

Plot J2, Kingsway Ground Investigation Factual Report March 2023

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Introduction

BWB Consulting Ltd (BWB) was instructed by Wilson Bowden Developments Ltd (the Client) to carry out a Supplementary Ground investigation at Plot J2, Kingsway Business Park, Rochdale.

BWB's original ground investigation was undertaken between 08/01/2018 and 12/01/2018. The findings of the original investigation were presented in BWB's Phase 2 Geo-Environmental Assessment Report (Ref. KBP-BWB-ZJ-XX-RP-YE-0002_Ph2), included here for reference as **Appendix 1**.

The proposed development layout has changed since 2018 and currently comprises two commercial units with associated loading bays, parking, and infrastructure. The proposed development masterplan is presented as **Appendix 2**.

The 2018 ground investigation did not include boreholes under the footprint of the now-proposed Unit J2-1 and also encountered localised zones of soft organic material in the natural valleys on site. These valleys are located in the central (western) part of the site and on the eastern boundary. BWB has therefore undertaken a supplementary ground investigation to verify the design assumptions for Plot J2-1 and further assess the extent of the identified organic materials.

Scope of Works

The ground investigation was undertaken on 21/05/2022 and comprised:

- Clearance of exploratory hole locations by a specialist sub-surface utility tracing company.
- Collection of coordinates and elevations of exploratory hole locations.
- The advancement of 6 no. machine excavated trial pits to a maximum depth of 4.70m.
- 8 no. cone penetration tests (CPT) to a maximum depth of 19.97m.

CPTs were located on site to supplement the 2018 intrusive investigation to inform the design of foundations and ground improvement (if required) for proposed structures. Trial pits were located to investigate the extent of soft, organic alluvial material encountered during previous investigations.

An exploratory hole location plan is presented in **Appendix 3**. Trial pits were logged by BWB's engineer and are presented in **Appendix 4**. Photographs of the trial pits and arisings are presented as **Appendix 5**. Cone Penetration Testing was undertaken by In Situ Ltd, results are presented in **Appendix 6**. No sampling or laboratory testing was undertaken.

The site investigation works were carried out in general accordance with BS5930:2015 'Code of Practice for Site Investigations' and BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites'.

The site conditions presented challenges for plant access and excavation, resulting in the following limitations and considerations regarding uncertainty:

- Soft, wet, boggy conditions required use of tracked CPT and excavation plant.
- CPT07 could not be undertaken at its original proposed location in the base of the central valley, as the slopes were too steep for the plant to access.
- TP05 was terminated at 1.0m depth due to swift water ingress through a broken land drain, causing collapse of pit sides.
- The base of organic, alluvial material was not proved in TP01, TP02, TP05 and TP06 due to pit collapse, or reaching the maximum practical depth of the pit (maximum depth proved 3.50m in TP01).

Ground Conditions

The ground conditions encountered generally confirmed the published geology and results of the 2018 investigation presented in BWB's Phase 2 Report. The recorded ground conditions from trial pits undertaken during the 2022 investigation are summarised in Table 1 below.

Table 1: Summary of Ground Conditions encountered in Trial Pits

Stratum	Locations Encountered	Top Depth (mbgl)		Base Depth (mbgl)		Thickness (m)	
		Min	Max	Min	Max	Min	Max
Topsoil	All Locations	0.00		0.10	0.40	0.10	0.40
Made Ground	TP01-02	0.20		1.50		0.30-1.10	
Alluvium	TP02-03, TP05-06	0.10	0.20	1.00	3.30	0.80	3.50
Hummocky Glacial Deposits	TP01-04	0.30	1.50	4.00	4.70	Maximum depth not proved	

Geological Descriptions

Geological descriptions for each stratum are summarised below.

Topsoil covered the entirety of the site, comprising dark brown clayey sand with rootlets.

Made Ground was encountered only in TP01 and TP02 and consisted of brown sand with gravel and cobbles of sandstone.

Alluvium consisted of soft, brown, sandy, silt with lenses of black silt (with organic odour) and peat.

Hummocky Glacial Deposits consisted of sandy silt or clayey sand, often with low gravel or cobble content. The gravel and cobbles were generally sandstone and mudstone. Plant material including wood fragments was present in the Hummocky Glacial Deposits in TP02. Hand shear vane (HSV) tests were undertaken where suitable cohesive deposits were encountered. Each comprised three tests with the average taken and presented on exploratory hole logs. HSV results ranged between 4 and 5 KPa.

Contamination Observations

No visual or olfactory evidence of contamination was noted during the ground investigation.

Groundwater

Groundwater observations from trial pits are summarised in **Table 2** below. Groundwater was encountered in TP02, TP03, TP05 and TP06 as inflow from the pit sides, or through land drains. No surface water features were encountered within the site boundary during this investigation.

Table 2: Groundwater Observations.

Exploratory Hole	Groundwater Depth (mbgl)	Groundwater Level (mAOD)	Stratum	Observations
TP01	Dry	Dry	NA	
TP02	4.00	148.30	Silty Sand	Located in valley at eastern end of site.
TP03	3.70	147.48	Gravelly Sand	
TP04	Dry	Dry	NA	
TP05	1.00	154.45	Alluvium	Encountered in land drain
TP06	0.20	150.38	Sandy Silt	Land drain in wall of pit may have altered profile

During the 2018 investigation Groundwater was monitored to rest at reduce levels of between 149.63mAOD and 155.02mAOD (between 4.26m and 0.82m below existing ground level).

Groundwater levels noted during the 2022 investigation fell largely within this range, with one reading in TP02 from the eastern river valley of 148.30mAD, 4.00mbgl.

Conclusions

- Groundwater was only encountered in trial pits located in the natural valley features during this investigation, observed as seepage from water-bearing strata or through historic terracotta land drains.
- Organic-rich alluvial material was observed in both eastern and western valleys, with lenses of very soft organic material and peat noted in the western (central) valley to a maximum (unproven) depth of 3.5m bgl.

Appendix 1 – BWB 2018 Phase 2 Report
 Appendix 2 – Proposed Masterplan
 Appendix 3 – BWB 2022 Exploratory Hole Location Plan
 Appendix 4 – Exploratory hole Logs
 Appendix 5 – Trial Pits Photographs
 Appendix 6 – CPT Report

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Appendix 1 – BWB 2018 Phase 2 Report



BWB

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Phase 2 Geo-Environmental Assessment

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EXECUTIVE SUMMARY

Site Address and Setting	The site is located at Plot J, Kingsway Business Park, Rochdale. During the ground investigation the site was noted to be undulating and surfaced by mature vegetation. It was bisected by two streams orientated north west to south east; ground conditions were generally soft, becoming boggy in areas of standing water and in close proximity to the streams.
Published Geology, Hydrogeology and Hydrology	British Geological Survey (BGS) 1:50,000 mapping indicates that the site is underlain by superficial Hummocky Glacial Deposits, with two bands of Head Deposits trending north west to south east following the course of the two streams on site. Bedrock is anticipated to comprise the Pennine Lower Coal Measures Formation and Milnrow Sandstone, beneath the south and north of the site respectively. The superficial deposits and bedrock are classified by the Environment Agency as Secondary A Aquifers. The site is bisected by two streams, both flowing into an unnamed secondary river approximately 145m to the north west. The site is considered by the Environment Agency to be at very low risk of flooding.
Scope of Investigation Works	Ground investigation comprised six cable percussive boreholes advanced to a maximum depth of 15.50m bgl, thirty machine excavated trial pits to a maximum depth of 4.30m bgl and thirty dynamic cone penetrometer tests.
Ground Conditions Encountered	Ground conditions were recorded to comprise Topsoil or Made Ground to a maximum depth of 1.10m bgl and 1.40m bgl respectively overlying Hummocky Glacial Deposits to a proven depth of 10.00m bgl. The underlying Glacial Till was recorded to a maximum depth of 15.50m bgl, although the base was unproven. Head Deposits, as mapped by the BGS, were encountered on site as Alluvium within the base of the two streams between 0.25m and 3.70m bgl. Groundwater was monitored to rest between 149.63m and 155.02m AOD and is indicated to flow in a northerly direction with a hydraulic gradient of 0.1.
Geotechnical Appraisal	It is anticipated that shallow pad foundations will be taken into the underlying Hummocky Glacial Deposits. Due to its compressible nature the Alluvium will likely require removal prior to development, with the resulting excavation backfilled with engineered fill to an agreed specification. Ground bearing floor slabs are anticipated to be acceptable across the site.
Contamination Sources	Leachate assessment has identified minor exceedances in the screening criteria for copper and lead and groundwater assessment has identified minor exceedances in the screening criteria for copper and nickel; no exceedances were identified by the soil chemical assessment. Ground gas monitoring has identified the site to be subject to a Characteristic Situation 2 gassing regime, whereby ground gas protection measures will be required. Soils and groundwater on site are considered to pose a low to moderate risk to human health and a low risk to controlled waters receptors.
Recommendations	A Remediation Strategy detailing mitigation measures and validation expectations and an Earthworks Strategy should be completed prior to development.
This summary should be read in conjunction with BWB's full report (ref. KBP-BWB-ZJ-XX-RP-YE-0002_Ph2_P1) and reflects an assessment of the site based on information received by BWB at the time of production.	

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APPENDICES

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Appendix 2	Exploratory Hole Records
Appendix 3	Drillers' Logs
Appendix 4	Trip Hammer Calibration Certificate
Appendix 5	Gas and Groundwater Monitoring Results
Appendix 6	Soil Chemical Analysis Results

Appendix 7	Groundwater Chemical Analysis Results
Appendix 8	Geotechnical Laboratory Testing Results
Appendix 9	Dynamic Cone Penetrometer Test Results
Appendix 10	Derivation of BWB GSACs
Appendix 11	CLEA Screening Worksheets
Appendix 12	Soil Leachate Results Summary
Appendix 13	Groundwater Chemical Laboratory Results Summary
Appendix 14	UKWIR Values

1 INTRODUCTION

Instruction

- 1.1 BWB Consulting (BWB) was instructed by Wilson Bowden Developments Ltd (the Client) to carry out a Phase 2 Geo-Environmental Assessment for the site at Plot J Kingsway Business Park, Rochdale. Details of the project brief are included in BWB proposal reference 171221/R1/0001/MCS2210/KES/RTR, dated December 2017.
- 1.2 The proposed development is anticipated to comprise the construction of a new distribution warehouse with associated loading bays, parking and infrastructure. Access will be from James Kearnes Avenue to the south of the site. A proposed Masterplan, current at the time of writing, is presented as **Appendix 1**.

Previous Reports

- 1.3 Familiarity with the following Phase 1 Geo-Environmental Assessment, previously completed by BWB for the site, is assumed:
- 'Phase 1 Geo-Environmental Assessment for Plot J, Kingsway Business Park, Rochdale' by BWB Consulting Ltd for Wilson Bowden Developments Ltd, reference KBP-BWB-ZJ-XX-RP-YE-0001-Ph1, dated January 2018.

Objectives

- 1.4 The objectives of the report are to assess:
- The prevailing ground and groundwater conditions across the site;
 - The potential presence and extent of contamination in shallow soil and groundwater beneath the site;
 - The significance and magnitude of the observed contamination through comparison of analytical data to appropriate published environmental screening criteria;
 - The strength properties of the soil beneath the site to enable foundation design; and
 - The ground gas regime beneath the site.
- 1.5 The objectives above will allow the preliminary Conceptual Site Model (CSM) presented in the Phase 1 Assessment to be verified and updated. The report has been completed in accordance with BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites, Code of Practice' and CLR11 'Model Procedures for the Management of Land Contamination'.
- 1.6 This report presents the information obtained from a Phase 1 Geo-Environmental Assessment and the supplementary ground investigations and contains relevant factual information from the previous investigations undertaken by others. Sections 2 to 5 of the report, together with the associated Figures and Appendices, constitute a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007.

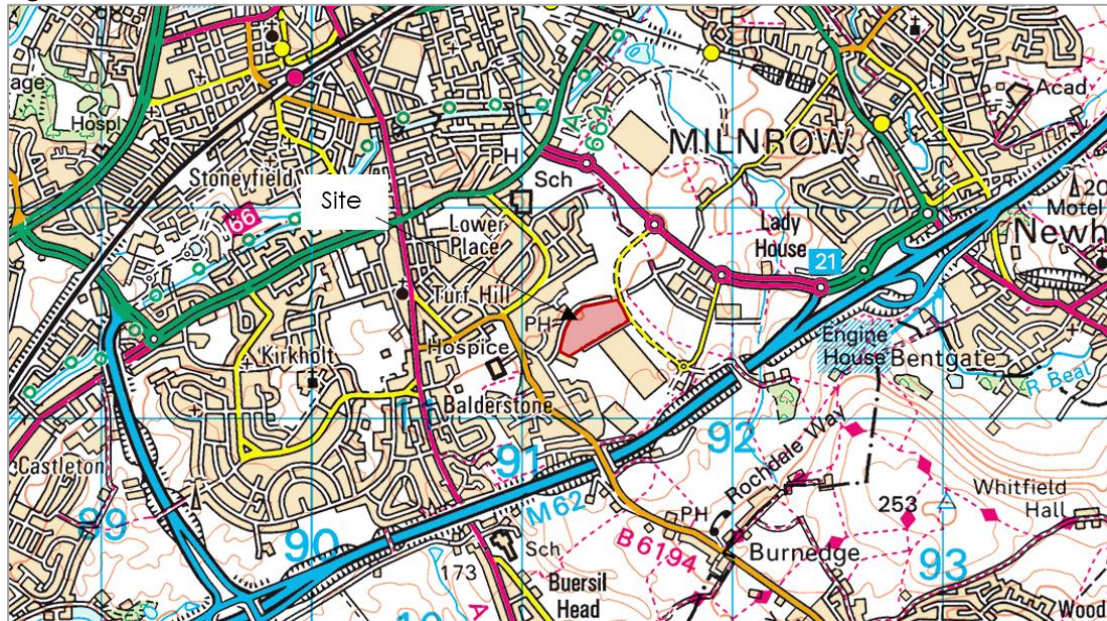
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- 1.7 The report also includes information required to form a Geotechnical Design Report as defined in BS EN 1997-1:2004, and the salient information, assessments and recommendations are presented in Sections 6 to 11 of the report, together with the associated Figures and Appendices.

2 THE SITE

Site Location

- 2.1 The site is located at Plot J Kingsway Business Park, Rochdale at National Grid Co-ordinates 391310, 411464. The approximate location of the site is shown below in **Figure 1**.

Figure 1 Site Location Plan



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Site Description and Surroundings

- 2.2 The layout of the site with the main features is presented as **Drawing 1**. A detailed description of the key features of the site and its surroundings is included in the Phase 1 Geo-Environmental Assessment.
- 2.3 During the ground investigation the site was noted to be undulating and surfaced by mature vegetation. It was bisected by two streams orientated north west to south east; ground conditions were generally soft, becoming boggy in areas of standing water and in close proximity to the streams.
- 2.4 A temporary footpath was noted to cut through the middle of the site, linking the Asda distribution warehouse with the nearby residential estate.

3 GEO-ENVIRONMENTAL SETTING

Published Geology

- 3.1 British Geological Survey (BGS) 1:50,000 mapping (Sheet 85, Manchester, dated 2011) indicates that the site is underlain by superficial Hummocky Glacial Deposits, with an area of peat identified immediately to the north. BGS 1:10,000 mapping, reviewed within the Phase 1 Geo-Environmental Assessment, also records two bands of Head Deposits trending north west to south east and following the course of the two streams on site.
- 3.2 Bedrock is anticipated to comprise the Pennine Lower Coal Measures Formation and Milnrow Sandstone, beneath the south and north of the site respectively.
- 3.3 Although none has been recorded on available mapping, it is anticipated that limited Made Ground will be encountered in the north east of the site associated with historical development.

Hydrogeology

- 3.4 The underlying ground conditions have been classified by the Environment Agency (EA) as follows:
- Head Deposits: Secondary A Aquifer;
 - Hummocky Glacial Deposits: Secondary A Aquifer;
 - Pennine Lower Coal Measures Formation: Secondary A Aquifer; and
 - Milnrow Formation: Secondary A Aquifer.
- 3.5 Two abstraction licences were historically present on site associated with a historical well at Castle Farm. The site is not located within 500m of a Source Protection Zone.

Hydrology

- 3.6 The site is bisected by a stream running through the centre of the site, with another along the northern boundary, both flowing towards the north west. Although the stream running through the centre of the site is identified by the Groundsure report as being culverted, it was recorded as being above ground during the ground investigation. Both streams flow into an unnamed secondary river approximately 145m to the north west.
- 3.7 The site is considered by the Environment Agency to be at very low risk of flooding, with the chance of flooding defined as being less than 1 in 1000 in any given year.

4 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

Introduction

- 4.1 The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.
- 4.2 The following sections discuss all the identified potential on and off-site sources, pathways and receptors in the context of the proposed development. Plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters are based on the data gained from the Phase 1 Geo-Environmental Assessment. At this stage the assessment is qualitative and aimed to determine all relevant pollutant linkages, irrespective of significance or allowing for uncertainty.
- 4.3 Three impact potentials exist for any given site; these are:
- The site impacting upon itself;
 - The site impacting on its surroundings; and
 - The surroundings impacting on the site.
- 4.4 All three impacts need to be considered in a risk assessment.
- 4.5 A Source, Pathway, Receptor analysis has been undertaken for the site to develop a CSM based on the information provided in the Phase 1 Geo-Environmental Assessment. This is presented as **Table 1**.
- 4.6 **Sources (S);** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks).
- 4.7 **Pathways (P);** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.
- 4.8 **Receptors (R);** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

Table 1 *Preliminary Conceptual Site Model*

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-Site Sources S1a: Made Ground associated with former site use, including Castle's Farm and Agriculture. Contaminants of potential concern (CoPC) may include heavy metals, petroleum hydrocarbons, PAHs, phenols, sulphates, pesticides, herbicides, asbestos and ACMs. Made Ground and deeper coal measures may represent a source of ground gas.	P1: Dermal contact, incidental ingestion, and inhalation of particulates.	R1: Construction workers	Mi	Li	M/L	The exposure to construction workers can be mitigated by utilising appropriate PPE and maintaining good hygiene levels. Contaminants are unlikely to be present at significant concentrations based on the current and historical site use.
		R2: Future site users (commercial)	Mi	Lw	L	Pesticides and herbicides may be present in low enough quantities that they will not pose a significant risk. Ground investigation should be undertaken in order to characterise the chemical status of the Made Ground. If significant asbestos is recorded, the requirements of CAR 2012 should be complied with.
	P2: Inhalation of Vapours	R1: Construction workers	Mi	Lw	L	Made Ground may represent a potential source of hazardous ground gases and vapours that could pose a risk to construction workers and future site users, through accumulation and subsequent asphyxiation and/or explosion. The risk should be mitigated against by conducting a gas assessment in accordance with CIRIA guidance, including a suitable period of ground gas monitoring.
		R2: Future site users (commercial)	Mi	Lw	L	
	P3: Migration and accumulation of ground gasses in enclosed spaces leading to asphyxiation	R1: Construction workers	Sv	UI	M/L	
		R2: Future site users (commercial)	Sv	UI	M/L	

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
	(carbon dioxide) or explosions (methane).					elevated concentrations of hazardous ground gases being identified.
	P4: Vertical migration of contaminants in the soil leachate.	R3: Underlying Secondary A Aquifers	Mi	Lw	L	No groundwater data is currently available for the site. Ground investigation and subsequent monitoring would confirm whether potentially unacceptable risks are present.
	P5: Lateral migration of contaminated groundwater.	R4: Surface water features (Culvert/tertiary/secondary rivers)	Mi	Lw	L	The recommendations of EA document PPG6: <i>Construction and Demolition Sites: Prevent Pollution</i> should be considered during construction.
	P4: Direct contact.	R5: Water utility pipes	Mi	Lw	L	Organic compounds in the shallow soils could taint the water supply. A ground investigation and subsequent laboratory analysis should be undertaken to inform the design of new services.
		R7: Buried structures/foundations.	Mi	Lw	L	Sulphates and low pH in the ground could accelerate the degradation of buried concrete structures (e.g. foundations). Ground investigation should include an assessment of the concrete design class.
Off-site Sources S2a: Agricultural and farm works with an associated tank.	P1: Incidental ingestion and inhalation of particulates.	R1: Construction workers.	Mi	UI	VL	Based on the expected presence of Made Ground at the Site and the historical/current potentially contaminating land uses, it is considered that concentrations of CoPC are likely to be higher on Site than from off-site
		R2: Future site users	Mi	UI	VL	
	P2: Inhalation of vapours.	R1: Construction workers	Mi	UI	VL	

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
CoPC are likely to be similar to those encountered on site. S2b: Peat 50m to the north. Peat may present a source of ground gas generation including methane and carbon dioxide.		R2: Future site users	Mi	UI	VL	sources. Therefore, the risk from off-site sources is considered to be very low.
	P3: Migration and accumulation of ground gasses in enclosed spaces leading to asphyxiation (carbon dioxide) or explosions (methane).	R1: Construction workers	Sv	UI	M/L	Ground investigation should include exploratory hole locations adjacent to the site boundaries, where possible, to allow for interpretation of potential soil/groundwater contamination and ground gases.
		R2: Future site users	Sv	UI	M/L	
	P5: Lateral migration of contaminated groundwater.	R3: Underlying Secondary A Aquifers	Mi	UI	VL	
		R1: Construction workers	Mi	UI	VL	

VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low

KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely

Pollutant Linkage Assessment Summary

When considered in the context of the CSM and the historical activities that have taken place at the site (former castle and farm), the proposed development is considered to pose a moderate/low risk to human health and low risk to controlled waters.

It is considered that the main driver for the risk rating for human health is the unknown contamination associated with the Made Ground and Topsoil from the previous activities onsite and the potential for elevated ground gas concentrations to accumulate within enclosed spaces.

It is recommended that a ground investigation be undertaken to quantify the identified pollutant linkages and assess likely mitigation measures.

5 PHASE II ENVIRONMENTAL AND GEOTECHNICAL GROUND INVESTIGATION

Scope of Works

- 5.1 Intrusive ground investigation works were undertaken between 8th January and 12th January 2018 and comprised the following works:
- Clearance of investigation locations by a specialist buried services tracing company;
 - Collection of coordinates and elevations of exploratory hole locations;
 - The advancement of six cable percussive boreholes (BH01 to BH06 inclusive) to a maximum depth of 15.50m bgl with in-situ standard penetration tests (SPTs) and installation of gas and groundwater monitoring wells;
 - The advancement of 30 machine excavated trial pits (TP01 to TP30 inclusive) to a maximum depth of 4.30m bgl;
 - TRL dynamic cone penetration (TRL DCP) testing at selected locations to infer California bearing ratio (CBR) values;
 - Collection of environmental soil and groundwater water samples for chemical analysis at a UKAS and MCERTS accredited laboratory;
 - Collection of bulk and disturbed soil samples for geotechnical analysis at a UKAS accredited laboratory; and
 - Four post investigation ground gas and groundwater level monitoring visits.
- 5.2 An exploratory hole location plan is presented as **Drawing 2**. BWB exploratory hole records are presented as **Appendix 2**, Drillers' Logs are presented as **Appendix 3**, the SPT calibration certificates are presented in **Appendix 4**, and the post investigation gas and groundwater monitoring data is presented as **Appendix 5**.
- 5.3 The site investigation works were carried out in general accordance with BS5930:2015 'Code of Practice for Site Investigations' and BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites'.

Chemical Sampling and Analytical Strategy

Soil Strategy

- 5.4 Exploratory holes were positioned and representative samples collected from across the site to determine the site wide soil chemical status. Where encountered, samples of Made Ground were submitted for asbestos screening.
- 5.5 Selected soil samples collected from exploratory hole locations were sent to i2 Analytical Laboratories Ltd (UKAS and MCERTS accredited) for chemical analysis. The following chemical analytical testing was undertaken:
- 15 soil samples were tested for a soil suite (BWB Standard Suite) comprising arsenic, barium, beryllium, water soluble boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate (2:1 extract), total phenols, total free and complex

cyanide, fraction of organic carbon, pH, polycyclic aromatic hydrocarbons (United States Environment Protection Agency priority 16 compounds, USEPA 16 PAH) and total petroleum hydrocarbons (TPH) C6-C40;

- 5 soil samples were tested for speciated US Criteria Working Group (TPHCWG) aliphatic and aromatic compounds;
- 7 soil samples were submitted for asbestos screening; and
- 6 soil samples were tested for a suite of common leachable contaminants, namely arsenic, barium, beryllium, water soluble boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate, total sulphate, total cyanide and pH.

5.6 The results of the soil chemical testing are presented as **Appendix 6**.

Groundwater Strategy

5.7 Groundwater samples obtained using a bailer following the removal of 3 times the well volume of water or the well bailed dry and was allowed to recharge. The groundwater samples were sent to i2 Analytical Laboratories Ltd (UKAS and MCERTS accredited) for the following suite of groundwater chemical testing:

- Six water samples tested for arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, conductivity, sulphate, ammoniacal nitrogen, total phenols, total cyanide, pH, total organic carbon, USEPA 16 PAH; and
- Six water samples tested for TPHCWG.

5.8 The results of the groundwater chemical testing are presented as **Appendix 7**.

Geotechnical Strategy

5.9 The cable percussive borehole locations were positioned beneath the proposed building footprints to assess underlying ground conditions for geotechnical purposes. The trial pits were positioned to assess relatively shallow ground conditions, strength properties and characteristics across the wider site, with the CBR tests undertaken within the proposed service yards and car parking areas to allow for pavement design.

5.10 In-situ soil strength testing comprising SPTs were undertaken in the cable percussive boreholes. SPT 'N' values are included on the exploratory hole logs presented as **Appendix 2**.

5.11 Selected disturbed and bulk samples were collected from the investigation locations and sent to the geotechnical project laboratory (i2 Analytical Laboratories Ltd), which is UKAS accredited. The following geotechnical testing was undertaken;

- 14 samples tested for moisture content;
- 8 samples tested for Atterberg (liquid and plastic) limits;
- 10 samples tested for particle size distribution by sieve and pipette;
- 11 samples tested for a BRE Suite comprising aqueous sulphate and pH;
- 6 quick undrained triaxial compaction tests; and
- 10 compaction tests (2.5kg rammer) and particle density tests.

-
- 5.12 The results of the geotechnical testing are included as **Appendix 8**.

Limitations and Uncertainty

- 5.13 The cable percussive boreholes BH01 and BH02 could not be positioned beneath the proposed building in the north of the site due to boggy ground conditions; both boreholes were moved to firmer areas as close to the proposed building footprint as possible.

6 GROUND CONDITIONS ENCOUNTERED

Geological Summary

- 6.1 The ground conditions recorded generally confirmed the published geology discussed in the Phase 1 Geo-Environmental Assessment, although bedrock was not encountered during the ground investigation.
- 6.2 The recorded ground conditions are summarised in **Table 2** below and **Sketch 1** presents a geological cross section through the site. Uncorrected SPT results collected from the borehole locations are presented on the exploratory hole records presented in **Appendix 2**.

Table 2 Summary of Ground Conditions

Stratum	Top Depth (m)		Base Depth (m)		Thickness (m)		SPT 'N' Value	
	Min	Max	Min	Max	Min	Max	Min	Max
Topsoil	0.00		0.25	1.10	0.25	0.80	NR	
Made Ground	0.00		0.25	1.40	0.25	1.40	NR	
Alluvium	0.25	0.80	2.60	3.70	1.80	3.45	NR	
Hummocky Glacial Deposits	0.25	2.60	0.55	10.50	0.90	10.00	4	27
Glacial Till*	6.40	10.50	15.00	15.50	4.50	9.50	16	51
*Base unproven								

Geological Descriptions

Topsoil

- 6.3 Topsoil was encountered consistently across the site at thicknesses of between 0.25m and 0.80m, only absent from TP02 to TP04, TP21, TP27, TP29 and TP30 where Made Ground was recorded from ground level. It was generally recorded to comprise dark brownish grey slightly gravelly silty sand and soft slightly gravelly sandy clay with abundant rootlets and rarely an organic odour. Gravel was recorded as subangular and subrounded fine to coarse granite, quartz, shale and sandstone.

Made Ground

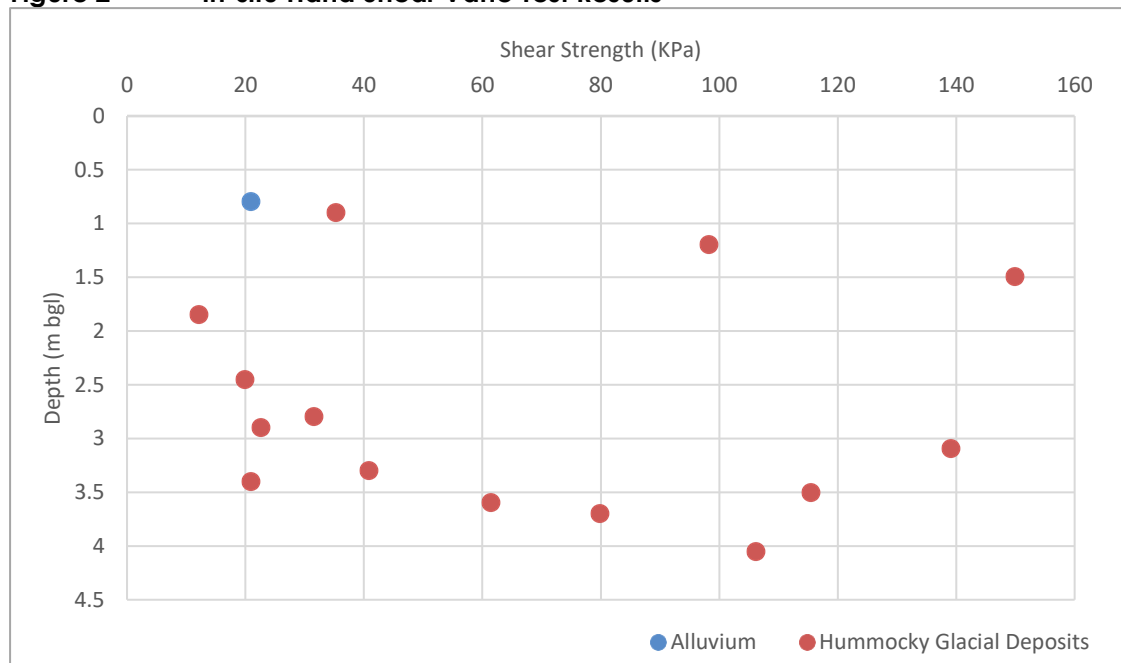
- 6.4 Made Ground was encountered at TP02 to TP04, TP21, TP29 and TP30 with thicknesses ranging between 0.25m and 1.40m. It was generally recorded to comprise brownish grey clayey gravelly sand and soft slightly sandy slightly gravelly clay, frequently with

rootlets. Gravel was noted to include brick, quartz, sandstone, slate and granite with occasional textile, glass, metal and tile.

Alluvium

- 6.5 Alluvium was recorded at exploratory hole locations TP01 and TP02, associated with the stream mapped in the north east of the site. Although mapped by the BGS as Head Deposits, it is considered likely that the material encountered is more representative of Alluvium.
- 6.6 Alluvium was generally encountered as very soft to soft brownish grey and light bluish grey slightly gravelly sandy clay, silty gravelly sand and very sandy gravel with rare black mottling, plant remains, wood fragments up to 0.50m in length and an organic odour. Gravel was recorded as subangular and subrounded fine to coarse quartz and sandstone. A low subrounded sandstone cobble content was recorded within granular material.
- 6.7 Hand shear vane (HSV) tests were undertaken where suitable cohesive deposits were encountered. Each comprised three tests with the average taken and presented as a graph below as **Figure 2**. The HSV results obtained at trial pits are presented on the exploratory hole records presented in **Appendix 2**.

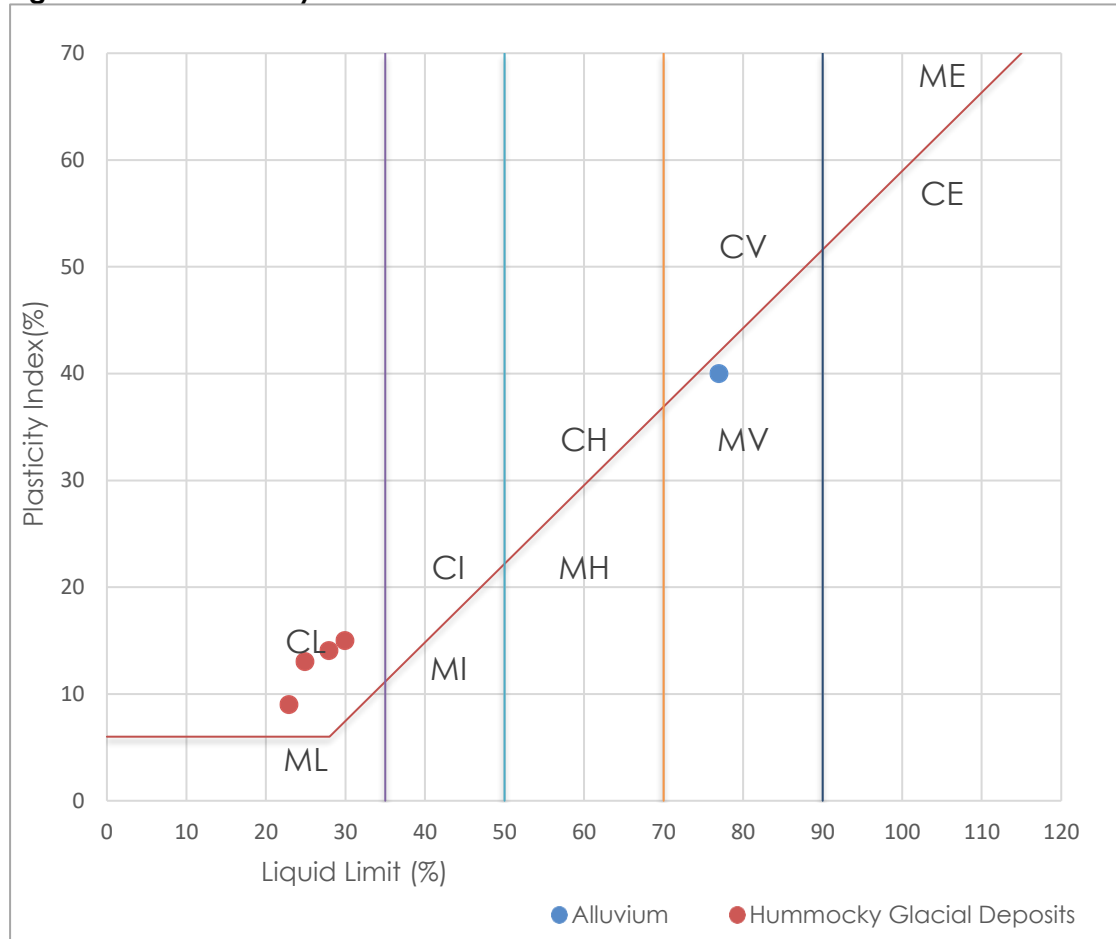
Figure 2 In-situ Hand Shear Vane Test Results



- 6.8 The peak shear strength value was obtained within a test at 0.80m bgl in TP01, recorded as 21kPa, based on the average of three results.
- 6.9 Geotechnical laboratory testing on one sample from TP01 (0.75 – 0.85m bgl) has indicated a moisture content of 83%, plastic limit of 37%, liquid limit of 77% and plasticity index of 40%, indicating a clay of very high plasticity. The large difference between

plastic limit and natural moisture content is indicative of high volume change potential of the material. A Plasticity Chart is presented below as **Figure 3**.

Figure 3 Plasticity Chart



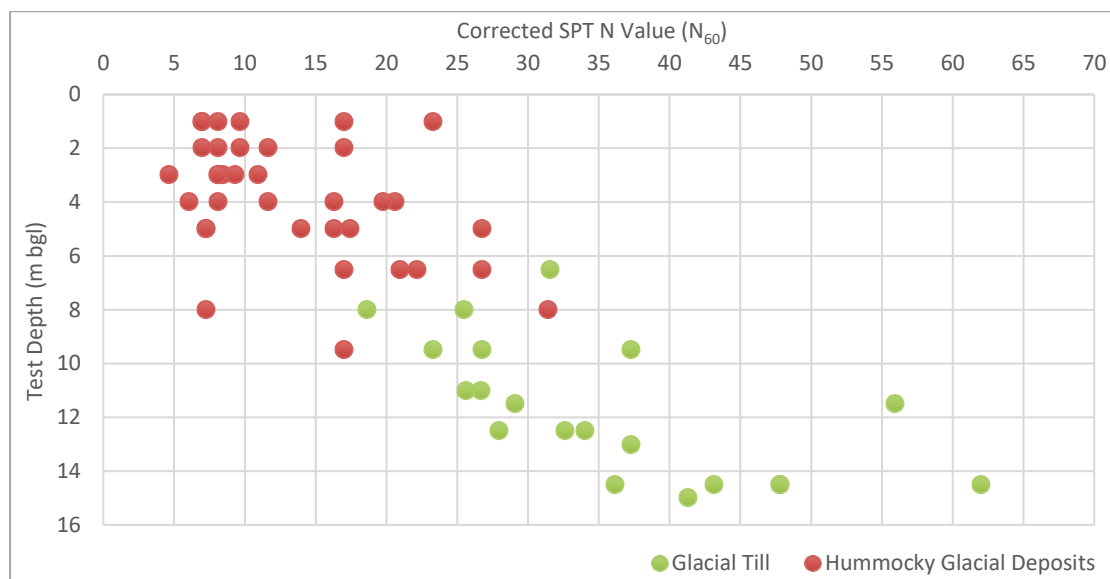
- 6.10 One particle size distribution (PSD) tested on a sample of non-cohesive Alluvium from TP01 (1.75 to 1.85m bgl) indicated the sample to comprise 74% sand, with minor constituents of gravel (12%), silt (10%) and clay (4%). This correlates with descriptions made during the ground investigation. The test curve indicates poorly graded material, predominantly comprising fine to medium sand.

Hummocky Glacial Deposits

- 6.11 Hummocky Glacial Deposits were encountered at all locations, ranging in thickness from 0.90m to 10.0m. The deposits were generally described as reddish and orangish brown silty very gravelly sand and very sandy gravel, occasionally with subangular and subrounded granite and sandstone cobbles. Gravel was recorded to comprise angular to subrounded fine to coarse siltstone, quartz, sandstone, granite, mudstone and shale.
- 6.12 Although generally granular in the north east and south west of the site, cohesive bands were recorded at BH02, BH03, BH05, TP08, TP12 to TP14 and TP16 to TP27. Cohesive material was generally identified to comprise reddish brown slightly gravelly sandy silt.

- 6.13 Where suitable cohesive deposits were encountered, hand shear vane tests were undertaken. The tests are summarised above in **Figure 2**.
- 6.14 SPT N_{60} values within the Hummocky Glacial Deposits were recorded in the range of 5 to 32 blows. The values were between 5 and 32 within the granular deposits and from 7 to 20 within the cohesive deposits. A plot of corrected SPT ' N_{60} ' Value vs Depth is presented as **Figure 4** below.

Figure 4 Corrected SPT ' N_{60} ' Value Versus Depth



- 6.15 The geotechnical laboratory testing has indicated moisture contents to range between 12% and 17%, liquid limits to range between 23% and 30% and plasticity indices to be in the range of 9% to 15% (low plasticity). A Plasticity Chart is presented above as **Figure 3**.
- 6.16 Nine PSD tests were undertaken on samples of Hummocky Glacial Deposits; a summary of the results is provided in **Table 3** below.

Table 3 PSD Results Summary

Location	Depth (m)	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay Content (%)	Earthworks Classification
TP01	1.75 – 1.85	11.70	74.00	9.90	4.40	1A
TP03	3.00 – 3.10	6.90	64.50	19.50	9.10	2A&2B
TP07	1.90 – 2.00	35.80	57.20	6.90		1A
TP10	2.15 – 2.25	2.10	86.60	9.30	2.00	1A
TP16	2.60 – 2.40	23.90	58.30	12.60	5.20	2C
TP21	1.20 – 1.30	0.00	98.40	1.60		1A
TP23	2.40 – 2.50	57.10	34.00	8.90		1A

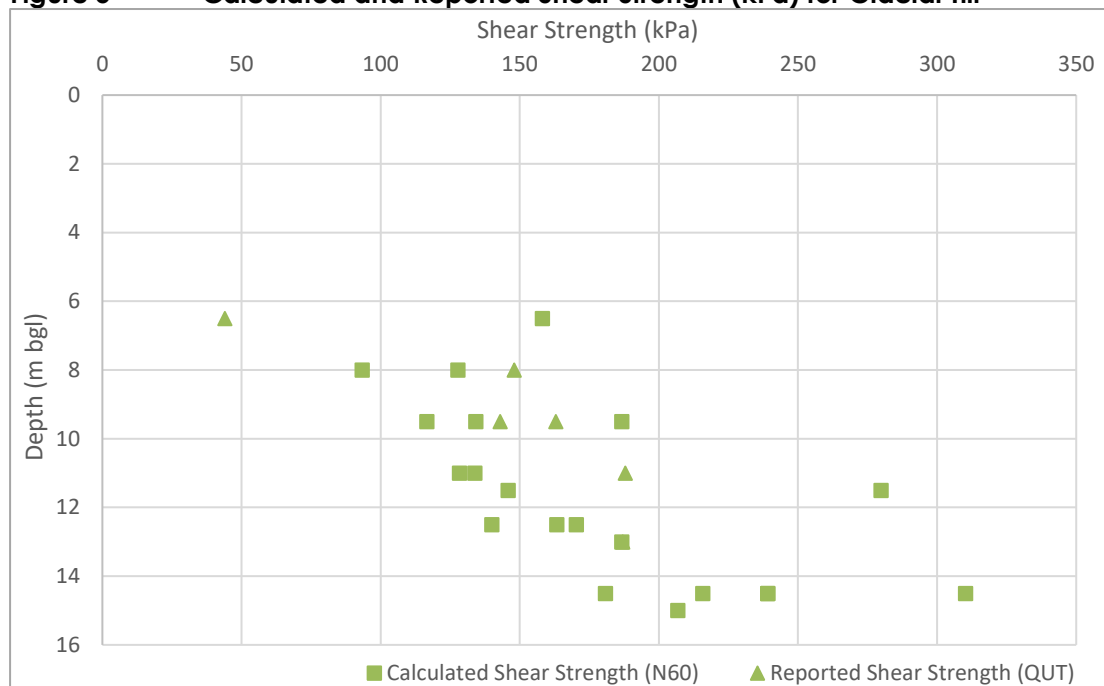
Location	Depth (m)	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay Content (%)	Earthworks Classification
TP25	1.40 – 1.50	0.00	56.60	29.20	14.20	2A&2B
TP26	1.85 – 1.95	1.70	52.90	32.90	12.50	2A&2B
TP29	1.80 – 1.90	15.60	37.80	31.30	15.30	2A&2B

- 6.17 Material was identified to predominantly comprise slightly clayey slightly gravelly silty sand, which correlates with descriptions made during the ground investigation.
- 6.18 Ten 2.5kg compaction tests were undertaken; results indicate that the majority of material is wet of optimum, although two samples were noted to be dry of optimum. Maximum dry densities were recorded to range between 1.72Mg/m³ and 2.04Mg/m³.
- 6.19 The SPT N₆₀ values obtained during the ground investigation have been used to derive angles of internal friction for the Hummocky Glacial Deposits, using the correlations proposed by Peck, Hanson and Thornburn (1963). N₆₀ values were recorded in the range of 5 to 32 blows, equating to a phi angle range of 29° to 37°.

Glacial Till

- 6.20 Glacial Till was recorded in BH01 to BH06 to a maximum unproven depth of 15.50m bgl; **Drawing 3** presents the depth to the Glacial Till.
- 6.21 It was generally recorded as firm to stiff greyish brown slightly gravelly sandy clay, although at one location was recorded as firm greyish brown slightly sandy silt. Gravel was recorded as angular to subrounded fine to coarse granite, sandstone, mudstone, siltstone and shale.
- 6.22 SPT N₆₀ values within the Glacial Till were recorded in the range of 16 to 51 blows. A plot of corrected SPT 'N₆₀' Value vs Depth is presented above as **Figure 4**.
- 6.23 The geotechnical laboratory testing has indicated moisture contents to range between 12% and 16%.
- 6.24 Based on the empirical relationship between plasticity index and shear strength, as developed by Stroud (1971, for over-consolidated clays), a conservative f1 factor of 5.0 has been adopted. The corrected SPT N₆₀ values indicate the Glacial Till to have potential shear strengths ranging between 93kPa and 310kPa. These are presented below as **Figure 5**.

Figure 5 Calculated and Reported Shear Strength (kPa) for Glacial Till



- 6.25 Six single stage triaxial tests were undertaken on samples of Glacial Till. Calculated undrained shear strengths were found to range between 44kPa and 188kPa and were noted to increase with depth. These have been included above on **Figure 5**.

In Situ Testing

Dynamic Cone Penetrometer Testing

- 6.26 Dynamic Cone Penetrometer Tests were undertaken adjacent to all trial pit locations in order to infer California bearing ratio (CBR) values to inform pavement design. The testing was undertaken in accordance with Transport Research Laboratory (TRL) methodology. The results of the testing are presented as **Appendix 9** and are summarised in **Table 4** below.

Table 4 Summary of DCP Results

Location	Total Depth (mm bgl)	Strata	Min CBR (%)	Max CBR (%)
TP01	800	TS / AL	0.7	5.1
TP02	420	MG	2.1	7.7
TP03	785	MG / HGD	5.5	41.5
TP04	822		0.9	12.4
TP05	693	TS / HGD	2.3	>100
TP06	747		2.1	19.2
TP07	729	TS / HGD	2.2	

Location	Total Depth (mm bgl)	Strata	Min CBR (%)	Max CBR (%)
TP08	861		1.5	17.3
TP09	661		3.3	11.1
TP10	704		4.4	38.5
TP11	857		1.2	12.1
TP12	870		0.8	17.7
TP13	795		2.2	29.0
TP14	726		1.6	24.4
TP15	746		4.1	42.1
TP16	705		2.7	26.8
TP17	822		3.0	30.0
TP18	725		4.1	22.7
TP19	617		1.0	23.4
TP20	749		3.7	18.5
TP21	698	MG / HGD	1.8	6.7
TP22	714	TS / HGD	2.8	27.2
TP23	680		4.6	20.3
TP24	690		3.9	23.2
TP25	675		3.0	50.5
TP26	776		4.6	34.6
TP27	821		3.8	7.2
TP28	673		5.2	31.7
TP29	648	MG / HGD	2.3	20.1
TP30	779	MG	3.7	64.1
TS = Topsoil, MG = Made Ground, AL = Alluvium, HGD = Hummocky Glacial Deposits				

- 6.27 Results obtained from TP01, TP02 and TP21, where Topsoil was recorded to overlie Alluvium, recorded maximum CBR values of 7.7%. At all other locations the maximum CBR value was found to exceed 10%, with the minimum CBR values generally corresponding to the overlying Topsoil.

Hydrogeology

- 6.28 Groundwater was encountered in BH01, BH02 and BH05 during drilling and at a number of trial pit locations during the ground investigation. This data and the subsequent monitored groundwater levels are summarised below in **Table 5**.

Table 5 Groundwater Strikes and Post Ground Investigation Monitoring

Location	Strike Depth (m bgl)	Inflow Rate	Stratum	Monitored Groundwater Levels (m AOD)	
				Min	Max
BH01	3.60	-	HGD	149.74	149.89
BH02	4.80	-	HGD	151.31	151.56
BH03	NR	-	-	149.63	149.66
BH04	Obscured	-	-	151.18	151.37
BH05	3.30	-	HGD	153.63	155.02
BH06	Obscured	-	-	150.88	153.00
TP01	3.40	Slow	ALL	-	-
TP02	1.85	Fast	ALL	-	-
TP03	3.05	Seepage	HGD	-	-
TP06	1.70	Seepage	HGD	-	-
TP07	2.30	Seepage	HGD	-	-
TP08	2.50	Very slow	HGD	-	-
TP12	1.30	Slow	HGD	-	-
TP13	1.35	Slow	HGD	-	-
TP14	1.85	Fast	HGD	-	-
TP17	3.70	Very slow	HGD	-	-
TP19	2.50	Very slow	HGD	-	-
TP21	1.05	Seepage	HGD	-	-
TP22	1.00	Seepage	HGD	-	-
TP23	0.80	Seepage	HGD	-	-
	2.50	Slow		-	-
TP24	3.85	Medium	HGD	-	-
TP27	3.65	Slow	HGD	-	-
TP30	3.00	Medium	HGD	-	-
HGD = Hummocky Glacial Deposits, ALL = Alluvium, NR = Not Recorded. All response zones targeted the Hummocky Glacial Deposits. Pink cells highlight overall maximum and minimum values.					

- 6.29 Although a groundwater strike was not recorded at BH03, BH04 and BH06 it is likely that it was obscured by the addition of water to the borehole during the drilling process.
- 6.30 The monitoring data has been used to infer the likely groundwater flow profile across the site. The groundwater is indicated to flow in a northerly direction, falling from approximately 155m AOD in the south to 150m AOD in the north on a hydraulic

gradient of approximately 0.1. The inferred groundwater flow profile at the site is presented as **Drawing 4**.

Hydrology

- 6.31 No surface water features were monitored as part of this investigation.

Contamination Observations

- 6.32 No visual or olfactory evidence of contamination was noted during the ground investigation, groundwater sampling visit or subsequent gas and groundwater monitoring period.

7 GEOTECHNICAL ASSESSMENT

Introduction

- 7.1 The proposed development is anticipated to comprise the construction of a new distribution warehouse with associated loading bays, parking and infrastructure. Access will be from James Kearnes Avenue to the south of the site.
- 7.2 Column loads for the proposed development are indicated to be in the region of 500kN, with an anticipated floor slab load of 30kN/m².
- 7.3 **Drawing 3** shows the depth to Glacial Till beneath the site and **Sketch 1** presents a cross-section through the site.

Ground Model

- 7.4 Due to variations in topography across the site a cut and fill exercise is likely to be required prior to development; as such two scenarios have been discussed below to account for the variation in ground conditions.

Areas of Cut

- 7.5 Areas of cut are likely to be focused in the centre and west of the site. **Sketch 2** shows the position of the proposed development in relation to the present topography; should the Masterplan be finalised in its present layout then the structures in the south west of the site are likely to be located in areas of cut. The below Ground Model, presented as **Table 6**, identifies likely ground conditions in areas of cut.

Table 6 *Ground Model for Areas of Cut*

Stratum	Depth (m bgl)	Bulk Unit Weight (kN/m ³)	Shear Strength Range (kPa)	Mv Range (m ² /MN)	Phi Angle (°)
Hummocky Glacial Deposits	0.0 – 7.0	19	-	-	29 - 37
Glacial Till*	7.0 - >15.0	19	45 - 310	0.1071 - 0.0322	-
*Base unproven.					

- 7.6 Groundwater has been monitored to rest at approximately 3.0m bgl, with the flow direction indicated to be towards the north.
- 7.7 Hummocky Glacial Deposits have been recorded to predominantly comprise granular material, although bands of cohesive material were recorded within the stratum, particularly in the south of the site.

Areas of Fill

- 7.8 The main areas of fill are likely to be located in the north east and centre of the site, in association with the two streams that bisect the site. Trial pits in these locations

recorded up to 3.0m of Alluvium comprising very soft to soft brownish grey and light bluish grey slightly gravelly sandy clay, silty gravelly sand and very sandy gravel with rare black mottling, plant remains, wood fragments up to 0.50m in length and an organic odour.

- 7.9 In these areas the Alluvium should be excavated and subsequently backfilled with engineered fill in accordance with the agreed Earthworks Specification.

Foundation Solutions

- 7.10 Shallow pad foundations have been considered the most economically feasible solution, however, alternative foundations solutions such as vibro-stone columns or piled foundations may have to be investigated should the proposed loadings exceed the values presented below.

Shallow Pad Foundation – Areas of Cut

- 7.11 It is generally not recommended that foundations are constructed bearing into untreated Made Ground in order to avoid unpredictable and excessive total and differential settlements. Similarly, the Alluvium would not be considered suitable for the support of the proposed structures. It is therefore anticipated that foundations will be taken into the underlying Hummocky Glacial Deposits, although it should be noted that this stratum was variable in composition and foundations should bear onto similar material to avoid differential settlement.
- 7.12 Indicative loads achievable within 25mm settlement are presented within **Table 7** below.

Table 7 Achievable bearing Capacities

Size of Pad	Depth (m bgl)	Bearing Capacity (kN/m ²)	Load (kN)
1m x 1m	1.0	250	250
	2.0	285	285
	3.0	350	350
2m x 2m	1.0	140	560
	2.0	165	660

- 7.13 Detailed foundation design will be required upon receipt of loadings for the proposed development.

Shallow Pad Foundations – Areas of Engineered Fill

- 7.14 Due to its compressible nature the Alluvium will likely require removal prior to development. The resulting excavation will need to be backfilled with engineered fill to a specification determined by an Earthworks Specification. Earthworks should be designed to achieve a minimum undrained shear strength of 75kN/m² that would likely to provide a safe bearing capacity of the order of 130kN/m².

- 7.15 Differential movements between varying strata such as engineered fill and natural Hummocky Glacial Deposits should be accommodated within the design.

Floor Slabs

- 7.16 Ground floor slabs laid on any untreated Made Ground or soft Alluvium risk unacceptable total and differential settlements.
- 7.17 No details of floor slab are available at this stage, however, a design load of 30kN/m² has been assumed. A ground bearing floor slab bearing on to the underlying Hummocky Glacial Deposits or engineered fill represents a potential solution, however, there will be a risk of differential settlement owing to potential variation between these two strata; potential differential movements would need to be accommodated within the slab design. The choice of final floor slab solution will be dependent on final slab loadings.
- 7.18 Ground gas assessment (Section 8.0) has classified the site as Characteristic Situation 2. Based on a Type D development a point score of 1.5 will need to be achieved. A cast in situ ground bearing floor slab with nominal mesh reinforcement would provide 0.5 points.

Roads and Pavements

- 7.19 Dynamic Cone Penetrometer Tests were undertaken in accordance with Transport Research Laboratory (TRL) methodology adjacent to a number of exploratory hole locations in order to infer California Bearing Ratio (CBR) values to inform road and pavement design.
- 7.20 Based on the variability of the results and the likelihood that earthworks will occur on site, it is recommended that a subgrade CBR value of 3% is adopted. This will need to be further confirmed via in-situ testing when subgrade levels are available.

Drainage

- 7.21 No soakaway testing was conducted during the ground investigation and due to the shallow depth of groundwater it is considered unlikely that soakaways will be feasible at the site.

Excavations

Ease and Stability of Excavation

- 7.22 Use of a conventional backhoe machine is anticipated to be suitable for removal of all soils on site.
- 7.23 Excavations displayed generally poor stability during the site investigation due to running sands and are likely to become unstable within a short period of time.

Legislation on Personnel Entry to Excavations

- 7.24 Excavations should not be entered by personnel unless full risk assessments and method statements have been completed.
- 7.25 It is recommended that no excavations should be entered without appropriate support and a full risk assessment should be completed prior to entry. Mitigation measures to protect from accumulating ground gases should be implemented.
- 7.26 Where personnel entry is required for inspection, excavations should be sufficiently enlarged and an assessment of safe temporary angles should be made. Alternatively, temporary shoring should be provided.

Groundwater

- 7.27 Groundwater is indicated to flow in a northerly direction with a hydraulic gradient of 0.1. It is likely that groundwater will affect excavations at the site which are progressed to depths greater than 2.0m bgl and left open for extended periods, although seasonal variations may alter this depth.

Chemical Attack on Buried Concrete

- 7.28 Water soluble sulphate concentrations in soils varied from 6.9 mg/l to 53 mg/l with soil pH values ranging from 4.6 to 8.6. Total sulphur concentration ranged from 0.007 % to 0.075 %.
- 7.29 Sulphate concentrations in the groundwater ranged from 1.7 mg/l to 105 mg/l with groundwater pH values ranging from 5.9 to 7.7.
- 7.30 In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils at the site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-2z for soils and groundwater, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

Earthworks

- 7.31 The majority of material was found to be Class 1A or 2A&2B, however, further assessment is likely to be required prior to development.
- 7.32 Due to significant variations in topography across the site, earthworks are anticipated to be required prior to development to create a suitable development platform; an Earthworks Strategy will be required to support this.

8 GROUND GAS ASSESSMENT

Introduction

- 8.1 A ground gas assessment has been undertaken to assess the risks associated with ground gases to new buildings and their occupants. The results obtained have been assessed in line with relevant guidance (notably CIRIA C665).
- 8.2 CIRIA C665 guidance indicates that for a site with very low gas generation potential, as identified in the Desk Study and based on the potential for limited Made Ground, and a low sensitivity development (the proposed commercial unit), a typical monitoring programme may comprise four visits over a period of one month.
- 8.3 BWB have undertaken four visits over a period of one month and therefore this assessment is considered to be sufficient to satisfy planning conditions for the proposed development.

Methodology

- 8.4 All boreholes were installed with ground gas monitoring wells with response zones within the superficial Hummocky Glacial Deposits. Exploratory hole records showing monitoring well constructions are presented in **Appendix 2**.
- 8.5 The assessment of potential ground gas generation is based on the observation of trends and changes in gas evolution by the direct measurement of ground gases from gas wells. The works included measurement of methane, carbon dioxide, oxygen, hydrogen sulphide, carbon monoxide, gas flows and barometric pressure. Volatile organic compounds were also measured using a photoionisation detector (PID).

Results

- 8.6 The minimum and maximum steady state concentrations recorded for borehole flow, oxygen, carbon dioxide and methane are summarised below in **Table 8**.

Table 8 Summary of Recorded Ground Gas Results

Borehole ID	Targeted Geology	Steady Flow (l/hr)		Carbon Dioxide (%v/v)		Methane (%v/v)	
		min.	max.	min.	max.	min.	max.
BH01	HGD	<0.1	5.1	0.3	4.7	<0.1	<0.1
BH02	HGD	<0.1	<0.1	0.9	1.8	<0.1	<0.1
BH03	HGD	<0.1	2.6	2.9	4.0	<0.1	<0.1
BH04	HGD	<0.1	0.1	2.3	3.9	<0.1	<0.1
BH05	HGD	<0.1	<0.1	1.8	3.3	<0.1	<0.1
BH06	HGD	<0.1	-0.3	<0.1	13.1	<0.1	<0.1

Atmospheric Pressure and Flow

- 8.7 During the monitoring programme completed at the site the atmospheric pressure ranged between 976mb (recorded on 18/01/2018) and 1005mb (recorded on 29/01/2018). Steady flow rates ranged between <0.1l/hr (recorded at multiple locations on multiple occasions) and 5.1l/hr (recorded at BH01 on 29th January).
- 8.8 Three monitoring visits were undertaken when atmospheric pressure was recorded below 1000mB, representing a low pressure event and the worst case scenario for the site.
- 8.9 The pressure was recorded as rising during one monitoring visit, as static during two monitoring visits and falling during one monitoring visit.
- 8.10 On this basis, the monitoring is considered likely to have captured the worst case gassing scenario at the site as generally, ground gas emissions tend to increase when atmospheric pressure falls and particularly when the pressure drops below 1000mB.

Hazardous Ground Gas and Volatile Vapours

- 8.11 Steady carbon dioxide concentrations recorded ranged between <0.1% v/v (recorded at BH06 on 29th January) and 13.1% v/v (recorded at BH06 on 18th January).
- 8.12 Steady methane concentrations were not recorded above <0.1%v/v and hydrogen sulphide concentrations were not recorded above the limit of detection of the equipment during the monitoring visits.
- 8.13 Carbon monoxide concentrations were generally not recorded above the limit of detection of the equipment during the monitoring visits with the exception of BH06 (10ppm on 18th January).
- 8.14 PID concentrations were not recorded above <0.1ppm (the limit of detection of the equipment).
- 8.15 Ground gas monitoring results are presented in **Appendix 5**.

Risk Assessment

- 8.16 CIRIA Report 665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" presents current best practice on the assessment of ground gases for commercial and residential buildings (with the exception of low rise traditional housing). The report presents a risk based approach based on gas screening levels which depend on both the concentration and emission rate of gas from the ground. Gas screening levels are calculated as follows:

$$\text{Gas screening value (l/hr)} = \frac{\text{gas concentration (\%)} \times \text{measured borehole flow rate (l/h)}}{100}$$

- 8.17 A maximum gas screening level of 0.66l/hr (for carbon dioxide) was recorded, giving a classification of Characteristic Situation 2. Based on this data, gas protection measures are required to be included within all new structures.

Recommendations

- 8.18 Gas protection measures should be installed in accordance with BS848:2015. Based on a Type D development (the proposed commercial units) and the CS2 classification, a gas protection score of 1.5 will need to be achieved.
- 8.19 There are a range of mitigation measures available which offer varying degrees of protection and corresponding number of points. It should be noted that no one single gas protection measure is likely to offer a sufficient number of points and, therefore, a combination of techniques may need to be adopted.
- Cast in Situ ground bearing floor slab – 0.5 points;
 - Cast in situ raft or suspended floor slab with minimal penetrations – 1.5 points;
 - Pressure relief pathways (geo composite blankets / strips) – 0.5 points;
 - Passive subfloor venting layer (void former / no fines gravel) – 1.5 points; and
 - Gas resistant membrane installed and verified in accordance with CIRIA 735 – 2 points.
- 8.20 It should be noted that depending on the selected method of gas protection and risks posed to occupants of the proposed development, visual inspection and integrity testing of the gas membrane may need to be undertaken.

9 HUMAN HEALTH RISK ASSESSMENT

9.1 Soil contaminant data have been compared against Generic Site Assessment Criteria (GSAC) developed by BWB using the CLEA model 1.071 and the updated CLEA framework (2009) for assessing risk from soil contamination to human health. Details of the derivation of the GSACs are presented in **Appendix 10**. The results of the soil chemical laboratory results are provided within **Appendix 6** with a table summarising the results presented as **Appendix 11**.

9.2 The GSACs have been developed with the following assumptions which have been changed from the CLEA default parameter set. Soil type is a sandy loam with an organic matter content of 1%. This is considered to be more representative of shallow Made Ground found on most Brownfield sites than the CLEA default of 6% organic matter.

Pathways

9.3 Contamination data have been compared to generic site assessment criteria (GSAC) for a commercial end use (i.e. using all pathways for that end use) based on an organic matter content of 1%. The building type for a commercial development is assumed to be a post 1970s office which is representative of new commercial buildings.

9.4 The site is to be developed for commercial end use and therefore the key receptor is considered to be an adult female worker and GSACs for a commercial industrial end use have been adopted.

9.5 Exposure pathways considered in this assessment are presented in **Table 9**.

Table 9 Commercial Exposure Pathways

Source	Shallow Soils		Deep Soils
Pathway	Commercial / Industrial with managed landscaped areas	Commercial / Industrial with Hard standing areas	Commercial / Industrial
Ingestion of Soil	✓	✗	✗
Ingestion of site derived household dust	✓	✗	✗
Ingestion of contaminated vegetables	✗	✗	✗
Ingestion of soil attached to vegetables	✗	✗	✗
Dermal contact with Soil	✓	✗	✗
Dermal contact with site derived household dust	✓	✗	✗

Source	Shallow Soils		Deep Soils
Inhalation of fugitive soil dust	✓	✗	✗
Inhalation of fugitive site derived household dust	✓	✗	✗
Inhalation of vapours outside	✓	✓	✓
Inhalation of vapours inside	✓	✓	✓

- 9.6 The whole site is considered to be one averaging area due to the limited dataset and similarity in site conditions.

Summary

- 9.7 None of the samples submitted for testing were found to exceed the applied screening criteria.
- 9.8 No asbestos was recorded to be within the seven samples submitted for asbestos screening.
- 9.9 Based on the above findings it is considered that the recorded contaminant concentrations do not pose an unacceptable risk to human health receptors.

10 CONTROLLED WATERS RISK ASSESSMENT

- 10.1 The results of soil leachate analysis and groundwater sampling are presented as **Appendix 6** and **Appendix 7** respectively.
- 10.2 The controlled waters assessment considers the potential impact of on-site contamination to pertinent controlled waters receptors identified at the site including:
- Underlying Secondary A Aquifers, including superficial Hummocky Glacial Deposits and underlying bedrock comprising the Pennine Lower Coal Measures Formation and Milnrow Formation; and
 - On site tertiary watercourses, which flow into an un-named secondary river approximately 145m to the north west.

Pathways

- 10.3 Controlled water risk assessment has been undertaken through assessment of leachable concentrations of contaminants in soil referring to exposure pathways considered and referencing **Table 10**.

Table 10 **Controlled Water Exposure Pathways**

Controlled Waters Exposure Pathway	Receptor
Leaching of soil contamination into recharge infiltration	✓
Vertical migration of impacted pore water through unsaturated zone into underlying aquifer	✓
Horizontal migration of groundwater through aquifer to off site receptors	✓

- 10.4 The site is underlain by superficial Hummocky Glacial Deposits (Secondary A Aquifer) and bisected by a number of tertiary watercourses which flow into a secondary river approximately 145m to the north west.
- 10.5 In the absence of a sensitive potable supply it is considered appropriate to adopt environmental quality standards (EQS) for freshwater when assessing groundwater quality and soil leachate concentrations. Where EQS are not available, World Health Organisation Standards (WHO) and UK Drinking Water Standards (DWS) have been adopted as the relevant screening criteria.

Soil Leachability

- 10.6 A summary of the soil leachate concentrations and adopted guideline concentrations are presented within **Appendix 12**; exceedances of the soil chemical laboratory results are presented in **Table 11** below.

Table 11 Summary of Leachate Chemical Testing Results

Contaminant	No. of Samples	Range of Concentrations (µg/l)	Generic Screening level (µg/l)	No. of Exceedances
Copper	5	5.90 – 37.00	1.00	5
Lead	5	1.20 – 6.70	1.20	4

- 10.7 Although exceedances of mercury and cyanide were noted, this is due to the screening criteria being below the laboratory limits of detection; as such, they have not been considered as exceedances.
- 10.8 The recorded concentrations of copper and lead are marginally above the applied screening criteria. Given the anticipated end use of the site and the likelihood of a significant area of the site being covered by hardstanding, rainwater infiltration rates will be significantly reduced.
- 10.9 As no source of contamination has been identified within soils on site, the above exceedances have been attributed to naturally elevated background levels.

Groundwater

- 10.10 A summary of the groundwater concentrations and adopted guideline concentrations are presented within **Appendix 13**; exceedances of the groundwater results are presented in **Table 12** below.

Table 12 Summary of Groundwater Chemical Testing Results

Contaminant	No. of Samples	Range of Concentrations (µg/l)	Generic Screening level (µg/l)	No of Exceedances
Copper	6	2.50 – 10.00	1.0	6
Nickel	6	1.40 – 12.00	4.0	4

- 10.11 Although exceedances of benzo(a)pyrene and fluoranthene were noted, this is due to the screening criteria being below the laboratory limits of detection; as such, they have not been considered as exceedances.
- 10.12 The recorded concentrations are only marginally higher than the applied water quality standards for copper and nickel and therefore are still considered to be at acceptable concentrations.
- 10.13 As no source of contamination has been identified within soils on site, the above exceedances have been attributed to naturally elevated background levels.

Surface Water

- 10.14 No surface water monitoring was conducted as part of this ground investigation.

Summary

- 10.15 Based on the above findings it is considered that the recorded contaminant concentrations do not pose an unacceptable risk to controlled waters receptors.

11 ENVIRONMENTAL RISK ASSESSMENT

- 11.1 An updated assessment of identified pollutant linkages has been made following completion of a ground investigation. The preliminary risk assessment presented in **Section 3** has been updated in the light of the findings of the ground investigation and the revised conceptual site model developed, as presented in **Table 13**.

Sources

- Marginally elevated carbon dioxide concentrations.

Pathway

- Accumulation and inhalation of ground gases within new development.

Receptor

- Future site users.

Summary of Potentially Significant Pollutant Linkages

- 11.2 The potentially significant pollutant linkages are summarised below.

Potential Accumulation of Hazardous Ground Gas to Future Site Users

- 11.3 There is a risk that carbon dioxide concentrations could accumulate within enclosed spaces within the proposed development and present a risk to future site users through asphyxiation.
- 11.4 The recorded concentrations indicate that the site is categorised as a CS2 site, whereby enhanced ground gas protection measures are required to mitigate against the risk.
- 11.5 Ground gas protection measures should be installed in accordance with CIRIA C735 and verified by an accredited third party.

Table 13 *Revised Conceptual Site Model*

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-Site Sources Natural soil conditions of the Hummocky Glacial Deposits.	P1: Vertical migration of contaminants in the soil leachate.	R1: Underlying Secondary A Aquifers	Mi	Lw	L	Leachate assessment has identified minor exceedances in the screening criteria for copper and lead. Given the anticipated end use of the site and the likelihood of extensive hardstanding being incorporated into the development, rainwater rates are likely to be significantly reduced, thus limiting vertical migration.
	P2: Direct contact.	R2: Water utility pipes	Mi	Lw	L	Barrier pipes are not considered to be required as part of the development when considered in the context of the guidance presented as Appendix 14 .
		R3: Buried structures / foundations.	Mi	Lw	L	Soils at the site have been classified as Design Sulphate Class DS-1 and ACEC Class AC-2z for soils and groundwater (assuming mobile groundwater in non-pyritic soils).
	P3: Lateral migration of contaminated groundwater.	R4: Surface water features (culvert/ tertiary/ secondary rivers)	Mi	Lw	L	Groundwater assessment has identified minor exceedances of the screening criteria for copper and nickel. Recorded concentrations are considered to be reflective of background levels and as such are not considered to pose a significant risk to controlled waters receptors.

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-Site Ground gases associated with the Alluvium that bisects the site.	P4: Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide).	R5: Future site users (commercial)	Sv	UI	M/L	Ground gas monitoring has identified the site to be subject to a Characteristic Situation 2 gassing regime, whereby ground gas protection measures will be required.
VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely						
Pollutant Linkage Assessment Summary When considered in the context of the conceptual site model and the historical activities that have taken place at the site (former agricultural activities), the proposed development is considered to pose a moderate to low risk to human health and a low risk to controlled waters. It is considered that the main driver for the risk rating for human health is the potential for marginally elevated carbon dioxide concentrations to accumulate within enclosed spaces.						

12 ENVIRONMENTAL LIABILITY ASSESSMENT AND DEVELOPMENT CONSTRAINTS

Statutory Liability

12.1 The contaminated land regime has implications for those who cause or knowingly permit land to be contaminated, or who own or occupy land that is contaminated.

12.2 Contaminated land is defined in Section 78A(2) of Part IIA of the Environmental Protection Act 1990 as:

'Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under land, that:

- a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- b) Pollution of controlled waters is being or is likely to be, caused'.*

12.3 Harm is defined in Section 78(4) of the Environmental Protection Act 1990 as:

'Harm to the health of living organisms or other interference with ecological systems of which they form part and, in the case of man, includes harm to his property'.

12.4 Once an area of land has been identified as contaminated land, appropriate persons will be identified as being responsible for the cost of cleaning up the land by the enforcing authority. The appropriate person will be liable for all or part of the remediation of the land. Two classes of appropriate person have been identified:

- Class A appropriate persons are those who cause or knowingly permit the pollutants to be in, on or under the land.
- Class B appropriate persons are the owners(s) or occupier(s) of the land.

12.5 Where no Class A appropriate persons can be identified, then Class B appropriate persons may become liable.

12.6 Based on the information available regarding the site, the potential for Statutory Authority action based on 'pollution of controlled waters' or 'significant harm' as defined by Part IIA of the Environmental Protection Act 1990 is considered to be **LOW**.

Third Party Liability

12.7 Based on the information contained in this report, it is the opinion of BWB that the potential for legal action by surrounding landowners, based on the potential for contamination to migrate off-site, is considered to be **LOW** when considering the limited contamination present on site and surrounding land use.

Public Relations

- 12.8 The likelihood of public relations being tarnished due to contamination issues at the site are considered to be **LOW**.

Development Implications

- 12.9 The Alluvium recorded at the base of the streams on site is not anticipated to be suitable as a founding stratum and as such will need removing and replacing with engineered fill to an agreed specification prior to development.
- 12.10 Excavations at the site are likely to exhibit significant instability with running sands prevailing. Where excavations advance below 2.0m, temporary shoring may be required for even short periods. Significant problems with running sands may be encountered below 2.0m (from existing levels) and suitable groundwater control measures such as well pointing/dewatering wells may be required to enable excavations to be dug; it may be that the issue is highly seasonal/subject to inclement weather. Care should be taken to avoid the removal of excessive fines by the pumping process which could lead to further localised and general instability of the area.
- 12.11 Due to the variable topography across the site it is anticipated that earthworks will be required at the site and therefore an Earthworks Strategy will need to be provided prior to development.

13 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- 13.1 Ground conditions were recorded to comprise Topsoil or Made Ground to a maximum depth of 1.10m bgl and 1.40m bgl respectively overlying Hummocky Glacial Deposits to a proven depth of 10.00m bgl. The underlying Glacial Till was recorded to a maximum depth of 15.50m bgl, although the base was unproven.
- 13.2 Head Deposits, as mapped by the BGS, were encountered on site as Alluvium within the base of the two streams between 0.25m and 3.70m bgl.
- 13.3 Groundwater was monitored between 149.63m and 155.02m AOD and is indicated to flow in a northerly direction with a hydraulic gradient of 0.1.

Environmental

- 13.4 Leachate assessment has identified minor exceedances in the screening criteria for copper and lead and groundwater assessment has identified minor exceedances in the screening criteria for copper and nickel; no exceedances were identified by the soil chemical assessment. As such, the soils and groundwater on site are considered to pose a low risk to human health and controlled waters receptors.
- 13.5 Recorded concentrations are considered to be reflective of background levels and are not considered to pose a significant risk to controlled waters receptors. In addition, rainwater infiltration is likely to be significantly reduced given the anticipated end use of the site and the likelihood of extensive hardstanding, thus limiting vertical migration.
- 13.6 Ground gas monitoring has identified the site to be subject to a Characteristic Situation 2 gassing regime, whereby ground gas protection measures will be required; this presents a moderate to low risk to human health receptors.

Geotechnical

- 13.7 Column loads for the proposed development are indicated to be in the region of 500kN; shallow pad foundations taken into the underlying Hummocky Glacial Deposits have been considered the most economically feasible solution, however, this may need to be reviewed if final loadings are significantly higher.
- 13.8 At this stage a design load of 30kN/m² has been assumed for the floor slab. A ground bearing floor slab bearing on to the underlying Hummocky Glacial Deposits or engineered fill represents a potential solution, however, there will be a risk of differential settlement owing to potential variation between the two strata.
- 13.9 Soils at the site have been classified as Design Sulphate Class DS-1 and ACEC Class AC-2z for soils and groundwater (assuming mobile groundwater in non-pyritic soils).
- 13.10 No soakaway testing has been conducted and due to the shallow depth of groundwater it is considered unlikely that soakaways will be feasible at the site.

- 13.11 Excavations at the site are likely to exhibit significant instability with running sands prevailing. Where excavations advance below 2.0m, temporary shoring may be required for even short periods. Significant problems with running sands may be encountered below 2.0m (from existing levels) and suitable groundwater control measures such as well pointing/dewatering wells may be required to enable excavations to be dug; it may be that the issue is highly seasonal/subject to inclement weather. Care should be taken to avoid the removal of excessive fines by the pumping process which could lead to further localised and general instability of the area.
- 13.12 Earthworks are anticipated to be required prior to development due to significant variations in topography across the site.
- 13.13 Based on the variability of the DCP results and the likelihood that earthworks will occur on site, it is recommended that a subgrade CBR value of 3% is adopted.

Recommendations

Environmental

- 13.14 Based on a Characteristic Situation 2 gassing regime and a Type D development a point score of 1.5 within protection measures installed will need to be achieved.
- 13.15 A gas verification plan should be produced and agreed with the regulators before gas protection is installed.

Geotechnical

- 13.16 An Earthworks Strategy will be required to inform the proposed development, detailing specifications for engineered fill.
- 13.17 Contingency arrangements for groundwater control should be considered.

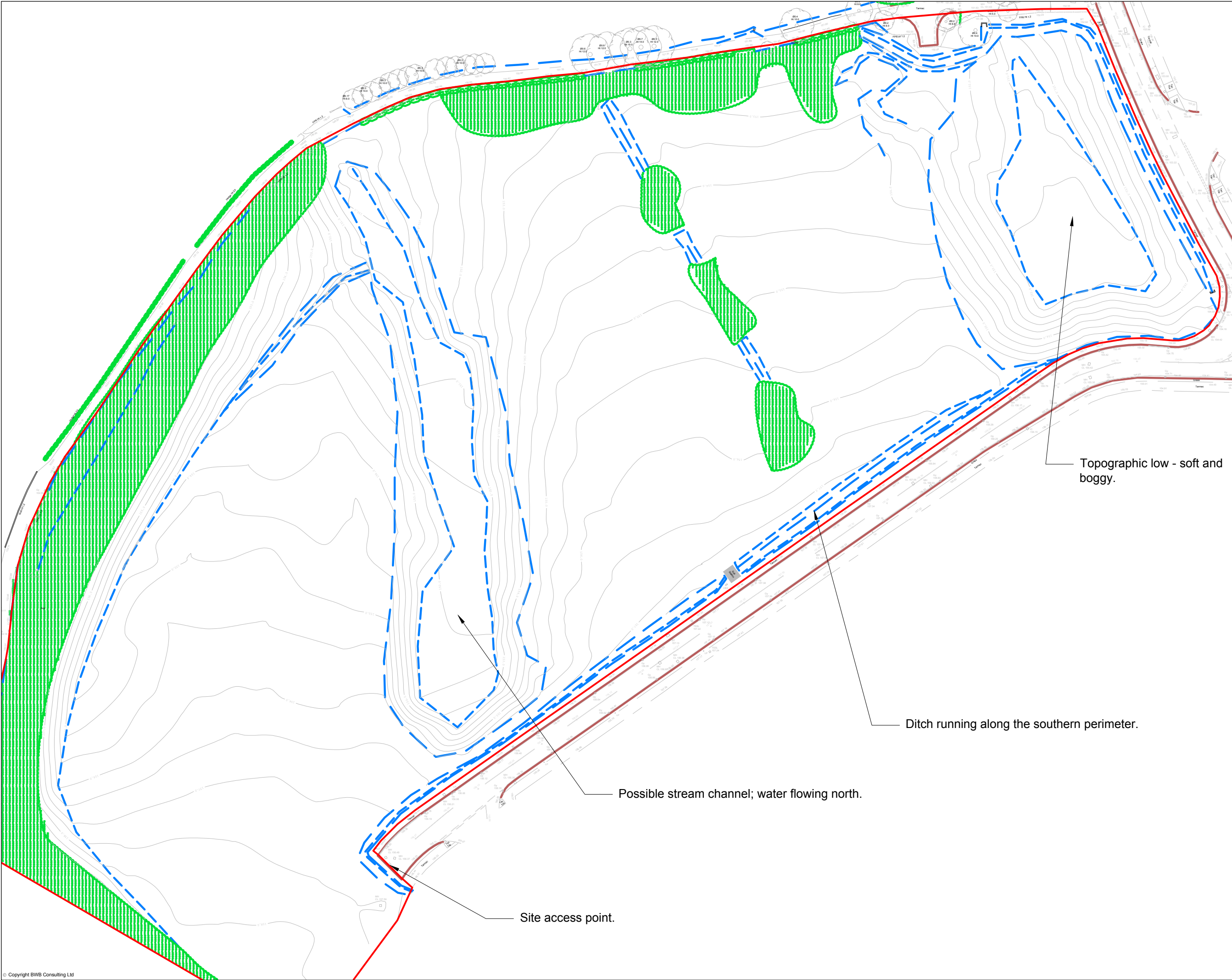
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DRAWINGS

DRAWING 1
SITE LAYOUT PLAN



- Notes**
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Legend

 Site Boundary

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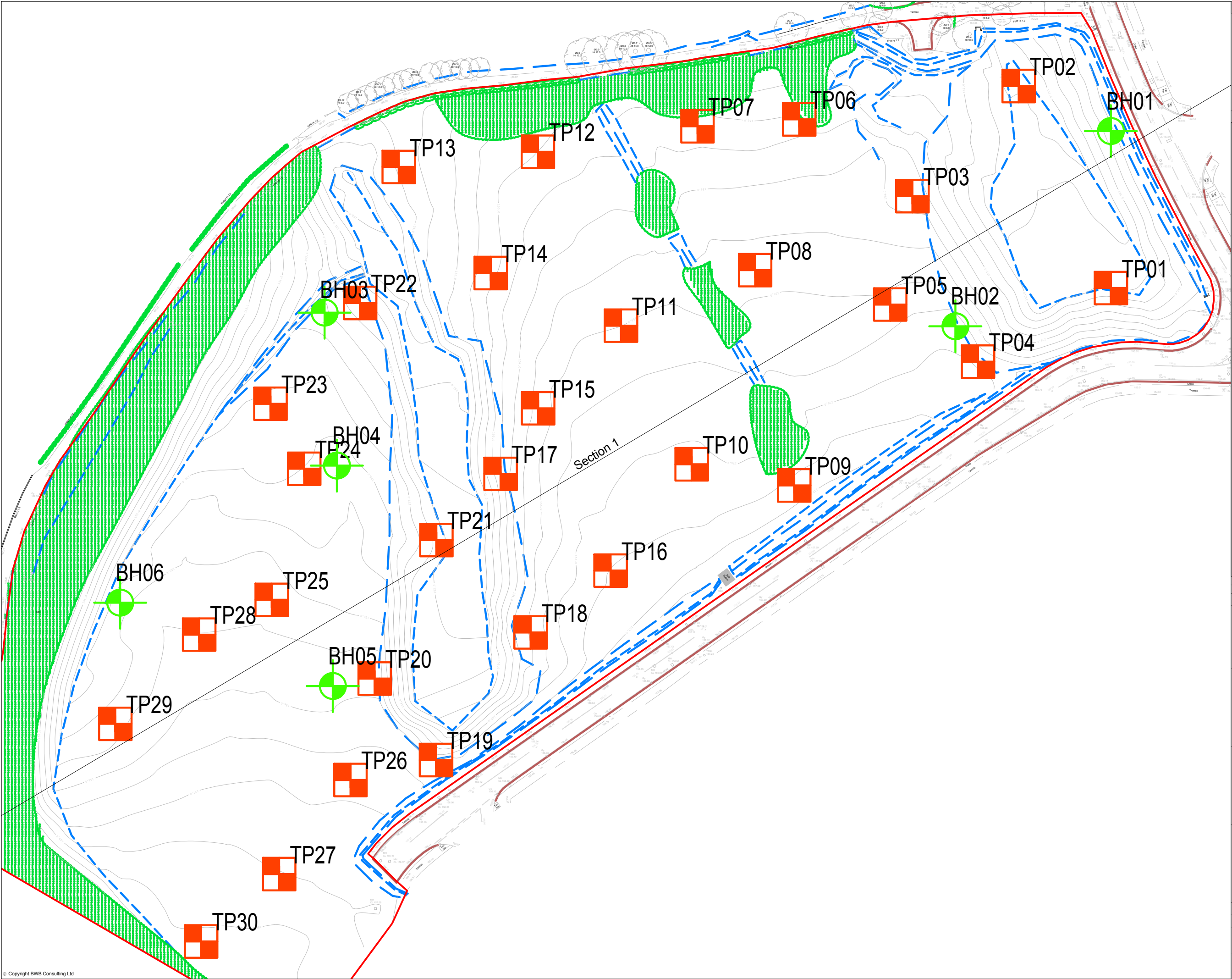
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Drawing Title
SITE LAYOUT

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Drawing Status						
FINAL						
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KBP-BWB-ZJ-XX-DR-YE-0001					P1	V1

DRAWING 2
EXPLORATORY HOLE LOCATION PLAN



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Legend



Site Boundary



BH**
Cable Percussion Borehole



TP**
Trial Pit

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**EXPLORATORY HOLE
LOCATION PLAN**

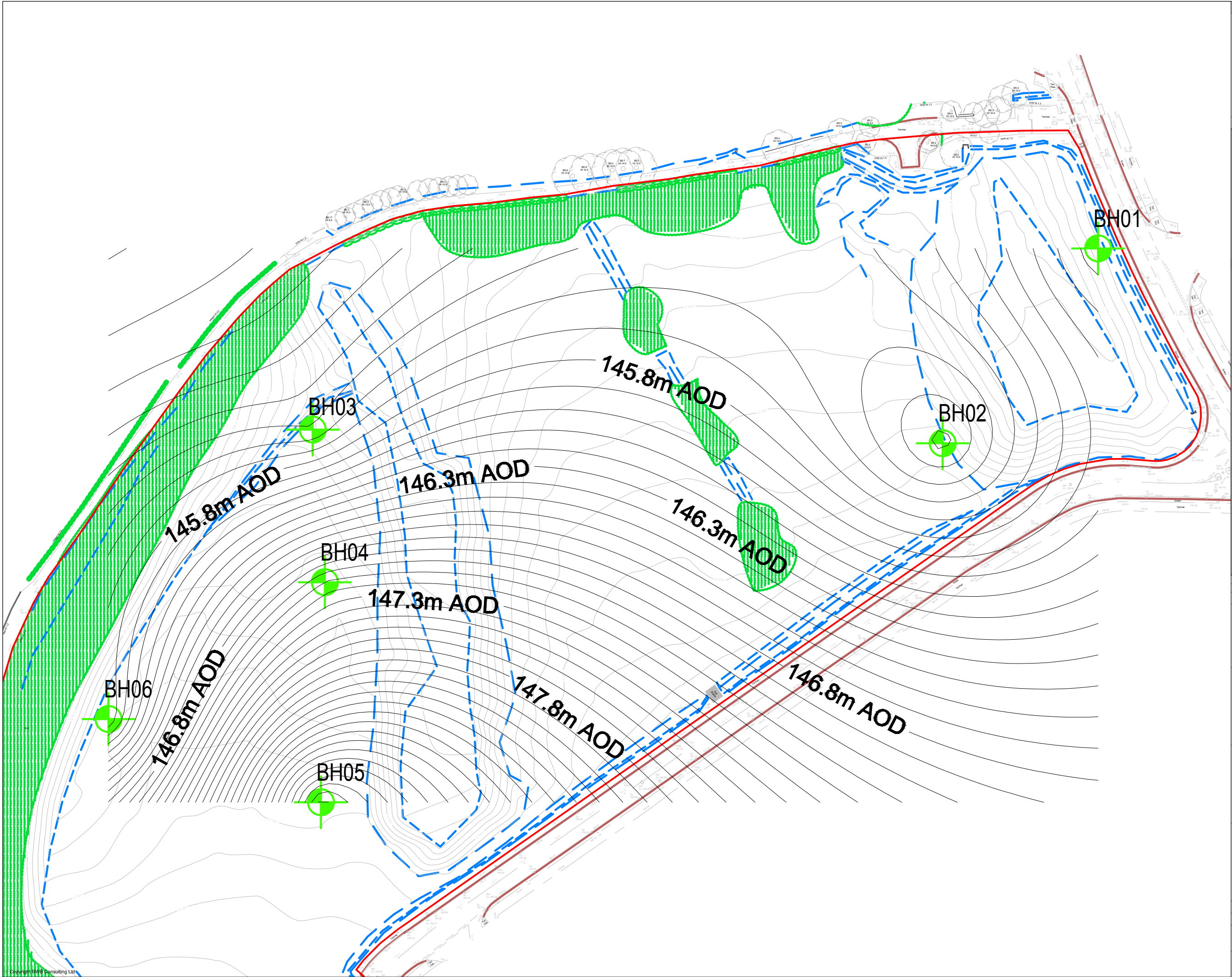
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DRAWING 3
DEPTH TO GLACIAL TILL



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Legend

Site Boundary

BH**
Cable Percussion Borehole

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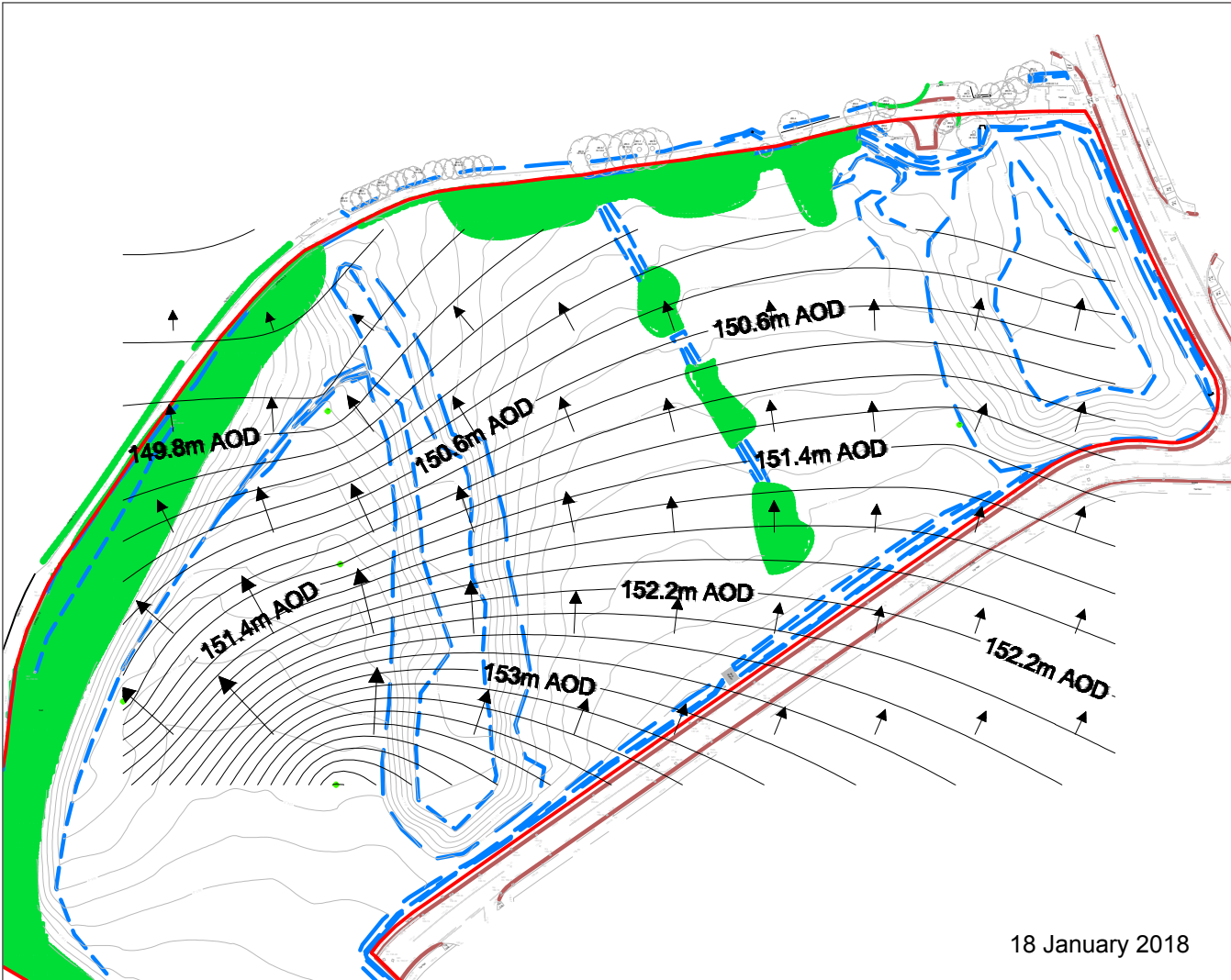
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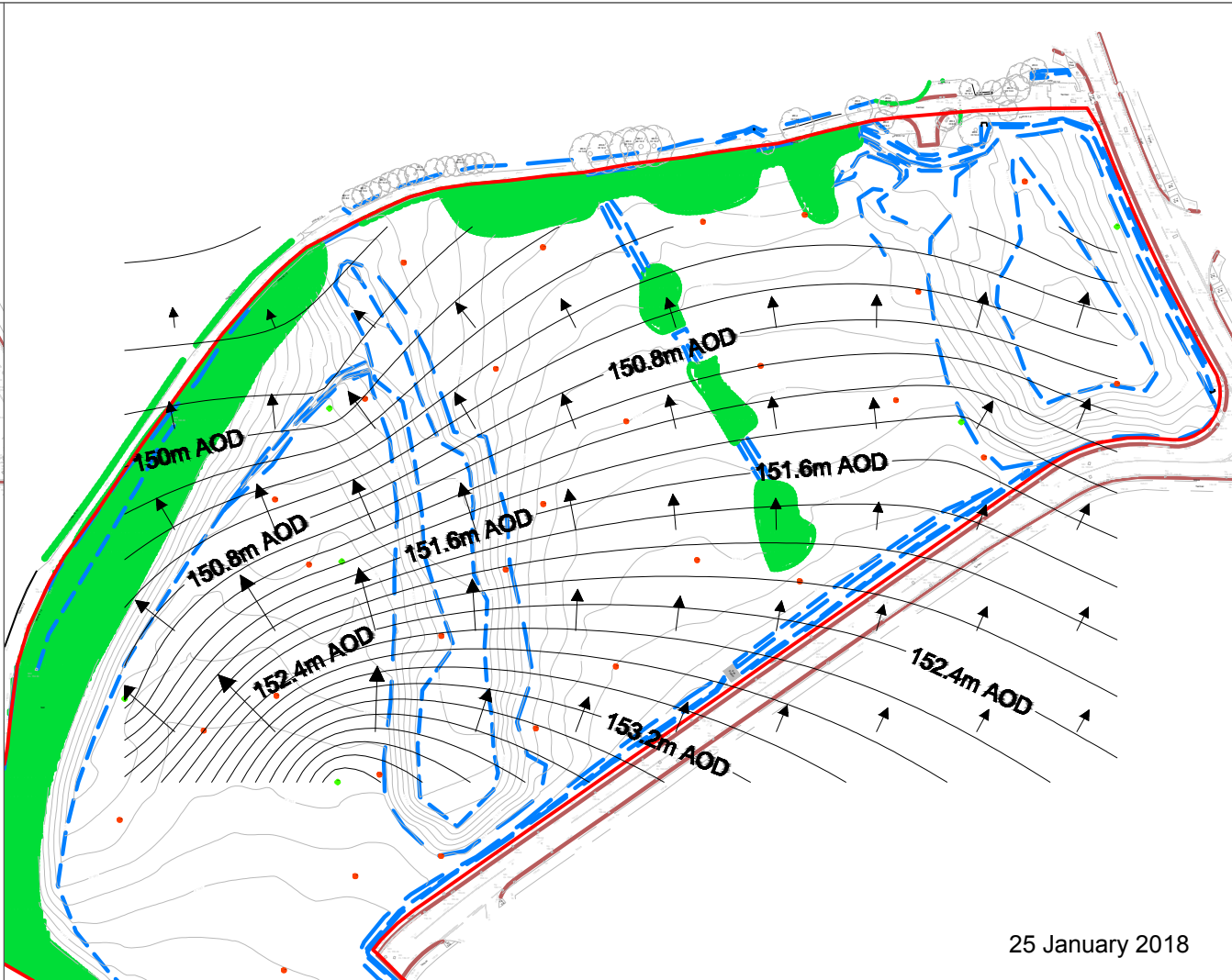
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DEPTH TO GLACIAL TILL

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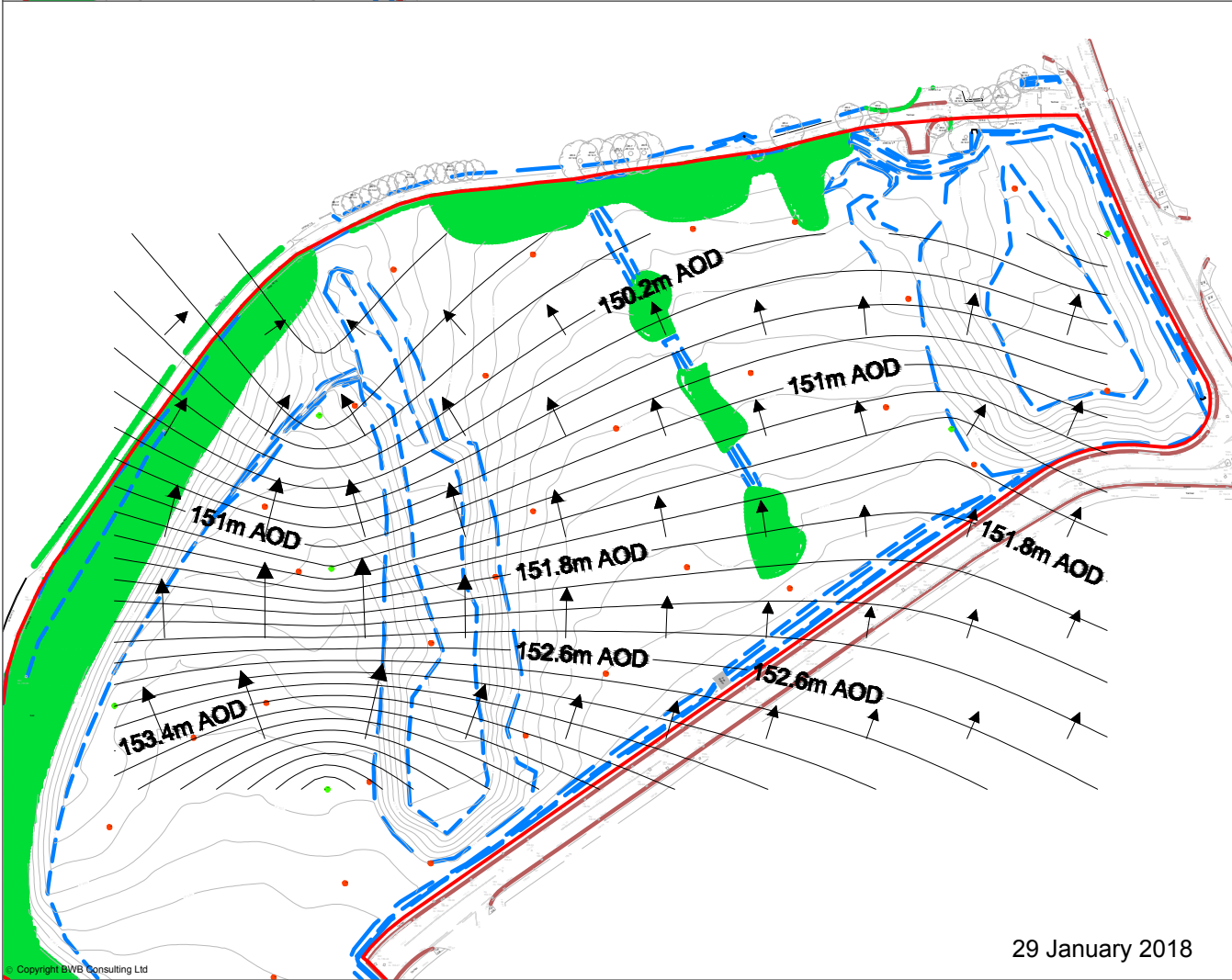
DRAWING 4
GROUNDWATER FLOW PROFILE



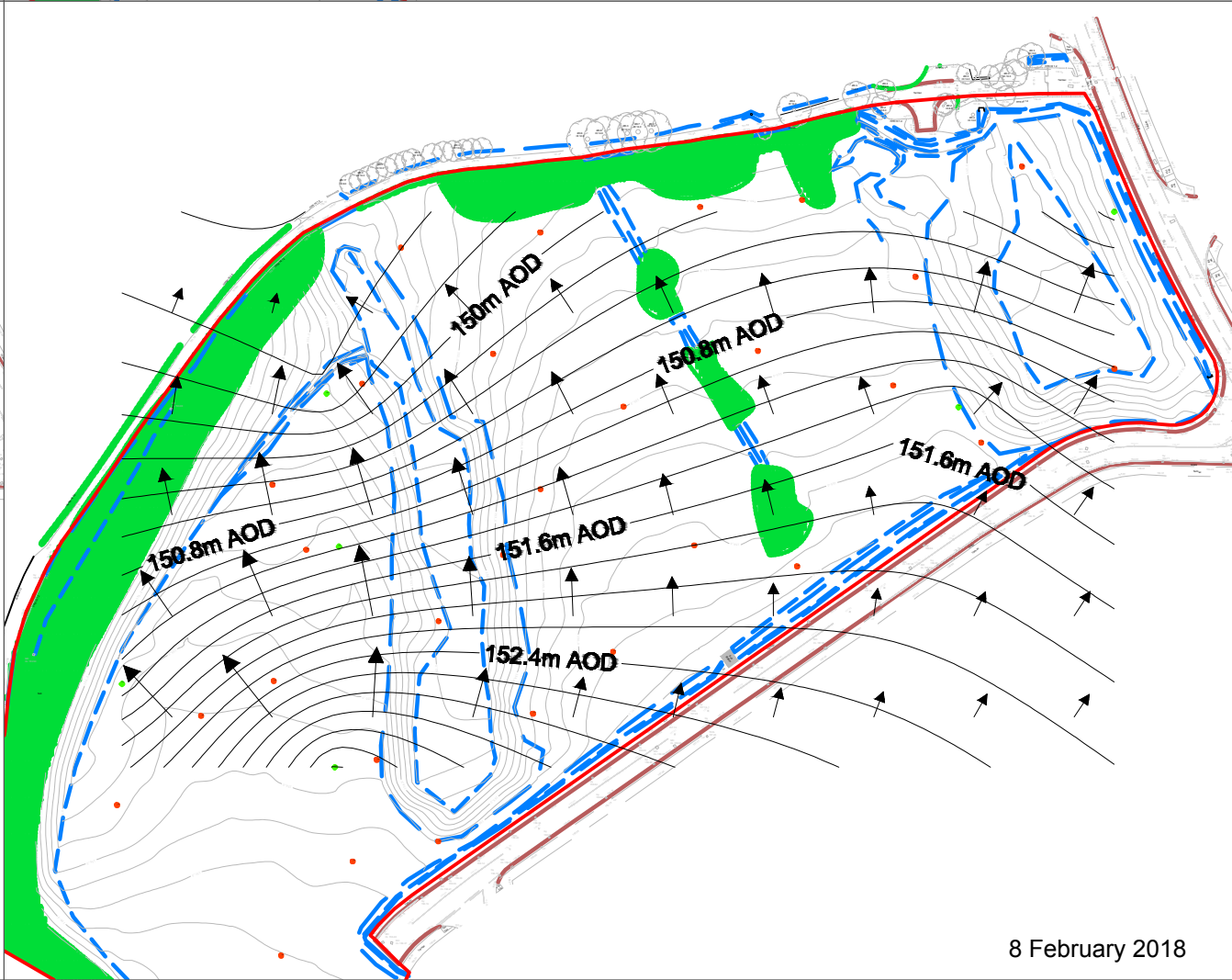
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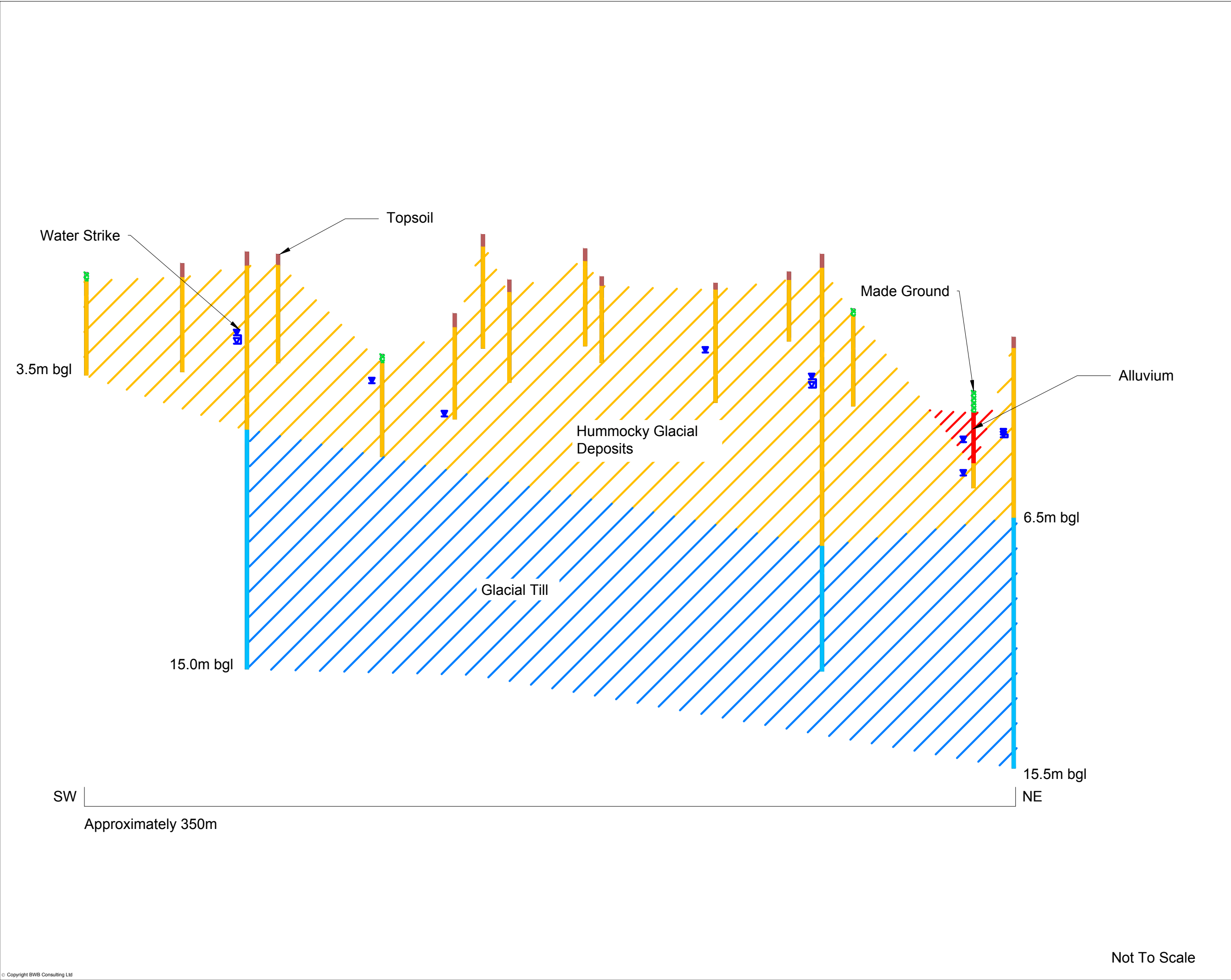
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**GROUNDWATER FLOW
PROFILE**

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SKETCHES

SKETCH 1
GEOLOGICAL CROSS SECTION



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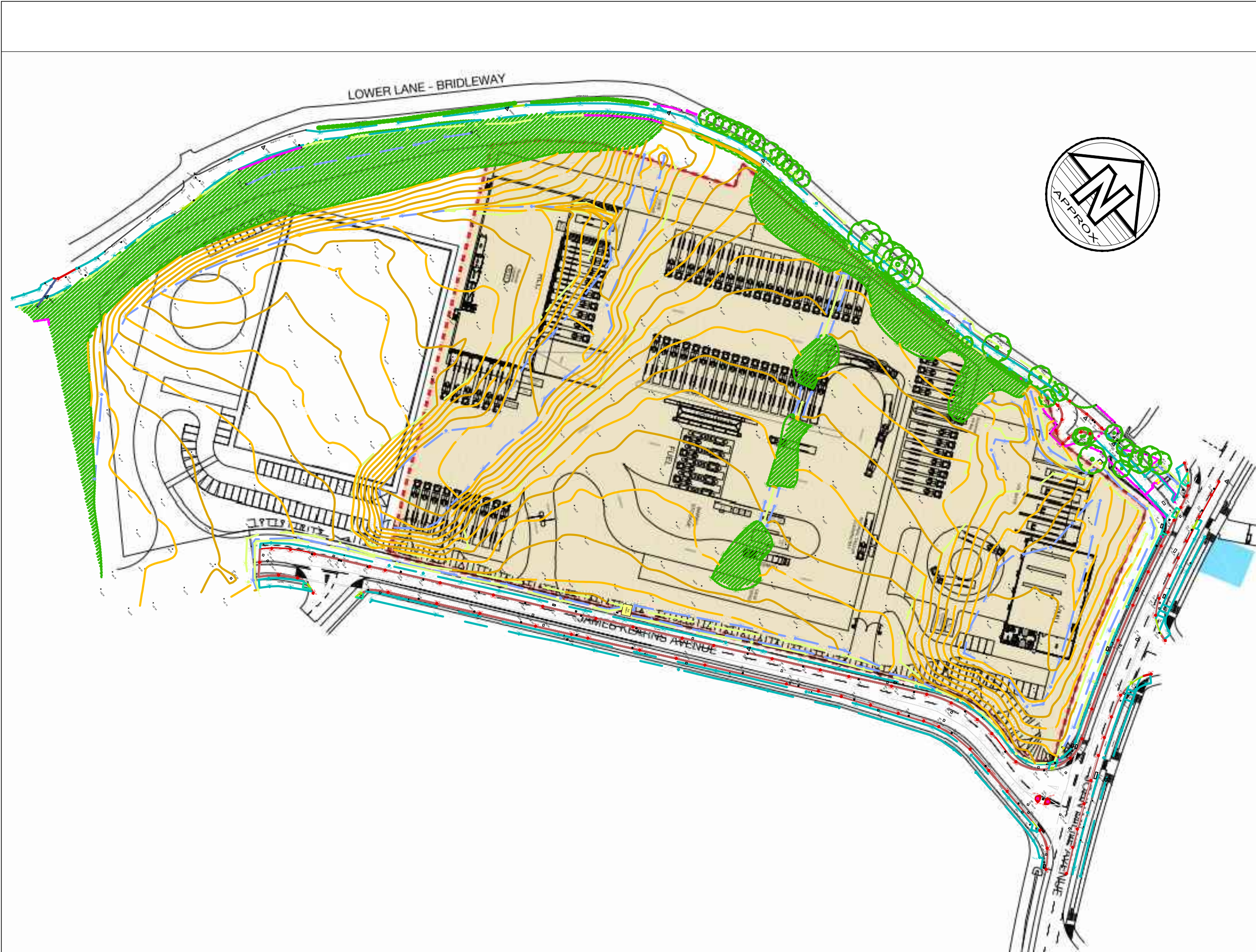
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SKETCH 2

PROPOSED DEVELOPMENT AND PRESENT TOPOGRAPHY



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Client

WILSON BOWDEN
DEVELOPMENTS LTD

Project Title

PLOT J, KINGSWAY
BUSINESS PARK

Drawing Title

PROPOSED
DEVELOPMENT AND
PRESENT TOPOGRAPHY

Drawn: L. WestobyReviewed: x.x

BWB Ref: MCS2374Date: 13/02/18Scale@A3: NTS

Drawing Status

FINAL

Project - Originator - Zone - Level - Type - Role - NumberStatusRev

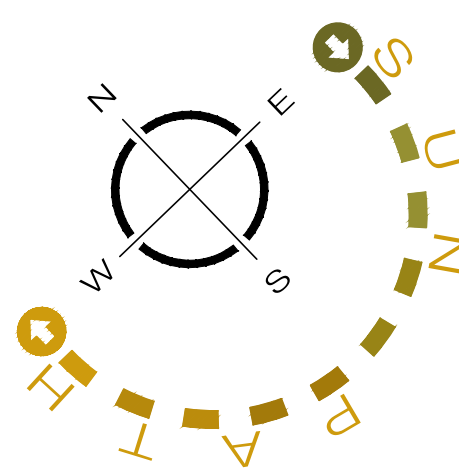
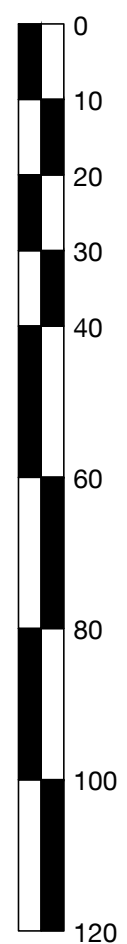
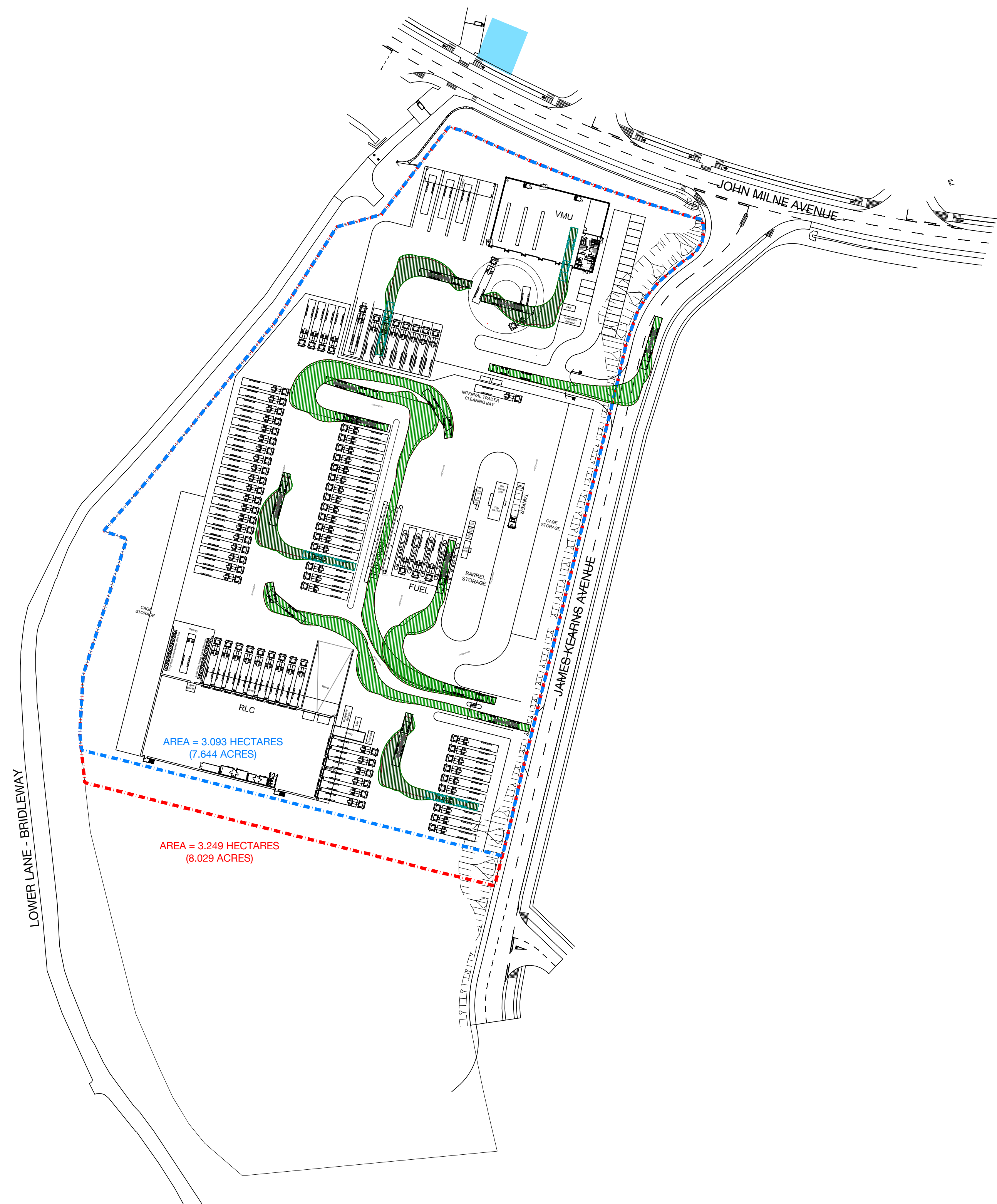
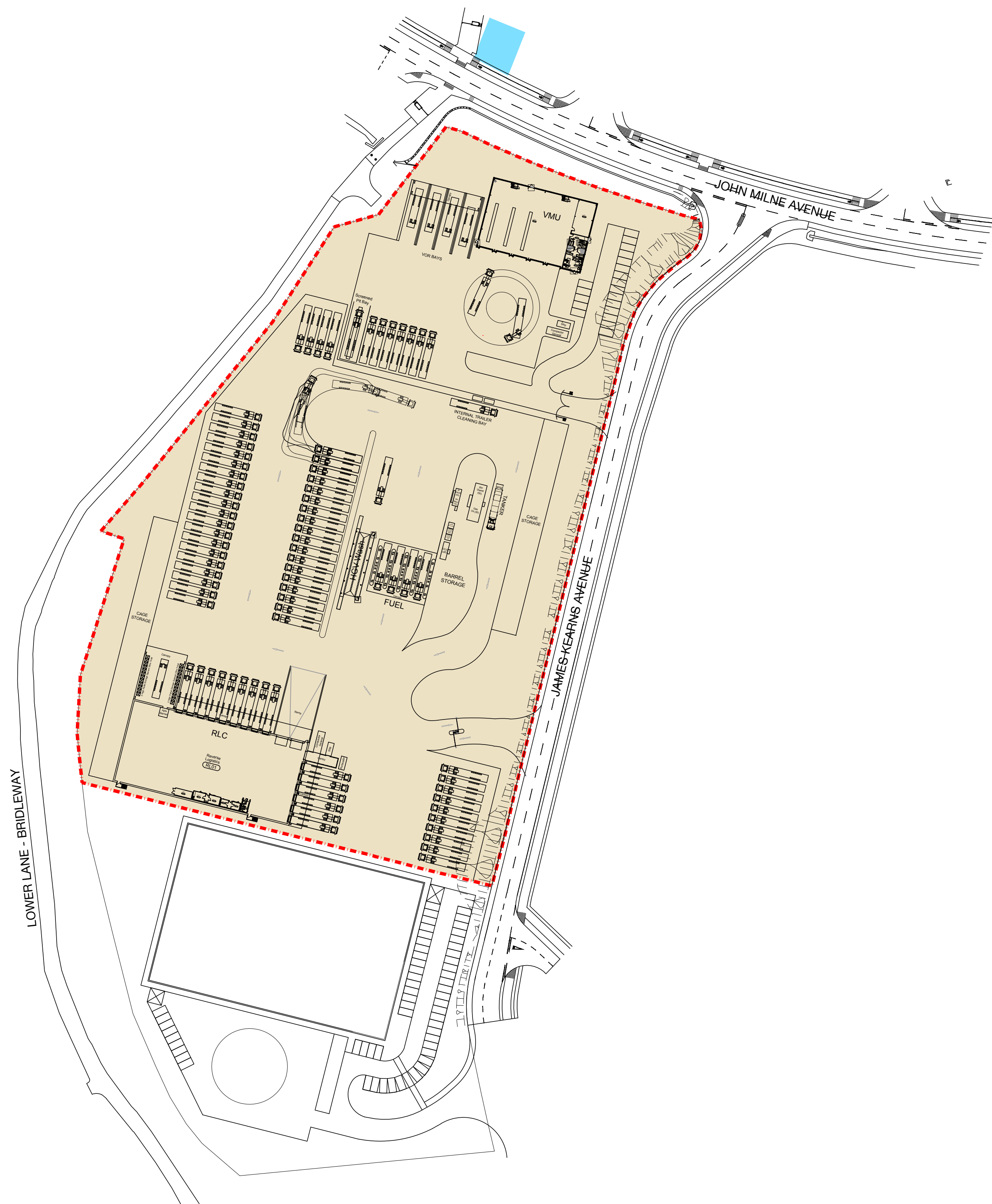
KBP-BWB-ZJ-XX-SK-YE-0002P1V1

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APPENDICES

APPENDIX 1

PROPOSED MASTERPLAN



For Comment

DLA ARCHITECTURE
www.dla-architecture.co.uk
55 St Pauls Street
LEEDS | LS1 2TE
T : 0113 887 3100

PROJECT
KINGSWAY BUSINESS PARK
ROCHDALE

TITLE
MARTIN BROWER ENQUIRY
PLOT J - SITE PLAN

SCALE
1:1000 @ A1

DATE
21/11/17

DRAWN
PSL

REVIEWED
BLG

DRAWING NO
2010-095/1754

REVISION

FILE PATH
T:\2010\2010-095 KINGSWAY GENERAL\CAD\05-Autocad\Drawgs\1754

APPENDIX 2

EXPLORATORY HOLE RECORDS

BOREHOLE LOG

LOCATION ID			Project Name: Plot J, Kingsway Business Park						Ground Level (m AOD): 152.78								
BH01			Project Number: MCS2374						Eastings: 391486.25								
			Client: Wilson Bowden Developments Ltd						Northings: 411534.68								
Hole Type: CP			Rig: Dando 1500			Start & End Date: 08/01/2018 - 09/01/2018			Engineer: LJW			Checker: AD					
Groundwater			Strata						Samples			In-Situ Tests					
Strike	Strike Details	Well	Level (m AOD) & Thickness (m)	Description			Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)		
			[0.40]	Grass over very soft dark brownish grey slightly gravelly sandy CLAY with occasional rootlets. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Topsoil)				0.40									
			152.38 [2.20]	Loose yellowish brown medium and coarse gravelly SAND. Gravel is angular to subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)					D	1.00	1.45	S	1.00	N=8 (2,2/2,2,2,2)	1.00m (NR)		
				Below 2.00m bgl with pockets of very soft orangish brown clay up to 10mm in size.					D	2.00	2.45	S	2.00	N=8 (2,2/2,2,2,2)	2.00m (NR)		
			150.18 [3.90]	Loose yellowish brown slightly gravelly silty SAND. Gravel is angular fine to coarse mudstone and shale. (Hummocky Glacial Deposits)				2.60	D	3.00	3.45	S	3.00	N=7 (2,2/1,2,2,2)	3.00m (NR)		
									D	4.00	4.45	S	4.00	N=5 (1,1/2,1,1,1)	4.00m (NR)		
									D	5.00	5.45	S	5.00	N=6 (1,2/2,1,1,2)	5.00m (NR)		
			146.28 [9.00]	Stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine to coarse mudstone, sandstone and shale. (Glacial Till)				6.50	D	6.50	6.95	S	6.50	N=26 (3,4/4,5,7,10)	6.00m (NR)		
				At 7.50m bgl granite cobble.					B	7.50	7.50						
									D	8.00	8.45	C	8.00	N=21 (3,4/4,5,5,7)	8.00m (NR)		
									U (62)	9.50	9.95						
															</		

BOREHOLE LOG

Scale 1:50

Sheet 2 of 2

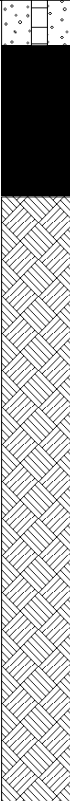
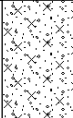
[illegible]

BOREHOLE LOG

LOCATION ID			Project Name: Plot J, Kingsway Business Park							Ground Level (m AOD): 155.76							
BH02			Project Number: MCS2374							Eastings: 391441.36							
			Client: Wilson Bowden Developments Ltd							Northings: 411478.39							
Hole Type: CP			Rig: Dando 1500			Start & End Date: 09/01/2018 - 10/01/2018					Engineer: LJW		Checker: AD				
Groundwater			Strata							Samples			In-Situ Tests				
Strike	Strike Details	Well	Level (m AOD) & (Thickness (m))	Description			Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)		
			[0.50]	Grass over very soft dark brownish grey slightly gravelly sandy CLAY with occasional rootlets. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Topsoil)				0.50	D	0.40							
			155.26 [3.20]	Medium dense orangish brown slightly gravelly medium and coarse SAND. Gravel is subangular fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)					D	1.00	1.45	S	1.00	N=14 (2,3/3,3,4,4)			
				Between 2.50m - 3.70m bgl, clayey bands.					D	2.00	2.45	S	2.00	N=14 (1,3/4,3,4,3)	2.00m (NR)		
									D	3.00	3.45	S	3.00	N=9 (1,1/2,2,2,3)			
			152.06 [1.10]	Medium dense dark orangish brown slightly silty slightly gravelly fine and medium SAND. Gravel is subangular fine to medium siltstone. (Hummocky Glacial Deposits)				3.70	D	4.00	4.45	S	4.00	N=17 (2,3/4,4,4,5)			
			150.96 [3.00]	Loose orangish brown slightly silty slightly gravelly SAND. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)				4.80	D	5.00	5.45	S	5.00	N=6 (1,2/1,2,1,2)			
				Below 6.50m bgl, sand is medium dense.					D	6.50	6.95	S	6.50	N=14 (2,3/3,3,4,4)			
			147.96 [0.70]	Soft dark orangish brown slightly sandy SILT. Sand is fine. (Hummocky Glacial Deposits)				7.80	D	8.00	8.45	S	8.00	N=6 (1,1/1,1,2,2)			
			147.26 [2.00]	Medium dense orangish brown slightly silty slightly gravelly SAND. Gravel is subangular and subrounded fine sandstone and quartz. (Hummocky Glacial Deposits)				8.50	D	9.50	9.95	S	9.50	N=14 (2,2/3,3,4,4)			
Chiseling			Remarks							Legend							
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:							Sample Type:		Groundwater:		In-Situ Tests			
			Target depth achieved.							B - Bulk		Groundwater		C - Cone Penetration Test			
			Groundwater Remarks:							C - Core		Strike		HSV - Hand Shear Vane Test			
			Groundwater encountered at 4.80m bgl, rising to 4.50m bgl after 20 minutes.							D - Disturbed		Resting		PID - Photo Ionisation			
										ES - Environmental		Groundwater		Detection Screen			
										Sample		NR = Not		S - Standard Penetration			
										U - Undisturbed		Recorded		Test			
Water Added			Other Remarks:							BWB Consulting Ltd		Web:		BWB			
From (m bgl)	To (m bgl)	Volume (l)	1. No visual or olfactory evidence of contamination.							Waterfront House		bwbconsulting.com		CONSULTANCY ENVIRONMENT			
										Station Street		P: 0115 9241100		INFRASTRUCTURE BUILDINGS			
										Nottingham		E: nottingham					
										NG2 3DQ		@bwbconsulting.com					

Scale 1:50

Sheet 2 of 2

LOCATION ID		Project Name: Plot J, Kingsway Business Park							Ground Level (m AOD): 155.76					
BH02		Project Number: MCS2374							Eastings: 391441.36					
		Client: Wilson Bowden Developments Ltd							Northings: 411478.39					
Hole Type: CP		Rig: Dando 1500			Start & End Date: 09/01/2018 - 10/01/2018				Engineer: LJW		Checker: AD			
Groundwater			Strata					Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description		Legend	Depth (m bgl)	Type (Ublows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			145.26 [1.00]	Medium dense orangish brown slightly silty slightly gravelly SAND. Gravel is subangular and subrounded fine sandstone and quartz. (Hummocky Glacial Deposits)			10.50	D	10.50					
				Firm greyish brown slightly sandy SILT. Sand is fine and medium. (Glacial Till)				B	11.00	11.20				
			144.26 [3.50]	Very stiff greyish brown slightly gravelly sandy CLAY. Gravel is subangular fine and medium granite, mudstone and siltstone. (Glacial Till)			11.50	D	11.50	11.95	S	11.50	N=46 (12,7/8,11,13,14)	
								U	13.00	13.35				
								D	13.40					
								D	14.50	14.95	S	14.50	N=51 (7,8/11,12,13,15)	
			140.76	Hole Terminated at 15.00m bgl.			15.00							

BOREHOLE LOG

Scale 1:50

Sheet 1 of 2

LOCATION ID		Project Name: Plot J, Kingsway Business Park							Ground Level (m AOD): 152.71						
BH03		Project Number: MCS2374							Eastings: 391259.31						
		Client: Wilson Bowden Developments Ltd							Northings: 411482.30						
Hole Type: CP		Rig: Dando 1500			Start & End Date: 10/01/2018 - 11/01/2018				Engineer: LJW		Checker: AD				
Groundwater			Strata						Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & (Thickness (m))	Description			Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[0.50]	Grass over soft dark grey slightly gravelly sandy CLAY with abundant rootlets. Gravel is subangular and subrounded fine to coarse sandstone and quartz.					D	0.20					
			152.21 [1.50]	(Topsoil) Loose reddish brown gravelly very silty SAND with occasional black mottling, rare wood fragments up to 10mm in size and rare rootlets. Gravel is subangular and subrounded fine to coarse flint, sandstone and quartz. (Hummocky Glacial Deposits)				0.50	D	0.50					
									D	1.00	1.45	S	1.00	N=6 (1,0/1,1,2,2)	
			150.71 [2.10]	Firm orangish brown slightly gravelly sandy SILT with occasional black speckling. Gravel is subangular and subrounded fine and medium flint, sandstone and quartz. (Hummocky Glacial Deposits)				2.00	D	2.00	2.45	S	2.00	N=10 (1,1/2,2,3,3)	
									D	3.00	3.45	S	3.00	N=7 (1,0/1,2,2,2)	
				Below 3.00m bgl, becoming greyish brown and soft.											
									B	4.00	4.45	S	4.00	N=17 (2,3/3,4,5,5)	
			148.61 [3.10]	Medium dense light orangish brown slightly silty fine and medium SAND. (Hummocky Glacial Deposits)				4.10	D	4.00	4.45				
									D	5.00	5.45	S	5.00	N=23 (3,4/5,6,6,6)	
				Below 5.00m bgl, sand is fine to coarse.											
									D	6.50	6.95	S	6.50	N=19 (2,3/4,5,5,5)	
				Below 6.50m bgl, fine to coarse sand.											
			145.51 [7.80]	Stiff greyish brown slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine to coarse granite sandstone and siltstone. (Glacial Till)				7.20	U	8.00	8.45				
									D	8.50					
									D	9.50	9.95	S	9.50	N=20 (2,3/4,5,5,6)	
Chiseling			Remarks						Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)													
			Reason for Termination: Target depth achieved.						Sample Type: B - Bulk C - Core D - Disturbed ES - Environmental Sample U - Undisturbed						
Groundwater Remarks:			No groundwater encountered.						Groundwater: Groundwater Strike Resting Groundwater NR = Not Recorded						
Water Added			Other Remarks: 1. No visual or olfactory evidence of contamination.						In-Situ Tests C - Cone Penetration Test HSV - Hand Shear Vane Test PID - Photo Ionisation Detection Screen S - Standard Penetration Test						
From (m bgl)	To (m bgl)	Volume (l)													
									BWb Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ						
									Web: bwbcconsulting.com P: 0115 9241100 E: nottingham@bwbcconsulting.com						
									BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDING						

BOREHOLE LOG

Scale 1:50

Sheet 2 of 2

[illegible]

Scale 1:50

Sheet 1 of 2

LOCATION ID			Project Name: Plot J, Kingsway Business Park					Ground Level (m AOD): 154.31						
BH04			Project Number: MCS2374					Eastings: 391262.85						
			Client: Wilson Bowden Developments Ltd					Northings: 411438.20						
Hole Type: CP			Rig: Dando 1500		Start & End Date: 09/01/2018 - 10/01/2018			Engineer: LJW		Checker: AD				
Groundwater			Strata					Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & (Thickness (m))	Description	Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)	
			[0.80]	Soft dark brownish grey slightly gravelly sandy SILT with occasional rootlets. Gravel is subangular and subrounded fine and medium flint quartz. (Topsoil)			D	0.30						
			153.51 [3.00]	Medium dense reddish brown silty gravelly SAND with rare black mottling. Gravel is subangular and subrounded fine to coarse flint, granite, siltstone and quartz. (Hummocky Glacial Deposits)		0.80	B D	1.00 1.00	1.45 1.45	S	1.00	N=20 (8,12/7,5,4,4)		
							U	2.00	2.45					
							D	2.50						
				Below 3.00m bgl, loose sand.			D	3.00	3.45	S	3.00	N=4 (1,0/0,1,1,2)		
			150.51 [3.40]	Loose reddish brown slightly gravelly silty fine and medium SAND with rare black speckling. Gravel is subangular and subrounded fine to coarse quartz. (Hummocky Glacial Deposits)		3.80	D	4.00	4.45	S	4.00	N=7 (1,0/1,2,2,2)		
				Below 5.00m bgl, medium dense sand.			D	5.00	5.45	S	5.00	N=14 (1,2/2,3,4,5)		
				Below 5.50m bgl, gravel is fine to medium granite, shale and quartz.										
				Below 6.50m bgl, fine to coarse sand and gravel is subrounded fine to coarse.			D	6.50	6.95	S	6.50	N=18 (2,3/3,4,5,6)		
			147.11 [7.80]	Stiff dark reddish brown slightly gravelly sandy CLAY. Gravel is subangular fine to coarse granite, mudstone and siltstone. (Glacial Till)		7.20	U	8.00	8.45					
							D	8.50						
				Below 9.50m bgl, very stiff.			D	9.50	9.95	S	9.50	N=32 (2,3/5,9,10,8)		
Chiseling			Remarks					Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)												
			Reason for Termination: Target depth achieved. Groundwater Remarks: No groundwater encountered.					Sample Type: B - Bulk C - Core D - Disturbed ES - Environmental Sample U - Undisturbed Groundwater: Groundwater Strike Resting Groundwater NR = Not Recorded In-Situ Tests C - Cone Penetration Test HSV - Hand Shear Vane Test PID - Photo Ionisation Detection Screen S - Standard Penetration Test						
Water Added														
From (m bgl)	To (m bgl)	Volume (l)	Other Remarks: 1. No visual or olfactory evidence of contamination. 2. Groundwater obscured by drilling, groundwater encountered on second day at 2.80m bgl.					BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ Web: bwbconsulting.com P: 0115 9241100 E: nottingham@bwbconsulting.com						

Scale 1:50

[illegible]

BOREHOLE LOG

LOCATION ID			Project Name: Plot J, Kingsway Business Park					Ground Level (m AOD): 155.84						
BH05			Project Number: MCS2374					Eastings: 391261.67						
			Client: Wilson Bowden Developments Ltd					Northings: 411374.64						
Hole Type: CP			Rig: Dando 1500		Start & End Date: 08/01/2018			Engineer: LJW		Checker: AD				
Groundwater			Strata					Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & (Thickness (m))	Description		Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[0.50]	Grass over dark brown slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse granite and quartz.				D	0.20	0.20				
			155.34 [2.80]	(Topsoil) Loose orangish brown gravelly very silty SAND. Gravel is angular to subrounded fine to coarse sandstone and quartzite. (Hummocky Glacial Deposits)			0.50	D	0.50	0.50				
								D	1.00	1.45	S	1.00	N=6 (1,0/1,1,2,2)	0.00m (NR)
								D	2.00	2.45	S	2.00	N=7 (1,1/2,1,2,2)	2.00m (NR)
								D	3.00	3.45	S	3.00	N=8 (1,0/2,2,2,2)	3.00m (NR)
			152.54 [2.10]	Soft brown sandy CLAY (Hummocky Glacial Deposits)			3.30							
				Below 4.00m bgl, firm.				D	4.00	4.45	S	4.00	N=10 (1,1/2,2,3,3)	4.00m (2.70m bgl)
								D	5.00	5.45	S	5.00	N=15 (2,2/3,4,4,4)	5.00m (3.30m bgl)
			150.44 [1.00]	Firm brown slightly gravelly very sandy SILT with rare roots. Gravel is angular and subangular fine and medium mudstone and shale. (Hummocky Glacial Deposits)			5.40	B	5.50	6.00				
			149.44 [8.60]	Firm dark brown slightly sandy slightly gravelly CLAY with occasional pockets of sandy clay up to 15mm in size. Gravel is angular to subrounded fine to coarse mudstone and shale. (Glacial Till)			6.40	U (40)	6.50	6.95				
								D	7.00	7.00				
								D	8.00	8.45	S	8.00	N=16 (2,3/3,4,4,5)	8.00m (NR)
								U (65)	9.50	9.95				
Chiseling			Remarks					Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:					Sample Type:		Groundwater:		In-Situ Tests		
			Target depth achieved.					B - Bulk		Groundwater Strike		C - Cone Penetration Test		
			Groundwater Remarks:					C - Core		Resting		HSV - Hand Shear Vane Test		
			Groundwater encountered at 3.30m bgl, rising to 2.70m bgl after 20 minutes.					D - Disturbed		Groundwater NR = Not Recorded		PID - Photo Ionisation Detection Screen		
			Other Remarks:					ES - Environmental Sample				S - Standard Penetration Test		
			1. No visual or olfactory evidence of contamination.					U - Undisturbed						
Water Added			BWB Consulting Ltd					Web:		bwbconsulting.com		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS		
From (m bgl)	To (m bgl)	Volume (l)	Waterfront House					P: 0115 9241100						
			Nottingham					E: nottingham						
			NG2 3DQ					@bwbconsulting.com						

BOREHOLE LOG

LOCATION ID		Project Name: Plot J, Kingsway Business Park					Ground Level (m AOD): 155.84							
BH05		Project Number: MCS2374					Eastings: 391261.67							
		Client: Wilson Bowden Developments Ltd					Northings: 411374.64							
Hole Type: CP		Rig: Dando 1500			Start & End Date: 08/01/2018			Engineer: LJW		Checker: AD				
Groundwater			Strata					Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & Thickness (m)	Description	Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)	
				Firm dark brown slightly sandy slightly gravelly CLAY with occasional pockets of sandy clay up to 15mm in size. Gravel is angular to subrounded fine to coarse mudstone and shale. (Glacial Till)			D	10.00	10.00					
							D	11.00	11.45	S	11.00	N=22 (2,4/4,5,6,7)	9.00m (NR)	
							U (90)	12.50	12.95					
							D	13.00	13.00					
							D	14.50	14.95	S	14.50	N=31 (2,1/5,7,9,10)	9.00m (NR)	
			140.84	Hole Terminated at 15.00m bgl.		15.00								
Chiseling			Remarks					Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:					Sample Type:		Groundwater:		In-Situ Tests		
			Target depth achieved.					B - Bulk		Groundwater		C - Cone Penetration Test		
			Groundwater Remarks:					C - Core		Strike		HSV - Hand Shear Vane Test		
			Groundwater encountered at 3.30m bgl, rising to 2.70m bgl after 20 minutes.					D - Disturbed		Resting		PID - Photo Ionisation Detection Screen		
								ES - Environmental Sample		Groundwater		NR = Not Recorded		
								U - Undisturbed				S - Standard Penetration Test		
Water Added			Other Remarks:					BWB Consulting Ltd		Web:				
From (m bgl)	To (m bgl)	Volume (l)	1. No visual or olfactory evidence of contamination.					Waterfront House		bwiconsulting.com				
								Station Street		P: 0115 9241100				
								Nottingham		E: nottingham				
								NG2 3DQ		@bwiconsulting.com				

BOREHOLE LOG

LOCATION ID		Project Name: Plot J, Kingsway Business Park				Ground Level (m AOD): 155.00							
BH06		Project Number: MCS2374				Eastings: 391200.32							
		Client: Wilson Bowden Developments Ltd				Northings: 411398.68							
Hole Type: CP		Rig: Dando 1500		Start & End Date: 11/01/2018 - 12/01/2018		Engineer: TY		Checker: AD					
Groundwater			Strata				Samples		In-Situ Tests				
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description	Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[0.70]	Grass over dark brown slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse granite and quartz. (Topsoil)			D	0.20					
			154.29 [2.30]	Loose orangish brown slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse granite and quartz. (Hummocky Glacial Deposits)		0.70	D	0.70					
							D	1.00	1.45	S	1.00	N=7 (1,0/1,2,2,2)	
							D	2.00	2.45	S	2.00	N=6 (1,1/1,1,2,2)	
				Below 2.00m bgl, gravel includes sandstone.									
			152.00 [3.20]	Loose yellowish brown slightly silty slightly gravelly SAND. Gravel is angular to subangular fine to medium granite and shale. (Hummocky Glacial Deposits)		3.00	D	3.00	3.45	S	3.00	N=7 (1,1/2,2,1,2)	
							B	4.00	4.45	S	4.00	N=14 (2,2/3,3,4,4)	
				Below 4.00m bgl, medium dense sand, gravel includes sandstone.			D	4.00	4.45				
							B	5.00	5.45	S	5.00	N=12 (1,2/2,3,3,4)	
				Between 5.70m - 6.20m bgl, Band of stiff brown sandy clay.									
			148.79 [3.10]	Medium dense brown slightly silty slightly gravelly SAND. Gravel is angular to subangular fine to coarse granite and sandstone. (Hummocky Glacial Deposits)		6.20	D	6.50	6.95	S	6.50	N=23 (2,3/4,6,6,7)	
				Below 8.00m bgl, gravel is fine to medium.			D	8.00	8.45	S	8.00	N=27 (3,4/5,6,8,8)	
			145.70 [5.70]	Stiff dark grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium mudstone.		9.30	D	9.50	9.95	S	9.50	N=23 (2,3/4,6,6,7)	
Chiseling			Remarks				Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:				Sample Type:		Groundwater:		In-Situ Tests		
			Target depth achieved.				B - Bulk		Groundwater Strike		C - Cone Penetration Test		
			Groundwater Remarks:				C - Core		Resting		HSV - Hand Shear Vane Test		
			No groundwater encountered.				D - Disturbed		Groundwater NR = Not Recorded		PID - Photo Ionisation Detection Screen		
Water Added			Other Remarks:				ES - Environmental Sample				S - Standard Penetration Test		
From (m bgl)	To (m bgl)	Volume (l)	1. No visual or olfactory evidence of contamination.				U - Undisturbed						
			2. Groundwater obscured by drilling, groundwater recorded on second day at 4.00m bgl.				BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com P: 0115 9241100 E: nottingham@bwbconsulting.com		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS		

BOREHOLE LOG

Scale 1:50

Sheet 2 of 2

[illegible]

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP01	Project Name: Plot J, Kingsway Business Park		2.35 Pit Dimensions (m) Degrees		
	Project Number: MCS2374				
	Client: Wilson Bowden Developments Ltd				
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 09/01/2018		Stability: Unstable
Ground Level (m AOD): 151.92		Eastings & Northings: 391486E 411489N		Engineer: LJW	Checker: AD

Groundwater		Strata				Samples			In-Situ Tests				
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			151.67	0.25m	Grass over very soft dark brownish grey slightly gravelly sandy CLAY with abundant rootlets and slight organic odour. Gravel is subangular and subrounded fine to coarse quartz. (Topsoil)		0.25	D ES	0.75	0.85	0.80	0.80	(17)kPa (20)kPa (26)kPa
			1.10m	Soft brownish grey sandy CLAY with rare plant remains. Sand is fine and medium. (Alluvium)	0.75		0.85		0.80	0.80			
			150.57	2.35m	Brownish grey silty gravelly SAND with rare black mottling, rare wood fragments up to 50mm in size and organic odour. Gravel is subangular and subrounded fine to coarse quartz. (Alluvium)		1.35	B ES	1.75	1.85	1.80	1.80	
							1.75		1.85				
								Below 3.00 bgl slightly gravelly very silty.			B	3.40	3.50
			148.22		Hole Terminated at 3.70m bgl.		3.70						

Remarks		Legend		
Reason for Termination: Target depth achieved.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: Slow inflow noted at 3.40m bgl.				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP02		Project Name: Plot J, Kingsway Business Park			2.65 0.70 Pit Dimensions (m) Degrees		
		Project Number: MCS2374					
		Client: Wilson Bowden Developments Ltd					
Hole Type: TP		Plant: CAT 320 F		Start & End Date: 10/01/2018			
Ground Level (m AOD): 150.85		Eastings & Northings: 391460E 411548N			Stability: Unstable		
					Engineer: LJW		
					Checker: AD		

Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
				0.50m	Grass over very soft dark grey slightly sandy slightly gravelly CLAY with abundant rootlets. Gravel is subrounded fine to coarse quartz.		0.50	ES	0.55	0.65			
			150.35	0.30m	(Made Ground)		0.80						
			150.05	0.35m	Greenish grey mottled orangish brown slightly gravelly very silty SAND with rare material fragments up to 5mm in thickness. Gravel is subrounded fine to coarse quartz.		1.15						
			149.70		(Made Ground)								
				1.45m	Very soft brown slightly sandy slightly gravelly CLAY with abundant wood fragments up to 300m in size. Gravel is subrounded fine to coarse quartz.			B	1.70	1.80			
					(Alluvium)			ES	1.70	1.80			
			148.25		Light bluish grey very sandy GRAVEL with a low subrounded sandstone cobble content and abundant wood fragments up to 0.50m in length. Gravel is subangular and subrounded fine to coarse sandstone and quartz.		2.60						
				0.90m	(Alluvium)			B	3.10	3.20			
			147.35		Below 1.85m bgl, becoming slightly gravelly silty.		3.50						
					Orangish brown silty fine and medium SAND.								
					(Hummocky Glacial Deposits)								
					Hole Terminated at 3.50m bgl.								

Remarks		Legend	
Reason for Termination:		Samples:	
Trial pit unstable.		B - Bulk	
Groundwater Notes:		D - Disturbed	
Seepage noted at 1.85m bgl.		ES - Environmental	
Other Remarks:		Groundwater Strikes:	
1. No visual or olfactory evidence of contamination.		Groundwater Strike	
		Resting	
		Groundwater Level	
		In-Situ Tests:	
		HSV - Hand Shear	
		Vane Test	
		PID - Photo Ionisation	
		Detector Test	
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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP03

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:09/01/2018

Eastings & Northings:391429E 411516N

2.50

0.65

Pit Dimensions (m)

Degrees

Stability: Unstable

Engineer: LJW

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickness

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

153.55

0.25m

Grass over brownish grey clayey gravelly SAND with abundant rootlets. Gravel is angular to subrounded fine to coarse brick and quartzite. (Made Ground)

0.25

ES

0.10

0.20

1.20m

Orangish brown gravelly medium and coarse SAND with occasional roots. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)

1.45

BES

1.00

1.10

152.35

0.75m

Reddish brown clayey gravelly SAND. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)

2.20

151.60

1.30m

Light orange gravelly medium and coarse sand with a low subangular sandstone cobble content. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)

3.50

B

3.00

3.10

150.30

Hole Terminated at 3.50m bgl.

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
No groundwater encountered

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

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LOCATION ID: TP04		Project Name: Plot J, Kingsway Business Park			2.20 0.75Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 09/01/2018			Stability: Unstable							
Ground Level (m AOD): 155.84		Eastings & Northings: 391448E 411468N			Engineer: TY		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			155.44	0.40m	Grass over soft dark grey slightly gravelly sandy CLAY with a low subrounded mudstone and quartz cobble content, abundant rootlets and occasional metal up to 60mm. Gravel is subangular and subrounded fine and medium quartz. (Made Ground) Yellowish brown slightly gravelly fine to coarse SAND. Gravel is subangular and subrounded fine to coarse mudstone and quartz. (Hummocky Glacial Deposits) <i>Below 2.20m bgl, pockets of orange clay up to 70mm and gravel includes slate.</i>		0.40	ES	0.50	0.60			
				3.10m					B ES	1.40 1.40	1.50 1.50		
			152.34		Hole Terminated at 3.50m bgl.		3.50						
Remarks						Legend							
Reason for Termination: Target depth achieved.						Samples: B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strikes: Groundwater Strike Resting Groundwater Level		In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes: No groundwater encountered													
Other Remarks: 1. No visual or olfactory evidence of contamination.						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS			

TRIAL PIT LOG

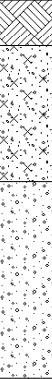
Scale: 1:50Sheet 1 of 1

LOCATION ID: TP05		Project Name: Plot J, Kingsway Business Park			2.65 1.40Pit Dimensions (m)Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 09/01/2018			Stability: Unstable							
Ground Level (m AOD): 155.13		Eastings & Northings: 391423E 411485N			Engineer: LJW		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			154.83	0.30m	Dark brownish grey clayey gravelly SAND with abundant rootlets. Gravel is subrounded fine to coarse quartz. (Topsoil)		0.30	ES	0.20	0.30			
				2.20m	Orangish brown gravelly medium and coarse SAND with a low subangular and subrounded granite and sandstone cobble content. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)			B	1.70	1.80			
			152.63		Hole Terminated at 2.50m bgl.		2.50						
Remarks						Legend							
Reason for Termination:						Samples:		Groundwater Strikes:		In-Situ Tests:			
Trial pit unstable.						B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strike Resting Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes:													
No groundwater encountered													
Other Remarks:						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS			
1. No visual or olfactory evidence of contamination.													

TRIAL PIT LOG

Scale: 1:50

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LOCATION ID:		Project Name: Plot J, Kingsway Business Park				3.00 0.90 Pit Dimensions (m) Degrees								
TP06		Project Number: MCS2374												
		Client: Wilson Bowden Developments Ltd												
		Plant: CAT 320 F		Start & End Date: 09/01/2018										
Hole Type: TP						Stability: Unstable								
Ground Level (m AOD): 153.13		Eastings & Northings: 391396E 411538N				Engineer: LJW		Checker: AD						
Groundwater		Strata					Samples			In-Situ Tests				
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result	
	1.7m bgl		152.82	0.30m	Grass over dark grey slightly gravelly clayey SAND with abundant rootlets. Gravel is subangular and subrounded fine to coarse shale and quartz. (Topsoil)		0.30	ES	0.15	0.25				
				0.90m	Reddish brown silty very gravelly SAND. Gravel is subangular and subrounded fine to coarse mudstone and quartz. (Hummocky Glacial Deposits)		1.20							
				151.93	1.30m		Reddish brown very sandy GRAVEL with a low subrounded granite and quartzite cobble content. Sand is medium and coarse. Gravel is subrounded fine to coarse siltstone and quartz. (Hummocky Glacial Deposits)							2.50
				150.62	Hole Terminated at 2.50m bgl.									
Remarks								Legend						
Reason for Termination:								Samples:		Groundwater Strikes:		In-Situ Tests:		
Trial pit unstable.								B - Bulk D - Disturbed ES - Environmental Sample		 Groundwater Strike Resting Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test		
Groundwater Notes:														
Seepage noted at 1.70m bgl.														
Other Remarks:														
1. No visual or olfactory evidence of contamination.								BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100				

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP07

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:09/01/2018

Ground Level (m AOD):153.14

Eastings & Northings:391367E 411536N

Stability:Unstable

Engineer: TY

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

2.3m bgl

Grass over soft slightly gravelly sandy CLAY with abundant rootlets. Gravel is subangular and subrounded fine to coarse granite and quartz. (Topsoil)

Reddish brown gravelly very silty SAND with rare rootlets and a low subangular granite cobble content. Gravel is angular to subrounded fine to coarse granite and quartz. (Hummocky Glacial Deposits)

Below 1.00m bgl, silty

Reddish brown sandy GRAVEL with a low subangular to subrounded granite cobble content. Gravel is angular to rounded fine to coarse granite, mudstone, shale and quartz. (Hummocky Glacial Deposits)

Hole Terminated at 2.60m bgl.

0.55m

1.05m

1.60m

2.60m

B

ES

B

1.00

1.00

1.90

1.10

1.10

2.00

Type

From (m)

To (m)

Type

Depth (m)

Result

Remarks

Reason for Termination:
Trial pit unstable.

Groundwater Notes:
Seepage noted at 2.30m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP08

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Hole Type: TPPlant: CAT 320 FStart & End Date:09/01/2018

3.60

0.80Pit Dimensions (m)Degrees

Stability: Unstable

Ground Level (m AOD):154.72

Eastings & Northings:391384E 411495N

Engineer: TY

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

2.5m bgl

154.470.25m

154.170.30m

153.320.85m

151.421.90m

150.421.00m

150.424.30m

Grass over gravelly clayey SAND with abundant rootlets. Gravel is subangular to rounded fine to coarse mudstone and quartz. (Topsoil)

Dark orangish brown slightly gravelly clayey SAND with occasional rootlets. Gravel is subangular and subrounded fine to coarse mudstone and quartz. (Hummocky Glacial Deposits)

Reddish brown mottled grey slightly gravelly sandy SILT with rare rootlets. Gravel is angular and subangular fine to medium shale. (Hummocky Glacial Deposits)

Reddish brown very gravelly SAND. Gravel is subangular to rounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

Orangish brown slightly gravelly sandy SILT. Gravel is subangular to subrounded fine to medium mudstone. (Hummocky Glacial Deposits)

Hole Terminated at 4.30m bgl.

ES0.100.20

B0.400.50

D1.801.90

B2.002.10

D3.403.50

ES3.403.50

Type

From (m)

To (m)

Type

Depth (m)

Result

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Very slow inflow noted at 2.50m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

Scale: 1:50

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LOCATION ID: TP09	Project Name: Plot J, Kingsway Business Park		3.00 0.70 Pit Dimensions (m) Degrees		
	Project Number: MCS2374				
	Client: Wilson Bowden Developments Ltd				
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 10/01/2018	Stability: Unstable	
Ground Level (m AOD): 156.31		Eastings & Northings: 391395E 411433N		Engineer: LJW	Checker: AD

[illegible]

Remarks		Legend		
Reason for Termination: Trial pit collapsed back to 2.10m bgl.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: No groundwater encountered				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	 CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS

TRIAL PIT LOG

Scale: 1:50

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LOCATION ID: TP10	Project Name: Plot J, Kingsway Business Park		2.75 0.70 Pit Dimensions (m) Degrees	
	Project Number: MCS2374			
	Client: Wilson Bowden Developments Ltd			
	Hole Type: TP	Plant: CAT 320 F		Start & End Date: 10/01/2018
Ground Level (m AOD): 155.96		Eastings & Northings: 391365E 411439N	Engineer: LJW	Checker: AD

[illegible]

Remarks		Legend		
Reason for Termination: Trial pit collapsed back to 2.20m bgl.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: No groundwater encountered				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	 CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP11		Project Name: Plot J, Kingsway Business Park			3.20 0.70Pit Dimensions (m) Degrees																				
		Project Number: MCS2374																							
		Client: Wilson Bowden Developments Ltd																							
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 10/01/2018					Stability: Unstable																	
Ground Level (m AOD): 154.96		Eastings & Northings: 391345E 411479N			Engineer: LJW		Checker: AD																		
Groundwater		Strata					Samples		In-Situ Tests																
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result												
			154.61	0.35m	Grass over dark brownish grey slightly gravelly silty SAND with abundant rootlets. Gravel is subangular and subrounded fine to coarse granite. (Topsoil)		0.35																		
			154.16	0.45m			0.80																		
			153.76	0.40m	Dark orangish brown slightly gravelly silty SAND with rare rootlets. Gravel is subangular and subrounded fine to coarse granite. (Hummocky Glacial Deposits)		1.20	D	1.00	1.10															
			153.36	0.40m			1.60	ES	1.00	1.10															
					Light reddish brown slightly gravelly silty SAND. Gravel is angular to subrounded fine to coarse flint, granite and sandstone. (Hummocky Glacial Deposits)			B	1.30	1.40															
				1.20m			2.80																		
			152.16		Light reddish brown slightly silty very sandy GRAVEL with a low subangular granite cobble content. Gravel is subangular and subrounded fine to coarse granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)		3.10																		
			151.86	0.30m					2.45	2.55															
					Light reddish brown slightly gravelly silty SAND with rare black mottling, Gravel is subangular and subrounded fine to coarse granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)																				
					Lightly yellowish brown silty SAND. (Hummocky Glacial Deposits)																				
					Hole Terminated at 3.10m bgl.																				
Remarks														Legend											
Reason for Termination: Trial pit unstable.														Samples: B - Bulk, D - Disturbed, ES - Environmental Sample				Groundwater Strikes: Groundwater Strike, Resting, Groundwater Level				In-Situ Tests: HSV - Hand Shear Vane Test, PID - Photo Ionisation Detector Test			
Groundwater Notes: No groundwater encountered																									
Other Remarks: 1. No visual or olfactory evidence of contamination.														BWB Consulting Ltd, Waterfront House, Station Street, Nottingham, NG2 3DQ				Web: bwbconsulting.com, E: nottingham@bwbconsulting.com, P: 0115 9241100				BWB CONSULTANCY ENVIRONMENT, INFRASTRUCTURE BUILDINGS			

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP12

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:10/01/2018

3.10

0.90Pit Dimensions (m)Degrees

Stability: Unstable

Ground Level (m AOD):153.02

Eastings & Northings:391321E 411529N

Engineer: TY

Checker: AD

Groundwater

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

▼1.3m bgl

Grass over dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is angular to subrounded fine to coarse granite, shale, and quartz. (Topsoil)

Orangish brown slightly gravelly sandy SILT with occasional rootlets. Gravel is angular to subrounded fine to coarse granite, shale and quartz. (Hummocky Glacial Deposits)

Reddish brown slightly silty sandy GRAVEL with a medium subrounded granite cobble content. Gravel is angular to subrounded granite and mudstone. (Hummocky Glacial Deposits)

Reddish brown slightly gravelly sandy SILT. Gravel is angular to subrounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

Orangish brown gravelly SAND. Gravel is angular to rounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

Soft dark grey slightly sandy slightly gravelly CLAY. Gravel is angular to rounded fine to coarse granite, mudstone, shale and quartz. (Hummocky Glacial Deposits)

Below 3.50m bgl, low subangular to subrounded granite cobble content.

Hole Terminated at 4.10m bgl.

ES0.300.40

B0.800.90

D1.401.50

ES1.401.50

D3.103.20

ES3.103.20

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Slow inflow noted at 1.30m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP13

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:10/01/2018

3.15

0.85

Pit Dimensions (m)

Degrees

Stability: Unstable

Ground Level (m AOD):151.16

Eastings & Northings:391281E 411524N

Engineer: TY

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

1.35m bgl

150.81

0.35m

Grass over dark greyish brown slightly gravelly very silty SAND with abundant rootlets. Gravel is subangular to rounded fine to coarse shale and quartz. (Topsoil)

0.35

ES

0.10

0.20

150.26

0.55m

Orangish brown slightly gravelly very silty SAND with occasional rootlets. Gravel is angular to subrounded fine to coarse granite, shale and quartz. (Hummocky Glacial Deposits)

0.90

B

1.00

1.10

149.81

0.45m

Below 0.50m bgl, slightly silty.

1.35

D

1.50

1.60

149.01

0.80m

Reddish brown sandy GRAVEL with a low subangular and subrounded granite cobble content. Gravel is angular to rounded fine to coarse granite, mudstone, and shale. (Hummocky Glacial Deposits)

2.15

ES

1.50

1.60

147.56

1.45m

Soft greyish brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine to coarse granite and shale. (Hummocky Glacial Deposits)

3.60

B

2.40

2.50

Yellowish brown slightly gravelly SAND. Gravel is subangular and subrounded fine to coarse granite, sandstone and quartz. (Hummocky Glacial Deposits)

Hole Terminated at 3.60m bgl.

Type

From (m)

To (m)

Type

Depth (m)

Result

Remarks

Reason for Termination:
Trial pit unstable.

Groundwater Notes:
Slow inflow noted at 1.35m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:

Groundwater Strikes:

In-Situ Tests:

B - Bulk

D - Disturbed

ES - Environmental Sample

Groundwater Strike

Resting

Groundwater Level

HSV - Hand Shear

Vane Test

PID - Photo Ionisation

Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:

TP14

Hole Type: TP

Project Name:

Plot J, Kingsway Business Park

Project Number:

MCS2374

Client:

Wilson Bowden Developments Ltd

Plant:

CAT 320 F

Start & End Date:

10/01/2018

Ground Level (m AOD):

152.97

Eastings & Northings:

391307E 411494N

Engineer:

TY

Checker:

AD

2.95

0.95

Pit Dimensions (m)

Degrees

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

1.85m bgl

152.52

0.45m

Grass over dark greyish brown slightly gravelly silty SAND and abundant rootlets. Gravel is subangular to rounded fine to coarse granite, shale and quartz. (Topsoil)

0.45

152.17

0.35m

Orangish brown slightly gravelly silty SAND with occasional rootlets. Gravel is angular and subangular fine to coarse granite, shale and quartz. (Hummocky Glacial Deposits)

0.80

151.27

0.90m

Soft reddish brown mottled grey slightly gravelly sandy SILT. Gravel is angular to subrounded fine to coarse granite and shale. (Hummocky Glacial Deposits)

1.70

150.17

1.10m

Orangish brown very sandy GRAVEL. Gravel is angular to rounded fine to coarse granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)

2.80

150.07

0.10m

Soft dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

2.90

Type

From (m)

To (m)

Type

Depth (m)

Result

Remarks

Reason for Termination:

Trial pit unstable.

Groundwater Notes:

Fast inflow noted at 1.85m bgl.

Other Remarks:

1. No visual or olfactory evidence of contamination.

Samples:

B - Bulk

D - Disturbed

ES - Environmental Sample

Groundwater Strikes:

Groundwater Strike

Resting

Groundwater Level

In-Situ Tests:

HSV - Hand Shear

Vane Test

PID - Photo Ionisation

Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP15		Project Name: Plot J, Kingsway Business Park			3.00 0.80 Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 12/01/2018			Stability: Unstable							
Ground Level (m AOD): 154.84		Eastings & Northings: 391321E 411455N			Engineer: TY		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			154.39	0.45m	Dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is subangular to rounded fine to coarse granite and sandstone. (Topsoil)		0.45	ES	0.10	0.20			
					Orangish brown slightly silty gravelly SAND with a low subangular and subrounded granite cobble content with rare rootlets. Gravel is subangular to rounded granite, mudstone and quartz. (Hummocky Glacial Deposits)			B	1.10	1.20			
				3.25m	Below 1.20m bgl, becoming silty.								
					Below 2.90m bgl, very silty, gravel is granite, mudstone and shale.			D	3.00	3.10			
					Below 3.30m bgl, silty gravelly SAND.			B	3.50	3.60			
			151.14		Hole Terminated at 3.70m bgl.		3.70						
Remarks						Legend							
Reason for Termination:						Samples:		Groundwater Strikes:		In-Situ Tests:			
Target depth achieved.						B - Bulk D - Disturbed ES - Environmental Sample		 Groundwater Strike  Resting Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes:													
No groundwater encountered													
Other Remarks:						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100					
1. No visual or olfactory evidence of contamination.													

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:

TP16

Hole Type: TP

Project Name:

Plot J, Kingsway Business Park

Project Number:

MCS2374

Client:

Wilson Bowden Developments Ltd

Plant:

CAT 320 F

Start & End Date:

12/01/2018

Ground Level (m AOD):

156.47

Eastings & Northings:

391342E 411408N

Engineer:

TY

Checker:

AD

3.20

0.75

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			156.02	0.45m	Grass over dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is subrounded and subangular granite and quartz.		0.45	ES	0.20	0.30			
			155.67	0.35m	(Topsoil)		0.80	ES	0.50	0.60			
			154.97	0.70m	Orangish brown slightly gravelly very silty SAND. Gravel is subrounded and subangular granite and quartz.		1.50	B	1.20	1.30			
			154.27	0.70m	(Hummocky Glacial Deposits)		2.20	B	2.30	2.40			
			152.47	1.80m	Reddish brown slightly silty very gravelly SAND with a low subangular and subrounded granite cobble content. Gravel is subangular to rounded granite, mudstone and shale.		4.00						
			152.37	0.10m	(Hummocky Glacial Deposits)		4.10	D	4.00	4.10		4.05	(104)kPa
					Reddish brown slightly silty very sandy GRAVEL with a low subangular and subrounded granite cobble content. Gravel is subangular to rounded granite, mudstone and shale.							4.05	(121)kPa
					(Hummocky Glacial Deposits)							4.05	(94)kPa
					Yellowish brown gravelly SAND with a low subangular to subrounded granite cobble content. Gravel is angular to subrounded coal, granite, mudstone and sandstone.								
					(Hummocky Glacial Deposits)								
					Below 3.10m bgl, slightly gravelly silty SAND with cobble absent.								
					Firm reddish brown slightly gravelly sandy CLAY. Gravel is angular to rounded coal and mudstone.								
					(Hummocky Glacial Deposits)								
					Hole Terminated at 4.10m bgl.								

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
No groundwater encountered

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP17

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:12/01/2018

Ground Level (m AOD):153.63

Eastings & Northings:391310E 411436N

Engineer: TY

Checker: AD

2.95

0.80

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

3.7m bgl

153.13

0.50m

Grass over soft dark greyish brown slightly gravelly sandy SILT with abundant rootlets. Gravel is subangular and subrounded granite and quartz. (Topsoil)

0.50

ES

0.60

0.70

1.95m

Orangish brown slightly silty gravelly SAND with a low subangular and subrounded granite content. Gravel is angular to subrounded fine to coarse granite, sandstone and quartz. (Hummocky Glacial Deposits)

Below 1.05m bgl, light brown mottled grey with pockets of soft clay up to 40mm.

Below 1.70m bgl, slightly gravelly silty.

2.45

B

1.20

1.30

151.18

1.05m

Brown slightly gravelly very silty SAND. Gravel is angular to subrounded fine to coarse coal, granite, mudstone, sandstone and quartz.

2.45

B ES

2.50

2.60

150.13

0.30m

(Hummocky Glacial Deposits)

3.50

D

3.70

3.80

149.83

Soft reddish brown slightly gravelly sandy SILT. Gravel is angular to subrounded fine to medium flint and granite. (Hummocky Glacial Deposits)

3.80

Hole Terminated at 3.80m bgl.

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Very slow inflow noted at 3.70m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:		Project Name: Plot J, Kingsway Business Park				3.10 0.90 Pit Dimensions (m) Degrees							
TP18		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
		Plant: CAT 320 F		Start & End Date: 11/01/2018									
Hole Type: TP						Stability: Unstable							
Ground Level (m AOD): 155.10		Eastings & Northings: 391319E 411390N				Engineer: TY		Checker: AD					
Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is subangular and subrounded granite, shale and quartz. (Topsoil)		0.55	ES	0.10	0.20			
			154.55	0.55m	Orangish brown slightly silty gravelly SAND with a low subrounded granite content. Gravel is subangular to subrounded granite and shale. (Hummocky Glacial Deposits)			B	0.80	0.90			
					Below 0.75m bgl, patches of mottled black.			ES	0.80	0.90			
					Below 1.40m bgl, orangish brown and slightly gravelly.								
					Below 1.70m bgl, silty.								
			152.40	2.15m									
					Soft greyish brown slightly gravelly sandy CLAY. Gravel is angular and subangular mudstone and shale. (Hummocky Glacial Deposits)		2.70	D	2.80	2.90			
					Below 3.40m bgl, firm dark grey and gravel including mudstone and sandstone.			D	3.40	3.50			
			151.40	1.00m								3.50	(104)kPa
					Hole Terminated at 3.70m bgl.		3.70					3.50	(121)kPa
												3.50	(122)kPa
Remarks													
Reason for Termination:							Legend						
Target depth achieved.							Samples:Groundwater Strikes:In-Situ Tests:						
Groundwater Notes:							B - BulkGroundwater StrikeHSV - Hand Shear						
No groundwater encountered							D - DisturbedStrikeVane Test						
							ES - EnvironmentalSampleRestingPID - Photo Ionisation						
							Groundwater LevelDetector Test						
Other Remarks:							BWB Consulting LtdWeb: bwbconsulting.com						
1. No visual or olfactory evidence of contamination.							Waterfront HouseE: nottingham						
							Station Street@bwbconsulting.com						
							NottinghamP: 0115 9241100						
							NG2 3DQ						
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							INFRASTRUCTURE BUILDINGS						

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP19

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:11/01/2018

Ground Level (m AOD):155.89

Eastings & Northings:391291E 411353N

Engineer:TY

Checker:AD

3.20

0.85

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

2.5m bgl

Dark greyish brown slightly silty sightly gravelly SAND with a low subrounded granite cobble content and abundant rootlets. Gravel is subangular and subrounded granite and quartz. (Topsoil)

Orangish brown slightly silty slightly gravelly SAND. Gravel is subangular to rounded granite and quartz. (Hummocky Glacial Deposits)

Orangish brown slightly silty sandy GRAVEL with a low subangular and subrounded granite content. Gravel is angular to rounded granite, sandstone and quartz. (Hummocky Glacial Deposits)

Below 1.10m bgl, silty

Orangish brown gravelly very silty SAND. Gravel is angular to subrounded granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)

Stiff reddish brown slightly gravelly sandy SILT. Gravel is angular and subangular granite and shale. (Hummocky Glacial Deposits)

Yellowish brown slightly gravelly SAND. Gravel is subangular and surrounded fine to coarse sandstone and shale. (Hummocky Glacial Deposits)

Hole Terminated at 4.05m bgl.

ES

0.40

0.50

B

0.90

1.00

D

2.30

2.40

B

2.70

2.80

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Very slow inflow noted at 2.50m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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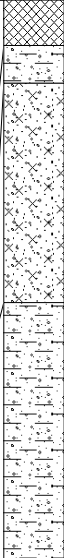
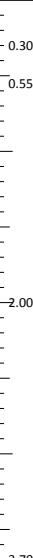
TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP20		Project Name: Plot J, Kingsway Business Park			3.20 0.85 Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 11/01/2018			Stability: Unstable							
Ground Level (m AOD): 155.76		Eastings & Northings: 391274E 411377N			Engineer: TY		Checker: AD						
Groundwater		Strata				Samples			In-Situ Tests				
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			155.36	0.40m	Grass over dark greyish brown slightly silty slightly gravelly SAND with abundant rootlets. Gravel is subrounded fine to medium quartz. (Topsoil)		0.40	ES	0.50	0.60			
			154.71	0.65m	Reddish brown mottled grey slightly silty gravelly SAND. Gravel is subangular and subrounded granite and quartz. (Hummocky Glacial Deposits)		1.05	D	1.20	1.30			
				1.65m	Reddish brown slightly sandy very clayey GRAVEL with a low subrounded granite cobble content. Gravel is subangular to subrounded fine to coarse coal and granite. (Hummocky Glacial Deposits)			B	2.50	2.60			
			153.06				2.70	D	2.80	2.90		2.90	(21)kPa
				0.70m	Soft orangish brown slightly gravelly sandy SILT. Gravel is angular to rounded fine to coarse granite and shale. (Hummocky Glacial Deposits)			ES	2.80	2.90		2.90	(23)kPa
			152.36				3.40						
				0.50m	Firm brown mottled grey slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine coarse granite, mudstone, shale and quartz. (Hummocky Glacial Deposits)			D	3.60	3.70		3.70	(69)kPa
			151.86				3.90					3.70	(83)kPa
												3.70	(88)kPa
					Hole Terminated at 3.90m bgl.								
Remarks													
Reason for Termination: Target depth achieved.								Samples: B - Bulk D - Disturbed ES - Environmental Sample					
Groundwater Notes: No groundwater encountered								Groundwater Strikes: Strike Resting Groundwater Level					
In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test													
Other Remarks: 1. No visual or olfactory evidence of contamination.								BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ					
								Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100					
								BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS					

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP21		Project Name: Plot J, Kingsway Business Park			3.05 1.30Pit Dimensions (m)Degrees								
Project Number: MCS2374													
Client: Wilson Bowden Developments Ltd													
Hole Type: TP	Plant: CAT 320 F	Start & End Date: 11/01/2018		Stability: Unstable									
Ground Level (m AOD): 152.17		Eastings & Northings: 391292E 411417N			Engineer: LJW		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
 1.05m bgl			151.87	0.30m	Grass over dark brownish grey slightly gravelly very clayey SAND with abundant rootlets and rare glass fragments.			ES	0.10	0.20			
			151.62	0.25m	Gravel is angular to subrounded fine to coarse granite, slate and quartzite. (Made Ground)								
				1.45m	Firm brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular and subrounded fine to coarse granite and quartz. (Hummocky Glacial Deposits)								
			150.17		Light grey mottled orangish brown slightly gravelly silty SAND. Gravel is subrounded fine to coarse coal and quartz. (Hummocky Glacial Deposits)								
				1.70m	Firm purplish grey slightly gravelly sandy CLAY with a low subrounded granite cobble content. Gravel is subangular and subrounded fine to coarse coal, granite and siltstone. (Hummocky Glacial Deposits)								
			148.47		Hole Terminated at 3.70m bgl.								
Remarks						Legend							
Reason for Termination:						Samples:		Groundwater Strikes:		In-Situ Tests:			
Target depth achieved.						B - Bulk D - Disturbed ES - Environmental Sample		 Groundwater Strike Resting Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes:													
Seepage noted at 1.05m bgl.													
Other Remarks:													
1. No visual or olfactory evidence of contamination.						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100					

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP22

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:11/01/2018

Eastings & Northings:391270E 411485N

3.15

0.70

Pit Dimensions (m)

Degrees

Stability: Unstable

Engineer: LJW

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

1m bgl

151.50

0.25m

Soft brownish grey slightly gravelly sandy CLAY with abundant rootlets. Gravel is subrounded fine to coarse quartz. (Topsoil)

0.25

150.75

0.75m

Orangish brown slightly gravelly silty SAND with rare rootlets and a moderate subangular granite cobble content. Gravel is subangular and subrounded fine to coarse granite and sandstone. (Hummocky Glacial Deposits)

1.00

149.70

1.05m

Stiff dark reddish brown slightly gravelly sandy CLAY with a low subrounded granite cobble content and rare pockets of medium and coarse grey sand. Gravel is subangular and subrounded fine to coarse granite, siltstone and shale. (Hummocky Glacial Deposits)

2.05

148.35

1.35m

Light orangish brown silty SAND. (Hummocky Glacial Deposits)

3.40

Hole Terminated at 3.40m bgl.

Type

From (m)

To (m)

Type

Depth (m)

Result

B

0.65

0.75

D

0.65

0.75

ES

0.65

0.75

D

1.40

1.50

B

2.35

2.45

1.50

1.50

1.50

(150)kPa

(150)kPa

(150)kPa

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Seepage noted at 1.00m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP23

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:11/01/2018

Ground Level (m AOD):153.47

Eastings & Northings:391244E 411456N

Engineer:TY

Checker:AD

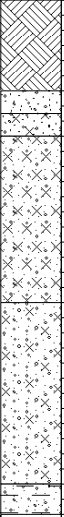
3.00

0.85

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater		Strata				Samples			In-Situ Tests						
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result		
▼	0.8m bgl		152.87 152.72 152.57	0.60m	Grass over dark grey brown slightly gravelly silty SAND with abundant rootlets and a strong organic odour. Gravel is angular to rounded granite, sandstone and quartz. (Topsoil) Yellowish brown gravelly SAND with rare rootlets. Gravel is subangular and subrounded granite, sandstone and quartz. (Hummocky Glacial Deposits) Orangish brown mottled grey slightly silty gravelly SAND. Gravel is angular to subrounded granite and sandstone. (Hummocky Glacial Deposits) Soft brown mottled grey slightly gravelly sandy SILT. Gravel is angular to rounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits) Reddish brown slightly silty sandy GRAVEL. Gravel is angular to rounded granite, mudstone, shale sandstone and quartz. (Hummocky Glacial Deposits) Soft to firm greyish brown slightly gravelly sandy CLAY. Gravel is angular to subangular mudstone and shale. (Hummocky Glacial Deposits) Hole Terminated at 3.40m bgl.		0.60 0.75 0.90	ES	0.10	0.20					
				D				0.75	0.85						
ES	0.75			0.85											
▼	2.5m bgl		151.47	1.10m			2.00	B	2.40	2.50		1.85 1.85 1.85	(10)kPa (12)kPa (15)kPa		
			150.27 150.07	1.20m 0.20m			3.20 3.40	D	3.30	3.40		3.30 3.30 3.30	(33)kPa (36)kPa (54)kPa		

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Seepage noted at 0.80m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
 Groundwater Strike
 Resting
 Groundwater Level

In-Situ Tests:
HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:

TP24

Hole Type: TP

Project Name:

Plot J, Kingsway Business Park

Project Number:

MCS2374

Client:

Wilson Bowden Developments Ltd

Plant:

CAT 320 F

Start & End Date:

11/01/2018

Ground Level (m AOD):

154.00

Eastings & Northings:

391253E 411437N

Engineer:

LJW

Checker:

AD

3.20

0.70

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater		Strata					Samples			In-Situ Tests												
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result									
3.85m bgl			153.50	0.50m	Grass over very soft dark brownish grey slightly gravelly sandy CLAY with abundant rootlets. Gravel is angular to subrounded fine to coarse flint, granite and sandstone. (Topsoil)		0.50	ES	0.20	0.30												
				0.40m	Yellowish brown silty sandy GRAVEL with rare rootlets and a low subrounded granite cobble content. Gravel is angular to subrounded fine to coarse flint, granite, sandstone and quartz. (Hummocky Glacial Deposits)			B	0.60	0.70												
				153.10	1.25m			Reddish brown silty very sandy GRAVEL with rare plant material. Gravel is subangular and subrounded fine to coarse granite, mudstone, sandstone and quartz. (Hummocky Glacial Deposits)	B	1.80				1.90								
								151.85	0.15m	Light orangish brown slightly silty gravelly SAND with occasional black mottling. Gravel is subangular fine to coarse granite and sandstone. (Hummocky Glacial Deposits)				B	2.20	2.30						
				151.70	1.20m			Soft reddish brown sandy SILT. Sand is fine and medium. (Hummocky Glacial Deposits)	D	2.50				2.60	2.80 2.80 2.80	(29)kPa (30)kPa (36)kPa						
				150.50				0.40m	Firm brown slightly sandy slightly gravelly CLAY with a low subrounded granite cobble content. Gravel is angular to subrounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)	D				3.60			3.70	3.60 3.60 3.60	(58)kPa (60)kPa (67)kPa			
				150.10					ES	3.60				3.70								
				Hole Terminated at 3.90m bgl.																		

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Medium inflow noted at 3.85m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:

B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:

Groundwater Strike

Resting

Groundwater Level

In-Situ Tests:

HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP25		Project Name: Plot J, Kingsway Business Park			2.90 1.00 Pit Dimensions (m) Degrees																				
Project Number: MCS2374																									
Client: Wilson Bowden Developments Ltd																									
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 11/01/2018			Stability: Unstable																			
Ground Level (m AOD): 155.35		Eastings & Northings: 391244E 411400N			Engineer: TY		Checker: AD																		
Groundwater		Strata				Samples			In-Situ Tests																
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result												
					Grass over dark grey brown slightly gravelly silty SAND with a low subangular and subrounded granite cobble content and abundant rootlets. Gravel is angular to subrounded granite, shale and quartz. (Topsoil)		0.50																		
			154.85	0.50m			0.50																		
				0.35m			0.85	D	0.85	0.95		0.90	(28)kPa												
			154.50					ES	0.85	0.95		0.90	(38)kPa												
				0.35m	Reddish brown mottled grey slightly gravelly sandy SILT. Gravel is subangular and subrounded granite and quartz. (Hummocky Glacial Deposits)		1.20	B	1.40	1.50		0.90	(40)kPa												
			154.15																						
				0.85m	Reddish brown silty sandy GRAVEL. Gravel is subangular and subrounded granite, shale and quartz. (Hummocky Glacial Deposits)		2.05																		
			153.30					D	2.40	2.50		2.45	(14)kPa												
				1.20m	Reddish brown slightly gravelly very silty SAND. Gravel is angular to subrounded granite, mudstone and shale. (Hummocky Glacial Deposits)			ES	2.40	2.50		2.45	(22)kPa												
					Soft reddish brown slightly gravelly sandy SILT. Gravel is angular to subrounded granite, mudstone and shale. (Hummocky Glacial Deposits)							2.45	(24)kPa												
			152.10		Below 2.80m bgl, very sandy.		3.25																		
				0.35m	Yellowish brown slightly gravelly SAND. Gravel is subangular and rounded granite and sandstone. (Hummocky Glacial Deposits)		3.60	B	3.50	3.60															
			151.75		Hole Terminated at 3.60m bgl.																				
Remarks														Legend											
Reason for Termination: Target depth achieved.														Samples: B - Bulk D - Disturbed ES - Environmental Sample				Groundwater Strikes: Groundwater Strike Resting Groundwater Level				In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes: No groundwater encountered																									
Other Remarks: 1. No visual or olfactory evidence of contamination.														BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ				Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100				BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS			

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP26		Project Name: Plot J, Kingsway Business Park		3.05	
		Project Number: MCS2374		0.75 Pit Dimensions (m) Degrees	
		Client: Wilson Bowden Developments Ltd			
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 11/01/2018		Stability: Unstable
Ground Level (m AOD): 156.76		Eastings & Northings: 391267E 411348N		Engineer: TY	Checker: AD

Groundwater		Strata				Samples			In-Situ Tests				
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			156.21	0.55m	Grass over dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is angular to subrounded fine to coarse granite, shale and quartz. (Topsoil)		0.55	ES	0.10	0.20			
			155.31	0.90m	Orangish brown slightly silty sandy GRAVEL. Gravel is subangular and subrounded granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)		1.45	B ES	0.90 0.90	1.00 1.00			
			153.86	1.45m	Reddish brown slightly gravelly very silty SAND. Gravel is angular to subrounded granite, mudstone and shale. (Hummocky Glacial Deposits)		2.90	B D	1.85 1.85	1.95 1.95			
			153.01	0.85m	Reddish brown slightly gravelly sandy SILT. Gravel is angular and subangular granite, mudstone and shale. (Hummocky Glacial Deposits)		3.75	D	3.40	3.50		3.40 3.40 3.40	(17)kPa (22)kPa (24)kPa
					Hole Terminated at 3.75m bgl.								

Remarks						Legend					
Reason for Termination: Target depth achieved.						Samples: B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strikes: Groundwater Strike Resting Groundwater Level		In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test	
Groundwater Notes: No groundwater encountered											
Other Remarks: 1. No visual or olfactory evidence of contamination.						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS	

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP27		Project Name: Plot J, Kingsway Business Park			2.30 0.65 Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 08/01/2018			Stability: Unstable							
Ground Level (m AOD): 157.50		Eastings & Northings: 391246E 411320N			Engineer: LJW		Checker: AD						
Groundwater		Strata				Samples			In-Situ Tests				
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
				1.10m	Grass over dark grey very clayey SAND with rare glass fragments up to 30mm and organic odour. (Topsoil)			B ES	0.45 0.45	0.55 0.55			
			156.40	0.55m	Firm orangish brown mottled grey slightly gravelly sandy CLAY. Gravel is subrounded fine to coarse quartz. (Hummocky Glacial Deposits)		1.10	B	1.20	1.30		1.20 1.20 1.20	(108)kPa (88)kPa (99)kPa
			155.85	2.00m	Orangish brown mottled grey silty gravelly SAND with a low subrounded quartz cobble content. Gravel is subrounded fine to coarse quartz. (Hummocky Glacial Deposits) Below 1.85m bgl, slightly gravelly very silty.		1.65	B ES	1.75 1.75	1.85 1.85			
								B	3.20	3.30			
	3.65m bgl		153.85		Hole Terminated at 3.65m bgl.		3.65						
Remarks								Legend					
Reason for Termination: Target depth achieved.								Samples: B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strikes: Groundwater Strike Resting Groundwater Level		In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test	
Groundwater Notes: Slow inflow noted at 3.65m bgl.													
Other Remarks: 1. No visual or olfactory evidence of contamination.								BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS	

TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

LOCATION ID: TP28	Project Name: Plot J, Kingsway Business Park		2.30 0.65 Pit Dimensions (m) Degrees	
	Project Number: MCS2374			
	Client: Wilson Bowden Developments Ltd			
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 08/01/2018	Stability: Unstable
Ground Level (m AOD): 155.43		Eastings & Northings: 391223E 411389N	Engineer: LJW	Checker: AD

Groundwater		Strata						Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result	
				0.50m	Grass over very soft dark grey slightly gravelly sandy CLAY with abundant rootlets and organic odour. Gravel is subangular fine to coarse sandstone.		0.50	D	0.20	0.30				
			154.93	0.50m	(Topsoil)			0.50	B	0.60	0.70			
			154.43	0.60m	Light grey mottled orange silty gravelly SAND. Gravel is subrounded fine to coarse quartz. (Hummocky Glacial Deposits)			1.00						
			153.83		Reddish brown sandy very silty GRAVEL. Gravel is subrounded fine to coarse quartz. (Hummocky Glacial Deposits)			1.60						
					Reddish brown slightly gravelly very silty SAND. (Hummocky Glacial Deposits)				D ES	2.00 2.00	2.10 2.10			
					2.10m					B	3.40	3.50		
			151.73					B	3.70	3.90				
			151.53	0.20m	Light orangish brown slightly gravelly medium and coarse SAND. Gravel is angular and subangular fine to coarse black stained sandstone (Hummocky Glacial Deposits)		3.70 3.90							
					Hole Terminated at 3.90m bgl.									
									</					

Remarks		Legend		
Reason for Termination: Target depth achieved.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: No groundwater encountered				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	 CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS

TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

LOCATION ID: TP29

Hole Type: TP

Project Name: Plot J, Kingsway Business Park

Project Number: MCS2374

Client: Wilson Bowden Developments Ltd

Plant: CAT 320 F

Start & End Date: 08/01/2018

Ground Level (m AOD): 155.11

Eastings & Northings: 391199E 411364N

Engineer: LJW

Checker: AD

2.15

0.65

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

154.81

0.30m

Very soft dark grey slightly sandy slightly gravelly CLAY with abundant rootlets and slight organic odour. Gravel is subangular and subrounded fine and medium sandstone, tile and quartz. (Made Ground)

0.30

154.26

0.55m

Light yellowish grey slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse sandstone and siltstone. (Hummocky Glacial Deposits)

0.85

2.85m

Reddish brown slightly gravelly very silty fine and medium SAND. Gravel is subrounded fine to coarse flint and quartzite. (Hummocky Glacial Deposits)

151.41

Hole Terminated at 3.70m bgl.

3.70

Type

From (m)

To (m)

Type

Depth (m)

Result

ES

0.10

0.20

B

0.50

0.60

ES

0.50

0.60

B

1.80

1.90

Remarks

Reason for Termination: Target depth achieved.

Groundwater Notes: No groundwater encountered

Other Remarks: 1. No visual or olfactory evidence of contamination.

Samples: B - Bulk D - Disturbed ES - Environmental Sample

Groundwater Strikes: Groundwater Strike Resting Groundwater Level

In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:		Project Name: Plot J, Kingsway Business Park				2.25 0.65 Pit Dimensions (m) Degrees							
TP30		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
		Plant: CAT 320 F		Start & End Date: 08/01/2018									
Hole Type: TP						Stability: Unstable							
Ground Level (m AOD): 158.09		Eastings & Northings: 391224E 411301N				Engineer: LJW		Checker: AD					
Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Soft greyish brown slightly gravelly sandy CLAY with a low angular brick cobble content and organic odour. Gravel is angular to subrounded fine to coarse brick and quartz. (Made Ground)			ES	0.35	0.45			
			156.69	0.70m	Orangish brown mottled grey slightly gravelly SAND. Gravel is angular to subrounded fine to coarse siltstone and quartz. (Hummocky Glacial Deposits)		1.40	B	1.70	1.80			
			155.99	0.80m	Orangish brown gravelly very silty SAND. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)		2.10	ES	1.70	1.80			
			155.19	0.60m	Orangish brown with rare green mottling silty sandy GRAVEL. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)		2.90	B	2.80	2.90			
			154.59		Hole Terminated at 3.50m bgl.		3.50						
Remarks													
Reason for Termination:								Samples:					
Target depth achieved.								Groundwater Strikes:					
Groundwater Notes:								In-Situ Tests:					
Medium inflow noted at 3.00m bgl.								B - Bulk					
Other Remarks:								D - Disturbed					
1. No visual or olfactory evidence of contamination.								ES - Environmental					
								Sample					
								Groundwater Level					
								BWB Consulting Ltd					
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								Station Street					
								Nottingham					
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								INFRASTRUCTURE BUILDINGS					

APPENDIX 3

DRILLERS' LOGS

DAILY REPORT

[illegible]

QUANTITIES:	Boring <u>6.50</u> m	Bulks	Jars <u>5</u>	U100	GPT/SPT <u>5</u>
				Reason	Hrs. Drillers Signature

QUANTITIES:								
Hours on Site	Boring	G m	Hrs.	Standing Time of Day Works	Reason	Hrs.	Drillers Signature 	
	Boring and Sampling from	to	Hrs.					Supervisors Signature
	Moves Between		Hrs.					
	Delays		Hrs.					
	Total		Hrs.					
Remarks	Standing from 8am till 1pm waiting for SCB			Chiselling	From	To	Hrs.	Clients Representatives Signature
					2.4	3.0	1/2 hr.	

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DAILY REPORT

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DP DRILLING.

DAILY REPORT

LOCATION <u>Roumdine Plot 5</u>					CLIENT <u>BWB</u>				
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No. <u>MCS2379</u>
Depth to Water						250 mm			Rig No. <u>Dansolao</u>
Depth of Borehole						200 mm			Date <u>10 / 18</u>
Depth Cased						150 mm	<u>91</u>	<u>13.50</u>	BH No. <u>2</u>
Water Strike	<u>4.80</u>					BH Dia			Sheet No. of <u>1 of 1</u>
Depth Cased	<u>4.50</u>					250 mm			Weather Conditions <u>Cloudy</u>
Depth Sealed	<u>11.00</u>					200 mm			
Depth Water Added						150 mm			
					Movement in the water level after strike. Level in Metres BGL		Crew		
					5 MIN.	<u>4.60</u>			
					10 MIN.	<u>4.50</u>			
					15 MIN.	<u>4.50</u>			
					20 MIN.	<u>4.50</u>			
							Hrs.		

Thickness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES			U100	SPT/CPT BLOWS					
From	To		From	To	No	Type	Jar Tube No	Length Re-covered	Blows	150 mm	75 mm	75 mm	75 mm	S/C
<u>91</u>	<u>0.50</u>	<u>Soil</u>	<u>0.40</u>		<u>1</u>	<u>D</u>								
<u>0.50</u>	<u>1.00</u>	<u>MEDIUM DENSE BEAN SAND</u>	<u>1.00</u>		<u>2</u>	<u>D</u>								
<u>1.00</u>	<u>2.50</u>	<u>MEDIUM DENSE SAND & GRAVEL</u>	<u>1.00</u>	<u>1.45</u>	<u>3</u>	<u>Sed</u>				<u>2</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>4</u>
<u>2.50</u>	<u>3.70</u>	<u>Loose to Medium Bean Sand</u>	<u>2.00</u>	<u>2.45</u>	<u>4</u>	<u>Sed</u>				<u>1</u>	<u>3</u>	<u>4</u>	<u>3</u>	<u>4</u>
		<u>With Clayey Bands</u>	<u>3.00</u>	<u>3.45</u>	<u>5</u>	<u>Sed</u>				<u>1</u>	<u>1</u>	<u>2</u>	<u>2</u>	<u>3</u>
<u>3.70</u>	<u>4.80</u>	<u>Dense Bean fine Silty Sand</u>	<u>4.00</u>	<u>4.45</u>	<u>6</u>	<u>Sed</u>				<u>2</u>	<u>3</u>	<u>4</u>	<u>4</u>	<u>5</u>
<u>4.80</u>	<u>7.80</u>	<u>Loose Bean Silty Sand</u>	<u>5.00</u>	<u>5.45</u>	<u>7</u>	<u>Sed</u>				<u>1</u>	<u>2</u>	<u>1</u>	<u>2</u>	<u>1</u>
		<u>With Dense Bands</u>	<u>6.50</u>	<u>6.95</u>	<u>8</u>	<u>Sed</u>				<u>2</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>4</u>
<u>7.80</u>	<u>8.50</u>	<u>Soft Bean Silty with Sand</u>	<u>8.00</u>	<u>8.45</u>	<u>9</u>	<u>Sed</u>				<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>2</u>
<u>8.50</u>	<u>10.50</u>	<u>Medium Dense Bean Silty Sand</u>	<u>9.50</u>	<u>9.95</u>	<u>10</u>	<u>Sed</u>				<u>2</u>	<u>2</u>	<u>3</u>	<u>3</u>	<u>4</u>
<u>10.50</u>	<u>11.00</u>	<u>Stiff Bean Sandy Clay</u>	<u>10.50</u>		<u>11</u>	<u>D</u>								
<u>11.00</u>	<u>11.50</u>	<u>Very Stiff Bean Sandy</u>	<u>11.00</u>	<u>11.20</u>	<u>12</u>	<u>UB</u>		<u>0%</u>	<u>100</u>	<u>No Records Refused</u>				
		<u>Boulder Clay</u>	<u>11.50</u>	<u>11.95</u>	<u>13</u>	<u>Sed</u>				<u>12</u>	<u>7</u>	<u>8</u>	<u>11</u>	<u>13</u>
			<u>13.00</u>	<u>13.35</u>	<u>14</u>	<u>U</u>		<u>65%</u>	<u>110</u>					
		<u>Sand</u>	<u>13.40</u>		<u>15</u>	<u>D</u>								
		<u>200</u>	<u>14.50</u>	<u>14.95</u>	<u>16</u>	<u>Sed</u>				<u>7</u>	<u>8</u>	<u>11</u>	<u>12</u>	<u>13</u>
		<u>100</u>												
		<u>100</u>												
		<u>100</u>												
		<u>100</u>												

QUANTITIES: Boring 1.540... m Bulks 3... Jars 14... U100 2... CPT/SPT 10...

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason	Hrs.	Drillers Signature <u>[Signature]</u>	
	Moves Between		Hrs					
	Delays		Hrs					
	Total		Hrs					
Remarks <u>1 1/2 hr Get all gear of BH1 with HYDRA TO BH2</u> <u>1 1/2 hr Get Rig and all gear back out of field</u>				Chiselling	From	To	Hrs.	Clients Representatives Signature
	<u>11.20</u>	<u>11.50</u>	<u>45 min</u>					

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
 U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DP DRILLING.

DAILY REPORT

LOCATION <u>Rochdale</u>					CLIENT <u>BWB.</u>				
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No.
Depth to Water			<u>DR1</u>			250 mm			Rig No. <u>Dando 2000</u>
Depth of Borehole			<u>3.50</u>			200 mm			Date <u>10.1.18</u>
Depth Cased			<u>3.00</u>			150 mm	<u>GL</u>	<u>3.00</u>	BH No. <u>03</u>
Water Strike				Movement in the water level after strike. Level in Metres BGL		250 mm			Sheet No. of
Depth Cased				5 MIN.		200 mm			Weather Conditions
Depth Sealed				10 MIN.		150 mm			<u>overcast.</u>
Depth Water Added				15 MIN.		Crew <u>D. Pennington</u> Hrs.			
				20 MIN.		<u>D. Cahill.</u>			

Thickness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES			U100	SPT/CPT BLOWS					S/C
From	To		From	To	No.	Type	Jar Tube No	Length Re-covered	Blows	150 mm	75 mm	75 mm	75 mm	
<u>GL</u>	<u>0.50</u>	<u>Top Soil.</u>	<u>0.20</u>			<u>D</u>								
<u>0.50</u>	<u>2.80</u>	<u>Soft brown Sandy clay.</u>	<u>0.50</u>			<u>D</u>								
		<u>with Sand bench.</u>	<u>1.00</u>	<u>1.45</u>		<u>SA</u>				<u>1</u>	<u>-</u>	<u>1</u>	<u>2</u>	<u>2</u>
<u>2.80</u>	<u>3.50</u>	<u>Soft brown Sandy boulder clay.</u>	<u>2.00</u>	<u>2.45</u>		<u>SA</u>				<u>1</u>	<u>1</u>	<u>2</u>	<u>2</u>	<u>3</u>
			<u>3.00</u>	<u>3.45</u>		<u>SA</u>				<u>1</u>	<u>-</u>	<u>1</u>	<u>2</u>	<u>2</u>

QUANTITIES: Boring 3.50 ... m Bunks Jars 5 U100 CPT/SPT 3

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason	Hrs.	Drillers Signature <u>D. Cahill</u>	
	Moves Between		Hrs					
	Delays		Hrs					
	Total		Hrs					
Remarks <u>1 1/2 hr waiting for machine and move rig and bunks.</u>				Chiselling	From	To	Hrs.	Clients Representatives Signature

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DP DRILLING.

DAILY REPORT

LOCATION Rochdale					CLIENT BWB				
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No.
Depth to Water	2.80		DRY.			250 mm			Rig No. Dando 2000
Depth of Borehole	3.45		14.95			200 mm			Date 10.1.18
Depth Cased	3.00		9.00			150 mm	GL 9.00		BH No. 04
Water Strike				Movement in the water level after strike. Level in Metres BGL				BH Dia	
						250 mm			
Depth Cased				5 MIN.		200 mm			Sheet No. of
Depth Sealed				10 MIN.		150 mm			Weather Conditions
Depth Water Added				15 MIN.					overcast.
				20 MIN.					
						Crew	Hrs.		
						D. Pennington			
						D. Cahill			

Thickiness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES				U100		SPT/CPT BLOWS					
From	To		From	To	No.	Type	Jar Tube No	Length m	Blows		150 mm	75 mm	75 mm	75 mm	75 mm	S/C
3.45	3.80	Soft clayey Sand and gravel.	4.00	4.45	SD						1	-	1	2	2	2
3.80	4.70	Soft clayey brown Sand	5.00	5.45	SD						1	2	2	3	4	5
4.70	7.20	medium dense brown Sand	6.50	6.95	SD						2	3	3	4	5	6
			8.00	8.45	U			100%	43							
7.20		Stiff brown Sandy boulder clay.	8.50		O											
			9.50	9.95	SD						2	3	5	9	10	8
			11.00	11.45	U			100%	67							
			11.50		D											
			12.50	12.95	U			NL	56							
		Gas Valve Flush Cover.	13.00	13.45	SD						3	4	6	8	9	9
			14.50	14.95	SD						3	5	8	9	11	13
		GL														
		Sam Plain														
		Bentonite.														
		2.00														
		Sam Slotted														
		gravel.														
		7.00														
		Bentonite.														
		8.00														
		Spoil														
		14.95.														

QUANTITIES: Boring **14.95** m Bulks **2** Jars **9** U100 **3** CPT/SPT **6**

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason	Hrs.	Drillers Signature D. Cahill	
	Moves Between		Hrs					
	Delays		Hrs					
	Total		Hrs					
Remarks 1 1/2 hr Collect water. 'Bowsse' 1 1/2 hr waiting for machine and move rig and book.				Chiselling	From 9.70	To 9.90	Hrs. 1/2	Supervisors Signature
							Clients Representatives Signature	

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U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DP DRILLING.

DAILY REPORT

LOCATION <u>Rochdale</u>				CLIENT <u>BWB</u>					
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No.
Depth to Water			<u>Damp</u>			250 mm			Rig No. <u>Dands 2000</u>
Depth of Borehole			<u>3.45</u>			200 mm			Date <u>9.1.18</u>
Depth Cased			<u>3.00</u>			150 mm	<u>GL</u>	<u>3.00</u>	BH No. <u>04</u>
Water Strike				Movement in the water level after strike. Level in Metres BGL		BH Dia			Sheet No. of
Depth Cased				5 MIN.		250 mm			Weather Conditions
Depth Sealed				10 MIN.		200 mm			<u>overcast.</u>
Depth Water Added				15 MIN.		150 mm			
				20 MIN.		Crew	Hrs.		
						<u>D. Pennington</u>			
						<u>D. Cahill</u>			

Thickness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES			U100		SPT/CPT BLOWS					
From	To		From	To	No.	Type	Jar Tube No.	Length Re- covered	Blows	150 mm	75 mm	75 mm	75 mm	75 mm	S/C
<u>GL</u>	<u>0.80</u>	<u>Top Soil</u>	<u>0.30</u>			<u>D</u>									
<u>0.80</u>	<u>1.30</u>	<u>Stiff brown very gravelly clay</u>	<u>1.00</u>	<u>1.45</u>		<u>CD</u>				<u>8</u>	<u>12</u>	<u>7</u>	<u>5</u>	<u>4</u>	<u>4</u>
			<u>2.00</u>	<u>2.45</u>		<u>J</u>		<u>100%</u>	<u>26</u>						
<u>1.30</u>		<u>Soft brown sandy boulder clay with sand and gravel bould.</u>	<u>2.50</u>			<u>D</u>									
			<u>3.00</u>	<u>3.45</u>		<u>CD</u>				<u>1</u>	<u>-</u>	<u>-</u>	<u>1</u>	<u>1</u>	<u>2</u>
<u>2.00</u>	<u>3.45</u>	<u>Soft clayey sand and gravel.</u>													

QUANTITIES: Boring 3.45 m Bulks 1 Jars 4 U100 1 CPT/SPT 2

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason		Hrs.	Drillers Signature <u>D. Cahill</u> Supervisors Signature
	Moves Between		Hrs					
	Delays		Hrs					
	Total		Hrs					
Remarks				Chiselling	From	To	Hrs.	Clients Representatives Signature
					<u>0.90</u>	<u>1.30</u>	<u>45</u>	

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
 U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

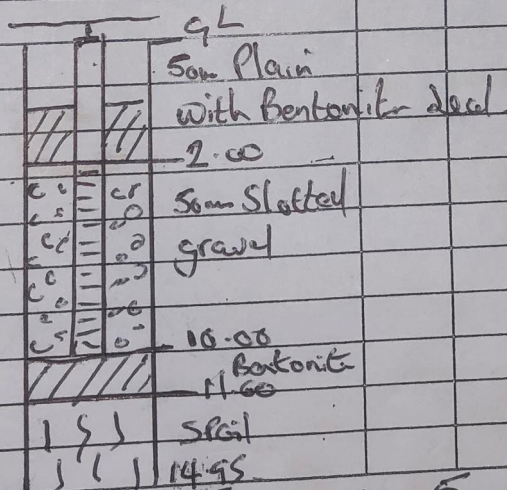
DP DRILLING.

DAILY REPORT

LOCATION <u>Lochdale</u>					CLIENT <u>BWB</u>				
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No.
Depth to Water	5.80		DRY			250 mm			Rig No. <u>Dando 2000</u>
Depth of Borehole	7.50		14.95			200 mm			Date <u>9.1.18</u>
Depth Cased	6.00		9.00			150 mm	9.00		BH No. <u>05</u>
Water Strike				Movement in the water level after strike. Level in Metres BGL		BH Dia			Sheet No. of
Depth Cased				5 MIN.		250 mm			Weather Conditions
Depth Sealed				10 MIN.		200 mm			<u>overcast</u>
Depth Water Added				15 MIN.		150 mm			
				20 MIN.		Crew	Hrs.		
						<u>D. Pennington</u>			
						<u>D. Cahill</u>			

Thickness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES			U100	SPT/CPT BLOWS					
From	To		From	To	No.	Type	Jar Tube No	Length Re-covered	BloWS	150 mm	75 mm	75 mm	75 mm	S/C
7.50	14.95	Stiff brown Sandy	8.00	8.45	SD					2	3	3	4	5
		boulder clay with sand bands	9.50	9.95	U			100%	65					
			10.00		D									
			11.00	11.45	SD					2	4	4	5	6
			12.50	12.95	U			100%	90					
			13.00		D									
			14.50	14.95	SD					3	5	7	9	10

gas valve and flush cover.



QUANTITIES: Boring 14.95 m Bults 5 Jars 5 U100 2 CPT/SPT 3

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason	Hrs.	Drillers Signature <u>D. Cahill</u>	
	Moves Between		Hrs					
	Delays		Hrs					
	Total		Hrs					
Remarks	1 hr to move rig and back to BH04 with machine. 1/2 hr collect water.			Chiselling	From	To	Hrs.	Clients Representatives Signature
				13.70	14.10	1		

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U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DP DRILLING.

DAILY REPORT

LOCATION Rochdale					CLIENT BWB.				
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No.
Depth to Water			DAY			250 mm			Rig No. Dando 2000
Depth of Borehole			7.50			200 mm			Date 8.1.18
Depth Cased			6.00			150 mm	GL 6.00		BH No. 05.
Water Strike	3.30			Movement in the water level after strike. Level in Metres BGL		BH Dia			Sheet No. of
Depth Cased	3.00			5 MIN.	2.7	250 mm			Weather Conditions
Depth Sealed	6.00			10 MIN.	2.7	200 mm			
Depth Water Added				15 MIN.	2.7	150 mm			
				20 MIN.	2.7				
						Crew	Hrs.		
						D. Pennington			
						D. Cahill.			

Thickness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES			U100		SPT/CPT BLOWS					
From	To		From	To	No.	Type	Jar Tube No	Length Re-covered	Blows	150 mm	75 mm	75 mm	75 mm	75 mm	S/C
GL	0.50	Top Soil.	0.20			D									
0.50	3.30	Soft brown Sandy boulder clay.	0.50			D									
			1.00	1.45		SD		NE		1	-	1	1	2	2
3.30	5.40	Soft brown Sandy clay.	2.00	2.45		SD				1	1	2	1	2	2
5.40	6.40	Medium dense brown Sand	3.00	3.45		SD				1	-	2	2	2	2
6.40	7.50	Stiff brown Sandy boulder clay with Sand bands.	4.00	4.45		SD				1	1	2	2	3	3
			5.00	5.45		SD				2	2	3	4	4	4
			5.50	6.00		B									
			6.50	6.95		U		50/40							
			7.00			D									

QUANTITIES: Boring **7.50**...m Bunks **2**... Jars **8**... U100 **1**... CPT/SPT **5**...

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason	Hrs.	Drillers Signature D. Cahill	
	Moves Between		Hrs					
	Delays		Hrs					
	Total		Hrs					
Remarks 5hr Standing waiting for machine and putting last van and 1/2 into field				Chiselling	From	To	Hrs.	Clients Representatives Signature
1hr collect water.								

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DP DRILLING.

DAILY REPORT

LOCATION <u>Rochdale</u>				CLIENT <u>BWB</u>					
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No.
Depth to Water	4.00		DRY			250 mm			Rig No. <u>Daniel 2000</u>
Depth of Borehole	4.50		14.95			200 mm			Date <u>12-1-18</u>
Depth Cased	4.00		10.50			150 mm	9.2	10.50	BH No. <u>06</u>
Water Strike				Movement in the water level after strike. Level in Metres BGL		BH Dia			Sheet No. of
Depth Cased				5 MIN.		250 mm			Weather Conditions
Depth Sealed				10 MIN.		200 mm			<u>overcast</u>
Depth Water Added				15 MIN.		150 mm			
				20 MIN.					
						Crew	Hrs.		
						<u>E. Pennington</u>			
						<u>D. Cathall</u>			

Thickness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES		U100		SPT/CPT BLOWS						
From	To		From	To	No.	Type	Jar tube No	Length Re- covered	Blows	150 mm	75 mm	75 mm	75 mm	75 mm	S/C
4.50	5.70	Medium dense brown sand	5.00	5.45	SB			NR		1	2	2	3	3	4
5.70	6.20	Stiff brown sandy boulder clay.	6.50	6.95	SD					2	3	4	6	6	7
			8.00	8.45	SD					3	4	5	6	8	8
6.20	9.30	Dense brown sand.	9.50	9.95	SA					2	3	4	6	6	7
9.30	14.95	Stiff brown sandy boulder clay.	11.00	11.45	UB			NR 64							
			11.50	11.95	SD					2	3	5	6	7	7
			12.50	12.95	SD					2	4	6	6	7	7
			14.50	14.95	SD					3	5	7	9	12	13

Gravelle Flush Carw.

5.1	1.3	5m Plain Bentonite
1.1	2.0	2.0m -
2.1	2.5	5m Slotted with gravel.
2.6	3.0	
3.1	3.5	
3.6	4.0	9.0m Bentonite
4.1	4.5	10.0m
4.6	5.0	Spill
5.1	5.5	
5.6	6.0	
6.1	6.5	
6.6	7.0	
7.1	7.5	
7.6	8.0	
8.1	8.5	
8.6	9.0	
9.1	9.5	
9.6	10.0	
10.1	10.5	
10.6	11.0	
11.1	11.5	
11.6	12.0	
12.1	12.5	
12.6	13.0	
13.1	13.5	
13.6	14.0	
14.1	14.5	
14.6	15.0	

QUANTITIES: Boring 14.95 m Bulks 2 Jars 7 U100 1 CPT/SPT 7

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason		Hrs.	Drillers Signature	
	Moves Between		Hrs						
	Delays		Hrs						
	Total		Hrs						
Remarks	<u>1/2h collect water</u> <u>1/2h to take rig and tools off site with machine</u>				Chiselling	From	To	Hrs.	Supervisors Signature
						11.10	11.40	1	
Clients Representatives Signature									

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
 U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

DP DRILLING.

DAILY REPORT

LOCATION Rochdale				CLIENT Bwb.					
Water Levels	Start of Day	Mid-day	End of Day	On Pulling Casing	24 Hrs After Pulling Casing	Casing Diameter	Depth Start of Day	Depth End of Day	Contract No.
Depth to Water			Dref.			250 mm			Rig No. Dando 2000
Depth of Borehole			4.50			200 mm			Date 11.1.18
Depth Cased			4.00			150 mm	GL 4.00		BH No. 06
						BH Dia			Sheet No. of
Water Strike				Movement in the water level after strike. Level in Metres BGL		250 mm			Weather Conditions
Depth Cased				5 MIN.		200 mm			overcast.
Depth Sealed				10 MIN.		150 mm			
				15 MIN.					
Depth Water Added				20 MIN.					
Crew		Hrs.							
D. Pennington									
D. Cahill									

Thickness of Strata Change		DESCRIPTION OF STRATA Consistency - Colour - Soil Type	DEPTH TAKEN/DRIVEN		SAMPLES			U100		SPT/CPT BLOWS					
From	To		From	To	No.	Type	Jar Tube No	Length of core	Blows	150 mm	75 mm	75 mm	75 mm	75 mm	S/C
GL	0.70	Top Soil.	0.20			D									
0.70	4.10	Soft brown sandy clay.	0.70			D									
4.10	4.50	medium dense brown sand.	1.00	1.45		SD B.				1	-	1	2	2	2.
			2.00	2.45		SD				1	1	1	1	2	2.
			3.00	3.45		SD				1	1	2	2	1	2.
			4.00	4.45		SD B				2	2	3	3	4	4.

QUANTITIES: Boring **4.30** m Bools **2** Jars **6** U100 **1** CPT/SPT **4**

Hours on Site	Boring and Sampling from	to	Hrs	Standing Time of Day Works	Reason		Hrs.	Drillers Signature D. Cahill
	Moves Between		Hrs					
	Delays		Hrs					
	Total		Hrs					
Remarks 1/2 hr collect water.				Chiselling	From	To	Hrs.	Supervisors Signature
								Clients Representatives Signature

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
 U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.

APPENDIX 4
TRIP HAMMER CALIBRATION CERTIFICATES

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: AR1943
Test Date: 22/09/2017
Report Date: 22/09/2017
File Name: AR1943.spt
Test Operator: SH

Instrumented Rod Data

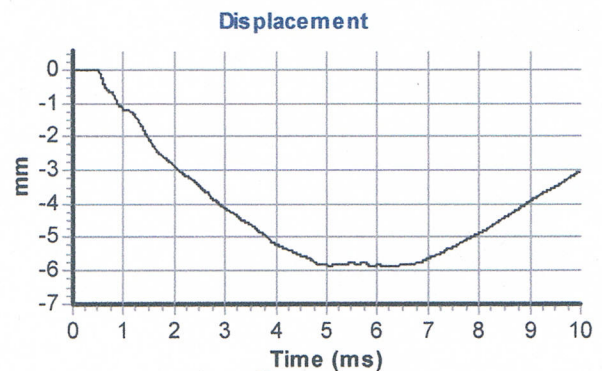
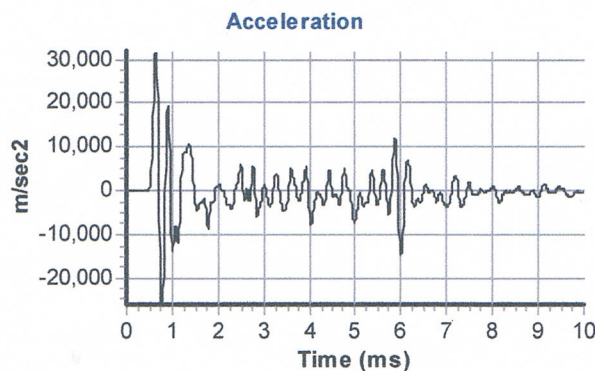
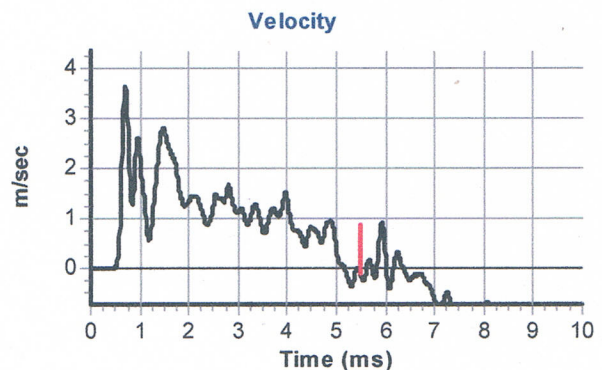
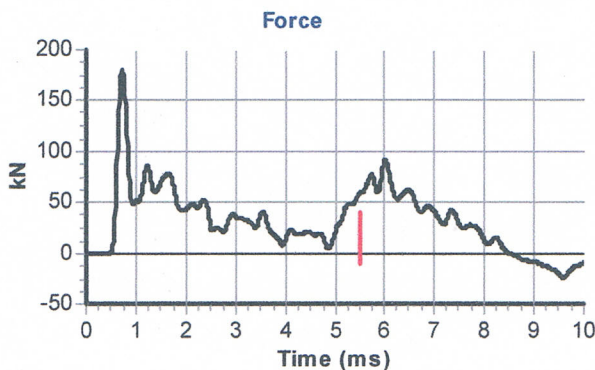
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 200
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

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

Comments / Location

CALIBRATION



Calculations

Area of Rod A (mm^2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 345

Energy Ratio E_r (%): **73**

Signed: S. HOWARTH

Title: FITTER

The recommended calibration interval is 12 months

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: AR1979
Test Date: 07/11/2017
Report Date: 07/11/2017
File Name: AR1979.spt
Test Operator: SH

Instrumented Rod Data

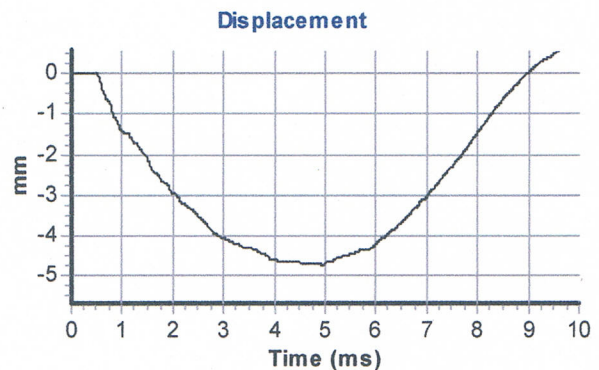
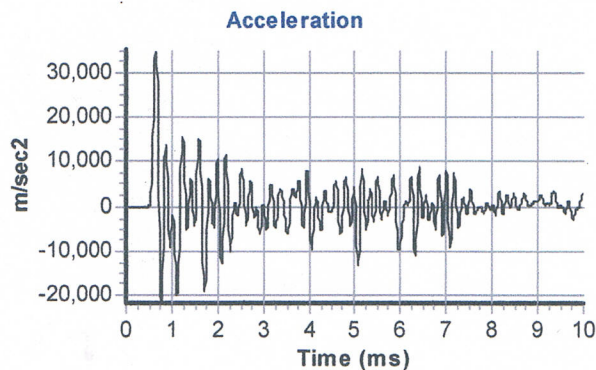
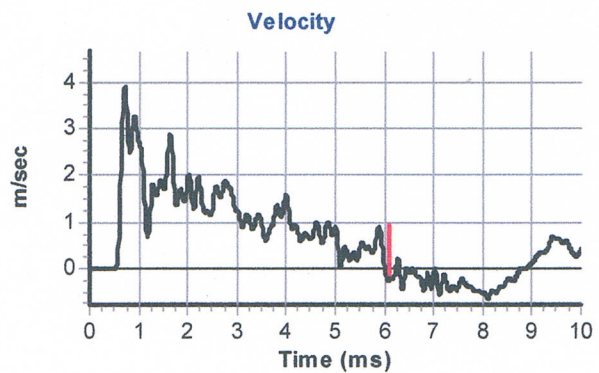
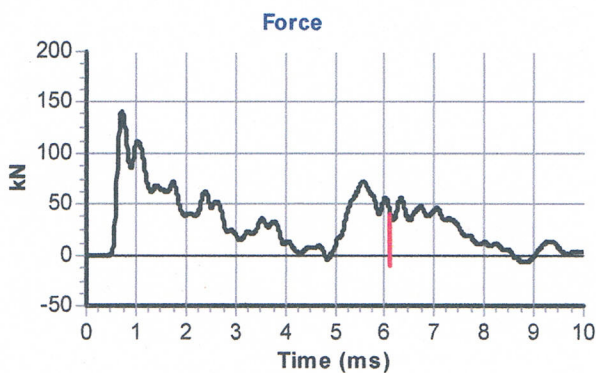
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 200
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

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

Comments / Location

CALIBRATION



Calculations

Area of Rod A (mm²): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 332

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

Signed: M.GARDNER

Title: FITTER

The recommended calibration interval is 12 months

APPENDIX 5

GAS AND GROUNDWATER MONITORING RESULTS

BWB GAS AND GROUNDWATER MONITORING

Site:		Plot J, Kingsway Business Park	
Client:		Wilson Bowden Developments Ltd	
Job No.:		MCS2374	
Date:		18 January 2018	
Start / End Time:		11:15 - 12:45	
Engineer:		TY	
Monitoring Equipment:	Gas Meter ID	-	
	PID ID	-	
	Dip Tape	-	
	Other		

NR = Not Recorded
Dry = No Groundwater



Weather Conditions	Start	End
(Dry / Raining)	DRIZZLE	DRIZZLE
Cloud Cover (Oktas)	8/8	8/8
Wind Strength (m/s)	2.3	1.1
Wind Direction (from)	SW	SW
Temperature (°C)	6.0	5.0
Barometric Pressure (mb)	976	976
(Rising/ Falling)		STEADY
PID - Air	-	-
PID - Calibration Gas	-	-

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)																	
Ambient Air Finish (Calibration)																	
BH01	976		0.0		<0.1		0.3		19.9	<1	<1	-	2.89	7.47		149.89	
BH02	976		0.0		<0.1		0.9	19.1	19.2	<1	<1	-	4.45	9.98		151.31	
BH03	976		0.0		<0.1		4.0		9.4	<1	<1	-	3.06	6.09		149.65	Values steadily decreased/ increased for over 6 minutes
BH04	976	-0.9	0.0		<0.1		3.9		9.3	<1	<1	-	3.11	6.72		151.20	
BH05	976		0.0		<0.1		1.8		16.4	<1	<1	-	0.99	7.44		154.85	
BH06	975	-3.4	0.0		<0.1		13.1		2.6	<1	10.0	-	4.12	8.36		150.88	Values steadily decreased/ increased for over 6 minutes

BWB GAS AND GROUNDWATER MONITORING

Site:		Plot J, Kingsway Business Park	
Client:		Wilson Bowden Developments Ltd	
Job No.:		MCS2374	
Date:		25 January 2018	
Start / End Time:		08:00 - 12:00	
Engineer:		ZT	
Monitoring Equipment:	Gas Meter ID	-	
	PID ID	-	
	Dip Tape	-	
	Other		

NR = Not Recorded
Dry = No Groundwater



Weather Conditions	Start	End
(Dry / Raining)	DRY	DRY
Cloud Cover (Oktas)	6	7
Wind Strength (m/s)	0.2	0.5
Wind Direction (from)	SW	SW
Temperature (°C)	11.0	12.0
Barometric Pressure (mb)	984	985
(Rising/ Falling)		RISING
PID - Air	-	-
PID - Calibration Gas	-	-

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)																	
Ambient Air Finish (Calibration)																	
BH01		-0.4	<0.1		<0.1		4.6		11.5	<1	<1	<0.1	2.95	7.42		149.83	
BH02		-0.1	<0.1		<0.1		1.8		17.4	<1	<1	<0.1	4.32	8.72		151.44	
BH03		10.7	2.6		<0.1		3.7		6.2	<1	<1	<0.1	2.85	6.16		149.86	
BH04		-11.5	-11.3		<0.1		2.3		13.1	<1	<1	<0.1	2.94	6.76		151.37	
BH05		1.9	<0.1		<0.1		2.3		15.4	<1	<1	<0.1	1.21	7.38		154.63	
BH06		-9.1	<0.1		<0.1	10.6	10.4		7.9	<1	<1	<0.1	4.12	8.40		150.88	

BWB GAS AND GROUNDWATER MONITORING

Site:		Plot J, Kingsway Business Park	
Client:		Wilson Bowden Developments Ltd	
Job No.:		MCS2374	
Date:		29 January 2018	
Start / End Time:		14:00 - 15:00	
Engineer:		ZT	
Monitoring Equipment:	Gas Meter ID	-	
	PID ID	-	
	Dip Tape	-	
	Other		

NR = Not Recorded
Dry = No Groundwater



Weather Conditions	Start	End
(Dry / Raining)	DRY	DRY
Cloud Cover (Oktas)	6	5
Wind Strength (m/s)	0.3	0.6
Wind Direction (from)	W	W
Temperature (°C)	9.0	8.0
Barometric Pressure (mb)	1006	1005
(Rising/ Falling)		FALLING
PID - Air	-	-
PID - Calibration Gas	-	-

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)																	
Ambient Air Finish (Calibration)																	
BH01		-1.5	5.1		<0.1		1.7		18.4	<1	<1	<0.1	3.01	5.81		149.77	
BH02		0.1	<0.1		<0.1	2.0	1.6		17.0	<1	<1	<0.1	4.27	6.47		151.49	
BH03		9.4	0.1		<0.1		3.6		8.0	<1	<1	<0.1	3.05	6.14		149.66	
BH04		-26.3	0.1		<0.1		2.4		13.1	<1	<1	<0.1	3.09	6.68		151.22	
BH05		7.6	<0.1		<0.1		1.8		15.3	<1	<1	<0.1	0.82	7.21		155.02	
BH06		-18.6	-0.3		<0.1		<0.1		20.5	<1	<1	<0.1	2.00	7.81		153.00	Silt on dip

BWB GAS AND GROUNDWATER MONITORING

Site:		Plot J, Kingsway Business Park
Client:		Wilson Bowden Developments Ltd
Job No.:		MCS2374
Date:		08 February 2018
Start / End Time:		08:15 - 09:30
Engineer:		ZT
Monitoring Equipment:	Gas Meter ID	-
	PID ID	-
	Dip Tape	-
	Other	

NR = Not Recorded
Dry = No Groundwater



Weather Conditions	Start	End
(Dry / Raining)	DRY	DRY
Cloud Cover (Oktas)	8	8
Wind Strength (m/s)	0.6	0.5
Wind Direction (from)	SW	SW
Temperature (°C)	3.0	4.0
Barometric Pressure (mb)	995	995
(Rising/ Falling)		STEADY
PID - Air	-	-
PID - Calibration Gas	-	-

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)																	
Ambient Air Finish (Calibration)																	
BH01		0.1	<0.1		<0.1		4.7		13.0	<1	<1	<0.1	3.04	5.67		149.74	
BH02			<0.1		<0.1		1.6		17.7	<1	<1	<0.1	4.20	6.43		151.56	
BH03		0.1	<0.1		<0.1		2.9		11.6	<1	<1	<0.1	3.08	6.10		149.63	
BH04		25.4	<0.1		<0.1		2.4		13.3	<1	<1	<0.1	3.13	5.18		151.18	
BH05			<0.1		<0.1		3.3		15.1	<1	<1	<0.1	2.21	3.95		153.63	
BH06			<0.1		<0.1		1.8		18.8	<1	<1	<0.1	3.70	7.82		151.30	

APPENDIX 6

SOIL AND SOIL LEACHATE CHEMICAL ANALYSIS RESULTS

**Thomas Yarnall**

BWB Consulting Limited
Livery Place
35 Livery Street Birmingham
B3 2PB

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

t: 01217962087

e: thomas.yarnall@bwbconsulting.com

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 18-72894

Project / Site name:	Plot J.Rochdale	Samples received on:	12/01/2018
Your job number:	MCS2374	Samples instructed on:	15/01/2018
Your order number:	POR015715	Analysis completed by:	22/01/2018
Report Issue Number:	1	Report issued on:	22/01/2018
Samples Analysed:	6 leachate samples - 22 soil samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number				888910	888911	888912	888913	888914
Sample Reference				TP01	TP02	TP02	TP03	TP04
Sample Number				2	1	2	3	4
Depth (m)				0.75-0.85	0.55-0.65	0.55-0.65	0.10-0.20	0.50-0.60
Date Sampled				09/01/2018	10/01/2018	10/01/2018	09/01/2018	09/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	-	-	-
Moisture Content	%	N/A	NONE	27	27	-	-	-
Total mass of sample received	kg	0.001	NONE	0.51	1.5	-	-	-

Asbestos in Soil	Type	N/A	ISO 17025	-	-	Not-detected	Not-detected	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.4	6.3	-	-	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	-	-
Complex Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	-	-
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0084	0.010	-	-	-
Total Sulphur	mg/kg	50	MCERTS	350	340	-	-	-
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.028	0.022	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-	-
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.40	-	-	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.51	-	-	-
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.44	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.24	-	-	-
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.29	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.35	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.16	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.32	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	2.71	-	-	-
-----------------------------	-------	-----	--------	--------	------	---	---	---

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	7.8	-	-	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	130	80	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.42	0.68	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	2.4	0.7	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	-	-
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14	20	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	5.9	27	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	7.6	33	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	8.5	19	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	13	23	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	17	45	-	-	-

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number	888910	888911	888912	888913	888914
Sample Reference	TP01	TP02	TP02	TP03	TP04
Sample Number	2	1	2	3	4
Depth (m)	0.75-0.85	0.55-0.65	0.55-0.65	0.10-0.20	0.50-0.60
Date Sampled	09/01/2018	10/01/2018	10/01/2018	09/01/2018	09/01/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
Toluene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
Ethylbenzene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
p & m-xylene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
o-xylene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	< 1.0	-	-	-

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	44	< 10	-	-	-
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	-	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	< 8.0	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	< 8.0	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	-	-	-

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number	888915	888916	888917	888918	888919
Sample Reference	TP05	TP06	TP09	TP11	TP13
Sample Number	1	4	4	1	1
Depth (m)	0.20-0.30	1.50-1.60	2.40-2.50	1.00-1.10	0.10-0.20
Date Sampled	09/01/2018	09/01/2018	10/01/2018	10/01/2018	10/01/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	-
Moisture Content	%	N/A	NONE	22	9.8
Total mass of sample received	kg	0.001	NONE	1.2	0.61

Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	5.6	6.2	6.1	6.4	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	-
Complex Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	-
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0099	0.0072	0.0080	0.0069	-
Total Sulphur	mg/kg	50	MCERTS	430	90	120	62	-
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.032	0.0048	0.0033	0.0046	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	-
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.18	< 0.05	< 0.05	< 0.05	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	0.20	< 0.05	< 0.05	< 0.05	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	-
Phenanthrene	mg/kg	0.05	MCERTS	0.91	< 0.05	< 0.05	< 0.05	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	0.81	< 0.05	< 0.05	< 0.05	-
Pyrene	mg/kg	0.05	MCERTS	0.69	< 0.05	< 0.05	< 0.05	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.50	< 0.05	< 0.05	< 0.05	-
Chrysene	mg/kg	0.05	MCERTS	0.39	< 0.05	< 0.05	< 0.05	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.45	< 0.05	< 0.05	< 0.05	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.23	< 0.05	< 0.05	< 0.05	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.42	< 0.05	< 0.05	< 0.05	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	4.78	< 0.80	< 0.80	< 0.80	-
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	3.4	3.6	5.9	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	75	37	20	25	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.53	0.47	0.30	0.54	-
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1	0.4	0.5	0.4	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	-
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12	18	8.5	15	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	25	13	11	17	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	54	7.2	6.1	7.5	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	16	11	16	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	26	22	10	18	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	63	32	23	28	-

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number				888915	888916	888917	888918	888919
Sample Reference				TP05	TP06	TP09	TP11	TP13
Sample Number				1	4	4	1	1
Depth (m)				0.20-0.30	1.50-1.60	2.40-2.50	1.00-1.10	0.10-0.20
Date Sampled				09/01/2018	09/01/2018	10/01/2018	10/01/2018	10/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics

Benzene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
Toluene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
Ethylbenzene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
p & m-xylene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
o-xylene	ug/kg	1	MCERTS	-	< 1.0	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	< 1.0	-	-	-

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	23	< 10	< 10	< 10	-
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	< 8.0	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	< 8.0	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	-	-	-

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number	888920	888921	888922	888923	888924
Sample Reference	TP13	TP16	TP19	TP21	TP21
Sample Number	2	11	2	4	3
Depth (m)	0.10-0.20	0.20-0.30	0.40-0.50	0.10-0.20	0.10-0.20
Date Sampled	10/01/2018	12/01/2018	09/01/2018	11/01/2018	11/01/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	32	16
Total mass of sample received	kg	0.001	NONE	1.5	1.4

Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	Not-detected	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	5.7	4.8	5.8	-	5.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	-	< 1
Complex Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	-	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	-	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.013	0.014	0.016	-	0.013
Total Sulphur	mg/kg	50	MCERTS	480	460	380	-	370
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.037	0.035	0.033	-	0.030

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	0.19
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.41	0.23	0.39	-	1.1
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	0.18
Fluoranthene	mg/kg	0.05	MCERTS	0.87	0.38	0.63	-	1.2
Pyrene	mg/kg	0.05	MCERTS	0.89	0.33	0.56	-	1.0
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.73	0.23	0.43	-	0.70
Chrysene	mg/kg	0.05	MCERTS	0.56	0.22	0.35	-	0.55
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.68	0.23	0.41	-	0.64
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.30	0.16	0.20	-	0.28
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.65	0.28	0.34	-	0.59
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.23	< 0.05	< 0.05	-	0.24
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.22	< 0.05	< 0.05	-	0.27

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	5.54	2.06	3.31	-	6.96
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18	16	15	-	14
Barium (aqua regia extractable)	mg/kg	1	MCERTS	100	99	77	-	55
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.73	0.85	0.78	-	0.66
Boron (water soluble)	mg/kg	0.2	MCERTS	0.9	1.0	0.9	-	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	-	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	19	19	-	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	34	39	34	-	32
Lead (aqua regia extractable)	mg/kg	1	MCERTS	110	68	68	-	54
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	16	17	-	16
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	35	32	25	-	28
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	74	81	57	-	47

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Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number				888920	888921	888922	888923	888924
Sample Reference				TP13	TP16	TP19	TP21	TP21
Sample Number				2	11	2	4	3
Depth (m)				0.10-0.20	0.20-0.30	0.40-0.50	0.10-0.20	0.10-0.20
Date Sampled				10/01/2018	12/01/2018	09/01/2018	11/01/2018	11/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics

Benzene	ug/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Toluene	ug/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Ethylbenzene	ug/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
p & m-xylene	ug/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
o-xylene	ug/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	< 1.0	-	-	-	< 1.0

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	21	< 10	< 10	-	< 10
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	< 0.1
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	-	-	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	-	-	-	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	-	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	14	-	-	-	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	21	-	-	-	< 10

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Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number	888925	888926	888927	888928	888929
Sample Reference	TP23	TP25	TP27	TP27	TP29
Sample Number	4	5	2	6	5
Depth (m)	0.75-0.85	2.40-2.50	0.45-0.55	1.75-1.85	0.50-0.60
Date Sampled	11/01/2018	11/01/2018	08/01/2018	08/01/2018	08/01/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	21
Moisture Content	%	N/A	NONE	11	11
Total mass of sample received	kg	0.001	NONE	0.55	0.51

Asbestos in Soil	Type	N/A	ISO 17025	-	-	Not-detected	-	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	4.6	6.1	-	6.3	6.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	< 1	< 1
Complex Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.019	0.018	-	0.013	0.0087
Total Sulphur	mg/kg	50	MCERTS	84	85	-	73	100
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.0026	0.0032	-	0.0036	0.0051

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	-	< 0.80	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.0	5.7	-	5.7	3.4
Barium (aqua regia extractable)	mg/kg	1	MCERTS	31	69	-	36	25
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.41	0.63	-	0.58	0.30
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	0.5	-	0.4	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	-	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	20	-	22	14
Copper (aqua regia extractable)	mg/kg	1	MCERTS	18	18	-	16	8.2
Lead (aqua regia extractable)	mg/kg	1	MCERTS	7.7	8.5	-	10	6.9
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15	20	-	19	11
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	20	21	-	22	20
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	27	38	-	32	19

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number	888925	888926	888927	888928	888929
Sample Reference	TP23	TP25	TP27	TP27	TP29
Sample Number	4	5	2	6	5
Depth (m)	0.75-0.85	2.40-2.50	0.45-0.55	1.75-1.85	0.50-0.60
Date Sampled	11/01/2018	11/01/2018	08/01/2018	08/01/2018	08/01/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	ug/kg	1	MCERTS	-	-	-	-	-
Toluene	ug/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	ug/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	ug/kg	1	MCERTS	-	-	-	-	-
o-xylene	ug/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	-	-	-	-

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	< 10	< 10	-	< 10	< 10
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number	888930	888931			
Sample Reference	TP30	TP30			
Sample Number	2	1			
Depth (m)	0.35-0.45	0.35-0.45			
Date Sampled	08/01/2018	08/01/2018			
Time Taken	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	-	< 0.1
Moisture Content	%	N/A	NONE	-	17
Total mass of sample received	kg	0.001	NONE	-	1.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-		
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	6.7		
Total Cyanide	mg/kg	1	MCERTS	-	< 1		
Complex Cyanide	mg/kg	1	MCERTS	-	< 1		
Free Cyanide	mg/kg	1	MCERTS	-	< 1		
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.014		
Total Sulphur	mg/kg	50	MCERTS	-	300		
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	-	0.025		

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0		
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05		
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05		
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05		
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05		
Phenanthrene	mg/kg	0.05	MCERTS	-	1.5		
Anthracene	mg/kg	0.05	MCERTS	-	0.22		
Fluoranthene	mg/kg	0.05	MCERTS	-	2.2		
Pyrene	mg/kg	0.05	MCERTS	-	1.9		
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	1.3		
Chrysene	mg/kg	0.05	MCERTS	-	1.3		
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	1.7		
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.48		
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	1.4		
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.50		
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.61		

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	13.1		
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	10		
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	80		
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.63		
Boron (water soluble)	mg/kg	0.2	MCERTS	-	0.6		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2		
Chromium (hexavalent)	mg/kg	4	MCERTS	-	< 4.0		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	19		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	25		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	41		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	< 0.3		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	15		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0		
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	19		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	49		

Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number				888930	888931			
Sample Reference				TP30	TP30			
Sample Number				2	1			
Depth (m)				0.35-0.45	0.35-0.45			
Date Sampled				08/01/2018	08/01/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	ug/kg	1	MCERTS	-	< 1.0			
Toluene	ug/kg	1	MCERTS	-	< 1.0			
Ethylbenzene	ug/kg	1	MCERTS	-	< 1.0			
p & m-xylene	ug/kg	1	MCERTS	-	< 1.0			
o-xylene	ug/kg	1	MCERTS	-	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	< 1.0			

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	-	36			
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	-	< 0.1			
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	< 8.0			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	< 8.0			
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10			
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	2.1			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	< 10			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	25			
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	36			



Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number				888932	888933	888934	888935	888936
Sample Reference				TP02	TP06	TP13	TP21	TP29
Sample Number				1	4	2	3	5
Depth (m)				0.55-0.65	1.50-1.60	0.10-0.20	0.10-0.20	0.50-0.60
Date Sampled				10/01/2018	09/01/2018	10/01/2018	11/01/2018	08/01/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status		

General Inorganics

	pH Units	N/A	ISO 17025	7.1	6.8	6.5	6.5	6.7
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Sulphate as SO ₄	mg/l	0.1	ISO 17025	2.7	1.7	2.1	1.9	2.7

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1	< 1.1	1.8	< 1.1	< 1.1
Barium (dissolved)	µg/l	0.05	ISO 17025	15	1.5	6.0	7.1	3.4
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.3	< 0.2	< 0.2	< 0.2
Boron (dissolved)	µg/l	10	ISO 17025	< 10	< 10	17	14	< 10
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Chromium (dissolved)	µg/l	0.4	ISO 17025	0.7	< 0.4	0.9	0.8	1.6
Copper (dissolved)	µg/l	0.7	ISO 17025	13	5.9	37	31	21
Lead (dissolved)	µg/l	1	ISO 17025	2.7	1.2	6.7	3.5	2.7
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.9	< 0.3	2.5	1.8	0.8
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7	< 1.7	< 1.7	3.6	< 1.7
Zinc (dissolved)	µg/l	0.4	ISO 17025	7.1	3.6	7.7	9.7	7.6



Analytical Report Number: 18-72894

Project / Site name: Plot J.Rochdale

Your Order No: POR015715

Lab Sample Number				888937				
Sample Reference				TP30				
Sample Number				1				
Depth (m)				0.35-0.45				
Date Sampled				08/01/2018				
Time Taken				None Supplied				
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.7				
Total Cyanide	µg/l	10	ISO 17025	< 10				
Sulphate as SO ₄	mg/l	0.1	ISO 17025	2.5				

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1				
Barium (dissolved)	µg/l	0.05	ISO 17025	19				
Beryllium (dissolved)	µg/l	0.2	ISO 17025	0.3				
Boron (dissolved)	µg/l	10	ISO 17025	< 10				
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08				
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.0				
Copper (dissolved)	µg/l	0.7	ISO 17025	18				
Lead (dissolved)	µg/l	1	ISO 17025	3.0				
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5				
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.8				
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0				
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Zinc (dissolved)	µg/l	0.4	ISO 17025	5.9				

Analytical Report Number : 18-72894

Project / Site name: Plot J.Rochdale

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
888910	TP01	2	0.75-0.85	Brown clay and sand.
888911	TP02	1	0.55-0.65	Brown clay and sand with vegetation.
888912	TP02	2	0.55-0.65	-
888913	TP03	3	0.10-0.20	-
888914	TP04	4	0.50-0.60	-
888915	TP05	1	0.20-0.30	Brown loam and clay with gravel and vegetation.
888916	TP06	4	1.50-1.60	Light brown sand with gravel.
888917	TP09	4	2.40-2.50	Light brown sandy clay with gravel.
888918	TP11	1	1.00-1.10	Light brown sandy clay.
888919	TP13	1	0.10-0.20	-
888920	TP13	2	0.10-0.20	Brown loam and clay with vegetation.
888921	TP16	11	0.20-0.30	Brown loam and clay with gravel and vegetation.
888922	TP19	2	0.40-0.50	Brown loam and clay with gravel and vegetation.
888923	TP21	4	0.10-0.20	-
888924	TP21	3	0.10-0.20	Brown loam and clay with gravel and vegetation.
888925	TP23	4	0.75-0.85	Light brown clay and sand.
888926	TP25	5	2.40-2.50	Light brown sandy clay.
888927	TP27	2	0.45-0.55	-
888928	TP27	6	1.75-1.85	Light brown clay and sand with gravel.
888929	TP29	5	0.50-0.60	Brown sandy clay with gravel and stones.
888930	TP30	2	0.35-0.45	-
888931	TP30	1	0.35-0.45	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 18-72894

Project / Site name: Plot J.Rochdale

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Complex Cyanide in soil	Determination of complex cyanide by calculation.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L009-PL	D	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS

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The results included within the report are representative of the samples submitted for analysis.

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Analytical Report Number : 18-72894

Project / Site name: Plot J.Rochdale

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding.	L076-PL	W	MCERTS
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
TP27	6	S	18-72894	888928	c	Total cyanide in soil	L080-PL	c
TP29	5	S	18-72894	888929	c	Total cyanide in soil	L080-PL	c
TP30	1	S	18-72894	888931	c	Total cyanide in soil	L080-PL	c

APPENDIX 7

GROUNDWATER CHEMICAL ANALYSIS RESULTS

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Leeds
LS1 4EH

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

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Analytical Report Number : 18-74222

Project / Site name:	Plot J, Rochdale	Samples received on:	29/01/2018
Your job number:	MC52210	Samples instructed on:	29/01/2018
Your order number:		Analysis completed by:	05/02/2018
Report Issue Number:	1	Report issued on:	05/02/2018
Samples Analysed:	6 water samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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



Analytical Report Number: 18-74222

Project / Site name: Plot J, Rochdale

Lab Sample Number				897166	897167	897168	897169	897170
Sample Reference				BH01	BH02	BH03	BH04	BH05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				25/01/2018	25/01/2018	25/01/2018	25/01/2018	25/01/2018
Time Taken				1030	1045	0820	0930	0915
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	6.1	6.5	6.1	6.0	6.2
Electrical Conductivity at 20 °C	µS/cm	10	ISO 17025	300	200	130	190	170
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Sulphate as SO ₄	µg/l	45	ISO 17025	36700	12400	16900	11500	13700
Sulphate as SO ₄	mg/l	0.045	ISO 17025	36.7	12.4	16.9	11.5	13.7
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	42	50	23	28	41
Dissolved Organic Carbon (DOC)	mg/l	0.1	NONE	3.45	3.31	3.76	3.46	10.4

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16
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Analytical Report Number: 18-74222

Project / Site name: Plot J, Rochdale

Lab Sample Number				897166	897167	897168	897169	897170
Sample Reference				BH01	BH02	BH03	BH04	BH05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				25/01/2018	25/01/2018	25/01/2018	25/01/2018	25/01/2018
Time Taken				1030	1045	0820	0930	0915
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	1.3
Barium (dissolved)	µg/l	0.05	ISO 17025	260	91	67	110	110
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Boron (dissolved)	µg/l	10	ISO 17025	24	27	16	15	13
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Calcium (dissolved)	mg/l	0.012	ISO 17025	34	29	16	24	18
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	0.7	< 0.4	< 0.4	0.4	1.1
Copper (dissolved)	µg/l	0.7	ISO 17025	2.5	3.0	6.3	3.3	10
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	12	7.2	3.7	1.4	7.2
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Vanadium (dissolved)	µg/l	1.7	ISO 17025	3.8	< 1.7	< 1.7	4.6	< 1.7
Zinc (dissolved)	µg/l	0.4	ISO 17025	5.5	7.1	4.8	3.6	9.5

Monoaromatics

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH2 (C6 - C10)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 18-74222

Project / Site name: Plot J, Rochdale

Lab Sample Number				897171				
Sample Reference				BH06				
Sample Number				None Supplied				
Depth (m)				None Supplied				
Date Sampled				25/01/2018				
Time Taken				0845				
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	5.9				
Electrical Conductivity at 20 °C	µS/cm	10	ISO 17025	470				
Total Cyanide	µg/l	10	ISO 17025	< 10				
Sulphate as SO ₄	µg/l	45	ISO 17025	105000				
Sulphate as SO ₄	mg/l	0.045	ISO 17025	105				
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	22				
Dissolved Organic Carbon (DOC)	mg/l	0.1	NONE	4.98				

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10				
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01				
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01				
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01				
Fluorene	µg/l	0.01	ISO 17025	< 0.01				
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01				
Anthracene	µg/l	0.01	ISO 17025	< 0.01				
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Pyrene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01				
Chrysene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01				
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01				
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01				

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16				
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Analytical Report Number: 18-74222

Project / Site name: Plot J, Rochdale

Lab Sample Number				897171				
Sample Reference				BH06				
Sample Number				None Supplied				
Depth (m)				None Supplied				
Date Sampled				25/01/2018				
Time Taken				0845				
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	1.3				
Barium (dissolved)	µg/l	0.05	ISO 17025	250				
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2				
Boron (dissolved)	µg/l	10	ISO 17025	30				
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08				
Calcium (dissolved)	mg/l	0.012	ISO 17025	74				
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0				
Chromium (dissolved)	µg/l	0.4	ISO 17025	< 0.4				
Copper (dissolved)	µg/l	0.7	ISO 17025	4.5				
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0				
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5				
Nickel (dissolved)	µg/l	0.3	ISO 17025	7.3				
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0				
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Zinc (dissolved)	µg/l	0.4	ISO 17025	3.7				

Monoaromatics

Benzene	µg/l	1	ISO 17025	< 1.0				
Toluene	µg/l	1	ISO 17025	< 1.0				
Ethylbenzene	µg/l	1	ISO 17025	< 1.0				
p & m-xylene	µg/l	1	ISO 17025	< 1.0				
o-xylene	µg/l	1	ISO 17025	< 1.0				
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0				

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10				
TPH2 (C6 - C10)	µg/l	10	ISO 17025	< 10				
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10				

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 18-74222

Project / Site name: Plot J, Rochdale

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammoniacal Nitrogen as N in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Electrical conductivity at 20oC of water	Determination of electrical conductivity in water by electrometric measurement. Accredited Matrices SW, GW, PW	In-house method	L031-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	NONE
TPH2 (Waters)	Determination of hydrocarbons C6-C10 by headspace GC-MS. Accredited Matrices SW, PW. GW.	In-house method based on USEPA8260	L088-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Iss No 18-74222-1 Plot J, Rochdale MC52210

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The results included within the report are representative of the samples submitted for analysis.

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Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
BH01		W	18-74222	897166	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH01		W	18-74222	897166	c	Electrical conductivity at 20oC of water	L031-PL	c
BH01		W	18-74222	897166	c	pH at 20oC in water (automated)	L099-PL	c
BH02		W	18-74222	897167	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH02		W	18-74222	897167	c	Electrical conductivity at 20oC of water	L031-PL	c
BH02		W	18-74222	897167	c	pH at 20oC in water (automated)	L099-PL	c
BH03		W	18-74222	897168	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH03		W	18-74222	897168	c	Electrical conductivity at 20oC of water	L031-PL	c
BH03		W	18-74222	897168	c	pH at 20oC in water (automated)	L099-PL	c
BH04		W	18-74222	897169	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH04		W	18-74222	897169	c	Electrical conductivity at 20oC of water	L031-PL	c
BH04		W	18-74222	897169	c	pH at 20oC in water (automated)	L099-PL	c
BH05		W	18-74222	897170	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH05		W	18-74222	897170	c	Electrical conductivity at 20oC of water	L031-PL	c
BH05		W	18-74222	897170	c	pH at 20oC in water (automated)	L099-PL	c
BH06		W	18-74222	897171	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH06		W	18-74222	897171	c	Electrical conductivity at 20oC of water	L031-PL	c
BH06		W	18-74222	897171	c	pH at 20oC in water (automated)	L099-PL	c

APPENDIX 8

GEOTECHNICAL LABORATORY TESTING RESULTS



TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



4041

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

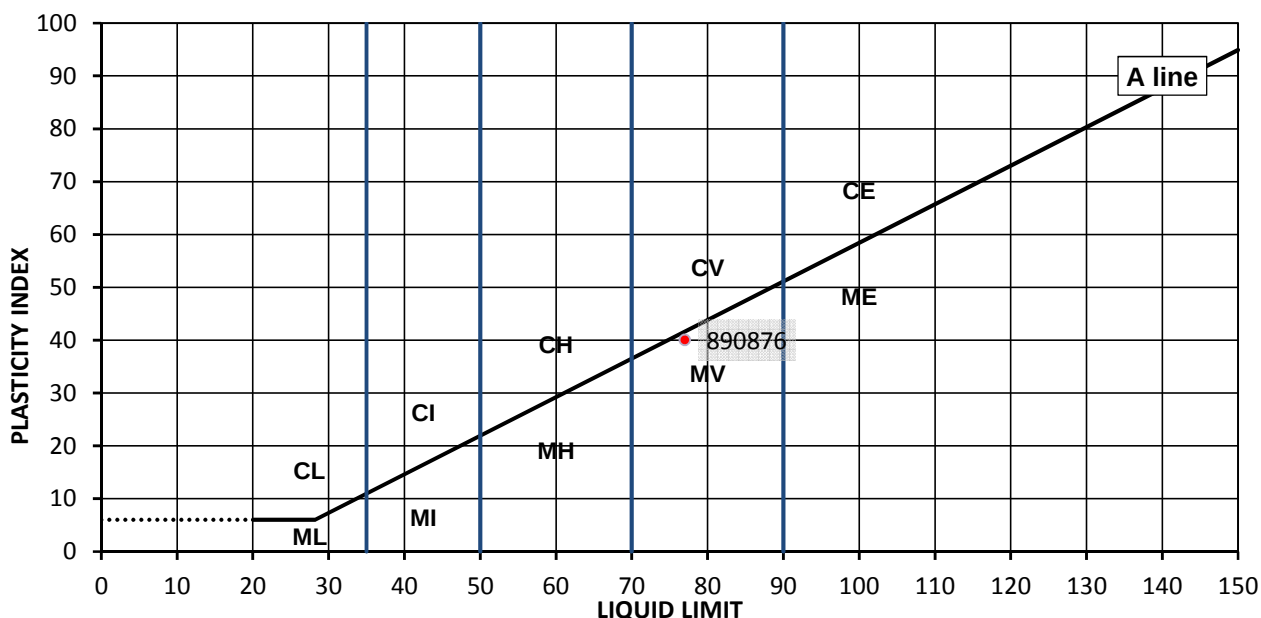
TEST RESULTS

Laboratory Reference: 890876
Sample Reference: Not Given

Description: Dark brown slightly organic CLAY
Location: TP01
Sample Preparation: Tested in natural condition

Sample Type: D
Depth Top [m]: 0.75
Depth Base [m]: 0.85

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
83	77	37	40	100



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
Organic	O	append to classification for organic material (eg CHO)

Remarks

Approved:

Signed:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Piotrowski

Darren Berrill
Geotechnical General
Manager

D. Berrill

for and on behalf of i2 Analytical Ltd

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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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



Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

4041

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

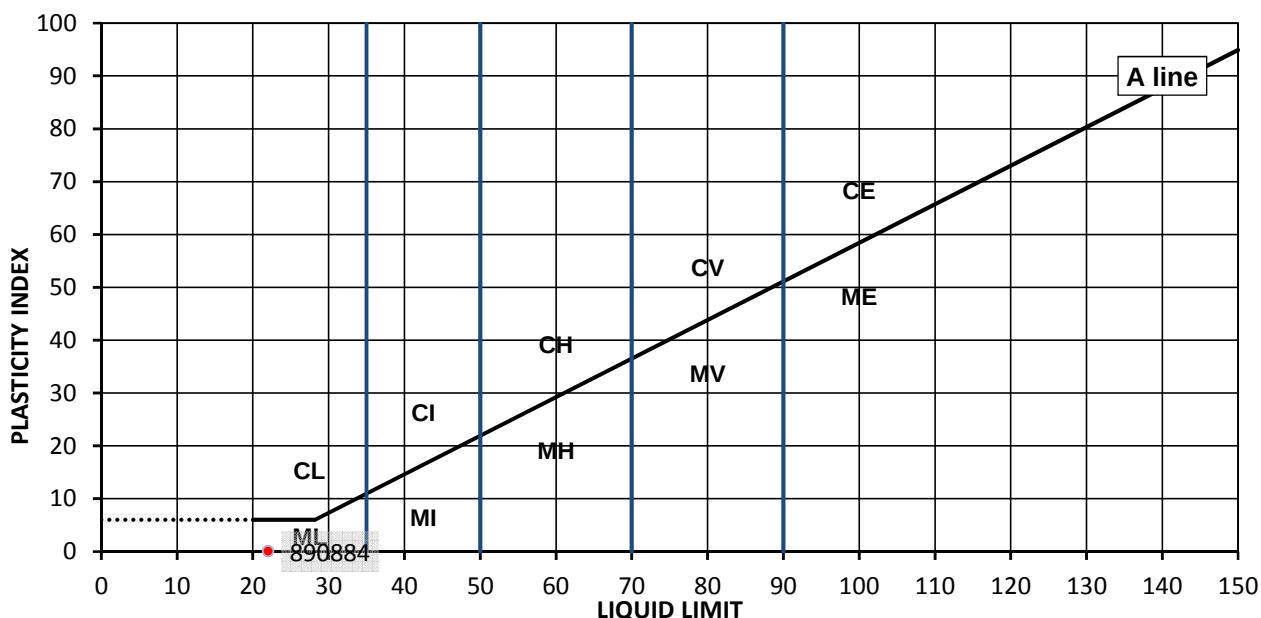
TEST RESULTS

Laboratory Reference: 890884
Sample Reference: Not Given

Description: Yellowish brown slightly gravelly slightly clayey SAND
Location: TP08
Sample Preparation: Tested after >425um removed by hand

Sample Type: D
Depth Top [m]: 3.40
Depth Base [m]: 3.50

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
19	22	NP	NP	97



Remarks NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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Client Reference: MCS2374
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Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

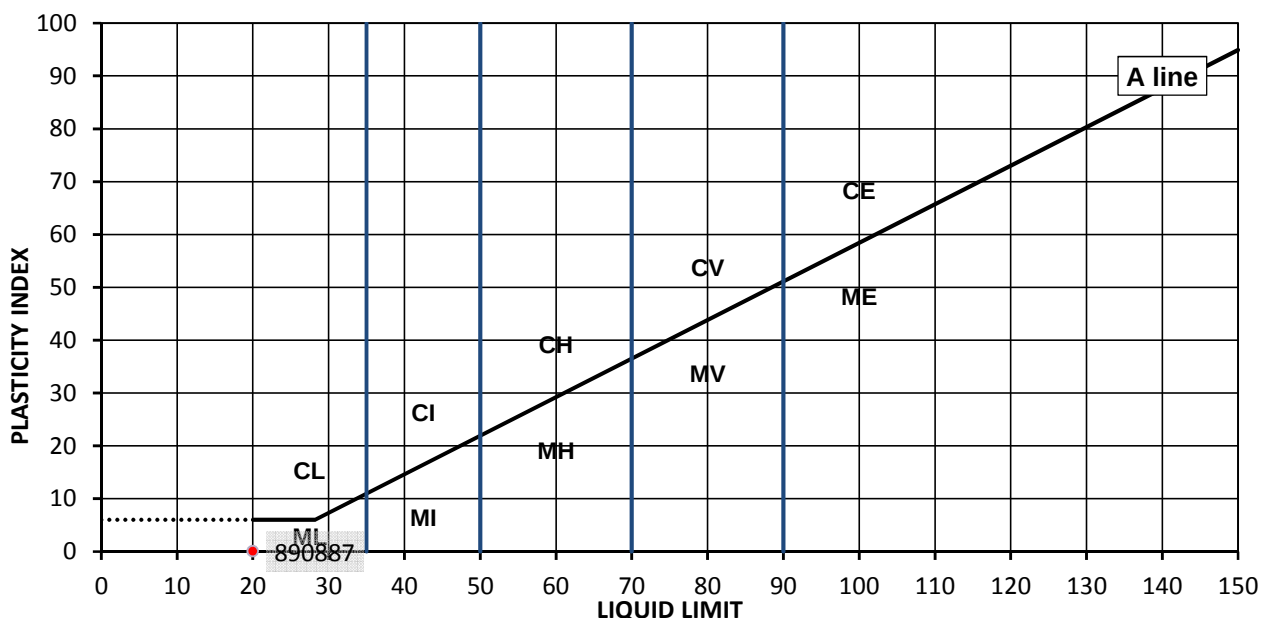
TEST RESULTS

Laboratory Reference: 890887
Sample Reference: Not Given

Description: Yellowish brown slightly gravelly SAND
Location: TP11
Sample Preparation: Tested after >425um removed by hand

Sample Type: D
Depth Top [m]: 1.00
Depth Base [m]: 1.10

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	20	NP	NP	98



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L Low	50 to 70
	I Medium	70 to 90
	H High	exceeding 90
	V Very high	
	E Extremely high	
Organic	O	append to classification for organic material (eg CHO)

Remarks NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Piotrowski

Signed:

Darren Berrill
Geotechnical General
Manager

D. Berrill

for and on behalf of i2 Analytical Ltd

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Determination of Liquid and Plastic Limits

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Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

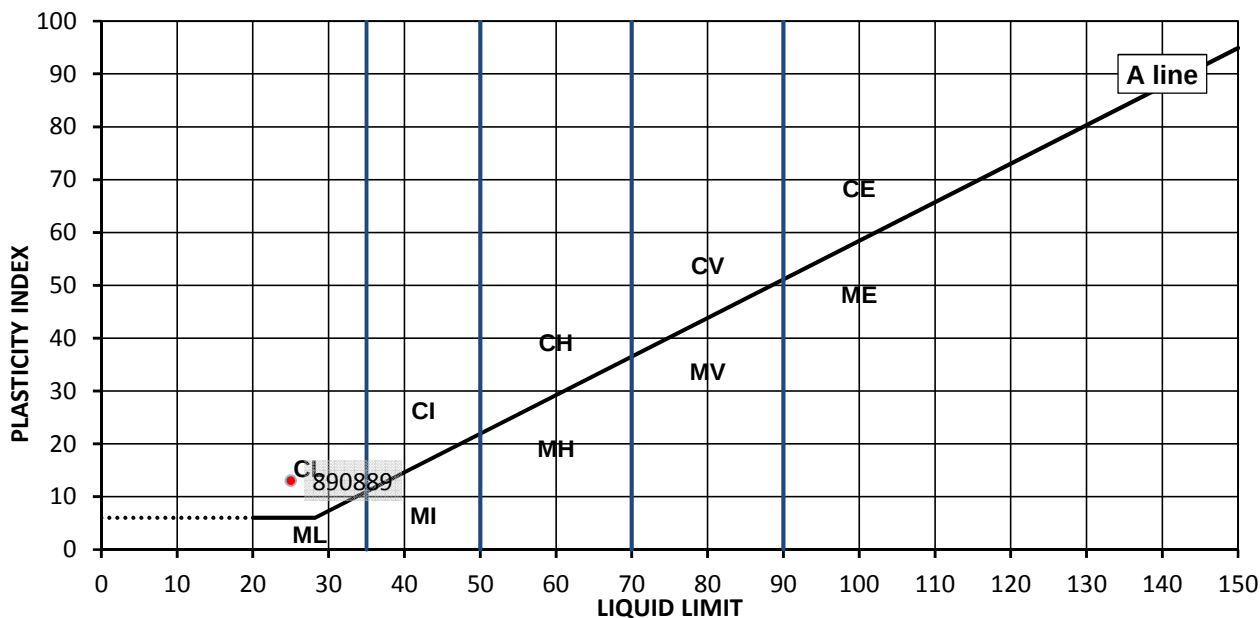
TEST RESULTS

Laboratory Reference: 890889
Sample Reference: Not Given

Description: Dark brown slightly gravelly very sandy CLAY
Location: TP12
Sample Preparation: Tested after >425um removed by hand

Sample Type: D
Depth Top [m]: 3.10
Depth Base [m]: 3.20

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
12	25	12	13	97



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
Organic	O	append to classification for organic material (eg CHO)

Remarks

Approved:

Signed:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Piotrowski

Darren Berrill
Geotechnical General
Manager

[Signature]

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

4041

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35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

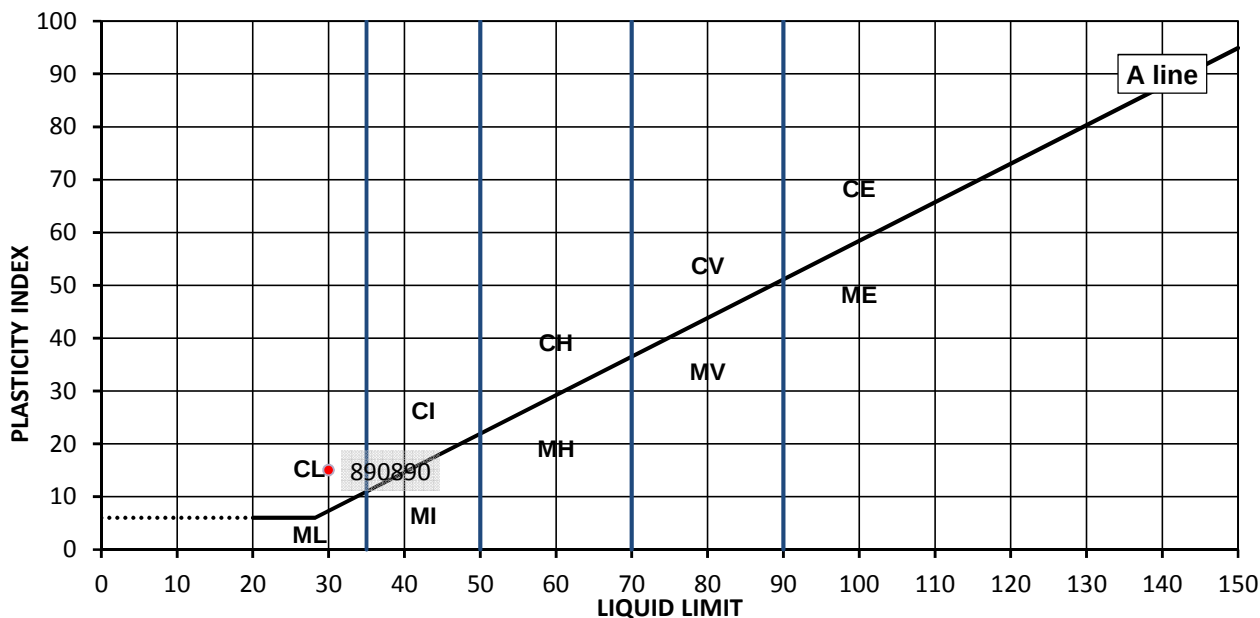
TEST RESULTS

Laboratory Reference: 890890
Sample Reference: Not Given

Description: Dark brown slightly gravelly very sandy CLAY
Location: TP13
Sample Preparation: Tested after >425um removed by hand

Sample Type: D
Depth Top [m]: 1.50
Depth Base [m]: 1.60

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
16	30	15	15	98



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
Organic	O	append to classification for organic material (eg CHO)

Remarks

Approved:

Signed:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Piotrowski

Darren Berrill
Geotechnical General
Manager

[Signature]

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Determination of Liquid and Plastic Limits

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Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

4041

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Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

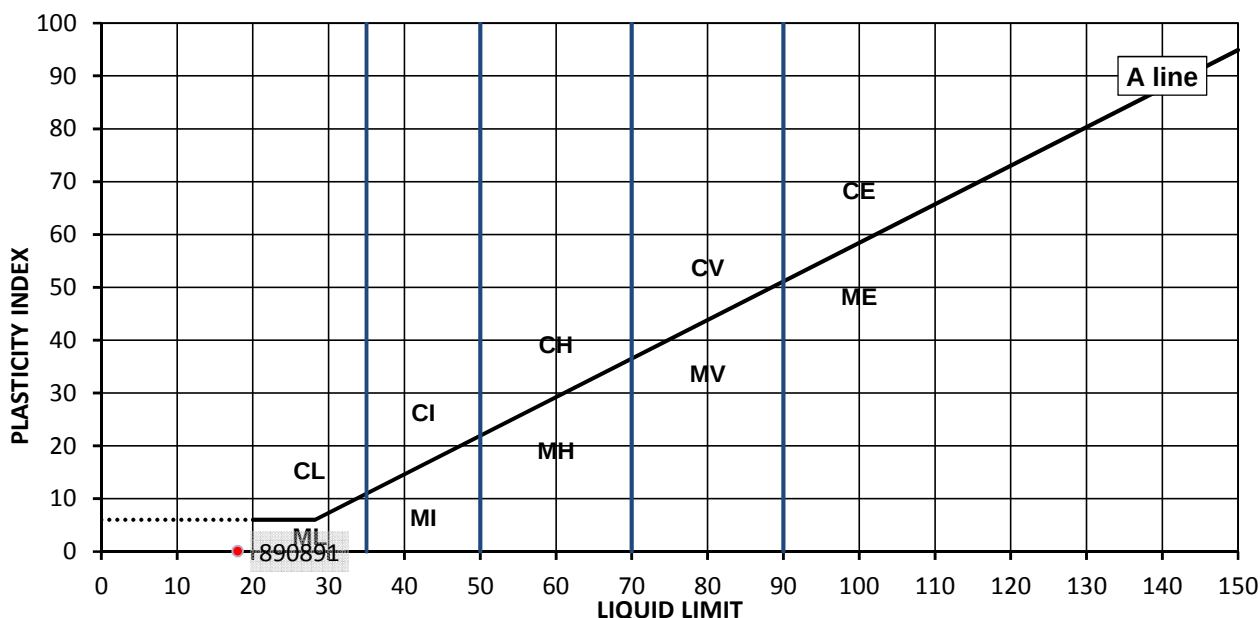
TEST RESULTS

Laboratory Reference: 890891
Sample Reference: Not Given

Description: Yellowish brown slightly gravelly SAND
Location: TP14
Sample Preparation: Tested after >425um removed by hand

Sample Type: D
Depth Top [m]: 1.00
Depth Base [m]: 1.10

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
14	18	NP	NP	99



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
Organic	O	append to classification for organic material (eg CHO)

Remarks NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Piotrowski

Signed:

Darren Berrill
Geotechnical General
Manager

D. Berrill

for and on behalf of i2 Analytical Ltd

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Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

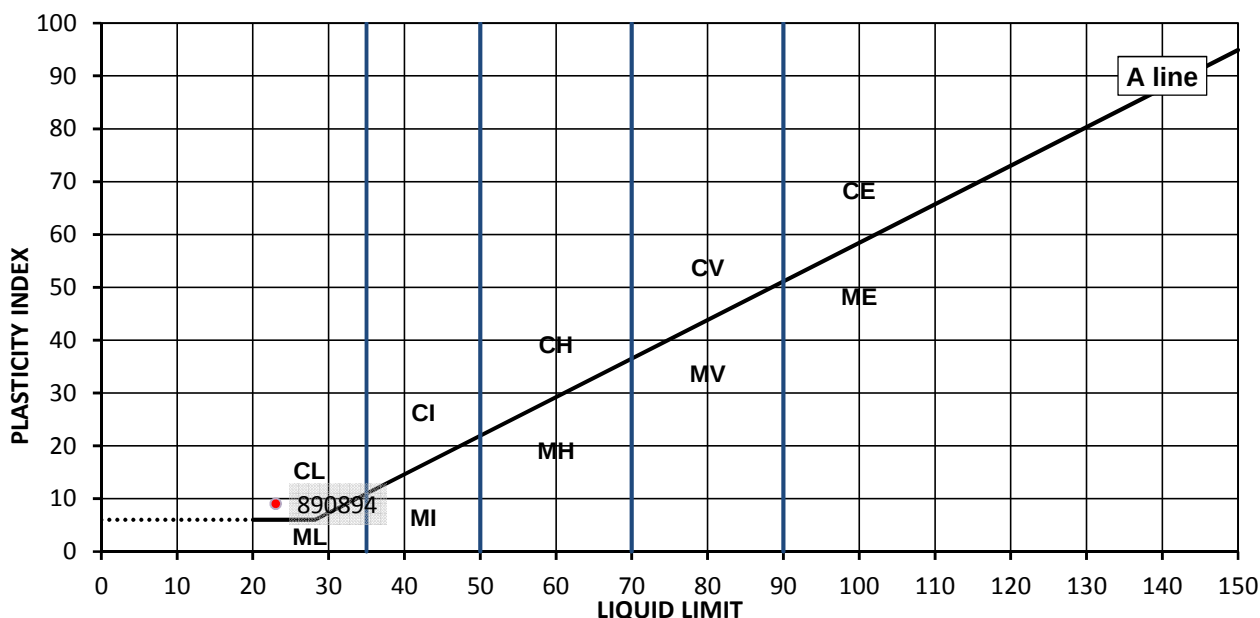
TEST RESULTS

Laboratory Reference: 890894
Sample Reference: Not Given

Description: Dark brown slightly gravelly clayey SAND
Location: TP17
Sample Preparation: Tested after >425um removed by hand

Sample Type: D
Depth Top [m]: 3.70
Depth Base [m]: 3.80

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
17	23	14	9	98



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
Organic	O	append to classification for organic material (eg CHO)

Remarks

Approved:

Signed:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Piotrowski

Darren Berrill
Geotechnical General
Manager

D. Berrill

for and on behalf of i2 Analytical Ltd

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35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

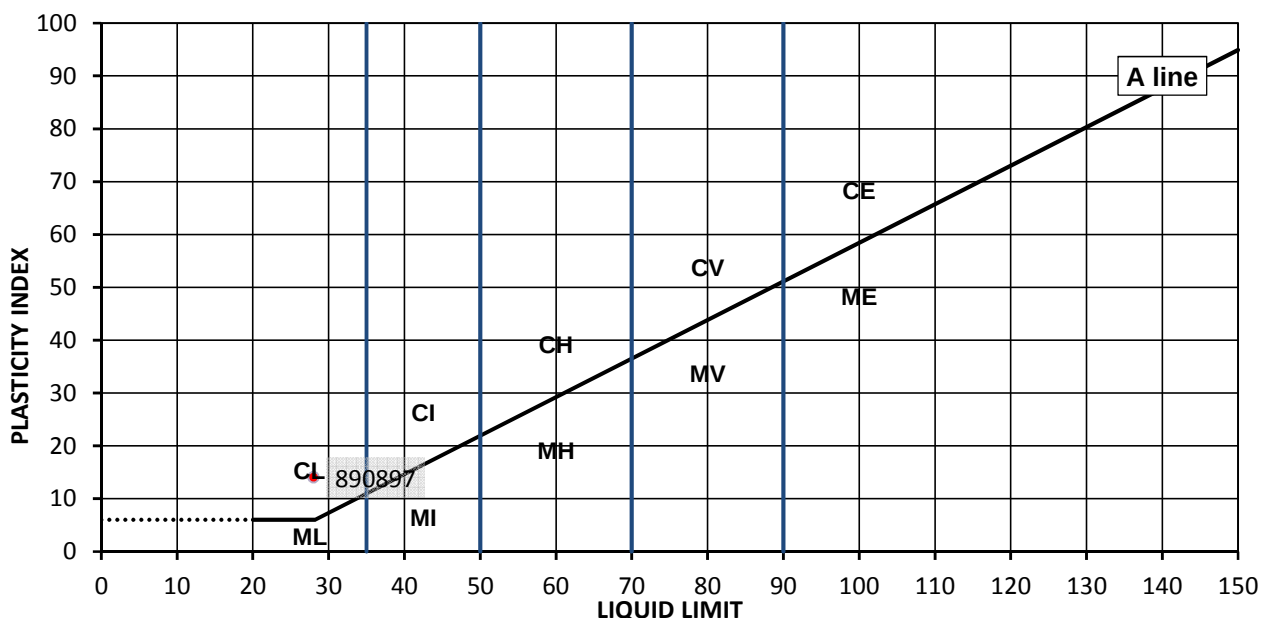
TEST RESULTS

Laboratory Reference: 890897
Sample Reference: Not Given

Description: Dark brown slightly gravelly very sandy CLAY
Location: TP21
Sample Preparation: Tested after >425um removed by hand

Sample Type: D
Depth Top [m]: 2.10
Depth Base [m]: 2.20

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
17	28	14	14	97



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
Organic	O	append to classification for organic material (eg CHO)

Remarks

Approved:

Signed:

Dariusz Piotrowski
PL Laboratory
Manager Geotechnical
Section
Date Reported: 02/02/2018

Piotrowski

Darren Berrill
Geotechnical General
Manager

[Signature]

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TEST CERTIFICATE

Summary of Classification Test Results

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3						
890870	BH01	Not Given	9.50	9.95	U	Dark brown slightly gravelly CLAY			16					
890871	BH02	Not Given	13.00	Not Given	U	Dark brown slightly gravelly CLAY			13					
890872	BH03	Not Given	8.00	Not Given	U	Dark brown slightly gravelly CLAY			15					
890873	BH04	Not Given	11.00	Not Given	U	Dark brown slightly gravelly CLAY			12					
890874	BH05	Not Given	6.50	Not Given	U	Brown sandy CLAY			14					
890875	BH05	Not Given	9.50	9.95	U	Dark brown slightly gravelly CLAY			15					
890876	TP01	Not Given	0.75	0.85	D	Dark brown slightly organic CLAY			83	100	77	37	40	
890878	TP03	Not Given	1.00	1.10	B	Yellowish brown gravelly SAND								2.64
890880	TP04	Not Given	1.40	1.50	D	Yellowish brown slightly gravelly SAND								2.72
890881	TP07	Not Given	1.00	1.10	B	Brown clayey SAND								2.69

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3		%	%	%	%	%
890883	TP08	Not Given	0.40	0.50	B	Brown clayey SAND								2.7
890884	TP08	Not Given	3.40	3.50	D	Yellowish brown slightly gravelly slightly clayey SAND			19	97	22	NP	NP*	
890885	TP10	Not Given	0.90	1.00	B	Yellowish brown slightly clayey SAND								2.68
890887	TP11	Not Given	1.00	1.10	D	Yellowish brown slightly gravelly SAND			24	98	20	NP	NP*	
890888	TP12	Not Given	0.80	0.90	B	Brown sandy clayey GRAVEL								2.69
890889	TP12	Not Given	3.10	3.20	D	Dark brown slightly gravelly very sandy CLAY			12	97	25	12	13	
890890	TP13	Not Given	1.50	1.60	D	Dark brown slightly gravelly very sandy CLAY			16	98	30	15	15	
890891	TP14	Not Given	1.00	1.10	D	Yellowish brown slightly gravelly SAND			14	99	18	NP	NP*	
890892	TP15	Not Given	1.10	1.20	B	Brown gravelly sandy CLAY								2.68
890894	TP17	Not Given	3.70	3.80	D	Dark brown slightly gravelly clayey SAND			17	98	23	14	9	

Comments: * NP – non plastic

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk	dry		% Passing 425um	LL	PL	PI	
							Mg/m3	Mg/m3		%	%	%	%	Mg/m3
890895	TP19	Not Given	0.90	1.00	B	Brown slightly gravelly slightly sandy CLAY								2.69
890897	TP21	Not Given	2.10	2.20	D	Dark brown slightly gravelly very sandy CLAY			17	97	28	14	14	
890899	TP24	Not Given	0.60	0.70	B	Dark brown sandy gravelly CLAY								2.66
890902	TP27	Not Given	1.20	1.30	B	Dark brown slightly gravelly sandy CLAY								2.66

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

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Geotechnical General Manager

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4041

TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

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



Environmental Science

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890877

Sample Reference: Not Given

Sample description: Orangish brown gravelly clayey SAND

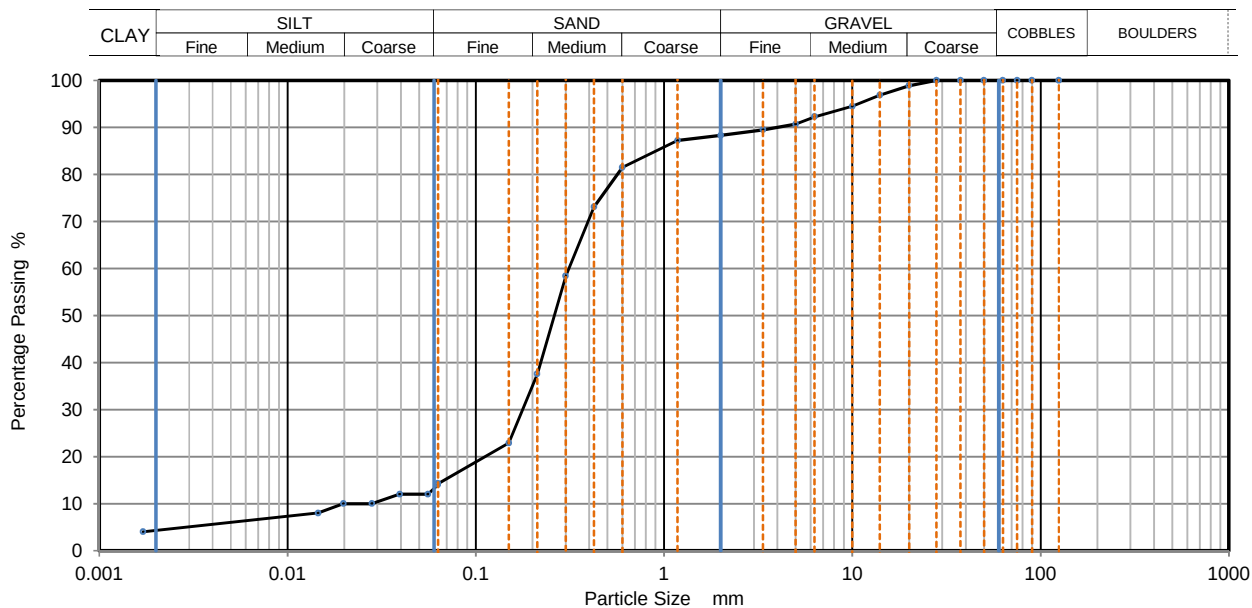
Sample Type: D

Location: TP01

Depth Top [m]: 1.75

Supplier: Not Given

Depth Base [m]: 1.85



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	14
90	100	0.0557	12
75	100	0.0394	12
63	100	0.0280	10
50	100	0.0198	10
37.5	100	0.0146	8
28	100	0.0017	4
20	99		
14	97		
10	95		
6.3	92		
5	91		
3.35	90		
2	88		
1.18	87		
0.6	82	Particle density (assumed) 2.65 Mg/m3	
0.425	73		
0.3	58		
0.212	38		
0.15	23		
0.063	14		

Dry Mass of sample [g]: 929

Sample Proportions		% dry mass
Very coarse		0.00
Gravel		11.70
Sand		74.00
Silt		9.90
Clay		4.40

Grading Analysis		
D100	mm	28
D60	mm	0.312
D30	mm	0.177
D10	mm	0.0192
Uniformity Coefficient		16
Curvature Coefficient		5.3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General
Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

i2 Analytical Ltd
7 Woodshots Meadow
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Environmental Science

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

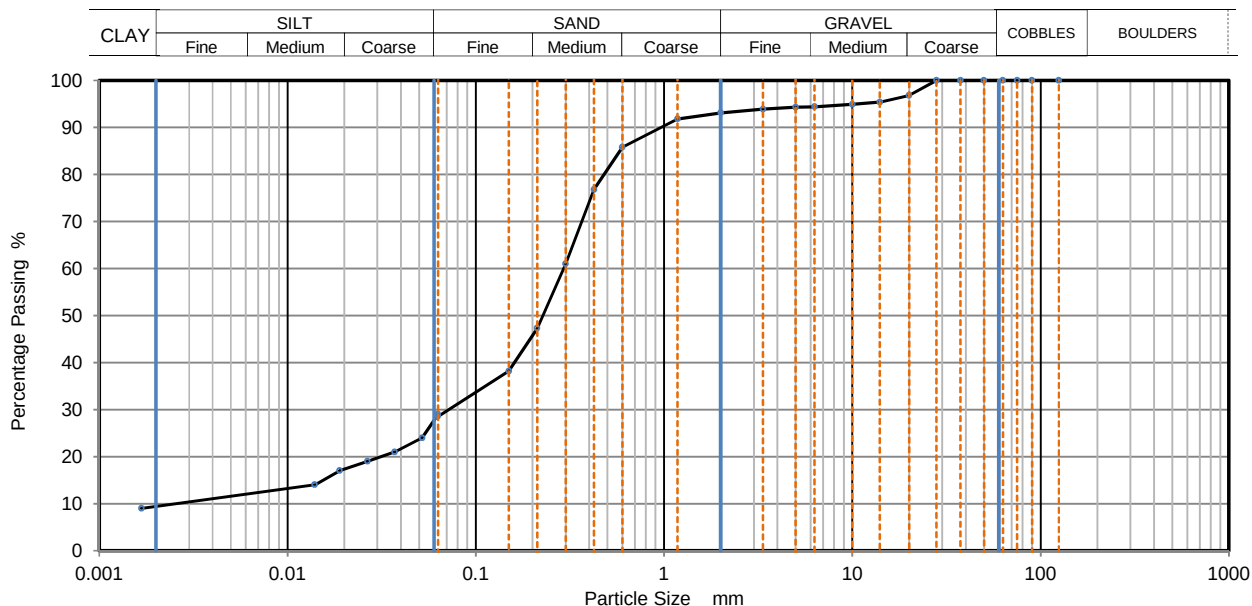
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890879
Sample description: Yellowish brown gravelly clayey SAND
Location: TP03
Supplier: Not Given

Sample Reference: Not Given
Sample Type: B
Depth Top [m]: 3.00
Depth Base [m]: 3.10



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	29
90	100	0.0519	24
75	100	0.0371	21
63	100	0.0266	19
50	100	0.0189	17
37.5	100	0.0140	14
28	100	0.0017	9
20	97		
14	95		
10	95		
6.3	94		
5	94		
3.35	94		
2	93		
1.18	92		
0.6	86	Particle density (assumed) 2.65 Mg/m3	
0.425	77		
0.3	61		
0.212	47		
0.15	38		
0.063	29		

Dry Mass of sample [g]: 612

Sample Proportions		% dry mass
Very coarse		0.00
Gravel		6.90
Sand		64.50
Silt		19.50
Clay		9.10

Grading Analysis		
D100	mm	28
D60	mm	0.293
D30	mm	0.0717
D10	mm	0.00283
Uniformity Coefficient		100
Curvature Coefficient		6.2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General
Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



4041

TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890882

Sample Reference: Not Given

Sample description: Yellowish brown clayey very gravelly SAND

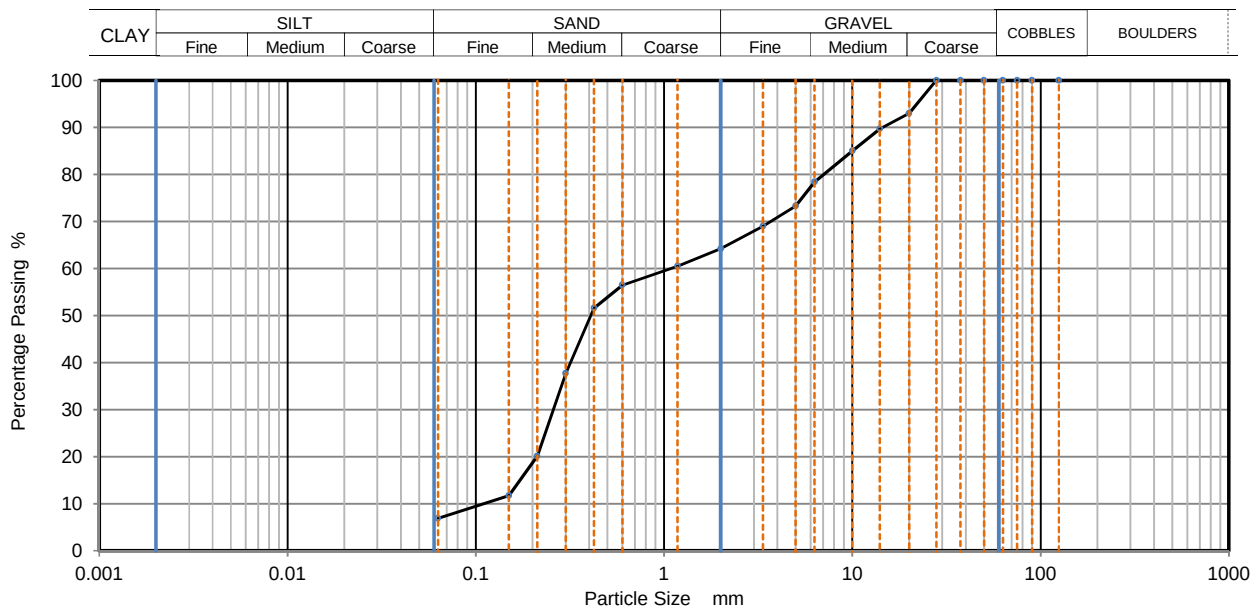
Sample Type: B

Location: TP07

Depth Top [m]: 1.90

Supplier: Not Given

Depth Base [m]: 2.00



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	93		
14	90		
10	85		
6.3	78		
5	73		
3.35	69		
2	64		
1.18	61		
0.6	57		
0.425	52		
0.3	38		
0.212	20		
0.15	12		
0.063	7		

Dry Mass of sample [g]: 2642

Sample Proportions		% dry mass
Very coarse		0.00
Gravel		35.80
Sand		57.20
Fines <0.063mm		6.90

Grading Analysis		
D100	mm	28
D60	mm	1.08
D30	mm	0.258
D10	mm	0.111
Uniformity Coefficient		9.8
Curvature Coefficient		0.56

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General
Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

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



Environmental Science

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890886

Sample Reference: Not Given

Sample description: Yellowish brown slightly gravelly clayey SAND

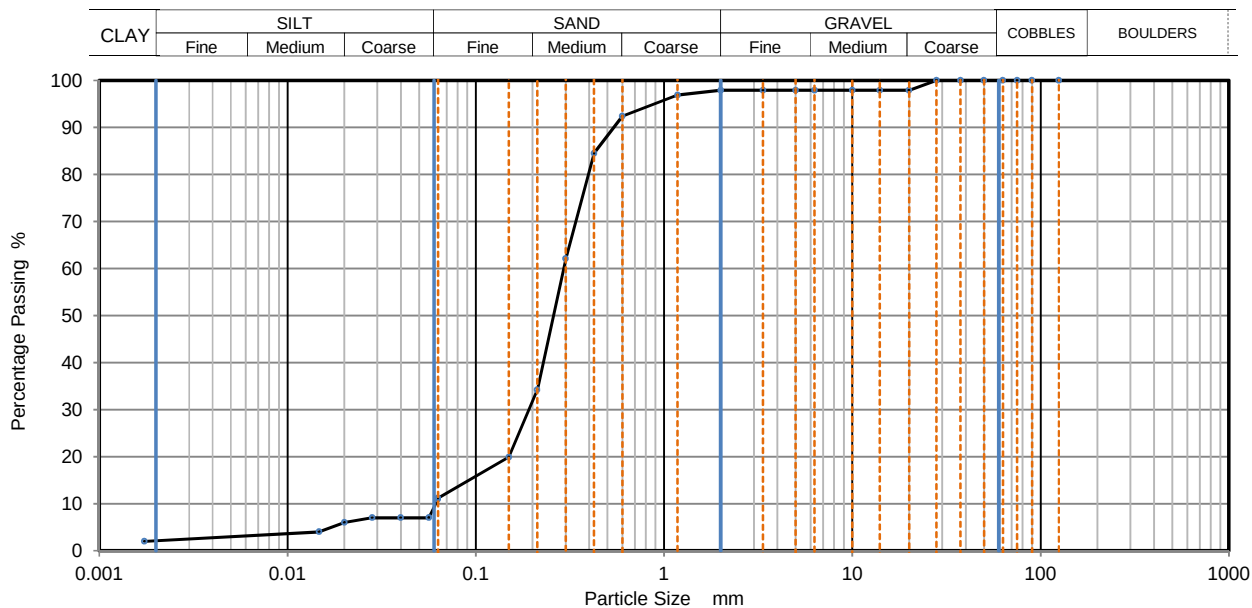
Sample Type: D

Location: TP10

Depth Top [m]: 2.15

Supplier: Not Given

Depth Base [m]: 2.25





4041

TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

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



Environmental Science

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890893

Sample Reference: Not Given

Sample description: Yellowish brown clayey very gravelly SAND

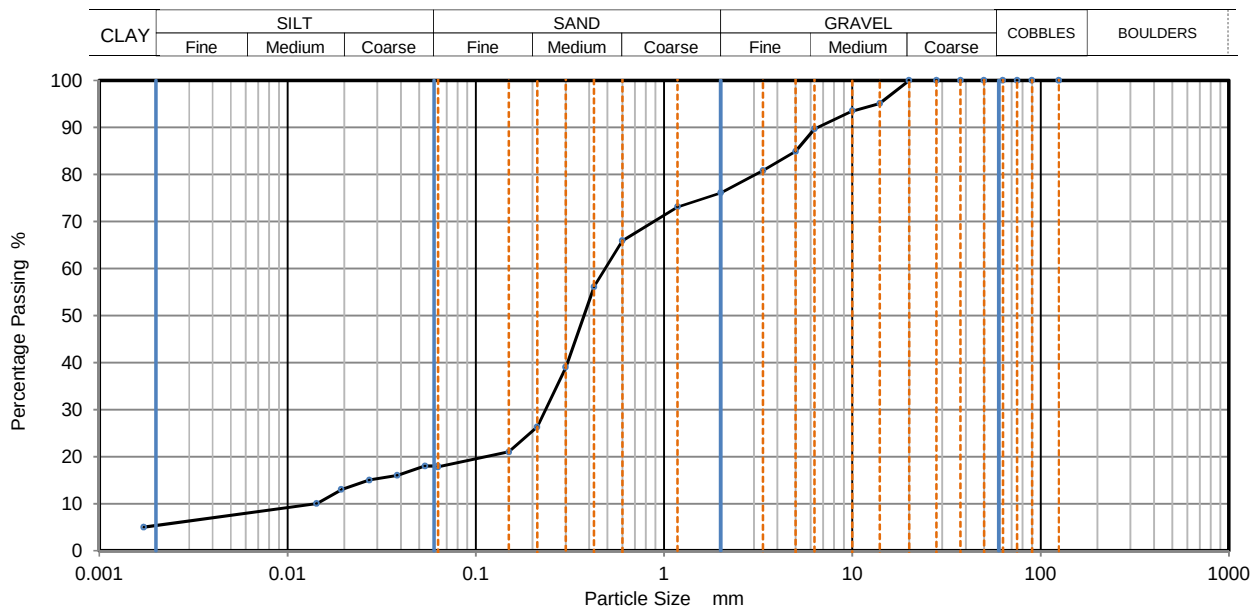
Sample Type: D

Location: TP16

Depth Top [m]: 2.30

Supplier: Not Given

Depth Base [m]: 2.40



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	18
90	100	0.0537	18
75	100	0.0382	16
63	100	0.0272	15
50	100	0.0193	13
37.5	100	0.0143	10
28	100	0.0017	5
20	100		
14	95		
10	94		
6.3	90		
5	85		
3.35	81		
2	76		
1.18	73		
0.6	66	Particle density (assumed) 2.65 Mg/m ³	
0.425	56		
0.3	39		
0.212	26		
0.15	21		
0.063	18		

Dry Mass of sample [g]: 912

Sample Proportions		% dry mass
Very coarse		0.00
Gravel		23.90
Sand		58.30
Silt		12.60
Clay		5.20

Grading Analysis		
D100	mm	20
D60	mm	0.488
D30	mm	0.235
D10	mm	0.0147
Uniformity Coefficient		33
Curvature Coefficient		7.7

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General
Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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Determination of Particle Size Distribution

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



Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

TEST RESULTS

Laboratory Reference: 890896

Sample Reference: Not Given

Sample description: Orangish brown SAND

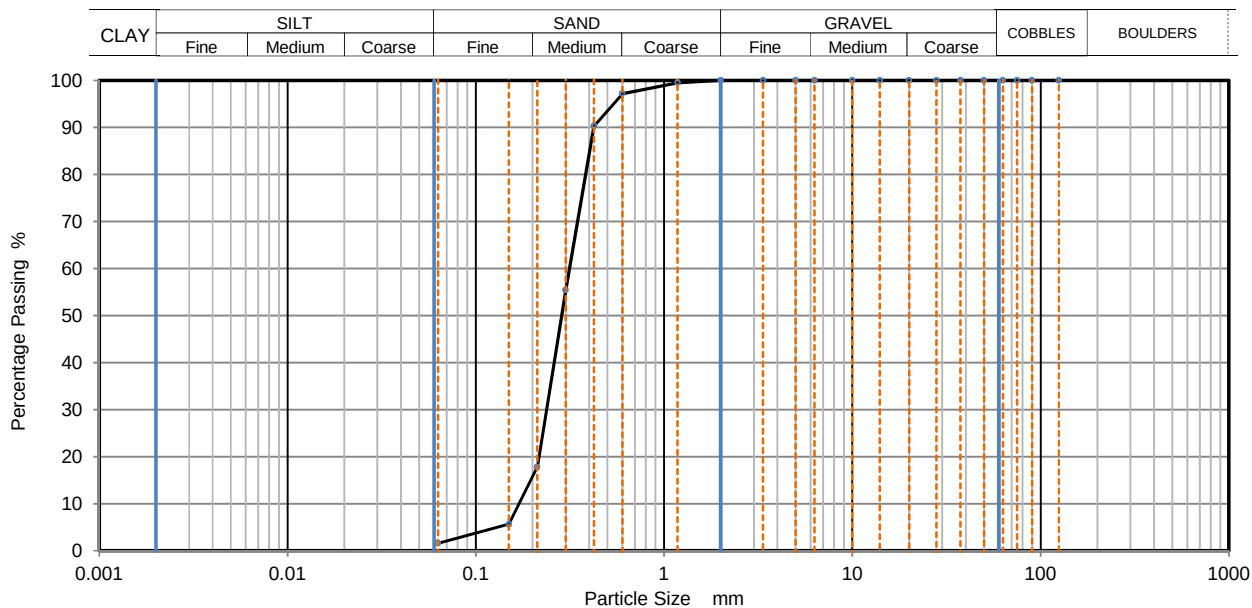
Sample Type: D

Location: TP21

Depth Top [m]: 1.20

Supplier: Not Given

Depth Base [m]: 1.30



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	97		
0.425	90		
0.3	55		
0.212	18		
0.15	6		
0.063	2		

Dry Mass of sample [q]: 446

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	98.40
Fines <0.063mm	1.60

Grading Analysis		
D100	mm	2
D60	mm	0.314
D30	mm	0.237
D10	mm	0.17
Uniformity Coefficient		1.8
Curvature Coefficient		1.1

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Pootnli

Signed:

Darren Berrill
Geotechnical General
Manager

[Handwritten signature]

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

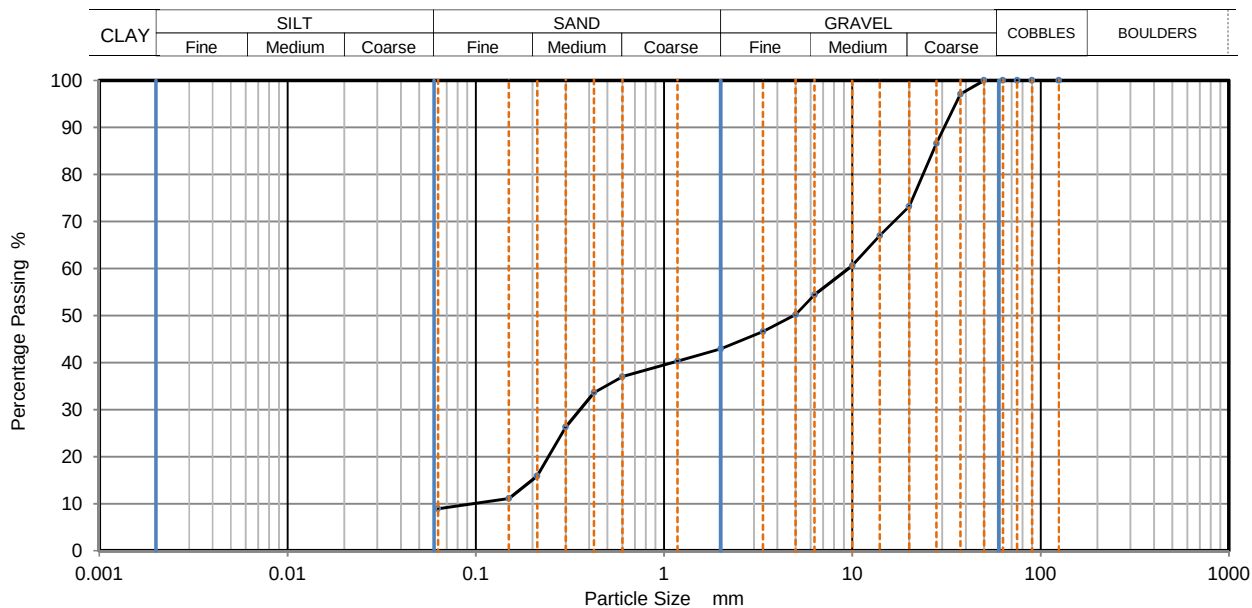
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 24/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890898
Sample description: Brown clayey very sandy GRAVEL
Location: TP23
Supplier: Not Given

Sample Reference: Not Given
Sample Type: B
Depth Top [m]: 2.40
Depth Base [m]: 2.50





4041

TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

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



Environmental Science

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890900

Sample Reference: Not Given

Sample description: Brown silty clayey SAND

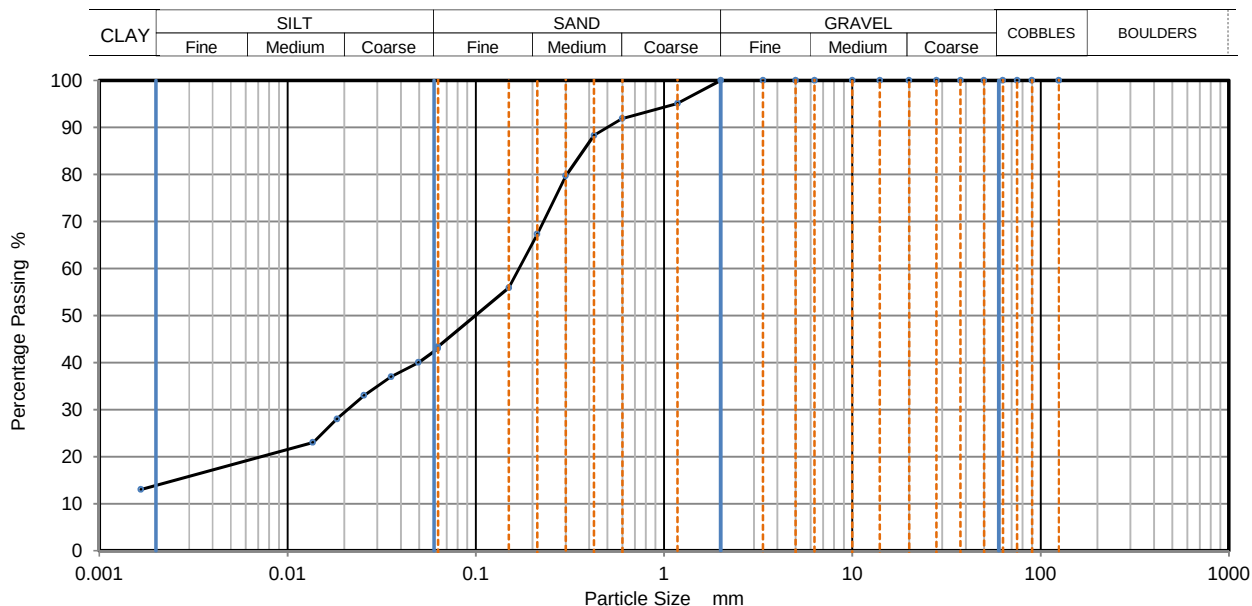
Sample Type: D

Location: TP25

Depth Top [m]: 1.40

Supplier: Not Given

Depth Base [m]: 1.50



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	43
90	100	0.0496	40
75	100	0.0355	37
63	100	0.0254	33
50	100	0.0183	28
37.5	100	0.0136	23
28	100	0.0017	13
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	95		
0.6	92	Particle density (assumed) 2.65 Mg/m ³	
0.425	88		
0.3	80		
0.212	67		
0.15	56		
0.063	43		

Dry Mass of sample [g]: 524

Sample Proportions		% dry mass
Very coarse		0.00
Gravel		0.00
Sand		56.60
Silt		29.20
Clay		14.20

Grading Analysis		
D100	mm	2
D60	mm	0.17
D30	mm	0.0204
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General
Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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Determination of Particle Size Distribution



Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890901

Sample Reference: Not Given

Sample description: Yellowish brown slightly gravelly silty clayey SAND

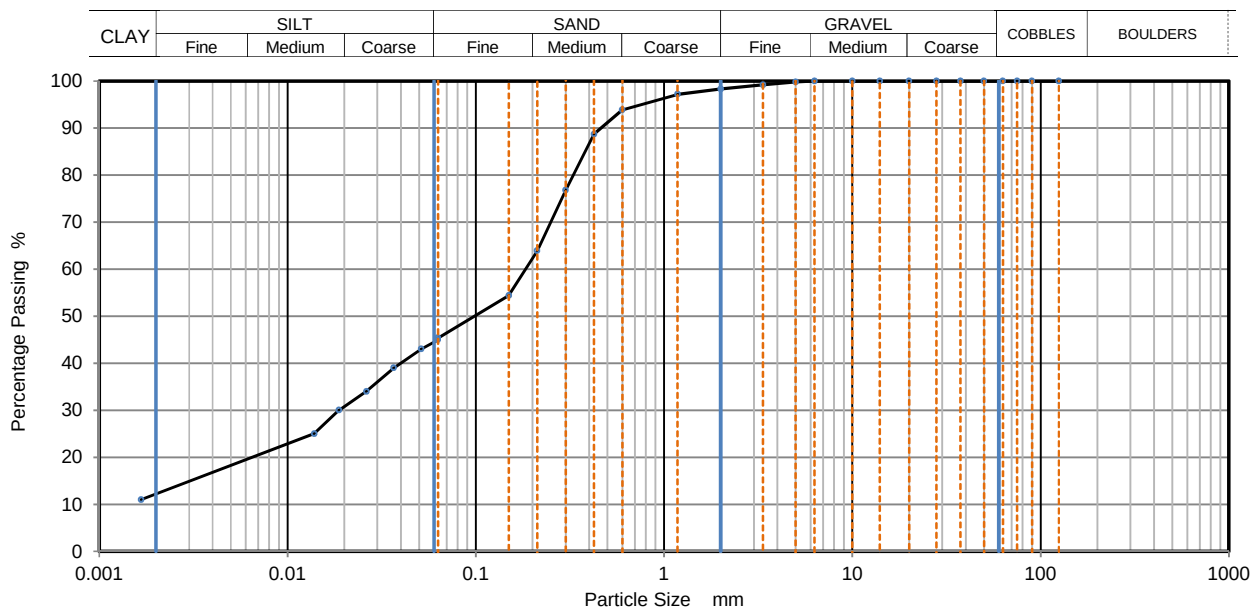
Sample Type: D

Location: TP26

Depth Top [m]: 1.85

Supplier: Not Given

Depth Base [m]: 1.95



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	45
90	100	0.0512	43
75	100	0.0367	39
63	100	0.0262	34
50	100	0.0188	30
37.5	100	0.0139	25
28	100	0.0017	11
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	98		
1.18	97		
0.6	94		
0.425	89	Particle density	(assumed)
0.3	77	2.65	Mg/m3
0.212	64		
0.15	54		
0.063	45		

Dry Mass of sample [g]: 534

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	1.70
Sand	52.90
Silt	32.90
Clay	12.50

Grading Analysis		
D100	mm	6.3
D60	mm	0.184
D30	mm	0.0195
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Signed:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Darren Berrill
Geotechnical General
Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Determination of Particle Size Distribution**

Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

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



Environmental Science

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890903

Sample Reference: Not Given

Sample description: Brown slightly gravelly very sandy silty CLAY

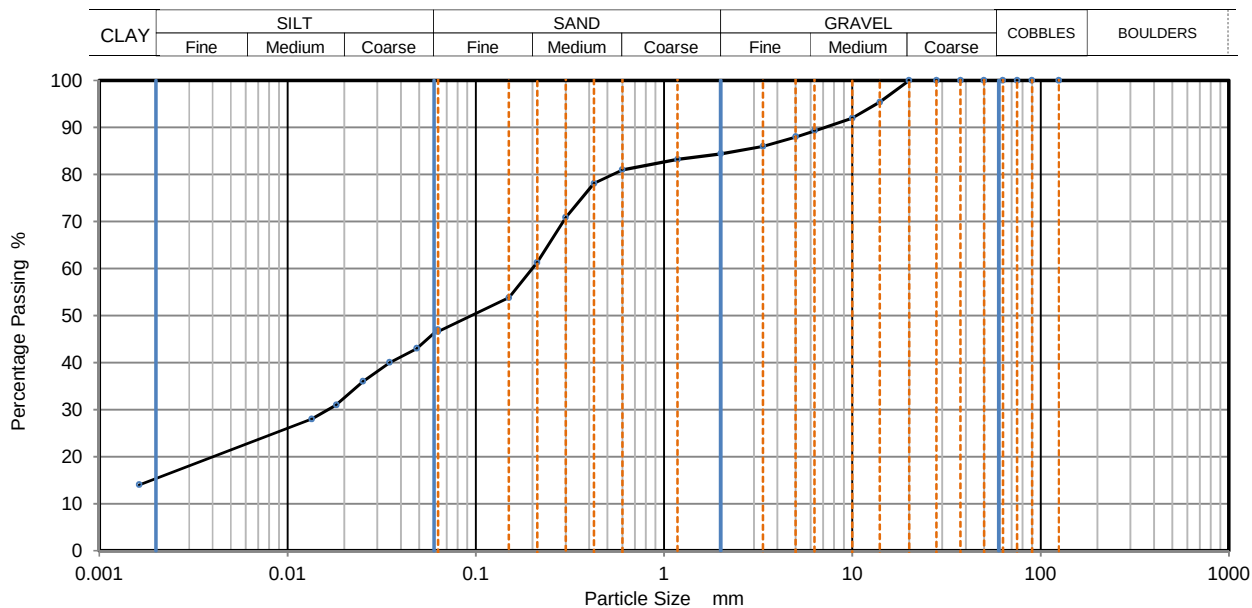
Sample Type: D

Location: TP29

Depth Top [m]: 1.80

Supplier: Not Given

Depth Base [m]: 1.90





4041

TEST CERTIFICATE**Dry Density / Moisture Content Relationship****Light Compaction**

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



Environmental Science

Tested in accordance with BS 1377-4:1990: Clause 3.4 using 2.5kg[light] Rammer

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

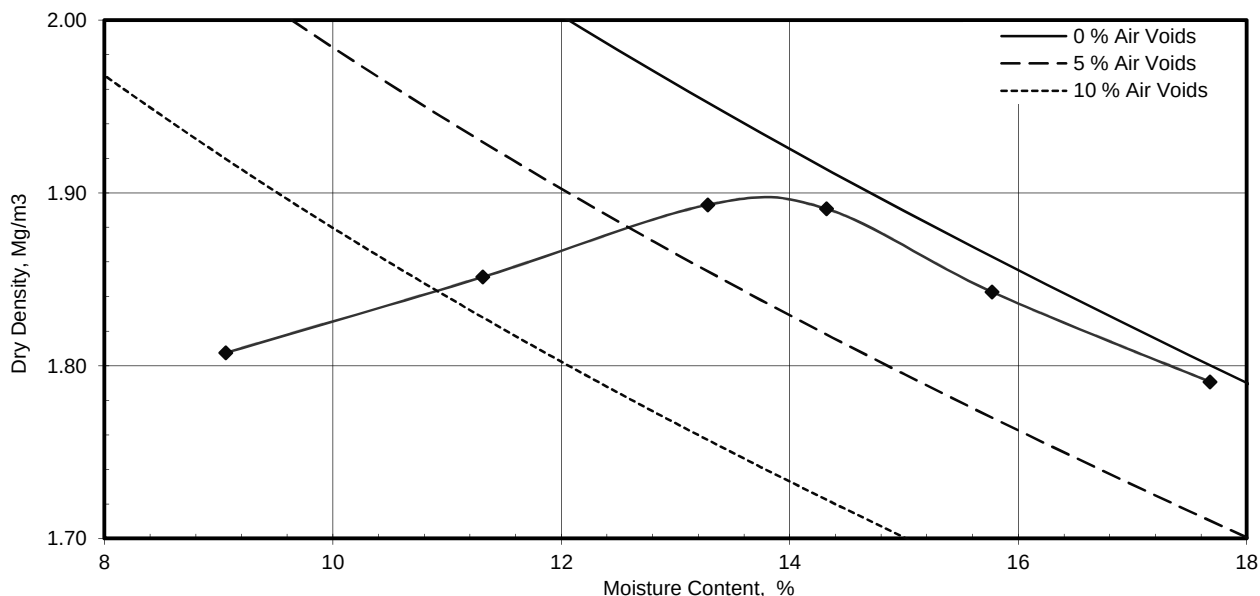
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890878
Hole No.: TP03
Sample Reference: Not Given
Sample Description: Yellowish brown gravelly SAND

Depth Top [m]: 1.00
Depth Base [m]: 1.10
Sample Type: B



Preparation		Material used was natural
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	6
Material Retained on 20.0 mm Sieve	%	8
Particle Density - Measured using gas jar	Mg/m³	2.64
As received Moisture Content	%	9.1
Maximum Dry Density	Mg/m³	1.90
Optimum Moisture Content	%	14

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE**Dry Density / Moisture Content Relationship****Light Compaction**

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



Environmental Science

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

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

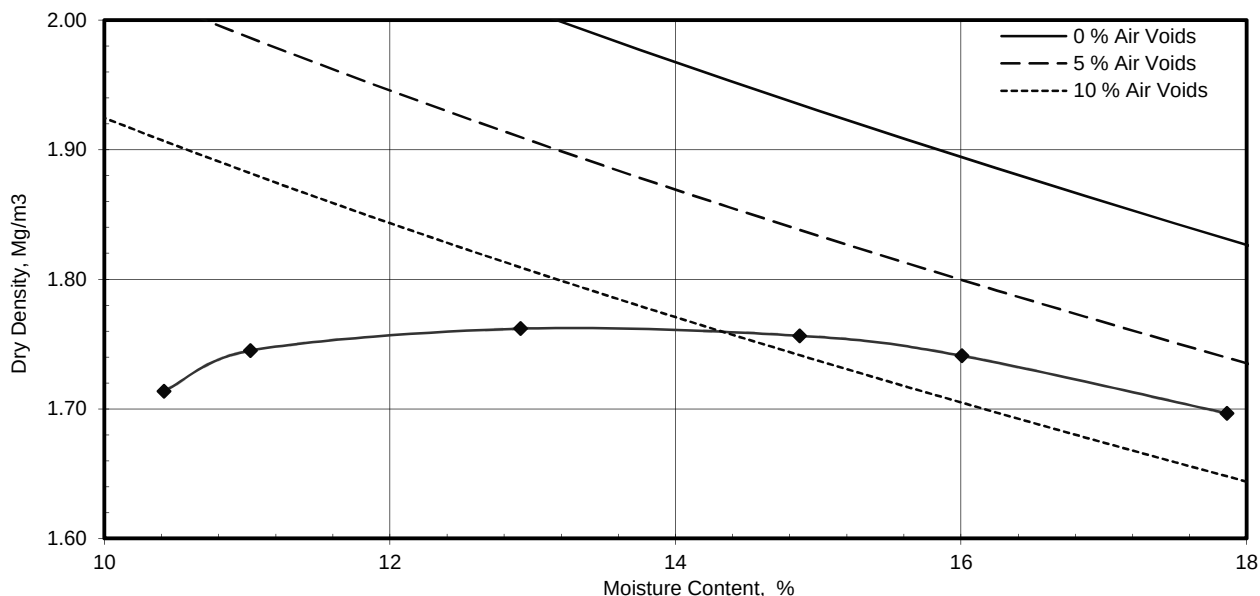
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890880
Hole No.: TP04
Sample Reference: Not Given
Sample Description: Yellowish brown slightly gravelly SAND

Depth Top [m]: 1.40
Depth Base [m]: 1.50
Sample Type: D



Preparation	Material used was natural	
Mould Type	1 Litre	
Samples Used	Composite specimens tested	
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	1
Particle Density - Measured using gas jar	Mg/m³	2.72
As received Moisture Content	%	10
Maximum Dry Density	Mg/m³	1.76
Optimum Moisture Content	%	13

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Dry Density / Moisture Content Relationship

Light Compaction

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



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

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

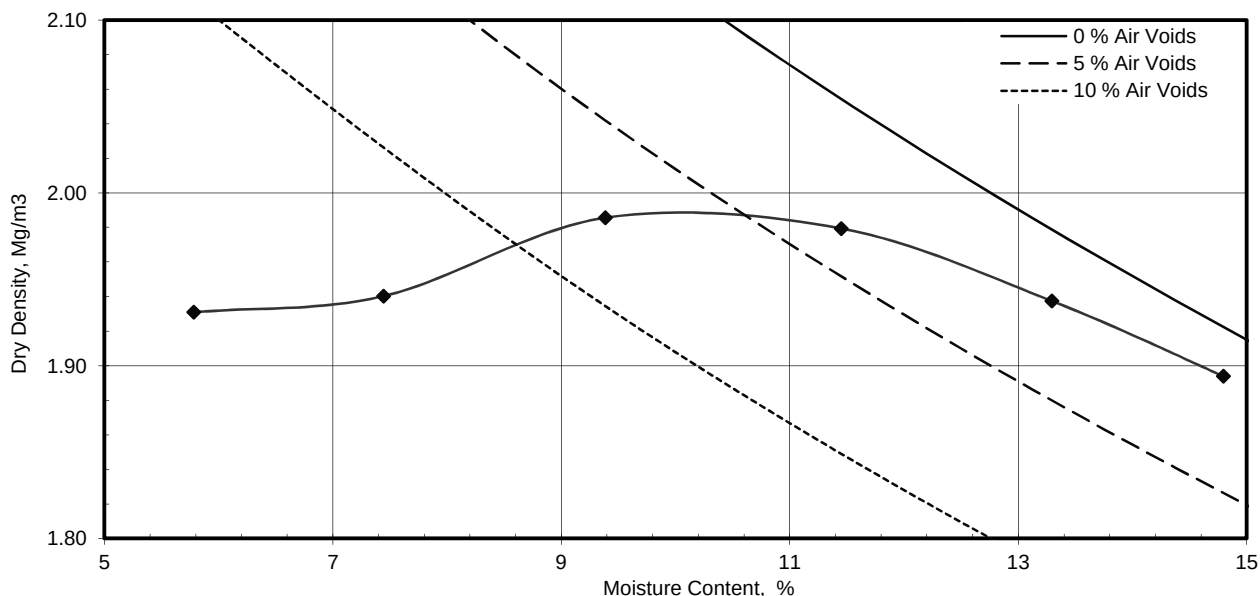
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890881
Hole No.: TP07
Sample Reference: Not Given
Sample Description: Brown clayey SAND

Depth Top [m]: 1.00
Depth Base [m]: 1.10
Sample Type: B



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Measured using gas jar	Mg/m³	2.69
As received Moisture Content	%	15
Maximum Dry Density	Mg/m³	1.99
Optimum Moisture Content	%	10

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Dry Density / Moisture Content Relationship****Light Compaction**

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



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

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

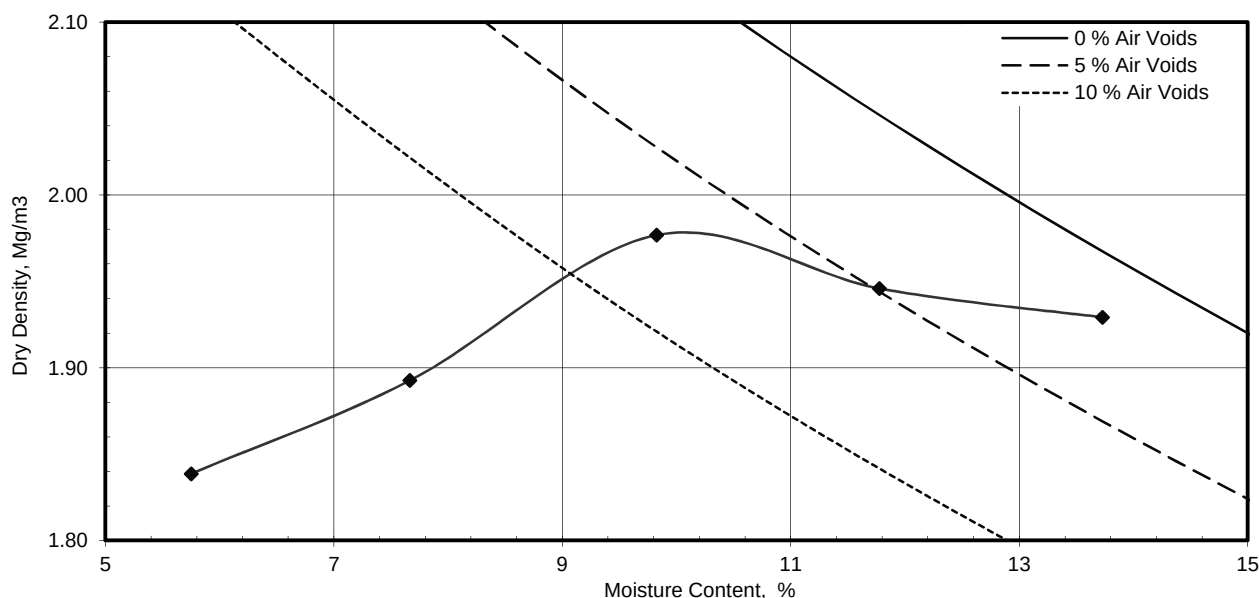
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890883
Hole No.: TP08
Sample Reference: Not Given
Sample Description: Brown clayey SAND

Depth Top [m]: 0.40
Depth Base [m]: 0.50
Sample Type: B



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Measured using gas jar	Mg/m³	2.70
As received Moisture Content	%	14
Maximum Dry Density	Mg/m³	1.98
Optimum Moisture Content	%	9.8

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE

Dry Density / Moisture Content Relationship

Light Compaction

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



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

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

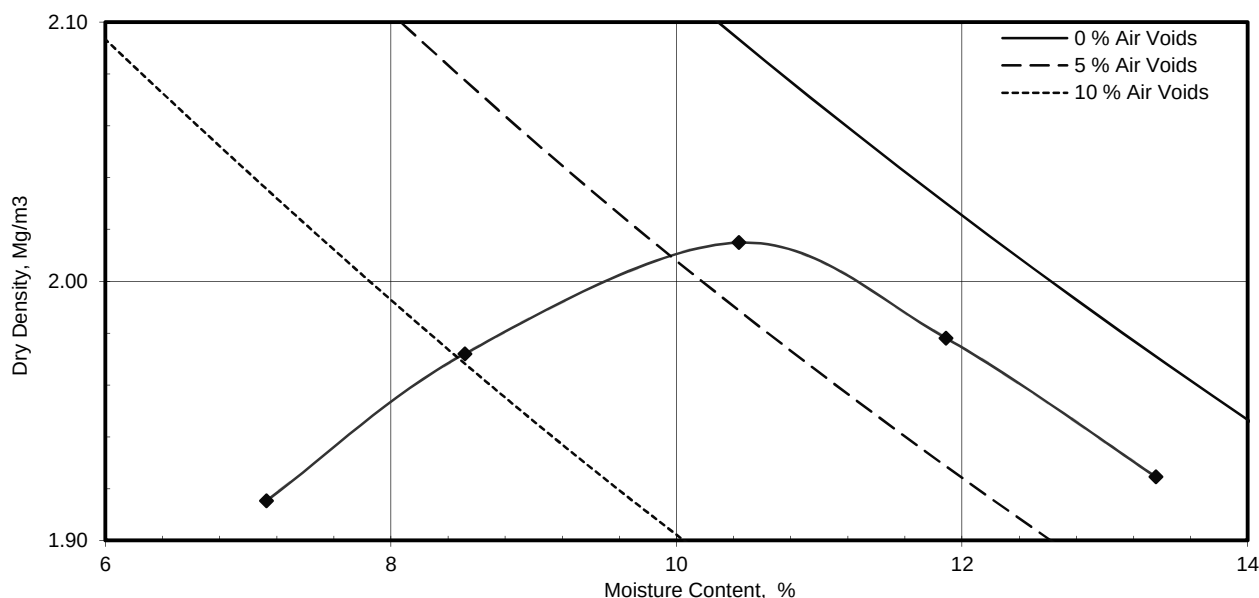
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890885
Hole No.: TP10
Sample Reference: Not Given
Sample Description: Yellowish brown slightly clayey SAND

Depth Top [m]: 0.90
Depth Base [m]: 1.00
Sample Type: B



Preparation	Material used was natural	
Mould Type	1 Litre	
Samples Used	Composite specimens tested	
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Measured using gas jar	Mg/m³	2.68
As received Moisture Content	%	13
Maximum Dry Density	Mg/m³	2.01
Optimum Moisture Content	%	10

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Dry Density / Moisture Content Relationship

Light Compaction

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



Environmental Science

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

Client: BWB Consulting Limited
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35 Livery Street Birmingham
B3 2PB

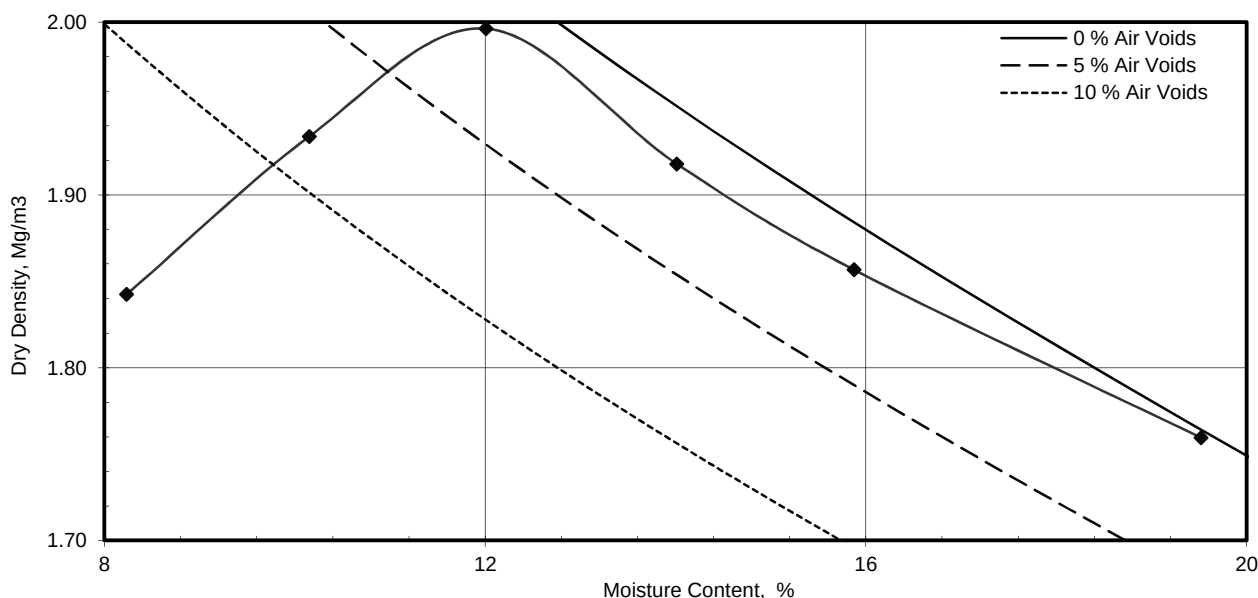
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890888
Hole No.: TP12
Sample Reference: Not Given
Sample Description: Brown sandy clayey GRAVEL

Depth Top [m]: 0.80
Depth Base [m]: 0.90
Sample Type: B



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	35
Material Retained on 20.0 mm Sieve	%	33
Particle Density - Measured using gas jar	Mg/m³	2.69
As received Moisture Content	%	20
Maximum Dry Density	Mg/m³	2.00
Optimum Moisture Content	%	12

Remarks: Insufficient material - compacted in proctor mould; Zone X - test carried out as per client request

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

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TEST CERTIFICATE

Dry Density / Moisture Content Relationship

Light Compaction

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7 Woodshots Meadow
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Watford Herts WD18 8YS



Tested in accordance with BS 1377-4:1990: Clause 3.4 using 2.5kg[light] Rammer

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35 Livery Street Birmingham
B3 2PB

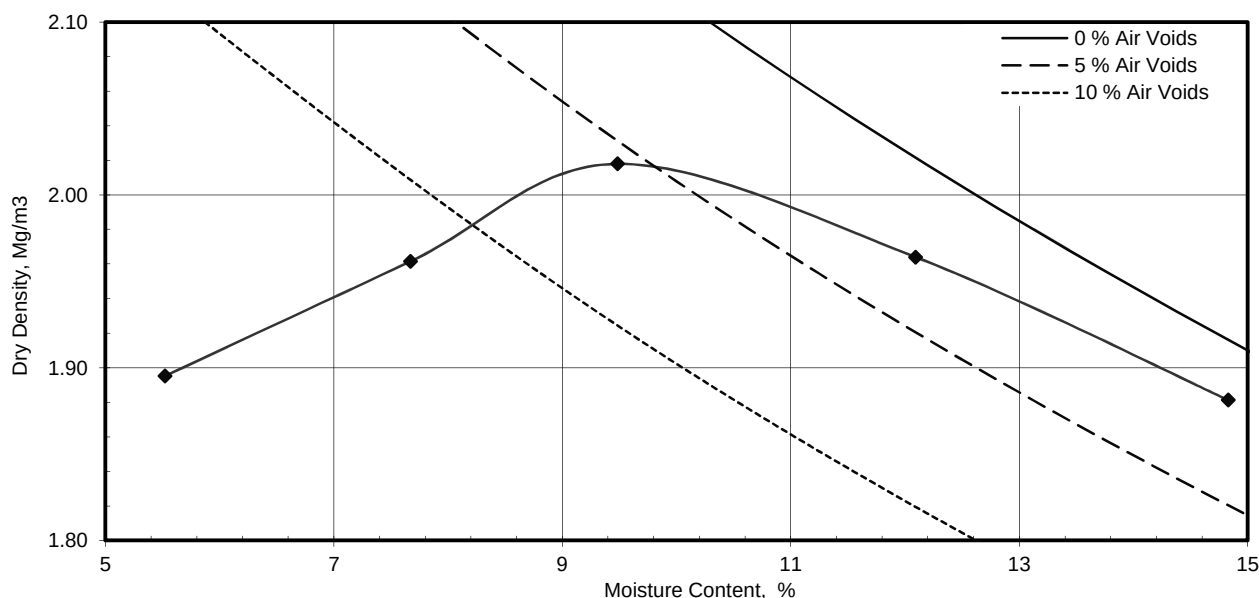
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890892
Hole No.: TP15
Sample Reference: Not Given
Sample Description: Brown gravelly sandy CLAY

Depth Top [m]: 1.10
Depth Base [m]: 1.20
Sample Type: B



Preparation		Material used was natural
Mould Type		CBR
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	11
Material Retained on 20.0 mm Sieve	%	8
Particle Density - Measured using gas jar	Mg/m³	2.68
As received Moisture Content	%	15
Maximum Dry Density	Mg/m³	2.02
Optimum Moisture Content	%	9.5

Remarks: Zone X - test carried out as per client request

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

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TEST CERTIFICATE

Dry Density / Moisture Content Relationship

Light Compaction

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



Environmental Science

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

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

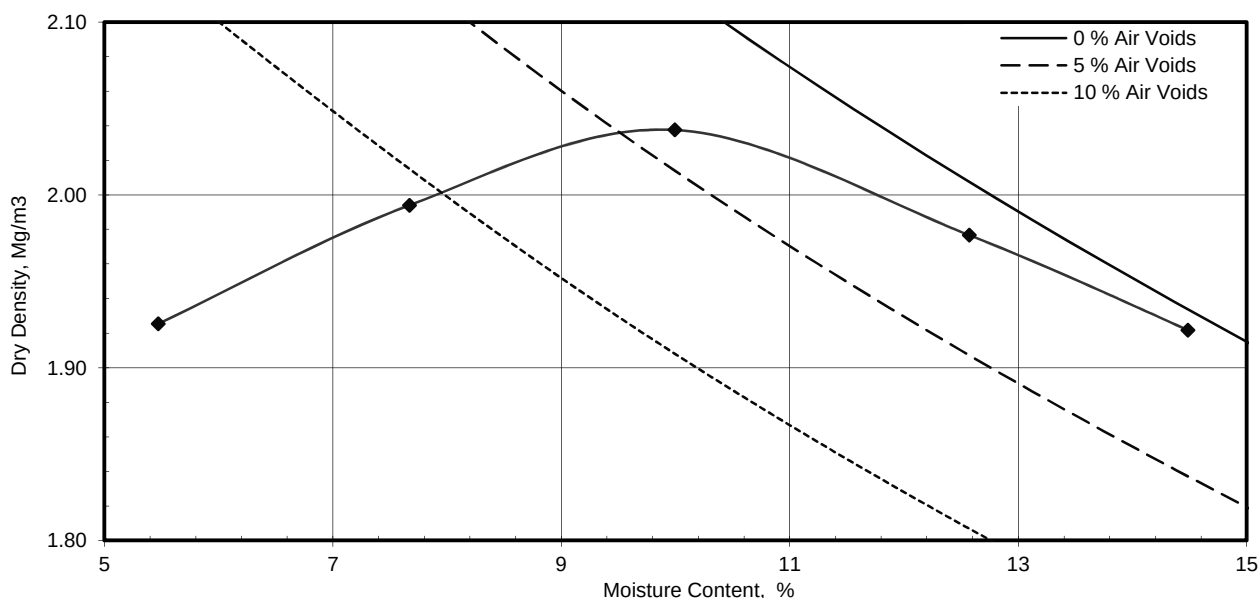
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890895
Hole No.: TP19
Sample Reference: Not Given
Sample Description: Brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 0.90
Depth Base [m]: 1.00
Sample Type: B



Preparation		Material used was natural
Mould Type		1 Litre
Samples Used		Composite specimens tested
Material Retained on 37.5 mm Sieve	%	2
Material Retained on 20.0 mm Sieve	%	6
Particle Density - Measured using gas jar	Mg/m³	2.69
As received Moisture Content	%	14
Maximum Dry Density	Mg/m³	2.04
Optimum Moisture Content	%	10

Remarks: Insufficient material - compacted in proctor mould

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**Dry Density / Moisture Content Relationship****Light Compaction**

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



Environmental Science

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

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

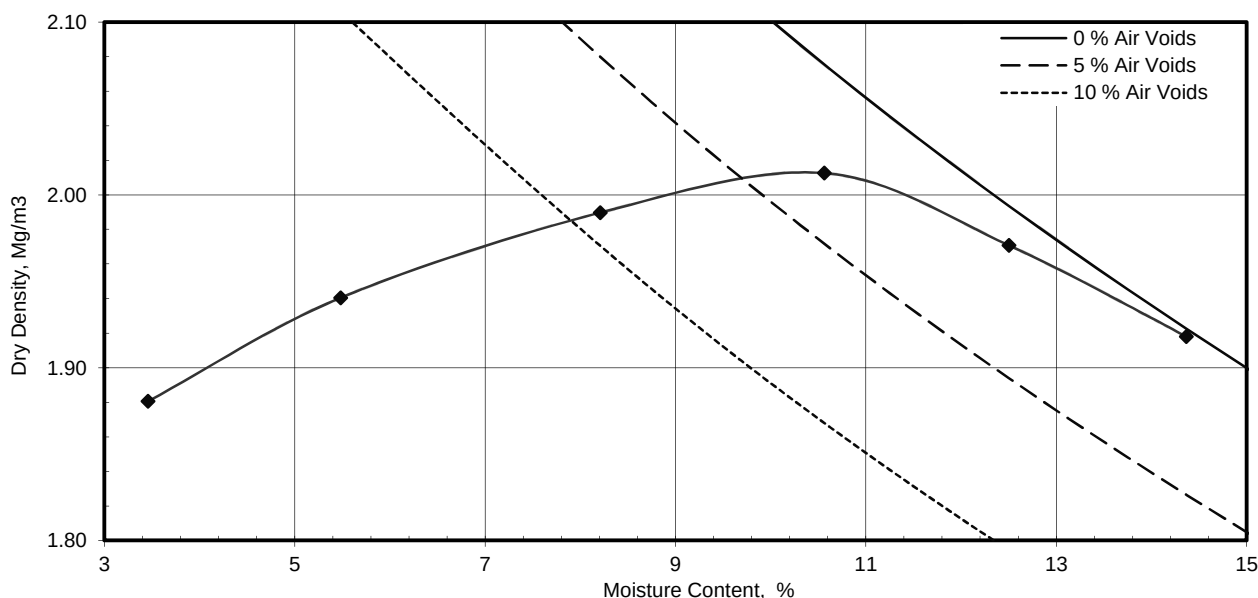
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890899
Hole No.: TP24
Sample Reference: Not Given
Sample Description: Dark brown sandy gravelly CLAY

Depth Top [m]: 0.60
Depth Base [m]: 0.70
Sample Type: B



Preparation	Material used was natural	
Mould Type	1 Litre	
Samples Used	Composite specimens tested	
Material Retained on 37.5 mm Sieve	%	11
Material Retained on 20.0 mm Sieve	%	5
Particle Density - Measured using gas jar	Mg/m³	2.66
As received Moisture Content	%	14
Maximum Dry Density	Mg/m³	2.01
Optimum Moisture Content	%	11

Remarks: Insufficient material - compacted in proctor mould; Zone X - test carried out as per client request

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Dry Density / Moisture Content Relationship

Light Compaction

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



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

Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB

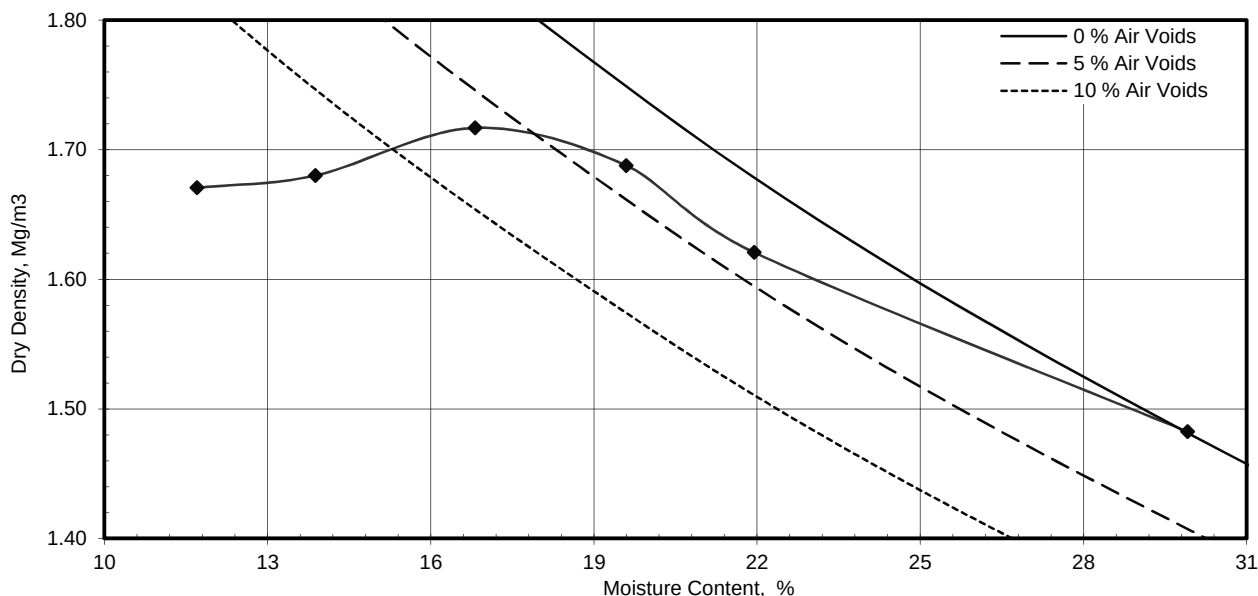
Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 25/01/2018
Sampled By: Not Given

Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

TEST RESULTS

Laboratory Reference: 890902
Hole No.: TP27
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: 1.30
Sample Type: B



Preparation	Material used was natural	
Mould Type	1 Litre	
Samples Used	Composite specimens tested	
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Measured using gas jar	Mg/m³	2.66
As received Moisture Content	%	30
Maximum Dry Density	Mg/m³	1.72
Optimum Moisture Content	%	17

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Mark Beastall
Geotechnical
Commercial Manager

Date Reported: 02/02/2018

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Test Result

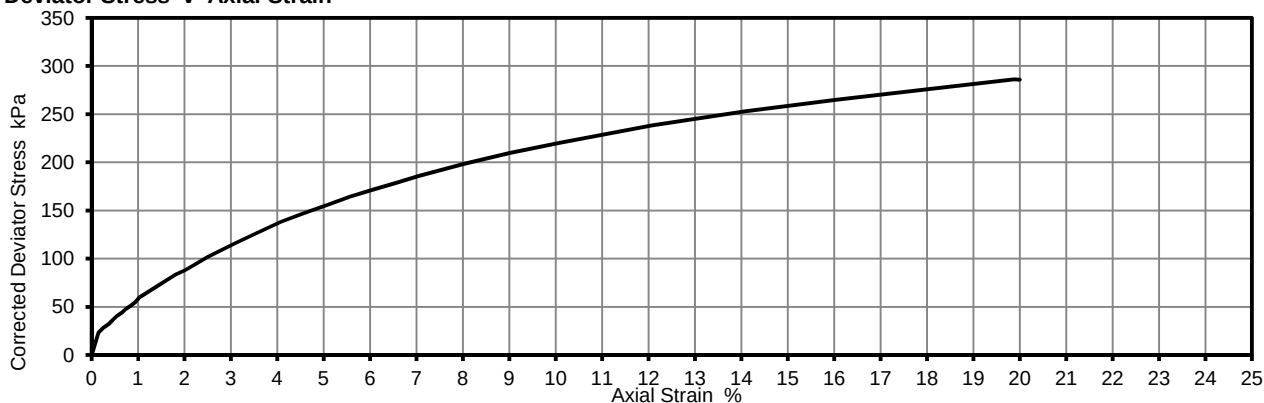
Laboratory Reference: 890870
Hole No.: BH01
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly CLAY

Depth Top [m]: 9.50
Depth Base [m]: 9.95
Sample Type: U

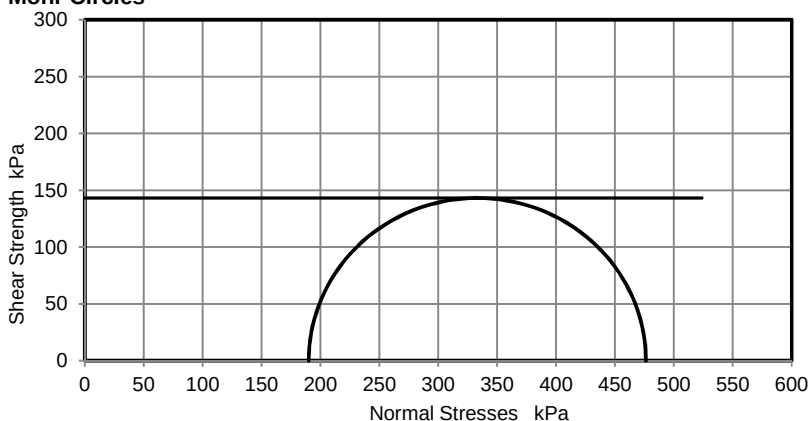
Test Number	1
Length	200.00 mm
Diameter	101.50 mm
Bulk Density	2.19 Mg/m ³
Moisture Content	16 %
Dry Density	1.90 Mg/m ³

Rate of Strain	2.00 %/min
Cell Pressure	190 kPa
Axial Strain at failure	19.9 %
Deviator Stress, $(\sigma_1 - \sigma_3)_f$	286 kPa
Undrained Shear Strength, c_u	143 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Test Result

Laboratory Reference: 890871
Hole No.: BH02
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly CLAY

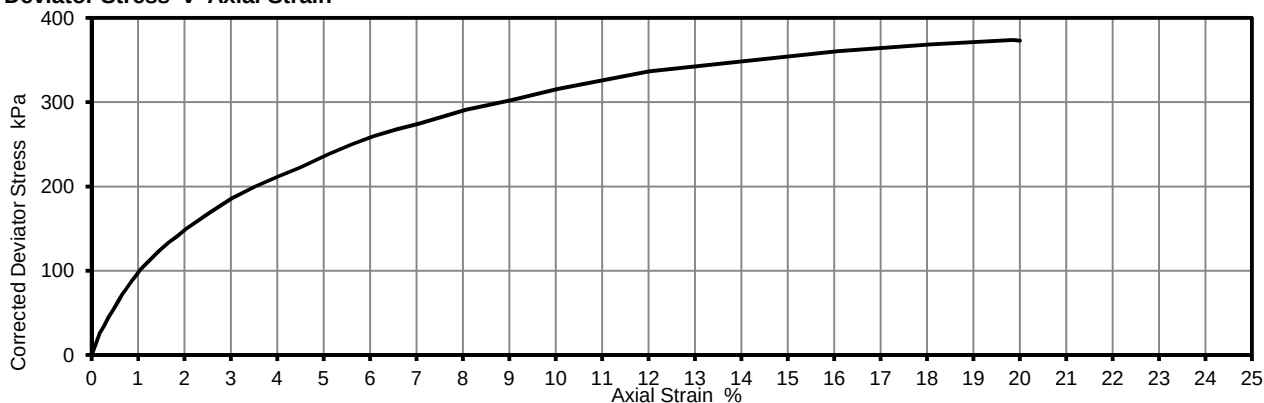
Depth Top [m]: 13.00
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	199.70 mm
Diameter	100.59 mm
Bulk Density	2.21 Mg/m ³
Moisture Content	13 %
Dry Density	1.95 Mg/m ³

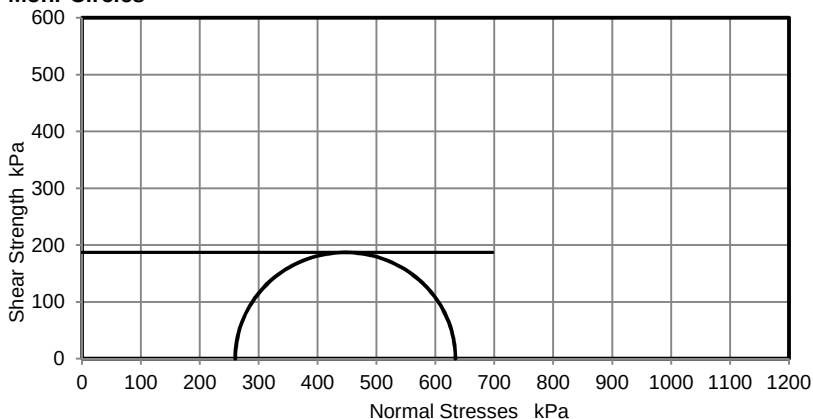
Rate of Strain
Cell Pressure
Axial Strain at failure
Deviator Stress, $(\sigma_1 - \sigma_3)_f$
Undrained Shear Strength, c_u
Mode of Failure

2.00	%/min
260	kPa
19.8	%
374	kPa
187	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

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Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Test Result

Laboratory Reference: 890872
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly CLAY

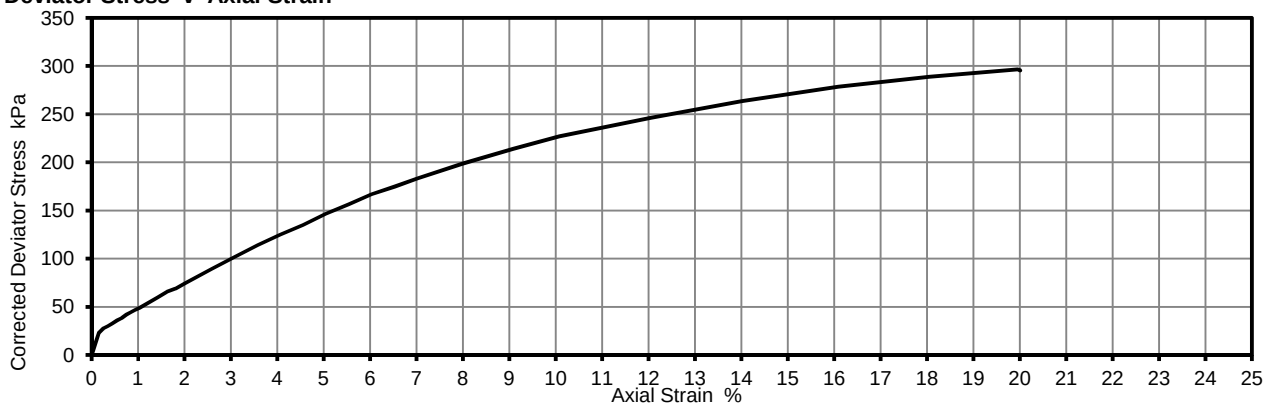
Depth Top [m]: 8.00
Depth Base [m]: Not Given
Sample Type: U

Test Number	1
Length	189.30 mm
Diameter	102.55 mm
Bulk Density	2.20 Mg/m ³
Moisture Content	15 %
Dry Density	1.91 Mg/m ³

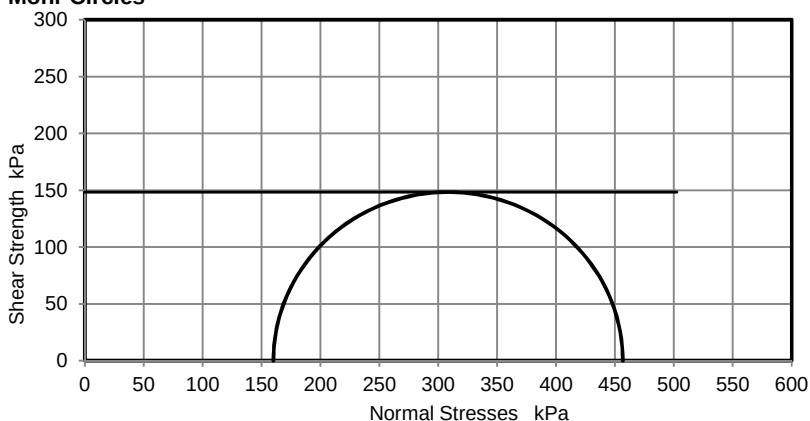
Rate of Strain
Cell Pressure
Axial Strain at failure
Deviator Stress, $(\sigma_1 - \sigma_3)_f$
Undrained Shear Strength, c_u
Mode of Failure

2.00	%/min
160	kPa
19.9	%
297	kPa
148	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General
Manager

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Test Result

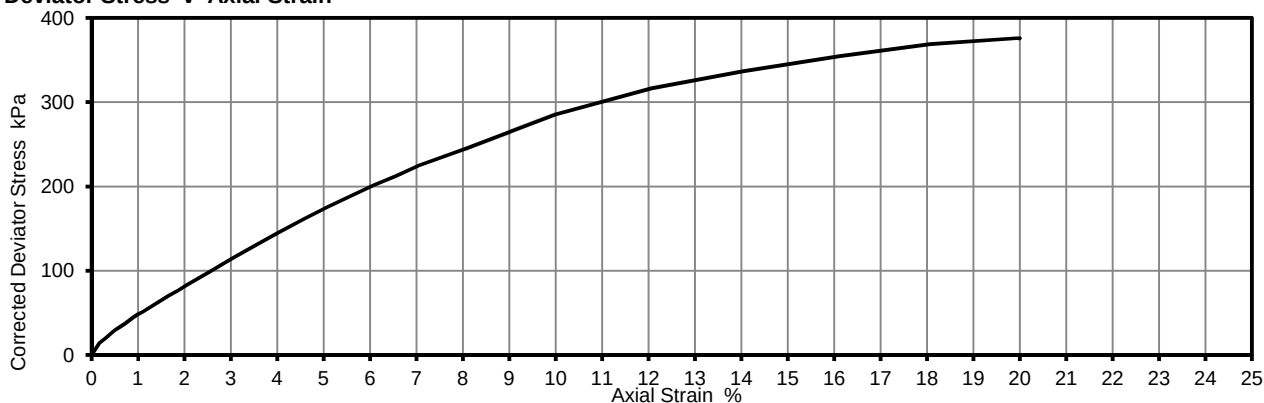
Laboratory Reference: 890873
Hole No.: BH04
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly CLAY

Depth Top [m]: 11.00
Depth Base [m]: Not Given
Sample Type: U

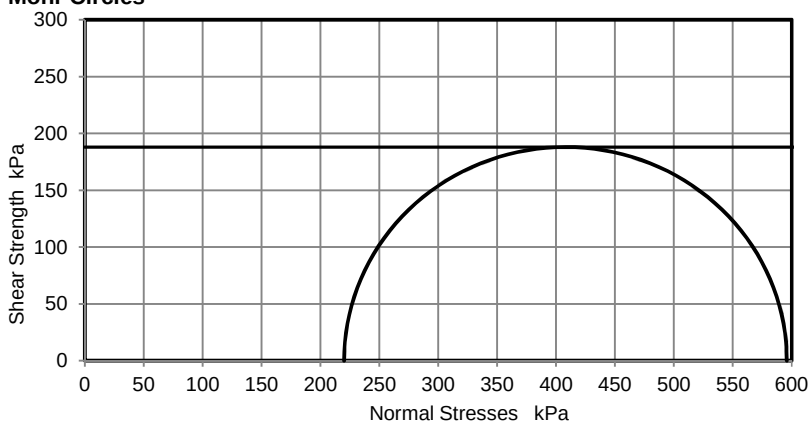
Test Number	1
Length	201.61 mm
Diameter	102.61 mm
Bulk Density	2.20 Mg/m ³
Moisture Content	12 %
Dry Density	1.95 Mg/m ³

Rate of Strain	1.98 %/min
Cell Pressure	220 kPa
Axial Strain at failure	19.9 %
Deviator Stress, $(\sigma_1 - \sigma_3)_f$	376 kPa
Undrained Shear Strength, c_u	188 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Brittle

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General
Manager

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TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Test Result

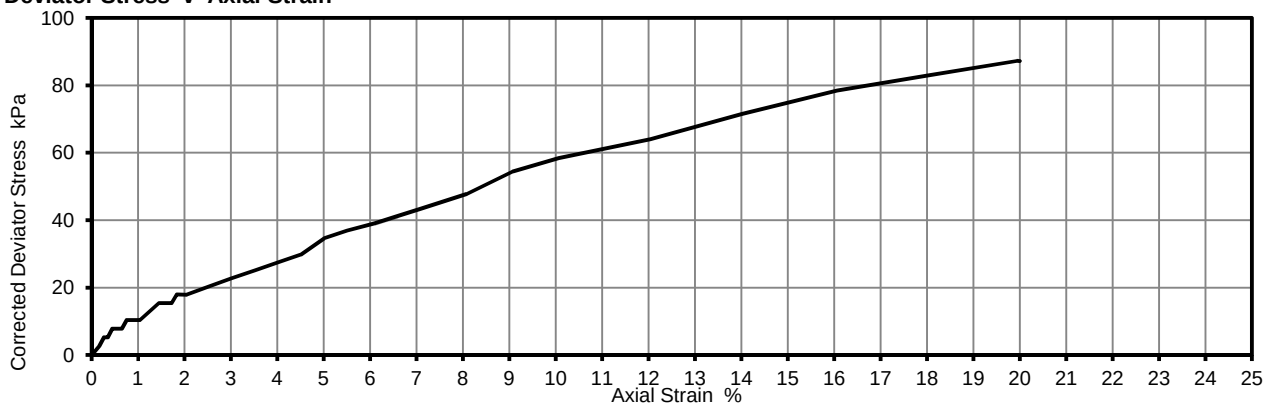
Laboratory Reference: 890874
Hole No.: BH05
Sample Reference: Not Given
Sample Description: Brown sandy CLAY

Depth Top [m]: 6.50
Depth Base [m]: Not Given
Sample Type: U

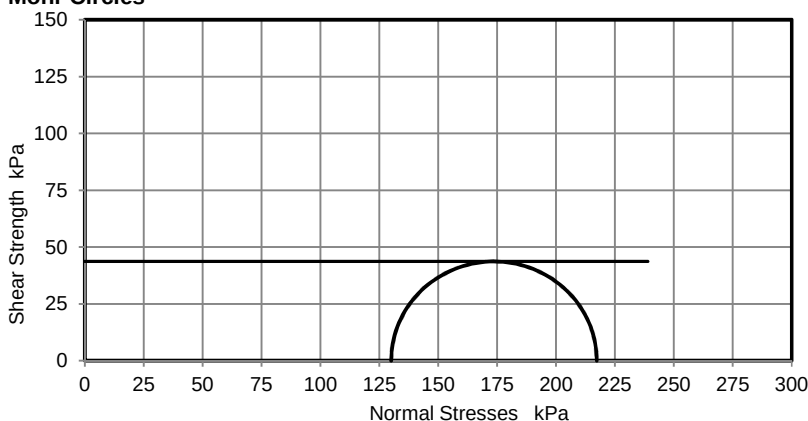
Test Number	1
Length	137.70 mm
Diameter	69.50 mm
Bulk Density	2.17 Mg/m ³
Moisture Content	14 %
Dry Density	1.91 Mg/m ³

Rate of Strain	2.00 %/min
Cell Pressure	130 kPa
Axial Strain at failure	19.9 %
Deviator Stress, $(\sigma_1 - \sigma_3)_f$	87 kPa
Undrained Shear Strength, c_u	44 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound

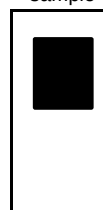
Deviator Stress v Axial Strain



Mohr Circles



Position
within
sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

"Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation.
This report may not be reproduced other than in full without the prior written approval of the issuing laboratory.
The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



4041

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

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



Client: BWB Consulting Limited
Client Address: Livery Place
35 Livery Street Birmingham
B3 2PB
Contact: Laura Westoby
Site Name: Plot J, Rochdale
Site Address: Not Given

Client Reference: MCS2374
Job Number: 18-73207
Date Sampled: Not Given
Date Received: 12/01/2018
Date Tested: 26/01/2018
Sampled By: Not Given

Test Result

Laboratory Reference: 890875
Hole No.: BH05
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly CLAY

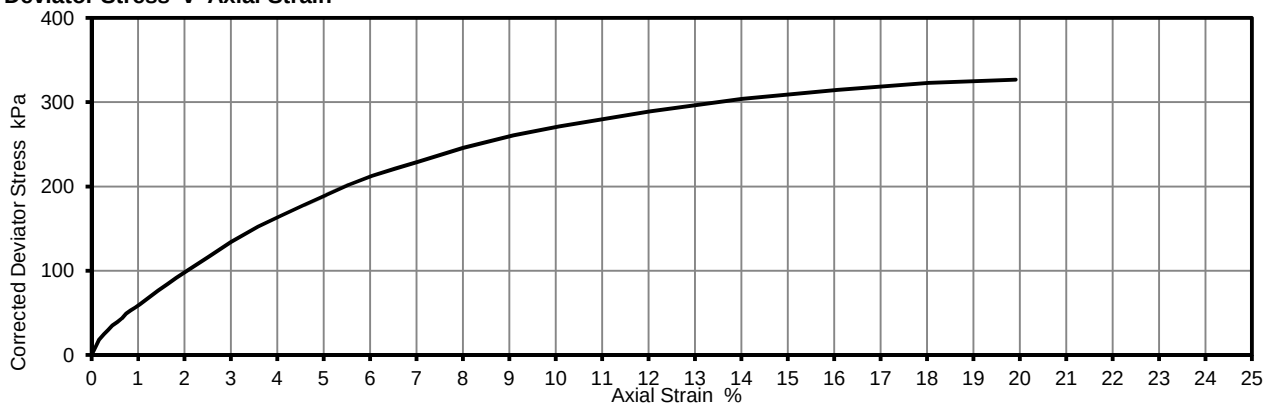
Depth Top [m]: 9.50
Depth Base [m]: 9.95
Sample Type: U

Test Number	1
Length	201.60 mm
Diameter	101.60 mm
Bulk Density	2.22 Mg/m ³
Moisture Content	15 %
Dry Density	1.92 Mg/m ³

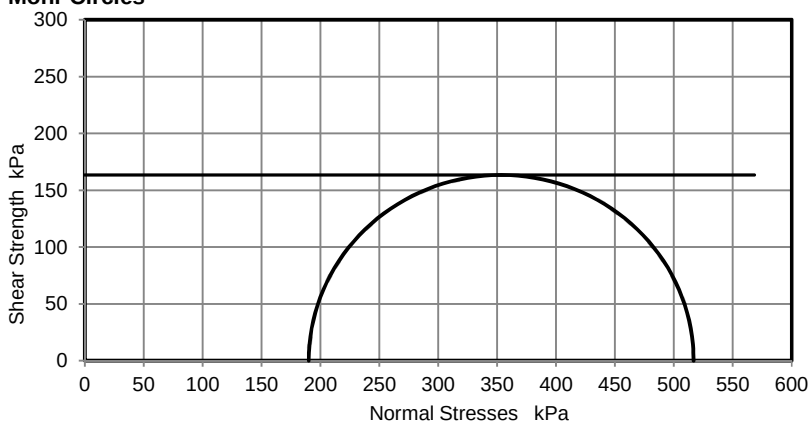
Rate of Strain
Cell Pressure
Axial Strain at failure
Deviator Stress, $(\sigma_1 - \sigma_3)_f$
Undrained Shear Strength, c_u
Mode of Failure

1.98	%/min
190	kPa
19.9	%
327	kPa
163	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 02/02/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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Laura Westaby
BWB Consulting Limited
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35 Livery Street Birmingham
B3 2PB

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Watford,
Herts,
WD18 8YS

t: 01217962087

e: laura.westaby@bwbconsulting.com

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 18-73225

Project / Site name: Plot J Rochdale

Samples received on: 12/01/2018

Your job number: MCS2374

Samples instructed on: 17/01/2018

Your order number:

Analysis completed by: 30/01/2018

Report Issue Number: 1

Report issued on: 30/01/2018

Samples Analysed: 11 soil samples

Signed: 

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

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

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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



Analytical Report Number: 18-73225

Project / Site name: Plot J Rochdale

Lab Sample Number				891024	891025	891026	891027	891028
Sample Reference				BH01	BH04	BH05	TP01	TP03
Sample Number				1	None Supplied	9	1	1
Depth (m)				9.50-9.95	11.00	6.50-6.95	0.75-0.85	1.00-1.10
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	12	11	9.8	43	6.8
Total mass of sample received	kg	0.001	NONE	0.36	0.27	0.29	0.18	0.56

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.6	8.5	8.4	6.6	8.2
Total Sulphate as SO ₄	%	0.005	MCERTS	0.034	0.032	0.032	0.067	0.028
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.052	0.053	0.050	0.021	0.0084
Total Sulphur	%	0.005	MCERTS	0.063	0.062	0.062	0.075	0.010

Analytical Report Number: 18-73225

Project / Site name: Plot J Rochdale

Lab Sample Number				891029	891030	891031	891032	891033
Sample Reference				TP04	TP10	TP14	TP19	TP23
Sample Number				2	4	2	3	5
Depth (m)				1.40-1.50	0.90-1.00	1.00-1.10	0.90-1.00	2.40-2.50
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	9.2	13	12	12	12
Total mass of sample received	kg	0.001	NONE	0.58	0.61	0.25	0.44	0.56

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	7.9	7.9	6.6	6.6
Total Sulphate as SO ₄	%	0.005	MCERTS	0.019	0.024	0.020	0.027	0.024
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0085	0.013	0.017	0.018	0.014
Total Sulphur	%	0.005	MCERTS	0.007	0.009	0.009	0.012	0.008



Analytical Report Number: 18-73225

Project / Site name: Plot J Rochdale

Lab Sample Number				891034				
Sample Reference				TP25				
Sample Number				3				
Depth (m)				1.40-1.50				
Date Sampled				Deviating				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	12				
Total mass of sample received	kg	0.001	NONE	0.41				

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.1				
Total Sulphate as SO ₄	%	0.005	MCERTS	0.029				
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.041				
Total Sulphur	%	0.005	MCERTS	0.011				



Analytical Report Number : 18-73225

Project / Site name: Plot J Rochdale

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
891024	BH01	1	9.50-9.95	Brown clay and sand with vegetation.
891025	BH04	None Supplied	11.00	Brown clay.
891026	BH05	9	6.50-6.95	Brown clay and sand with gravel.
891027	TP01	1	0.75-0.85	Brown clay.
891028	TP03	1	1.00-1.10	Brown sand with gravel.
891029	TP04	2	1.40-1.50	Brown sandy clay.
891030	TP10	4	0.90-1.00	Brown clay and sand.
891031	TP14	2	1.00-1.10	Brown clay and sand.
891032	TP19	3	0.90-1.00	Brown clay and sand with gravel.
891033	TP23	5	2.40-2.50	Brown sand with gravel.
891034	TP25	3	1.40-1.50	Brown clay and sand.

Analytical Report Number : 18-73225

Project / Site name: Plot J Rochdale

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"	L038	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

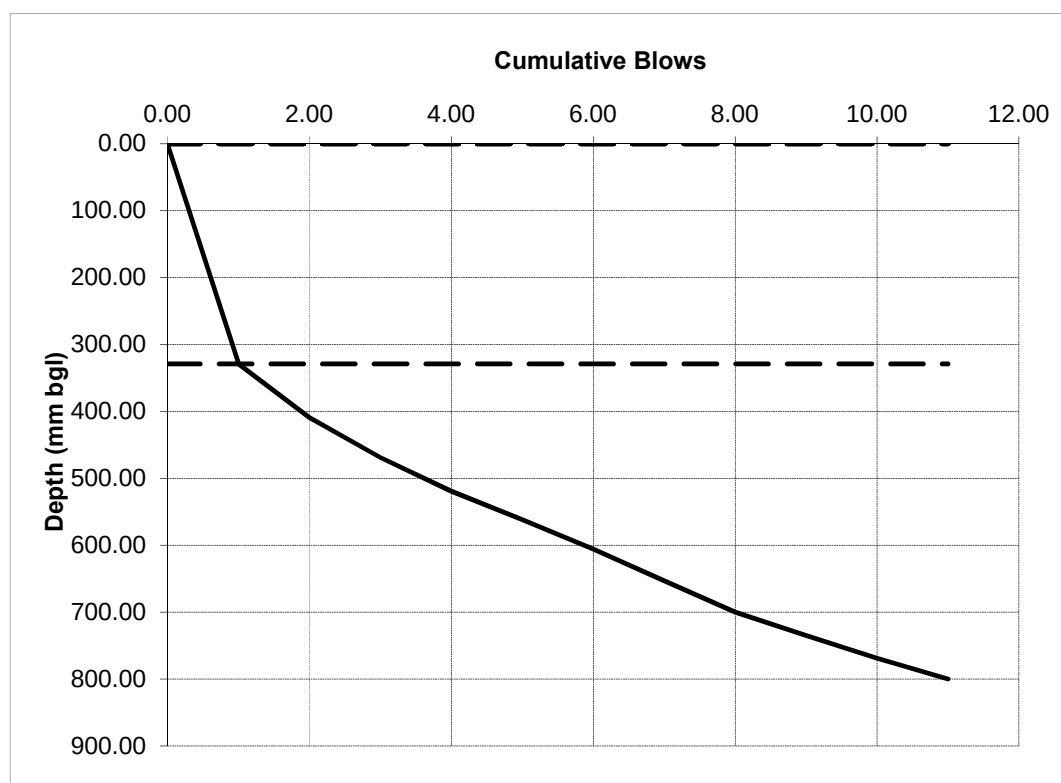
Sample Deviation Report



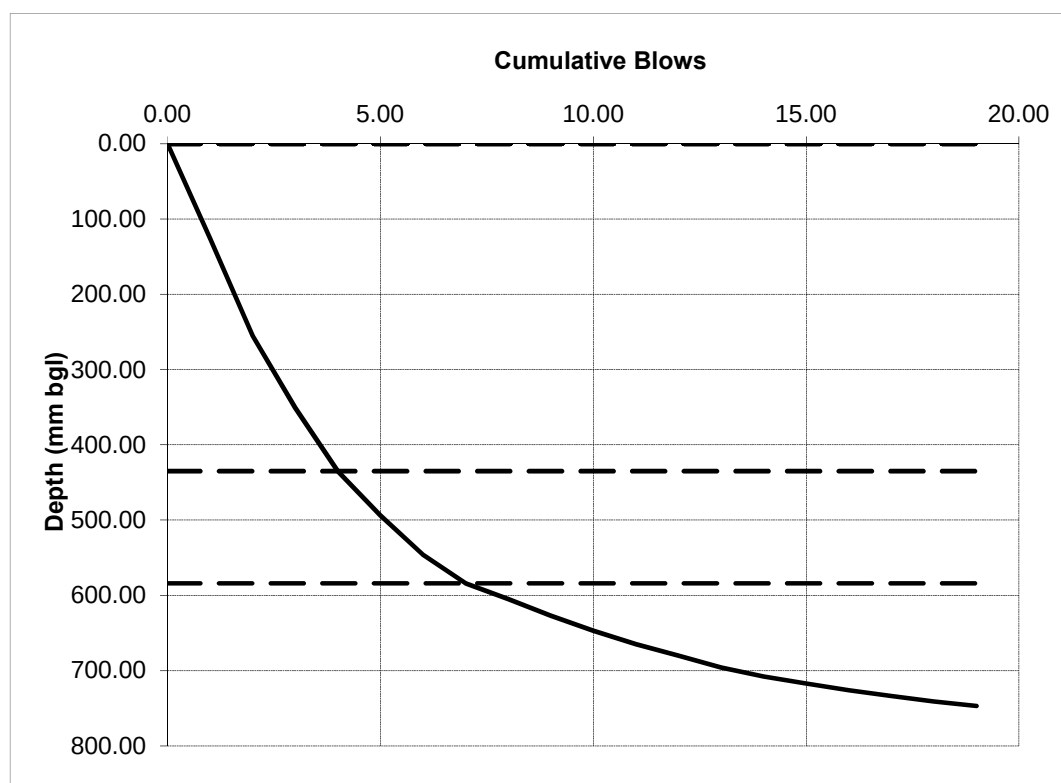
Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
BH01	1	S	18-73225	891024	a			
BH04		S	18-73225	891025	a			
BH05	9	S	18-73225	891026	a			
TP01	1	S	18-73225	891027	a			
TP03	1	S	18-73225	891028	a			
TP04	2	S	18-73225	891029	a			
TP10	4	S	18-73225	891030	a			
TP14	2	S	18-73225	891031	a			
TP19	3	S	18-73225	891032	a			
TP23	5	S	18-73225	891033	a			
TP25	3	S	18-73225	891034	a			

APPENDIX 9

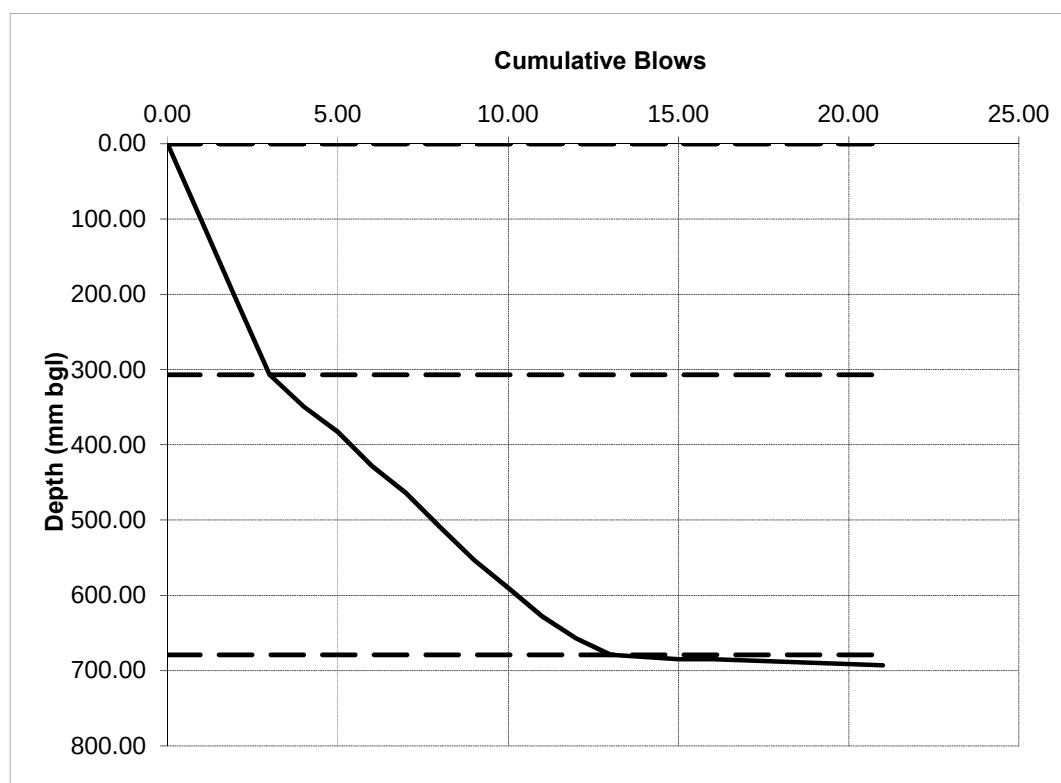
DYNAMIC CONE PENETROMETER TEST RESULTS

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CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

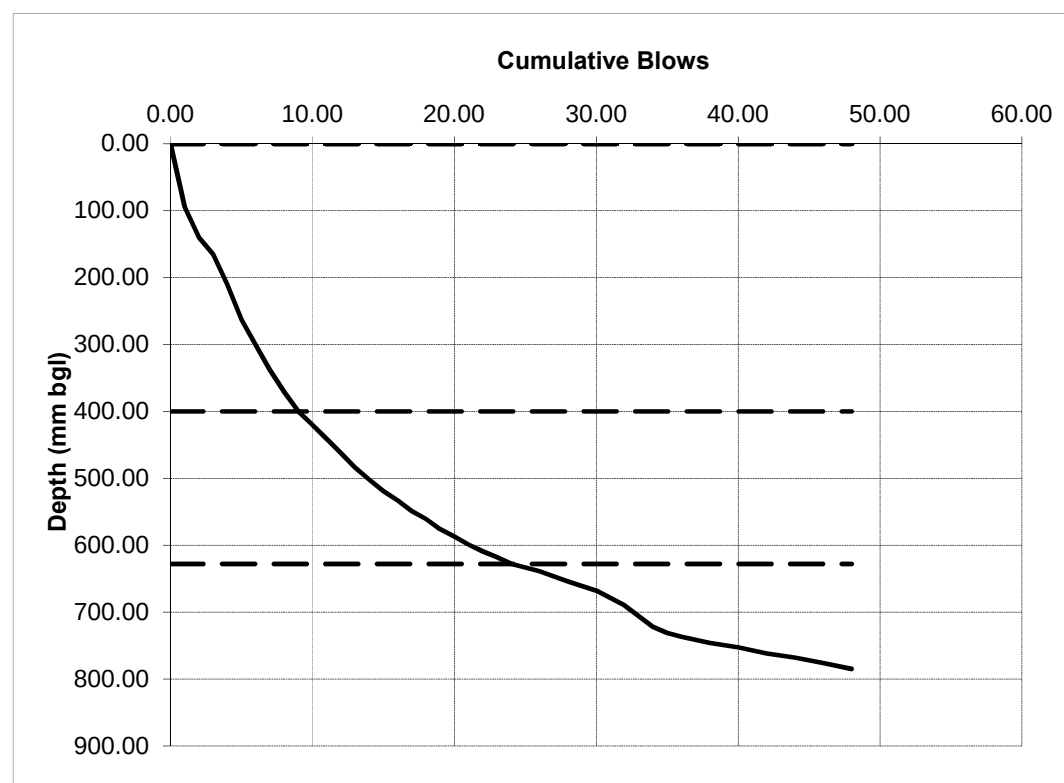
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CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

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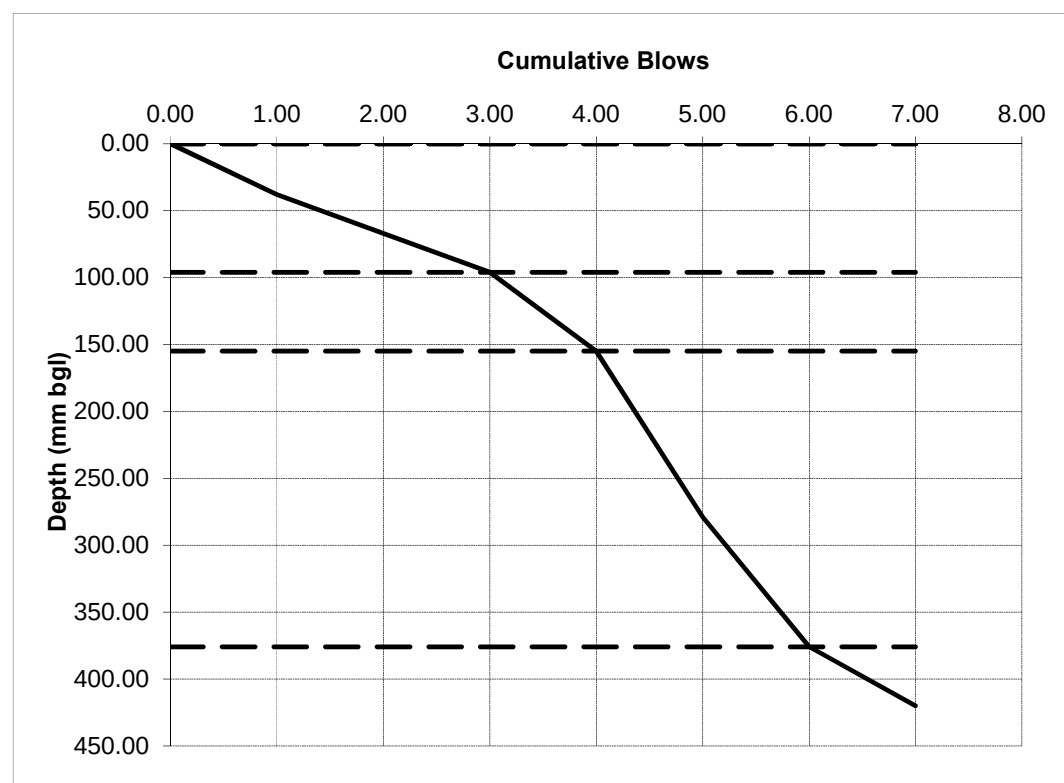
CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB**BWB****BWB****BWB**

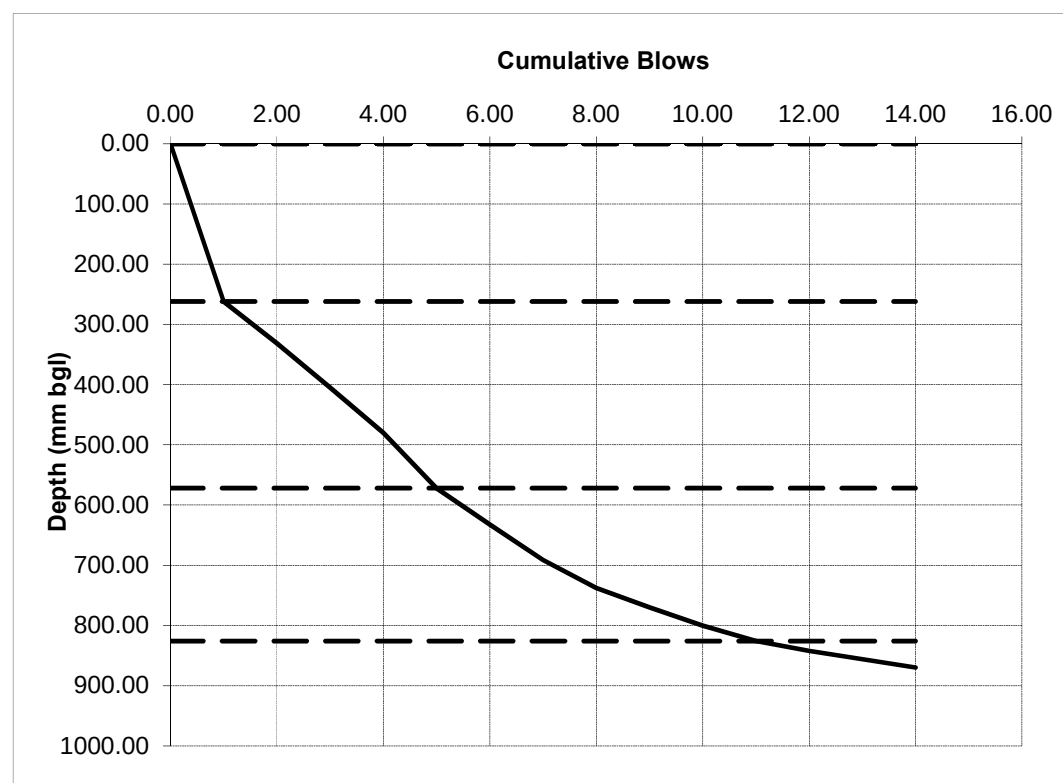
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CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

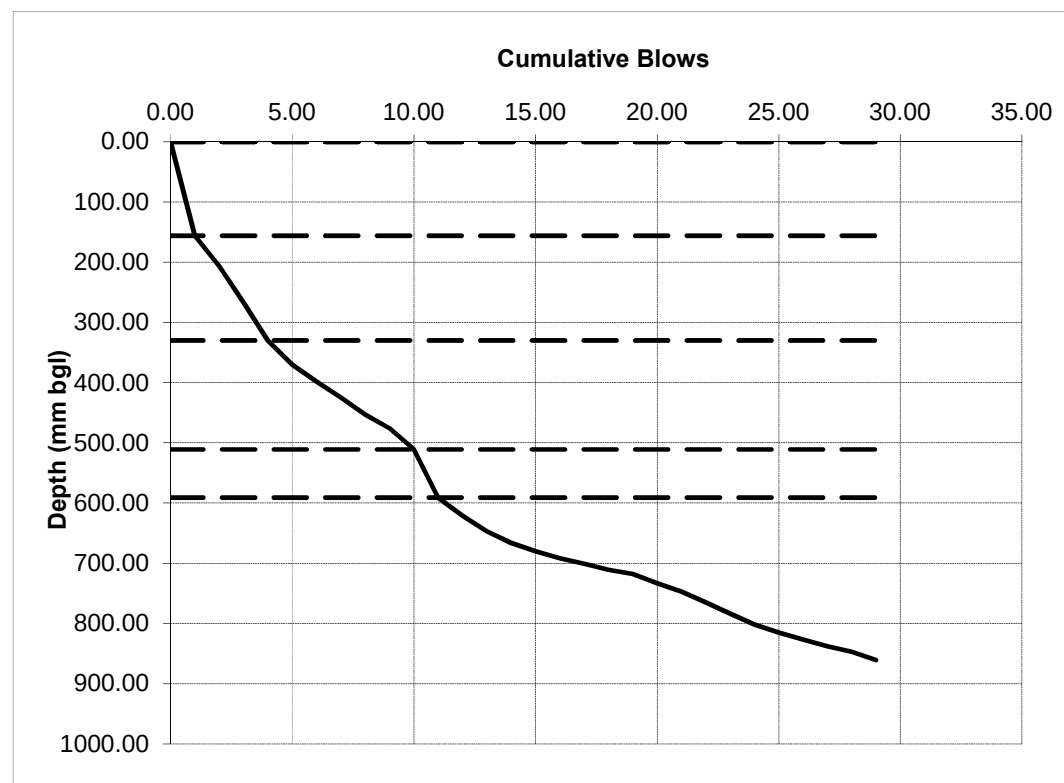
BWB**BWB****BWB****BWB**

BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

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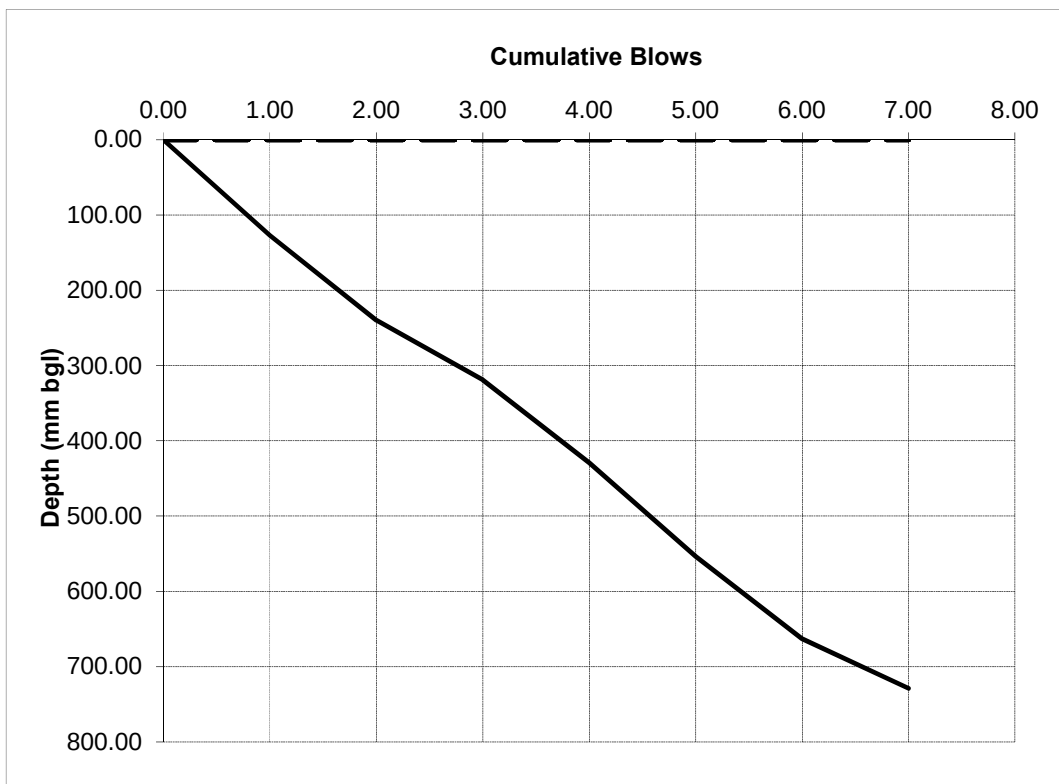
CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

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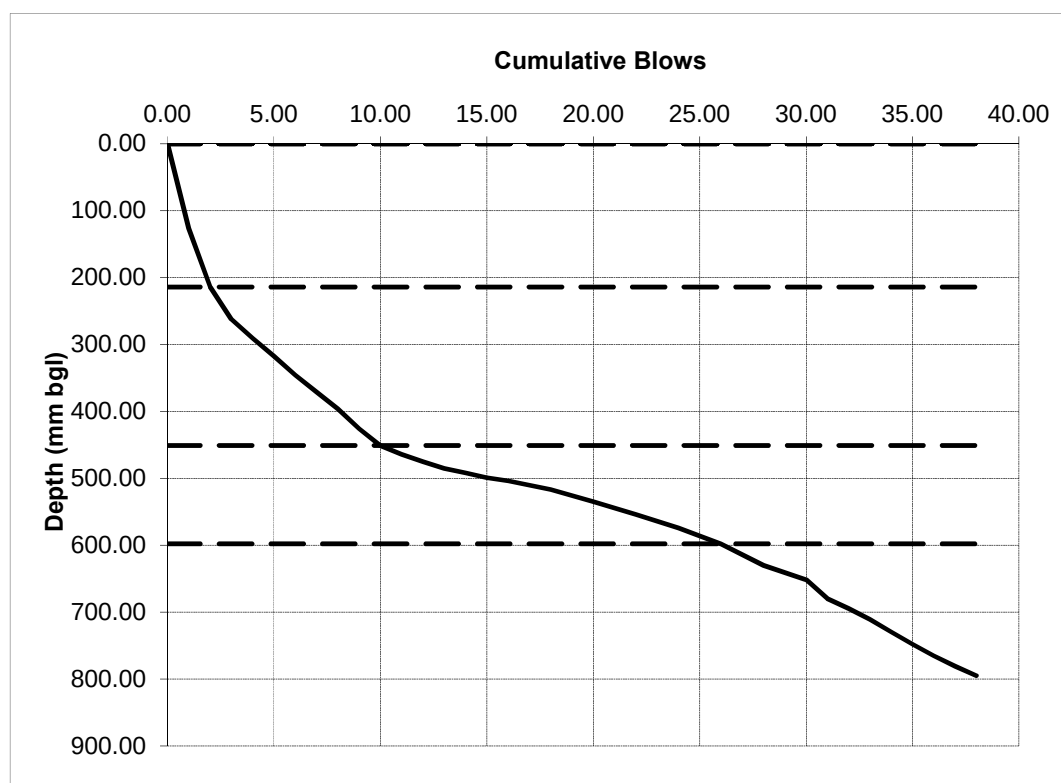
CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

Dynamic Cone Penetrometer

PROJECT NUMBER	MCS2374
PROJECT TITLE	Plot J, Kingsway BP
TEST REFERENCE	TP07
DATE	10-Jan-18
MATERIAL/ STRATA TYPE	Topsoil / HGD
START DEPTH (mm bgl)	0
WEATHER/ GROUND CONDITION	Damp

BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB[illegible]

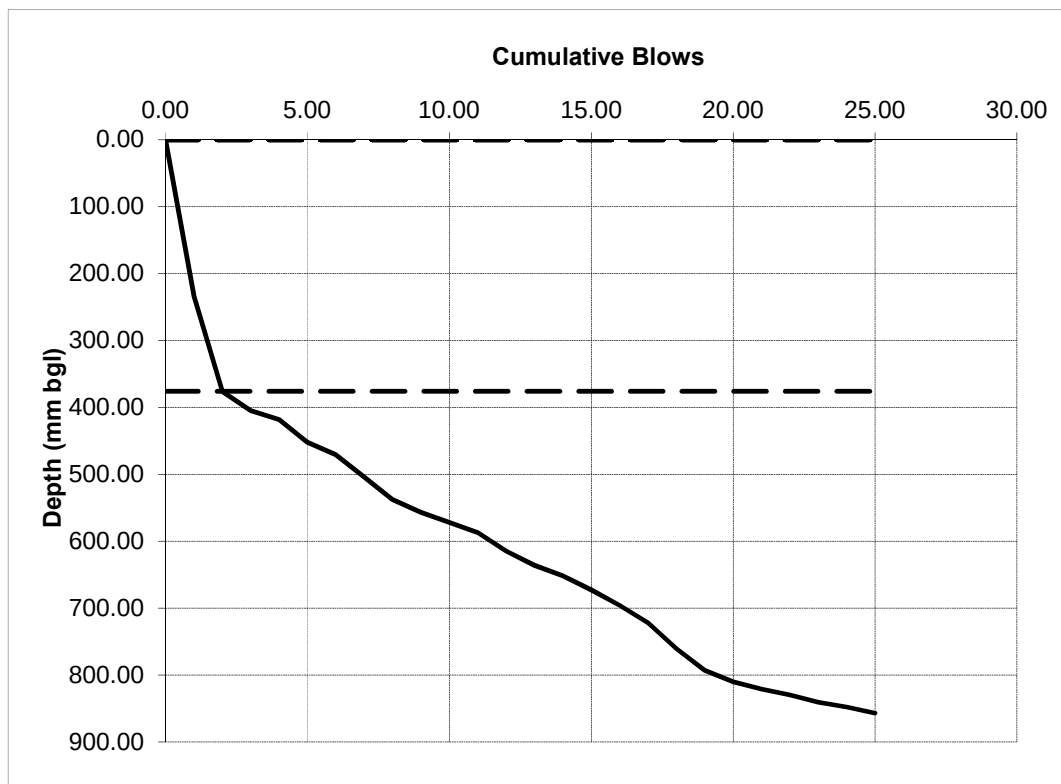
CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB**BWB****BWB****BWB**

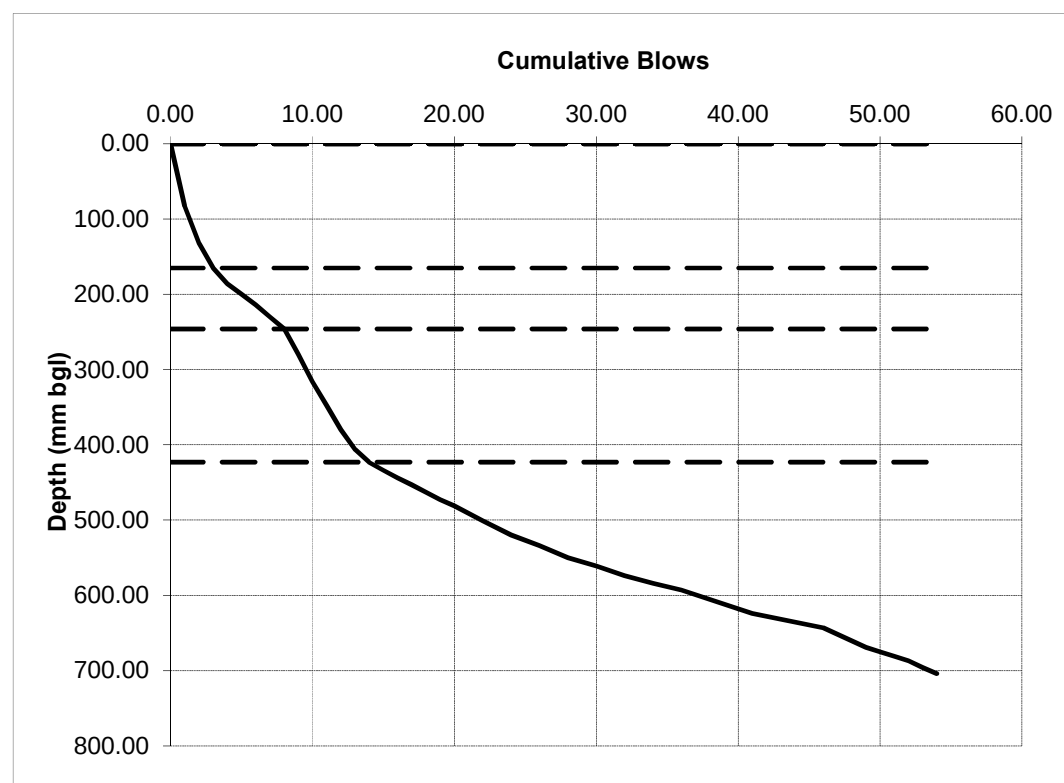
BWB**BWB****BWB****BWB**

Dynamic Cone Penetrometer

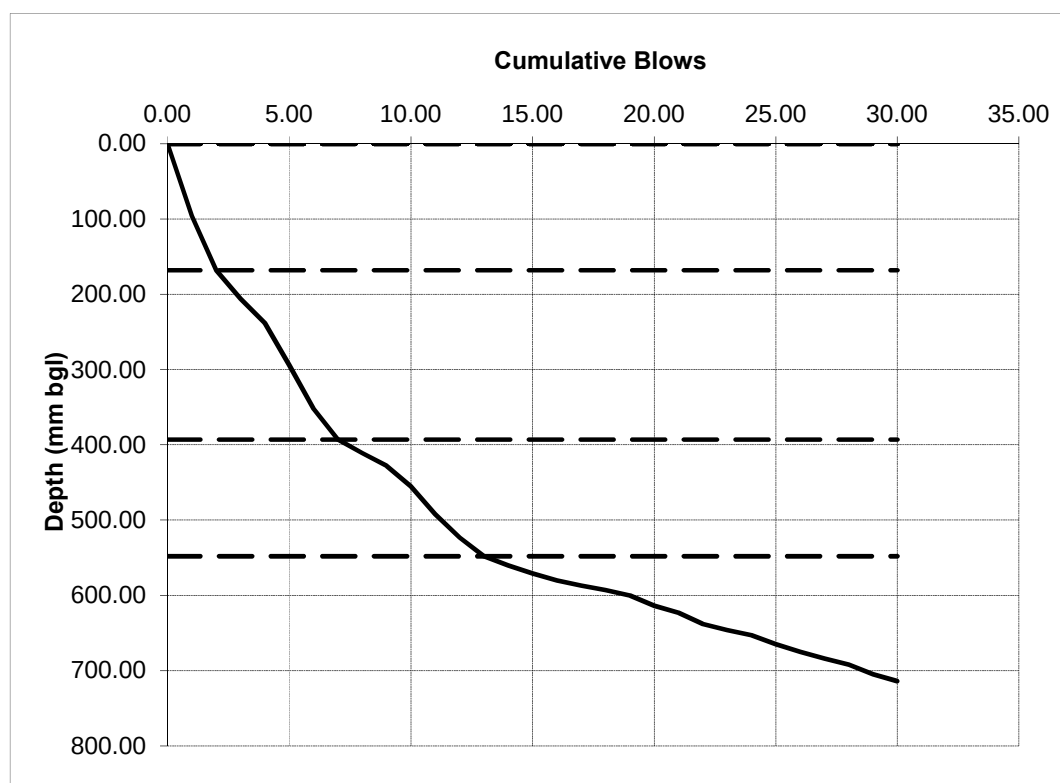
PROJECT NUMBER	MCS2374
PROJECT TITLE	Plot J, Kingsway BP
TEST REFERENCE	TP11
DATE	10-Jan-18
MATERIAL/ STRATA TYPE	Topsoil / HGD
START DEPTH (mm bgl)	0
WEATHER/ GROUND CONDITION	Damp

BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB[illegible]

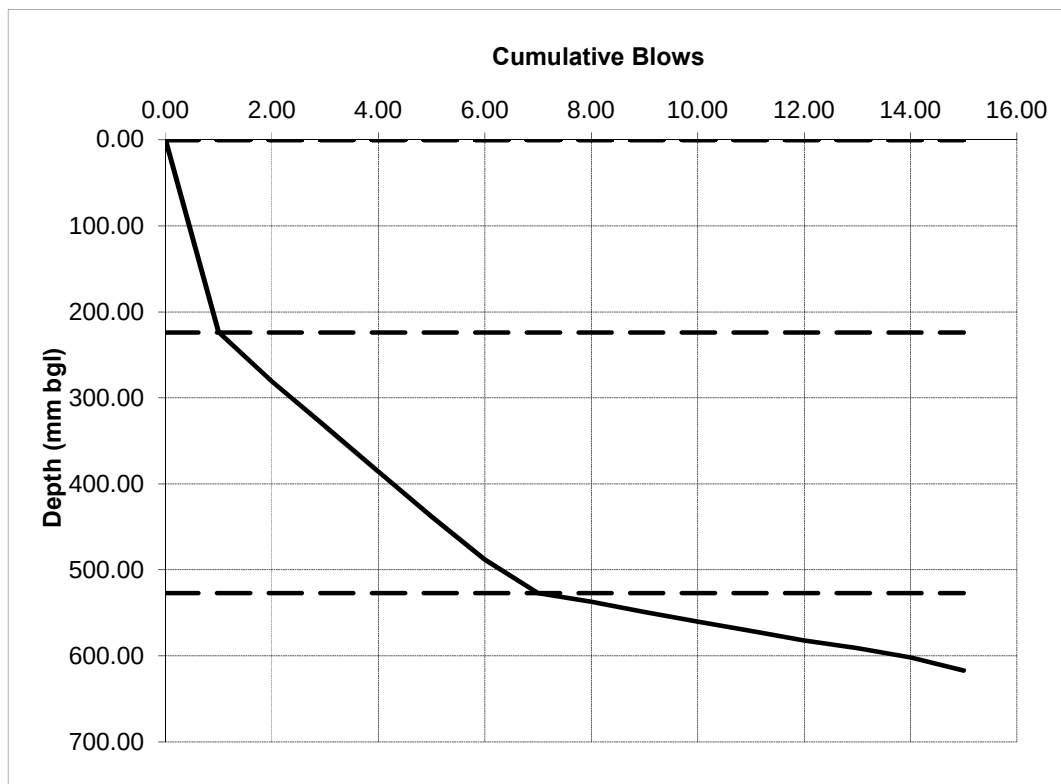
CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB**BWB****BWB****BWB**

BWB**BWB****BWB****BWB**

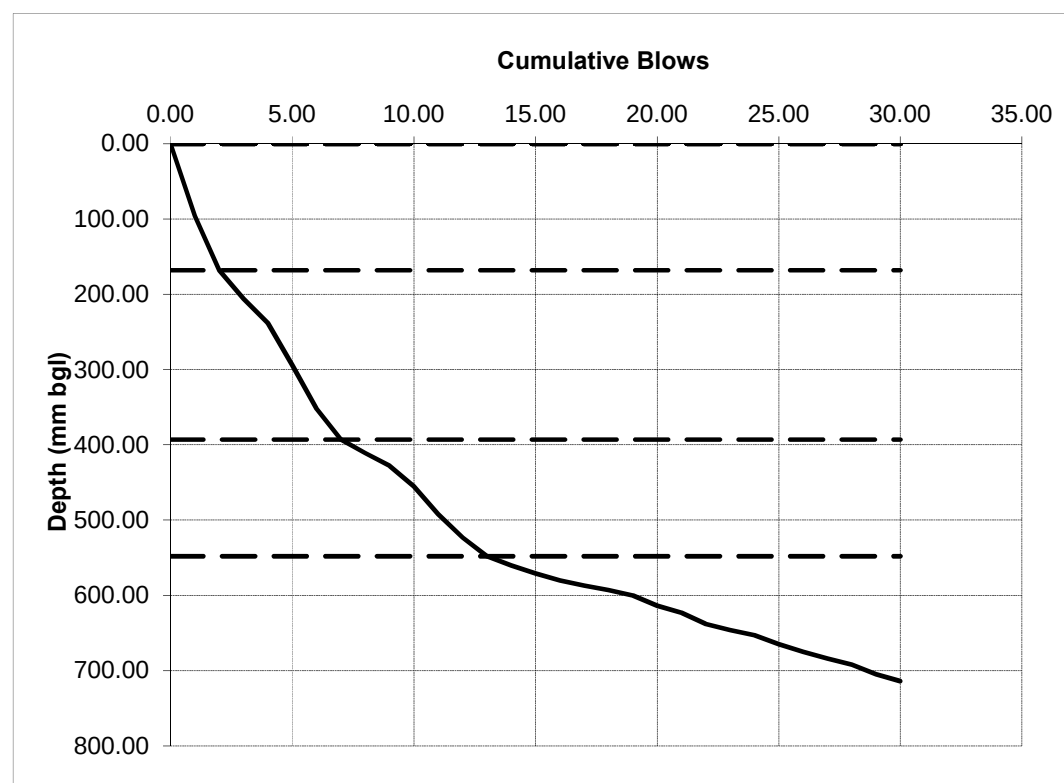
Dynamic Cone Penetrometer

PROJECT NUMBER	MCS2374
PROJECT TITLE	Plot J, Kingsway BP
TEST REFERENCE	TP19
DATE	12-Jan-18
MATERIAL/ STRATA TYPE	Topsoil / HGD
START DEPTH (mm bgl)	0
WEATHER/ GROUND CONDITION	Damp

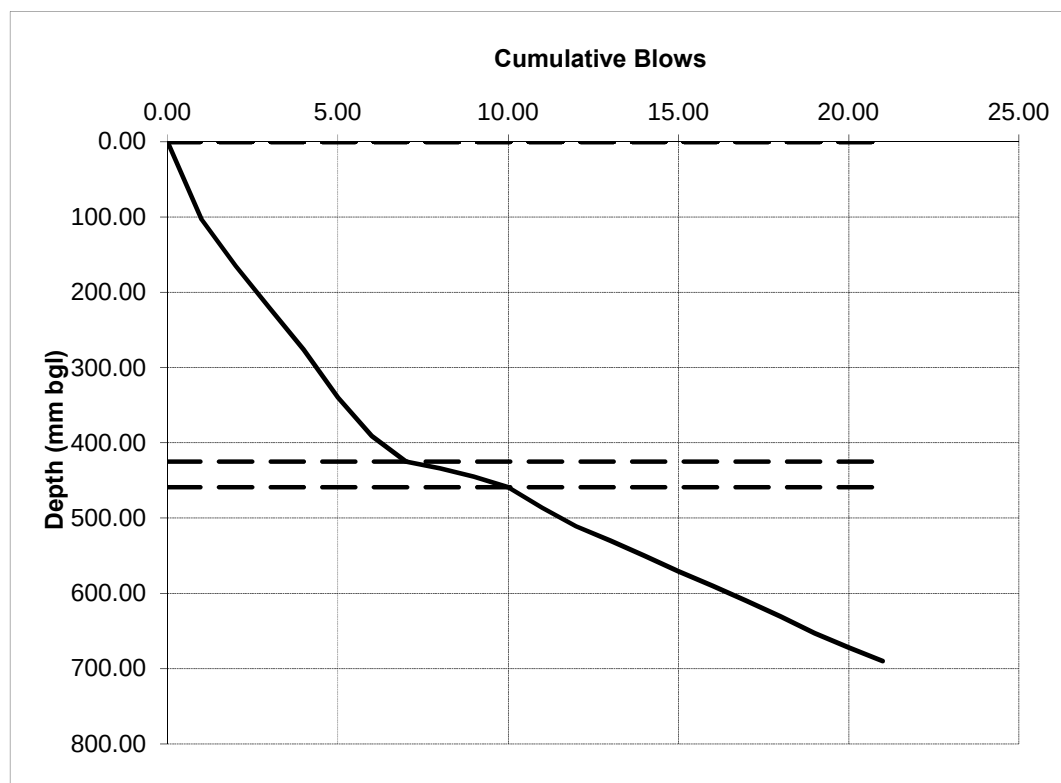
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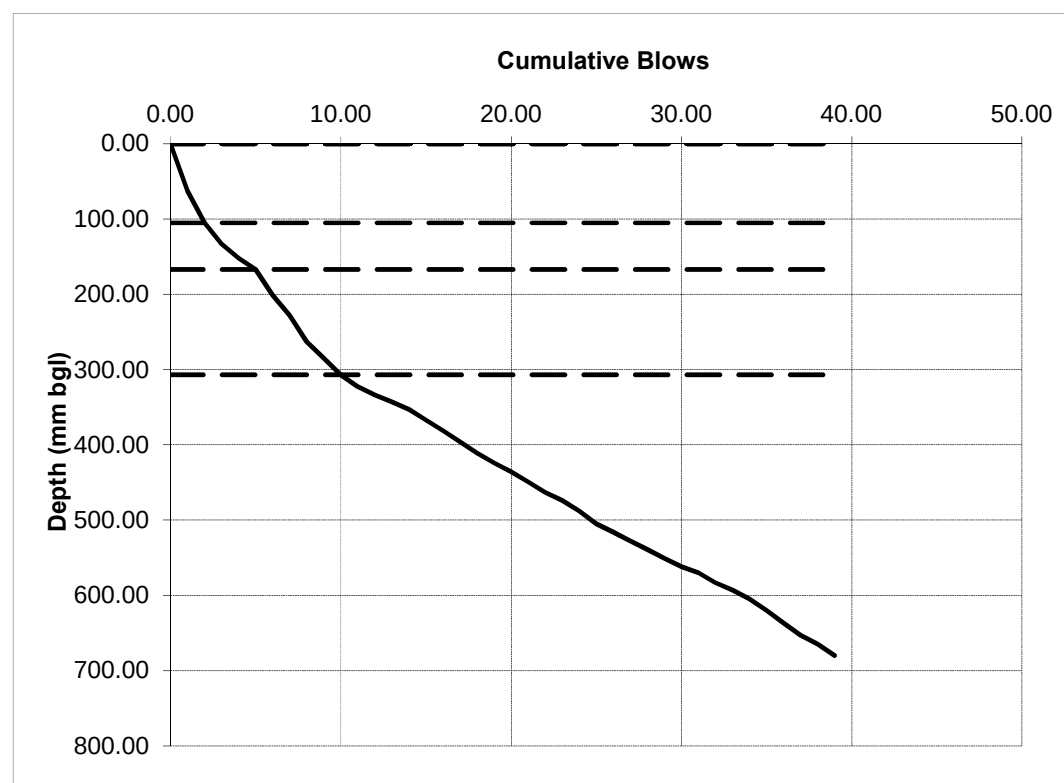
BWB**BWB****BWB****BWB**

BWB[illegible]

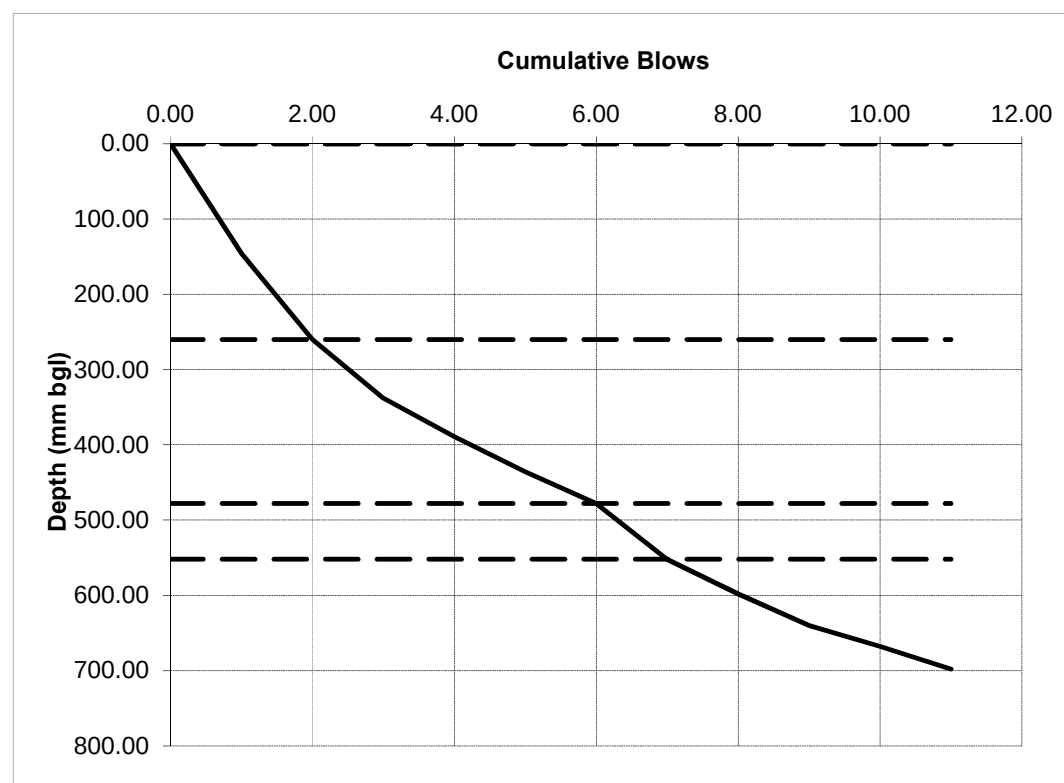
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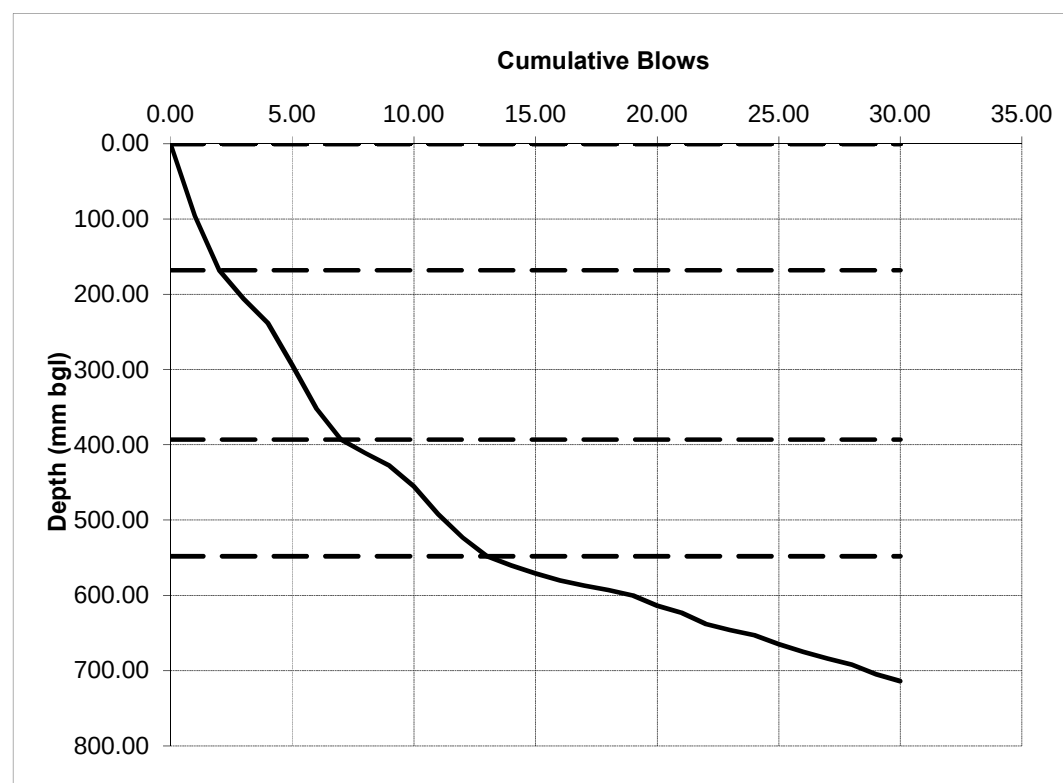
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BWB[illegible]

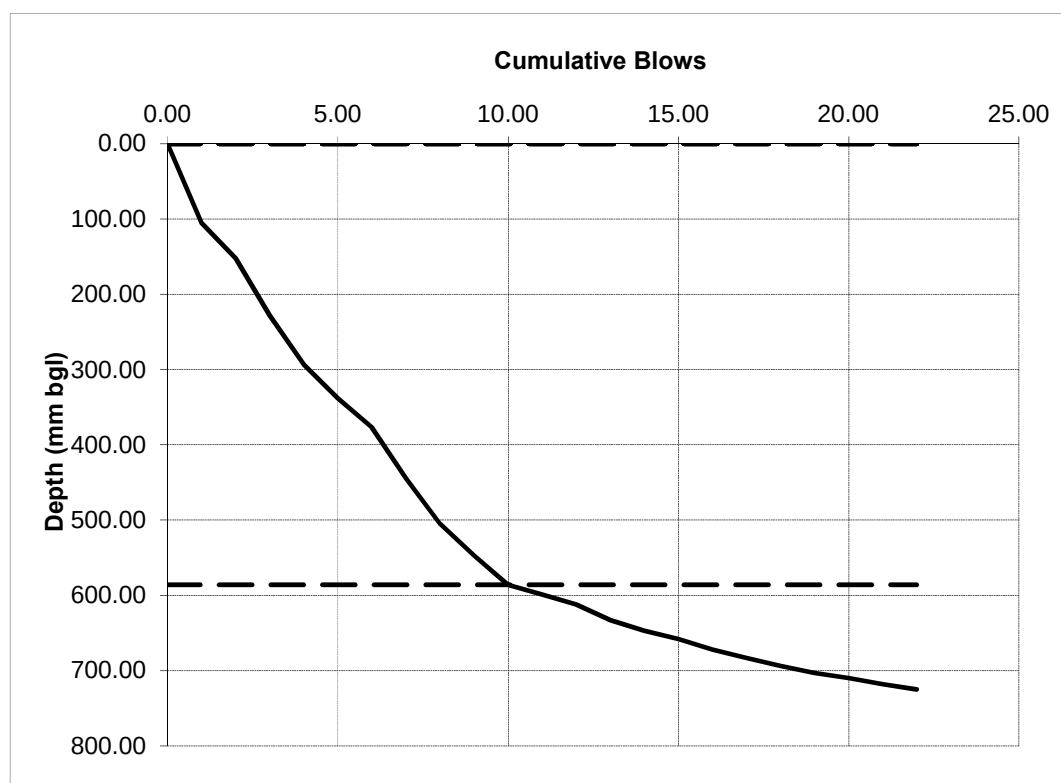
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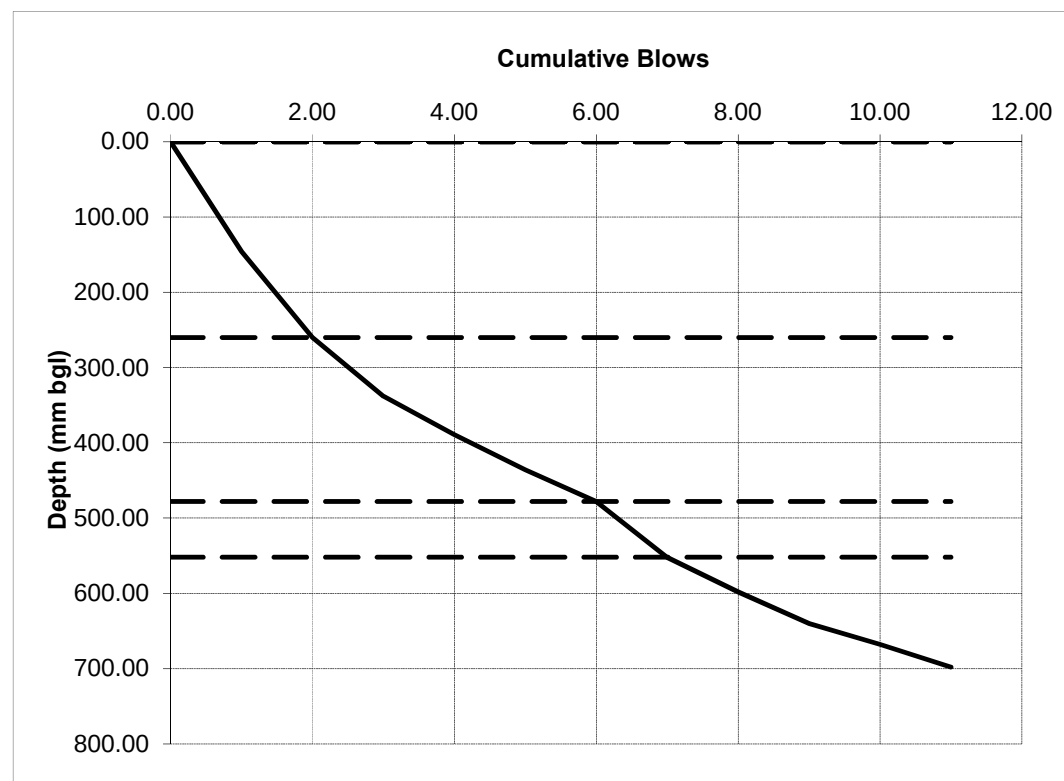
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BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

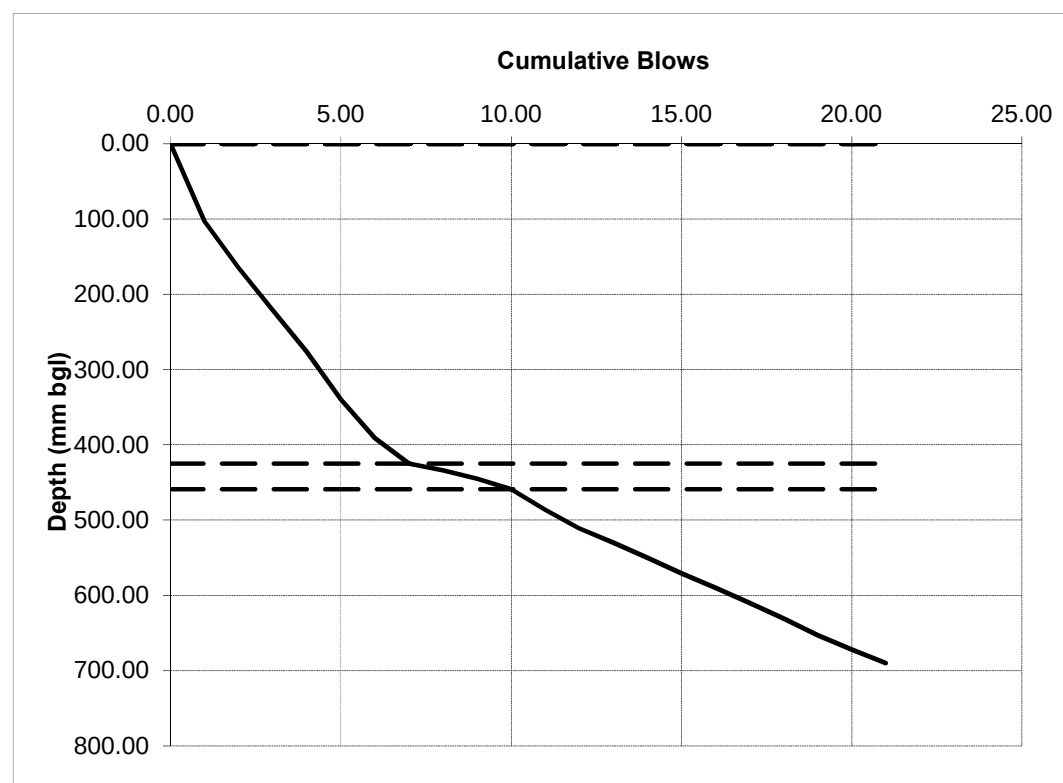
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CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

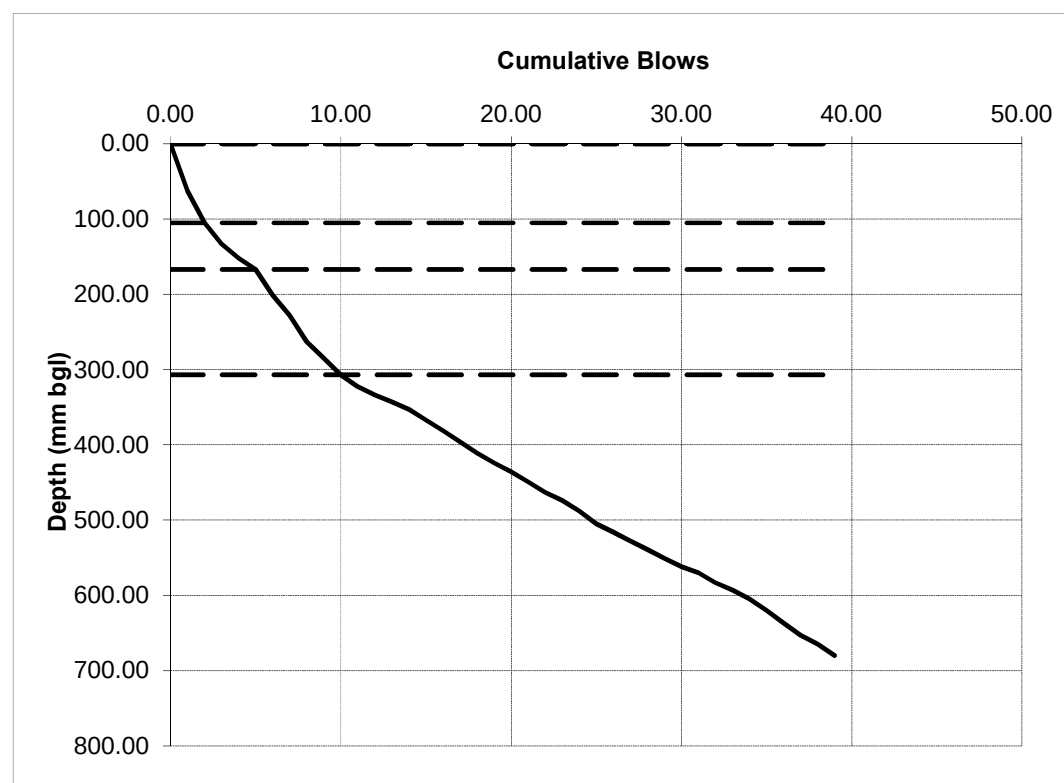
BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB**BWB****BWB****BWB**

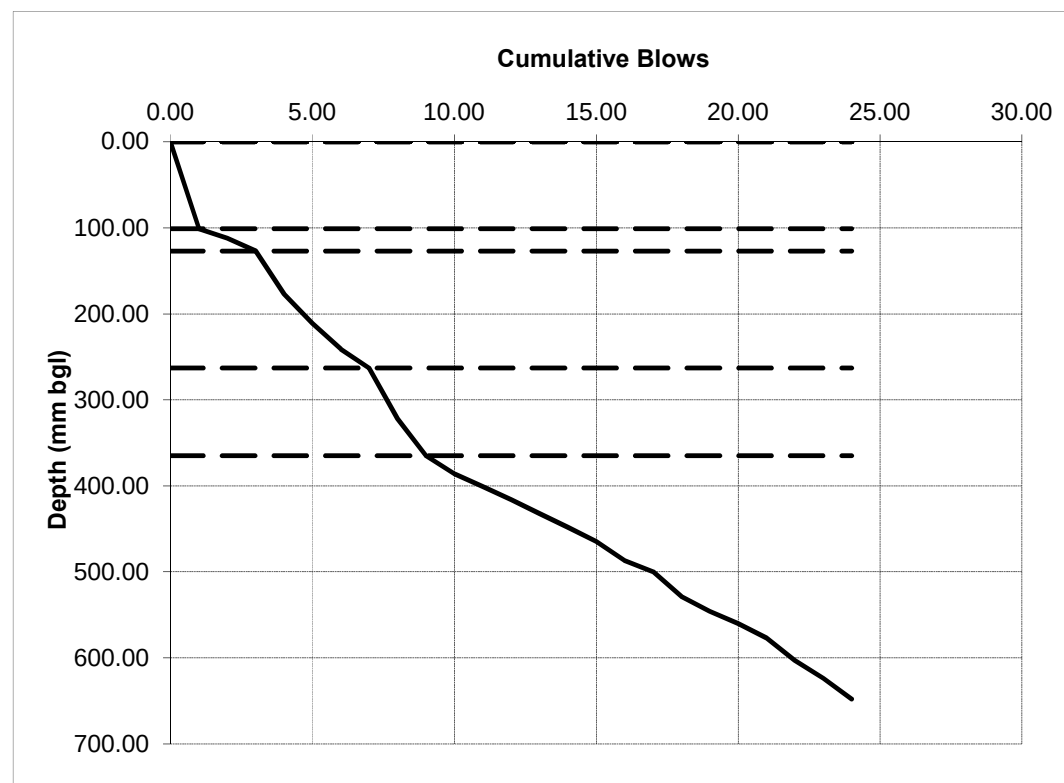
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CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB[illegible]

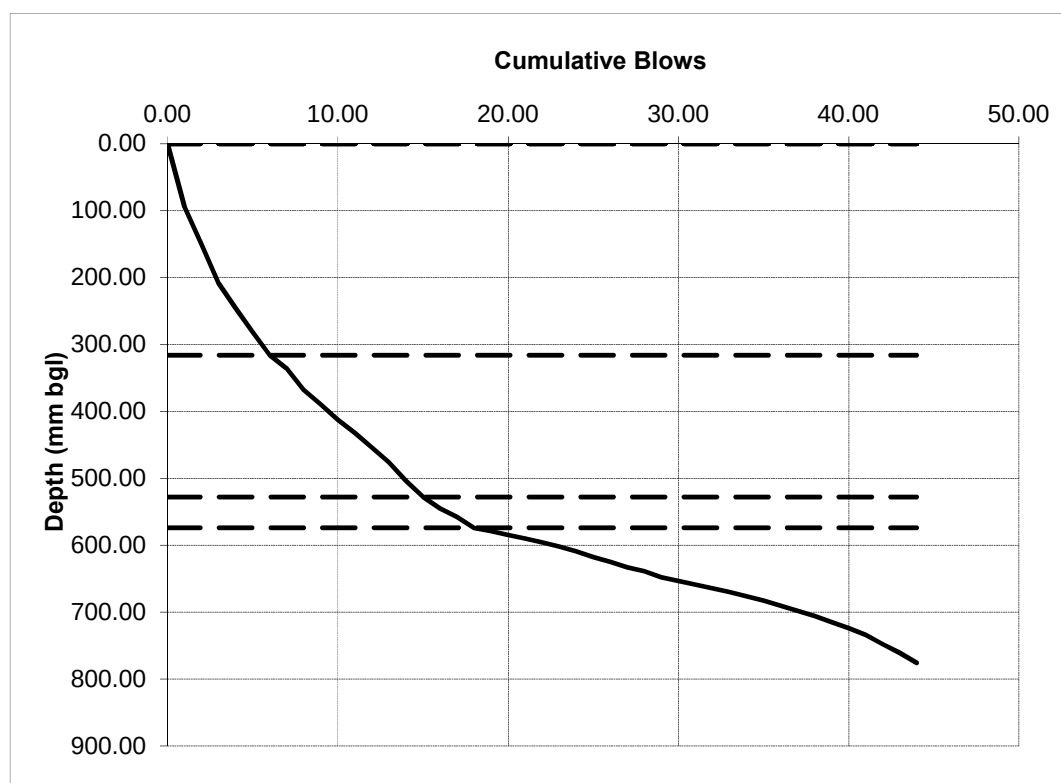
CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB**BWB****BWB****BWB**

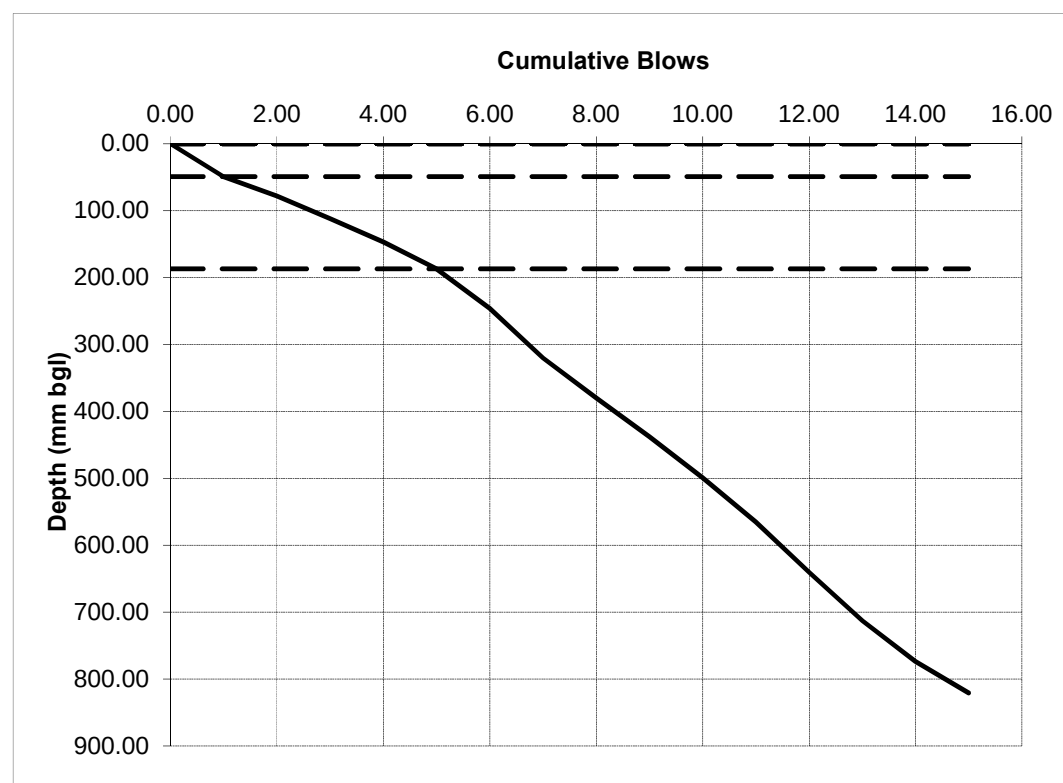
BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB**BWB****BWB****BWB**

BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

BWB[illegible]

CBR Interpretation based on the TRL Equation: $\text{Log}_{10}(\text{CBR}) = 2.480 - [1.057 \times \text{Log}_{10}(\text{DCP Strength})]$

APPENDIX 10

DERIVATION OF BWB GSAC

BWB HUMAN HEALTH GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

Human Health Generic Screening Criteria

The Environment Agency published the revised CLEA framework for assessing the risk to human health from soil contamination in January 2009. The framework comprises a technical background document (EA, 2009a), toxicological assessment EA 2009b and CLEA spreadsheet model (EA 2009c). The new framework supersedes the 2002 CLEA model and subsequent briefing notes. The 2002 CLEA software and CLEA 2005 have also been withdrawn and all previously published Soil Guideline Values (SGV) have been withdrawn. The EA have issued revised SGVs for the following substances.

- Arsenic
- selenium
- ethylbenzene
- Phenol
- cadmium
- benzene
- xylene
- Mercury
- nickel
- toluene
- dioxins and dioxin like PCBs

In the absence of an SGV for a particular contaminant Generic assessment criteria have been generated by BWB using the CLEA framework. This is a similar approach to Generic screening criteria published by LQM/CIEH and CLAIRE/EIC.

The Statutory Guidance on Part IIa of the Environment Act was revised in 2012 and introduced the concept of characterising Land into 4 categories. Categories 1 and 2 were classed as "Contaminated Land" and Categories 3 and 4 as "not Contaminated Land". DEFRA commissioned a research project to develop Category 4 Screening Levels (C4SLs) which would be used to rapidly screen sites as not contaminated land. These values would be less conservative than SGVs or equivalent GSACs but still be strongly precautionary. In 2014 DEFRA published the framework for deriving C4SLs and C4SLs for six substances:

Arsenic
Cadmium
Chromium VI
Lead
Benzo(a)pyrene
Benzene

The framework recommended changes to exposure parameters as well as introducing a new Health Criteria Value known as a "Low level of Toxicological Concern" (LLTC). This would be less conservative than the minimal risk approach used to derive TDIs and IDs under the 2009b CLEA framework.

In response LQM/CIEH published their third edition of Generic screening criteria for human health in January 2015. These were known as "Suitable for Use Levels" (S4ULs) and adopted the changes to exposure parameters that were developed under the Category 4 Screening Level methodology. The

report also reviewed toxicity information but adopted the minimal risk approach as set out in EA 2009b. This report presented revised data for some substances for which an SGV had been developed, therefore some of the existing SGVs have been superseded.

BWB have updated their GSACs to take into account the LQM/CIEH S4ULs and DEFRA C4SLs but have retained the CLEA exposure assumptions, the BWB GSACs represent the most conservative minimal risk approach.

The screening approach comprises tiered assessment of contaminant data against BWB GSACs in the first instance, then S4ULs and finally C4SLs if available.

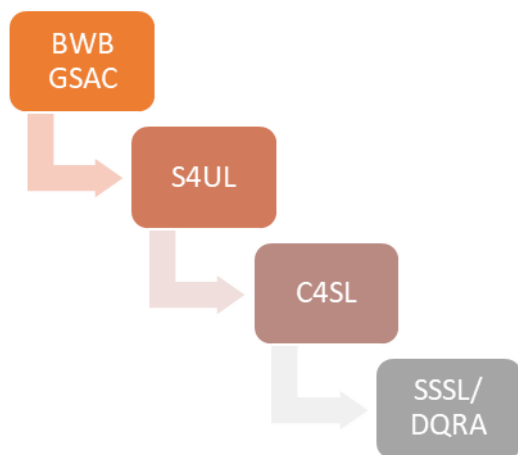


Figure 1 GSAC Hierarchy

Conceptual Site Model

The standard exposure pathways and Conceptual Models for human exposure to contaminants for different site uses are set out in the updated technical background to the CLEA model (Environment Agency 2009a).

Descriptive Conceptual Models (From Environment Agency 2009a)

Residential This generic scenario assumes a typical residential property consisting of a two-storey house built on a ground bearing slab with a private garden consisting of lawn, flower beds and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden area. The key assumptions for BWB GSACs are Critical receptor is a young female child (aged zero to six years old) Exposure duration is six years Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce, consumption of soil attached to home grown produce, skin contact with soils and indoor dusts, and inhalation of indoor and outdoor dust and vapours. Soil type is a Sandy Loam with 1% organic matter Building type is a two storey small terraced house
Commercial/Industrial There are many different kinds of workplace and work-related activities. This generic scenario assumes a typical commercial or light industrial property consisting of a three storey building at which employees spend most time indoors and are involved in office based or relatively light physical work. The key assumptions for BWB GSACs are Critical receptor is a working female adult (aged 16 to 65 years) Exposure duration is a working lifetime of 49 years Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts, and inhalation of dust and vapours. Soil type is a Sandy Loam with 1% organic matter Building type is a three storey office (post 1970) (Representative of new buildings)

The 2009a report identifies 10 potential exposure pathways by which contaminated soils may impact human health and also sets out which pathways are applicable for four standard land uses. The pathways for the residential and commercial end uses are shown below.

Screening Criteria Modelling

The CLEA model version 1.071 has been used to calculate BWB GSACs. BWB have used the model to calculate Individual criteria for each relevant

pathway so, for example, in a residential with vegetable uptake scenario we would need six individual criteria:-

- Ingestion of soil and dust
- Ingestion of contaminated vegetables and soil attached to vegetables
- Dermal contact indoors and outdoors
- Particulate dust inhalation indoors and outdoors
- Vapour inhalation indoors
- Vapour inhalation outdoors

The final overall assessment criteria is calculated by adding together the reciprocal of the individual criteria for each pathway, therefore if several of the individual criteria are of similar magnitude the final criteria may be substantially lower than the lowest individual criteria so that total exposure is below the respective health threshold.

$$1/GSAC = \sum 1/ASC_{\text{ingestion}} + 1/ASC_{\text{inhalation}} + 1/ASC_{\text{dermal}}$$

By adopting this methodology BWB are able to provide a more flexible site specific approach to generic human health risk assessment.

Pathway Selection - Generic Site Assessment Criteria

Pathway	Residential	Commercial / Industrial
Ingestion of Soil	Yes	Yes
Ingestion of site derived household dust	Yes	Yes
Ingestion of contaminated homegrown produce	Optional	No
Ingestion of soil attached to homegrown produce	Optional	No
Dermal contact with Soil	Yes	Yes
Dermal contact with site derived household dust	Yes	Yes
Inhalation of fugitive soil dust	Yes	Yes
Inhalation of fugitive site derived household dust	Yes	Yes
Inhalation of vapours outside	Yes	Yes
Inhalation of vapours inside	Yes	Yes

Health Criteria Values

The general hierarchy for selecting health criteria values is as follows:

1. EA / DEFRA TOX report
2. Other UK authoritative body e.g. Committee on toxicity, Food Standards Agency
3. EU authoritative body
4. Other EU body e.g. RIVM
5. Other US/International Body

In the absence of updated TOX reports which take into account the recommendations of EA report (2009b) TOX reports produced under the old

regime have been used and GSACs will be updated accordingly as further authoritative information is issued.

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Residential Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic Matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg	mg/kg
Arsenic	NR	NR	3.50E+01	4.29E+02	8.50E+01	3.24E+01	N/A
Barium	NR	NR	1.35E+03		4.25E+05	1.34E+03	N/A
Beryllium	NR	NR	1.56E+02	2.96E+03	1.21E+00	1.21E+00	N/A
Boron	NR	NR	1.08E+04	3.00E+02	3.65E+06	2.91E+02	N/A
Cadmium	NR	NR	1.21E+02	1.24E+01	1.27E+02	1.03E+01	N/A
Chromium III	NR	NR	1.98E+04	1.25E+06	6.37E+02	6.17E+02	N/A
Chromium VI	NR	NR	7.05E+01	1.22E+01	4.25E+00	4.25E+00	N/A
Copper	NR	NR	1.08E+04	3.54E+03	9.89E+03	2.10E+03	N/A
Lead						2.00E+02	N/A
Inorganic Mercury	NR	NR	5.71E+01	1.40E+02	2.55E+03	3.99E+01	N/A
Nickel	NR	NR	7.89E+02	1.64E+03	1.27E+02	1.27E+02	N/A
Selenium	NR	NR	4.31E+02	6.15E+02	1.36E+05	2.53E+02	N/A
Vanadium	NR	NR	1.17E+03	6.21E+02	1.03E+03	2.91E+02	N/A
Zinc	NR	NR	4.05E+04	4.13E+03	2.55E+07	3.74E+03	N/A
Cyanide (free)						4.30E+01	N/A
Cyanide (Complex)						2.13E+02	N/A
Phenol	3.43E+02	4.21E+05	6.56E+02	1.55E+02	3.22E+05	9.18E+01	4.16E+04
Benzene	2.69E-01	5.63E+03	2.58E+01	1.13E-01	5.95E+04	7.93E-02	1.22E+03
Toluene	6.38E+02	8.78E+06	1.98E+04	1.48E+02	5.92E+07	1.19E+02	8.69E+02
Ethylbenzene	5.86E+01	6.17E+05	8.88E+03	1.07E+02	3.11E+06	3.77E+01	5.18E+02
Total Xylene	5.57E+01	5.15E+05	1.60E+04	1.87E+02	2.28E+06	4.28E+01	4.78E+02
TPH (EC5-6) aliphatic	2.88E+01	2.41E+06	2.23E+05	4.90E+03	1.06E+08	2.86E+01	3.04E+02
TPH (>EC6-8) aliphatic	7.02E+01	3.76E+06	2.23E+05	1.53E+04	1.06E+08	6.99E+01	1.44E+02
TPH (>EC8-10) aliphatic	1.82E+01	4.61E+05	4.45E+03	2.17E+03	6.16E+06	1.80E+01	7.77E+01
TPH (>EC10-12) aliphatic	9.02E+01	1.03E+06	4.45E+03	1.67E+04	6.16E+06	8.79E+01	4.75E+01

Residential Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic Matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	7.55E+02	2.97E+06	4.45E+03	2.32E+05	6.16E+06	6.43E+02	2.37E+01
TPH (>EC16-35) aliphatic	8.91E+04	8.47E+07	8.91E+04	1.15E+07	4.25E+07	4.43E+04	8.48E+00
TPH (>EC35-44) aliphatic	8.91E+04	8.47E+07	8.91E+04	1.15E+07	4.25E+07	4.43E+04	8.48E+00
TPH (>EC6-7) aromatic (benzene)	2.69E-01	5.63E+03	2.58E+01	1.13E-01	5.95E+04	7.93E-02	1.22E+03
TPH (>EC7-8) aromatic (toluene)	6.26E+02	8.62E+06	1.98E+04	1.48E+02	5.81E+07	1.19E+02	8.69E+02
TPH (>EC8-10) aromatic	3.22E+01	2.79E+05	1.78E+03	5.73E+01	1.28E+06	2.04E+01	6.13E+02
TPH (>EC10-12) aromatic	1.75E+02	6.50E+05	1.78E+03	8.34E+01	1.28E+06	5.47E+01	3.64E+02
TPH (>EC12-16) aromatic	1.94E+03	2.15E+06	1.78E+03	1.52E+02	1.28E+06	1.31E+02	2.37E+01
TPH (>EC16-21) aromatic	3.54E+04	5.95E+06	1.34E+03	3.06E+02	6.38E+05	2.47E+02	5.37E+01
TPH (>EC21-35) aromatic	3.99E+06	2.67E+07	1.34E+03	2.66E+03	6.38E+05	8.90E+02	4.83E+00
TPH (>EC35-44) aromatic	3.99E+06	2.67E+07	1.34E+03	2.66E+03	6.38E+05	8.90E+02	4.83E+00
Naphthalene	1.64E+00	3.17E+04	1.58E+03	2.72E+01	2.93E+04	1.55E+00	7.64E+01
Acenaphthylene	3.27E+03	1.26E+07	4.85E+03	1.84E+02	2.55E+06	1.68E+02	8.61E+01
Acenaphthene	3.47E+03	1.32E+07	4.85E+03	2.28E+02	2.55E+06	2.05E+02	5.70E+01
Fluorene	4.37E+03	1.17E+07	3.23E+03	1.79E+02	1.70E+06	1.63E+02	3.09E+01
Phenanthrene	5.09E+03	6.29E+06	1.00E+03	1.03E+02	5.30E+05	9.17E+01	3.60E+01
Anthracene	1.09E+05	1.48E+08	2.43E+04	2.55E+03	1.27E+07	2.26E+03	1.17E+00
Fluoranthene	2.84E+04	1.26E+07	1.01E+03	3.49E+02	5.31E+05	2.57E+02	1.89E+01
Pyrene	6.50E+04	2.87E+07	2.42E+03	7.43E+02	1.27E+06	5.63E+02	2.20E+00
Benzo(a)anthracene	2.40E+01	3.37E+03	1.25E+01	2.11E+01	6.37E+01	5.41E+00	1.71E+00
Chrysene	2.53E+02	5.87E+03	2.51E+01	2.90E+01	1.27E+02	1.16E+01	4.40E-01
Benzo(b)fluoranthene	9.32E+01	1.05E+03	3.15E+00	7.43E+00	1.61E+01	1.90E+00	1.22E+00
Benzo(k)fluoranthene	4.04E+03	3.28E+04	8.33E+01	2.85E+02	4.25E+02	5.51E+01	6.87E-01
Benzo(a)pyrene	1.04E+02	9.12E+02	2.51E+00	7.36E+00	1.27E+01	1.60E+00	9.11E-01
Indeno(123-cd)pyrene	8.78E+02	1.10E+04	3.58E+01	6.93E+01	1.83E+02	2.04E+01	6.14E-02
Dibenzo(ah)anthracene	5.23E+00	1.13E+02	2.51E-01	1.11E+00	1.27E+00	1.70E-01	3.93E-03

Residential Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic Matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
Benzo(g,h,i)perylene	2.34E+04	1.83E+05	2.78E+02	2.77E+03	1.40E+03	2.12E+02	1.54E-02
Tetrachloroethene (PCE)	1.26E-01	2.48E+04	4.92E+02	4.36E+00	2.34E+05	1.22E-01	4.24E+02
Trichloroethene (TCE)	1.21E-02	2.44E+03	4.45E+01	2.74E-01	2.42E+04	1.15E-02	1.54E+03
cis-1,2-Dichloroethene	1.20E-01	2.33E+04	4.82E+02	1.75E+00	2.30E+05	1.12E-01	3.94E+03
Vinyl Chloride (VC)	5.43E-04	3.59E+02	1.25E+00	3.70E-03	1.27E+04	4.73E-04	1.36E+03
1,1,2,2-Tetrachloroethane (PCA)	2.76E+00	1.17E+05	5.07E+02	2.72E+00	2.41E+05	1.37E+00	2.67E+03
1,1,1-Trichloroethane (TCA)	6.33E+00	1.79E+06	5.34E+04	3.22E+02	2.46E+07	6.21E+00	1.43E+03
1,2-Dichloroethane	6.46E-03	8.09E+02	1.07E+01	3.07E-02	5.10E+03	5.33E-03	3.41E+03
Carbon Tetrachloride	1.81E-02	5.07E+03	5.38E+02	3.00E+00	6.93E+04	1.80E-02	1.52E+03
Carbon disulphide	1.01E-01	3.42E+04	3.55E+02	3.20E+01	6.08E+05	1.01E-01	2.11E+03

ASC exceeds soil saturation limit

Residential Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg	mg/kg
Arsenic	NR	NR	3.50E+01	4.29E+02	8.50E+01	3.24E+01	N/A
Barium	NR	NR	1.35E+03		4.25E+05	1.34E+03	N/A
Beryllium	NR	NR	1.56E+02	2.96E+03	1.21E+00	1.21E+00	N/A
Boron	NR	NR	1.08E+04	3.00E+02	3.65E+06	2.91E+02	N/A
Cadmium	NR	NR	1.21E+02	1.24E+01	1.27E+02	1.03E+01	N/A
Chromium III	NR	NR	1.98E+04	1.25E+06	6.37E+02	6.17E+02	N/A
Chromium VI	NR	NR	7.05E+01	1.22E+01	4.25E+00	4.25E+00	N/A
Copper	NR	NR	1.08E+04	3.54E+03	9.89E+03	2.10E+03	N/A
Lead						2.00E+02	N/A
Inorganic Mercury	NR	NR	5.71E+01	1.40E+02	2.55E+03	3.99E+01	N/A
Nickel	NR	NR	7.89E+02	1.64E+03	1.27E+02	1.27E+02	N/A
Selenium	NR	NR	4.31E+02	6.15E+02	1.36E+05	2.53E+02	N/A
Vanadium	NR	NR	1.17E+03	6.21E+02	1.03E+03	2.91E+02	N/A
Zinc	NR	NR	4.05E+04	4.13E+03	2.55E+07	3.74E+03	N/A
Cyanide (free)						4.30E+01	N/A
Cyanide (Complex)						2.13E+02	N/A
Phenol	5.39E+02	5.28E+05	6.56E+02	2.88E+02	3.22E+05	1.46E+02	8.15E+04
Benzene	4.99E-01	7.68E+03	2.58E+01	2.30E-01	5.95E+04	1.57E-01	2.26E+03
Toluene	1.41E+03	1.30E+07	1.98E+04	3.41E+02	5.92E+07	2.71E+02	1.92E+03
Ethylbenzene	1.37E+02	9.44E+05	8.88E+03	2.58E+02	3.11E+06	8.88E+01	1.22E+03
Total Xylene	1.31E+02	7.89E+05	1.60E+04	4.50E+02	2.28E+06	1.01E+02	1.12E+03
TPH (EC5-6) aliphatic	5.28E+01	3.26E+06	2.23E+05	1.14E+04	1.06E+08	5.25E+01	5.58E+02
TPH (>EC6-8) aliphatic	1.57E+02	5.62E+06	2.23E+05	3.75E+04	1.06E+08	1.56E+02	3.22E+02
TPH (>EC8-10) aliphatic	4.44E+01	7.20E+05	4.45E+03	5.38E+03	6.16E+06	4.36E+01	1.90E+02

Residential Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
TPH (>EC10-12) aliphatic	2.24E+02	1.62E+06	4.45E+03	4.00E+04	6.16E+06	2.12E+02	1.18E+02
TPH (>EC12-16) aliphatic	1.89E+03	4.69E+06	4.45E+03	3.64E+05	6.16E+06	1.32E+03	5.91E+01
TPH (>EC16-35) aliphatic	2.23E+05	1.34E+08	8.91E+04	1.16E+07	4.25E+07	6.32E+04	2.12E+01
TPH (>EC35-44) aliphatic	2.23E+05	1.34E+08	8.91E+04	1.16E+07	4.25E+07	6.32E+04	2.12E+01
TPH (>EC6-7) aromatic (benzene)	4.99E-01	7.68E+03	2.58E+01	2.30E-01	5.95E+04	1.56E-01	2.26E+03
TPH (>EC7-8) aromatic (toluene)	1.38E+03	1.28E+07	1.98E+04	3.41E+02	5.81E+07	2.70E+02	1.92E+03
TPH (>EC8-10) aromatic	7.88E+01	4.36E+05	1.78E+03	1.42E+02	1.28E+06	4.93E+01	1.50E+03
TPH (>EC10-12) aromatic	4.34E+02	1.02E+06	1.78E+03	2.07E+02	1.28E+06	1.30E+02	8.99E+02
TPH (>EC12-16) aromatic	4.83E+03	3.39E+06	1.78E+03	3.79E+02	1.28E+06	2.93E+02	5.91E+01
TPH (>EC16-21) aromatic	8.83E+04	9.40E+06	1.34E+03	7.61E+02	6.38E+05	4.82E+02	1.34E+02
TPH (>EC21-35) aromatic	9.98E+06	4.23E+07	1.34E+03	6.50E+03	6.38E+05	1.11E+03	1.21E+01
TPH (>EC35-44) aromatic	9.98E+06	4.23E+07	1.34E+03	6.50E+03	6.38E+05	1.11E+03	1.21E+01
Naphthalene	3.93E+00	4.91E+04	1.58E+03	6.63E+01	2.93E+04	3.70E+00	1.83E+02
Acenaphthylene	8.06E+03	1.97E+07	4.85E+03	4.56E+02	2.55E+06	3.96E+02	2.12E+02
Acenaphthene	8.57E+03	2.07E+07	4.85E+03	5.67E+02	2.55E+06	4.79E+02	1.41E+02
Fluorene	1.08E+04	1.84E+07	3.23E+03	4.45E+02	1.70E+06	3.77E+02	7.65E+01
Phenanthrene	1.27E+04	9.91E+06	1.00E+03	2.57E+02	5.30E+05	2.01E+02	8.96E+01
Anthracene	2.70E+05	2.33E+08	2.43E+04	6.34E+03	1.27E+07	4.93E+03	2.91E+00
Fluoranthene	7.08E+04	2.00E+07	1.01E+03	8.68E+02	5.31E+05	4.63E+02	4.73E+01
Pyrene	1.62E+05	4.54E+07	2.42E+03	1.85E+03	1.27E+06	1.04E+03	5.49E+00
Benzo(a)anthracene	6.00E+01	5.32E+03	1.25E+01	5.18E+01	6.37E+01	7.60E+00	4.28E+00
Chrysene	6.32E+02	9.28E+03	2.51E+01	7.15E+01	1.27E+02	1.58E+01	1.10E+00
Benzo(b)fluoranthene	2.33E+02	1.66E+03	3.15E+00	1.81E+01	1.61E+01	2.28E+00	3.04E+00
Benzo(k)fluoranthene	1.01E+04	5.19E+04	8.33E+01	6.87E+02	4.25E+02	6.27E+01	1.72E+00
Benzo(a)pyrene	2.61E+02	1.44E+03	2.51E+00	1.78E+01	1.27E+01	1.86E+00	2.28E+00
Indeno(123-cd)pyrene	2.20E+03	1.74E+04	3.58E+01	1.70E+02	1.83E+02	2.51E+01	5.30E-01

Residential Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
Dibenzo(ah)anthracene	1.31E+01	1.79E+02	2.51E-01	2.65E+00	1.27E+00	1.91E-01	9.82E-03
Benzo(g,h,i)perylene	5.85E+04	2.89E+05	2.78E+02	6.27E+03	1.40E+03	2.23E+02	3.85E-02
Tetrachloroethene (PCE)	2.82E-01	3.71E+04	4.92E+02	1.02E+01	2.34E+05	2.74E-01	9.51E+02
Trichloroethene (TCE)	2.52E-02	3.53E+03	4.45E+01	6.09E-01	2.42E+04	2.42E-02	3.22E+03
cis-1,2-Dichloroethene	2.02E-01	3.02E+04	4.82E+02	3.35E+00	2.30E+05	1.90E-01	6.61E+03
Vinyl Chloride (VC)	7.02E-04	4.08E+02	1.25E+00	6.67E-03	1.27E+04	6.35E-04	1.76E+03
1,1,2,2-Tetrachloroethane (PCA)	5.65E+00	1.68E+05	5.07E+02	5.92E+00	2.41E+05	2.87E+00	5.46E+03
1,1,1-Trichloroethane (TCA)	1.29E+01	2.55E+06	5.34E+04	7.06E+02	2.46E+07	1.27E+01	2.92E+03
1,2-Dichloroethane	9.32E-03	9.72E+02	1.07E+01	5.56E-02	5.10E+03	7.98E-03	4.91E+03
Carbon Tetrachloride	3.97E-02	7.50E+03	5.38E+02	6.95E+00	6.93E+04	3.95E-02	3.32E+03
Carbon disulphide	2.02E-01	4.83E+04	3.55E+02	6.84E+01	6.08E+05	2.01E-01	4.21E+03

ASC exceeds soil saturation limit

Residential Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg	mg/kg
Arsenic	NR	NR	3.50E+01	4.29E+02	8.50E+01	3.24E+01	N/A
Barium	NR	NR	1.35E+03		4.25E+05	1.34E+03	N/A
Beryllium	NR	NR	1.56E+02	2.96E+03	1.21E+00	1.21E+00	N/A
Boron	NR	NR	1.08E+04	3.00E+02	3.65E+06	2.91E+02	N/A
Cadmium	NR	NR	1.21E+02	1.24E+01	1.27E+02	1.03E+01	N/A
Chromium III	NR	NR	1.98E+04	1.25E+06	6.37E+02	6.17E+02	N/A
Chromium VI	NR	NR	7.05E+01	1.22E+01	4.25E+00	4.25E+00	N/A
Copper	NR	NR	1.08E+04	3.54E+03	9.89E+03	2.10E+03	N/A
Lead						2.00E+02	N/A
Inorganic Mercury	NR	NR	5.71E+01	1.40E+02	2.55E+03	3.99E+01	N/A
Nickel	NR	NR	7.89E+02	1.64E+03	1.27E+02	1.27E+02	N/A
Selenium	NR	NR	4.31E+02	6.15E+02	1.36E+05	2.53E+02	N/A
Vanadium	NR	NR	1.17E+03	6.21E+02	1.03E+03	2.91E+02	N/A
Zinc	NR	NR	4.05E+04	4.13E+03	2.55E+07	3.74E+03	N/A
Cyanide (free)						4.30E+01	N/A
Cyanide (Complex)						2.13E+02	N/A
Phenol	9.95E+02	7.17E+05	6.56E+02	5.72E+02	3.22E+05	2.34E+02	1.74E+05
Benzene	1.04E+00	1.11E+04	2.58E+01	4.98E-01	5.95E+04	3.32E-01	4.71E+03
Toluene	3.20E+03	1.97E+07	1.98E+04	7.89E+02	5.92E+07	6.13E+02	4.36E+03
Ethylbenzene	3.22E+02	1.44E+06	8.88E+03	6.09E+02	3.11E+06	2.06E+02	2.84E+03
Total Xylene	3.06E+02	1.21E+06	1.60E+04	1.06E+03	2.28E+06	2.34E+02	2.62E+03
TPH (EC5-6) aliphatic	1.09E+02	4.68E+06	2.23E+05	2.62E+04	1.06E+08	1.08E+02	1.15E+03
TPH (>EC6-8) aliphatic	3.59E+02	8.49E+06	2.23E+05	8.91E+04	1.06E+08	3.57E+02	7.36E+02
TPH (>EC8-10) aliphatic	1.06E+02	1.11E+06	4.45E+03	1.27E+04	6.16E+06	1.03E+02	4.51E+02

Residential Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
TPH (>EC10-12) aliphatic	5.38E+02	2.51E+06	4.45E+03	8.76E+04	6.16E+06	4.77E+02	2.83E+02
TPH (>EC12-16) aliphatic	4.53E+03	7.27E+06	4.45E+03	4.67E+05	6.16E+06	2.23E+03	1.42E+02
TPH (>EC16-35) aliphatic	5.34E+05	2.07E+08	8.91E+04	1.17E+07	4.25E+07	7.57E+04	5.09E+01
TPH (>EC35-44) aliphatic	5.34E+05	2.07E+08	8.91E+04	1.17E+07	4.25E+07	7.57E+04	5.09E+01
TPH (>EC6-7) aromatic (benzene)	1.04E+00	1.11E+04	2.58E+01	4.98E-01	5.95E+04	3.32E-01	4.71E+03
TPH (>EC7-8) aromatic (toluene)	3.14E+03	1.93E+07	1.98E+04	7.89E+02	5.81E+07	6.11E+02	4.36E+03
TPH (>EC8-10) aromatic	1.88E+02	6.73E+05	1.78E+03	3.38E+02	1.28E+06	1.13E+02	3.58E+03
TPH (>EC10-12) aromatic	1.04E+03	1.58E+06	1.78E+03	4.95E+02	1.28E+06	2.82E+02	2.15E+03
TPH (>EC12-16) aromatic	1.16E+04	5.25E+06	1.78E+03	9.07E+02	1.28E+06	5.71E+02	1.42E+02
TPH (>EC16-21) aromatic	2.12E+05	1.46E+07	1.34E+03	1.81E+03	6.38E+05	7.66E+02	3.21E+02
TPH (>EC21-35) aromatic	2.39E+07	6.54E+07	1.34E+03	1.48E+04	6.38E+05	1.23E+03	2.90E+01
TPH (>EC35-44) aromatic	2.39E+07	6.54E+07	1.34E+03	1.48E+04	6.38E+05	1.23E+03	2.90E+01
Naphthalene	9.28E+00	7.55E+04	1.58E+03	1.57E+02	2.93E+04	8.71E+00	4.32E+02
Acenaphthylene	1.92E+04	3.05E+07	4.85E+03	1.09E+03	2.55E+06	8.50E+02	5.06E+02
Acenaphthene	2.05E+04	3.20E+07	4.85E+03	1.36E+03	2.55E+06	1.01E+03	3.36E+02
Fluorene	2.58E+04	2.85E+07	3.23E+03	1.06E+03	1.70E+06	7.74E+02	1.83E+02
Phenanthrene	3.03E+04	1.53E+07	1.00E+03	6.14E+02	5.30E+05	3.75E+02	2.14E+02
Anthracene	6.48E+05	3.60E+08	2.43E+04	1.52E+04	1.27E+07	9.21E+03	6.96E+00
Fluoranthene	1.70E+05	3.09E+07	1.01E+03	2.07E+03	5.31E+05	6.75E+02	1.12E+02
Pyrene	3.89E+05	7.03E+07	2.42E+03	4.40E+03	1.27E+06	1.55E+03	1.32E+01
Benzo(a)anthracene	1.44E+02	8.24E+03	1.25E+01	1.20E+02	6.37E+01	9.01E+00	1.03E+01
Chrysene	1.52E+03	1.44E+04	2.51E+01	1.67E+02	1.27E+02	1.84E+01	2.64E+00
Benzo(b)fluoranthene	5.59E+02	2.57E+03	3.15E+00	4.12E+01	1.61E+01	2.47E+00	7.29E+00
Benzo(k)fluoranthene	2.43E+04	8.03E+04	8.33E+01	1.53E+03	4.25E+02	6.63E+01	4.12E+00
Benzo(a)pyrene	6.27E+02	2.23E+03	2.51E+00	4.01E+01	1.27E+01	1.98E+00	5.46E+00
Indeno(123-cd)pyrene	5.27E+03	2.69E+04	3.58E+01	3.90E+02	1.83E+02	2.76E+01	3.68E-01

Residential Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
Dibenzo(ah)anthracene	3.14E+01	2.78E+02	2.51E-01	5.77E+00	1.27E+00	2.01E-01	2.36E-02
Benzo(g,h,i)perylene	1.41E+05	4.48E+05	2.78E+02	1.24E+04	1.40E+03	2.27E+02	9.23E-02
Tetrachloroethene (PCE)	6.47E-01	5.61E+04	4.92E+02	2.38E+01	2.34E+05	6.29E-01	2.18E+03
Trichloroethene (TCE)	5.60E-02	5.25E+03	4.45E+01	1.39E+00	2.42E+04	5.38E-02	7.14E+03
cis-1,2-Dichloroethene	3.93E-01	4.22E+04	4.82E+02	6.91E+00	2.30E+05	3.72E-01	1.29E+04
Vinyl Chloride (VC)	1.07E-03	5.05E+02	1.25E+00	1.22E-02	1.27E+04	9.83E-04	2.69E+03
1,1,2,2-Tetrachloroethane (PCA)	1.24E+01	2.49E+05	5.07E+02	1.33E+01	2.41E+05	6.34E+00	1.20E+04
1,1,1-Trichloroethane (TCA)	2.84E+01	3.78E+06	5.34E+04	1.59E+03	2.46E+07	2.79E+01	6.39E+03
1,2-Dichloroethane	1.60E-02	1.27E+03	1.07E+01	1.06E-01	5.10E+03	1.39E-02	8.43E+03
Carbon Tetrachloride	8.99E-02	1.13E+04	5.38E+02	1.61E+01	6.93E+04	8.94E-02	7.54E+03
Carbon disulphide	4.37E-01	7.10E+04	3.55E+02	1.52E+02	6.08E+05	4.35E-01	9.11E+03

ASC exceeds soil saturation limit

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.35E+02	6.95E+02	6.40E+02	N/A
Barium	NR	NR	2.22E+04	3.48E+06	2.21E+04	N/A
Beryllium	NR	NR	3.97E+03	1.24E+01	1.24E+01	N/A
Boron	NR	NR	2.38E+05	2.99E+07	2.36E+05	N/A
Cadmium	NR	NR	3.99E+02	2.43E+02	2.30E+02	N/A
Chromium III	NR	NR	3.31E+05	9.09E+03	8.84E+03	N/A
Chromium VI	NR	NR	1.79E+03	3.48E+01	3.48E+01	N/A
Copper	NR	NR	1.89E+05	9.50E+04	6.33E+04	N/A
Lead					2.33E+03	N/A
Inorganic Mercury	NR	NR	1.18E+03	2.09E+04	3.60E+03	N/A
Nickel	NR	NR	2.22E+04	1.04E+03	1.04E+03	N/A
Selenium	NR	NR	1.23E+04	1.93E+06	1.30E+04	N/A
Vanadium	NR	NR	2.15E+04	9.58E+03	6.63E+03	N/A
Zinc	NR	NR	7.35E+05	2.09E+08	7.33E+05	N/A
Cyanide (free)					4.30E+01	N/A
Cyanide (Complex)					2.13E+02	N/A
Phenol	8.34E+04	1.09E+06	4.07E+04	3.28E+06	2.65E+04	4.16E+04
Benzene	2.97E+01	1.17E+04	5.53E+02	4.87E+05	2.81E+01	1.22E+03
Toluene	6.91E+04	1.83E+07	4.25E+05	4.86E+08	5.92E+04	8.69E+02
Ethylbenzene	6.28E+03	1.30E+06	1.91E+05	2.57E+07	6.05E+03	5.18E+02
Total Xylene	6.43E+03	1.17E+06	3.43E+05	2.03E+07	6.28E+03	4.78E+02
TPH (EC5-6) aliphatic	3.31E+03	5.01E+06	4.77E+06	8.69E+08	3.31E+03	3.04E+02
TPH (>EC6-8) aliphatic	8.06E+03	7.82E+06	4.77E+06	8.69E+08	8.04E+03	1.44E+02
TPH (>EC8-10) aliphatic	2.09E+03	9.59E+05	9.53E+04	5.04E+07	2.04E+03	7.77E+01
TPH (>EC10-12) aliphatic	1.04E+04	2.13E+06	9.53E+04	5.04E+07	9.33E+03	4.75E+01

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	8.68E+04	6.18E+06	9.53E+04	5.04E+07	4.51E+04	2.37E+01
TPH (>EC16-35) aliphatic	1.02E+07	1.76E+08	1.91E+06	3.48E+08	1.59E+06	8.48E+00
TPH (>EC35-44) aliphatic	1.02E+07	1.76E+08	1.91E+06	3.48E+08	1.59E+06	8.48E+00
TPH (>EC6-7) aromatic (benzene)	4.75E+01	1.17E+04	5.53E+02	4.87E+05	4.36E+01	1.22E+03
TPH (>EC7-8) aromatic (toluene)	6.88E+04	1.83E+07	4.25E+05	4.84E+08	5.90E+04	8.69E+02
TPH (>EC8-10) aromatic	3.70E+03	5.80E+05	3.81E+04	1.04E+07	3.35E+03	6.13E+02
TPH (>EC10-12) aromatic	2.02E+04	1.35E+06	3.81E+04	1.04E+07	1.31E+04	3.64E+02
TPH (>EC12-16) aromatic	2.25E+05	4.48E+06	3.81E+04	1.04E+07	3.22E+04	2.37E+01
TPH (>EC16-21) aromatic	4.59E+06	1.24E+07	2.86E+04	5.22E+06	2.82E+04	5.37E+01
TPH (>EC21-35) aromatic	7.57E+08	5.56E+07	2.86E+04	5.22E+06	2.84E+04	4.83E+00
TPH (>EC35-44) aromatic	7.57E+08	5.56E+07	2.86E+04	5.22E+06	2.84E+04	4.83E+00
Naphthalene	2.06E+02	7.85E+04	3.64E+04	2.85E+05	2.04E+02	7.64E+01
Acenaphthylene	3.76E+05	2.62E+07	1.10E+05	2.09E+07	8.45E+04	8.61E+01
Acenaphthene	3.87E+05	2.74E+07	1.10E+05	2.09E+07	8.50E+04	5.70E+01
Fluorene	5.10E+05	2.44E+07	7.31E+04	1.39E+07	6.35E+04	3.09E+01
Phenanthrene	6.87E+05	1.31E+07	2.28E+04	4.34E+06	2.19E+04	3.60E+01
Anthracene	1.41E+07	3.07E+08	5.49E+05	1.04E+08	5.25E+05	1.17E+00
Fluoranthene	4.36E+06	2.63E+07	2.29E+04	4.34E+06	2.26E+04	1.89E+01
Pyrene	1.02E+07	5.98E+07	5.49E+04	1.04E+07	5.43E+04	2.20E+00
Benzo(a)anthracene	4.04E+03	7.01E+03	2.84E+02	5.21E+02	1.71E+02	1.71E+00
Chrysene	5.01E+04	1.22E+04	5.67E+02	1.04E+03	3.54E+02	4.40E-01
Benzo(b)fluoranthene	1.86E+04	2.18E+03	7.13E+01	1.32E+02	4.52E+01	1.22E+00
Benzo(k)fluoranthene	8.14E+05	6.83E+04	1.88E+03	3.48E+03	1.20E+03	6.87E-01
Benzo(a)pyrene	2.10E+04	1.90E+03	5.67E+01	1.04E+02	3.60E+01	9.11E-01
Indeno(123-cd)pyrene	1.75E+05	2.29E+04	8.10E+02	1.49E+03	5.12E+02	6.14E-02
Dibenzo(ah)anthracene	1.01E+03	2.36E+02	5.67E+00	1.04E+01	3.60E+00	3.93E-03
Benzo(g,h,i)perylene	4.64E+06	3.81E+05	6.29E+03	1.15E+04	4.02E+03	1.54E-02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
Tetrachloroethene (PCE)	1.98E+01	7.63E+04	1.12E+04	2.83E+06	1.97E+01	4.24E+02
Trichloroethene (TCE)	1.31E+00	5.07E+03	9.53E+02	1.98E+05	1.30E+00	1.54E+03
cis-1,2-Dichloroethene	1.45E+01	5.26E+04	1.12E+04	2.04E+06	1.45E+01	3.94E+03
Vinyl Chloride (VC)	6.31E-02	7.47E+02	2.67E+01	1.04E+05	6.29E-02	1.36E+03
1,1,2,2-Tetrachloroethane (PCA)	2.98E+02	2.49E+05	1.10E+04	2.01E+06	2.90E+02	2.67E+03
1,1,1-Trichloroethane (TCA)	7.01E+02	3.81E+06	1.14E+06	2.07E+08	7.00E+02	1.43E+03
1,2-Dichloroethane	7.14E-01	1.68E+03	2.29E+02	4.17E+04	7.11E-01	3.41E+03
Carbon Tetrachloride	3.04E+00	1.65E+04	7.62E+03	8.85E+05	3.04E+00	1.52E+03
Carbon disulphide	1.16E+01	7.12E+04	9.53E+04	4.97E+06	1.16E+01	2.11E+03

ASC exceeds soil saturation limit

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.35E+02	6.95E+02	6.40E+02	N/A
Barium	NR	NR	2.22E+04	3.48E+06	2.21E+04	N/A
Beryllium	NR	NR	3.97E+03	1.24E+01	1.24E+01	N/A
Boron	NR	NR	2.38E+05	2.99E+07	2.36E+05	N/A
Cadmium	NR	NR	3.99E+02	2.43E+02	2.30E+02	N/A
Chromium III	NR	NR	3.31E+05	9.09E+03	8.84E+03	N/A
Chromium VI	NR	NR	1.79E+03	3.48E+01	3.48E+01	N/A
Copper	NR	NR	1.89E+05	9.50E+04	6.33E+04	N/A
Lead					2.33E+03	N/A
Inorganic Mercury	NR	NR	1.18E+03	2.09E+04	3.60E+03	N/A
Nickel	NR	NR	2.22E+04	1.04E+03	1.04E+03	N/A
Selenium	NR	NR	1.23E+04	1.93E+06	1.30E+04	N/A
Vanadium	NR	NR	2.15E+04	9.58E+03	6.63E+03	N/A
Zinc	NR	NR	7.35E+05	2.09E+08	7.33E+05	N/A
Cyanide (free)					4.30E+01	N/A
Cyanide (Complex)					2.13E+02	N/A
Phenol	1.31E+05	1.37E+06	4.07E+04	3.28E+06	3.01E+04	8.15E+04
Benzene	5.53E+01	1.60E+04	5.53E+02	4.87E+05	5.01E+01	2.26E+03
Toluene	1.52E+05	2.72E+07	4.25E+05	4.86E+08	1.12E+05	1.92E+03
Ethylbenzene	1.47E+04	1.99E+06	1.91E+05	2.57E+07	1.36E+04	1.22E+03
Total Xylene	1.51E+04	1.79E+06	3.43E+05	2.03E+07	1.43E+04	1.12E+03
TPH (EC5-6) aliphatic	6.07E+03	6.79E+06	4.77E+06	8.69E+08	6.06E+03	5.58E+02
TPH (>EC6-8) aliphatic	1.80E+04	1.17E+07	4.77E+06	8.69E+08	1.79E+04	3.22E+02
TPH (>EC8-10) aliphatic	5.11E+03	1.50E+06	9.53E+04	5.04E+07	4.83E+03	1.90E+02
TPH (>EC10-12) aliphatic	2.58E+04	3.37E+06	9.53E+04	5.04E+07	2.02E+04	1.18E+02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	2.17E+05	9.77E+06	9.53E+04	5.04E+07	6.57E+04	5.91E+01
TPH (>EC16-35) aliphatic	2.56E+07	2.79E+08	1.91E+06	3.48E+08	1.76E+06	2.12E+01
TPH (>EC35-44) aliphatic	2.56E+07	2.79E+08	1.91E+06	3.48E+08	1.76E+06	2.12E+01
TPH (>EC6-7) aromatic (benzene)	5.53E+01	1.60E+04	5.53E+02	4.87E+05	5.01E+01	2.26E+03
TPH (>EC7-8) aromatic (toluene)	1.52E+05	2.71E+07	4.25E+05	4.84E+08	1.11E+05	1.92E+03
TPH (>EC8-10) aromatic	9.06E+03	9.08E+05	3.81E+04	1.04E+07	7.26E+03	1.50E+03
TPH (>EC10-12) aromatic	4.99E+04	2.13E+06	3.81E+04	1.04E+07	2.13E+04	8.99E+02
TPH (>EC12-16) aromatic	5.59E+05	7.06E+06	3.81E+04	1.04E+07	3.54E+04	5.91E+01
TPH (>EC16-21) aromatic	1.15E+07	1.96E+07	2.86E+04	5.22E+06	2.83E+04	1.34E+02
TPH (>EC21-35) aromatic	1.89E+09	8.79E+07	2.86E+04	5.22E+06	2.84E+04	1.21E+01
TPH (>EC35-44) aromatic	1.89E+09	8.79E+07	2.86E+04	5.22E+06	2.84E+04	1.21E+01
Naphthalene	4.93E+02	1.21E+05	3.64E+04	2.85E+05	4.84E+02	1.83E+02
Acenaphthylene	9.26E+05	4.11E+07	1.10E+05	2.09E+07	9.76E+04	2.12E+02
Acenaphthene	9.56E+05	4.31E+07	1.10E+05	2.09E+07	9.80E+04	1.41E+02
Fluorene	1.26E+06	3.84E+07	7.31E+04	1.39E+07	6.86E+04	7.65E+01
Phenanthrene	1.71E+06	2.07E+07	2.28E+04	4.34E+06	2.24E+04	8.96E+01
Anthracene	3.51E+07	4.84E+08	5.49E+05	1.04E+08	5.37E+05	2.91E+00
Fluoranthene	1.09E+07	4.16E+07	2.29E+04	4.34E+06	2.27E+04	4.73E+01
Pyrene	2.54E+07	9.45E+07	5.49E+04	1.04E+07	5.45E+04	5.49E+00
Benzo(a)anthracene	1.01E+04	1.11E+04	2.84E+02	5.21E+02	1.77E+02	4.28E+00
Chrysene	1.25E+05	1.93E+04	5.67E+02	1.04E+03	3.59E+02	1.10E+00
Benzo(b)fluoranthene	4.66E+04	3.45E+03	7.13E+01	1.32E+02	4.57E+01	3.04E+00
Benzo(k)fluoranthene	2.03E+06	1.08E+05	1.88E+03	3.48E+03	1.21E+03	1.72E+00
Benzo(a)pyrene	5.26E+04	3.00E+03	5.67E+01	1.04E+02	3.63E+01	2.28E+00
Indeno(123-cd)pyrene	4.38E+05	3.62E+04	8.10E+02	1.49E+03	5.17E+02	5.30E-01
Dibenzo(ah)anthracene	2.53E+03	3.73E+02	5.67E+00	1.04E+01	3.63E+00	9.82E-03
Benzo(g,h,i)perylene	1.16E+07	6.02E+05	6.29E+03	1.15E+04	4.03E+03	3.85E-02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
Tetrachloroethene (PCE)	4.43E+01	1.14E+05	1.12E+04	2.83E+06	4.41E+01	9.51E+02
Trichloroethene (TCE)	2.74E+00	7.34E+03	9.53E+02	1.98E+05	2.73E+00	3.22E+03
cis-1,2-Dichloroethene	2.43E+01	6.81E+04	1.12E+04	2.04E+06	2.42E+01	6.61E+03
Vinyl Chloride (VC)	8.16E-02	8.50E+02	2.67E+01	1.04E+05	8.13E-02	1.76E+03
1,1,2,2-Tetrachloroethane (PCA)	6.11E+02	3.56E+05	1.10E+04	2.01E+06	5.78E+02	5.46E+03
1,1,1-Trichloroethane (TCA)	1.43E+03	5.46E+06	1.14E+06	2.07E+08	1.43E+03	2.92E+03
1,2-Dichloroethane	1.03E+00	2.02E+03	2.29E+02	4.17E+04	1.02E+00	4.91E+03
Carbon Tetrachloride	6.67E+00	2.44E+04	7.62E+03	8.85E+05	6.66E+00	3.32E+03
Carbon disulphide	2.32E+01	1.00E+05	9.53E+04	4.97E+06	2.32E+01	4.21E+03

ASC exceeds soil saturation limit

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.35E+02	6.95E+02	6.40E+02	N/A
Barium	NR	NR	2.22E+04	3.48E+06	2.21E+04	N/A
Beryllium	NR	NR	3.97E+03	1.24E+01	1.24E+01	N/A
Boron	NR	NR	2.38E+05	2.99E+07	2.36E+05	N/A
Cadmium	NR	NR	3.99E+02	2.43E+02	2.30E+02	N/A
Chromium III	NR	NR	3.31E+05	9.09E+03	8.84E+03	N/A
Chromium VI	NR	NR	1.79E+03	3.48E+01	3.48E+01	N/A
Copper	NR	NR	1.89E+05	9.50E+04	6.33E+04	N/A
Lead					2.33E+03	N/A
Inorganic Mercury	NR	NR	1.18E+03	2.09E+04	3.60E+03	N/A
Nickel	NR	NR	2.22E+04	1.04E+03	1.04E+03	N/A
Selenium	NR	NR	1.23E+04	1.93E+06	1.30E+04	N/A
Vanadium	NR	NR	2.15E+04	9.58E+03	6.63E+03	N/A
Zinc	NR	NR	7.35E+05	2.09E+08	7.33E+05	N/A
Cyanide (free)					4.30E+01	N/A
Cyanide (Complex)					2.13E+02	N/A
Phenol	2.42E+05	1.86E+06	4.07E+04	3.28E+06	3.39E+04	1.74E+05
Benzene	1.15E+02	2.30E+04	5.53E+02	4.87E+05	9.47E+01	4.71E+03
Toluene	3.46E+05	4.11E+07	4.25E+05	4.86E+08	1.90E+05	4.36E+03
Ethylbenzene	3.45E+04	3.04E+06	1.91E+05	2.57E+07	2.89E+04	2.84E+03
Total Xylene	3.53E+04	2.74E+06	3.43E+05	2.03E+07	3.16E+04	2.62E+03
TPH (EC5-6) aliphatic	1.25E+04	9.74E+06	4.77E+06	8.69E+08	1.25E+04	1.15E+03
TPH (>EC6-8) aliphatic	4.12E+04	1.77E+07	4.77E+06	8.69E+08	4.08E+04	7.36E+02
TPH (>EC8-10) aliphatic	1.21E+04	2.31E+06	9.53E+04	5.04E+07	1.07E+04	4.51E+02
TPH (>EC10-12) aliphatic	6.18E+04	5.22E+06	9.53E+04	5.04E+07	3.72E+04	2.83E+02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	5.20E+05	1.51E+07	9.53E+04	5.04E+07	8.00E+04	1.42E+02
TPH (>EC16-35) aliphatic	6.14E+07	4.32E+08	1.91E+06	3.48E+08	1.83E+06	5.09E+01
TPH (>EC35-44) aliphatic	6.14E+07	4.32E+08	1.91E+06	3.48E+08	1.83E+06	5.09E+01
TPH (>EC6-7) aromatic (benzene)	1.15E+02	2.30E+04	5.53E+02	4.87E+05	9.48E+01	4.71E+03
TPH (>EC7-8) aromatic (toluene)	3.45E+05	4.09E+07	4.25E+05	4.84E+08	1.89E+05	4.36E+03
TPH (>EC8-10) aromatic	2.16E+04	1.40E+06	3.81E+04	1.04E+07	1.36E+04	3.58E+03
TPH (>EC10-12) aromatic	1.19E+05	3.29E+06	3.81E+04	1.04E+07	2.85E+04	2.15E+03
TPH (>EC12-16) aromatic	1.34E+06	1.09E+07	3.81E+04	1.04E+07	3.68E+04	1.42E+02
TPH (>EC16-21) aromatic	2.75E+07	3.03E+07	2.86E+04	5.22E+06	2.84E+04	3.21E+02
TPH (>EC21-35) aromatic	4.54E+09	1.36E+08	2.86E+04	5.22E+06	2.84E+04	2.90E+01
TPH (>EC35-44) aromatic	4.54E+09	1.36E+08	2.86E+04	5.22E+06	2.84E+04	2.90E+01
Naphthalene	1.16E+03	1.87E+05	3.64E+04	2.85E+05	1.11E+03	4.32E+02
Acenaphthylene	2.21E+06	6.35E+07	1.10E+05	2.09E+07	1.04E+05	5.06E+02
Acenaphthene	2.28E+06	6.67E+07	1.10E+05	2.09E+07	1.04E+05	3.36E+02
Fluorene	3.02E+06	5.94E+07	7.31E+04	1.39E+07	7.09E+04	1.83E+02
Phenanthrene	4.09E+06	3.20E+07	2.28E+04	4.34E+06	2.25E+04	2.14E+02
Anthracene	8.41E+07	7.50E+08	5.49E+05	1.04E+08	5.42E+05	6.96E+00
Fluoranthene	2.61E+07	6.44E+07	2.29E+04	4.34E+06	2.28E+04	1.12E+02
Pyrene	6.09E+07	1.46E+08	5.49E+04	1.04E+07	5.45E+04	1.32E+01
Benzo(a)anthracene	2.42E+04	1.72E+04	2.84E+02	5.21E+02	1.80E+02	1.03E+01
Chrysene	3.00E+05	2.99E+04	5.67E+02	1.04E+03	3.62E+02	2.64E+00
Benzo(b)fluoranthene	1.12E+05	5.34E+03	7.13E+01	1.32E+02	4.59E+01	7.29E+00
Benzo(k)fluoranthene	4.88E+06	1.67E+05	1.88E+03	3.48E+03	1.21E+03	4.12E+00
Benzo(a)pyrene	1.26E+05	4.65E+03	5.67E+01	1.04E+02	3.64E+01	5.46E+00
Indeno(123-cd)pyrene	1.05E+06	5.60E+04	8.10E+02	1.49E+03	5.20E+02	3.68E-01
Dibenzo(ah)anthracene	6.07E+03	5.78E+02	5.67E+00	1.04E+01	3.65E+00	2.36E-02
Benzo(g,h,i)perylene	2.78E+07	9.33E+05	6.29E+03	1.15E+04	4.04E+03	9.23E-02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
Tetrachloroethene (PCE)	1.02E+02	1.73E+05	1.12E+04	2.83E+06	1.01E+02	2.18E+03
Trichloroethene (TCE)	6.07E+00	1.09E+04	9.53E+02	1.98E+05	6.03E+00	7.14E+03
cis-1,2-Dichloroethene	4.73E+01	9.50E+04	1.12E+04	2.04E+06	4.71E+01	1.29E+04
Vinyl Chloride (VC)	1.25E-01	1.05E+03	2.67E+01	1.04E+05	1.24E-01	2.69E+03
1,1,2,2-Tetrachloroethane (PCA)	1.34E+03	5.27E+05	1.10E+04	2.01E+06	1.19E+03	1.20E+04
1,1,1-Trichloroethane (TCA)	3.14E+03	8.08E+06	1.14E+06	2.07E+08	3.13E+03	6.39E+03
1,2-Dichloroethane	1.77E+00	2.65E+03	2.29E+02	4.17E+04	1.76E+00	8.43E+03
Carbon Tetrachloride	1.51E+01	3.67E+04	7.62E+03	8.85E+05	1.51E+01	7.54E+03
Carbon disulphide	5.01E+01	1.48E+05	9.53E+04	4.97E+06	5.01E+01	9.11E+03

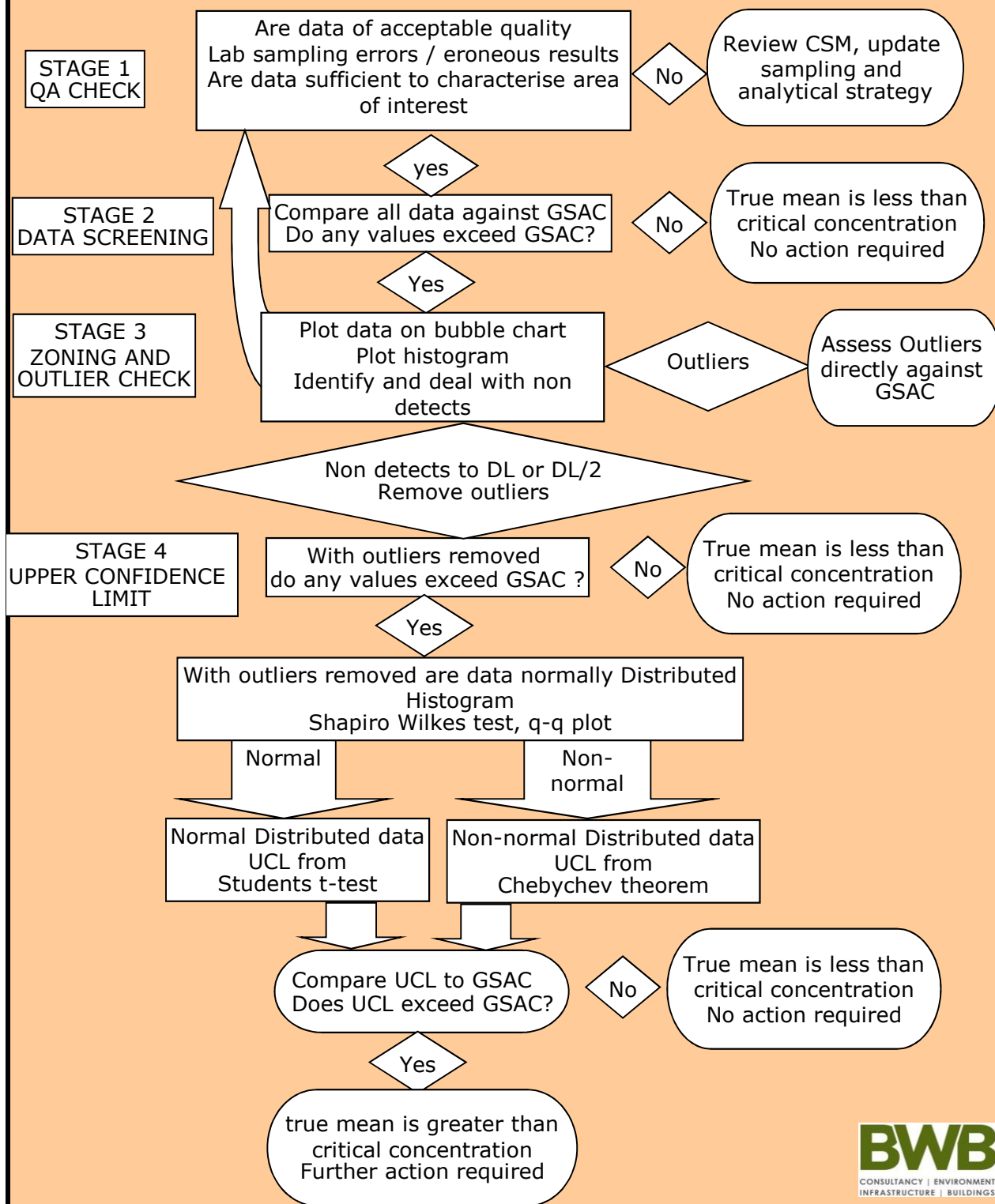
 ASC exceeds soil saturation limit

APPENDIX 11

CLEA FLOW CHART & SCREENING WORKSHEETS

STATISTICAL APPROACH FOR ASSESSING RISK TO HUMAN HEALTH FROM CONTAMINATED LAND 2008

CIEH/CLAIRE Guidance on Comparing Soil Contamination Data with a Critical Concentration May 2008



Human Health Generic QRA Worksheet



Plot J, Kingsway Business Park

MCS2374

Due to the limited dataset all the samples have been assessed together.

Define CSM – Is site represented by a standard land use?

Residential with / without homegrown produce

Commercial / Industrial

Public Open Space - Residential (S4UL/C4SL only)

Public Open Space - Park (S4UL/C4SL only)

GSAC Type (BWB, LQM S4UL, C4SL, Bespoke)

Key Receptor/CSM (Residential/Commercial/POS)

BWB_GSAC

Commercial

Organic Matter % (If unknown use 1%)

1

Exposure Pathway Selection for BWB GSAC

(Residential/Commercial scenarios only)

Soil Ingestion, dermal contact, particulate inhalation

TRUE

Ingestion of site grown vegetables and soil attached to vegetables

FALSE

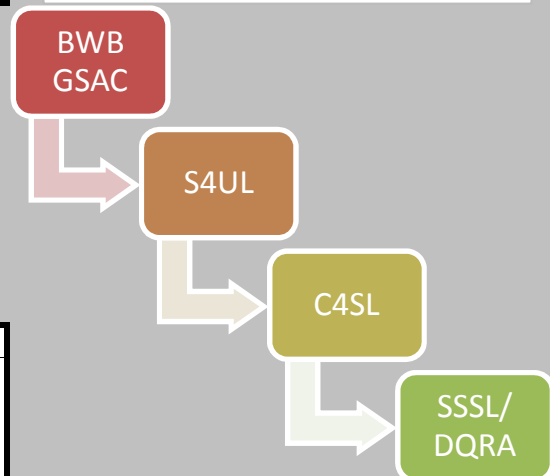
Inhalation of vapours Indoors

TRUE

Inhalation of vapours Outdoors

TRUE

GSAC Hierarchy



Default pathways

Residential	Commercial
TRUE	TRUE
Optional	FALSE
TRUE	TRUE
TRUE	TRUE

Generic Assessment Criteria
**Plot J, Kingsway Business Park
MCS2374**
**Commercial
mg/kg**

Source

Arsenic	640.00	BWB_GSAC
Barium	22075.98	BWB_GSAC
Beryllium	12.36	BWB_GSAC
Boron	236162.71	BWB_GSAC
Cadmium	230.00	BWB_GSAC
Chromium VI	34.10	BWB_GSAC
Chromium III	9086.88	BWB_GSAC
Copper	63257.96	BWB_GSAC
Lead*	2330.00	DEFRA_C4SL
Inorganic Mercury	3600.00	BWB_GSAC
Nickel	1042.26	BWB_GSAC
Selenium	13000.00	BWB_GSAC
Vanadium	6625.16	BWB_GSAC
Zinc	732811.46	BWB_GSAC
Cyanide (Free)	43.00	BWB_GSAC
Cyanide (Complex)	213.00	BWB_GSAC
Phenols (Total)	26470.70	BWB_GSAC
Benzene	28.13	BWB_GSAC
Toluene	59239.76	BWB_GSAC
Ethyl benzene	6048.35	BWB_GSAC
Total Xylene	6276.89	BWB_GSAC
TPH (EC5-6) aliphatic	3305.51	BWB_GSAC
TPH (>EC6-8) aliphatic	8038.06	BWB_GSAC
TPH (>EC8-10) aliphatic	2040.71	BWB_GSAC
TPH (>EC10-12) aliphatic	9333.90	BWB_GSAC
TPH (>EC12-16) aliphatic	45054.03	BWB_GSAC
TPH (>EC16-21) aliphatic	1586911.64	BWB_GSAC
TPH (>EC21-35) aliphatic	1586911.64	BWB_GSAC
TPH (>EC35-44) aliphatic	1586911.64	BWB_GSAC
TPH (>EC6-7) aromatic (benzene)	43.58	BWB_GSAC
TPH (>EC7-8) aromatic (toluene)	59016.08	BWB_GSAC
TPH (>EC8-10) aromatic	3351.91	BWB_GSAC
TPH (>EC10-12) aromatic	13056.78	BWB_GSAC
TPH (>EC12-16) aromatic	32247.11	BWB_GSAC
TPH (>EC16-21) aromatic	28204.67	BWB_GSAC
TPH (>EC21-35) aromatic	28428.54	BWB_GSAC
TPH (>EC35-44) aromatic	28428.54	BWB_GSAC
Total TPH	500.00	BWB_GSAC
Naphthalene	204.16	BWB_GSAC
Acenaphthylene	84484.45	BWB_GSAC
Acenaphthene	85039.57	BWB_GSAC
Fluorene	63477.55	BWB_GSAC
Phenanthrene	21919.25	BWB_GSAC
Anthracene	524854.95	BWB_GSAC
Fluoranthene	22641.89	BWB_GSAC
Pyrene	54271.58	BWB_GSAC
Benzo(a)anthracene	171.36	BWB_GSAC
Chrysene	354.05	BWB_GSAC
Benzo(b)fluoranthene	45.25	BWB_GSAC
Benzo(k)fluoranthene	1198.49	BWB_GSAC
Benzo(a)pyrene	35.97	BWB_GSAC
Indeno(1,2,3-c,d)pyrene	512.12	BWB_GSAC
Dibenzo(a,h)anthracene	3.60	BWB_GSAC
Benzo(g,hi)perylene	4016.76	BWB_GSAC

Location	Sample depth	Easting	Northing	Strata Type	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium VI	Chromium III	Copper	Lead	Inorganic Mercury	Nickel	Selenium	Vanadium	Zinc
Detection Limit					1	1	0.06	0.2	0.2	4	1	1	1	0.3	1	1	1	1
GSAC					640.00	22075.98	12.36	236162.7	230.00	34.10	9086.88	63257.96	2330.00	3600.00	1042.26	13000.00	6625.16	732811.5
TP01	0.75 - 0.85	391486	411489	Alluvium	1	130	0.42	2.4	0.2	4	14	5.9	7.6	0.3	8.5	1	13	17
TP02	0.55 - 0.65	391460	411548	Made Ground	7.8	80	0.68	0.7	0.2	4	20	27	33	0.3	19	1	23	45
TP05	0.20 - 0.30	391423	411485	Hummocky Glacial Deposits	12	75	0.53	1.1	0.2	4	12	25	54	0.3	16	1	26	63
TP06	1.50 - 1.60	391396	411538	Hummocky Glacial Deposits	3.4	37	0.47	0.4	0.2	4	18	13	7.2	0.3	16	1	22	32
TP09	2.40 - 2.50	391395	411433	Hummocky Glacial Deposits	3.6	20	0.3	0.5	0.2	4	8.5	11	6.1	0.3	11	1	10	23
TP11	1.00 - 1.10	391345	411479	Hummocky Glacial Deposits	5.9	25	0.54	0.4	0.2	4	15	17	7.5	0.3	16	1	18	28
TP13	0.10 - 0.20	391281	411524	Topsoil	18	100	0.73	0.9	0.2	4	17	34	110	0.3	16	1	35	74
TP16	0.20 - 0.30	391342	411408	Topsoil	16	99	0.85	1	0.2	4	19	39	68	0.3	16	1	32	81
TP19	0.40 - 0.50	391291	411353	Topsoil	15	77	0.78	0.9	0.2	4	19	34	68	0.3	17	1	25	57
TP21	0.10 - 0.20	391292	411417	Topsoil	14	55	0.66	0.7	0.2	4	17	32	54	0.3	16	1	28	47
TP23	0.75 - 0.85	391244	411456	Hummocky Glacial Deposits	5	31	0.41	0.6	0.2	4	17	18	7.7	0.3	15	1	20	27
TP25	2.40 - 2.50	391244	411400	Hummocky Glacial Deposits	5.7	69	0.63	0.5	0.2	4	20	18	8.5	0.3	20	1	21	38
TP27	1.75 - 1.85	391246	411320	Hummocky Glacial Deposits	5.7	36	0.58	0.4	0.2	4	22	16	10	0.3	19	1	22	32
TP29	0.50 - 0.60	391199	411364	Hummocky Glacial Deposits	3.4	25	0.3	0.5	0.2	4	14	8.2	6.9	0.3	11	1	20	19
TP30	0.35 - 0.45	391224	411301	Made Ground	10	80	0.63	0.6	0.2	4	19	25	41	0.3	15	1	19	49

Location	Sample depth	Cyanide (Free)	Cyanide (Complex)	Phenols (Total)	Benzene	Toluene	Ethyl benzene	Total Xylene	TPH (EC5-6) aliphatic	TPH (>EC6-8) aliphatic	TPH (>EC9-10) aliphatic	TPH (>EC10-12) aliphatic	TPH (>EC12-16) aliphatic	TPH (>EC16-21) aliphatic	TPH (>EC21-35) aliphatic	TPH (>EC6-7) aromatic (benzene)	TPH (>EC7-8) aromatic (toluene)	TPH (>EC8-10) aromatic	TPH (>EC10-12) aromatic	TPH (>EC12-16) aromatic	TPH (>EC16-21) aromatic	TPH (>EC21-35) aromatic	Total TPH
Detection Limit		1	1	1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	1	2	8	8	0.001	0.001	0.001	1	2	10	10	10
GSAC		43.00	213.00	26470.70	28.13	59239.76	6048.35	6276.89	3305.51	8038.06	2040.71	9333.90	45054.03	1586912	1586912	43.58	59016.08	3351.91	13056.78	32247.11	28204.67	28428.54	500.00
TP01	0.75 - 0.85	1	1	1																			44
TP02	0.55 - 0.65	1	1	1	1	1	1	1	0.001	0.001	0.001	1	2	8	8	0.001	0.001	0.001	1	2	10	10	10
TP05	0.20 - 0.30	1	1	1																			23
TP06	1.50 - 1.60	1	1	1	1	1	1	1	0.001	0.001	0.001	1	2	8	8	0.001	0.001	0.001	1	2	10	10	10
TP09	2.40 - 2.50	1	1	1																			10
TP11	1.00 - 1.10	1	1	1																			10
TP13	0.10 - 0.20	1	1	1	1	1	1	1	0.001	0.001	0.001	1	2	8	8	0.001	0.001	0.001	1	2	10	14	21
TP16	0.20 - 0.30	1	1	1																			10
TP19	0.40 - 0.50	1	1	1																			10
TP21	0.10 - 0.20	1	1	1	1	1	1	1	0.001	0.001	0.001	1	2	8	8	0.001	0.001	0.001	1	2	10	10	10
TP23	0.75 - 0.85	1	1	1																			10
TP25	2.40 - 2.50	1	1	1																			10
TP27	1.75 - 1.85	1	1	1																			10
TP29	0.50 - 0.60	1	1	1																			10
TP30	0.35 - 0.45	1	1	1	1	1	1	1	0.001	0.001	0.001	1	2	8	8	0.001	0.001	0.001	1	2.1	10	25	36

Location	Sample depth	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene
Detection Limit		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
GSAC		204.16	84484.4	85039.6	63477.6	21919.2	524854.9	22641.89	54271.58	171.36	354.05	45.25	1198.49	35.97	512.12	3.60	4016.76
TP01	0.75 - 0.85	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP02	0.55 - 0.65	0.05	0.05	0.05	0.05	0.4	0.05	0.51	0.44	0.24	0.29	0.35	0.16	0.32	0.05	0.05	0.05
TP05	0.20 - 0.30	0.18	0.05	0.2	0.05	0.91	0.05	0.81	0.69	0.5	0.39	0.45	0.23	0.42	0.05	0.05	0.05
TP06	1.50 - 1.60	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP09	2.40 - 2.50	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP11	1.00 - 1.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP13	0.10 - 0.20	0.05	0.05	0.05	0.05	0.41	0.05	0.87	0.89	0.73	0.56	0.68	0.3	0.65	0.23	0.05	0.22
TP16	0.20 - 0.30	0.05	0.05	0.05	0.05	0.23	0.05	0.38	0.33	0.23	0.22	0.23	0.16	0.28	0.05	0.05	0.05
TP19	0.40 - 0.50	0.05	0.05	0.05	0.05	0.39	0.05	0.63	0.56	0.43	0.35	0.41	0.2	0.34	0.05	0.05	0.05
TP21	0.10 - 0.20	0.05	0.05	0.19	0.05	1.1	0.18	1.2	1	0.7	0.55	0.64	0.28	0.59	0.24	0.05	0.27
TP23	0.75 - 0.85	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP25	2.40 - 2.50	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP27	1.75 - 1.85	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP29	0.50 - 0.60	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TP30	0.35 - 0.45	0.05	0.05	0.05	0.05	1.5	0.22	2.2	1.9	1.3	1.3	1.7	0.48	1.4	0.5	0.05	0.61

APPENDIX 12

SOIL LEACHATE ASSESSMENT SHEETS

*EQS Standard: Phenol and Benzene annual average of 300µg/l; Toluene 500µg/l for Freshwater, 400µg/l for Saltwater; 1,1,1-TCA 1,000µg/l.

Project Name:	Plot J, Kingsway Business Park
Project Number:	MCS2374
Assessment for:	Soil Leachate Assessment
Laboratory:	i2
Receptor:	Freshwater
Receptor Water Hardness:	<40 (No Data)

100 = Assessment Criteria Exceedance)

50 = M-BAT Bioavailability Assessment Required

Contaminant	Units	Detection Limit	Guideline Concentration	Source	Number of Samples	Min	Max	No of Exceedences	TP02	TP06	TP13	TP21	TP29	TP30
									0.55 - 0.65	1.5 - 1.60	0.10 - 0.20	0.10 - 0.20	0.50 - 0.60	0.35 - 0.45
Heavy Metals	Arsenic	µg/l	1.1	50	EQS Freshwater	6	1.10	1.80	0	1.10	1.10	1.80	1.10	1.10
	Barium	mg/l	0.05	700	UK DWS	6	0.00	0.02	0	0.02	0.00	0.01	0.01	0.00
	Beryllium	µg/l	0.2	None Available		6	0.20	0.30	0	0.20	0.30	0.20	0.20	0.20
	Cadmium	µg/l	0.08	0.08	EQS Freshwater	6	0.08	0.08	0	0.08	0.08	0.08	0.08	0.08
	Chromium III	µg/l	0.4	4.7	EQS Freshwater	6	0.40	1.60	0	0.70	0.40	0.90	0.80	1.60
	Copper	µg/l	0.7	1	EQS Freshwater	6	5.90	37.00	6	13.00	5.90	37.00	31.00	21.00
	Lead	µg/l	1	1.2	EQS Freshwater	6	1.20	6.70	5	2.70	1.20	6.70	3.50	2.70
	Mercury	µg/l	0.5	0.07	EQS Freshwater	6	0.50	0.50	6	0.50	0.50	0.50	0.50	0.50
	Nickel	µg/l	0.3	4	EQS Freshwater	6	0.30	2.50	0	0.90	0.30	2.50	1.80	0.80
	Selenium	µg/l	4	10	UK DWS	6	4.00	4.00	0	4.00	4.00	4.00	4.00	4.00
	Vanadium	µg/l	1.7	None Available		6	1.70	3.60	0	1.70	1.70	1.70	3.60	1.70
	Zinc	µg/l	0.4	10.9	EQS Freshwater	6	3.60	9.70	0	7.10	3.60	7.70	9.70	7.60
	Sulphate	mg/l	0.1	400	EQS Freshwater	6	1.70	2.70	0	2.70	1.70	2.10	1.90	2.70
	Boron	mg/l	10	2000	EQS Freshwater	6	0.01	0.02	0	0.01	0.01	0.02	0.01	0.01
Inorganics	pH					6	6.50	7.70	0	7.10	6.80	6.50	6.50	7.70
	Cyanide (total)	µg/l	10	1	EQS Freshwater	6	10.00	10.00	6	10.00	10.00	10.00	10.00	10.00

APPENDIX 13

GROUNDWATER ASSESSMENT SHEETS

*EQS Standard: Phenol and Benzene annual average of 300µg/l; Toluene 500µg/l for Freshwater, 400µg/l for Saltwater; 1,1,1-TCA 1,000µg/l.

Project Name:	Plot J, Kingsway Business Park
Project Number:	MCS2374
Assessment for:	Water Assessment
Laboratory:	i2
Receptor:	Freshwater
Receptor Water Hardness:	<40 (No Data)

100 = Assessment Criteria Exceedance)

50 = M-BAT Bioavailability Assessment Required

	Contaminant	Units	Detection Limit	Guideline Concentration	Source	Number of Samples	Min	Max	No of Exceedences	BH01	BH02	BH03	BH04	BH05	BH06
Heavy Metals	Arsenic	µg/l	1	50	EQS Freshwater	6	1.00	1.30	0	1.00	1.00	1.00	1.00	1.30	1.30
	Barium	mg/l	0.05	700	UK DWS	6	0.07	0.26	0	0.26	0.09	0.07	0.11	0.11	0.25
	Beryllium	µg/l	0.2	None Available		6	0.20	0.20	0	0.20	0.20	0.20	0.20	0.20	0.20
	Cadmium	µg/l	0.08	0.08	EQS Freshwater	6	0.08	0.08	0	0.08	0.08	0.08	0.08	0.08	0.08
	Chromium III	µg/l	0.4	4.7	EQS Freshwater	6	0.40	1.10	0	0.70	0.40	0.40	0.40	1.10	0.40
	Chromium VI	µg/l	5	3.4	EQS Freshwater	6	5.00	5.00	6	5.00	5.00	5.00	5.00	5.00	5.00
	Copper	µg/l	0.7	1	EQS Freshwater	6	2.50	10.00	6	2.50	3.00	6.30	3.30	10.00	4.50
	Lead	µg/l	1	1.2	EQS Freshwater	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Mercury	µg/l	0.5	0.07	EQS Freshwater	6	0.50	0.50	6	0.50	0.50	0.50	0.50	0.50	0.50
	Nickel	µg/l	0.3	4	EQS Freshwater	6	1.40	12.00	4	12.00	7.20	3.70	1.40	7.20	7.30
	Selenium	µg/l	4	10	UK DWS	6	4.00	4.00	0	4.00	4.00	4.00	4.00	4.00	4.00
	Vanadium	µg/l	1.7	None Available		6	1.70	4.60	0	3.80	1.70	1.70	4.60	1.70	1.70
	Zinc	µg/l	0.4	10.9	EQS Freshwater	6	3.60	9.50	0	5.50	7.10	4.80	3.60	9.50	3.70
	Sulphate	mg/l	45	400	EQS Freshwater	6	11.50	105.00	0	36.70	12.40	16.90	11.50	13.70	105.00
	Boron	mg/l	10	2000	EQS Freshwater	6	0.01	0.03	0	0.02	0.03	0.02	0.02	0.01	0.03
	pH					6	5.90	6.50	0	6.10	6.50	6.10	6.00	6.20	5.90
Inorganics	Cyanide (total)	µg/l	10	1	EQS Freshwater	6	10.00	10.00	6	10.00	10.00	10.00	10.00	10.00	10.00
	Phenol*	µg/l	10	7.7	EQS Freshwater	6	10.00	10.00	6	10.00	10.00	10.00	10.00	10.00	10.00
BTEX	Benzene*	µg/l	1	10	EQS Freshwater	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Ethylbenzene	µg/l	1	300	UK DWS	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Toluene*	µg/l	1	74	EQS Freshwater	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
Total Petroleum Hydrocarbons	Xylene	µg/l	0	30	EQS Freshwater	6	2.00	2.00	0	2.00	2.00	2.00	2.00	2.00	2.00
	Aliphatic C5-C6	µg/l	1	10	UK DWS	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Aliphatic C6-C8	µg/l	1	10	UK DWS	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Aliphatic C8-C10	µg/l	1	10	UK DWS	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Aliphatic C10-C12	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Aliphatic C12-C14	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Aliphatic C14-C21	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Aliphatic C21-C35	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Aromatic EC5-EC7	µg/l	1	10	EQS Freshwater	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Aromatic EC7-EC8	µg/l	1	74	EQS Freshwater	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Aromatic EC8-EC10	µg/l	1	10	UK DWS	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Aromatic EC10-EC12	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Aromatic EC12-EC14	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Aromatic EC14-EC21	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Aromatic EC21-EC35	µg/l	10	10	UK DWS	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
	Total TPH (EC5-EC35)	µg/l	10	10	EQS Freshwater	6	10.00	10.00	0	10.00	10.00	10.00	10.00	10.00	10.00
Polycyclic Aromatic Hydrocarbons	Acenaphthene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Acenaphthylene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Anthracene	µg/l	0.01	0.1	EQS Freshwater	6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Benzo(a)anthracene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Benzo(a)pyrene	µg/l	0.01	0.00017	EQS Freshwater	6	0.01	0.01	6	0.01	0.01	0.01	0.01	0.01	0.01
	Benzo(b)fluoranthene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Benzo(k)fluoranthene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Benzo(g,h,i)perylene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Chrysene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Dibenzo(a,h)anthracene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Fluoranthene	µg/l	0.01	0.0063	EQS Freshwater	6	0.01	0.01	6	0.01	0.01	0.01	0.01	0.01	0.01
	Fluorene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Indeno(1,2,3-c,d)pyrene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Naphthalene	µg/l	0.01	2	EQS Freshwater	6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Phenanthrene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Pyrene	µg/l	0.01	None Available		6	0.01	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01
	Benzene	µg/l	1	10	EQS Freshwater	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Ethylbenzene	µg/l	1	300	UK DWS	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
	Xylene	µg/l	0	30	EQS Freshwater	6	2.00	2.00	0	2.00	2.00	2.00	2.00	2.00	2.00
	Toluene	µg/l	1	74	EQS Freshwater	6	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00

APPENDIX 14

UKWIR VALUES

UK Water Industry Research (2010) Guidance on the Selection of Water Supply Pipes: Table 3.1 Pipe Selection

Note: concentrations are mg/kg

	Parameter Group	Polyethylene (PE)	Polyvinyl chloride (PVC)	Barrier pipe (Polyethylene-Aluminium-Polyethylene (PE-AL-PE))	Wrapped Steel	Wrapped Ductile Iron	Copper
1	Extended VOC Suite by purge and trap or head space and GC-MS with TIC	0.5	0.125	Pass	Pass	Pass	Pass
1a	BTEX + MTBE	0.1	0.03	Pass	Pass	Pass	Pass
2	SVOCs TIC by purge and trap or head space and GC-MS with TIC (Aliphatic and aromatic C5-C10)	2	1.4	Pass	Pass	Pass	Pass
2e	+Phenols	2	0.4	Pass	Pass	Pass	Pass
2f	+Cresols and chlorinated phenols	2	0.04	Pass	Pass	Pass	Pass
3	Mineral Oil C11-C20	10	Pass	Pass	Pass	Pass	Pass
4	Mineral Oil C21-C40	500	Pass	Pass	Pass	Pass	Pass
5	Corrosive (Conductivity, Redox and pH)	Pass	Pass	Pass	Corrosive if pH < 7 and conductivity > 400 μ S/cm	Corrosive if pH < 5 and Eh not neutral and conductivity > 400 μ S/cm	Corrosive if pH < 5 or > 8 and Eh positive
Specific suite identified as relevant following site investigation							
2a	Ethers	0.5	1	Pass	Pass	Pass	Pass
2b	Nitrobenzene	0.5	0.4	Pass	Pass	Pass	Pass
2c	Ketones	0.5	0.02	Pass	Pass	Pass	Pass
2d	Aldehydes	0.5	0.02	Pass	Pass	Pass	Pass
6	Amins	Fail	Pass	Pass	Pass	Pass	Pass

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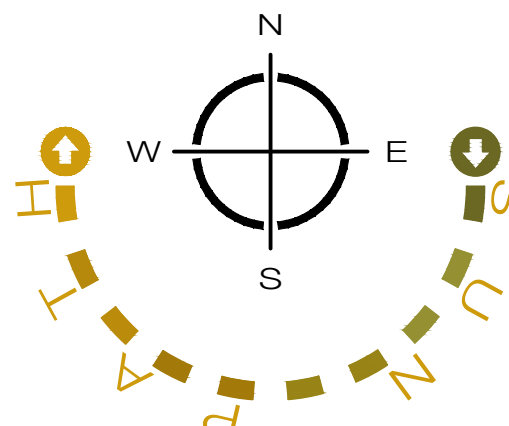
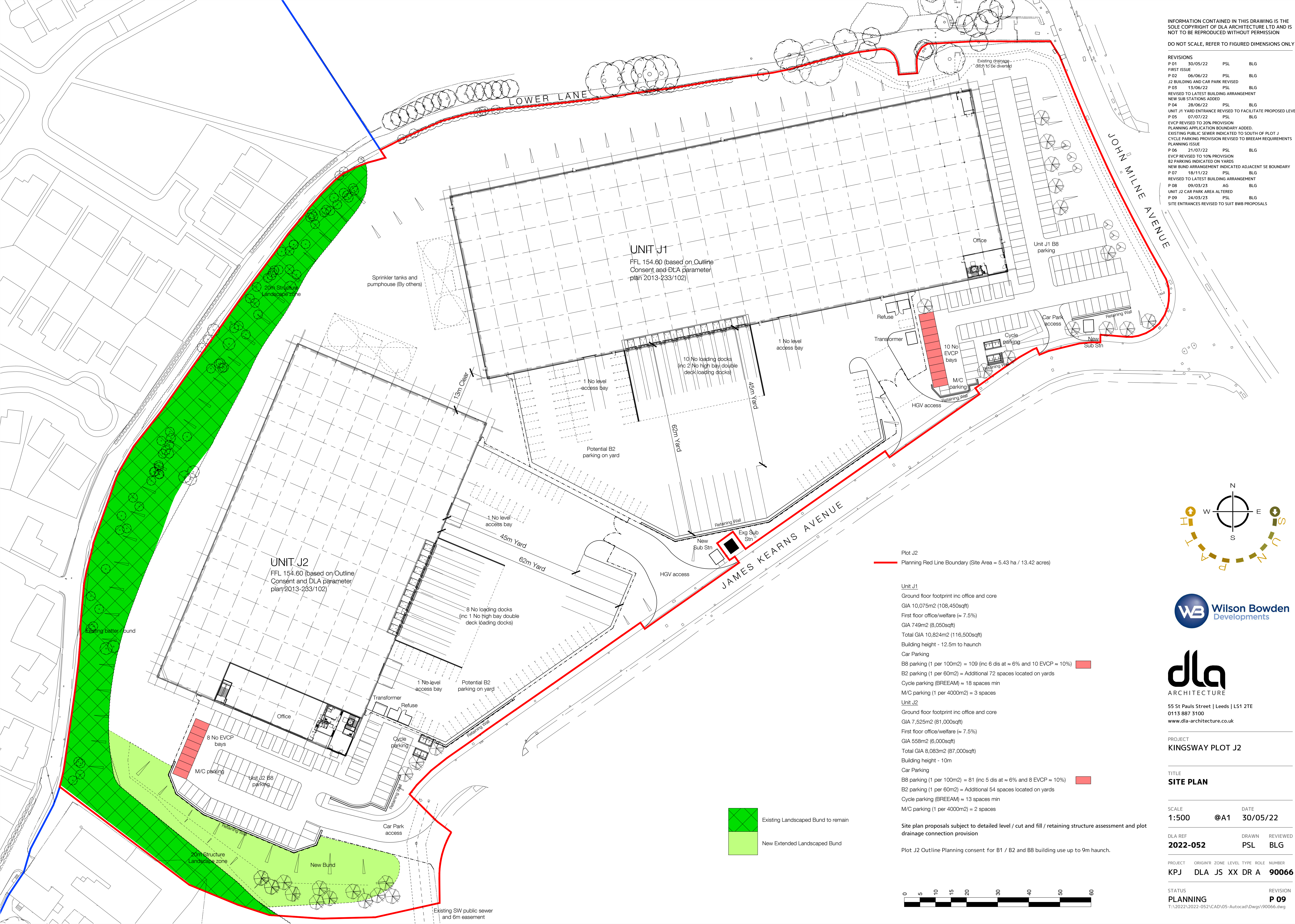
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Appendix 2 – Proposed Masterplan

REVISIONS			
P 01	30/05/22	PSL	BLG
FIRST ISSUE			
P 02	06/06/22	PSL	BLG
J2 BUILDING AND CAR PARK REVISED			
P 03	13/06/22	PSL	BLG
REVISED TO LATEST BUILDING ARRANGEMENT NEW SUB STATIONS ADDED			
P 04	28/06/22	PSL	BLG
UNIT J1 YARD ENTRANCE REVISED TO FACILITATE PROPOSED LEVELS			
P 05	07/07/22	PSL	BLG
EVCP REVISED TO 20% PROVISION PLANNING APPLICATION BOUNDARY ADDED. EXISTING PUBLIC SEWER INDICATED TO SOUTH OF PLOT J CYCLE PARKING PROVISION REVISED TO BREEAM REQUIREMENTS PLANNING ISSUE			
P 06	21/07/22	PSL	BLG
EVCP REVISED TO 10% PROVISION B2 PARKING INDICATED ON YARDS NEW BUND ARRANGEMENT INDICATED ADJACENT SE BOUNDARY			
P 07	18/11/22	PSL	BLG
REVISED TO LATEST BUILDING ARRANGEMENT			
P 08	09/03/23	AG	BLG
UNIT J2 CAR PARK AREA ALTERED			
P 09	24/03/23	PSL	BLG
SITE ENTRANCES REVISED TO SUIT BWB PROPOSALS			



PROJECT
KINGSWAY PLOT J2

TITLE
SITE PLAN

SCALE
1:500

DATE
30/05/22

DLA REF
2022-052

DRAWN
PSL

REVIEWED
BLG

PROJECT
KPJ

ORIGIN'R
DLA

ZONE
JS

LEVEL
XX

TYPE
DR

ROLE
A

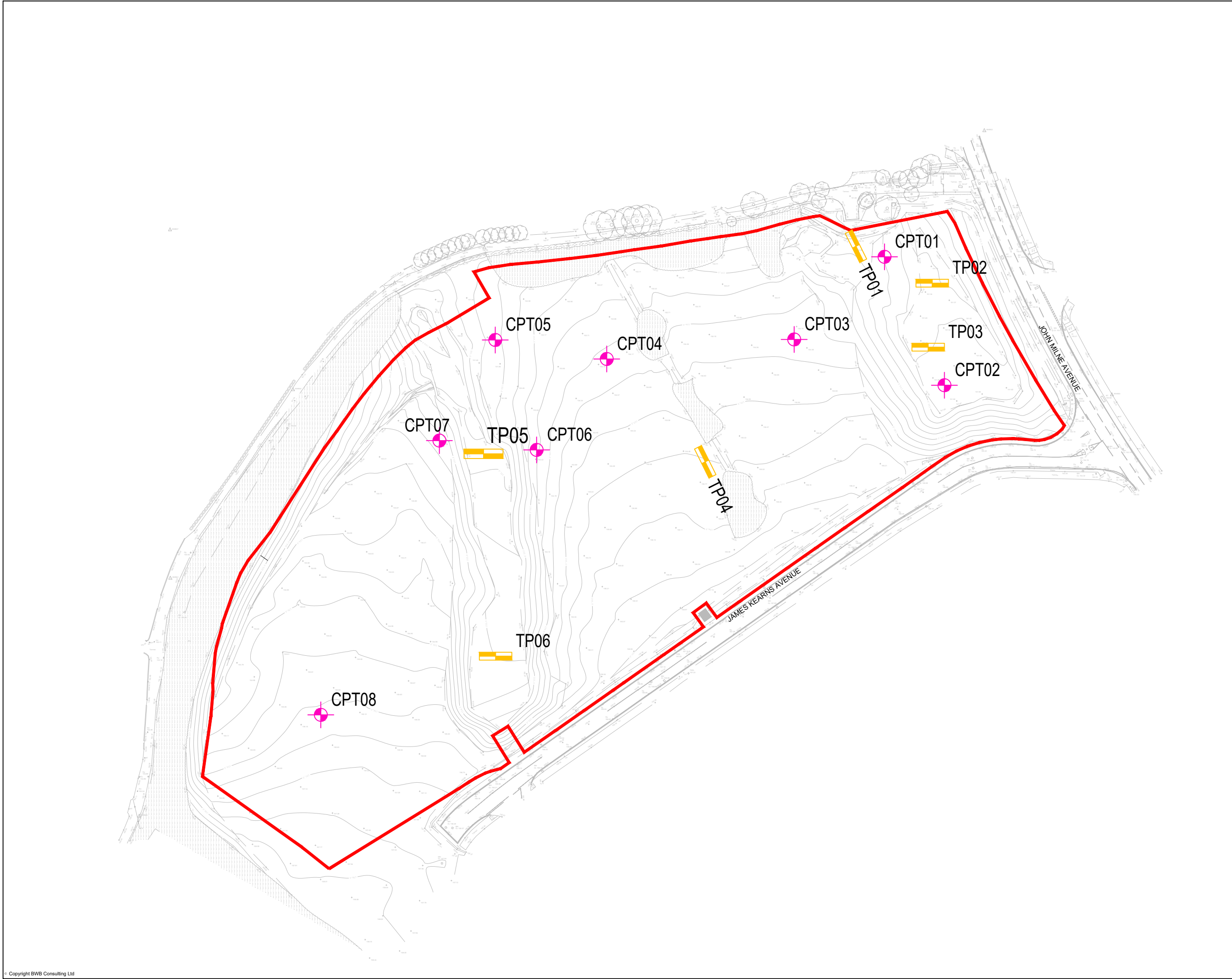
NUMBER
90066

STATUS
PLANNING

REVISION
P 09

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Appendix 3 – BWB 2022 Exploratory Hole Location Plan



Notes

1.

Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.

2.

This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

3.

All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.

Key Plan

Legend

TP**

Trial Pit/Trench

CPT**

Cone Penetration Test

F1	08.07.22	FINAL	TF	AB
Rev	Date	Details of issue / revision	Dnw	Rev

Issues & Revisions

Birmingham

| 0121 233 3322

Leeds

| 0113 233 8000

London

| 020 7234 9122

Manchester

| 0161 233 4260

Nottingham

| 0115 924 1100

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Client

WILSON BOWDEN DEVELOPMENTS LTD

Project Title

PLOT J2 KINGSWAY BUSINESS PARK

Drawing Title

EXPLORATORY HOLE LOCATION PLAN

Drawn:	T Flame	Reviewed:	A Boor
BWB Ref:	220810	Date:	08.07.22
Scale@A3:	NTS		

Drawing Status

FINAL

Project - Originator - Zone - Level - Type - Role - Number

Status

Rev

KPJ2-BWB-ZZ-XX-SK-YE-0001-EHLPS1F1

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Appendix 4 – Exploratory hole Logs

TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

Sheet 1 of 1

LOCATION ID:		Project Name: Plot J2, Kingsway (WBD)		2.20 1.00Pit Dimensions (m)Degrees Stability: Pit unstable below 4m	
TP01	Project Number: 220810				
	Client: Wilson Bowden Developments				
	Plant: 14 tonne excavator	Start & End Date: 21/06/2022			
Ground Level (m AOD): 152.30		Eastings & Northings: 391433E 411548N		Engineer: OS	Checker: TF

Strata						Samples			In-Situ Tests		
Groundwater Strike	Backfill	Level (m AOD)	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
		0.20m	Dark brown clayey SAND with high rootlet content (Topsoil)		0.20						
		152.10									
		0.30m	Brown gravelly sand with low cobble content. Gravel is subangular to subrounded, fine to coarse of sandstone, cobbles are subangular of sandstone (Made Ground)		0.50						
		151.80									
		1.00m	Light brown slightly clayey slightly gravelly SAND. Gravel is subrounded, fine to medium of sandstone (Hummocky Glacial Deposits)		1.50				HSV	1.60	(4, 4, 5)kPa
		150.80	Very soft brown slightly gravelly sandy SILT. Gravel is subangular to subrounded, fine to medium of sandstone (Hummocky Glacial Deposits)								
		2.80m									
		148.00	Hole Terminated at 4.30m bgl.		4.30						

	Remarks
--	---------

Reason for Termination:

Side collapse

Groundwater Notes:

No groundwater encountered.

Other Remarks:

Cleared of services, backfilled with arisings



TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:	Project Name: Plot J2, Kingsway (WBD)		2.00 1.00 Pit Dimensions (m) Degrees Stability: Pit unstable below 4.00m								
TP02	Project Number: 220810										
	Client: Wilson Bowden Developments										
	Plant: 14 tonne excavator	Start & End Date: 21/06/2022									
Ground Level (m AOD): 151.18		Eastings & Northings: 391463E 411533N		Engineer: OS		Checker: TF					
Strata						Samples		In-Situ Tests			
Groundwater Strike	Backfill	Level (m AOD)	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
▼		0.40m	Brown clayey SAND with high rootlet content (Topsoil)		0.400.901.504.20						
		150.78	Light brown slightly clayey SAND (Made Ground)								
		0.50m									
		150.28	Grey clayey sandy GRAVEL with high cobble content. Gravel is subrounded, fine to coarse of sandstone. Cobbles are subrounded of sandstone (Made Ground)								
		0.60m									
149.68	0.9m: Membrane visible in pit										
	Grey slightly gravelly silty SAND with plant material including wood fragments. Gravel is subangular to subrounded fine to medium of sandstone. (Alluvium)										
			2.1m-4.2m: Colour change to orange and light brown								
		2.70m									
		146.98	Hole Terminated at 4.20m bgl.								
Remarks											
Reason for Termination: Side collapse											
Groundwater Notes: Seepage at 4m											
Other Remarks: Cleared of services, backfilled with arisings											
BWB A CAF GROUP COMPANY											

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:		Project Name: Plot J2, Kingsway (WBD)				3.20 1.10 Pit Dimensions (m) Degrees					
TP03		Project Number: 220810									
		Client: Wilson Bowden Developments									
		Plant: 14 tonne excavator	Start & End Date: 21/06/2022								
Ground Level (m AOD): 151.39		Eastings & Northings: 391461E 411509N				Engineer: OS		Checker: TF			
Strata						Samples		In-Situ Tests			
Groundwater Strike	Backfill	Level (m AOD)	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
		0.20m	Grass over dark brown clayey SAND (Topsoil)		0.20						
		151.19	Brown sandy SILT with plant material including wood fragments (Alluvium)								
		0.80m									
		150.39	Light grey slightly clayey slightly gravelly SAND with low cobble content. Gravel is subangular to subrounded, fine to medium of sandstone and mudstone. Cobbles are subangular to subrounded of sandstone (Hummocky Glacial Deposits)		1.00						
			1.8m-4m: Colour change to orange and light brown								
		3.00m									
		147.39	Hole Terminated at 4.00m bgl.		4.00						
Remarks											
Reason for Termination: Side collapse											
Groundwater Notes: Seepage at 3.7m											
Other Remarks: Cleared of services, backfilled with arisings											
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TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

LOCATION ID:		Project Name: Plot J2, Kingsway (WBD)		2.00 1.00 Pit Dimensions (m) Degrees Stability: Pit stable, slight collapses at 4.7m							
TP04		Project Number: 220810									
		Client: Wilson Bowden Developments									
		Plant: 14 tonne excavator	Start & End Date: 21/06/2022								
Ground Level (m AOD): 155.45		Eastings & Northings: 391376E 411465N		Engineer: OS		Checker: TF					
Strata						Samples			In-Situ Tests		
Groundwater Strike	Backfill	Level (m AOD)	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
		0.30m	Grass over dark brown slightly clayey SAND with high rootlet content (Topsoil)		0.30						
		155.15	Reddish brown slightly clayey SAND with pockets of stiff reddish brown clay (Hummocky Glacial Deposits)								
		1.40m									
		153.75	Light brown slightly clayey SAND (Hummocky Glacial Deposits)								
		3.00m									
		150.75	Hole Terminated at 4.70m bgl.		4.70						
Remarks											
Reason for Termination: Limit of machine reached											
Groundwater Notes: No groundwater encountered.											
Other Remarks: Cleared of services, backfilled with arisings											

TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

Sheet 1 of 1

LOCATION ID:	Project Name: Plot J2, Kingsway (WBD)		2.00 1.00 Pit Dimensions (m) Degrees	
TP05	Project Number: 220810			
	Client: Wilson Bowden Developments			
	Plant: 14 tonne excavator	Start & End Date: 21/06/2022		
Ground Level (m AOD): 150.58		Eastings & Northings: 391290E 411468N	Engineer: OS	Checker: TF

[illegible]

Remarks

Reason for Termination:

Land drain causing rapid water ingress

Groundwater Notes:

No groundwater level found due to drainage pipe

Other Remarks:

Cleared of services. Land drain encountered at 1m depth, backfilled with arisings



TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:		Project Name: Plot J2, Kingsway (WBD)			2.00 1.00 Pit Dimensions (m) Degrees Stability: Pit unstable below 3.3m						
TP06		Project Number: 220810									
		Client: Wilson Bowden Developments									
		Plant: 14 tonne excavator	Start & End Date: 21/06/2022								
Ground Level (m AOD): 151.61		Eastings & Northings: 391295E 411390N			Engineer: OS		Checker: TF				
Strata						Samples			In-Situ Tests		
Groundwater Strike	Backfill	Level (m AOD)	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
		0.20m	Vegetation over dark brown clayey SAND with high rootlet content (Topsoil)		0.20						
		151.41	Brown sandy SILT with lenses of black sandy silt with organic odour, additional lenses of soft black peat. (Alluvium)								
		1m: Land drain in pit wall									
		3.30m	2m: Sandstone cobbles appear								
		148.11	Hole Terminated at 3.50m bgl.								
Remarks											
Reason for Termination: Side collapse											
Groundwater Notes: Seepage											
Other Remarks: Cleared of services. Land drain in trial pit wall at 1m depth, backfilled with arisings											

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Appendix 5 – Trial Pits Photographs

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs



Photo 1—TP01

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP01 Arisings

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP02

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP02 arisings

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs



Photo 2: TP03

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP03 arisings

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP04

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs



Photo 2: TP04 Arisings

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP05, infilled with water due to land drain

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP05 arisings, with fragment of land drain

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs

BWB



Photo 2: TP06, with land drain visible in pit wall

Project Number: 220810
Project Name: Plot J2 Kingsway Business Park
Site Photographs



Photo 2: TP06 arisings

Appendix 6 – CPT Report

IN SITU

SITE INVESTIGATION

STATIC CONE PENETRATION TEST

FACTUAL REPORT

CLIENT: BWB Consulting Ltd

PROJECT: Plot J2 Rochdale



Project	Plot J2 Rochdale
Project No.	1220329
Client	BWB Consulting Ltd
Address	Waterfront House, Station Street, Nottingham, NG2 3DQ

Attention: Ms Elizabethe Sakalas

Dear Ms Sakalas,

We have pleasure in providing a digital copy of our report and data in AGS format for the above project.

We hope that you are satisfied with the performance of our staff, equipment and reporting on this project. If you should have any queries about any aspect of the works carried out, please do not hesitate to contact us. We look forward to being of service to you in the future.

Yours faithfully,

In Situ Site Investigation Limited



Darren Ward

Director

Report Issue

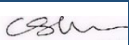
Issue	Date	Prepared	Sign	Checked	Sign	Approved	Sign
01	27/06/2022	Chloe Donovan		Luisa Dhimitri		Darren Ward	

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1.0 INTRODUCTION

In Situ Site Investigation Limited (In Situ) was engaged in a geotechnical site investigation at Plot J2 Rockdale at the request of BWB Consulting. The site investigation consisted of completing 8 Static Piezocone Penetration Tests (CPTU) to provide information on the soil conditions and derived geotechnical parameters at:

Plot J2,
James Kearns Avenue,
Kingsway Business Park,
Rochdale
OL16 4NZ

All test locations were provided by the client. A site map is included in the end of Appendix A of this report (if provided by the client). The tests were stopped when they reached the target depth as per the client's technical specifications or for other technical reasons, as detailed in the *Project Summary Table* in *Appendix A.1* and on each CPTU log included in Appendix B of this report.

The fieldwork was carried out on 21st June 2022 as per the client's request.

The work on site and the final factual reporting have been undertaken in accordance with the international technical standard *BS EN ISO 22476-1:2012*.

2.0 FIELDWORK

2.1 CONE PENETRATION TESTS

The fieldwork activity is summarised in Table 2.1.

Table 2.1 Fieldwork Summary	
CPT Operator/s	Callum Murray
Date Started	21 st June 2022
Date Finished	21 st June 2022
In Situ S.I. Project Manager	Darren Ward
Main Contractor's Site Manager	Tom Flame

2.1.1 Rig Information

Details of CPTU rig used in this project are shown in Table 2.2. Full data sheet for the rig is presented in *Appendix A.2*.

Table 2.2 Rig Summary	
Rig Name	Rig Description
CPT022	20 Tonne Track Mounted CPT Rig

2.1.2 CPTU Cone

Details of electric CPTU cone (Type TE2) used in this project conforming to the requirements of Application Class 2 of *ISO 22476-1:2012*, are shown in Table 2.3.

Table 2.3 Cone Summary		
Number	Cross-section area	Filter position
DP10-CFPTxy.60195	10cm ²	u ₂

A full datasheet of the cone used is shown in *Appendix A.3*.

The cone's measured parameters are shown in Table 2.4.

Table 2.4 Completed Fieldwork Summary
8 CPTU to a maximum depth of 19.97m. Each test measured Cone Resistance, q_c , Sleeve Friction, f_s , Porewater Pressure in the shoulder position, u_2 , Inclination in X and Y axes.
<i>Provision of factual report with estimated soil type, derived geotechnical parameters & AGS datafile.</i>

2.1.3 CPTU Cone Calibration

The cone resistance and sleeve friction are recorded by calibrated load cells in the cone. The CPTU load cells and pressure transducers are regularly calibrated in line with *ISO 22476-1:2012* standard by the cone manufacturer. The cone calibration certificate for the cone used at this site are presented in *Appendix A.4*.

2.1.4 CPTU Cone Saturation

The pore water pressure is recorded using a calibrated pressure transducer located in the piezocone. To ensure pore water pressure measurements are not affected by the presence of air in the measuring transducer, a de-airing procedure is carried out prior to each test. The cone and filter are saturated using a glycerine fluid with a viscosity of 10,000CST.

2.1.5 Test Procedure

The tests are carried out in accordance with the *International Standard for Electrical Cone and Piezocone Penetration Test (ISO 22476-1:2012)*.

The final depths of the tests were determined by either completion to the specified test depth or when the maximal safe capacity of the equipment was reached. A schedule of the tests performed is shown in *Appendix A.1*, which has been compiled from the operators' daily progress reports.

The data is transmitted from the digital CPTU through an umbilical cable that runs through the push rods to the data acquisition system. Results are displayed instantaneously on the computer logging screen. The results are recorded on the computer hard disc.

The rate of penetration is kept constant at 20 mm/s $\pm$ 5 mm/s except when penetrating very dense or hard strata. Before each test is carried out zero values are taken of the cone to check if it is within calibration. At the end of each test, zero values are taken again to see if there has been any drift during the test. These values are inspected during the post processing stage. This is a quality check on the data and the testing procedure. Individual test zero values are shown on their corresponding test results in *Appendix B*.

2.1.6 In Situ Pore Pressure (u_0)

The in situ or hydrostatic pore pressure is required for the calculation of several derived parameters included in this report. For this report, the groundwater level is assumed at 0.5m below ground surface, for calculation purposes. The in situ pore pressure (u_0) values are presented on the pore pressure plot, on *CPT Log 01*, which is included in *Appendix B*.

2.2 POSITIONING

Positioning and surveying of all investigated locations was the responsibility of the client. All tests coordinates are included in the summary sheet in *Appendix A.1*.

3.0 CONE PENETRATION MEASURED PARAMETERS

All measured parameters of tests carried with the CPTU cone are shown in *Appendix B* and all the information about data processing and results are given in sections 3.1, 3.2 and 3.3.

3.1 DATA PROCESSING

The measured parameters, cone end resistance, q_c , sleeve friction, f_s , porewater pressure measurements with filter in shoulder position, u_2 and inclination for x and y axis, I_x , I_y , were recorded for every 10 mm of penetration keeping a constant speed of $20 \text{ mm/s} \pm 5 \text{ mm/s}$, which may slightly change when the cone is penetrating hard strata.

The measured data from the site works is processed and presented using specialised CPT software. The interpretations on the CPTU results were carried out following the recommendations of *Lunne et al. (1997)*, *Robertson (2015)* and *BS EN ISO 22476-1:2012*. Measured parameters, mentioned in *Sections 3.2* and *3.3*, were used to derive all the geotechnical parameters, which are presented in *Chapter 4.0*. The soil behaviour type method used on this report is *Robertson et al. (1986)*, shown in *Figure 3.2*.

3.1.1 Zero Measurements

Before and after each CPTU test, zero measurements are recorded for each channel of the cone. The zero measurements are presented on the logs in *Appendix B*. This is a routine quality check carried out on site.

3.2 MEASURED PARAMETERS

3.2.1 Cone Resistance (q_c)

Cone resistance, q_c , is measured as the total force acting on the cone, divided by the projected area of the cone. The results are presented in MPa, on *CPT Log 01*, in *Appendix B*, scale 0-20 MPa with a minor scale printing on the same graph at 0-4 MPa.

3.2.2 Sleeve Friction (f_s)

Sleeve friction, f_s , is measured as the total frictional force acting on the friction sleeve divided by its surface area. The results are presented in kPa, on *CPT Log 01*, in *Appendix B*, using a scale of 0-500 kPa.

3.2.3 Porewater pressure (u_2)

The pore pressure, u_2 , is measured during the test. If the material is free draining and saturation is maintained it will normally measure hydrostatic pore pressure. In materials that are not free draining, it will record the total pore pressure (hydrostatic plus any excess pore pressures generated) created by the cone penetration through this material.

The filter element can be mounted in one of three positions. For all tests carried out in this project the filter was mounted in the u_2 position (see *Figure 3.1*).

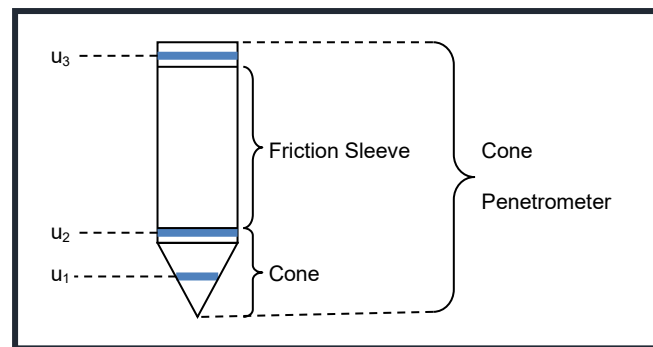


Figure 3.1: Diagram showing pore pressure filter locations (after Lunne et al., 1997)

3.2.4 Inclination (I_x , I_y)

The CPT rig was set up to obtain a thrust direction as near as possible to vertical. The CPTU cones have inclinometers incorporated to measure the non-verticality of the test. For test depths less than 15m, significant non-verticality is unusual, provided the initial thrust direction is vertical.

3.3 ESTIMATED SOIL BEHAVIOUR TYPE

3.3.1 Friction Ratio (R_f)

The friction ratio, R_f is the ratio between the sleeve friction and the cone resistance (Lunne et al., 1997).

$$\text{Friction Ratio } (R_f) = \left(\frac{\text{Sleeve Friction } (f_s)}{\text{Cone Resistance } (q_c)} \right) \times 100$$

3.3.2 Estimated Soil Behaviour Type (SBT)

The estimation of soil behaviour type, *SBT*, using measurements of cone resistance and sleeve friction is based upon the variations of the friction ratio and cone resistance. The

friction ratio varies depending upon whether the soil is cohesive or granular. The cone resistance varies depending on the strength and densities of the soil.

The interpretation used in this report is *Robertson et al. (1986)*, which is shown in Figure 3.2. The results are presented on *CPT Log 01*, in *Appendix B*.

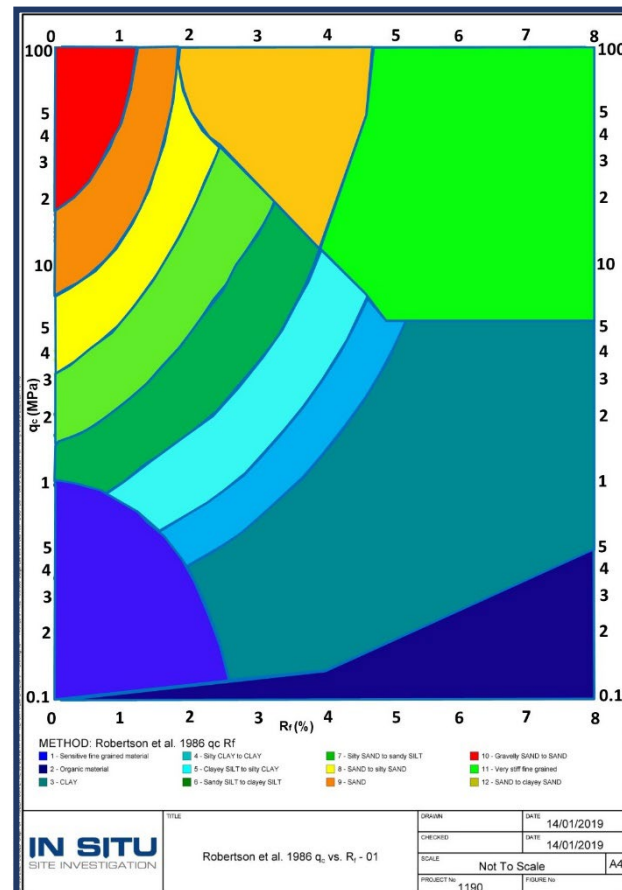


Figure 3.2: *Robertson et al., 1986 soil behaviour type chart.*

3.3.3 Pore Pressure Ratio (B_q)

Pore pressure ratio, B_q is the ratio between the measured pore pressure generated during penetration and the corrected cone resistance minus the total overburden stress.

Pore pressure ratio as defined by *Senneset and Janbu (1985)* is defined as:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{v0}}$$

where

- u_2 is pore pressure measured between the cone and the friction sleeve
- u_0 is equilibrium pore pressure
- σ_{v0} is total overburden stress
- q_t is cone resistance corrected for unequal end area effects

3.4 APPLIED CORRECTIONS

3.4.1 Corrected Cone Resistance (q_t)

For each penetration test, the measured cone resistance, q_c , can be corrected for the “unequal area effect” due to the influence of the ambient pore water pressure acting on the cone.

The correction has been applied using the following equation by Lunne et al., 1997:

$$q_t = q_c + [u_2 \cdot (1 - \alpha)]$$

where

α is the cone area ratio

The cone used on this project has a cone area ratio of 0.79. This value is geometrically measured.

3.4.2 Depth Correction

All tests in the report have been corrected for depth difference caused by inclination. This has been calculated using the method described in ISO 22476-1:2012.

To calculate the corrected depth the following formula is used:

$$z = \int_0^l C_{inc} \cdot dl$$

where

z is penetration depth, in m

l is penetration length, in m

C_{inc} is correction factor for the effect of the inclination of the CPTU relative to the vertical axis.

The equation for calculating the correction factor for the influence of the inclination for a bi-axial inclinometer is:

$$C_{inc} = \frac{1}{\sqrt{(1 + \tan^2 \beta_1 + \tan^2 \beta_2)}}$$

where

β_1 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees

β_2 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1 , in degrees

4.0 GEOTECHNICAL DERIVED PARAMETERS

A number of empirical correlations can be used to derive geotechnical parameters from CPTU data. This report includes only the parameters which are described in this chapter. The results of all correlations used to obtain the geotechnical derived parameters are presented on *CPT Log 02* and *CPT Log 03* in *Appendix B*.

Please, note that each empirical correlation is derived for a certain type of soil, and may not be appropriate for all the soil types encountered on this project.

4.1 SOIL BEHAVIOUR TYPE INDEX (I_c)

The soil behaviour type index, I_c , was derived by *Jefferies and Davies (1991)*, and was created to simplify the application of CPTU SBT chart shown in *Chapter 3, Figure 3.2*. This approach has been modified for use with the *Robertson (1990)* normalised CPT soil classification chart, *Figure 4.1*. The normalised cone parameters Q_t and F_r (for definitions see *Appendix A5 Symbol List*) can be combined into one Soil Behaviour Type Index, I_c , (*Lunne et al., 1997*).

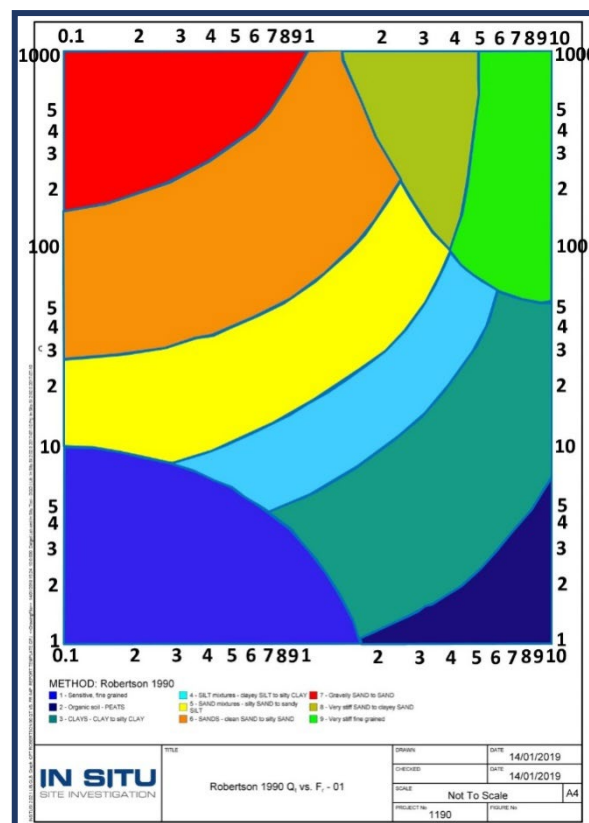


Figure 4.1: Robertson 1990 soil behaviour type chart.

The soil behaviour type index, I_c , can then be defined using *Robertson (2010)* formula, given below:

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

where

Q_t is the normalized cone resistance which represents the simple normalization with a stress exponent (n) of 1.0, which applies well to clay-like soils

F_R is the normalized friction ratio, in %

The boundaries of soil behaviour type are then given in terms of the index, I_c , presented in *Table 4.1* below.

The soils behaviour type index does not apply to zones 1, 8 and 9. The profiles of I_c provide a simple guide to the continuous variation of soil behaviour type in a given soil profile based on CPTU results, with a reliability greater than 80% compared with soil samples (*Robertson, 2015*).

Zone	Soil Behaviour Type	I_c
1	Sensitive fine grained	N/A
2	Organic Soils – clay	>3.6
3	Clays – silty clay to clay	2.95 – 3.6
4	Silt mixtures – clayey silt to silty clay	2.60 – 2.95
5	Sand mixtures – silty sand to sandy silt	2.05 – 2.6
6	Sands – clean sand to silty sand	1.31 – 2.05
7	Gravelly sand to dense sand	<1.31
8	Very stiff sand to clayey sand*	N/A
9	Very stiff fine grained *	N/A

* Heavily over consolidated or cemented

Table 4.1: Normalized CPTU Soil Behaviour Type (SBT_n) Index values, I_c . (*Robertson, 2010*)

4.2 N VALUE OF STANDARD PENETRATION TEST (SPT) (N_{60})

The derived N value of SPT , N_{60} , is strongly and directly related to the cone resistance, q_c .

In this report the N_{60} value is derived using the following correlations, developed by *Robertson and Wride (1998)* and *Jefferies and Davies (1998)*

1) *Robertson & Wride (1998)*

$$N_{60} = \frac{q_c}{8.5 \cdot p_a \left(1 - \frac{I_c}{4.6}\right)}$$

2) *Jefferies and Davies (1993)*

$$N_{60} = \frac{q_c}{0.85 \cdot \left(1 - \frac{I_c}{4.75}\right)}$$

where

- q_c is the cone resistance
- p_a is the atmospheric pressure equal to *100 kPa*
- I_c is the soil behaviour type index calculated as given in *section 4.1*

It is suggested that this method provides a better estimation of the N value than the actual SPT test, due to its poor repeatability. But in fine grained soil with high sensitivity these methods of estimating N_{60} may overestimate it (*Jefferies and Davies, 1991*).

4.3 RELATIVE DENSITY (D_r)

Relative density, D_r , is an intermediate parameter for coarse grained soils, widely used to describe sand deposits. All the research on deriving the relative density from CPTU tests results are carried out for **clean predominantly quartz sands**. The studies have shown that CPTU resistance in granular soils is controlled by sand relative density, in situ effective stresses and compressibility. The more compressible sands tend to give lower penetration resistance for a given relative density than less compressible sands.

In this report relative density is calculated using the methods suggested by *Baldi et al., (1986)*, *Jamiolkowski et al., (2001)* and *Kulhawy and Mayne (1990)* as shown in the equations below:

1) *Baldi et al., (1986)*

$$D_r = \frac{1}{C_2} \cdot \ln \left(\frac{q_c \cdot Wehr}{C_1 \cdot (\sigma'_{v0})^{0.55}} \right) \cdot 100$$

where

C_1 is a consolidation coefficient which is **157** for normally consolidated soils and **181** for over consolidated soils

C_2 is a consolidation coefficient which is **2.41** for normally consolidated soils and **2.46** for over consolidated soils

Wehr is a correction coefficient for calcareous soils

2) Jamiolkowski et al., (2001)

$$D_r = 100 \cdot \left[0.268 \cdot \ln \left(\frac{q_t / \sigma_{atm}}{\sqrt{\sigma'_{v0} / \sigma_{atm}}} \right) + C_1 \right]$$

where

C_1 is a compressibility coefficient which is **-0.675** for average compressible soils, **≤1.0** for high compressible soils and carbonate or calcareous sands and **≥-2.0** for low compressible soils

q_t is corrected cone resistance

σ_{atm} is the atmospheric pressure

3) Kulhawy and Mayne, (1990)

$$D_r = \left[\frac{q_{c1}}{305 \cdot C_1 \cdot OCR^{0.18} \cdot (1.2 + 0.05 \cdot \log(t/100))} \right]^{0.5} \cdot 100$$

where

q_{c1} is the cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula

$$q_{c1} = \frac{q_c}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

where

q_c is the cone resistance in **kPa**

σ'_{v0} is the initial vertical effective stress in **kPa**

C_1 is a compressibility coefficient which is **-0.91** for low compressible sands, **1.0** for medium compressible sands and **1.09** for high compressible sands

t is time in years

4.4 FRICTION ANGLE (ϕ')

Friction angle, ϕ' , is used to express the shear strength of uncemented, coarse grained soils. In this report friction angle is derived by the correlations of *Mayne and Campanella (2005)*, *Robertson and Campanella (1983)* and *Kulhawy and Mayne (1990)*.

- 1) Mayne and Campanella, (2005)

$$\phi' = 29.5^0 \cdot B_q^{0.121} \cdot [0.256 + 0.336 \cdot B_q + \log Q_t]$$

where

B_q is the pore pressure ratio, calculated as in Session 3.3

Q_t is the normalized cone resistance

- 2) Robertson and Campanella, (1983)

$$\phi' = \tan^{-1} \left(0.1 + 0.38 \cdot \log \left(\frac{q_t}{\sigma'_{v0}} \right) \right)$$

where

q_c is the cone resistance in *kPa*

σ'_{v0} is the initial vertical effective stress in *kPa*

- 3) Kulhawy and Mayne, (1990)

$$\phi' = 17.6^0 + 11.0^0 \cdot \log(q_{t1})$$

where

q_{t1} is the corrected cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula

$$q_{t1} = \frac{q_t}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

The method suggested by *Mayne and Campanella (2005)* will not provide reliable results for heavily over consolidated soils, fissured geomaterials and highly cemented or structures clays. This approach gives reliable results when pore pressure is positive and varies $0.1 < B_q < 1.0$. The correlation suggested by *Robertson and Campanella (1983)* estimates the peak friction angle for uncemented, unaged, moderately compressible, predominately quartz sands. For sands of higher compressibility, the method will tend to predict low friction angles. The method suggested by *Kulhawy and Mayne (1990)* is an alternate relationship for clean, rounded, uncemented, quartz sands.

4.5 FINES CONTENT (FC)

The fines content, FC , in this report is estimated using two different methods, one from *Robertson and Wride (1998)* and the other, *Suzuki et al. (1998)* as presented below:

- 1) Robertson and Wride (1998)

$$I_c < 1.26: FC = 0$$

$$1.26 \leq I_c \leq 3.5: FC(\%) = 1.75I_c^{3.25} - 3.7$$

$$3.5 < I_c: FC = 100\%$$

- 2) Suzuki et al. (1998)

$$FC(\%) = 2.8I_c^{2.6}$$

where

I_c is the soil behaviour type index, calculated as in section 4.1

4.6 UNDRAINED SHEAR STRENGTH (s_u)

Estimation of undrained shear strength, s_u , from CPTU tests using corrected cone resistance is carried out using the following correlation from *Lunne et al. (1981)*:

$$S_u = \frac{(q_t - \sigma_{v0})}{N_{kt}}$$

where

N_{kt} is the empirical cone factor, which varies from 10 (6 for very soft sensitive fine grained soils) to 20. In this report 3 values are considered: 15, 17.5 and 20. N_{kt} tends to increase with increasing plasticity and decrease with increasing soil sensitivity. It decreases as B_q increases. (*Lunne et al., 1997*)

σ_{v0} = total overburden stress.

This report only presents the undrained shear strength data on soils with soil behaviour type index, I_c values greater than 2.60.

The value of undrained shear strength, s_u to be used in analysis depends on the design problem. In general, the simple shear in the direction of loading often represents the average undrained strength. For larger, moderate to high risk projects, where high quality field and laboratory data may be available, site specific correlations should be developed based on appropriate and reliable values of s_u .

4.7 SENSITIVITY (S_t)

The sensitivity, S_t of clays is defined as the ratio of undisturbed peak undrained shear strength to totally remoulded undrained shear strength.

In this report S_t is calculated using two correlations developed by *Schmertmann (1978)* and *Mayne (2007)*.

- 1) Schmertmann (1978)

$$S_t = \frac{s_u}{s_{u(rem)}} = \frac{q_t - \sigma_v}{N_{kt}} \left(\frac{1}{f_s} \right)$$

where

$s_{u(rem)}$ is the remoulded undrained shear strength. It can be assumed equal to the sleeve resistance, f_s .

- 2) Mayne (2007)

$$S_t = \frac{0.073 \cdot (q_t - \sigma_{v0})}{f_s}$$

For relatively sensitive clays, $S_t > 10$, the value of f_s can be very low and not very accurate, hence the estimate of sensitivity should be used as a guide only.

4.8 SOIL UNIT WEIGHT (γ)

Soil unit weight, γ in this report is calculated by using one method for sands, considered under dry conditions and two methods for clays, considered under saturated conditions. These relationships are developed by *Mayne (2007)* and the equations are presented below:

- 1) Mayne (2007)

Dry unit weight for sands:

$$\gamma_{dry} = 1.89 \cdot \log(q_{t1}) + 11.82$$

Saturated unit weight for clays method 1

$$\gamma_{sat} = 8.32 \cdot \log(V_s) - 1.61 \cdot \log(z)$$

Saturated unit for clays method 2

$$\gamma_{sat} = 2.60 \cdot \log(f_s) + 15 \cdot G_s - 26.5$$

where

q_{t1} is the corrected cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula:

$$q_{t1} = \frac{q_t}{\sqrt{\sigma'_{v0} \cdot \sigma_{atm}}}$$

z is the depth

V_s is the shear wave velocity, calculated as $V_s = 118.8 \cdot \log(f_s) + 18.5$

G_s is the specific gravity of solids, typically between 2.40 and 2.90

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APPENDIX A

APPENDIX A1 – Project Summary Sheet

Piezoecone Tests Summary Sheet

HOLE ID	Final Depth (m)	Date of Test	Cone Used	Test Remarks
CPT01	9.99	21/06/2022	DP10-CFPTxy.60195	Test completed at target depth.
CPT02	14.99	21/06/2022	DP10-CFPTxy.60195	Test completed at target depth.
CPT03	9.99	21/06/2022	DP10-CFPTxy.60195	Test completed at target depth.
CPT04	9.97	21/06/2022	DP10-CFPTxy.60195	Test completed at target depth.
CPT05	9.97	21/06/2022	DP10-CFPTxy.60195	Test completed at target depth.
CPT06	19.97	21/06/2022	DP10-CFPTxy.60195	Test completed at target depth.
CPT07	9.99	21/06/2022	DP10-CFPTxy.60195	Test completed at target depth.
CPT08	9.20	21/06/2022	DP10-CFPTxy.60195	Test refused on total pressure.

Piezoecone Tests Coordinates

HOLE ID	Eastings	Northings	Elevation
CPT01	391444.52	411543.89	152.40
CPT02	391467.27	411494.30	151.72
CPT03	391409.56	411511.81	154.21
CPT04	391337.53	411504.78	154.03
CPT05	391294.34	411511.67	151.79
CPT06	391310.52	411469.29	153.57
CPT07	391293.94	411437.62	151.10
CPT08	391227.32	411367.47	156.16

APPENDIX A2 – CPT Rig Datasheet

RIGS

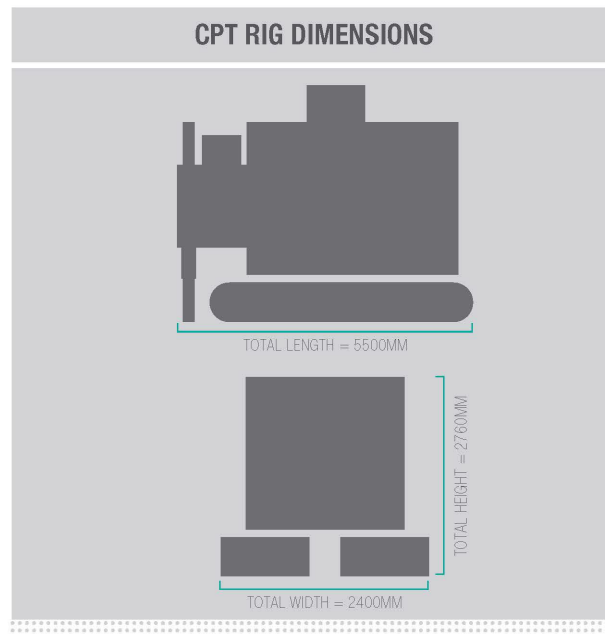
20 TONNE CPT TRACK MOUNTED RIGS (CPT012) and (CPT022)

CPT012 (Bob) and CPT022 (Vic) are 20 Tonne tracked crawler rigs. Their relatively high weight serves as a counterweight to provide the required penetrative force when testing. These machines are ideal for soft, boggy sites where access can be tricky. Fitted with three levelling jacks, the crawlers can be levelled exactly horizontally assuring stability during testing. All movements of the rigs are driven hydraulically using a remote control thus allowing 100% accuracy over positions.

CPT RIG DETAILS

DRIVE SYSTEM	TRACKED RIG
TOTAL WEIGHT	20 TONNES
GROUND BEARING PRESSURE	36KPA
CPT RAM THRUST CAPACITY	20 TONNES
MAXIMUM PENETRATION	20-40M DEPENDING ON THE GROUND CONDITIONS.
PERFORMANCE RATES	100-150M OF TESTING A DAY, DEPENDING ON ACCESS TO POSITIONS.
TYPICAL SITES FOR THIS RIG	SOFT, BOGGY SITES. LOW GROUND BEARING PRESSURE

CPT RIG DIMENSIONS



APPENDIX A3 – Cone Datasheet

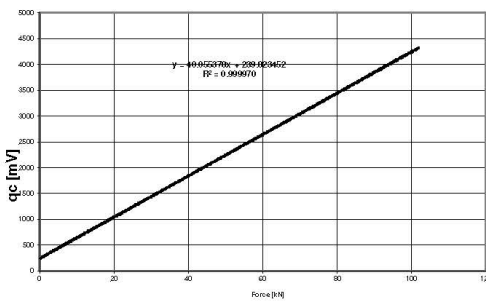
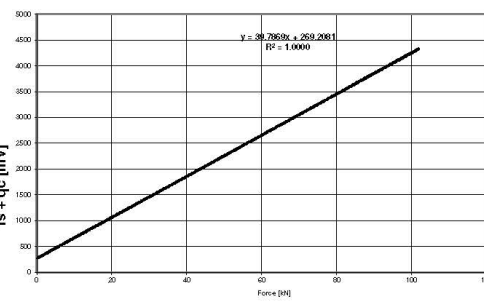


Manual: Electric CPT Cone P10-CFPTxy and P15CFPTxy (PIEZOCONE)

All cones are temperature compensated and provided with a built-in precision strain-gauge amplifier. The cone characteristics and available measurement ranges are listed below.

2	Technical Specifications	P10CFPTxy	P15CFPTxy
	Overall length	: 254 mm	307 mm
	Section area of conical tip	: 1,000 mm ²	1,500 mm ²
	Apex angle of conical tip	: 60°	60°
	Surface of friction sleeve	: 15,000 mm ²	22,500 mm ²
	Weight	: 1,480 gr	2,250 gr
	Power supply	: 5 Vdc	5 Vdc
	Analogue signal output	: 0 – 5 Vdc	0 – 5 Vdc
	Digital signal output	: RS-485	RS-485
	Screw thread	: Female GHD-36	Female GHD-44
	Connector	: Gold-plated 10 pins	Gold-plated 10 pins
	Working temperature	: 0 till 60 °C	0 till 60 °C
	Storage temperature	: -40 till 85 °C	-40 till 85 °C
	Cone Resistance (q_c)		
	Available measuring ranges *)	: 0 – 100 MPa	0 – 100 MPa
	Accuracy	: 0.25% of the full scale (FS)	0.25% of the full scale
	Maximum allowable load	: 150% of the measuring range	150% of the range
	Cone area factor	: 0.71	0.75
	Local Sleeve Friction (f_s) + Cone Resistance (q_c)		
	Available measuring ranges *)	: 0 – 100 kN	0 – 150 kN
	Accuracy local sleeve friction	: 0.50% of the full scale (FS)	0.50% of the full scale
	Maximum allowable load	: 150% of the measuring range	150% of the range
	Sleeve area ratio	: 1.0	1.0
	Inclination	(biaxial)	
	Available measuring range	: 0 – 25° (biaxial)	0 – 25° (biaxial)
	Accuracy	: < 0,5°	< 0,5°
	Pore Pressure (p)		
	Available measuring ranges *)	: 0 – 5 MPa (standard)	0 – 5 MPa
	Accuracy	: 0.5% of the full scale (FS)	0.5% of the full scale
	Temperature (T)		
	Available measuring ranges	: 0 – 50 °C	0 – 50 °C

APPENDIX A4 – Cone Calibration Certificate

 WWW.GOUDA-GE.COM Down to Earth	Gouda Geo-Equipment B.V. Satellietbaan 8 2181 MH Hillegom The Netherlands Tel. + 31 (0)715.318.475 E-mail: info@gouda-geo.com Certificate of Calibration Certificate No. CMI 22.06.4686
Instrument	
Instrument Type: Electrical Subtraction Cone Manufacturer: Gouda Geo-Equipment B.V. Model No.: DP10-CFPTxy Serial No.: 60195 Cone area factor: 0,71 Used Calibration Procedure: GGECP004, ISO22476	Calibration Result: Certified Date Calibrated: 9-6-2022 Next Due Date: 9-12-2022 Location: Hillegom (The Netherlands)
Customer	
In Site Site Investigation Ltd.	
Calibration Instruments	
Instrument Type: CPT Logger Manufacturer: Gouda Geo Equipment Model No.: A Serial No.: 3010 Accuracy: 0.01% + 2 Counts Date Calibrated: 20 December, 2021 Next Due Date: 20 June, 2022 Calibrated By: Manufacturer Traceability: CMI 21.12.4332	Instrument Type: CPT Logger Manufacturer: Gouda Geo Equipment Model No.: A Serial No.: 3129 Accuracy: 0.01% + 2 Counts Date Calibrated: 20 December, 2021 Next Due Date: 20 June, 2022 Calibrated By: Manufacturer Traceability: CMI 21.12.4333
Instrument Type: Load-cell + amplifier Manufacturer: Futek Model No.: LCF500 + IAA100 Serial No.: 704380 + 695053 Accuracy: 0.1% Date Calibrated: 16 June, 2021 Next Due Date: 16 June, 2022 Calibrated By: Futek Traceability: 2106160028	
Calibration Conditions	
Environmental conditions whilst performing the calibration: Ambient Temperature: 51.1 °C Relative Humidity: 21.7 % Condition of Calibrated Apparatus when Received: Fair	
Measurement Parameters	
zero value 238 mV Full scale 4006 @ 100 kN 	zero value 272 mV Full scale 3979 @ 100 kN 
Remarks	
Data "As Received" = "As Left" unless otherwise noted. Calibration data for this item was derived from one or more of the following sources: the Netherlands Meetinstituut (NMI) or other national laboratory, a natural physical constant, or a ratio technique. The data is on file at the NMI. This calibration is compliant with Gouda Geo-Equipment's internal quality system, internal calibration procedure and meets the requirements of standard ISO22476. The Calibration Interval will vary from customer use and different conditions. All calibrations are verified at a moment in time; and confirmed within controlled temperature and humidity specified standards. Gouda Geo-Equipment is not responsible for future calibrations. Improper use of the apparatus (e.g. dropping) may cause loss of calibration.	
Calibration performed by: Vincent Vermeer (Engineer)	Approved by: Rogier Tijm (Senior Engineer)

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APPENDIX A5 – Symbol List

English

a	is area ratio of the cone ($= A_n/A_c$)
A	is area
A_c	is projected area of the cone
A_n	is cross sectional area of load cell or shaft
A_s	is area of friction sleeve
A_{sb}	is bottom end area of friction sleeve
A_{st}	is top end area of friction sleeve
B_q	is pore pressure parameter ($= (u_2 - u_0)/(q_t - \sigma_{v0})$)
C_h	is horizontal coefficient of consolidation
C_v	is vertical coefficient of consolidation
D	is diameter
D_r	is relative density ($= \frac{e_{max}-e}{e_{max}-e_{min}} \times 100\%$)
e	is void ratio
e_{max}	is maximum void ratio
e_{min}	is minimum void ratio
E	is Young's modulus
f_s	is unit sleeve friction resistance
f_t	is sleeve friction corrected for pore pressure effects
F_s	is total force acting on friction sleeve
F_R	is normalized friction ratio ($= f_s/(q_t - \sigma_{v0})$)
FoS	is factor of safety
FC	is fines content
g	is acceleration due to gravity
G_0	is initial or maximum shear modulus, shear stiffness
I_c	is soil behavior type index
I_r	is rigidity index ($= G/s_u$)
I_p	is plasticity index
k	is coefficient of permeability
k_h	is coefficient of permeability in horizontal direction
k_v	is coefficient of permeability in vertical direction
K_0	is coefficient of earth pressure at rest ($= \sigma'_{h0}/\sigma'_{v0}$)
L	is length
m_v	is coefficient of volume change
M	is constrained deformation modulus
M7.5	is earthquake magnitude of 7.5 Richter scale
N	is number of blows of SPT
N_{60}	is SPT energy ratio
N_k	is cone factor
N_{ke}	is cone factor
N_{kt}	is cone factor
$N_{\Delta u}$	is cone factor
p_a	is reference stress ($= 100 \text{ kPa}$)
q_c	is measured cone resistance
q_e	is effective cone resistance ($= q_t - u_2$)
q_n	is net cone resistance ($= q_t - \sigma_{v0}$)
q_t	is corrected cone resistance ($= q_c - (1 - a)u_2$)
Q_c	is total force acting on the cone
Q_t	is normalized cone resistance ($= q_t - \sigma_{v0}/\sigma'_{v0}$)

R_f	is friction ratio $(= (f_t/q_t) \times 100\%)$ or alternatively $(= (f_t/q_t) \times 100\%)$
s_u	is undrained shear strength
s_{ur}	is remoulded undrained shear strength
S_t	is sensitivity
t	is time
t_{50}	is time for 50% dissipation of excess pore water pressure
T_{50}	is time factor at $U = 50\%$
u	is pore water pressure
u_0	is in situ pore pressure
u_1	is pore pressure measured on the cone
u_2	is pore pressure measured behind the cone
u_3	is pore pressure measured behind sleeve friction
Δu	is excess pore water pressure
U	is normalized excess pore pressure
V_s	is shear wave velocity
z	is depth

Greek

α	is constant
α	is cone roughness
β	is constant
β_1	is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees
β_2	is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1 , in degrees
γ	is unit weight of soil
γ_w	unit weight of water
Δ	is change
Δu	is excess pore pressure $(= u - u_0)$
μ	is Poisson's ratio
ρ	is density
ψ	is state parameter
σ, σ'	is normal stress (total, effective)
σ_h, σ'_h	is horizontal stress (total, effective)
σ_v, σ'_v	is horizontal stress (total, effective)
$\sigma_{v0}, \sigma'_{v0}$	is overburden stress (total, effective)
T_{av}	is average cyclic shear stress
T_{cy}	is cyclic shear stress
ϕ'	is effective friction angle

APPENDIX A6 –Abbreviations

ASTM	American Society for Testing and Materials
CPTU	Cone Penetration Test with Pore Pressure Measurement (Piezocone Test)
CRR	Cyclic Resistance Ratio
CSR	Cyclic Stress Ratio
GWT	Ground Water Table
NC	Normally Consolidated
OC	Over consolidated
OCR	Over consolidation Ratio
PL	Limit Pressure
SDMT	Seismic Dilatometer Marchetti
SPT	Standard Penetration Test
TC	Technical Committee

APPENDIX A7 – Glossary

CPT

Cone Penetration Test.

Cone

The part of the cone penetrometer on which the end bearing is developed.

Cone Penetrometer

The assembly containing the *cone*, *friction sleeve*, any other sensors and measuring systems, as well as the connections to the *push-rods*.

Cone resistance, q_c

The total force acting on the cone, Q_c , divided by the projected area of the cone, A_c . $q_c = Q_c / A_c$

Corrected cone resistance, q_t

The *cone resistance*, q_c corrected for pore water pressure effects.

Corrected sleeve friction, f_t

The *sleeve friction* corrected for pore water pressure effects on the ends of the *friction sleeve*.

Data acquisition system

The system used to measure and record the measurements made by the *cone penetrometer*.

Dissipation Test

A test when the decay of the pore water pressure is monitored during a pause in penetration.

Filter element

The porous element inserted into the cone penetrometer to allow transmission of the pore water pressure to the pore pressure sensor, while maintaining the correct profile of the *cone penetrometer*.

Friction ratio, R_f

The ratio, expressed as a percentage of the *sleeve friction*, f_s , to the *cone resistance*, q_c , both measured at the same depth.

Friction reducer

A local enlargement on the push-rod surface, placed at a distance above the cone penetrometer, and provided to reduce the friction on the *push-rods*.

Friction sleeve

The section of the *cone penetrometer* upon which the *sleeve friction* is measured.

Normalized cone resistance, Q_c or Q_t

The *cone resistance* expressed in a non-dimensional form and taking account of stress changes *in situ*, $Q_c = (q_c - \sigma_{v0}) / \sigma'_{v0}$, or when the *corrected cone resistance* is used $Q_t = (q_t - \sigma_{v0}) / \sigma'_{v0}$. Where σ_{v0} and σ'_{v0} are the total and effective vertical stress respectively.

Net cone resistance, q_n

The *corrected cone resistance* minus the vertical total stress. $q_n = q_t - \sigma_{v0}$

Normalized friction ratio, F_r

The *sleeve friction* normalized by the *net cone resistance*.

Piezococone

A *cone penetrometer* containing a pore pressure sensor.

Pore pressure, u

The pore pressure generated during penetration and measured by a pore pressure sensor, u_1 when measured on the cone, u_2 when measured just behind the cone and u_3 when measured just behind the friction sleeve.

Pore pressure ratio, B_q

The *net pore pressure* normalized with respect to the *net cone resistance*.

Push-rods

The thick-walled tubes or rods used for advancing the cone penetrometer.

Rig machine

The equipment which pushes the cone penetrometer and rods into the ground.

Sleeve friction, f_s

The total frictional force acting on the *friction sleeve*, F_s , divided by its *surface area*, A_s . $f_s = F_s / A_s$

APPENDIX A8 – Soils Description Tables

GRANULAR SOILS (Sands and Gravels)

Description	Relative Density D_r (%)	SPT N value, N_{SPT}
Very Loose	0 – 15	0 - 4
Loose	15 – 35	4 - 10
Medium Dense	35 – 65	10 - 30
Dense	65 – 85	30 - 50
Very Dense	>85	>50

COHESIVE SOILS (Clays and Silts)

Term based on measurement	Undrained Shear Strength Classification, s_u (kPa)
Extremely low	<10
Very low	10 - 20
Low	20 - 40
Medium	40 - 75
High	75 - 150
Very high	150 - 300
Extremely high	>300

APPENDIX B

Cone Penetration Measured Parameters and Geotechnical Derived Parameters

PointID

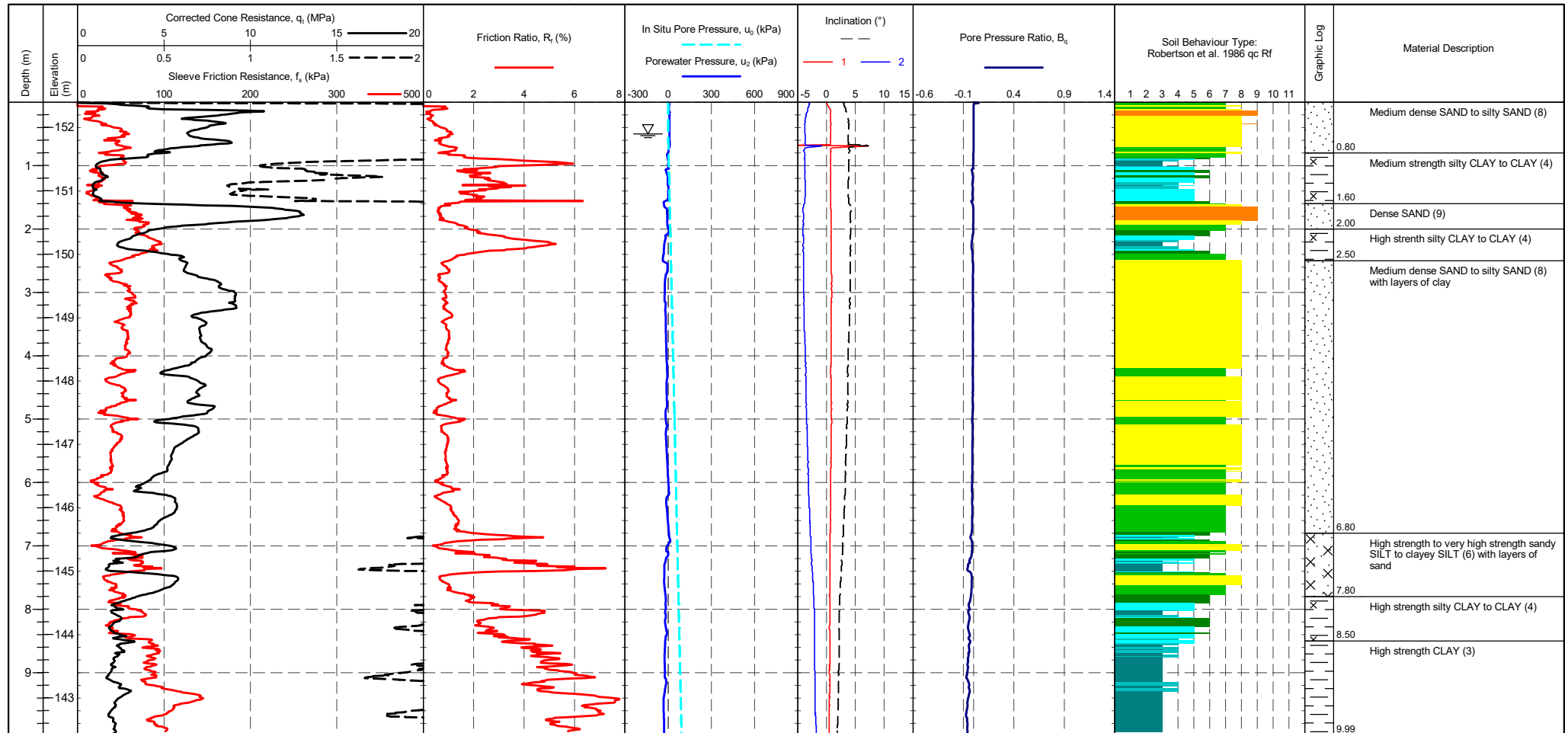
CPT01

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391444.521 m
NORTHING : 411543.888 m
ELEVATION : 152.397 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE
TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPT ZERO VALUES
Transducer Pre Post Difference
Tip (MPa) 0.0578 0.0825 -0.0248
Sleeve (kPa) 0.00784 0.00745 0.0004
 u_2 (kPa) 0.00976 0.0103 -0.0005
Inclinometer 1 ($^\circ$) 0.0530 0.130 -0.0768
Inclinometer 2 ($^\circ$) -2.84 -2.83 -0.0058

METHOD: Robertson et al. 1986 $q_c R_f$

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravely SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test

PointID

CPT01

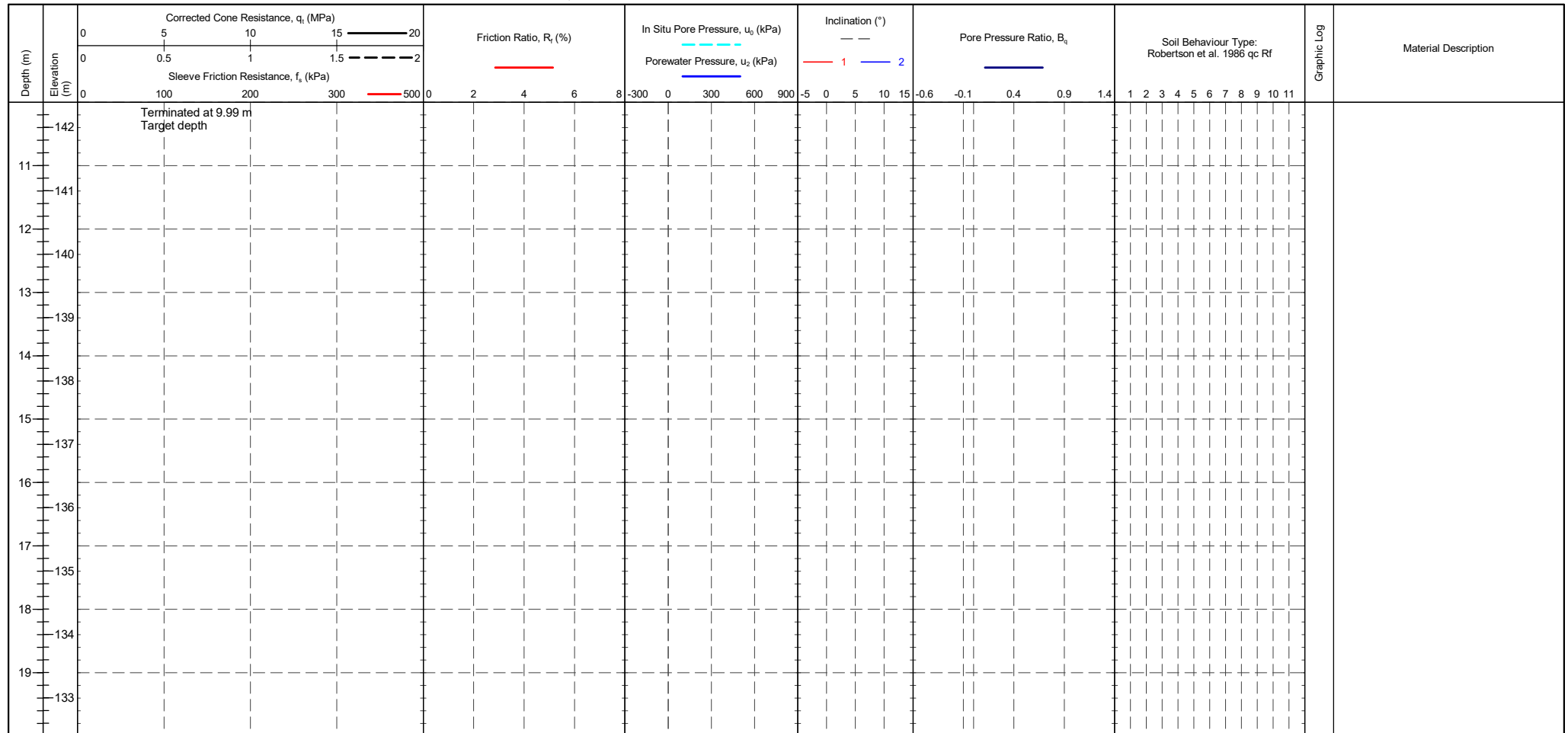
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PROJECT : Plot J2 Rochdale

LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391444.521 m
NORTHING : 411543.888 m
ELEVATION : 152.397 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0825	-0.0248
Sleeve (kPa)	0.00784	0.00745	0.0004
u2 (kPa)	0.00976	0.0103	-0.0005
Inclinometer 1 (°)	0.0530	0.130	-0.0768
Inclinometer 2 (°)	-2.84	-2.83	-0.0058

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

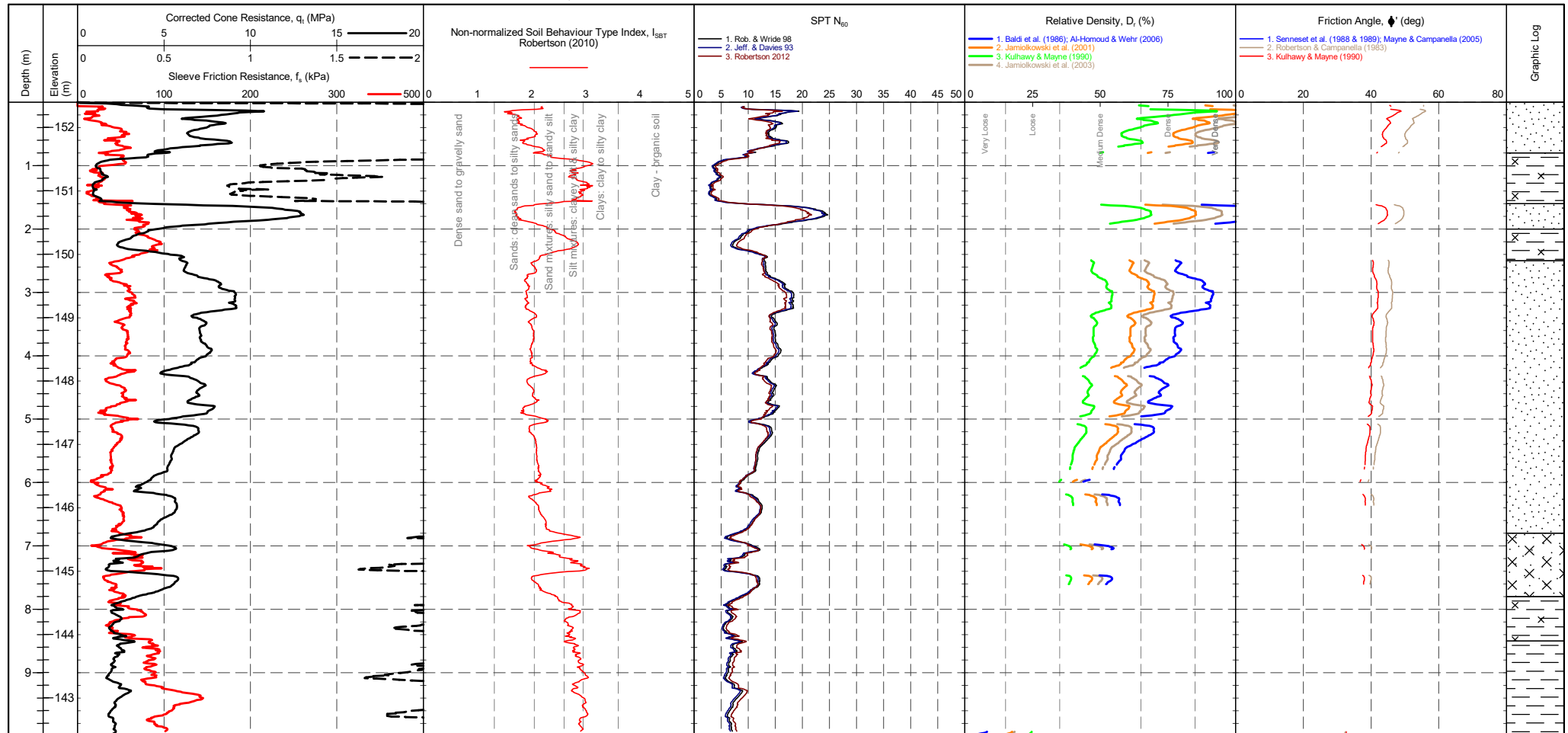
CPT01

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391444.521 m
NORTHING : 411543.888 m
ELEVATION : 152.397 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0825	-0.0248
Sleeve (kPa)	0.00784	0.00745	0.0004
u2 (kPa)	0.00976	0.0103	-0.0005
Inclinometer 1 (°)	0.0530	0.130	-0.0768
Inclinometer 2 (°)	-2.84	-2.83	-0.0058

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test

PointID

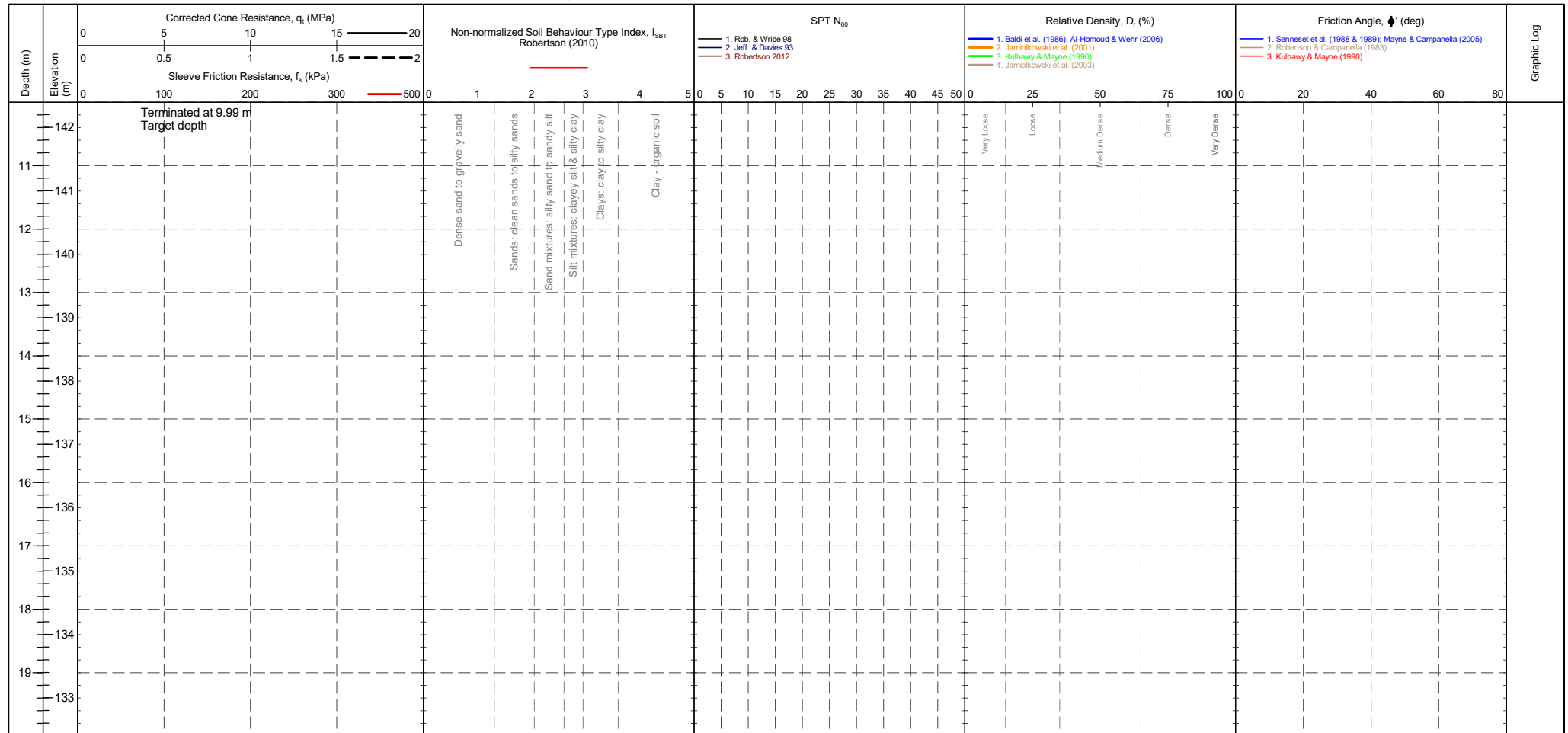
CPT01

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391444.521 m
NORTHING : 411543.888 m
ELEVATION : 152.397 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0825	-0.0248
Sleeve (kPa)	0.00784	0.00745	0.0004
u2 (kPa)	0.00976	0.0103	-0.0005
Inclinometer 1 (")	0.0530	0.130	-0.0768
Inclinometer 2 (")	-2.84	-2.83	-0.0058

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12			
Description	SBT Index, I_c	Description	SPT N value, NSPT
Clays	2.95-3.60	Very Loose	0 - 4
Silt mixtures	2.60-2.95	Loose	4 - 10
Sand mixtures	2.05-2.60	Medium Dense	10 - 30
Sands	1.31-2.05	Dense	30 - 50
Gravelly sand	<1.31	Very Dense	>50

Groundwater Level
Dissipation Test

PointID

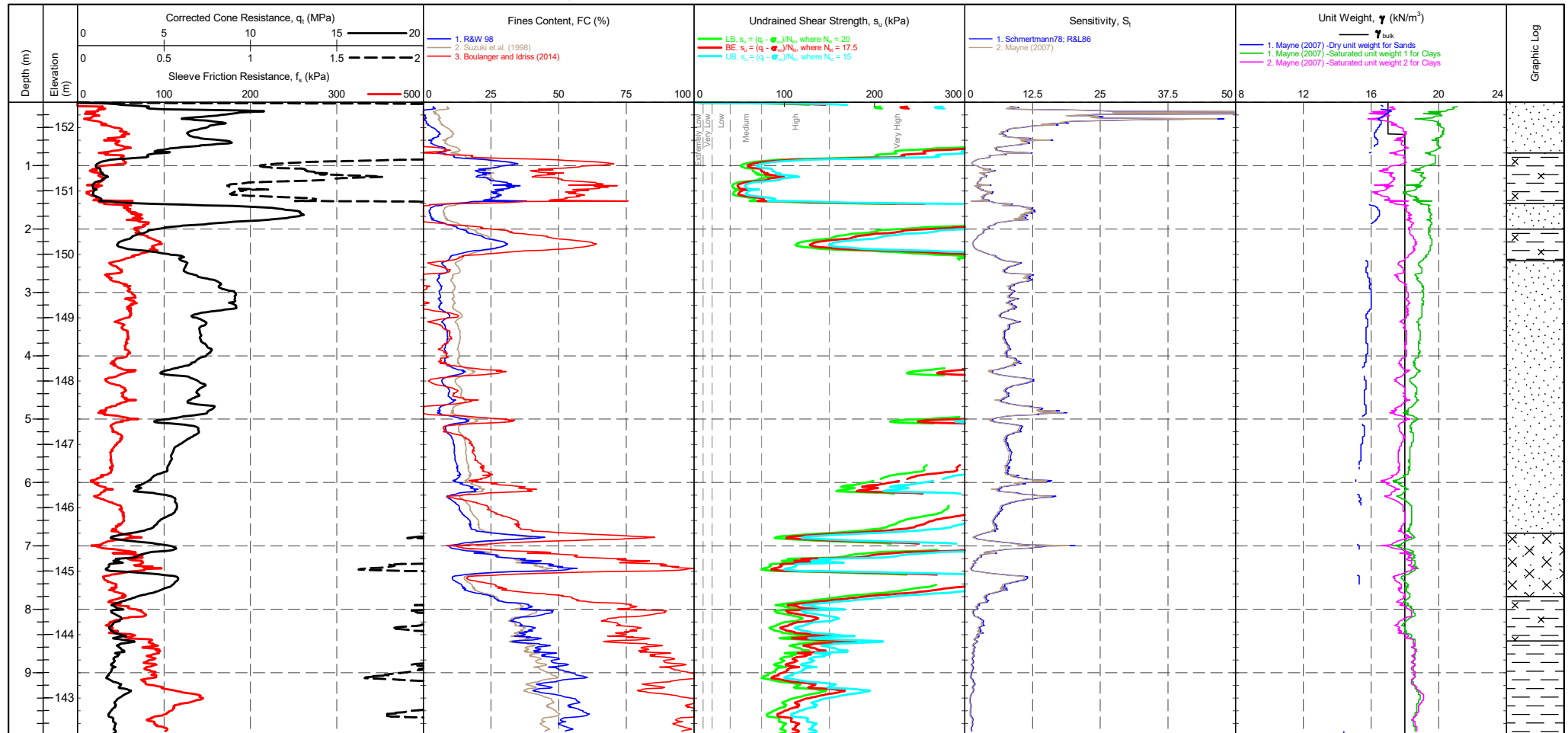
CPT01

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391444.521 m
NORTHING : 411543.888 m
ELEVATION : 152.397 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0825	-0.0248
Sleeve (kPa)	0.00784	0.00745	0.0004
u2 (kPa)	0.00976	0.0103	-0.0005
Inclinometer 1 (°)	0.0530	0.130	-0.0768
Inclinometer 2 (°)	-2.84	-2.83	-0.0058

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

CPT01

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391444.521 m
NORTHING : 411543.888 m
ELEVATION : 152.397 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

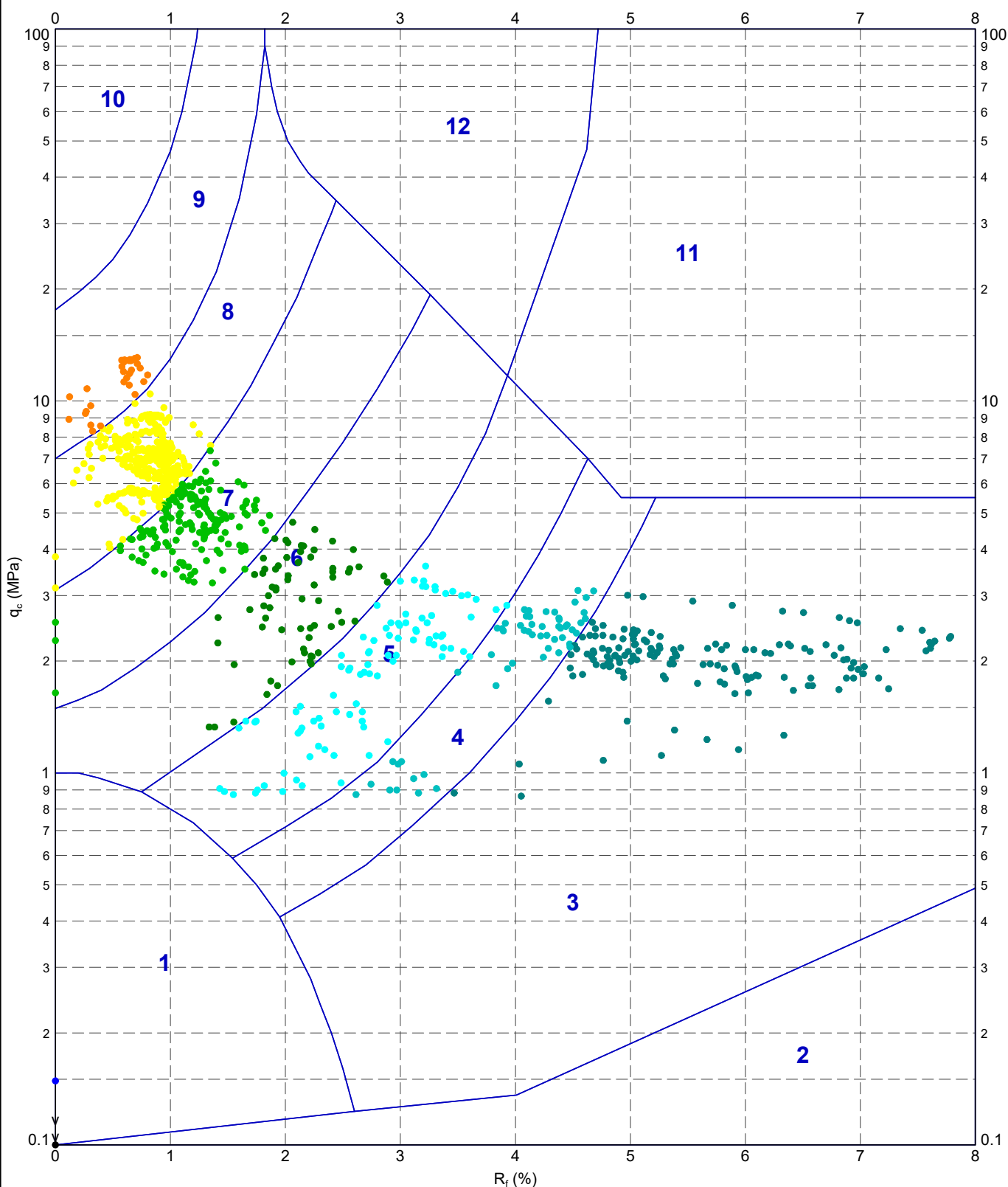
Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0825	-0.0248
Sleeve (kPa)	0.00784	0.00745	0.0004
u2 (kPa)	0.00976	0.0103	-0.0005
Inclinometer 1 (°)	0.0530	0.130	-0.0768
Inclinometer 2 (°)	-2.84	-2.83	-0.0058

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:12 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: In Situ SI 2.02.0 2017-07-10 Pjt: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs. R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

TITLE

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 q_c vs. R_f - CPT01

DRAWN

DATE

27/06/2022

CHECKED

DATE

27/06/2022

SCALE

Not To Scale

A4

PROJECT No

1220329

FIGURE No

PointID

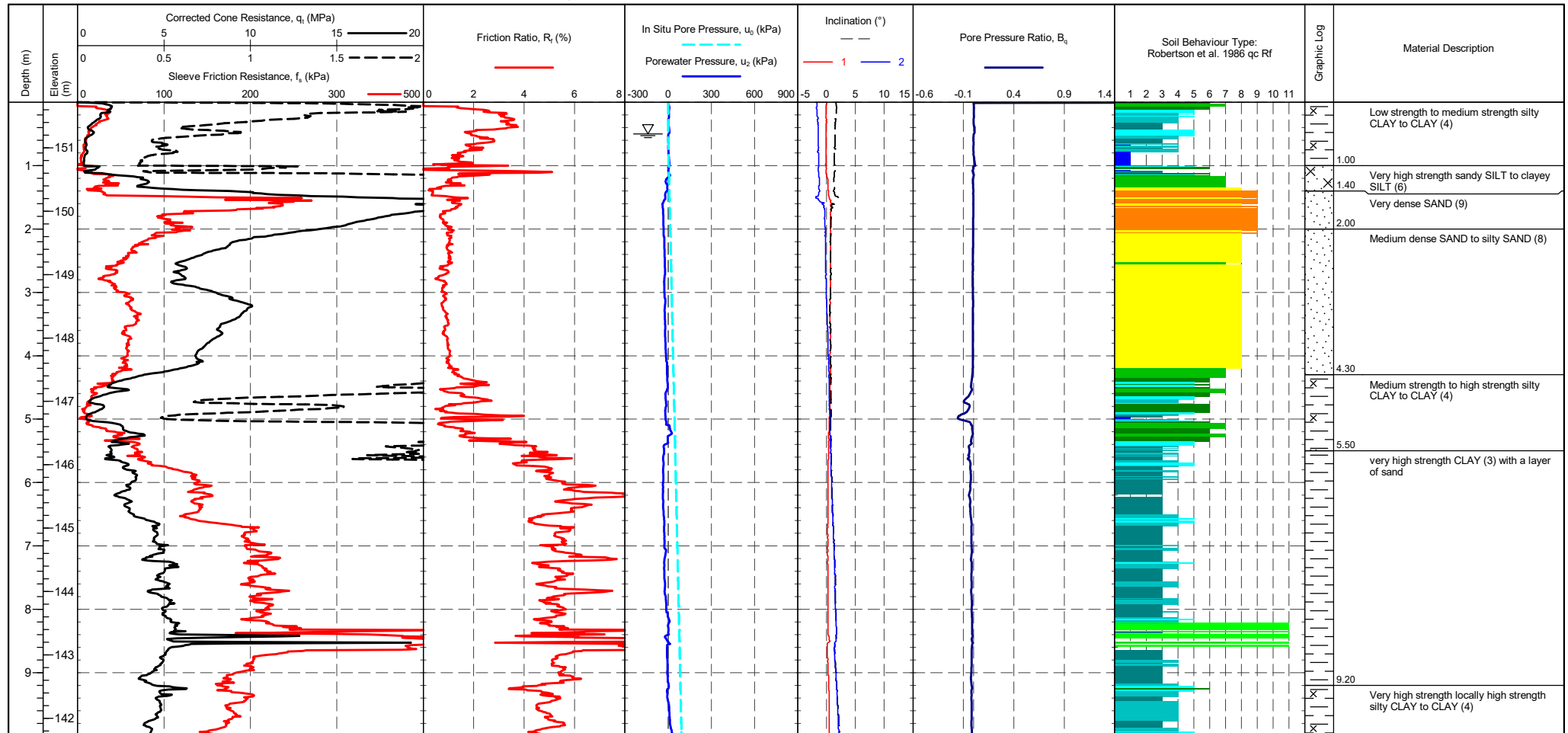
CPT02

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391467.267 m
NORTHING : 411494.304 m
ELEVATION : 151.719 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPT ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0908	0.0578	0.033
Sleeve (kPa)	0.00829	0.0103	-0.0021
u2 (kPa)	0.00984	0.00244	0.0074
Inclinometer 1 ($^\circ$)	0.0123	0.0929	-0.0806
Inclinometer 2 ($^\circ$)	-1.78	-1.81	0.0363

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravely SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

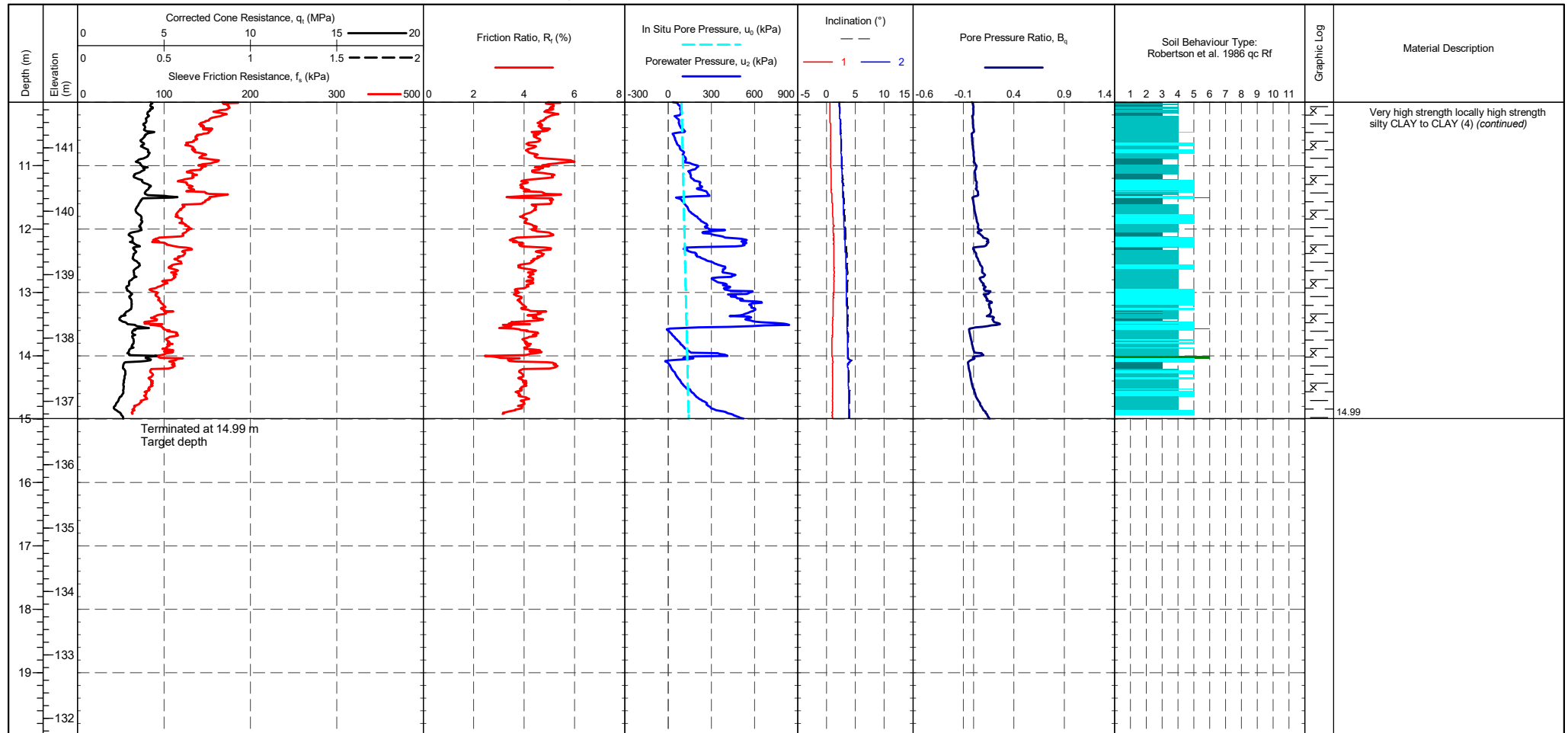
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CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391467.267 m
NORTHING : 411494.304 m
ELEVATION : 151.719 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0908	0.0578	0.033
Sleeve (kPa)	0.00829	0.0103	-0.0021
u_2 (kPa)	0.00984	0.00244	0.0074
Inclinometer 1 ($^\circ$)	0.0123	0.0929	-0.0806
Inclinometer 2 ($^\circ$)	-1.78	-1.81	0.0363

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

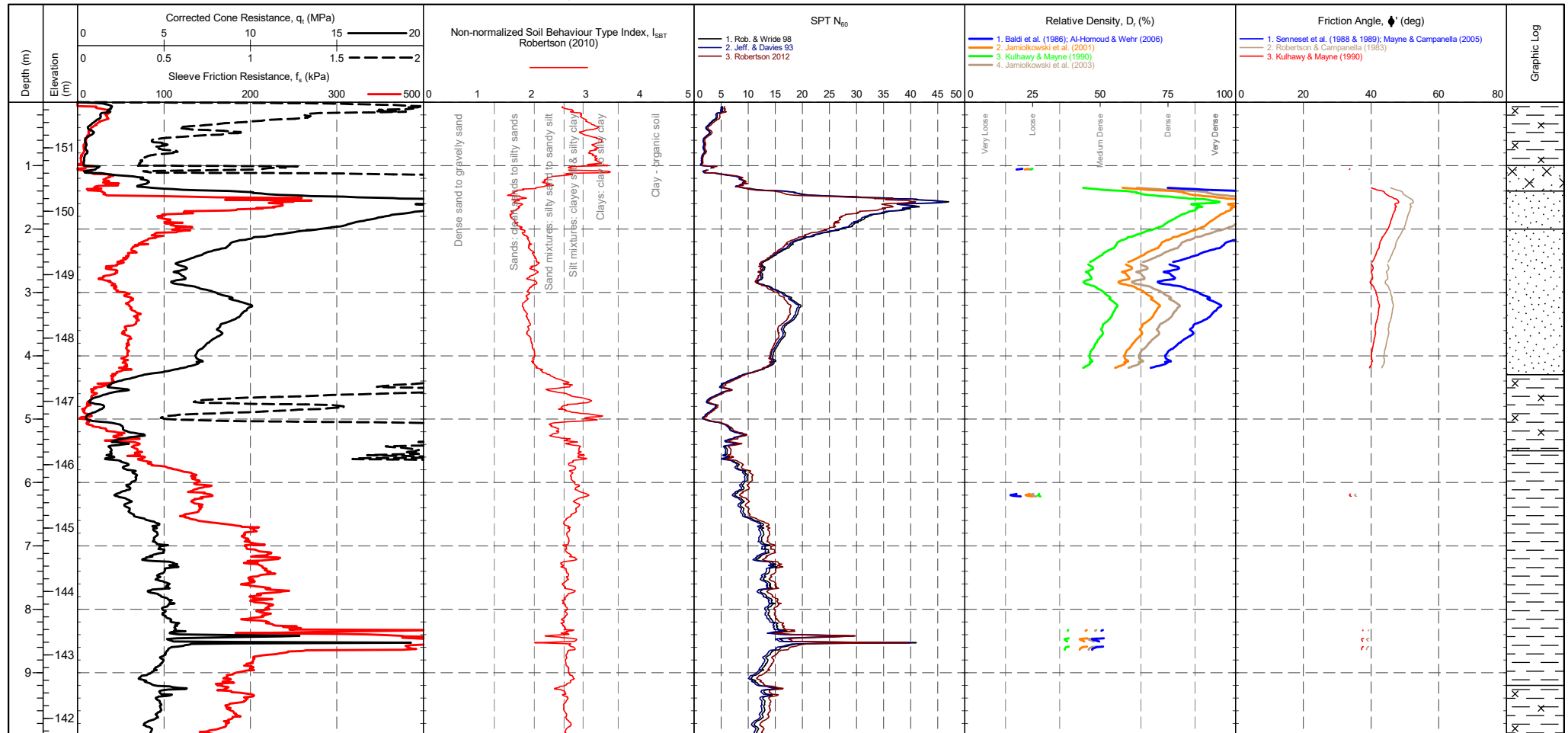
CPT02

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391467.267 m
NORTHING : 411494.304 m
ELEVATION : 151.719 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
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Sleeve (kPa)	0.00829	0.0103	-0.0021
u2 (kPa)	0.00984	0.00244	0.0074
Inclinometer 1 (°)	0.0123	0.0929	-0.0806
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GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test

PointID

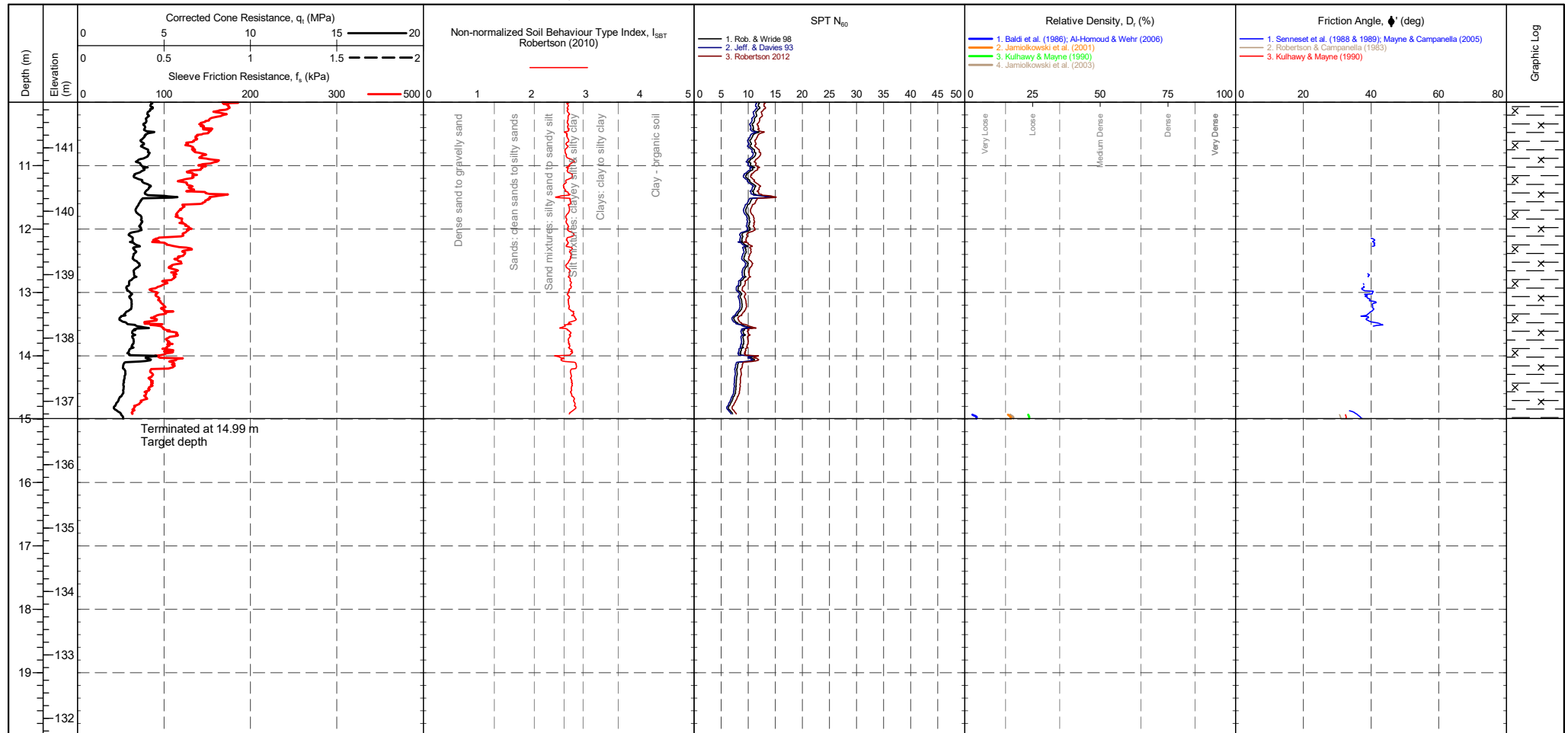
CPT02

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391467.267 m
NORTHING : 411494.304 m
ELEVATION : 151.719 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0908	0.0578	0.033
Sleeve (kPa)	0.00829	0.0103	-0.0021
u2 (kPa)	0.00984	0.00244	0.0074
Inclinometer 1 (°)	0.0123	0.0929	-0.0806
Inclinometer 2 (°)	-1.78	-1.81	0.0363

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test

PointID

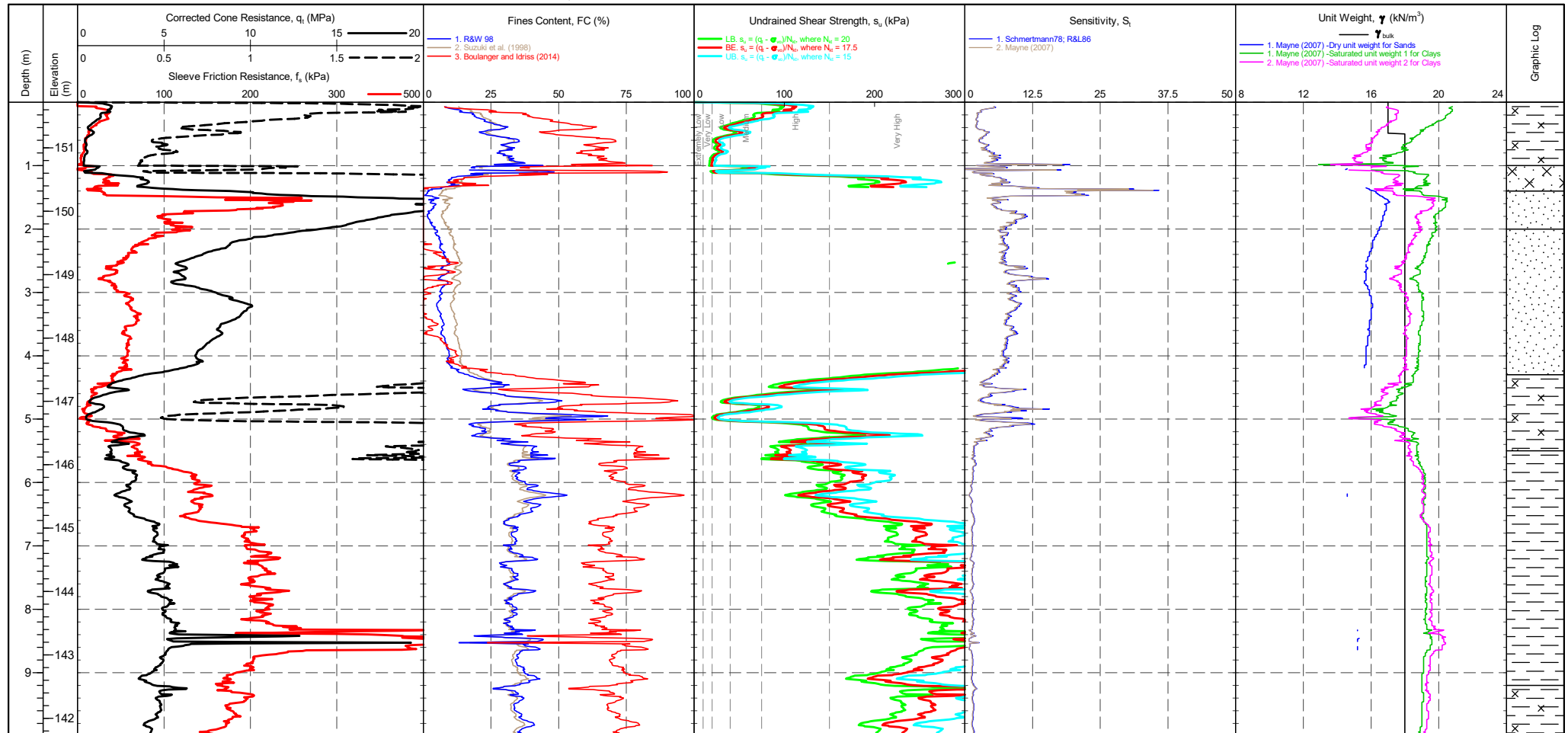
CPT02

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391467.267 m
NORTHING : 411494.304 m
ELEVATION : 151.719 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0908	0.0578	0.033
Sleeve (kPa)	0.00829	0.0103	-0.0021
u2 (kPa)	0.00984	0.00244	0.0074
Inclinometer 1 (°)	0.0123	0.0929	-0.0806
Inclinometer 2 (°)	-1.78	-1.81	0.0363

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

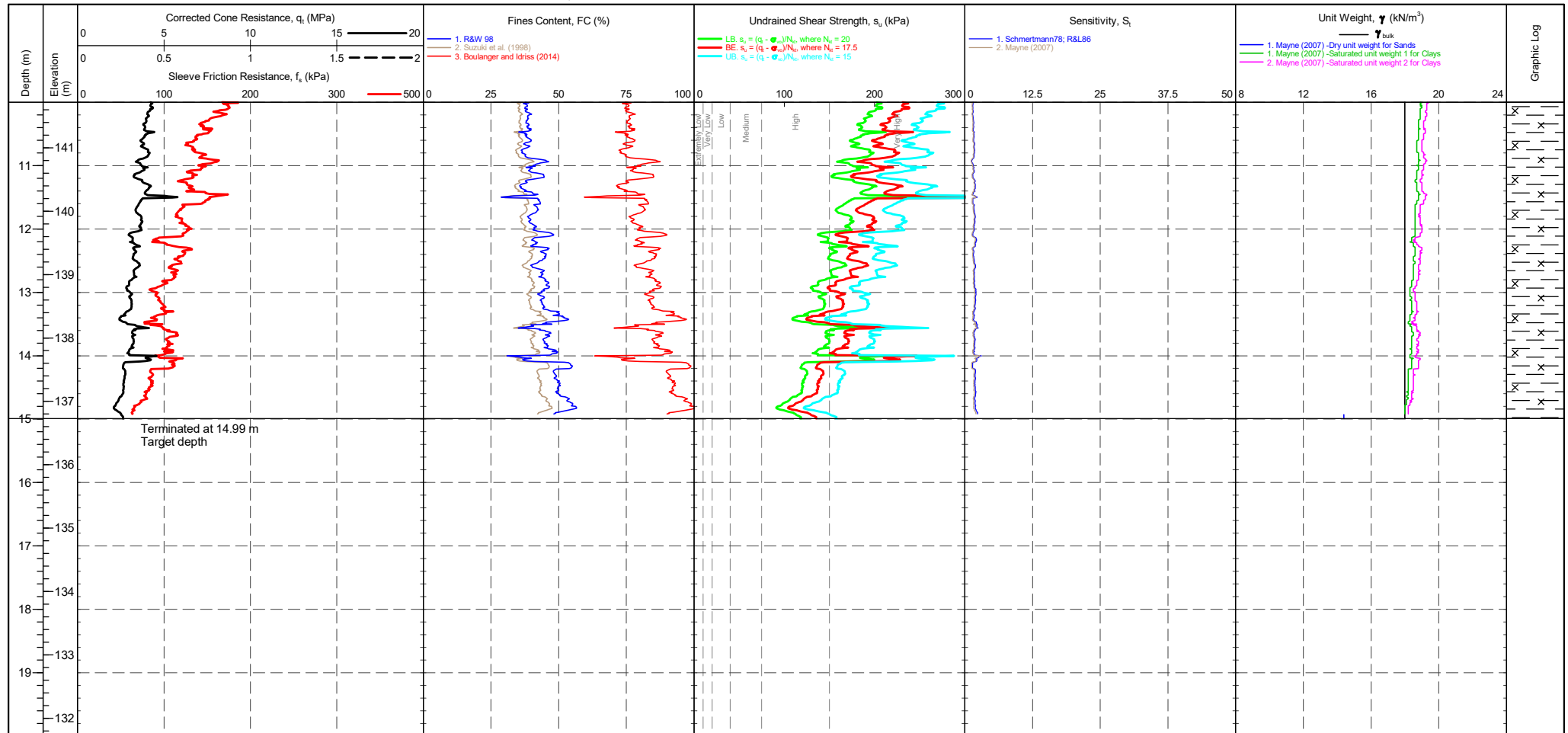
CPT02

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391467.267 m
NORTHING : 411494.304 m
ELEVATION : 151.719 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0908	0.0578	0.033
Sleeve (kPa)	0.00829	0.0103	-0.0021
u2 (kPa)	0.00984	0.00244	0.0074
Inclinometer 1 (°)	0.0123	0.0929	-0.0806
Inclinometer 2 (°)	-1.78	-1.81	0.0363

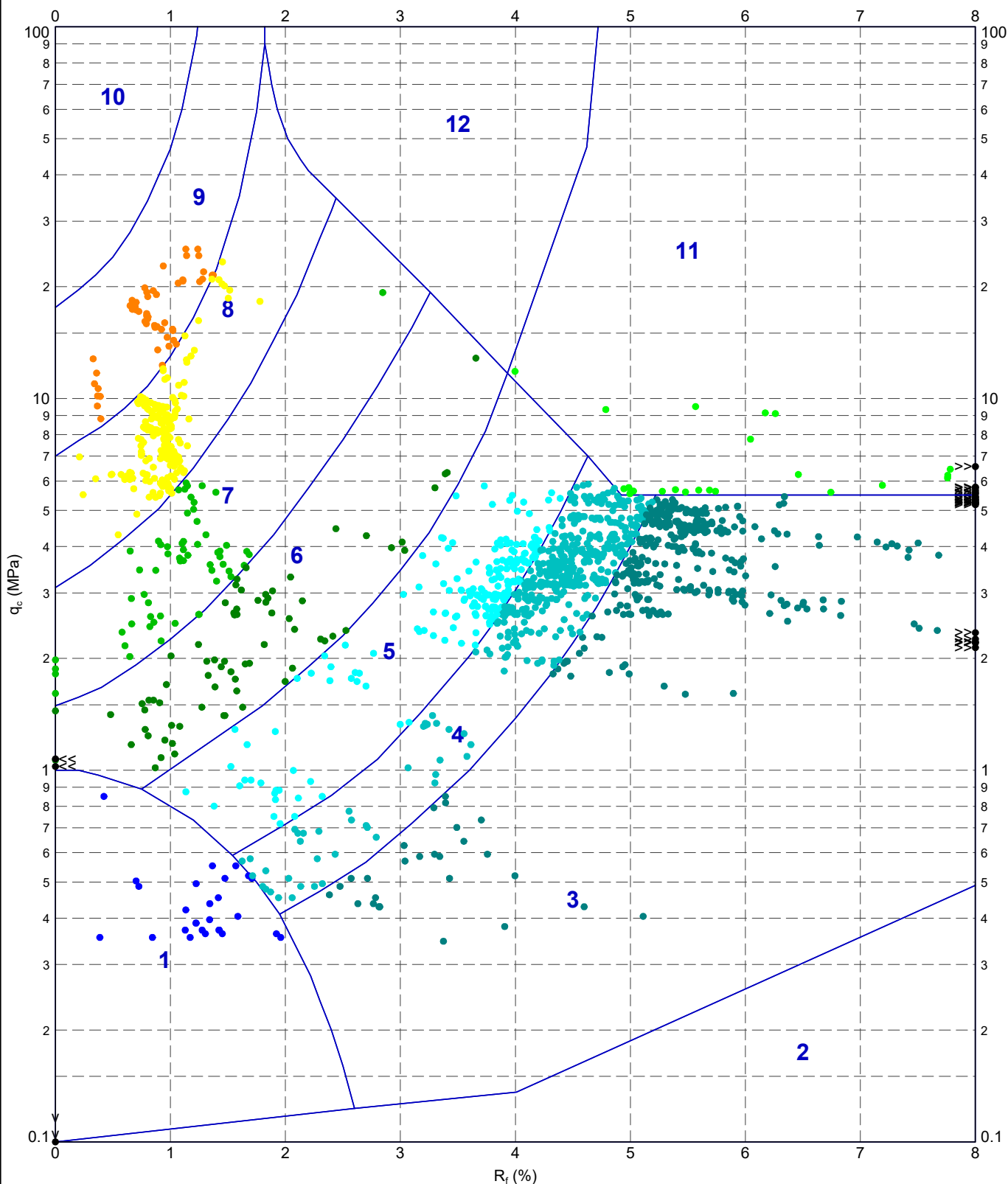
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF AP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:15 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: In Situ SI 2.02.0 2017-07-10 Pjt: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

TITLE

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 q_c vs. R_f - CPT02

DRAWN

DATE

27/06/2022

CHECKED

DATE

27/06/2022

SCALE

Not To Scale

A4

PROJECT No

1220329

FIGURE No

PointID

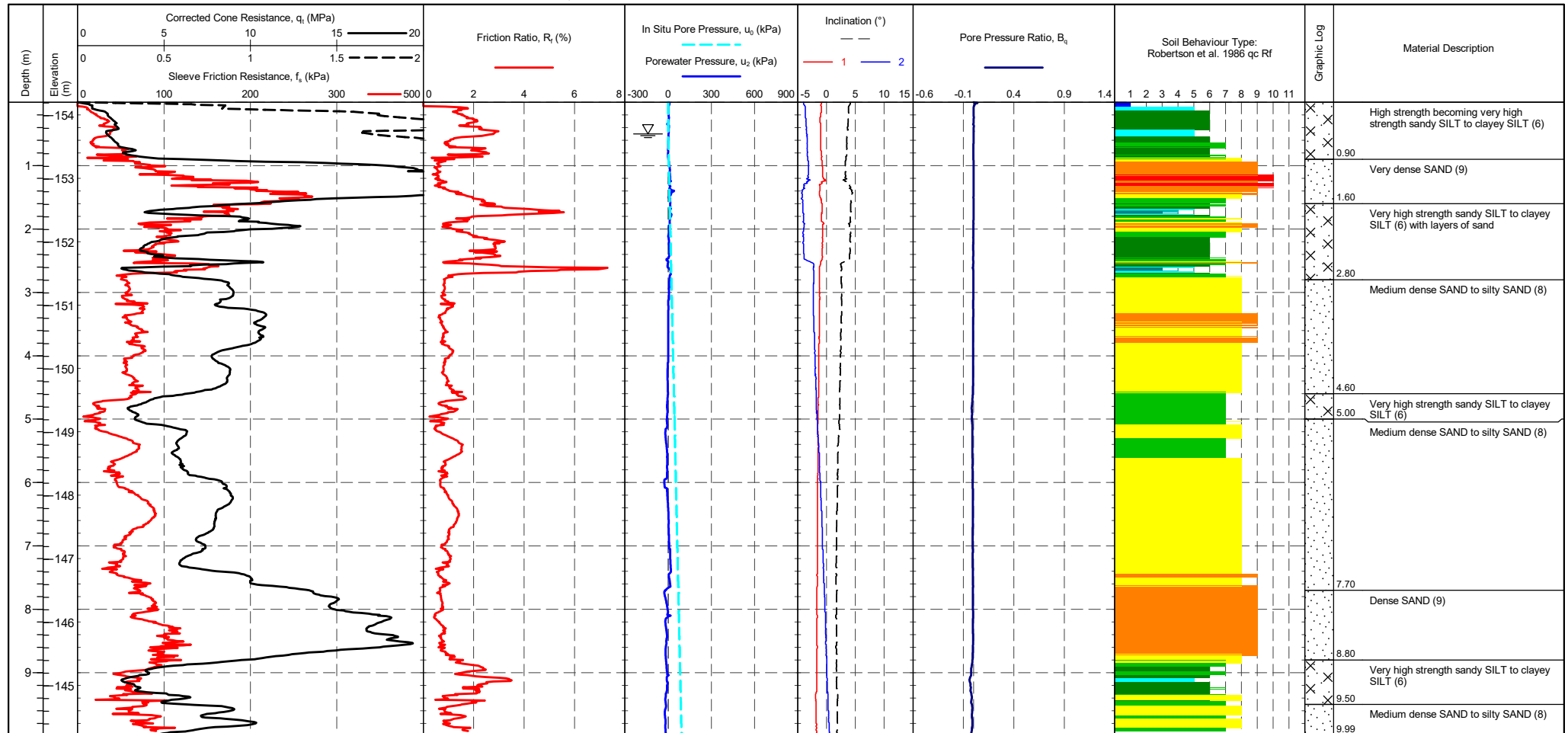
CPT03

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391409.562 m
NORTHING : 411511.807 m
ELEVATION : 154.210 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195		TEST TYPE : TE2		CPTU ZERO VALUES			METHOD: Robertson et al. 1986 $q_c R_f$			Groundwater Level Dissipation Test
CALIBRATION DATE : 31/05/2021		APPLICATION CLASS : 2		Transducer	Pre	Post	Difference	1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	
CONE MODEL : Subtraction		RIG : CPT 012 - Bob		Tip (MPa)	0.0718	0.0578	0.014	2 - Organic material	6 - Sandy SILT to clayey SILT	
CONE AREA : 10cm ²		OPERATOR : CM		Sleeve (kPa)	0.0107	0.00740	0.0033	3 - CLAY	7 - Silty SAND to sandy SILT	
CONE AREA RATIO : 0.74		FRICTION REDUCER : None		u_2 (kPa)	0.0102	0.00988	0.0003	4 - Silty CLAY to CLAY	8 - SAND to silty SAND	
FILTER POSITION : u_2		WEATHER : Sunny & Hot		Inclinometer 1 ($^\circ$)	-0.788	-0.876	0.0874		9 - SAND	
FILTER TYPE : HDPE		GROUNDWATER DEPTH : Assumed for calculation purposes		Inclinometer 2 ($^\circ$)	-4.00	-3.91	-0.0885		10 - Gravelly SAND to SAND	
									11 - Very stiff fine grained	
									12 - SAND to clayey SAND	

PointID

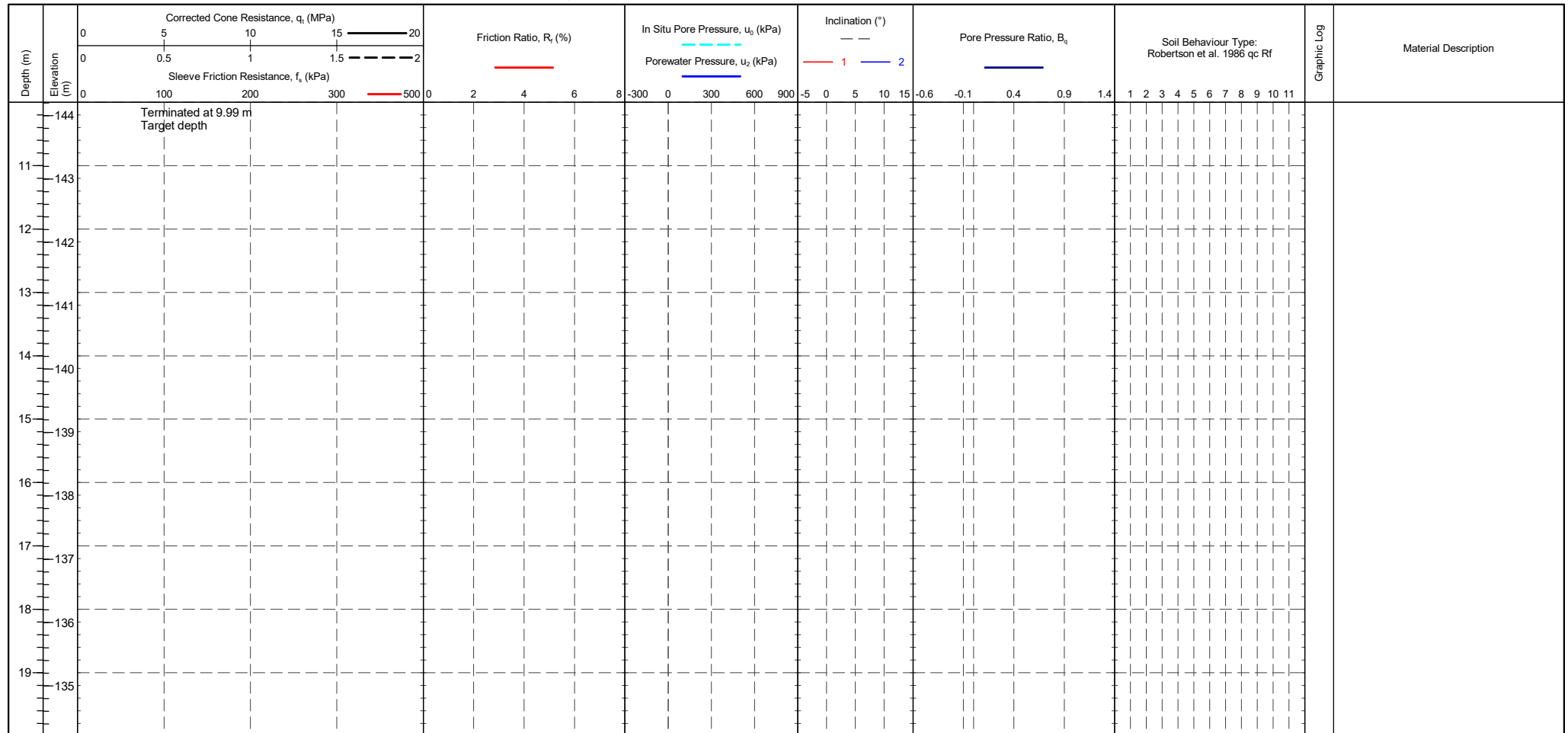
CPT03

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391409.562 m
NORTHING : 411511.807 m
ELEVATION : 154.210 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPT ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0718	0.0578	0.014
Sleeve (kPa)	0.0107	0.00740	0.0033
u2 (kPa)	0.0102	0.00988	0.0003
Inclinometer 1 (i)	-0.788	-0.876	0.0874
Inclinometer 2 (i)	-4.00	-3.91	-0.0885

METHOD: Robertson et al. 1986 $q_c R_f$

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

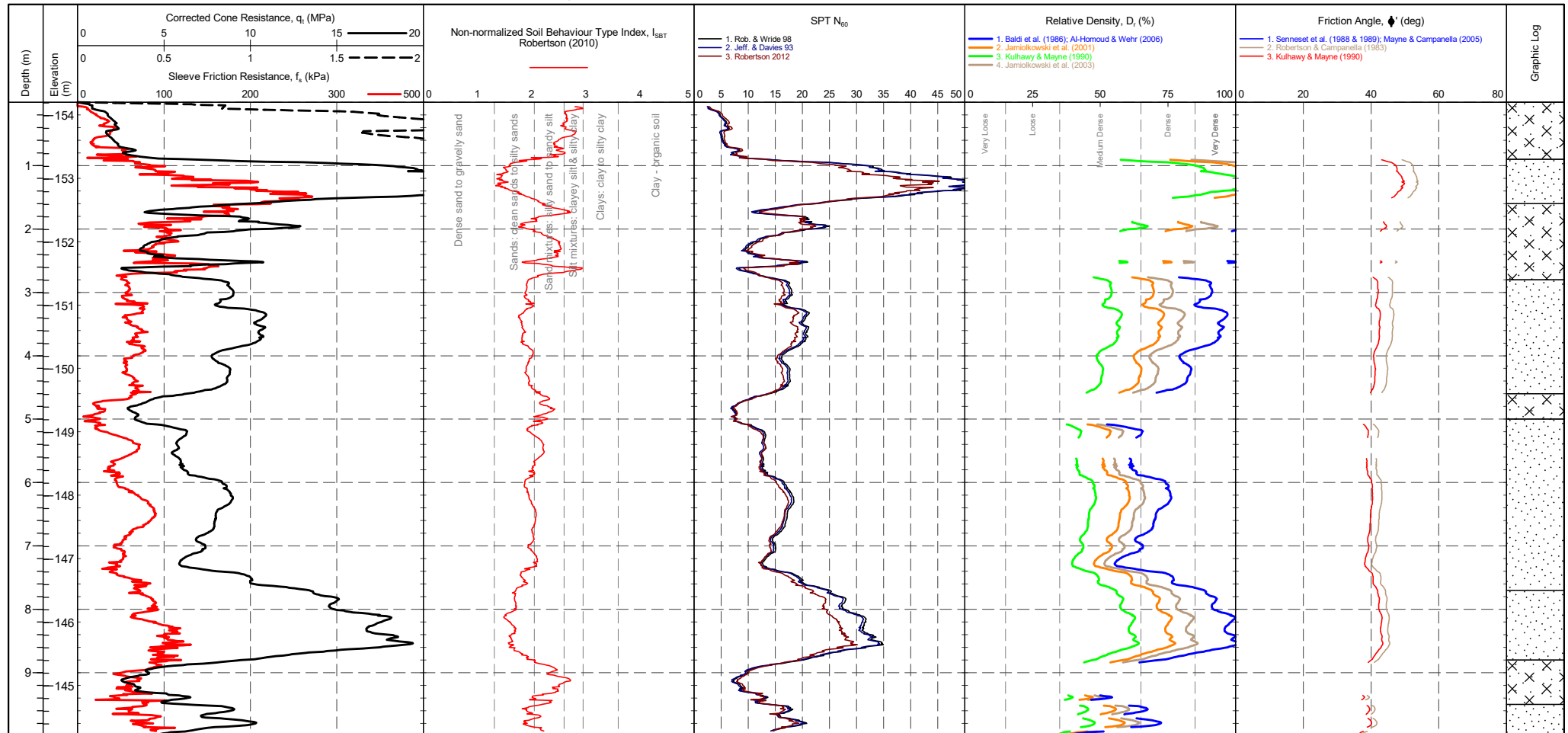
CPT03

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391409.562 m
NORTHING : 411511.807 m
ELEVATION : 154.210 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0718	0.0578	0.014
Sleeve (kPa)	0.0107	0.00740	0.0033
u2 (kPa)	0.0102	0.00988	0.0003
Inclinometer 1 (°)	-0.788	-0.876	0.0874
Inclinometer 2 (°)	-4.00	-3.91	-0.0885

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test

PointID

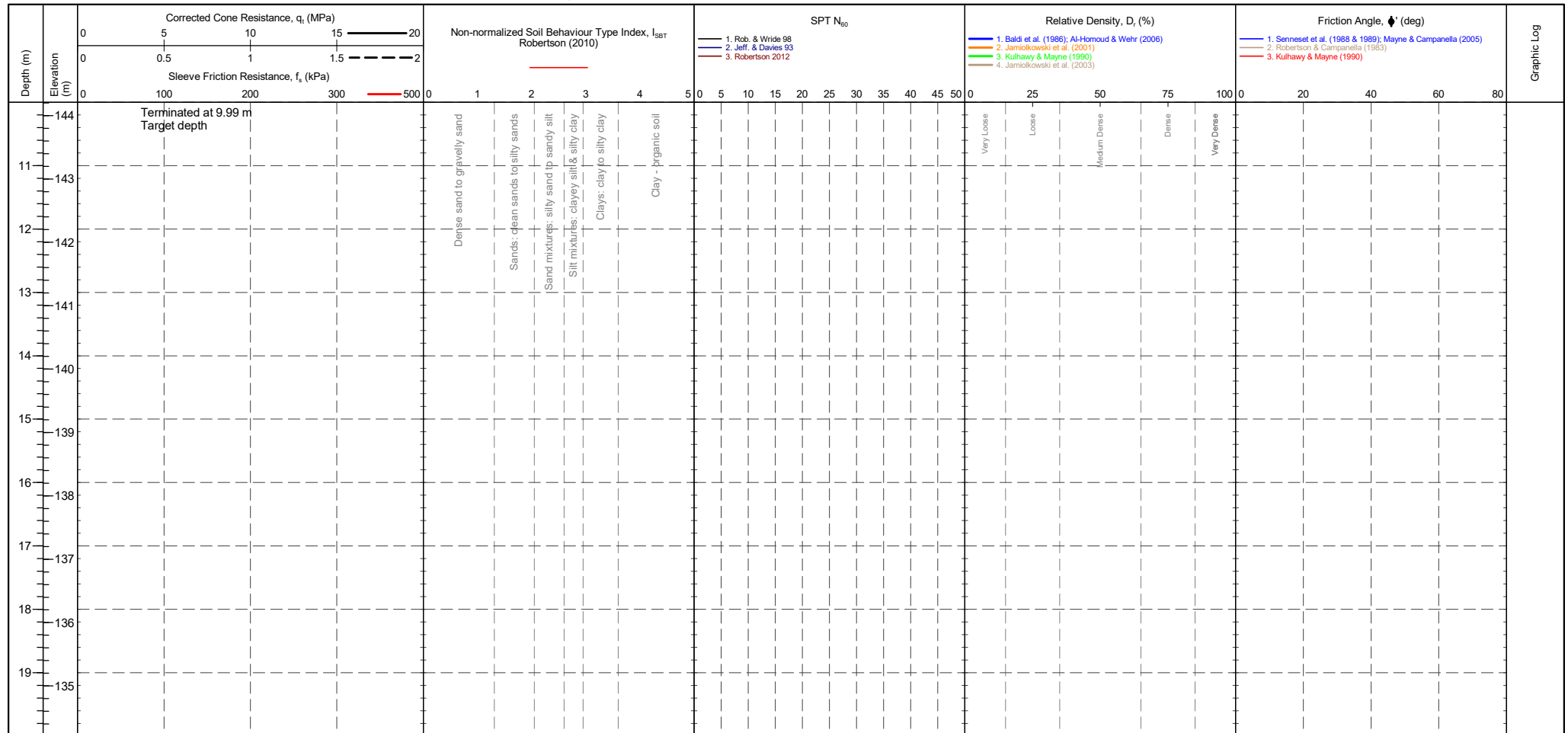
CPT03

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391409.562 m
NORTHING : 411511.807 m
ELEVATION : 154.210 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0718	0.0578	0.014
Sleeve (kPa)	0.0107	0.00740	0.0033
u2 (kPa)	0.0102	0.00988	0.0003
Inclinometer 1 (°)	-0.788	-0.876	0.0874
Inclinometer 2 (°)	-4.00	-3.91	-0.0885

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12			
Description	SBT Index, I_c	Description	SPT N value, NSPT
Clays	2.95-3.60	Very Loose	0 - 4
Silt mixtures	2.60-2.95	Loose	4 - 10
Sand mixtures	2.05-2.60	Medium Dense	10 - 30
Sands	1.31-2.05	Dense	30 - 50
Gravelly sand	<1.31	Very Dense	>50

Description	Relative Density D_r (%)
Very Loose	0 - 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	>85

Groundwater Level
Dissipation Test

PointID

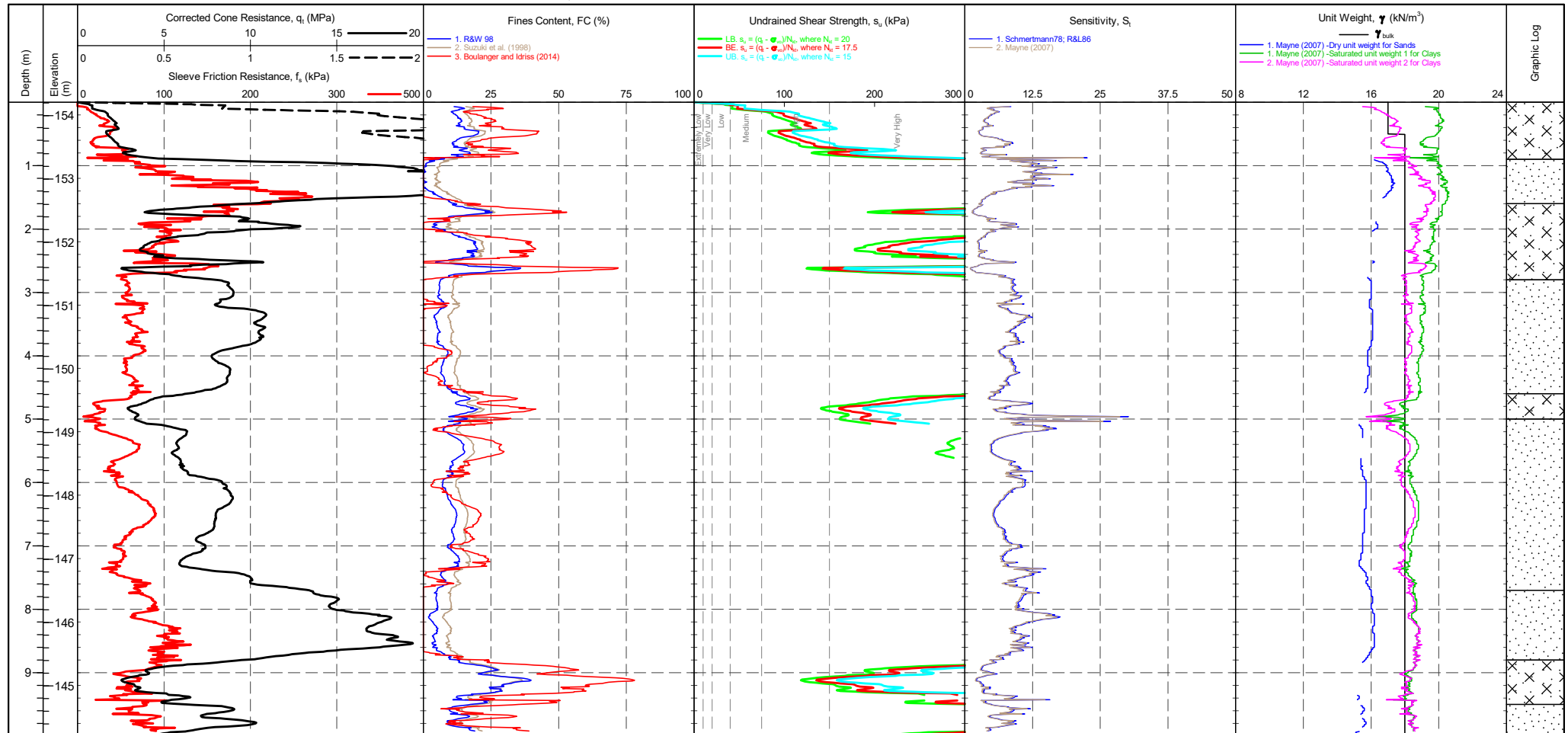
CPT03

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391409.562 m
NORTHING : 411511.807 m
ELEVATION : 154.210 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

Transducer Pre Post Difference
Tip (MPa) 0.0718 0.0578 0.014
Sleeve (kPa) 0.0107 0.00740 0.0033
u2 (kPa) 0.0102 0.00988 0.0003
Inclinometer 1 (°) -0.788 -0.876 0.0874
Inclinometer 2 (°) -4.00 -3.91 -0.0885

CPTU ZERO VALUES

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	su (kPa)	Term based on measurement	su (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

CPT03

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391409.562 m
NORTHING : 411511.807 m
ELEVATION : 154.210 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

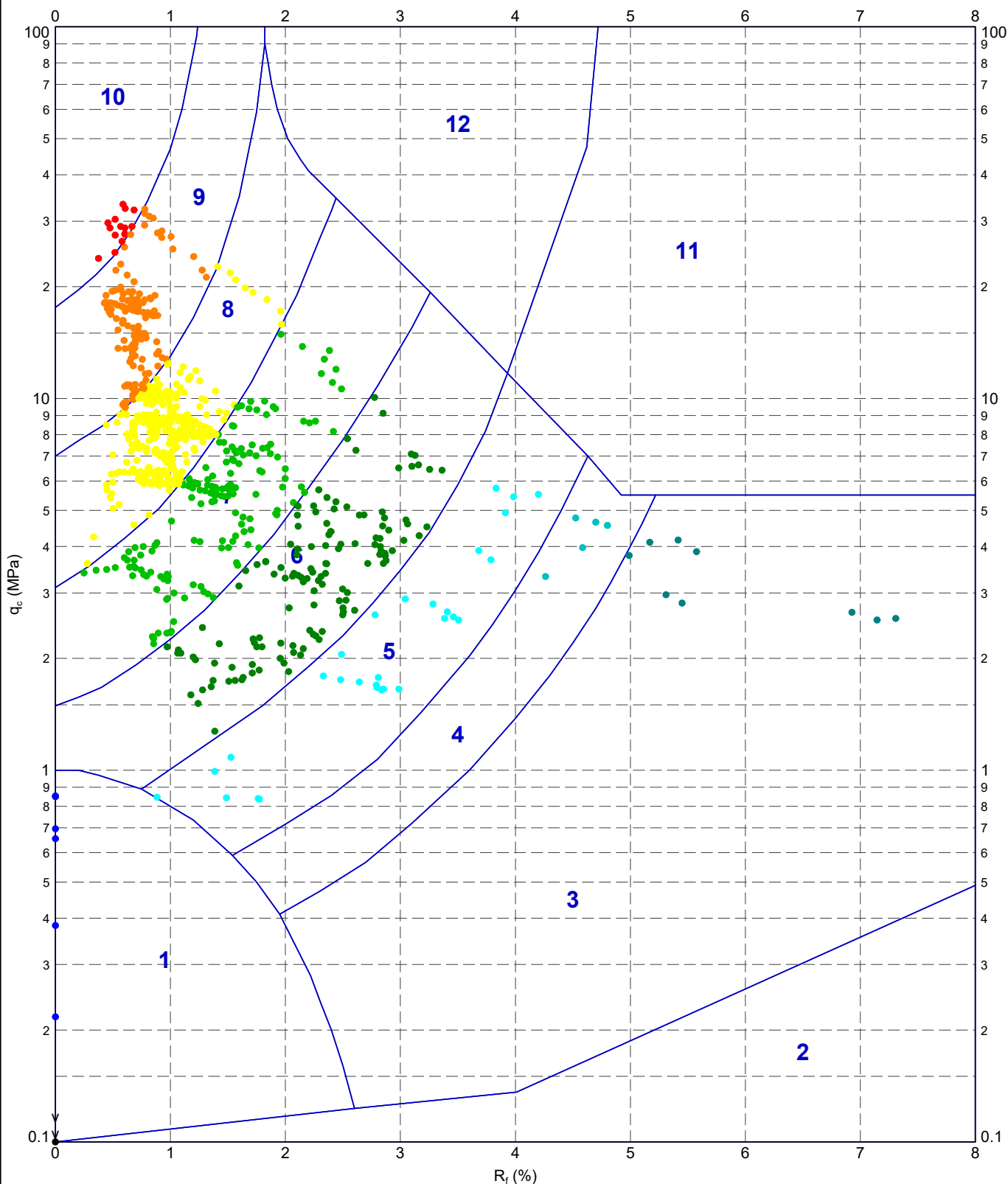
Transducer	Pre	Post	Difference
Tip (MPa)	0.0718	0.0578	0.014
Sleeve (kPa)	0.0107	0.00740	0.0033
u2 (kPa)	0.0102	0.00988	0.0003
Inclinometer 1 (°)	-0.788	-0.876	0.0874
Inclinometer 2 (°)	-4.00	-3.91	-0.0885

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level
Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:17 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: In Situ SI 2.02.0 2017-07-10 Pjt: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 q_c vs. R_f - CPT03

DRAWN	DATE	27/06/2022
CHECKED	DATE	27/06/2022
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1220329		

PointID

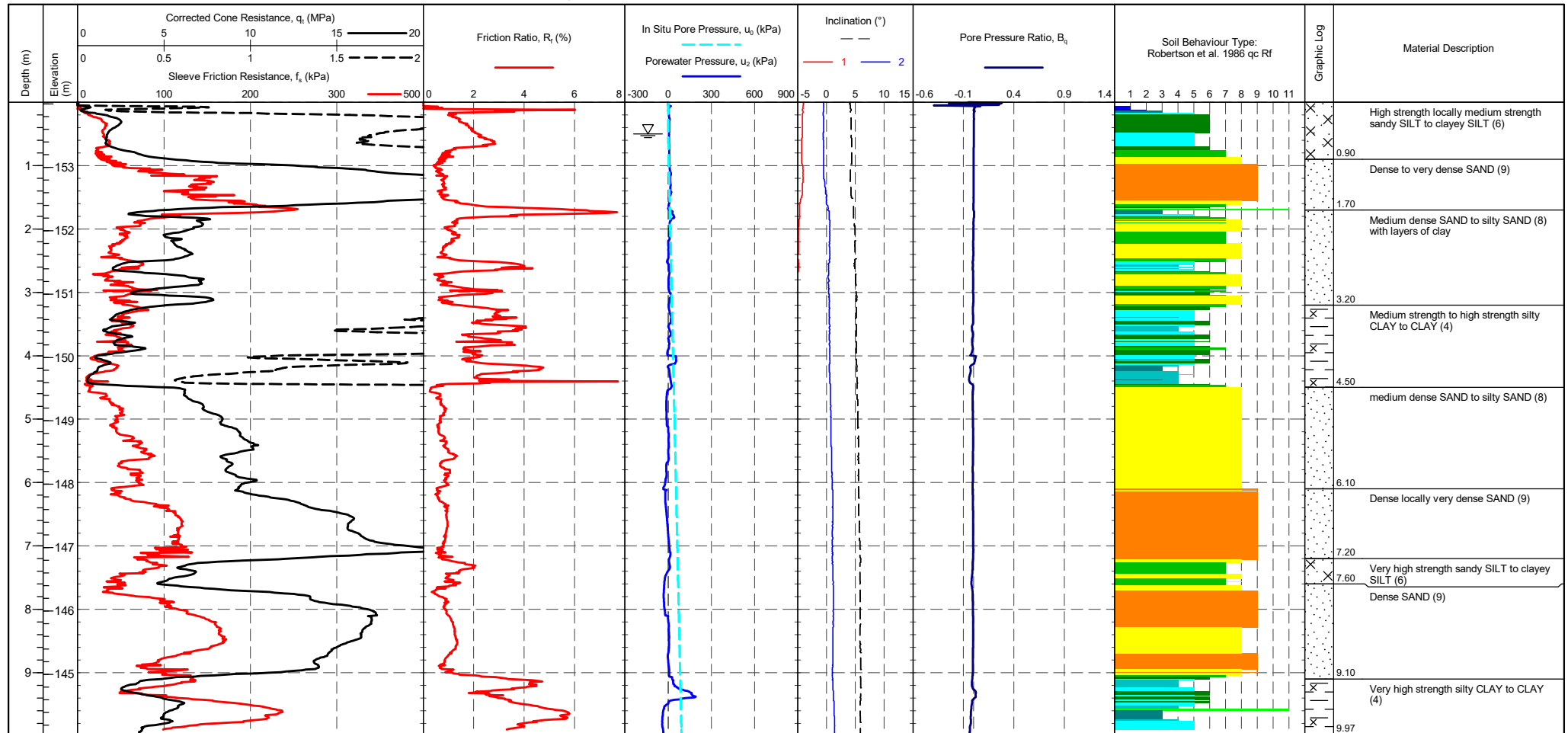
CPT04

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391337.527 m
NORTHING : 411504.780 m
ELEVATION : 154.027 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0693	0.0743	-0.005
Sleeve (kPa)	0.0115	0.0111	0.0004
u_2 (kPa)	0.0100	0.00773	0.0023
Inclinometer 1 (i)	-3.99	-3.91	-0.0757
Inclinometer 2 (i)	-0.501	-0.392	-0.1088

METHOD: Robertson et al. 1986 $q_c R_f$

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

CPT04

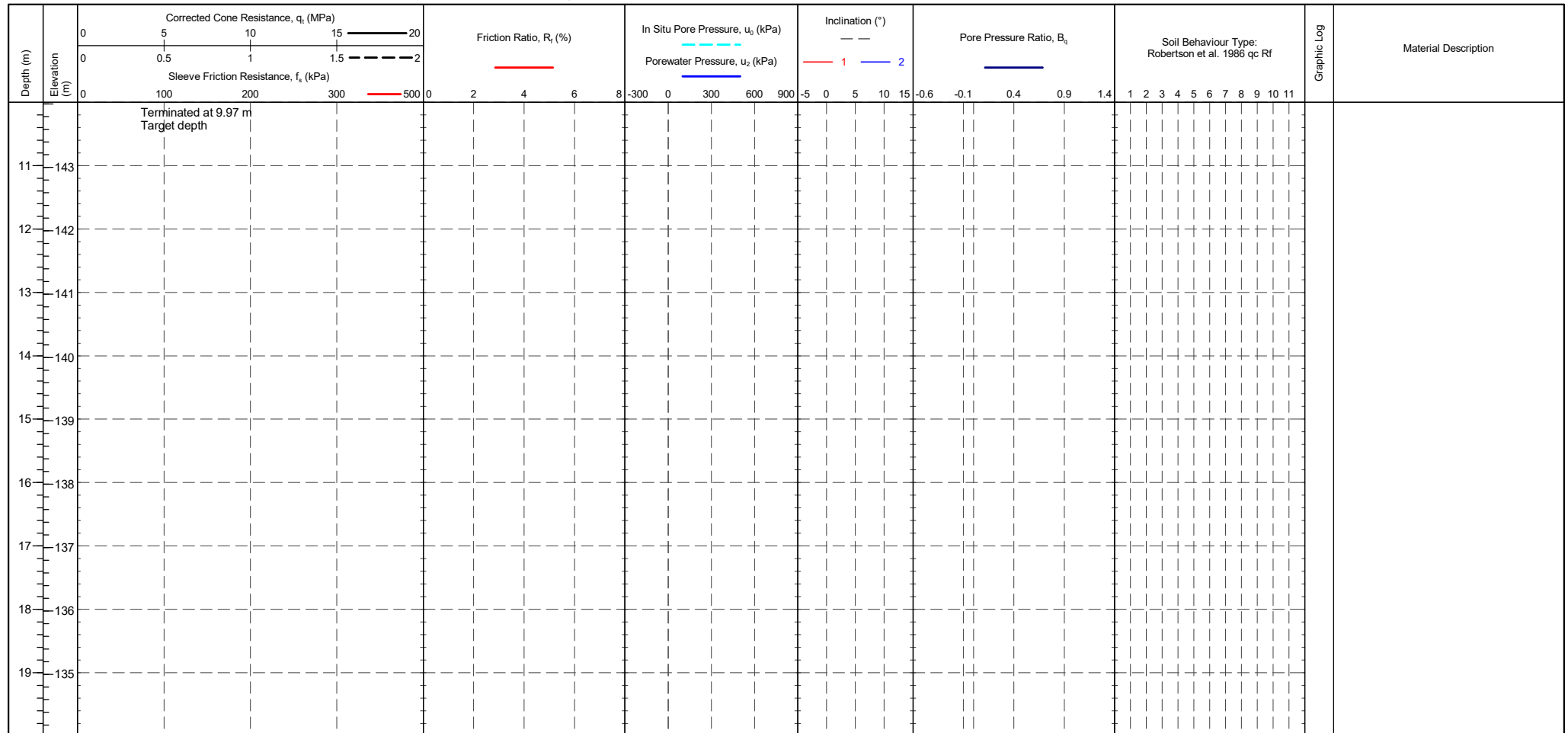
CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale

LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391337.527 m
NORTHING : 411504.780 m
ELEVATION : 154.027 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPT ZERO VALUES
Transducer Pre Post Difference
Tip (MPa) 0.0693 0.0743 -0.005
Sleeve (kPa) 0.0115 0.0111 0.0004
u2 (kPa) 0.0100 0.00773 0.0023
Inclinometer 1 (°) -3.99 -3.91 -0.0757
Inclinometer 2 (°) -0.501 -0.392 -0.1088

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

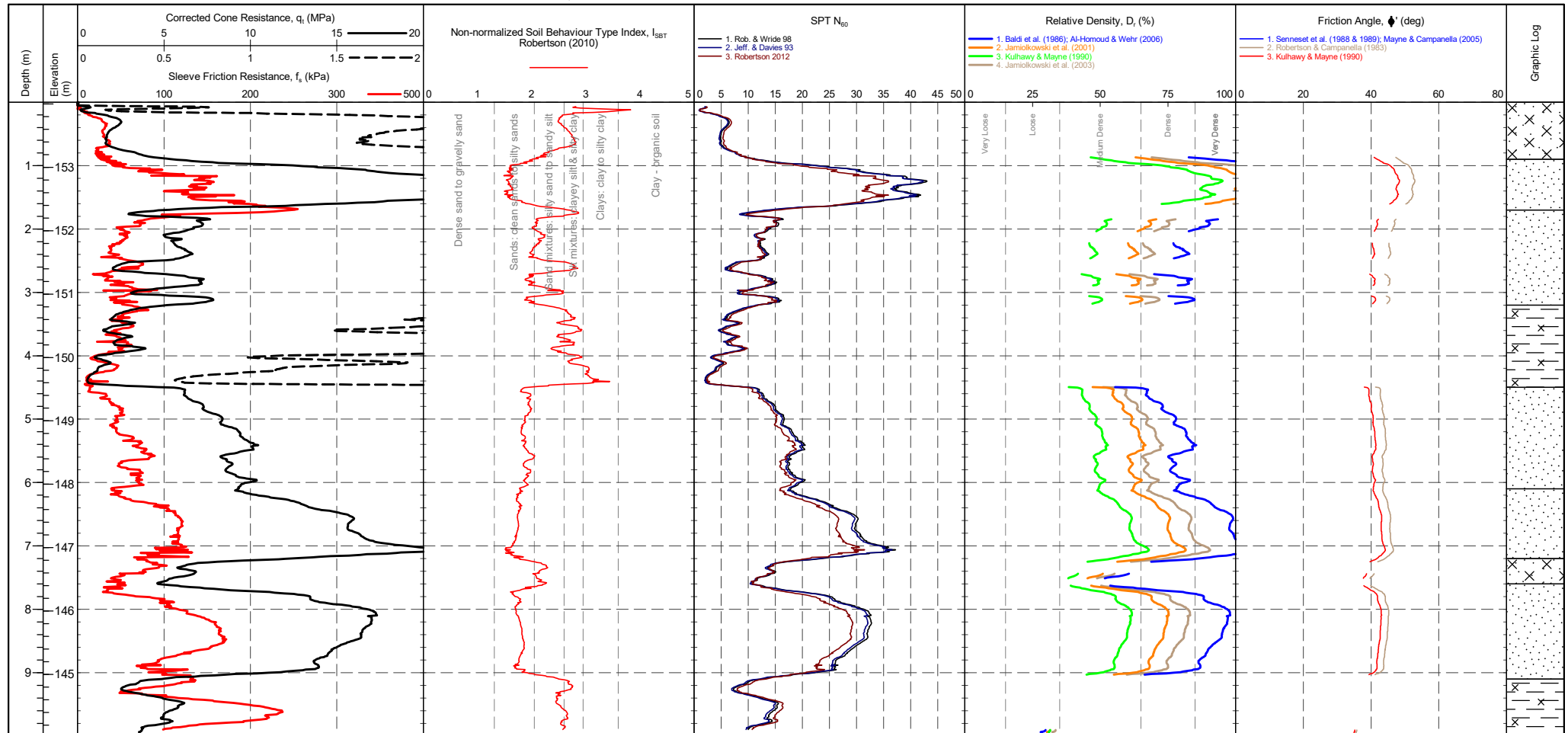
CPT04

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391337.527 m
NORTHING : 411504.780 m
ELEVATION : 154.027 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0693	0.0743	-0.005
Sleeve (kPa)	0.0115	0.0111	0.0004
u2 (kPa)	0.0100	0.00773	0.0023
Inclinometer 1 (")	-3.99	-3.91	-0.0757
Inclinometer 2 (")	-0.501	-0.392	-0.1088

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test

PointID

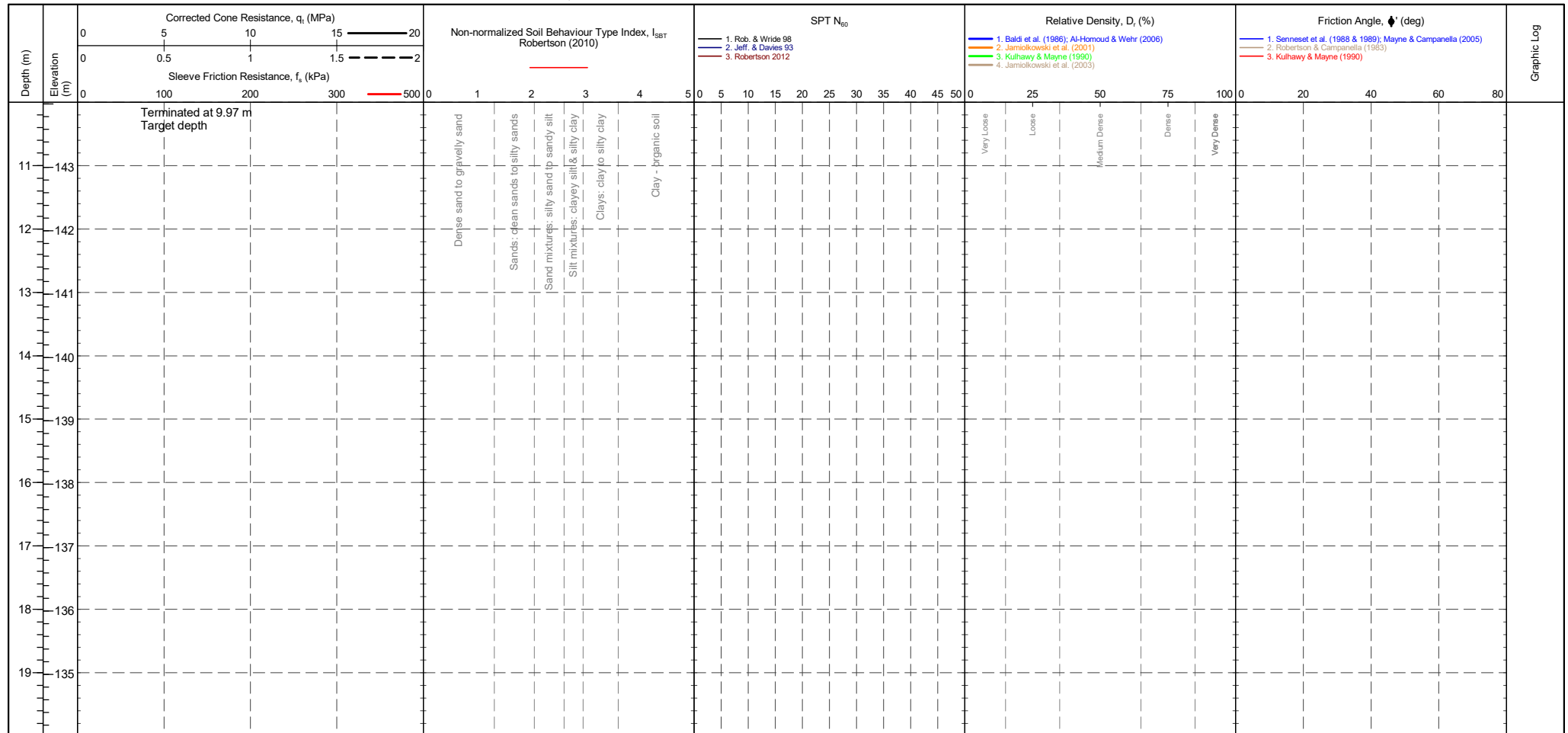
CPT04

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391337.527 m
NORTHING : 411504.780 m
ELEVATION : 154.027 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0693	0.0743	-0.005
Sleeve (kPa)	0.0115	0.0111	0.0004
u2 (kPa)	0.0100	0.00773	0.0023
Inclinometer 1 (")	-3.99	-3.91	-0.0757
Inclinometer 2 (")	-0.501	-0.392	-0.1088

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12			
Description	SBT Index, I_c	Description	SPT N value, NSPT
Clays	2.95-3.60	Very Loose	0 - 4
Silt mixtures	2.60-2.95	Loose	4 - 10
Sand mixtures	2.05-2.60	Medium Dense	10 - 30
Sands	1.31-2.05	Dense	30 - 50
Gravelly sand	<1.31	Very Dense	>50

Description	Relative Density D_r (%)
Very Loose	0 - 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	>85

Groundwater Level

Dissipation Test

PointID

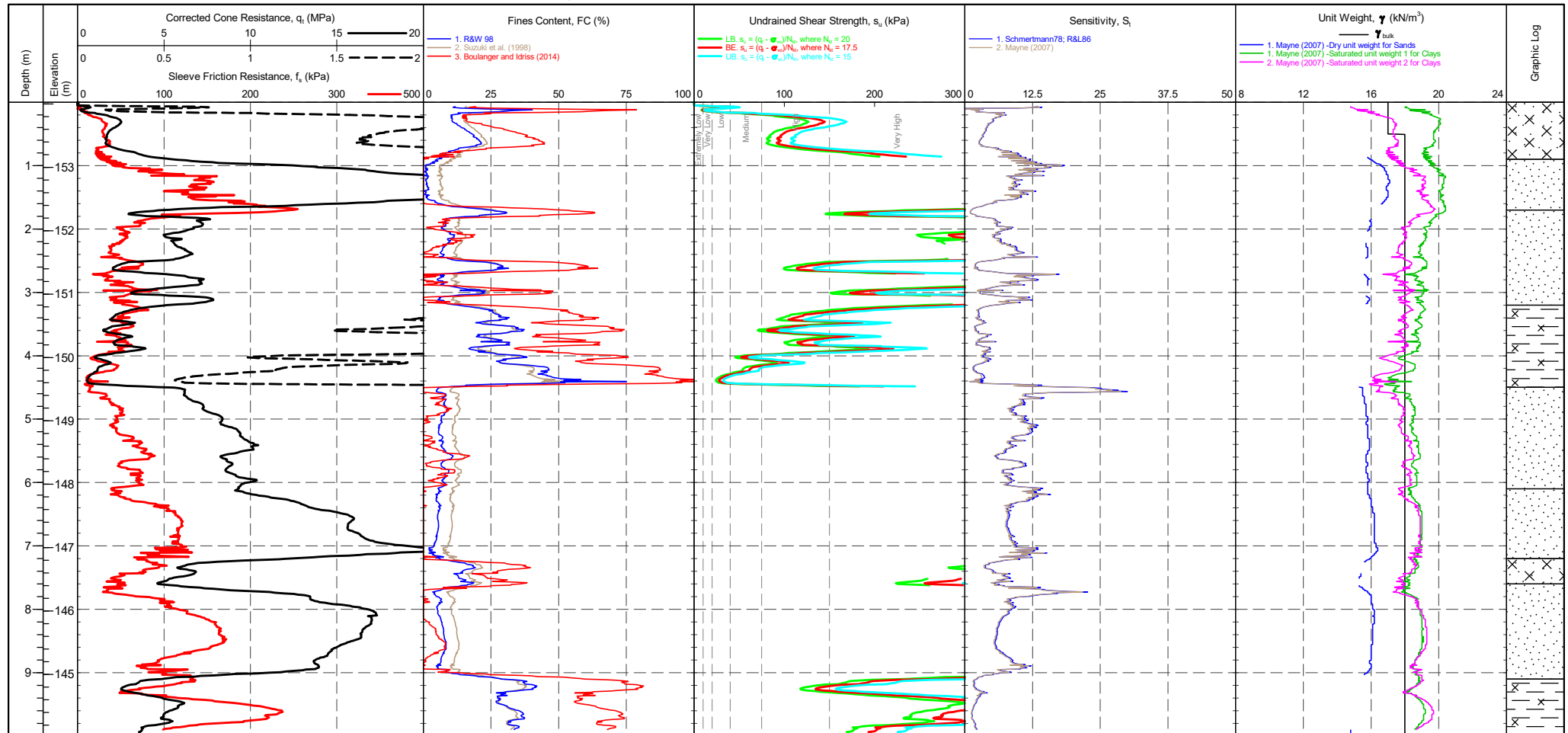
CPT04

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391337.527 m
NORTHING : 411504.780 m
ELEVATION : 154.027 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

Transducer Pre Post Difference
Tip (MPa) 0.0693 0.0743 -0.005
Sleeve (kPa) 0.0115 0.0111 0.0004
u2 (kPa) 0.0100 0.00773 0.0023
Inclinometer 1 (°) -3.99 -3.91 -0.0757
Inclinometer 2 (°) -0.501 -0.392 -0.1088

CPTU ZERO VALUES

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	su (kPa)	Term based on measurement	su (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

CPT04

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391337.527 m
NORTHING : 411504.780 m
ELEVATION : 154.027 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0693	0.0743	-0.005
Sleeve (kPa)	0.0115	0.0111	0.0004
u2 (kPa)	0.0100	0.00773	0.0023
Inclinometer 1 (°)	-3.99	-3.91	-0.0757
Inclinometer 2 (°)	-0.501	-0.392	-0.1088

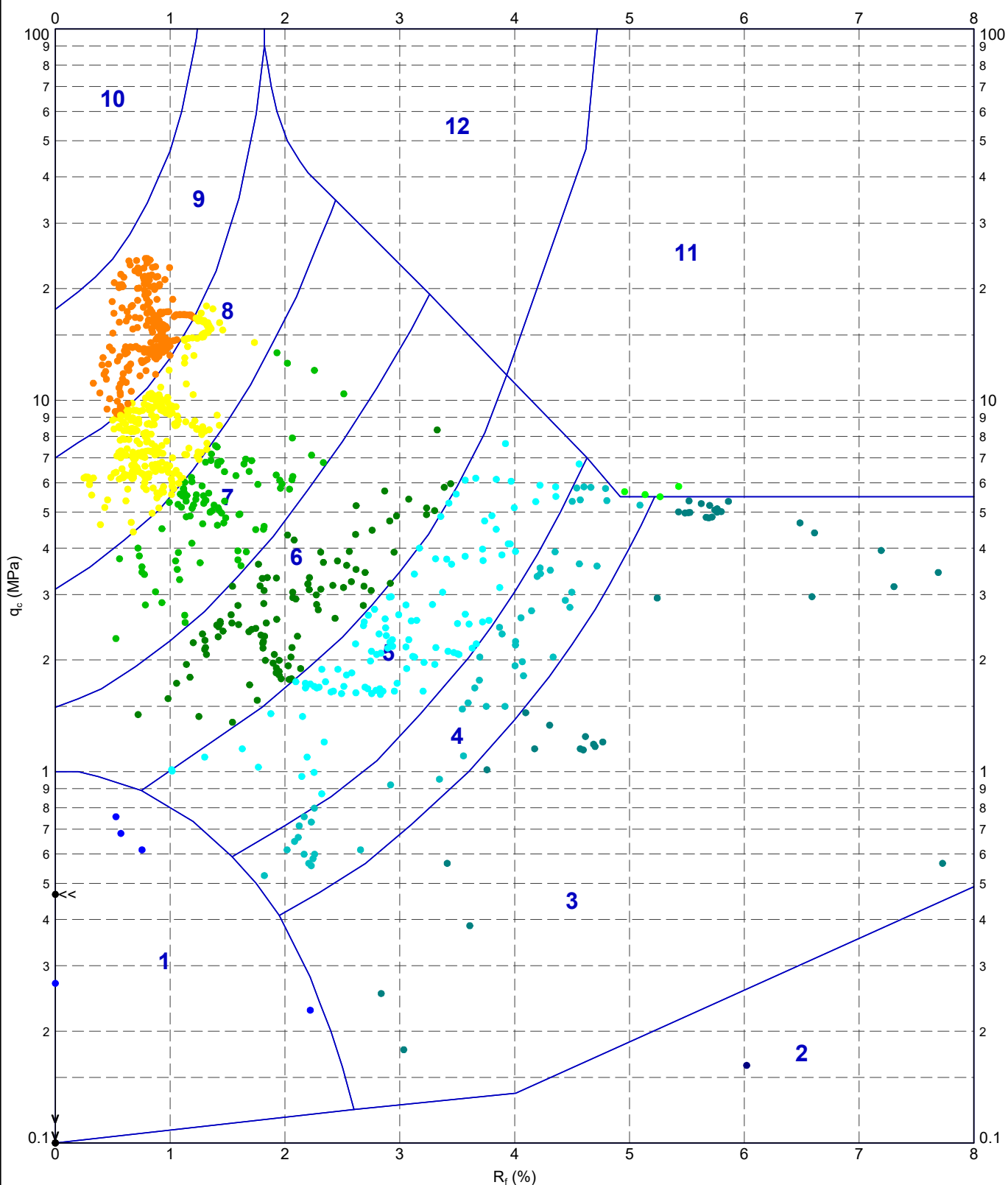
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:19 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: In Situ SI 2.02.0 2017-07-10 PjP: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs. R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

TITLE

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 q_c vs. R_f - CPT04

DRAWN

DATE

27/06/2022

CHECKED

DATE

27/06/2022

SCALE

Not To Scale

A4

PROJECT No

1220329

FIGURE No

PointID

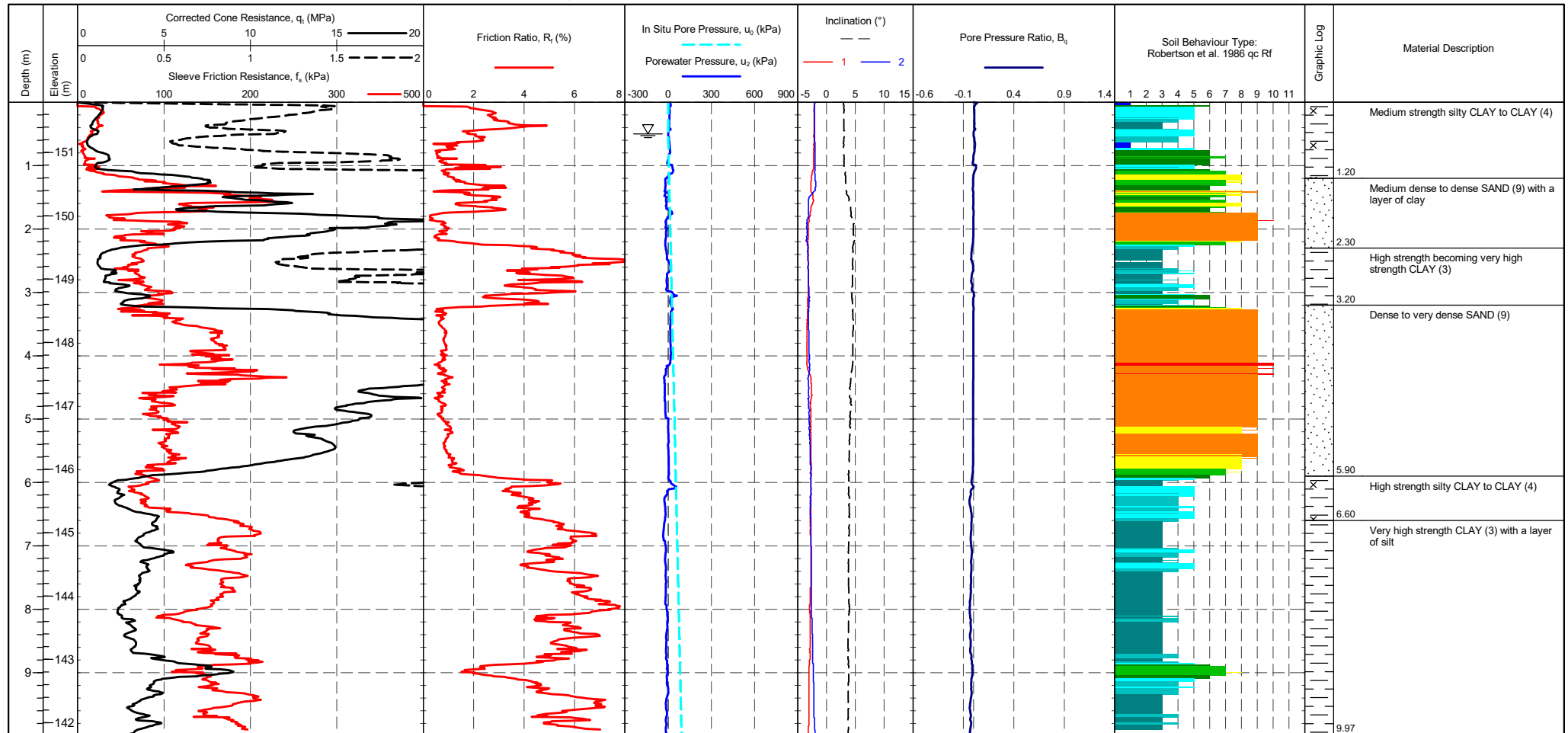
CPT05

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391294.339 m
NORTHING : 411511.666 m
ELEVATION : 151.791 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE
TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES
Transducer Pre Post Difference
Tip (MPa) 0.0602 0.0693 -0.0091
Sleeve (kPa) 0.0102 0.0113 -0.0012
u2 (kPa) 0.00976 0.00952 0.0002
Inclinometer 1 (i) -1.81 -1.81 0.0039
Inclinometer 2 (i) -2.21 -2.31 0.1008

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravely SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

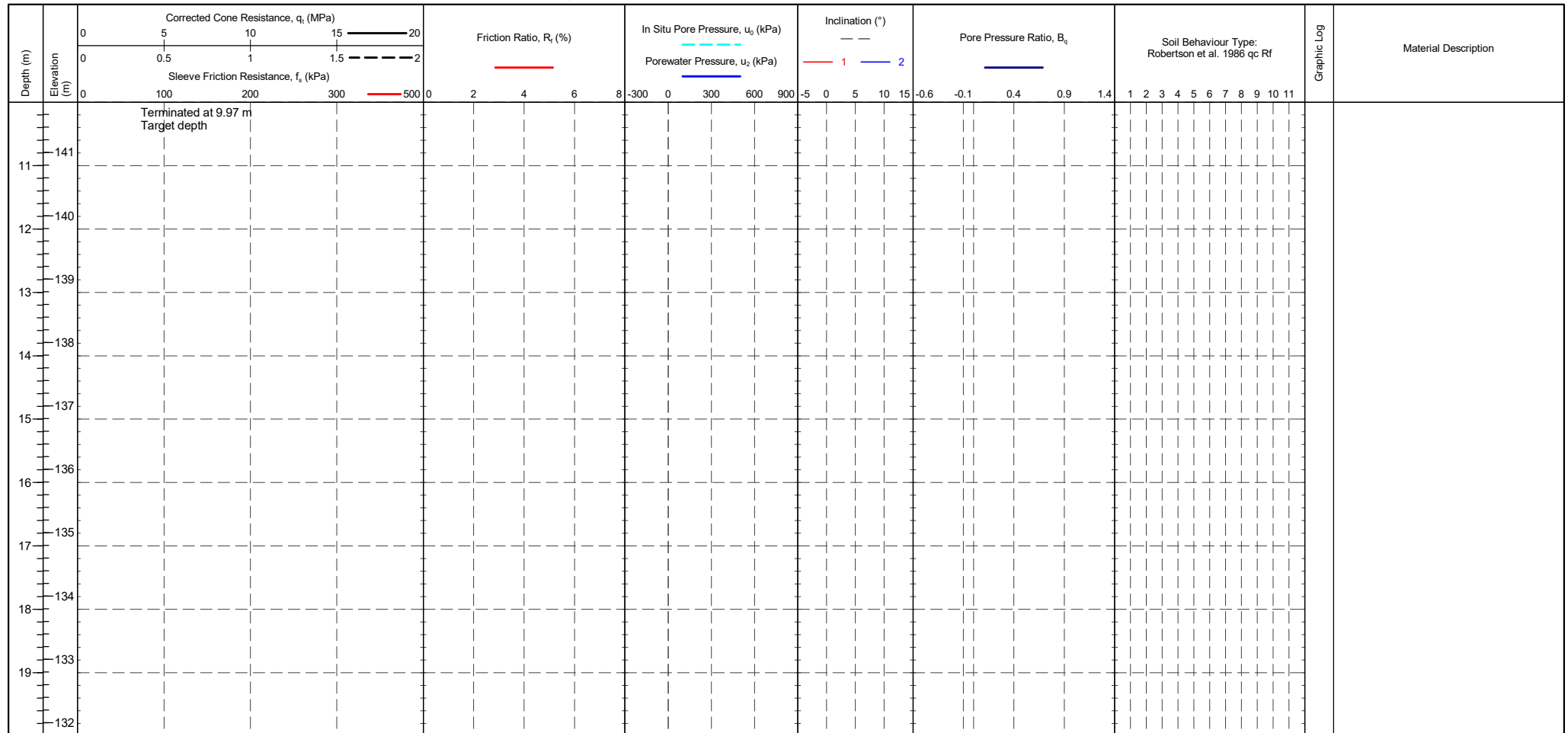
CPT05

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391294.339 m
NORTHING : 411511.666 m
ELEVATION : 151.791 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPT ZERO VALUES
Transducer Pre Post Difference
Tip (MPa) 0.0602 0.0693 -0.0091
Sleeve (kPa) 0.0102 0.0113 -0.0012
u2 (kPa) 0.00976 0.00952 0.0002
Inclinometer 1 (°) -1.81 -1.81 0.0039
Inclinometer 2 (°) -2.21 -2.31 0.1008

METHOD: Robertson et al. 1986 q_c R_f

1 - Sensitive fine grained material
2 - Organic material
3 - CLAY
4 - Silty CLAY to CLAY
5 - Clayey SILT to silty CLAY
6 - Sandy SILT to clayey SILT
7 - Silty SAND to sandy SILT
8 - SAND to silty SAND
9 - SAND
10 - Gravelly SAND to SAND
11 - Very stiff fine grained
12 - SAND to clayey SAND

Groundwater
Level

Dissipation Test

PointID

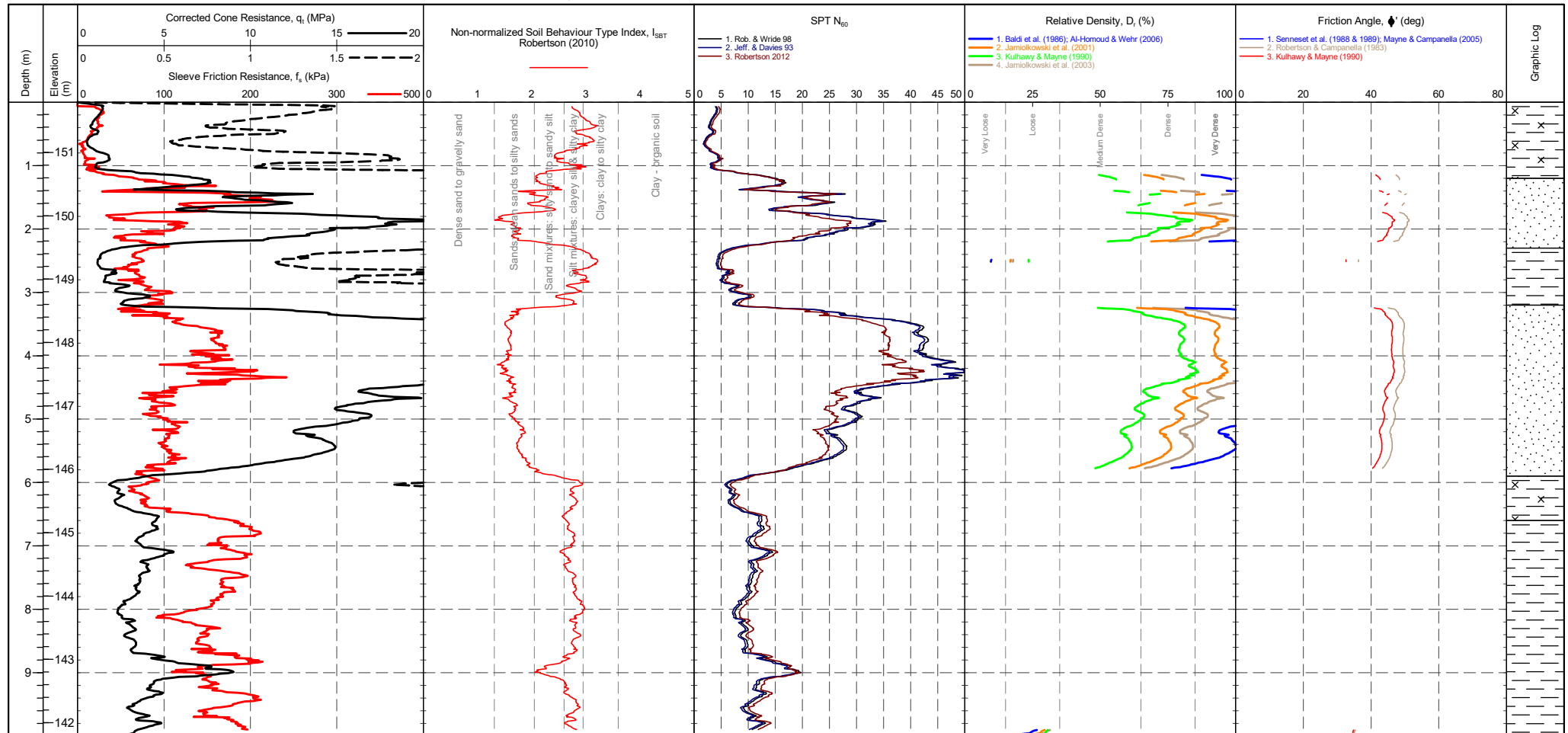
CPT05

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391294.339 m
NORTHING : 411511.666 m
ELEVATION : 151.791 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0602	0.0693	-0.0091
Sleeve (kPa)	0.0102	0.0113	-0.0012
u2 (kPa)	0.00976	0.00952	0.0002
Inclinometer 1 (")	-1.81	-1.81	0.0039
Inclinometer 2 (")	-2.21	-2.31	0.1008

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test

PointID

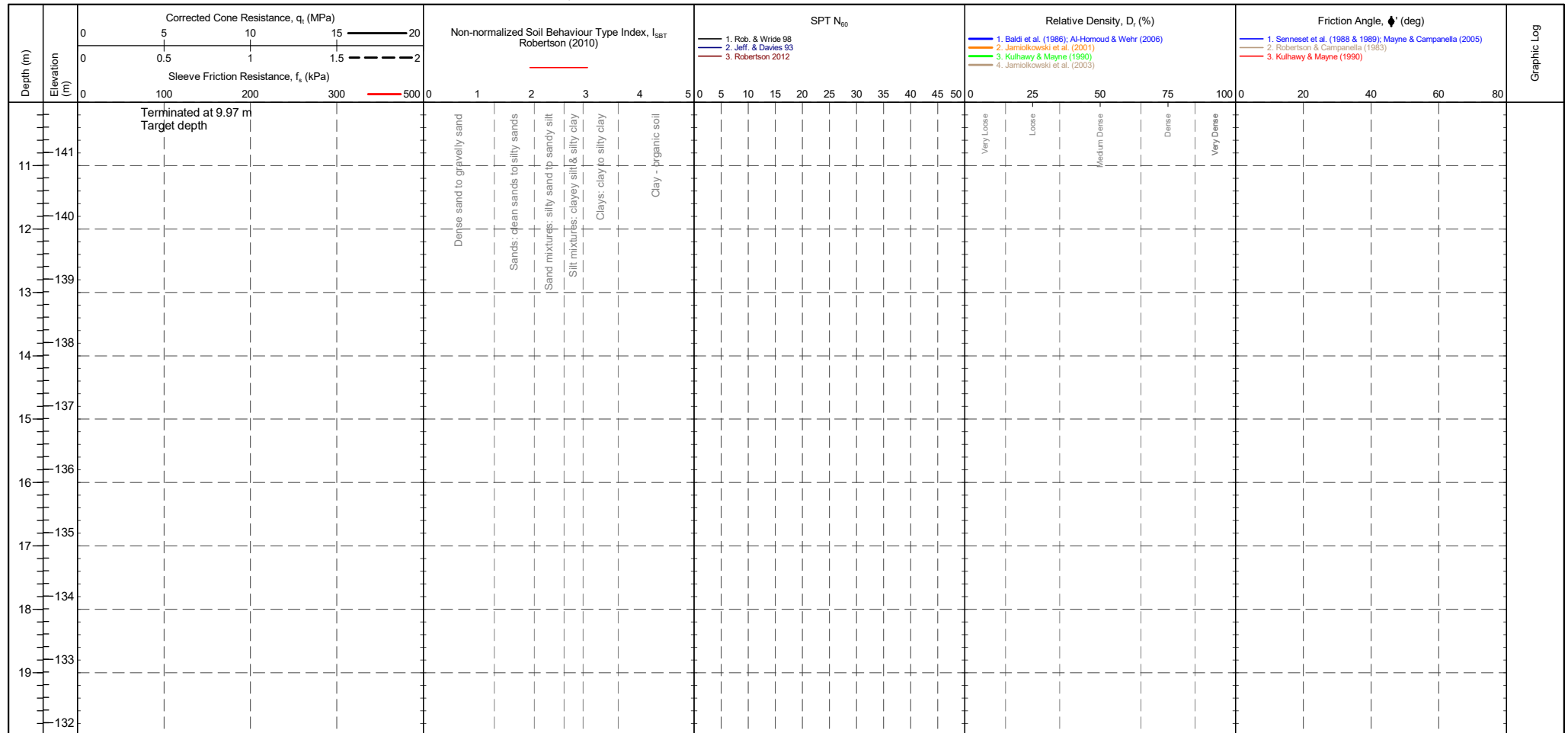
CPT05

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391294.339 m
NORTHING : 411511.666 m
ELEVATION : 151.791 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0602	0.0693	-0.0091
Sleeve (kPa)	0.0102	0.0113	-0.0012
u2 (kPa)	0.00976	0.00952	0.0002
Inclinometer 1 (")	-1.81	-1.81	0.0039
Inclinometer 2 (")	-2.21	-2.31	0.1008

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test

PointID

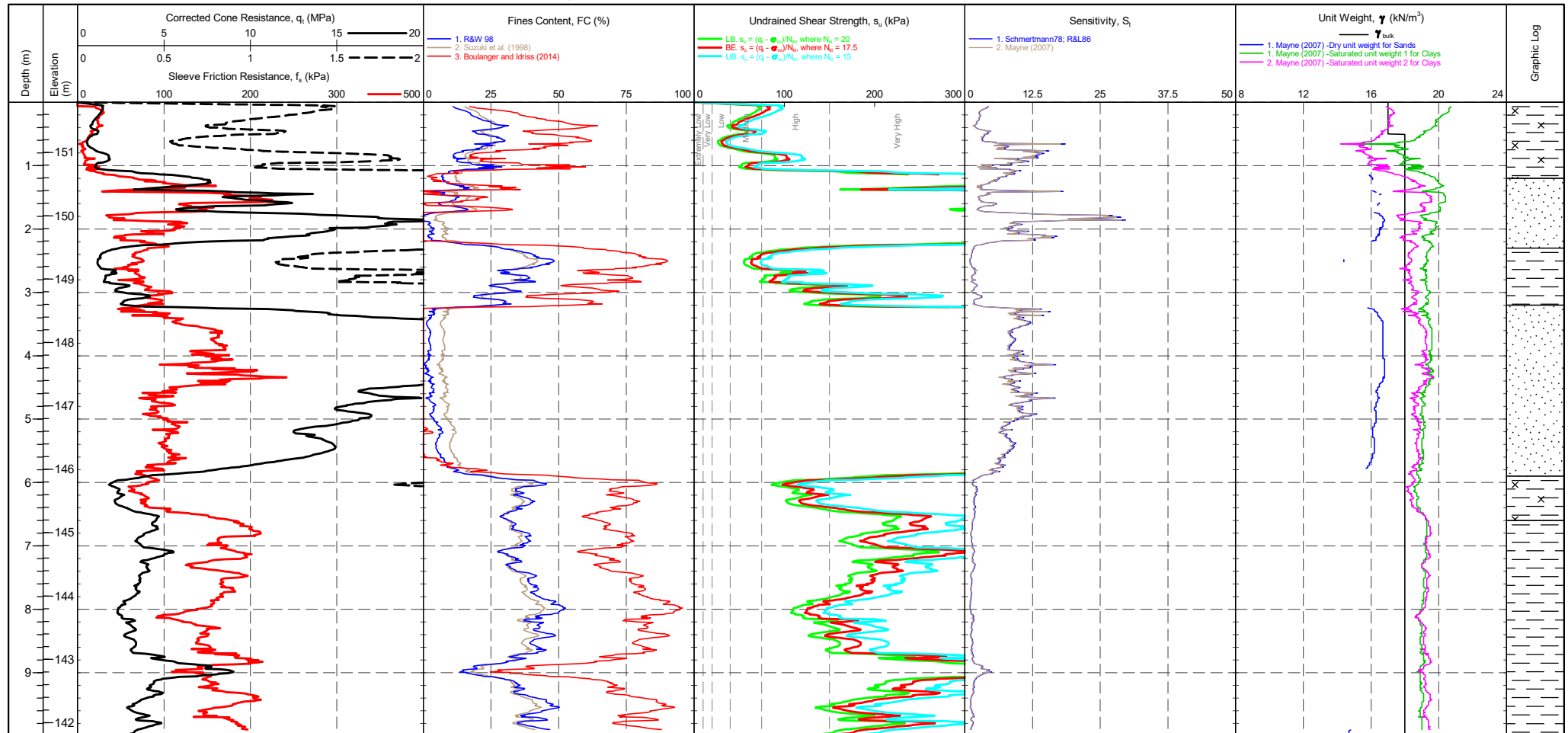
CPT05

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391294.339 m
NORTHING : 411511.666 m
ELEVATION : 151.791 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0602	0.0693	-0.0091
Sleeve (kPa)	0.0102	0.0113	-0.0012
u2 (kPa)	0.00976	0.00952	0.0002
Inclinometer 1 (°)	-1.81	-1.81	0.0039
Inclinometer 2 (°)	-2.21	-2.31	0.1008

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

CPT05

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391294.339 m
NORTHING : 411511.666 m
ELEVATION : 151.791 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

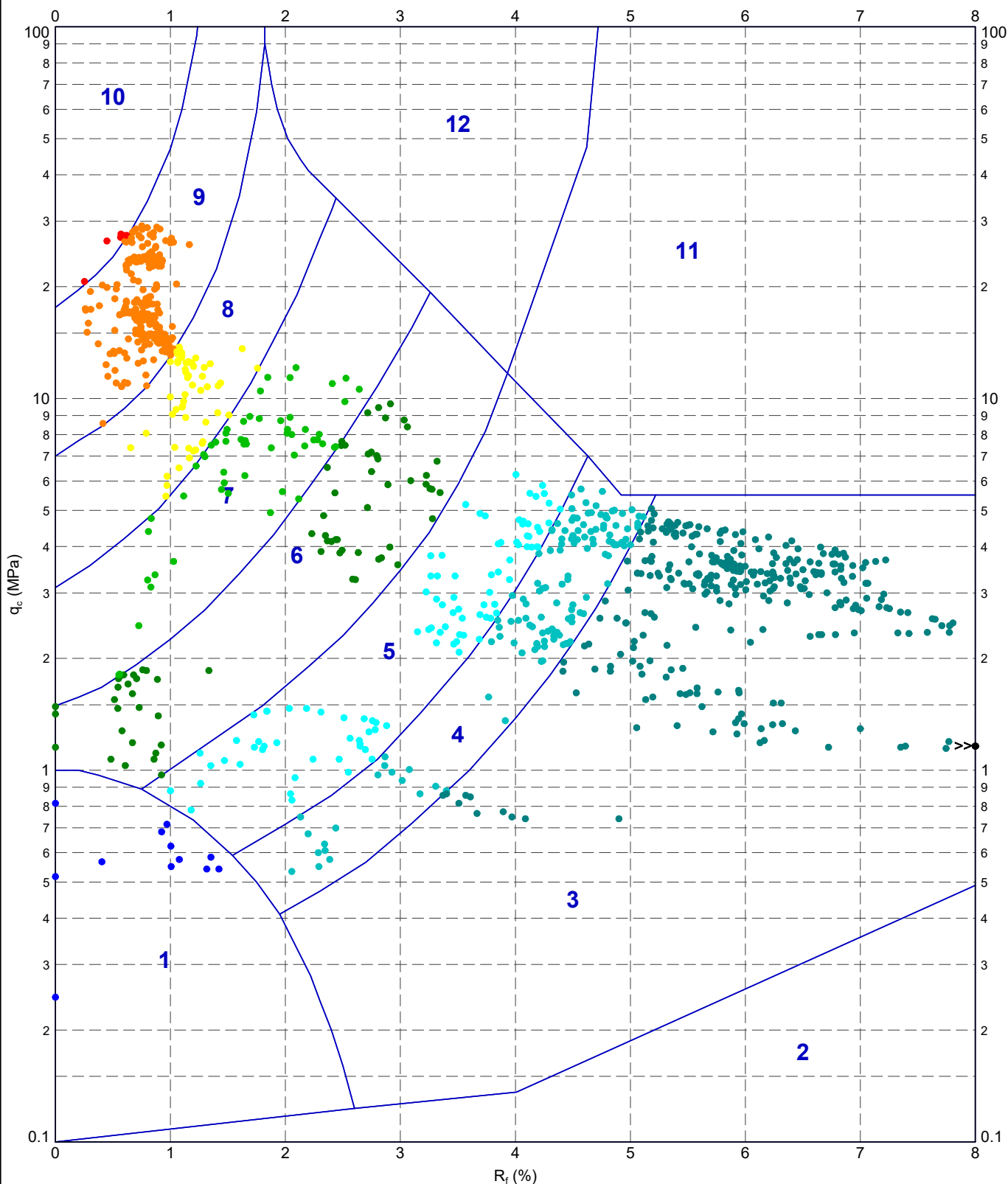
TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES			
Transducer	Pre	Post	Difference
Tip (MPa)	0.0602	0.0693	-0.0091
Sleeve (kPa)	0.0102	0.0113	-0.0012
u2 (kPa)	0.00976	0.00952	0.0002
Inclinometer 1 (°)	-1.81	-1.81	0.0039
Inclinometer 2 (°)	-2.21	-2.31	0.1008

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11		
Term based on measurement	s_u (kPa)	Term based on measurement
Extremely low strength	<10	Medium strength
Very low strength	10-20	High strength
Low strength	20-40	Very high strength
		Extremely high strength

Groundwater Level
Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:22 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: In Situ SI 2.02.0 2017-07-10 PjP: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 q_c vs. R_f - CPT05

DRAWN	DATE	27/06/2022
CHECKED	DATE	27/06/2022
SCALE	Not To Scale	
PROJECT No	FIGURE No	A4
1220329		

PointID

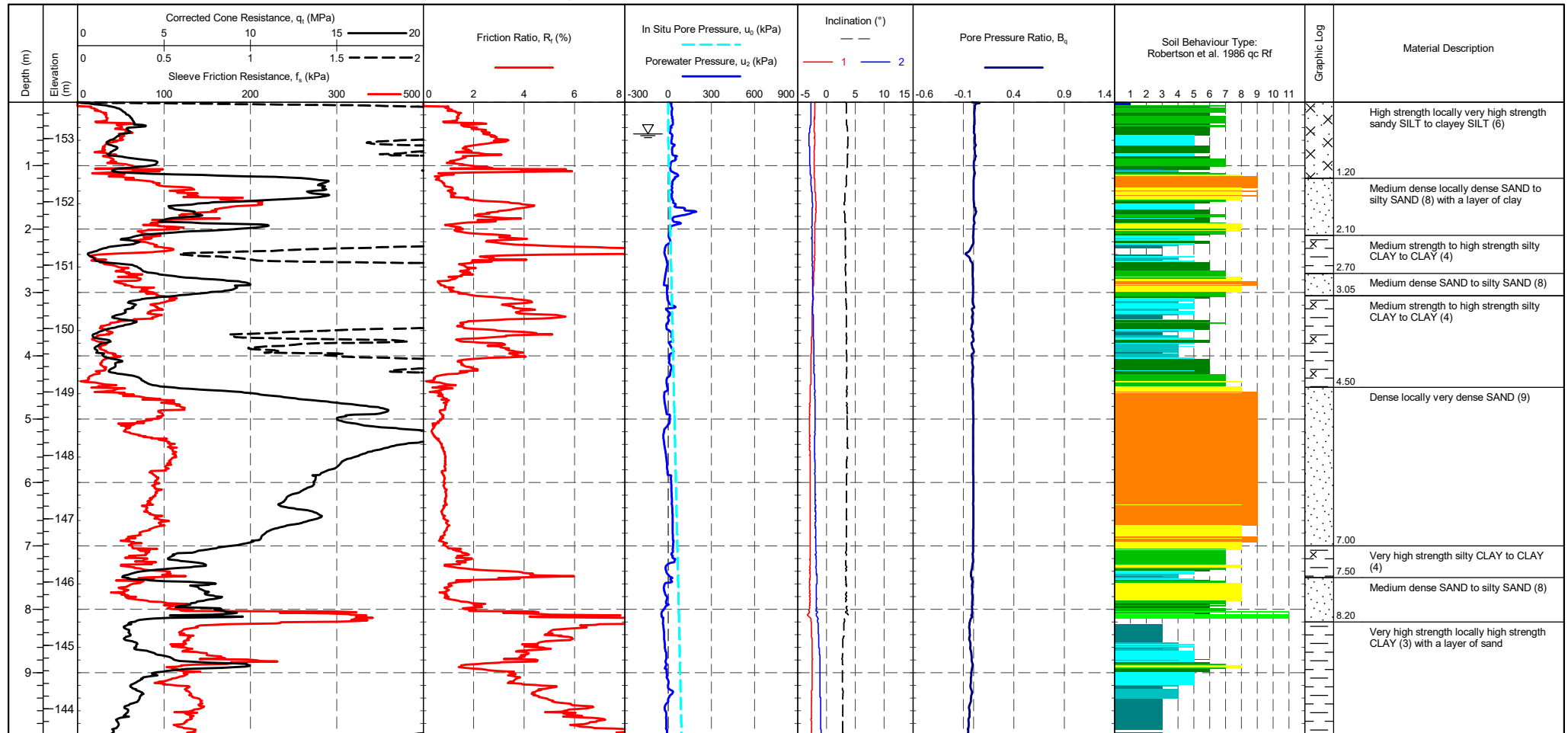
CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPT ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0660	0.0578	0.0083
Sleeve (kPa)	0.0111	0.0100	0.0011
u_2 (kPa)	0.0105	0.00976	0.0007
Inclinometer 1 ($^\circ$)	-1.81	-2.04	0.2287
Inclinometer 2 ($^\circ$)	-2.63	-2.63	0.0073

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

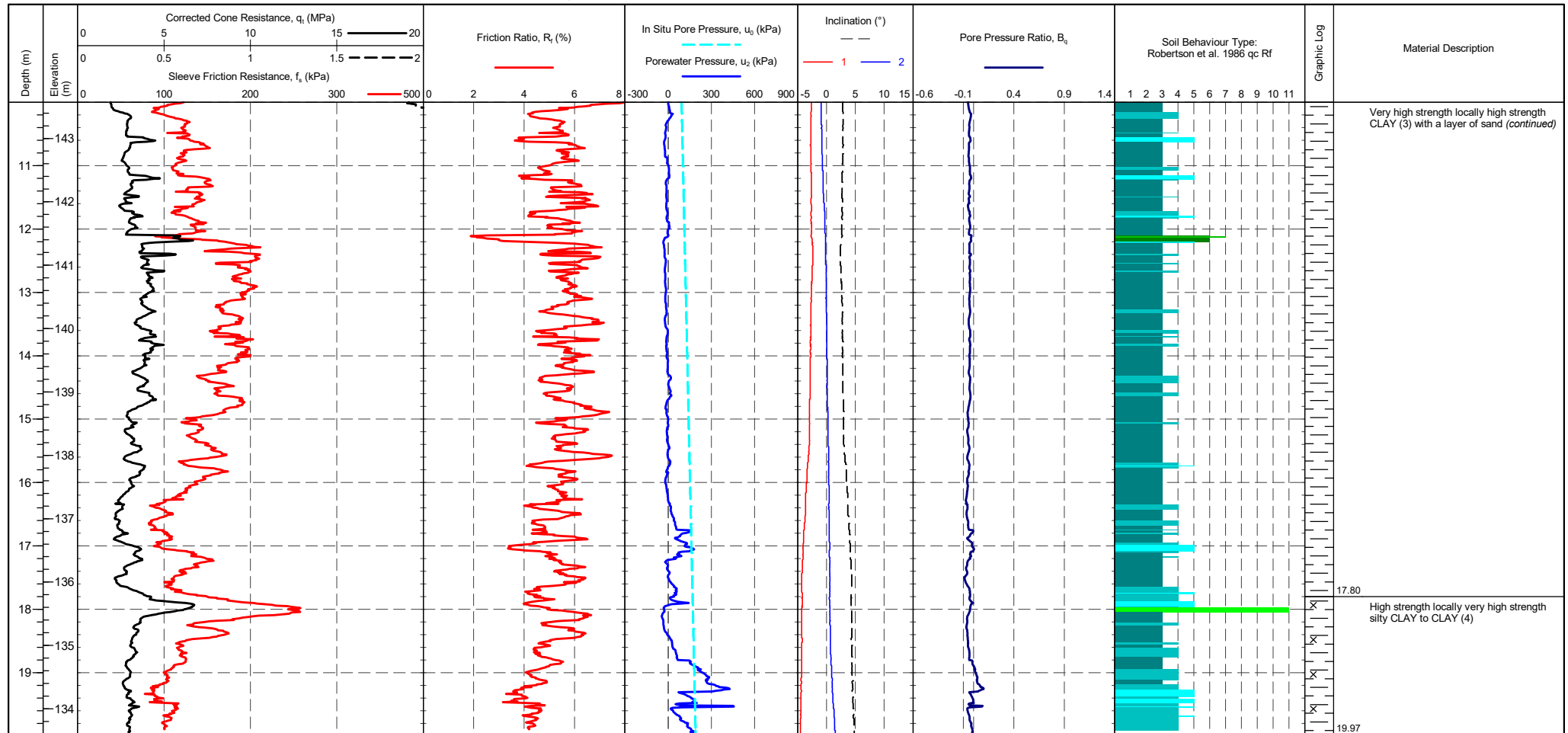
CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID	: DP10-CFPTxy.60195	TEST TYPE	: TE2	CPTU ZERO VALUES				METHOD: Robertson et al. 1986 qc Rf				Groundwater Level Dissipation Test
CALIBRATION DATE	: 31/05/2021	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference	1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND		
CONE MODEL	: Subtraction	RIG	: CPT 012 - Bob	Tip (MPa)	0.0660	0.0578	0.0083	2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND		
CONE AREA	: 10cm ²	OPERATOR	: CM	Sleeve (kPa)	0.0111	0.0100	0.0011	3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained		
CONE AREA RATIO	: 0.74	FRICTION REDUCER	: None	u2 (kPa)	0.0105	0.00976	0.0007	4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND		
FILTER POSITION	: u2	WEATHER	: Sunny & Hot	Inclinometer 1 (°)	-1.81	-2.04	0.2287					
FILTER TYPE	: HDPE	GROUNDWATER DEPTH	: Assumed for calculation purposes	Inclinometer 2 (°)	-2.63	-2.63	0.0073					

PointID

CPT06

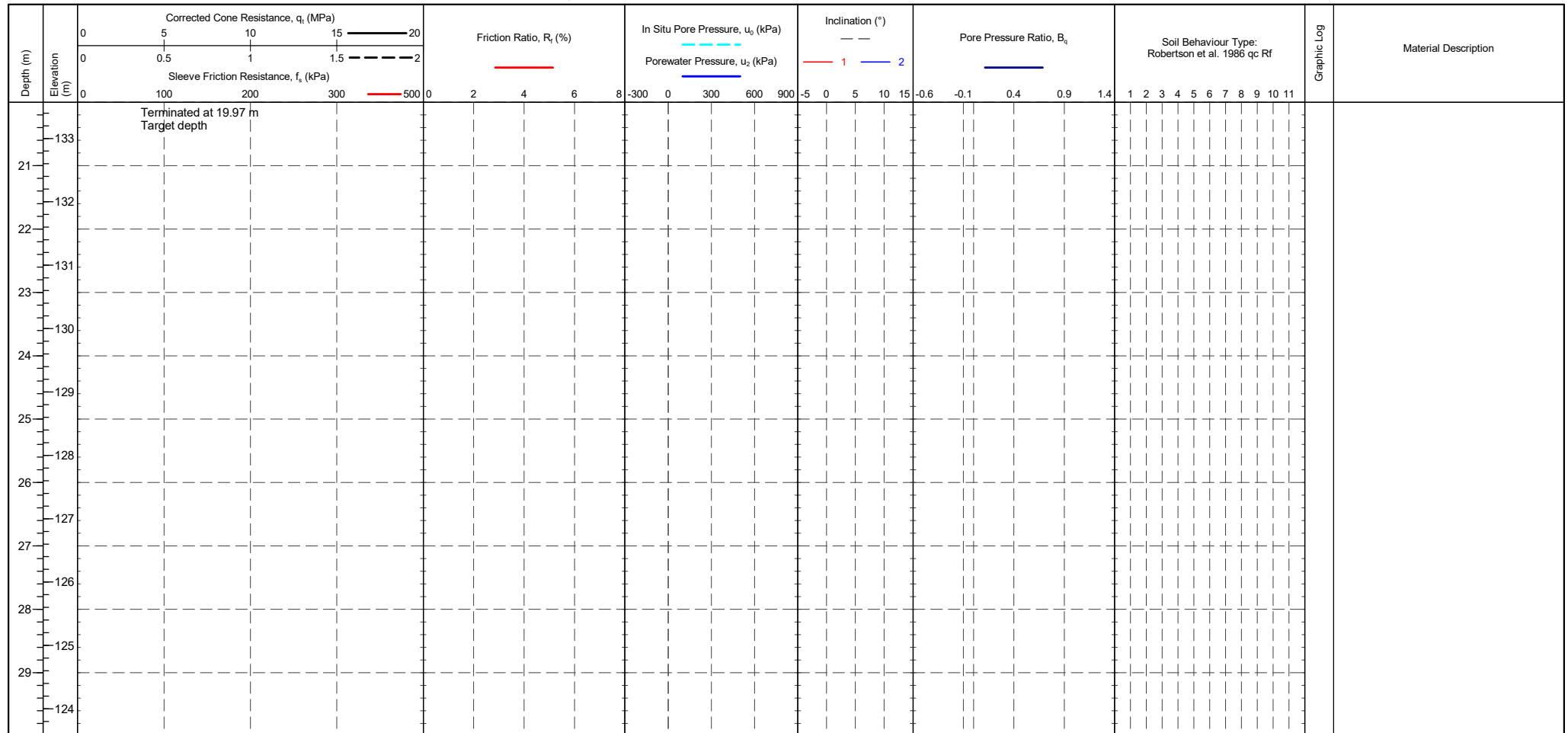
CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale

LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 3 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID	: DP10-CFPTxy.60195	TEST TYPE	: TE2	CPTU ZERO VALUES				METHOD: Robertson et al. 1986 qc Rf				Groundwater Level Dissipation Test
CALIBRATION DATE	: 31/05/2021	APPLICATION CLASS	: 2	Transducer	Pre	Post	Difference	1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND		
CONE MODEL	: Subtraction	RIG	: CPT 012 - Bob	Tip (MPa)	0.0660	0.0578	0.0083	2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND		
CONE AREA	: 10cm ²	OPERATOR	: CM	Sleeve (kPa)	0.0111	0.0100	0.0011	3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained		
CONE AREA RATIO	: 0.74	FRICTION REDUCER	: None	u2 (kPa)	0.0105	0.00976	0.0007	4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND		
FILTER POSITION	: u2	WEATHER	: Sunny & Hot	Inclinometer 1 (°)	-1.81	-2.04	0.2287					
FILTER TYPE	: HDPE	GROUNDWATER DEPTH	: Assumed for calculation purposes	Inclinometer 2 (°)	-2.63	-2.63	0.0073					

PointID

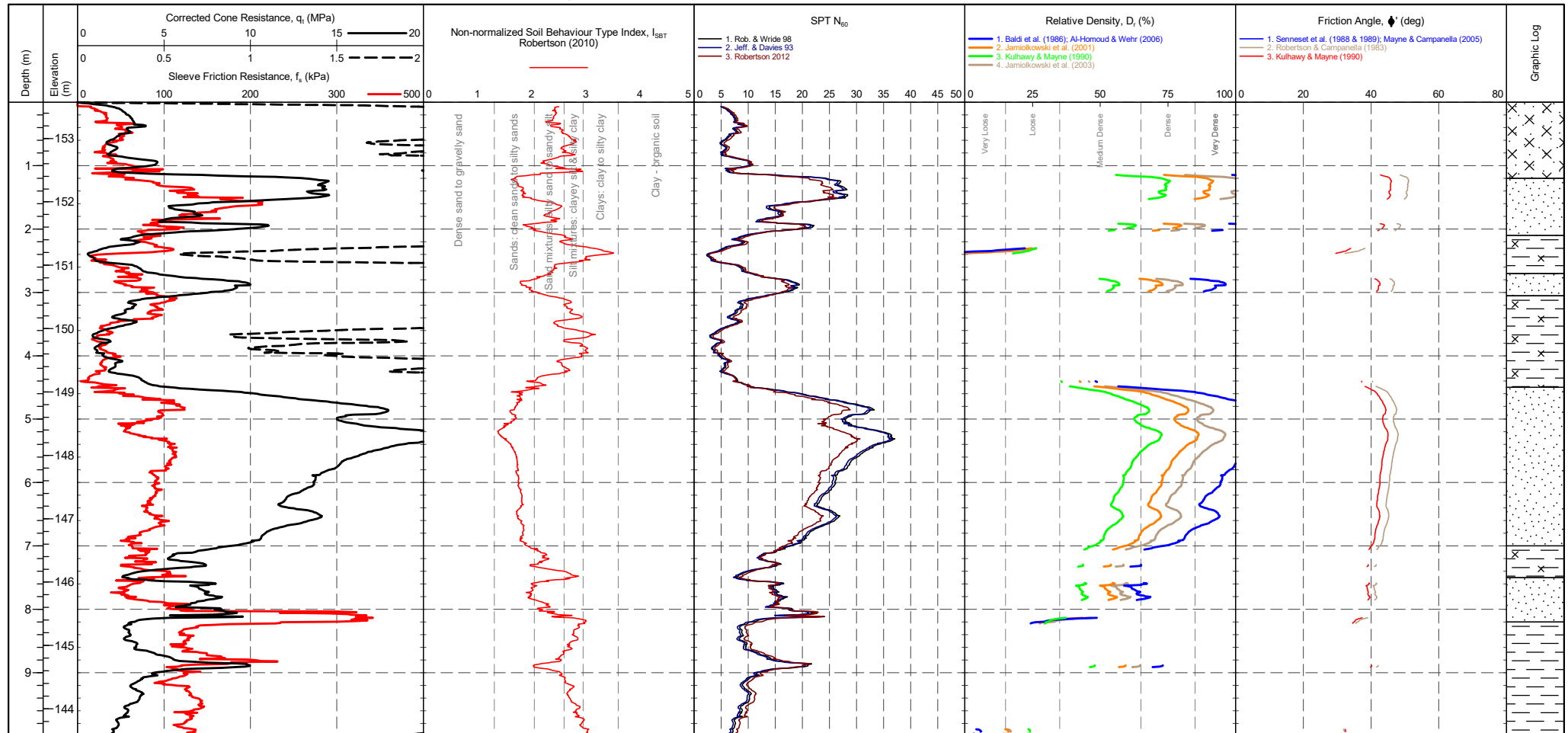
CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0660	0.0578	0.0083
Sleeve (kPa)	0.0111	0.0100	0.0011
u2 (kPa)	0.0105	0.00976	0.0007
Inclinometer 1 (°)	-1.81	-2.04	0.2287
Inclinometer 2 (°)	-2.63	-2.63	0.0073

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test

PointID

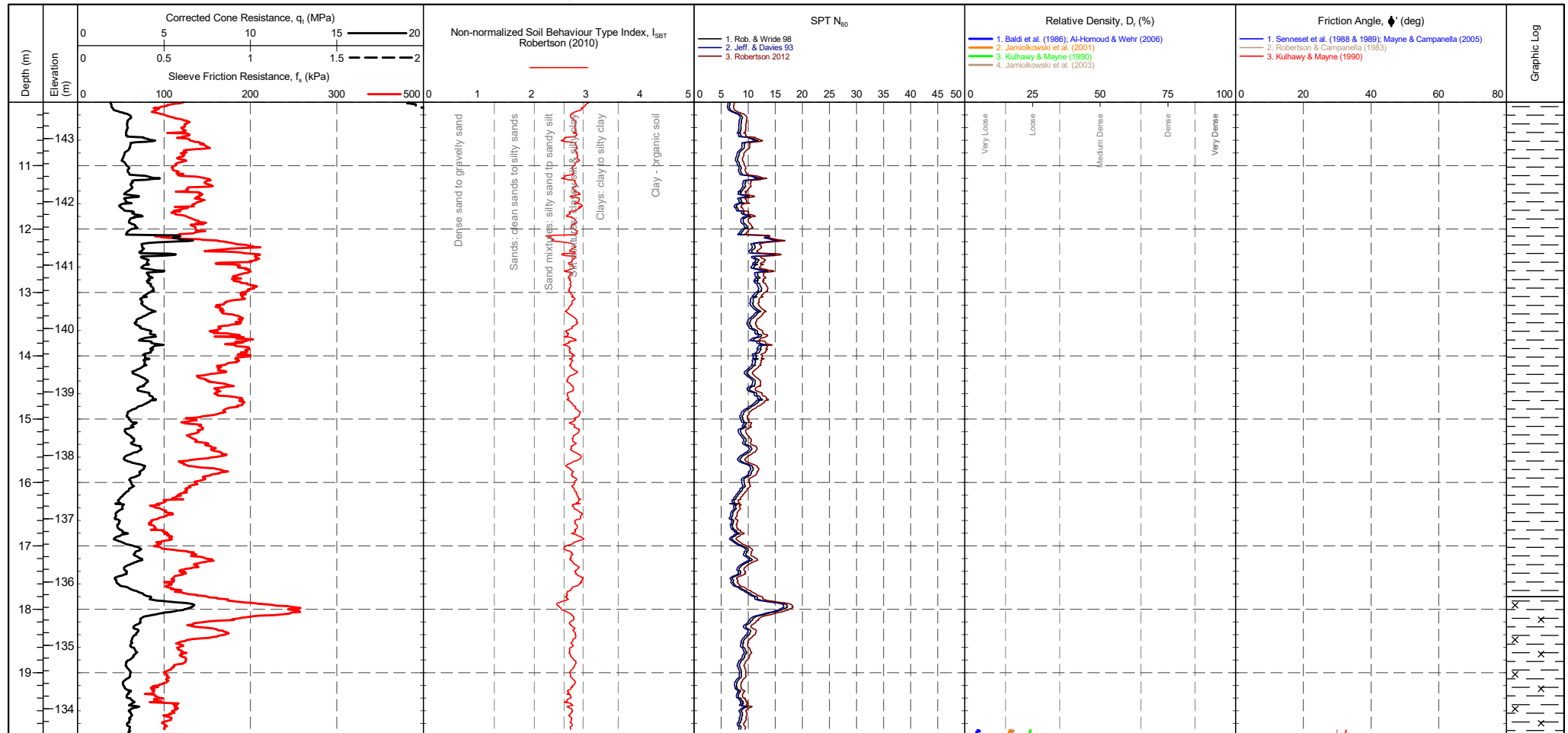
CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0660	0.0578	0.0083
Sleeve (kPa)	0.0111	0.0100	0.0011
u2 (kPa)	0.0105	0.00976	0.0007
Inclinometer 1 (")	-1.81	-2.04	0.2287
Inclinometer 2 (")	-2.63	-2.63	0.0073

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density Dr (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test

PointID

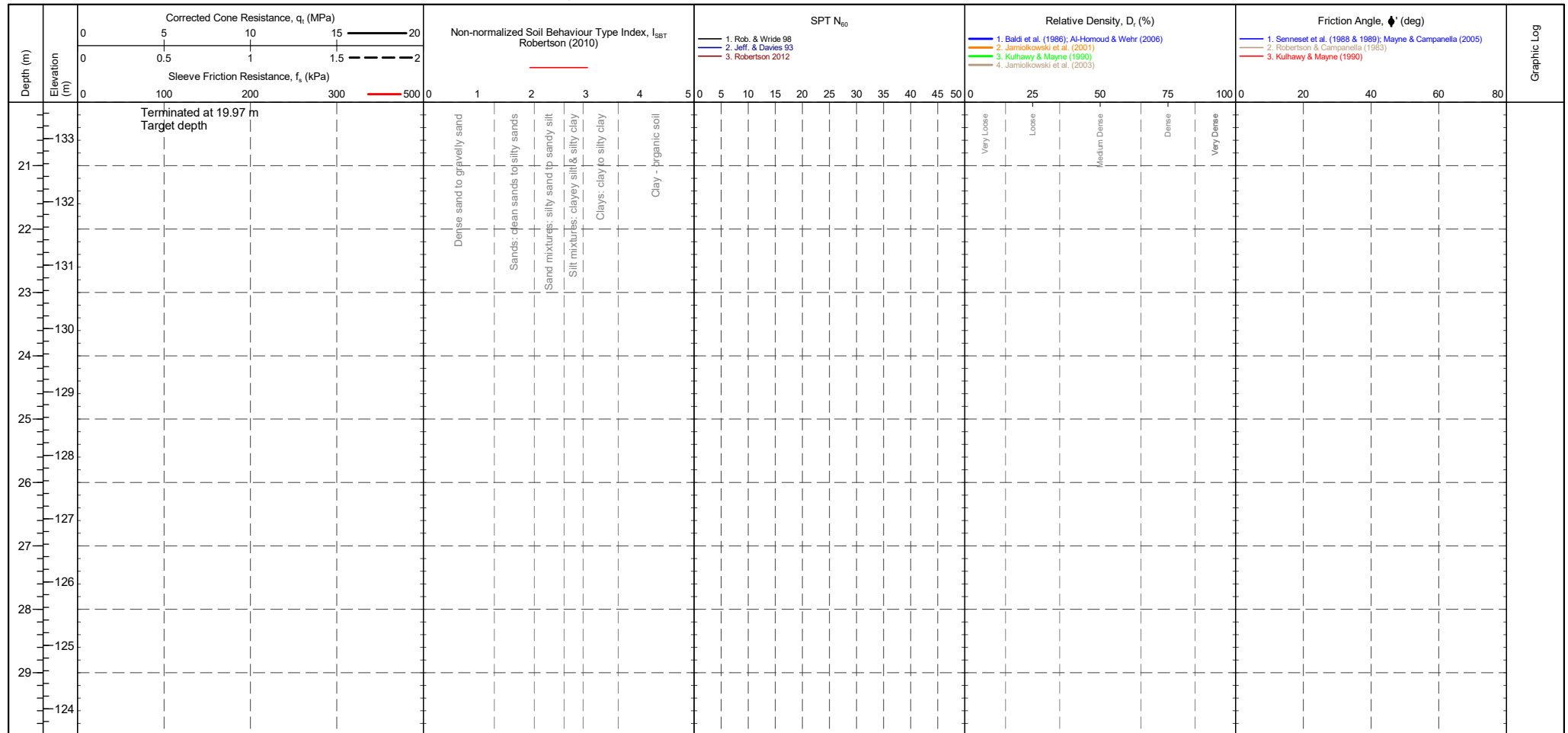
CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 3 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0660	0.0578	0.0083
Sleeve (kPa)	0.0111	0.0100	0.0011
u2 (kPa)	0.0105	0.00976	0.0007
Inclinometer 1 (")	-1.81	-2.04	0.2287
Inclinometer 2 (")	-2.63	-2.63	0.0073

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12			
Description	SBT Index, I_c	Description	SPT N value, NSPT
Clays	2.95-3.60	Very Loose	0 - 4
Silt mixtures	2.60-2.95	Loose	4 - 10
Sand mixtures	2.05-2.60	Medium Dense	10 - 30
Sands	1.31-2.05	Dense	30 - 50
Gravelly sand	<1.31	Very Dense	>50

Description	Relative Density D_r (%)
Very Loose	0 - 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	>85

Groundwater Level

Dissipation Test

PointID

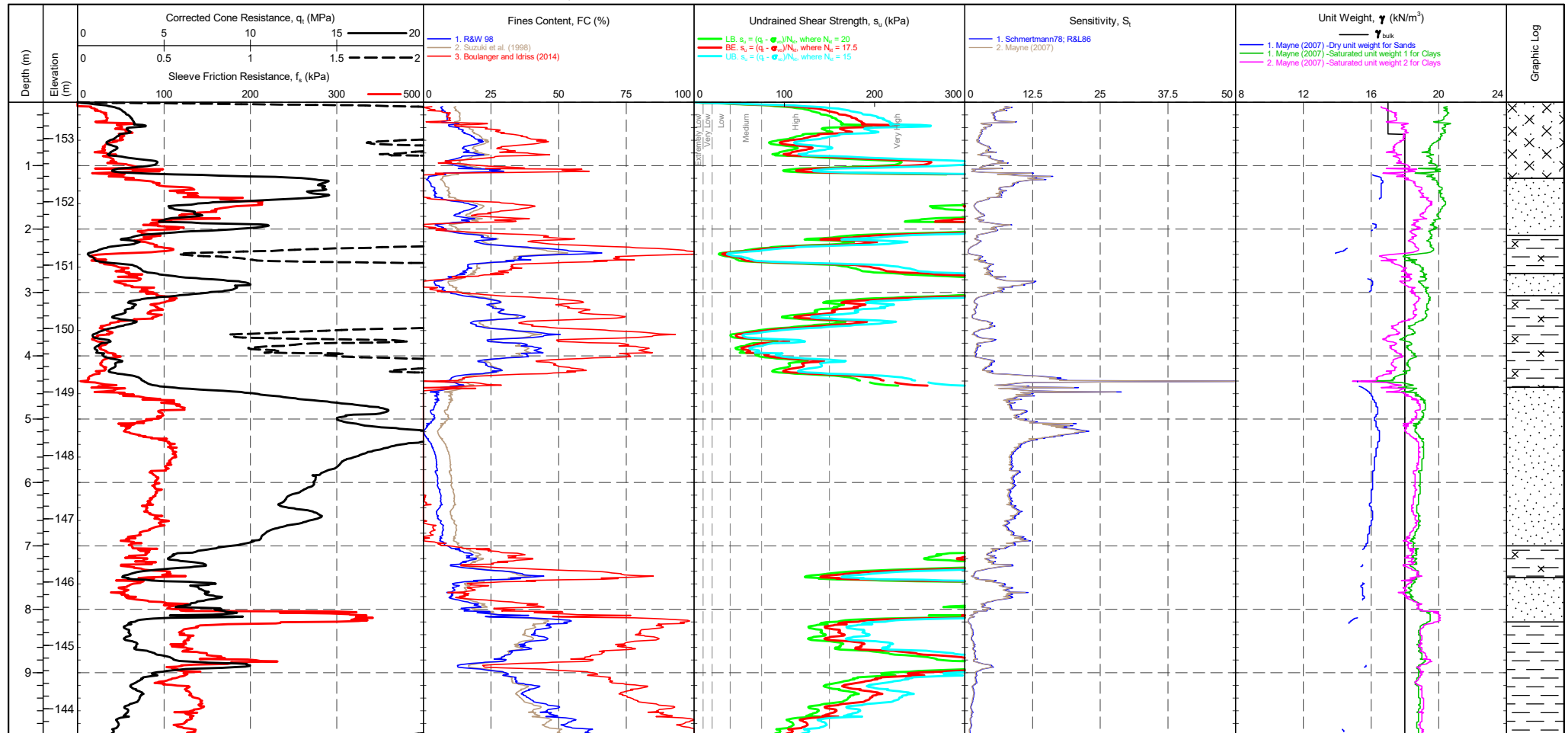
CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

Transducer Pre Post Difference
Tip (MPa) 0.0660 0.0578 0.0083
Sleeve (kPa) 0.0111 0.0100 0.0011
u2 (kPa) 0.0105 0.00976 0.0007
Inclinometer 1 (°) -1.81 -2.04 0.2287
Inclinometer 2 (°) -2.63 -2.63 0.0073

CPTU ZERO VALUES

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

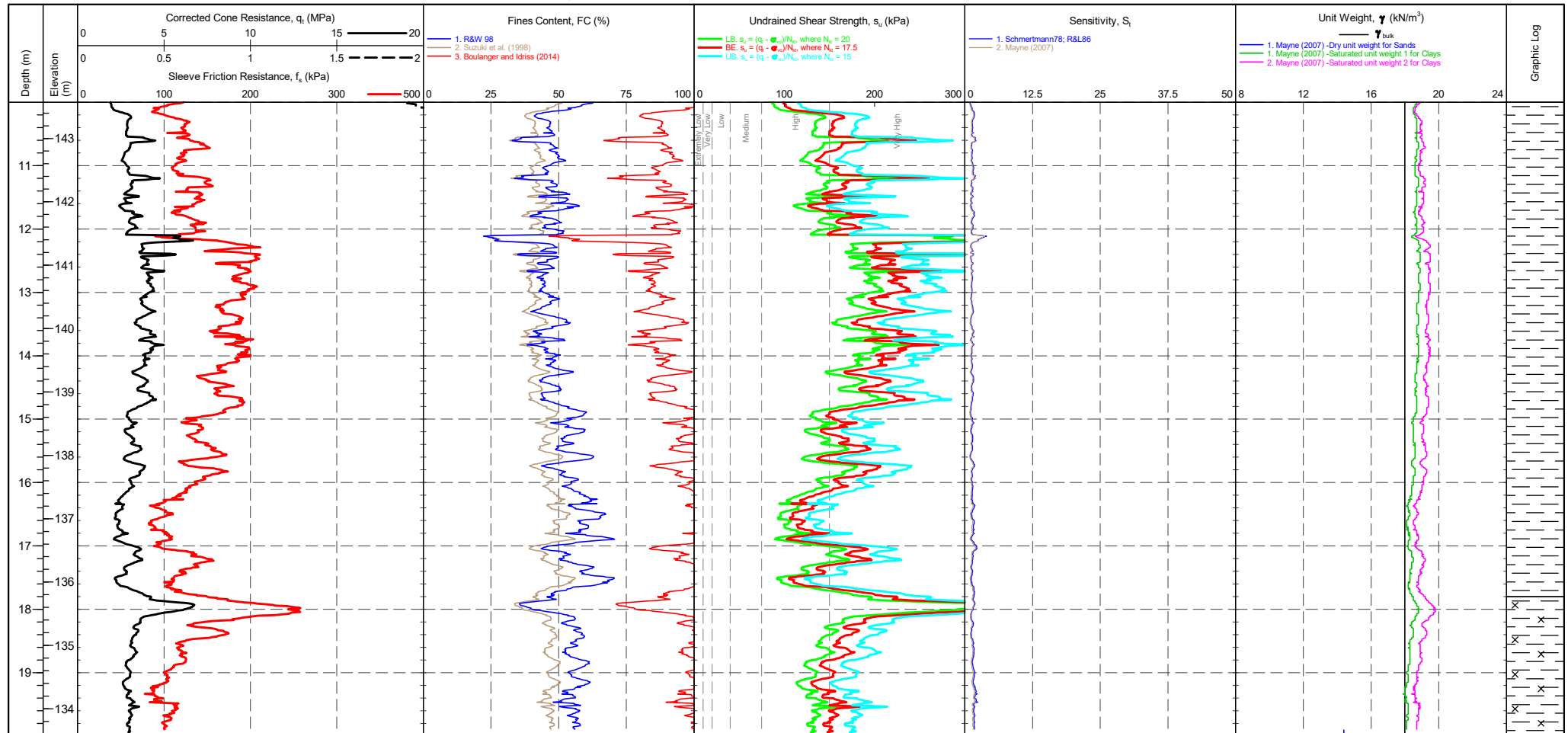
CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

Transducer Pre Post Difference
Tip (MPa) 0.0660 0.0578 0.0083
Sleeve (kPa) 0.0111 0.0100 0.0011
u2 (kPa) 0.0105 0.00976 0.0007
Inclinometer 1 (°) -1.81 -2.04 0.2287
Inclinometer 2 (°) -2.63 -2.63 0.0073

CPTU ZERO VALUES

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

CPT06

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391310.515 m
NORTHING : 411469.290 m
ELEVATION : 153.571 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 3 OF 3
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES			
Transducer	Pre	Post	Difference
Tip (MPa)	0.0660	0.0578	0.0083
Sleeve (kPa)	0.0111	0.0100	0.0011
u2 (kPa)	0.0105	0.00976	0.0007
Inclinometer 1 (°)	-1.81	-2.04	0.2287
Inclinometer 2 (°)	-2.63	-2.63	0.0073

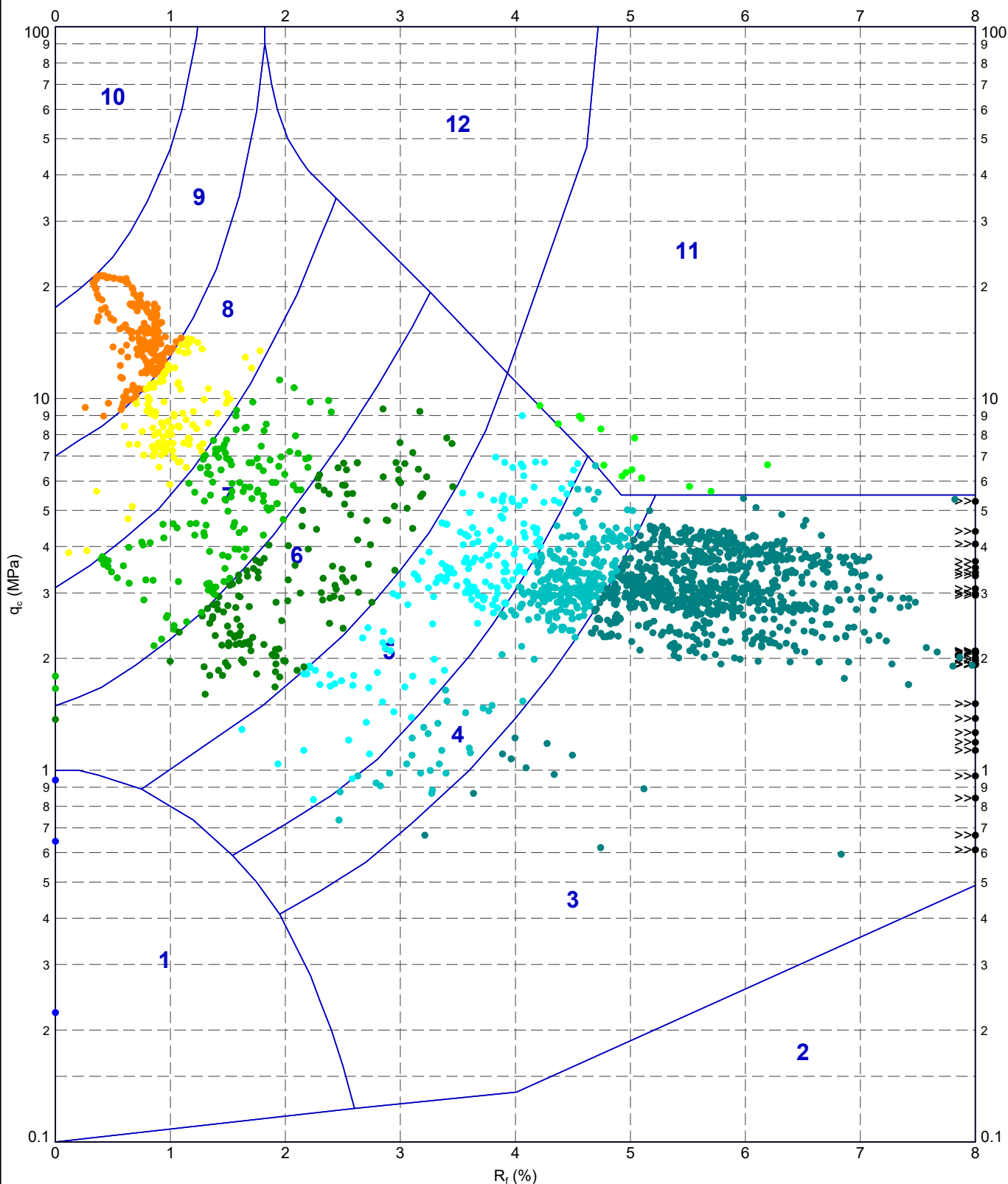
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:25 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: In Situ SI 2.02.0 2017-07-10 PjPj In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs. R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

TITLE

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 q_c vs. R_f - CPT06

DRAWN

DATE

27/06/2022

CHECKED

DATE

27/06/2022

SCALE

Not To Scale

A4

PROJECT No

1220329

FIGURE No

PointID

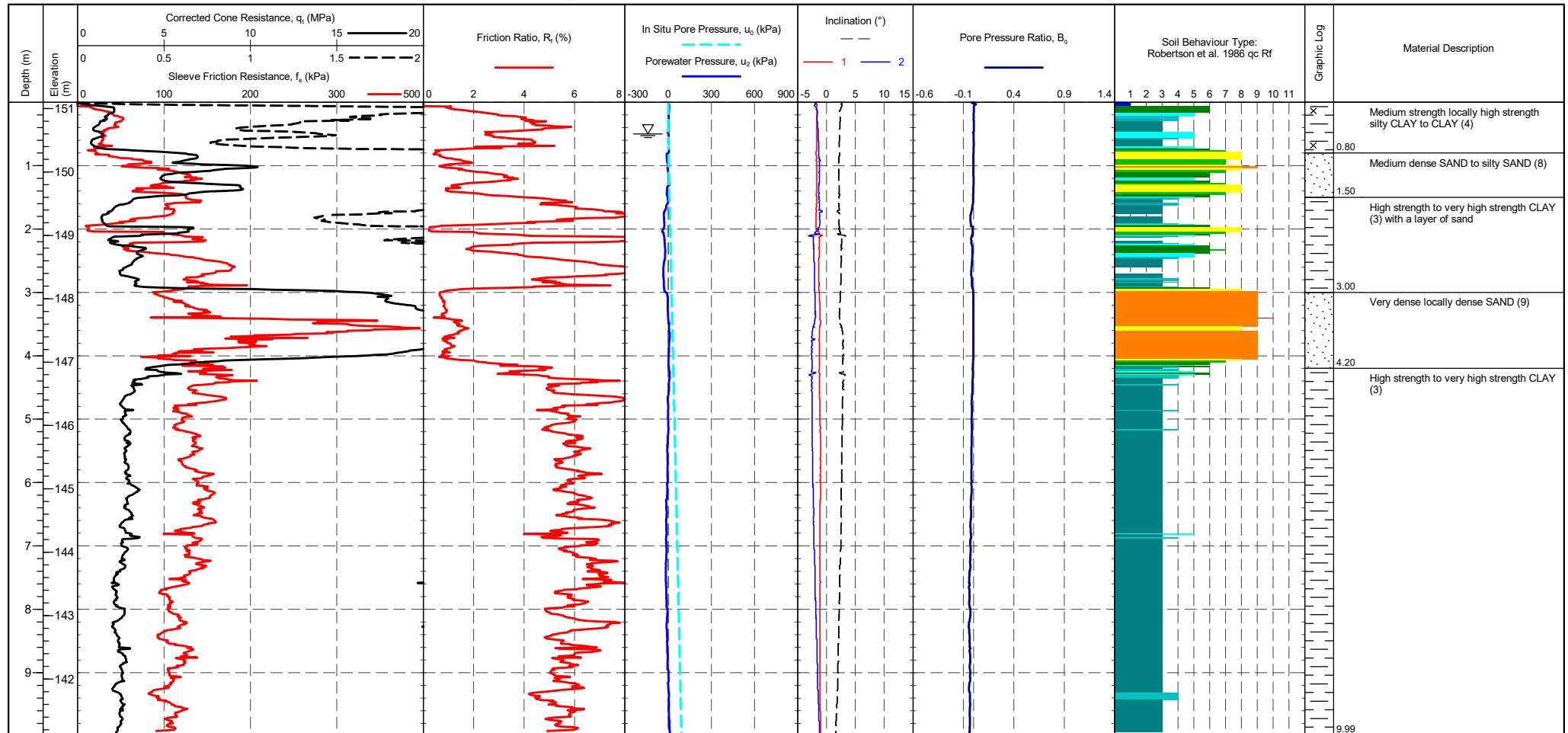
CPT07

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391293.938 m
NORTHING : 411437.620 m
ELEVATION : 151.100 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195		TEST TYPE : TE2		CPT ZERO VALUES			METHOD: Robertson et al. 1986 $q_c R_f$			Groundwater Level
CALIBRATION DATE : 31/05/2021	APPLICATION CLASS : 2	RIG : CPT 012 - Bob	Transducer	Pre	Post	Difference	1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND	
CONE MODEL : Subtraction	OPERATOR : CM	WEATHER : Sunny & Hot	Tip (MPa)	0.0578	0.0809	-0.0231	2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND	Dissipation Test
CONE AREA : 10cm ²	FRICITION REDUCER : None	GROUNDWATER DEPTH : Assumed for calculation purposes	Sleeve (kPa)	0.00790	0.0131	-0.0052	3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained	
CONE AREA RATIO : 0.74	WEATHER : Sunny & Hot		u_2 (kPa)	0.00976	0.00809	0.0017	4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND	
FILTER POSITION : u2			Inclinometer 1 ($^\circ$)	-1.70	-1.71	0.0047				
FILTER TYPE : HDPE			Inclinometer 2 ($^\circ$)	-1.74	-1.87	0.132				

PointID

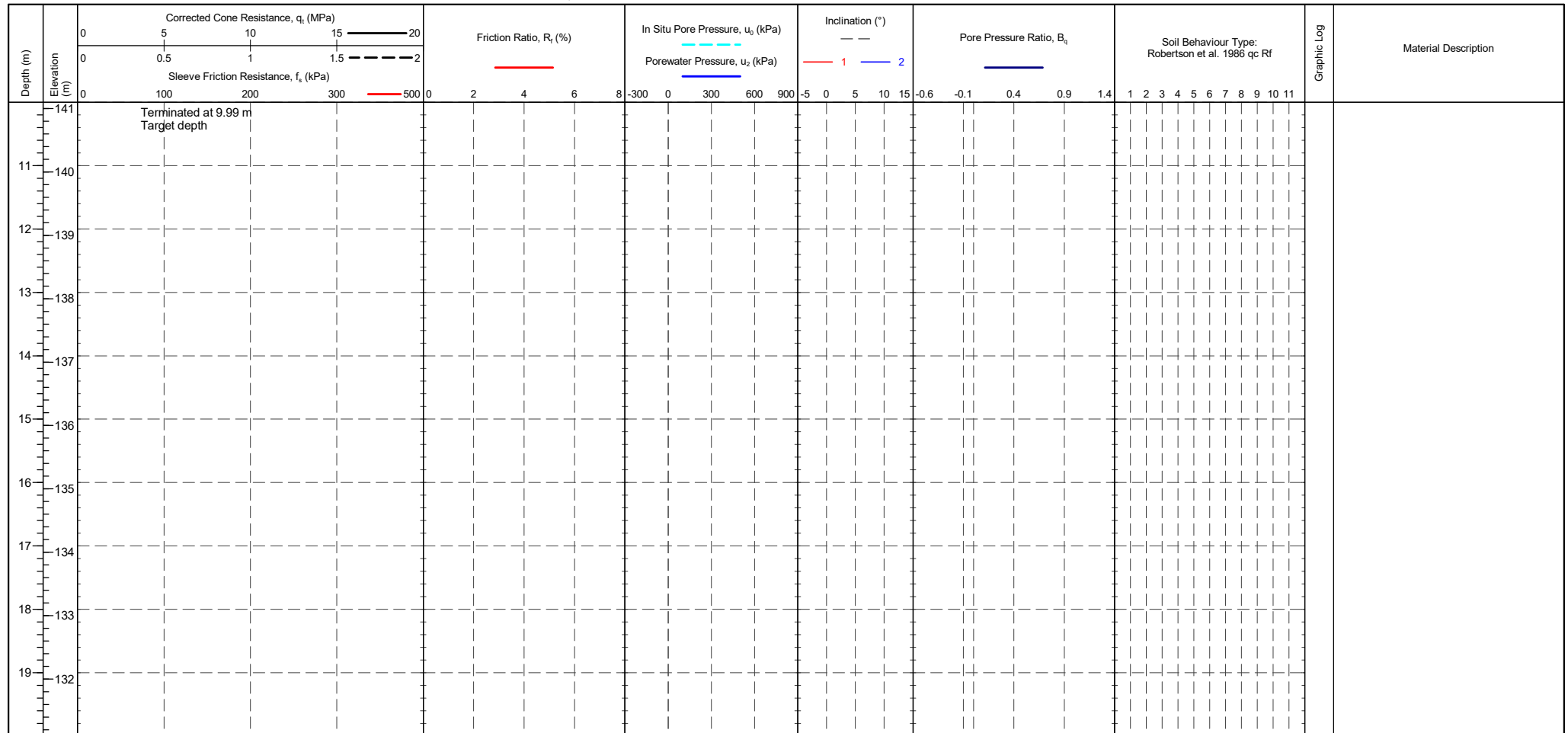
CPT07

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391293.938 m
NORTHING : 411437.620 m
ELEVATION : 151.100 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPT ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0809	-0.0231
Sleeve (kPa)	0.00790	0.0131	-0.0052
u2 (kPa)	0.00976	0.00809	0.0017
Inclinometer 1 (°)	-1.70	-1.71	0.0047
Inclinometer 2 (°)	-1.74	-1.87	0.132

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

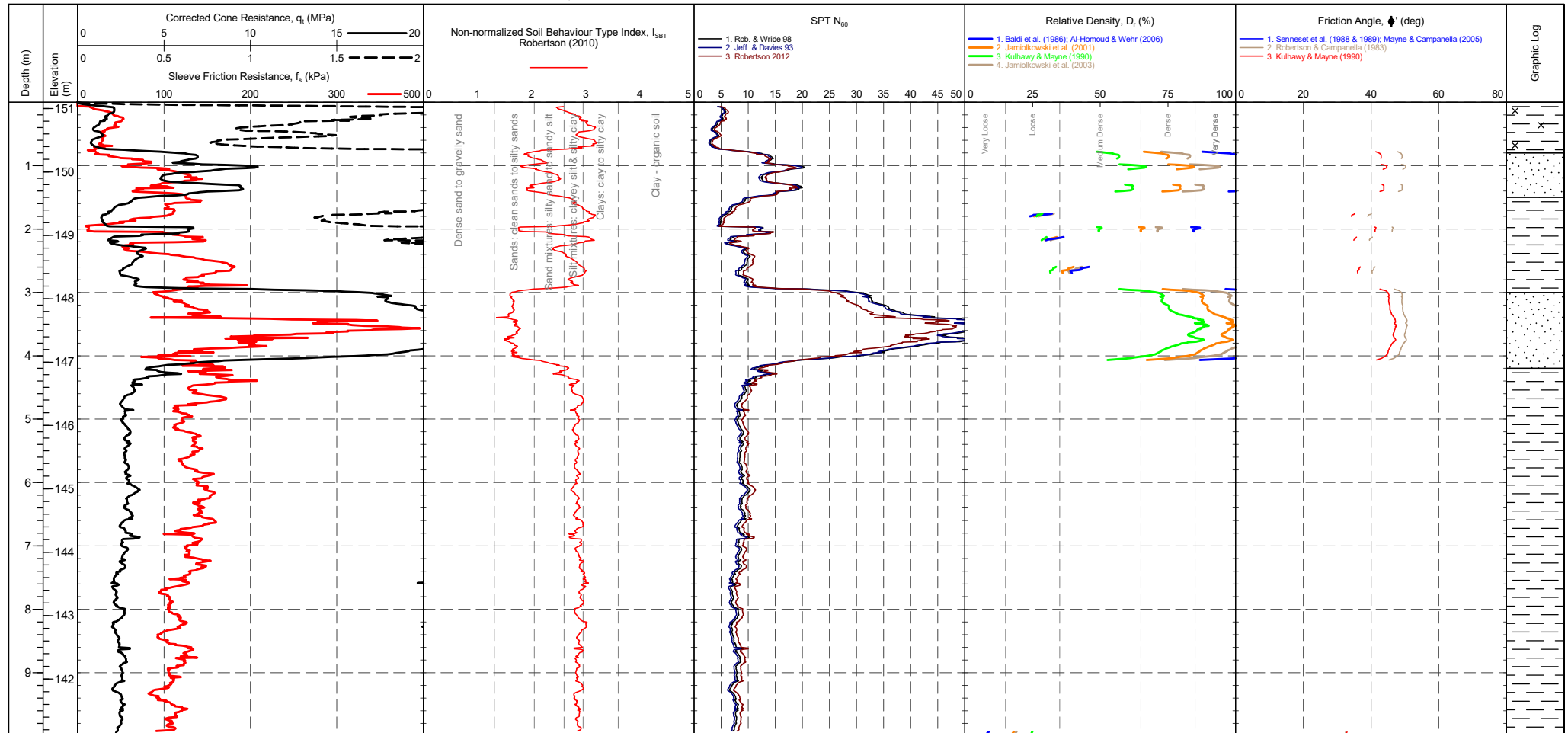
CPT07

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391293.938 m
NORTHING : 411437.620 m
ELEVATION : 151.100 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0809	-0.0231
Sleeve (kPa)	0.00790	0.0131	-0.0052
u2 (kPa)	0.00976	0.00809	0.0017
Inclinometer 1 (")	-1.70	-1.71	0.0047
Inclinometer 2 (")	-1.74	-1.87	0.132

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test

PointID

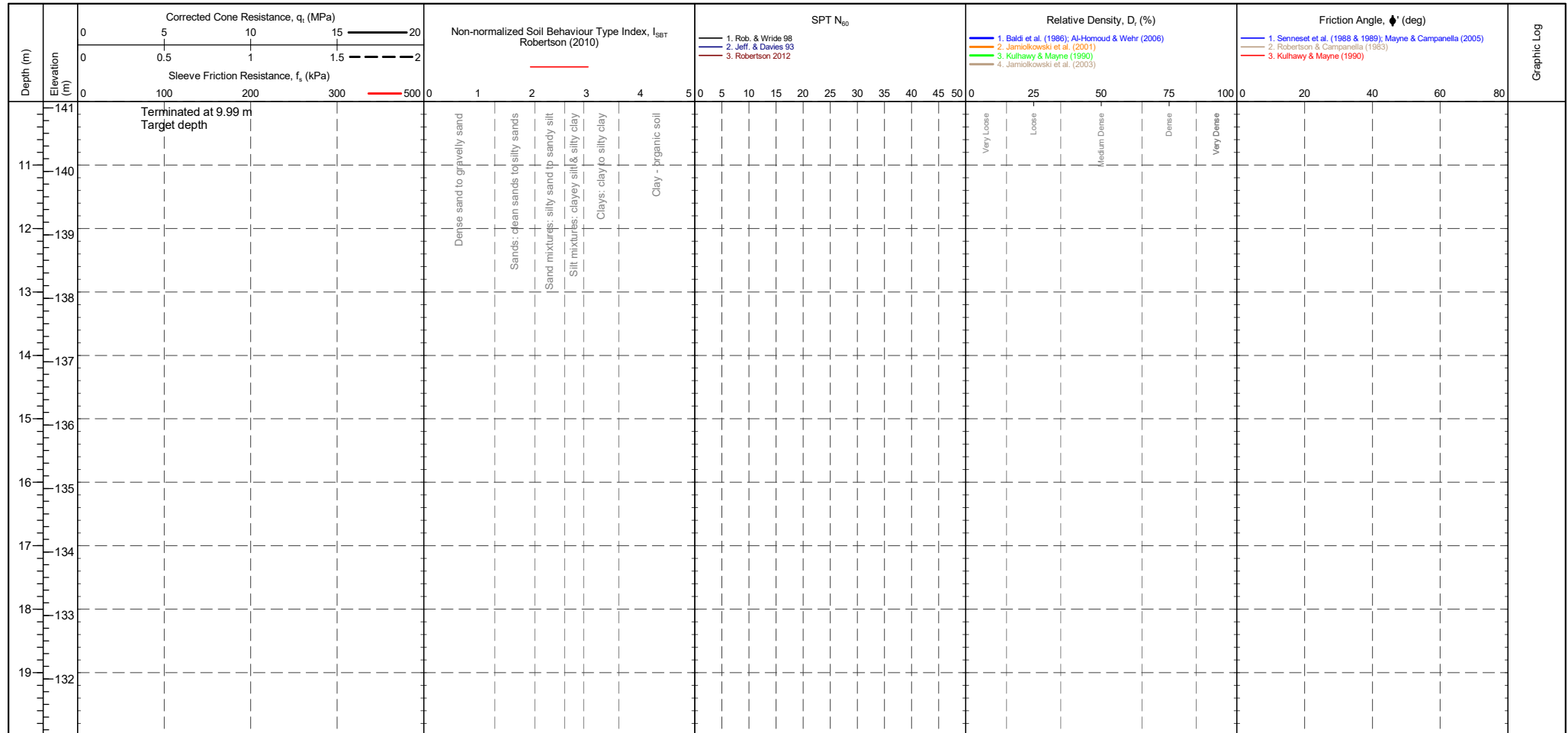
CPT07

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391293.938 m
NORTHING : 411437.620 m
ELEVATION : 151.100 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0809	-0.0231
Sleeve (kPa)	0.00790	0.0131	-0.0052
u2 (kPa)	0.00976	0.00809	0.0017
Inclinometer 1 (")	-1.70	-1.71	0.0047
Inclinometer 2 (")	-1.74	-1.87	0.132

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level
Dissipation Test

PointID

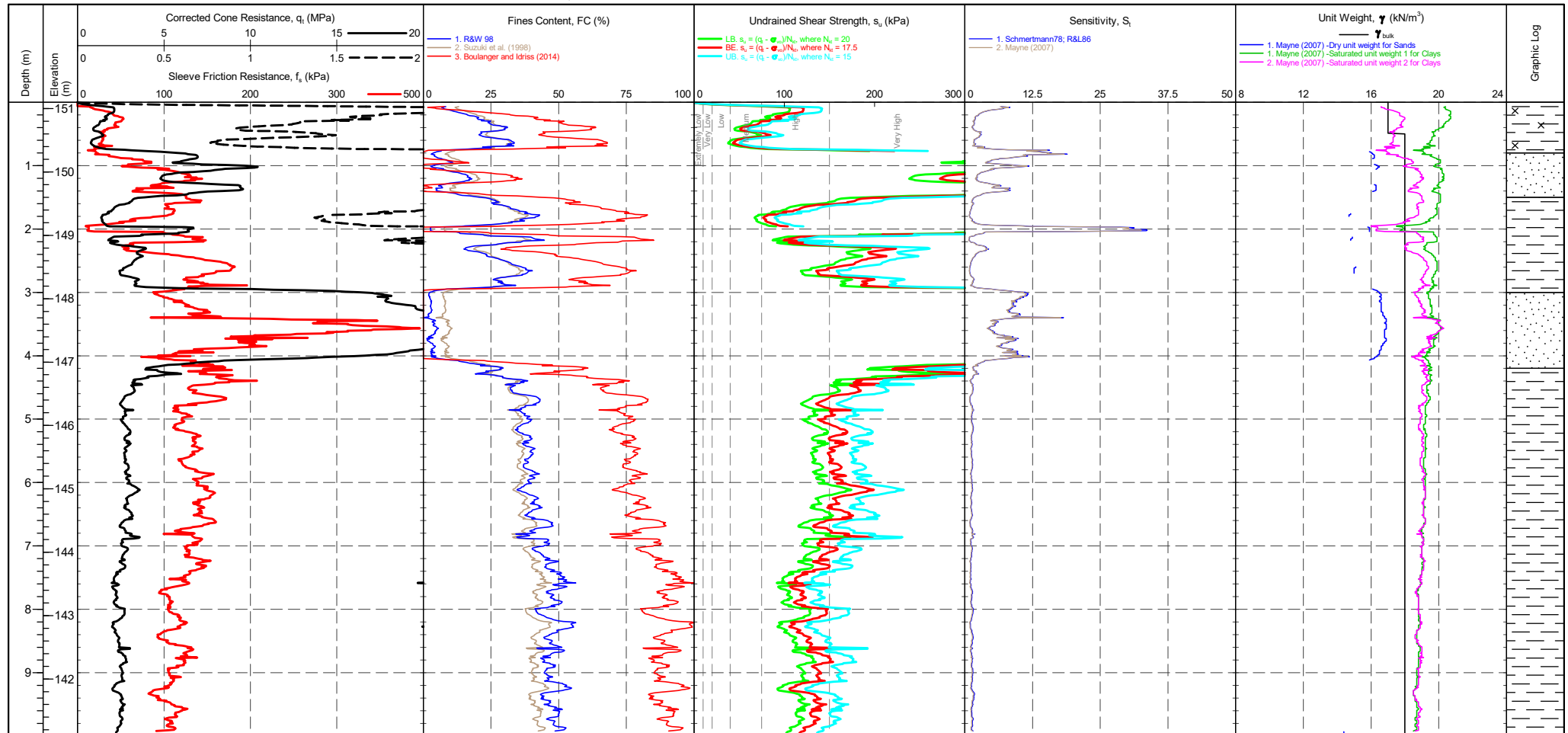
CPT07

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391293.938 m
NORTHING : 411437.620 m
ELEVATION : 151.100 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 1 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0809	-0.0231
Sleeve (kPa)	0.00790	0.0131	-0.0052
u2 (kPa)	0.00976	0.00809	0.0017
Inclinometer 1 (°)	-1.70	-1.71	0.0047
Inclinometer 2 (°)	-1.74	-1.87	0.132

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	s_u (kPa)	Term based on measurement	s_u (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

PointID

CPT07

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391293.938 m
NORTHING : 411437.620 m
ELEVATION : 151.100 m OD
CHECKED BY : LD
TERMINATION REASON : Target depth

Remark:
Test completed at target depth.

SHEET : 2 OF 2
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

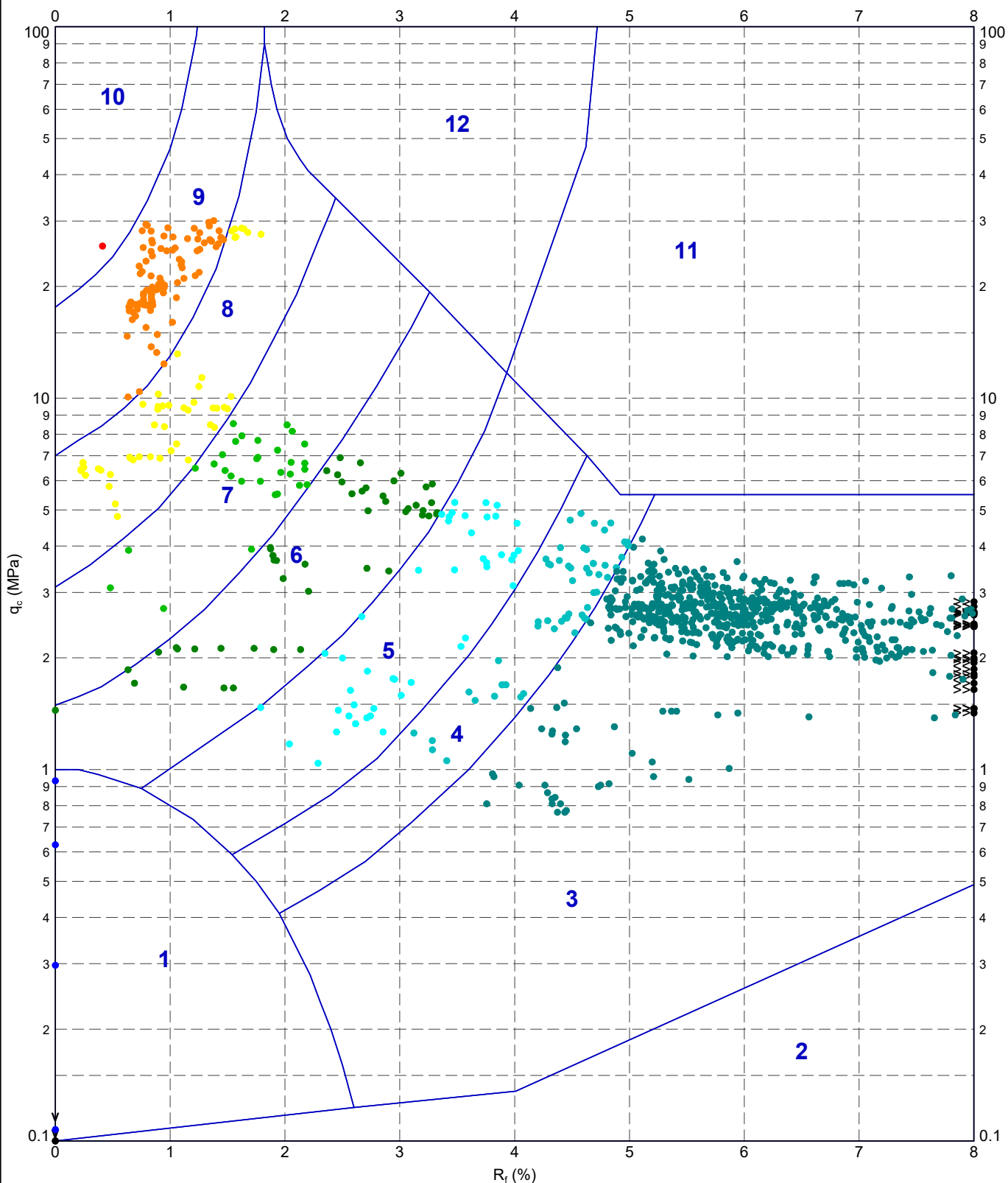
TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES			
Transducer	Pre	Post	Difference
Tip (MPa)	0.0578	0.0809	-0.0231
Sleeve (kPa)	0.00790	0.0131	-0.0052
u2 (kPa)	0.00976	0.00809	0.0017
Inclinometer 1 (°)	-1.70	-1.71	0.0047
Inclinometer 2 (°)	-1.74	-1.87	0.132

COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11		
Term based on measurement	s_u (kPa)	Term based on measurement
Extremely low strength	<10	Medium strength
Very low strength	10-20	High strength
Low strength	20-40	Very high strength
		Extremely high strength

Groundwater Level
Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:27 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: in Situ SI 2.02.0 2017-07-10 PjP: in Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 q_c vs. R_f

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

TITLE

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 q_c vs. R_f - CPT07

DRAWN

DATE

27/06/2022

CHECKED

DATE

27/06/2022

SCALE

Not To Scale

A4

PROJECT No

1220329

FIGURE No

PointID

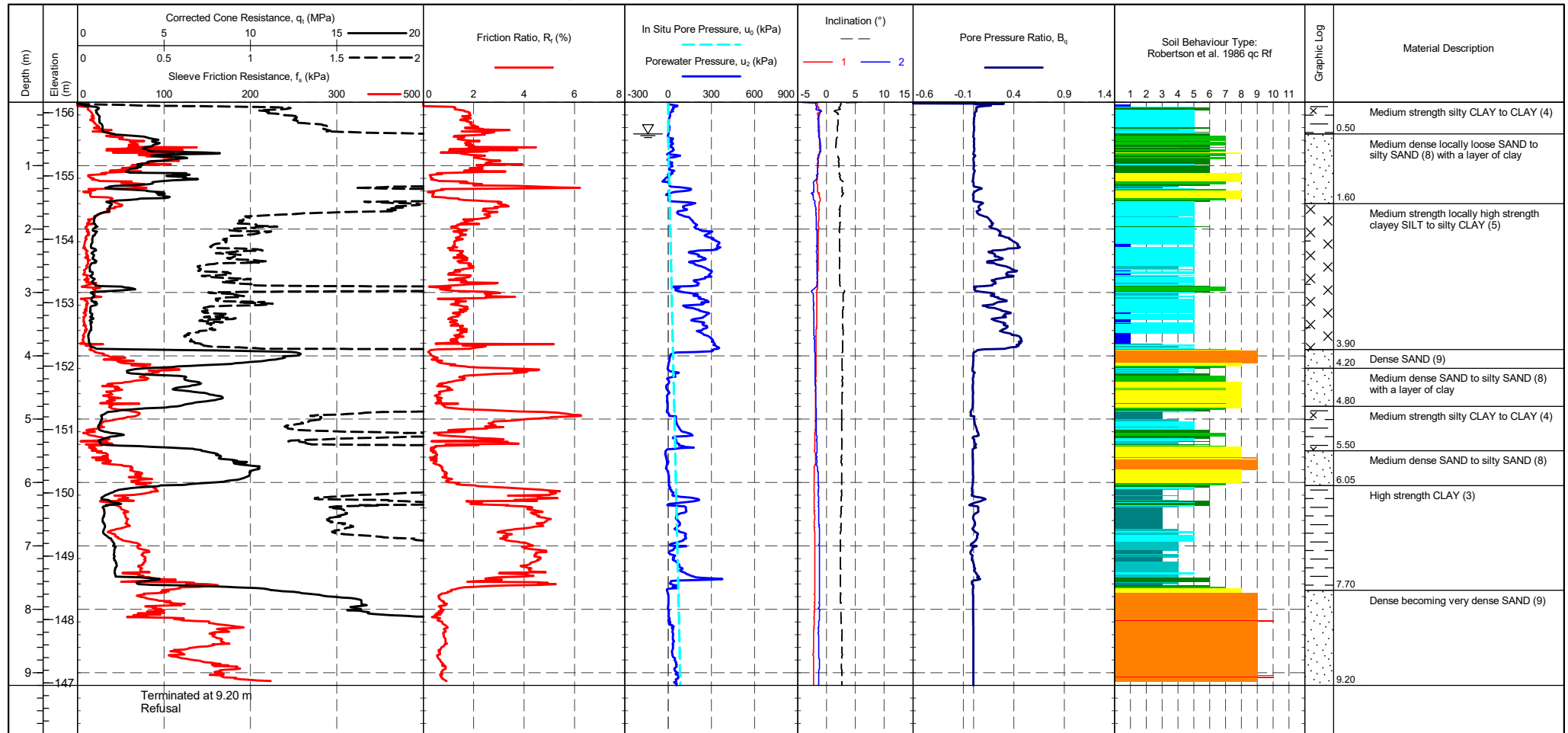
CPT08

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391227.316 m
NORTHING : 411367.469 m
ELEVATION : 156.163 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CALIBRATION DATE : 31/05/2021
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot
GROUNDWATER DEPTH : Assumed for calculation purposes

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0248	0.0594	-0.0347
Sleeve (kPa)	0.00834	0.0121	-0.0037
u_2 (kPa)	0.0103	0.0109	-0.0006
Inclinometer 1 ($^\circ$)	-3.29	-1.81	-1.4832
Inclinometer 2 ($^\circ$)	-4.32	-1.86	-2.4527

METHOD: Robertson et al. 1986 qc Rf

1 - Sensitive fine grained material	5 - Clayey SILT to silty CLAY	9 - SAND
2 - Organic material	6 - Sandy SILT to clayey SILT	10 - Gravelly SAND to SAND
3 - CLAY	7 - Silty SAND to sandy SILT	11 - Very stiff fine grained
4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 - SAND to clayey SAND

Groundwater Level

Dissipation Test

PointID

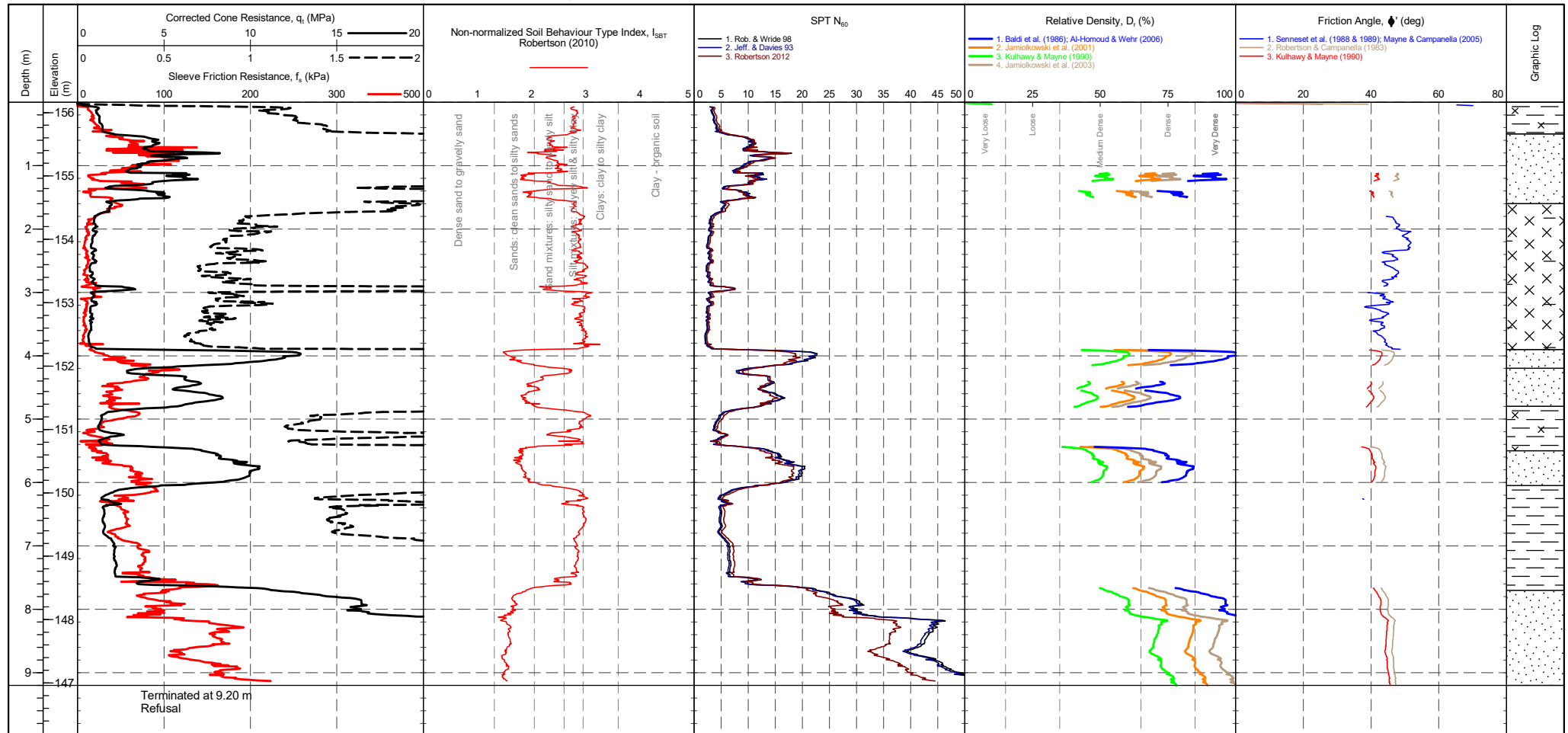
CPT08

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391227.316 m
NORTHING : 411367.469 m
ELEVATION : 156.163 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

CPTU ZERO VALUES

Transducer	Pre	Post	Difference
Tip (MPa)	0.0248	0.0594	-0.0347
Sleeve (kPa)	0.00834	0.0121	-0.0037
u2 (kPa)	0.0103	0.0109	-0.0006
Inclinometer 1 (°)	-3.29	-1.81	-1.4832
Inclinometer 2 (°)	-4.32	-1.86	-2.4527

GRANULAR SOILS (Sands & Gravels) Robertson et al. 1986 Zones 7-10 and Zone 12

Description	SBT Index, I_c	Description	SPT N value, NSPT	Description	Relative Density D_r (%)
Clays	2.95-3.60	Very Loose	0 - 4	Very Loose	0 - 15
Silt mixtures	2.60-2.95	Loose	4 - 10	Loose	15 - 35
Sand mixtures	2.05-2.60	Medium Dense	10 - 30	Medium Dense	35 - 65
Sands	1.31-2.05	Dense	30 - 50	Dense	65 - 85
Gravelly sand	<1.31	Very Dense	>50	Very Dense	>85

Groundwater Level

Dissipation Test

PointID

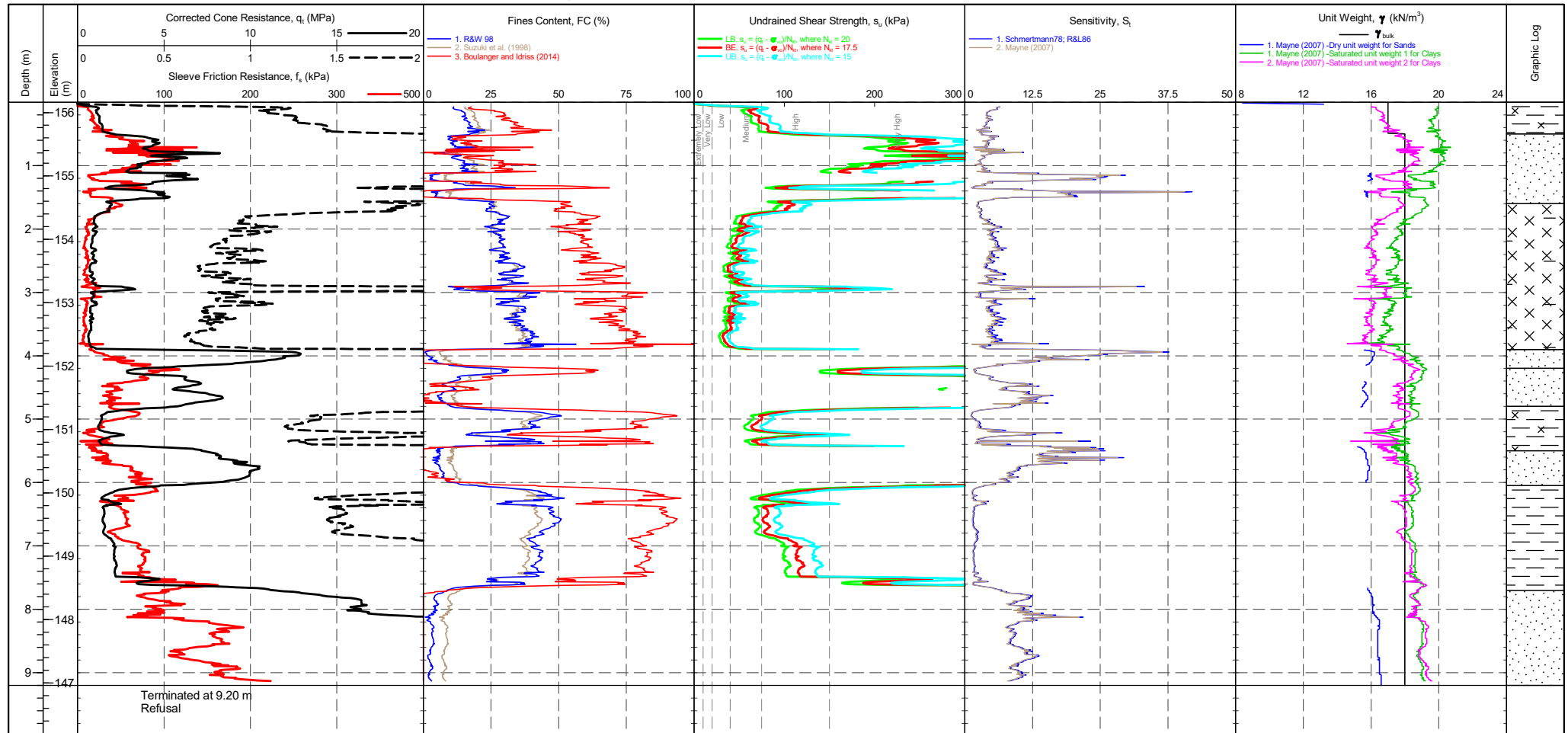
CPT08

CLIENT : BWB Consulting
PROJECT : Plot J2 Rochdale
LOCATION : Rochdale
PROJECT No. : 1220329

EASTING : 391227.316 m
NORTHING : 411367.469 m
ELEVATION : 156.163 m OD
CHECKED BY : LD
TERMINATION REASON : Refusal

Remark:
Test refused on total pressure.

SHEET : 1 OF 1
STATUS : Final
TEST DATE : 21/06/2022
PLOT DATE : 27/06/2022
METHOD : ISO 22476-1:2012



CONE ID : DP10-CFPTxy.60195
CONE MODEL : Subtraction
CONE AREA : 10cm²
CONE AREA RATIO : 0.74
FILTER POSITION : u2
FILTER TYPE : HDPE

TEST TYPE : TE2
APPLICATION CLASS : 2
RIG : CPT 012 - Bob
OPERATOR : CM
FRICTION REDUCER : None
WEATHER : Sunny & Hot

Transducer Pre Post Difference
Tip (MPa) 0.0248 0.0594 -0.0347
Sleeve (kPa) 0.00834 0.0121 -0.0037
u2 (kPa) 0.0103 0.0109 -0.0006
Inclinometer 1 (°) -3.29 -1.81 -1.4832
Inclinometer 2 (°) -4.32 -1.86 -2.4527

CPTU ZERO VALUES

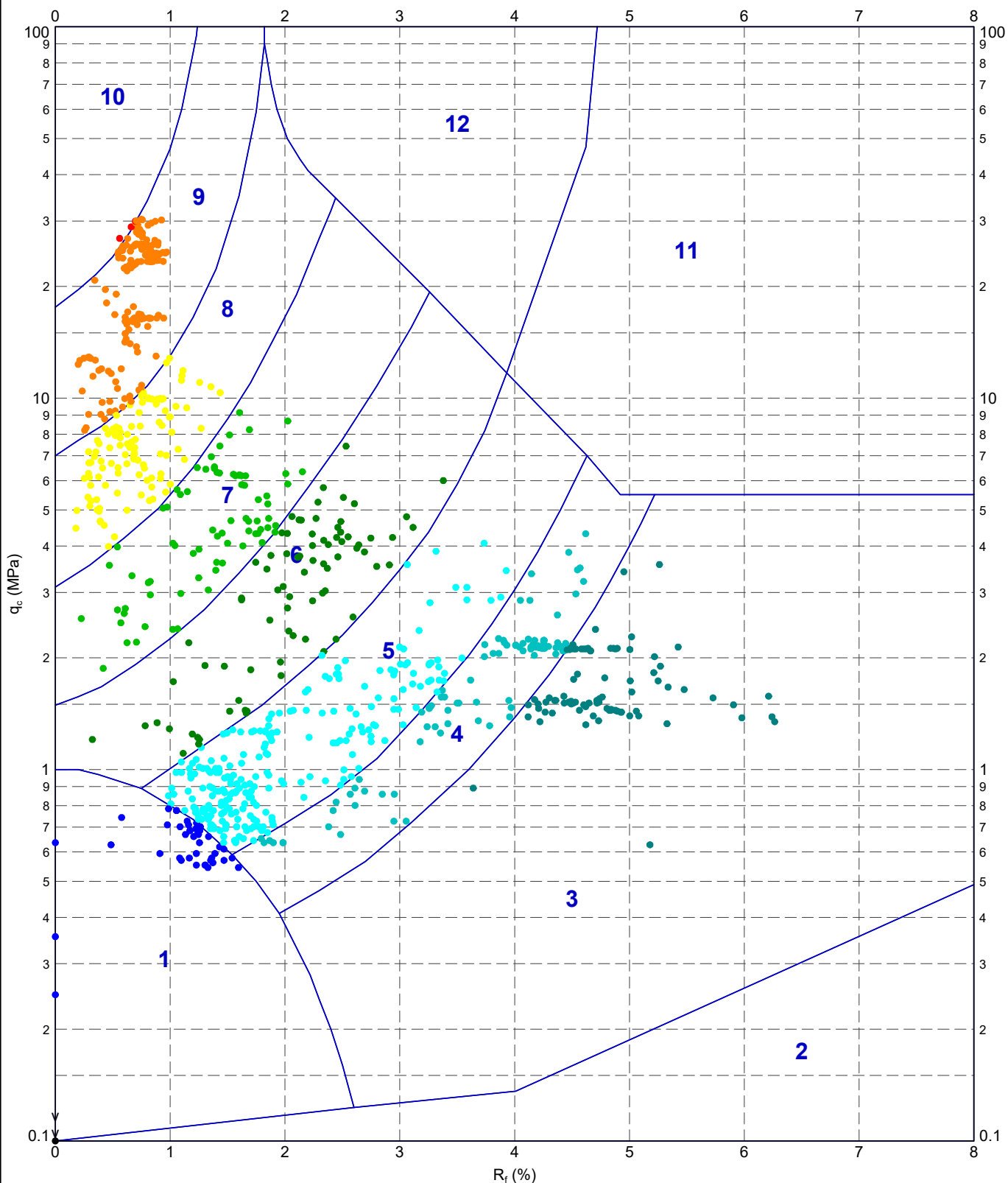
COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11

Term based on measurement	su (kPa)	Term based on measurement	su (kPa)
Extremely low strength	<10	Medium strength	40-75
Very low strength	10-20	High strength	75-150
Low strength	20-40	Very high strength	150-300
		Extremely high strength	>300

Groundwater Level

Dissipation Test

220228-ADVANCED REPORT INSTITUSI 2.02.1 LUB - CHLOE GLB Graph CPT ROBERTSON ET AL. 86 QC VS. RF MAP 1220329 PLOT J2 ROCHDALE BWB CONSULTING GPJ <<DrawingFile>> 27/06/2022 12:29 10.03.00.09 Datagel Lab and In Situ Tool - DSD | Lib: In Situ SI 2.02.0 2017-07-10 PjP: In Situ SI 2.02.0 2017-07-10



METHOD: Robertson et al. 1986 qc Rf

- | | | | |
|-------------------------------------|-------------------------------|------------------------------|------------------------------|
| 1 - Sensitive fine grained material | 4 - Silty CLAY to CLAY | 7 - Silty SAND to sandy SILT | 10 - Gravelly SAND to SAND |
| 2 - Organic material | 5 - Clayey SILT to silty CLAY | 8 - SAND to silty SAND | 11 - Very stiff fine grained |
| 3 - CLAY | 6 - Sandy SILT to clayey SILT | 9 - SAND | 12 - SAND to clayey SAND |

IN SITU
SITE INVESTIGATION

TITLE

BWB Consulting
Rochdale
Plot J2 Rochdale
Robertson et al. 1986 qc vs. Rf - CPT08

DRAWN

DATE

27/06/2022

CHECKED

DATE

27/06/2022

SCALE

Not To Scale

A4

PROJECT No

1220329

FIGURE No



IN SITU SITE INVESTIGATION

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Centre,
Highfield Drive
St. Leonards on Sea, East Sussex,
TN38 9UH, U.K.

Company No.: 6339499
VAT No.: 922 3561 41