

Rosedale, Newton Heath, Manchester

Phase 2 Ground Investigation

Curtins Ref: 079193-CUR-XX-XX-T-GE-00003

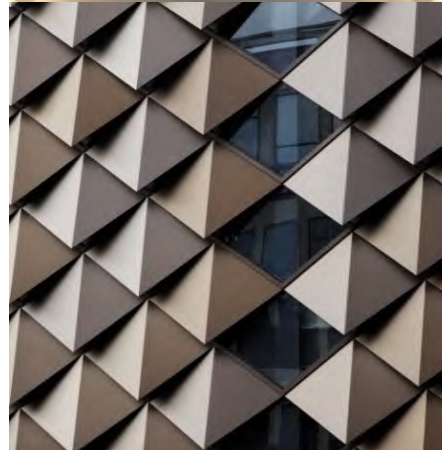
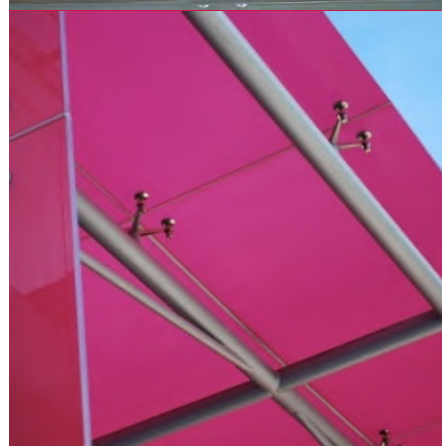
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Executive Summary

Appointment	<p>In September 2021 Curtins were instructed by One Manchester to undertake a Phase 2 Ground Investigation at the Rosedale site in Newton Heath, Manchester. The site is centred on NGR 387490, 400630, and covers an area of approximately 0.21 Ha.</p> <p>This investigation addresses recommendations as presented in the Phase 1 report (ref. 13), with the aim of the Phase 2 works to characterise geo-environmental conditions prior to redevelopment as residential apartments and support an associated planning application.</p>
Current Site Status	<p>The site has undergone demolition works of the above ground structures. However, below ground structures remain as confirmed by this ground investigation. The site rises to the south-west corner of the site. Most of the surface is brick rubble fill across the former building footprint with Dulverton Street remaining in the east of the site.</p> <p>Oldham Road (A62) immediately north, with residential housing and apartment blocks beyond along with Newton Heath & Moston tram stop. Dulverton Street immediately east. With unused land with a building formerly associated with YES Group catering supplies and Newton Street beyond. Old Church Street immediately south. With Newton Heath Terminus stop and the Newton Heath Library beyond. The Rochdale canal is also situated beyond the library. Old Church Street and Troydale Drive immediately west of the site. Newton Heath Health Centre along with residential housing located to the west.</p>
Summary of Phase 1 PRA	<p>Historically the site is recorded to be occupied by terraced housing. A change is noted in the 1930s when larger buildings are recorded to occupy the site, but no description is provided. From 2017 onwards these buildings have progressively been demolished. The site is likely to be underlain by made ground deposits, till superficial deposits and bedrock of the Collyhurst Sandstone Formation. The BGS records the site to be in an area of a buried glacial valley where deep superficial deposits are expected. Site is underlain by Secondary Undifferentiated Aquifer in the superficial deposits and Principal Aquifer in the bedrock deposits. Site is not within an SPZ and no licensed groundwater abstractions within 1km of the site.</p> <p>Primary potential risks to be investigated during the Phase 2, as well as establishing ground conditions for geotechnical design, included; potential for ground gas and, risks to human health.</p>
Fieldworks Undertaken	<p>The ground investigation works were carried out in two stages due to below ground obstructions. The first phase was completed between the 4th and 8th October 2021. This consisted of three cable percussive boreholes up to 25.00m bgl, and six machine excavated trial pits up to 2.80m bgl. The position of CP01 could not advance past the obstruction encountered at 2.60m bgl. Therefore, a return visit was made between the 22nd and 24th November 2021 to complete the position of CP01A breaking out the obstruction. Ground gas and groundwater monitoring standpipes/piezometers were installed in selected boreholes. Selected and soil samples were subjected to chemical and geotechnical laboratory analysis. In total eight monitoring visits have been completed between October 2021 and December 2021.</p>
Encountered Ground Conditions	<p>Made ground deposits were recorded to range to maximum depths of 0.40m and 3.00m bgl. The north and centre of the site encountered obstructions associated with a backfilled basement. Backfill material consisted of demolition arisings. This is underlain by till deposits and most likely a glaciofluvial channel consisting of bands of clay, silt, sand, and gravels at depths ranging between 6.00m to 22.00m at it's maximum depths. This goes back into a till deposit which is recorded to be very stiff to hard to a maximum proven depth of 25.00m bgl. Bedrock was not proven. Groundwater was struck within the glaciofluvial deposits and underlying till with groundwater levels generally siting between 7m to 8m bgl. The made ground was recorded to observe ashy soil conditions. No other visual or olfactory indication of contamination was recorded during the ground investigation works.</p>
Environmental Laboratory Testing and Land Gas Monitoring Results	<p>Concentrations of lead have been recorded in six out of the seven made ground samples above the Tier 1 thresholds for the site. These are likely to be associated with the minor ashy conditions of the made ground and amount of metal present within the made ground soils. No other exceedances were identified as part of the ground investigation works.</p>

	<p>Groundwater sampling and assessment is outside the scope of this ground investigation report.</p> <p>During land gas monitoring, a maximum concentration of 4.1% v/v carbon dioxide (CO₂) was encountered. Some of the ground gas flows have been discounted from the assessment due to the piston and stack effects providing anomalous results. The likely representative flow was recorded to be -2.8l/hr during the monitoring period. Concentrations of methane (CH₄) encountered have been below the monitor's detection limit. Hydrogen sulphide (H₂S) and carbon monoxide (CO) have been recorded between 0ppm to 2ppm generally. Oxygen (O₂) concentrations were recorded to be depleted during one visit in one location with a minimum of 7.2% v/v. Worst credible scenario produces a Qhg of -0.014 l/hr. Worst possible scenario produces a Qhg of -0.079 l/hr.</p>
Ground Contamination and Ground Gas Assessment	<p>It is considered that the risk presented to site end users from lead concentrations in the made ground soils on site will be Moderate / Low. It is recommended that a suitable engineered cover system is installed in areas of soft landscaping to break the source-pathway-receptor linkage. The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the remainder of the site.</p> <p>The risk to groundwater and surface water receptors has been assessed as Low. This is due to the site not being recorded within a SPZ or a licensed groundwater abstraction within 1km. The cohesive till deposits are also likely to inhibit migration of any potential contaminants present both laterally and vertically. The closest surface water receptor of the canal to the south is likely to be lined by clay as part of the construction.</p> <p>The maximum methane and carbon dioxide concentrations and respective gas screening values indicate a Gas Characterisation Situation 1 (CS1) gas regime, requiring no gas protection measures for the proposed new development.</p>
Materials Management & Soils Reuse	<p>Excavated soils may be suitable for reuse at the site following appropriate waste management regulations and/or under a Materials Management Plan (MMP) – subject to consideration of potential contaminants of concern and geotechnical properties. Materials should be placed in accordance with an engineering specification.</p>
Geotechnical Assessment	<p>As part of the ground investigation made ground deposits are recorded to range to maximum depths between 0.40m bgl in TP04 and 3.00m bgl in CP01A and CP02 respectively. Where the made ground is shallow, in the south of the site for example, the superficial till deposit is initially recorded to range from very soft to soft consistencies initially, progressing to firm to stiff consistencies. Therefore, it is unlikely that conventional shallow foundations would be viable given the anticipated size and potential imposed loads of the proposed structure and the encountered made ground and natural soil conditions. Ground improvement techniques of the shallow natural ground is also unlikely to be a viable option as it is unlikely to provide the required bearing capacities for the loads required for the proposed structure. Therefore, it is recommended that a piled foundation solution should be adopted as the chosen foundation method, ideally founding within the deeper till deposits. The presence of the glaciofluvial deposits and groundwater are likely to affect the installation of the piles. Due to the depths of made ground encountered and the presence of very soft to soft cohesive materials it is recommended that a suspended ground floor slab should be adopted. The suspended floor slab should be linked to the pile caps. Concrete classification for aggressive ground conditions has been assessed as DS-3 and AC-3 for the made ground deposits, whereas the underlying superficial deposits have been assessed as DS-1 and AC-1.</p>
Ground Contamination Recommendations	<p>Overall, the site is deemed suitable for use as residential apartments, subject to specific mitigation measures. Engineered cover system minimum 300mm thickness should be installed in proposed soft landscaping areas to break the SPR linkage. Any imported topsoil for the soft landscaping designs should be chemically analysed to determine that the topsoil is suitable for the intended end use. An allowance should be made for a Remediation Strategy to detail the engineered cover system and specify the chemical testing required for imported topsoil materials. An allowance should be made for a Verification Report to confirm the engineered cover system has been installed and the imported topsoil material has been approved by testing and acceptable for the intended end use.</p>

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1.0 Introduction

1.1 Project Background

In September 2021 Curtins were instructed by One Manchester to undertake a Phase 2 Ground Investigation at the Rosedale site in Newton Heath, Manchester. The site is centred on an easting and northing of 387940, 400630 and covers an area of approximately 0.21 ha. A site location plan is presented as *Figure 2.1*.

1.2 Scope of Services

This investigation addresses recommendations as presented in the Phase 1 report (ref. 13), with the aim of the Phase 2 works to characterise geo-environmental conditions prior to redevelopment as residential apartments and support an associated planning application. The current development plans for which can be referred to within Appendix A1 of this report.

Specifically, the Phase 2 report is intended to determine:

- a) If there is a risk of the proposed end user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
- b) If there is a risk of groundwater and/or surface water being adversely impacted upon by potential contamination that may be present on the site due to its known current, recent and historical use;
- c) If there is a risk to the end user from soil gases including methane, carbon dioxide, oxygen, and hydrogen sulphide;
- d) Recommendations for the design of foundations and building ground floor slabs; and
- e) Recommendations for the specification of sub-structure concrete and water supply pipes.

Consideration of detailed flood risk, ecology and archaeological issues are outside of the scope of this report.

2.0 Phase 1 Preliminary Site Assessment Summary

This section presents a summary of the current site setting, history, geology, and hydrogeology/hydrology, as presented in the Curtins Phase 1 report (ref. 14). It is not the intention of this report to duplicate the Phase 1, with the information below providing the background information to support the revised post Phase 2 Ground Investigation works Conceptual Site Model (CSM), as presented in Section 8.

2.1 Current Setting

The site is recorded as a small parcel of land between Old Church Street and Dulverton Street. An existing façade remains in the north of the site adjacent to Oldham Road (A62). The central and southern areas of the site have undergone demolition works between July 2017 and May 2018. It is not known how deep the demolition works were advanced. It appears that Dulverton Street is no longer accessible as it has been blocked at both the north and south entrances with metal fencing. A basement is reported to be present within the site boundary.

The site is bounded to the north by Oldham Road (A62), to the east by Dulverton Street with unused land. To the south by Old Church Street with a bus stop and library close by. To the west by Old Church Street with residential housing beyond this.

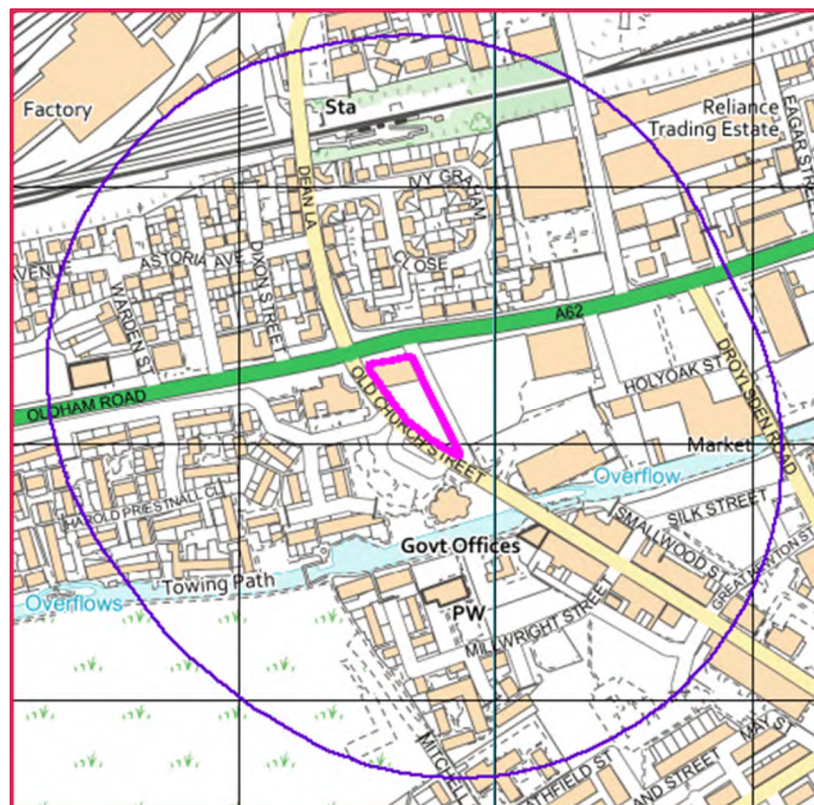


Fig 2.1 – Site Location Plan, site boundary shown in pink.

2.2 Previous Site Use

A review of the available historical mapping information for the site (as presented within Curtins Phase 1 PRA) (Ref. 13) has been undertaken with specific reference to potential sources of contamination.

The earliest available historical mapping (1840s) show the site to be occupied by unspecified buildings, potentially terraced housing. In the 1930s the building layouts change across the entire site with no description on what they are used for. In 2017 the buildings in the centre and south of the site are demolished. After production of the Phase 1 PRA, it was noted that the building in the north had also been demolished.

2.3 Published Geology

A study of the Envirocheck, BGS borehole records and BGS 1:50,000 mapping (Solid and Superficial Editions) for Manchester (Sheet 85) indicates the following geological succession underlying the site:

- Till (Diamicton); and
- Collyhurst Sandstone Formation.

2.3.1 Made Ground Deposits

Made ground deposits are not recorded to be present. However, given the cycles of re-development at the site, it is likely that made ground deposits will be encountered.

2.3.2 Superficial Deposits

Till (Diamicton) deposits are recorded to be present.

2.3.3 Bedrock Deposits

Bedrock deposits are present as the Collyhurst Sandstone Formation. It is unlikely that this deposit will be encountered as part of the ground investigation works.

There are five BGS geological fault lines located within 1 kilometre (km) of the site, with the closest being 450m north-east of the site. The strike of the geological fault is north-west to south-east with the downthrow to the north-east.

2.3.4 Mining and Quarrying

There are no BGS recorded mineral sites within 250m of the site boundary. However, the closest is recorded to be Mitchell Street Brickworks which is located approximately 315m south-west of the site boundary.

A Consultants Coal Mining Report (included within the Curtins Phase 1 PRA) identified that the site is not within a zone of likely physical influence from past, present, and/or future coal mining activities. Therefore, the risk has not been considered further.

2.3.5 Other Pertinent Existing Geological Records

There is no hazard to very low hazard potential from the following ground stability hazards on and around the site; collapsible ground, compressible ground, ground dissolution, landslides, running sands and, shrinking or swelling clays.

UK Radon Mapping confirms the site is situated in an area where less than 1% of homes are above the radon action level. No radon protective measures are necessary in the construction of new developments. Where the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

2.4 Hydrogeology and Hydrology

Environment Agency data indicates that the site, corresponding with the underlying bedrock geology, overlies a Principal Aquifer. These are;

Layers of rock or drift deposits that have high intergranular and/or fracture permeability meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, Principal Aquifers are aquifers previously designated as Major Aquifers.

This is noted as being overlain by a superficial Secondary Undifferentiated Aquifer. These are;

Assigned in cases where it has not been possible to attribute either category A or B to a soil or rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the soil or rock type.

The site is not situated within a groundwater source protection zone (SPZ). There are no recorded licensed groundwater abstractions recorded to be within 1km of the site.

There are no surface water receptors recorded within the site boundary. The closest surface water receptor is recorded to be the Rochdale Canal approximately 52m south of the site boundary.

2.5 Landfill & Pollution

There are no records of historical or currently operational landfills within 250m of the site. However, there is one registered landfill site approximately 140m south-west of the site boundary at the former Mitchell Street Brickworks. The landfill stopped taking waste in July 1978.

There are no records of registered waste treatment or disposal sites within 250m of the site. The closest is approximately 298m east of the site.

There are two local authority pollution and prevention control permits within 250m of the site. The closest is recorded approximately 160m north-east of the site at Newton Heath Service station in relation to petrol filling station.

The surrounding area has recorded some instances of potentially infilled land both formerly land and water that could be potential sources of ground gas. There is one instance of previously infilled land (non-water) within 250m of the site boundary. The closest instance of infilled land (non-water) is recorded to be approximately 134m south of the site at the former Mitchell Street Brickworks. There are nine instances of previously infilled land (previously a water body) within 250m of the site boundary. The closest instance of infilled land (previously a water body) is recorded to be approximately 84m south-west of the site.

2.6 Unexploded Ordnance (UXO) Risk Assessment

The historical mapping does not indicate any ruins, or buildings that disappeared during WWII, on the site. However, three separate ruins are recorded within 250m of the site boundary; two of these are approximately 120m east of the site and 170m west of the site.

Analysis of additional online historical bomb mapping from the University of Manchester shows the area on or immediately surrounding the site has no recorded bomb strikes or damaged buildings. Based on the forgoing commentary, the likelihood of encountering UXO on site as part of the ground investigation or future intrusive ground works is assessed as Low.

2.7 Previous Reports

Previous geo-environmental reports for the development site include:

- Curtins – Phase 2 Ground Investigation (2021) Report ref: 074031-CUR-00-XX-RP-GE-002-V03_Phase 2 SI).

A detailed summary of the above report is included within the previous Phase 1 PRA report undertaken by Curtins.

2.8 Summary of Phase 1 PCSM

Table 2.8 below provides a summary of the PCSM which was developed as part of the Phase 1 PRA. This only highlights Moderate / Low or higher risk items for the site.

Table 2.8 – Summary of Phase 1 PCSM

Conceptual Site Model			Qualitative Risk Assessment		
Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk
<p>Made Ground</p> <ul style="list-style-type: none"> Limited potential for the generation of contamination on-site. No conclusive recordings of potential industry on the site. Uncontrolled deposition of Made Ground from demolition of the former brick buildings on-site. Includes potential asbestos containing materials (ACMs). 	Direct contact, ingestion, inhalation (dust and vapours)	End user of site	Medium	Likely	Moderate / Low
	Direct contact, ingestion, and inhalations (dust and vapours)	Construction and Maintenance workers	Mild	Likely	Moderate / Low
<ul style="list-style-type: none"> On and off-site soils with the potential to generate ground gases. 	Vertical and horizontal migration through the superficial and bedrock deposits.	End user of site	Medium	Low	Moderate / Low

3.0 Phase 2 Ground Investigation Scope of Works

The ground investigation works were undertaken in two phases due to below ground obstructions. The first phase was between the 4th and 8th October 2021. The second phase was completed between the 22nd and 24th November 2021.

The scope of the ground investigation was designed in general accordance with current UK guidance including Land Contamination: Risk Management (Ref.1), British Standard (BS) 10175:2011+A2:2017 (Ref.2), BS5930: 2015+A1:2020 (Ref.3), and Eurocode 7 (Ref.4). A summary of the scope and rationale are summarised in Table 3.0 below.

Table 3.0 - Scope and Rationale of Fieldwork Undertaken

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depth (m bgl)	Rationale
Machine Excavated Trial Pits	TP01 – TP06	2.80	Confirm shallow ground conditions and whether any obstructions are present. Collect soil samples for chemical and geotechnical analysis. Determine geotechnical parameters.
Cable Percussive Boreholes	CP01 – CP03	25.00	Confirm shallow and deep ground conditions. Collect soil samples for chemical and geotechnical analysis. Undertake in-situ geotechnical testing. Post site works ground gas and groundwater monitoring. Determine geotechnical parameters.

The position of CP01 during the first phase encountered an obstruction at 2.60m bgl which broke the 8 inch auger equipment. Therefore, the position was terminated and a return visit made in late November 2021 to break out the obstruction, backfill the position and commence with cable percussive drilling to obtain the ground condition information required.

Curtins drawing ref. 079193-CUR-XX-XX-D-GE-80002-P03_EHLP records the locations of the exploratory holes, a copy of which is contained within Appendix A1.

3.1 Soil Logging and Sampling

Exploratory machine excavated trial pit and cable percussive borehole arisings were logged on site by a qualified Engineer. All exploratory holes were logged in accordance with the requirements of BS5930 (Ref.3), including recording observed visual and olfactory indications of contamination. Exploratory hole logs are provided in Appendix A2.

3.2 Monitoring Well Installations

Ground gas and groundwater monitoring installations (50mm & 19mm diameter) were dual installed within the three cable percussive boreholes. A bentonite seal was placed above and below the screened section of the borehole to minimise potential for downward migration of contaminants and the creation of a preferential migratory pathway. A gravel surround was installed in the annulus between the sides of the borehole and the slotted sections of pipe.

The 19mm diameter monitoring wells were primarily designed to assess the potential for ground gas and strata likely to have the highest permeability and as such the screened section focussed on made ground where sufficient depth was encountered or the underlying natural strata. The 50mm diameter pipe focused on the groundwater conditions for the deeper ground stratum.

A summary of the response zones is presented in Table 3.2 below.

Table 3.2 - Monitoring Well Response Zones

Borehole Reference	Response Zone(s) (m bgl)	Strata Description(s)
CP01A(s)	2.00 – 5.00	MADE GROUND into Natural CLAY
CP01A(d)	10.00 – 15.00	CLAY into clayey SILT
CP02(s)	1.00 – 3.00	MADE GROUND
CP02(d)	15.00 – 20.00	CLAY into SAND
CP03(s)	2.00 – 4.00	CLAY
CP03(d)	20.00 – 25.00	CLAY

Copies of borehole logs can be referred to in Appendix A2 of this report.

3.3 Post-Investigation Monitoring

3.3.1 Ground Gas & Groundwater Monitoring

An initial programme of four ground gas and groundwater monitoring visits over four weeks was proposed to assess ground gas conditions as identified in the Preliminary Conceptual Site Model in the Phase 1 Preliminary Site Assessment (Ref.13). However, this was increased to eight visits after completed of the position of CP01A.

3.3.2 Groundwater Sampling

Groundwater sampling is outside the scope of this report. This is discussed further in section 6.2.

4.0 Laboratory Analysis

Representative soil samples were selected for laboratory chemical analysis, based on field observations and to provide a characterisation of the made ground and natural strata encountered. Selected soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical analysis was i2 Analytical Ltd, a UKAS and MCERTS accredited laboratory.

Given the potential site wide source of contamination (made ground) the sampling positions (boreholes) were generally located in a non-targeted, systematic array to give adequate and representative coverage of the site accounting for the historical site use, proposed end use and the immediate environmental setting.

4.1 Soil Analysis

The contaminants of concern potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g., fuel/oils), heavy metals and asbestos the extent of which is captured by the broad environmental testing suite listed in Table 4.1 below.

Table 4.1 - Environmental Chemistry Analysis Suite: Soils

Suite Ref.	Analyte	LOD
Soils Suite 1B	Asbestos Screen	Type
	pH	0.1 pH units
	Soil Organic Matter (SOM)	0.1 %
	Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Zinc, Nickel	1 mg/kg
	Boron (water soluble)	0.2 mg/kg
	Cadmium	0.2 mg/kg
	Mercury	0.3 mg/kg
	Cyanide (total)	1 mg/kg
	Sulphate (total)	1.25 mg/l
	Phenols (screen)	1 mg/kg
	Poly Aromatic Hydrocarbons (PAHs) (USEPA 16)	0.05 – 0.1 mg/kg
	Total Petroleum Hydrocarbons (TPH) (Aromatic/Aliphatic split)	0.1 – 10 mg/kg

Soil samples were taken from the made ground soils from each exploratory hole location and tested for Suite 1B.

Copies of the environmental chemistry testing certificates are presented in Appendix A3.

4.2 QA/QC

Cyanide is recorded as deviating in the environmental chemical samples due to holding time. No other samples are recorded as deviating. Cyanide was not a contaminant that was identified previously to be a risk.

4.3 Geotechnical Analysis

Soil samples for testing were prepared in accordance with BS1377: Part One: 1990 and representative sub-samples were taken for testing. The following tests were carried out:

- 18 No. Water Soluble Sulphate, Water Soluble Chloride, Water Soluble Nitrate, Total Sulphate and Total Sulphur.
- 18 No. pH value
- 16 No. Atterberg Limits
- 15 No. Moisture content
- 8 No. Water Soluble Sulphate from environmental chemistry analysis
- 8 No. pH value from environmental chemistry analysis
- 6 No. Quick Undrained Triaxial (Single Stage)
- 5 No. Particle Size Distribution by wet sieve
- 3 No. Remoulded California Bearing Ratio (CBR) tests
- 3 No. Oedometer Consolidation tests (5 days)
- 2 No. Quick Undrained Triaxial (Multi-Stage)

Copies of the geotechnical testing certificates are presented in Appendix A4.

5.0 Encountered Ground Conditions

5.1 General

A summary of the ground conditions encountered during the ground investigation works is presented below, with detailed information presented in the exploratory hole logs included in Appendix A2 and a summary of each strata presented in subsequent sections.

Table 5.1 - Summary of Ground Conditions Encountered

Stratum	Depth to top of strata (m bgl)	Thickness (m)		Description
		Min	Max	
Made Ground	0.00	0.40	3.00	Generally encountered as demolition rubble, silty sandy GRAVEL with frequent cobbles and boulders. Gravel is medium to coarse grained and angular to very angular of brick, glass, concrete, metal pipes, plastic sheets, sandstone, and timber. Cobbles and boulders are of the same nature. In the south of the site as a very soft to soft silty gravelly CLAY.
Superficial Deposits (Till & Glaciofluvial channel)	0.40 – 3.00	1.60*	23.00*	Initially encountered as a very soft ranging to firm to stiff silty gravelly CLAY. This is interpreted to be underlain by a glaciofluvial channel deposit which is recorded to vary between a clay, silt, sand and gravel deposit of varying strengths and consistencies. This is underlain by a very stiff to hard till deposit.

* - Thickness not proved

5.2 Made Ground

The made ground deposits were recorded at all the exploratory hole positions. Typically, the made ground is deepest in the north of the site and progressively gets shallower towards the south and south-west of the site. The deposits were proven to maximum depths ranging between 0.40m in TP04 and 3.00m bgl in CP01A and CP02. The made ground deposits in the north and centre of the site are primarily dominated by demolition rubble. This is recorded as a silty sandy GRAVEL with frequent cobbles and boulders of medium to coarse grained and angular to very angular brick, glass, concrete, metal pipes, plastic sheets, sandstone and timber. In the positions of TP01 – TP03, CP01 and CP01A a potential concrete and in some places brick basement floor was encountered at depths ranging between 1.80m bgl in TP03 and 2.80m bgl in TP02.

In the south of the site in the positions of TP05, TP06, CP02 and CP03 underneath the initial granular made ground layer, is a cohesive made ground layer which was described as a very soft to firm slightly clayey SILT and slightly silty gravelly CLAY. The gravel content was described as medium to coarse grained and very angular to angular of brick, sandstone, and wood. In the positions of TP05 and TP06

this was described as ashy. This was proven to maximum depths ranging between 0.70m bgl in TP06 and 3.00m bgl in CP02.

Table 5.2 below provides a summary of the chemical lab analysis as well as in-situ and laboratory geotechnical analysis of the various made ground deposits encountered.

Table 5.2 - Summary of Geotechnical Test Results – Superficial Deposits

Parameter	No. of tests	Minimum	Maximum	Average
Moisture Content (%)	9	14	21	18
pH	9	7.7	8.5	8.0
Water Soluble Sulphate (mg/l)	9	213	3,320	1,398
SPT 'N' Value	6	7	50+ ⁽¹⁾	20 ⁽²⁾
Organic Content (%)	7	2.6	5.6	3.7
Water Soluble Chloride (mg/l)	2	7.9	20	14
Total Sulphate (SO ₄) (%)	2	0.096	0.96	0.53
Total Sulphur (%)	2	0.056	0.506	0.281

(1) SPT refusal values are contained within the borehole logs in Appendix A2.

(2) SPT average based on 50+ values taken as a value of 50.

5.3 Superficial Deposits

The superficial deposits of the Till (Diamicton) deposits is recorded to be present beneath the site in accordance with the geological map sheet number 85 for Manchester. The BGS Geoindex also records the site to be in an area of a buried valley where the superficial deposits are modelled to range between 20m thickness up to >40m thickness in some locations adjacent to the site. The ground investigation was scoped to advance up to 30m below existing ground levels after the demolition works had taken place. Due to the very stiff to hard nature of the till deposits from approximately 22.00m bgl the boreholes were advanced to maximum depths of 25.00m bgl.

The deposits that were encountered were variable both laterally and vertically in terms of the primary soil type and strength of the specific soil type. The superficial deposits were encountered at depths ranging between 0.40m bgl in TP04 and 3.00m bgl in the positions of CP01A and CP02 respectively. The deposit is initially encountered as an initially very soft to soft progressing to firm, firm to stiff and stiff brown mottled grey silty gravelly CLAY with fibres of plant debris in isolated locations. The gravel was described as fine to medium grained and sub-angular to sub-rounded sandstone. This was typically proven to maximum depths ranging between 6.00m bgl in CP01A and 7.50m bgl in CP02.

This initial clay layer is then underlain by interbeds of clay, silt, sands and gravels. These are also variable both laterally and vertically in terms of composition and the in-situ strength displayed by the deposit. It is possible that this interbedded zone of the superficial geology is more likely to be representative of a glaciofluvial or glaciofluvial sheet channel deposit rather than a till and encapsulates the complex three dimensional superficial geology of the Manchester area.

The interbedded layers are described as follows:

- CLAY – Stiff to Very Stiff brown slightly sandy silty gravelly CLAY. Gravel is medium to coarse grained and sub-rounded of sandstone.
- SILT – Very stiff brown very clayey SILT, with occasional silty sand bands.
- SAND AND GRAVEL – Medium dense to very dense brown silty SAND or slightly clayey SAND AND GRAVEL. Sand is medium to coarse grained. Gravel is fine to medium grained and sub-rounded of mudstone and siltstone. Rare cobbles are also noted to be sub-rounded of sandstone and siltstone.

In the position of CP03 between 10.50m and 16.00m bgl a brown to grey SAND is initially recorded to be medium dense, at 15.00m bgl the SPT test returned an N value of 2 indicating a very loose deposit at the base. Whereas the position of CP02 recorded a bed of fine grained brown SAND between 16.00m and 23.50m with all SPT values refusing with N values of 50 and the SPT increments ranging between 220mm and 285mm. Typically, this interbedded zone is recorded to maximum depths ranging between 16.00m bgl in CP01A and 23.50m bgl in CP02.

Beneath the interbedded zone the deposit is interpreted to return to a till. This is recorded as a stiff to very stiff brown silty sandy gravelly CLAY. Gravel is medium to coarse grained and sub-angular to sub-rounded of sandstone and siltstone. SPT values completed in this lower zone of the till deposits typically recorded refusals with N values of 50 with the SPT increments ranging between 150mm and 280mm. It is difficult to determine whether this is due to the natural strength of the till deposits, or whether the gravels within the till are affecting the SPT results. Figure 5.1 below provides an indication of the SPT test results completed versus the depth.

Based on published relationships, undrained shear strengths (c_u) may be estimated from SPT 'N' values where full penetration has been achieved. Using a factor of 5.2 estimated c_u values range between 70kPa and 260kPa. Taking into consideration the logging descriptions from all exploratory holes, *in-situ* and laboratory geotechnical testing, the clay is likely to range from low to high strength in the upper till deposit. The deeper till deposit is likely to range from high to very high strength. As noted above the presence of the gravels within the deeper till deposit could be influencing the results of the SPT tests.

Plasticity testing has been undertaken for the clay soils, which is recorded to be of low to high plasticity. In accordance with NHBC standards Part 4 Chapter 4.2 building near trees, the clay can be described

as having a medium volume change potential in the upper till deposit which reduces to low volume change potential in the deeper till deposits. Table 5.3 below provides a summary of the *in-situ* and laboratory geotechnical results completed for the superficial deposits.

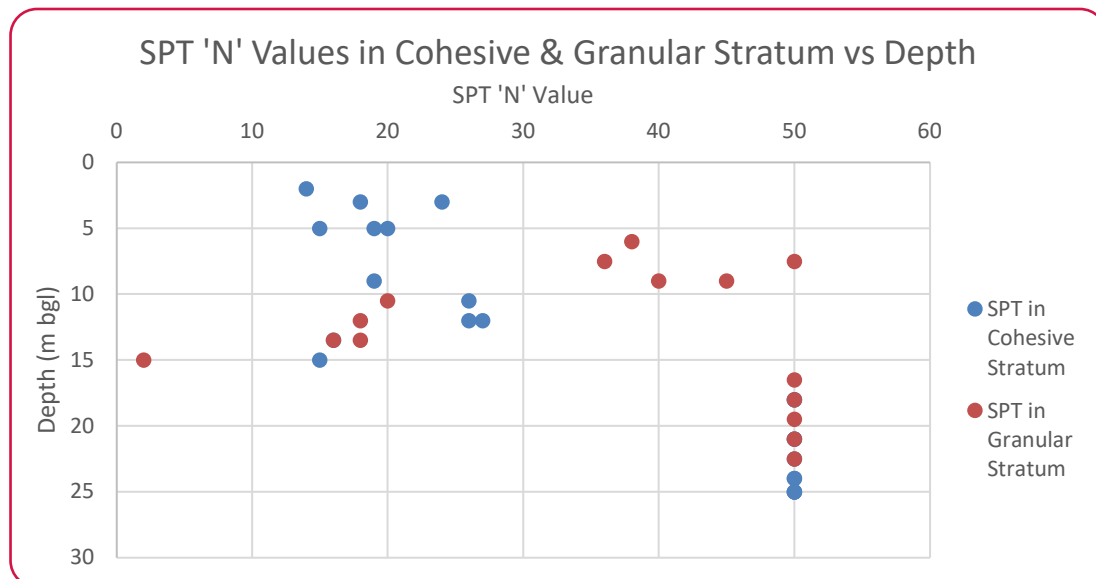


Figure 5.3: SPT 'N' values in cohesive and granular stratum vs Depth within the superficial deposits.

Table 5.3 - Summary of Geotechnical Test Results – Superficial Deposits

Parameter	No. of tests	Minimum	Maximum	Average
Moisture Content (%)	16	9.8	18	14
pH	16	8.0	8.8	8.5
Water Soluble Sulphate (mg/l)	16	19.7	200	84
Water Soluble Chloride (mg/l)	16	2.6	16	7.1
Total Sulphate (SO ₄) (%)	16	0.011	0.063	0.038
Total Sulphur (%)	16	0.016	0.114	0.074
Liquid Limit (%)	16	26	50	37
Plastic Limit (%)	16	12	23	18
Plasticity Index (%)	16	12	29	19
PSD (%) ⁽¹⁾				
Cobbles	5	0	0	0
Gravel		1	37	14
Sand		43	88	67

Parameter	No. of tests	Minimum	Maximum	Average
Fines <0.063mm		7	46	19
SPT 'N' Values in Sands & Gravels	15	2	50+ ⁽²⁾	36 ⁽⁵⁾
SPT 'N' Values in Clays & Silts	22	14	50+ ⁽²⁾	34 ⁽⁵⁾
Estimated Undrained Shear Strength c_u (kPa) ⁽³⁾	22	70	260	175
Estimated Coefficient of volume compressibility (mv) (m ² /MN) ⁽⁴⁾	22	0.04	0.14	0.07
Undrained Shear Strength from Single Stage Undrained Triaxial Laboratory Testing (c_u) (kPa)	7	51	273	119
Bulk Density (Mg/m ³) from Undrained Triaxial Tests	7	2.04	2.25	2.14
Dry Density (Mg/m ³) from Undrained Triaxial Tests	7	1.66	1.98	1.80
Coefficient of volume compressibility from Oedometer Laboratory Testing (mv) (m ² /MN) at overburden to 2x overburden pressure	3	0.06	0.07	0.07

1) PSD results are intended to show the variation in the sizes present. Full results are contained in Appendix A4.

2) SPT refusal values are contained within the borehole logs in Appendix A2.

3) c_u estimated from SPT N value correlation with average Plasticity Index using a Factor of 5.2 (Stroud and Butler, 1975).

4) mv estimated from SPT N value correlation with average Plasticity Index using a Factor of 0.52 (Stroud and Butler, 1975).

5) SPT average based on 50+ values taken as a value of 50.

The bedrock deposits were not encountered as part of this ground investigation.

5.4 Observed Potential Contamination

Soils and groundwater which exhibited either visual or olfactory potential contamination were noted during the ground investigation works and detailed in Table 5.4 as follows:

Table 5.4 - Observed Potential Contamination

Location Number	Depth (mbgl)	Strata	Observed Contamination
TP05	0.40 – 0.80	Made Ground	Ashy deposits
TP06	0.20 – 0.70	Made Ground	Ashy deposits

5.5 Obstructions Encountered

As part of the ground investigation works several obstructions were encountered in the north and centre of the site. These are listed in table 5.5 below.

It should also be noted that the previous building basement wall was present along the north and north-west boundary of the site. Appeared to be brick construction.

Table 5.5 – Obstructions Encountered

Location Number	Depth (m bgl)	Strata	Type of Obstruction
TP01	2.50	Made Ground	Flat concrete surface. Potential basement floor.
TP02	2.80	Made Ground	Flat concrete surface. Potential basement floor. Former brick wall running approximately north to south, present in the sides of the pit wall.
TP03	1.80	Made Ground	Flat concrete surface. Potential basement floor.
CP01	2.60	Made Ground	Possible concrete basement floor. 8 inch tooling has bent due to hardness of structure trying to chisel through.
CP01A	2.40 – 2.65	Made Ground	Grey concrete. Potential basement floor.

5.6 Groundwater

A summary of the groundwater levels recorded during the ground investigation works, and subsequent monitoring, is presented in Table 5.6. Full details of the water strikes recorded during progression of the investigation positions are presented on the exploratory hole logs included in Appendix A2 and full details of the water levels recorded during the monitoring visits are presented in Appendix A5.

Table 5.6 - Groundwater strikes during investigation and subsequent monitoring levels.

Exploratory Hole Location Ref.	Water Strikes During Ground Investigation		Post Investigation Monitored Water Levels	
	Strike Depth (m bgl)	Strata	Installation Strata	Monitored Levels (m bgl)
TP01	-	-	*	*
TP02	-	-	*	*
TP03	-	-	*	*
TP04	-	-	*	*
TP05	2.20	CLAY	*	*
TP06	-	-	*	*
CP01A(s)	-	-	MADE GROUND / CLAY	5.28 – Dry

Exploratory Hole Location Ref.	Water Strikes During Ground Investigation		Post Investigation Monitored Water Levels	
	Strike Depth (m bgl)	Strata	Installation Strata	Monitored Levels (m bgl)
CP01A(d)	12.00 rose to 11.00 after 20 minutes	SILT	CLAY & SILT	7.67 – 7.77
	21.70 rose to 15.00 after 20 minutes	CLAY		
CP02(s)	-	-	MADE GROUND	3.01 – Dry
CP02(d)	16.70 rose to 14.00 after 20 minutes	SAND	SAND	7.68 – 7.87
CP03(s)	-	-	CLAY	2.20 – Dry
CP03(d)	24.00 rose to 14.70 after 20 minutes	CLAY	SAND / CLAY	7.95 – 8.15

- No strikes during the ground investigation works.

* No installs for long term monitoring.

In the position of TP05 this is anticipated to be a zone of perched water within upper clay. This is not likely to be representative of the natural groundwater level. The deep borehole installations do appear to be more representative of the natural groundwater levels, with some strikes recorded in the deeper till deposits. It is possible that this deposit is fissured allowing the till deposit to hold large volumes of groundwater should the water table be penetrated. Groundwater strikes were also recorded in the silt and sand deposits.

In the silt and sand deposits it is likely that the groundwater levels will vary seasonally and with heavy precipitation periods or events.

In the shallow installations most positions were recorded to be dry. There were a couple of visits during wet periods where water was present as the base of the installations. But this is more likely to be surface water accumulation, rather than groundwater.

5.7 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, third edition of 2005. Table 5.7 details the classification.

Table 5.7 - Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Made Ground ⁽²⁾	DS-3	AC-3

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Superficial Deposits ⁽³⁾	DS-1	AC-1

(1) ACEC assessment was based on the mobile groundwater condition for the scheme area.

(2) 5-9 samples collected. Mean of the highest two should be taken as the characteristic value.

(3) >10 samples collected. Mean of the highest 20% should be taken as the characteristic value. In this case highest 3 samples.

The made ground stratum is assessed as DS-3 and AC-3 due to the mean of the highest two soluble sulphate results recording a value of 2,635 mg/l in accordance with BRE Special Digest 1. The superficial deposits are unlikely to be impacted by soluble sulphates with assessed values of DS-1 and AC-1 based on a mean of the highest 20% of the samples taken. Analysis of the results also indicates that pyrite is not likely to be present within the made ground deposits.

6.0 Ground and Groundwater Contamination Assessment

This section of the report includes the assessment of the potential contamination, solid, liquid and gas, identified on the subject site which may present a risk to the proposed end users, associated utilities, and the wider environment.

In guidance published by the Environment Agency, the risk to human health or controlled waters is determined through an assessment of pollutant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (Ref.5).

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required for the site to be deemed so.

The sub-sections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in the Phase 1 Preliminary Risk Assessment in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins ground investigation. The GQRA is used to build/refine the Conceptual Site Model (CSM) for the site as detailed and presented in Section 8.0 of this report.

The following sections present more detail on the risk assessment methodology rationale for the main receptors.

6.1 Human Health GQRA

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency and Defra. Guidance includes Contaminated Land Exposure Assessment (CLEA) v1.071 model (Ref.6), Science Report 2 (Ref.7) and Science Report 3 (Ref.8).

A generic quantitative risk assessment (GQRA) has been carried out for the Potential Contaminant Linkages (PCLs) investigated by screening of soil contamination data against relevant Generic Assessment Criteria (GAC) where available, including:

- i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. SGVs give an indication of representative average concentrations of chemicals in soil, below which long-term health risks are likely to be minimal. SGVs have been published for several contaminants including arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and

- dioxin-like PCB substances for land uses including residential, allotments and commercial. The SGVs have been developed for a sandy loam soil with 6% soil organic matter (SOM) content;
- ii) **Supplementary Screening Values (SSVs):** In addition to the SGVs developed by the EA, other third-party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed by Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL: AIRE published thresholds;
 - iii) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium, and lead. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 (Ref.9) in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). C4SLs are not representative of significant possibility of significant harm (SPoSH) and are low risk levels which, and therefore where the C4SLs are not exceeded, land can be demonstrated to be in Category 4 and cannot be determined as contaminated land.

6.1.1 Adopted Soil Human Health GACs Screening Methodology

The proposed use of the site, noted as a 5 to 7 storey structure with hardstanding and car parking facilities for residential apartments; is most analogous with a '*Residential without home grown produce*' end-use scenario and so assessment has been undertaken against the following GACs, in order of preference:

1. Environment Agency Soil Guideline Values,
2. CL: AIRE, AGS, EIC. Soil Generic Assessment Criteria for Human Health Risk Assessments,
3. LQM/CIEH 2015 S4ULs for Human Health Risk Assessment, and
4. DEFRA Category 4 Screening Levels.

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e., the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for the made ground soils ranged from 2.6% to 5.6%. A single result in the underlying natural clay deposit recorded an SOM content of 11%. It was noted that the clay was dark grey in colour.

With consideration for a calculated geometric average, made ground features determine a SOM of 3.7 % while natural soils from the single result would indicate 6%. However, this is unlikely to be the case across the site for the natural soils. As such, a comparison against Tier 1 thresholds for a conservative SOM of 2.5% for '*Residential without home grown produce*' end use has been adopted for both made ground and natural soil features for the proposed redevelopment as residential apartments.

The adopted GACs are listed in Appendix A6.

Many of the exposure pathways considered in the CLEA model assume that the adult or child is in contact with the contaminated ground or that such contamination is easily mobilised from the surface. However, plant uptake of chemicals and the release of soil vapour may occur from greater depths. Although, the highest density of roots occurs in the top 80 cm, many crop plant root depths are between one and two metres (applicable when private gardens or allotments are considered in redevelopments). Although the transport potential decreases, vapours have the potential of migrating to the surface over distances of tens of metres (Updated technical background to the CLEA model - SC050021/SR3).

6.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

The results of the environmental testing can be referred to in Appendix A3.

With respect to the proposed end use of the site, several locations identify one contaminant that is recorded to exceed the end use thresholds within the recovered soil samples as detailed below.

Table 6.1.2 - Soil Tier 1 Exceedances for a Residential without home grown produce end use with a SOM of 2.5%

Exploratory Hole ID	Depth (m bgl)	Stratum	Determinant	Concentration (mg/kg)	GAC (mg/kg)
TP01	1.50	Made Ground	Lead	540	310
TP02	0.50	Made Ground	Lead	390	310
TP03	0.30	Made Ground	Lead	760	310
TP06	0.40	Made Ground	Lead	320	310
CP01	0.70	Made Ground	Lead	560	310
CP02	0.50	Made Ground	Lead	450	310

Selected soil samples were screened for asbestos. No suspected asbestos containing materials (ACMs) were identified in the exploratory hole logs and laboratory screening confirmed that asbestos was absent in the soil samples tested.

The above results table shows that exceedances of Tier 1 thresholds for lead within the made ground deposits have been recorded across much of the site area. It is possible that this is due to the ashy nature of the made ground deposits, or the presence of lead metal present in the made ground deposits. However, there are no exceedances for any of the PAH species.

6.2 Controlled Waters GQRA

Historically the site has been recorded to have buildings present throughout from the 1840s. However, there is no detail as to what industry, if any, was present on the site historically. The layout of the buildings initially indicate terraced housing up to the 1930s. With a change to small warehouse type buildings across the entire site. There are several small to medium scale sized works including timber yard, sawmills, glass works, and dye works in the surrounding area. The superficial deposits of till are recorded as a Secondary Undifferentiated Aquifer, which is underlain by a Principal Aquifer within the bedrock deposits of the Collyhurst Sandstone Formation. The site is not recorded to be within a groundwater source protection zone (SPZ) and, there are no licensed groundwater abstractions recorded to be within 1km of the site.

The ground conditions encountered made ground to varying depths, with the deepest zones being in the north, centre and along the eastern boundary of the site. The underlying till deposits were primarily recorded to be cohesive in nature with secondary constituents of gravel and sand. Where any water is to migrate vertically or laterally, it is unlikely to migrate through the till deposits at this site as no evidence of fissuring was identified in the borehole arisings or machine excavated trial pits. As part of the chemical analysis elevated concentrations of lead have been identified. However, concentrations of the remaining heavy metals, PAHs and TPHs are generally low. The natural sample collected from TP04 directly beneath the made ground records very low heavy metal concentrations and below laboratory detection limit concentrations for PAHs and TPHs. Therefore, due to the above reasons, the risk to the groundwater receptors is assessed as Low.

The closest surface water feature is recorded to be the Rochdale canal which is approximately 52m south of the site. The canal is likely to have been constructed with an impermeable clay liner which would prevent migration of potential contamination. The natural deposits are also likely to be cohesive till, inhibiting any migration of potential contamination. Therefore, the risk to the surface water receptor is assessed as Low.

6.3 Water Supply Pipe Assessment

With reference to the UKWIR publication 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' document reference 10/MM/03/21 advice is given on the appropriate materials for these ground conditions.

The concentrations observed within the site shallow soils indicate that Barrier (PE-Al-PE) pipe would be suitable materials for the water supply pipes. The exact requirements are to be confirmed with the relevant utility supplier.

6.4 Materials Management

6.4.1 Re-use of Site Soils

Based on the geochemical testing results presented as part of this investigation it is considered that there is no specific requirement to remove soils from site because of them presenting an unacceptable risk to human health or the environment (albeit with some mitigation measures for end users).

The re-use of site-won soils may therefore be undertaken if the following principles are met: i) the geotechnical suitability of the material needs to be confirmed; ii) the re-use of the material needs to be covered as part of the planning approval, e.g., site levels maintained within agreed limits; iii) the volume of the material being re-used needs to be confirmed and traceable and iv) regulatory approval from the relevant authorities has been sought. These principles are outlined within the CL: AIRE Definition of Waste Code of Practice (v2) and if and where the re-use of site-won soils is proposed as part of the development works it is recommended that a Materials Management Plan is produced in line with the Definition of Waste Code of Practice to detail and document the process.

7.0 Ground Gas Assessment

The assessment of risk presented by ground gases is assessed with reference to BSI Publication (Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2015+A1:2019 (Ref.10), guidance published by CIRIA (Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (Ref.11), and other broadly accepted references such as the Ground Gas Handbook 2009 (Ref.12).

The gas risk assessment adopts a tiered approach. In the first instance this involves a re-evaluation of the Conceptual Site Model described within the Phase 1 Preliminary Risk Assessment (desk study) and thereafter validating this conceptual model with the ground gas data, the semi-quantitative risk assessment.

7.1 Land Gas Monitoring Results

To characterise the site's ground gas regime and validate the qualitative assessment of ground gas risk standpipe installations were incorporated within all three of the cable percussive borehole locations with dual installs as detailed in section 3.2. It is noted that the shallow (s) boreholes are intended to be used for the ground gas monitoring assessment. Whereas the deep (d) boreholes are intended to be used for the groundwater monitoring.

An initial programme of four ground gas monitoring visits over two months was proposed initially. Another four visits were added over four weeks once the position of CP01A had been completed. Eight ground gas monitoring visits have been undertaken in total between October 2021 and December 2021, with barometric pressure recorded between 979 and 1033 mb and the monitoring period included three monitoring visits during heavy precipitation. The results log sheets are contained within Appendix A5 and summarised in Table 7.1 below:

Table 7.1 - Summary of Ground Gas Monitoring Results

Location	Maximum Methane Concentration (%) v/v	Maximum Carbon Dioxide Concentration (%) v/v	Minimum Oxygen Steady Reading (%)	Maximum Gas Flow (l/hr)
CP01A(s)	0.0	1.7	19.0	0.1*
CP01A(d)	0.0	3.3	16.5	- 5.7
CP02(s)	0.0	2.8	7.2	- 0.7
CP02(d)	0.0	4.1	16.1	- 5.2
CP03(s)	0.0	0.5	18.3	14.5
CP03(d)	0.0	0.8	17.6	- 13.3

Methane (CH₄) was recorded below the detection limit of the gas monitor across all eight visits. Carbon monoxide (CO) and hydrogen sulphide (H₂S) were recorded to range between concentrations of 0ppm and 2ppm. With an outlier of 6ppm for CO on the fifth visit. Oxygen (O₂) concentrations were recorded to be depleted during one visit in one location with a minimum of 7.2% v/v. Carbon dioxide (CO₂) was recorded in peak concentrations between 0.5% v/v and 4.1% v/v. Typical concentrations across the site visits were generally lower than the peak concentrations recorded. Maximum gas flow was recorded to be at the detection limit of the gas monitor for most visits. However, there were visits where the peak flows elevated to flow rates between -13.3l/hr and 14.5 l/hr. In most cases the peak flow rates reduced to much lower flow rates or at the detection limit of the gas monitor. It is also noted that the flow rates are inconsistent across visits.

As noted above the deep boreholes are intended to be used primarily for groundwater monitoring purposes. In this case all three of the response zones are flooded in the deep borehole installation. Therefore, the flow rates and concentrations are only representative of the gas trapped between the closed gas bung and the groundwater level. Therefore, due to these reasons the ground gas monitoring data from the deep boreholes will not be utilised as part of the ground gas assessment.

There are also numerous peak flow rates in the shallow installations that are onerous most likely due to the stack effect where the temperature within the well is greater than the atmosphere, causing an artificial flow.

7.2 Land Gas Assessment

The Conceptual Site Model presented within the Phase I Preliminary Risk Assessment identified made ground deposits as a potential source of ground gas generation both on-site and off-site resulting from historical development and land use. Other surrounding area sources included small locations of infilled land and a former landfill approximately 140m south-west of the site. The report suggests no records of organic rich drift deposits (e.g., peat) being present. Coal deposits are likely to underlie the site, however, they are likely to be situated at such a depth that they are unlikely to affect the site. Noxious and asphyxiate gases were attributed to include, but not limited to, carbon dioxide, carbon monoxide, methane, and hydrogen sulphide. The consequence was evaluated as a Moderate / Low risk.

Made Ground soils were encountered to maximum depths ranging between 0.40 m to 3.00 m bgl but with limited putrescible content generally. The north and centre of the site also encountered a backfilled basement area. This will require to be excavated out with the breaking out of the basement foundations as part of the development. This would most likely remove the majority of the made ground encountered. The ground investigation revealed a ground model generally consistent with the preliminary conceptual site model. Natural deposits were generally clay at shallow depths with no significant putrescible/organic content.

Consideration of the recorded soil gas flow rates, presented above, enables hazardous gas flow rates to be evaluated. Q_{hg} can be derived for both 'worst credible', and 'worst possible' scenarios and a comparison made in support of an appropriate assessment of ground gas risk. For a 'worst credible' scenario steady state flow rates are adopted, whilst for a 'worst possible' scenario peak flows are adopted. Methane concentrations were all detected to be below the limit of detection and therefore this assessment is based on the carbon dioxide concentrations encountered.

Evaluation of the 'worst credible scenario' (highest hazardous gas flow rate that is realistically possible, i.e., in a single borehole) records a maximum Q_{hg} of -0.014 l/hr for carbon dioxide where the flow rate of -2.8 l/hr is used from CP03(s) on the third visit.

Evaluation of the 'worst possible scenario' (highest Q_{hg} across the entire dataset irrespective of location and discrete monitoring events) again records a maximum Q_{hg} of -0.079 l/hr for carbon dioxide. This is utilising the flow rate of -2.8 l/hr from CP03(s) on the third visit and carbon dioxide concentration of 2.8% v/v from CP02(s) on the sixth visit.

After review of the monitoring results and subsequent Q_{hg} analysis, the worst credible scenario has been adopted as the sites Gas Screening Value (GSV) and in accordance with an assessment by BS:8485 the GSV indicates a Characteristic Situation 1 (CS1) gas regime which does not require any gas protection measures.

The site is situated within a lower probability radon area where <1% of properties are above the radon action level. No radon protective measures are necessary in the construction of new developments. Where the new development incorporates a basement the advice of a specialist radon assessor must be obtained.

The potential risks from ground gases to the excavations are to be dealt with by the Contractor, in accordance with the Confined Space Regulations, during construction. Appropriate ground gas monitoring and safety measures should be in place during the works, as the potential presence of ground gases could pose a risk in any confined spaces of deep excavations.

8.0 Revised Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented in the Phase 1 report (Ref. 13) and discussed in Section 2.0 of this report has been revised following the GQRA in Section 7.0 above. The Revised Conceptual Site Model (CSM) is summarised in the table overleaf.

The CSM details the source-pathway-receptor linkages or potential pollutant linkages (PPL) that have been identified as relevant for the site. The GQRA details the associated level of risk relating to these potential pollutant linkages.

The CSM follows the framework outlined within CIRIA C552 which is summarised within Appendix A7.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PPL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

Risks presented by Unexploded Ordnance is discussed and assessed in Section 2.6.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors, and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk. It has been assumed that any future construction works on site will be undertaken in compliance with these requirements and therefore construction workers involved in the building works at the site have been discounted as a human receptor in the conceptual site model. Reference should be given to the environmental testing results discussed within Section 6.0 and presented within Appendix A3.

Phase 2 Ground Investigation

Qualitative Risk
AssessmentGeneric
Quantitative Risk
AssessmentDetailed
Quantitative Risk
Assessment or;
Remedial Action

- The table below represents the Second stage in the land quality risk assessment process; the Revised Conceptual Site Model following the Quantitative Risk Assessment.
- For a development site to be deemed 'suitable for use' the level of risk needs to be brought down to acceptable levels, i.e., low to negligible risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g., remedial action.

Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
Lead exceedances within made ground soils in six out of seven samples Made ground deposits including fragments of brick, concrete, glass, metal pipes plastic sheets, sandstone, and timber	Direct contact and dermal uptake, soil and dust ingestion, dust, and migration inhalation (indoor & outdoor air)	Residential end users (without home grown produce)	Medium	Low	Moderate / Low	Lead exceedances in six out of the seven made ground sampled locations.	Will be dependent on presence of proposed soft landscaping for the development. Available development plans suggest there are discrete areas of soft landscaping. Therefore, a minimum 300mm engineered cover system should be incorporated into the design to break the SPR linkage.
	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation (outdoor air)	Construction and maintenance workers	Mild	Likely	Moderate / Low	Construction workers are likely to encounter the soils as part of the construction process.	Standard Health & Safety precautions to be used by workers. Relevant RAMS to be completed by specific contractors.
	Soil dust ingestion/inhalation produced during construction (indoor and outdoor air)	Adjacent residents	Medium	Unlikely	Low	Likely that site soils will be dampened down to prevent dust and reduce ingestion.	No further action required.
	Vertical Migration through the superficial deposits	Water Environment (Groundwater – underlying Principal and Secondary Undifferentiated Aquifers)	Mild	Low	Low	Material beneath made ground is typically impermeable clay and silt. Cohesive soils will generally inhibit the migration of lead leachates.	No further action required.
	Horizontal Migration over and through the superficial deposits (soils)	Water Environment (Surface Water – Rochdale Canal)	Mild	Low	Low	Material beneath made ground is typically impermeable clay and silt. Cohesive soils will generally inhibit the migration of lead leachates. Canal will most likely be clay lined as part of its construction.	No further action required.
Organic matter and/or contamination as source material for the generation of ground gas (SOM range of 2.6% to 11% in made ground and superficial deposits)	Ground gas & vapour (migration and inhalation)	Residential end users	Medium	Unlikely	Low	Reflecting the low concentrations found to date and worst credible Q _{hg} calculated for the site. Site assessed as CS1.	No further action required.
		Construction and maintenance workers	Medium	Unlikely	Low	Reflecting the low concentrations found to date.	No further action required.

8.1 Summary of Significant Pollutant Linkages

The risk to the end users of the site from the site soils including exceedances of lead is assessed as Moderate / Low. The available proposed development plans indicate discrete areas of soft landscaping to be present. Therefore, to break the source-pathway-receptor linkage it is recommended an engineering cover system minimum 300mm thickness should be installed in the soft landscaping areas.

The risk to end users from ground gases is assessed as Low. This is due to the generally low concentrations, Q_{hg} calculation and the site being classed as CS1. No ground gas protection measures are considered to be necessary.

The risk to the groundwater and surface water receptors is assessed as Low. This is due to the site not being recorded within a SPZ or a licensed groundwater abstraction within 1km. The cohesive till deposits are also likely to inhibit the migration of any potential contaminants present both laterally and vertically by the reduction in infiltration. In addition, the nearest recorded surface water receptor is the Rochdale Canal which is likely to have been constructed with an impermeable clay liner which would prevent migration of potential contamination.

9.0 Engineering Assessment and Recommendations

9.1 Introduction

This section will assess the relevant geotechnical issues for the proposed residential apartment development. The proposed development plan is contained within Appendix A1. The engineering assessment considers foundation design, bearing capacity, settlement, excavations, earthworks, and hardstanding design) for the site. Structural details and loadings have not yet been provided. It should be noted that detail may change in the development of designs beyond the issue of this Phase 2 Report and the Construction designer should satisfy themselves regarding the adequacy of their design and proposed approach to construction by reference to the on-going project design proposals, the ground investigation information, and their own examination of the site.

9.2 Summary of Ground Conditions

The ground conditions at the site generally comprises demolition rubble across the surface of the site, other than the presence of Dulverton Street along the eastern boundary of the site. Made ground was proven to maximum depths ranging between 0.40m in TP04 and 3.00m bgl in CP01A and CP02. In the north and centre of the site this is dominated by demolition rubble. In the south, this progresses onto a cohesive made ground deposit. Superficial deposits of till were encountered beneath the made ground. These materials were primarily encountered as a firm, firm to stiff and stiff brown mottled grey silty gravelly CLAY with fibres of plant debris in isolated locations. It is interpreted that a glaciofluvial deposit is present at depths ranging between 6.00m bgl and 22.00m bgl and displays highly variable strength both laterally and vertically. This is interpreted to be underlain by a till deposit again as a stiff, very stiff, and hard stiff brown silty sandy gravelly CLAY to maximum depths of 25.00m bgl.

Groundwater strikes were encountered in the glaciofluvial deposit and deeper till deposits with water levels recorded to sit around 7.00m to 8.00m bgl.

The geotechnical parameters recommended for use in the design based on the ground conditions encountered are summarised in Table 9.2 below.

Table 9.2 - Geotechnical Parameters for the Superficial Deposits

Parameter	Upper Till Deposit	Cohesive Glaciofluvial Deposit	Granular Glaciofluvial Deposit	Deeper Till Deposit
Unit Weight Above Water Table, γ (kN/m ³) ⁽¹⁾	15 – 20	16 – 20	15 – 20	18 – 24
Unit Weight Below Water Table, γ (kN/m ³) ⁽¹⁾	15 – 19	15 – 20	18 – 22	19 – 24
Effective Angle of Shearing Resistance, Φ' (°) ^(1 & 2)	24 – 27	24 – 27	30 – 40	24 – 27

Parameter	Upper Till Deposit	Cohesive Glaciofluvial Deposit	Granular Glaciofluvial Deposit	Deeper Till Deposit
Undrained Shear Strength C_u (kPa) ⁽³⁾	20 – 75	75 – 100	-	150 - 300
Coefficient of volume compressibility m_v (m ² /MN) ⁽³⁾	0.15 – 0.30	0.10 – 0.20	-	0.05 – 0.10

(1) From published sources (BS8002).

(2) Estimated from the relationship between typical SPT 'N' value and angle of shearing resistance (Peck et al, 1976).

(3) Average value estimated from the correlation between SPT' N value and average plasticity index (Stroud and Butler, 1975) Also considers logging descriptions for the upper till deposit.

9.3 Engineering Constraints

Presence of existing and relic services

The Principal Contractor should seek to obtain all available information on existing services from the client prior to construction and ensure that appropriate mitigation measures are put in place during the construction phase. It is likely that services will require disconnecting and decommissioning/diversion, subject to final structural loadings/layout.

It should be ensured that all existing foundations associated with the existing structures present within the development platform are removed in their entirety during demolition works. Existing foundations should be removed to avoid forming hard spots and backfilled in accordance with an engineering specification to avoid soft spots.

Made Ground and Obstructions

Made Ground was encountered across the site in north, centre, and eastern boundary of the site. It was interpreted that the basement of the previous building has been infilled with demolition rubble material. This basement and other below ground structures will require locating, breaking out and excavating to remove any 'hard spots'. It is inevitable that an enabling works package will be required to facilitate this.

Given its inherent variability, the Made Ground should not be considered as a suitable founding stratum for the proposed buildings, however, these materials may be re-used during any proposed earthworks operations subject to further validation testing.

Variability of natural near surface deposits

Very soft silt or clay superficial drift deposits were encountered in localised areas within the near surface soils during the ground investigation. The contractor should be aware that these soils are to be removed and replaced with a suitable well-compacted granular fill.

9.4 Excavations

Based on observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to less than 1.2 m depth from current ground levels would not stand unsupported in the short term. Excavated side slope angles in wet soft to firm Clay of 10 -25 degrees is likely to be suitable increasing to 30-45 degrees for dry soft-firm Clay. Suitable side slope angles excavated in sand to cobble material is likely to be in the region of 10-35 degrees when wet increasing to 30-40 degrees when dry based on guidance provided by CIRIA report 97 Trenching Practice.

Side support for safety purposes should of course be provided to all excavations which appear unstable, and those more than 1.2m deep, in accordance with Health and Safety Regulations. Groundwater is unlikely to be encountered as seepages in shallow excavations for foundations or services. It is considered that groundwater or surface water inflows, if encountered, may be controlled by pumping from sumps.

Excavation through layers of made ground and till encountered across the site should be feasible using conventional site plant with the appropriate trenching support (collapse was identified in the made ground during the trial pitting exercise). Following periods of heavy rainfall, the use of a tracked excavator may be required to prevent plant subsidence.

9.5 Foundation Design

As noted in section 9.1, no structural loadings have been provided at the time of writing and are likely to predetermine the suitability of the foundations to be adopted at the site. It is also understood that the residential apartment structure is to range between five storeys to seven storeys in height.

As part of the ground investigation made ground deposits are recorded to range to maximum depths between 0.40m bgl in TP04 and 3.00m bgl in CP01A and CP02 respectively. Where the made ground is shallow, in the south of the site for example, the superficial till deposit is initially recorded to range from very soft to soft consistencies initially, progressing to firm to stiff consistencies. Therefore, it is unlikely that conventional shallow foundations would be viable given the anticipated size and potential imposed loads of the proposed structure and the encountered shallow made ground and natural soil conditions.

Ground improvement techniques of the shallow natural ground is also unlikely to be a viable option as it is unlikely to provide the required bearing capacities for the loads required for the proposed structure.

Therefore, it is recommended that a piled foundation solution should be adopted as the chosen foundation method, ideally founding within the deeper till deposits. The presence of the glaciofluvial deposits and groundwater are likely to affect the installation of the piles. The carrying capacity of the piles depends not only on their size and the ground conditions but also on their method of installation. Pile design and installation are continuously evolving processes, therefore, it is recommended that a

specialist piling contractor be contacted and provided with this ground investigation report to determine whether their company specific designs of their piles would be suitable in the ground conditions pertaining to the site.

9.6 Ground Floor slabs

Due to the depths of made ground encountered and the presence of very soft to soft cohesive materials it is recommended that a suspended ground floor slab should be adopted. The suspended floor slab should be linked to the pile caps.

9.7 Pavement Assessment

As part of the ground investigation works no in-situ testing was completed to determine estimated CBR values for areas of hardstanding. However, two remoulded CBR tests were completed on shallow cohesive deposits. The results returned values ranging between 1.3% and 5.6%.

Ground conditions could be improved by using geotextile in the form of geogrid within the sub-base construction to reduce the overall sub-base thickness. A geotextile specialist should be able to provide specific recommendations based on the loads required. It is not currently known whether the proposed ground levels are to be higher or lower than the existing ground levels. It is inevitable that the north and centre of the site will require excavating to remove the basement construction. This will require geotechnically suitable material to be replaced and compacted in accordance with an appropriate specification.

In-situ California bearing ratio (CBR), or preferably, in-situ plate load tests should be completed at the proposed formation levels to confirm the design values.

The engineering characteristics of any clayey and silty soils at shallow depth are particularly sensitive to changes in soil moisture content and will soften considerably when exposed to free water. It would therefore be prudent to programme pavement construction for the dry summer months where possible. Where this is not possible, steps should therefore be taken to protect construction activities in adverse weather, for example not placing any fill until compaction plant is on site to work it and excavating grips or temporary drainage ditches to collect run off and/or groundwater during periods of particularly heavy rain.

9.8 Soakaway Assessment

Soakaway testing is outside the scope of this Phase 2 Ground Investigation. The Phase 2 Ground Investigation has identified made ground thickness to vary from the north to the south of the site to maximum depths of 0.40m in the south-west to 3.00m bgl in the north in the backfilled basement. The underlying natural till was proven to be present initially as a very soft to soft cohesive deposit with no fissures recorded to be present that would act as a migratory pathway. With depth this improved to a

firm to stiff consistency but still no fissures to act as a migratory pathway. Till is renowned for being at best poor at worst very poor infiltration media. Therefore, it is unlikely that soakaways will be a viable drainage solution for the intended end use of the development.

10.0 Conclusions & Recommendations

10.1 Conclusions

A revised tabulated revised Conceptual Site Model has been derived following the findings on the Generic Quantitative Risk Assessment risk assessment and is presented in Section 8.0.

10.1.1 Geotechnical Assessment

As part of the ground investigation made ground deposits are recorded to range to maximum depths between 0.40m bgl in TP04 and 3.00m bgl in CP01A and CP02 respectively. Where the made ground is shallow, in the south of the site for example, the superficial till deposit is initially recorded to range from very soft to soft consistencies initially, progressing to firm to stiff consistencies. Therefore, it is unlikely that conventional shallow foundations would be viable given the anticipated size and potential imposed loads of the proposed structure and the encountered made ground and natural soil conditions. Ground improvement techniques of the shallow natural ground is also unlikely to be a viable option as it is unlikely to provide the required bearing capacities for the loads required for the proposed structure. Therefore, it is recommended that a piled foundation solution should be adopted as the chosen foundation method, ideally founding within the deeper till deposits.

The presence of the glaciofluvial deposits and groundwater are likely to affect the installation of the piles. Due to the depths of made ground encountered and the presence of very soft to soft cohesive materials it is recommended that a suspended ground floor slab should be adopted. The suspended floor slab should be linked to the pile caps. Localised very soft near surface natural deposits will require excavation and replacement with a suitable well-compacted granular fill.

Concrete classification for aggressive ground conditions has been assessed as DS-3 and AC-3 for the made ground deposits, whereas the underlying superficial deposits have been assessed as DS-1 and AC-1.

10.1.2 Ground and Groundwater Assessment

The environmental chemistry soil results have been compared with the Tier 1 criteria for soils with respect to human health against '*Residential without home grown produce*' end use thresholds.

With respect to the proposed end use of the site Tier 1 thresholds with a SOM of 2.5% have been exceeded in six of seven made ground samples with respect to lead. These concentrations are likely to be associated with ashy soil conditions noted within the made ground and may pose a risk if future site users become exposed to these soils, primarily in landscaped areas. It

is considered that the risk presented to site end users from made ground soils on site will be Moderate / Low without mitigation measures such as a suitable engineered cover system installed in areas of soft landscaping. The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the remainder of the site.

The risk to groundwater and surface water receptors has been assessed as Low. This is due to the site not being recorded within a SPZ or a licensed groundwater abstraction within 1km. The cohesive till deposits are also likely to inhibit migration of any potential contaminants present both laterally and vertically. The closest surface water receptor of the canal to the south is likely to be lined by clay as part of the construction.

10.1.3 Ground Gas Assessment

Eight ground gas monitoring visits have been undertaken between October 2021 and December 2021, with maximum carbon dioxide concentration of 4.1% v/v and a maximum representative flow of -2.8 l/hr recorded. Several gas flows were discounted from the assessment due to either installations primarily used for groundwater monitoring, piston effect and stack effect. The risk to the end user the development site from soil gases is, therefore, assessed as Low. The gas regime for the site is CS1, requiring no ground gas protection measures.

The BGS Radon Mapping confirms the site is situated in an area where <1% of homes are above the radon action level. Radon protection measures are therefore not considered necessary within the proposed development. However, where the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

10.1.4 Additional Considerations

As part of the ground investigation works, obstructions were encountered and there was visual evidence of the basement wall still present along the north and north-western boundary of the site. It is not known whether breaking out of any obstructions or known below ground structures should have been excavated as part of the previous demolition works package.

Following any enabling works, fill materials should be placed to an engineered specification suitable for the proposed development.

10.2 Recommendations

Based on the findings of the ground investigation, the following recommendations are made:

- 1) It is recommended that construction workers are provided with appropriate PPE and sanitary facilities with reference to the environmental testing results presented herein and within Appendix A3.

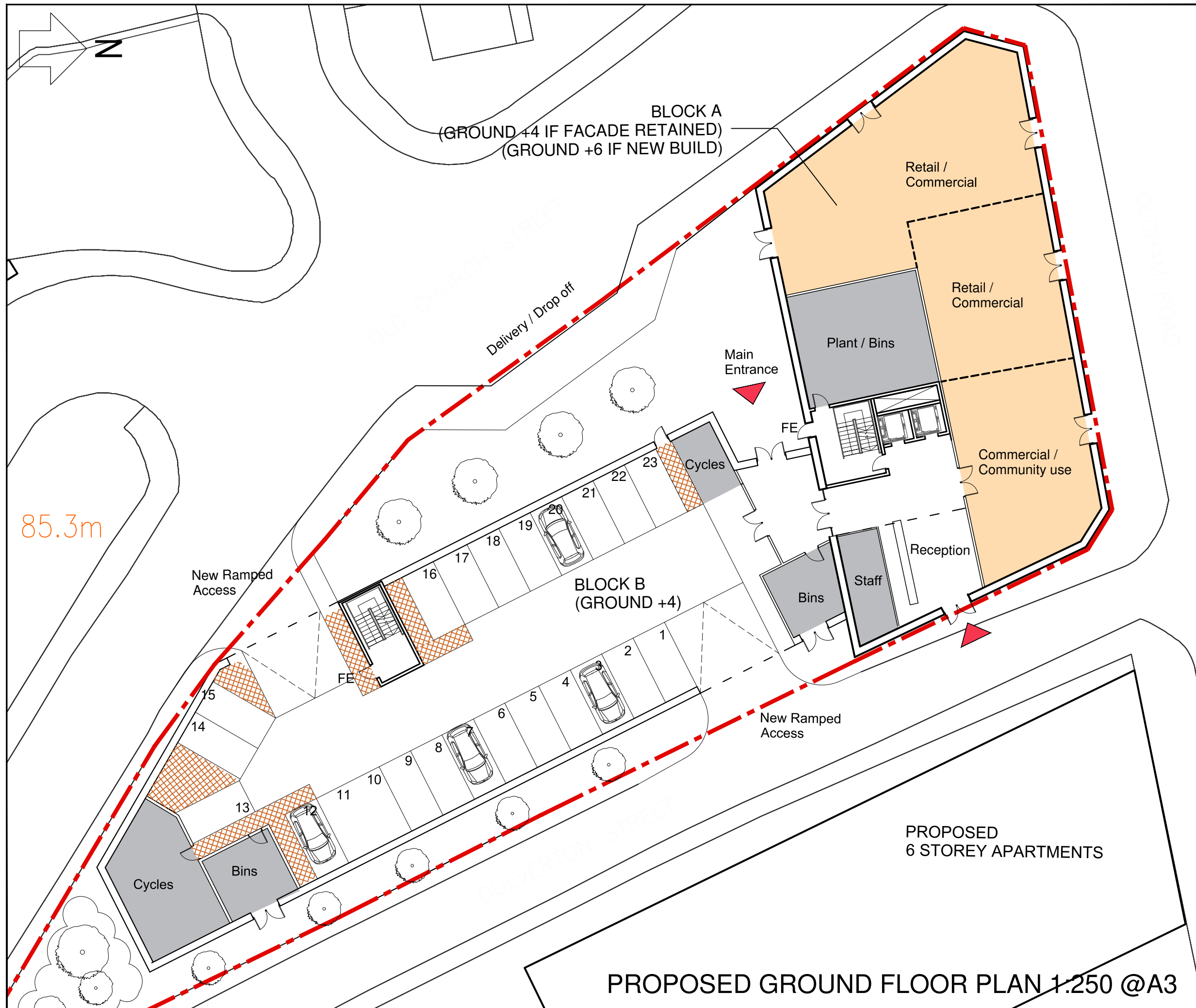
- 2) Enabling works package should be produced to detail that all the below ground obstructions should be excavated and removed as part of the development process. In addition, the removal of very soft silt or clay superficial drift deposits encountered in localised areas within the near surface soils to be replaced with a suitable well-compacted granular fill.
- 3) Following the substructure excavations, materials placed to form the development platform should be placed in accordance with an engineered specification to support the proposed development.
- 4) The presence of concentrations of lead in the made ground soils above the relevant thresholds for the development presents a potential risk to site end users. It is therefore recommended that in areas of soft landscaping, 300mm engineered cover system is installed to break the source-pathway-receptor (SPR) linkage. For the remainder of the site, the building footprint and areas of hard standing will break the SPR.
- 5) Should imported topsoil materials be brought to site, information on the source details and chemical analysis should be made available to Curtins to review that this material is suitable for the end use. When the topsoil material is imported to site, this should be chemically tested by Curtins to confirm that it is suitable for use.
- 6) Allowance for a Remediation Strategy or Specification to detail the requirements for the engineered cover system. Allowance for a Verification Report to confirm that the engineered cover system has been implemented and imported topsoil materials have been chemically analysed to determine that they are acceptable for the end use at the site.
- 7) In-situ California bearing ratio (CBR), or preferably, in-situ plate load tests should be completed at the proposed formation levels to confirm the design values.

11.0 References

- 1 Land Contamination: Risk Management (2019) (ref: <https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks>) (formerly Environment Agency (2004) Model Procedures for the management of land Contamination Contaminated Land Report 11 (CLR11)).
- 2 British Standards Institution (2011) *Investigation of Potentially Contaminated Sites* (report no. BS10175:2011+A2:2017).
- 3 British Standards Institution BSI (2010) *Code of Practice for Site Investigations* (report no. BS5930:2015+A1:2020).
- 4 British Standards Institution (2006) *Eurocode 7: Geotechnical Design* (report no. BS EN 1997).
- 5 British Standards Institution (2013) *Guidance on Investigations for Ground Gas, Permanent Gas and Volatile Organic Compounds (VOCs)* (report no. BS8576:2013).
- 6 Environment Agency (2014) *Contaminated Land Exposure (CLEA) Tool* (version 1.071).
- 7 Environment Agency (2009) *Human Health Toxicological Assessment of Contaminants in Soil* (report no. SC050021/SR2)
- 8 Environment Agency (2009) *Updated Technical Background to the CLEA Model* (report no. SC050021/SR3).
- 9 Department of Environment Food and Rural Affairs (DEFRA) (2012) *Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance* (report no. PB13735).
- 10 British Standards Institution (2015 +A1:2019) *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* (report no. BS8485: 2015 +A1:2019).
- 11 CIRIA (2007) *Assessing Risks Posed by Hazardous Ground Gases to Buildings* (report no. C665)
- 12 S Wilson, G Card, S Haines (2009) *Ground Gas Handbook* Cathness, Scotland, Whittles Publishing.
- 13 Curtins Phase 1 Preliminary Risk Assessment (2021) Report ref: 079193-CUR-XX-XX-RP-GE-00001-P01_Phase 1 PRA

Appendix A1 – Drawings

- Proposed Development Plan
- Curtins drawing ref. 079193-CUR-XX-XX-D-GE-80002-P03_EHLP



CLIENT
MANCHESTER ONE

CONTRACTOR

STRUCTURAL ENGINEER

SERVICES ENGINEER

CONSULTANT

KEY PLAN

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	BLOCK A (7 Storey)			BLOCK B (5 Storey)			
Floor	1bed (2p)	2bed (3p)	3bed (4p)	1bed (2p)	2bed (3p)	3bed (5p)	Total
Ground	0	0	0	0	0	0	0
1	1	4	2	2	7	1	17
2	1	4	2	2	7	1	17
3	1	4	2	2	7	1	17
4	1	4	2	2	7	1	17
5	1	4	2	-	-	-	7
6	1	4	2	-	-	-	7
Sub-total	6 (7.3%)	24 (29.7%)	12 (9.8%)	8 (9.8%)	28 (34%)	4 (4.8%)	82

CAR PARKING: 23 SPACES (12%)

1b2p 50m² / 538sqft

2b3p 61m² / 656sqft

3b4p 74m² / 797sqft

Ancillary

(63 If existing Facade retained)

P1 19.11.20 INITIAL ISSUE

STS A.J.L.

No. Date Comment

Drawn Chk'd

Revisions

Issue Status

PRELIMINARY

tp bennett

architecture

interiors

planning

Royal Mills Unit 2B 17 Radcliffe Street Manchester M14 5BA UK (0) 161 694 7700 www.tpbenett.com

Project

ROSEDALE BUILDING

OLDHAM ROAD

NEWTON HEATH

Drawing Title

FEASIBILITY PLAN

GROUND FLOOR

Drawn

STS

Date

11.20

Scale @ A3

1:250

Alt. Ref.

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tp bennett Project No.

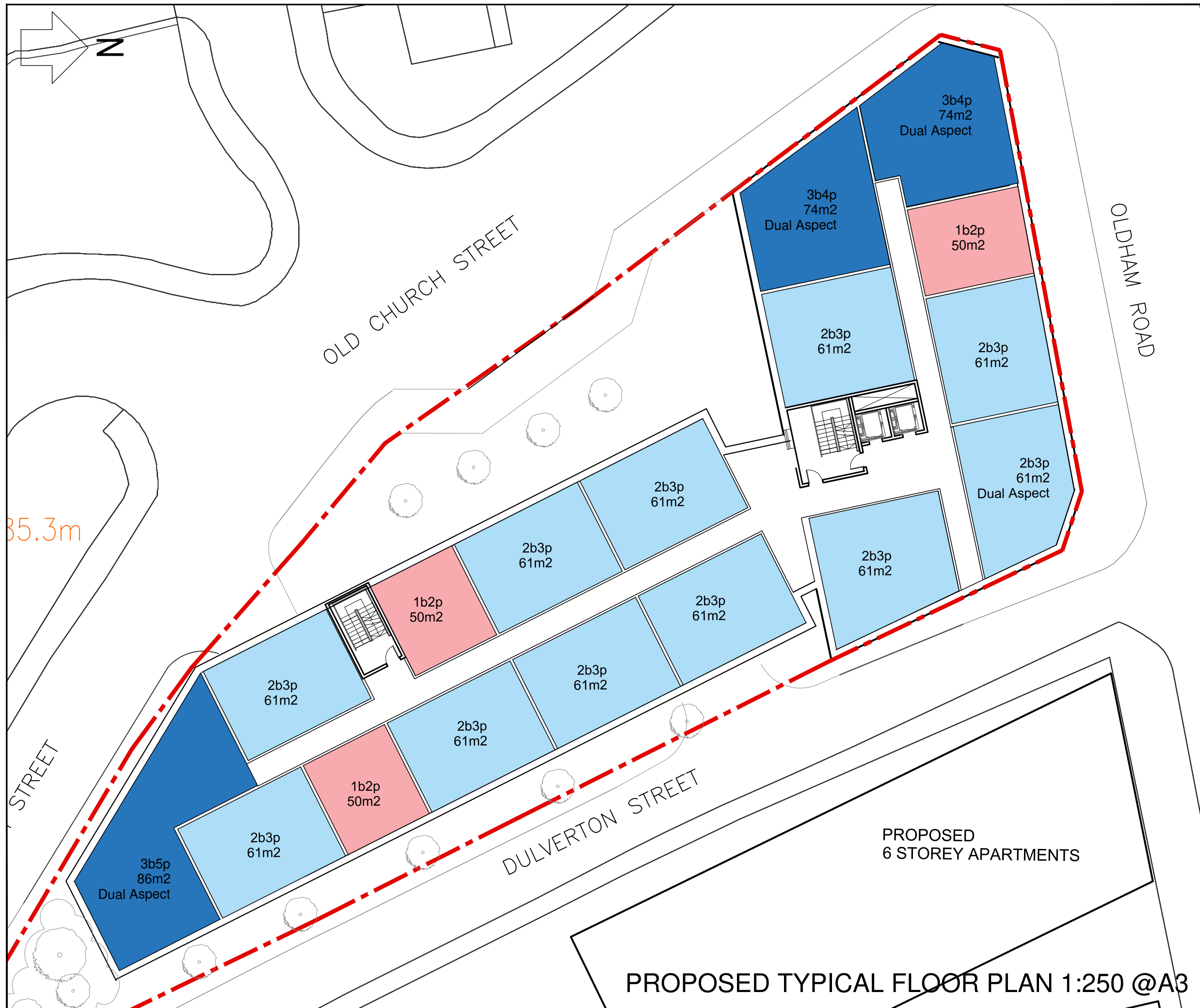
T8154

Drawing Number

A 0100

Rev

P1



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MANCHESTER ONE

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KEY PLAN

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Floor	BLOCK A (7 Storey)			BLOCK B (5 Storey)			Total
	1bed (2p)	2bed (3p)	3bed (4p)	1bed (2p)	2bed (3p)	3bed (5p)	
Ground	0	0	0	0	0	0	0
1	1	4	2	2	7	1	17
2	1	4	2	2	7	1	17
3	1	4	2	2	7	1	17
4	1	4	2	2	7	1	17
5	1	4	2	-	-	-	7
6	1	4	2	-	-	-	7
Sub-total	6 (7.3%)	24 (29.7%)	12 (9.8%)	8 (9.8%)	28 (34%)	4 (4.8%)	82

CAR PARKING: 23 SPACES (12%)
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Ancillary

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Issue Status

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tp bennett

architecture
interiors
planning

Royal Mills Unit 2B 17 Radcliffe Street Manchester M14 6BA UK (0) 161 694 7700 www.tpben.co.uk

Project

ROSEDALE BUILDING
OLDHAM ROAD
NEWTON HEATH

Drawing Title

FEASIBILITY PLAN
TYPICAL FLOOR

Drawn

STS

Date

11.20

Scale @ A3

1:250

Alt. Ref.

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tp bennett Project No.

Drawing Number

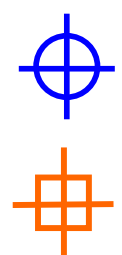
Rev

T8154

A 0101

P1

PROPOSED TYPICAL FLOOR PLAN 1:250 @A3



Cable Percussive Boreholes up to 30m bgl

Machine Excavated Trial Pits up 3.50m bgl



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Civils & Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Principal Designer
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Project: Rosedale Building, Manchester

Drg Title: Exploratory Hole Location Plan

Project No: Originator: Zone: Level: Type: Discipline: Category / Number: Rev:

079193-CUR-XX-XX-D-GE-80002-P03

Status: FINAL

Drawn By: RS Checked By: BC

Designed By: RS Date: 17/01/2022

Scale: NTS

GENERAL NOTES:

---	DRAFT Proposed Plan	17/09/21	RS
Rev:	Description:	Date:	By:

Appendix A2 – Exploratory Hole Logs



Trial Pit Log

Trialpit No

TP01

Sheet 1 of 1

Project Name: Rosedale Building

Project No.
079193Co-ords: -
Level:Date
04/10/2021

Location: Manchester

Dimensions
(m):Depth
2.50Scale
1:25Logged
RH

Client: One Manchester

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	1.50	ES					MADE GROUND: Whole bricks on top. Brown coarse silty sandy gravelly cobbles consisting of angular to sub-angular bricks, sandstones, concrete, wood planks, glass, plastic sheets and metal pipes.
				2.50 2.55			MADE GROUND: Flat concrete surface. Potential basement floor. End of pit at 2.50 m

1

2

3

4

5

Remarks: Machine excavated to 2.5m. Made ground encountered throughout hole. No Groundwater Encountered. Dig was stopped due to nature of made ground collapsing in on itself.

Stability:





Trial Pit Log

Trialpit No

TP02

Sheet 1 of 1

Project Name: Rosedale Building

Project No.
079193Co-ords: -
Level:Date
04/10/2021

Location: Manchester

Dimensions
(m):Depth
2.85Scale
1:25Logged
RH

Client: One Manchester

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	ES					MADE GROUND: Whole bricks on top. Brown coarse silty sandy gravelly cobbles consisting of angular to sub-angular bricks, sandstones, wood planks, glass and metal pipes.
				2.80 2.85			MADE GROUND: Flat concrete surface. Potential basement floor. Former brick wall running approximately north to south, present in the sides of the pit wall. End of pit at 2.85 m

1

2

3

4

5

Remarks: Machine excavated to 2.8m. Made ground encountered throughout hole. No Groundwater Encountered. Dig was stopped due to obstruction of concrete basement. Previous brick wall from former building was present.

Stability:





Trial Pit Log

Trialpit No

TP03

Sheet 1 of 1

Project Name: Rosedale Building

Project No.
079193Co-ords: -
Level:Date
04/10/2021

Location: Manchester

Dimensions
(m):Depth
1.85Scale
1:25Logged
RH

Client: One Manchester

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	ES					MADE GROUND: Whole bricks on top. Brown coarse silty sandy gravelly cobbles consisting of angular to sub-angular bricks, sandstones, concrete, wood planks, glass, plastic sheets and metal pipes.
				1.80 1.85			MADE GROUND: Flat concrete surface. Potential basement floor. End of pit at 1.85 m

1

2

3

4

5

Remarks: Machine excavated to 1.8m. Made ground encountered throughout hole. No Groundwater Encountered. Dig was stopped due to obstruction of potential concrete floor basement.

Stability:





Trial Pit Log

Trialpit No

TP04

Sheet 1 of 1

Project Name: Rosedale Building

Project No.
079193Co-ords: -
Level:Date
04/10/2021

Location: Manchester

Dimensions
(m):Depth
2.30Scale
1:25Logged
RH

Client: One Manchester

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.40			MADE GROUND: Whole bricks on top. Brown coarse silty sandy gravelly cobbles consisting of angular to sub-angular bricks, sandstones, concrete, wood planks, glass, plastic sheets and metal pipes.	
							Very soft to soft, friable dark grey to black CLAY grades into a light grey-brown clay.	
				0.90			Firm dark brown mottled grey CLAY containing fibres of plant debris. Rare laminations of dark grey-blue are observed.	1
				2.30			End of pit at 2.30 m	2
								3
								4
								5

Remarks: Machine excavated to 2.3m. Made ground encountered. No Groundwater Encountered.

Stability:





Trial Pit Log

Trialpit No

TP05

Sheet 1 of 1

Project Name: Rosedale Building

Project No.
079193Co-ords: -
Level:Date
04/10/2021

Location: Manchester

Dimensions
(m):Depth
2.40Scale
1:25Logged
RH

Client: One Manchester

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.40			MADE GROUND: Whole bricks on top. Brown coarse silty sandy gravelly cobbles consisting of angular to sub-angular bricks, sandstones, wood planks, glass and metal pipes.	
				0.80			Black-brown fine grained ashly slightly clayey SILT with very fine to medium grained sand.	
				2.00			Soft to firm black-brown CLAY.	1
				2.40			Soft to firm light grey-blue mottled brown CLAY containing fibres of plant debris.	2
							End of pit at 2.40 m	3
								4
								5

Remarks: Machine excavated to 2.4m. Made ground encountered. Groundwater Encountered at 2.2m

Stability:





Trial Pit Log

Trialpit No

TP06

Sheet 1 of 1

Project Name: Rosedale Building

Project No.
079193Co-ords: -
Level:Date
04/10/2021

Location: Manchester

Dimensions
(m):Depth
2.80Scale
1:25Logged
RH

Client: One Manchester

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.20			MADE GROUND: Whole bricks on top. Brown coarse silty sandy gravelly cobbles consisting of angular to sub-angular bricks, sandstones, wood planks, glass and metal pipes.	
				0.70			Black ashy slightly clayey SILT with coarse grains of sand and blocks of broken brick.	
				1.00			Very soft to soft black to dark grey CLAY.	1
							Soft to firm light grey mottled brown CLAY with fibres of plant debris.	
				2.80			End of pit at 2.80 m	3
								4
								5

Remarks: Machine excavated to 2.8m. Made ground encountered. No Groundwater Encountered.

Stability:





Borehole Log

Borehole No.

CP01

Sheet 1 of 1

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 07/10/2021 - 07/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00	B					MADE GROUND: Whole bricks on top. Brown coarse silty sandy gravelly cobbles consisting of angular to sub-angular bricks, sandstones, wood planks, glass and metal pipes.	1
		0.70	ES						
		1.20 1.20	B	N=18 (3,4/4,4,5,5)					
		2.00		N=25 (3,5/5,6,7,7)					
		2.40		50 (25 for 4mm/50 for 5mm)					
					2.60 2.65			MADE GROUND: Possible concrete basement floor. 8 inch tooling has bent due to hardness trying to chisel. Hole terminated. End of borehole at 2.65 m	3
									4
									5
									6
									7
									8

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. No Groundwater Encountered. Cable rig could not progress at 2.6m due to obstruction of potential concrete floor basement even after chiselling. 8 inch drilling tool had also bent out of shape.





Borehole Log

Borehole No.

CP01A

Sheet 1 of 3

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:50

Client: One Manchester

Dates: 22/11/2021 - 24/11/2021

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								MADE GROUND: Brown slightly clayey gravel with frequent cobbles and boulders. Gravel is medium to coarse and angular of brick, glass, timber, concrete. Cobbles and boulders of angular brick, concrete and timber.	1
					2.40				2
					2.65			MADE GROUND: Grey Concrete.	
		3.20 - 3.65	B		3.00			MADE GROUND: Firm brown slightly silty gravelly clay. Gravel is medium to coarse and angular of brick. Firm brown silty CLAY.	3
		4.00 - 4.45	U100	Ublow=110					4
		4.50	D						
		5.00		N=19 (3,3/4,4,5,6)					
		5.00 - 5.45	B					Stiff below 5.00m bgl.	5
		5.00 - 5.45	D						
		6.00		N=38 (4,5/8,9,10,11)	6.00			Dense brown GRAVEL and SAND. Sand is medium to coarse. Gravel is fine to medium and sub-rounded of mudstone and siltstone.	6
		6.00 - 6.45	B						
		7.00 - 7.45	B		7.00			Stiff brown slightly sandy CLAY.	7
		7.50 - 7.95	U100	Ublow=120					8
		7.50 - 8.00	B						
		9.00		N=19 (3,4/4,5,5,5)	9.00			Medium dense brown silty fine SAND.	9
		9.00 - 9.45	B						
		10.00 - 10.50	B		10.00				10

Continued on next sheet

Remarks

Area scanned for services. Trial pit excavation to 2.40m bgl to expose concrete slab. Breaker used to break concrete slab and excavated to 3.00m bgl. Casing placed within trial pit and backfilled around casing. Groundwater strikes encountered at 12.00m bgl, which risen to 11.00m bgl after 20 minutes, and at 21.70m bgl, which risen to 15.00m bgl after 20 minutes. Borehole terminated at 25.45m bgl due to SPT refusals.





Borehole Log

Borehole No.

CP01A

Sheet 2 of 3

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:50

Client: One Manchester

Dates: 22/11/2021 - 24/11/2021

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 - 10.95	U100	Ublow=110	12.00			Stiff brown silty gravelly CLAY. Gravel is medium to coarse and sub-rounded of sandstone.	11
		11.00	D						
		12.00	B	N=27 (4,5/6,6,7,8)					
		12.00 - 12.45	D		16.00			Very stiff brown very clayey SILT. Occasional silty sand bands between 12.00-16.00m bgl.	12
		12.00 - 12.45	D						
		13.50	B	N=16 (2,3/4,3,4,5)	17.00			Stiff below 13.50m bgl.	13
		13.50 - 13.95	B						
		15.00	B	N=15 (2,3/3,4,4,4)	17.00				14
		15.00 - 15.45	B						
		16.00	D		17.00			Stiff brown silty sandy gravelly CLAY. Gravel is medium to coarse and sub-angular to sub-rounded of siltstone and sandstone.	15
		16.50 - 16.95	U100	Ublow=125					
		17.00	D						
		18.00	B	N=50 (8,9/50 for 275mm)	18.00			Very stiff brown silty gravelly CLAY. Gravel is medium to coarse and sub-rounded of sandstone.	16
		18.00 - 18.45	D						
		18.00 - 18.45	D		19.00				17
		19.50 - 19.95	U100	Ublow=130	20.00				18
		20.00	D						
					20.00			Continued on next sheet	19

Remarks

Area scanned for services. Trial pit excavation to 2.40m bgl to expose concrete slab. Breaker used to break concrete slab and excavated to 3.00m bgl. Casing placed within trial pit and backfilled around casing. Groundwater strikes encountered at 12.00m bgl, which risen to 11.00m bgl after 20 minutes, and at 21.70m bgl, which risen to 15.00m bgl after 20 minutes. Borehole terminated at 25.45m bgl due to SPT refusals.





Borehole Log

Borehole No.

CP01A

Sheet 3 of 3

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:50

Client: One Manchester

Dates: 22/11/2021 - 24/11/2021

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		21.00		50 (10,12/50 for 205mm)				Very dense brown GRAVEL and SAND with cobbles. Sand is medium to coarse. Gravel is fine to medium and sub-rounded of mudstone and siltstone. Cobbles of sub-rounded siltstone and sandstone. Very stiff brown silty CLAY.	21
		21.00 - 21.45	B						
		21.00 - 21.45	D		21.70				
					22.00				22
		22.50		50 (25 for 145mm/50 for 195mm)					
		22.50 - 22.95	D						23
		24.00		56 (10,15/56 for 190mm)					24
		24.00 - 24.45	D						
		25.00		50 (25 for 135mm/50 for 150mm)					25
		25.00 - 25.45	D		25.45			End of borehole at 25.45 m	26
									27
									28
									29
									30

Remarks

Area scanned for services. Trial pit excavation to 2.40m bgl to expose concrete slab. Breaker used to break concrete slab and excavated to 3.00m bgl. Casing placed within trial pit and backfilled around casing. Groundwater strikes encountered at 12.00m bgl, which risen to 11.00m bgl after 20 minutes, and at 21.70m bgl, which risen to 15.00m bgl after 20 minutes. Borehole terminated at 25.45m bgl due to SPT refusals.





Borehole Log

Borehole No.

CP02

Sheet 1 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 07/10/2021 - 08/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 1.20	B					MADE GROUND: Whole bricks and weeds on top. Brown very silty, sandy, gravelly cobbles consisting of whole and broken bricks, glass, metal pipes, old service cables, plastic and blocks of concrete.	1
		0.50	ES						
		1.20		N=8 (2,3/2,1,3,2)					
		2.00		N=7 (1,1/2,2,1,2)	2.00				
		2.00 - 2.45	B					MADE GROUND: Very soft dark brown gravelly slightly silty CLAY. Gravel comprises of broken sandstones and brick.	2
		3.00		N=24 (3,4/5,6,6,7)	3.00				
		3.00 - 3.45	B					Stiff brown with light grey mottling silty gravelly CLAY. Gravel comprises of sub-angular to rounded or lenticular light grey fine-medium grained sandstones.	3
		3.00 - 3.45	D						
		4.00 - 4.50	U	Ublow=125					4
		4.50	D						
		5.00		N=20 (3,4/4,5,5,6)					5
		5.00 - 5.45	D						
		6.00 - 6.45	D						6
		6.00 - 6.45	U	Ublow=125					
		7.50		50 (9,10/50 for 210mm)	7.50			Dense brown fine-medium grained silty SAND with prominent medium to coarse sandy gravelly horizons.	7
		7.50 - 7.95	B						8

Continued on next sheet

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. No Groundwater Encountered. Cable rig refused at 25m





Borehole Log

Borehole No.

CP02

Sheet 2 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 07/10/2021 - 08/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		9.00 9.00 - 9.45	D	N=40 (7,8/9,10,10,11)	10.50				9
		10.00 - 10.45	B						
		10.50 10.50 - 10.95	D	N=26 (3,4/4,7,7,8)					
		12.00 12.00 - 12.45	D	N=26 (3,4/5,6,7,8)	13.50			Stiff brown silty CLAY grading into a clayey silty sand at the base.	11
		13.50 13.50 - 13.95	D	N=18 (3,4/5,4,5,4)					
		15.00 - 15.45	U	Ublow=120	15.00			Medium dense fine to medium grained brown silty SAND retrieved as a paste. Some sandy gravel present at the base.	14
		15.50	D						
					16.00			Stiff to very stiff brown silty CLAY with occasional gravel horizons. Gravel are sub-angular to lenticular light grey fine grained sandstones.	15
								Continued on next sheet	16

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. No Groundwater Encountered. Cable rig refused at 25m





Borehole Log

Borehole No.

CP02

Sheet 3 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 07/10/2021 - 08/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		16.50		N=50 (3,4/50 for 285mm)				Very dense fine grained brown SAND.	
		16.50 - 16.95	D						17
		17.45	B						
		18.00		50 (25 for 70mm/50 for 225mm)					18
		18.00 - 18.45	D						
		19.50		50 (25 for 145mm/50 for 220mm)					19
		19.50 - 19.95	D						
		21.00		N=50 (10,11/50 for 275mm)					20
		21.00 - 21.45	D					Sandstone clasts range between 1-2cm in size Sandstone clasts range between 2-7cm in size	21
		22.50		N=50 (10,11/50 for 255mm)					22
		22.50 - 22.95	D						
		23.50	B		23.50				23
								Very stiff brown silty, sandy CLAY with fine grained light grey to brown sandstone gravel throughout.	24

Continued on next sheet

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. No Groundwater Encountered. Cable rig refused at 25m





Borehole Log

Borehole No.

CP02

Sheet 4 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 07/10/2021 - 08/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		24.00	D	50 (10,12/50 for 210mm)	25.00				
		24.00 - 24.45							
		25.00	D	50 (10,12/50 for 150mm)	25.00			End of borehole at 25.00 m	25
		25.00 - 25.45							
									26
									27
									28
									29
									30
									31
									32

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. No Groundwater Encountered. Cable rig refused at 25m





Borehole Log

Borehole No.

CP03

Sheet 1 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 04/10/2021 - 06/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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Continued on next sheet

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. Groundwater Encountered at 14m. Cable rig refused at 25m





Borehole Log

Borehole No.

CP03

Sheet 2 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

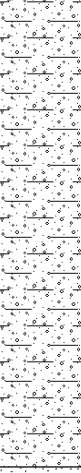
Level:

Scale
1:40

Client: One Manchester

Dates: 04/10/2021 - 06/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		9.00 9.00 - 9.45	B	N=45 (5,8/10,15,10,10)	10.50				9
		10.50 10.50 - 10.95 10.50 - 10.95	B D	N=20 (3,4/5,5,5,5)					10
		12.00 12.00 - 12.45 12.00 - 12.45	B D	N=18 (4,5/4,5,4,5)				Initially medium dense progressively becomes very loose fine grained dark brown-grey SAND which grades into a medium grained brown sand towards base.	11
		13.50 13.50	D	N=16 (4,3/3,4,5,4)					12
		15.00 15.00 - 15.45	D	N=2 (2,1/1,0,1,0)					13
		16.00 - 16.45	B						14
					16.00				15
								Continued on next sheet	16

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. Groundwater Encountered at 14m. Cable rig refused at 25m





Borehole Log

Borehole No.

CP03

Sheet 3 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 04/10/2021 - 06/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		16.50 - 16.95	U	Ublow=115	18.00			Firm to stiff brown CLAY with rare black fine to medium grained mudstone gravels.	17
		17.00	D						
		18.00		50 (8,9/50 for 225mm)					18
		18.00 - 18.45	B		22.00			Stiff brown silty sandy CLAY with gravel sized sandstone clasts throughout.	19
		18.00 - 18.45	D						20
		19.50 - 19.95	U	Ublow=125					21
		20.00	D		23.00				22
		21.00		N=50 (7,8/50 for 275mm)					23
		21.00 - 21.45	B						24
		21.00 - 21.45	D		24.00				
		22.50 - 22.95	U	Ublow=125				Very stiff dark grey-brown silty CLAY with sandstone gravel throughout.	
		23.00	D					Very stiff dark brown silty sandy CLAY.	

Continued on next sheet

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. Groundwater Encountered at 14m. Cable rig refused at 25m





Borehole Log

Borehole No.

CP03

Sheet 4 of 4

Project Name: Rosedale Building

Project No.
079193

Co-ords: -

Hole Type
CP

Location: Manchester

Level:

Scale
1:40

Client: One Manchester

Dates: 04/10/2021 - 06/10/2021

Logged By
RH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		25.00	D	N=50 (6,9/50 for 280mm)	25.00			Very stiff brown sandy CLAY with large-medium sized brown sandstone gravel clasts throughout. Several sandy gravel bands are prominent throughout the clay.	25
		25.00							26
								End of borehole at 25.00 m	27
									28
									29
									30
									31
									32

Remarks

Hand pit to 1m due to nature of Made ground. Made ground encountered. Groundwater Encountered at 14m. Cable rig refused at 25m



Appendix A3 – Chemical laboratory Testing Results

- Environmental Chemistry Analysis Results (Soil)
 - I2 Analytical Ltd, Certificate No. 21-15861-1

**Rob Swinnerton**

Curtins
2 The Wharf
Bridge Street
Birmingham
B1 2JS

e: rob.swinnerton@curtins.com

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 21-15861

Project / Site name:	Rosedale Manchester	Samples received on:	06/10/2021
Your job number:	079193	Samples instructed on/ Analysis started on:	13/10/2021
Your order number:	EBBI1006	Analysis completed by:	20/10/2021
Report Issue Number:	1	Report issued on:	20/10/2021
Samples Analysed:	8 soil samples		

Signed: 

Agnieszka Czerwińska
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 21-15861
Project / Site name: Rosedale Manchester
Your Order No: EBB11006

Lab Sample Number				2044117	2044118	2044119	2044120	2044121
Sample Reference				TP01	TP02	TP03	TP04	TP05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.50	0.50	0.30	0.40	0.20
Date Sampled				04/10/2021	04/10/2021	04/10/2021	04/10/2021	04/10/2021
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	%	0.01	NONE	14	17	16	32	21
Total mass of sample received	kg	0.001	NONE	0.40	0.40	0.40	0.40	0.40

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

pH - Automated	pH Units	N/A	MCERTS	8.2	8.3	8.0	7.4	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	2700	2900	2600	2000	2000
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	1.4	1.5	1.3	0.99	1.0
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	1370	1460	1310	986	1020
Organic Matter (automated)	%	0.1	MCERTS	2.6	2.9	2.8	11	5.5

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	0.86	0.74	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.36	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.33	0.35	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.26	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	2.8	2.6	1.4	< 0.05	0.51
Anthracene	mg/kg	0.05	MCERTS	0.57	0.49	0.31	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	3.9	2.9	2.0	< 0.05	0.56
Pyrene	mg/kg	0.05	MCERTS	3.6	2.7	1.6	< 0.05	0.57
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.5	1.7	1.2	< 0.05	0.38
Chrysene	mg/kg	0.05	MCERTS	1.7	1.4	0.87	< 0.05	0.35
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.8	1.4	1.1	< 0.05	0.33
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.4	1.1	0.83	< 0.05	0.22
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.0	1.8	1.4	< 0.05	0.34
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.64	0.73	0.63	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.27	0.25	0.24	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.0	1.1	1.1	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	24.1	19.2	12.6	< 0.80	3.26
-----------------------------	-------	-----	--------	------	------	------	--------	------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	32	21	15	7.6	31
Boron (water soluble)	mg/kg	0.2	MCERTS	3.7	4.1	2.7	0.8	1.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	21	23	25	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	56	53	61	30	64
Lead (aqua regia extractable)	mg/kg	1	MCERTS	540	390	760	39	160
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	0.8
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	20	15	13	30
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	210	200	210	47	62

Analytical Report Number: 21-15861
Project / Site name: Rosedale Manchester
Your Order No: EBB11006

Lab Sample Number	2044117	2044118	2044119	2044120	2044121
Sample Reference	TP01	TP02	TP03	TP04	TP05
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.50	0.50	0.30	0.40	0.20
Date Sampled	04/10/2021	04/10/2021	04/10/2021	04/10/2021	04/10/2021
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

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

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	2.1	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	5.9	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	16	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	45	23	31	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	69	33	37	< 10	< 10

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



Analytical Report Number: 21-15861
 Project / Site name: Rosedale Manchester
 Your Order No: EBB11006

Lab Sample Number				2044122	2044468	2044469
Sample Reference				TP06	CP01	CP02
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.70	0.50
Date Sampled				04/10/2021	04/10/2021	04/10/2021
Time Taken				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
Moisture Content	%	0.01	NONE	21	17	18
Total mass of sample received	kg	0.001	NONE	0.40	0.50	0.50

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	8.2	8.5	8.5
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	1100	2800	6600
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.54	1.4	3.3
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	545	1390	3320
Organic Matter (automated)	%	0.1	MCERTS	5.6	3.5	3.0

Total Phenols

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

Naphthalene	mg/kg	0.05	MCERTS	0.25	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.32	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.75	0.43	0.79
Fluorene	mg/kg	0.05	MCERTS	0.48	0.22	0.53
Phenanthrene	mg/kg	0.05	MCERTS	4.5	2.7	5.2
Anthracene	mg/kg	0.05	MCERTS	0.78	0.56	1.1
Fluoranthene	mg/kg	0.05	MCERTS	5.9	2.8	5.4
Pyrene	mg/kg	0.05	MCERTS	5.8	2.6	5.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.5	1.2	2.2
Chrysene	mg/kg	0.05	MCERTS	2.5	1.1	2.1
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	2.3	0.95	1.9
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.4	0.59	0.93
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.5	1.0	2.0
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.98	0.45	0.87
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.30	0.13	0.26
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.3	0.61	1.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	33.6	15.3	29.8
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	36	24	22
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	1.9	2.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	20	21
Copper (aqua regia extractable)	mg/kg	1	MCERTS	230	58	44
Lead (aqua regia extractable)	mg/kg	1	MCERTS	320	560	450
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.6	0.4	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	34	21	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	130	170	150

Analytical Report Number: 21-15861
Project / Site name: Rosedale Manchester
Your Order No: EBB11006

Lab Sample Number				2044122	2044468	2044469
Sample Reference				TP06	CP01	CP02
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.70	0.50
Date Sampled				04/10/2021	04/10/2021	04/10/2021
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Monoaromatics & Oxygenates						
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	14
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	2.6	< 2.0	48
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	16	46	81
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	32	99	130
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	51	140	270

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



Analytical Report Number : 21-15861

Project / Site name: Rosedale Manchester

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2044117	TP01	None Supplied	1.5	Brown loam and clay with gravel and vegetation.
2044118	TP02	None Supplied	0.5	Brown loam and clay with gravel and vegetation.
2044119	TP03	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
2044120	TP04	None Supplied	0.4	Brown loam and clay.
2044121	TP05	None Supplied	0.2	Brown loam and clay with gravel.
2044122	TP06	None Supplied	0.4	Brown loam and clay with gravel.
2044468	CP01	None Supplied	0.7	Brown loam and sand with gravel and vegetation.
2044469	CP02	None Supplied	0.5	Brown loam and sand with gravel and vegetation.

Analytical Report Number : 21-15861
Project / Site name: Rosedale Manchester

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
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
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
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
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
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
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L0738-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

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.



Analytical Report Number : 21-15861
Project / Site name: Rosedale Manchester

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Sample Deviation Report



Analytical Report Number : 21-15861
Project / Site name: Rosedale Manchester

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
CP01	None Supplied	S	2044468	c	Total cyanide in soil	L080-PL	c
CP02	None Supplied	S	2044469	c	Total cyanide in soil	L080-PL	c
TP01	None Supplied	S	2044117	c	Total cyanide in soil	L080-PL	c
TP02	None Supplied	S	2044118	c	Total cyanide in soil	L080-PL	c
TP03	None Supplied	S	2044119	c	Total cyanide in soil	L080-PL	c
TP04	None Supplied	S	2044120	c	Total cyanide in soil	L080-PL	c
TP05	None Supplied	S	2044121	c	Total cyanide in soil	L080-PL	c
TP06	None Supplied	S	2044122	c	Total cyanide in soil	L080-PL	c

079193-CUR-XX-XX-T-GE-00003

Rosedale, Newton Heath, Manchester

Phase 2 Ground Investigation



Appendix A4 – Geotechnical Laboratory Testing Results

- Geotechnical Analysis Results
 - I2 Analytical Ltd, Certificate No. 21-16224-1
 - I2 Analytical Ltd, Certificate No. 21-25839-1
 - I2 Analytical Ltd, Certificate No. 21-16217
 - I2 Analytical Ltd, Certificate No. 21-25837

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Analytical Report Number : 21-16224

Project / Site name:	Rosedale, Manchester	Samples received on:	08/10/2021
Your job number:	079193	Samples instructed on/ Analysis started on:	14/10/2021
Your order number:	EBBI1010	Analysis completed by:	26/10/2021
Report Issue Number:	1	Report issued on:	26/10/2021
Samples Analysed:	13 soil samples		

Signed:

Agnieszka Czerwińska
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 21-16224
Project / Site name: Rosedale, Manchester
Your Order No: EBB11010

Lab Sample Number				2046191	2046192	2046193	2046194	2046195
Sample Reference				CP02	CP02	CP02	CP02	CP02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00-2.45	4.50	9.00-9.45	13.50-13.95	15.50
Date Sampled				07/10/2021	07/10/2021	07/10/2021	07/10/2021	07/10/2021
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	%	0.01	NONE	18	15	14	18	9.8
Total mass of sample received	kg	0.001	NONE	0.40	0.50	0.50	0.40	0.50

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.9	8.0	8.7	8.5	8.8
Total Sulphate as SO ₄	%	0.005	MCERTS	0.096	0.037	0.011	0.045	0.028
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.21	0.080	0.020	0.084	0.057
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	213	79.5	19.7	83.8	57.2
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	7.9	5.1	6.0	11	6.9
Total Sulphur	%	0.005	MCERTS	0.056	0.025	0.072	0.114	0.084
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	17	26	11	28	27
Magnesium (leachate equivalent)	mg/l	2.5	NONE	8.6	13	5.7	14	13

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



Analytical Report Number: 21-16224
Project / Site name: Rosedale, Manchester
Your Order No: EBB11010

Lab Sample Number				2046196	2046197	2046198	2046199	2046200
Sample Reference				CP02	CP02	CP03	CP03	CP03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				19.00-19.45	23.50	1.20-1.65	3.00-3.45	5.45
Date Sampled				08/10/2021	08/10/2021	04/10/2021	04/10/2021	05/10/2021
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	%	0.01	NONE	15	15	21	15	13
Total mass of sample received	kg	0.001	NONE	0.30	0.40	0.40	0.40	0.40

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	8.8	7.7	8.7	8.7
Total Sulphate as SO ₄	%	0.005	MCERTS	0.041	0.045	0.960	0.032	0.042
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.092	0.11	2.0	0.060	0.074
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	91.8	109	1950	60.3	73.9
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	5.4	5.7	20	3.5	5.4
Total Sulphur	%	0.005	MCERTS	0.088	0.114	0.506	0.023	0.089
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	32	23	50	16	11
Magnesium (leachate equivalent)	mg/l	2.5	NONE	16	12	25	8.2	5.7

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



Analytical Report Number: 21-16224
Project / Site name: Rosedale, Manchester
Your Order No: EBBI1010

Lab Sample Number				2046201	2046202	2046203
Sample Reference				CP03	CP03	CP03
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				6.45	10.45-10.95	12.00-12.45
Date Sampled				05/10/2021	05/10/2021	05/10/2021
Time Taken				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
Moisture Content	%	0.01	NONE	13	16	17
Total mass of sample received	kg	0.001	NONE	0.50	0.40	0.40

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.3	8.4	8.6
Total Sulphate as SO ₄	%	0.005	MCERTS	0.032	0.044	0.040
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.072	0.10	0.069
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	72.4	101	69.1
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	9.4	4.3	4.9
Total Sulphur	%	0.005	MCERTS	0.016	0.106	0.109
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	13	23	19
Magnesium (leachate equivalent)	mg/l	2.5	NONE	6.3	12	9.5

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



Analytical Report Number : 21-16224
Project / Site name: Rosedale, Manchester

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2046191	CP02	None Supplied	2.00-2.45	Brown clay and sand with gravel.
2046192	CP02	None Supplied	4.5	Brown clay with gravel.
2046193	CP02	None Supplied	9.00-9.45	Brown clay and sand with gravel.
2046194	CP02	None Supplied	13.50-13.95	Brown clay and sand with gravel.
2046195	CP02	None Supplied	15.5	Brown clay and sand with gravel.
2046196	CP02	None Supplied	19.00-19.45	Brown clay and sand with gravel.
2046197	CP02	None Supplied	23.5	Brown clay and sand with gravel.
2046198	CP03	None Supplied	1.20-1.65	Brown clay and sand with gravel.
2046199	CP03	None Supplied	3.00-3.45	Brown clay and sand with gravel.
2046200	CP03	None Supplied	5.45	Brown clay.
2046201	CP03	None Supplied	6.45	Brown clay and sand with gravel.
2046202	CP03	None Supplied	10.45-10.95	Brown clay and sand with gravel.
2046203	CP03	None Supplied	12.00-12.45	Brown clay and sand with gravel.



Analytical Report Number : 21-16224
Project / Site name: Rosedale, Manchester

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	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.	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
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

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.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

**Rebecca Tidsey**

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e: reception@i2analytical.com

Analytical Report Number : 21-25839

Project / Site name:	Rosedale Building Manchester	Samples received on:	24/11/2021
Your job number:	B079193	Samples instructed on/ Analysis started on:	29/11/2021
Your order number:	EBMA3157	Analysis completed by:	13/12/2021
Report Issue Number:	1	Report issued on:	13/12/2021
Samples Analysed:	5 soil samples		

Signed:

Izabela Wójcik

Izabela Wójcik
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 21-25839
Project / Site name: Rosedale Building Manchester
Your Order No: EBMA3157

Lab Sample Number				2098540	2098541	2098542	2098543	2098544
Sample Reference				CP01A	CP01A	CP01A	CP01A	CP01A
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.20-3.65	7.00-7.45	16.00	21.00-21.45	24.00-24.45
Date Sampled				22/11/2021	23/11/2021	23/11/2021	24/11/2021	24/11/2021
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	%	0.01	NONE	17	14	12	11	14
Total mass of sample received	kg	0.001	NONE	0.50	0.20	0.40	0.20	0.20

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	8.2	8.3	8.5	8.2
Total Sulphate as SO ₄	%	0.005	MCERTS	0.063	0.036	0.032	0.035	0.042
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.20	0.062	0.073	0.065	0.13
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	16	14	8.9	3.9	2.6
Total Sulphur	%	0.005	MCERTS	0.029	0.053	0.081	0.101	0.073
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	20	17	20	30	27
Magnesium (leachate equivalent)	mg/l	2.5	NONE	9.8	8.6	9.8	15	13

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



Analytical Report Number : 21-25839
Project / Site name: Rosedale Building Manchester

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2098540	CP01A	None Supplied	3.20-3.65	Brown clay.
2098541	CP01A	None Supplied	7.00-7.45	Brown clay.
2098542	CP01A	None Supplied	16	Brown clay.
2098543	CP01A	None Supplied	21.00-21.45	Brown clay.
2098544	CP01A	None Supplied	24.00-24.45	Brown clay.



Analytical Report Number : 21-25839

Project / Site name: Rosedale Building Manchester

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	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.	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
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	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.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.



4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 07/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

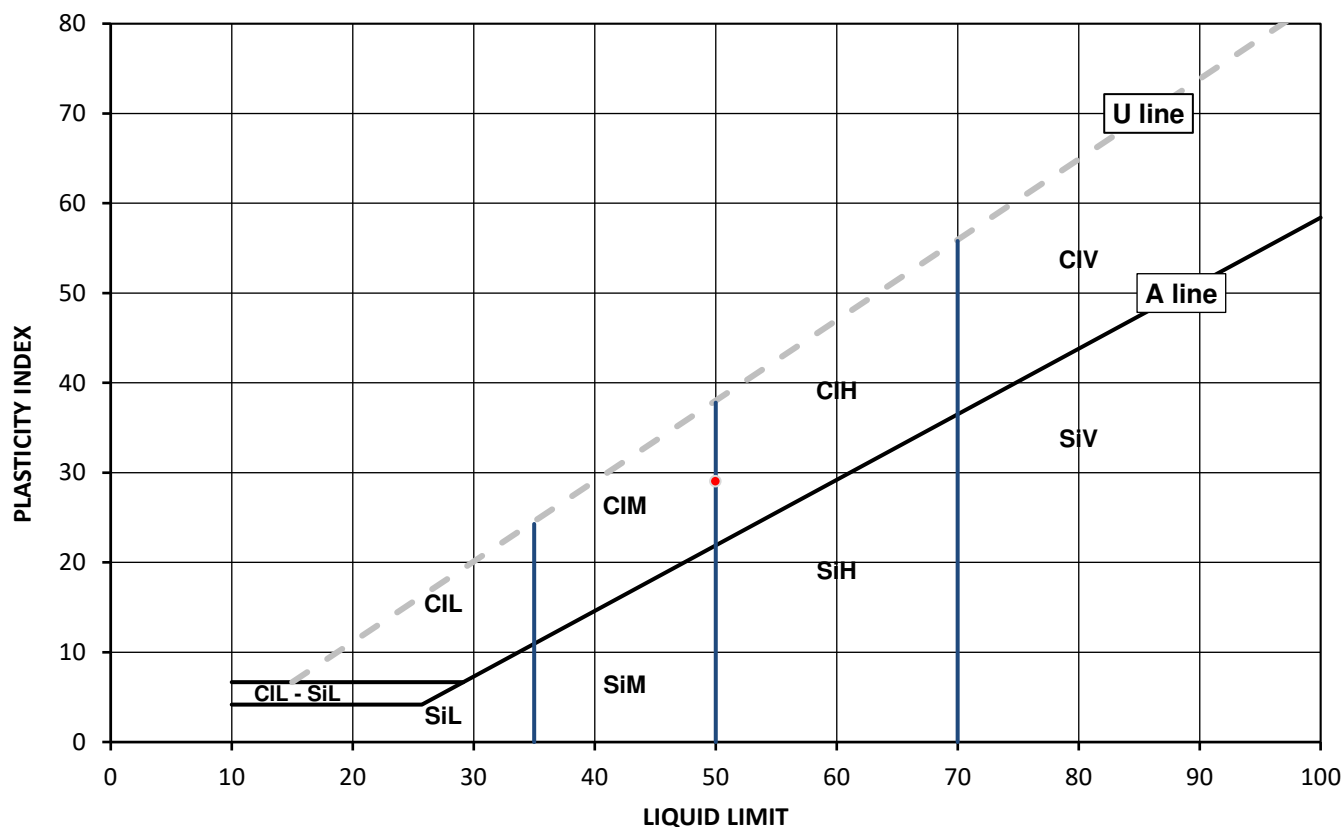
Test Results:

Laboratory Reference: 2046134
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Greyish brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 3.00
Depth Base [m]: 3.45
Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
22	50	21	29	98



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 07/10/2021
Date Received: 08/10/2021
Date Tested: 20/10/2021
Sampled By: Not Given

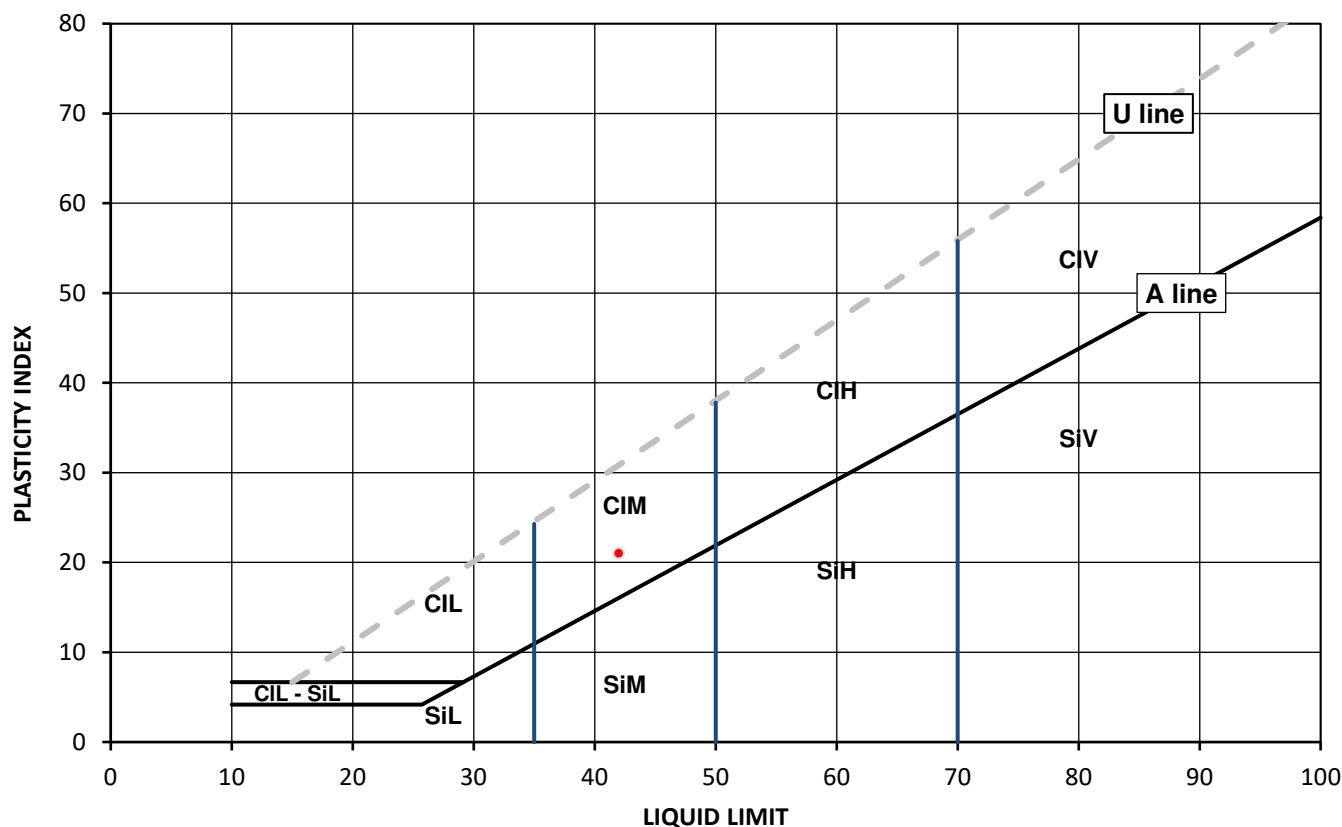
Test Results:

Laboratory Reference: 2046136
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 5.00
Depth Base [m]: 5.45
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
18	42	21	21	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 07/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

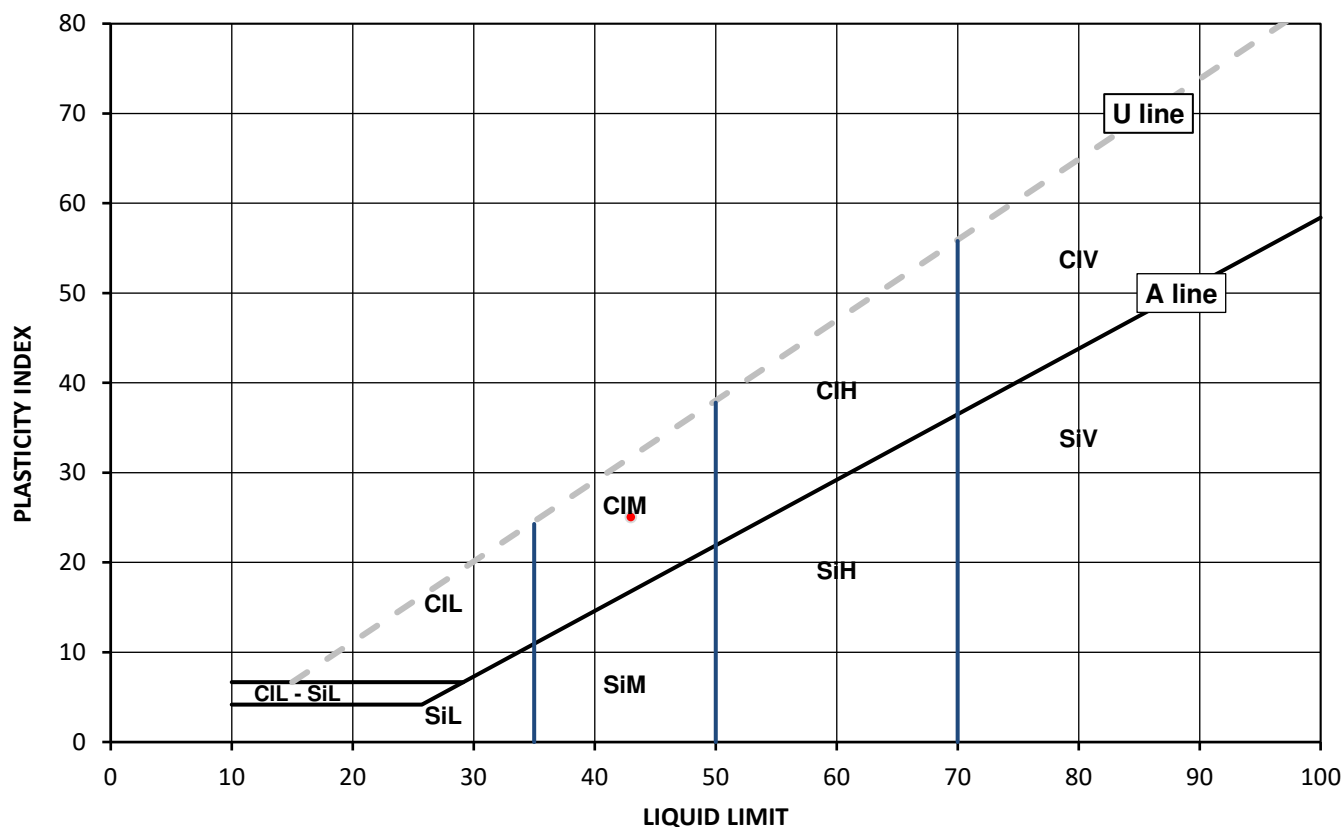
Test Results:

Laboratory Reference: 2046137
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly sandy CLAY

Depth Top [m]: 6.00
Depth Base [m]: 6.45
Sample Type: U

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
22	43	18	25	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Silt	Plasticity	Liquid Limit
Cl	Clay		L Low	below 35
Si		Silt	M Medium	35 to 50
			H High	50 to 70
			V Very high	exceeding 70
			O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 08/10/2021
Date Received: 08/10/2021
Date Tested: 20/10/2021
Sampled By: Not Given

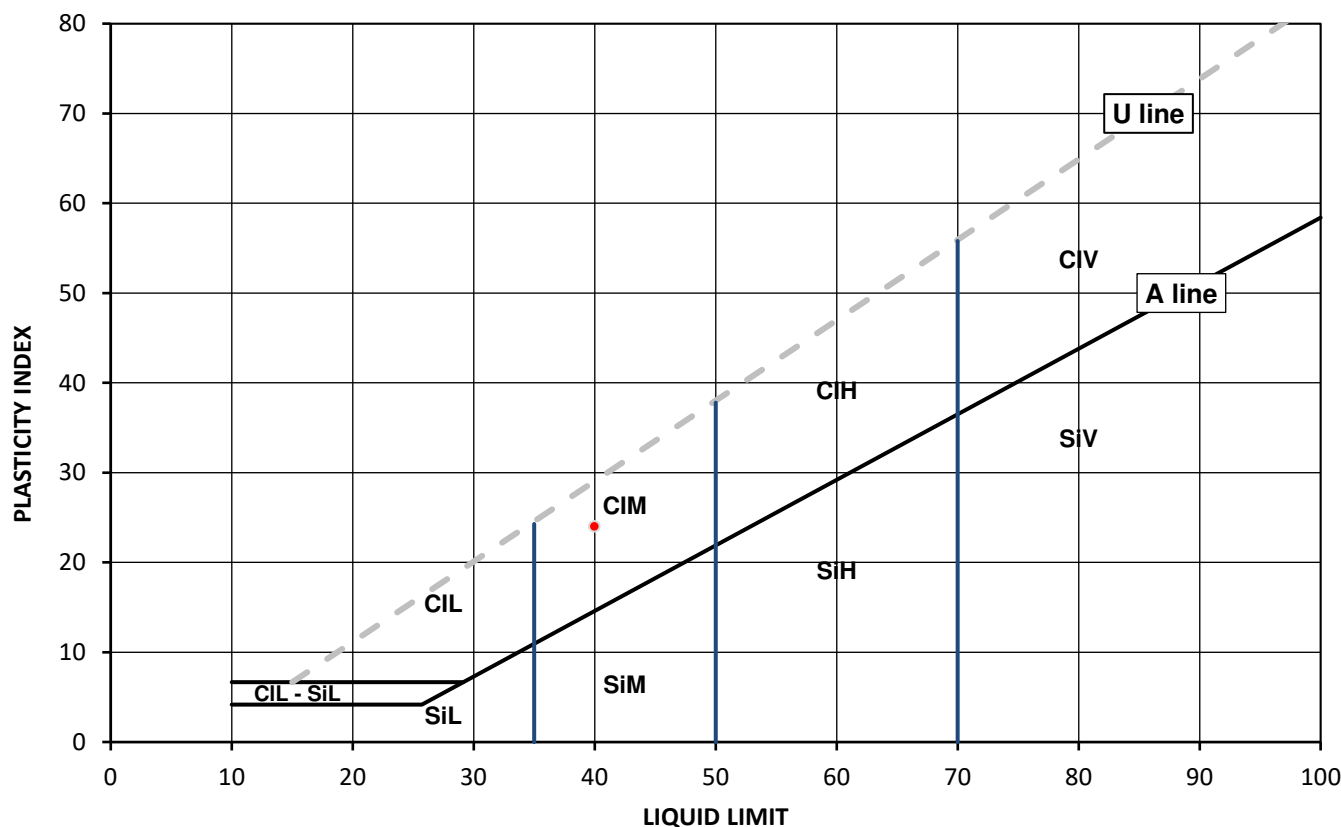
Test Results:

Laboratory Reference: 2046140
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 24.00
Depth Base [m]: 24.45
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
19	40	16	24	97



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
CI	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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Northampton NN4 7EB



Client: CURTINS
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Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 08/10/2021
Date Received: 08/10/2021
Date Tested: 20/10/2021
Sampled By: Not Given

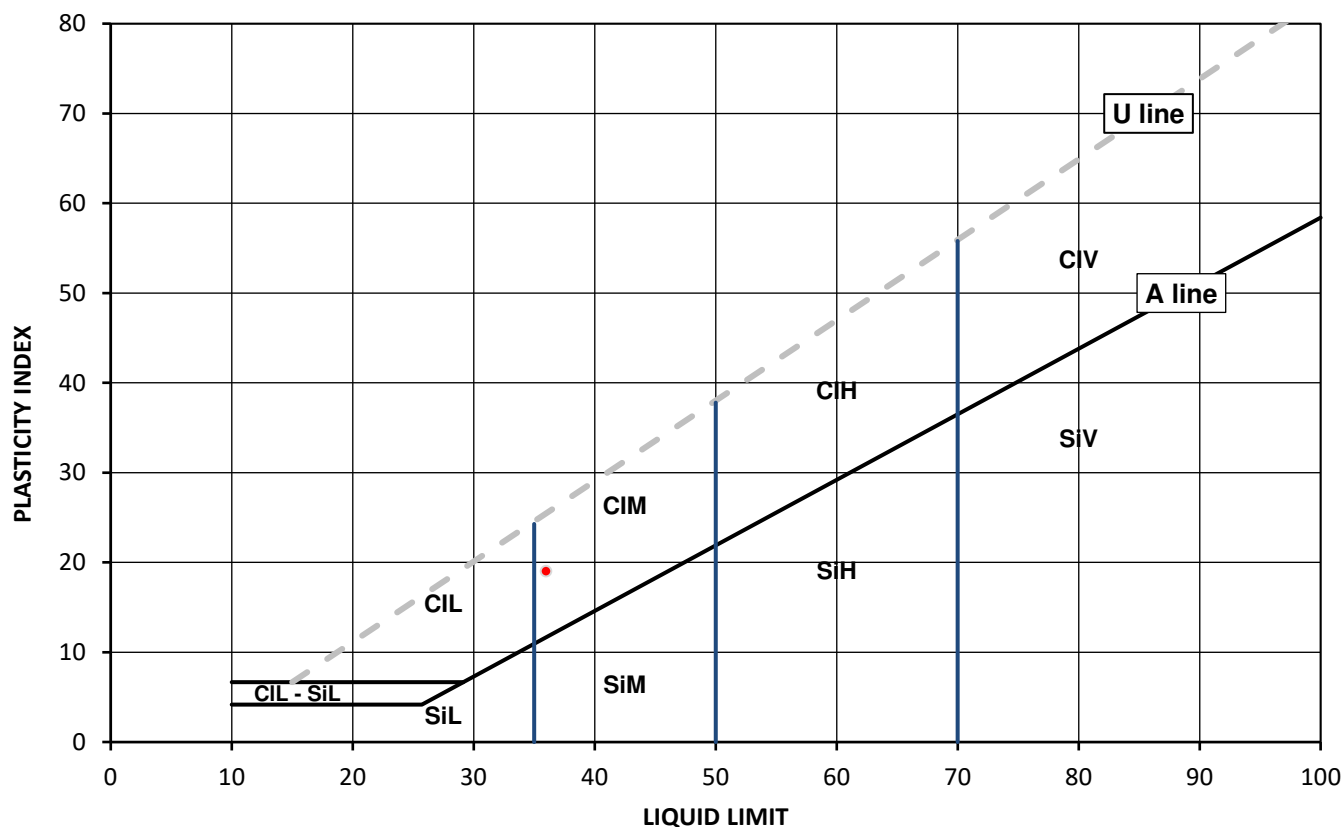
Test Results:

Laboratory Reference: 2046141
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Brown sandy CLAY

Depth Top [m]: 25.00
Depth Base [m]: 25.45
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
16	36	17	19	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

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Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 04/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

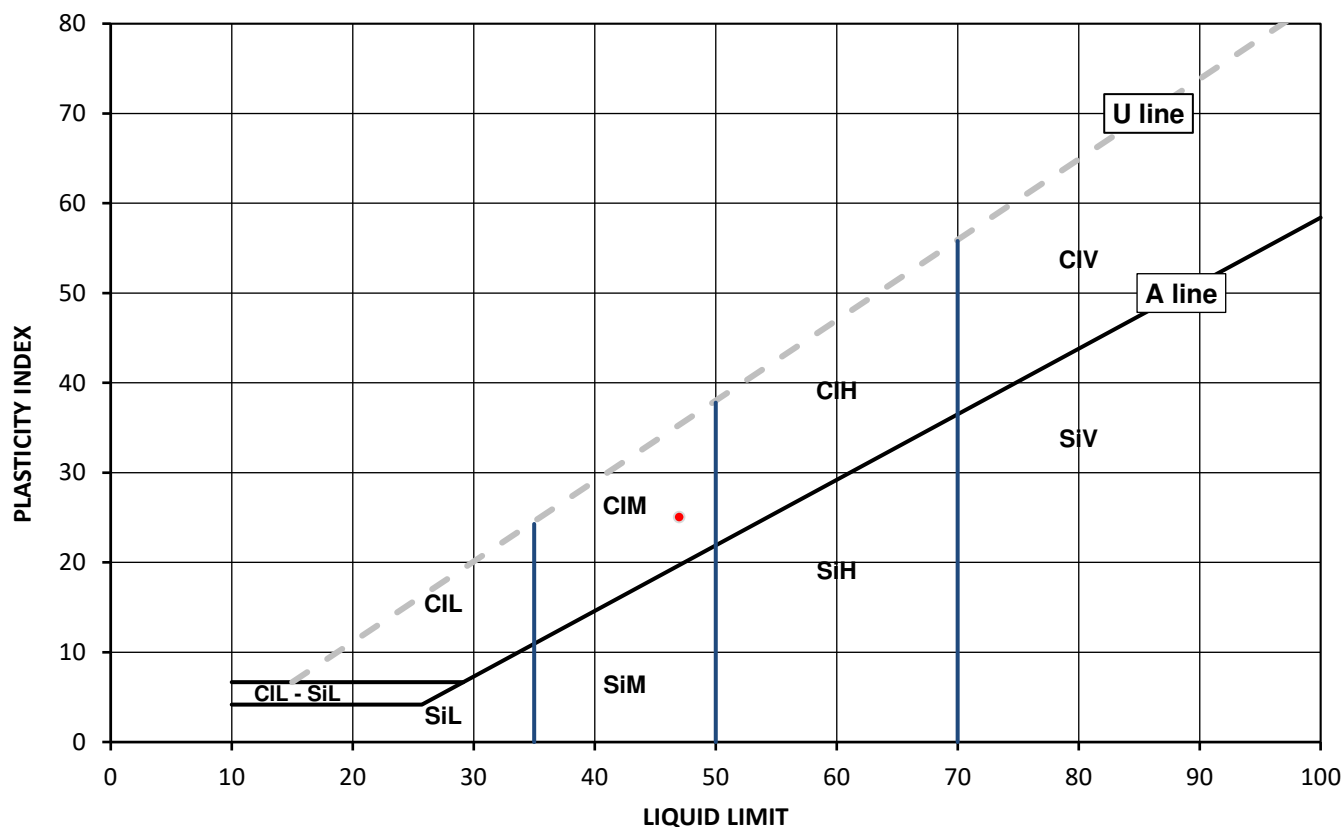
Test Results:

Laboratory Reference: 2046143
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Greyish brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 2.00
Depth Base [m]: 2.45
Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
25	47	22	25	95



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 05/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

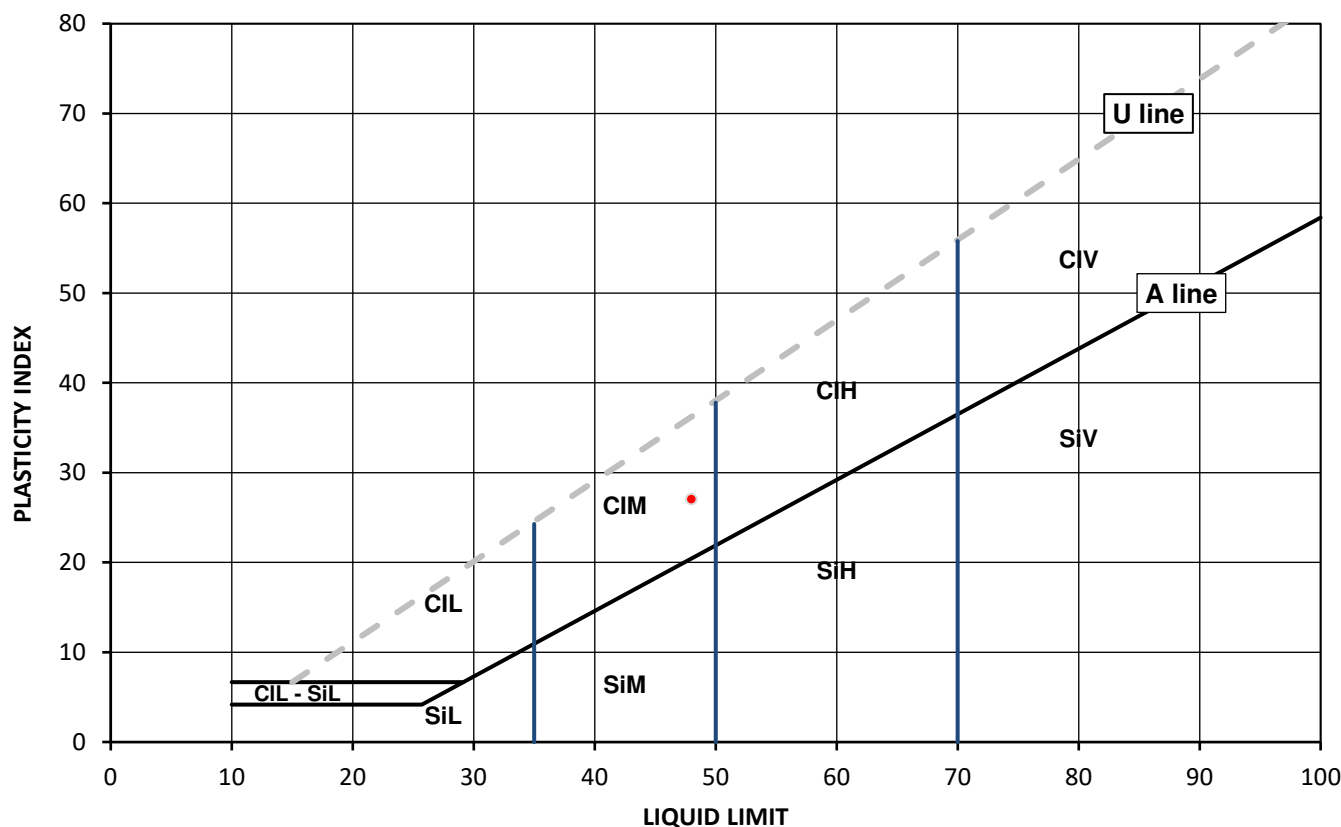
Test Results:

Laboratory Reference: 2046145
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Greyish brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 5.00
Depth Base [m]: 5.45
Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
24	48	21	27	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 06/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

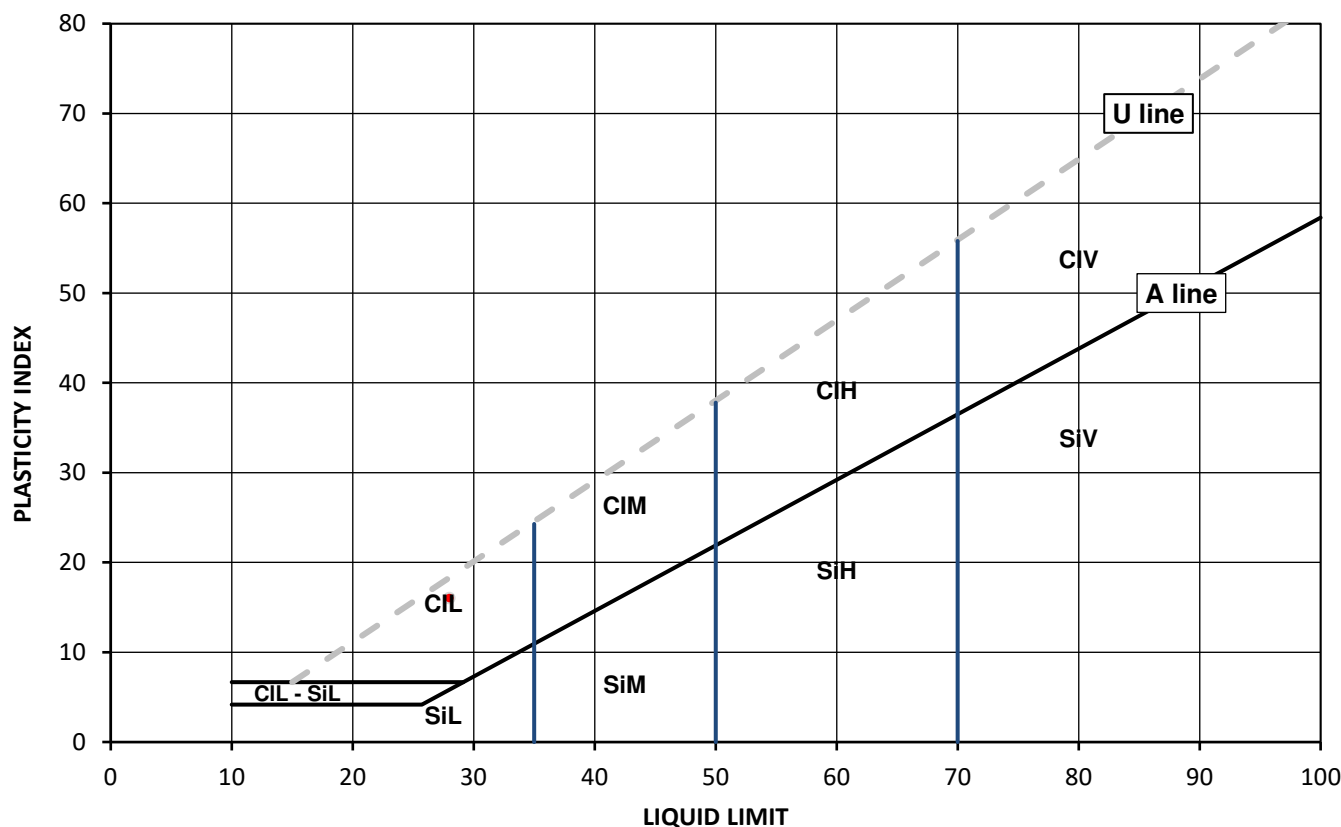
Test Results:

Laboratory Reference: 2046148
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Greyish brown slightly gravelly very sandy CLAY

Depth Top [m]: 16.00
Depth Base [m]: 16.45
Sample Type: B

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425um BS Test Sieve
14	28	12	16	94



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	
	V Very high	
	O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 06/10/2021
Date Received: 08/10/2021
Date Tested: 20/10/2021
Sampled By: Not Given

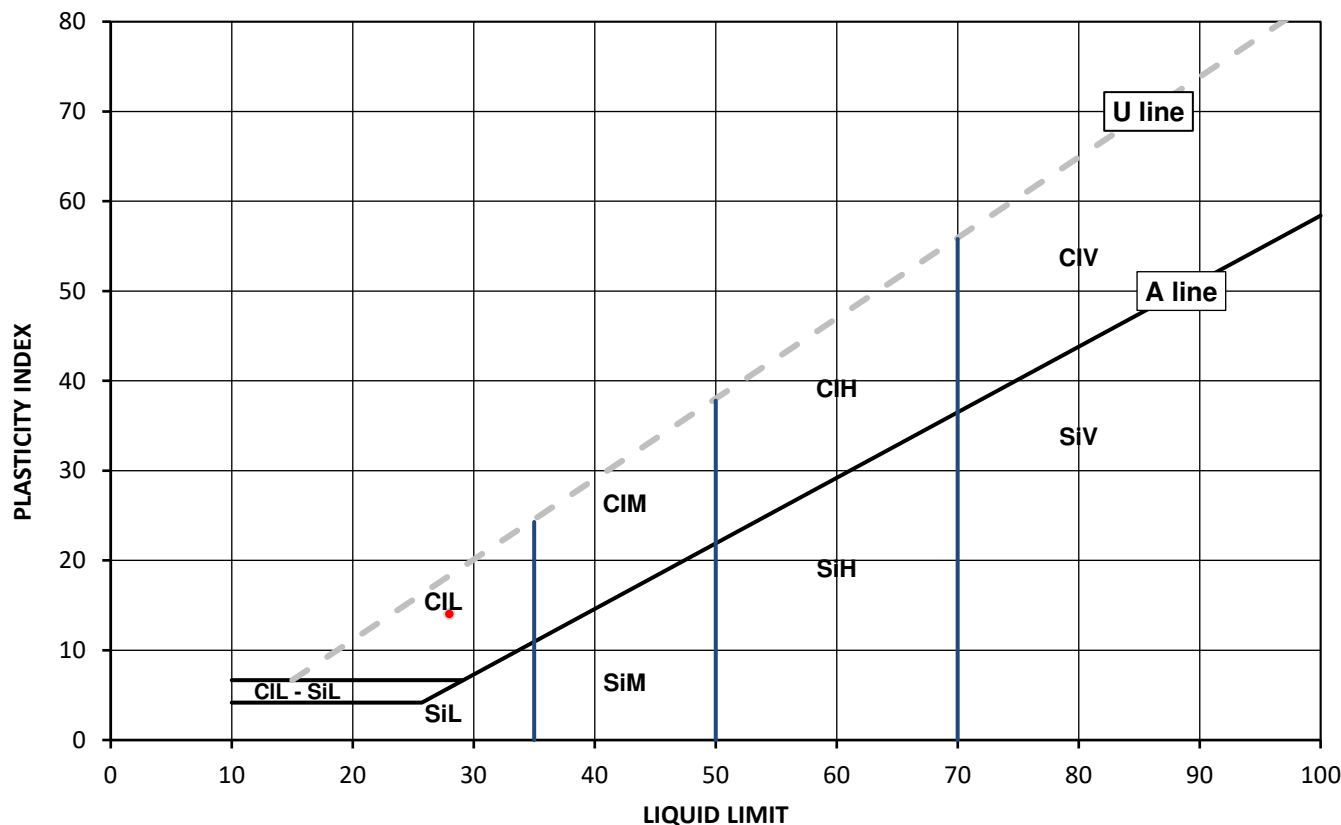
Test Results:

Laboratory Reference: 2046149
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 18.00
Depth Base [m]: 18.45
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
11	28	14	14	98



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 06/10/2021
Date Received: 08/10/2021
Date Tested: 20/10/2021
Sampled By: Not Given

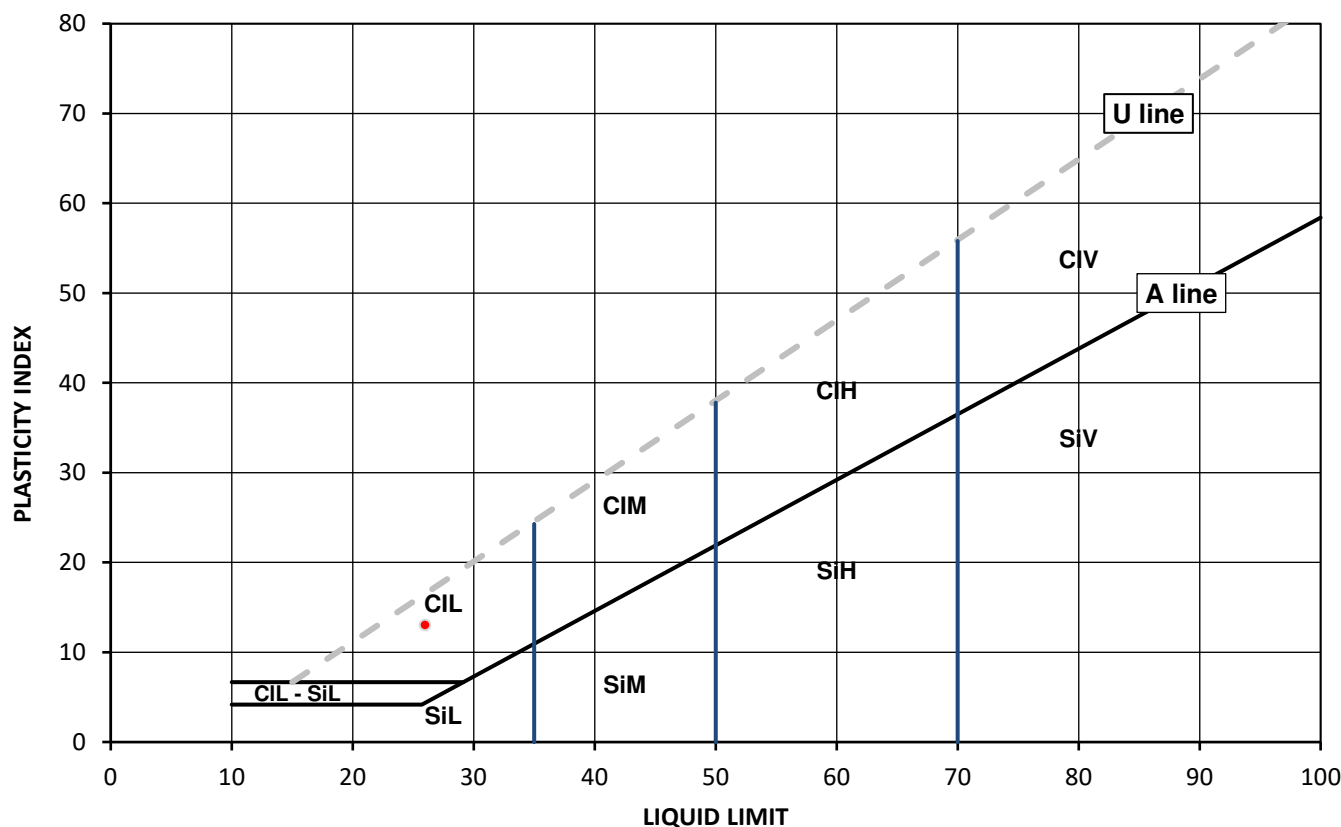
Test Results:

Laboratory Reference: 2046152
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 21.00
Depth Base [m]: 21.45
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
13	26	13	13	94



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	
	V Very high	
	O Organic	append to classification for organic material (eg CIHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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4041

Client: CURTINS
 Client Address: 2 The Wharf, Bridge Street,
 Birmingham, B1 2JS

Contact: Rowshi Hussain
 Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN
 17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test),
 Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

i2 Analytical Ltd
 Unit 8 Harrowden Road
 Brackmills Industrial Estate
 Northampton NN4 7EB



Environmental Science

Client Reference: 79193
 Job Number: 21-16217
 Date Sampled: 04/10 - 08/10/2021
 Date Received: 08/10/2021
 Date Tested: 20/10 - 22/10/2021
 Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity#		
		Reference	Depth Top	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
			m	m															
2046134	CP02	Not Given	3.00	3.45	B	Greyish brown slightly gravelly slightly sandy CLAY	Atterberg 1 Point	22		98	50	21	29						
2046136	CP02	Not Given	5.00	5.45	D	Brown slightly gravelly sandy CLAY	Atterberg 1 Point	18		99	42	21	21						
2046137	CP02	Not Given	6.00	6.45	U	Dark brown slightly gravelly sandyCLAY	Atterberg 1 Point	22		99	43	18	25						
2046140	CP02	Not Given	24.00	24.45	D	Brown slightly gravelly sandy CLAY	Atterberg 1 Point	19		97	40	16	24						
2046141	CP02	Not Given	25.00	25.45	D	Brown sandy CLAY	Atterberg 1 Point	16		100	36	17	19						
2046143	CP03	Not Given	2.00	2.45	B	Greyish brown slightly gravelly slightly sandy CLAY	Atterberg 1 Point	25		95	47	22	25						
2046145	CP03	Not Given	5.00	5.45	B	Greyish brown slightly gravelly slightly sandy CLAY	Atterberg 1 Point	24		99	48	21	27						
2046148	CP03	Not Given	16.00	16.45	B	Greyish brown slightly gravelly very sandy CLAY	Atterberg 1 Point	14		94	28	12	16						
2046149	CP03	Not Given	18.00	18.45	D	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	11		98	28	14	14						
2046152	CP03	Not Given	21.00	21.45	D	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	13		94	26	13	13						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Katarzyna Koziel

Katarzyna Koziel
 Technical Reviewer
 for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

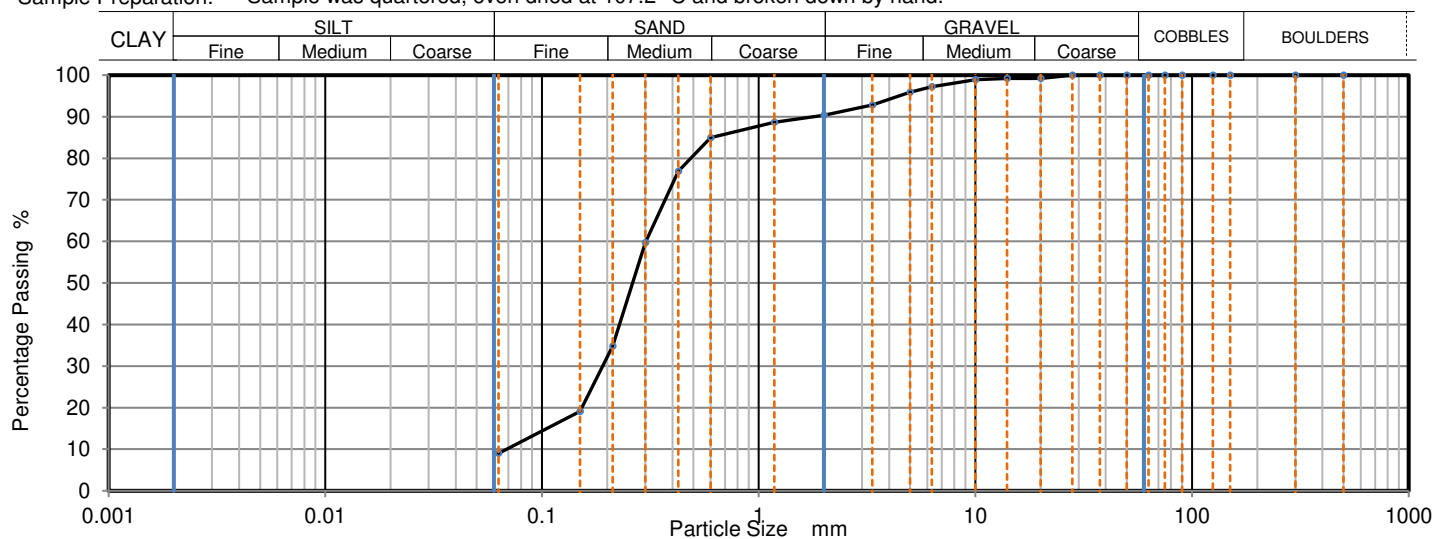
Client Reference: 79193
Job Number: 21-16217
Date Sampled: 07/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2046138
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Brown slightly gravelly slightly clayey SAND
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 7.45
Depth Base [m]: 7.95
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	99		
14	99		
10	99		
6.3	97		
5	96		
3.35	93		
2	90		
1.18	89		
0.6	85		
0.425	77		
0.3	60		
0.212	35		
0.15	19		
0.063	10		

Sample Proportions	% dry mass
Very coarse	0
Gravel	10
Sand	80
Fines <0.063mm	10

Grading Analysis	
D100	mm 28
D60	mm 0.302
D30	mm 0.191
D10	mm 0.0633
Uniformity Coefficient	4.8
Curvature Coefficient	1.9

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

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

Remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Particle Size Distribution

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-2: 1990

Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

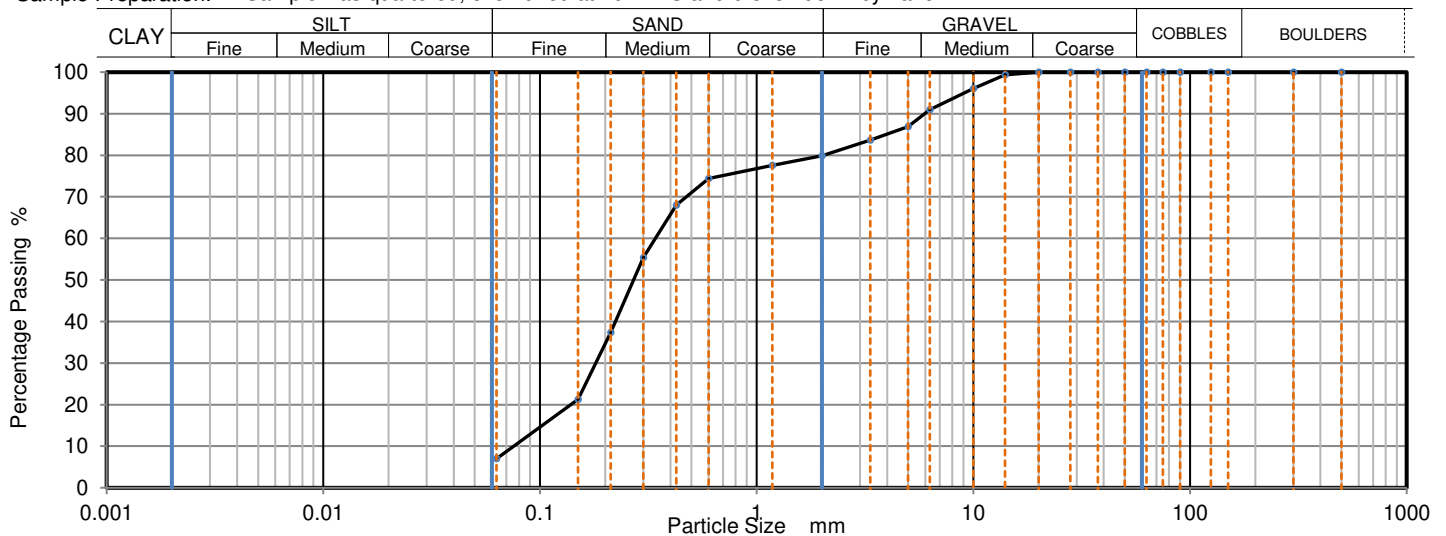
Client Reference: 79193
Job Number: 21-16217
Date Sampled: 05/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2046147
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Greyish brown gravelly slightly clayey SAND
Sample Preparation: Sample was quartered, oven dried at 107.2 °C and broken down by hand.

Depth Top [m]: 9.05
Depth Base [m]: 9.45
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	96		
6.3	91		
5	87		
3.35	84		
2	80		
1.18	78		
0.6	74		
0.425	68		
0.3	55		
0.212	37		
0.15	21		
0.063	7		

Sample Proportions	% dry mass
Very coarse	0
Gravel	20
Sand	73
Fines <0.063mm	7

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

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

Remarks:

Signed:

Katarzyna
Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of California Bearing Ratio

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-4: 1990: Clause 7

Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 07/10/2021
Date Received: 08/10/2021
Date Tested: 02/11/2021
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2046133
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Brown to dark brown gravelly slightly sandy CLAY

Depth Top [m]: 0.00
Depth Base [m]: 1.20
Sample Type: B

Specimen Preparation:

Condition Remoulded
Details Recompacted with specified standard effort using 2.5kg rammer

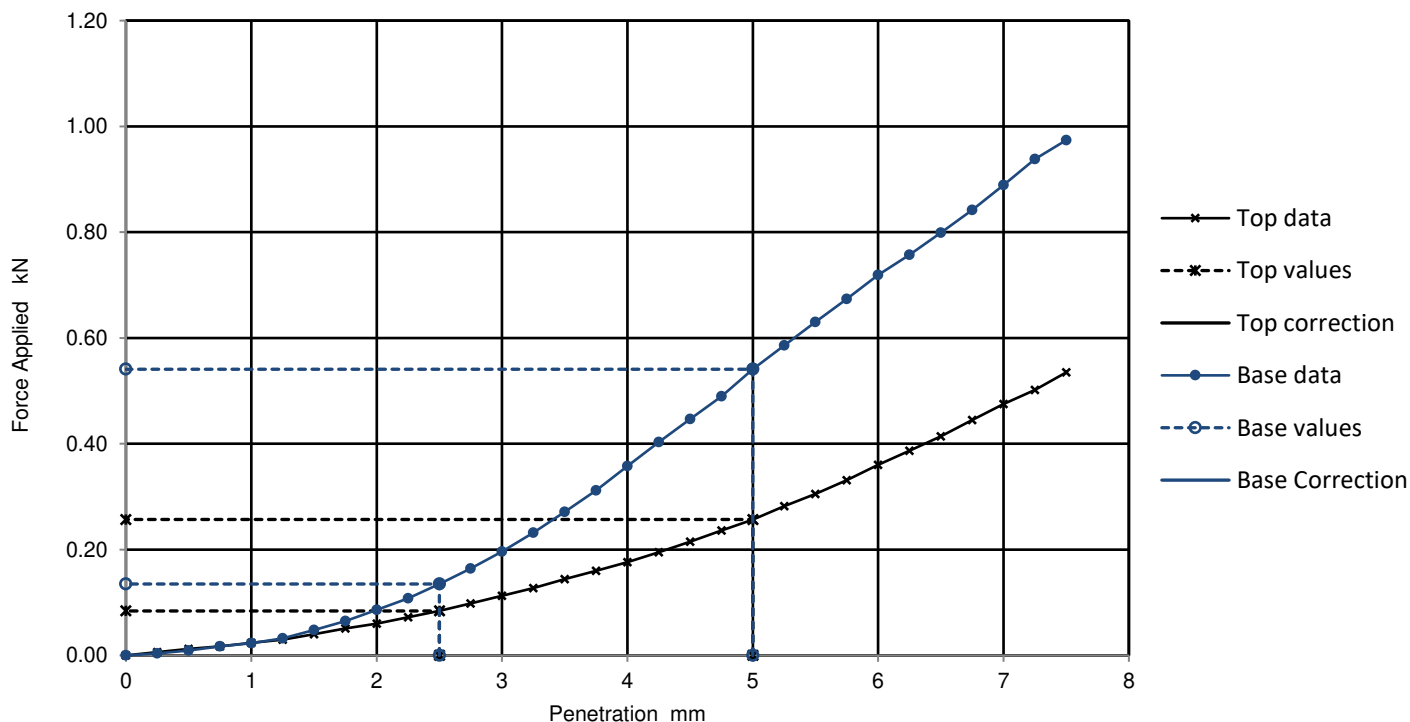
Soaking details Not soaked
Period of soaking days
Time to surface days
Amount of swell recorded mm
Dry density after soaking Mg/m³

Material retained on 20mm sieve removed 31 %

Initial Specimen details Bulk density 2.06 Mg/m³
Dry density 1.73 Mg/m³
Moisture content 19 %

Surcharge applied 8 kg
4.8 kPa

Force v Penetration Plots



Results

TOP
BASE

Curve correction applied	CBR Values, %			
	2.5mm	5mm	Highest	Average
No	0.6	1.3	1.3	
No	1.0	2.7	2.7	

Moisture Content %
18
18

Remarks: Test carried out with > 25 % retained on 20mm as per clause 7.2.1.2

Test/ Specimen specific remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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Tested in Accordance with: BS 1377-4: 1990: Clause 7

Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 04/10/2021
Date Received: 08/10/2021
Date Tested: 01/11/2021
Sampled By: Not Given

Test Results:

Laboratory Reference: 2046142
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Brown gravelly sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: Not Given
Sample Type: B

Specimen Preparation:

Condition Remoulded
Details Recompacted with specified standard effort using 2.5kg rammer

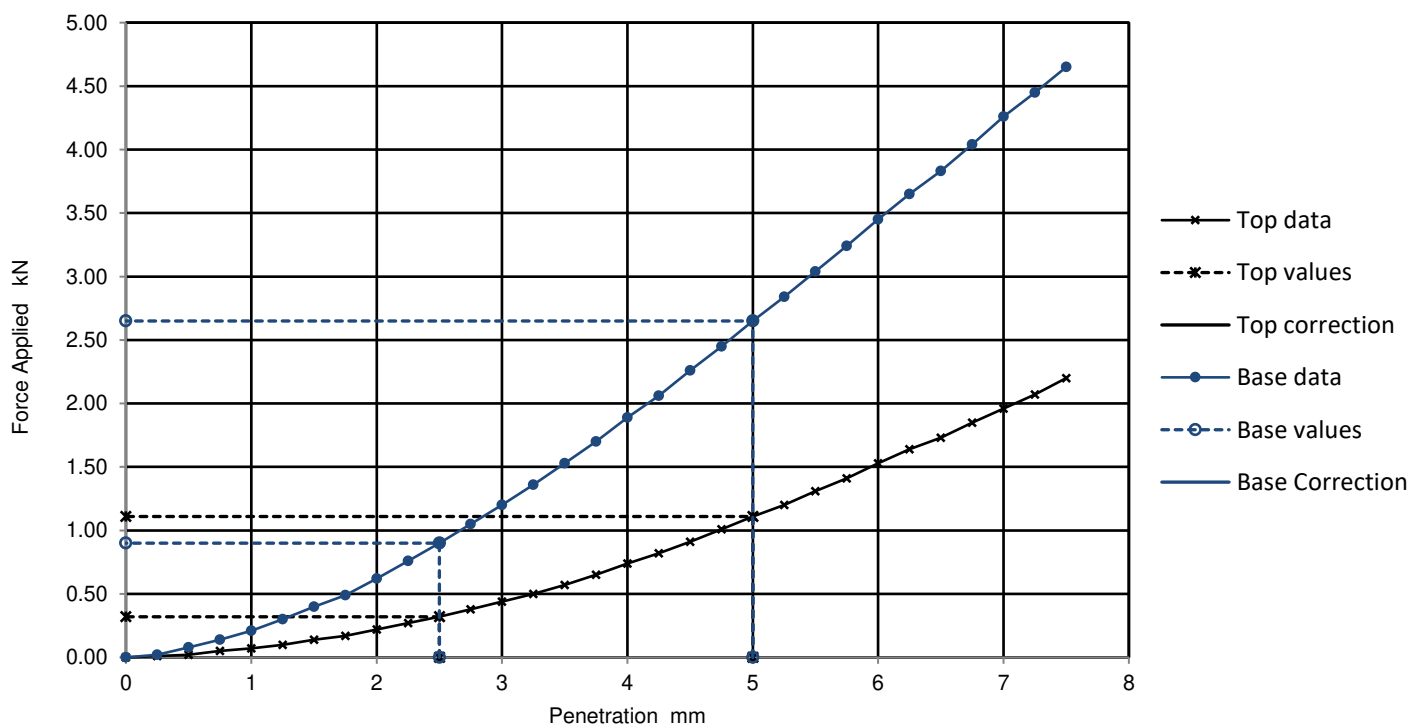
Soaking details Not soaked
Period of soaking days
Time to surface days
Amount of swell recorded mm
Dry density after soaking Mg/m³

Material retained on 20mm sieve removed 34 %

Initial Specimen details Bulk density 1.99 Mg/m³
Dry density 1.64 Mg/m³
Moisture content 21 %

Surcharge applied 8 kg
4.9 kPa

Force v Penetration Plots



Results

TOP
BASE

Curve correction applied	CBR Values, %			
	2.5mm	5mm	Highest	Average
No	2.4	5.6	5.6	
No	6.8	13.0	13.0	

Moisture Content %
21
22

Remarks: Test carried out with > 25 % retained on 20mm as per clause 7.2.1.2

Test/ Specimen specific remarks:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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Client: CURTINS
 Client Address: 2 The Wharf, Bridge Street,
 Birmingham, B1 2JS

Contact: Rowshi Hussain
 Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
 Job Number: 21-16217
 Date Sampled: 07/10/2021
 Date Received: 08/10/2021
 Date Tested: 22/10/2021
 Sampled By: Not Given

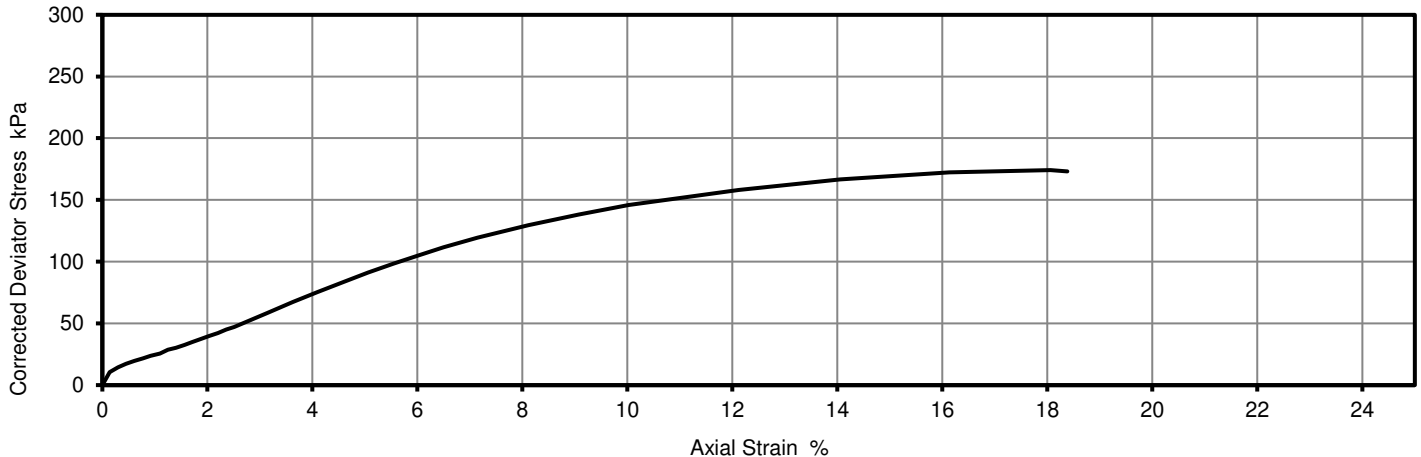
Test Results:

Laboratory Reference: 2046135
 Hole No.: CP02
 Sample Reference: Not Given
 Sample Description: Greyish brown slightly gravelly CLAY

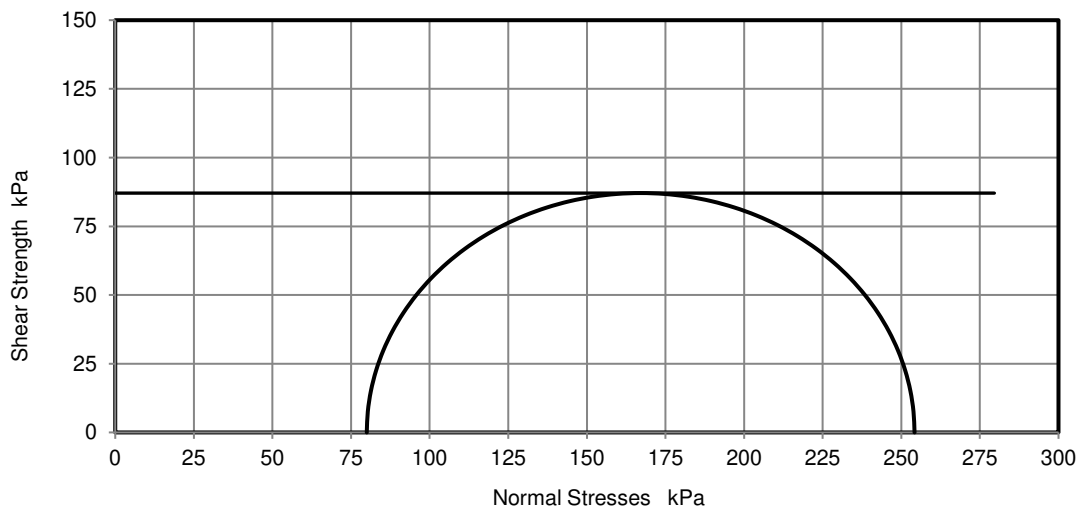
Depth Top [m]: 4.00
 Depth Base [m]: 4.50
 Sample Type: U

Test Number	1	Rate of Strain	1.94	%/min
Length	205.81	Cell Pressure	80	kPa
Diameter	100.11	Axial Strain at failure	18.1	%
Bulk Density	2.08	Deviator Stress, ($\sigma_1 - \sigma_3$) _f	174	kPa
Moisture Content	23	Undrained Shear Strength, c_u	87	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Dry Density	1.69	Mode of Failure	Compound	
Membrane Correction	1.09	Membrane thickness	0.31	mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: 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:

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Signed:

Katarzyna Koziel

Katarzyna Koziel
 Technical Reviewer
 for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE
Unconsolidated Undrained
Triaxial Compression
Tested in Accordance with:
BS 1377-7: 1990: Clause 8

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 07/10/2021
Date Received: 08/10/2021
Date Tested: 22/10/2021
Sampled By: Not Given

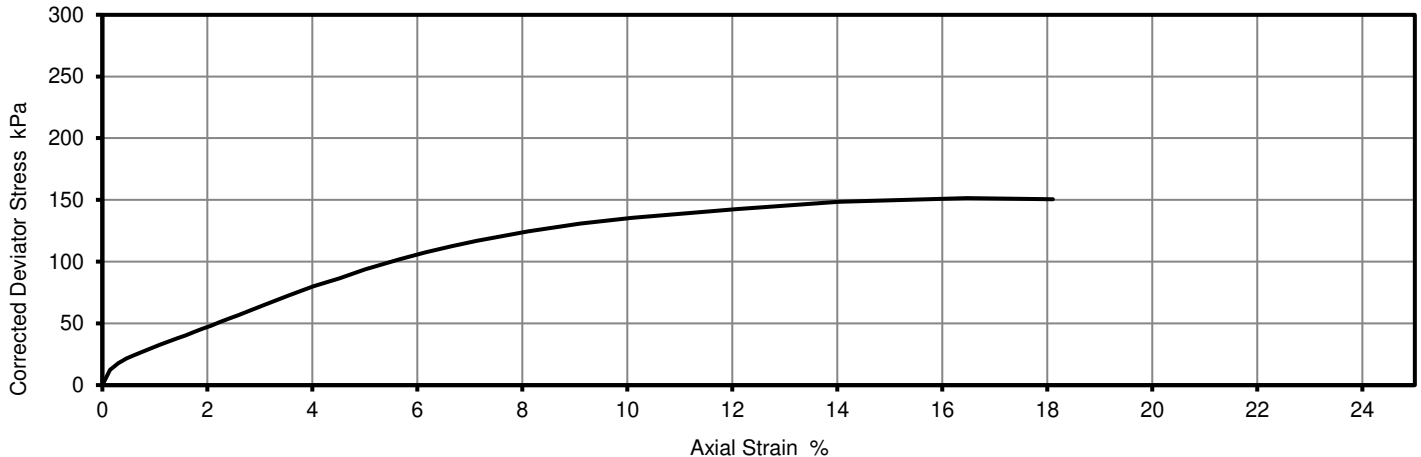
Test Results:

Laboratory Reference: 2046137
Hole No.: CP02
Sample Reference: Not Given
Sample Description: Dark brown slightly gravelly sandy CLAY

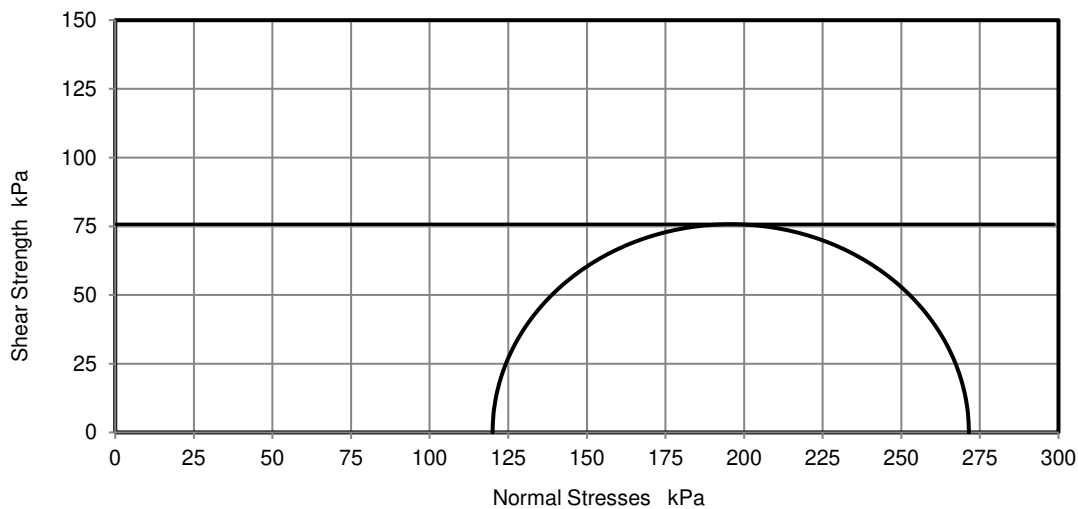
Depth Top [m]: 6.00
Depth Base [m]: 6.45
Sample Type: U

Test Number	1	Rate of Strain	1.98	%/min
Length	201.99	Cell Pressure	120	kPa
Diameter	101.10	Axial Strain at failure	16.5	%
Bulk Density	2.14	Deviator Stress, ($\sigma_1 - \sigma_3$) _f	152	kPa
Moisture Content	22	Undrained Shear Strength, c_u	76	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Dry Density	1.76	Mode of Failure	Compound	
Membrane Correction	0.71	Membrane thickness	0.22	mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: 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:

Signed:

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Katarzyna
Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

Client: CURTINS
 Client Address: 2 The Wharf, Bridge Street,
 Birmingham, B1 2JS

Contact: Rowshi Hussain
 Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
 Job Number: 21-16217
 Date Sampled: 05/10/2021
 Date Received: 08/10/2021
 Date Tested: 22/10/2021
 Sampled By: Not Given

Test Results:

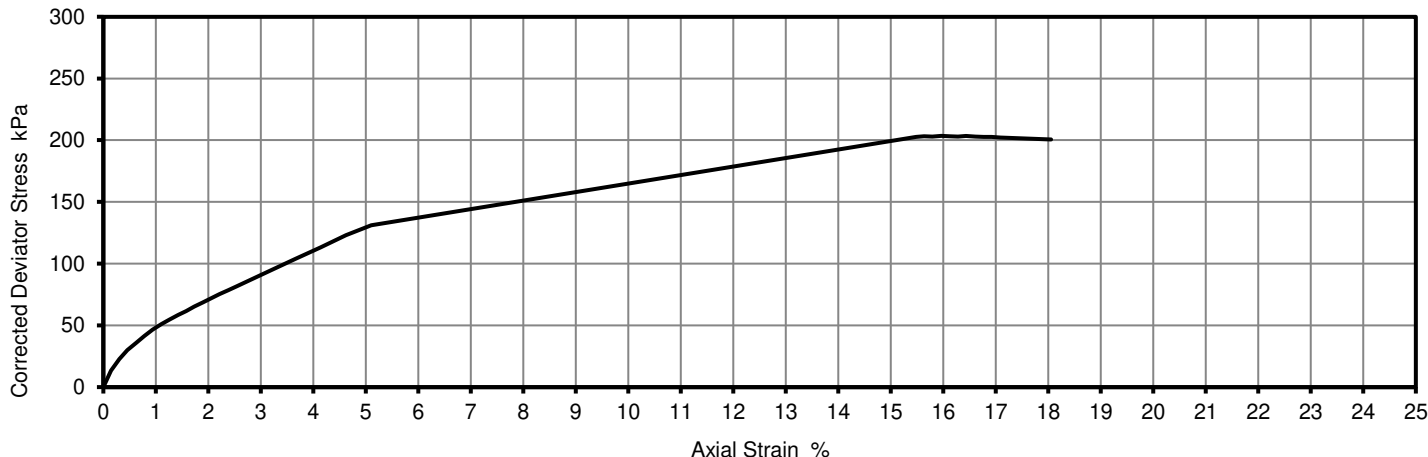
Laboratory Reference: 2046144
 Hole No.: CP03
 Sample Reference: Not Given
 Sample Description: Greyish brown slightly gravelly CLAY

Depth Top [m]: 4.45
 Depth Base [m]: Not Given
 Sample Type: U

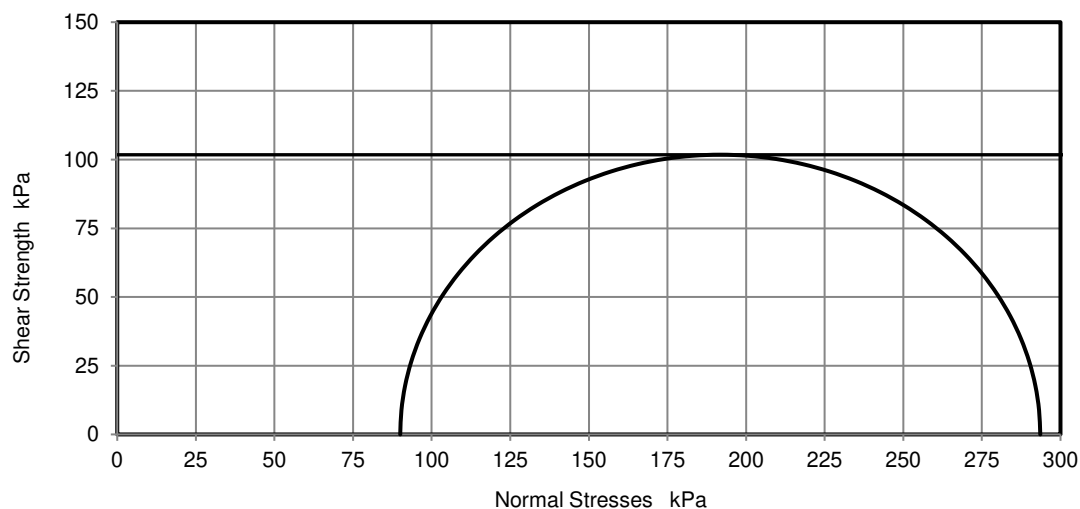
Test Number	1
Length	205.13 mm
Diameter	102.10 mm
Bulk Density	2.04 Mg/m ³
Moisture Content	23 %
Dry Density	1.66 Mg/m ³
Membrane Correction	0.91 kPa

Rate of Strain	1.95 %/min
Cell Pressure	90 kPa
Axial Strain at failure	16.0 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	204 kPa
Undrained Shear Strength, c_u	102 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Brittle
Membrane thickness	0.29 mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: 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:

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Signed:

Katarzyna Koziel

Katarzyna Koziel
 Technical Reviewer
 for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE
Unconsolidated Undrained
Triaxial Compression
Tested in Accordance with:
BS 1377-7: 1990: Clause 8

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 05/10/2021
Date Received: 08/10/2021
Date Tested: 23/10/2021
Sampled By: Not Given

Test Results:

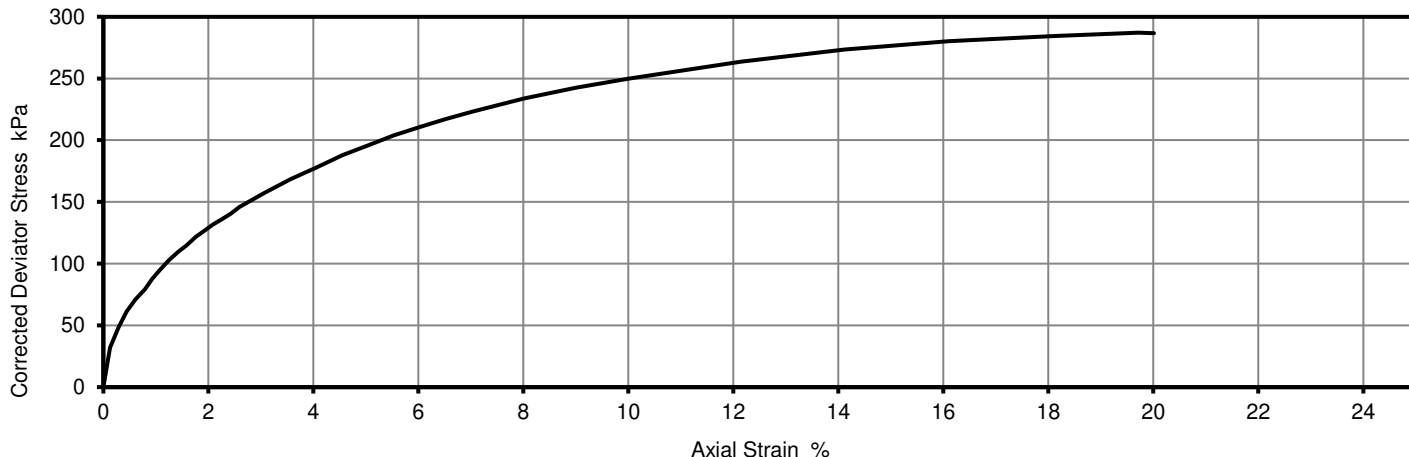
Laboratory Reference: 2046146
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Dark brown slightly sandy CLAY

Depth Top [m]: 6.45
Depth Base [m]: Not Given
Sample Type: U

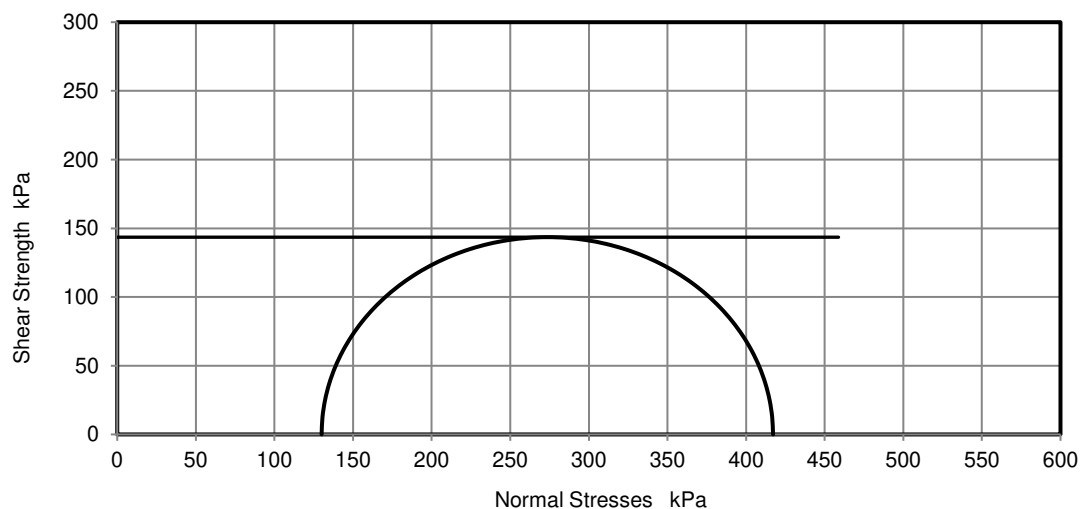
Test Number	1
Length	138.97 mm
Diameter	69.80 mm
Bulk Density	2.14 Mg/m ³
Moisture Content	17 %
Dry Density	1.83 Mg/m ³
Membrane Correction	1.36 kPa

Rate of Strain	2.00 %/min
Cell Pressure	130 kPa
Axial Strain at failure	19.7 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	287 kPa
Undrained Shear Strength, c_u	144 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.25 mm

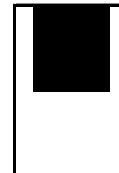
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: 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:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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Client: CURTINS
 Client Address: 2 The Wharf, Bridge Street,
 Birmingham, B1 2JS

Contact: Rowshi Hussain
 Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
 Job Number: 21-16217
 Date Sampled: 06/10/2021
 Date Received: 08/10/2021
 Date Tested: 23/10/2021
 Sampled By: Not Given

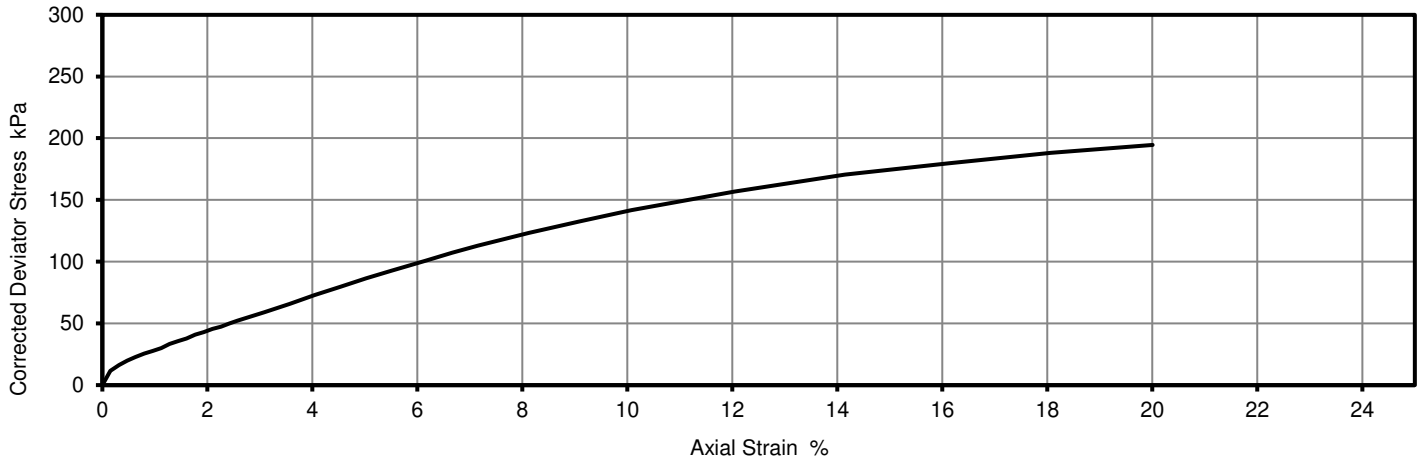
Test Results:

Laboratory Reference: 2046150
 Hole No.: CP03
 Sample Reference: Not Given
 Sample Description: Dark brown slightly gravelly slightly sandy CLAY

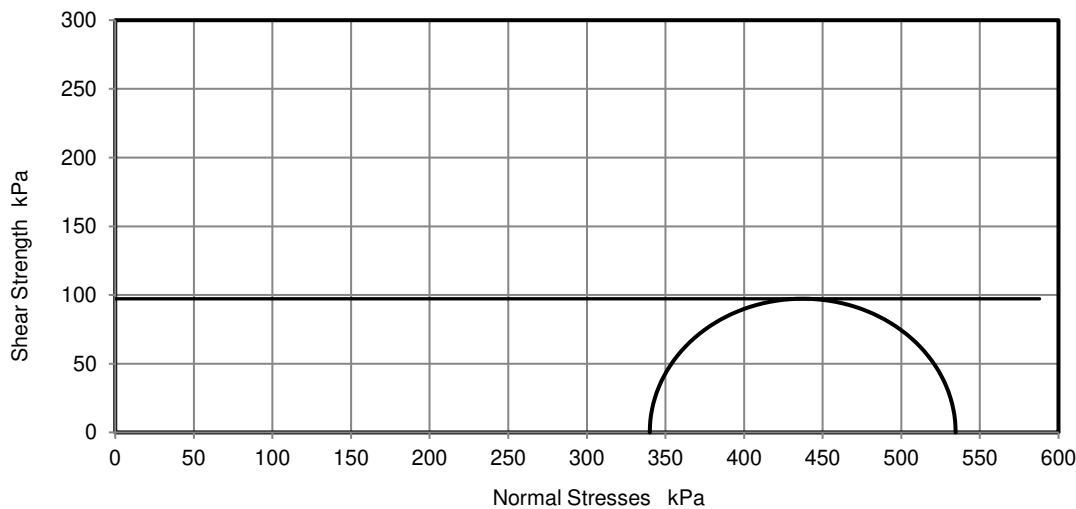
Depth Top [m]: 16.95
 Depth Base [m]: Not Given
 Sample Type: U

Test Number	1	Rate of Strain	1.97	%/min
Length	203.10	Cell Pressure	340	kPa
Diameter	101.25	Axial Strain at failure	20.0	%
Bulk Density	2.25	Deviator Stress, ($\sigma_1 - \sigma_3$)f	195	kPa
Moisture Content	13	Undrained Shear Strength, cu	97	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)$ f
Dry Density	1.98	Mode of Failure	Compound	
Membrane Correction	1.06	Membrane thickness	0.28	mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: 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:

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Signed:

Katarzyna Koziel

Katarzyna Koziel
 Technical Reviewer
 for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE
Unconsolidated Undrained
Triaxial Compression
Tested in Accordance with:
BS 1377-7: 1990: Clause 8

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 2 The Wharf, Bridge Street,
Birmingham, B1 2JS

Contact: Rowshi Hussain
Site Address: Rosedale, Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 06/10/2021
Date Received: 08/10/2021
Date Tested: 23/10/2021
Sampled By: Not Given

Test Results:

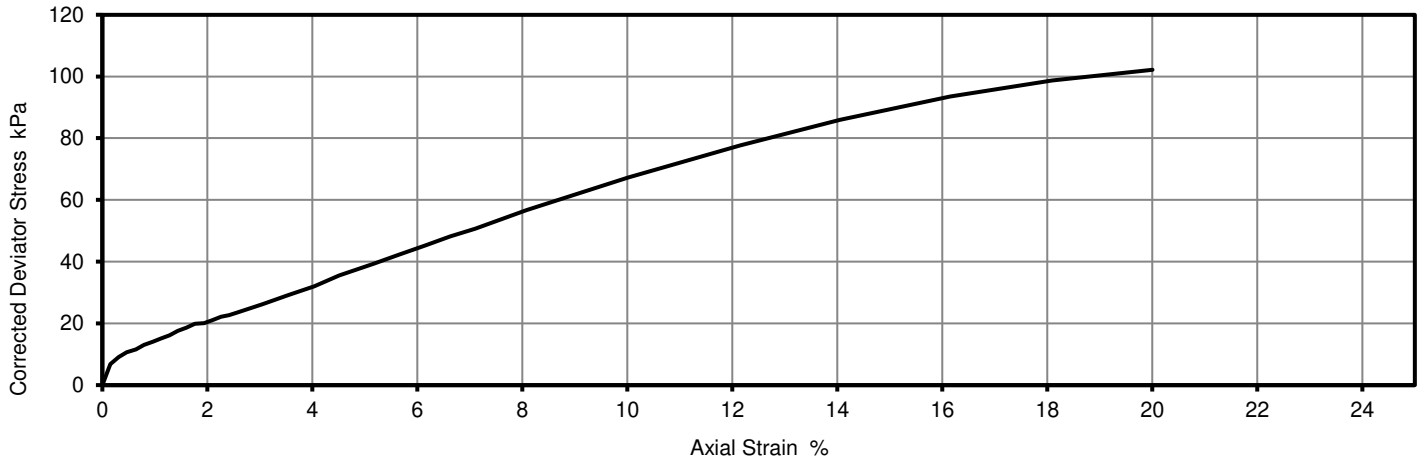
Laboratory Reference: 2046153
Hole No.: CP03
Sample Reference: Not Given
Sample Description: Dark brown sandy CLAY

Depth Top [m]: 23.00
Depth Base [m]: Not Given
Sample Type: U

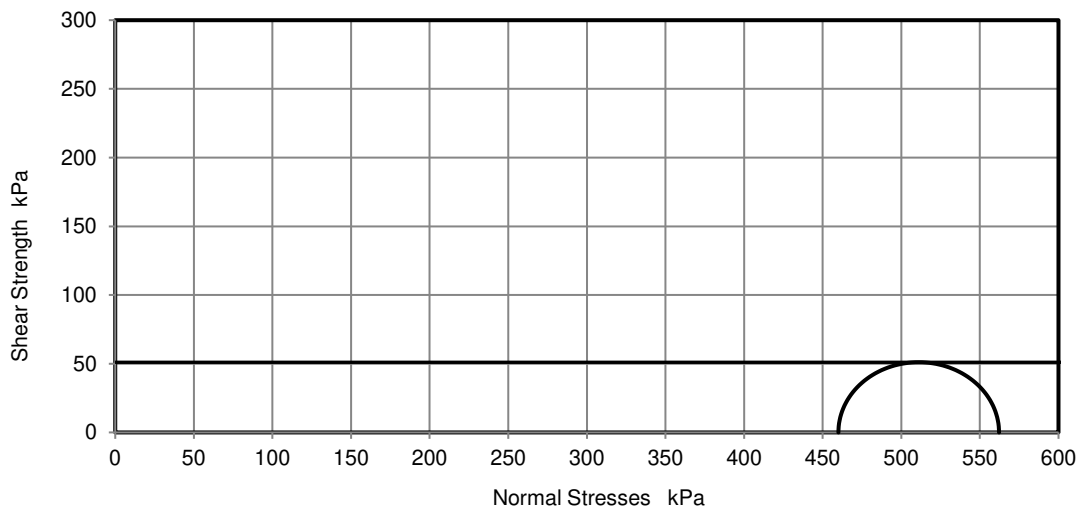
Test Number	1
Length	204.07 mm
Diameter	99.92 mm
Bulk Density	2.12 Mg/m ³
Moisture Content	23 %
Dry Density	1.73 Mg/m ³
Membrane Correction	1.15 kPa

Rate of Strain	1.96 %/min
Cell Pressure	460 kPa
Axial Strain at failure	20.0 %
Deviator Stress, ($\sigma_1 - \sigma_3$) _f	102 kPa
Undrained Shear Strength, c_u	51 kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Mode of Failure	Compound
Membrane thickness	0.30 mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: 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:

Signed:

Katarzyna Koziel

Katarzyna Koziel
Technical Reviewer
for and on behalf of i2 Analytical Ltd

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DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client Reference: 79193
Job Number: 21-16217
Date Sampled: 07/10/2021
Date Received: 08/10/2021
Date Tested: 18/10/2021
Sampled By: Not Given

Depth Top [m]: 15.00
Depth Base [m]: 15.45
Sample Type: U



Initial	Final	
50.10	-	mm
20.00	19.08	mm
13	12	%
2.22	2.32	Mg/m3
1.97	2.06	Mg/m3
0.345	0.283	
99	114	%
22.0		°C
Not measured		kPa
		%
5		days

GF 172.16



DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client Reference: 79193
Job Number: 21-16217
Date Sampled: 06/10/2021
Date Received: 08/10/2021
Date Tested: 18/10/2021
Sampled By: Not Given

Depth Top [m]: 19.50
Depth Base [m]: 19.95
Sample Type: U



Initial	Final	
50.00	-	mm
20.00	18.90	mm
14	12	%
2.22	2.31	Mg/m3
1.94	2.05	Mg/m3
0.366	0.290	
103	113	%
22.0		°C
Not measured		kPa
		%
5		days

GF 172.16



4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 24/11/2021
Date Received: 24/11/2021
Date Tested: 14/12/2021
Sampled By: Client - RT

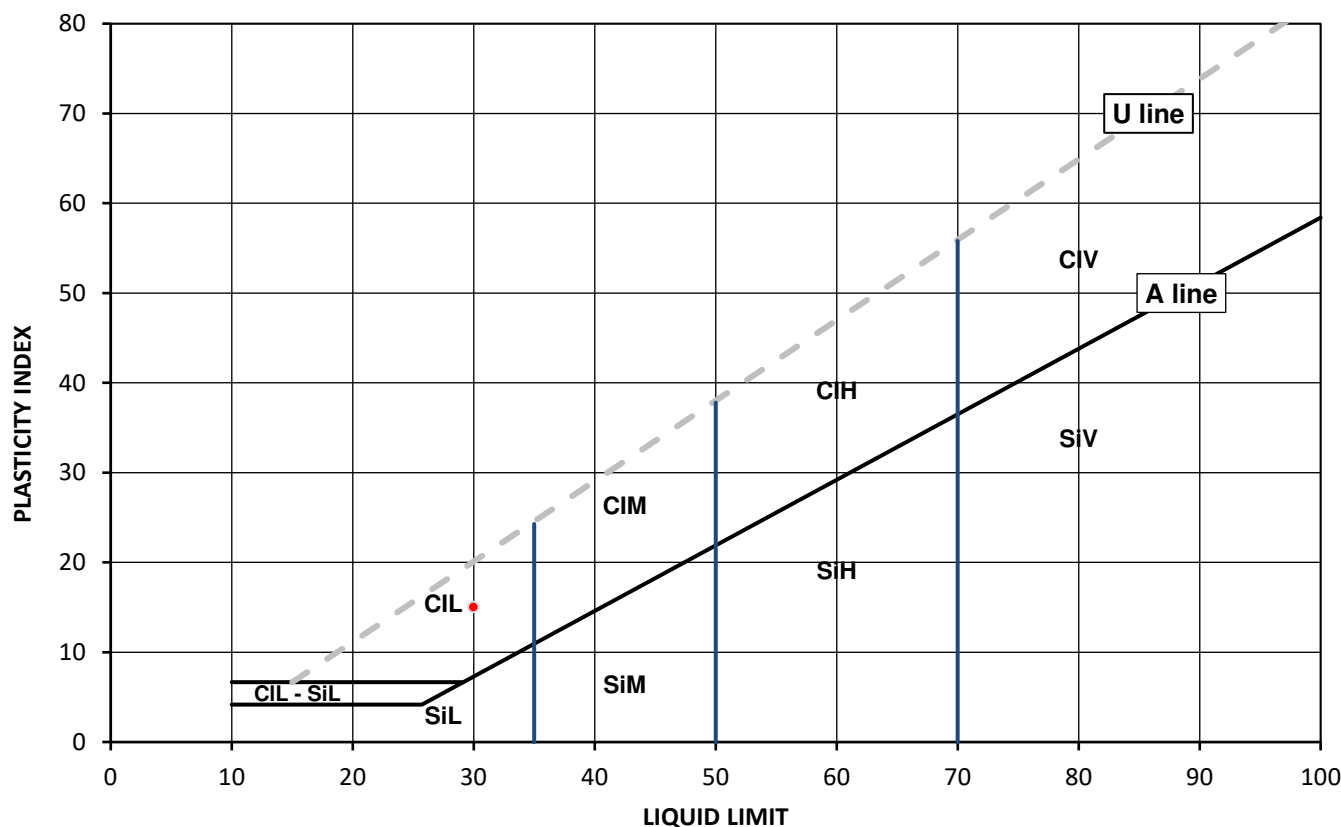
Test Results:

Laboratory Reference: 2098536
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 22.50
Depth Base [m]: 22.95
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
11	30	15	15	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
CI	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 232.12

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 22/11/2021
Date Received: 24/11/2021
Date Tested: 14/12/2021
Sampled By: Client - RT

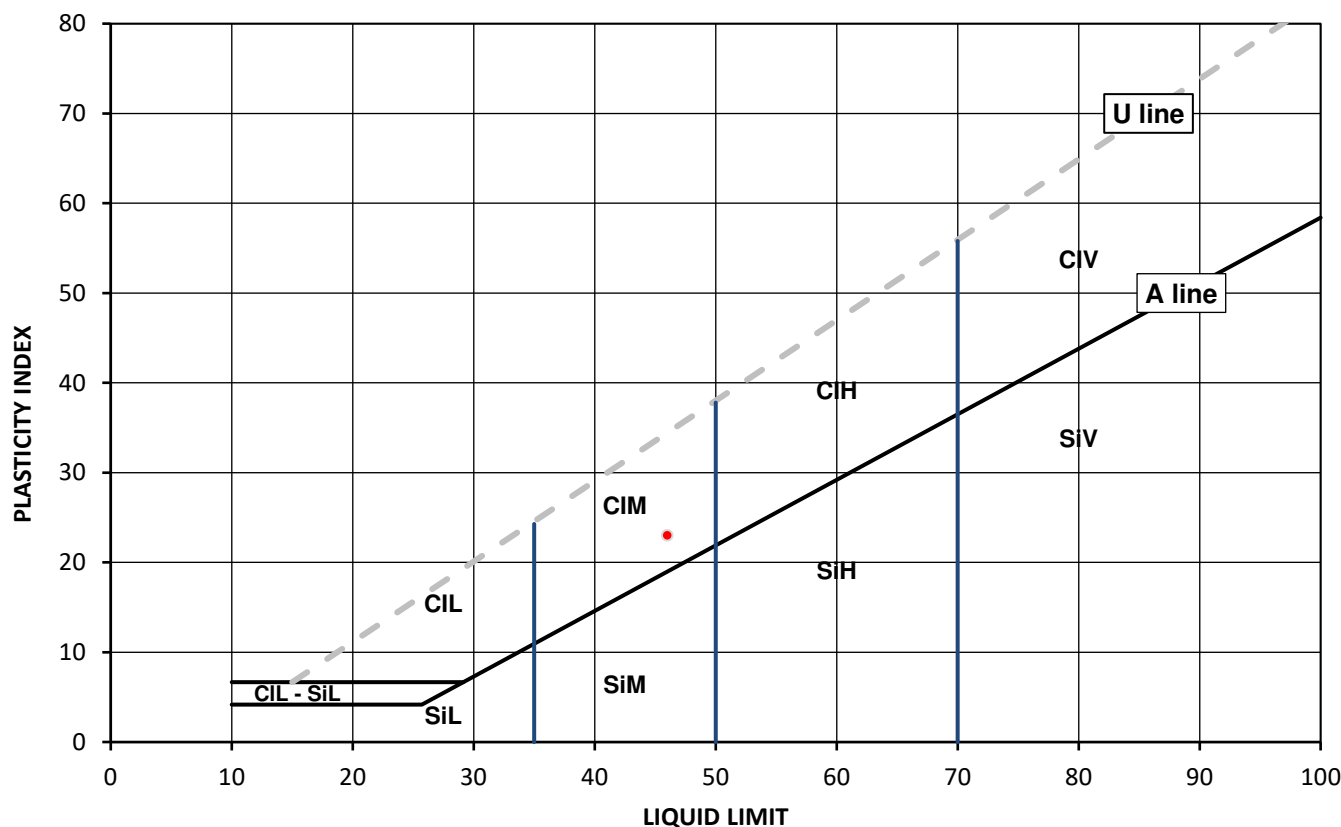
Test Results:

Laboratory Reference: 2098523
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 5.00
Depth Base [m]: 5.45
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
21	46	23	23	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 236.12



4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 23/11/2021
Date Received: 24/11/2021
Date Tested: 14/12/2021
Sampled By: Client - RT

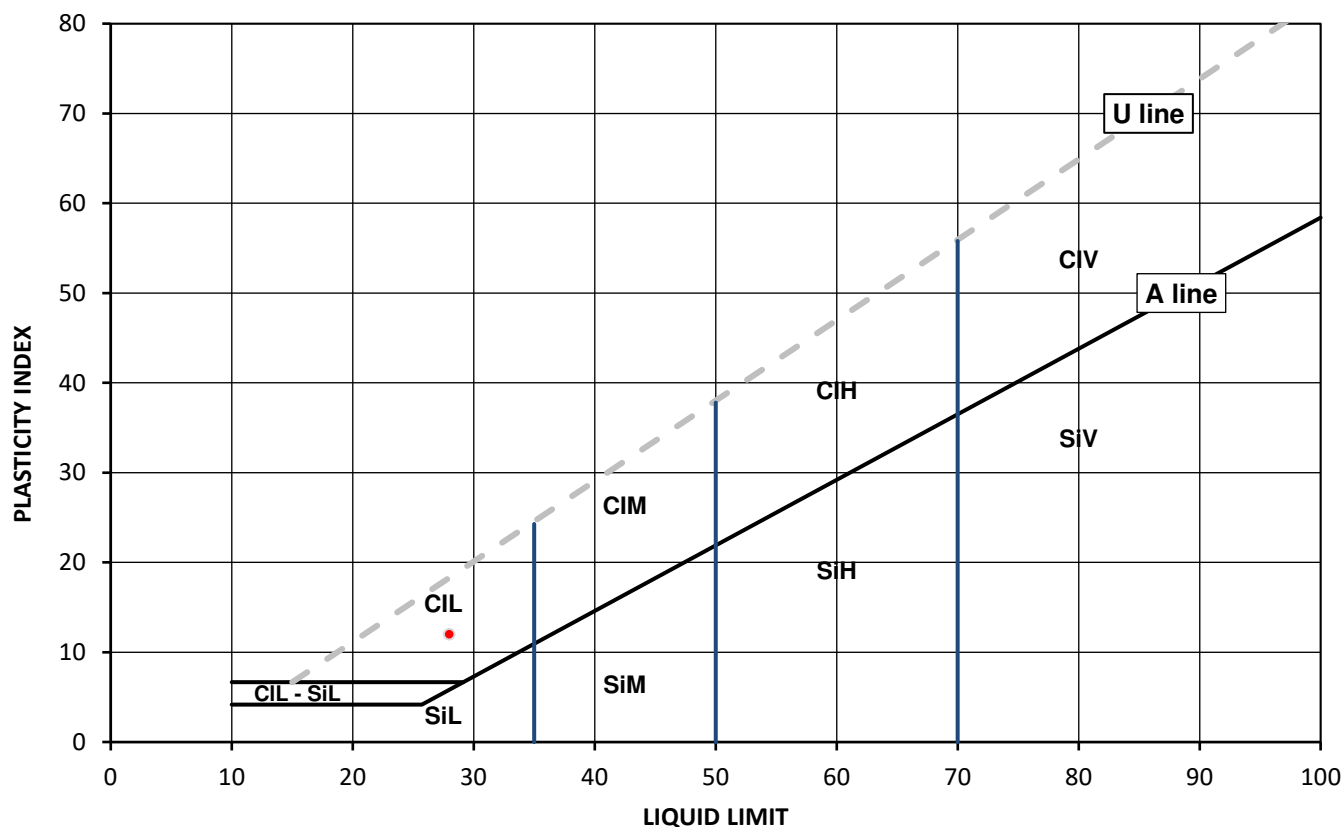
Test Results:

Laboratory Reference: 2098528
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

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

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
20	28	16	12	97



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	L Low below 35
Si	Silt	M Medium 35 to 50
		H High 50 to 70
		V Very high exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 236.12



4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 23/11/2021
Date Received: 24/11/2021
Date Tested: 14/12/2021
Sampled By: Client - RT

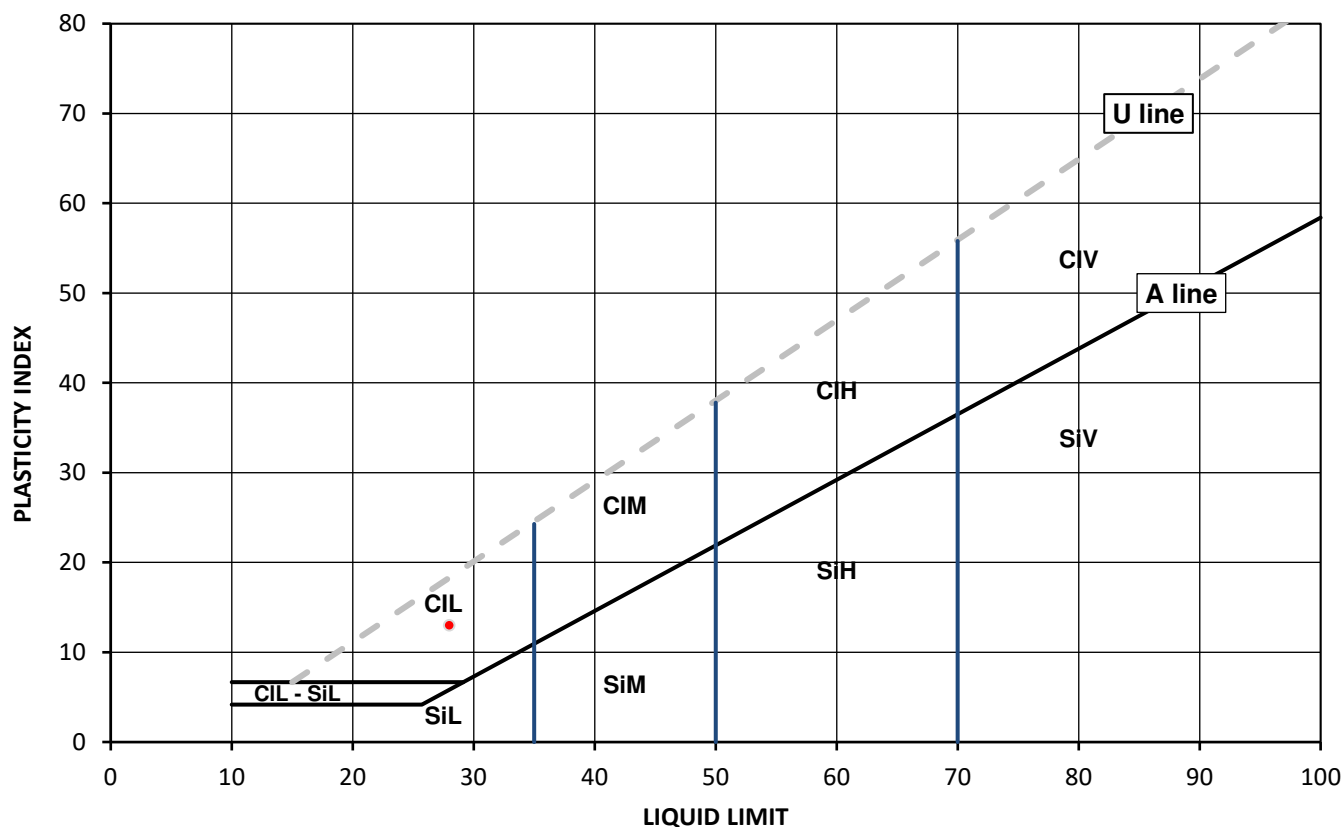
Test Results:

Laboratory Reference: 2098532
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 17.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
14	28	15	13	94



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 236.12



4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 24/11/2021
Date Received: 24/11/2021
Date Tested: 14/12/2021
Sampled By: Client - RT

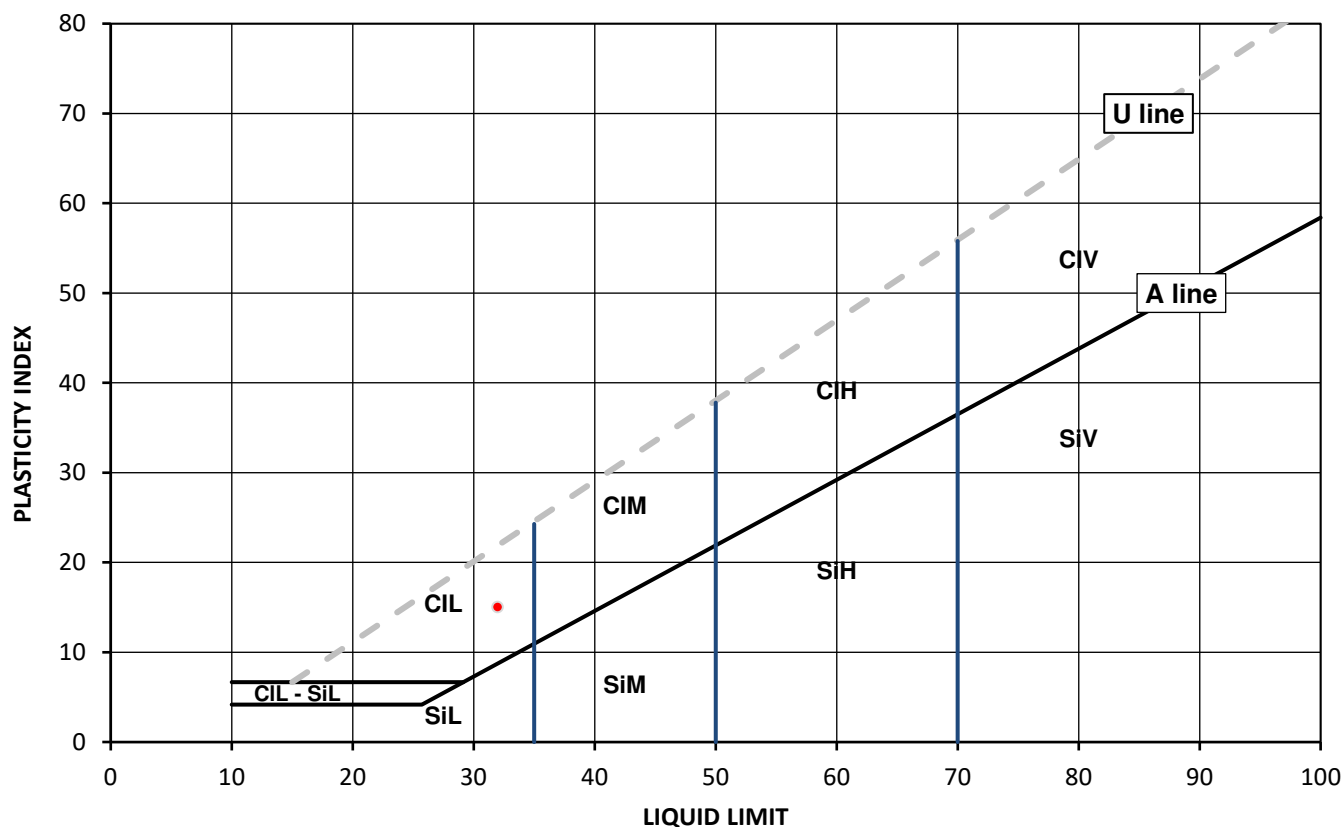
Test Results:

Laboratory Reference: 2098533
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown very sandy CLAY

Depth Top [m]: 20.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
15	32	17	15	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 236.12



4041

TEST CERTIFICATE**DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 24/11/2021
Date Received: 24/11/2021
Date Tested: 14/12/2021
Sampled By: Client - RT

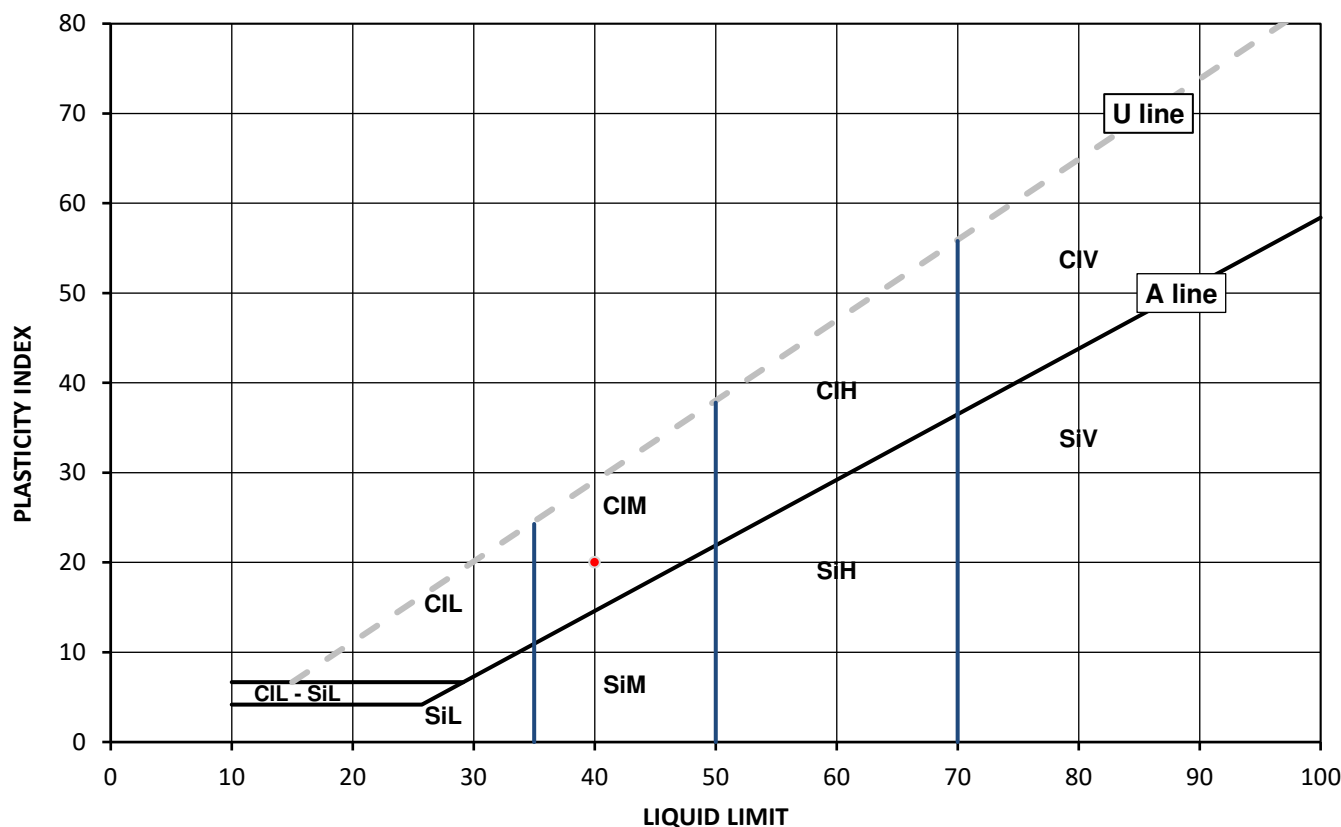
Test Results:

Laboratory Reference: 2098538
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 25.00
Depth Base [m]: 25.45
Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
19	40	20	20	95



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 236.12



4041

Client: CURTINS

Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey

Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT**SUMMARY OF CLASSIFICATION TEST RESULTS**

Tested in Accordance with:

Water Content by BS 1377-2:1990: Clause 3.2; Atterberg by BS 1377-2: 1990:
Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2:
1990: Clause 8.2i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

Client Reference: B079193

Job Number: 21-25837

Date Sampled: 22/11 - 24/11/2021

Date Received: 24/11/2021

Date Tested: 14/12 - 16/12/2021

Sampled By: Client - RT

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W] %	Water Content BS EN ISO 17892-1 [W] %	Atterberg				Density			Total Porosity# %		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	WL %	Wp %	Ip %	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
2098522	CP01A	Not Given	3.20	3.65	B	Brown CLAY		23											
2098523	CP01A	Not Given	5.00	5.45	D	Brown slightly sandy CLAY	Atterberg 4 Point	21		100	46	23	23						
2098525	CP01A	Not Given	7.00	7.45	B	Brown silty CLAY		19											
2098528	CP01A	Not Given	11.00	Not Given	D	Brown slightly gravelly very sandy CLAY	Atterberg 4 Point	20		97	28	16	12						
2098530	CP01A	Not Given	16.00	Not Given	D	Brown slightly gravelly sandy CLAY		15											
2098532	CP01A	Not Given	17.00	Not Given	D	Brown slightly gravelly very sandy CLAY	Atterberg 4 Point	14		94	28	15	13						
2098533	CP01A	Not Given	20.00	Not Given	D	Brown very sandy CLAY	Atterberg 4 Point	15		100	32	17	15						
2098534	CP01A	Not Given	21.00	21.45	D	Brown slightly sandy CLAY		15											
2098536	CP01A	Not Given	22.50	22.95	D	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	11		99	30	15	15						
2098537	CP01A	Not Given	24.00	24.45	D	Brown slightly gravelly slightly sandy CLAY		14											

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: CURTINS

Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey

Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Water Content by BS 1377-2:1990: Clause 3.2; Atterberg by BS 1377-2: 1990:
Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2:
1990: Clause 8.2

Client Reference: B079193

Job Number: 21-25837

Date Sampled: 24/11/2021

Date Received: 24/11/2021

Date Tested: 14/12 - 16/12/2021

Sampled By: Client - RT

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W] %	Water Content BS EN ISO 17892-1 [W] %	Atterberg				Density			Total Porosity# %		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	WL %	Wp %	Ip %	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
2098538	CP01A	Not Given	25.00	25.45	D	Brown slightly gravelly sandy CLAY	Atterberg 4 Point	19		95	40	20	20						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Monika Janoszek

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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4041

Client: CURTINS

Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey

Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT

DETERMINATION OF WATER CONTENT

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

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

Client Reference: B079193

Job Number: 21-25837

Date Sampled: 22/11 - 24/11/2021

Date Received: 24/11/2021

Date Tested: 14/12 - 16/12/2021

Sampled By: Client - RT

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2098522	CP01A	Not Given	3.20	3.65	B	Brown CLAY		23	Sample was quartered, oven dried at 106.0°C			
2098523	CP01A	Not Given	5.00	5.45	D	Brown slightly sandy CLAY		21	Sample was quartered, oven dried at 106.0 °C			
2098525	CP01A	Not Given	7.00	7.45	B	Brown silty CLAY		19	Sample was quartered, oven dried at 106.9 °C			
2098528	CP01A	Not Given	11.00	Not Given	D	Brown slightly gravelly very sandy CLAY		20	Sample was quartered, oven dried at 106.0 °C			
2098530	CP01A	Not Given	16.00	Not Given	D	Brown slightly gravelly sandy CLAY		15	Sample was quartered, oven dried at 106.0 °C			
2098532	CP01A	Not Given	17.00	Not Given	D	Brown slightly gravelly very sandy CLAY		14	Sample was quartered, oven dried at 106.0 °C			
2098533	CP01A	Not Given	20.00	Not Given	D	Brown very sandy CLAY		15	Sample was quartered, oven dried at 106.0 °C			
2098534	CP01A	Not Given	21.00	21.45	D	Brown slightly sandy CLAY		15	Sample was quartered, oven dried at 106.0 °C			
2098536	CP01A	Not Given	22.50	22.95	D	Brown slightly gravelly very sandy CLAY		11	Sample was quartered, oven dried at 106.0 °C			
2098537	CP01A	Not Given	24.00	24.45	D	Brown slightly gravelly slightly sandy CLAY		14	Sample was quartered, oven dried at 106.0 °C			

Comments:

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Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



4041

Client: CURTINS
 Client Address: 17-19 Whitworth Street West, Manchester,
 M1 5WG

Contact: Rebecca Tidsey
 Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT

DETERMINATION OF WATER CONTENT

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

i2 Analytical Ltd
 Unit 8 Harrowden Road
 Brackmills Industrial Estate
 Northampton NN4 7EB



Environmental Science

Client Reference: B079193
 Job Number: 21-25837
 Date Sampled: 24/11/2021
 Date Received: 24/11/2021
 Date Tested: 14/12/2021
 Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2098538	CP01A	Not Given	25.00	25.45	D	Brown slightly gravelly sandy CLAY		19	Sample was quartered, oven dried at 106.0 °C			

Comments:

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Monika Janoszek
 PL Deputy Geotechnical Laboratory Manager
 for and on behalf of i2 Analytical Ltd



4041

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

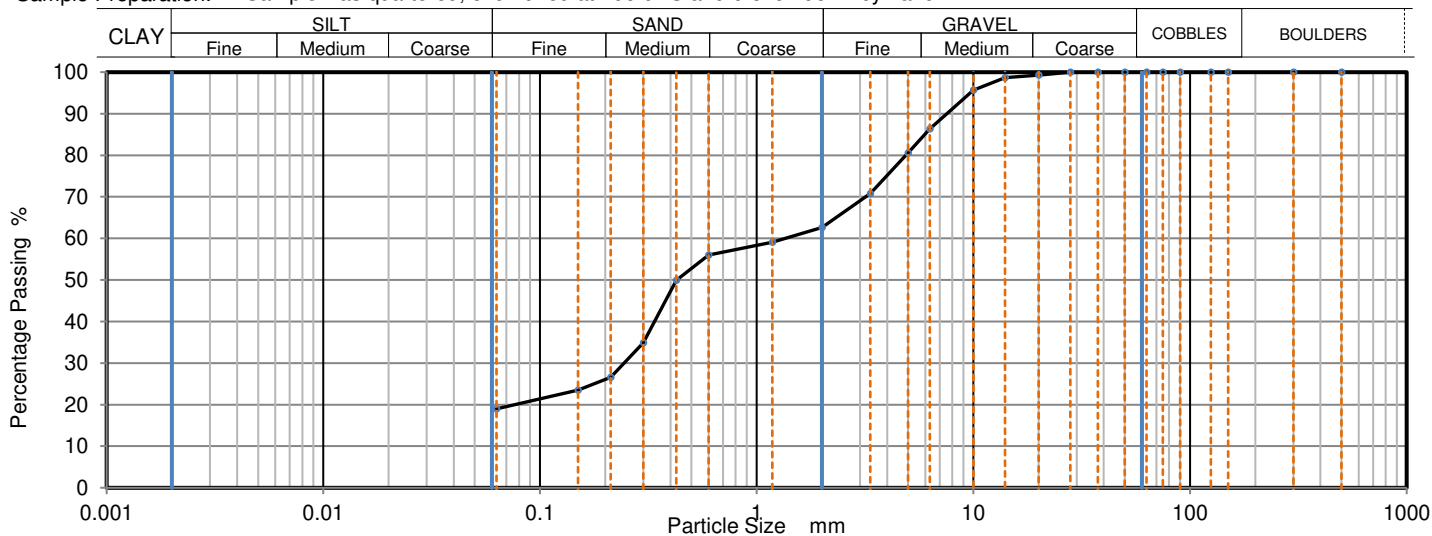
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 23/11/2021
Date Received: 24/11/2021
Date Tested: 16/12/2021
Sampled By: Client - RT

Test Results:

Laboratory Reference: 2098524
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown clayey very gravelly SAND
Sample Preparation: Sample was quartered, oven dried at 106.0 °C and broken down by hand.

Depth Top [m]: 6.00
Depth Base [m]: 6.45
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	99		
14	99		
10	96		
6.3	86		
5	81		
3.35	71		
2	63		
1.18	59		
0.6	56		
0.425	50		
0.3	35		
0.212	27		
0.15	24		
0.063	19		

Sample Proportions	% dry mass
Very coarse	0
Gravel	37
Sand	43
Fines <0.063mm	19

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 21
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

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

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 100.21



4041

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

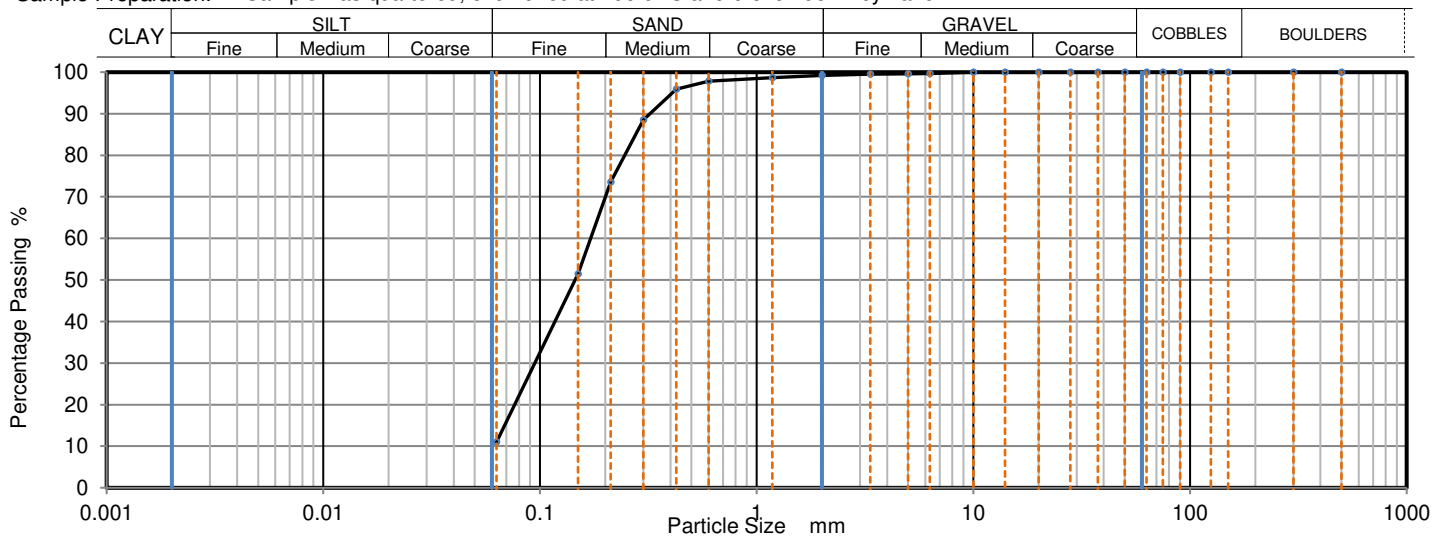
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 23/11/2021
Date Received: 24/11/2021
Date Tested: 16/12/2021
Sampled By: Client - RT

Test Results:

Laboratory Reference: 2098526
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 106.0 °C and broken down by hand.

Depth Top [m]: 9.00
Depth Base [m]: 9.45
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
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	99		
1.18	99		
0.6	98		
0.425	96		
0.3	89		
0.212	74		
0.15	52		
0.063	12		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	88
Fines <0.063mm	12

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 2.7
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

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

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

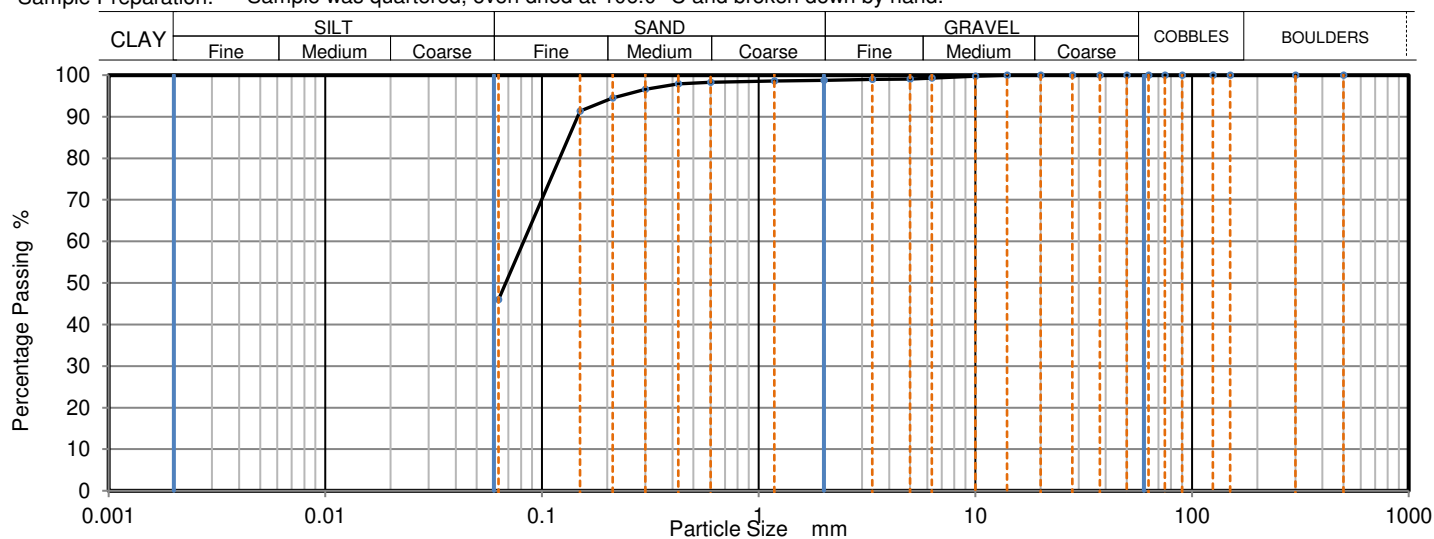
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 23/11/2021
Date Received: 24/11/2021
Date Tested: 16/12/2021
Sampled By: Client - RT

Test Results:

Laboratory Reference: 2098529
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown very clayey SAND
Sample Preparation: Sample was quartered, oven dried at 106.0 °C and broken down by hand.

Depth Top [m]: 15.00
Depth Base [m]: 15.45
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	98		
0.425	98		
0.3	97		
0.212	95		
0.15	91		
0.063	46		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	53
Fines <0.063mm	46

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 1.3
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

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

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 22/12/2021

GF 100.21



4041

TEST CERTIFICATE

DETERMINATION OF THE UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-7: 1990: Clause 8

Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 24/11/2021
Date Received: 24/11/2021
Date Tested: 13/12/2021
Sampled By: Client - RT

Test Results:

Laboratory Reference: 2098535
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown slightly gravelly slightly sandy CLAY
Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

Depth Top [m]: 19.50

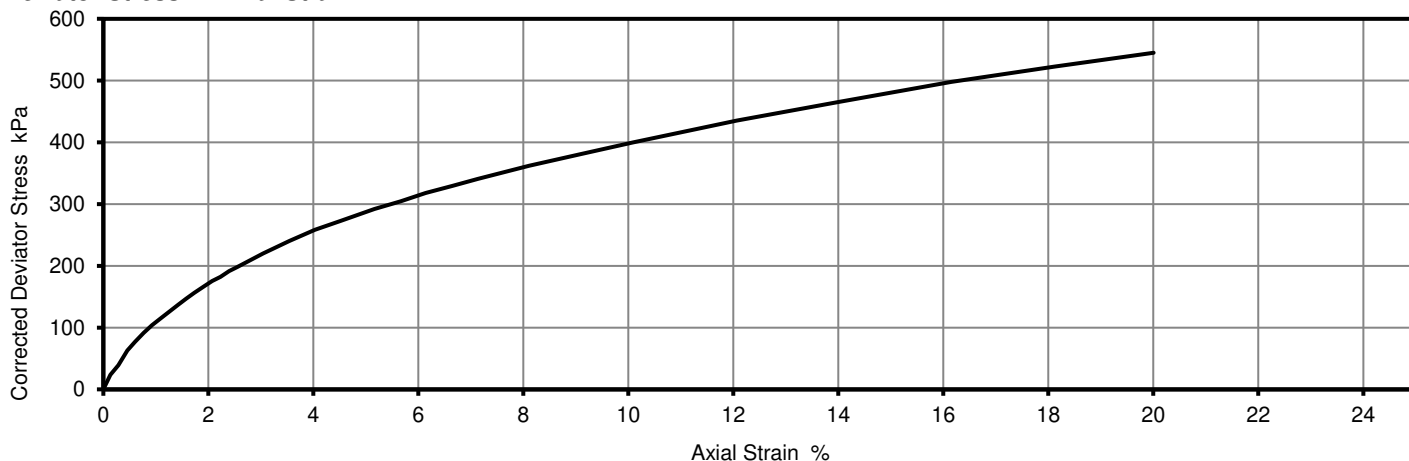
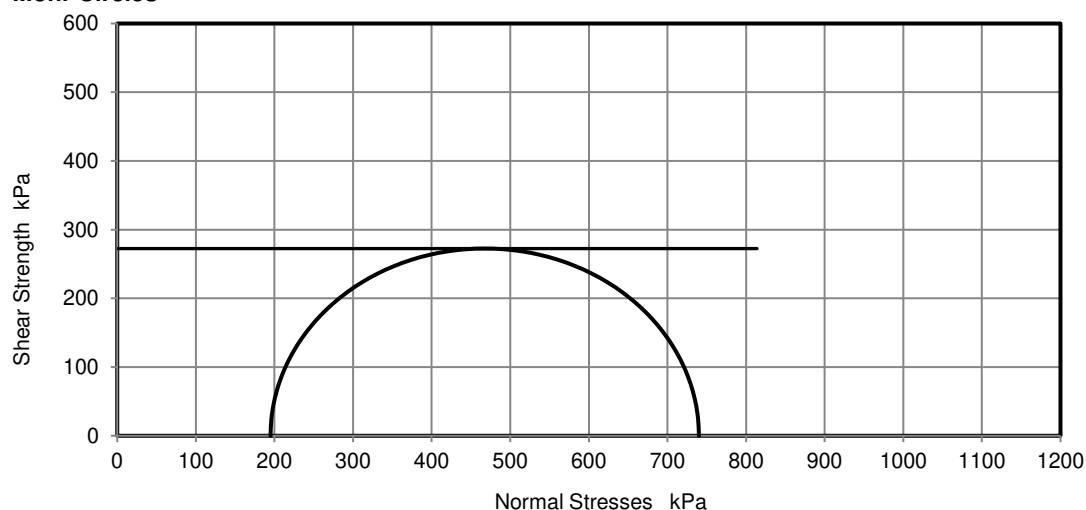
Depth Base [m]: 19.95

Sample Type: U

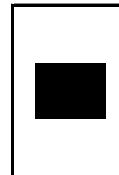
Test Number	1
Length	140.41 mm
Diameter	69.45 mm
Bulk Density	2.24 Mg/m ³
Moisture Content	15 %
Dry Density	1.95 Mg/m ³
Membrane Correction	1.44 kPa

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

2.00	%/min
195	kPa
20.0	%
545	kPa
273	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Compound	
0.26	mm

Deviator Stress v Axial Strain**Mohr Circles**

Position within sample



Note: 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: No failure occurred until 20% Axial Strain - reported as a single stage test.

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Monika Janoszek
Signature

Page 1 of 1

Date Reported: 22/12/2021

GF 184.12



4041

TEST CERTIFICATE

DETERMINATION OF THE UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Tested in Accordance with: BS 1377-7: 1990: Clause 9

Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 23/11/2021
Date Received: 24/11/2021
Date Tested: 13/12/2021
Sampled By: Client - RT

Test Results:

Laboratory Reference: 2098527
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown sandy CLAY
Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

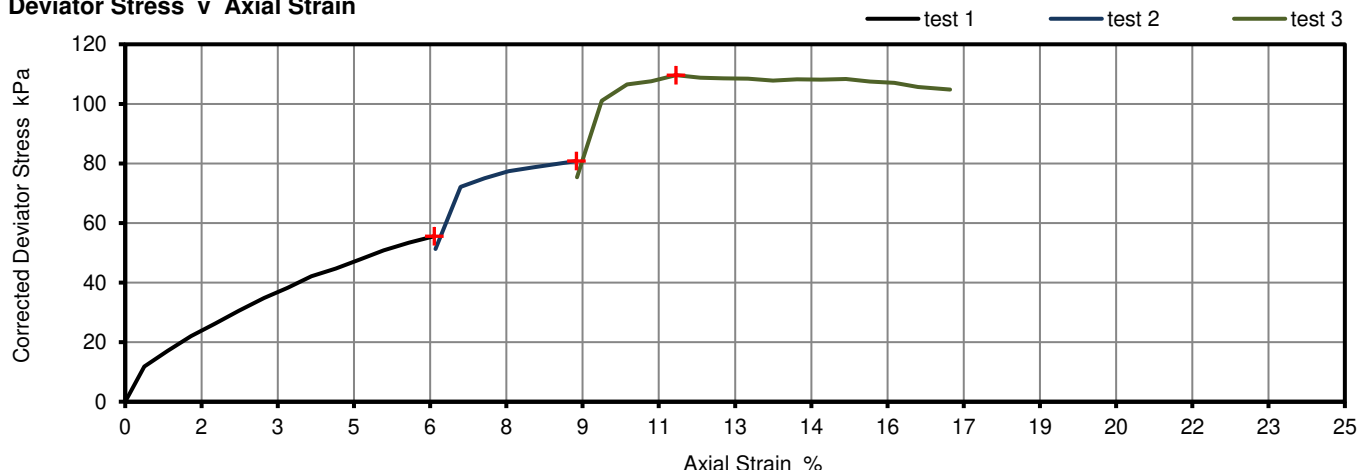
Depth Top [m]: 10.50
Depth Base [m]: 10.95
Sample Type: U

Length	141.36	mm
Diameter	68.51	mm
Bulk Density	2.07	Mg/m ³
Moisture Content	25	%
Dry Density	1.65	Mg/m ³
Membrane thickness	0.23	mm

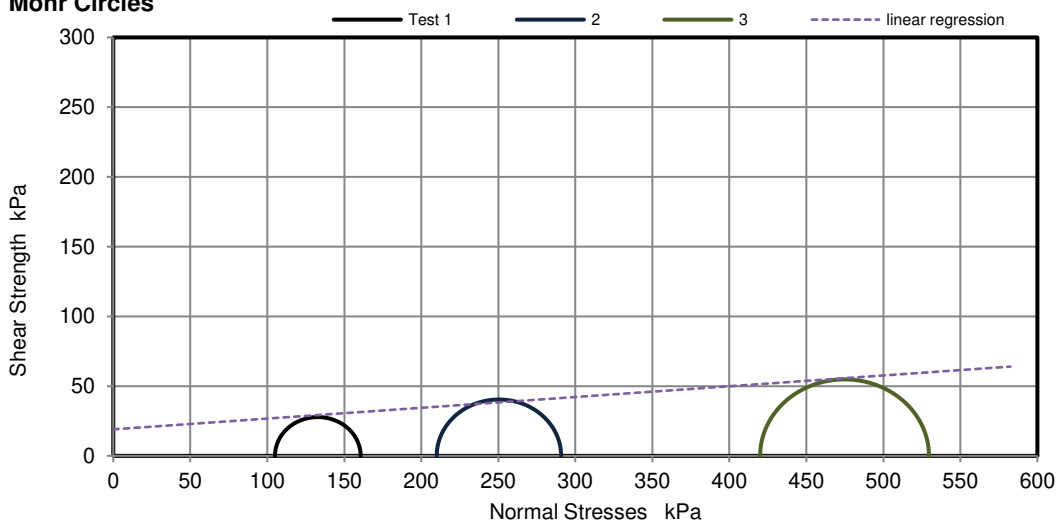
Rate of Strain
Stage Number
Cell Pressure
Axial Strain at failure
Deviator Stress, ($\sigma_1 - \sigma_3$) f
Shear strength, cu
Mode of failure
Membrane Correction

2.00			%/min
1	2	3	
105	210	420	kPa
6.3	9.2	11.3	%
56	81	110	kPa
28	40	55	kPa
Compound			
0.55	0.71	0.82	kPa

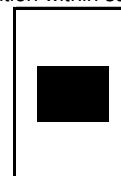
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Linear Regression
 ϕ_u 4.4 °
cu 19 kPa

Note: Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Remarks: Correction values: 105 kPa=49 N, 210 kPa= 99 N, 420 kPa= 214 N.

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Monika Janoszek
Page 1 of 1

Date Reported: 22/12/2021

GF 186.12



DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in Accordance with: BS 1377-5:1990: Clause 3



Client: CURTINS
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Rebecca Tidsey
Site Address: Rosedale Building Manchester

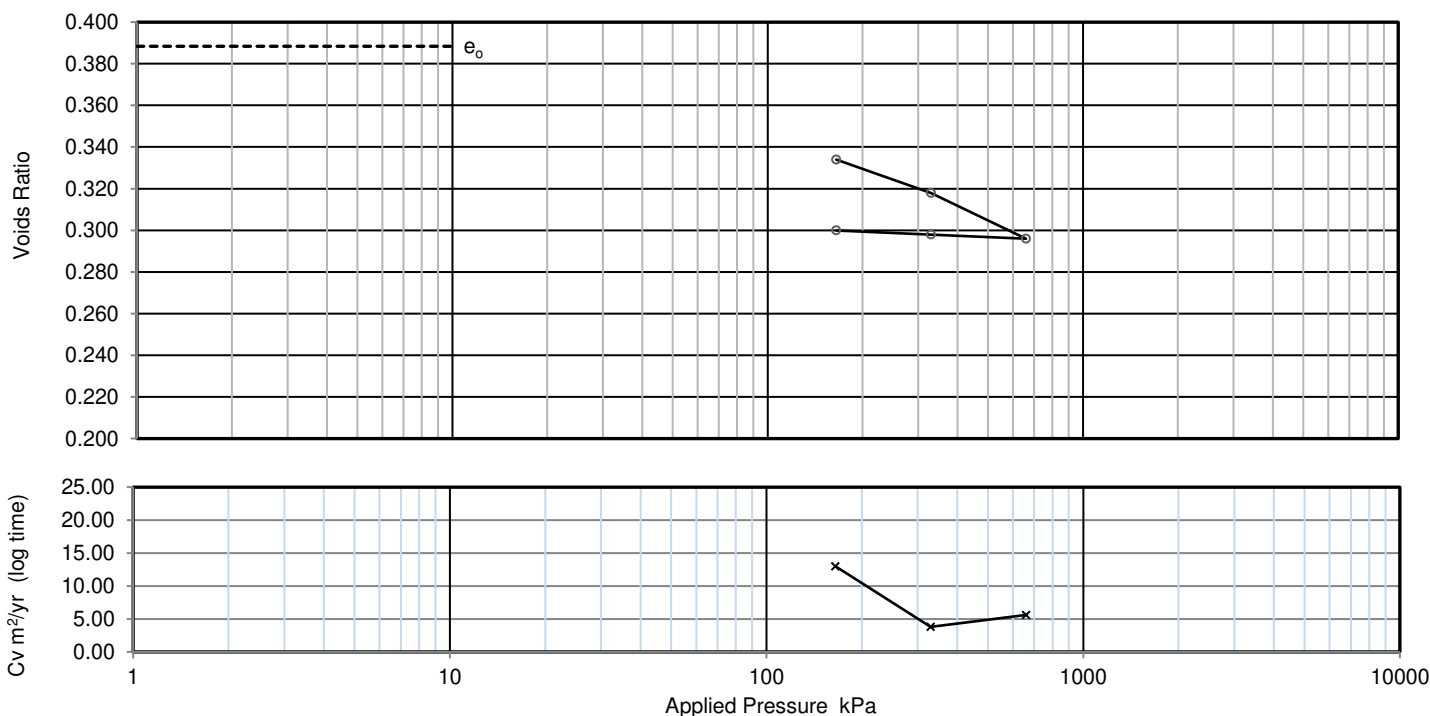
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B079193
Job Number: 21-25837
Date Sampled: 23/11/2021
Date Received: 24/11/2021
Date Tested: 13/12/2021
Sampled By: Client - RT

Test Results:

Laboratory Reference: 2098531
Hole No.: CP01A
Sample Reference: Not Given
Sample Description: Brown slightly sandy CLAY

Depth Top [m]: 16.50
Depth Base [m]: 16.95
Sample Type: U

[illegible]

Preparation

Sample squeezed out of core

Index tests

Orientation of the sample

Particle density

Liquid limit

Plastic limit

Specimen details

Diameter

Height

Moisture Content

Bulk density

Dry density

Voids Ratio

Saturation

Avg. temperature for test

Swelling Pressure

Settlement on saturation

Total test time

Vertical		
assumed	2.65	Mg/m3
N/A		%
N/A		%

Initial	Final	
50.00	-	mm
20.00	18.73	mm
16	13	%
2.22	2.31	Mg/m3
1.91	2.04	Mg/m3
0.388	0.300	
111	117	%
22.0		°C
Not measured		kPa
5		days

Note: Cv corrected to 20°C

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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Date Reported: 22/12/2021

GF 172.16

Appendix A5 – Ground Gas and Groundwater Monitoring Results

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Rosedale, Manchester	Date:	21/10/2021
Job Number:	B079193	Visit:	1
Client:	One Manchester	Weather:	Sunny, cold
Barometric State:	Rising	Ground Conditions:	Wet

Borehole Reference	Barometric Pressure mb	Flow		Methane		Carbon Dioxide		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		l/hr		%		%							
		Max	SS	Max	SS	Max	SS						
CP01(s)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP01(d)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP02(s)	1006	0.0	0.0	0.0	0.0	0.9	0.9	17.0	0	0	Dry	3.30	
CP02(d)	998	-2.3	-1.9	0.0	0.0	0.3	0.3	20.3	0	0	7.70	18.67	
CP03(s)	999	0.0	0.0	0.0	0.0	0.5	0.5	18.3	0	0	Dry	4.15	
CP03(d)	998	0.1	0.0	0.0	0.0	0.2	0.2	17.9	0	0	8.15	21.58	

Notes

1 - Borehole not yet completed

Logged by _____

SH

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Curtins

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
 Tel: 0161 236 2394
 Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Rosedale, Manchester	Date:	05/11/2021
Job Number:	B079193	Visit:	2
Client:	One Manchester	Weather:	Drizzling
Barometric State:	Falling	Ground Conditions:	Damp

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP01(s)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP01(d)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP02(s)	1015	-0.1	0.0	0.0	0.0	0.3	0.1	19.50	0	0	Dry	3.30	
CP02(d)	1015	-1.8	-1.5	0.0	0.0	0.0	0.0	20.10	0	0	7.75	18.65	
CP03(s)	1016	-0.7	-0.5	0.0	0.0	0.0	0.0	20.20	0	0	Dry	4.15	
CP03(d)	1016	0.0	0.0	0.0	0.0	0.6	0.6	19.8	0	0	7.96	21.58	

Notes

1 - Borehole not yet completed

Logged by

SH

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Rosedale, Manchester	Date:	18/11/2021
Job Number:	B079193	Visit:	3
Client:	One Manchester	Weather:	Raining
Barometric State:	Rising	Ground Conditions:	Wet

Borehole Reference	Barometric Pressure mb	Flow		Methane		Carbon Dioxide		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		l/hr		%		%							
		Max	SS	Max	SS	Max	SS						
CP01(s)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP01(d)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP02(s)	1026	-0.7	-0.7	0.0	0.0	0.2	0.1	19.8	0	0	Dry	3.30	2
CP02(d)	1026	-1.1	-1.0	0.0	0.0	0.0	0.0	20.9	0	0	7.87	18.67	2
CP03(s)	1026	-2.8	-2.8	0.0	0.0	0.5	0.5	19.4	1	0	Dry	4.15	2
CP03(d)	1026	-1.1	0.0	0.0	0.0	0.7	0.7	18.4	0	2	7.97	21.58	2

Notes

1 - Borehole not yet completed
2 - Steady state reached after 30 seconds.

Logged by _____

TW

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Rosedale, Manchester	Date:	22/11/2021
Job Number:	B079193	Visit:	4
Client:	One Manchester	Weather:	Sunny, Cold
Barometric State:	Rising	Ground Conditions:	Frozen

Borehole Reference	Barometric Pressure mb	Flow		Methane		Carbon Dioxide		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		l/hr		%		%							
		Max	SS	Max	SS	Max	SS						
CP01(s)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP01(d)	-	-	-	-	-	-	-	-	-	-	-	-	1
CP02(s)	1033	-0.7	-0.4	0.0	0.0	0.7	0.2	19.8	0	0	Dry	3.30	2
CP02(d)	1033	-3.5	-3.3	0.0	0.0	0.0	0.0	20.3	0	0	7.72	18.67	2
CP03(s)	1033	-1.0	-0.9	0.0	0.0	0.0	0.0	20.2	1	0	Dry	4.15	2
CP03(d)	1033	-0.8	0.0	0.0	0.0	0.7	0.7	17.6	0	1	8.03	21.58	2

Notes

- 1 - Borehole not yet completed
- 2 - Steady state reached after 30 seconds.

Logged by

TW

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Rosedale, Manchester	Date:	01/12/2021
Job Number:	B079193	Visit:	5
Client:	One Manchester	Weather:	Rain
Barometric State:	Rising	Ground Conditions:	Wet

Borehole Reference	Barometric Pressure mb	Flow		Methane		Carbon Dioxide		Oxygen	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		l/hr		%		%							
		Max	SS	Max	SS	Max	SS						
CP01A(s)	982	0.0	0.0	0.0	0.0	1.7	1.7	19.1	0	0	5.28	5.29	1
CP01A(d)	979	0.5	0.5	0.0	0.0	3.3	3.3	16.5	1	1	7.67	11.49	
CP02(s)	979	0.0	0.0	0.0	0.0	1.7	1.7	12.7	2	1	3.28	3.29	
CP02(d)	979	2.5	2.0	0.0	0.0	4.1	4.1	16.1	1	2	7.68	18.40	2
CP03(s)	977	14.5	0.0	0.0	0.0	0.1	0.1	19.6	1	2	4.10	4.12	3
CP03(d)	979	4.6	0.0	0.0	0.0	0.8	0.8	18.0	2	6	7.97	20.77	4

Notes

- 1 - No change in air flow rate or differential pressure for 3 minutes.
- 2 - Steady state air flow rate recorded after 3 minutes. No change in differential pressure at 10Pa from 10 seconds.
- 3 - Steady state air flow rate recorded after 2 minutes.
- 4 - Steady state air flow rate recorded after 40 seconds.

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Logged by _____

MH

Curtins

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG

Tel: 0161 236 2394

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**GAS MONITORING LOG SHEET**

Project: Rosedale, Manchester **Date:** 10/12/2021
Job Number: B079193 **Visit:** 6
Client: One Manchester **Weather:** Overcast
Barometric State: Rising **Ground Conditions:** Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP01A(s)	995	0.0	0.0	0.0	0.0	0.2	0.2	20.7	0	0	5.29	5.58	
CP01A(d)	995	-5.7	-5.7	0.0	0.0	2.1	2.1	18.6	0	0	7.77	11.4	
CP02(s)	995	0.1	0.0	0.0	0.0	2.8	2.8	7.2	0	1	3.10	3.33	
CP02(d)	995	-5.2	4.0	0.0	0.0	0.0	0.0	20.8	0	0	7.78	18.67	
CP03(s)	992	-5.2	-4.4	0.0	0.0	0.0	0.0	19.9	0	0	2.20	4.14	
CP03(d)	992	-13.3	-4.8	0.0	0.0	0.7	0.7	19.8	1	1	7.95	21.07	

Notes**Logged by**

RT

*1% gas volume = 10,000 ppm**Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.**All other gases recorded at 'steady state' unless otherwise stated*

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Rosedale, Manchester	Date:	14/12/2021
Job Number:	B079193	Visit:	7
Client:	One Manchester	Weather:	Rain
Barometric State:	Steady	Ground Conditions:	Wet

Borehole Reference	Barometric Pressure mb	Flow		Methane		Carbon Dioxide		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		l/hr		%		%							
		Max	SS	Max	SS	Max	SS						
CP01A(s)	1013	0.0	0.0	0.0	0.0	1.5	1.5	19	0	0	5.29	5.55	
CP01A(d)	1013	1.2	0.5	0.0	0.0	3.1	3.1	17.2	1	1	7.70	11.42	
CP02(s)	1011	0.0	0.0	0.0	0.0	1.5	1.5	14.5	0	1	3.10	3.34	
CP02(d)	1011	2.2	1.2	0.0	0.0	0.2	0.2	18.2	1	0	7.78	18.67	
CP03(s)	1010	5.4	0.0	0.0	0.0	0.1	0.1	19.2	1	0	2.20	4.14	
CP03(d)	1010	4.0	0.0	0.0	0.0	0.8	0.8	19	2	1	7.95	21.05	

RT

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Curtins

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Tel: 0161 236 2394
Fax: 0161 228 7902

**GAS MONITORING LOG SHEET**

Project: Rosedale, Manchester **Date:** 20/12/2021
Job Number: B079193 **Visit:** 8
Client: One Manchester **Weather:** Cold, Cloudy
Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP01A(s)	1029	0.0	0.0	0.0	0.0	1.2	0.7	20.1	0	1	Dry	5.55	
CP01A(d)	1029	-0.1	0.0	0.0	0.0	1.5	1.5	19.5	0	1	7.72	11.42	
CP02(s)	1029	0.0	0.0	0.0	0.0	0.4	0.4	20.3	1	1	3.01	3.34	
CP02(d)	1029	-0.3	0.0	0.0	0.0	0.3	0.1	20.3	0	2	7.68	18.67	
CP03(s)	1029	-0.1	0.0	0.0	0.0	0.4	0.4	20.5	1	2	Dry	4.14	
CP03(d)	1029	0.0	0.0	0.0	0.0	0.1	0.0	22	0	2	8.02	21.05	

Notes**Logged by**

TW

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Appendix A6 – Tier 1 Screening Thresholds

Adopted Soil Generic Assessment Criteria
Sandy loam with 6% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₆	160	160	3900	12000	600000	180000
EC ₅₋₆ - EC ₈	530	530	13000	40000	620000	320000
EC ₅₋₈ - EC ₁₀	150	150	1700	11000	13000	21000
EC ₁₀₋₁₀ - EC ₁₂	760	770	7300	47000	13000	24000
EC ₁₂₋₁₂ - EC ₁₆	4300	4400	13000	90000	13000	26000
EC ₅₋₁₆ - EC ₃₅	110000	110000	270000	1800000	250000	490000
EC ₃₅₋₃₅ - EC ₄₄	110000	110000	270000	1800000	250000	490000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₇	300	1400	57	86000	56000	92000
EC ₅₋₇ - EC ₈	660	3900	120	180000	56000	100000
EC ₅₋₈ - EC ₁₀	190	270	51	17000	5000	9300
EC ₁₀₋₁₀ - EC ₁₂	380	1200	74	34000	5000	10000
EC ₁₂₋₁₂ - EC ₁₆	660	2500	130	38000	5000	10000
EC ₅₋₁₆ - EC ₂₁	930	1900	260	28000	3800	7800
EC ₂₁₋₂₁ - EC ₃₅	1700	1900	1600	28000	3800	7900
EC ₃₅₋₃₅ - EC ₄₄	1700	1900	1600	28000	3800	7900
Aliph + Arom EC >44-70	1900	1900	3000	28000	3800	7900
Aromatic						
Benzene	0.33 0.87	1.0 3.3	0.07 0.18	95 98	73 140	110 230
Ethyl benzene	350	840	90	2800⁽⁸⁾ [66000]	2800⁽⁸⁾ [25000]	2800⁽⁸⁾ [27000]
Toluene	610	2700	120	4400⁽⁸⁾ [190000]	4400⁽⁸⁾ [56000]	4400⁽⁸⁾ [100000]
Xylene ⁽⁹⁾	230	290	160	2600⁽⁸⁾ [32000]	2600⁽⁸⁾ [43000]	2600⁽⁸⁾ [31000]
Phenol	420	520	280	3200⁽¹⁴⁾ (38000)	3200⁽¹⁴⁾ (10000)	3200⁽¹⁴⁾ (9300)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	13	13	24	1100	4900	3000
Acenaphthylene	920	6000	160	100000	15000	30000
Acenaphthene	1100	6000	200	100000	15000	30000
Fluorene	860	4500	160	71000	9900	20000
Phenanthrene	440	1500	90	23000	3100	6300
Anthracene	11000	37000	2200	540000	74000	150000
Fluoranthene	890	1600	290	23000	3100	6400
Pyrene	2000	3800	620	54000	7400	15000
Benz(a)anthracene	13	15	13	180	29	62
Chrysene	27	32	19	350	57	120
Benzo(b)fluoranthene	3.7	4.0	3.9	45	7.2	16.0
Benzo(k)fluoranthene	100	110	130	1200	190	440
Benzo(a)pyrene	3.0 5.0	3.2 5.3	3.5 5.7	36 77	5.7 10	13 21
Indeno(123cd)pyrene	41	46	39	510	82	180
Dibenzo(ah)anthracene	0.3	0.32	0.43	3.6	0.58	1.4
Benzo(ghi)perylene	350	360	640	4000	640	1600
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.0014	0.0015	0.0018	0.12	3.5	5.4
Trichloroethene (TCE)	0.075	0.08	0.21	5.7	120	120
1,1,1,2 Tetrachlorethane	6.4	8.2	4.4	560	1400	2100
Tetrachlorethane (PCE)	0.90	0.92	3.6	95	1400	1500
1,1,1 Trichlorethane	39	40	240	3000	140000	100000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 6% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	<u>80</u>	<u>2,300</u>	<u>630</u>	<u>1,300</u>
Mercury (elemental)	1	1	26	26	16	26 ⁽⁸⁾ [30]
Mercury (inorganic)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₆	78	78	1700	5900	590000	130000
EC ₆ - EC ₈	230	230	5600	17000	610000	220000
EC ₈ - EC ₁₀	65	65	770	4800	13000	18000
EC ₁₀ - EC ₁₂	330	330	4400	23000	13000	23000
EC ₁₂ - EC ₁₆	2400	2400	13000	82000	13000	25000
EC ₁₆ - EC ₃₅	92000	92000	270000	1700000	250000	480000
EC ₃₅ - EC ₄₄	92000	92000	270000	1700000	250000	480000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₇	140	690	27	46000	56000	84000
EC ₇ - EC ₈	290	1800	51	110000	56000	95000
EC ₈ - EC ₁₀	83	110	21	8100	5000	8500
EC ₁₀ - EC ₁₂	180	590	31	28000	5000	9700
EC ₁₂ - EC ₁₆	330	2300	57	37000	5100	10000
EC ₁₆ - EC ₂₁	540	1900	110	28000	3800	7700
EC ₂₁ - EC ₃₅	1500	1900	820	28000	3800	7800
EC ₃₅ - EC ₄₄	1500	1900	820	28000	3800	7800
Aliph + Arom EC >44-70	1800	1900	2100	28000	3800	7800
<i>Aromatic</i>						
Benzene	0.16	0.49	0.035	50	72	100
Ethyl benzene	150	380	39	1200⁽⁸⁾ [35000]	1200⁽⁸⁾ [24000]	1200⁽⁸⁾ [22000]
Toluene	270	1300	51	1900⁽⁸⁾ [110000]	1900⁽⁸⁾ [56000]	1900⁽⁸⁾ [95000]
Xylene ⁽⁹⁾	98	120	70	1200⁽⁸⁾ [14000]	1200⁽⁸⁾ [42000]	1200⁽⁸⁾ [23000]
Phenol	290	420	140	1500⁽¹⁴⁾ (35000)	1500⁽¹⁴⁾ (10000)	1500⁽¹⁴⁾ (8300)
<i>Polycyclic Aromatic Hydrocarbons (PAH)</i>						
Naphthalene	5.6	5.6	10	460	4900	1900
Acenaphthylene	420	4600	69	97000	15000	30000
Acenaphthene	510	4700	85	97000	15000	30000
Fluorene	400	3800	67	68000	9900	20000
Phenanthrene	220	1500	38	22000	3100	6200
Anthracene	5400	35000	950	540000	74000	150000
Fluoranthene	560	1600	130	23000	3100	6300
Pyrene	1200	3800	270	54000	7400	15000
Benz(a)anthracene	11	14	6.5	170	29	56
Chrysene	22	31	9.4	350	57	110
Benzo(b)fluoranthene	3.3	4.0	2.1	44	7.2	15
Benzo(k)fluoranthene	93	110	75	1200	190	410
Benzo(a)pyrene	2.7	3.2	2	35	5.7	12
Indeno(123cd)pyrene	36	46	21	510	82	170
Dibenzo(ah)anthracene	0.28	0.32	0.27	3.6	0.57	1.3
Benzo(ghi)perylene	340	360	470	4000	640	1500
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00087	0.001	0.001	0.077	3.5	5
Trichloroethene (TCE)	0.034	0.036	0.091	2.6	120	91
1,1,1,2 Tetrachlorethane	2.8	3.5	1.9	250	1400	1800
Tetrachlorethane (PCE)	0.39	0.4	1.5	42	1400	1100
1,1,1 Trichlorethane	18	18	110	1300	140000	76000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs
- Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	80	<u>2,300</u>	630	<u>1,300</u>
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₆	42	42	730	3200	570000	95000
EC ₆₋₆ - EC ₈	100	100	2300	7800	600000	150000
EC ₈₋₈ - EC ₁₀	27	27	320	2000	13000	14000
EC ₁₀₋₁₀ - EC ₁₂	130	130	2200	9700	13000	21000
EC ₁₂₋₁₂ - EC ₁₆	1100	1100	11000	59000	13000	25000
EC ₁₆₋₁₆ - EC ₃₅	65000	65000	260000	1600000	250000	450000
EC ₃₅₋₃₅ - EC ₄₄	65000	65000	260000	1600000	250000	450000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₇	70	370	13	26000	56000	76000
EC ₇₋₇ - EC ₈	130	860	22	56000	56000	87000
EC ₈₋₈ - EC ₁₀	34	47	8.6	3500	5000	7200
EC ₁₀₋₁₀ - EC ₁₂	74	250	13	16000	5000	9200
EC ₁₂₋₁₂ - EC ₁₆	140	1800	23	36000	5100	10000
EC ₁₆₋₁₆ - EC ₂₁	260	1900	46	28000	3800	7600
EC ₂₁₋₂₁ - EC ₃₅	1100	1900	370	28000	3800	7800
EC ₃₅₋₃₅ - EC ₄₄	1100	1900	370	28000	3800	7800
Aliph + Arom EC >44-70	1600	1900	1200	28000	3800	7800
Aromatic						
Benzene	0.08	0.3	0.017	28	72	90
Ethyl benzene	65	170	16	520⁽⁸⁾ [17000]	520⁽⁸⁾ [24000]	520⁽⁸⁾ [17000]
Toluene	120	610	22	860⁽⁸⁾ [59000]	860⁽⁸⁾ [56000]	860⁽⁸⁾ [87000]
Xylene ⁽⁹⁾	41	53	28	480⁽⁸⁾ [69000]	480⁽⁸⁾ [41000]	480⁽⁸⁾ [17000]
Phenol	180	310	66	760⁽¹⁴⁾ (31000)	760⁽¹⁴⁾ (10000)	760⁽¹⁴⁾ (7600)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	2.3	2.3	4.1	190	4900	1200
Acenaphthylene	170	2900	28	83000	15000	29000
Acenaphthene	210	3000	34	84000	15000	29000
Fluorene	170	2800	27	63000	9900	20000
Phenanthrene	95	1300	15	22000	3100	6200
Anthracene	2400	31000	380	520000	74000	150000
Fluoranthene	280	1500	52	23000	3100	6300
Pyrene	620	3700	110	54000	7400	15000
Benz(a)anthracene	7.2	11	2.9	170	29	49
Chrysene	15	30	4.1	350	57	93
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	13
Benzo(k)fluoranthene	77	110	37	1200	190	370
Benzo(a)pyrene	2.2	3.2	0.97	35	5.7	11
Indeno(123cd)pyrene	27	45	9.5	500	82	150
Dibenzo(ah)anthracene	0.24	0.31	0.14	3.5	0.57	1.1
Benzo(ghi)perylene	320	360	290	3900	640	1400
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00064	0.00077	0.00055	0.059	3.5	4.8
Trichloroethene (TCE)	0.016	0.017	0.041	1.2	120	70
1,1,1,2 Tetrachlorethane	1.2	1.5	0.79	110	1400	1500
Tetrachlorethane (PCE)	0.18	0.18	0.65	19	1400	810
1,1,1 Trichlorethane	8.8	9	48	660	140000	57000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Appendix A7 – Risk Assessment Methodology

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem, or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway, and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of an event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment the consequence of the hazard has been classified as severe, medium, mild, or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem.	<p>High concentrations of cyanide on the surface of an informal recreation area.</p> <p>Major spillage of contaminants from site into controlled water.</p> <p>Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).</p>
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	<p>Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria.</p> <p>Leaching of contaminants from a site to a Principal or Secondary A aquifer.</p> <p>Death of a species within a designated nature reserve.</p> <p>Lesser toxic and asphyxiate effects</p>
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures, and services. Damage to sensitive buildings/structures/services or the environment.	<p>Pollution of non-classified groundwater (Inc. Secondary B aquifers).</p> <p>Damage to building rendering it unsafe to occupy (e.g., foundation damage resulting in instability).</p>
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures, and services.	<p>The presence of contaminants at such concentrations that protective equipment is required during site works.</p> <p>The loss of plants in a landscaping scheme.</p> <p>Discoloration of concrete.</p>

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a <i>high probability</i> that <i>severe harm</i> could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	<i>Harm is likely to arise</i> to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	<i>It is possible</i> that without appropriate further action <i>harm could arise</i> to a designated receptor. It is relatively <i>unlikely</i> that any such harm would be <i>severe</i> , and if any harm were to occur it is <i>more likely</i> that such harm would be <i>relatively mild</i> .
Low Risk	<i>It is possible</i> that <i>harm could arise</i> to a designated receptor from an identified hazard. It is <i>likely</i> that, at worst, if any harm was realised any effects would be <i>mild</i> .
Negligible Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term 'risk' in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

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