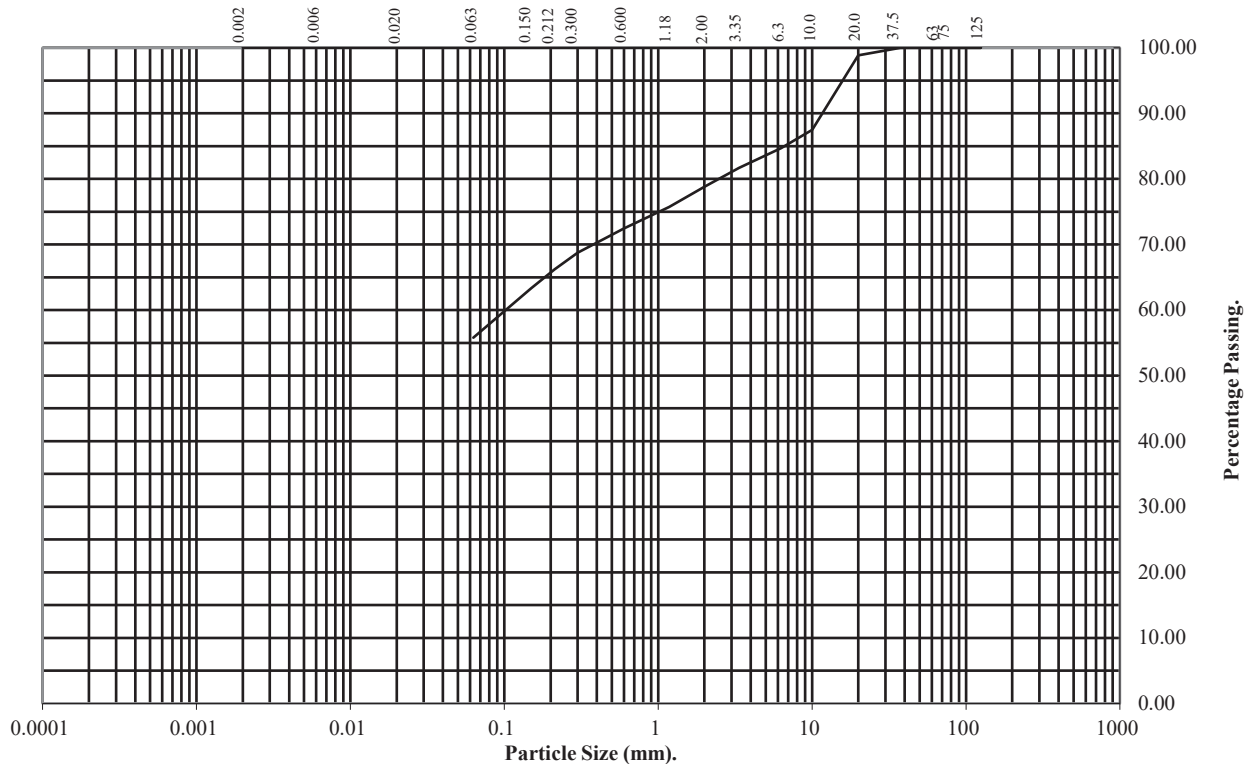
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **HD03** Top Depth (m): **0.80**

Sample Number: Base Depth(m): **1.20**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	99
10	87
6.3	85
3.35	82
2	79
1.18	76
0.6	72
0.3	69
0.212	66
0.15	63
0.063	56

Soil Fraction	Total Percentage
Cobbles	0
Gravel	21
Sand	23
Silt/Clay	56

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

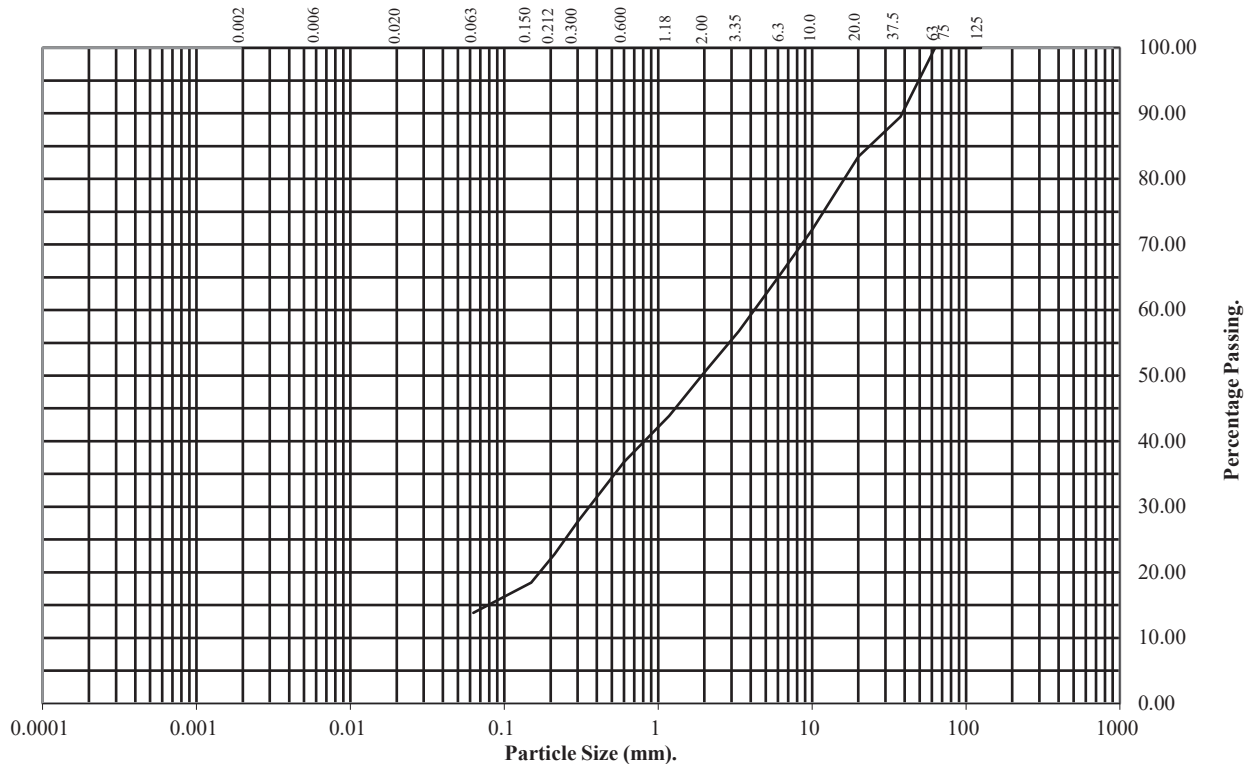
Hole Number: HD04

Top Depth (m): 0.40

Sample Number:

Base Depth(m): 0.80

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	89
20	83
10	72
6.3	66
3.35	57
2	50
1.18	44
0.6	37
0.3	28
0.212	23
0.15	18
0.063	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	50
Sand	36
Silt/Clay	14

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

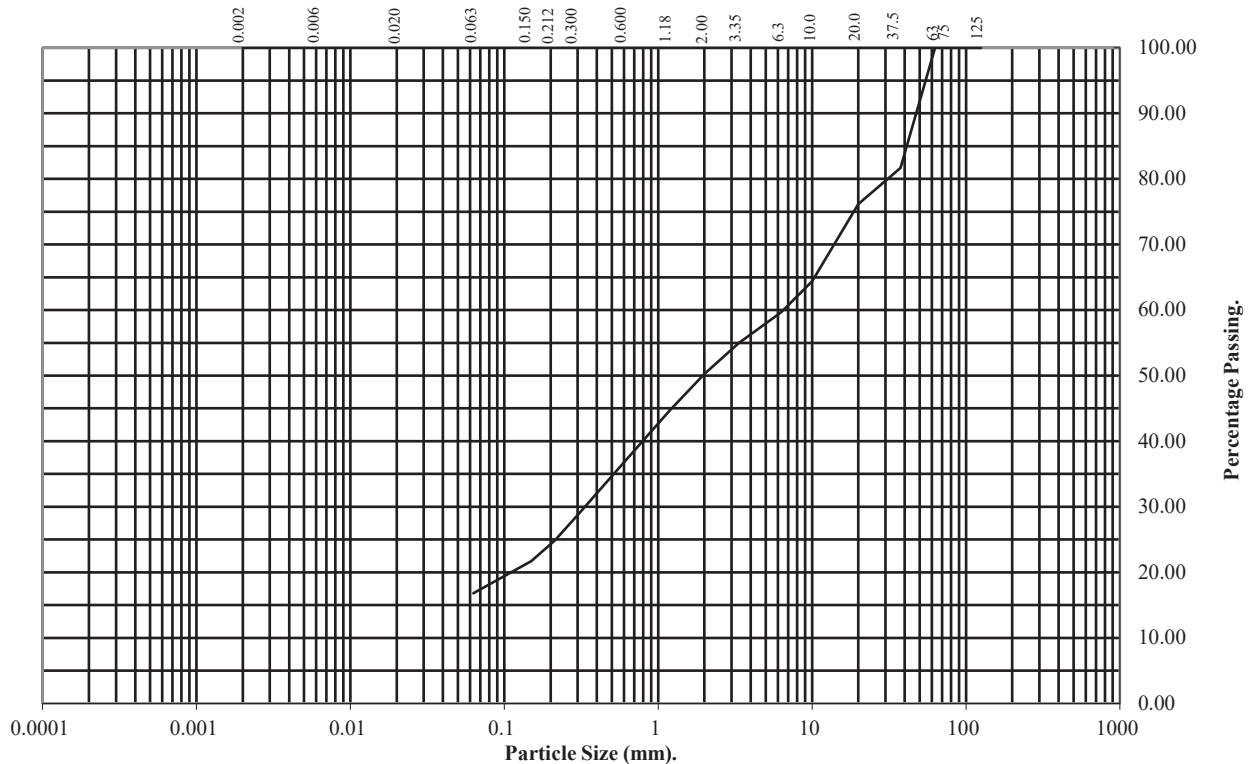
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **HD05** Top Depth (m): **0.80**

Sample Number: Base Depth(m): **1.20**

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	82
20	76
10	64
6.3	60
3.35	55
2	50
1.18	45
0.6	37
0.3	29
0.212	25
0.15	22
0.063	17

Soil Fraction	Total Percentage
Cobbles	0
Gravel	50
Sand	33
Silt/Clay	17

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

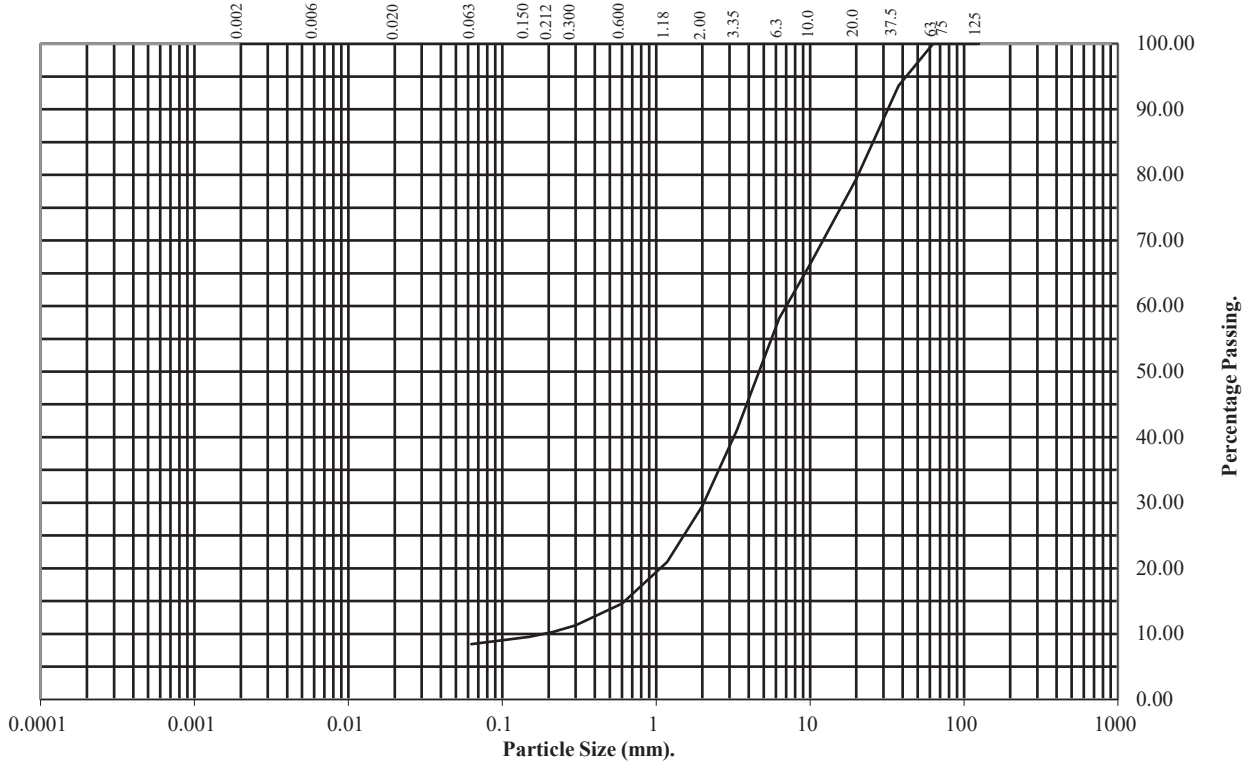
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP01 Top Depth (m): 0.60

Sample Number: Base Depth(m): 0.90

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	94
20	79
10	66
6.3	58
3.35	41
2	29
1.18	21
0.6	15
0.3	11
0.212	10
0.15	10
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	71
Sand	21
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

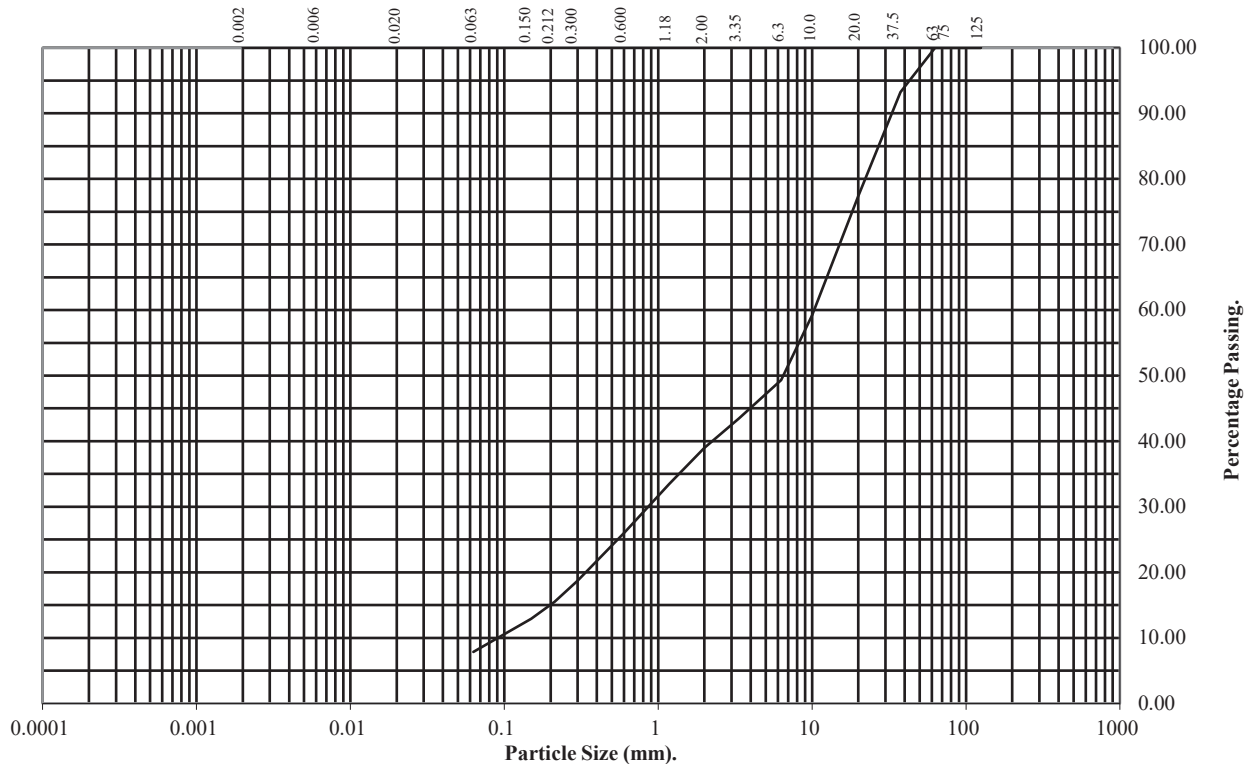
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP02 Top Depth (m): 0.40

Sample Number: Base Depth(m): 0.60

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	93
20	77
10	59
6.3	49
3.35	43
2	39
1.18	33
0.6	26
0.3	19
0.212	16
0.15	13
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	61
Sand	31
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

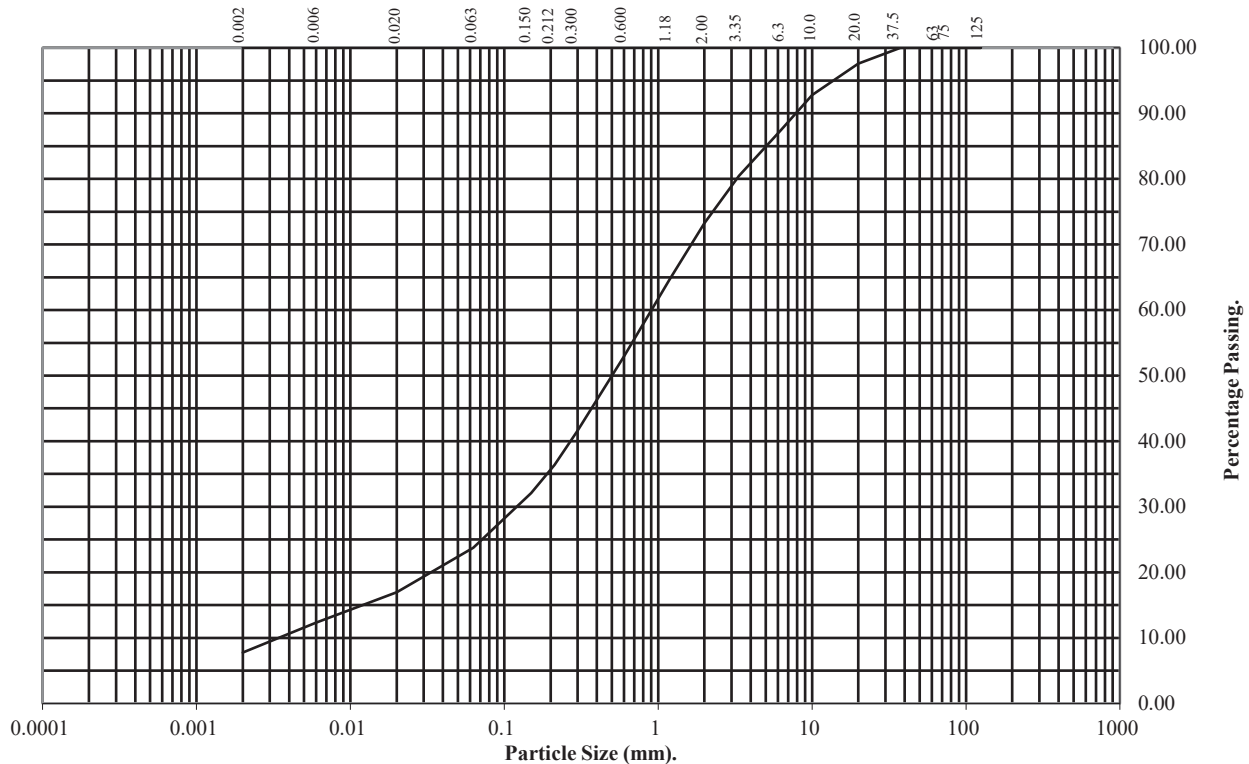
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP03 Top Depth (m): 1.40

Sample Number: Base Depth(m): 1.50

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	98
10	93
6.3	87
3.35	80
2	73
1.18	65
0.6	53
0.3	42
0.212	36
0.15	32
0.063	24

Particle Diameter	Percentage Passing
0.02	17
0.006	12
0.002	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	27
Sand	49
Silt	16
Clay	8

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

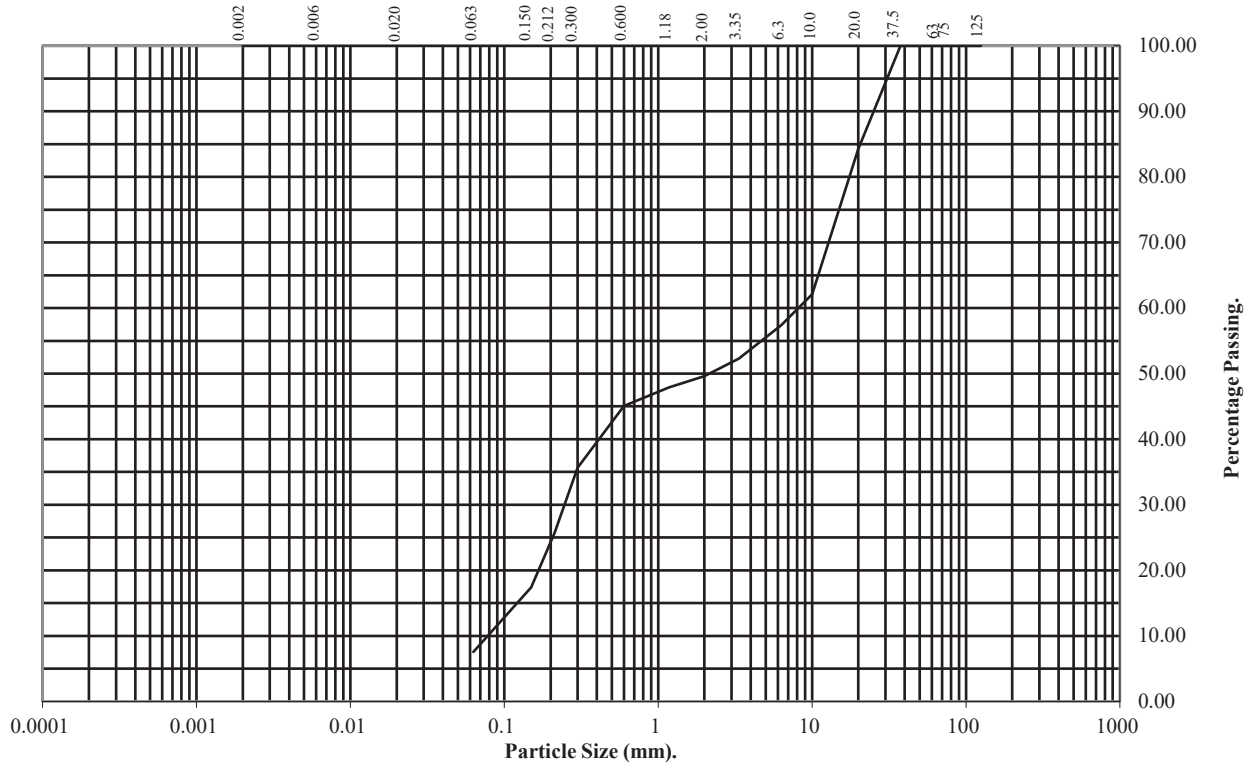
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP04 Top Depth (m): 0.40

Sample Number: Base Depth(m): 0.60

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	84
10	62
6.3	57
3.35	52
2	50
1.18	48
0.6	45
0.3	36
0.212	26
0.15	17
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	50
Sand	42
Silt/Clay	8

Remarks:

See Summary of Soil Descriptions



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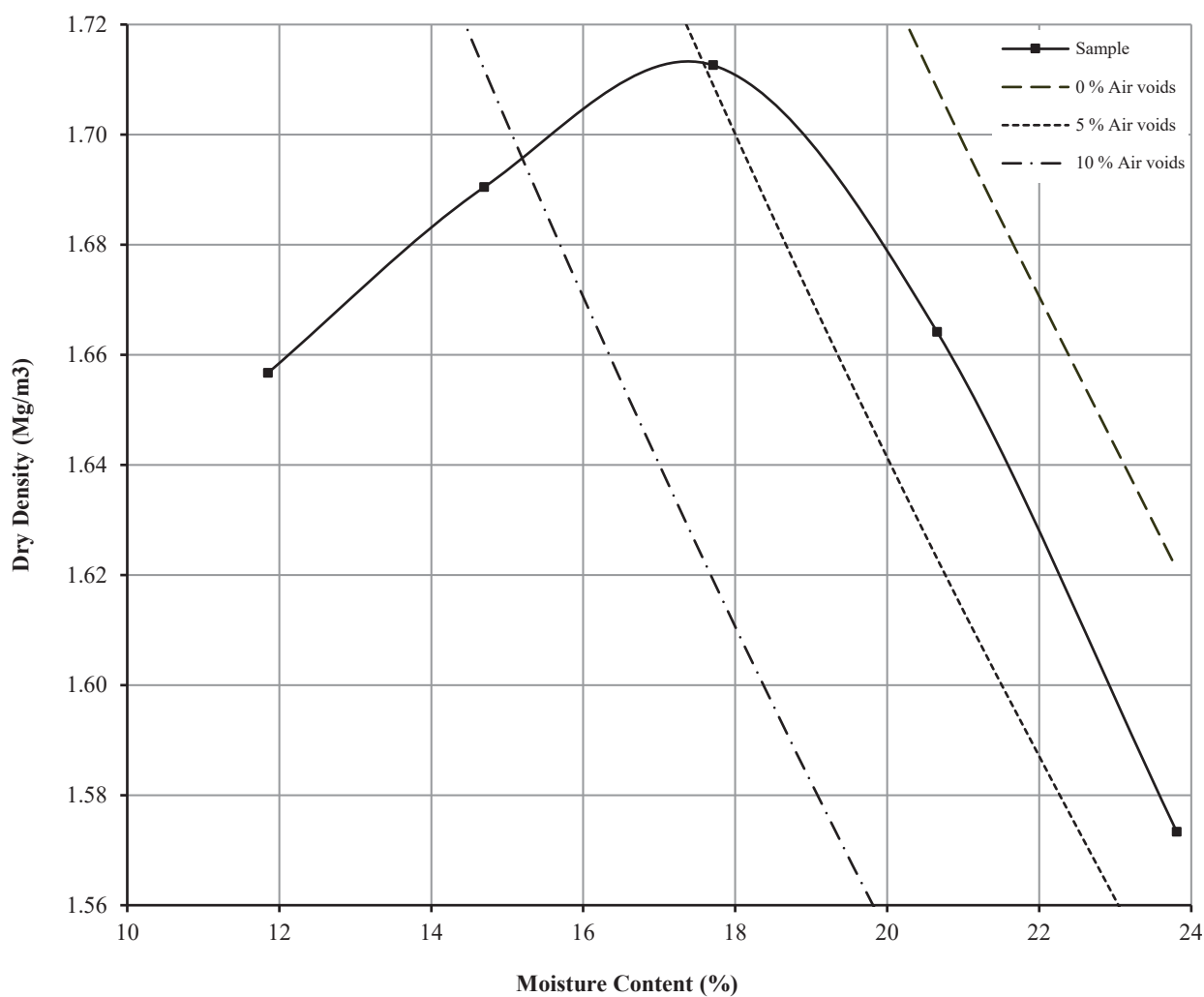
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

Hole Number: BH02 Top Depth (m) : 0.50

Sample Number: Base Depth (m) : 1.20

Sample Type: B



Initial Moisture Content:	24	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.64	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.71		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	18			
Remarks See summary of soil descriptions				



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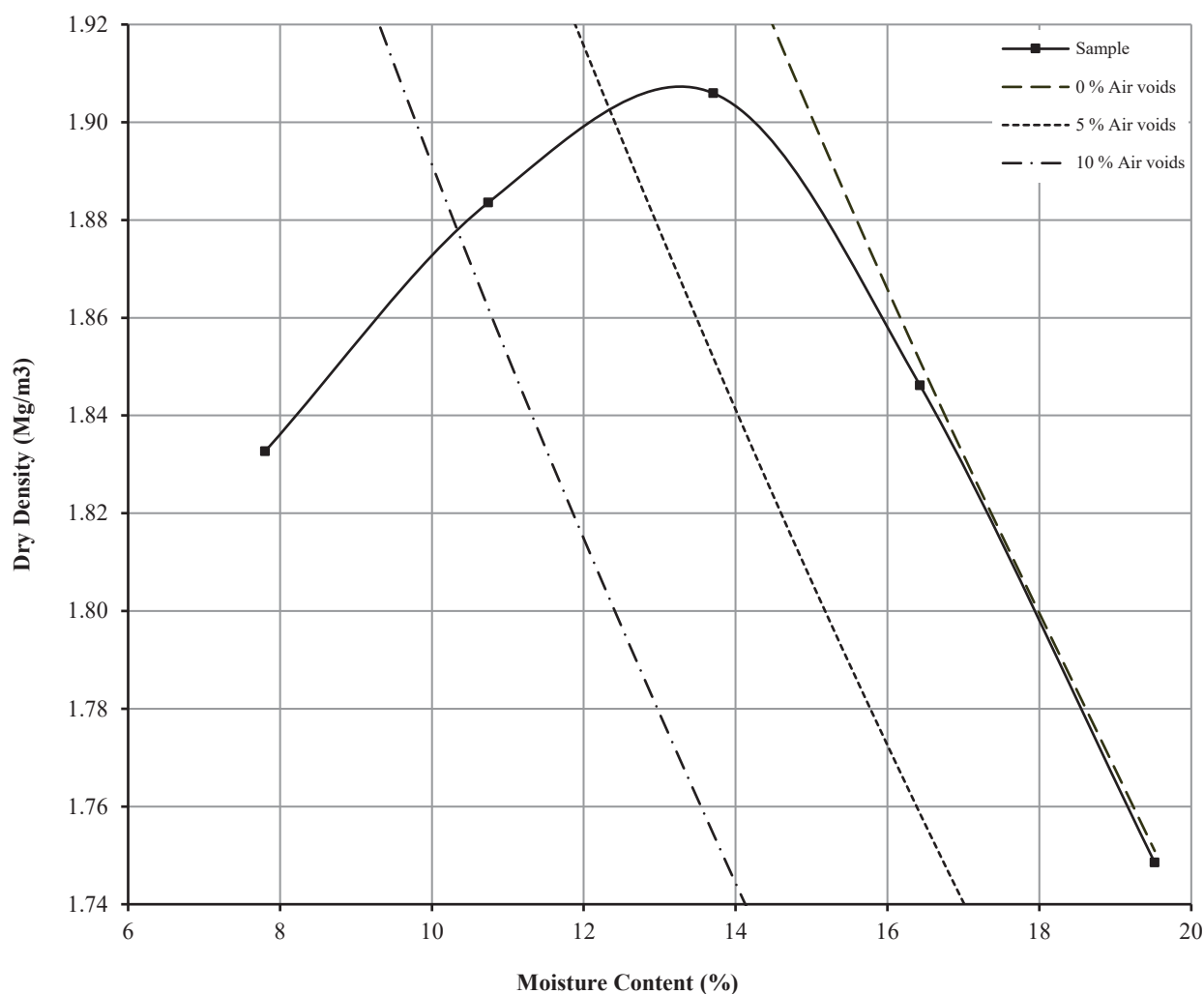
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.6 : 1990

Hole Number: BH02 Top Depth (m) : 1.20

Sample Number: Base Depth (m) : 1.65

Sample Type: B



Initial Moisture Content:	17	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.66	Assumed	Material Retained on 37.5 mm Test Sieve (%):	5
Maximum Dry Density (Mg/m ³):	1.91		Material Retained on 20.0 mm Test Sieve (%):	6
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				

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			PN224390

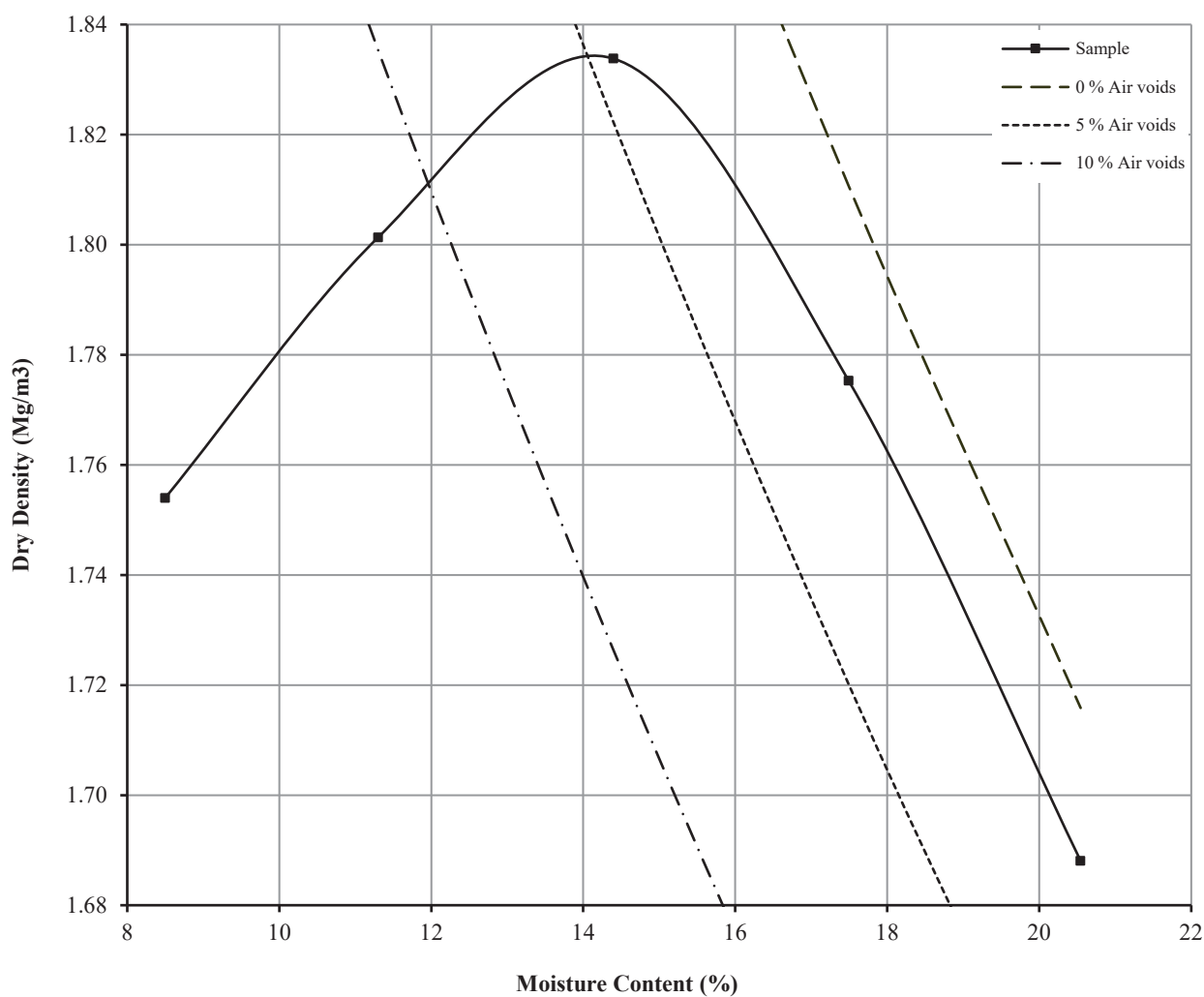
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

Hole Number: DCP01 Top Depth (m) : 0.30

Sample Number: Base Depth (m) : 0.70

Sample Type: B



Initial Moisture Content:	17	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.83		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				



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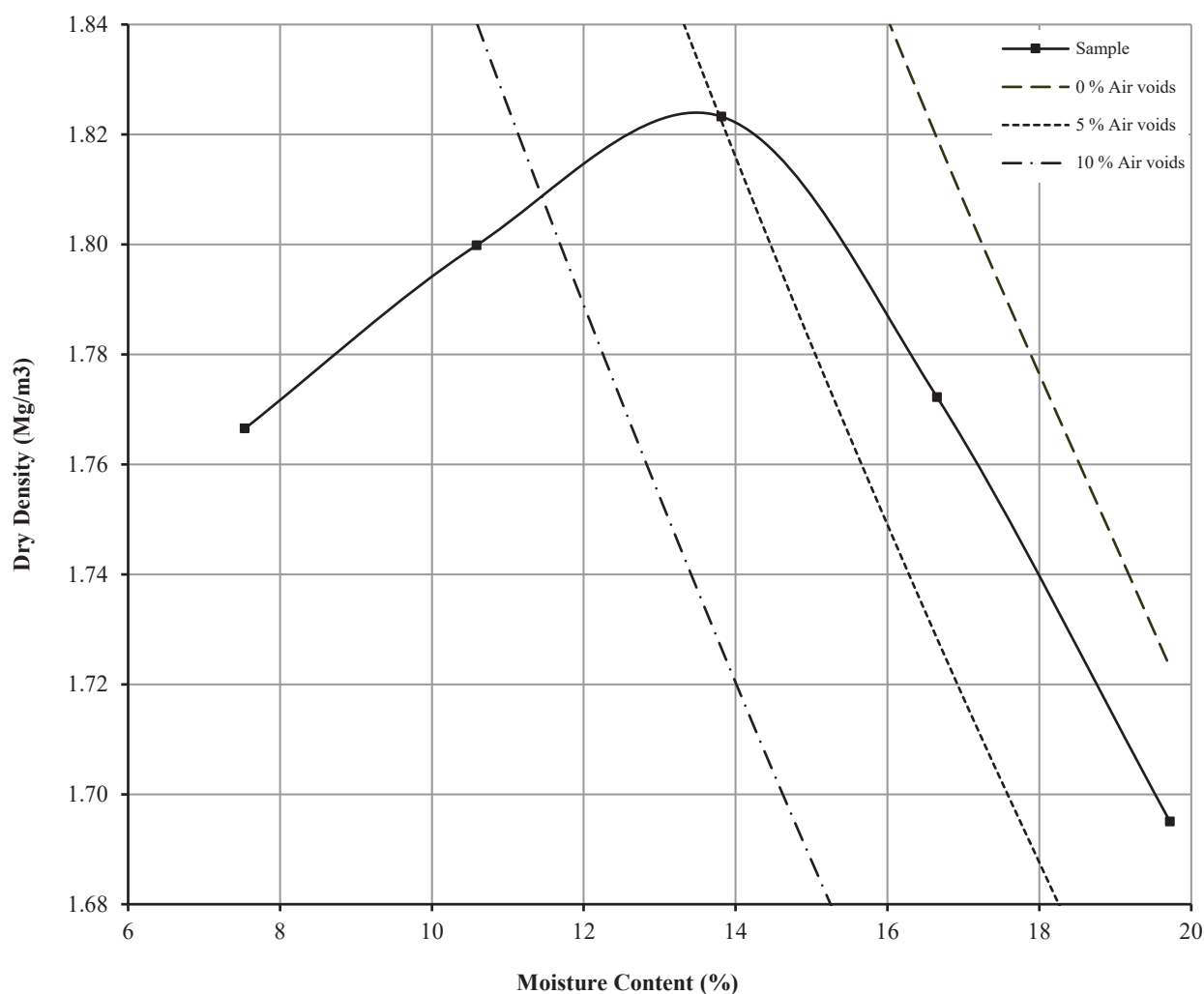
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.6 : 1990

Hole Number: DCP07 Top Depth (m) : 0.90

Sample Number: Base Depth (m) : 1.20

Sample Type: B



Initial Moisture Content:	20	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.61	Assumed	Material Retained on 37.5 mm Test Sieve (%):	3
Maximum Dry Density (Mg/m3):	1.82		Material Retained on 20.0 mm Test Sieve (%):	4
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				



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DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

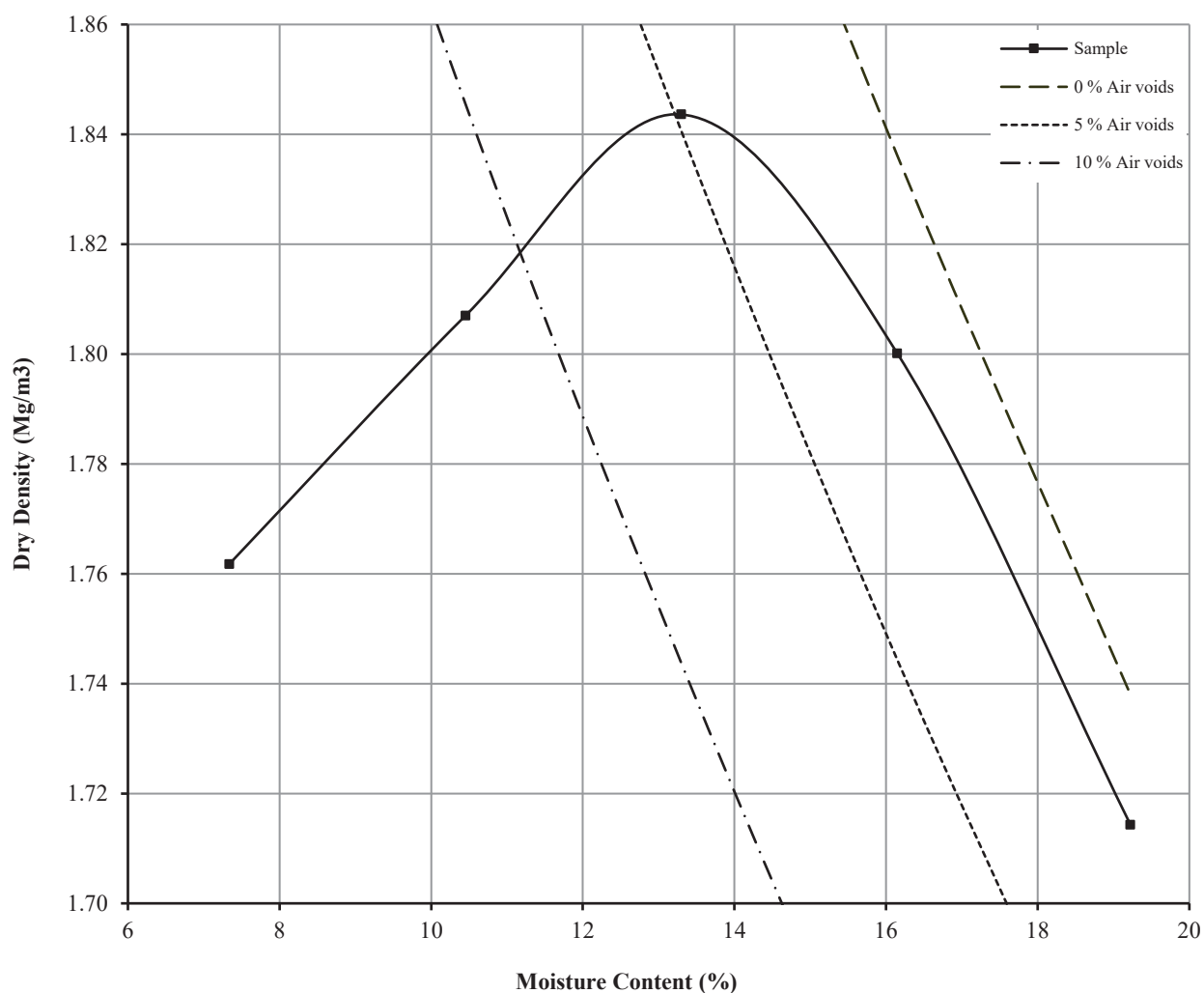
Hole Number: TP04

Top Depth (m) : 1.40

Sample Number:

Base Depth (m) : 1.60

Sample Type: B



Initial Moisture Content:		16	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.61	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.84	Material Retained on 20.0 mm Test Sieve (%):		0
Optimum Moisture Content (%):		13			
Remarks See summary of soil descriptions					



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DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

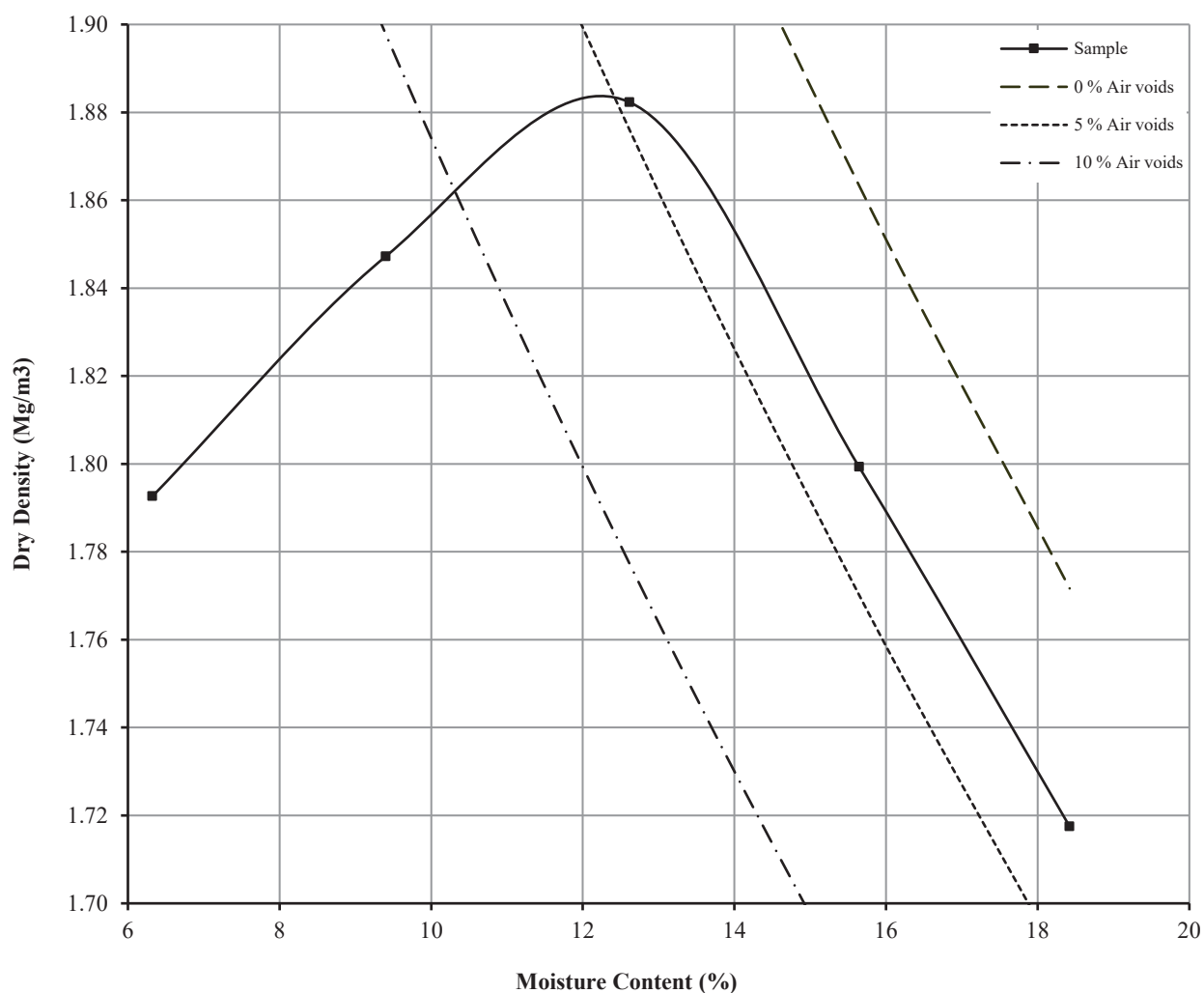
Hole Number: TP06

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) : 1.60

Sample Type: B



Initial Moisture Content:	22	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.63	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.88		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	13			
Remarks See summary of soil descriptions				



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CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

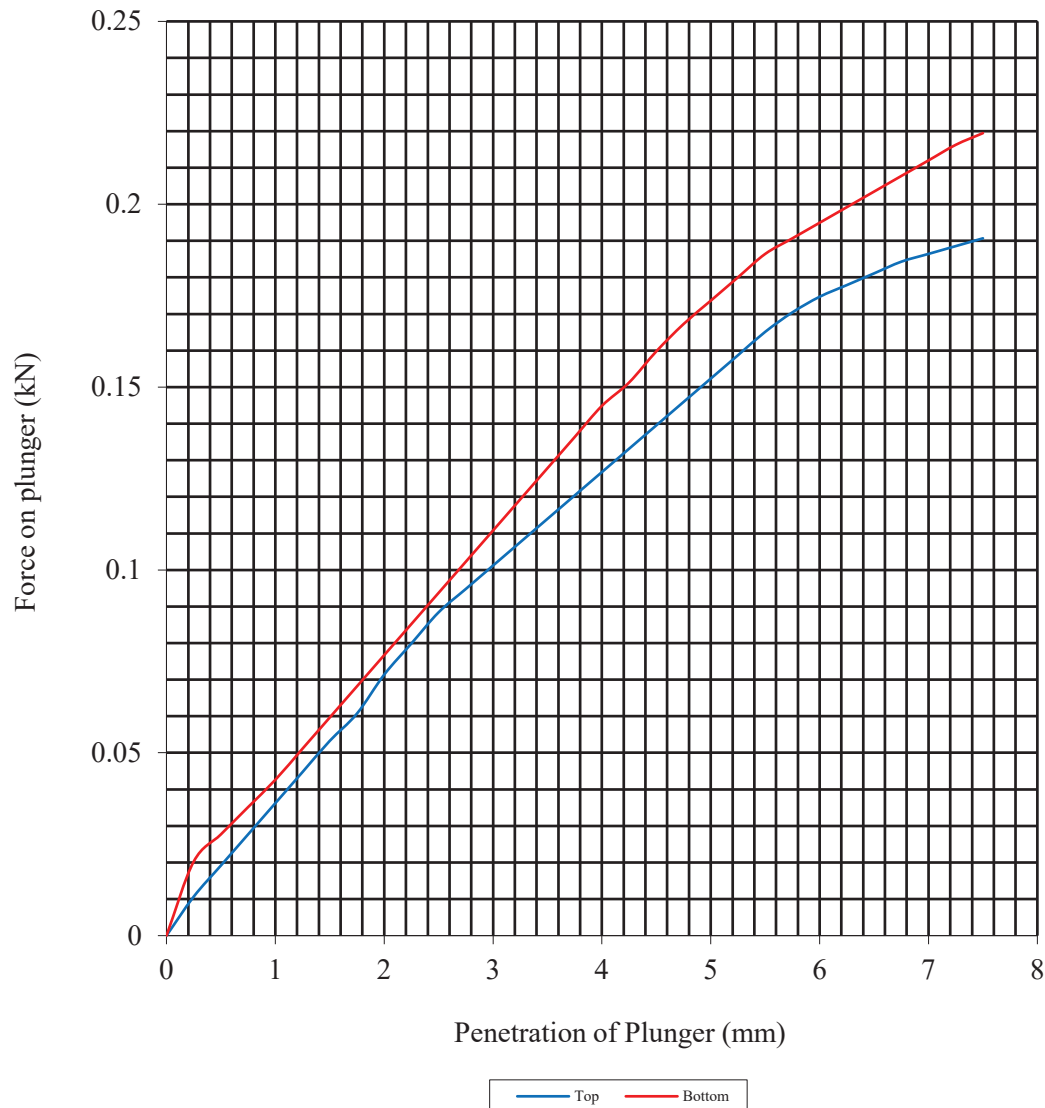
Hole Number: BH02

Top Depth (m): 3.00

Sample Number:

Base Depth (m): 3.45

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	15	Surcharge Kg:	4.20	Sample Top	15	Sample Top	0.8
Bulk Density Mg/m3:	2.16	Soaking Time hrs	0	Sample Bottom	15	Sample Bottom	0.9
Dry Density Mg/m3:	1.89	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:		0					
Compaction Conditions		2.5kg					



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CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

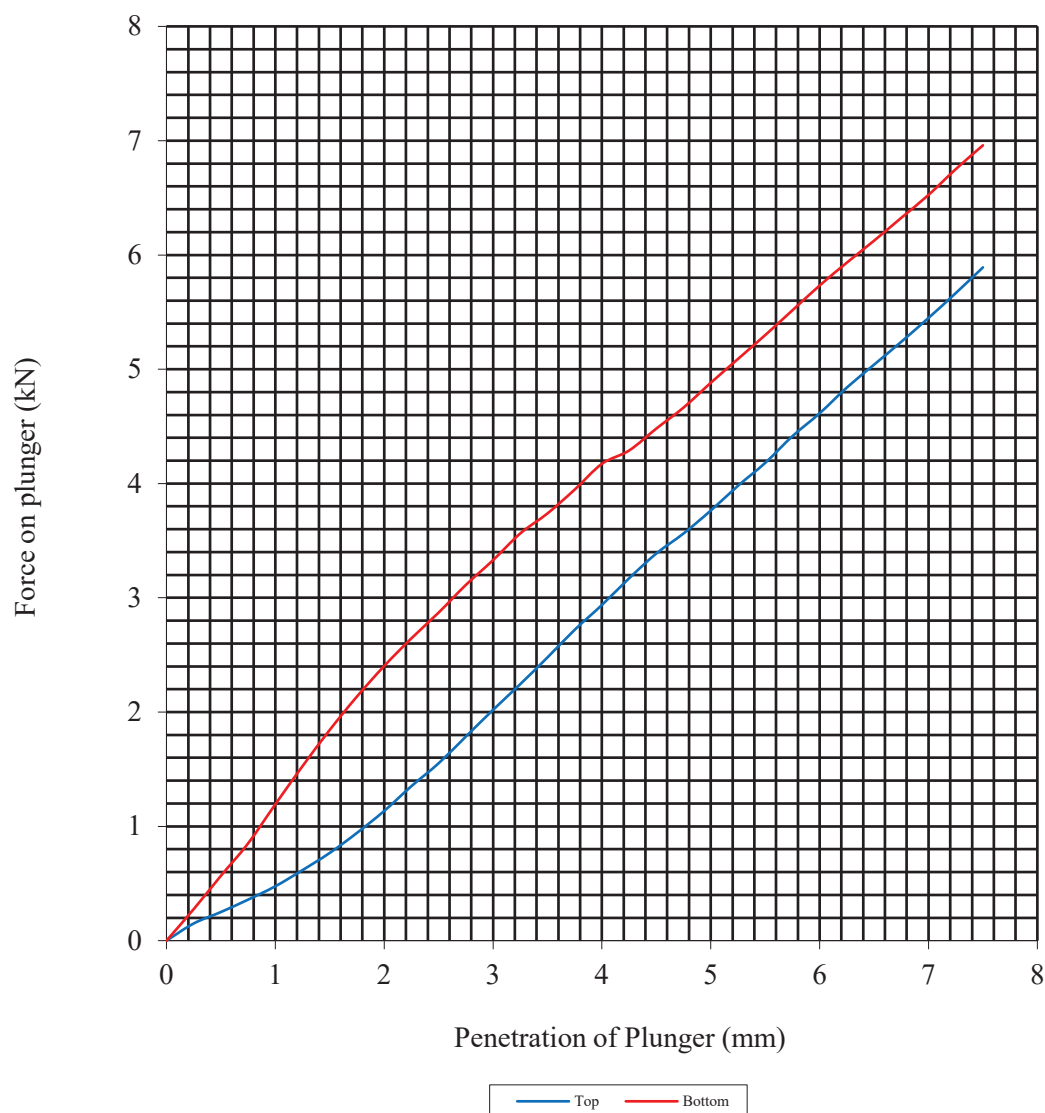
Hole Number: BH03

Top Depth (m): 0.80

Sample Number:

Base Depth (m): 1.20

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	12	Surcharge Kg:	4.20	Sample Top	12	Sample Top	18.8
Bulk Density Mg/m3:	2.14	Soaking Time hrs	0	Sample Bottom	12	Sample Bottom	24.4
Dry Density Mg/m3:	1.91	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:		24					
Compaction Conditions		2.5kg					



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CALIFORNIA BEARING RATIO TEST

Non compliance with BS 1377 : Part 4 : 1990

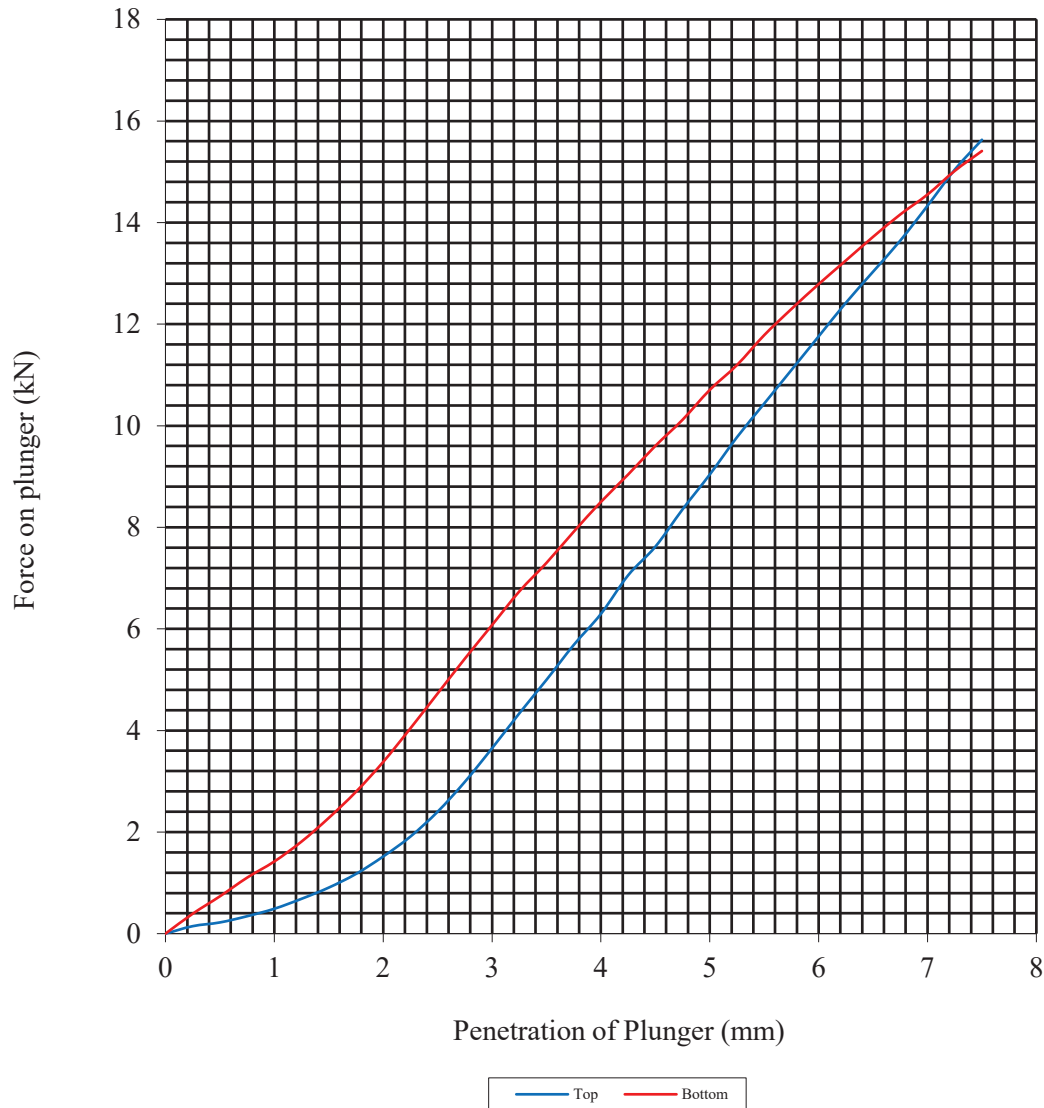
Hole Number: BH04

Top Depth (m): 0.60

Sample Number:

Base Depth (m): 1.20

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	18	Surcharge Kg:	4.20	Sample Top	18	Sample Top	45.2
Bulk Density Mg/m3:	1.52	Soaking Time hrs	0	Sample Bottom	18	Sample Bottom	53.5
Dry Density Mg/m3:	1.29	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:		39					
Compaction Conditions		2.5kg					



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CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

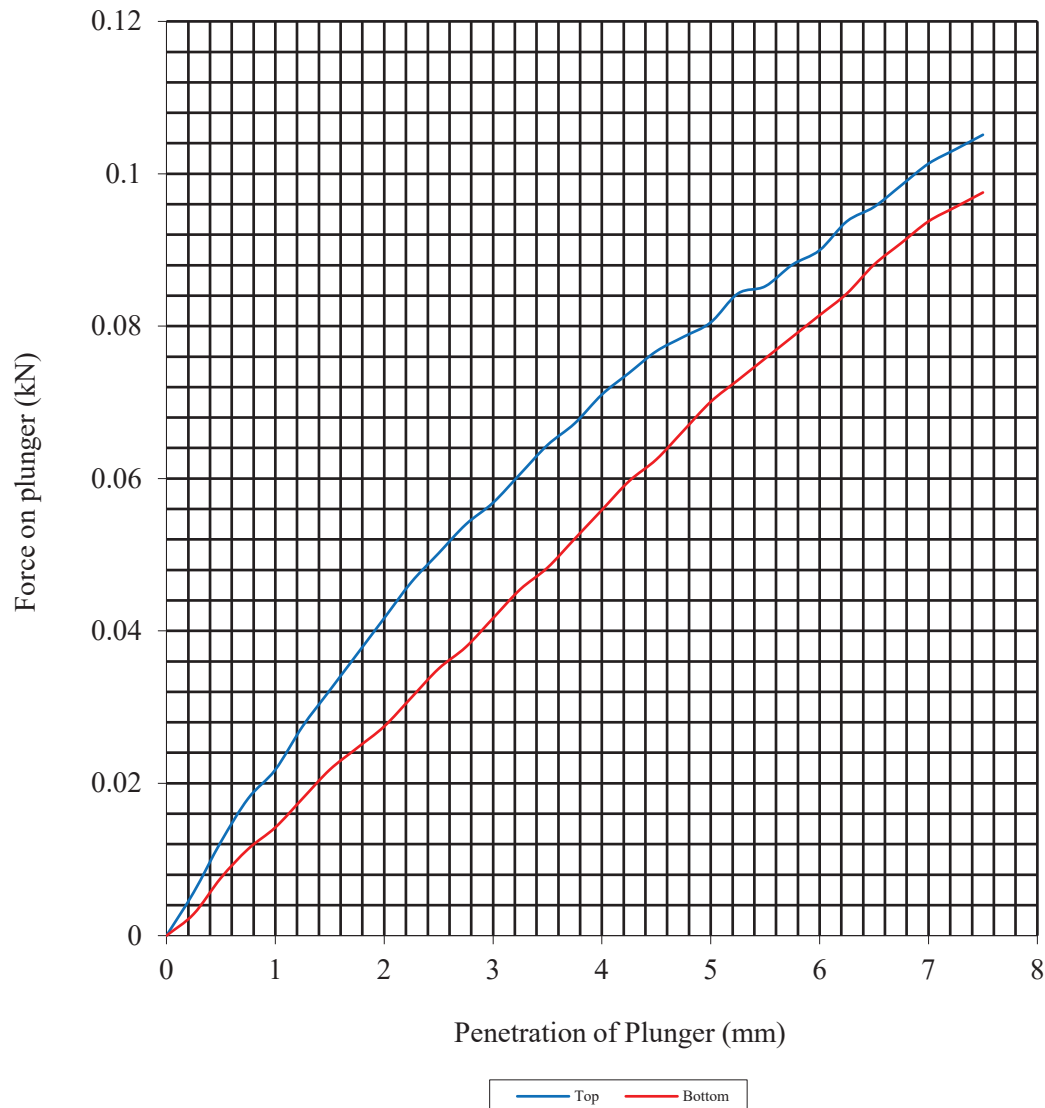
Hole Number: TP06

Top Depth (m): 1.50

Sample Number:

Base Depth (m): 1.60

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	22	Surcharge Kg:	4.20	Sample Top	22	Sample Top	0.4
Bulk Density Mg/m3:	2.01	Soaking Time hrs	0	Sample Bottom	22	Sample Bottom	0.4
Dry Density Mg/m3:	1.65	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:		0					
Compaction Conditions		2.5kg					



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

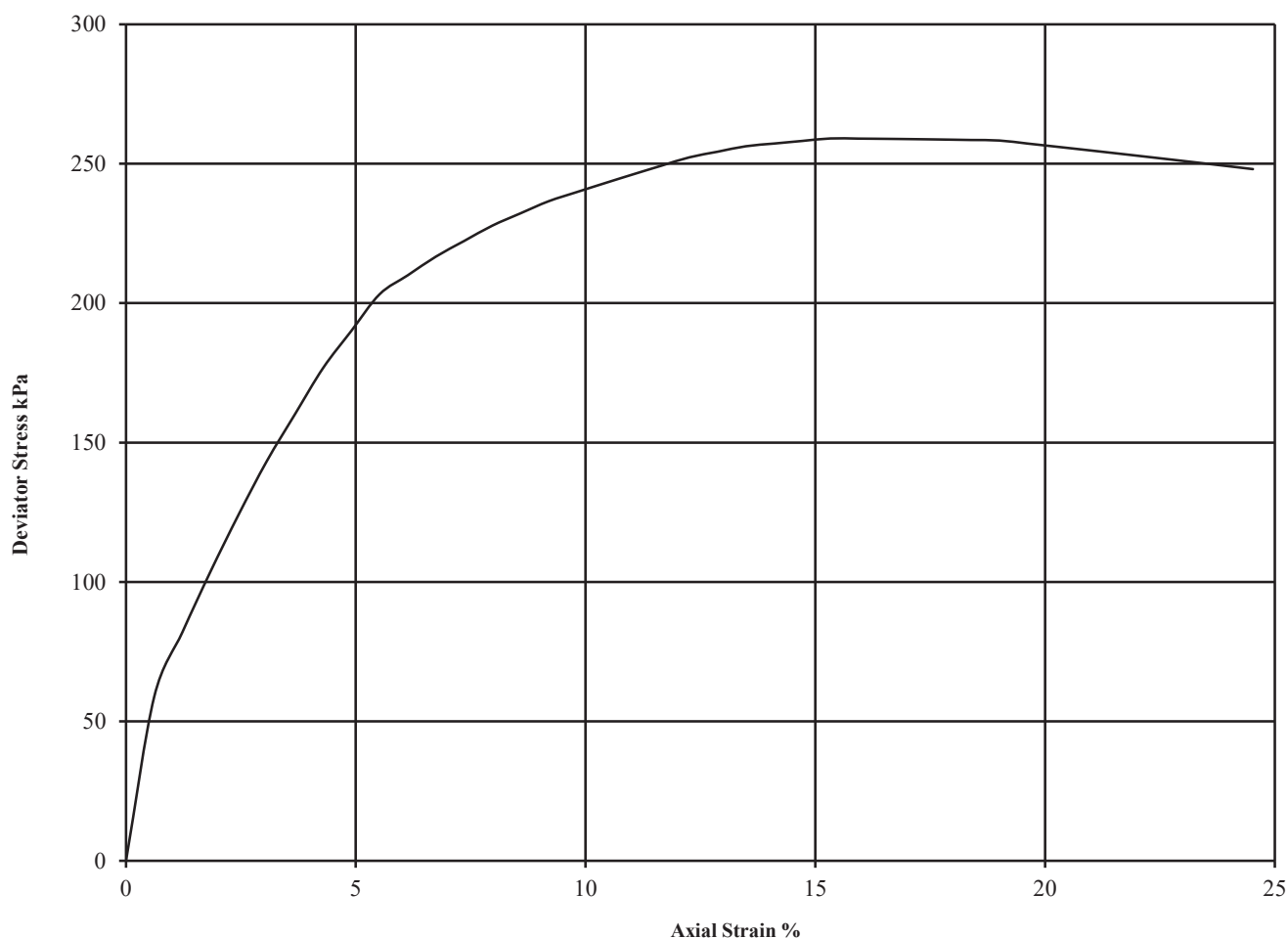
Hole Number: BH01

Top Depth (m): 6.50

Sample Number:

Base Depth (m): 6.95

Sample Type UT



Diameter (mm):		103	Height (mm):		168	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	15	2.18	1.90	130	259	130	15.3	Plastic	



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

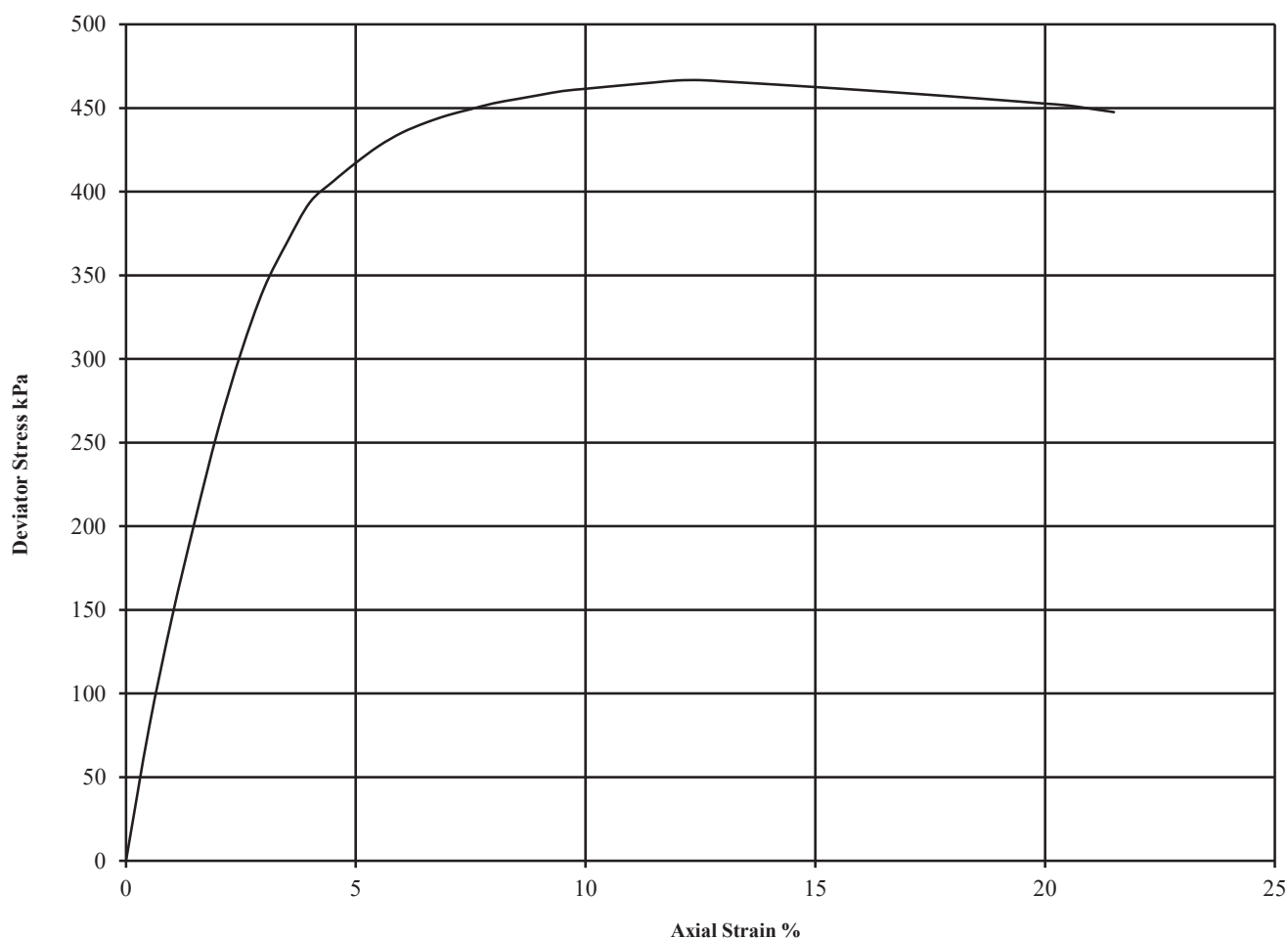
Hole Number: BH02

Top Depth (m): 5.00

Sample Number:

Base Depth (m): 5.45

Sample Type UT



Diameter (mm):		103	Height (mm):		206	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	10	2.22	2.02	100	467	233	12.5	Plastic	



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

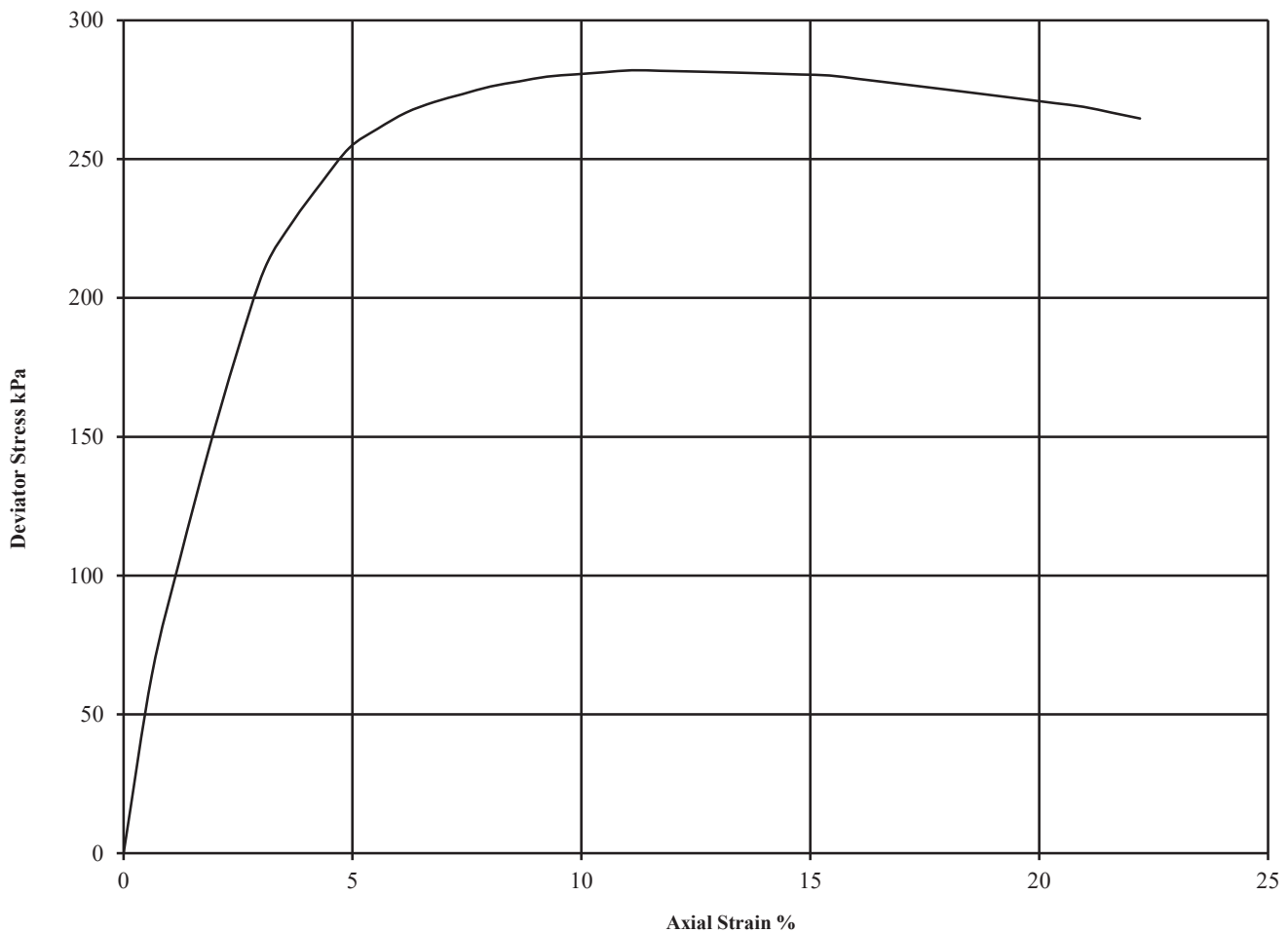
Hole Number: BH02

Top Depth (m): 8.00

Sample Number:

Base Depth (m): 8.45

Sample Type UT



Diameter (mm):		103	Height (mm):		167	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	22	2.05	1.68	160	282	141	11.1	Plastic	



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

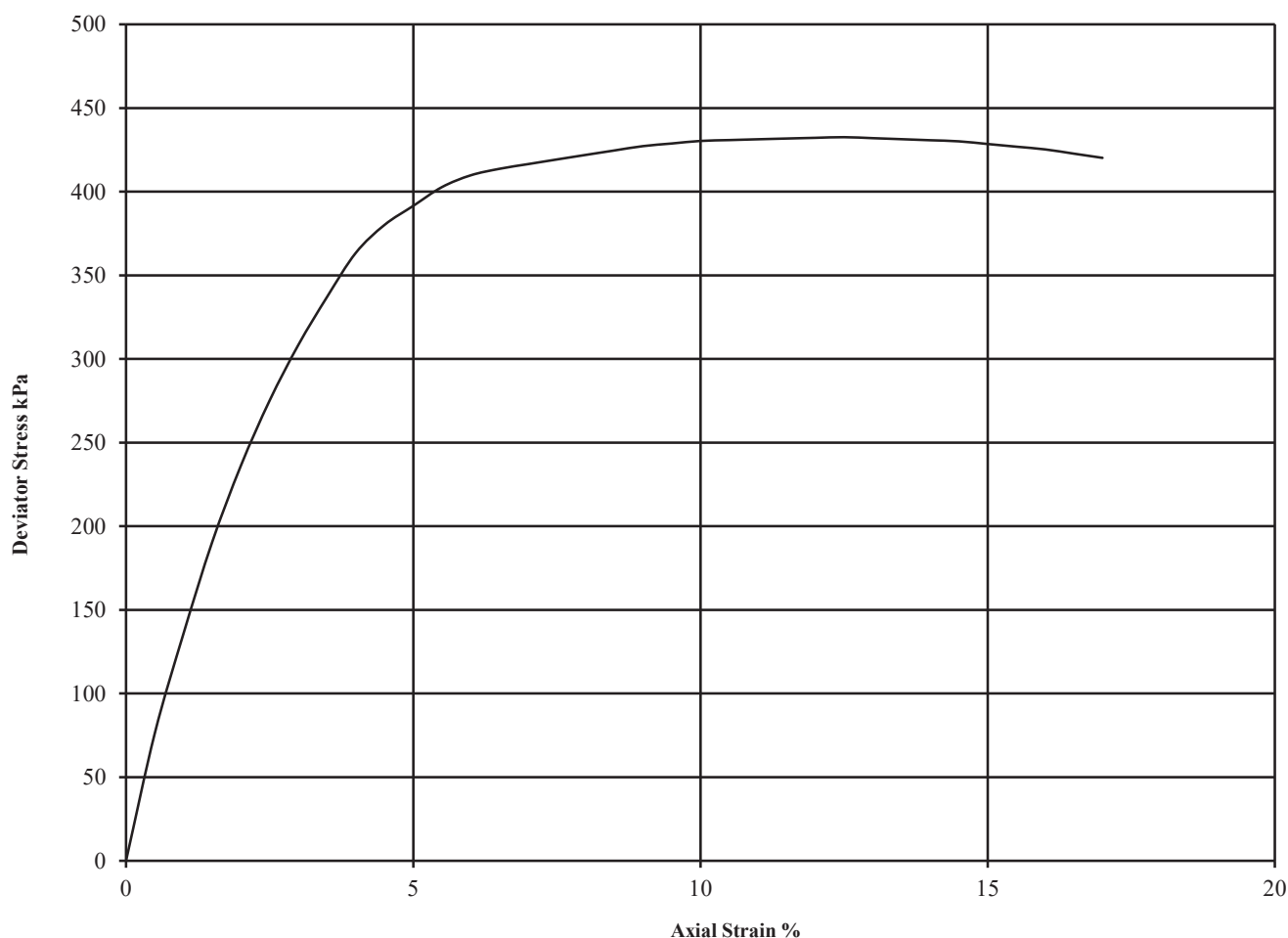
Hole Number: BH02

Top Depth (m): 14.00

Sample Number:

Base Depth (m): 14.45

Sample Type UT



Diameter (mm):		103	Height (mm):		206	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	11	2.27	2.05	280	433	216	12.5	Plastic	



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

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BS1377 : Part7 : 1990: Clause 8

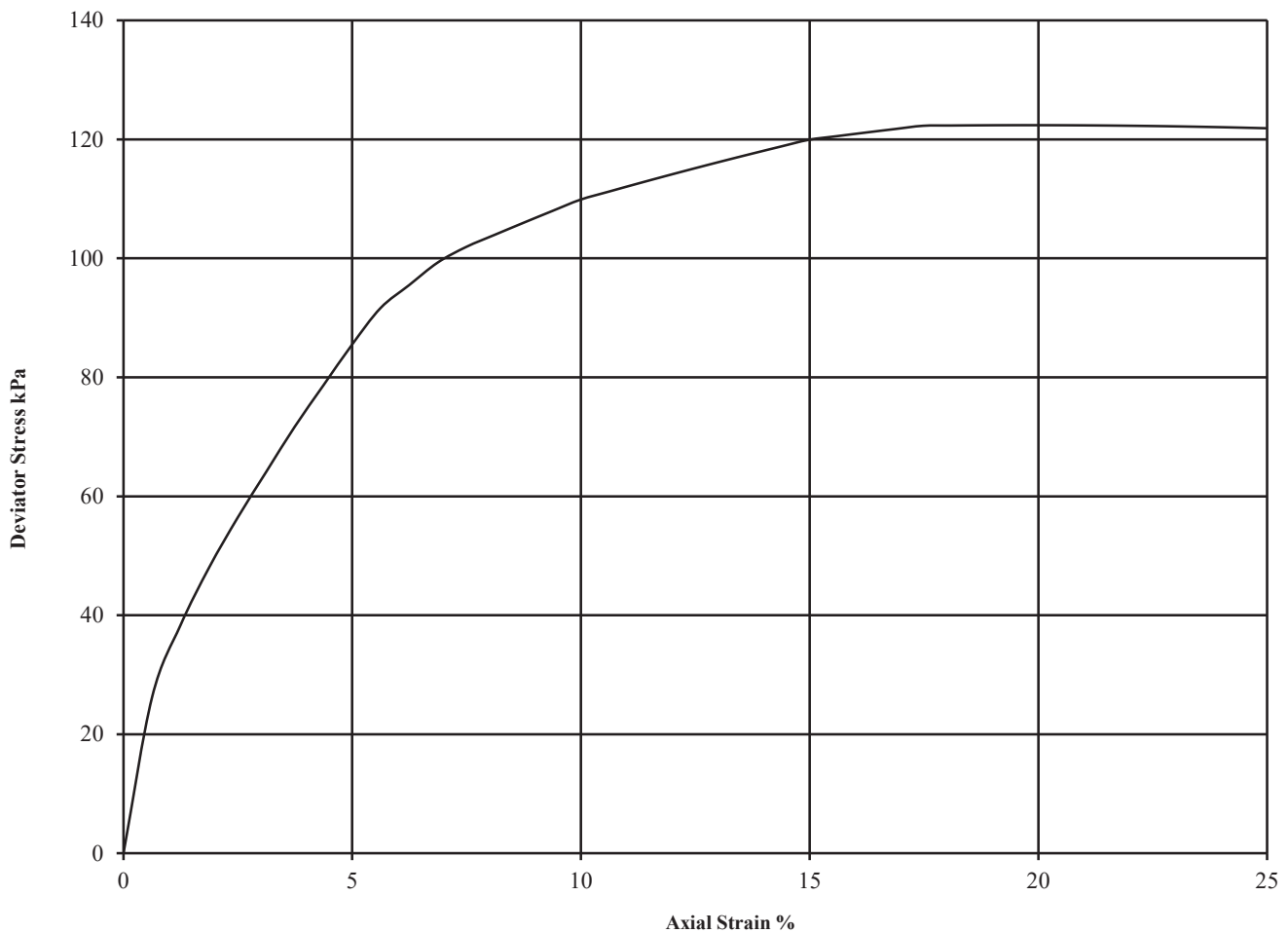
Hole Number: BH02

Top Depth (m): 17.00

Sample Number:

Base Depth (m): 17.45

Sample Type UT



Diameter (mm):		103	Height (mm):		165	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	13	2.22	1.97	340	122	61	20.0	Plastic	



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

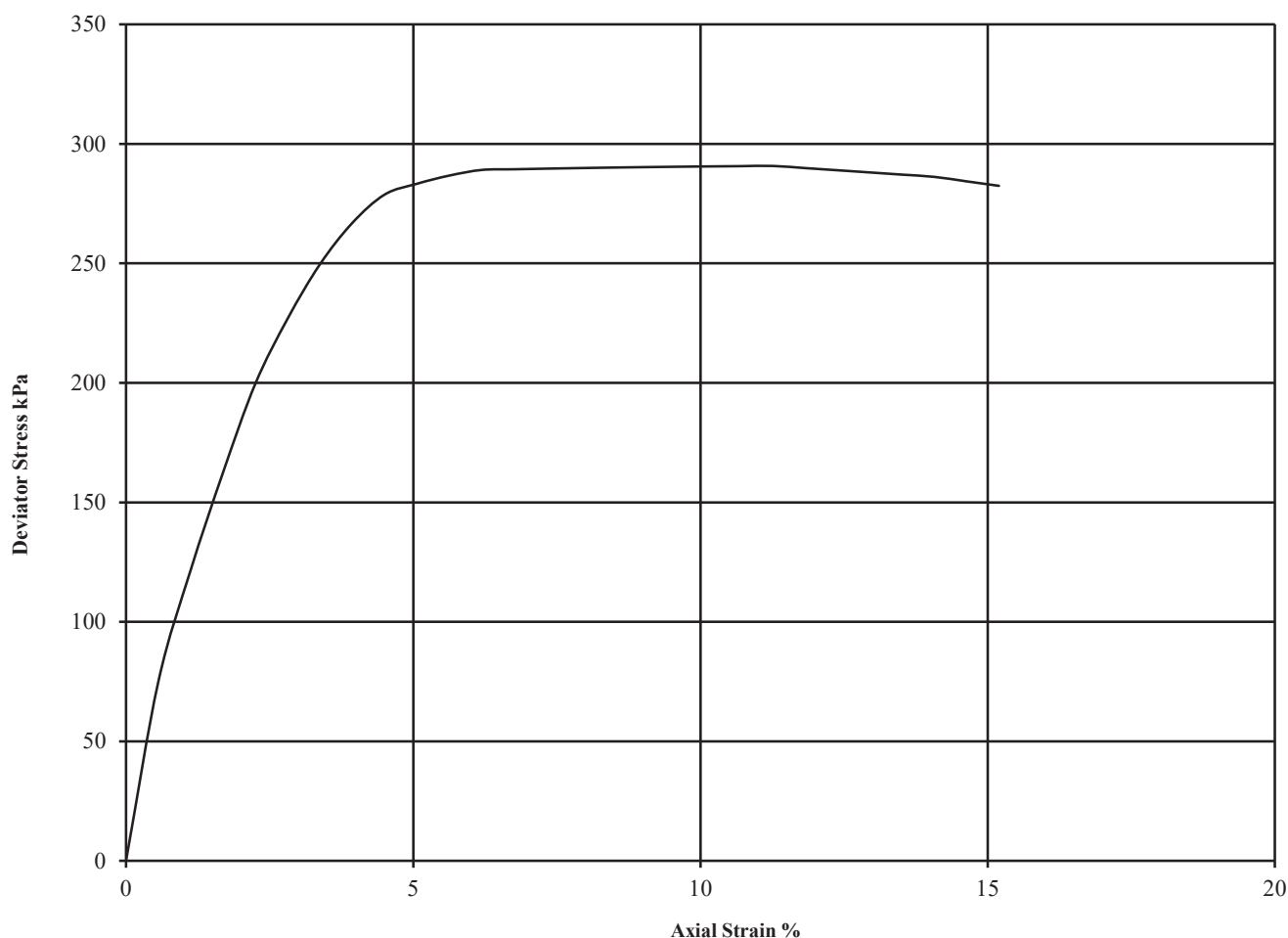
Hole Number: BH03A

Top Depth (m): 8.00

Sample Number:

Base Depth (m): 8.45

Sample Type UT



Diameter (mm):		103	Height (mm):		183	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	12	2.17	1.94	160	291	145	11.3	Intermediate	



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PN224390

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

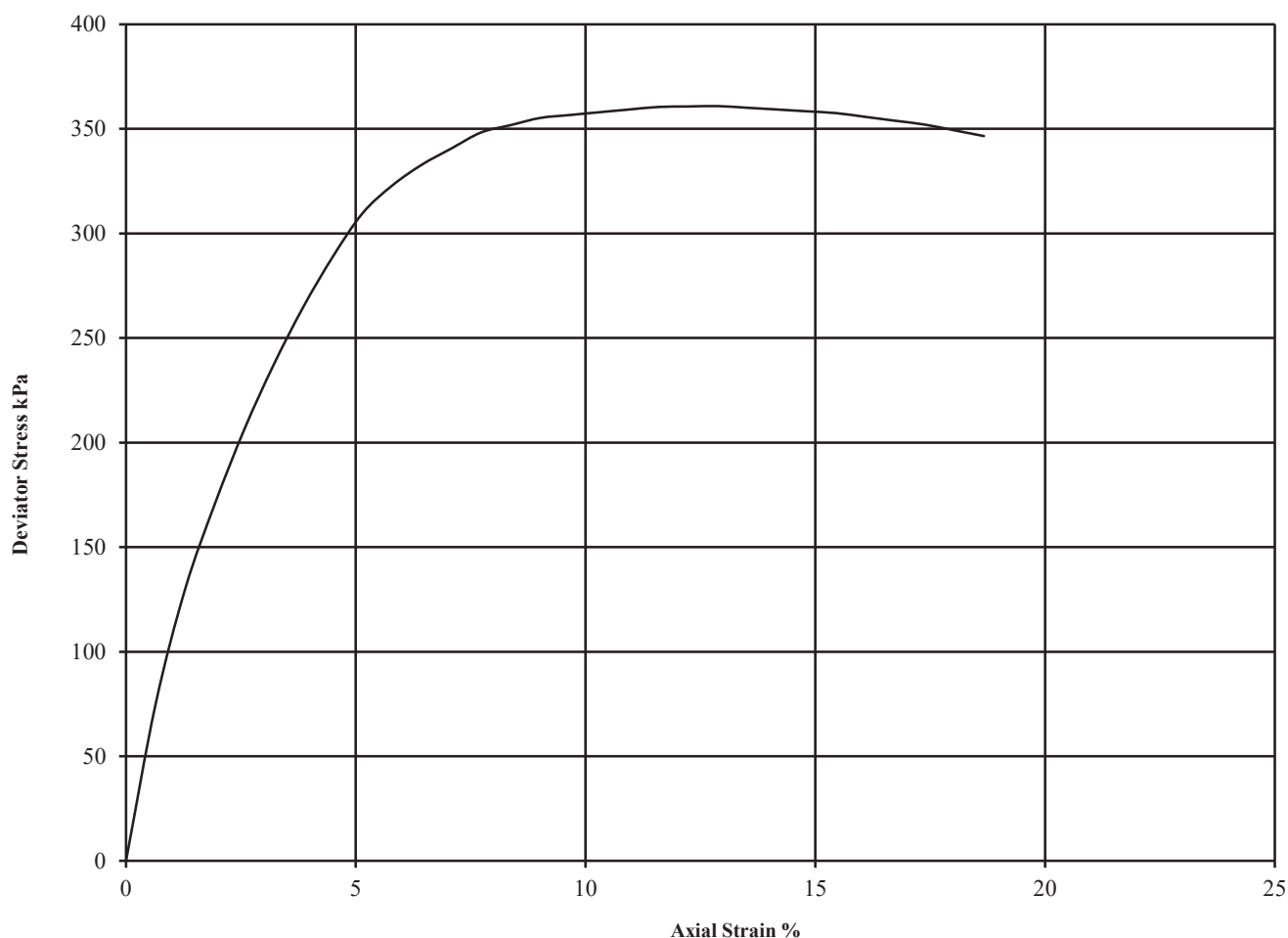
Hole Number: BH03A

Top Depth (m): 11.00

Sample Number:

Base Depth (m): 11.45

Sample Type UT



Diameter (mm):		103	Height (mm):		160	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	12	2.17	1.95	220	361	180	12.9	Intermediate	



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Star Radcliffe

Contract No:

PSL22/3908

Client Ref:

PN224390

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

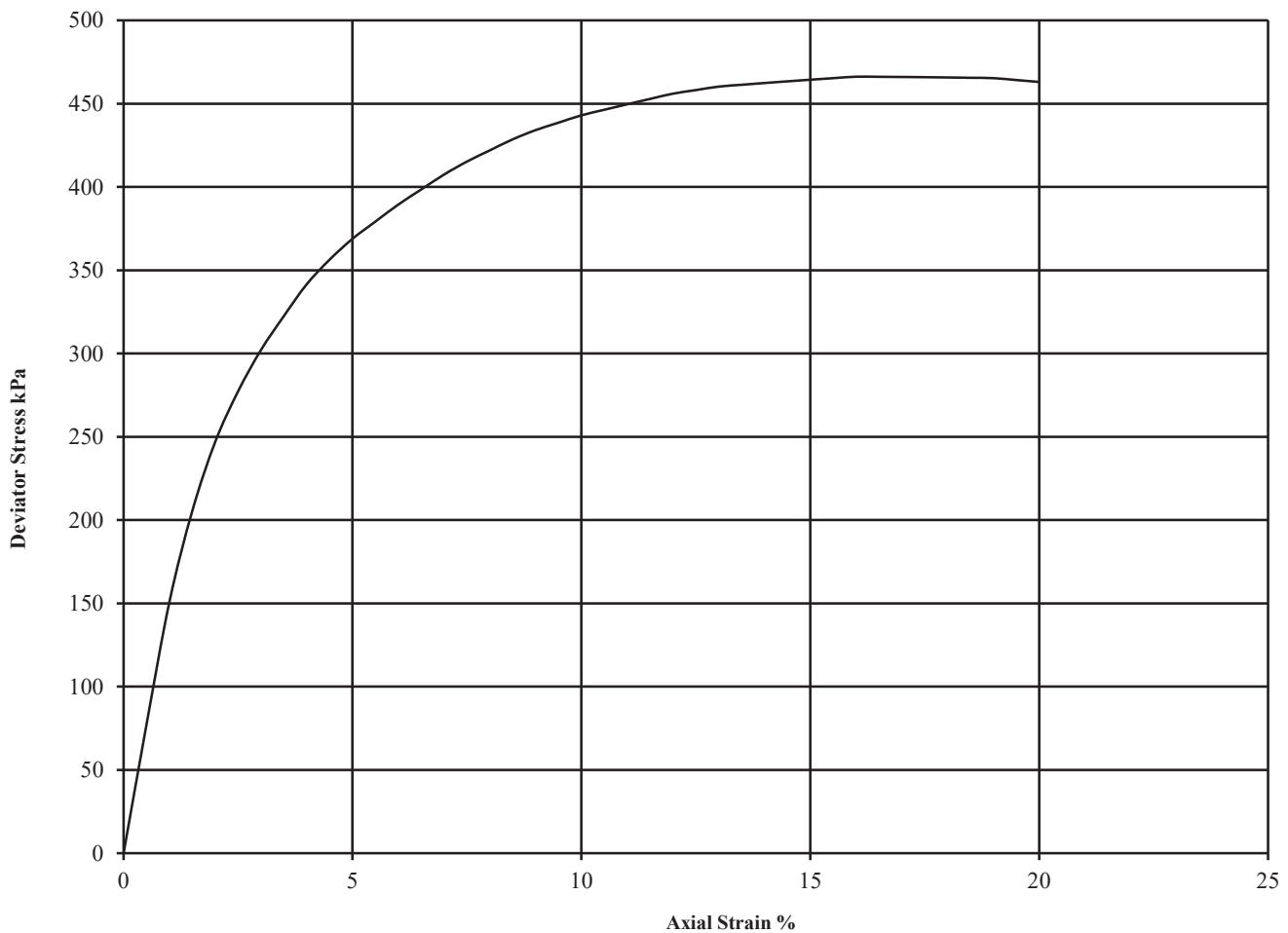
Hole Number: BH04

Top Depth (m): 3.00

Sample Number:

Base Depth (m): 3.45

Sample Type UT



Diameter (mm):		103	Height (mm):		206	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	14	2.20	1.93	60	466	233	16.0	Plastic	



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

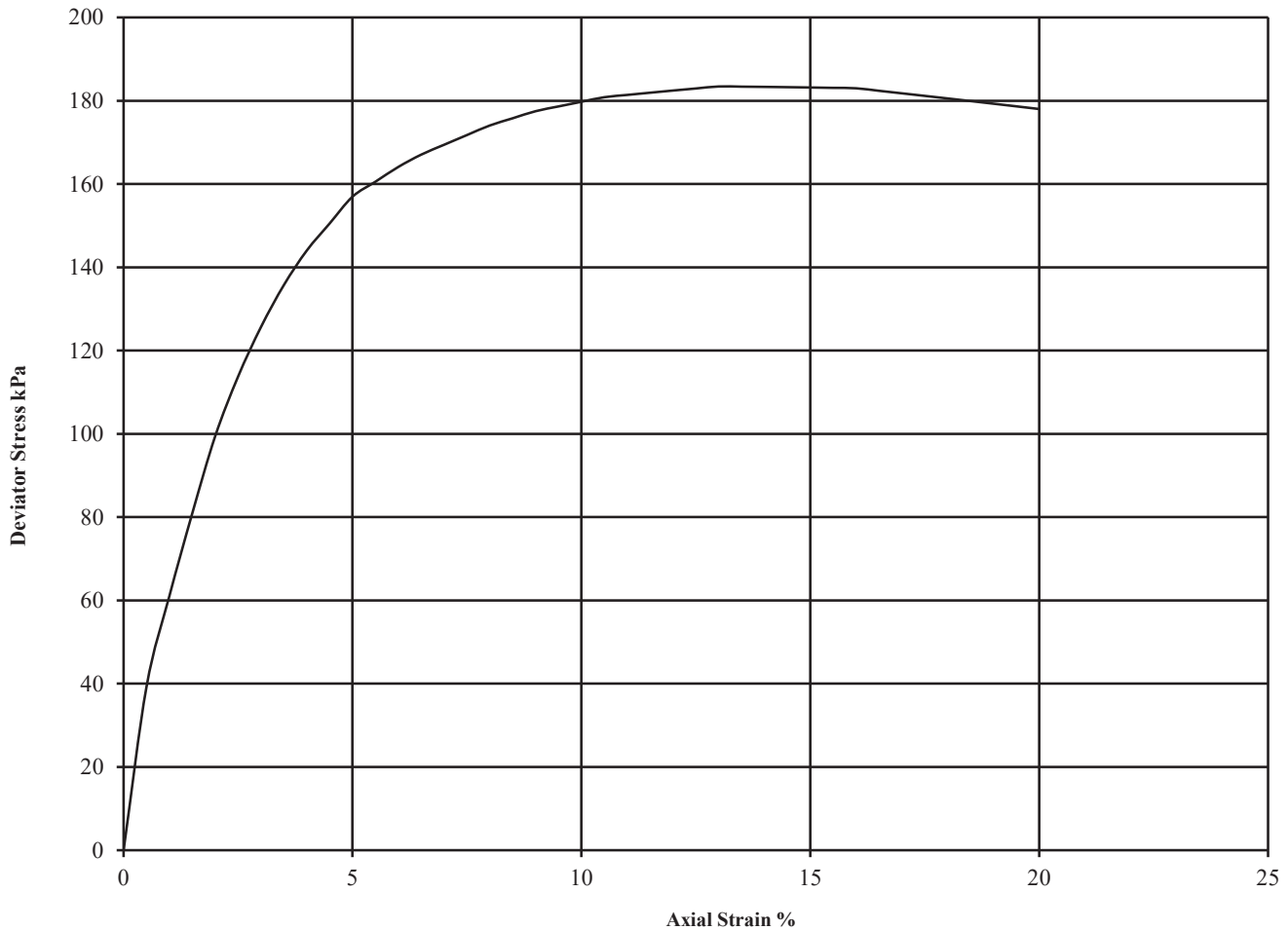
Hole Number: BH04

Top Depth (m): 8.00

Sample Number:

Base Depth (m): 8.45

Sample Type UT



Diameter (mm):		103	Height (mm):		206	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	11	2.27	2.03	160	183	92	13.0	Intermediate	



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ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: BH01

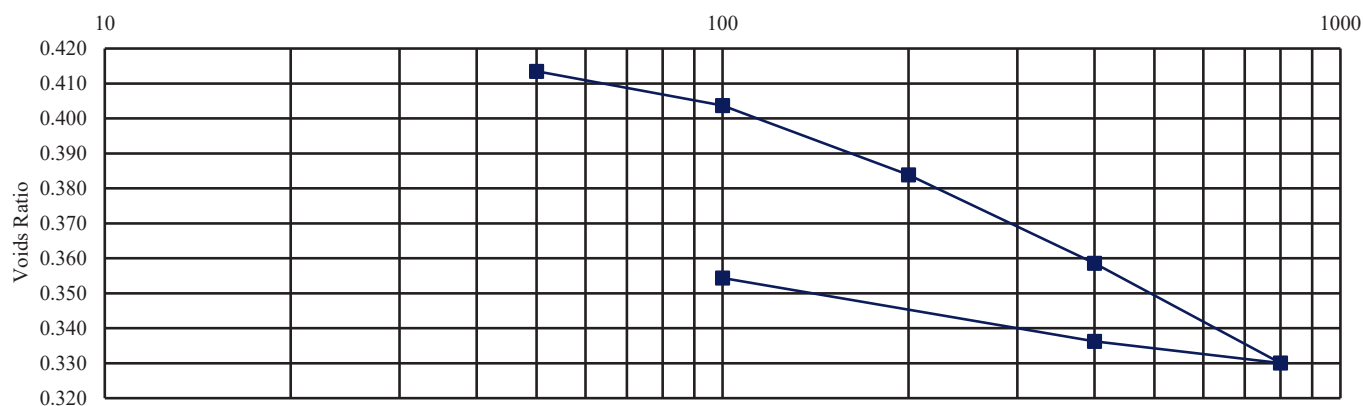
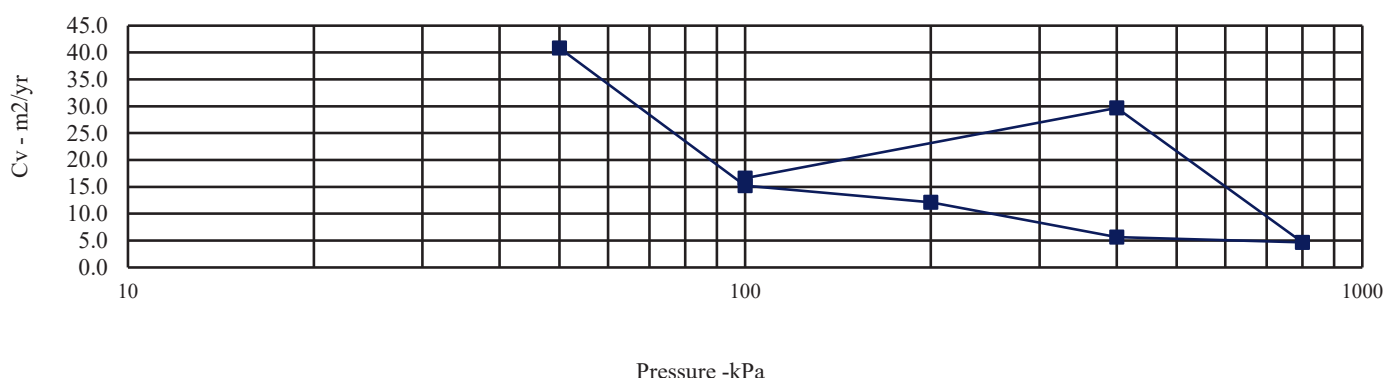
Top Depth (m): 6.50

Sample Number:

Base Depth (m) : 6.95

Sample Type: UT

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	15	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.14	0	50	0.168	40.852	Method used to	
Dry Density (Mg/m3):	1.86	50	100	0.139	15.247	determine CV:	T90
Voids Ratio:	0.425	100	200	0.141	12.109	Nominal temperature	
Degree of saturation:	94.7	200	400	0.092	5.657	during test ' C:	20
Height (mm):	20.03	400	800	0.053	4.672	Remarks:	
Diameter (mm)	75.06	800	400	0.012	29.667	See summary of soil descriptions	
Particle Density (Mg/m3):	2.65	400	100	0.045	16.611		
Assumed							



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Client Ref:

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ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: BH02

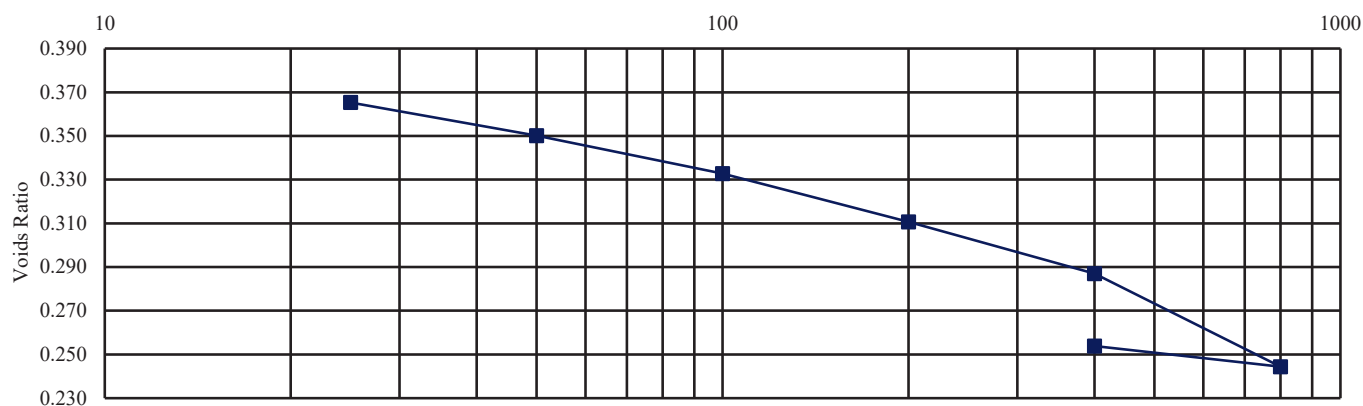
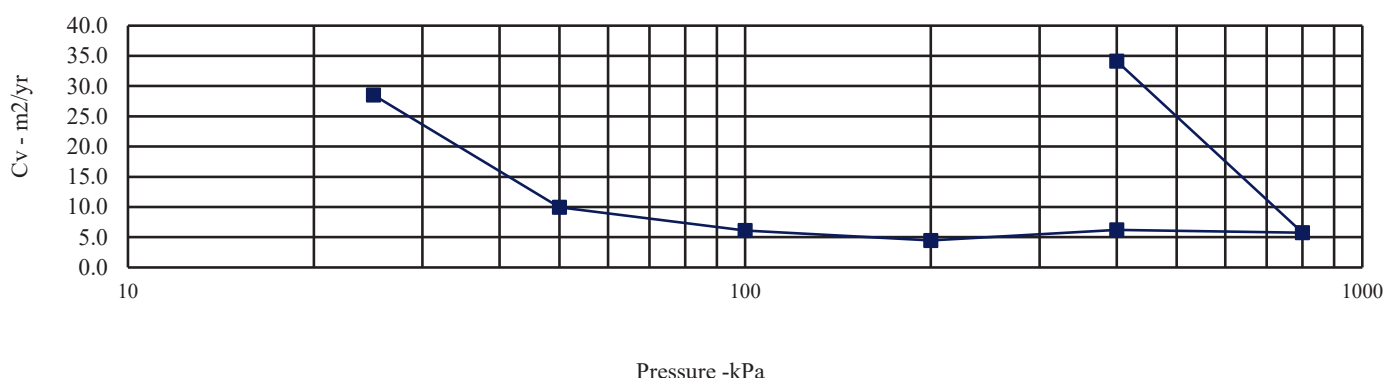
Top Depth (m): 2.00

Sample Number:

Base Depth (m) : 2.45

Sample Type: UT

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	14	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.17	0	25	0.637	28.506	Method used to	
Dry Density (Mg/m3):	1.90	25	50	0.442	9.954	determine CV:	T90
Voids Ratio:	0.387	50	100	0.258	6.108	Nominal temperature	
Degree of saturation:	95.2	100	200	0.165	4.473	during test ' C:	20
Height (mm):	20.04	200	400	0.091	6.228	Remarks:	
Diameter (mm)	75.06	400	800	0.083	5.731	See summary of soil descriptions	
Particle Density (Mg/m3):	2.64	800	400	0.019	34.125		
Measured							



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ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: BH02

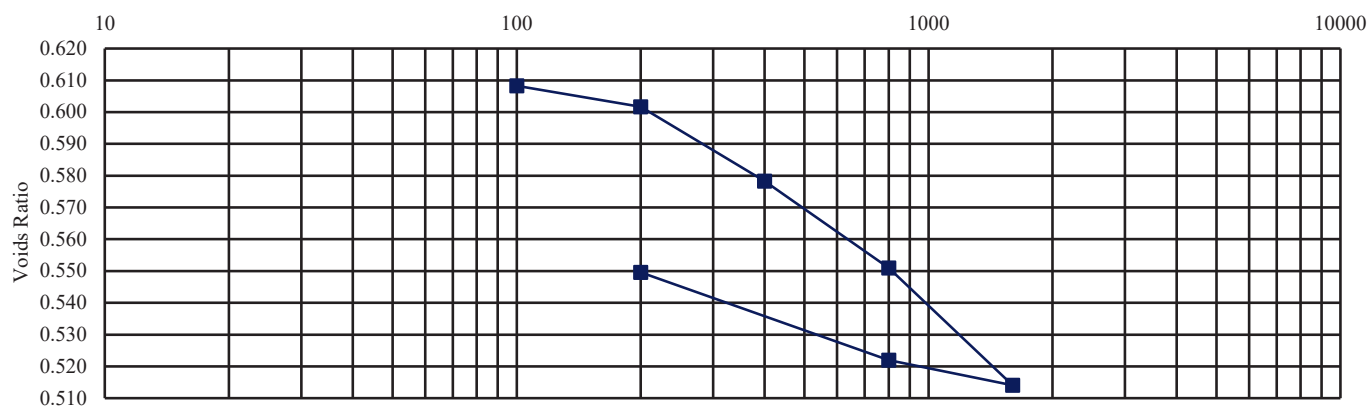
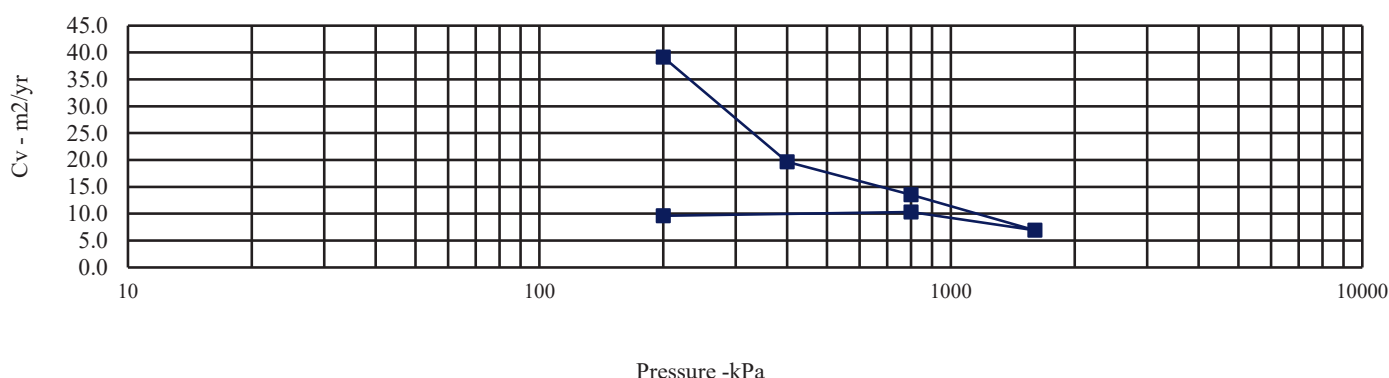
Top Depth (m): 8.00

Sample Number:

Base Depth (m) : 8.45

Sample Type: UT

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	23						
Bulk Density (Mg/m3):	2.01	0	100	Swelling	Swelling	Method used to	T90
Dry Density (Mg/m3):	1.63	100	200	0.041	39.144	determine CV:	
Voids Ratio:	0.621	200	400	0.073	19.640	Nominal temperature	20
Degree of saturation:	97.8	400	800	0.043	13.499	during test ' C:	
Height (mm):	20.01	800	1600	0.030	6.919	Remarks:	See summary of soil descriptions
Diameter (mm)	75.01	1600	800	0.007	10.321		
Particle Density (Mg/m3):	2.65	800	200	0.030	9.642		
Assumed							



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ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: BH03A

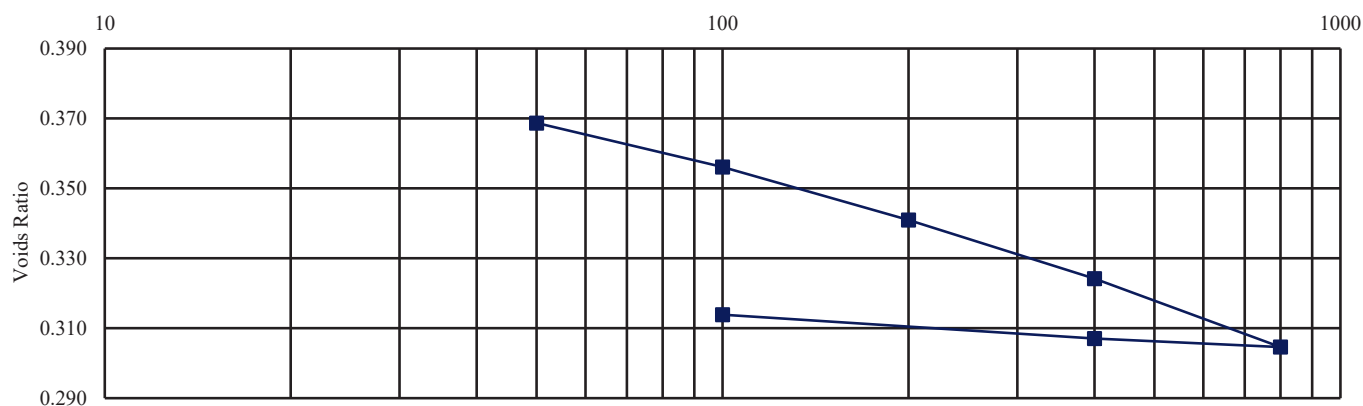
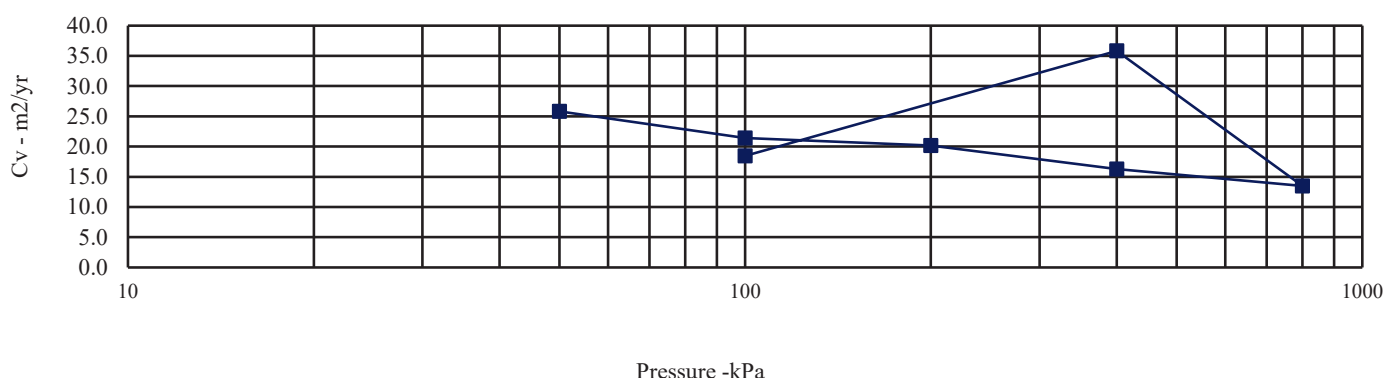
Top Depth (m): 5.00

Sample Number:

Base Depth (m) : 5.45

Sample Type: UT

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	13	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.16	0	50	0.319	25.846	Method used to	
Dry Density (Mg/m3):	1.91	50	100	0.184	21.417	determine CV:	T90
Voids Ratio:	0.391	100	200	0.112	20.185	Nominal temperature	
Degree of saturation:	89.1	200	400	0.063	16.292	during test ' C:	20
Height (mm):	20.05	400	800	0.037	13.485	Remarks:	
Diameter (mm)	75.08	800	400	0.005	35.820	See summary of soil descriptions	
Particle Density (Mg/m3):	2.66	400	100	0.018	18.466		
Measured							



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ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: BH03A

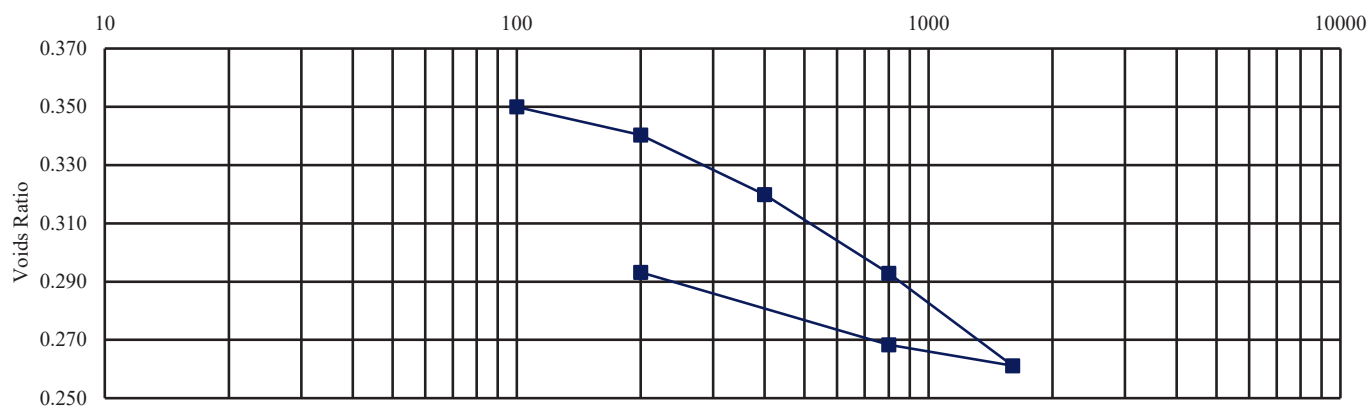
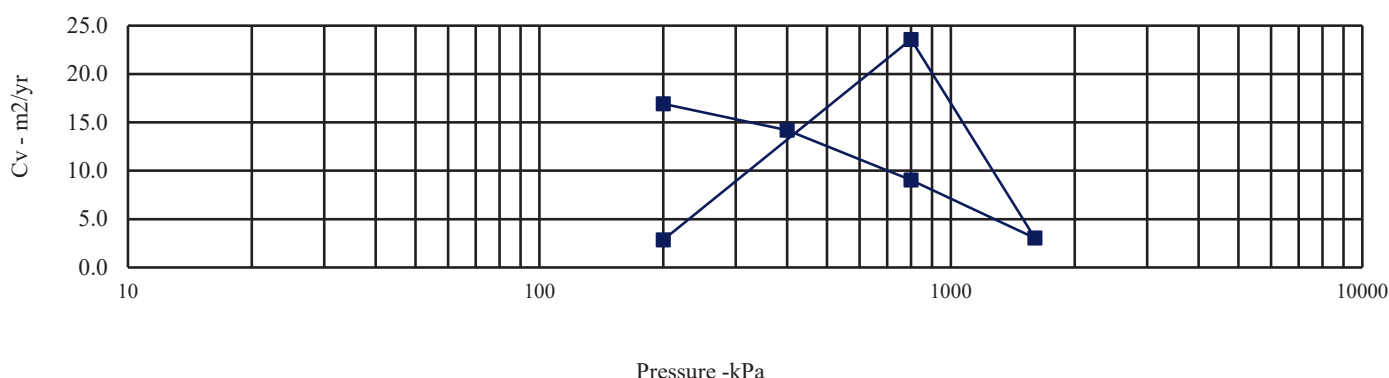
Top Depth (m): 8.00

Sample Number:

Base Depth (m) : 8.45

Sample Type: UT

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	14	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.19	0	100	Swelling	Swelling	Method used to	
Dry Density (Mg/m3):	1.92	100	200	0.072	16.913	determine CV:	T90
Voids Ratio:	0.379	200	400	0.076	14.206	Nominal temperature	
Degree of saturation:	98.3	400	800	0.051	9.031	during test ' C:	20
Height (mm):	20.07	800	1600	0.031	3.045	Remarks:	
Diameter (mm)	75.06	1600	800	0.007	23.580	See summary of soil descriptions	
Particle Density (Mg/m3):	2.65	800	200	0.033	2.854		
Assumed							



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ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: BH04

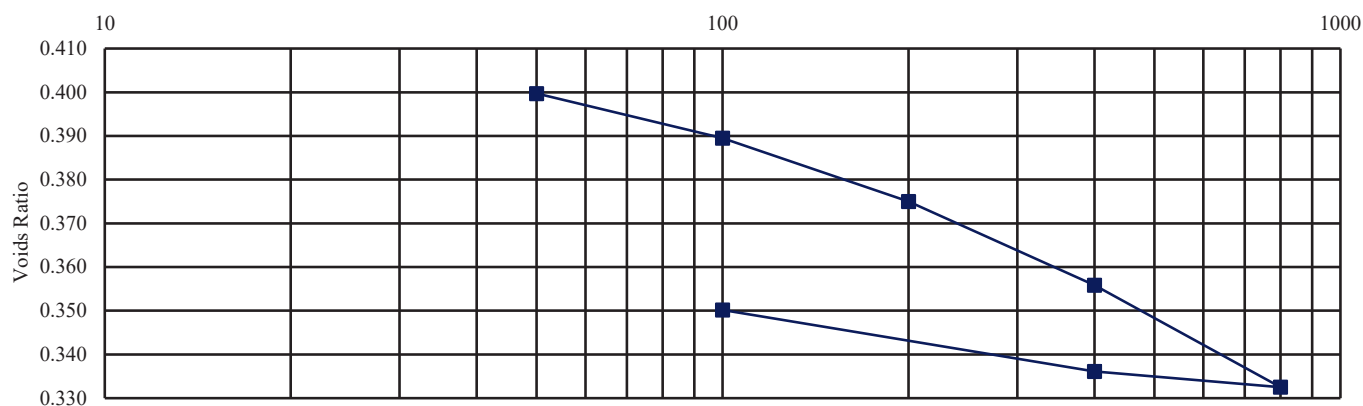
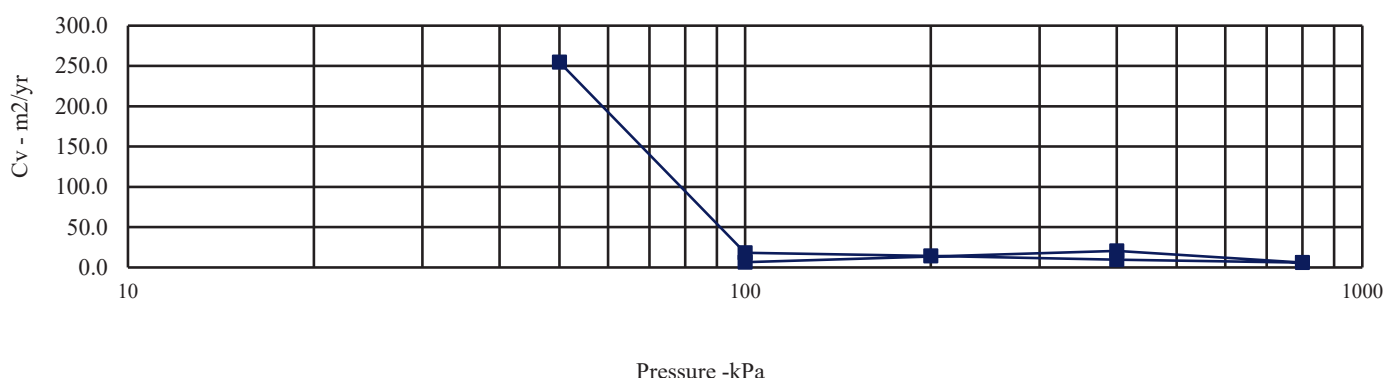
Top Depth (m): 3.00

Sample Number:

Base Depth (m) : 3.45

Sample Type: UT

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	16	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.18	0	50	0.151	254.777	Method used to	
Dry Density (Mg/m3):	1.88	50	100	0.146	18.048	determine CV:	T90
Voids Ratio:	0.410	100	200	0.105	14.471	Nominal temperature	
Degree of saturation:	102.1	200	400	0.070	9.574	during test ' C:	20
Height (mm):	20.06	400	800	0.043	6.062	Remarks:	
Diameter (mm)	75.09	800	400	0.007	20.587	See summary of soil descriptions	
Particle Density (Mg/m3):	2.65	400	100	0.035	6.621		
Assumed							



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SUMMARY OF LABORATORY HAND VANES
(BS1377 : PART 7 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Peak Shear Strength kPa	Remarks
BH01		UT	9.50	9.95	12	>150	
BH02		UT	11.00	11.45	12	>150	
BH02		UT	20.00	20.45	16	21	
BH04		UT	5.00	5.45	11	>150	
BH04		UT	11.00	11.45	12	>150	

* This test is out of our UKAS scope



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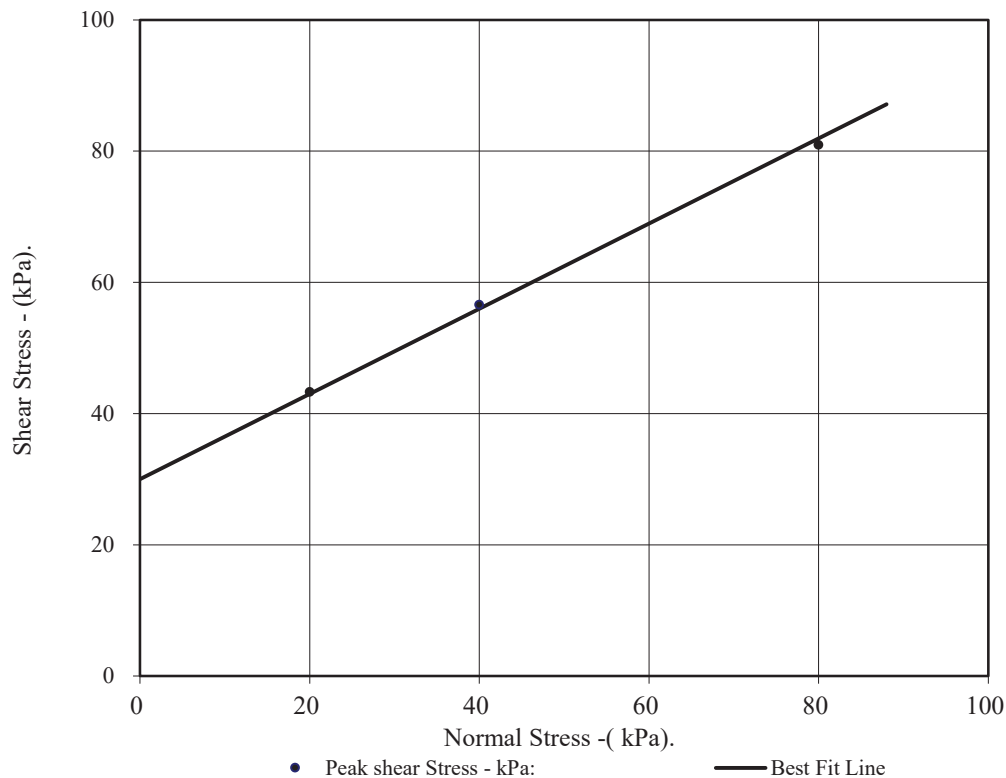
Client Ref:

PN224390

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	BH01		Top Depth:	0.50	
Sample Number:			Base Depth:	1.20	
Sample Conditions:	Dry		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	See summary of soil descriptions				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			9.2	9.2	9.2
Bulk Density - Mg/m3:			1.95	1.95	1.95
Dry Density - Mg/m3:			1.79	1.79	1.79
Voids Ratio:			0.483	0.483	0.483
Normal Pressure- kPa			20	40	80
Consolidation Stage					
Consolidated Height - mm:			19.71	19.63	19.50
Shearing Stage					
Rate of Strain (mm/min)			0.600	0.600	0.600
Displacement at peak shear stress (mm)			2.50	2.00	2.50
Peak shear Stress - kPa:			43	57	81
Final Consolidated Conditions					
Moisture Content - %:			11	11	11
Bulk Density - Mg/m3:			1.98	1.99	2.01
Dry Density - Mg/m3:			1.78	1.79	1.80
Peak					
Angle of Shearing Resistance:(θ)			33		
Effective Cohesion - kPa:			30		



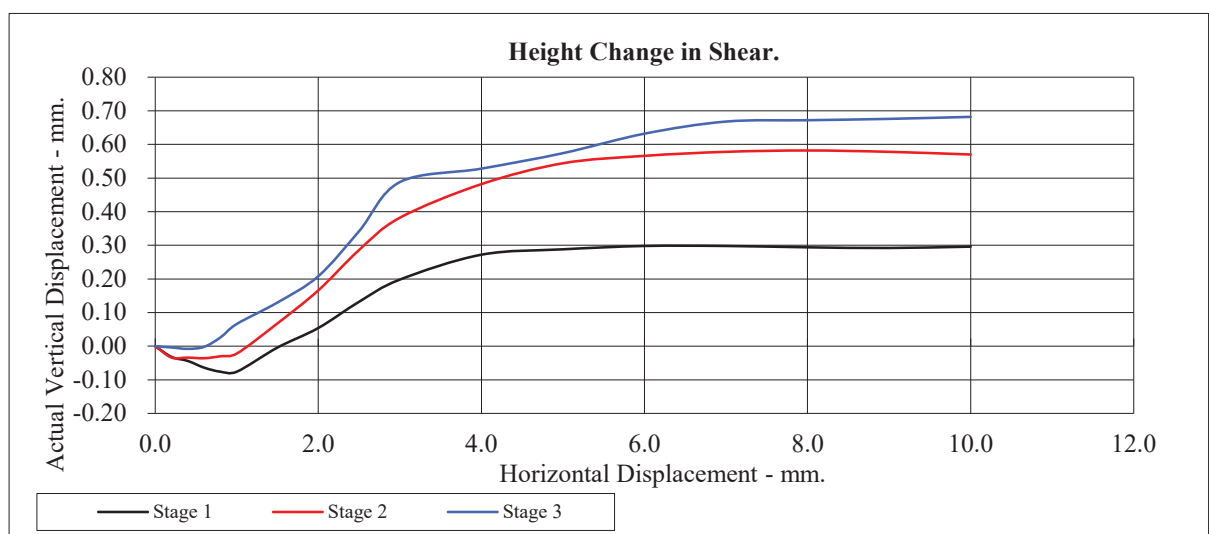
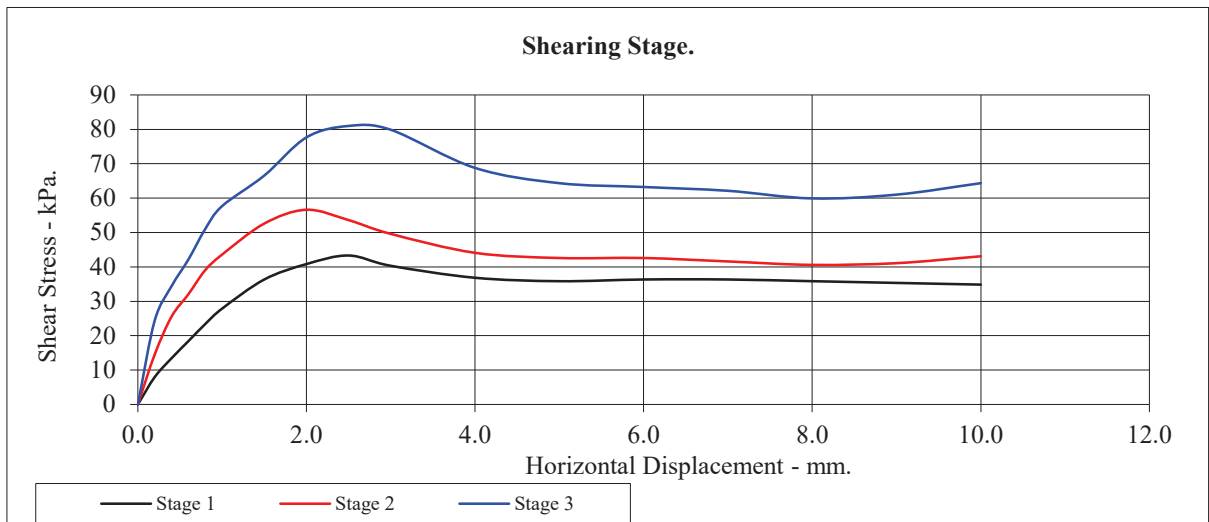
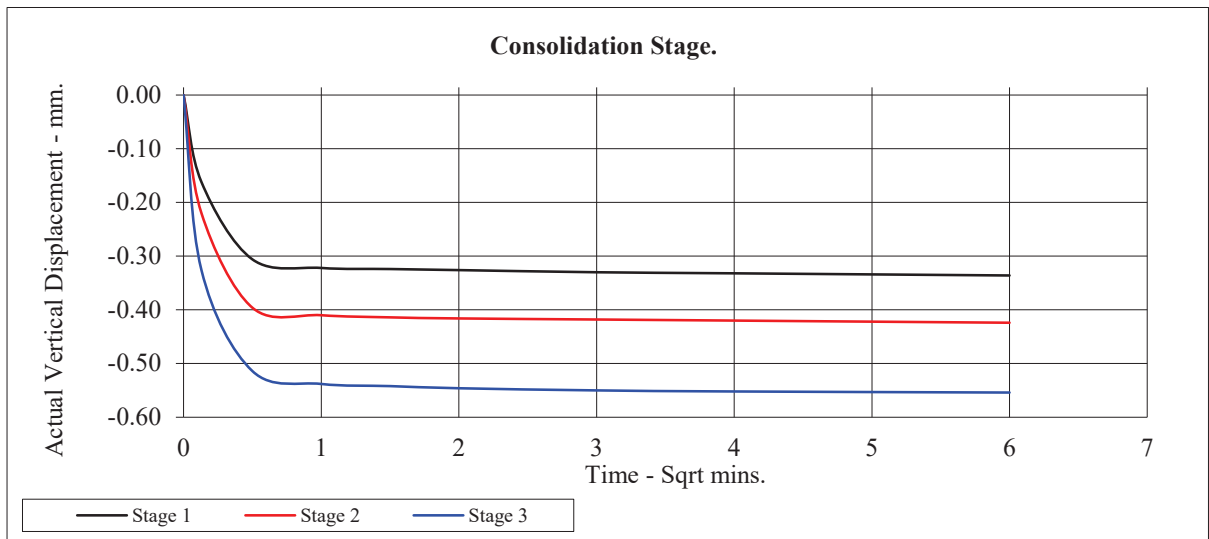
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	BH01	Top Depth:	0.50
Sample Number:		Base Depth:	1.20



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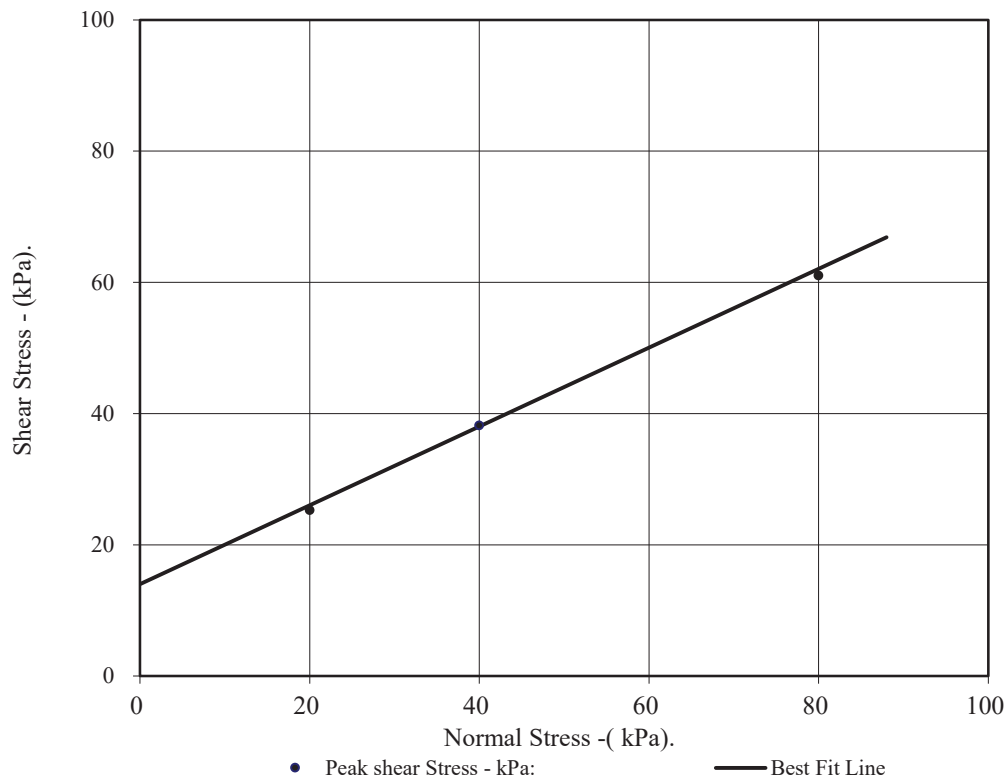
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CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	DCP01		Top Depth:	0.70	
Sample Number:			Base Depth:	1.20	
Sample Conditions:	Submerged		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	See summary of soil descriptions				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			18	18	18
Bulk Density - Mg/m3:			2.18	2.18	2.18
Dry Density - Mg/m3:			1.85	1.85	1.86
Voids Ratio:			0.434	0.429	0.426
Normal Pressure- kPa			20	40	80
Consolidation Stage					
Consolidated Height - mm:			19.51	19.31	19.14
Shearing Stage					
Rate of Strain (mm/min)			0.045	0.045	0.045
Displacement at peak shear stress (mm)			5.00	5.00	5.00
Peak shear Stress - kPa:			25	38	61
Final Consolidated Conditions					
Moisture Content - %:			16	15	14
Bulk Density - Mg/m3:			2.24	2.26	2.29
Dry Density - Mg/m3:			1.94	1.97	2.01
Peak					
Angle of Shearing Resistance:(θ)			31		
Effective Cohesion - kPa:			14		



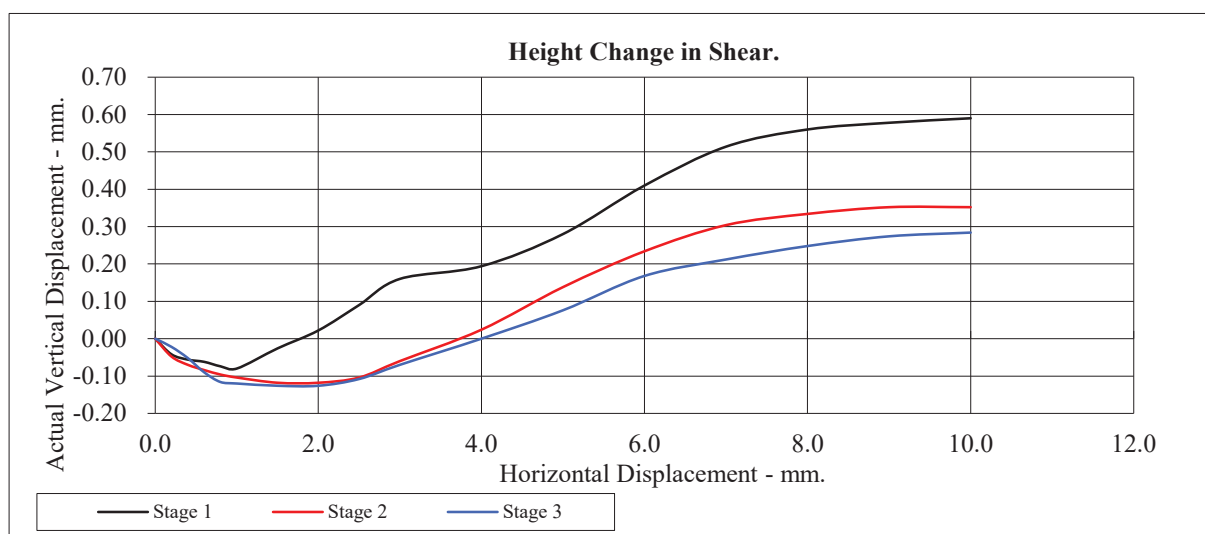
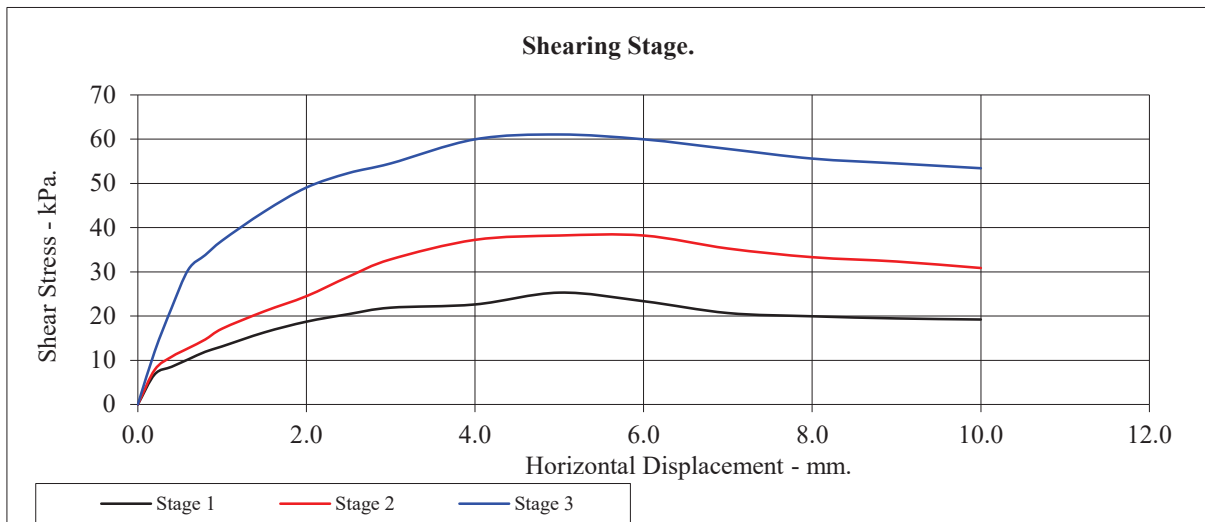
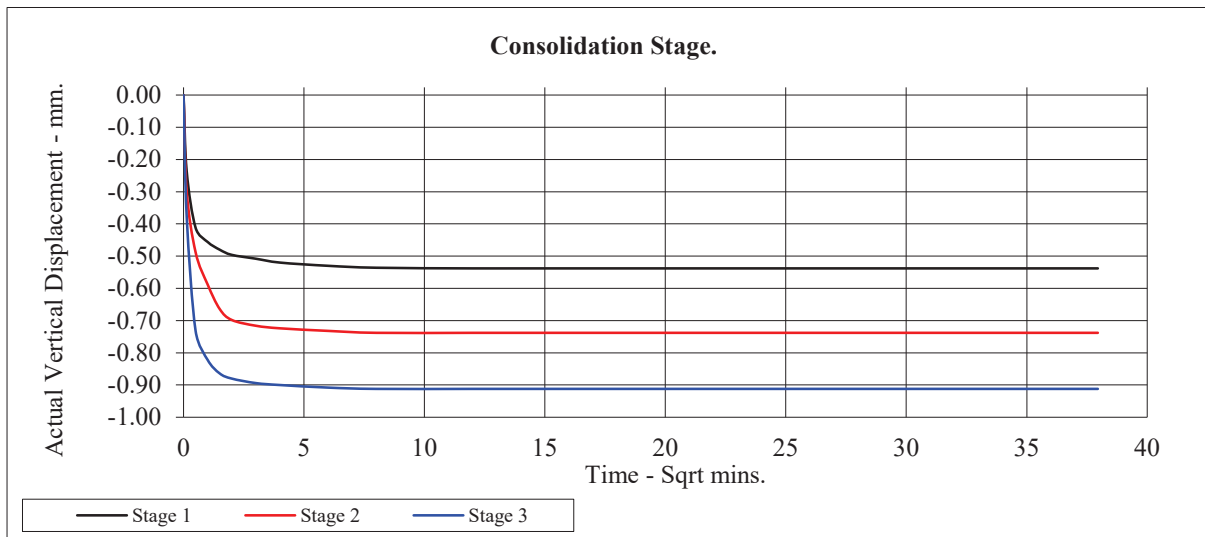
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PSL22/3908
Client Ref:
PN224390

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	DCP01	Top Depth:	0.70
Sample Number:		Base Depth:	1.20



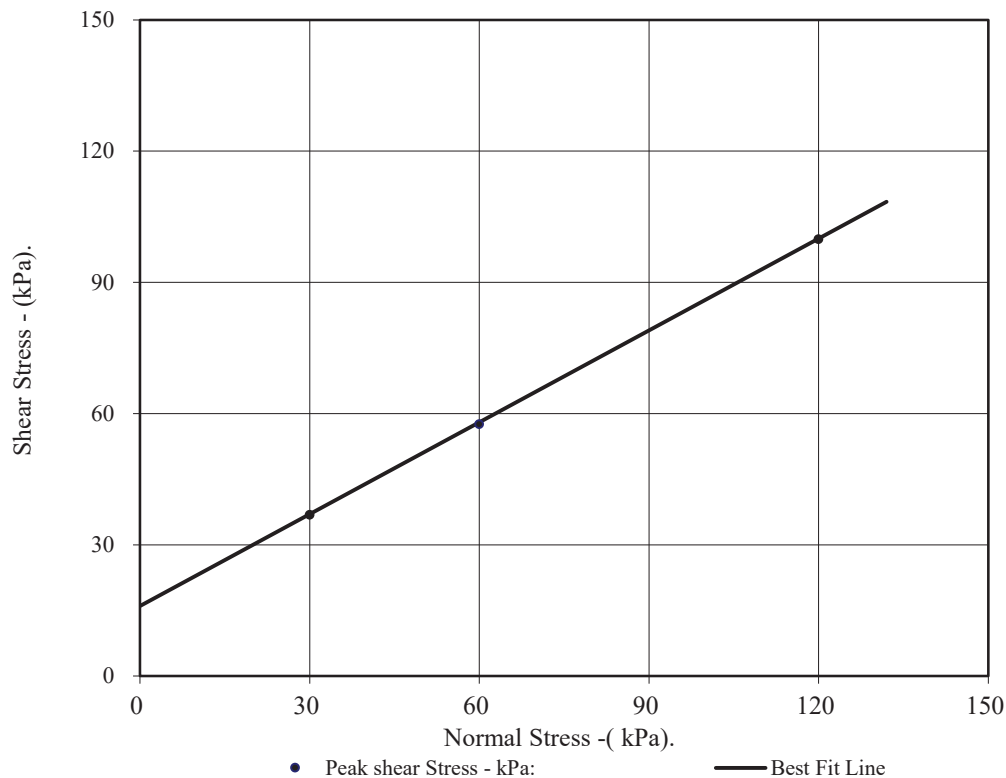
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Client Ref:
PN224390

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	DS02		Top Depth:	1.20	
Sample Number:			Base Depth:	2.00	
Sample Conditions:	Dry		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	See summary of soil descriptions				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			17	17	17
Bulk Density - Mg/m3:			1.92	1.92	1.92
Dry Density - Mg/m3:			1.64	1.64	1.64
Voids Ratio:			0.613	0.612	0.612
Normal Pressure- kPa			30	60	120
Consolidation Stage					
Consolidated Height - mm:			19.87	19.59	19.21
Shearing Stage					
Rate of Strain (mm/min)			0.600	0.600	0.600
Displacement at peak shear stress (mm)			4.00	4.00	4.00
Peak shear Stress - kPa:			37	58	100
Final Consolidated Conditions					
Moisture Content - %:			19	18	18
Bulk Density - Mg/m3:			1.94	1.97	2.01
Dry Density - Mg/m3:			1.63	1.66	1.70
Peak					
Angle of Shearing Resistance:(θ)			35		
Effective Cohesion - kPa:			16		



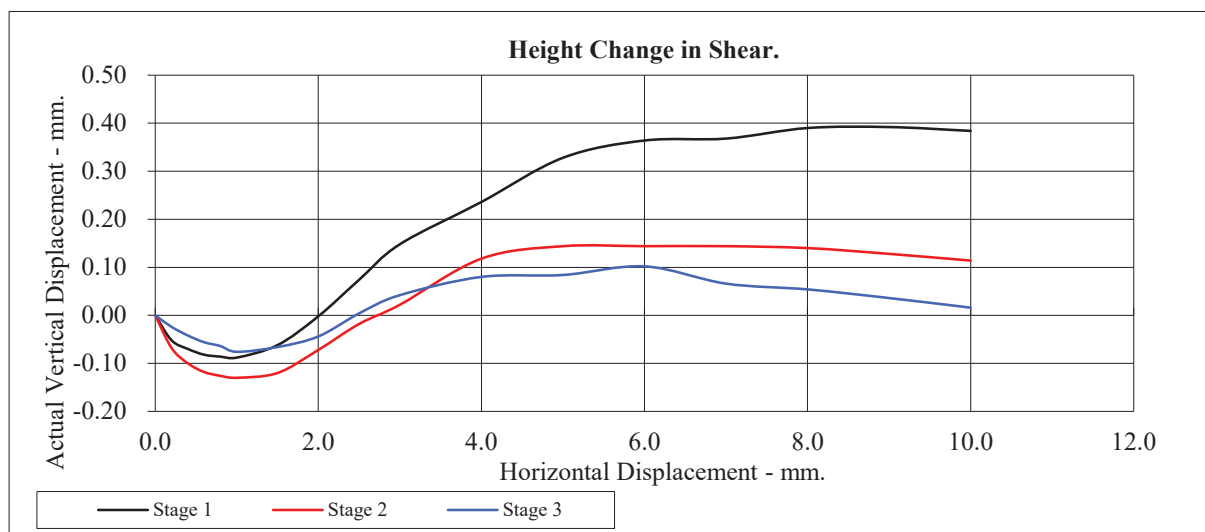
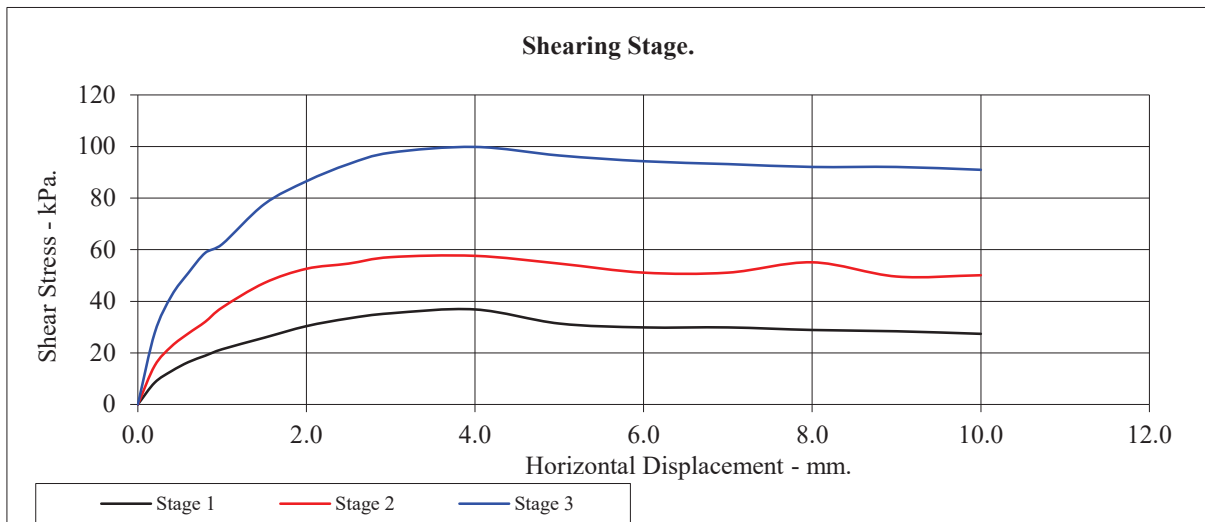
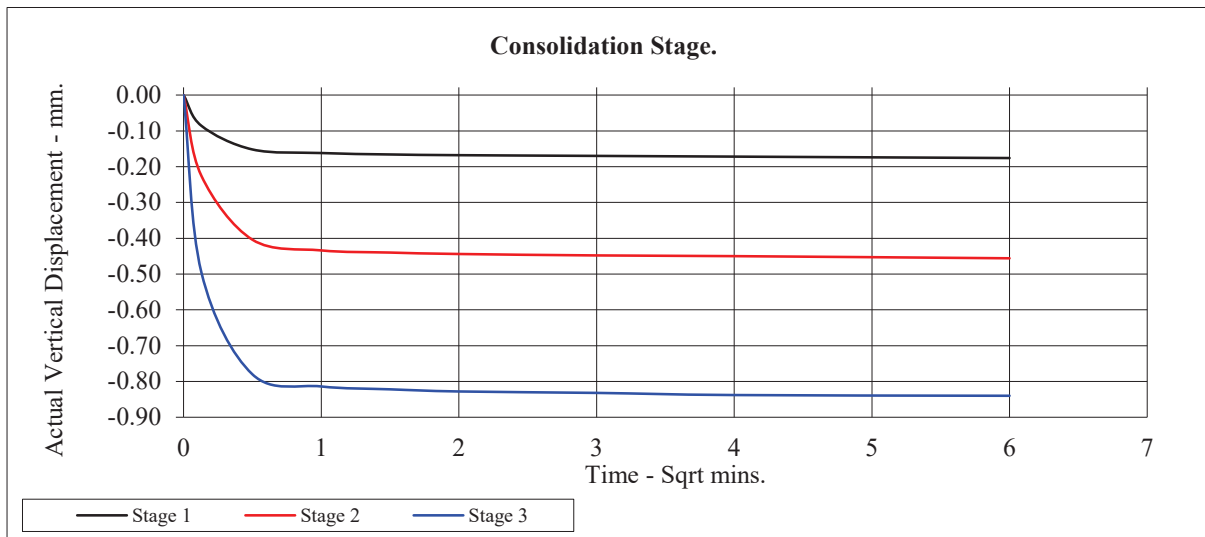
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Contract No:
PSL22/3908
Client Ref:
PN224390

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	DS02	Top Depth:	1.20
Sample Number:		Base Depth:	2.00



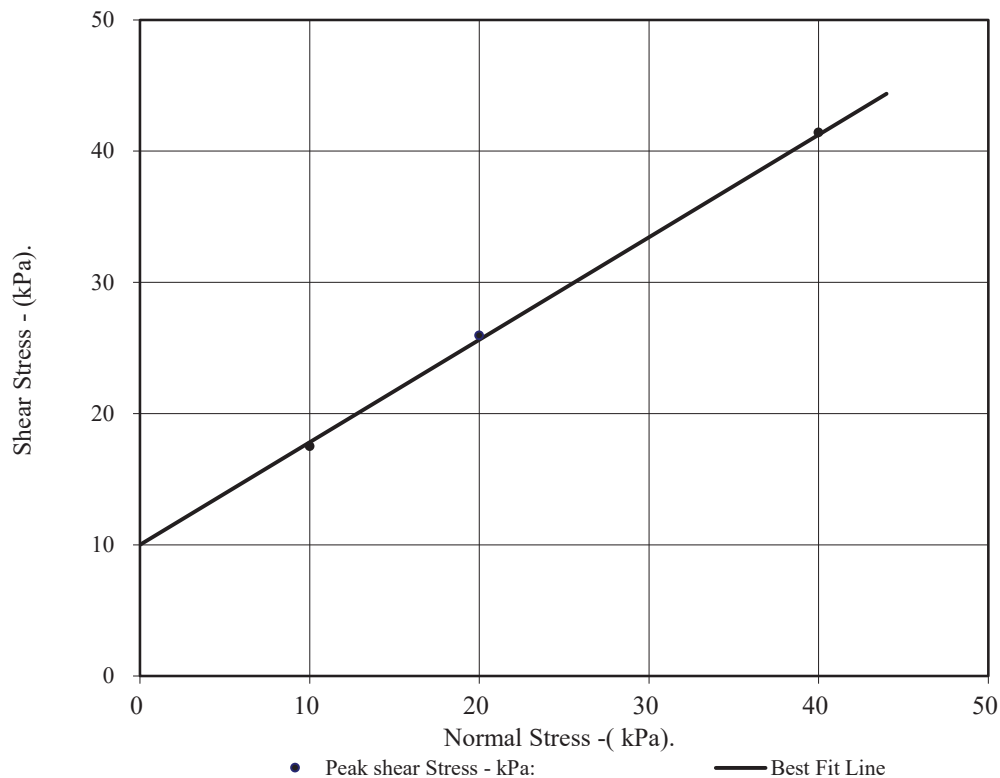
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Contract No:
PSL22/3908
Client Ref:
PN224390

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP04		Top Depth:	0.40	
Sample Number:			Base Depth:	0.60	
Sample Conditions:	Dry		Sample Type	B	
Particle Density - Mg/m3:	2.65	Assumed	Remarks:		
Sample Preparation:	Material tested passing 2mm sieve Remoulded using 2.5kg effort				
Sample Description:	See summary of soil descriptions				
STAGE			1	2	3
Initial Conditions					
Height - mm:			20.05	20.05	20.05
Length - mm:			59.97	59.97	59.97
Moisture Content - %:			16	16	16
Bulk Density - Mg/m3:			1.93	1.93	1.93
Dry Density - Mg/m3:			1.66	1.67	1.67
Voids Ratio:			0.592	0.591	0.591
Normal Pressure- kPa			10	20	40
Consolidation Stage					
Consolidated Height - mm:			20.00	19.90	19.77
Shearing Stage					
Rate of Strain (mm/min)			0.600	0.600	0.600
Displacement at peak shear stress (mm)			2.00	2.50	2.50
Peak shear Stress - kPa:			18	26	41
Final Consolidated Conditions					
Moisture Content - %:			14	14	14
Bulk Density - Mg/m3:			1.94	1.95	1.96
Dry Density - Mg/m3:			1.69	1.71	1.71
Peak					
Angle of Shearing Resistance:(θ)			38		
Effective Cohesion - kPa:			10		



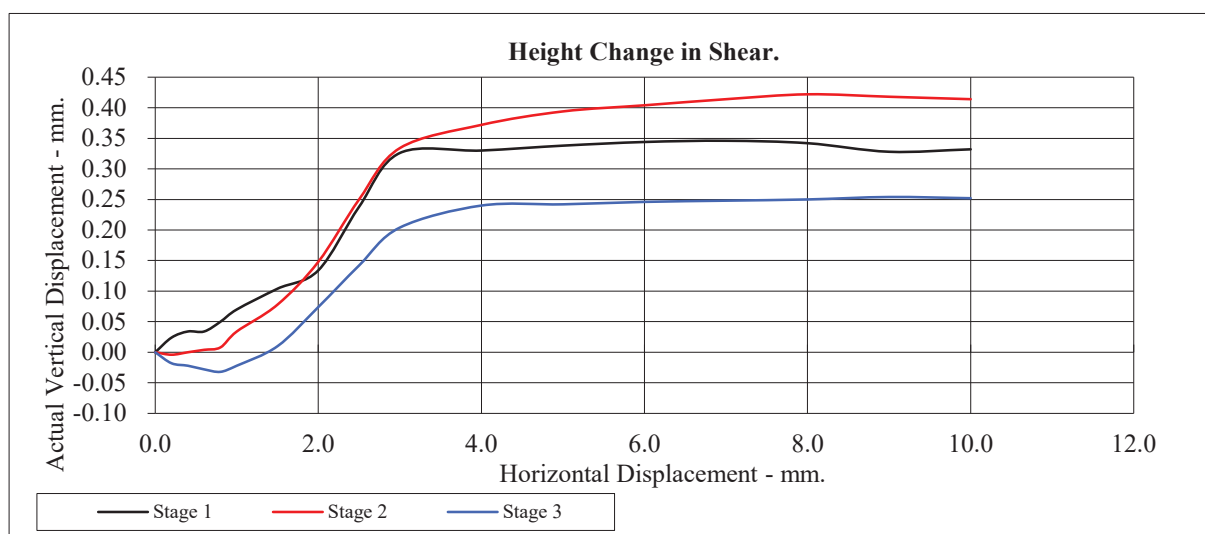
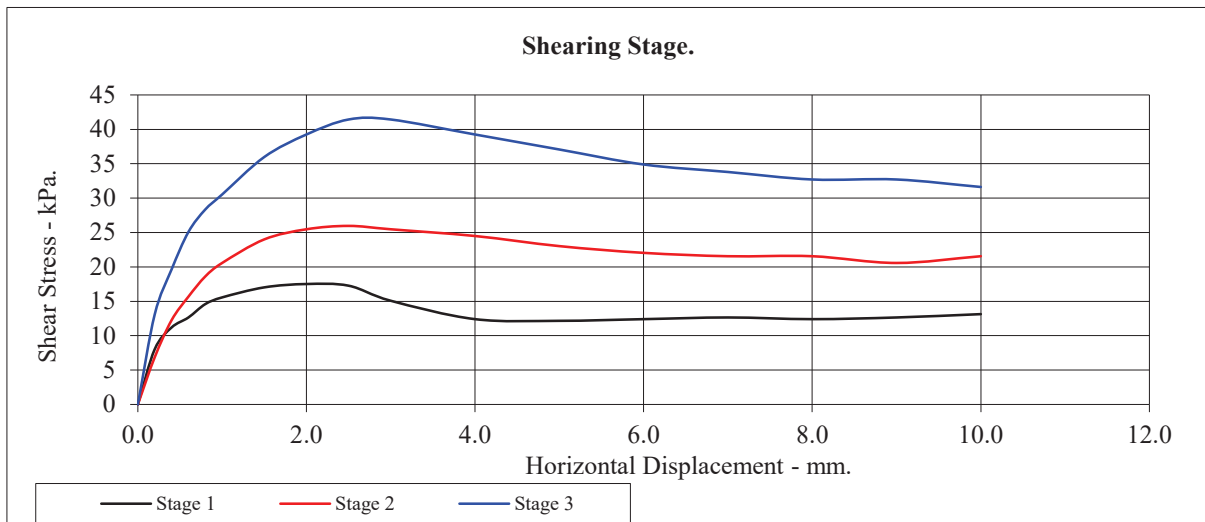
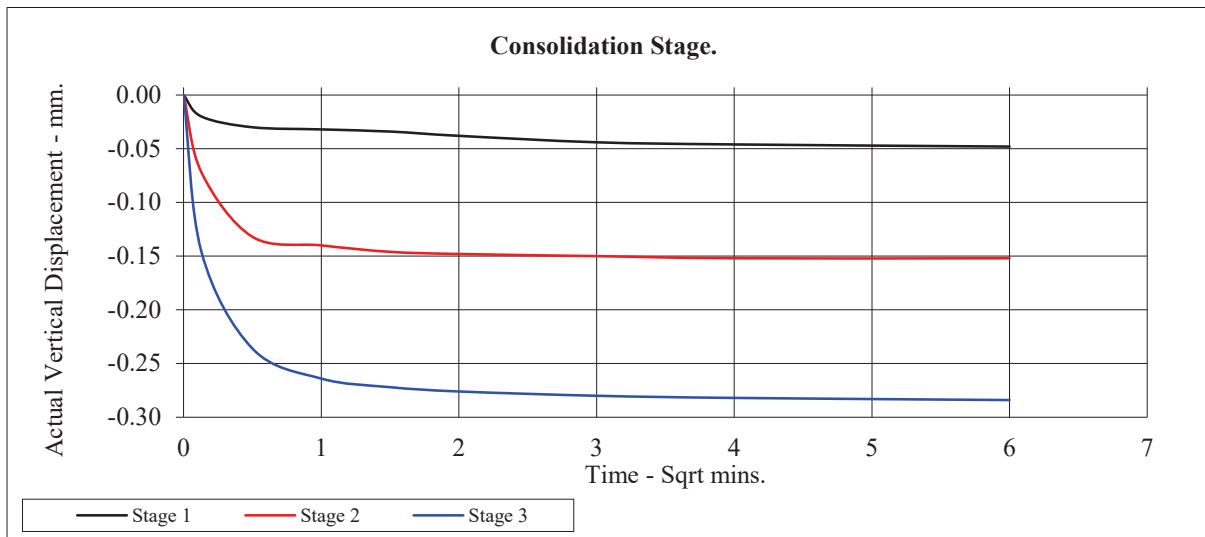
Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

CONSOLIDATED DRAINED SHEARBOX TEST

BS1377:Part 7:1990 Clause 4

Hole Number:	TP04	Top Depth:	0.40
Sample Number:		Base Depth:	0.60



PSL
Professional Soils Laboratory

Star Radcliffe

Contract No:
PSL22/3908
Client Ref:
PN224390

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	2.00-2.45m		
	Description Type	See summary of soil descriptions. Undisturbed, vertical orientation.		
	Initial Sample Length	L_0	(mm)	211.6
	Initial Sample Diameter	D_0	(mm)	105.4
	Initial Sample Weight	W_0	(gr)	3913.0
	Initial Bulk Density	ρ_0	(Mg/m ³)	2.12
	Particle Density	ρ_s	(Mg/m ³)	2.66

Initial Conditions			Stage 1	2
Initial Cell Pressure	σ_{3i}	(kPa)	340	
Initial Back Pressure	U_{bi}	(kPa)	300	
Membrane Thickness	m_b	(mm)	0.600	
Displacement Input	L_{IP}	(mm)	CH 2	
Load Input	N_{IP}	(N)	CH 4	
Pore Water Pressure Input	U_{pwp}	(kPa)	CH 3	
Sample Volume	V	(cc)	CH 2	
Initial Moisture	ω_i	(%)	13	
Initial Dry Density	ρ_{di}	(Mg/m ³)	1.87	
Initial Voids Ratio	e_i	.	0.420	
Initial Degree of Saturation	S_i	(%)	83	
B Value	B	.	0.96	

Final Conditions				
Final Moisture	ω_f	(%)	13	
Final Dry Density	ρ_{df}	(Mg/m ³)	1.90	
Final Voids Ratio	e_f	.	0.400	
Final Degree of Saturation	S_f	(%)	88.1	
			Stage 1	2
Failure Criteria			Max. Dev. Stress	
Strain At Failure	ϵ_f	(%)	19.90	
Stress At Failure	$(\sigma_1 - \sigma_3)$	(kPa)	151.1	
Minor Stress At Failure	σ_3'	(kPa)	77.1	
Major Stress At Failure	σ_1'	(kPa)	228.2	
Principal Stress Ratio At Failure	σ_1' / σ_3'		2.960	

Notes		
		 <i>Plastic</i>

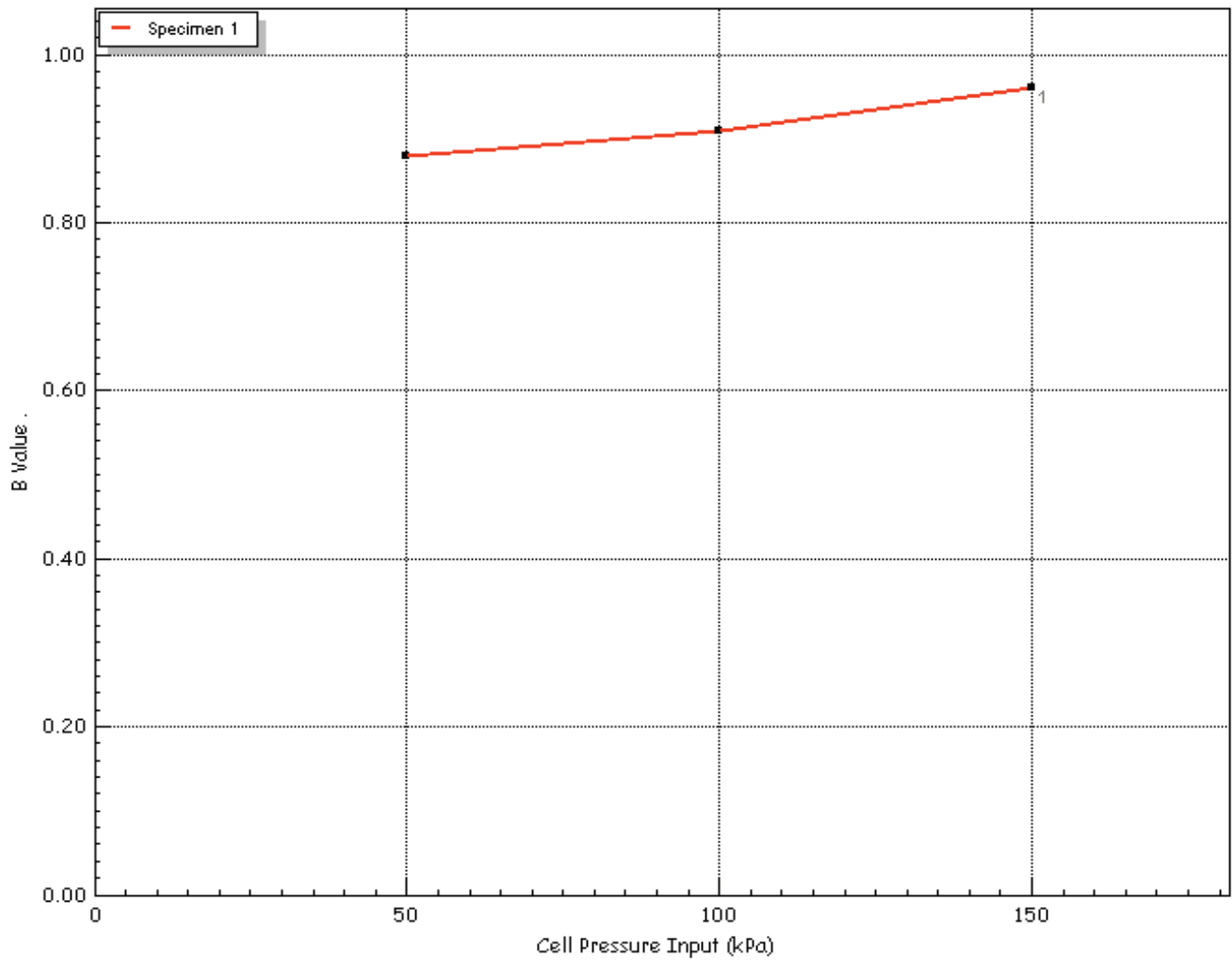
	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH02 2.00-2.45m U
			Test Date	27/06/2022
	Jobfile	Star Radcliffe	Borehole	BH02
	Client	Geotechnics Chester	Sample	2.00-2.45m U
			Depth	2.00-2.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method		Stepped
Cell Pressure Input	σ (kPa)	150
Pore Water Pressure Input	u_{pwp} (kPa)	138
B Value	B	0.96



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH02 2.00-2.45m U
			Test Date	27/06/2022
	Jobfile	Star Radcliffe	Borehole	BH02
	Client	Geotechnics Chester	Sample	2.00-2.45m U
			Depth	2.00-2.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Consolidation Plots

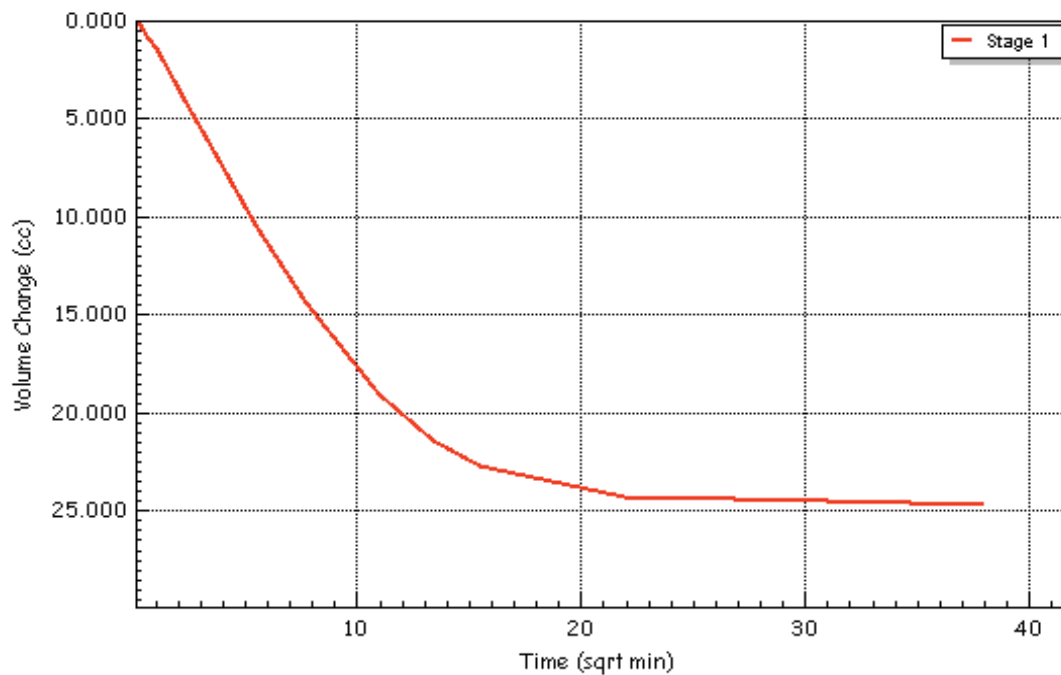
Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	340
Initial Back Pressure	u_{bi}	(kPa)	300
Pore Water Pressure Input	u_{pwp}	(kPa)	328
Drainage Method	Radial+One End		

Final Conditions

PWP Dissipation %	U%	(%)	100.00
Volumetric Strain	ϵ_v	(%)	1.34
Corrected Length	L_c	(mm)	210.7
Corrected Area	A_c	(cm ²)	86.47
Corrected Volume	V_c	(cc)	1821.553
T100 Time to Failure	t_{100}	(min)	152.21
Consolidation	c_v	(m ² /year)	1.507
Compressibility	m_v	(m ² /MN)	0.486
Test Time	t_F	(h:m:s)	04:33:58
Estimated Strain to Failure	ϵ	(%)	5.0
Shear Machine Speed	d_r	(mm/min)	0.03844

Notes

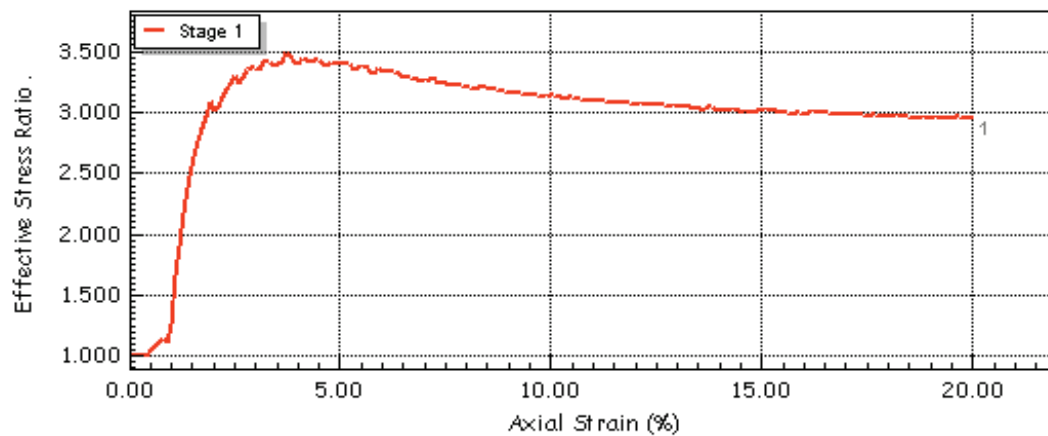
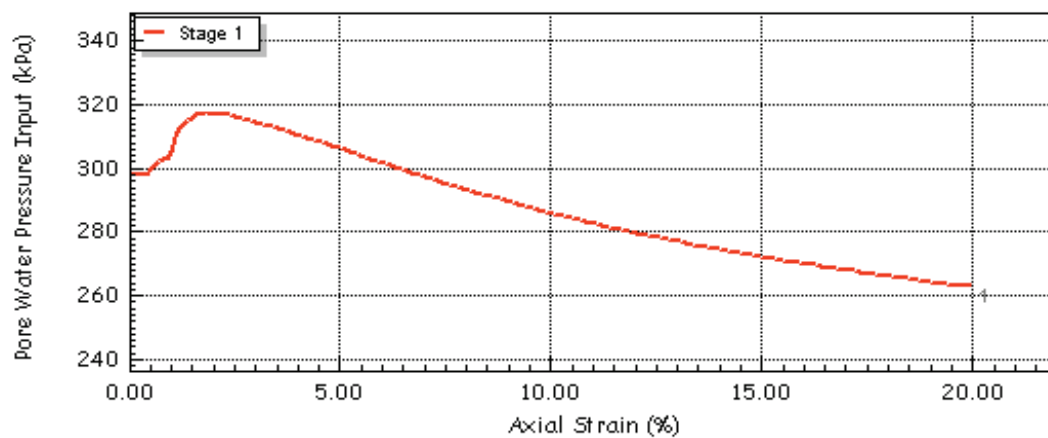
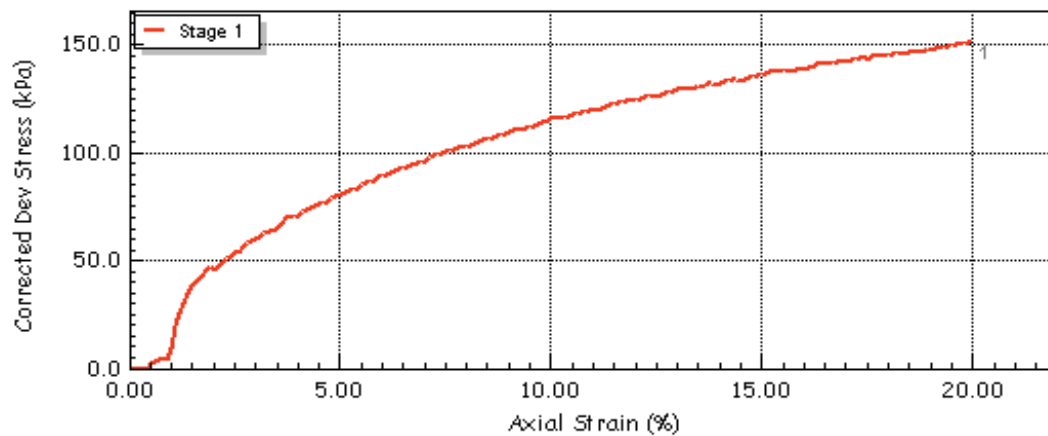


	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH02 2.00-2.45m U
			Test Date	27/06/2022
	Jobfile	Star Radcliffe	Borehole	BH02
	Client	Geotechnics Chester	Sample	2.00-2.45m U
			Depth	2.00-2.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots



Test Method BS1377-8 : 1990 : Clause 7

Test Name BH02 2.00-2.45m U
Test Date 27/06/2022

Jobfile Star Radcliffe
Client Geotechnics Chester

Borehole BH02
Sample 2.00-2.45m U
Depth 2.00-2.45m

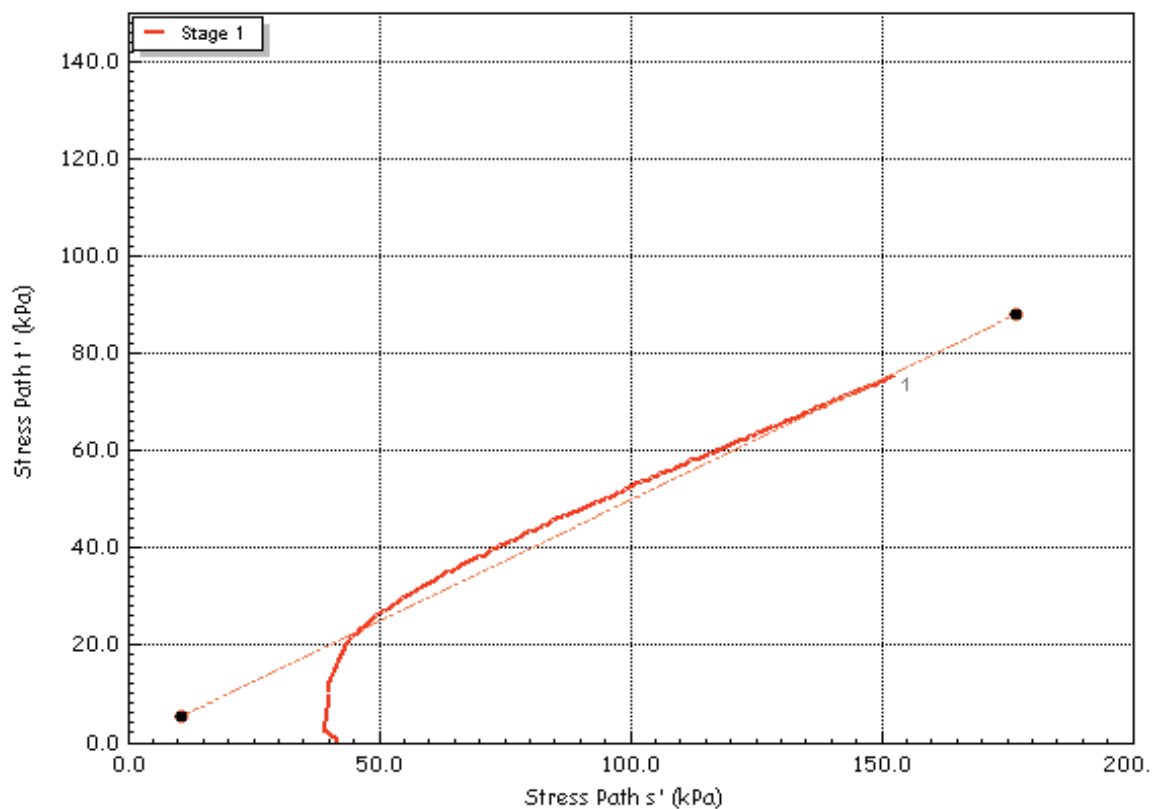
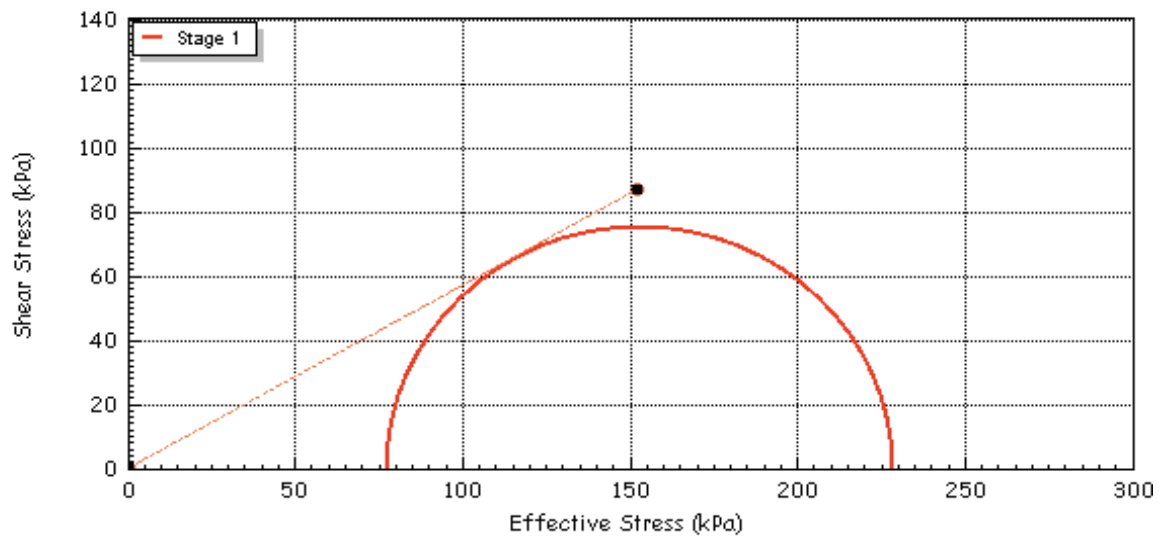


Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	0.00	Effective Cohesion c'	(kPa)	0.00
Effective Friction	ϕ'	(deg)	29.9	Effective Friction ϕ'	(deg)	29.9



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH02 2.00-2.45m U
	Jobfile	Star Radcliffe	Test Date	27/06/2022
Client	Star Radcliffe		Borehole	BH02
	Geotechnics Chester		Sample	2.00-2.45m U
			Depth	2.00-2.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Summary Report

Sample Details  <i>sketch showing specimen location in original sample</i>	Depth	5.00-5.45m		
	Description Type	See summary of soil descriptions. Undisturbed, vertical orientation.		
	Initial Sample Length	L ₀	(mm)	211.5
	Initial Sample Diameter	D ₀	(mm)	105.2
	Initial Sample Weight	W ₀	(gr)	4042.0
	Initial Bulk Density	ρ ₀	(Mg/m ³)	2.20
	Particle Density	ρ _s	(Mg/m ³)	2.66

Initial Conditions			Stage 1	2
Initial Cell Pressure	σ _{3i}	(kPa)	900	
Initial Back Pressure	U _{bi}	(kPa)	800	
Membrane Thickness	m _b	(mm)	0.600	
Displacement Input	L _{IP}	(mm)	CH 2	
Load Input	N _{IP}	(N)	CH 4	
Pore Water Pressure Input	U _{pwp}	(kPa)	CH 3	
Sample Volume	V	(cc)	CH 2	
Initial Moisture	ω _i	(%)	9.07	
Initial Dry Density	ρ _{di}	(Mg/m ³)	2.02	
Initial Voids Ratio	e _i	.	0.319	
Initial Degree of Saturation	S _i	(%)	75	
B Value	B	.	0.98	

Final Conditions				
Final Moisture	ω _f	(%)	9.31	
Final Dry Density	ρ _{df}	(Mg/m ³)	2.03	
Final Voids Ratio	e _f	.	0.312	
Final Degree of Saturation	S _f	(%)	79.4	
			Stage 1	2
Failure Criteria		.	Max. Dev. Stress	
Strain At Failure	ε _f	(%)	19.99	
Stress At Failure	(σ ₁ - σ ₃)	(kPa)	764.1	
Minor Stress At Failure	σ ₃ '	(kPa)	367.0	
Major Stress At Failure	σ ₁ '	(kPa)	1131.1	
Principal Stress Ratio At Failure	σ ₁ ' / σ ₃ '		3.082	

Notes		
		 <i>Plastic</i>

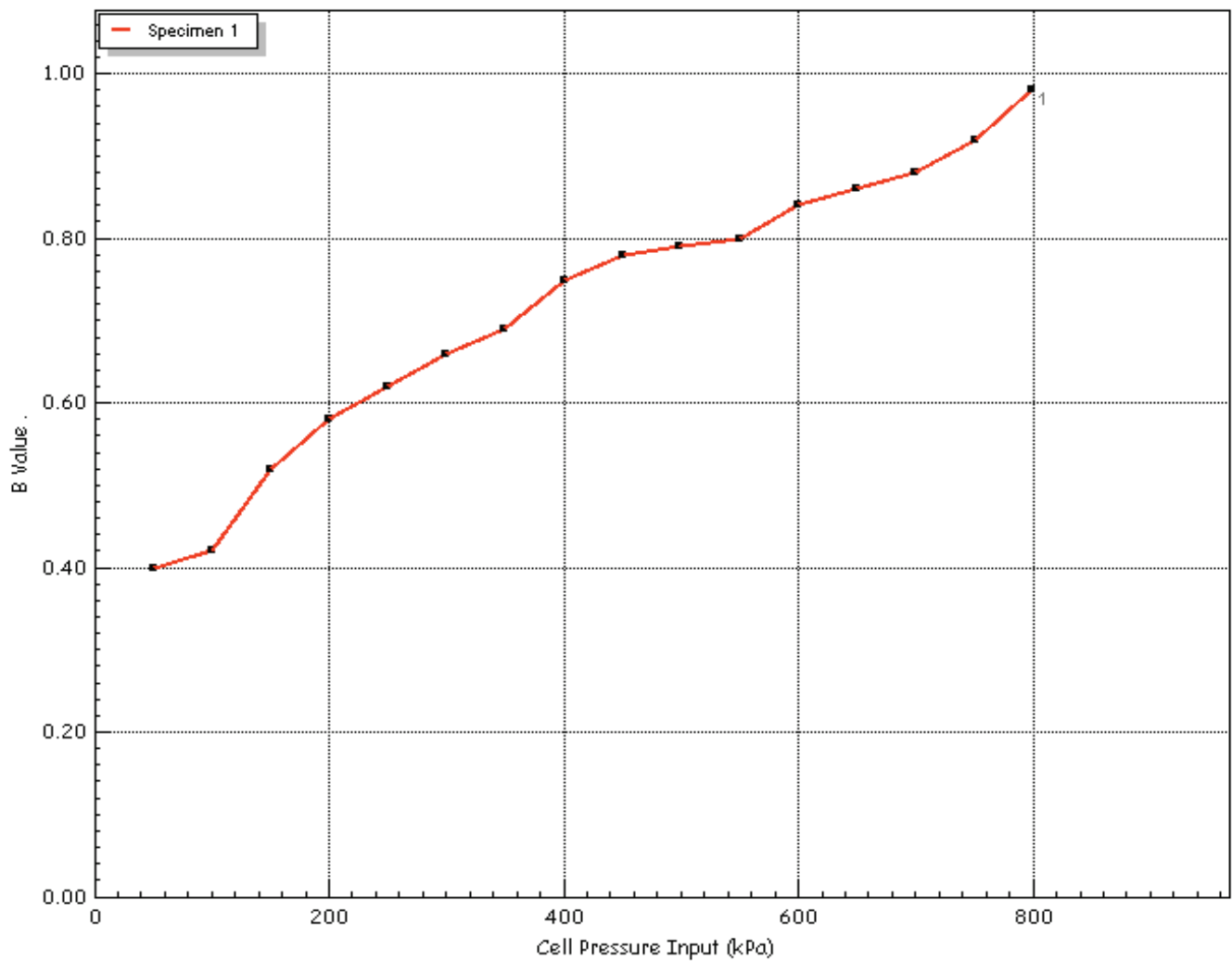
	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH03A 5.00-5.45m
			Test Date	27/06/2022
	Jobfile	Star Radcliffe	Borehole	BH03A
	Client	Geotechnics Chester	Sample	5.00-5.45m
			Depth	5.00-5.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Saturation Plots

Saturation Method		Stepped
Cell Pressure Input	σ (kPa)	799
Pore Water Pressure Input	u_{pwp} (kPa)	778
B Value	B	0.98



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH03A 5.00-5.45m
			Test Date	27/06/2022
Jobfile	Star Radcliffe		Borehole	BH03A
			Sample	5.00-5.45m
Client	Geotechnics Chester		Depth	5.00-5.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Consolidation Plots

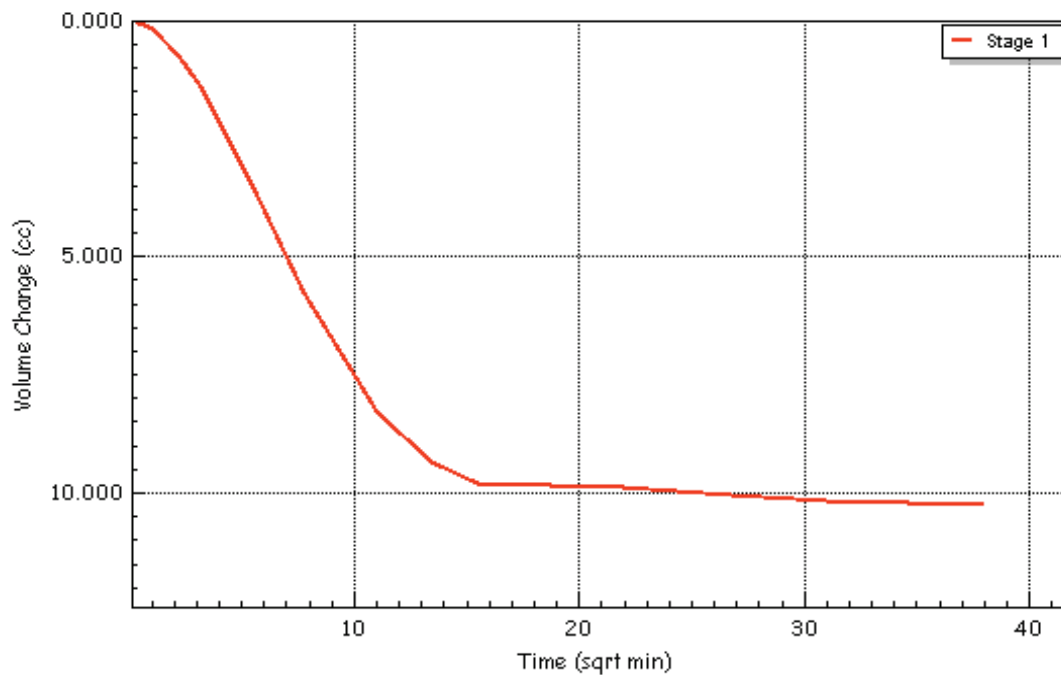
Initial Conditions

Initial Cell Pressure	σ_3	(kPa)	900
Initial Back Pressure	u_{bi}	(kPa)	800
Pore Water Pressure Input	u_{pwp}	(kPa)	857
Drainage Method			Radial+One End

Final Conditions

PWP Dissipation %	U%	(%)	100.00
Volumetric Strain	ϵ_v	(%)	0.56
Corrected Length	L _c	(mm)	211.1
Corrected Area	A _c	(cm ²)	86.60
Corrected Volume	V _c	(cc)	1828.114
T100 Time to Failure	t ₁₀₀	(min)	148.67
Consolidation	c _v	(m ² /year)	1.537
Compressibility	m _v	(m ² /MN)	0.098
Test Time	t _F	(h:m:s)	04:27:36
Estimated Strain to Failure	ϵ	(%)	5.0
Shear Machine Speed	d _r	(mm/min)	0.03944

Notes

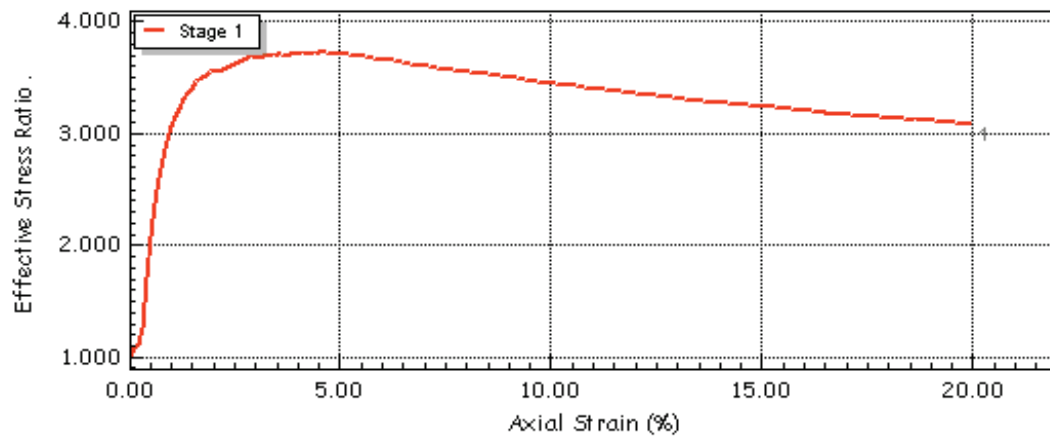
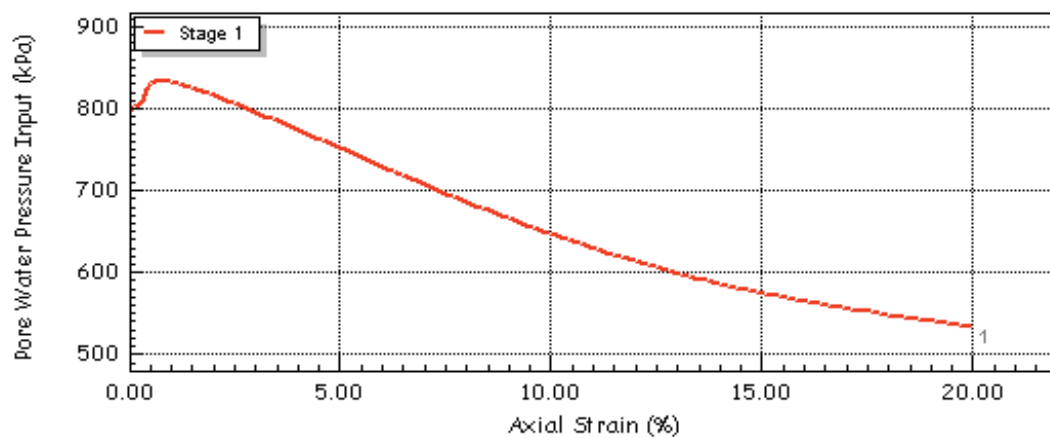
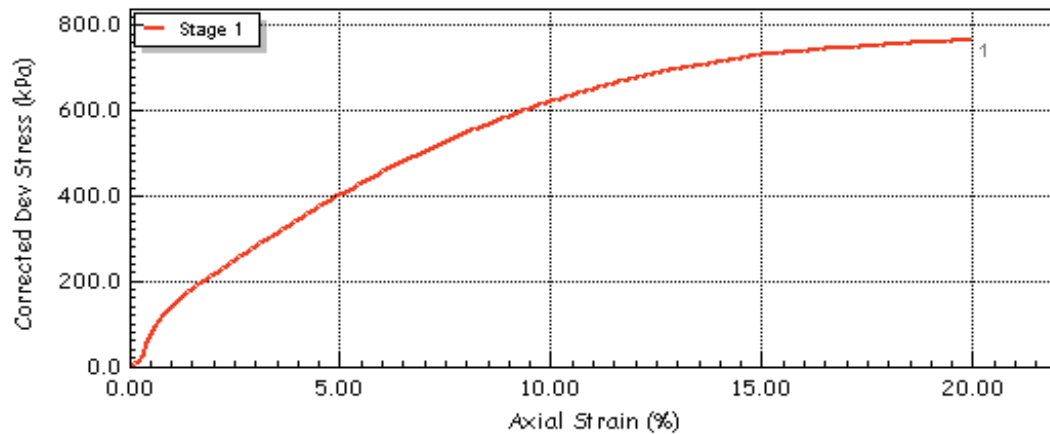


	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH03A 5.00-5.45m
			Test Date	27/06/2022
Jobfile	Star Radcliffe		Borehole	BH03A
Client	Geotechnics Chester		Sample	5.00-5.45m
			Depth	5.00-5.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots



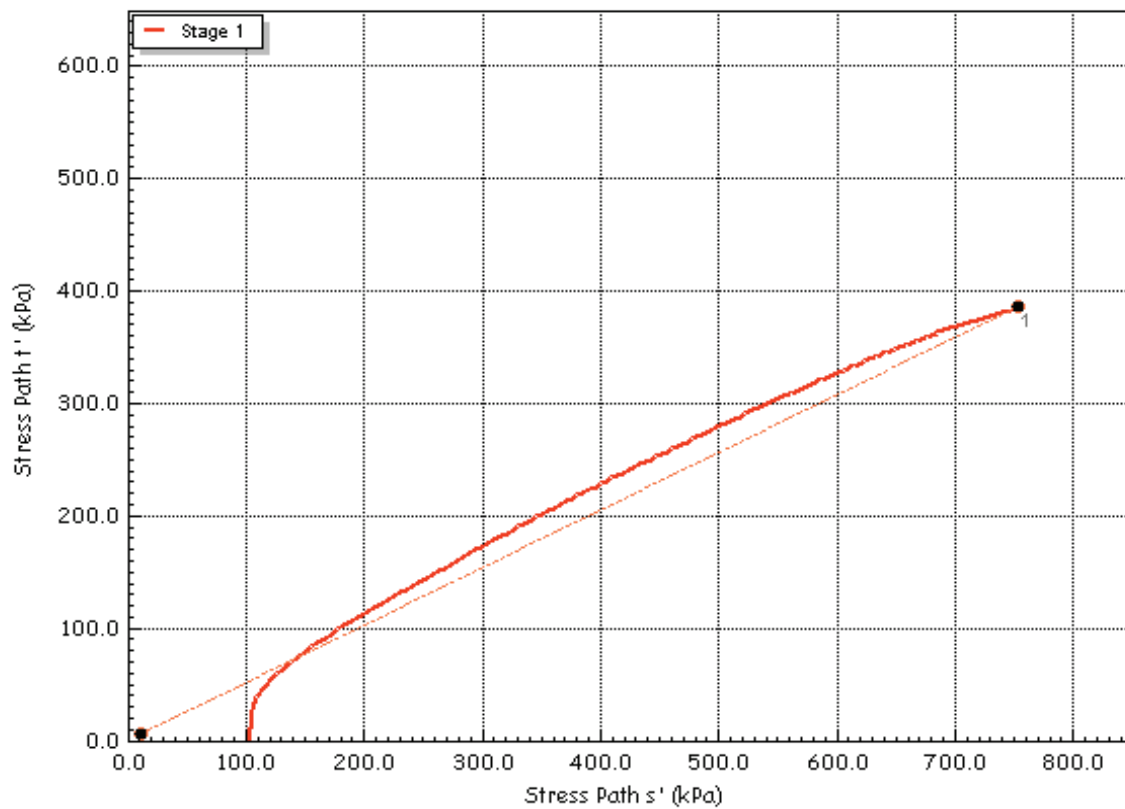
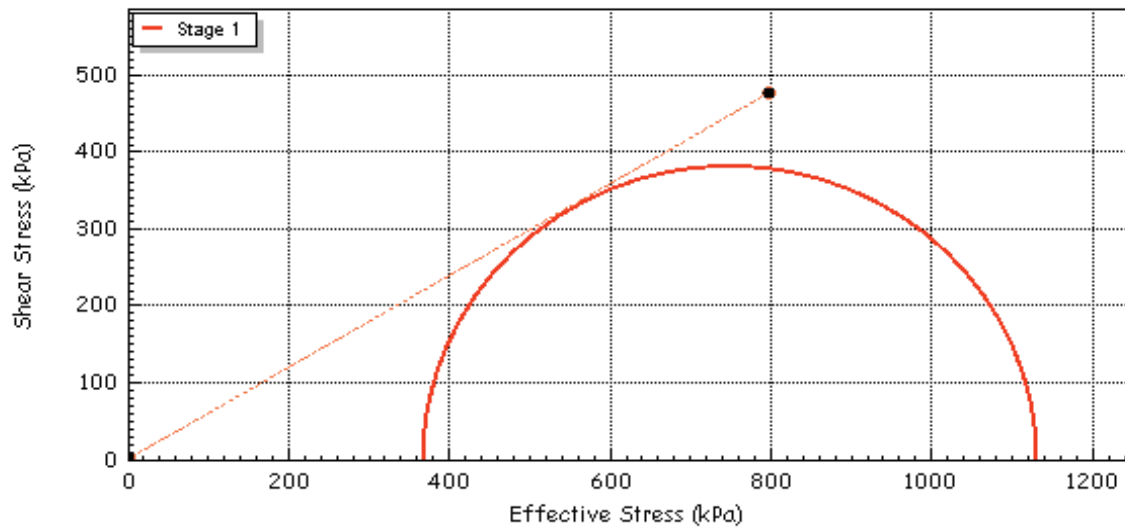
	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH03A 5.00-5.45m
			Test Date	27/06/2022
	Jobfile	Star Radcliffe	Borehole	BH03A
	Client	Geotechnics Chester	Sample	5.00-5.45m
			Depth	5.00-5.45m

Effective Stress Triaxial Compression

Consolidated Undrained

Shear Stage Plots

Effective	c'	(kPa)	0.00	Effective Cohesion c'	(kPa)	0.00
Effective Friction	ϕ'	(deg)	30.9	Effective Friction ϕ'	(deg)	30.9



	Test Method	BS1377-8 : 1990 : Clause 7	Test Name	BH03A 5.00-5.45m
			Test Date	27/06/2022
Jobfile Client	Star Radcliffe		Borehole	BH03A
	Geotechnics Chester		Sample	5.00-5.45m
			Depth	5.00-5.45m



ANALYTICAL TEST REPORT

Contract no: 110871

Contract name: Star Radcliffe

Client reference: PSL22/3908

Clients name: Professional Soils Laboratory

Clients address: 5/7 Hexthorpe Road
Doncaster
DN4 0AR

Samples received: 28 June 2022

Analysis started: 28 June 2022

Analysis completed: 05 July 2022

Report issued: 05 July 2022

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
\$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing

Approved by:

Will Fardon
Technical Director

Chemtech Environmental Limited

SOILS

Lab number			110871-1	110871-2	110871-3	110871-4	110871-5	110871-6
Sample id			BH01	BH02	BH03	BH03	BH03A	BH04
Depth (m)			2.00-2.45	2.50-3.00	1.00	1.80	2.80	2.80
Sample Type			D spt	D	D	D	B	D
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^U	units	5.2	6.5	5.7	-	5.8	6.8
Magnesium (2:1 water soluble)	CE061	mg/l Mg	0.9	6.7	5.3	-	5.5	4.6
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	4.2	4.4	5.1	-	3.6	10
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	25	27	46	-	28	23
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	33	102	133	-	26	15
Sulphate (total)	CE062 ^U	mg/kg SO ₄	193	323	707	-	107	<100
Sulphur (total)	CE119	mg/kg S	104	1133	505	-	143	<100
Sulphur (total)	CE119	% w/w S	0.01	0.11	0.05	-	0.01	<0.01
Total Organic Carbon (TOC)	CE197	% w/w C	-	-	-	1.5	-	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	-	-	-	2.7	-	-

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Sample Type Date sampled			110871-7 DCP05 0.80-1.20 B -	110871-8 DS02 0.50-0.80 B -	110871-9 DS03 2.00-2.45 D spt -	110871-10 DS04 1.20-1.30 D -	110871-11 DS05 1.20-1.75 B -	110871-12 TP04 2.00 D -
Test	Method	Units						
pH	CE004 ^U	units	-	-	5.7	5.8	6.9	5.7
Magnesium (2:1 water soluble)	CE061	mg/l Mg	-	-	6.6	2.6	14	2.0
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	-	-	3.7	3.0	5.4	2.6
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	-	-	27	24	33	24
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	-	-	48	94	298	17
Sulphate (total)	CE062 ^U	mg/kg SO ₄	-	-	143	468	443	150
Sulphur (total)	CE119	mg/kg S	-	-	<100	<100	<100	<100
Sulphur (total)	CE119	% w/w S	-	-	<0.01	<0.01	<0.01	<0.01
Total Organic Carbon (TOC)	CE197	% w/w C	8.4	4.3	-	-	4.6	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	14.5	7.4	-	-	7.9	-

Chemtech Environmental Limited

SOILS

Lab number			110871-13
Sample id			TP06
Depth (m)			1.00
Sample Type			D
Date sampled			-
Test	Method	Units	
pH	CE004 ^U	units	5.7
Magnesium (2:1 water soluble)	CE061	mg/l Mg	3.1
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	2.3
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	26
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	175
Sulphate (total)	CE062 ^U	mg/kg SO ₄	679
Sulphur (total)	CE119	mg/kg S	<100
Sulphur (total)	CE119	% w/w S	<0.01
Total Organic Carbon (TOC)	CE197	% w/w C	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO ₃
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

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

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

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

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
110871-1	BH01	2.00-2.45	Y	All (NSD)
110871-2	BH02	2.50	Y	All (NSD)
110871-3	BH03	1.00	Y	All (NSD)
110871-4	BH03	1.80	Y	All (NSD)
110871-5	BH03A	2.80	Y	All (NSD)
110871-6	BH04	2.80	Y	All (NSD)
110871-7	DCP05	0.80-1.20	Y	All (NSD)
110871-8	DS02	0.50-0.80	Y	All (NSD)
110871-9	DS03	2.00-2.45	Y	All (NSD)
110871-10	DS04	1.20-1.30	Y	All (NSD)
110871-11	DS05	1.20-1.75	Y	All (NSD)
110871-12	TP04	2.00	Y	All (NSD)
110871-13	TP06	1.00	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

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

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

Methods, procedures and performance data are available on request.

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

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

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

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

Analytical results are inclusive of stones, where applicable.



Certificate of Analysis

Certificate Number 22-12035

Issued: 01-Jul-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-12035

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description 4 Soil samples.

Date Received 27-Jun-22

Date Started 27-Jun-22

Date Completed 01-Jul-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "Kirk Bridgewood".

Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Soil Samples

Our Ref 22-12035

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2025292	2025293	2025294	2025295
Sample ID	BH01	BH02	BH03	BH04
Depth	17.00-17.45	21.00	14.00-14.45	14.00-14.45
Other ID				
Sample Type	D	D	D	D
Sampling Date	05/05/2022	05/05/2022	05/05/2022	05/05/2022
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Inorganics							
pH	DETSC 2008#		pH	8.5	8.7	8.7	7.4
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	16	31	54	480
Sulphur as S, Total	DETSC 2320	0.01	%	0.01	0.07	0.02	3.2
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.02	0.02	0.02	0.10

Information in Support of the Analytical Results

Our Ref 22-12035
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2025292	BH01 17.00-17.45 SOIL	05/05/22	PT 1L	Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
2025293	BH02 21.00 SOIL	05/05/22	PT 1L	Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
2025294	BH03 14.00-14.45 SOIL	05/05/22	PT 1L	Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
2025295	BH04 14.00-14.45 SOIL	05/05/22	PT 1L	Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/- 2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



LABORATORY REPORT



4043

Contract Number: PSL22/4118

Report Date: 06 July 2022

Client's Reference: PN224390

Client Name: Geotechnics Chester
The Geotechnical Centre
Unit 1 Borders Industrial Park
River Lane, Saltney
Chester
CH4 8RJ

For the attention of: John Knowles

Contract Title: Star Radcliffe

Date Received: 15/6/2022

Date Commenced: 15/6/2022

Date Completed: 6/7/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

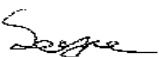
Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)


S Eyre
(Senior Technician)

T Watkins
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Page 1 of

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dimensions (mm)		Area (mm ²)	D _c ²	D _c (mm)	Failure Load (P)		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
					W	D				(Mpa)	(kN)					
BH01	17.21		A	Perp	85	47	3995	5086.59	71.32	-	0.46	0.09	1.173	0.11	Valid	
BH01	18.81		A	Perp	85	38	3230	4112.56	64.13	-	3.71	0.90	1.119	1.01	Valid	
BH01	20.00		I	Perp	58	55	3190	4061.63	63.73	-	4.02	0.99	1.115	1.10	Valid	
BH01	22.39		A	Perp	85	37	3145	4004.34	63.28	-	0.89	0.22	1.112	0.25	Valid	
BH01	23.07		A	Perp	85	29	2465	3138.54	56.02	-	2.26	0.72	1.053	0.76	Valid	
BH01	24.30		A	Perp	85	33	2805	3571.44	59.76	-	0.93	0.26	1.084	0.28	Valid	
BH01	25.92		A	Perp	85	43	3655	4653.69	68.22	-	3.13	0.67	1.150	0.77	Valid	
BH01	26.68		A	Perp	85	40	3400	4329.01	65.80	-	2.13	0.49	1.131	0.56	Valid	
BH01	27.40		A	Perp	85	44	3740	4761.92	69.01	-	0.22	0.05	1.156	0.05	Valid	
BH01	28.83		A	Perp	85	55	4675	5952.39	77.15	-	0.30	0.05	1.216	0.06	Valid	
BH02	21.77		A	Perp	85	45	3825	4870.14	69.79	-	0.28	0.06	1.162	0.07	Valid	
BH02	22.76		A	Perp	85	30	2550	3246.76	56.98	-	0.15	0.05	1.061	0.05	Valid	
BH02	23.40		A	Perp	85	37	3145	4004.34	63.28	-	0.08	0.02	1.112	0.02	Valid	
BH02	23.50		A	Perp	85	43	3655	4653.69	68.22	-	0.14	0.03	1.150	0.03	Valid	
BH02	24.45		A	Perp	85	26	2210	2813.86	53.05	-	0.13	0.05	1.027	0.05	Valid	
BH02	26.25		A	Perp	85	47	3995	5086.59	71.32	-	0.11	0.02	1.173	0.03	Valid	
BH02	26.76		A	Perp	85	38	3230	4112.56	64.13	-	0.02	0.00	1.119	0.01	Valid	
BH02	26.90		A	Perp	85	33	2805	3571.44	59.76	-	0.31	0.09	1.084	0.09	Valid	
BH02	27.87		A	Perp	85	38	3230	4112.56	64.13	-	0.32	0.08	1.119	0.09	Valid	
BH02	28.87		A	Perp	85	36	3060	3896.11	62.42	-	0.13	0.03	1.105	0.04	Valid	
BH02	29.50		A	Perp	85	41	3485	4437.24	66.61	-	0.37	0.08	1.138	0.09	Valid	
BH03A	15.38		A	Perp	85	54	4590	5844.17	76.45	-	0.22	0.04	1.211	0.05	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular

 4043		Star Radcliffe	Contract No:
			PSL22/4118
			Client Ref:
			PN224390

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_c^2	D_c (mm)	Failure Load		I_s (MPa)	Corr Fac F	I_{s50} (MPa)	Failure Type	Remarks
				Par / Perp	L	D			(Mpa)	(kN)					
BH01	17.21		D	Par	-	85	7225	85.00	-	0.44	0.061	1.270	0.08	Valid	
BH01	18.81		D	Par	-	85	7225	85.00	-	2.55	0.353	1.270	0.45	Valid	
BH01	22.39		D	Par	-	85	7225	85.00	-	0.37	0.051	1.270	0.07	Valid	
BH01	23.07		D	Par	-	85	7225	85.00	-	0.83	0.115	1.270	0.15	Valid	
BH01	24.30		D	Par	-	85	7225	85.00	-	0.23	0.032	1.270	0.04	Valid	
BH01	25.92		D	Par	-	85	7225	85.00	-	0.10	0.014	1.270	0.02	Valid	
BH01	26.68		D	Par	-	85	7225	85.00	-	0.14	0.019	1.270	0.02	Valid	
BH01	27.40		D	Par	-	85	7225	85.00	-	0.21	0.029	1.270	0.04	Valid	
BH01	28.83		D	Par	-	85	7225	85.00	-	0.13	0.018	1.270	0.02	Valid	
BH02	21.77		D	Par	-	85	7225	85.00	-	0.32	0.044	1.270	0.06	Valid	
BH02	22.76		D	Par	-	85	7225	85.00	-	0.12	0.017	1.270	0.02	Valid	
BH02	23.40		D	Par	-	85	7225	85.00	-	0.11	0.015	1.270	0.02	Valid	
BH02	23.50		D	Par	-	85	7225	85.00	-	0.18	0.025	1.270	0.03	Valid	
BH02	24.45		D	Par	-	85	7225	85.00	-	0.08	0.011	1.270	0.01	Valid	
BH02	26.25		D	Par	-	85	7225	85.00	-	0.04	0.006	1.270	0.01	Valid	
BH02	26.76		D	Par	-	85	7225	85.00	-	0.03	0.004	1.270	0.01	Valid	
BH02	27.87		D	Par	-	85	7225	85.00	-	0.21	0.029	1.270	0.04	Valid	
BH02	28.87		D	Par	-	85	7225	85.00	-	0.13	0.018	1.270	0.02	Valid	
BH02	29.50		D	Par	-	85	7225	85.00	-	0.23	0.032	1.270	0.04	Valid	
BH03A	15.38		D	Par	-	85	7225	85.00	-	0.14	0.019	1.270	0.02	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



Star Radcliffe

Contract No:

PSL22/4118

Client Ref:

PN224390

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dimensions (mm)		Area (mm ²)	D _c ²	D _c (mm)	Failure Load (P)		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
					W	D				(Mpa)	(kN)					
BH03A	16.06		A	Perp	85	44	3740	4761.92	69.01	-	0.21	0.04	1.156	0.05	Valid	
BH03A	17.30		A	Perp	85	34	2890	3679.66	60.66	-	0.31	0.08	1.091	0.09	Valid	
BH03A	18.21		A	Perp	85	38	3230	4112.56	64.13	-	1.21	0.29	1.119	0.33	Valid	
BH03A	19.00		A	Perp	85	47	3995	5086.59	71.32	-	0.71	0.14	1.173	0.16	Valid	
BH03A	20.40		A	Perp	85	37	3145	4004.34	63.28	-	0.37	0.09	1.112	0.10	Valid	
BH03A	21.97		A	Perp	85	35	2975	3787.89	61.55	-	0.33	0.09	1.098	0.10	Valid	
BH03A	22.06		A	Perp	85	33	2805	3571.44	59.76	-	0.21	0.06	1.084	0.06	Valid	
BH03A	22.21		A	Perp	85	40	3400	4329.01	65.80	-	0.21	0.05	1.131	0.05	Valid	
BH03A	24.00		A	Perp	83	21	1743	2219.26	47.11	-	0.56	0.25	0.974	0.25	Valid	
BH03A	25.87		A	Perp	85	43	3655	4653.69	68.22	-	1.24	0.27	1.150	0.31	Valid	
BH03A	28.38		A	Perp	85	45	3825	4870.14	69.79	-	0.33	0.07	1.162	0.08	Valid	
BH04	15.89		A	Perp	85	44	3740	4761.92	69.01	-	1.33	0.28	1.156	0.32	Valid	
BH04	16.25		A	Perp	85	47	3995	5086.59	71.32	-	0.37	0.07	1.173	0.09	Valid	
BH04	17.45		A	Perp	85	43	3655	4653.69	68.22	-	1.24	0.27	1.150	0.31	Valid	
BH04	18.92		A	Perp	85	30	2550	3246.76	56.98	-	0.92	0.28	1.061	0.30	Valid	
BH04	19.88		A	Perp	85	45	3825	4870.14	69.79	-	0.81	0.17	1.162	0.19	Valid	
BH04	20.82		A	Perp	85	31	2635	3354.99	57.92	-	0.48	0.14	1.068	0.15	Valid	
BH04	21.94		A	Perp	85	31	2635	3354.99	57.92	-	0.99	0.30	1.068	0.32	Valid	
BH04	22.78		A	Perp	85	37	3145	4004.34	63.28	-	0.24	0.06	1.112	0.07	Valid	
BH04	23.90		A	Perp	85	37	3145	4004.34	63.28	-	3.71	0.93	1.112	1.03	Valid	
BH04	24.90		A	Perp	85	55	4675	5952.39	77.15	-	1.88	0.32	1.216	0.38	Valid	
BH04	33.15		A	Perp	85	47	3995	5086.59	71.32	-	2.65	0.52	1.173	0.61	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular

 4043		Star Radcliffe	Contract No:
			PSL22/4118
			Client Ref:
			PN224390

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_c^2	D_c (mm)	Failure Load		I_s (MPa)	Corr Fac F	I_{s50} (MPa)	Failure Type	Remarks
				Par / Perp	L	D			(Mpa)	(kN)					
BH03A	16.06		D	Par	-	85	7225	85.00	-	0.31	0.043	1.270	0.05	Valid	
BH03A	17.30		D	Par	-	85	7225	85.00	-	0.47	0.065	1.270	0.08	Valid	
BH03A	18.21		D	Par	-	85	7225	85.00	-	0.34	0.047	1.270	0.06	Valid	
BH03A	19.00		D	Par	-	85	7225	85.00	-	0.87	0.120	1.270	0.15	Valid	
BH03A	20.40		D	Par	-	85	7225	85.00	-	0.18	0.025	1.270	0.03	Valid	
BH03A	22.06		D	Par	-	85	7225	85.00	-	0.11	0.015	1.270	0.02	Valid	
BH03A	22.21		D	Par	-	85	7225	85.00	-	0.05	0.007	1.270	0.01	Valid	
BH03A	24.00		D	Par	-	85	7225	85.00	-	0.71	0.098	1.270	0.12	Valid	
BH03A	25.87		D	Par	-	85	7225	85.00	-	0.18	0.025	1.270	0.03	Valid	
BH03A	28.38		D	Par	-	85	7225	85.00	-	0.21	0.029	1.270	0.04	Valid	
BH04	15.89		D	Par	-	85	7225	85.00	-	0.85	0.118	1.270	0.15	Valid	
BH04	16.25		D	Par	-	85	7225	85.00	-	0.24	0.033	1.270	0.04	Valid	
BH04	17.45		D	Par	-	85	7225	85.00	-	0.33	0.046	1.270	0.06	Valid	
BH04	18.92		D	Par	-	85	7225	85.00	-	0.21	0.029	1.270	0.04	Valid	
BH04	19.88		D	Par	-	85	7225	85.00	-	0.71	0.098	1.270	0.12	Valid	
BH04	20.82		D	Par	-	85	7225	85.00	-	0.37	0.051	1.270	0.07	Valid	
BH04	21.94		D	Par	-	85	7225	85.00	-	0.47	0.065	1.270	0.08	Valid	
BH04	22.78		D	Par	-	85	7225	85.00	-	0.31	0.043	1.270	0.05	Valid	
BH04	23.90		D	Par	-	85	7225	85.00	-	1.23	0.170	1.270	0.22	Valid	
BH04	24.90		D	Par	-	85	7225	85.00	-	1.41	0.195	1.270	0.25	Valid	
BH04	33.15		D	Par	-	85	7225	85.00	-	0.62	0.086	1.270	0.11	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

 PSL Professional Soils Laboratory	Star Radcliffe										Contract No:
											PSL22/4118
											Client Ref:
											PN224390

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

Hole Number	Sample Number	Sample Type	Top Depth (m)	Base Depth (m)	Sample Diameter (mm)	Sample Length (mm)	Height Ratio	Initial Mass (g)	Bulk Density (Mg/m)	Moisture Content (%)	Dry Density (Mg/m)	Load Failure (kN)	UCS (MPa)	Failure Mode	Date Tested	Remarks
BH01		C	19.33	19.91	85	160	1.9	2548	2.81	0.4	2.79	406.6	71.6	Brittle	05/07/22	
BH01		C	21.37	21.70	85	161	1.9	2424	2.65	5.9	2.51	222.3	39.2	Brittle	05/07/22	
BH01		C	30.00	30.40	85	160	1.9	2456	2.70	2.3	2.64	85.2	15.0	Brittle	05/07/22	
BH01		C	34.57	34.97	85	160	1.9	2419	2.66	2.3	2.60	248.2	43.7	Brittle	05/07/22	
BH01		C	36.00	36.23	85	162	1.9	2583	2.81	2.5	2.74	236.2	41.6	Brittle	05/07/22	
BH02		C	39.62	39.94	85	151	1.8	2150	2.51	5.5	2.38	13.5	2.4	Brittle	05/07/22	
BH03A		C	26.29	26.56	85	162	1.9	2199	2.39	4.0	2.30	211.2	37.2	Brittle	05/07/22	
BH03A		C	27.71	28.00	85	157	1.8	2098	2.35	1.1	2.33	238.6	42.0	Brittle	05/07/22	
BH03A		C	29.50	29.78	85	161	1.9	2192	2.40	4.2	2.30	206.1	36.3	Brittle	05/07/22	
BH04		C	31.65	31.90	85	160	1.9	2222	2.45	7.1	2.28	20.9	3.7	Brittle	05/07/22	
BH04		C	34.98	35.50	85	160	1.9	2208	2.43	2.9	2.36	220.1	38.8	Brittle	05/07/22	
BH04		C	36.45	36.92	85	160	1.9	2199	2.42	1.8	2.38	201.8	35.6	Brittle	05/07/22	
BH04		C	38.00	38.25	85	160	1.9	2278	2.51	4.9	2.39	197.8	34.9	Brittle	05/07/22	



Star Radcliffe

Contract No:

PSL22/4118

Client Ref:

PN224390



Professional Soils Laboratory

TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: Jay Stringer

To:

Date: 28 / 6 / 2021

Laboratory 3908

Ref:

Contract Number:

Location:

☒ BH ☐ TP Sample Number

Depth (m): 9.5 - 9.95

Sample Type: ☒ U ☐ B ☐ D ☐ W ☐ P ☐ C

Test/s:

BH01

Q.U.T

The above sample cannot be tested for the following reasons:

- ☐ The Sample has not been received
- ☒ There is insufficient material for BS1377: 1990 testing

Maximum Grain Size (Minimum 10%):

☐ Fine ☐ Medium ☐ Coarse

Sample Mass (kg):

Required Mass (kg):

- ☐ The Sample has been previously tested.
- ☐ The Sample has been misplaced in the Laboratory.
- ☐ The Sample is unsuitable for testing because:

Please advise action required:

- ☐ Perform original test on the following alternative Sample:

☐ BH ☐ TP Sample Number: Depth (m):
Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

- ☐ Combine original Sample with the following sample:

☐ BH ☐ TP Sample Number: Depth (m):
Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

- ☐ Perform the following alternative test/s on the original Sample
- ☐ Perform non-standard test on material available
- ☐ Take no further action.

Signed
(Project Engineer)

Date



Professional Soils Laboratory

TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: Jay Stringer

To:

Date: 28/6/2021

Laboratory PSL2213908

Ref:

Contract Number:

Location:

☒ BH02 ☐ TP Sample Number Depth (m): 11.00

Sample Type: ☒ U ☐ B ☐ D ☐ W ☐ P ☐ C

Test/s:

Q.U.T

The above sample cannot be tested for the following reasons:

- ☐ The Sample has not been received
- ☒ There is insufficient material for BS1377: 1990 testing
 - Maximum Grain Size (Minimum 10%): ☐ Fine ☐ Medium ☐ Coarse
 - Sample Mass (kg):
 - Required Mass (kg):
- ☐ The Sample has been previously tested.
- ☐ The Sample has been misplaced in the Laboratory.
- ☐ The Sample is unsuitable for testing because:

Please advise action required:

- ☐ Perform original test on the following alternative Sample:
 - ☐ BH ☐ TP Sample Number: Depth (m):
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Combine original Sample with the following sample:
 - ☐ BH ☐ TP Sample Number: Depth (m):
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Perform the following alternative test/s on the original Sample
- ☐ Perform non-standard test on material available
- ☐ Take no further action.

Signed
(Project Engineer)

Date



Professional Soils Laboratory

TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: Jon Stringer

To:

Date: 28/6 /2021

Laboratory

Ref:

Contract Number:

Location:

☒ BH ☐ TP Sample Number

Depth (m):

20-20.45

Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

Test/s:

BH02

Q.U.T

The above sample cannot be tested for the following reasons:

- ☒ The Sample has not been received
- ☒ There is insufficient material for BS1377: 1990 testing

Maximum Grain Size (Minimum 10%):

☐ Fine ☐ Medium ☐ Coarse

Sample Mass (kg):

Required Mass (kg):

.....

.....

- ☐ The Sample has been previously tested.
- ☐ The Sample has been misplaced in the Laboratory.
- ☐ The Sample is unsuitable for testing because:

Please advise action required:

- ☐ Perform original test on the following alternative Sample:

☐ BH ☐ TP Sample Number:

Depth (m):

Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

- ☐ Combine original Sample with the following sample:

☐ BH ☐ TP Sample Number:

Depth (m):

Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

- ☐ Perform the following alternative test/s on the original Sample
- ☐ Perform non-standard test on material available
- ☐ Take no further action.

Signed
(Project Engineer)

Date



Professional Soils Laboratory

TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: Jay Stringer

To:

Date: 28 / 6 /2021

Laboratory 3908

Ref:

Contract Number:

Location: S

☒ BH ☐ TP Sample Number

Depth (m): S-S-45

Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

Test/s:

BH04

Q.U.T

The above sample cannot be tested for the following reasons:

- ☒ The Sample has not been received
- ☒ There is insufficient material for BS1377: 1990 testing
 - Maximum Grain Size (Minimum 10%): ☐ Fine ☐ Medium ☐ Coarse
 - Sample Mass (kg):
 - Required Mass (kg):
- ☐ The Sample has been previously tested.
- ☐ The Sample has been misplaced in the Laboratory.
- ☐ The Sample is unsuitable for testing because:

Please advise action required:

- ☐ Perform original test on the following alternative Sample:
 - ☐ BH ☐ TP Sample Number: Depth (m):
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Combine original Sample with the following sample:
 - ☐ BH ☐ TP Sample Number: Depth (m):
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Perform the following alternative test/s on the original Sample
- ☐ Perform non-standard test on material available
- ☐ Take no further action.

Signed
(Project Engineer)

Date

PSL**Professional Soils Laboratory****TEST AMENDMENT NOTICE**

(Please tick boxes as appropriate)

From: Clare Fletcher

To:

Date: 28 / 6 /2021Laboratory: 3908

Ref:

Star Radcliffe

Contract Number:

Location:

☒ BH ☐ TP Sample Number

Depth (m):

11 - 11.45Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

Test/s:

BH104Q-U-T

The above sample cannot be tested for the following reasons:

- ☒ The Sample has not been received
- ☒ There is insufficient material for BS1377: 1990 testing

Maximum Grain Size (Minimum 10%):

☐ Fine ☐ Medium ☐ Coarse

Sample Mass (kg):

Required Mass (kg):

.....

.....

- ☐ The Sample has been previously tested.
- ☐ The Sample has been misplaced in the Laboratory.
- ☐ The Sample is unsuitable for testing because:

Please advise action required:

- ☐ Perform original test on the following alternative Sample:

☐ BH ☐ TP Sample Number:

Depth (m):

Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

- ☐ Combine original Sample with the following sample:

☐ BH ☐ TP Sample Number:

Depth (m):

Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C

- ☐ Perform the following alternative test/s on the original Sample
- ☐ Perform non-standard test on material available
- ☐ Take no further action.

Signed

Date

(Project Engineer)

APPENDIX 15

Laboratory Test Results - Contamination



Certificate of Analysis

Certificate Number 22-08937

Issued: 20-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-08937

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description One Soil sample.

Date Received 11-May-22

Date Started 11-May-22

Date Completed 20-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "K. Bridgewood".

Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Soil Samples

Our Ref 22-08937

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007339
Sample ID	BH01
Depth	0.50
Other ID	4
Sample Type	ES
Sampling Date	03/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Antimony	DETSC 2301*	1	mg/kg	1.4
Arsenic	DETSC 2301#	0.2	mg/kg	7.5
Barium	DETSC 2301#	1.5	mg/kg	54
Beryllium	DETSC 2301#	0.2	mg/kg	0.7
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2
Chromium III	DETSC 2301*	0.15	mg/kg	14
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	21
Iron	DETSC 2301	25	mg/kg	52000
Lead	DETSC 2301#	0.3	mg/kg	17
Molybdenum	DETSC 2301#	0.4	mg/kg	1.8
Nickel	DETSC 2301#	1	mg/kg	18
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	24
Zinc	DETSC 2301#	1	mg/kg	60
Inorganics				
pH	DETSC 2008#		pH	6.8
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	0.6
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	18
Sulphur as S, Total	DETSC 2320	0.01	%	0.01
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10

Summary of Chemical Analysis

Soil Samples

Our Ref 22-08937

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007339
Sample ID	BH01
Depth	0.50
Other ID	4
Sample Type	ES
Sampling Date	03/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3
VOCs				
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-08937

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007339
Sample ID	BH01
Depth	0.50
Other ID	4
Sample Type	ES
Sampling Date	03/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01

Summary of Asbestos Analysis

Soil Samples

Our Ref 22-08937

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2007339	BH01 4 0.50	SOIL	NAD	none	Keith Wilson
Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.					

Information in Support of the Analytical Results

Our Ref 22-08937
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2007339	BH01 0.50 SOIL	03/05/22	GJ 250ml x2, GJ 60ml, PT 1L	Total Sulphur ICP (7 days), pH + Conductivity (7 days), VOC (7 days)	

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-08940

Issued: 20-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-08940

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description 3 Soil samples, 1 Leachate sample.

Date Received 11-May-22

Date Started 11-May-22

Date Completed 20-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "K. Bridgwood", written over a horizontal line.

Kirk Bridgwood
General Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 22-08940

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007350	2007351	2007352
Sample ID	BH03	BH03	BH03A
Depth	0.50	2.00	2.00
Other ID			
Sample Type	ES	ES	ES
Sampling Date	05/05/2022	05/05/2022	06/05/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Metals						
Antimony	DETSC 2301*	1	mg/kg	1.5	1.4	2.1
Arsenic	DETSC 2301#	0.2	mg/kg	13	7.2	8.9
Barium	DETSC 2301#	1.5	mg/kg	99	43	33
Beryllium	DETSC 2301#	0.2	mg/kg	0.7	0.6	0.5
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.4	0.2	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	17	22	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	40	21	19
Iron	DETSC 2301	25	mg/kg	< 25	44000	63000
Lead	DETSC 2301#	0.3	mg/kg	42	14	18
Molybdenum	DETSC 2301#	0.4	mg/kg	1.8	0.6	0.6
Nickel	DETSC 2301#	1	mg/kg	20	26	16
Selenium	DETSC 2301#	0.5	mg/kg	0.5	0.7	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	25	23	29
Zinc	DETSC 2301#	1	mg/kg	110	82	89
Inorganics						
pH	DETSC 2008#		pH	7.2	6.6	6.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	2.2	0.9	0.9
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	27	28	14
Sulphur as S, Total	DETSC 2320	0.01	%	0.03	0.01	0.01
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10
PAHs						
Naphthalene	DETSC 3303#	0.03	mg/kg	0.36	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 22-08940

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007350	2007351	2007352
Sample ID	BH03	BH03	BH03A
Depth	0.50	2.00	2.00
Other ID			
Sample Type	ES	ES	ES
Sampling Date	05/05/2022	05/05/2022	06/05/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.39	0.21	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	0.36	0.12	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	1.6	0.06	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	0.37	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	1.7	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	1.4	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.37	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.50	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.40	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.17	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.30	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.10	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.13	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	8.1	< 0.34	< 0.10
Phenols						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.3	< 0.3	< 0.3
VOCs						
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-08940

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007350	2007351	2007352
Sample ID	BH03	BH03	BH03A
Depth	0.50	2.00	2.00
Other ID			
Sample Type	ES	ES	ES
Sampling Date	05/05/2022	05/05/2022	06/05/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Leachate Samples

Our Ref 22-08940

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007353
Sample ID	BH03
Depth	0.50
Other ID	
Sample Type	ES
Sampling Date	05/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Preparation				
BS EN 12457 10:1	DETSC 1009*			Y
Metals				
Antimony, Dissolved	DETSC 2306	0.17	ug/l	0.64
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.8
Barium, Dissolved	DETSC 2306	0.26	ug/l	7.4
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12
Calcium, Dissolved	DETSC 2306	0.09	mg/l	2.4
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.69
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	3.7
Iron, Dissolved	DETSC 2306	5.5	ug/l	2300
Lead, Dissolved	DETSC 2306	0.09	ug/l	3.0
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	0.23
Manganese, Dissolved	DETSC 2306	0.22	ug/l	33
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	1.4
Nickel, Dissolved	DETSC 2306	0.5	ug/l	1.1
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.28
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	1.3
Zinc, Dissolved	DETSC 2306	1.3	ug/l	4.4
Inorganics				
pH	DETSC 2008		pH	6.8
Cyanide, Total	DETSC 2130	40	ug/l	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.18
Chloride	DETSC 2055	0.1	mg/l	0.90
Fluoride	DETSC 2055*	0.1	mg/l	0.11
Sulphate as SO4	DETSC 2055	0.1	mg/l	4.2
Sulphide	DETSC 2208	10	ug/l	16
Phenols				
Phenol	DETSC 3451*	0.1	ug/l	< 1.00
4-Chloro-3-methylphenol	DETSC 3451*	0.1	ug/l	< 1.00
2,4-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 1.00
2,4-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 1.00
p-cresol	DETSC 3451*	0.1	ug/l	< 1.00
2,6-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 1.00
2,6-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 1.00
2,4,6-Trichlorophenol	DETSC 3451*	0.1	ug/l	< 1.00

Summary of Asbestos Analysis Soil Samples

Our Ref 22-08940

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2007350	BH03 0.50	SOIL	NAD	none	Michael Kay
2007351	BH03 2.00	SOIL	NAD	none	Michael Kay
2007352	BH03A 2.00	SOIL	NAD	none	Michael Kay

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-08940
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2007350	BH03 0.50 SOIL	05/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
2007351	BH03 2.00 SOIL	05/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
2007352	BH03A 2.00 SOIL	06/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
2007353	BH03 0.50 LEACHATE	05/05/22	GJ 250ml x2, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-08941

Issued: 20-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-08941

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description 1 Soil sample, 1 Leachate sample.

Date Received 11-May-22

Date Started 11-May-22

Date Completed 20-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager



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Summary of Chemical Analysis

Soil Samples

Our Ref 22-08941

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007354
Sample ID	HD03
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	10/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Antimony	DETSC 2301*	1	mg/kg	1.3
Arsenic	DETSC 2301#	0.2	mg/kg	7.3
Barium	DETSC 2301#	1.5	mg/kg	130
Beryllium	DETSC 2301#	0.2	mg/kg	0.8
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.4
Chromium III	DETSC 2301*	0.15	mg/kg	15
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	27
Iron	DETSC 2301	25	mg/kg	32000
Lead	DETSC 2301#	0.3	mg/kg	16
Molybdenum	DETSC 2301#	0.4	mg/kg	1.3
Nickel	DETSC 2301#	1	mg/kg	30
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	21
Zinc	DETSC 2301#	1	mg/kg	61
Inorganics				
pH	DETSC 2008#		pH	7.4
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	2.9
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	15
Sulphur as S, Total	DETSC 2320	0.01	%	0.03
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10

Summary of Chemical Analysis

Soil Samples

Our Ref 22-08941

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007354
Sample ID	HD03
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	10/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.10
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.15
Pyrene	DETSC 3303#	0.03	mg/kg	0.14
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.05
Chrysene	DETSC 3303	0.03	mg/kg	0.07
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.06
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.05
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.55
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3
VOCs				
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-08941

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007354
Sample ID	HD03
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	10/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Leachate Samples

Our Ref 22-08941

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2007355
Sample ID	HD03
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	10/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Preparation				
BS EN 12457 10:1	DETSC 1009*			Y
Metals				
Antimony, Dissolved	DETSC 2306	0.17	ug/l	< 0.17
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.64
Barium, Dissolved	DETSC 2306	0.26	ug/l	8.0
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12
Calcium, Dissolved	DETSC 2306	0.09	mg/l	2.3
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.64
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	7.4
Copper, Dissolved	DETSC 2306	0.4	ug/l	2.3
Iron, Dissolved	DETSC 2306	5.5	ug/l	1400
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.79
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	0.77
Manganese, Dissolved	DETSC 2306	0.22	ug/l	7.5
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	< 1.1
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.8
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	1.0
Zinc, Dissolved	DETSC 2306	1.3	ug/l	2.7
Inorganics				
pH	DETSC 2008		pH	7.0
Cyanide, Total	DETSC 2130	40	ug/l	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.067
Chloride	DETSC 2055	0.1	mg/l	1.2
Fluoride	DETSC 2055*	0.1	mg/l	0.18
Sulphate as SO4	DETSC 2055	0.1	mg/l	2.0
Sulphide	DETSC 2208	10	ug/l	< 10
Phenols				
Phenol	DETSC 3451*	0.1	ug/l	< 1.00
4-Chloro-3-methylphenol	DETSC 3451*	0.1	ug/l	< 1.00
2,4-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 1.00
2,4-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 1.00
p-cresol	DETSC 3451*	0.1	ug/l	< 1.00
2,6-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 1.00
2,6-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 1.00
2,4,6-Trichlorophenol	DETSC 3451*	0.1	ug/l	< 1.00

Summary of Asbestos Analysis

Soil Samples

Our Ref 22-08941

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2007354	HD03 1.00	SOIL	NAD	none	Keith Wilson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-08941
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2007354	HD03 1.00 SOIL	10/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
2007355	HD03 1.00 LEACHATE	10/05/22	GJ 250ml x2, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-09258

Issued: 24-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-09258

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description 3 Soil samples.

Date Received 16-May-22

Date Started 16-May-22

Date Completed 24-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "Kirk Bridgewood".

Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09258

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2009377	2009378	2009379
Sample ID	DCP07	DCP08	HDP04
Depth	0.20	0.20	0.50
Other ID			
Sample Type	ES	ES	ES
Sampling Date	11/05/2022	11/05/2022	12/05/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Metals						
Antimony	DETSC 2301*	1	mg/kg	3.4	2.8	3.4
Arsenic	DETSC 2301#	0.2	mg/kg	14	9.7	18
Barium	DETSC 2301#	1.5	mg/kg	150	90	170
Beryllium	DETSC 2301#	0.2	mg/kg	0.8	0.7	0.8
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.3	0.3	0.4
Chromium III	DETSC 2301*	0.15	mg/kg	18	20	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	74	31	81
Iron	DETSC 2301	25	mg/kg	76000	70000	23000
Lead	DETSC 2301#	0.3	mg/kg	70	41	130
Molybdenum	DETSC 2301#	0.4	mg/kg	2.1	5.3	3.9
Nickel	DETSC 2301#	1	mg/kg	25	20	21
Selenium	DETSC 2301#	0.5	mg/kg	1.2	0.7	0.9
Vanadium	DETSC 2301#	0.8	mg/kg	28	30	28
Zinc	DETSC 2301#	1	mg/kg	180	150	110
Inorganics						
pH	DETSC 2008#		pH	6.8	6.8	7.8
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	3.8	1.7	7.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	13	< 10	55
Sulphur as S, Total	DETSC 2320	0.01	%	0.03	0.02	0.16
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg	< 1.20	< 1.20	< 1.20
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg	< 3.40	7.83	< 3.40
Aliphatic C5-C35	DETSC 3521*	10	mg/kg	< 10.00	12.86	< 10.00
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg	< 0.90	< 0.90	< 0.90
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg	< 0.50	< 0.50	7.61
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg	2.80	< 0.60	83.73
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg	< 1.40	< 1.40	89.72
Aromatic C5-C35	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	182.2
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg	14.84	16.93	191.1
PAHs						
Naphthalene	DETSC 3303#	0.03	mg/kg	0.07	< 0.03	0.53

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09258

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2009377	2009378	2009379
Sample ID	DCP07	DCP08	HDP04
Depth	0.20	0.20	0.50
Other ID			
Sample Type	ES	ES	ES
Sampling Date	11/05/2022	11/05/2022	12/05/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.17	0.05	1.2
Fluorene	DETSC 3303	0.03	mg/kg	0.12	0.05	0.80
Phenanthrene	DETSC 3303#	0.03	mg/kg	1.5	0.70	9.5
Anthracene	DETSC 3303	0.03	mg/kg	0.33	0.23	2.3
Fluoranthene	DETSC 3303#	0.03	mg/kg	2.3	1.6	12
Pyrene	DETSC 3303#	0.03	mg/kg	1.7	1.3	11
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.55	0.38	3.9
Chrysene	DETSC 3303	0.03	mg/kg	0.66	0.42	4.2
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.52	0.32	3.4
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.21	0.15	1.6
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.36	0.23	2.9
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.20	0.13	1.2
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.34
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.17	0.11	1.1
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	8.8	< 4.77	56
Phenols						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3
VOCs						
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09258

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2009377	2009378	2009379
Sample ID	DCP07	DCP08	HDP04
Depth	0.20	0.20	0.50
Other ID			
Sample Type	ES	ES	ES
Sampling Date	11/05/2022	11/05/2022	12/05/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01

Summary of Asbestos Analysis Soil Samples

Our Ref 22-09258

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2009377	DCP07 0.20	SOIL	NAD	none	Keith Wilson
2009378	DCP08 0.20	SOIL	NAD	none	Keith Wilson
2009379	HDP04 0.50	SOIL	NAD	none	Keith Wilson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-09258
Client Ref PN224390
Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2009377	DCP07 0.20 SOIL	11/05/22	GJ 250ml, GJ 60ml, PT 1L		
2009378	DCP08 0.20 SOIL	11/05/22	GJ 250ml, GJ 60ml, PT 1L		
2009379	HDP04 0.50 SOIL	12/05/22	GJ 250ml x2, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-09442

Issued: 26-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-09442

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description 1 Soil sample, 1 Leachate sample.

Date Received 17-May-22

Date Started 17-May-22

Date Completed 26-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "K. Bridgewood".

Kirk Bridgewood
General Manager



2139

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09442

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2010327
Sample ID	HD01
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Antimony	DETSC 2301*	1	mg/kg	2.5
Arsenic	DETSC 2301#	0.2	mg/kg	24
Barium	DETSC 2301#	1.5	mg/kg	180
Beryllium	DETSC 2301#	0.2	mg/kg	2.3
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	150
Iron	DETSC 2301	25	mg/kg	66000
Lead	DETSC 2301#	0.3	mg/kg	33
Molybdenum	DETSC 2301#	0.4	mg/kg	17
Nickel	DETSC 2301#	1	mg/kg	49
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	63
Zinc	DETSC 2301#	1	mg/kg	61
Inorganics				
pH	DETSC 2008#		pH	8.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	18
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	73
Sulphur as S, Total	DETSC 2320	0.01	%	0.17
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg	2.90
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg	< 1.20
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg	< 1.50
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg	< 3.40
Aliphatic C5-C35	DETSC 3521*	10	mg/kg	10.40
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg	< 0.90
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg	< 0.50
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg	1.90
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg	< 1.40
Aromatic C5-C35	DETSC 3521*	10	mg/kg	< 10.00
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg	15.76
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09442

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2010327
Sample ID	HD01
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.09
Anthracene	DETSC 3303	0.03	mg/kg	0.13
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.38
Pyrene	DETSC 3303#	0.03	mg/kg	0.44
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.17
Chrysene	DETSC 3303	0.03	mg/kg	0.21
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.27
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.09
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.20
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.08
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.08
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 1.76
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3
VOCs				
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09442

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2010327
Sample ID	HD01
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Leachate Samples

Our Ref 22-09442

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2010328
Sample ID	HD01
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Preparation				
BS EN 12457 10:1	DETSC 1009*			Y
Metals				
Antimony, Dissolved	DETSC 2306	0.17	ug/l	0.18
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.6
Barium, Dissolved	DETSC 2306	0.26	ug/l	7.9
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12
Calcium, Dissolved	DETSC 2306	0.09	mg/l	7.0
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	1.7
Iron, Dissolved	DETSC 2306	5.5	ug/l	48
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.37
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	0.46
Manganese, Dissolved	DETSC 2306	0.22	ug/l	0.76
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	2.0
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.28
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	1.0
Zinc, Dissolved	DETSC 2306	1.3	ug/l	< 1.3
Inorganics				
pH	DETSC 2008		pH	7.1
Cyanide, Total	DETSC 2130	40	ug/l	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.033
Chloride	DETSC 2055	0.1	mg/l	0.93
Fluoride	DETSC 2055*	0.1	mg/l	0.15
Sulphate as SO4	DETSC 2055	0.1	mg/l	8.3
Sulphide	DETSC 2208	10	ug/l	14
Phenols				
Phenol	DETSC 3451*	0.1	ug/l	< 0.10
4-Chloro-3-methylphenol	DETSC 3451*	0.1	ug/l	< 0.10
2,4-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 0.10
2,4-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 0.10
p-cresol	DETSC 3451*	0.1	ug/l	< 0.10
2,6-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 0.10
2,6-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 0.10
2,4,6-Trichlorophenol	DETSC 3451*	0.1	ug/l	< 0.10

Summary of Asbestos Analysis Soil Samples

Our Ref 22-09442

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2010327	HD01 1.00	SOIL	NAD	none	Keith Wilson
Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.					

Information in Support of the Analytical Results

Our Ref 22-09442
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2010327	HD01 1.00 SOIL	12/05/22	GJ 250ml, GJ 60ml, PT 1L		
2010328	HD01 1.00 LEACHATE	12/05/22	GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-09489

Issued: 27-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-09489

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description 1 Soil sample, 1 Leachate sample.

Date Received 18-May-22

Date Started 18-May-22

Date Completed 27-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "K. Bridgewood".

Kirk Bridgewood
General Manager



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Summary of Chemical Analysis

Soil Samples

Our Ref 22-09489

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2010610
Sample ID	DCP05
Depth	0.50
Other ID	
Sample Type	SOIL
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Antimony	DETSC 2301*	1	mg/kg	1.2
Arsenic	DETSC 2301#	0.2	mg/kg	7.3
Barium	DETSC 2301#	1.5	mg/kg	65
Beryllium	DETSC 2301#	0.2	mg/kg	0.5
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	9.9
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	44
Iron	DETSC 2301	25	mg/kg	13000
Lead	DETSC 2301#	0.3	mg/kg	40
Molybdenum	DETSC 2301#	0.4	mg/kg	1.9
Nickel	DETSC 2301#	1	mg/kg	14
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	18
Zinc	DETSC 2301#	1	mg/kg	57
Inorganics				
pH	DETSC 2008#		pH	9.7
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	3.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	85
Sulphur as S, Total	DETSC 2320	0.01	%	0.03
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg	< 1.50
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg	< 1.20
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg	< 1.50
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg	< 3.40
Aliphatic C5-C35	DETSC 3521*	10	mg/kg	< 10.00
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg	< 0.90
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg	2.48
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg	20.21
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg	14.83
Aromatic C5-C35	DETSC 3521*	10	mg/kg	38.57
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg	47.16
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	0.11

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09489
 Client Ref PN224390
 Contract Title Star Radcliffe

Lab No	2010610
Sample ID	DCP05
Depth	0.50
Other ID	
Sample Type	SOIL
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.38
Fluorene	DETSC 3303	0.03	mg/kg	0.29
Phenanthrene	DETSC 3303#	0.03	mg/kg	2.4
Anthracene	DETSC 3303	0.03	mg/kg	0.78
Fluoranthene	DETSC 3303#	0.03	mg/kg	3.6
Pyrene	DETSC 3303#	0.03	mg/kg	3.3
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	1.1
Chrysene	DETSC 3303	0.03	mg/kg	1.3
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	1.5
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.50
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	1.1
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.33
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.09
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.42
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	17
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3
VOCs				
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09489
 Client Ref PN224390
 Contract Title Star Radcliffe

Lab No	2010610
Sample ID	DCP05
Depth	0.50
Other ID	
Sample Type	SOIL
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Leachate Samples

Our Ref 22-09489

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2010611
Sample ID	DCP05
Depth	0.50
Other ID	
Sample Type	LEACHATE
Sampling Date	12/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Preparation				
BS EN 12457 10:1	DETSC 1009*			Y
Metals				
Antimony, Dissolved	DETSC 2306	0.17	ug/l	0.31
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	3.2
Barium, Dissolved	DETSC 2306	0.26	ug/l	4.4
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12
Calcium, Dissolved	DETSC 2306	0.09	mg/l	6.2
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.67
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	2.5
Iron, Dissolved	DETSC 2306	5.5	ug/l	23
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.23
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	0.31
Manganese, Dissolved	DETSC 2306	0.22	ug/l	1.8
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	< 1.1
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	2.4
Zinc, Dissolved	DETSC 2306	1.3	ug/l	< 1.3
Inorganics				
pH	DETSC 2008		pH	7.5
Cyanide, Total	DETSC 2130	40	ug/l	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.017
Chloride	DETSC 2055	0.1	mg/l	1.2
Fluoride	DETSC 2055*	0.1	mg/l	< 0.10
Sulphate as SO4	DETSC 2055	0.1	mg/l	3.9
Sulphide	DETSC 2208	10	ug/l	< 10
Phenols				
Phenol	DETSC 3451*	0.1	ug/l	< 0.10
4-Chloro-3-methylphenol	DETSC 3451*	0.1	ug/l	< 0.10
2,4-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 0.10
2,4-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 0.10
p-cresol	DETSC 3451*	0.1	ug/l	< 0.10
2,6-Dimethylphenol	DETSC 3451*	0.1	ug/l	< 0.10
2,6-Dichlorophenol	DETSC 3451*	0.1	ug/l	< 0.10
2,4,6-Trichlorophenol	DETSC 3451*	0.1	ug/l	< 0.10

Summary of Asbestos Analysis Soil Samples

Our Ref 22-09489

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2010610	DCP05 0.50	SOIL	NAD	none	Lee Kerridge

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-09489
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2010610	DCP05 0.50 SOIL	12/05/22	GJ 250ml, GJ 60ml, PT 1L		
2010611	DCP05 0.50 LEACHATE	12/05/22	GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
 Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
 The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
 Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-09262

Issued: 24-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-09262

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description One Soil sample.

Date Received 16-May-22

Date Started 16-May-22

Date Completed 24-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "Kirk Bridgewood".

Kirk Bridgewood
General Manager



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Summary of Chemical Analysis

Soil Samples

Our Ref 22-09262

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2009385
Sample ID	BH02
Depth	0.50
Other ID	
Sample Type	ES
Sampling Date	10/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Antimony	DETSC 2301*	1	mg/kg	1.3
Arsenic	DETSC 2301#	0.2	mg/kg	4.1
Barium	DETSC 2301#	1.5	mg/kg	82
Beryllium	DETSC 2301#	0.2	mg/kg	< 0.2
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.2
Chromium III	DETSC 2301*	0.15	mg/kg	7.6
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	6.0
Iron	DETSC 2301	25	mg/kg	15000
Lead	DETSC 2301#	0.3	mg/kg	8.4
Molybdenum	DETSC 2301#	0.4	mg/kg	< 0.4
Nickel	DETSC 2301#	1	mg/kg	4.3
Selenium	DETSC 2301#	0.5	mg/kg	0.5
Vanadium	DETSC 2301#	0.8	mg/kg	14
Zinc	DETSC 2301#	1	mg/kg	81
Inorganics				
pH	DETSC 2008#		pH	6.7
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	< 0.5
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	31
Sulphur as S, Total	DETSC 2320	0.01	%	0.01
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg	< 1.50
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg	< 1.20
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg	< 1.50
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg	4.13
Aliphatic C5-C35	DETSC 3521*	10	mg/kg	< 10.00
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg	< 0.90
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg	< 0.50
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg	< 0.60
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg	< 1.40
Aromatic C5-C35	DETSC 3521*	10	mg/kg	< 10.00
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg	12.93
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09262

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2009385
Sample ID	BH02
Depth	0.50
Other ID	
Sample Type	ES
Sampling Date	10/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3
VOCs				
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09262

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2009385
Sample ID	BH02
Depth	0.50
Other ID	
Sample Type	ES
Sampling Date	10/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01

Summary of Asbestos Analysis Soil Samples

Our Ref 22-09262

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2009385	BH02 0.50	SOIL	NAD	none	Michael Kay

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-09262
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date		Holding time exceeded for tests	Inappropriate container for tests
		Sampled	Containers Received		
2009385	BH02 0.50 SOIL	10/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
Key: G-Glass P-Plastic J-Jar T-Tub DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.					

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377. Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis. The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.
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Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :- Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-09620

Issued: 30-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-09620

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description 4 Soil samples.

Date Received 19-May-22

Date Started 19-May-22

Date Completed 30-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "Kirk Bridgewood".

Kirk Bridgewood
General Manager



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Summary of Chemical Analysis

Soil Samples

Our Ref 22-09620

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2011489	2011490	2011491	2011492
Sample ID	DS01	DS04	DS05	HD02
Depth	0.50	0.50	0.50	0.50
Other ID				
Sample Type	ES	ES	ES	ES
Sampling Date	12/05/2022	13/05/2022	13/05/2022	n/s
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Metals							
Antimony	DETSC 2301*	1	mg/kg	15	2.1	4.6	1.2
Arsenic	DETSC 2301#	0.2	mg/kg	130	12	28	9.7
Barium	DETSC 2301#	1.5	mg/kg	220	100	260	72
Beryllium	DETSC 2301#	0.2	mg/kg	1.2	0.8	2.2	0.6
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.6	0.3	1.0	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	160	19	29	11
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	190	48	190	43
Iron	DETSC 2301	25	mg/kg	55000	75000	92000	15000
Lead	DETSC 2301#	0.3	mg/kg	380	39	180	22
Molybdenum	DETSC 2301#	0.4	mg/kg	5.7	1.9	7.0	1.8
Nickel	DETSC 2301#	1	mg/kg	31	23	37	17
Selenium	DETSC 2301#	0.5	mg/kg	1.4	0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	36	26	61	20
Zinc	DETSC 2301#	1	mg/kg	220	90	170	49
Inorganics							
pH	DETSC 2008#		pH	5.9	7.6	7.8	8.8
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	32	2.7	17	4.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	38	29	200	79
Sulphur as S, Total	DETSC 2320	0.01	%	0.19	0.02	0.05	0.04
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg	< 1.20	< 1.20	< 1.20	< 1.20
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg	< 3.40	4.96	8.31	5.85
Aliphatic C5-C35	DETSC 3521*	10	mg/kg	10.62	< 10.00	13.04	10.75
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	0.01	< 0.01
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg	1.53	< 0.90	8.57	< 0.90
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg	7.55	0.61	89.93	< 0.50
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg	21.49	5.05	289.2	4.94
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg	3.47	1.72	194.1	1.70
Aromatic C5-C35	DETSC 3521*	10	mg/kg	34.07	< 10.00	581.8	< 10.00
TPH Ali/Aro Total C5-C35	DETSC 3521*	10	mg/kg	44.69	18.10	594.9	19.05
PAHs							
Naphthalene	DETSC 3303#	0.03	mg/kg	0.41	< 0.03	21	0.11

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09620

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2011489	2011490	2011491	2011492
Sample ID	DS01	DS04	DS05	HD02
Depth	0.50	0.50	0.50	0.50
Other ID				
Sample Type	ES	ES	ES	ES
Sampling Date	12/05/2022	13/05/2022	13/05/2022	n/s
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 1.00	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.54	0.04	21	0.20
Fluorene	DETSC 3303	0.03	mg/kg	0.26	< 0.03	15	0.11
Phenanthrene	DETSC 3303#	0.03	mg/kg	2.2	0.27	65	1.3
Anthracene	DETSC 3303	0.03	mg/kg	0.41	0.07	14	0.37
Fluoranthene	DETSC 3303#	0.03	mg/kg	2.1	0.44	79	1.9
Pyrene	DETSC 3303#	0.03	mg/kg	1.9	0.43	73	2.0
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.41	0.17	23	0.65
Chrysene	DETSC 3303	0.03	mg/kg	0.45	0.20	30	0.65
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.28	0.17	23	0.58
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.07	0.05	10	0.22
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.16	0.10	19	0.41
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.06	0.05	8.8	0.11
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	2.1	0.04
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.06	0.05	8.9	0.17
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	9.3	< 1.83	410	8.9
Phenols							
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.9	< 0.3	1.2	< 0.3
VOCs							
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09620

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2011489	2011490	2011491	2011492
Sample ID	DS01	DS04	DS05	HD02
Depth	0.50	0.50	0.50	0.50
Other ID				
Sample Type	ES	ES	ES	ES
Sampling Date	12/05/2022	13/05/2022	13/05/2022	n/s
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01

Summary of Asbestos Analysis Soil Samples

Our Ref 22-09620

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2011489	DS01 0.50	SOIL	NAD	none	Darryl Fletcher
2011490	DS04 0.50	SOIL	NAD	none	Darryl Fletcher
2011491	DS05 0.50	SOIL	NAD	none	Darryl Fletcher
2011492	HD02 0.50	SOIL	NAD	none	Darryl Fletcher

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-09620
Client Ref PN224390
Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2011489	DS01 0.50 SOIL	12/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
2011490	DS04 0.50 SOIL	13/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
2011491	DS05 0.50 SOIL	13/05/22	GJ 250ml x2, GJ 60ml, PT 1L		
2011492	HD02 0.50 SOIL		GJ 250ml x2, GJ 60ml, PT 1L	Sample date not supplied, Anions 2:1 (30 days), Aliphatics/Aromatics (14 days), Boron (365 days), BTEX (14 days), Chromium, Hexavalent (365 days), EPH/Aliphatic/Aromatic (14 days), Total Sulphur ICP (7 days), ICP WS Boron (182 days), Metals ICP (182 days), Metals ICP Prep (182 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Auto) (28 days), PAH MS (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), VOC (7 days)	

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-09727

Issued: 30-May-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-09727

Client Reference PN224390

Order No ON33823

Contract Title Star Radcliffe

Description One Soil sample.

Date Received 20-May-22

Date Started 20-May-22

Date Completed 30-May-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "Kirk Bridgewood".

Kirk Bridgewood
General Manager



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Summary of Chemical Analysis

Soil Samples

Our Ref 22-09727

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2012257
Sample ID	BH04
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	17/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Antimony	DETSC 2301*	1	mg/kg	1.5
Arsenic	DETSC 2301#	0.2	mg/kg	15
Barium	DETSC 2301#	1.5	mg/kg	200
Beryllium	DETSC 2301#	0.2	mg/kg	2.6
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2
Chromium III	DETSC 2301*	0.15	mg/kg	14
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	130
Iron	DETSC 2301	25	mg/kg	46000
Lead	DETSC 2301#	0.3	mg/kg	12
Molybdenum	DETSC 2301#	0.4	mg/kg	12
Nickel	DETSC 2301#	1	mg/kg	40
Selenium	DETSC 2301#	0.5	mg/kg	0.7
Vanadium	DETSC 2301#	0.8	mg/kg	72
Zinc	DETSC 2301#	1	mg/kg	22
Inorganics				
pH	DETSC 2008#		pH	7.5
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	22
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	100
Sulphur as S, Total	DETSC 2320	0.01	%	0.21
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	0.04

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09727

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2012257
Sample ID	BH04
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	17/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.04
Fluorene	DETSC 3303	0.03	mg/kg	0.04
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.47
Anthracene	DETSC 3303	0.03	mg/kg	0.10
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.57
Pyrene	DETSC 3303#	0.03	mg/kg	0.57
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.31
Chrysene	DETSC 3303	0.03	mg/kg	0.41
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.40
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.17
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.34
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.28
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.25
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	4.0
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3
VOCs				
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 22-09727

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2012257
Sample ID	BH04
Depth	1.00
Other ID	
Sample Type	ES
Sampling Date	17/05/2022
Sampling Time	n/s

Test	Method	LOD	Units	
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01

Summary of Asbestos Analysis Soil Samples

Our Ref 22-09727

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2012257	BH04 1.00	SOIL	NAD	none	Josh Best

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-09727
 Client Ref PN224390
 Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date		Holding time exceeded for tests	Inappropriate container for tests
		Sampled	Containers Received		
2012257	BH04 1.00 SOIL	17/05/22	GJ 250ml x2, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 22-12704

Issued: 13-Jul-22

Client Geotechnics LTD
The Geotechnical Centre
Unit 1B Borders Ind. Park
River Lane
Saltney
Chester
CH4 8RJ

Our Reference 22-12704

Client Reference PN224390

Order No (not supplied)

Contract Title Star Radcliffe

Description 4 Water samples.

Date Received 06-Jul-22

Date Started 06-Jul-22

Date Completed 13-Jul-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "K. Bridgewood", written over a horizontal line.

Kirk Bridgewood
General Manager



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Summary of Chemical Analysis

Water Samples

Our Ref 22-12704

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2028854	2028855	2028856	2028857
	BH01	BH02 (4.00m Shallow) P1	BH02 (15.00 Deep) P2	BH04
Sample ID				
Depth	1.71	1.03	1.90	1.77
Other ID				
Sample Type	WATER	WATER	WATER	WATER
Sampling Date	01/07/2022	01/07/2022	01/07/2022	01/07/2022
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Metals							
Antimony, Dissolved	DETSC 2306	0.17	ug/l	0.41	< 0.17	0.73	0.78
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.3	3.6	3.7	1.5
Barium, Dissolved	DETSC 2306	0.26	ug/l	120	110	240	260
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	96	300	320	160
Calcium, Dissolved	DETSC 2306	0.09	mg/l	50	53	25	87
Chromium, Dissolved	DETSC 2306	0.25	ug/l	25	1.5	15	1.9
Chromium III, Dissolved	DETSC 2306*	1	ug/l	25	1.5	15	1.9
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	2.0	< 0.4	1.6	1.5
Iron, Dissolved	DETSC 2306	5.5	ug/l	19	86	55	22
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.29	0.48	0.49	0.44
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	10	14	9.1	13
Manganese, Dissolved	DETSC 2306	0.22	ug/l	1500	300	58	360
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	5.5	19	54	20
Nickel, Dissolved	DETSC 2306	0.5	ug/l	5.0	3.5	3.9	7.7
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.55	0.25	1.2	1.5
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	0.7	< 0.6	1.1	0.8
Zinc, Dissolved	DETSC 2306	1.3	ug/l	37	15	32	59
Inorganics							
pH	DETSC 2008		pH	7.3	7.5	7.8	7.3
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20	< 20	< 20	< 20
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	166	191	99.7	269
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.25	0.45	0.60	0.13
Chloride	DETSC 2055	0.1	mg/l	16	17	17	20
Fluoride	DETSC 2055*	0.1	mg/l	0.17	0.29	0.48	0.28
Sulphate as SO4	DETSC 2055	0.1	mg/l	73	120	140	80
Sulphide	DETSC 2208	10	ug/l	130	49	51	89

Summary of Chemical Analysis

Water Samples

Our Ref 22-12704

Client Ref PN224390

Contract Title Star Radcliffe

Lab No	2028854	2028855	2028856	2028857
	BH01	BH02 (4.00m Shallow) P1	BH02 (15.00 Deep) P2	BH04
Sample ID				
Depth	1.71	1.03	1.90	1.77
Other ID				
Sample Type	WATER	WATER	WATER	WATER
Sampling Date	01/07/2022	01/07/2022	01/07/2022	01/07/2022
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	14	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	14	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	ug/l	< 10	15	< 10	< 10
PAHs							
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	0.06	0.18	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.02	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.04	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.03	0.16	0.03
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.03	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.01	0.01	0.04	0.02
Pyrene	DETSC 3304	0.01	ug/l	0.01	0.02	0.05	0.02
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	0.02	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.04	0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.03	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.02	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.03	0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	0.65	< 0.20

Information in Support of the Analytical Results

Our Ref 22-12704
Client Ref PN224390
Contract Star Radcliffe

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2028854	BH01 1.71 WATER	01/07/22	GB 1L, GV x2, PB 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), PAH MS (4 days)	
2028855	BH02 (4.00m Shallow) P1 1.03 WATER	01/07/22	GB 1L, GV x2, PB 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), PAH MS (4 days)	
2028856	BH02 (15.00 Deep) P2 1.90 WATER	01/07/22	GB 1L, GV x2, PB 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), PAH MS (4 days)	
2028857	BH04 1.77 WATER	01/07/22	GB 1L, GV x2, PB 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), PAH MS (4 days)	

Key: G-Glass P-Plastic B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

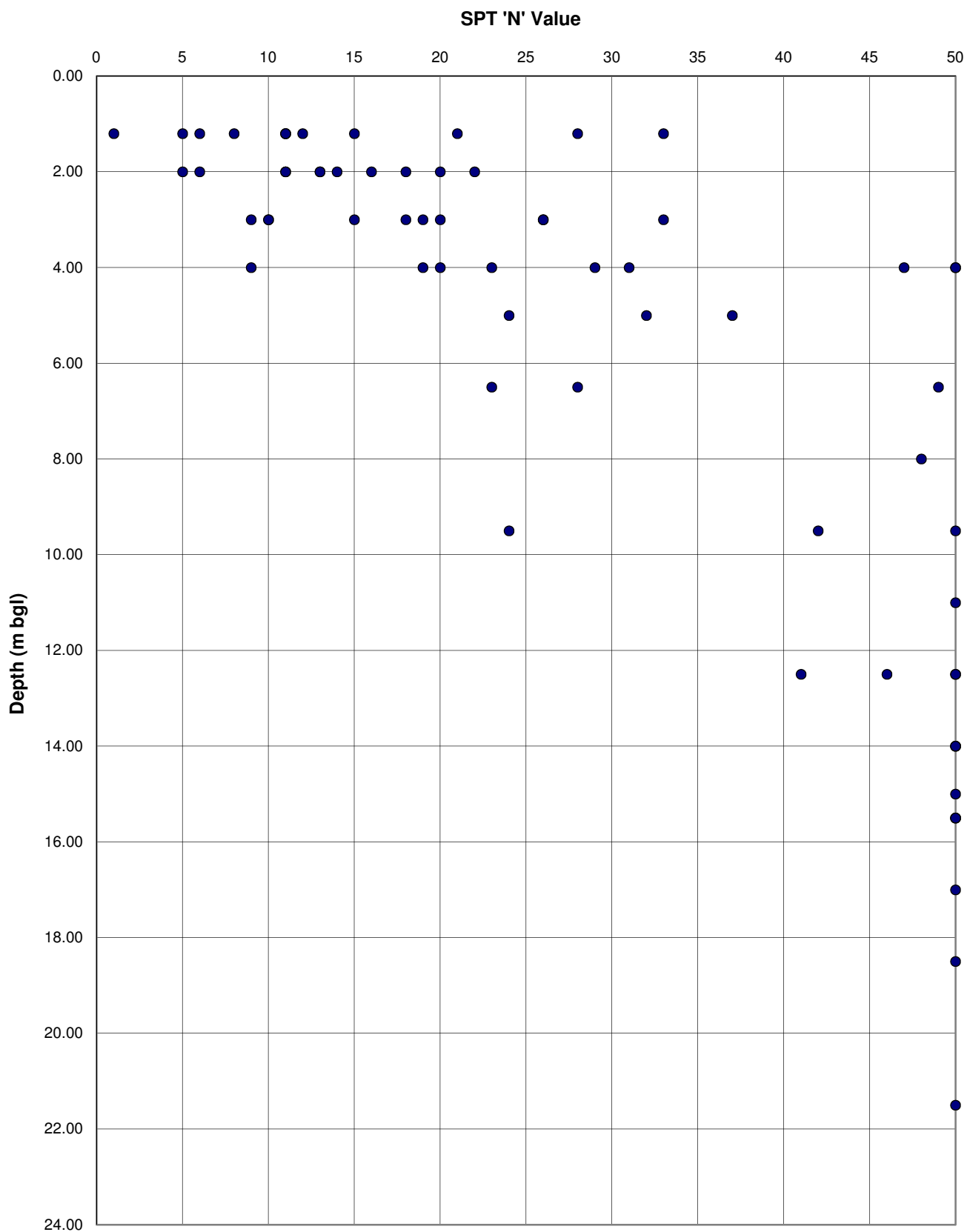
Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

APPENDIX I6

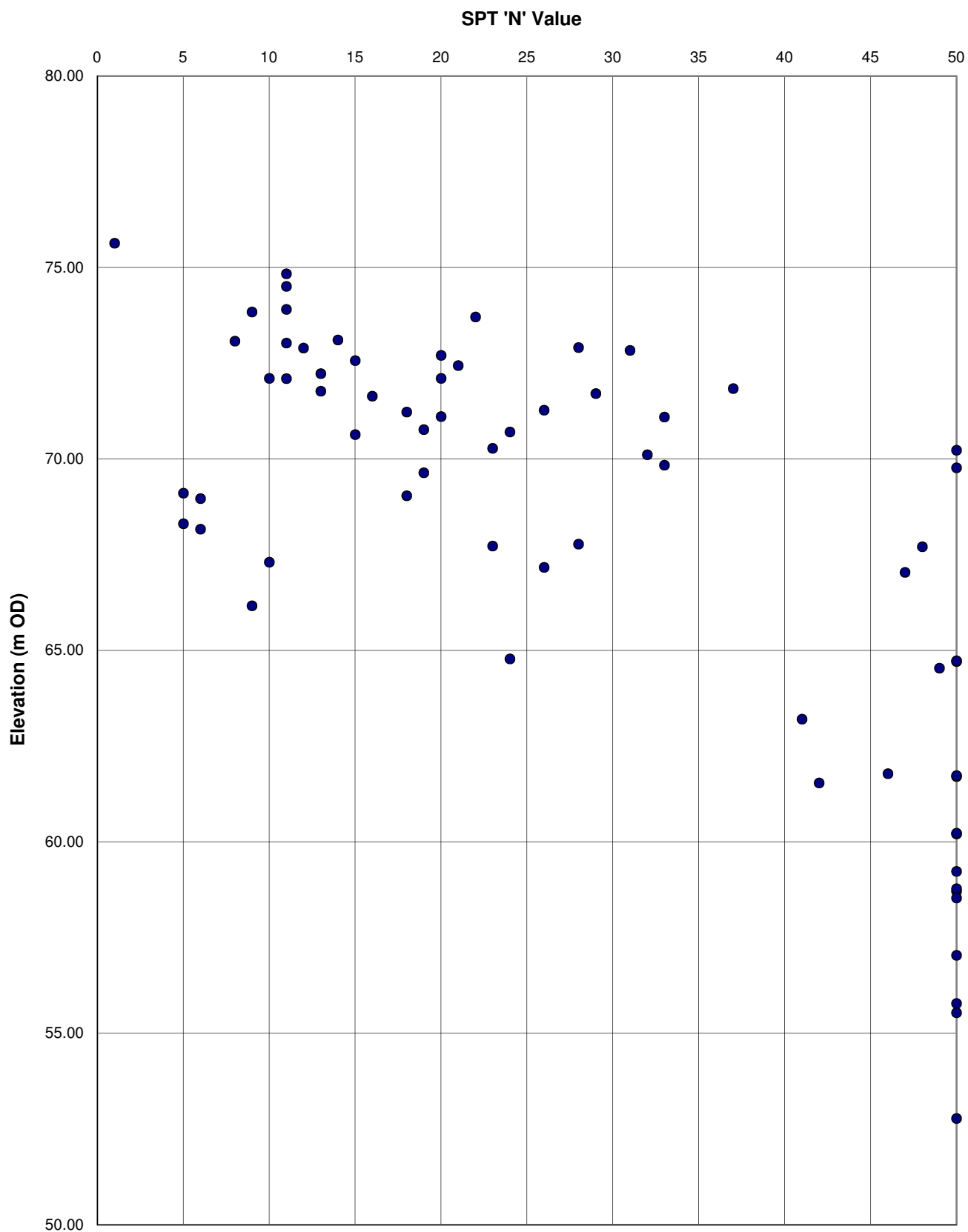
Ground Parameter Data Plots (All Strata)



Job No PN224390
Date 08/07/2022
Figure 1

STAR RADCLIFFE
 Plot of SPT - Depth Profile

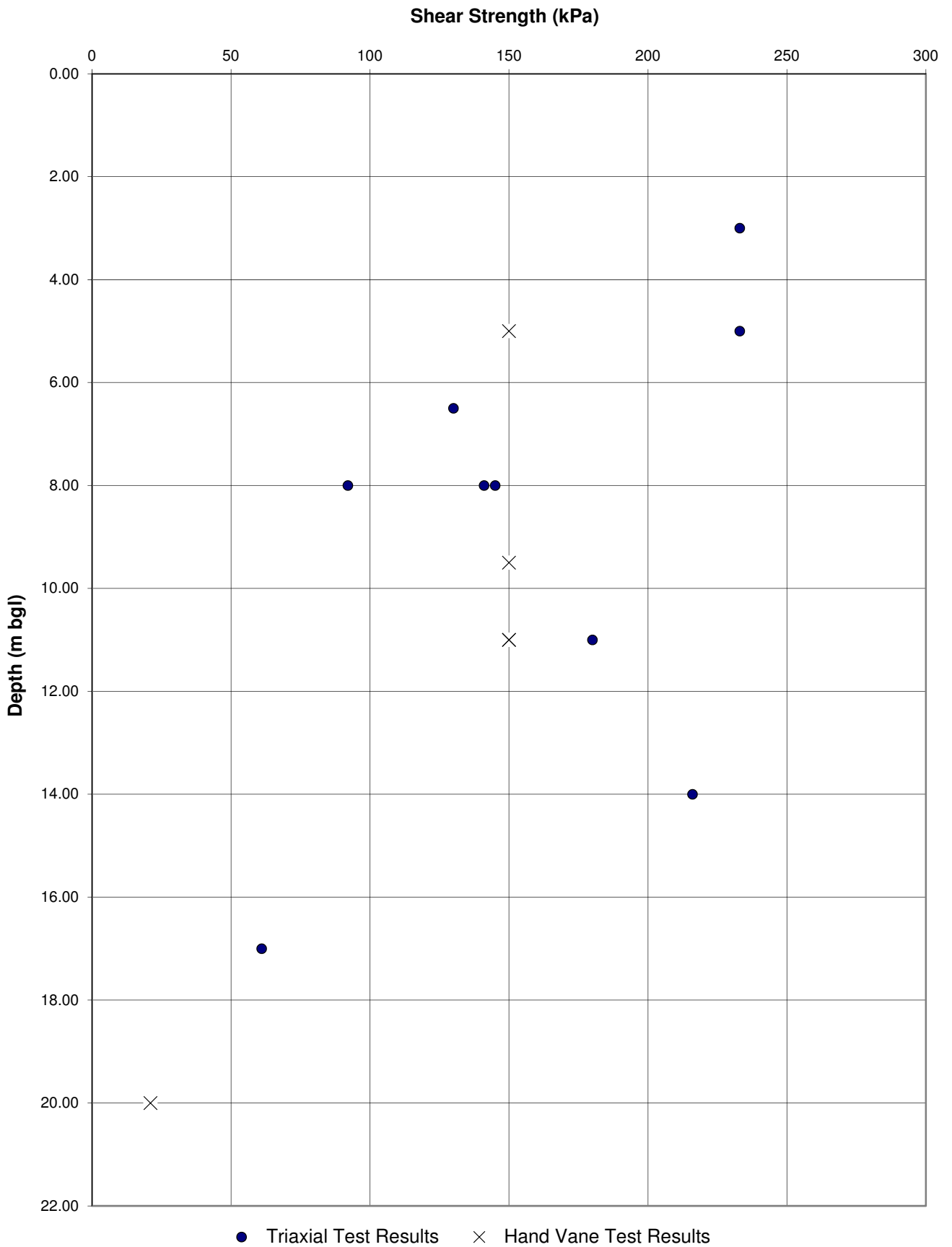
GEOTECHNICS



Job No PN224390
Date 08/07/2022
Figure 2

STAR RADCLIFFE
 Plot of SPT - Elevation Profile

GEOTECHNICS

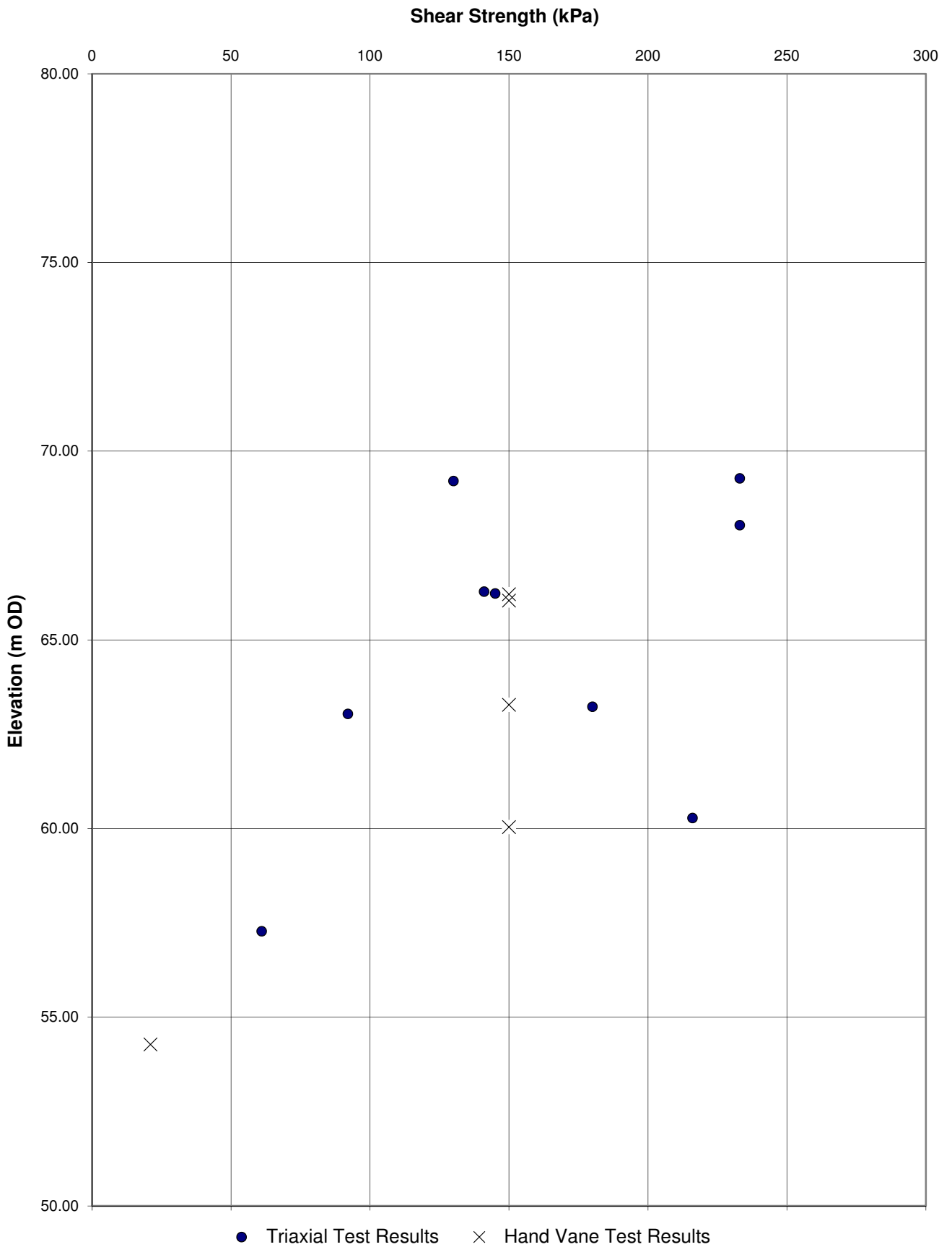


All Strata

Job No PN224390
Date 08/07/2022
Figure 3

STAR RADCLIFFE
 Plot of Shear Strength - Depth Profile

GEOTECHNICS

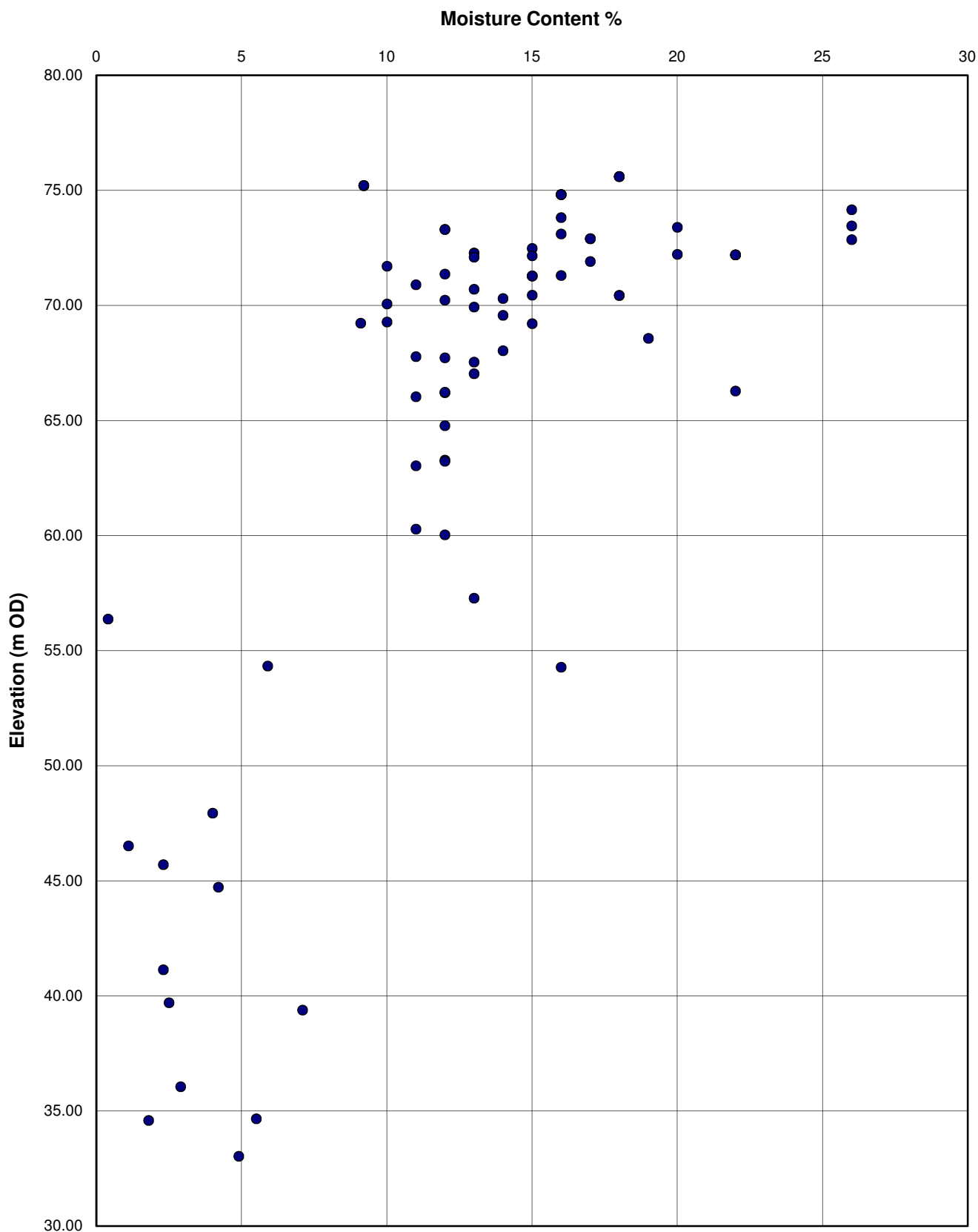


All Strata

Job No PN224390
Date 08/07/2022
Figure 4

STAR RADCLIFFE
 Plot of Shear Strength - Elevation Profile

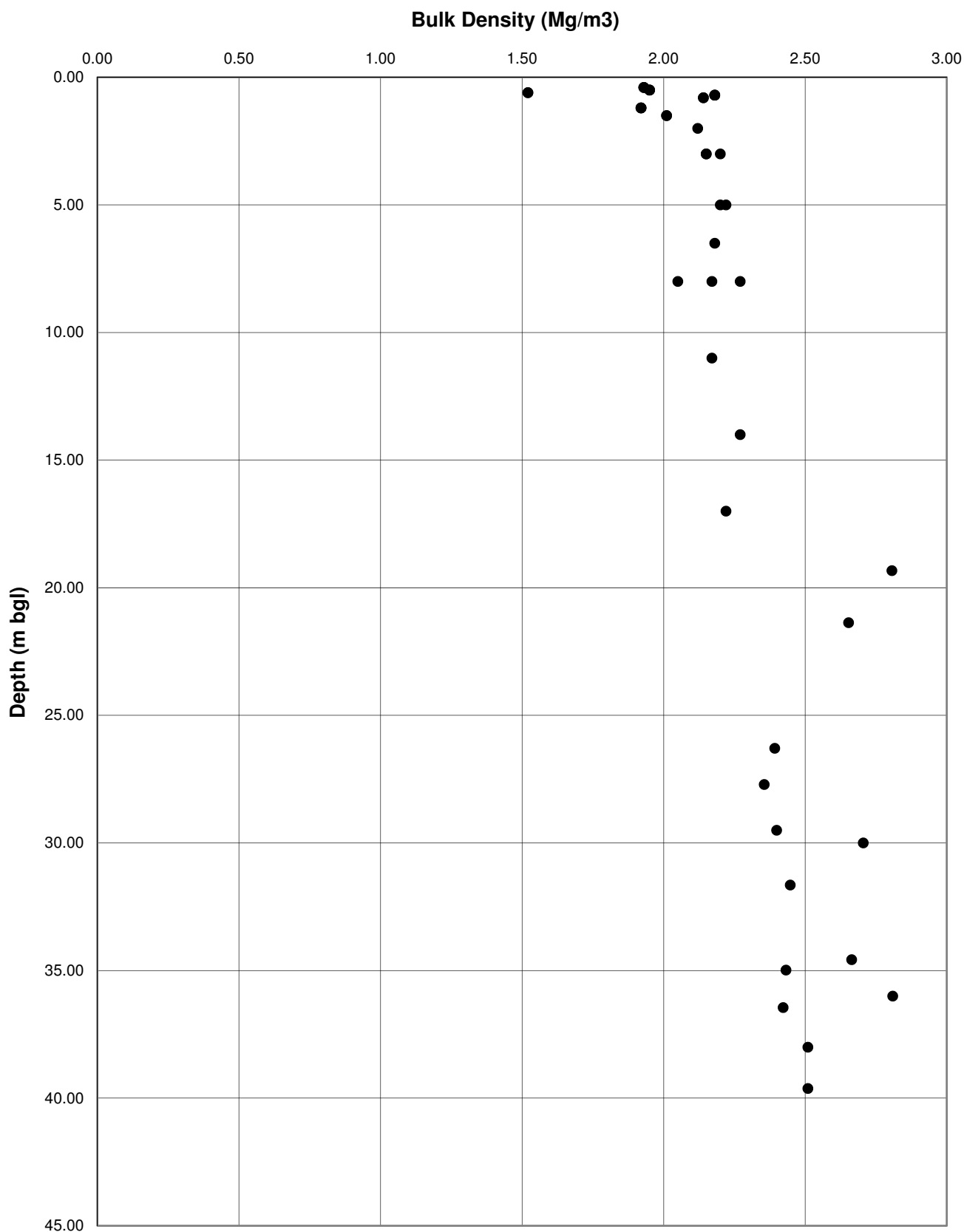
GEOTECHNICS



Job No	PN224390
Date	08/07/2022
Figure	6

STAR RADCLIFFE
Plot of Moisture Content - Elevation Profile

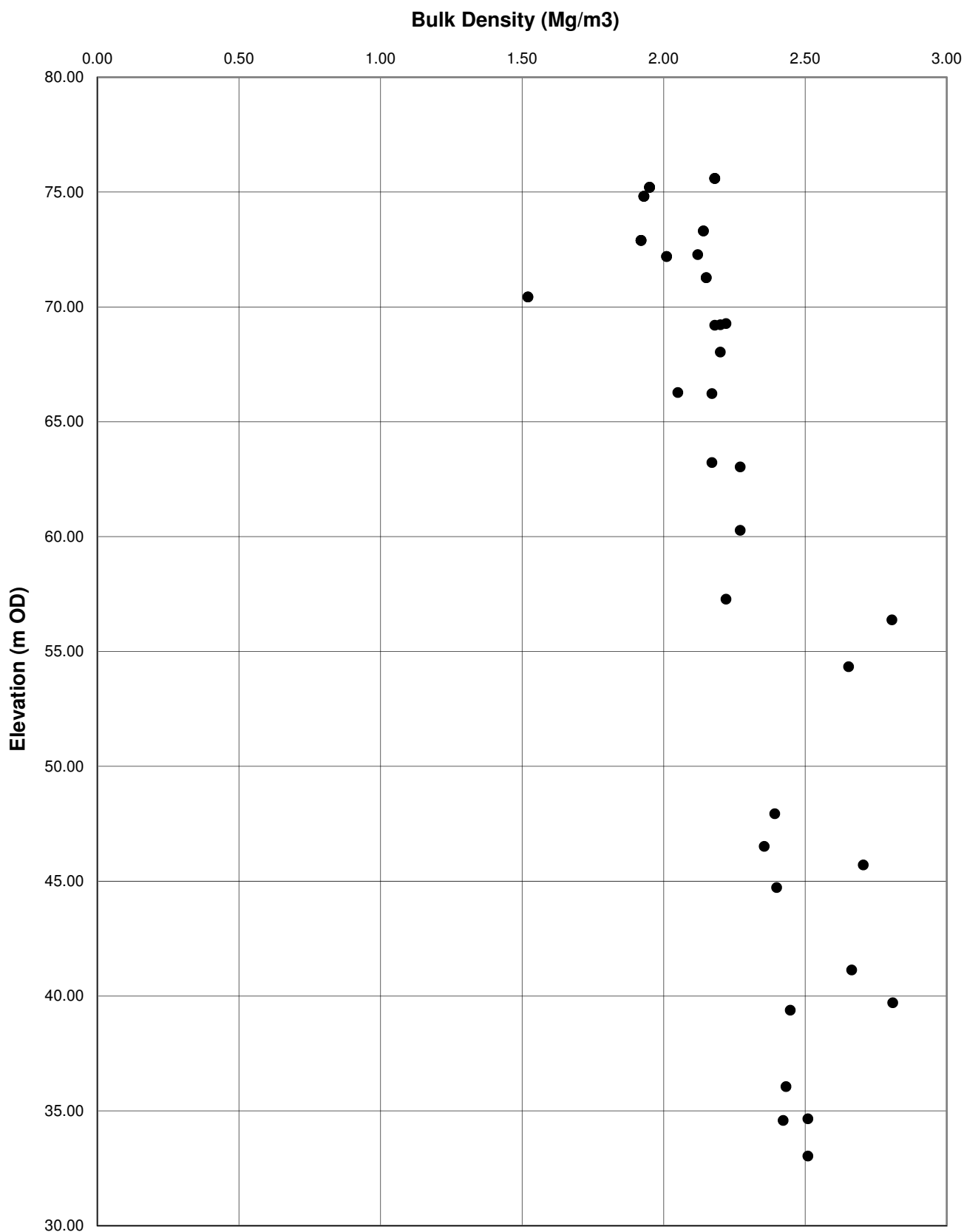
GEOTECHNICS



Job No PN224390
Date 08/07/2022
Figure 7

STAR RADCLIFFE
 Plot of Bulk Density - Depth Profile

GEOTECHNICS

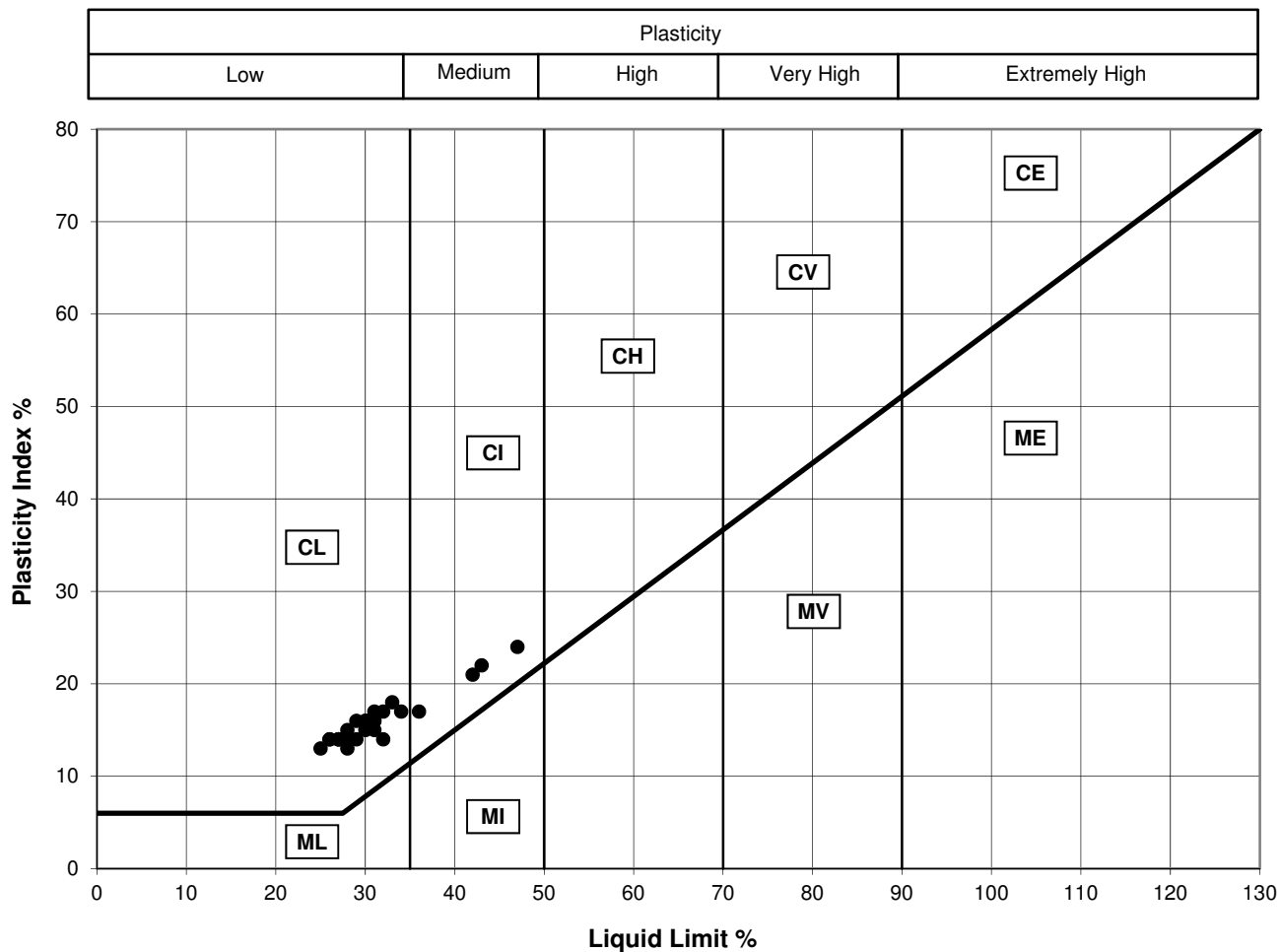


All Strata

Job No	PN224390
Date	08/07/2022
Figure	8

STAR RADCLIFFE
Plot of Bulk Density - Elevation Profile

GEOTECHNICS



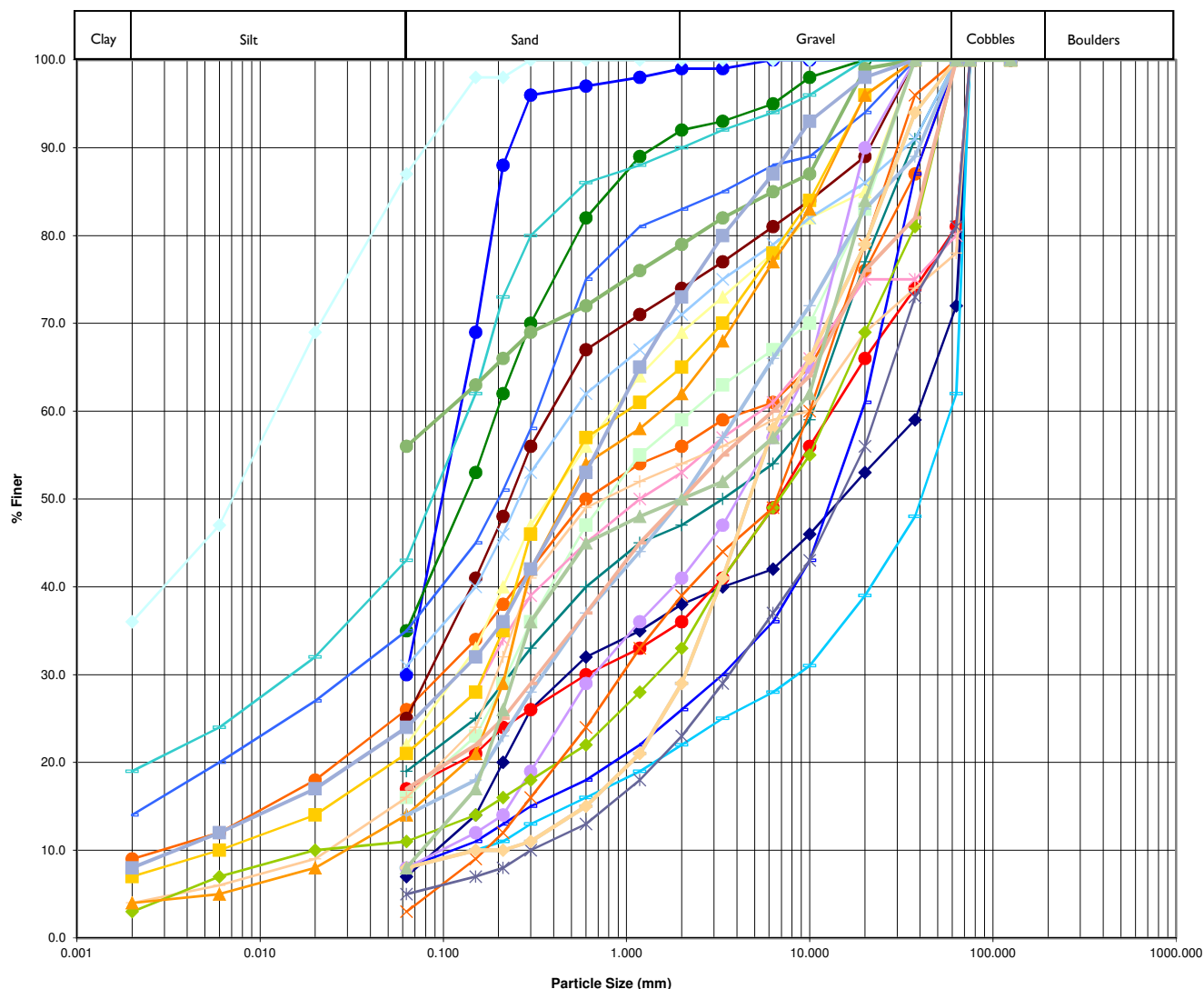
Soil Type	Plasticity Characteristics
C Clay	L Low
	I Intermediate
M Silt	H High
	V Very High
	E Extremely High

All Strata

Job No PN224390
Date 08/07/2022
Figure 9

STAR RADCLIFFE
Plasticity Chart

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BH01 0.5m	BH01 1.2m	BH01 2m	BH02 0.5m	BH03 0.8m	BH03A 1.2m	BH03A 2m	BH04 0.6m
BH04 1.2m	DCP01 0.7m	DCP05 0.2m	DCP05 0.8m	DCP07 0.2m	DCP08 0.2m	DS02 1.2m	DS03 0.6m
DS04 1.3m	DS04 2.8m	DS05 0.3m	DS05 2m	DS05 3m	DS06 0.6m	HD01 0.6m	HD03 0.8m
HD04 0.4m	HD05 0.8m	TP01 0.6m	TP02 0.4m	TP03 1.4m	TP04 0.4m		

All Strata

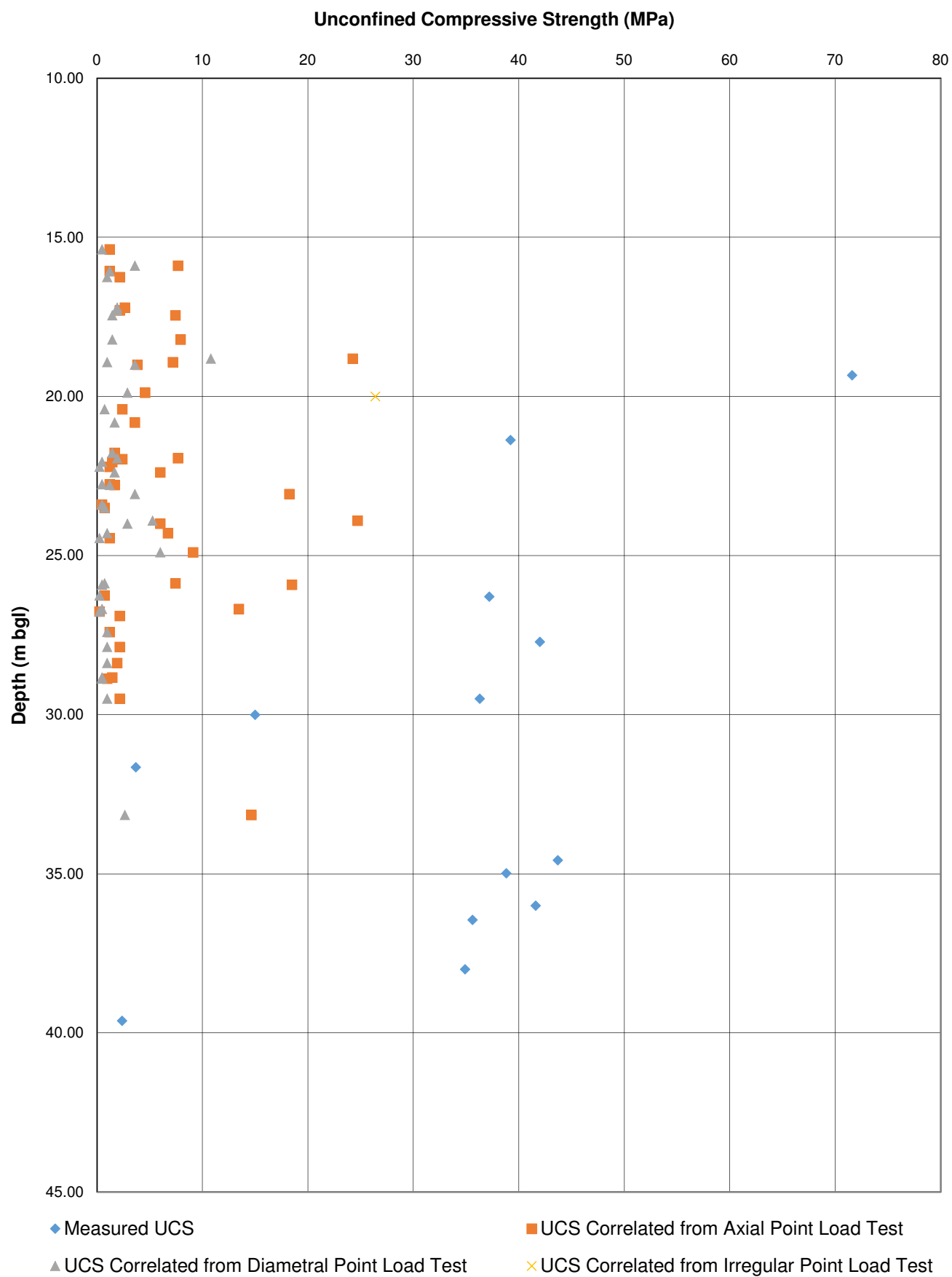
Job No PN224390

Date 08/08/2022

Figure 10

STAR RADCLIFFE
Summary of Particle Size Distribution
Analyses

GEOTECHNICS



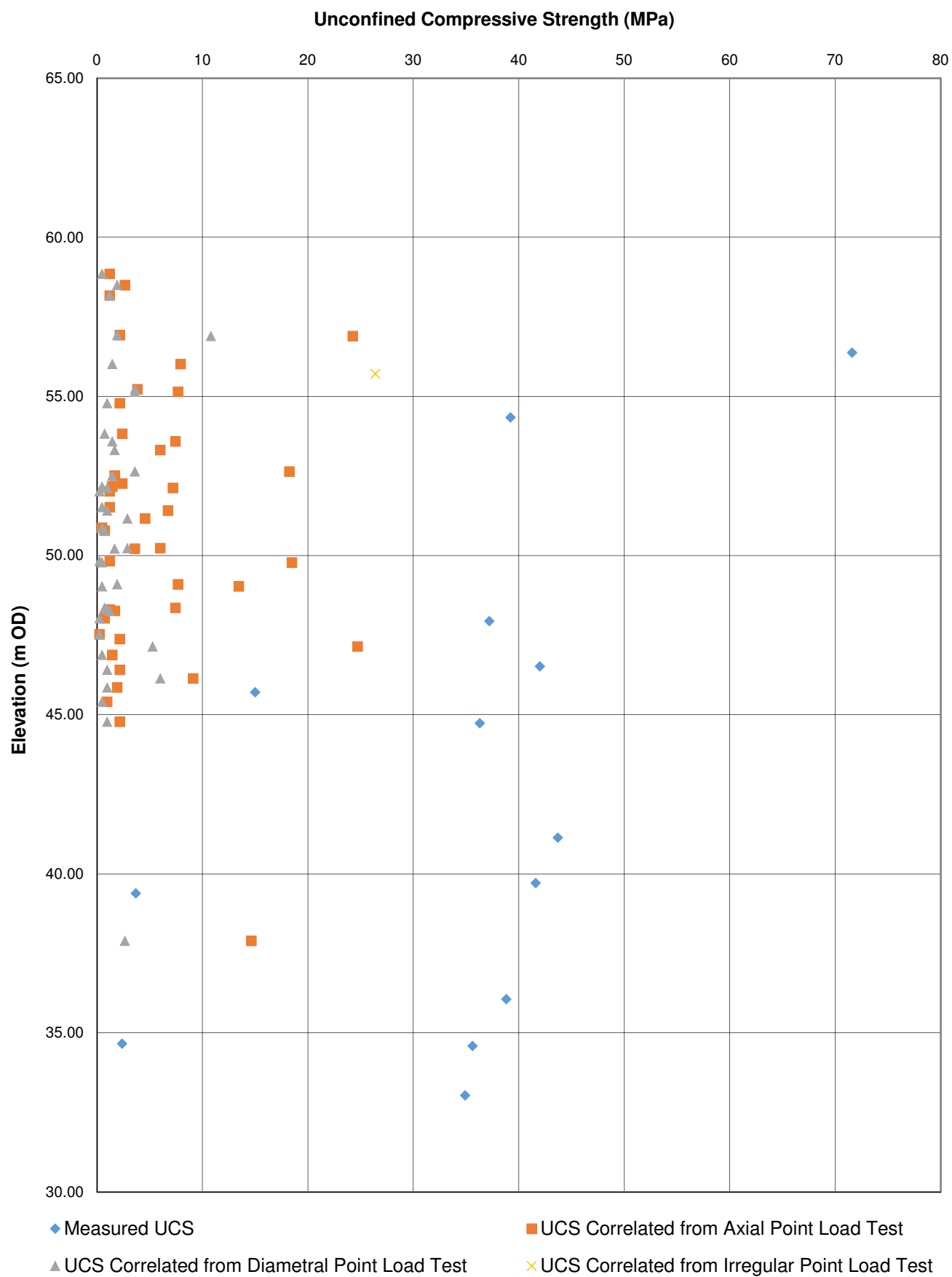
Job No PN224390

Date 12/07/2022

Figure 11

STAR RADCLIFFE
Plot of UCS - Depth Profile

GEOTECHNICS



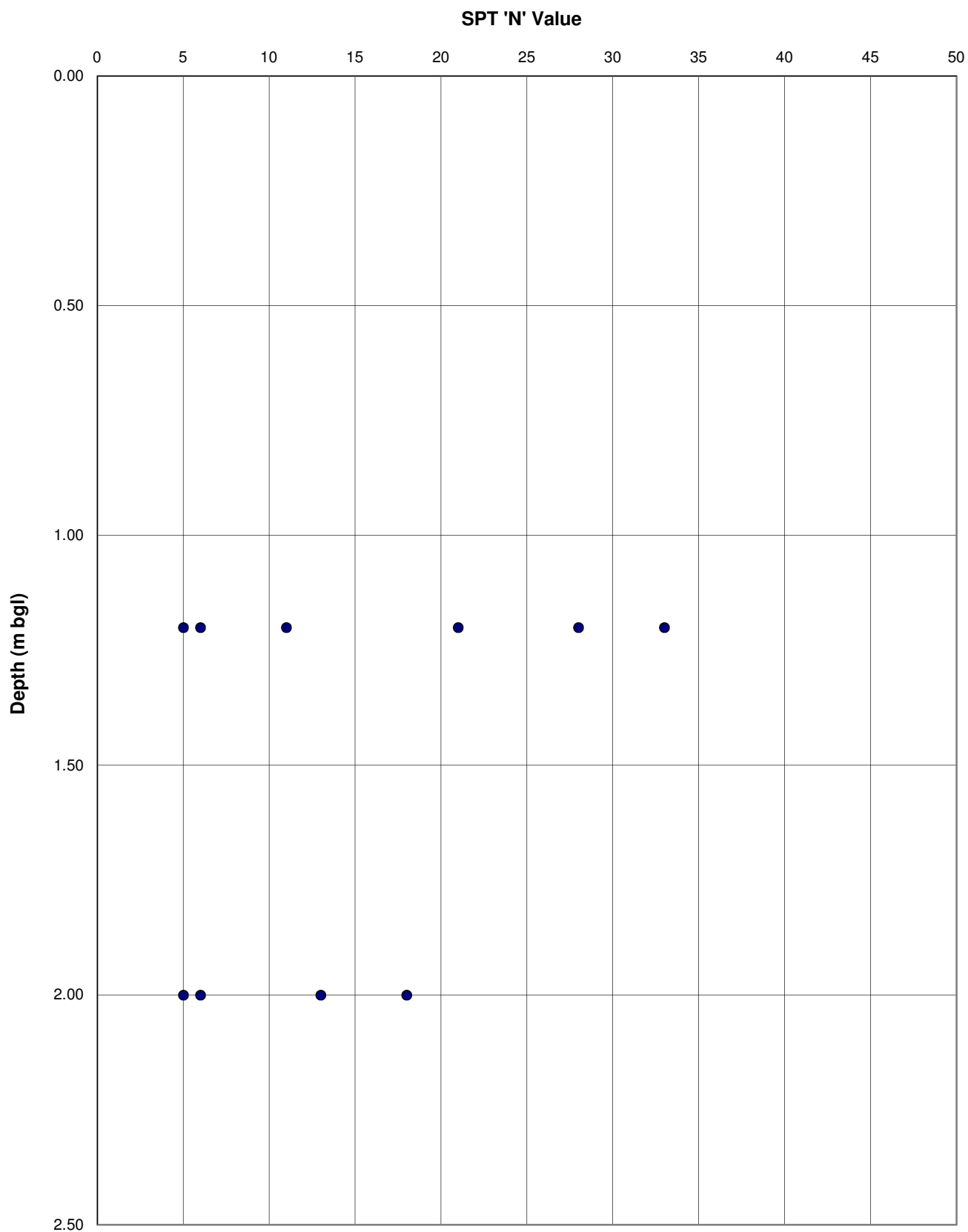
Job No PN224390
Date 12/07/2022
Figure 12

STAR RADCLIFFE
 Plot of UCS - Elevation Profile

GEOTECHNICS

APPENDIX 17

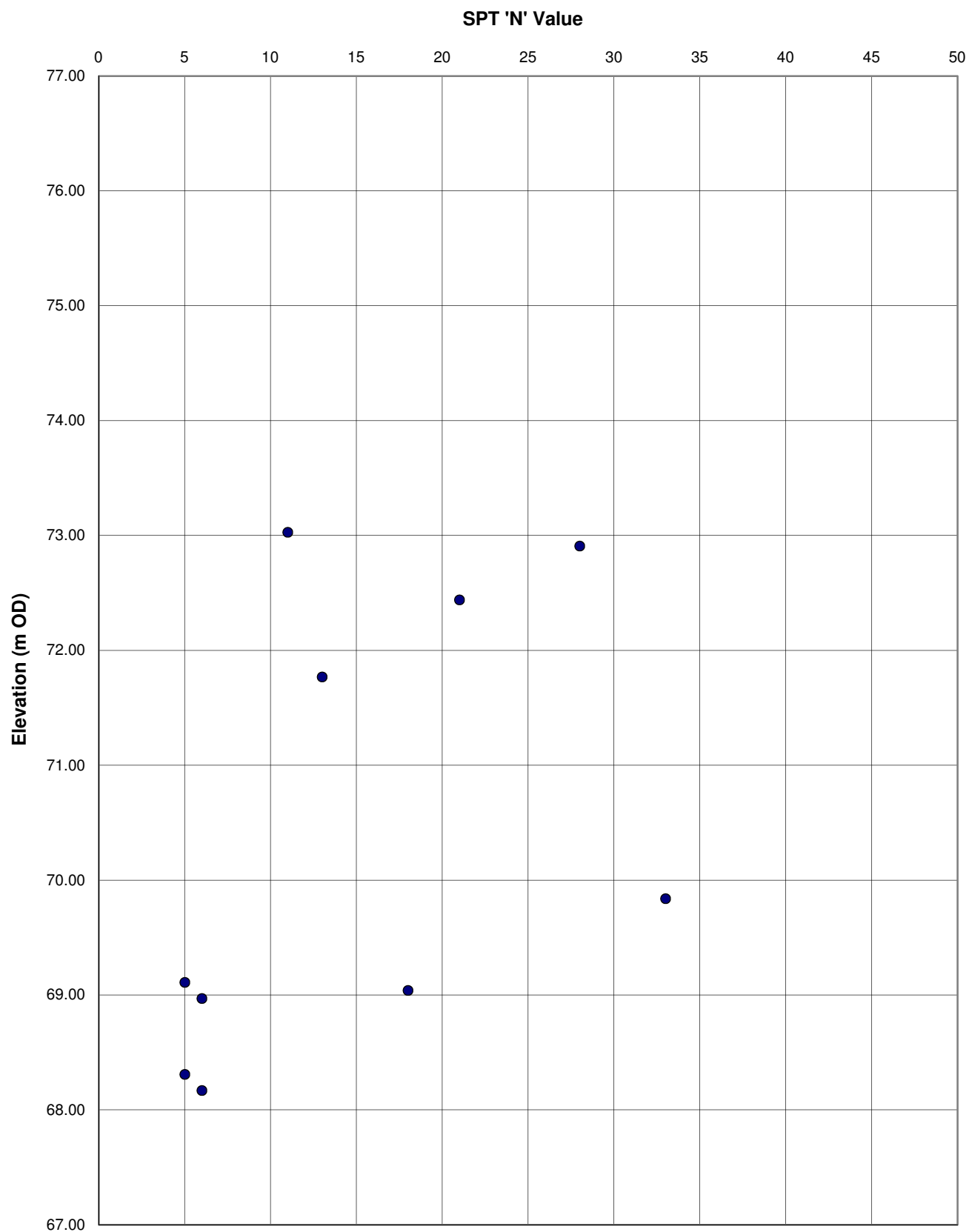
Ground Parameter Data Plots (Granular Made Ground)



Job No	PN224390
Date	11/07/2022
Figure	1

STAR RADCLIFFE
Plot of SPT - Depth Profile

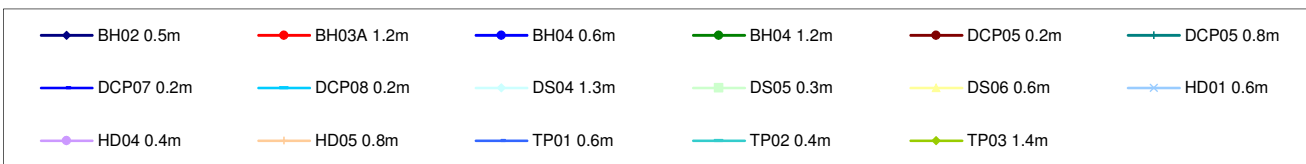
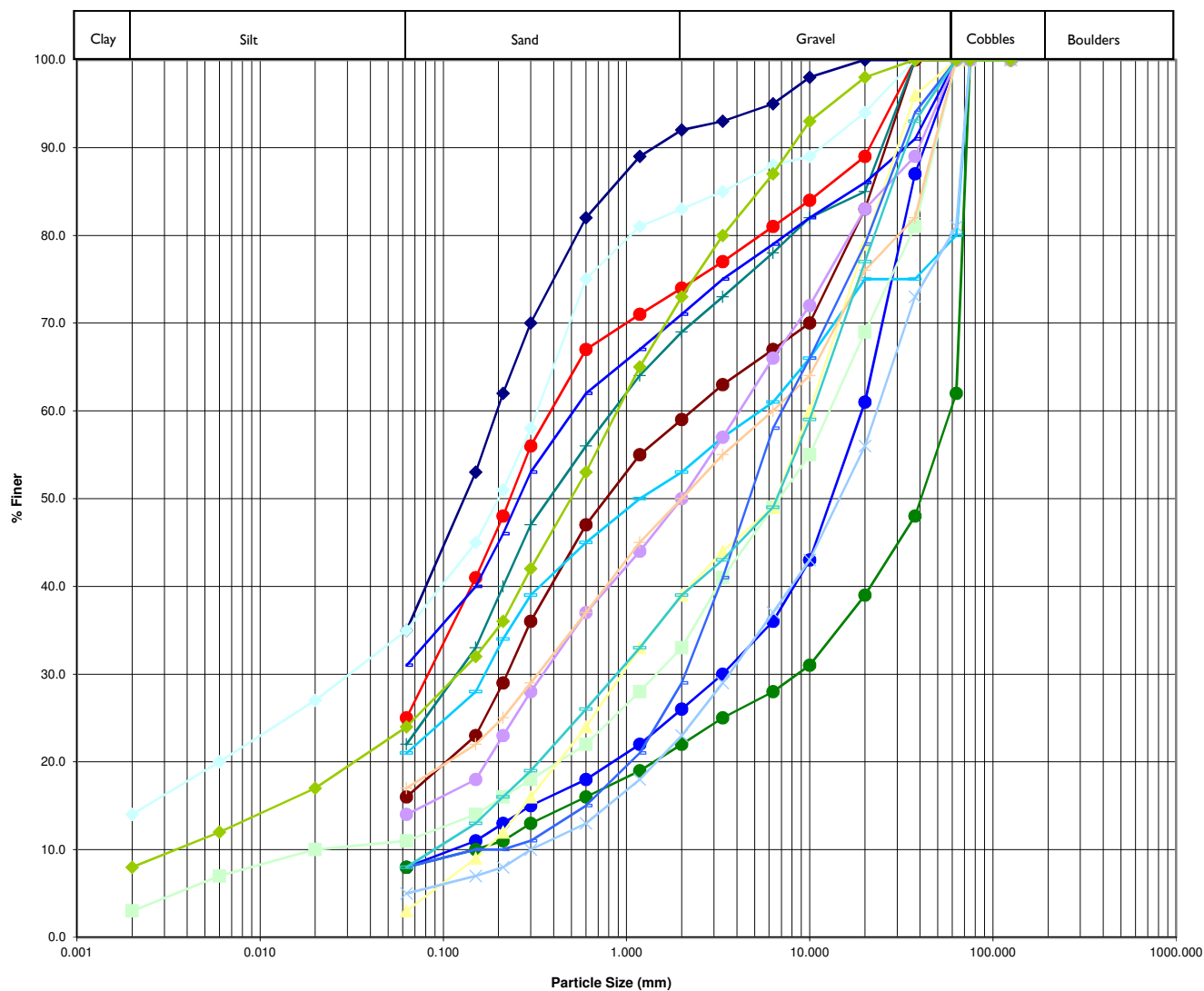
GEOTECHNICS



Job No	PN224390
Date	11/07/2022
Figure	2

STAR RADCLIFFE
Plot of SPT - Elevation Profile

GEOTECHNICS



Granular Made Ground

Job No PN224390

Date 08/08/2022

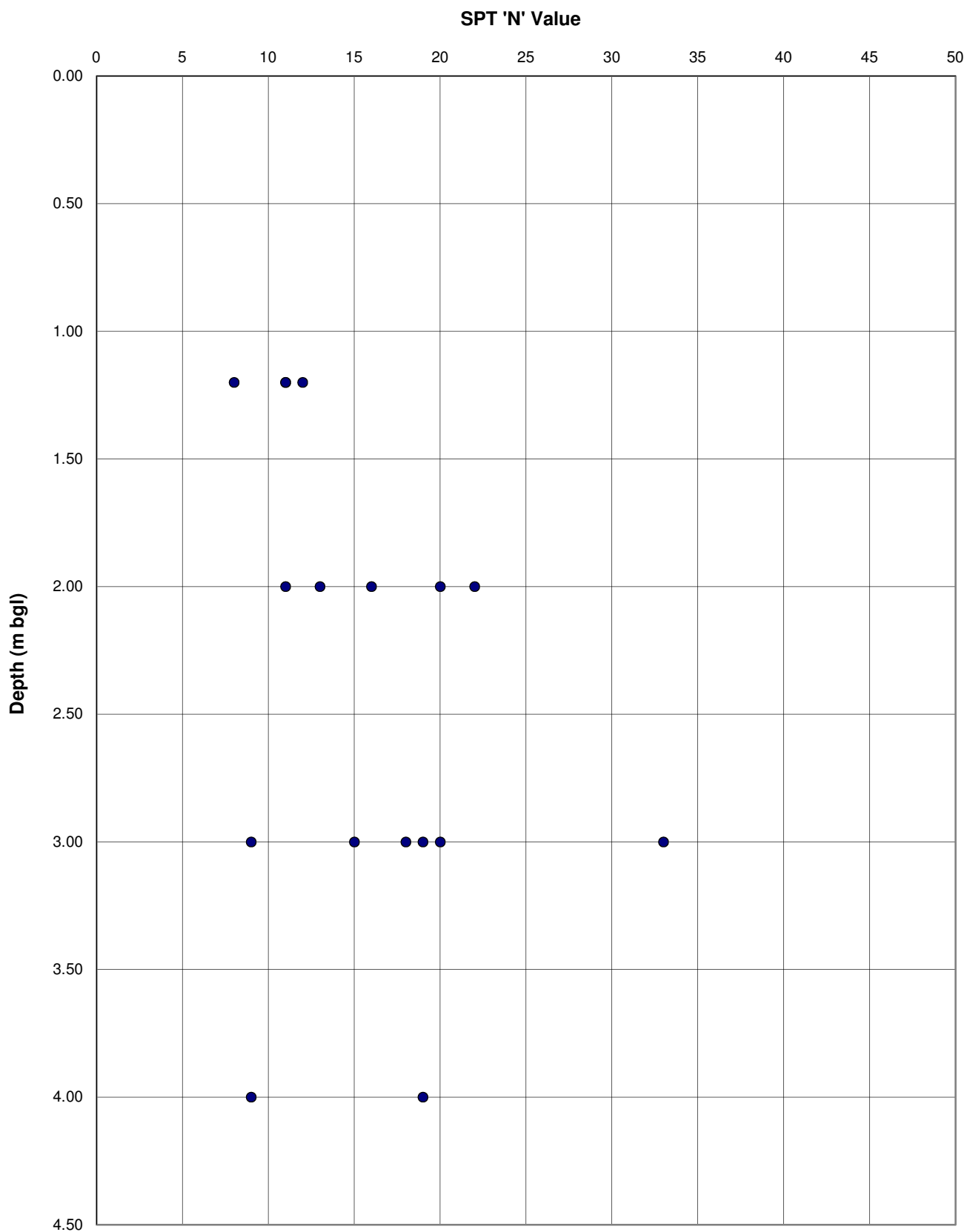
Figure 3

STAR RADCLIFFE
Summary of Particle Size Distribution
Analyses

GEOTECHNICS

APPENDIX 18

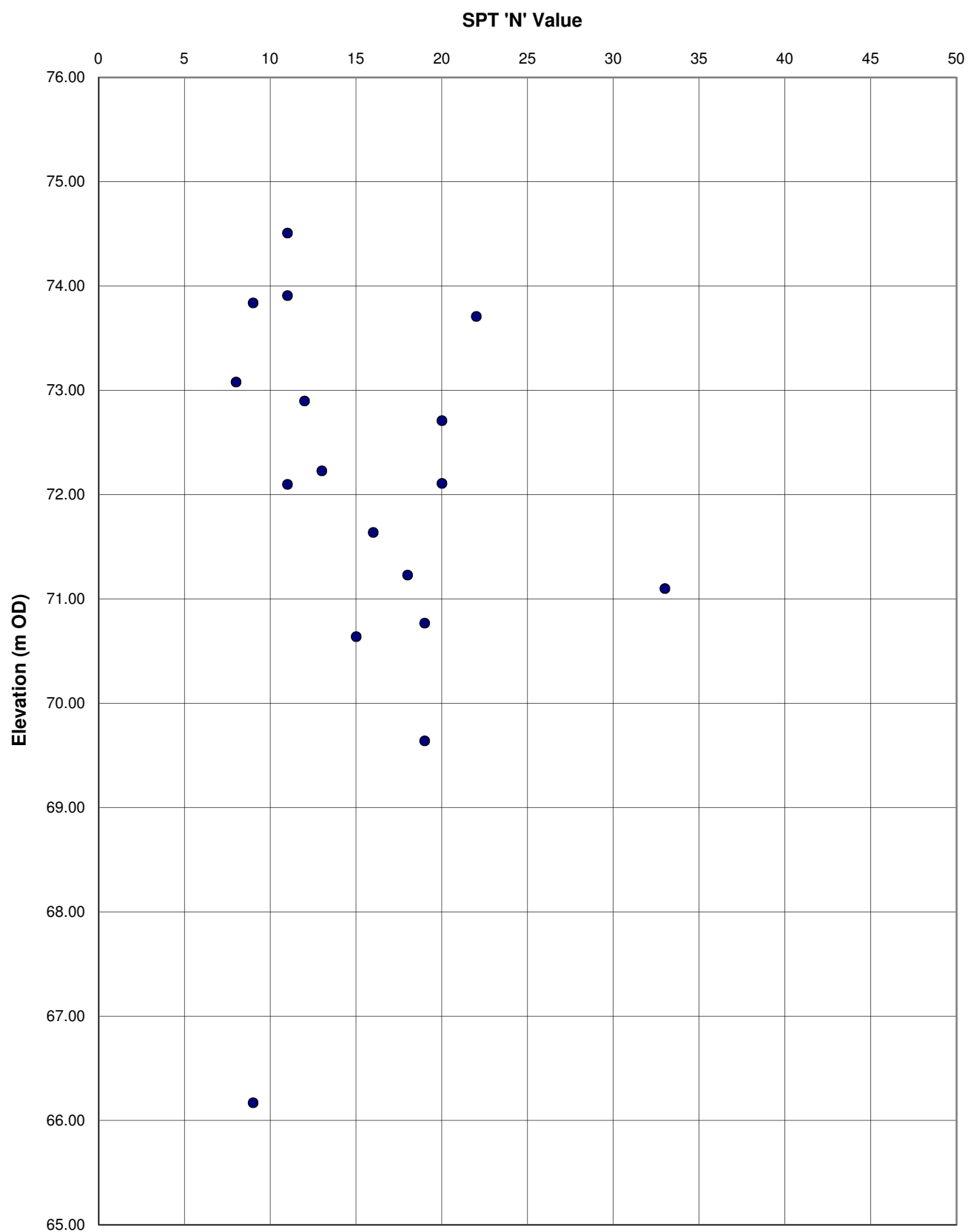
Ground Parameter Data Plots (Glacial Sand and Gravel)



Job No PN224390
Date 11/07/2022
Figure 1

STAR RADCLIFFE
 Plot of SPT - Depth Profile

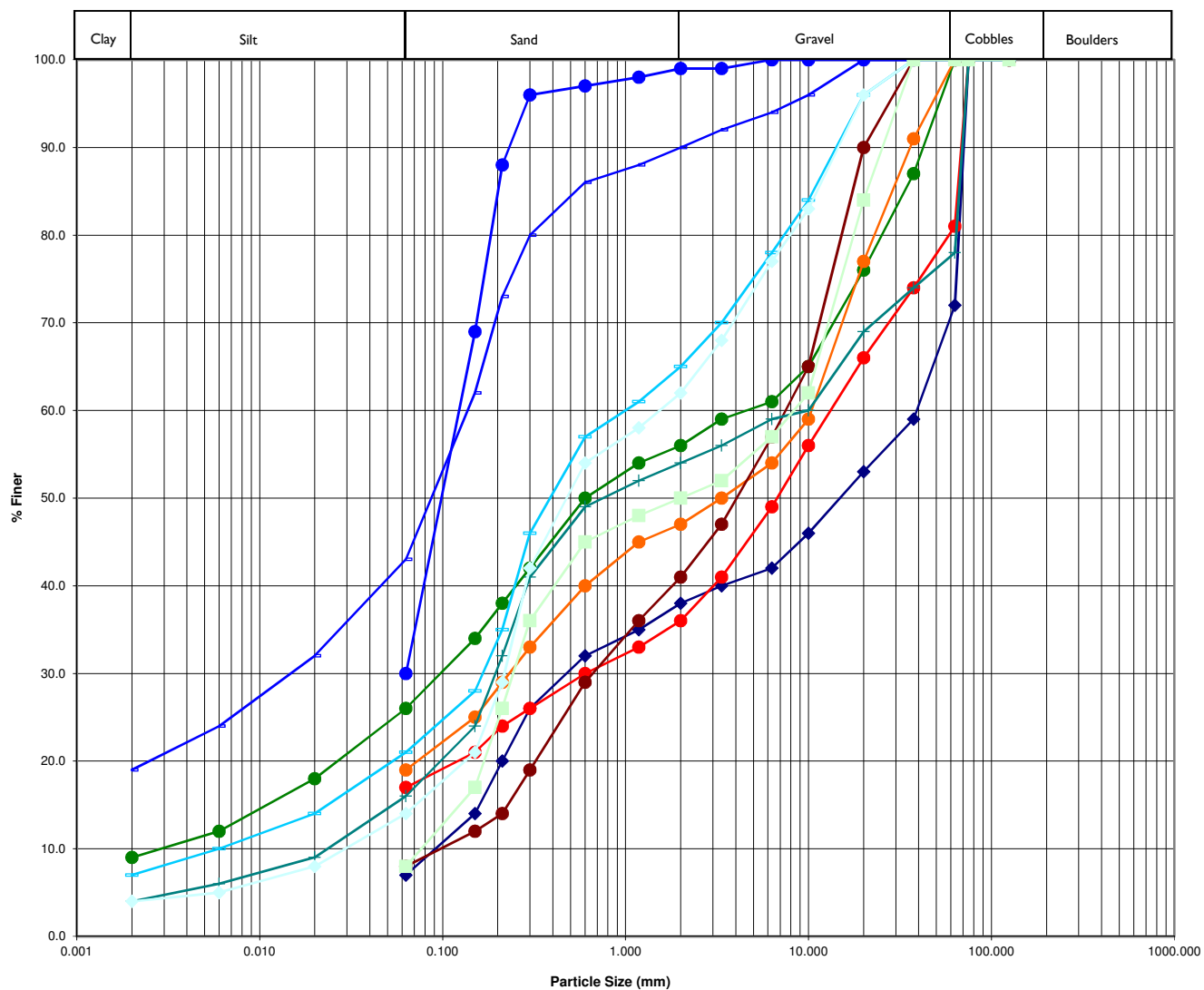
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Job No	PN224390
Date	11/07/2022
Figure	2

STAR RADCLIFFE
Plot of SPT - Elevation Profile

GEOTECHNICS



Glacial Sand and Gravel

Job No PN224390

Date 11/07/2022

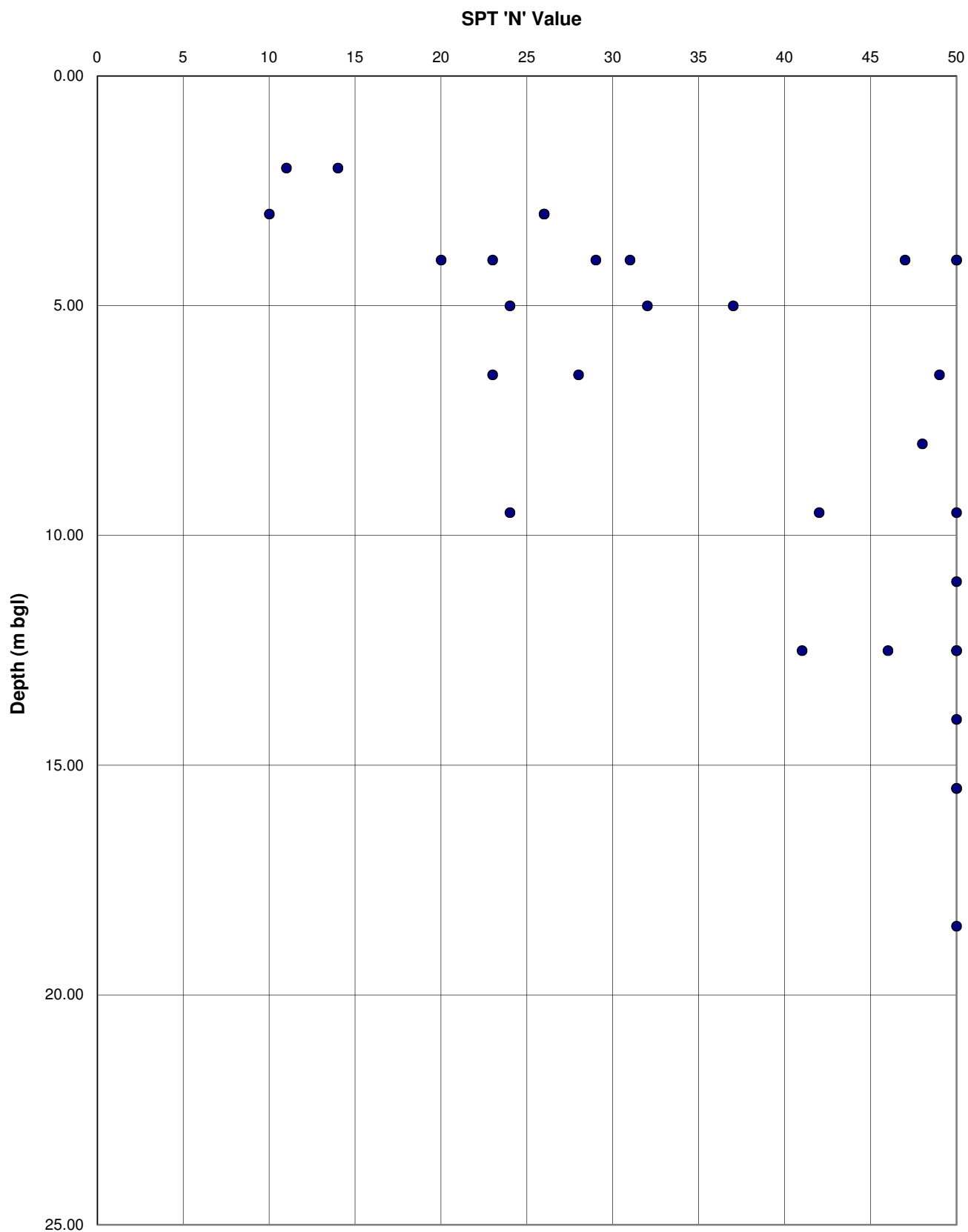
Figure 3

STAR RADCLIFFE
Summary of Particle Size Distribution
Analyses

GEOTECHNICS

APPENDIX 19

Ground Parameter Data Plots (Glacial Till)

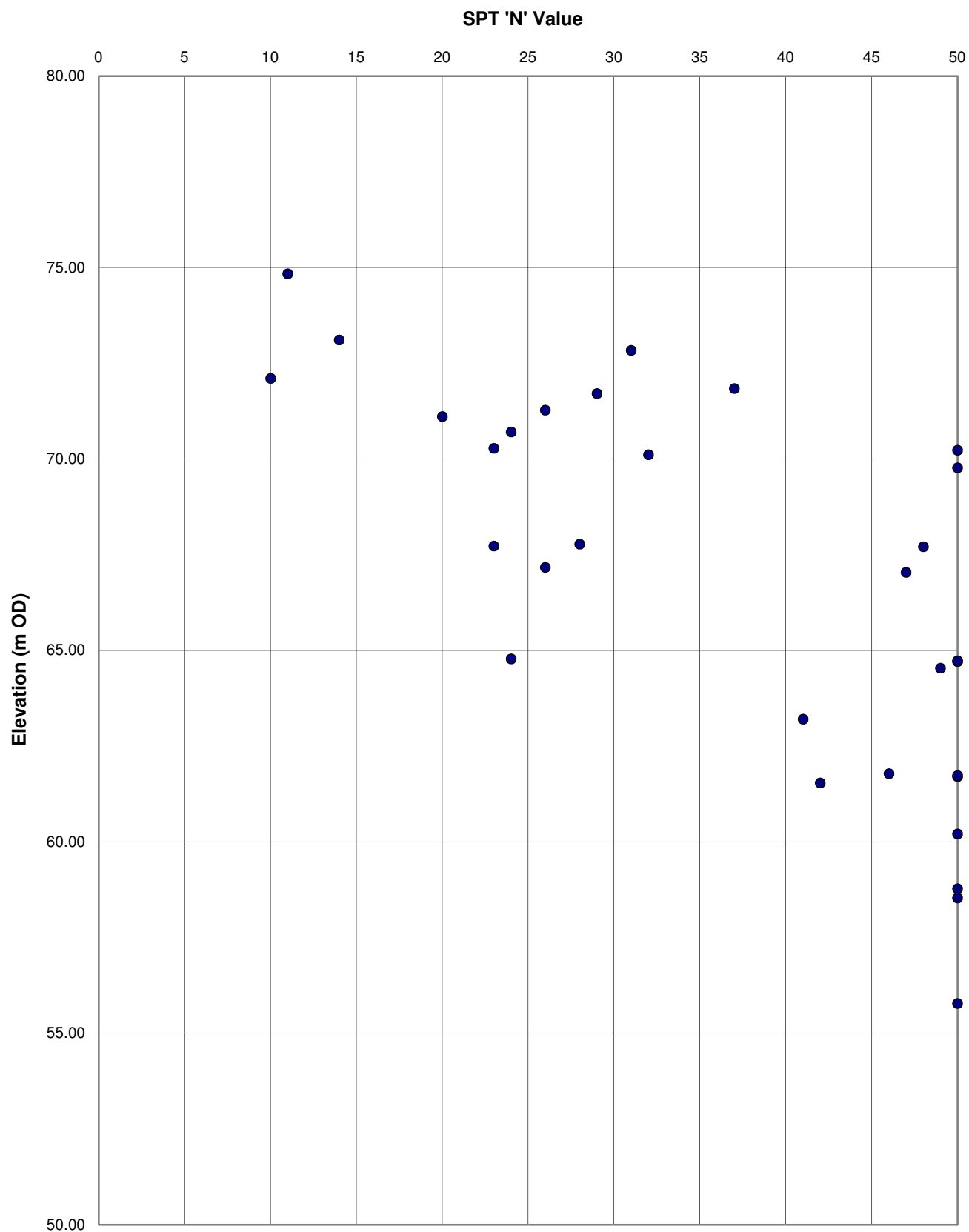


Glacial Till

Job No PN224390
Date 11/07/2022
Figure 1

STAR RADCLIFFE
Plot of SPT - Depth Profile

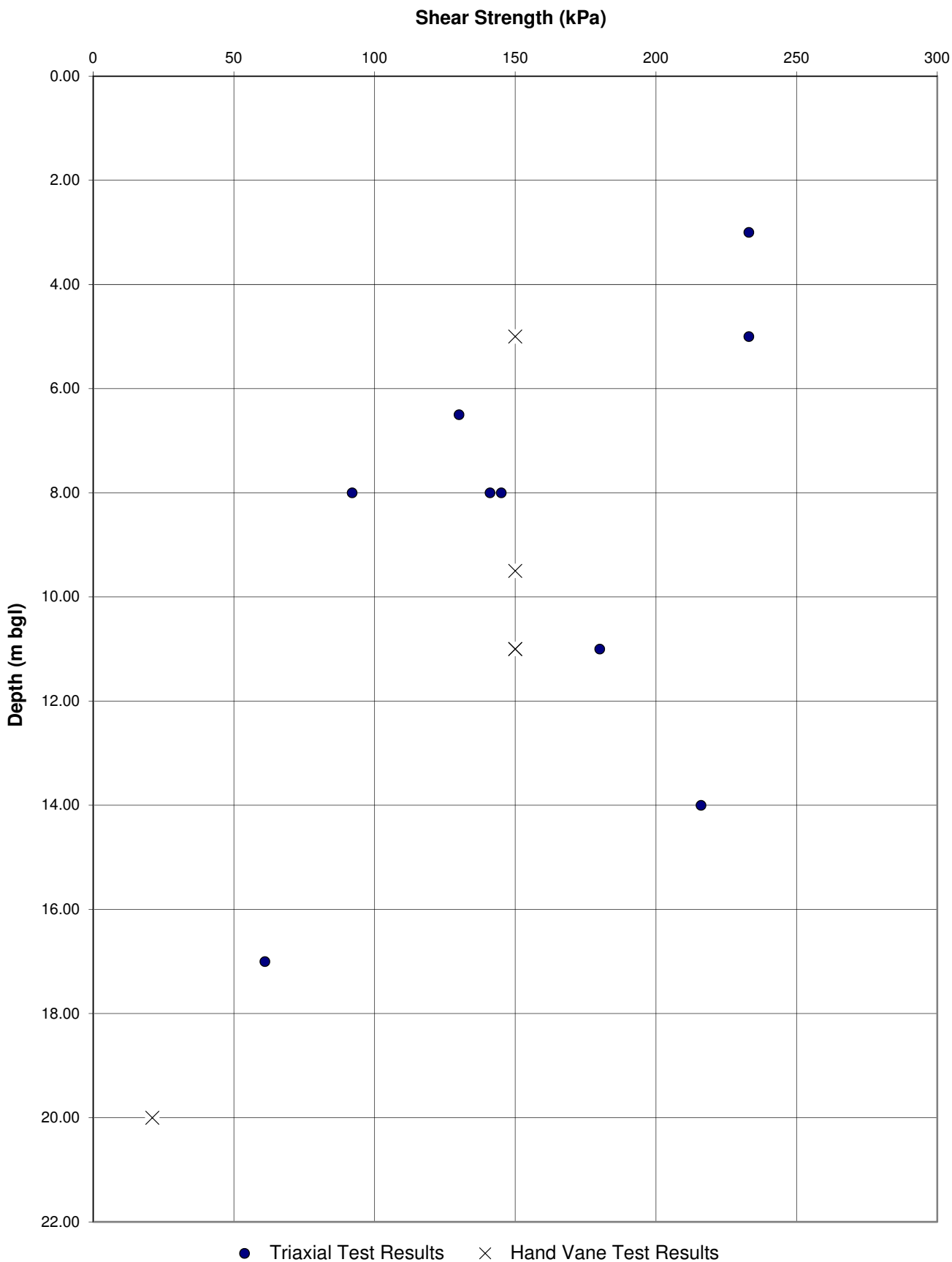




Job No	PN224390
Date	11/07/2022
Figure	2

STAR RADCLIFFE
Plot of SPT - Elevation Profile

GEOTECHNICS

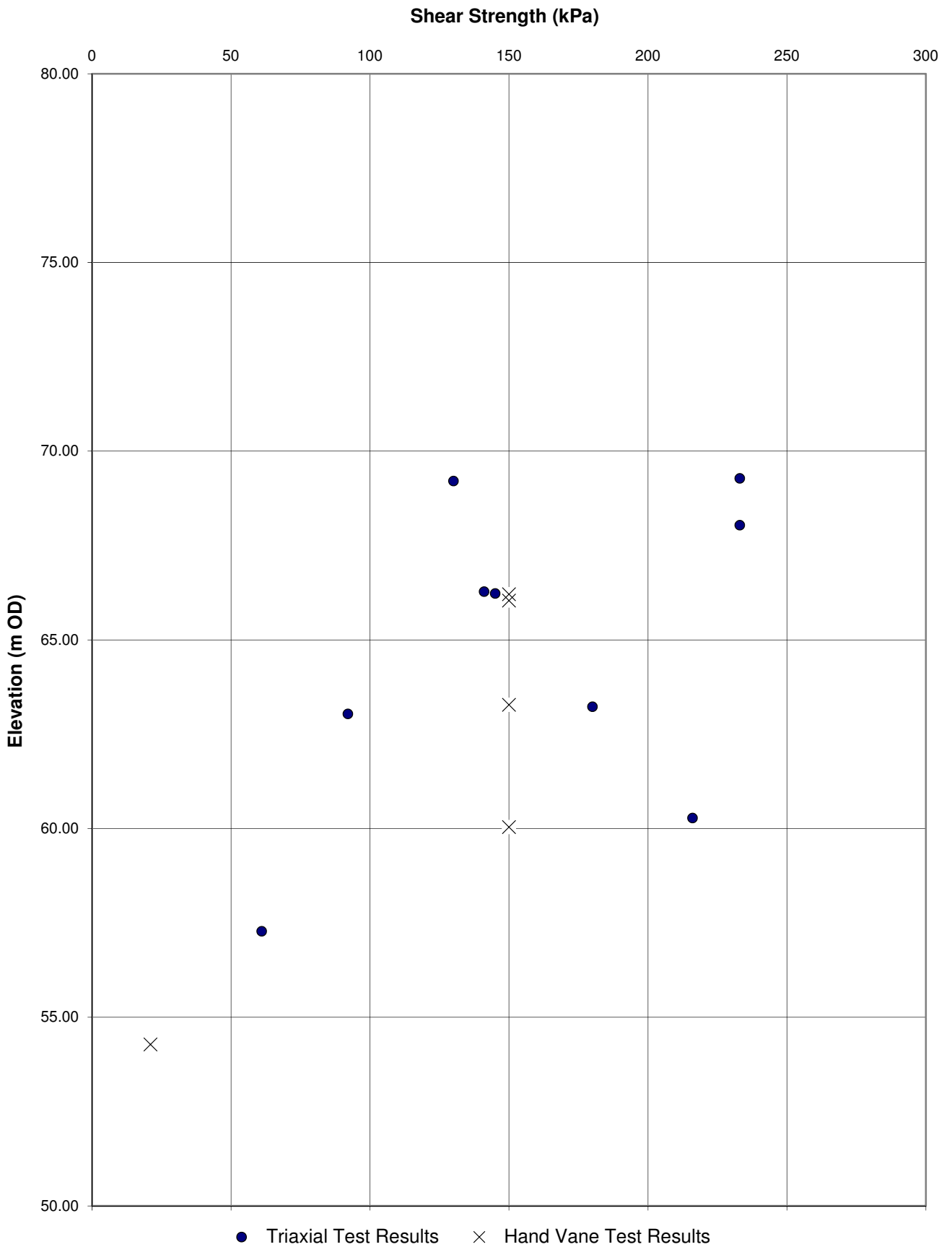


Glacial Till

Job No	PN224390
Date	11/07/2022
Figure	3

STAR RADCLIFFE
Plot of Shear Strength - Depth Profile

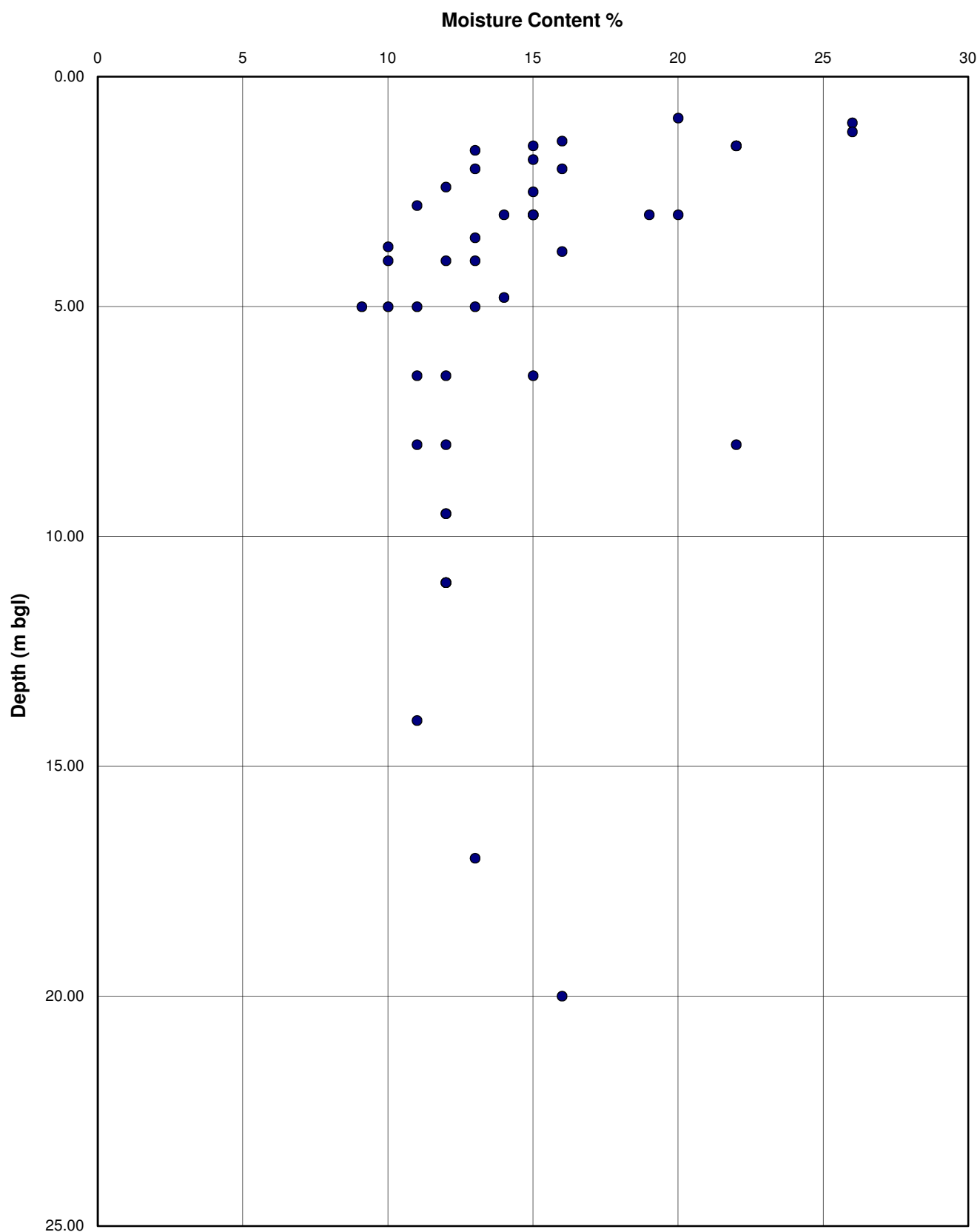
GEOTECHNICS



Job No PN224390
Date 11/07/2022
Figure 4

STAR RADCLIFFE
 Plot of Shear Strength - Elevation Profile

GEOTECHNICS

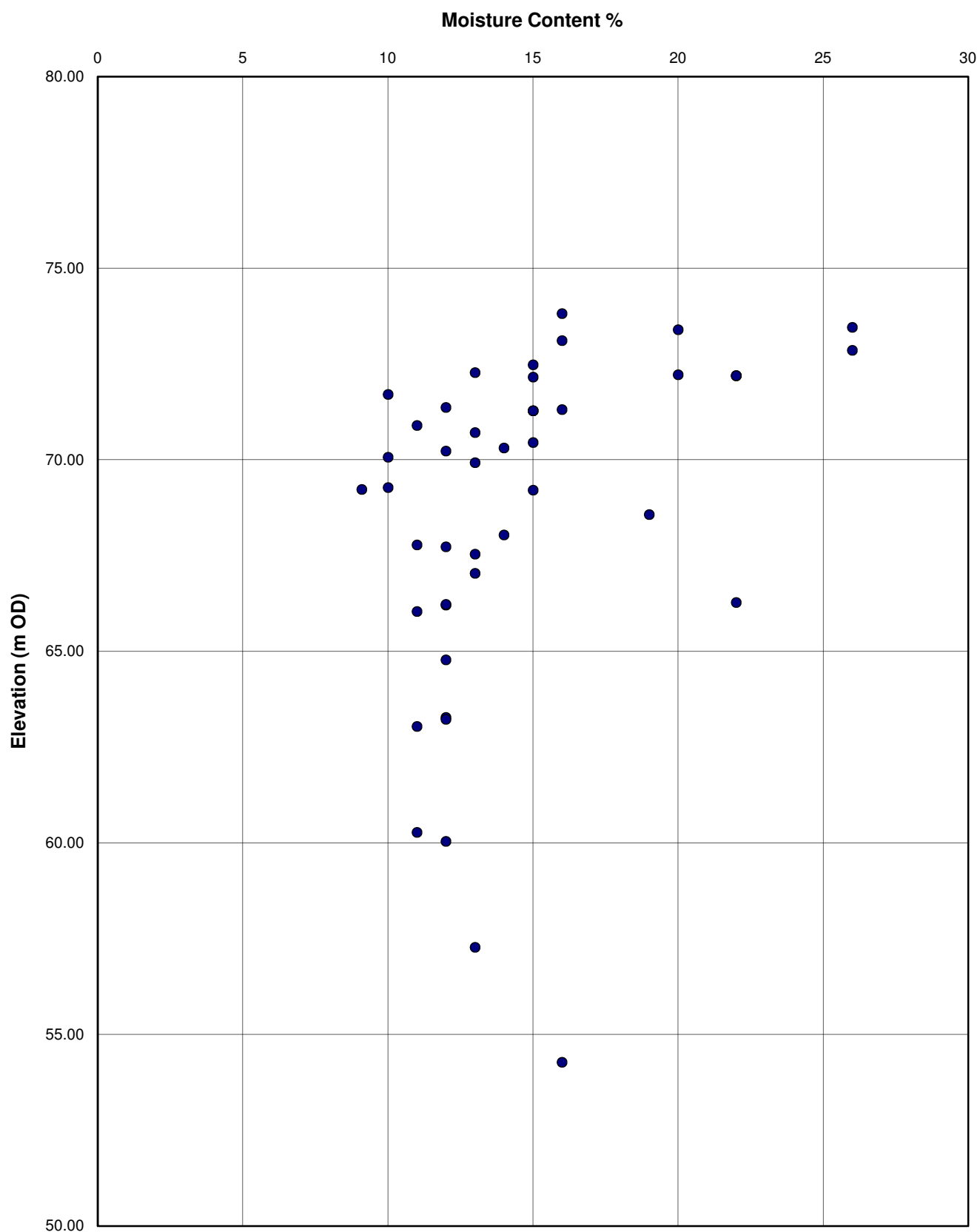


Job No	PN224390
Date	11/07/2022
Figure	5

STAR RADCLIFFE

Plot of Moisture Content - Depth Profile

GEOTECHNICS

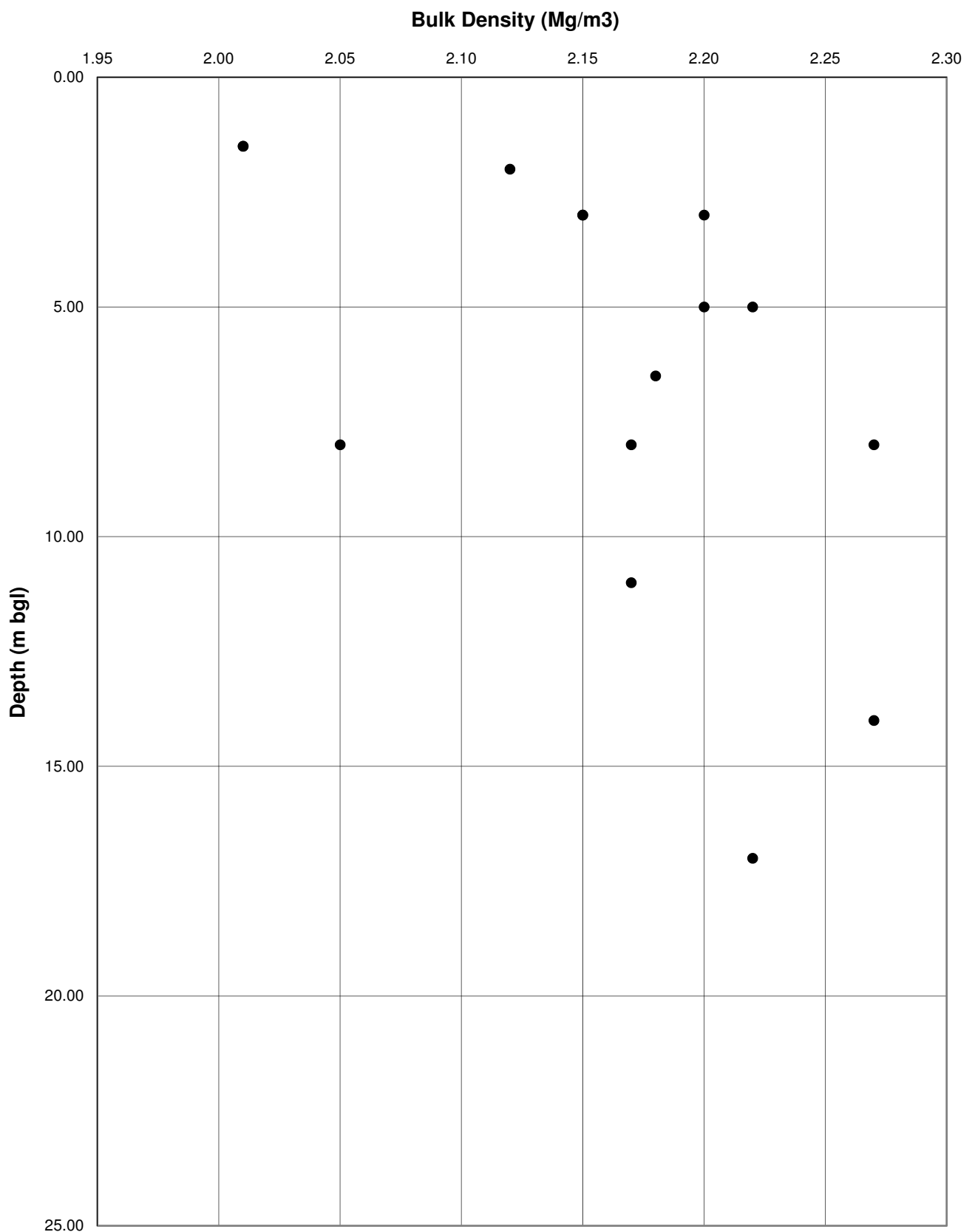


Job No	PN224390
Date	11/07/2022
Figure	6

STAR RADCLIFFE

Plot of Moisture Content - Elevation Profile

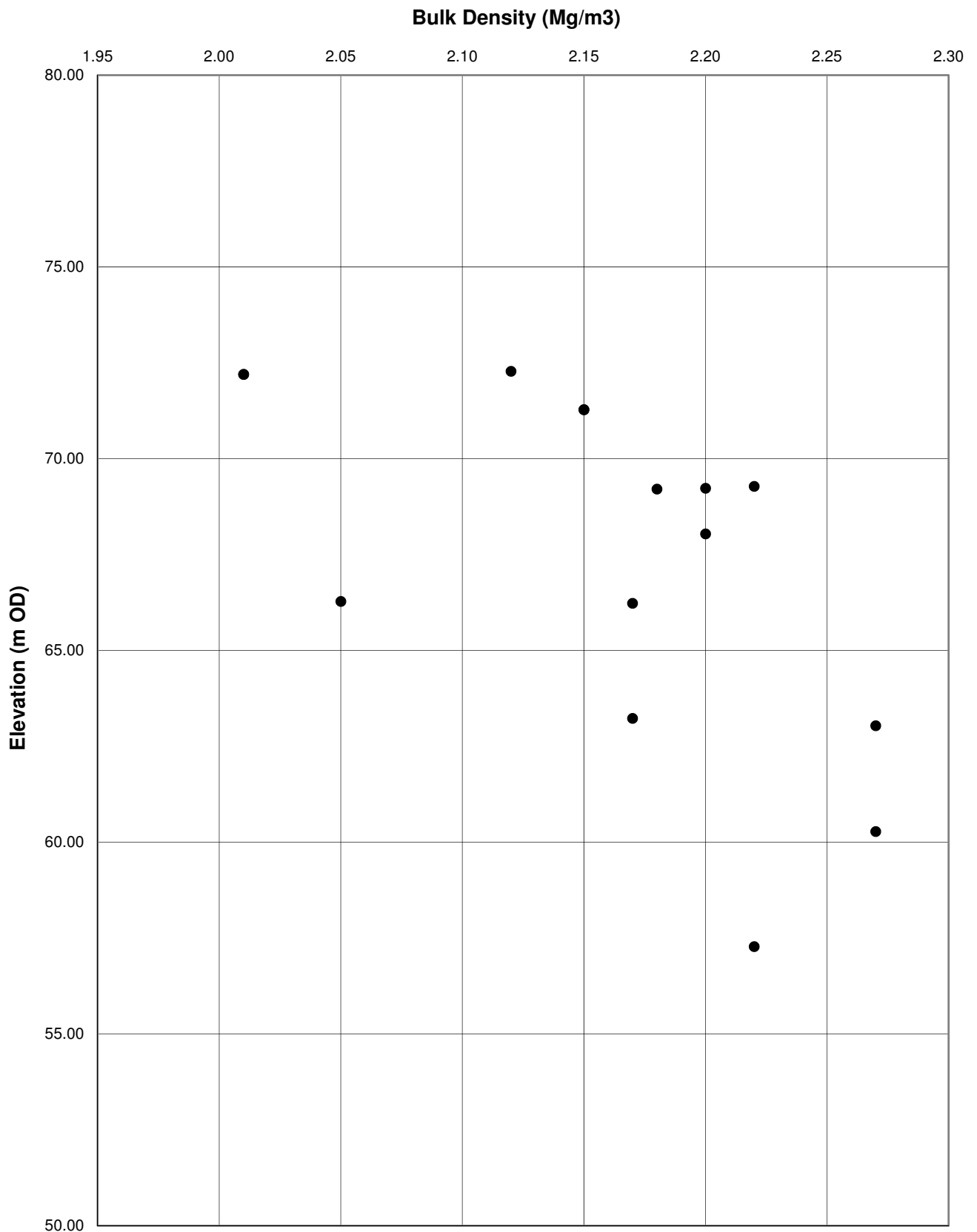
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Job No	PN224390
Date	11/07/2022
Figure	7

STAR RADCLIFFE
Plot of Bulk Density - Depth Profile

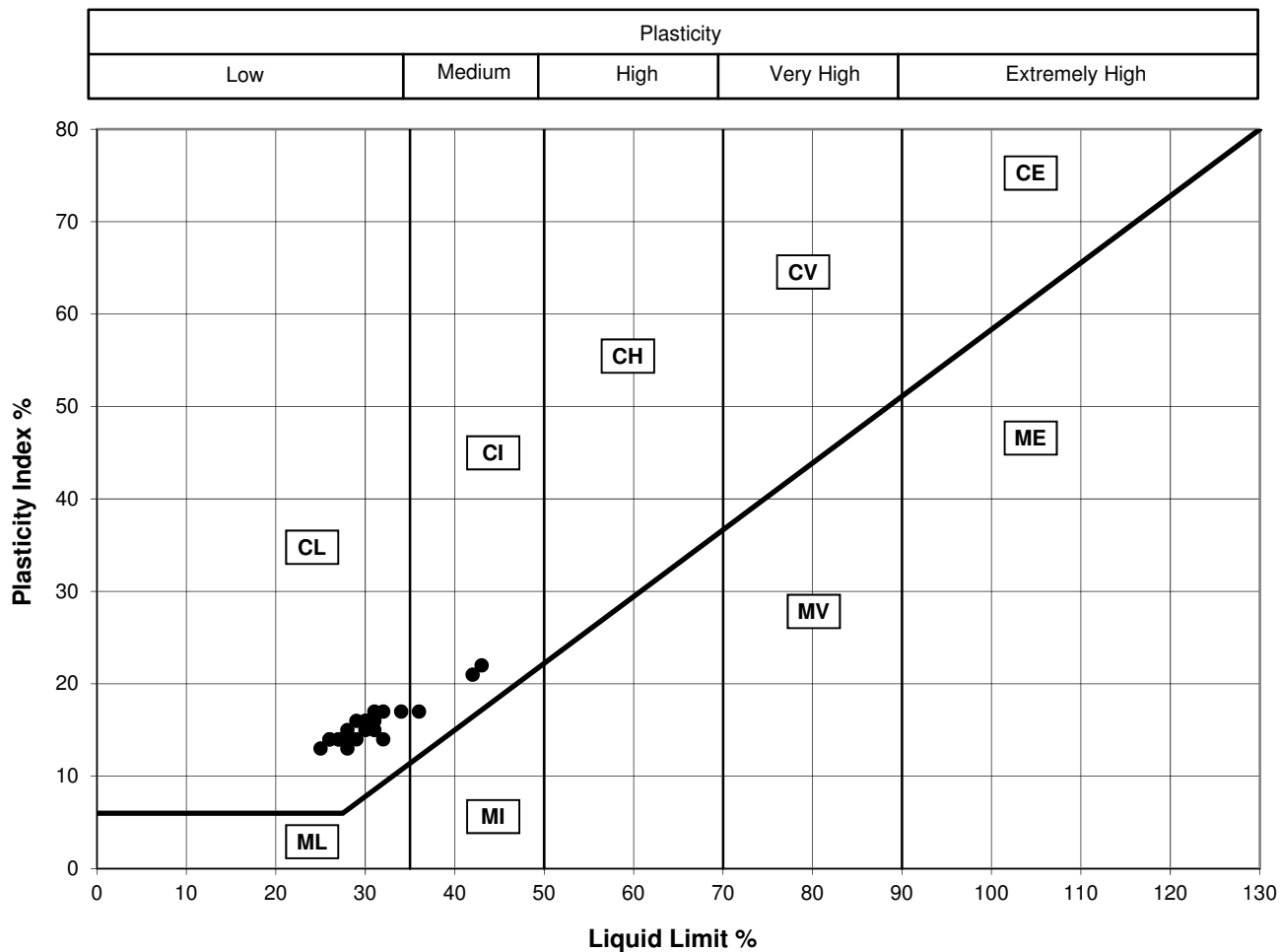
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Job No	PN224390
Date	11/07/2022
Figure	8

STAR RADCLIFFE
Plot of Bulk Density - Elevation Profile

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Soil Type	Plasticity Characteristics
C Clay	L Low
	I Intermediate
M Silt	H High
	V Very High
	E Extremely High

Glacial Till

Job No PN224390
Date 11/07/2022
Figure 9

STAR RADCLIFFE
Plasticity Chart

GEOTECHNICS

APPENDIX 20

Chemical Statistical Analysis & Summary of Water Analysis Tier I Screening

Job No: PN224390

Site: Star Radcliffe

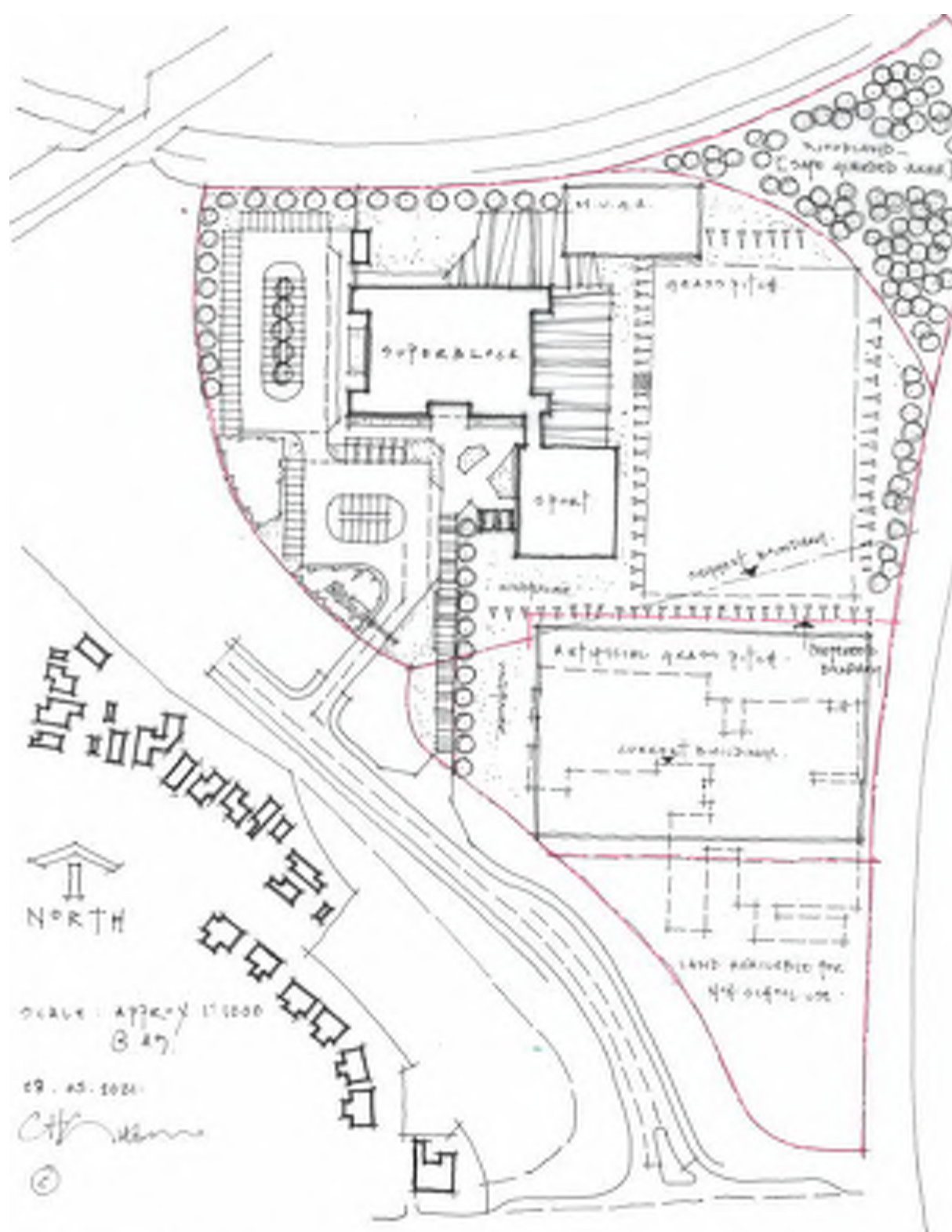
Summary of Water Analysis - Tier I Screening

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 geotechnical and geoenvironmental specialists

Sample Location	Units	Minimum Reporting Value	Drinking Water Standard (or closest value)	EQS Freshwater	Estuaries and coastal waters	Other	Soil Leaching Analysis				Groundwater Analysis			
							DCP05	BH03	HD01	HD03	BH01	BH02 (Shallow)	BH02 (Deep)	BH04
							0.5	0.5	1.0	1.0				
							12/05/2022	05/05/2022	12/05/2022	10/05/2022	01/07/2022	01/07/2022	01/07/2022	01/07/2022
Water Quality														
pH	pH units	-	-	-	-	-	7.5	6.8	7.1	7.0	7.3	7.5	7.8	7.3
Metals														
Arsenic	ug/l	-	10	50	25	50	3.2	1.8	1.6	0.64	1.3	3.6	3.7	1.5
Chromium (Total)	ug/l	-	50	Sum of III and VI			-	-	-	-	-	-	-	-
Chromium (III)	ug/l	-	50	4.7	-	-	0.67	0.69	< 0.25	0.64	25	1.5	15	1.9
Chromium (VI)	ug/l	-	-	3.4	0.6	-	< 7.0	< 7.0	< 7.0	7.4	< 7.0	< 7.0	< 7.0	< 7.0
Copper	ug/l	-	2000	1*	3.76 (where DOC <1mg/l) 3.76+((DOC/2)-0.5) where DOC >1mg/l	28	2.5	3.7	1.7	2.3	2.0	< 0.4	1.6	1.5
Iron	ug/l	-	200	1000	1000	-	23	2500	48	1600	19	86	55	22
Lead	ug/l	-	10	1.2	1.3	-	0.23	3.0	0.37	0.79	0.29	0.48	0.49	0.44
Manganese	ug/l	-	50	123*	-	500	1.8	33	0.76	7.5	1500	360	58	350
Nickel	ug/l	-	20	4*	8.6	200	< 0.5	1.1	< 0.5	0.8	5.0	3.5	3.9	7.7
Selenium	ug/l	-	10	-	-	10	< 0.25	0.28	0.28	< 0.25	0.55	0.25	1.2	1.5
Zinc	ug/l	-	3000+*	10.9*	6.8	500	< 1.3	4.4	< 1.3	2.7	37	15	32	59
Inorganic														
Chloride	mg/l	-	250	-	-	250	1.2	0.90	0.93	1.2	16	17	17	20
Ammoniacal Nitrogen as N	mg/l	-	50	1	1	-	0.017	0.18	0.033	0.067	0.25	0.45	0.60	0.13
Total Cyanide	ug/l	-	50	1	1	70	< 40	< 40	< 40	< 40	< 40	< 40	< 40	< 40
Organics														
Phenol	ug/l	0.5	-	7.7	7.7	300	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
4-Chloro-3-methylphenol	ug/l	-	-	-	-	-	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
2,4-Dichlorophenol	ug/l	0.1	-	4.30	-	-	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
2,4-Dimethylphenol	ug/l	-	-	-	-	-	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
p-cresol	ug/l	-	-	-	-	-	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
2,6-Dimethylphenol	ug/l	-	-	-	-	-	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
2,6-Dichlorophenol	ug/l	-	-	-	-	-	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
2,4,6-Trichlorophenol	ug/l	-	-	-	-	-	< 0.10	< 1.00	< 0.10	< 1.00	-	-	-	-
Petroleum Hydrocarbons														
Aliphatic C5-C6	ug/l	-	10	10	10	-	-	-	-	-	< 0.1	14	< 0.1	< 0.1
Aliphatic C6-C8	ug/l	-	10	10	10	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	ug/l	-	10	10	10	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	ug/l	-	10	10	10	-	-	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	ug/l	-	10	10	10	-	-	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	ug/l	-	10	10	10	-	-	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	ug/l	-	10	10	10	-	-	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C7	ug/l	-	10	10	10	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	ug/l	-	10	10	10	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	ug/l	-	10	10	10	-	-	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	ug/l	-	10	10	10	-	-	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0

APPENDIX 2I

Proposed Layout Plan



RADCLIFFE LEADERSHIP ACADEMY
 SECTION OPTION 02
 STAR ACADEMY

APPENDIX 22

Exploratory Hole Location Plans



Legend

- Locations By Type - CP
- Locations By Type - CP+RC
- Locations By Type - DCP
- Locations By Type - DS
- Locations By Type - HP
- Locations By Type - OP
- Locations By Type - TP

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www.geotechnics.co.uk

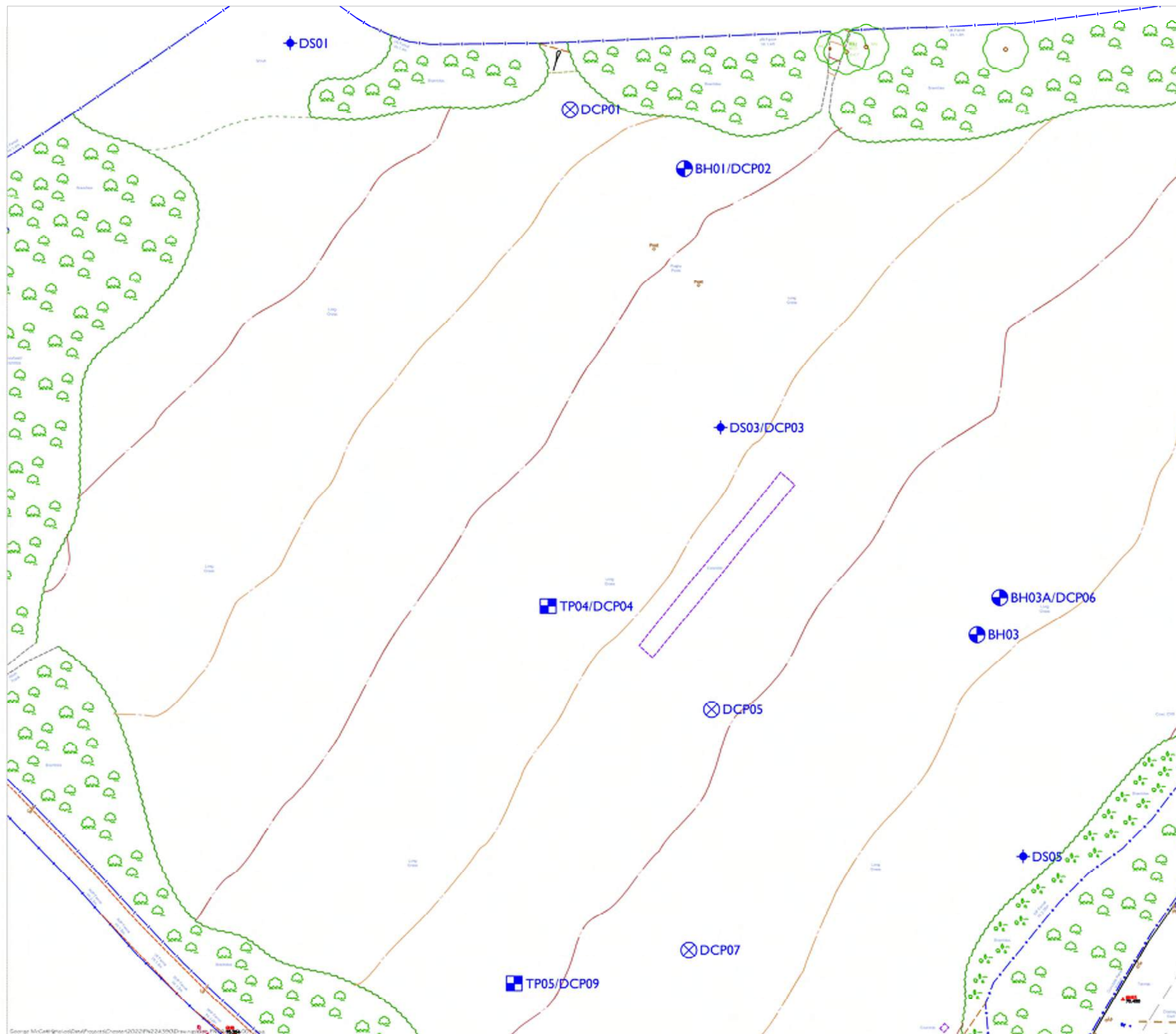
Engineer:
MOTT MACDONALD LIMITED

Client:
DEPARTMENT FOR EDUCATION

Project:
STAR RADCLIFFE

Drawing Title:
Exploratory Hole Location Plan

Scale: 1:1500 at A3	Date: 08/06/2022
Project No.: PN224390	Exploratory Hole Location Plan



Key

- Cable Percussion Borehole with Rotary-cored Follow-on (BH33 - Cable Percussion Only)
- Dynamic Sample Borehole
- Machine-dug Trial Pit
- Soakaway Test
- Hand-dug Trial Pit
- Dynamic Cone Penetration Test

Hole ID	Easting (m)	Northing (m)	Level (mOD)
BH01/DCP02	378011.0	407723.9	75.71
BH02	378711.3	407737.7	74.28
BH03	378869.7	407660.5	74.11
BH03A/DCP06	378712.7	407665.2	74.23
BH04	378737.5	407648.3	71.04
DCP01	378615.9	407728.7	76.30
DCP02	378634.6	407650.4	74.59
DCP03	378611.6	407658.5	74.30
DCP04	378654.1	407604.7	73.86
DS01	378578.9	407738.5	76.84
DS02	378736.1	407737.5	74.30
DS03/DCP03	378635.80	407667.70	75.11
DS04	378606.00	407679.40	75.77
DS05	378675.80	407661.00	76.64
DS06	378685.40	407604.40	70.17
DS07	378678.20	407554.70	70.81
DS08	378656.60	407608.80	70.44
DS09	378677.70	407554.80	70.89
DS09/DCP11	378681.70	407551.10	70.30
DS09/DCP13	378621.10	407609.60	70.64
DS09/DCP14	378612.50	407608.70	71.21
DS11	378685.70	407638.90	71.86
DS12	378612.30	407647.60	71.57
DS13	378689.10	407631.10	71.85
DS14	378611.40	407642.00	71.53
DS15/DCP12	378685.80	407558.90	70.42
DS16/DCP04	378613.00	407664.10	75.22
DS17/DCP08	378608.50	407654.20	74.66
DS18/DCP10	378654.40	407630.80	73.70



GEOTECHNICS
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Email: mail@geotechnics.co.uk
www.geotechnics.co.uk

Engineer:
MOTT MACDONALD LIMITED

Client:
DEPARTMENT FOR EDUCATION

Project:
STAR RADCLIFFE

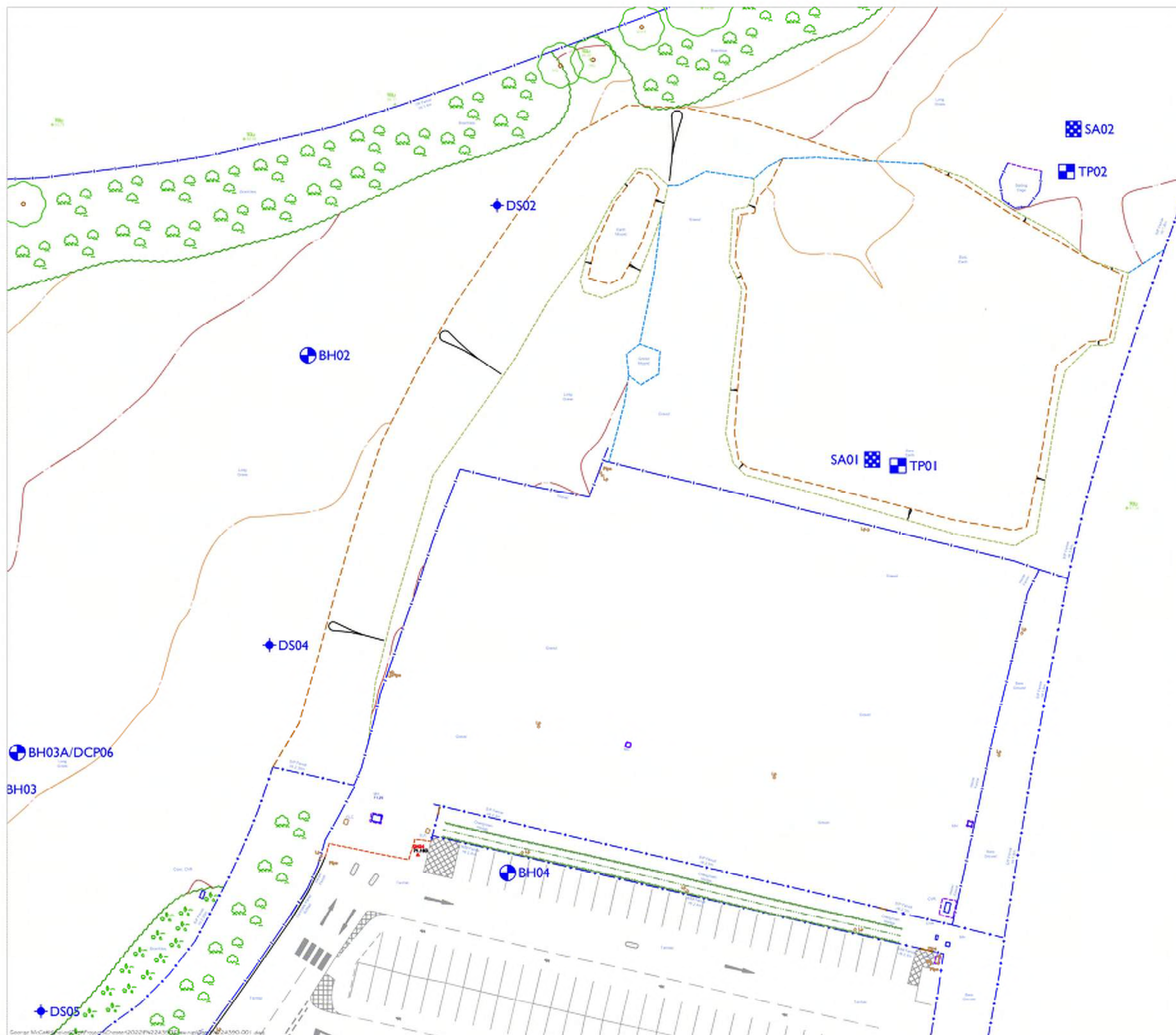
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EXPLORATORY HOLE LOCATION PLAN

Scale: 1:500@A3

Date:
June 2022

Project No:
PN224390

File Name:
Geo-PN224390-001(1)



Key

- Cable Percussion Borehole with Rotary coring Follow-on (BH03 - Cable Percussion Only)
- Dynamic Sample Borehole
- Machine-dug Trial Pit
- Soakaway Test
- Hand-dug Trial Pit
- Dynamic Cone Penetration Test

Hole ID	Easting (m)	Northing (m)	Level (mOD)
BH01/DCP02	378011.0	407723.9	75.71
BH02	378071.3	407737.7	74.28
BH03	378069.7	407660.5	74.11
BH03A/DCP06	378072.7	407665.2	74.23
BH04	378077.5	407648.3	71.04
DCP01	378055.9	407728.7	76.30
DCP05	378034.6	407650.4	74.59
DCP07	378011.6	407658.5	74.30
DCP08	378054.1	407604.7	73.86
DS01	378078.9	407738.5	76.84
DS02	378076.1	407737.5	74.30
DS03/DCP03	378035.80	407687.70	75.11
DS04	378006.00	407679.40	75.77
DS05	378075.80	407641.00	76.64
DS06	378065.40	407604.40	70.57
DS07	378078.20	407654.70	70.81
DS08	378056.60	407608.80	70.44
DS09	378077.70	407654.80	70.89
DS09/DCP11	378081.70	407651.10	70.30
DS09/DCP13	378021.10	407609.60	70.64
DS09/DCP14	378012.50	407608.70	71.21
SA01	378065.70	407733.90	71.96
SA02	378012.30	407747.60	71.57
TP01	378089.10	407731.10	71.85
TP02	378011.40	407742.00	71.53
TP03/SA03/DCP12	378085.80	407658.90	70.42
TP04/DCP04	378013.00	407664.10	75.22
TP05/DCP09	378068.50	407654.20	74.66
TP06/DCP10	378054.40	407620.80	73.70



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Project:
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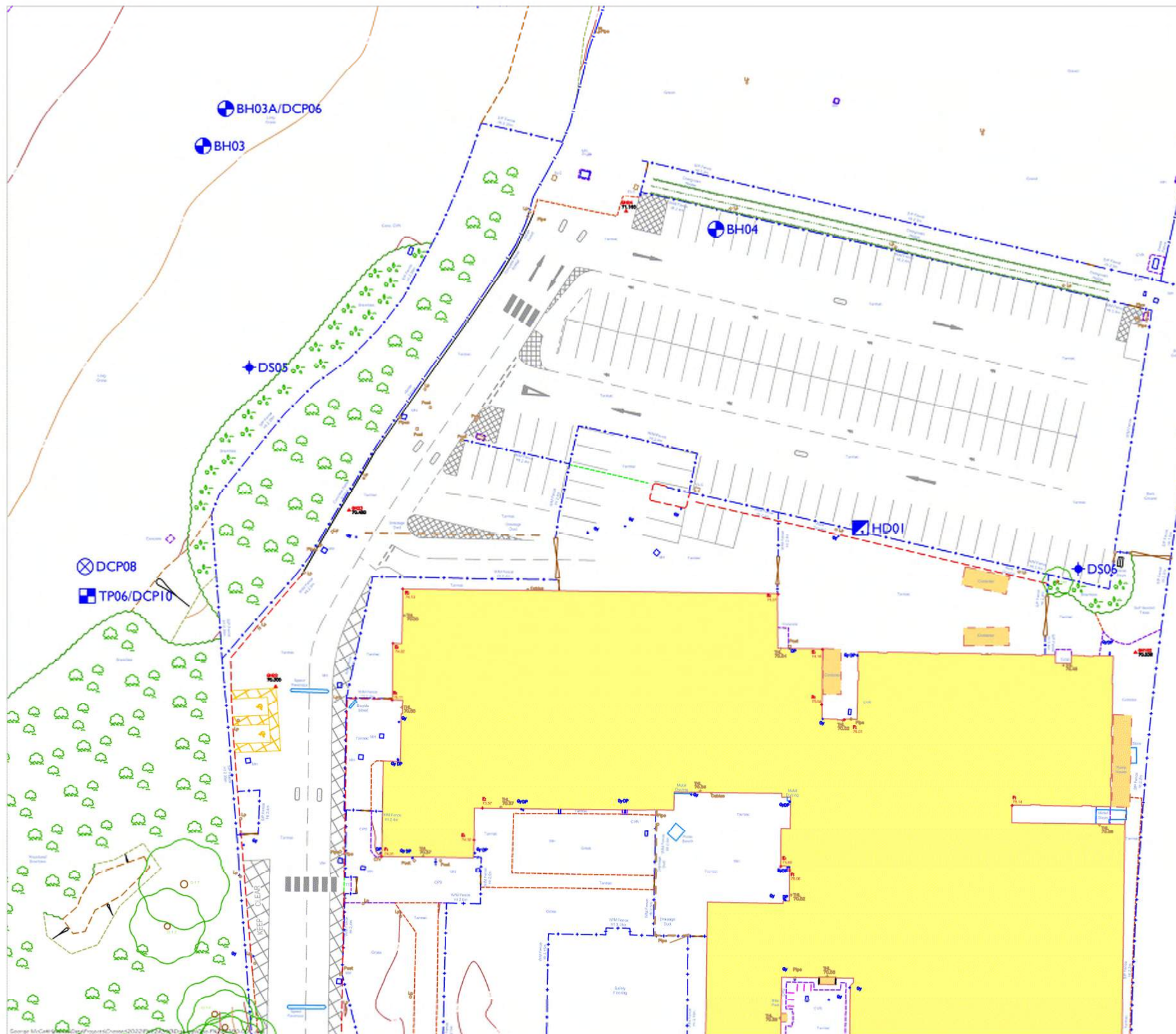
Drawing Title:
EXPLORATORY HOLE LOCATION PLAN

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Key

- Cable Percussion Borehole with Rotary-cored Follow-on (BH03 - Cable Percussion Only)
- Dynamic Sample Borehole
- Machine-dug Trial Pit
- Soakaway Test
- Hand-dug Trial Pit
- Dynamic Cone Penetration Test

Hole ID	Easting (m)	Northing (m)	Level (mOD)
BH01/DCP02	378011.0	407723.9	75.71
BH02	378011.3	407727.2	74.28
BH03	378009.7	407660.3	74.11
BH03A/DCP06	378012.7	407665.2	74.23
BH04	378017.5	407648.3	71.04
DCP01	378015.9	407728.7	76.30
DCP05	378034.6	407650.4	74.59
DCP07	378011.6	407658.6	74.30
DCP08	378054.1	407604.7	73.86
DS01	378078.9	407738.5	76.84
DS02	378036.1	407757.5	74.30
DS03/DCP03	378035.80	407687.70	75.11
DS04	378006.00	407679.40	75.77
DS05	378075.80	407601.00	76.64
DS06	378065.40	407604.40	70.17
DS07	378075.20	407554.70	70.81
HD05	378056.60	407608.80	70.44
HD02	378077.70	407564.60	70.89
HD03/DCP11	378081.70	407561.10	70.30
HD04/DCP13	378021.10	407609.60	70.64
HD05/DCP14	378012.50	407668.70	71.21
SA01	378065.70	407733.90	71.96
SA02	378012.30	407747.60	71.57
TP05	378089.10	407731.10	71.85
TP02	378011.40	407742.00	71.53
TP03/SA03/DCP12	378085.80	407558.90	70.42
TP04/DCP04	378013.00	407664.10	75.22
TP05/DCP09	378008.50	407654.20	74.66
TP06/DCP10	378054.40	407620.80	73.70



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MOTT MACDONALD LIMITED

Client:
DEPARTMENT FOR EDUCATION

Project:
STAR RADCLIFFE

Drawing Title:
EXPLORATORY HOLE LOCATION PLAN

Scale: 1:500@A3

Date:
June 2022

Project No:
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File Name:
Geo-PN224390-001(3)



Key

- Cable Percussion Borehole with Rotary-cored Follow-on (BH03 - Cable Percussion Only)
- Dynamic Sample Borehole
- Machine-dug Trial Pit
- Soakaway Test
- Hand-dug Trial Pit
- Dynamic Cone Penetration Test

Hole ID	Easting (m)	Northing (m)	Level (mOD)
BH01/DCP02	378611.0	407723.9	75.71
BH02	378711.3	407737.2	74.28
BH03	378669.7	407660.3	74.11
BH03A/DCP06	378672.7	407665.2	74.23
BH04	378737.5	407649.3	71.04
DCP01	378615.9	407729.7	76.30
DCP05	378634.6	407650.4	74.59
DCP07	378631.6	407638.6	74.30
DCP08	378654.1	407604.7	73.86
DS01	378578.9	407738.5	76.84
DS02	378736.1	407737.5	74.10
DS03/DCP03	378635.80	407687.70	75.11
DS04	378706.00	407679.40	73.77
DS05	378675.80	407631.00	73.64
DS06	378785.40	407604.40	70.17
DS07	378778.20	407514.70	70.31
HD01	378756.60	407609.80	70.43
HD02	378777.70	407564.80	70.89
HD03/DCP11	378681.70	407561.50	70.30
HD04/DCP13	378721.50	407529.60	70.64
HD05/DCP14	378712.50	407568.70	71.21
SA01	378763.70	407733.90	71.96
SA02	378812.30	407747.60	71.57
TP01	378789.50	407733.50	71.95
TP02	378811.40	407742.00	71.53
TP03/SA03/DCP12	378695.80	407518.90	70.42
TP04/DCP04	378613.00	407564.50	75.22
TP05/DCP09	378608.50	407554.20	74.66
TP06/DCP10	378654.40	407520.30	73.70



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Engineer:
MOTT MACDONALD LIMITED

Client:
DEPARTMENT FOR EDUCATION

Project:
STAR RADCLIFFE

Drawing Title:
EXPLORATORY HOLE LOCATION PLAN

Scale: 1:500@A3

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June 2022

Project No:
PN224390

File Name:
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APPENDIX 23

Investigation Techniques and General Notes

INTRODUCTION

The following brief review of Ground Investigation techniques, generally used as part of most Site Investigations in the UK, summarises their methodology, advantages and limitations. Detailed descriptions of the techniques are available and can be provided on request. This review should be read in conjunction with the accompanying General Notes.

TRIAL PITS

The trial pit is amongst the simplest yet most effective means of identifying shallow ground conditions on a site. Its advantages include simplicity, speed, potential accuracy and cost-effectiveness. The trial pit is most commonly formed using a back-acting excavator which can typically determine ground conditions to some 4 metres below ground level. Hand excavation is often used to locate, expose and detail existing foundations, features or services. In general, it is difficult to extend pits significantly below the water table in predominantly granular soils, where flows can cause instability. Unless otherwise stated, the trial pits will not have been provided with temporary side support during their construction. Under such circumstances, entrance into the pit is not permitted and hence observations will have been made from the ground surface and samples taken from the excavator bucket.

Where access for personnel is required to allow close observation of the exposed strata, the taking of samples and the carrying out of in situ tests, the sides of the trial pits (Observation Pits in BS 5930:2015) will be made safe using temporary supports or the sides battered back to a stable angle. Some limited access to such Trial Pits (Observation Pits) at depths less than 1m may be allowed in stable conditions or where the sides are benched or battered back to a safe angle.

Trends in strata type, level and thickness can be determined, shear surfaces identified and the behaviour of plant, excavation sides and excavated materials can be related to the construction process. They are particularly valuable in land slip investigations. Some types of in situ test can be undertaken in such pits and large disturbed or block samples obtained.

CABLE PERCUSSION BORING

The light Cable Percussion technique of soft ground boring, typically at a diameter of 150mm, is a well-established simple and flexible method of boring vertical holes and generally allows data to be obtained in respect of strata conditions other than rock. A tubular cutter (for cohesive soils) or shell with a flap valve (for granular soils) is repeatedly lifted and dropped using a winch and rope operating from an "A" frame. Soil which enters these tools is regularly removed and either sampled for subsequent examination or test, or laid to one side for later removal off site and licensed disposal or, if permitted by the Client, use as backfill. Steel casing will have been used to prevent collapse of the borehole sides where necessary. A degree of disturbance of soil and mixing of layers is inevitable and the presence of very thin layers of different soils within a particular stratum may not be identified. Changes in strata type can only be detected on recognition of a change in soil samples at the surface, after the interface has been passed. For the foregoing reasons, depth measurements should not be considered to be more accurate than 0.10 metre. The technique can determine ground conditions to depths in excess of 30 metres under suitable circumstances and usually causes less surface disturbance than trial pitting.

In cohesive soils cylindrical samples are retrieved by driving or pushing in 100mm nominal diameter tubes. In soft soils, piston sampling or vane testing may be undertaken. In granular soils and often in cohesive materials, in situ Standard Penetration Tests (SPT's) are performed. The SPT records the number of standard blows required to drive a 50mm diameter open or cone ended probe for 300mm after an initial 150mm penetration. A modified method of recording is used in denser strata. Small disturbed samples are obtained throughout.

ROTARY DRILLING

Rotary Drilling to produce cores by rotating an annular diamond-impregnated tube or barrel into the ground is the technique most appropriate to the forming of site investigation boreholes through rock or other hard strata. It has the advantage of being able to be used vertically or at an angle. Core diameters of less than 100mm are most common for site investigation purposes. Core is normally retrieved in plastic lining tubes. A flushing fluid such as air, water or foam is used to cool the bit and carry cuttings to the surface. Depths in excess of 60 metres can be achieved under suitable circumstances using rotary techniques, with minimal surface disturbance.

Examination of cores allows detailed rock description and generally enables angled discontinuity surfaces to be observed. However, vertical holes do not necessarily reveal the presence of vertical or near-vertical fissures or joint discontinuities. The core type and/or techniques used will depend on the ground conditions. Where open hole rotary drilling is employed, descriptions of strata result from examination at the surface of small particles ejected from the borehole in the flushing medium. In consequence, no indication of fissuring, bedding, consistency or degree of weathering can be obtained.

DYNAMIC SAMPLING

This technique involves the driving of an open-ended tube into the ground and retrieval of the soil which enters the tube. It was previously called window or windowless sampling. The term "window sample" arose from the original device which had a "window" or slot cut into the side of the tube through which samples were taken. This was superseded by the use of a thin-walled plastic liner to retrieve the soil sample from within a sampler (windowless sampling) which has a solid wall. Line diameters range from 36 to 86mm. Such samples can be used for qualitative logging, selection of samples for classification and chemical analysis and for obtaining a rudimentary assessment of strength.

Driving devices can be hand-held or machine mounted and the drive tubes are typically in 1m lengths. Depending on the type of rig used, the hole formed can be cased to prevent collapse of the borehole sides. Where the type of rig does not allow the insertion of casing, the success of this technique can be limited when soils and groundwater conditions are such that the sides of the hole collapse on withdrawal of the sampler. Obstructions within the ground, the density of the material or its strength can also limit the depth and rate of penetration of this light-weight investigation technique. Nevertheless, it is a valuable tool where access is constrained such as within buildings or on embankments. Depths of up to 10m can be achieved in suitable circumstances depending on the rig type but depths of 5m to 6m are more common.

EXPLORATORY HOLE RECORDS

The data obtained by these techniques are generally presented on Trial Pit, Borehole, Drillhole or Dynamic Sample Records. The descriptions of strata result from information gathered from a number of sources which may include published geological data, preliminary field observations and descriptions, in situ test results, laboratory test results and specimen descriptions. A key to the symbols and abbreviations used accompanies the records. The descriptions on the exploratory hole records accommodate but may not necessarily be identical to those on any preliminary records or the laboratory summaries.

The records show ground conditions at the exploratory hole locations. The degree to which they can be used to represent conditions between or beyond such holes, however, is a matter for geological interpretation rather than factual reporting and the associated uncertainties must be recognised.

DYNAMIC PROBING

This technique typically measures the number of blows of a standard weight falling over a standard height to advance a cone-ended rod over sequential standard distances (typically 100mm). Some devices measure the penetration of the probe per standard blow. It is essentially a profiling tool and is best used in conjunction with other investigation techniques where site-specific correlation can be used to delineate the distribution of soft or loose soils or the upper horizon of a dense or strong layer such as rock.

Both machine-driven and hand-driven equipment is available, the selection depending upon access restrictions and the depth of penetration required. It is particularly useful where access for larger equipment is not available, disturbance is to be minimised or where there are cost constraints. No samples are recovered and some techniques leave a sacrificial cone head in the ground. As with other lightweight techniques, progress is limited in strong or dense soils. The results are presented both numerically and graphically. Depths of up to 10m are commonly achieved in suitable circumstances.

The hand-driven DCP probing device has been calibrated by the Highways Agency to provide a profile of CBR values over a range of depths.

INSTRUMENTATION

The most common form of instrument used in site investigation is either the standpipe or else the standpipe piezometer which can be installed in investigation holes. They are used to facilitate monitoring of groundwater levels and water sampling over a period of time following site work. Normally a standpipe would be formed using rigid plastic tubing which has been perforated or slotted over much of its length whilst a standpipe piezometer would have a filter tip which would be placed at a selected level and the hole sealed above and sometimes below to isolate the zone of interest. Groundwater levels are determined using an electronic "dip meter" to measure the depth to the water surface from ground level. Piezometers can also be used to measure permeability. They are simple and inexpensive instruments for long term monitoring but response times can limit their use in tidal areas and access to the ground surface at each instrument is necessary. Remote reading requires more sophisticated hydraulic, electronic or pneumatic equipment.

Settlement can be monitored using surface or buried target plates whilst lateral movement over a range of depths is monitored using slip indicator or inclinometer equipment.

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4. The assessment of the significance of the factual data, where called for, is provided to assist the Client and their Engineer and/or Advisers in the preparation of their designs.
5. The report is based on the ground conditions encountered in the exploratory holes together with the results of field and laboratory testing in the context of the proposed development. The data from any commissioned desk study and site reconnaissance are also drawn upon. There may be special conditions appertaining to the site, however, which are not revealed by the investigation and which may not be taken into account in the report.
6. Methods of construction and/or design other than those proposed by the designers or referred to in the report may require consideration during the evolution of the proposals and further assessment of the geotechnical and any geoenvironmental data would be required to provide discussion and evaluations appropriate to these methods.
7. The accuracy of results reported depends upon the technique of measurement, investigation and test used and these values should not be regarded necessarily as characteristics of the strata as a whole (see accompanying notes on Investigation Techniques). Where such measurements are critical, the technique of investigation will need to be reviewed and supplementary investigation undertaken in accordance with the advice of the Company where necessary.
8. The samples selected for laboratory test are prepared and tested in accordance with the relevant Clauses and Parts of BS EN ISO 17892 and BS 1377 Parts 1 to 8, where appropriate, in Geotechnics Limited's UKAS accredited Laboratory, where possible. A list of tests is given.
9. Tests requiring the use of another laboratory having UKAS accreditation where possible are identified.
10. Any unavoidable variations from specified procedures are identified in the report.
11. Specimens are cut vertically, where this is relevant and can be identified, unless otherwise stated
12. All the data required by the test procedures are recorded on individual test sheets but the results in the report are presented in summary form to aid understanding and assimilation for design purposes. Where all details are required, these can be made available.
13. Whilst the report may express an opinion on possible configurations of strata between or beyond exploratory holes, or on the possible presence of features based on either visual, verbal, written, cartographical, photographic or published evidence, this is for guidance only and no liability can be accepted for its accuracy.
14. The Code of Practice for Ground Investigations – BS 5930:2015 calls for man-made soils to be described as Anthropogenic Ground with soils placed in an un-controlled manner classified as Made Ground and soils placed in a controlled manner as Fill. In view of the difficulty in always accurately determining the origin of man-made soils in exploratory holes, Geotechnics Limited classify such materials as Made Ground. Where soils can be clearly identified as being placed in a controlled manner then further classification of the soils as Fill has been added to the Exploratory Hole Records.
15. Classification of man-made soils is based on the inspection of retrieved samples or exposed excavations. Where it is obvious that foreign matter such as paper, plastic or metal is present, classification is clear. Frequently, however, for man-made soils that arise from the adjacent ground or from the backfilling of excavations, their visual characteristics can closely resemble those of undisturbed ground. Other evidence such as site history, exploratory hole location or other tests may need to be drawn upon to provide clarification. For these reasons, classification of soils on the exploratory hole records as either Made Ground or naturally occurring strata, the boundary between them and any interpretation that this gives rise to should be regarded as provisional and subject to re-evaluation in the light of further data.
16. The classification of materials as Topsoil is generally based on visual description and should not be interpreted to mean that the material so described complies with the criteria for Topsoil used in BS 3882:2015. Specific testing would be necessary where such a definition is a requirement.
17. Ground conditions should be monitored during the construction of the works and the report should be re-evaluated in the light of these data by the supervising geotechnical engineers.
18. Any comments on groundwater conditions are based on observations made at the time of the investigation, unless specifically stated otherwise. It should be noted, however, that the observations are subject to the method and speed of boring, drilling or excavation and that groundwater levels will vary due to seasonal or other effects.
19. Any bearing capacities for conventional spread foundations which are given in the report and interpreted from the investigation are for bases at a minimum depth of 1m below finished ground level in naturally occurring strata and at broadly similar levels throughout individual structures, unless otherwise stated. Typically they are based on serviceability criteria taking account of an assessment of the shear strength and/or density data obtained by the investigation. The foundations should be designed in accordance with the good practice embodied in BS 8004:2015 - Foundations, supplemented for housing by NHBC Standards. Foundation design is an iterative process and bearing pressures may need adjustment or other measures may need to be taken in the context of final layouts and levels prior to finalisation of proposals.
20. Unless specifically stated, the investigation does not take account of the possible effects of mineral extraction or of gases from fill or natural sources within, below or outside the site.
21. The costs or economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, will depend on very many factors in addition to geotechnical or geoenvironmental considerations and hence their evaluation is outside the scope of the report.