

The Island Site, Manchester

Phase 2 Ground Investigation

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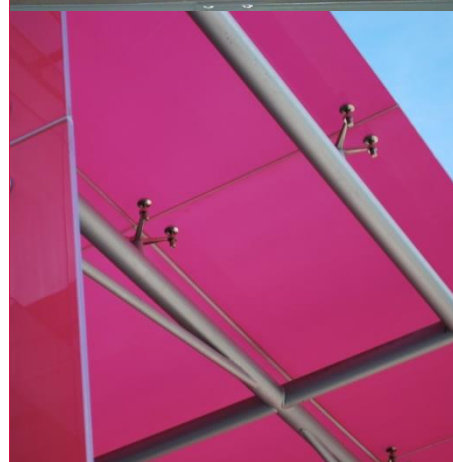
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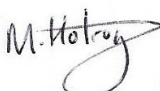
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Site Address: John Dalton St, Manchester, M2 6FW



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Executive Summary

Appointment	Curtins were instructed by Henry Boot Development Limit on behalf of to undertake a Phase 2 Ground Investigation for the site known as 'The Island Site' in Manchester. The site is centred on SJ 83714 98262 and covers an area of approximately 0.13 Ha. Development plan comprises the demolition of the existing buildings and structures and the erection of a 10-storey plus basement office building.
Current Site Status	The site comprises the three buildings of Old Colony House, Ridgefield House and Grange House consisting of basements, ground floor retail accommodation and upper floor offices. The site is bound by John Dalton Street, Ridgefield, Bow Street and South King Street, Manchester.
Summary of Preliminary Site Assessment	Historical mapping shows the site and the surrounding area partially developed with unspecified buildings. By 1917 the buildings are now noted as a tailor, yarn warehouse and bakehouse. Post war mapping (1948) indicated the building to the of the site were demolished and redeveloped as Old Colony House. By 1966, the buildings to the south and east of the site were demolished and redeveloped as St James House. BGS mapping indicates the site is underlain by sands and gravels of the Glaciofluvial Sheet Superficial Deposits and bedrock of Chester Formation comprising a red sandstone. The site is underlain by a Secondary A Aquifer associated with the superficial deposits and a Principal Aquifer within the bedrock deposits. The site is not located within a Source Protection Zone (SPZ). The nearest water feature is the River Irwell located 255, north of the site, river quality E which flows east to west.
Detailed Unexploded Ordnance (UXO) Risk Assessment	A Detailed Unexploded Ordnance (UXO) Risk Assessment report was obtained for the site in March 2021 and reported that although incendiary bombs were recorded on site during WWII, they do not appear to have resulted from any significant damage. The site was therefore assessed to have a Low risk from item of German aerial delivered UXO across the site. The following risk mitigation measures are recommended for all intrusive works: • UXO Risk Management Plan • Site Specific UXO Awareness Briefings to all personal conducting intrusive works. If unexploded ordnance is discovered during any works, stop immediately, prevent access to the area, and inform the police. If the site boundary or location changes then the UXO risk should be reassessed.
Fieldworks Undertaken	Fieldworks were carried out between the 22nd to the 25th April 2021, comprising four window sample boreholes to a maximum depth of 3.91m bgl and three hand excavated trial pits. Deeper investigation works were undertaken by Ian Farmer Associates (IFA) between 11th and 20th August 2021. Ground gas and groundwater monitoring standpipes were installed within all four of the window sample boreholes and BH101 and BH102. Selected soils were subjected to laboratory analysis. No groundwater samples were taken. Four ground gas and groundwater level monitoring visits have been undertaken in the shallow monitoring wells, with return groundwater level monitoring visits still to be undertaken for the deeper monitoring wells.
Encountered Ground Conditions	Made ground was encountered within all exploratory holes and was encountered from ground level to depths ranging between 0.19m to 1.30m bgl (33.05m to 32.88m AOD). The initial layer comprised hardstanding concrete. Within BH01 and BH02 an intact brick layer was present which varied in thickness from 0.20m to 0.69m. Beneath the concrete and intact brick layers a granular made ground deposit was encountered with anthropogenic material present, including concrete and brick. Outside of the building footprint, made ground soils were encountered to 1.60m to 2.00m bgl (34.80m to 34.31m AOD), comprising tarmacadam overlying concrete or granite slabs, and black, dark brown or greyish brown clayey gravelly fine to coarse sand, including brick, concrete, tarmacadam, ash, clinker, slate sandstone, mudstone and coal. Historic road cobbles were encountered in BH101 between 1.15m and 1.40m bgl. Underlying the made ground superficial deposits of the glaciofluvial sheets deposits were encountered, at depths ranging between 0.19m to 1.30m bgl. The deposits were generally granular in nature comprising a very dense orange/brown very sandy gravel or a very dense red/brown very gravelly sand. Within location BH01 a thin cohesive layer was encountered at a depth of 3.80m which comprised a stiff brown clay. Soils were encountered to depths of 30.95m to 30.11m AOD. Similar soils were encountered outside of the building footprint, to depths of 30.80m to 29.31m AOD. Directly below the superficial deposit's bedrock deposits of the Chester Formation were found within all borehole locations with the exception of BH04 and BH103 where obstructions were encountered. The bedrock was found at depths ranging between 3.70m and 3.90m bgl beneath the existing basement, and 6.00m to 7.00m bgl beneath the roads to the east. Rock head elevations range between 30.95m and 29.31m AOD. The unit was described as a extremely weak becoming very weak and weak reddish brown fine to coarse grained sandstone. No groundwater strikes were recorded during the course of the ground investigation, during the returned monitoring visits groundwater was only encountered within intrusive locations BH01 at depth ranging between 3.06m 3.41m bgl. No monitoring wells were flooded throughout the monitoring period.

Phase 2 Ground Investigation

Environmental Laboratory Testing	With respect to the proposed 10-storey office block end of the site, soils testing results were compared against 'Commercial' end use. No exceedances of contamination above the GAC's were recorded in any of the soil samples tested. No suspected asbestos containing materials (ACMs) were identified within any of the exploratory hole logs or laboratory screening. The risk to site end users for soils is therefore considered to be Low.
Ground Gas Monitoring Results	During the ground gas monitoring programme, methane (CH₄) was recorded below the instrument's detection limit <0.1% v/v with all monitoring wells. The greatest concentration of carbon dioxide (CO₂) was recorded in BH02 and BH03 at 0.1% v/v. Both peak and steady flow rates were recorded below the instrument detection limit <0.1 l/hr. Using the 'borehole scenario' steady state air flow rates and maximum gas concentrations results, a calculated Q_{hg} of 0.0001 l/hr for carbon dioxide and 0.0001 l/hr for methane. The greatest Q_{hg} for CO₂ is taken as the Gas Screening Value (GSV) for the site, indicating CS1 gas regime for the development, with no requirement for gas protection measures.
Ground Contamination and Ground Gas Assessment	A Low risk rating is identified to commercial site user and construction workers, soils and dust from inhalation and ingestions due no exceedances recorded within the made ground deposits and the absence of positive asbestos results across the site. A Low and Very Low risk rating is identified to controlled water (groundwater and surface waters) following the ground investigation. No evidence of free produce or gross contamination was identified in the site soil and no exceedance were recorded within the collected soil samples. A Low risk rating is identified to site end users from ground gases arising (carbon dioxide) from made ground and natural soil deposits. This corresponds to a Characteristic Gas Situation assessed as CS1, requiring no gas protection measures.
Geotechnical Assessment	It is understood that a raft foundation is the preferred option for the new basement. Current design proposals indicate construction of the raft basement floor level at a level of appropriately 31.00 to 31.50m AOD within the Glaciofluvial deposits some c. 0.55m to 2.19m above the weathered top of the Chester Formation. The glacio-fluvial soils are currently seen as being suitable for the construction of a raft foundation with an allowable bearing capacity of approximately 250 kPa at 31.5m AOD increasing to 400 kPa at 27m AOD within the unweathered sandstone. Bearing pressures subject to detailed design and in-situ testing following demolition of the existing building. Softer deposits, where encountered at formation layer should be over-excavated until competent granular material is encountered (complimented by in-situ strength testing) and fill to formation level with competent granular fill material (6N or 6P) to ensure a consistent granular foundation stratum; foundations should not be formed or spread across mixed bedrock and granular soils. In the event that the options above do not provide suitable bearing capacities for the proposed structures, and over-deepening to c.27m AOD is not viable, piled foundations may be adopted, socketed in the Chester Formation. It is noted that the groundwater readings recorded are above the proposed FFL's of the proposed raft foundation and therefore (subject to the receipt of the updated groundwater results) groundwater management techniques are likely to be required for both the demolition works and construction of the new basement. The chosen contractor should provide details on how they intend to ensure the safety and stability of the excavations on site. A Design Sulphate Class may be taken as Class DS-1 (AC-1) conditions for the Made Ground, DS-1 (AC-3z) for Glaciofluvial deposits and DS-1 (AC-1) for the Chester Formation, assuming mobile groundwater.
Recommendations	Based on the findings of the ground investigation, the following recommendations are made: 1) A full detailed raft analysis should be undertaken by the design team following demolition of the existing structures, frozen design layouts and receipt of further in-situ test results (notably plate testing) following demolition of the existing building, as detailed in this report. This analysis should be carried out with input from a qualified geotechnical engineer, including settlement analysis, serviceability limit state analysis and ultimate limit state analysis. 2) 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 C. 3) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer. 4) As the new development incorporates a basement the advice of a specialist Radon assessor must be obtained. It is recommended that this report is updated following additional groundwater monitoring and additional ground investigation works. Should building layout, proposed building loads or building design change subsequent to issue of this report, the findings should be reviewed. Additional ground investigation may be required to confirm ground suitability for updated proposals.

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1.0 Introduction

1.1 Project Background

Curtins were instructed by Henry Boot Developments Limited on behalf of The Island Site (General Partner) Limited in March 2021 to undertake a shallow Phase 2 Ground Investigation for a site bound by John Dalton Street, Ridgefield, Bow Street and South King Street, Manchester known as 'The Island Site'.

A second phase of investigation including deeper boreholes was instructed by Henry Boot Developments Limited on behalf of The Island Site (General Partner) Limited in April 2021.

The site location plan is presented on *Figure 2.1*.

The proposed works comprise the demolition of the existing buildings and structures and the erection of a 10-storey plus basement office building (Use Class E(g)), with flexible ground floor and basement uses (Use Class E) and a rooftop garden, works to facilitate the pedestrianisation of the southern part of Ridgefield and other associated works. Current development plans are contained within *Appendix A*.

1.2 Scope of Services

The Phase 2 Ground Investigation Report will characterise the environmental and geotechnical conditions of the site. The ground investigation has been undertaken to assess the ground and groundwater conditions across the site.

The ground investigation detailed herein encompasses a shallow ground investigation undertaken within the basements of the existing buildings on site together with a deeper pre-demolition ground investigation carried out outside the footprint of the proposed building. The deeper investigation was undertaken subsequent to the shallow investigation.

The Phase 2 Ground Investigation Report is intended to:

- a) Determine the risk of the proposed end-user being adversely impacted by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
- b) Determine if there is a risk to the end-user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide;
- c) Characterise site wide natural soils and provide classification of soils for re-use;
- d) Characterise bedrock formation beneath and in the immediate vicinity of the site;
- e) Recommendations for design of foundations and building ground floor slabs; and
- f) Recommendations for the specification of sub-structure concrete.

Detailed flood risk assessment, ecology and archaeological studies are outside of the scope of this report.

2.0 Preliminary Site Assessment Summary

A Phase 1 Preliminary Risk Assessment report was undertaken by Curtins in December 2019 and updated in April 2021 for submission to Manchester City Council for planning (Ref.1). A summary of the detailed findings of this report, comprising current site setting, history, geology and hydrogeology/hydrology is presented within this Section. This Phase 2 report must be read in conjunction with the Phase 1 Preliminary Risk Assessment Report.

2.1 Current Setting

The site extends to approximately 0.13 hectares and is located at the heart of Manchester City Centre. The site comprises a rectangular block of buildings bound by John Dalton Street to the south, South King Street to the north, Bow Street to the east and Ridgefield to the west. *Figure 2.1* illustrates the site's location. Three existing vacant buildings are located within the site boundary comprising:

- Old Colony House (25,968 sq ft), a 7-storey building, with single storey basement, comprising office accommodation with a vacant former restaurant at ground floor level. The building fronts onto South King Street;
- 5 Ridgefield (11,748 sq ft), a 3-storey building comprising a former restaurant use at basement and ground floor level and vacant offices at first and second floors. The site fronts onto Ridgefield and Bow Street; and
- Grange House (17,309 sq ft), a 6-storey building, with single storey basement comprising ground floor retail/restaurant/office use with vacant upper floors formerly in office use. The building fronts onto John Dalton Street.

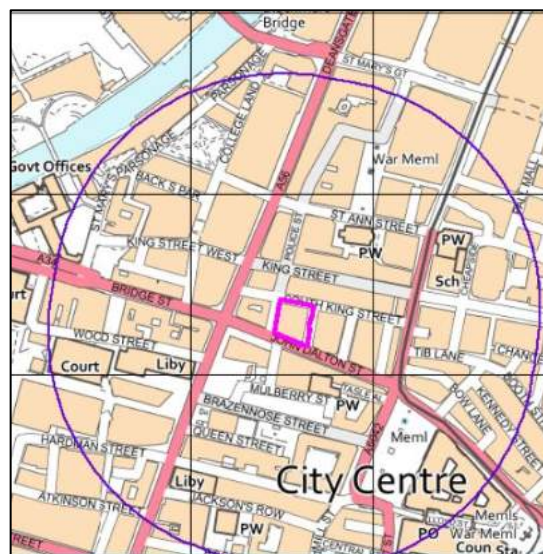


Figure 2.1 – Site Location Plan (site boundary shown in pink and 250m buffer in purple).
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2.2 Previous Site Use

The earliest mapping (1848) shows the site and surrounding area partially developed with unspecified buildings. The River Irwell is located 250m north flowing south-westwards. By 1891, the site was fully developed.

Mapping from 1917 specified the buildings as being occupied by a tailor, a yarn warehouse and a bakehouse. Post war mapping (1948) indicates the buildings at the north of the site were demolished and redeveloped as Old Colony House. Buildings at the south of the site are described as Ruins, possibly associated with bombing during WWII.

Between the 1960s and 1980s, the buildings at the south of the site, and south and east of the site were demolished and redeveloped. St James House with an electrical substation noted 35m south.

2.3 Published Geology

A study of the British Geological Survey (BGS) maps, 1:50,000 (Solid and Drift Edition, Sheet No. 085, Manchester, 2010 (Ref. 2)) indicates the following geological sequence underlying the site:

- **Superficial Deposits:** Glaciofluvial Sheet Deposits (north and west).
- **Solid Geology:** Chester Formation

Glacial Till (clay) is recorded in close proximity to the eastern boundary and may underlie the site.

There are seven BGS recorded boreholes within 50m of the site, summarised in *Table 2.3* below.

Table 2.3 – Historical Borehole Record from the Surrounding Area

Borehole Ref.	Location (Easting, Northing)	Details (depth to top of strata/lithology/thickness)	
SJ89NW3776	0m north (383710, 398280)	0.00m bgl	MADE GROUND bituminous surfacing (0.10m)
		0.10m bgl	MADE GROUND concrete (0.20m)
		0.30m bgl	MADE GROUND brick ashes (0.80m)
		1.10m bgl	Clayey SAND and GRAVEL (0.80m)
		1.90m bgl	Very dense very sand GRAVEL with cobbles (3.92m)
		5.82m bgl borehole termination	
SJ89NW1157	13m south (383730, 398220)	0.00m bgl	MADE GROUND tarmac, stone, sand and concrete (0.50m)
		0.50m bgl	MADE GROUND very loose topsoil, cinders, ashes and bricks (1.20m)
		1.70m bgl	Soft clayey brown SAND (0.90m)
		2.60m bgl	Medium dense slightly silty fine to coarse grained SAND and fine to coarse GRAVEL (1.70m)
		4.30m bgl	Very stiff brown silty sandy gravelly CLAY, grading to clayey fine to coarse SAND and fine to coarse GRAVEL (1.20m)
		5.50m bgl	Dense brown slightly clayey fine to coarse SAND (1.10m)

Borehole Ref.	Location (Easting, Northing)	Details (depth to top of strata/lithology/thickness)
		6.60m bgl Very weak moderately weathered dark red fine to medium grained sandstone 7.10m bgl borehole termination
SJ89NW3775	19m west (383680,398280)	0.00m bgl MADE GROUND bituminous surfacing (0.05m) 0.05m bgl MADE GROUND concrete (0.70m) 0.75m bgl MADE GROUND brick pieces and ashes (0.15m) 0.90m bgl MADE GROUND Soft brown silty and sandy CLAY with stone inclusions and brick (0.45m) 1.35m bgl Loose to dense SAND and GRAVEL (4.05m) 5.40m bgl Very dense orange SAND with clay lenses (0.60m) 6.00m bgl borehole termination
SJ89NW1158	26m south east (384338, 398210)	0.00m bgl MADE GROUND tarmac, stone, sand and concrete (0.50m) 0.50m bgl MADE GROUND very loose topsoil, cinders, ashes and bricks (1.90m) 2.40m bgl Medium dense brown clayey silty fine to coarse grained SAND and fine to coarse GRAVEL (1.60m) 4.00m bgl Medium dense becoming dense brown slightly silty fine to coarse grained SAND and GRAVEL (3.00m) 7.00m bgl Very weak moderately weathered dark red with bands of green/grey, fine to medium grained SANDSTONE (2.00m) 9.00m bgl Moderately weak becoming moderately strong, moderate to slightly weathered dark grey fine to medium grained SANDSTONE (3.00m) 12.00m bgl borehole termination
SJ89NW3777	36m east (383770, 398270)	0.00m bgl MADE GROUND bituminous surfacing (0.02m) 0.02m bgl MADE GROUND cobble sets (0.13m) 0.15m bgl MADE GROUND clay, ashes, stones, bricks (1.45m) 1.60m bgl MADE GROUND brown silty and sandy clay with stone and coal inclusions and brick pieces (0.80m bgl) 2.40m bgl MADE GROUND house bricks (0.10m) 2.50m bgl borehole termination
SJ89NW3521	43m west (383650,398250)	0.00m bgl MADE GROUND setts (0.20m) 0.20m bgl MADE GROUND concrete (0.25m) 0.45m bgl MADE GROUND dark brown sand, clay and gravel with bricks (0.75m) 1.20m bgl Medium dense brown slightly silty SAND and GRAVEL with cobbles and boulders (4.97m) 6.17m bgl Highly/moderately weathered inferior cemented red/brown SANDSTONE (8.83m) 15.00m bgl borehole termination
SJ89NW1160	49m south (383700, 398190)	0.00m bgl MADE GROUND setts (2.00m) 2.00m bgl Dense brown fine to coarse SAND and fine to coarse GRAVEL (2.60m) 4.60m bgl Very weak moderately weathered dark red fine to medium grained SANDSTONE (1.90m bgl) 6.50m bgl Moderately strong slightly weathered dark red fine to medium grained SANDSTONE (5.50m bgl) 12.00m bgl borehole termination

2.3.1 Made Ground Deposits

Made Ground deposits are not indicated on the geological maps; however, BGS borehole record SJ89NW3776, located on site, identifies made ground soils to 1.10m bgl. It is anticipated that made ground soils will be encountered beneath the entire site footprint.

2.3.2 Superficial Deposits

Superficial deposits (Glaciofluvial Sheet Deposits) are expected to consist of coarse-grained sediments (sand and gravel) with some finer-grained layers (clay and silt).

Glacial till may underlie the granular deposits or be interbedded within the formation.

2.3.3 Bedrock Deposits

The site is underlain by the Chester Formation, typically comprising conglomerates and reddish brown, cross-bedded, pebbly sandstones with subordinate beds of red-brown mudstone.

There are two faults recorded within 300m of the site. One fault is approximately 75m north trending north west and south east and one fault is trending 260m south running north west to south east.

While the site is located in a coal mining reporting area, it is not within a Development High Risk Area. The nearest recorded mine entries are approximately 2km east.

It has been confirmed from the Envirocheck report that there are no historic coal mining features (mine entries, outcrops, known workings or probable workings) are located within 2km of the site, it is unlikely that the development will be impacted by relic coal mining hazards. As such, a **Low** risk is identified to the proposed development and no further action is required.

The Phase 1 report (Ref. 1) confirms the site is situated in a lower probability radon area where <1% of homes are above the radon action level. On this basis radon protection measures are not considered necessary in the construction of new dwellings or extensions.

As the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

2.4 Hydrogeology and Hydrology

The Phase 1 Report (Ref. 1) data indicates that the geological sequence underlying the site has the following hydrogeological characteristics:

Geology	Associated Hydrogeological Classification
Made Ground deposits	N/A

Geology	Associated Hydrogeological Classification
Glaciofluvial Sheet Deposits	Secondary A Aquifer ¹
Chester Formation	Principal Aquifer ²

Notes:

- 1. Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.*
- 2. Layers of rock or drift deposits that have higher 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 aquifer.*

There are five groundwater abstraction points within 500m of the site boundary. The nearest entry is located 364m west and is operated by Her Majesty's Court Service for non-evaporative cooling for commercial/public services.

There are no potable groundwater abstractions within 750m of the site. The site is not located within a Source Protection Zone.

The nearest surface water feature is the River Irwell 255m north flowing east to west (River Quality E).

There are no active surface water abstraction points located within 1km of the site boundary.

2.5 Unexploded Ordnance (UXO) Risk Assessment

The likelihood of UXO being encountered on a development site is influenced by several factors including; the proximity to strategic targets, the nature of the development works being undertaken and evidence of local damage in the post-war periods amongst others. To determine the likelihood of UXO being present on a site, a step-wise risk assessment process is followed and was undertaken as a part of the Phase 1 Preliminary Risk Assessment report (Ref. 1). This process is outlined within CIRIA C681 Unexploded Ordnance: A Guide for the Construction Industry (Ref. 3)

Risk Mapping for UXO's (Ref. 4) has placed the site in a **Moderate** risk area. Moderate risk areas are those that show a bomb density of 11-50 bombs per 1000 acres and may contain WWII targets. Two Luftwaffe targets are located within 1km of the site; approximately 350m south and 750m north, and one post-war UXO find approximately 50m north of the site.

Analysis of historical bomb mapping from the University of Manchester (Ref. 5) shows the site was hit by a fire bomb in 1940, with the surrounding area to the east and sustaining fire bombs spanning 1940-1941 (see *Figure 2.5*). During this period, buildings were damaged (red hatching) 50m south east and 110m south west.

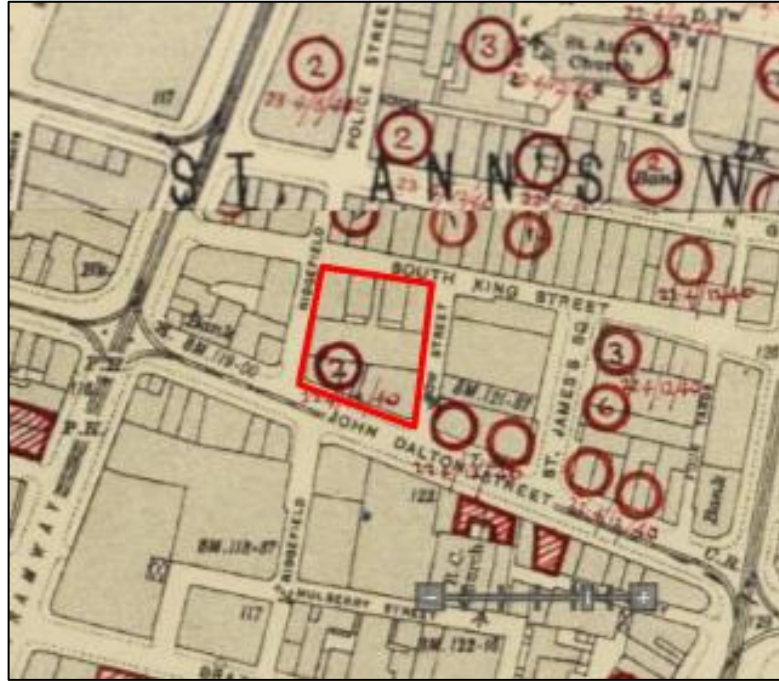


Figure 2.5: Site boundary shown in red. Fire bombs red circles, damaged building in red hatching

A review of historical mapping as a part of the Phase 1 report (Ref. 1) identified ruins on historical maps from 1948 which suggest possible bombings in the area during WWII.

Considering the above, the risk of encountering potential UXO as part of future intrusive works was considered to be **Moderate to High**. As such the procurement of a Detailed UXO Risk Assessment Report was recommended prior to any intrusive works taking place.

2.5.1 Detailed Unexploded Ordnance Risk Assessment Report

A Detailed Unexploded Ordnance (UXO) Risk Assessment report was obtained for the site in March 2021 (Ref. 6) with the findings summarised below:

- Incendiary bomb strikes were recorded on site on the 23rd December 1940. These are anticipated to have been 1kg Incendiary bombs as opposed to larger fire pots/phosphorus bombs.
- Post-WWII aerial imagery indicates that the structures on site appeared externally intact following the war. No indications of bomb damage, such as missing buildings or roofing repairs, were evident in available imagery. In addition, no damage is present on site on the Manchester Bomb and Damage map (Ref. 5, *Figure 2.5*). It is therefore assumed that the aforementioned incendiary bombing only resulted in minor damage and had a very minor effect on the condition and usage of the properties on site.

- It is anticipated that the site would have been subject to regular access during the war, given its occupation by several commercial structures and the presence of several roadways surrounding the site. In addition, WWII-era aerial imagery indicates that the structures on site were multi-storey and survived intact– any indications of bombing would likely have been obvious and therefore spotted, reported and dealt with.
- In summary, although incendiary bombs were recorded on site during the war, they do not appear to have resulted in any significant damage. 1kg incendiary bombs had very limited penetration capability and are likely to have remained on a structure's surface, where they are more likely to be observed. As such, while these incendiary bombs are noteworthy, they are not thought to increase the risk of UXO significantly in the site area.

1st Line Defence assessed the site to have a Low risk from item of German aerial delivered UXO across the site.

The following risk mitigation measures are recommended for all intrusive works:

- UXO Risk Management Plan
- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

If unexploded ordnance is discovered during any works, stop immediately, prevent access to the area, and inform the police. If the site boundary or location changes then the UXO risk should be reassessed.

2.6 Summary of Phase 1 Conceptual Site Model

Table 2.6 records initial Potential Pollutant Linkages (PPL) identified which are to be assessed further through the Phase 2 Investigation.

Table 2.6 – Potential Pollutant Linkages

Source	Pathway	Receptor	Risk Rating
On-site sources of potential contamination: Potential contamination associated with: • Made Ground of unknown composition from construction and demolition of historic buildings and backfilling of canal basins. • Potential contamination from historical industry on site including warehouses and tailors.	Direct contact, ingestion, inhalation (dust and vapours)	Site End Users (Commercial)	Moderate
	Vertical migration through the superficial deposits (soils)	Controlled Waters (Groundwater – Principal Aquifer in bedrock, no SPZ, no potable abstraction points within 750m)	Moderate / Low
	Horizontal migration over and through the superficial deposits (soils)	Controlled Waters (Surface Waters – River Irwell, 250m north, no potable abstraction points within 1km)	Very Low

Source	Pathway	Receptor	Risk Rating
Off-site sources of potential contamination: Potential contamination associated with the construction of commercial properties off site, including chimneys and back-filled canal.			
On and off-site soils with the potential to generate ground gases: Potential ground gas generation from Made Ground or superficial deposits containing organic/putrescible content.	Vertical and horizontal migration through underlying superficial deposits into buildings and air spaces	Site End Users (Commercial – BS8485)	Moderate / Low

Potential contaminants of concern associated with any Made Ground present include, amongst others; broad range aliphatic and aromatic hydrocarbons present within any fuel oils; inorganic compounds including heavy metals; and asbestos present in discarded building materials.

The qualitative risk assessment determined the above risks associated with the proposed development of the site warrant further investigation.

It was recommended that a ground investigation is conducted to both confirm this assessment and provide data in support of the structural and civil engineering design. The scope of the investigation undertaken in detailed in *Section 3.0*.

3.0 Ground Investigation Scope of Works

The shallow site investigation works were undertaken by Curtins between the 22nd to 25th April 2021.

The deeper site investigation works were undertaken by Ian Farmer Associates (IFA) between 11th to 20th August 2021.

The scope of the ground investigation was designed in general accordance with current UK guidance including:

- LCRM (Ref. 7);
- British Standard (BS) 10175:2011+A2:2017 (Ref. 8);
- BS5930:2015+2020 (Ref. 9);
- and BS EN1997: Part 2:2007 Eurocode 7 (Ref. 10).

The scope and rationale are summarised in *Table 3.0*.

Table 3.0 – Scope and Rationale of Fieldwork Undertaken

Investigation Reference	Exploratory Hole Type	Exploratory Hole Ref.	Ground level (m AOD)	Exploratory Hole Depth (m bgl)	Rationale
Stage I	Window Sample Boreholes	BH01 BH02 BH03	34.35 34.35 33.81	3.91 3.80 3.71	Confirm shallow ground conditions Collect soil samples for chemical analysis; Collect samples for geotechnical soil testing; and Gas and perched groundwater level monitoring
	Hand Excavated Trial Pits	BH04	33.07	1.21	
		TP01 TP02 TP03	34.35 33.81 33.07	1.14 0.70 1.90	Determine the foundations of the three existing buildings
Stage II	Dynamic Sampling with Rotary Cored Follow On Boreholes	BH101 BH102 BH103*	36.80 36.31 36.08	20.50 20.45 1.60	Confirm shallow and deeper ground conditions Collect rock core samples for geotechnical testing.
	Machine Excavated Trial Trench	TP101	36.45	1.40	Identify alignment of electricity cables entering site existing ramp to basement car park on Bow Street

* It was not possible to undertake a borehole in this location. A Hand excavated pit was progressed to 1.60m bgl.

Window Sample borehole BH04 was advanced as a hand pit only, as access restraints down a spiral staircase meant the drilling rig could not access this basement area.

Rotary boreholes were undertaken by Ian Farmer Associates in the surrounding highways due to access limitations on site prior to building demolition under license agreements with Manchester City Council. It was not possible to undertake rotary borehole BH103 west of the site due to presence of numerous underground

services beneath the road including a sewer with no accessible inspection chamber for tracing. A hand pit was instead advanced to 1.60m bgl.

Exploratory hole levels have been estimated from an available survey drawing of the basements and the area immediately adjacent to the site, which can be referred to in *Appendix A*. For The location of the exploratory holes refer to the exploratory hole location drawings ref: 070298-CUR-XX-DR-GE-80001-P02 included in *Appendix A*.

3.1 Soil and Rock Logging and Sampling

Exploratory hole arisings were logged onsite by a qualified Engineer from Curtins and in accordance with the requirements of BS5930 (Ref. 9). Rock cores were logged by a qualified Engineer from Ian Farmer Associates in accordance with the requirements of BS5930 (Ref. 9).

Observed visual and olfactory indications of contamination were recorded and are detailed in the logs and also within *Section 5.7*.

Exploratory hole logs can be referred to *Appendix B*.

3.2 Monitoring Well Installations

Ground gas and perched groundwater monitoring 50mm diameter pipes was installed within the four window sample boreholes. A 50mm diameter pipe monitoring installation wells was also installed in BH101. A 19mm diameter piezometer pipe was installed in BH102.

A bentonite seal was placed at the top and bottom of each of the exploratory holes, surrounding the screened sections of the pipe. A gravel surround was installed in the annulus between the sides of the borehole and the slotted sections of the pipe. A piezometer tip was placed at the base of the 19mm piezo (BH102) with sand surround.

The monitoring wells were designed to assess the potential for ground gas and monitor groundwater levels in all exploratory holes. The screened sections therefore focused on the more permeable deposits where encountered when possible, where ground gas and groundwater may be encountered. Monitoring wells within the rotary boreholes were installed to target groundwater strikes, where recorded in the exploratory hole logs.

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

Table 3.2 – Monitoring Well Response Zones

Borehole Ref.	Ground level (m AOD)	Response Zone m bgl (m AOD)	Strata Description(s)
BH01	34.35	1.00 – 3.50 (33.35 – 31.85)	GRAVEL (Glaciofluvial Sheet Deposits)

Borehole Ref.	Ground level (m AOD)	Response Zone m bgl (m AOD)	Strata Description(s)
BH02	34.35	1.00 – 3.00 (33.35 – 31.35)	GRAVEL (Glaciofluvial Sheet Deposits)
BH03	33.81	1.00 – 3.00 (32.81 – 30.81)	SAND and GRAVEL (Glaciofluvial Sheet Deposits)
BH04	33.07	0.50 – 1.00 (32.57 – 32.07)	GRAVEL (Glaciofluvial Sheet Deposits)
BH101	36.80	6.00 – 12.00 (30.80–24.80)	SANDSTONE (Chester Formation)
BH102	36.31	Piezo Tip 19.20 – 19.50 (17.11 – 16.81)	SANDSTONE (Chester Formation)

A copy of the borehole logs can be referred to in *Appendix B* of this report.

3.3 Post-Investigation Monitoring

3.3.1 Groundwater and Ground Gas Monitoring

In total, six monitoring visits have been undertaken by Curtins in BH01 to BH04 to assess the groundwater levels and the ground gas conditions between 8th April and 23rd June 2021.

The results of the groundwater level monitoring are detailed in *Section 5.8*.

Four monitoring visits are to be undertaken by Ian Farmer Associates in BH101 and BH102 to further assess the deeper groundwater levels. Results are yet to be received.

4.0 Laboratory Testing

4.1 Geo-environmental Analysis

Representative soil samples were selected for laboratory chemical analysis, based on field observations and to provide information about the encountered ground conditions.

Selected Made Ground and superficial soil samples for chemical testing 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 Envirolab (UKAS and MCERTS accredited) and for geotechnical analysis was Ian Farmer Associates (UKAS accredited).

Given the lack of any obvious sources of potential contamination the sampling positions were generally located in a non-targeted, systematic array, beneath the proposed building and where access could be obtained within the existing basements. The exploratory holes were positioned to give adequate and representative coverage of the sites proposed end use and the immediate environmental setting, concentrated in the near surface deposits.

4.1.1 Soil Analysis

The source material of contaminants of concern potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g. fuel/oils), polyaromatic hydrocarbons (PAHs), heavy metals, and asbestos.

The extent of the above is captured by the broad environmental testing suites listed in *Table 4.1.1*.

Table 4.1.1 – Environmental Chemistry Analysis Suite: Soils

Suite Ref.	Analyte	LOD
Soils Suite A	Asbestos Screen,	-
	pH Value,	0.01 pH
	2;1 Water Soluble Sulphate	0.01 g/l
	Soil Organic Matter (SOM)	0.1% w/w
	Arsenic, Chromium, Chromium VI, Copper, Lead, Nickel, Selenium	1 mg/kg
	Zinc	5 mg/kg
	Boron (water soluble)	1 mg/kg
	Cadmium	0.5 mg/kg
	Mercury	0.17 mg/kg

Suite Ref.	Analyte	LOD
	Cyanide (total)	1 mg/kg
	Phenols (screen)	0.2 mg/kg
	PAHs (USEPA 16)	0.01 to 0.08 mg/kg
	TPH (Aro/Alk Split)	0.01 to 1 mg/kg

A total of six soil samples were obtained and tested for Suite A, including one Made Ground sample and four in the natural sand and gravel superficial deposits.

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

4.2 Geotechnical Testing

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref. 11). Rock samples for testing were prepared and tested in accordance with ISRM Suggested Methods for Rock Characterisation (Ref. 12). The undertaken geotechnical testing is summarised in *Table 4.2*.

Table 4.2 – Geotechnical Testing

Test Type		Quantity	Standard
In Situ Testing			
Standard Penetration Testing		12	BS 5930: 2015, Clause 41
Laboratory Testing (General Testing Soils - Foundation Design) Stage I			
Moisture Content		5	BS1377 1990, Part 2
Water Soluble Sulphate		11	ISO 17025 MCERTS
pH Value		11	ISO 17025 MCERTS
Particle Size Distribution Wet Sieve		2	BS1377 1990, Part 2 (clause 9.2)
Laboratory Testing (General Testing Rock - Foundation Design) Stage II			
Sulphate (water sol 2:1)		4	ISO 17025 MCERTS
pH		4	ISO 17025 MCERTS
Unconfined Compressive Strength (UCS)		13	ISRM
Point Load Indices ($Is_{(50)}$)	Axial Plane	21	ISRM
	Diametral Plane	19	

The results of the geotechnical testing are summarised in *Section 6.0* of this report.

Copies of the geotechnical testing certificates can be referred to in *Appendix D*.

5.0 Ground Conditions

The ground conditions across the site, determined during the Curtins Stage I ground investigation works generally comprised the concrete floor slabs over minimal Made Ground / reworked natural soils, underlain by natural superficial granular deposits. Possible bedrock was encountered in three of the window sample boreholes. Intact brickwork was encountered underlying the concrete ground floor slabs in two exploratory holes.

Outside of the building footprint greater thicknesses of made ground were encountered, accounting for ground level elevations of the highways in which the boreholes were undertaken, underlain by natural superficial granular soils, and bedrock from depths of 6.00m and 7.30m in BH101 and BH102 respectively.

5.1 Encountered Ground Conditions

A summary of the ground conditions encountered during the site investigation works is presented below, with detailed information presented on the exploratory hole logs included in *Appendix B*.

A summary of the geotechnical test results recorded within the superficial deposits are presented in *Section 6.0*. Full details of the geotechnical results can be found in *Appendix D*.

Table 5.1 – Summary of Ground Conditions Encountered

Stratum	Depth to top of strata, m bgl (m AOD)	Thickness (m) ³		Description
		Min	Max	
Made Ground (Beneath proposed footprint)	0.00 (33.07 – 34.35)	0.19	1.30	Concrete/Reinforced Concrete Intact brick work Grey/brown very sandy angular to subrounded fine to coarse gravel of mixed lithology and brick.
Made Ground (Outside of proposed building footprint-adjacent highways)	0.00 (36.80 – 36.31)	1.60	2.00	Tarmacadam overlying concrete or granite slabs. Three concrete slabs encountered in TP1001 (0.0-0.49m). Black, dark brown or greyish brown gravelly clayey fine to coarse sand with varying proportions of minor constituents. Gravels include brick, concrete, tarmacadam, ash, clinker, slate sandstone, mudstone and coal. Historic road cobbles in BH101 (1.15 – 1.40m bgl).
Granular Superficial (Beneath proposed footprint)	0.19 – 1.30 (32.88 – 33.05)	1.02 ¹	3.46	Very dense orange/brown very sandy subrounded fine to medium GRAVEL and very gravelly medium and coarse SAND with occasional cobbles. Very dense red/brown very gravelly fine to medium SAND. Gravel is subrounded fine to coarse of mixed lithology.
Granular Superficial (Outside of proposed footprint)	1.60 - 2.00 (34.80 – 34.31)	4.00	5.00	

Stratum	Depth to top of strata, m bgl (m AOD)	Thickness (m) ³		Description
		Min	Max	
proposed building footprint- adjacent highways)				Very stiff brown CLAY.
Chester Formation (Beneath proposed footprint)	3.70 – 3.90 (30.11 – 30.95)	13.45 ¹	14.50 ¹	Extremely weak becoming very weak and weak reddish brown fine to coarse grained SANDSTONE.
Chester Formation (Outside of proposed building footprint)	6.00 – 7.00 (30.80 – 29.31)			

¹ Thickness not proven during this investigation

5.2 Made Ground

5.2.1 Beneath Proposed Footprint

Made ground was encountered in all exploratory holes and was encountered ground levels to depths between 0.19m to 1.30m bgl (32.88m and 33.05m AOD). The initial layer encountered was intact concrete with reinforcements within intrusive location BH01. This overlain by intact brickwork within locations BH01 (0.21 to 0.90m) and BH02 (0.60 to 0.80m). Beneath this made ground soils were generally recorded as granular soils, with anthropogenic materials. These materials frequently include concrete and brick. Noted obstructions are summarised in Section 5.8.

5.2.2 Outside of Proposed Footprint – Adjacent Highways

Made ground was encountered in all exploratory holes undertaken in surrounding highways (BH101 to BH103). A surface cover of tarmacadam (0.5 – 0.10m thickness) overlays a concrete sub-base or granite cobbles, to depths of between 0.26 and 0.27m bgl.

Three concrete slabs were encountered in TP1001 from ground level to 0.49m bgl with made ground below as well as a brick wall in part of the trench, identified to 1.40m bgl.

Underlying soils typically comprise layers of black, dark brown or greyish brown sand and gravel, with varying proportions of clay, silt, sand and gravel. Anthropogenic materials include brick, concrete, tarmacadam, ash, clinker, slate, wood sandstone, mudstone and coal.

A layer of cobbles, likely associated with a historic road, were encountered between 1.15m and 1.40m bgl in BH101.

5.3 Superficial Deposits

The superficial deposits recorded within the boreholes were generally as anticipated from published geological data. The Glaciofluvial Sheet Deposits, which is described by the BGS as a mixture of sand and gravel, locally with lenses of silt, clay organic material, were encountered in all exploratory holes. The glaciofluvial sheet deposits were encountered beneath made ground to elevations of between 30.80m to 29.31m AOD.

5.3.1 Glaciofluvial Sheet Deposits

Within BH01, BH02, BH04, BH101 and BH102 the initial layer encountered generally comprised a very dense orange/brown very sandy subrounded fine to medium gravel of very gravelly sand with occasional cobbles present. The gravel component comprised mixed lithologies. BH101 and BH102 identify the lithologies as sandstone, mudstone, quartzite and flint.

A layer of very dense red/brown very gravelly fine to medium sand was encountered within BH03 between 32.21m AOD and 30.11m AOD. The gravel component comprised subrounded fine to coarse mixed lithologies.

Within BH01, a cohesive unit, of thickness 0.10m, was encountered at the base of the superficial deposits at a depth of 3.80m bgl (30.55m AOD) the unit was described as a very stiff brown CLAY. The unit was only encountered within BH01 and the thickness of the unit was proven (0.10m).

5.4 Bedrock Deposits

The Chester Formation bedrock was encountered in most of the exploratory hole locations.

The bedrock was encountered between elevations of 30.95m and 29.31m AOD.

The bedrock geology comprises extremely weak becoming weak fine to coarse grained sandstone. The strength of the rock, determined from field descriptions generally increases with depth.

Where extremely weak, as recorded in BH101 from 30.80m to 30.60m AOD, rock is described as destructured, weather sandstone recovered as gravelly sand, with traces of organic material recorded in BH101. Furthermore, fractures are commonly infilled with sandy clay in BH101 between 29.01m and 23.96m AOD.

Generally, BH101 records two main discontinuity types, described as:

1. 0-10 degrees, closely spaced planar, rough, clean with occasional clay infill.
2. Rare 80-90 degrees, planar or undulating rough and clean.

Fractures angled between 50-60 degrees and 0-30 degrees were also recorded, with clay infill.

BH102 records

1. 0-8 degrees, very closely spaced, undulating, rough with sandy clay infill.

Fractures become:

2. 0-11 degrees, very closely spaced to closely spaced, unundulating, rough, open with rare sand and clay infill
3. 11 – 24 degrees, widely spaced, tight, clean.

Full detailed descriptions and a photographic core record can be referred to in the exploratory logs in *Appendix B*.

5.5 Observed Potential Contamination

No visual or olfactory indications of contaminations were recorded in any of the exploratory boreholes on site.

Possible asbestos containing material was identified by IFA in TP101 on Bow Street within made ground material between 0.49-1.40m bgl.

5.6 Obstructions Encountered

The following buried obstructions were encountered during the intrusive investigation works, Table 5.6. Hardstanding surfaces where encountered are not included in the table below.

Table 5.6 – Obstructions encountered during the Site Works

Exploratory Hole	Depth m bgl	Notes	Location on Site
BH04	1.20	Refusal no progress	Northwestern corner
BH101	0.10 - 0.27m	Granite cobbles- broken out	Bow Street South east of site (off-site)
BH101	1.15 - 1.40	Cobbles (possible former road) – broken out	Bow Street South east of site (off-site)
BH102	0.05 - 0.26m	Concrete slab- broken out	Bow Street North east of site (off-site)
BH103	0.05 - 0.26	Concrete slab- broken out	Ridgefield, West of site (off-site)
TP101	0.20 - 0.40	Concrete slabs- broken out	Bow Street South east of site (off-site)
TP101	0.49 - 1.40	Brick wall	Bow Street South east of site (off-site)

5.7 Groundwater

No groundwater was encountered during the course of the ground investigation works.

No groundwater strikes were recorded in the rotary boreholes however the use of water flush during progression of the borehole is likely to mask any strikes.

Four rounds of groundwater monitoring have been undertaken between 8th April 2021 and 17th June 2021, the results of which are presented in *Table 5.7*.

Table 5.7 – Groundwater Monitoring Results

Borehole Ref.	Installation Strata	Response Zone m bgl (m AOD)	Depth, m bgl (mAOD)					
			08/04/21	23/04/21	04/06/21	11/06/21	17/06/21	23/06/21
BH01	Granular (Glaciofluvial Sheet Deposit)	1.00 – 3.50 (33.35 – 31.85)	Dry	Dry	3.06	3.41	Dry	Dry
BH02	Granular (Glaciofluvial Sheet Deposit)	1.00 – 3.00 (33.35 – 31.35)	Dry	Dry	Dry	Dry	Dry	Dry
BH03	Granular (Glaciofluvial Sheet Deposit)	1.00 – 3.00 (32.81 – 30.81)	Dry	- ¹	- ¹	- ¹	- ¹	- ¹
BH04	Granular (Glaciofluvial Sheet Deposit)	0.50 – 1.00 (32.57 – 32.07)	Dry	- ¹	- ¹	Dry	Dry	Dry

¹ – Unable to access / open borehole

Four monitoring visits are to be undertaken by Ian Farmer Associates in BH101 and BH102 to further assess the deeper groundwater levels. Results are yet to be received.

The results of groundwater level monitoring undertaken to date indicate that, generally, the granular glaciofluvial sheet deposits are dry. Localised seepages were recorded in BH01, possibly indicating the presence of perched water. It is likely that the groundwater table will be encountered within the underlying Chester Formation, however groundwater level monitoring results in the sandstone remain outstanding. Assessment of the monitoring results will be undertaken upon receipt from IFA. Further discussion of the implications of the groundwater levels beneath the site is included in Section 10.

5.8 Trial Trench for Existing Utility Tracing

A hand excavated trench (TP101) was undertaken to identify the location of buried utilities, specifically electricity cables entering the site from Bow Street at the existing ramp to the basement car park. The trench was excavated in front of the roller shutter door, parallel to Bow Street. A gas pipe was identified at 0.40m bgl on the north of the trench and presumed electricity cables encased in bricks in the centre of the trench at 0.87m bgl. The cables were not investigated further for health and safety reasons. Appropriate health and safety documentation was in place during the progression of the excavation.

IFA's logs, cross section and plan drawings illustrate the exact location with measurements from existing site features together with a photographic record. These records are included in Appendix B.

6.0 Ground Model

6.1 Made Ground

Made Ground was encountered in exploratory holes to depths of 0.19m to 1.30m bgl.

The geotechnical test results recorded within the Made Ground are summarised in *Table 6.1*.

Table 6.1 – Summary of geotechnical test results –Made Ground

Parameter	No. of tests	Results
pH	1	pH: 8.43
Water Soluble Sulphate (mg/l)	1	SO ₄ : 10

6.2 Glaciofluvial Sheet Deposits

Glaciofluvial Sheet Deposits was encountered in all exploratory holes to depths of 3.70m to 3.90m bgl

The geotechnical test results recorded within the Reworked Ground are summarised in *Table 6.2*.

Table 6.2 – Summary of geotechnical test results – Glaciofluvial Sheet Deposits.

Parameter	No. of tests	Results
SPT 'N' Value	15	Min: 16 Max: 66 Average: 45
pH	9	Min: 4.94 Max: 9.69 Average: 7.20
Water Soluble Sulphate (mg/l)	9	Min: 10 Max: 170 Average: 63
Moisture Content	4	Min: 8.1 Max: 10.9 Average: 9.5
Particle Size Distribution	2	See <i>Appendix D</i> for details – BH01 and BH03.

Fifteen SPT 'N' values were recorded in the granular strata, ranging between 16 and 66 and correlating, generally, with the field descriptions which detail the strata as being in a dense and very dense state of compaction. An average SPT 'N' Values of 45 was determined.

Superficial soils beneath the road to the east of the site recorded 'N' values of 16 at 2.80m, indicating medium dense soils becoming very dense with depth.

The greatest was recorded at 2.00m bgl in BH03. The SPT N results are presented on *Figure 6.2.a*.

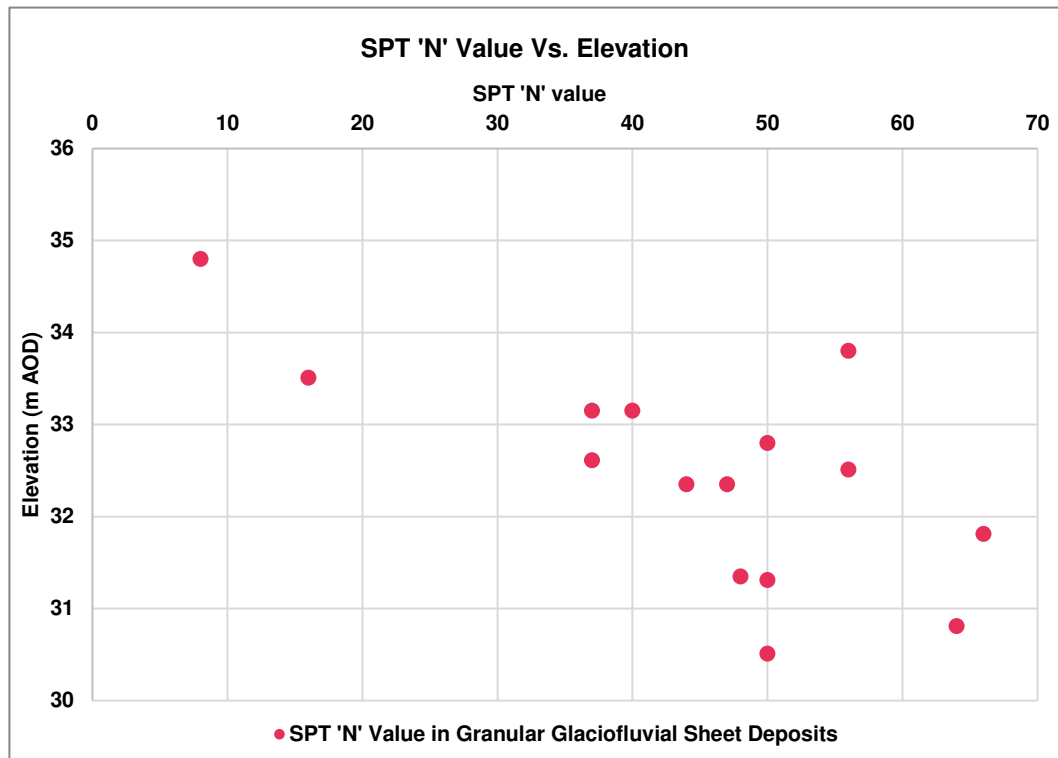


Figure 6.2a – Summary of SPT 'N' Values within Glaciofluvial Sheet Deposits

The PSD results carried out in the laboratory are generally consistent with the recorded findings during the investigation. Variability is shown the material with near 50/50 weight percentages of gravel and sand detailed.

A moderately conservative unit weight of 18-22 kN/m³ is deemed suitable for the very dense granular soils above water and a unit weight of 20-24 kN/m³ is deemed suitable for deposits below groundwater, from a review of published values (Ref. 13).

The Angle of Internal Friction ϕ' for the granular Glaciofluvial Sheet Deposits can be derived from a review of the relationships with SPT N values (Ref. 14 & 15) and published values, ranged between 37-43 present on Figure 6.2b.

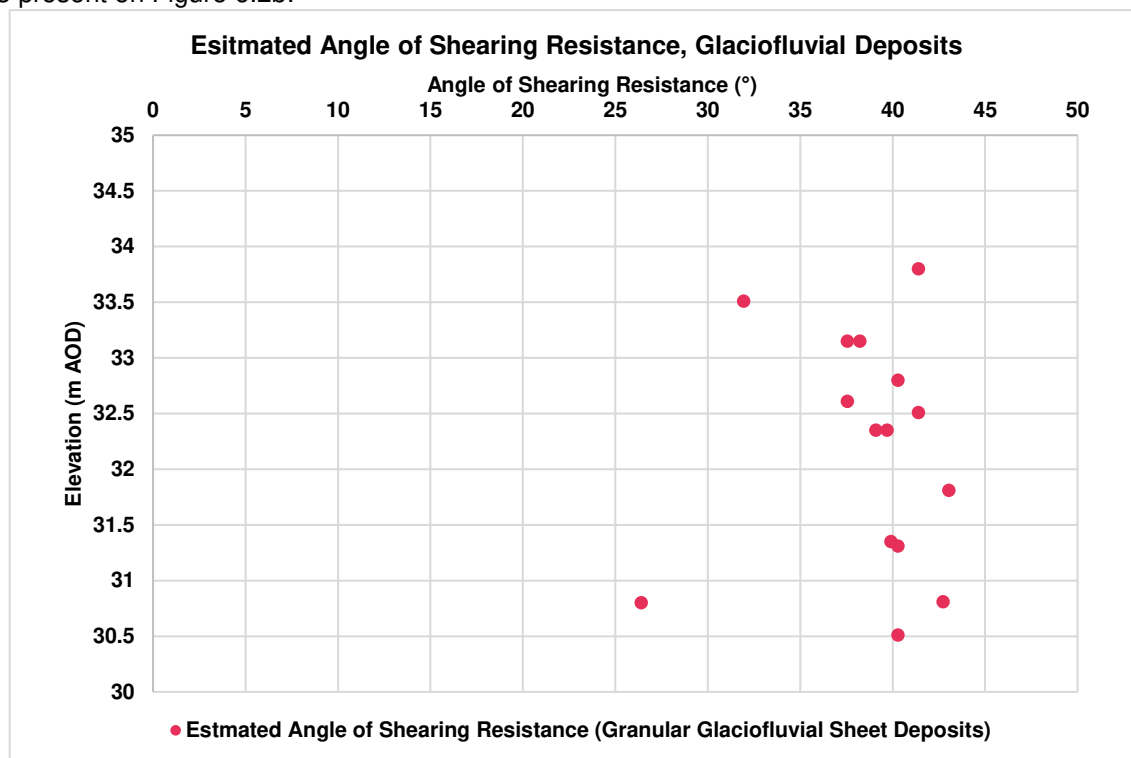


Figure 6.2b – Angle of Shearing Resistance Values Vs. Elevation

The Drained Young's Modulus, E' , can be derived for granular material from the relationship with SPT N values (Ref. 15), as presented in Equation 5.

$$E' = (\text{SPT } N / 2) + 7.5 \quad \text{Equation 1}$$

Where:

E' is the Drained Young's Modulus

SPT N is Characteristic Standard Penetration Test Result

It should be noted that care should be taken in using linear stiffness values derived from relationships as they do not necessarily reflect the non-linear nature of soil stiffness. The actual stiffness will be strain dependent and non-linear and thus should be considered in detailed design of sensitive structures.

The estimated drained Young's Modulus, E' , for granular Glaciofluvial Sheet deposits from correlation with SPT N values (Ref. 15) are presented on Figure 6.2c

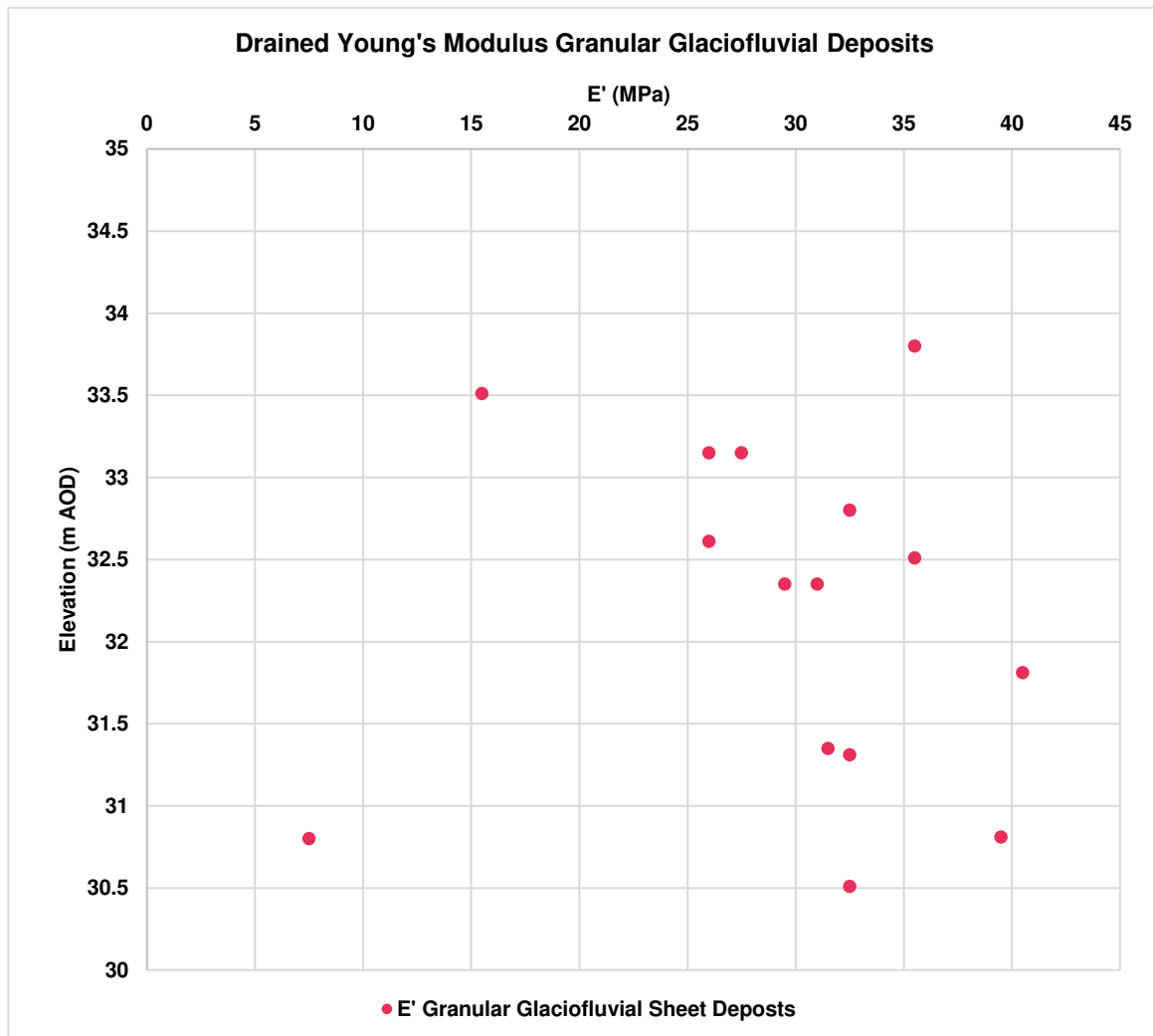


Figure 6.2c – Summary of Drained Young's Modulus in Glaciofluvial Deposit

6.3 Bedrock Deposits

The top of the Chester Formation was encountered in exploratory holes BH01, BH02 and BH03, as detailed in *Section 5.4*, in addition to progression through the rock in BH101 and BH102.

Total core recovery (TCR) at the top of the Chester Formation was poor, though gradually increases with depth. Initially solid core recovery (SCR) was poor, reflecting the lower values of TCR, however from elevations <28.3m AOD values ranged between 74% and 100%. The rock quality designation recorded in the sandstone cored samples was very poor to poor rock mass quality at elevations >28.3m AOD, improving to generally poor rock mass quality between 28.3m to 22.0m AOD, and generally good rock mass quality from 22.0m to 17.0m AOD.

The Rock Quality Parameters are presented in *Figure 6.4a* and *Figure 6.4b*.

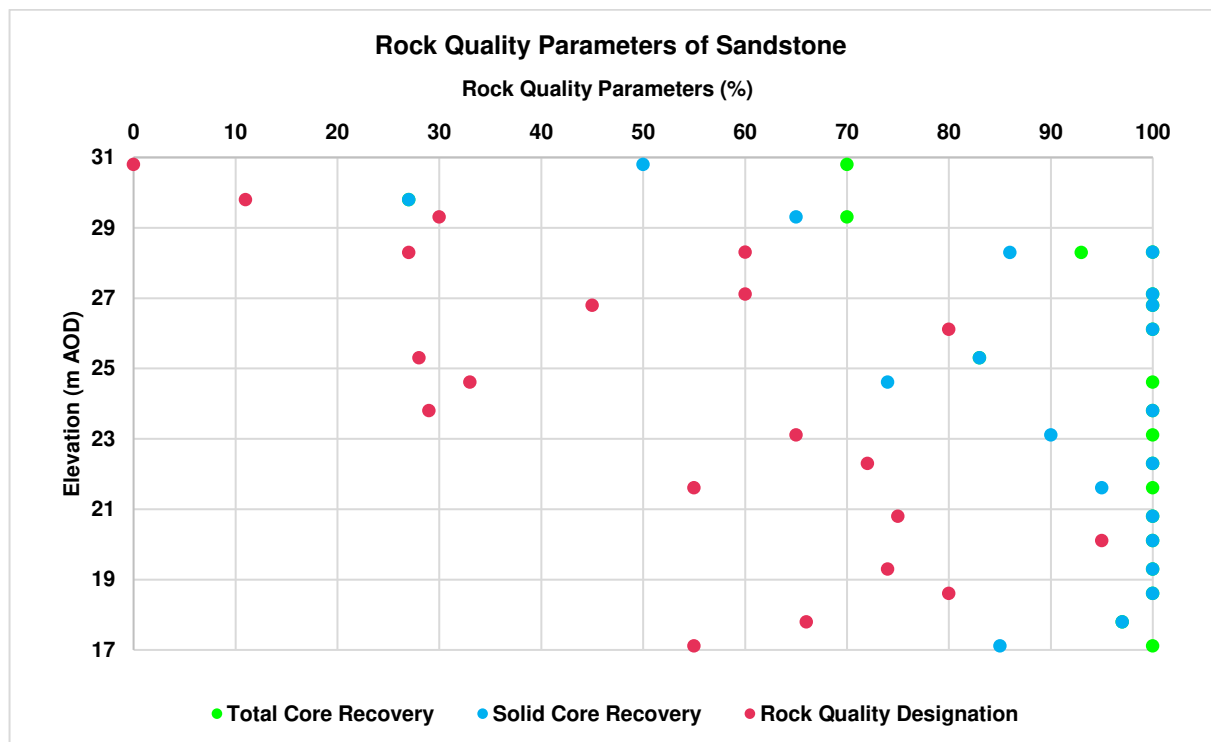


Figure 6.3a – Summary of Rock Quality Parameters vs. Elevation for Sandstone

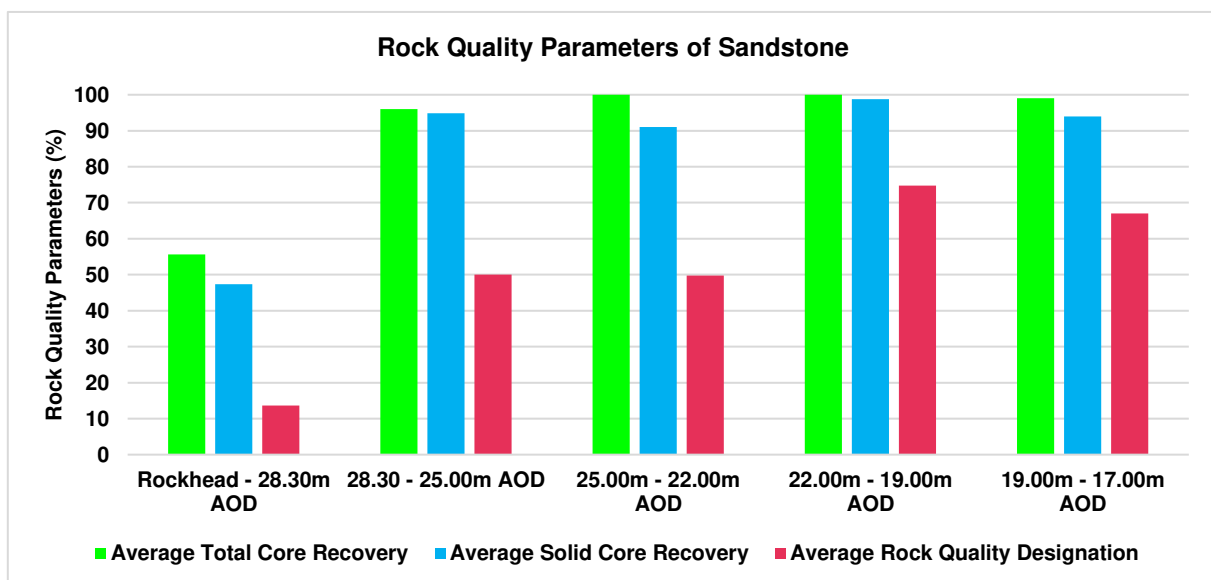


Figure 6.3b – Summary of Rock Quality Parameters vs. Elevation for Sandstone

Table 6.3 summarises the geotechnical testing, both in-situ and laboratory testing, undertaken on the sandstone of the Chester Formation.

Table 6.3 – Summary of Geotechnical Testing (Bedrock)

In-Situ Test			
Parameter		No. of Tests	Summary of Results
SPT 'N' Value		5	>50
pH		5	Min: 6.17 Max: 9.37 Average: 8.28
Water Soluble Sulphate (mg/l)		5	Min: 10 Max: 30 Average: 14
Laboratory Tests			
Uniaxial Compressive Strength (MPa)		13	Min: 9.7 Max: 23 Average: 15.9
Point Load Indices ($Is_{(50)}$) (MPa)	Axial Plane	21	Min: 1.0 Max: 11.6 Average: 6.4
	Diametral Plane	19	Min: 0.6 Max: 5.8 Average: 3.6

Table 6.3a summarises the geotechnical tests undertaken on the bedrock deposits.

The five SPT N values undertaken within the bedrock recorded SPT N >50. One was undertaken in weathered bedrock, in BH101 from 6.00m to 6.20m bgl (30.80m to 30.60m AOD), described as very gravelly, fine and medium sand. Gravel is subangular to subrounded, fine and medium including quartzite and basalt, with traces of organic material present.

Overall, 40 No Point Load Tests (PLTs) were undertaken on solid sandstone (unweathered), including 21 No. on the axial plane and 19 No. on the diametral plane.

An approximation of the unconfined compression strength (UCS) of the rock may be derived from the following relationship, described in *Equation 2*:

$$UCS = PLT Is_{(50)} \times f_1 \quad \text{Equation 2 (Tomlinson)}$$

Where f_1 is derived from the correlation between PLT $Is_{(50)}$ and UCS Results

In consideration of the correlation between $Is_{(50)}$ and UCS values reported from laboratory testing and of published literature (Tomlinson et al), a factor of 24 has been considered suitable.

Based on this relationship, estimated UCS values for sandstone range between 1.20 MPa and 13.92 MPa for axial tests and 0.72 MPa and 6.96 MPa for diametral tests, indicating notable variability in the rock strength of the samples tested. Notwithstanding, the tests generally indicate extremely weak to weak rock, consistent with the field descriptions.

Direct UCS test results ranged between 9.7 MPa and 23 MPa, generally increasing with depth. Test termination reasons were generally recorded as either single shear or multiple shear.

The recorded UCS values are typically greater than the estimated values derived from PLT results. This is considered to be due to the inherently stronger nature of rock core samples used for UCS of better rock mass quality, as opposed to smaller samples used for PLTs. At this stage, a conservative assessment of characteristic rock strength of Chester Formation sandstone has been undertaken, summarised in *Figure 6.3c*.

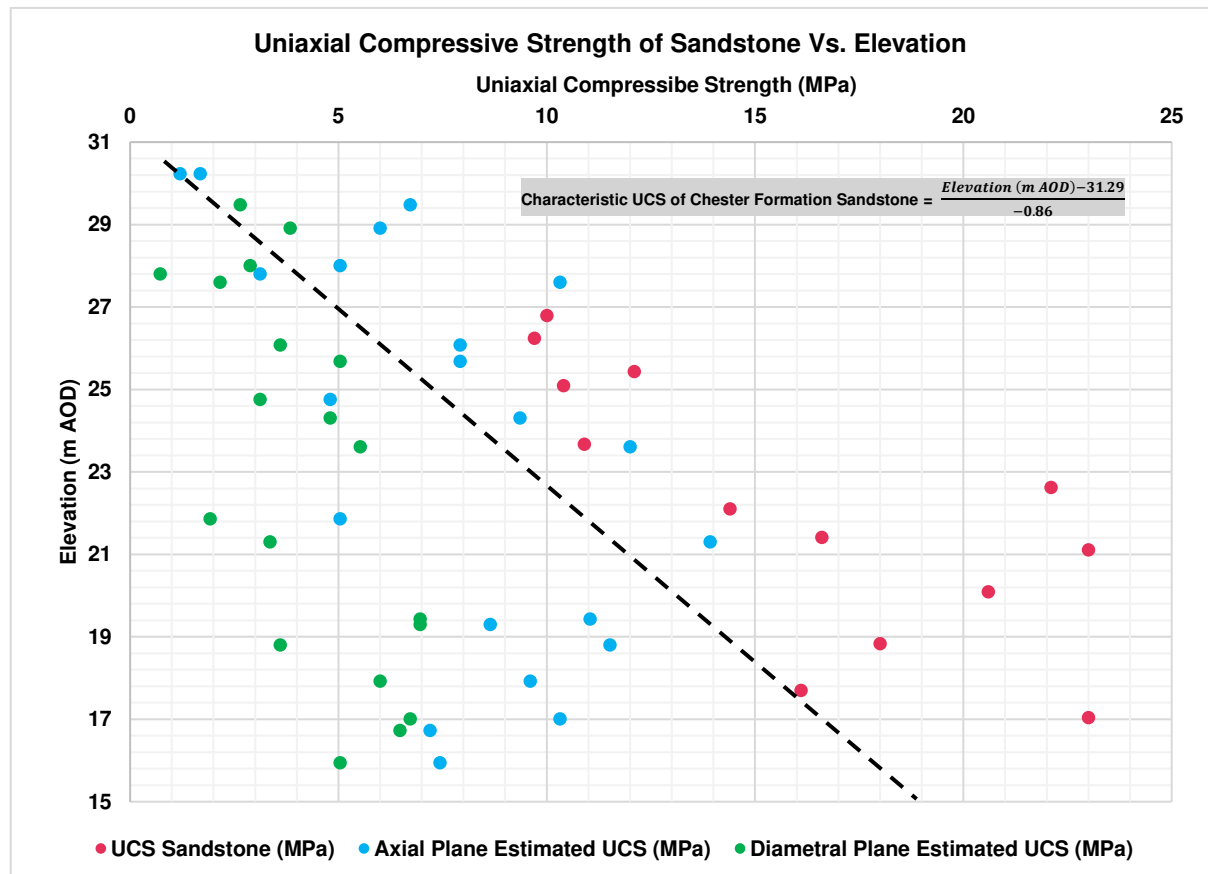


Figure 6.3c – Summary of Rock Strength Geotechnical Testing Results – Chester Formation

6.4 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, 3rd edition of 2005 (Ref. 16). A summary of the results obtained as a part of the ground investigation are summarised in *Table 6.4a* and *Table 6.4b*.

Table 6.4a – Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Test Type	Range
Made Ground	pH	8.43
	Water Soluble Sulphate (mg/l)	10
	pH	4.94 – 9.69

Stratum	Test Type	Range
Glaciofluvial Sheet Deposits	Water Soluble Sulphate (mg/l)	10 - 170
Chester Formation	pH	6.17 - 9.37
	Water Soluble Sulphate (mg/l)	<10-30

Table 6.4b – Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Made Ground	DS-1	AC-1
Glaciofluvial Sheet Deposits	DS-1	AC-3z
Chester Formation	DS-1	AC-1

(1) ACEC assessment was based on the *mobile* groundwater condition in a *brownfield* scheme area

The preliminary design of buried concrete according to Table C2 of BRE Special Digest 1:2005 should be in accordance with Class DS-1 (AC-1) conditions for the Made Ground, DS-1 (AC-3z) for Glaciofluvial deposits and DS-1 (AC-1) for the Chester Formation, assuming mobile groundwater.

7.0 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. 17).

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 Desk Study 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 9.0* of this report.

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

7.1 Human Health

The soil results will be screened against the 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. SGV's 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. 18) 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.

7.1.1 Adopted Soil Human Health GACs Screening Methodology

Current development proposals indicate the construction of a 10-storey plus basement office building, with a flexible ground floor and basement uses (Class E). The screening of soil results has been compared against GACs of conservative 'Commercial' end-use scenario. Assessment has therefore 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 soils ranged from 0.2% to 3.0%. The greatest organic matter concentrations were recorded in samples of natural soils.

With consideration for a calculated geometric average for both made ground and natural features determined a SOM of 1.08%. As such, a comparison against Tier 1 thresholds for a SOM of 1.0% for commercial end use has been adopted for both made ground and natural features.

The adopted GAC can be referred to in *Appendix F*.

7.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

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

With respect to the Commercial end-use thresholds, no exceedances of contamination GACs were recorded in any of the soil samples tested.

All soil samples were screened for asbestos. No suspected asbestos containing materials (ACMs) were identified within any of the exploratory hole logs or during laboratory screening.

7.2 Waste Classification

An initial assessment of the soil soils with respect to waste classification and disposal off site has been made separately and is referred to within Curtins' *Interim Letter Report for Shallow Ground Investigation*', ref. 072098-CUR-00-XX-RP-GE-002-V01 dated 4th June 2021.

8.0 Ground Gas Assessment

The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (Ref. 18), BSI Publication code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2019 (Ref. 19) and other broadly accepted references such as the Ground Gas Handbook 2009 (Ref. 20).

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) (Ref. 1) and thereafter validating this conceptual model with the ground gas data, the semi-quantitative risk assessment.

8.1 Ground 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 (four) of the window sample boreholes as detailed in *Section 3.2*.

An initial programme of six gas monitoring visits over three months was proposed and has been completed. The six gas monitoring visits have been undertaken between 8th April 2021 and 23rd June 2021, with barometric pressure recorded between 1007 mb to 1020 mb. Falling barometric pressure was recorded on the first (08/04) and second (23/04) visits, steady barometric pressure was recorded on the third (04/06), fifth (17/06) and sixth (23/06) visits and rising barometric pressure was recorded on the fourth (11/06) visit.

The results log sheets are contained within *Appendix E* and summarised in *Table 8.1*

Table 8.1 – Summary of Ground Gas Monitoring Results

Exploratory Hole ID	Maximum Methane Concentration (%)	Maximum Carbon Dioxide Concentration (%)	Minimum Steady Oxygen Concentration (%)	Maximum Peak Gas Flow (l/hr)	Maximum Steady State Gas Flow (l/hr)
BH01	<0.1	<0.1 (All Visits)	21.1	<0.1	<0.1
BH02	<0.1	0.1 (Visits 3-6)	21.0	<0.1	<0.1
BH03	<0.1	0.1 (Visit 1)	20.9	<0.1	<0.1
BH04	<0.1	<0.1 (All Visits)	21.4	<0.1	<0.1

As detailed in *Table 5.7* and the monitoring results sheets contained within *Appendix E*, during the monitoring period, no boreholes were flooded during any of the monitoring visits. Therefore, the monitoring results from all boreholes and all monitoring visits have been used for the ground risk assessment.

Methane (CH₄), Hydrogen Sulphide (H₂S) and Carbon Monoxide (CO) were not recorded in monitoring wells on any monitoring visit. Gas flow rates was not recorded above the instrument detection limit (0.1l/hr) within any of the monitoring wells.

Maximum carbon dioxide (CO₂) concentrations were recorded at a maximum concentration of 0.1% v/v (BH02 and BH03).

The results log sheets are contained within *Appendix E*.

8.2 Ground Gas Assessment

The Conceptual Site Model presented in *Section 2.8* highlighted potential Made Ground as a potential source of ground gas generation both on-site and off-site resulting from historical development and land use.

Noxious and asphyxiate gases were attributed to include, but not limited to, carbon dioxide, carbon monoxide, methane and hydrogen sulphide.

The ground investigation revealed a ground model generally consistent with the preliminary conceptual site model. Ground conditions pertaining to the development site comprise thin layers of made ground including intact concrete and brick and motor overlying granular made ground deposits. This underlain by glaciofluvial deposits which generally comprised granular deposits, this was followed by bedrock deposits of the Chester Formation which comprised of red sandstone.

In accordance with BS8485:2015+A1:2019 (Ref. 20), consideration of the recorded soil gas flow rates, presented below, enables hazardous gas flow rates (Q_{hg}) to be evaluated. Q_{hg} can be derived for both 'borehole' and 'worst case' scenarios and a comparison made in support of an appropriate assessment of ground gas risk. For a 'borehole' scenario (highest hazardous gas flow rate identified a single borehole) steady state flow rates and maximum gas concentrations are adopted, whilst for a 'worst case' scenario (highest Q_{hg} across the entire dataset irrespective of location and discrete monitoring events) peak flows and gas concentrations are adopted.

The dataset obtained is considered to be representative of site conditions beneath the proposed development footprint. A range of data has been collated which captures significant temporal variation including barometric variability and various ground saturation states. As such, the gas risk assessment will utilise steady state flow rates and peak gas concentrations when determining the maximum Q_{hg} .

Evaluation of the 'borehole' scenario (highest hazardous gas flow rate that is realistically possible, i.e. in a single borehole) records a maximum Q_{hg} of 0.0001l/hr for carbon dioxide where maximum steady state reading of 0.1 l/hr (accounting for the limit of detection of the monitoring instrument), and maximum gas concentrations of 0.1% v/v.

Evaluation of the 'borehole' scenario for methane records a maximum calculated Q_{hg} of 0.0001 l/hr utilising the <0.1% v/v concentration recorded during all the monitoring visits.

Given the steady state air flow rate recorded in all monitoring wells throughout the Curtins monitoring period was <0.1 l/hr, the Q_{hg} determined by the 'worst case' scenario records the same gas flow rate for carbon dioxide and methane.

The borehole Q_{hg} calculated from the available dataset therefore indicates a CS1 classification on site. No gas protection measures are required for the proposed development.

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.

9.0 Revised Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented *Section 2.7* 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 (Ref. 22) which is summarised within *Appendix G*.

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 2.5*.

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 (Ref. 23) 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 7.0* and presented within *Appendix C*.

Phase 2 Ground Investigation

Qualitative Risk Assessment

Generic Quantitative Risk Assessment

Detailed 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 very low 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.
- In the absence of specific site data, a Generic Quantitative Risk Assessment is invariably recommended.

Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
Limited potential sources of contamination identified. Made Ground soils across the site were recorded to contain anthropogenic material such as brick and concrete,	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation (indoor & outdoor air)	Site end users	Medium Human Health Risk	Unlikely	Low	No exceedances identified in any of the soil samples tested above 'Commercial' GAC. No suspected asbestos containing materials (ACMs) were identified within any of the exploratory hole logs or laboratory screening.	No further action required
		Construction and maintenance workers					
	Soil dust ingestion/inhalation produced during construction	Adjacent residents					
	Vertical and horizontal migration of soluble phase contamination through groundwater.	Controlled Waters (Surface Water) Nearest surface water feature is River Irwell located 255m north	Mild	Unlikely	Very Low	No gross contamination identified during ground investigation or subsequent monitoring to raise risk level identified in Phase 1 Preliminary Risk Assessment.	No further action required.
	Vertical and horizontal migration of soluble phase contamination through superficial deposits and bedrock.	Controlled Waters (Groundwater) Secondary A Aquifer (Superficial) Principal Aquifer (Bedrock)	Medium	Unlikely	Low	No gross contamination identified during ground investigation or subsequent monitoring to raise risk level identified in Phase 1 Preliminary Risk Assessment. Not within a Source Protection Zone (SPZ).	
Potential ground gas generation from Made Ground containing organic/putrescible content on site and off site.	Ground gas & vapour migration and inhalation. Vertical and horizontal migration through existing service corridors and the underlying superficial deposits.	Site End Users	Medium Human Health Risk	Unlikely	Low	Using the 'borehole Q_{hg} representative' scenario, due to a full data set within varying pressures, the calculated Q_{hg} for the site was 0.0001l/hr l/hr for carbon dioxide, with no notably elevated CO₂ recorded. For methane, the maximum calculated Q_{hg} is 0.0001 l/hr utilising the <0.1% v/v concentration as methane was not recorded above the limit of detect across the site Characteristic Gas Situation is assessed as CS1 no gas protection measures are required in accordance with BS8485..	No further action required.

9.1 Summary of Significant Pollutant Linkages

A **Low** risk rating is identified to site end-users and constructions workers, from soils and dust from inhalation and ingestion for the proposed multi-storey office.

A **Low** and **Very Low** risk rating is identified to controlled waters (Groundwater and Surface Waters) following the ground investigation, where no major sources of contamination were identified.

A **Low** risk rating is identified to site end users from ground gases arising from site soils, migrating into buildings and subsequent inhalation. This corresponds to a Characteristic Gas Situation assessed as CS1, therefore no gas protection measures are required.

As the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

10.0 Geotechnical Assessment and Recommendations

10.1 Introduction

This section will discuss the ground and groundwater conditions encountered across the site and assess their associated risk for the proposed scope of works. Development proposals for the site are understood to broadly comprise a 10-storey office building including basement.

At the time of writing no loading information or founding level have been provided. Any changes beyond the point of issue of this report, will therefore require further assessments.

10.2 Ground Model

The existing basement level is recorded at elevations of between 34.45m and 33.03m AOD, the shallowest floor level recorded in the south and deepest floor level in the north.

The ground conditions beneath the basement were relatively consistent, comprising a thin surface covering of concrete followed by granular made ground deposits (up to 1.30m in thickness), underlain by granular Glaciofluvial Sheet deposits, underlain by bedrock deposits of the Chester Formation. No groundwater strikes were recorded at the time of the ground investigation, perched water was encountered within a monitoring well at 3.41m bgl within the glaciofluvial deposits during one monitoring visit.

Bedrock of the Chester Formation was encountered at depths between 3.70m and 3.90m (30.95m and 30.11m AOD) below existing basement level, with rockhead identified at 30.80m and 29.31m AOD east of the site. Boreholes reached a maximum depth of 20.50m bgl (16.30m AOD) in BH101 and 20.45m bgl (15.86m AOD) in BH102.

10.3 Geotechnical Considerations

Presence of existing services

The presence of existing services, including the gas pipe and electricity cable identified in Trial Pit TP101, may require capping and/or diversion associated with the development, which should be managed through the appropriate utility suppliers during the construction phase. The Principal Contractor should ensure that appropriate mitigation measures are put in place during the construction phase (i.e. during excavation of foundations).

Obstructions and relict foundations

The site is underlain by an existing basement foundation. Three hand excavated foundation trial pits were undertaken in the basement, with sketches presented in *Appendix B*. Based on the findings of the hand pits, it is likely that pad foundations were previously adopted.

Detailed design of the foundations over the existing basement will be required following determination of the final development layout, at which time a specialist demolition contractor should be consulted. Where demolition works are to be undertaken of the existing structure, it should be ensured that all obstructions within influencing depth of the proposed development are removed as required. Existing foundations should be removed to avoid forming hard spots and backfilled in accordance with an engineering specification to avoid soft spots.

Consideration should be given, in liaison with the Principal Contractor, to re-use of former foundations/concrete obstructions via crushing, appropriate testing (environmental and geotechnical), screening and re-use on site as capping or fill to structures in accordance with Series 600 of the Specification for Highways Works (SHW) to reduce export/import costs.

Variable Made Ground

Made Ground was encountered in all of the exploratory hole locations from ground level to depths of between 0.19m and 1.30m below the existing basement level, and 1.60m to 2.00m below surface level adjacent to the site. The Made Ground should not be considered as a suitable founding stratum.

Earthworks

When considering earthworks and potential for re-use materials should be tested to show that they are chemically and geotechnically suitable for re-use at their proposed locations and to ensure that there are no unacceptable risks to identified receptors, which should be outlined in a site-specific earthworks specification and strategy.

Any arisings and cut levels will predominantly comprise the Made Ground, glacio-fluvial soils and sandstone bedrock which are likely to generally classify in accordance with the Specification for Highways Works (SHW) Series 600 as Class 1 materials, subject to specific classification testing and environmental suitability.

As an increased performance of materials placed below structures will be required over and above those defined for a general fill, soils that are to be used below structures would be reclassified and replaced to an appropriate Class (6N or 6P) as defined in the Specification for Highway Works (Highways Agency 2014). The formation strata shall be proof rolled and inspected for any soft/loose materials. Any soft/loose materials should be replaced with Engineered Fill or granular capping materials.

10.4 Foundation Options

Raft Foundation

It is understood that a raft foundation is the preferred option for the new basement. Current design proposals indicate construction of the raft basement floor level at a level of appropriately 31.00 to

31.50m AOD within the Glaciofluvial deposits some c. 0.55m to 2.19m above the top of the Chester Formation.

The glacio-fluvial soils at 31.50m AOD were found to be generally within a dense and very dense state of compaction. The underlying weathered top of the Chester Formation (encountered at depths of between 30.80m and 29.31m AOD) was recorded initially to comprise very weak to extremely weak heavily fractured rock of very poor to poor rock mass quality. On the basis of these results the glacio-fluvial soils is currently seen as being suitable for the construction of a raft foundation with an allowable bearing capacity of approximately 250 kPa (Look, 2007 & J. Bowles, 2001) at 31.5m AOD increasing to 400 kPa at 27m AOD within the unweathered sandstone.

The depth to competent granular strata and potential presence of any soft cohesive deposits would need to be considered in the design of the raft foundations. Should softer deposits be encountered at formation layer upon excavation, it is recommended to over-excavate until competent granular material is encountered (complimented by in-situ strength testing) and fill to formation level with competent granular fill material (6N or 6P) to ensure a consistent granular foundation stratum; foundations should not be formed or spread across mixed bedrock and granular soils. Bearing resistances and foundation settlement will be subject to detailed design and in-situ testing (notably plate testing) following demolition of the existing building.

The allowable bearing pressures above are based on the following assumptions:

- A further detailed raft analysis will need to be undertaken by the design team with input from a qualified geotechnical engineer, including settlement analysis, serviceability limit state analysis and ultimate limit state analysis following receipt of the post demolition testing as described above.
- The foundation formation will be inspected by a qualified engineer prior to construction of the foundations.
- The results of the updated groundwater monitoring are reviewed in the context of the excavation for the raft (see Section 10.5 below)
- All obstructions relating to the previous basement on site will be removed prior to construction of the raft foundation.

Piled Foundations, Socketed Within the Chester Formation

In the event that the options above do not provide suitable bearing capacities for the proposed structures, and over-deepening to c.27m AOD is not financially viable, piled foundations may be adopted, socketed in the Chester Formation.

The carrying capacity of piles depends not only on their size and the ground conditions, but also on their method of installation. Pile design and installations are a continuously evolving process and state of the art methods are often employed before they reach public domain, perhaps several years down the line.

If adopted, it is important that the piling contractor has experience piling in similar ground conditions and it is advised that early engagement with the suitably qualified and experienced piling contractor is considered.

10.5 Excavation and Support

Observation during the intrusive works indicates no groundwater strikes or perched water was encountered during the ground investigation works. Within the monitoring wells installed groundwater was recorded within the glaciofluvial sheet deposits at depths ranged between 3.06m and 3.41m bgl or 31.29m and 30.94m AOD, within BH01. Additional groundwater monitoring in BH101 and BH102 is ongoing and these results will be included in an updated report once available.

It is noted that the groundwater readings recorded are above the proposed FFL's of the proposed raft foundation and therefore (subject to the receipt of the updated groundwater results) groundwater management techniques are likely to be required for both the demolition works and construction of the new basement. The chosen contractor should provide details on how they intend to ensure the safety and stability of the excavations on site.

All retaining structures should be designed by a competent structural engineer with soil parameters used in the design as defined by a competent geotechnical engineer. Assessments should take into account both ground movement and settlement. It should be ensured that the stability of the surrounding buildings are not compromised during retaining wall construction.

10.6 Ground Floor Slabs

Proposals indicate the construction of a single storey basement. The basement floor slab may be constructed through a raft foundation formed on the bedrock encountered as outlined in Section 10.2. Columns supporting the ground floor slab are also anticipated to also bear at this level.

10.7 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest 1 (Ref. 14) and laboratory testing undertaken accordingly in *Section 6.4*. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as Class DS-1 (AC-1) conditions for the Made Ground, DS-1 (AC-3z) for Glaciofluvial deposits and DS-1 (AC-1) for the Chester Formation, assuming mobile groundwater.

11.0 Conclusions & Recommendations

11.1 Conclusions

11.1.1 Ground and Groundwater Contamination

The environmental chemistry soil results have been compared with the Generic Assessment Criteria (GAC) for soils with respect to human health against '*Commercial*' thresholds.

With respect to the proposed Commercial end-use no exceedances of contamination GAC's were recorded in any of the soil samples tested. The risk to site end users is therefore considered to be **Low**.

A **Low** risk rating is identified to adjacent residents and construction workers, from soils during inhalation and ingestion of soil or dust, assuming appropriate PPE and sanitary facilities are utilised during all groundworks and construction works.

A **Low** and **Very Low** risk rating is identified to controlled waters (Groundwater and Surface Waters) following the ground investigation, where no major sources of contamination were identified.

A **Low** risk rating is identified to site end users from ground gases arising from site soils, migrating into buildings. This corresponds to a Characteristic Gas Situation assessed as CS1, therefore no gas protection measures are required.

As the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

11.2 Recommendations

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

- 1) A full detailed raft analysis should be undertaken by the design team following demolition of the existing structures, frozen design layouts and receipt of further in-situ test results (notably plate testing) following demolition of the existing building. This analysis should be carried out with input from a qualified geotechnical engineer, including settlement analysis, serviceability limit state analysis and ultimate limit state analysis.
- 2) 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 C.

- 3) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.
- 4) As the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

It is recommended that this report is updated following additional groundwater monitoring and post-demolition investigation works.

Should building layout, proposed building loads or building design change subsequent to issue of this report, the findings should be reviewed. Additional ground investigation may be required to confirm ground suitability for updated proposals.

12.0 References

1. Curtins (2021) *Phase 1 Preliminary Risk Assessment, Land bound by John Dalton St, Ridgefield, Bow St and South King St, Manchester*, Ref. 070298-CUR-00-XX-RP-GE-001-V03.
2. British Geological Survey (BGS) 1:50,000 (Solid and Drift Edition, Sheet No. 085, 2010) for Manchester.
3. CIRA (2009) Unexploded ordnance (UXO) A guide for the construction industry (C681).
4. Zetica UXO Risk Maps. [Online] <https://zeticauxo.com/downloads-and-resources/risk-maps/>
5. Bomb and Damage Maps. [Online] https://luna.manchester.ac.uk/luna/servlet/detail/maps002~1~1~342596~123256?sort=reference_number%2Ctitle&qvq=q:bomb%20damage;sort:reference_number%2Ctitle;lc:maps002~1~1&mi=12&trs=49.
6. 1st Line Defence (2021) Detailed Unexploded Ordnance Report, Ref. DA13011-00.
7. Environmental Agency (2020) Land Contamination Risk Management (LCRM)
8. British Standards Institution (2011) Investigation of Potentially Contaminated Sites: Code of Practice (report no. BS10175:2011+A2:2017).
9. British Standards Institution BSI (2015+2000) Code of Practice for Site Investigations (report no. BS5930).
10. British Standards Institution (2006) Eurocode 7: Geotechnical Design (report no. BSEN1997).
11. British Standard (2016) Methods of test for soils for civil engineering purposes. General requirements and sample preparation (report no. BS1377-1).
12. International Society for Rock Mechanics (2007-2014) The ISRM Suggested Methods for Rock Characterization, Testing and Monitoring. British Standard Institution BSI (2020) Code of Practice for Foundations (report no. BS8004).
13. Tomlinson, M. J. (2001) Foundation Design and Construction.
14. ICE (2012) Manual of Geotechnical Engineering.
15. Building Research Establishment (2005) Concrete in Aggressive Ground (Special Digest 1).
16. British Standards Institution (2013) Guidance on Investigations for Ground Gas, Permanent Gas and Volatile Organic Compounds (VOCs) (Report No. BS8576:2013).
17. Department of Environment Food and Rural Affairs (DEFRA). (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).
18. CIRIA (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings (report no. C665).
19. British Standards Institution (2015) 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).
20. S Wilson, G Card, S Haines (2009) Ground Gas Handbook Cathness, Scotland, Whittles Publishing.
21. CIRIA (2001) Contaminated Land Risk Assessment. A guide to good practice (report no. C552).
22. CITB (2015) Construction (Design and Management) Regulations.
23. J Look (2007) Handbook of Geotechnical Investigation and Design Tables

24. Bowles, J. 2001. Foundation Analysis and Design Fifth Edition

Appendix A – Drawings

- Curtins (2021) *Exploratory Hole Location Plan, The Island Site*, Ref. 070298-CUR-00-XX-DR-GE-80001-P01.
- Curtins (2021) *Additional Ground Investigation Work, Proposed Exploratory Hole Locations*, Ref. 070298-CUR-00-XX-DR-GE-80002-P01.
- Survey & Engineering Projects (2020) *Basement Floor Plan at: The Island, John Dalton Street, Manchester, M2 6FW*, Ref. S20327-BM-01
- Survey & Engineering Projects (2020) *Topographical Survey of Land at: The Island, John Dalton Street, Manchester, M2 6FW*, Ref. S20327-BM-01
- Curtins (2021) *The Island Site, Building Sections Sheet 1, Stage 3 Tender*, Ref. 070298-CUR-00-ZZ-DR-S-21100-P02
- Curtins (2021) *The Island Site, Building Sections Sheet 2, Stage 3 Tender*, Ref. 070298-CUR-00-ZZ-DR-S-21101-P02
- Curtins (2021) *The Island Site, Basement General Arrangement, Stage 3 Tender*, Ref. 070928-CUR-00-B1-DR-S-20090-P02



PROPOSED SITE INVESTIGATION

-  BOREHOLE LOCATIONS
-  HAND EXCAVATED FOUNDATION PITS
-  INSTALLATION LOCATIONS

Rev:	Description:	Date:	By:	Chkd:
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Status:	INFORMATION
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Project:	THE ISLAND SITE
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Drg Title:	EXPLORATORY HOLE LOCATION PLAN
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Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	04/06.2021	PN	RA

Drg No:	Rev:
070298-CUR-00-XX-DR-GE-80001	P01



Key:



Rotary Boreholes: Dynamic Sampling With SPTs to Rockhead Followed by Rotary Coring to 20m bgl.
* Installations Targeting Groundwater Strikes



Trial Trench to expose the alignment of services entering site.

Notes:

Exploratory hole locations subject to accessibility and known underground service locations.



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Civils & Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Principal Designer
Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kental • Leeds • Liverpool • London • Manchester • Nottingham

Project: The Island Site

Status:

DRAFT

Drg Title:
Additional Ground Investigation
Work, Proposed Exploratory Hole
Locations

Drawn By: NF

Checked By: SH

Designed By: NF

Date: 09/08/21

Scale: NTS

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

070298-CUR-00-XX-DR-GE-80002-V01

GENERAL NOTES:

Rev:	Description:	Date:	By:
--			

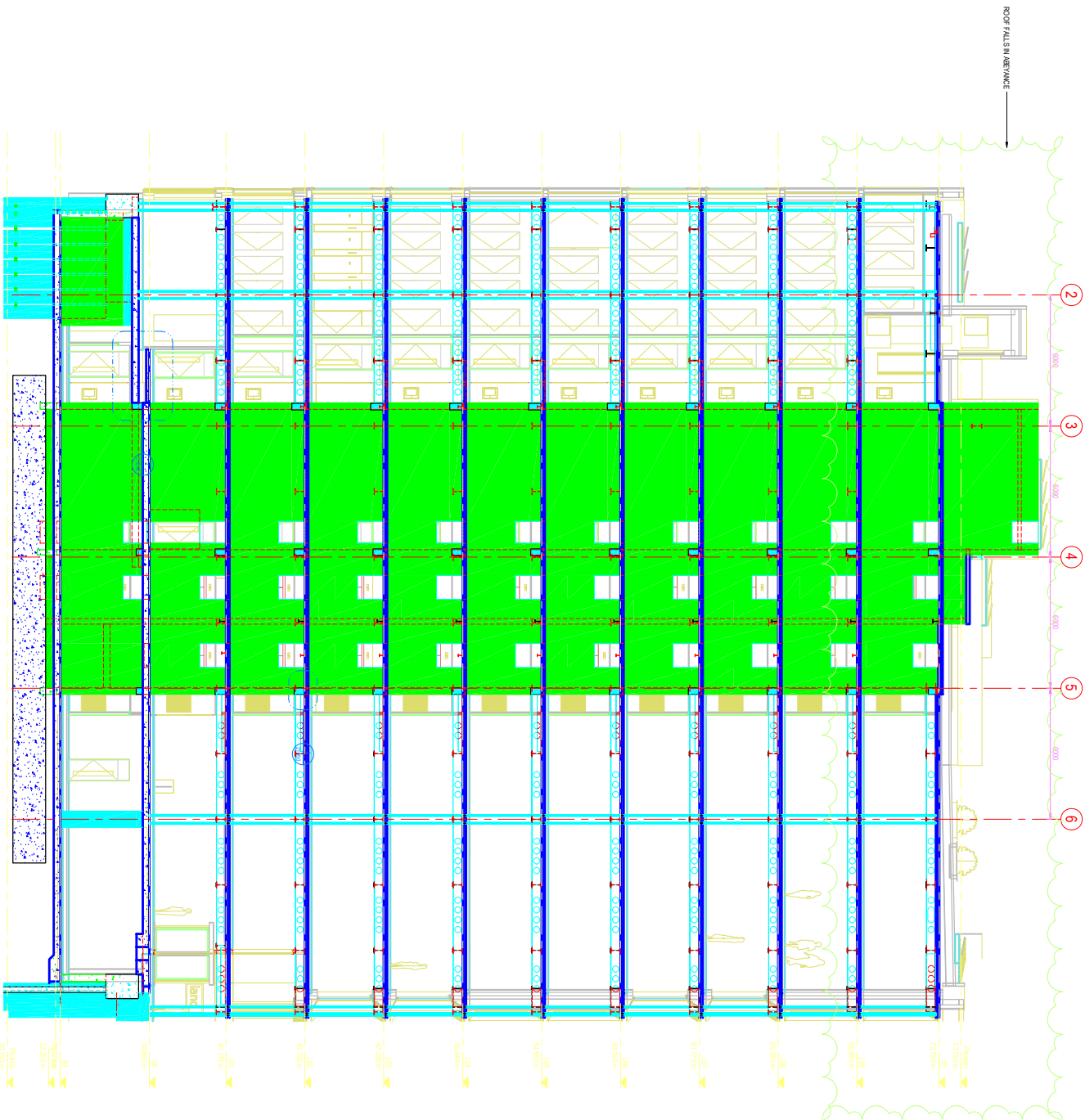
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS' DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE THIS DRAWING. ANY ABSOLUTE DIMENSIONS AND TOLERANCES SHOWN SHALL BE PRIOR TO THE ENGINEER'S ATTENTION AND DRAWING. ALL DIMENSIONS SHALL BE CHECKED / VERIFIED ON THE DRAWING.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
4. FOR GENERAL NOTES REFER TO DRAWING NUMBER 04-22-2005-RS-0001.
5. DRAWINGS TO BE READ IN CONJUNCTION WITH CIVIL AND STRUCTURAL DESIGN SPECIFICATIONS. REF: 02-28-2005-0004-RS-0001



Courins

STAGE 3 TENDER

Dong Tia



ROOF FALLS IN REVERSE

SECTION 2-2
SCALE 1:100

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE THIS DRAWING. ANY DIMENSIONS, DIMENSIONS AND PROPORTIONS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
3. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
4. FOR GENERAL NOTES REFER TO DRAWING 070298-CUR-22-00-00-S-0001.
5. DRAWINGS TO BE READ IN CONJUNCTION WITH C.A. AND STRUCTURAL DESIGN PHILOSOPHY REF 070298-CUR-XX-XX-S-0001.



070298-CUR-22-00-00-S-0001

070298-CUR-22-00-00-S-0001

STAGE 3 TENDER

ISLAND SITE

BUILDING SECTIONS SHEET 2

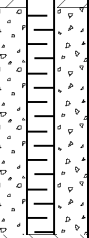
Rev	Rev	Rev	Rev	Rev
Rev	Rev	Rev	Rev	Rev
Rev	Rev	Rev	Rev	Rev

070298-CUR-22-00-00-S-21001-P02

Appendix B – Exploratory Hole Logs

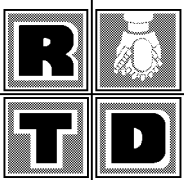
- Window Sample Borehole Logs, BH01 to BH04
- Hand Excavated Foundation Inspection Pit Logs and Sketches, TP01 to TP03
- Dynamic Sample and Rotary Cored Borehole Logs BH101 to BH103
- Machine Excavated Trial Pit Log TP101

ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543					Site The Island Site, Manchester (Bow Street)			Job No. 08/21	
					Client Curtins			Borehole BH1 Page 1 of 1	
					Date 23/03/21		O.D. Level		

Day	Water Level	Casing Depth	Strata Depth	Description of Strata	Leg-end	Inst.	Reduced Level	Sample		'N' Value
								Type	Depth	
			G.L. 0.05 0.21	CONCRETE Screed MADE GROUND (0.05) Reinforced CONCRETE with 13mm re-bar/mesh at 0.1 and 0.2m bgl MADE GROUND (0.16) Intact brickwork with mortar joints, cored, MADE GROUND (0.69)						
			0.90	Very dense orange/brown very sandy (f-c) fine to medium, subrounded GRAVEL/cobbles (2.90)				ES	1.00 - 1.20	
								D	1.30 - 1.40	37
								C	1.00 - 1.45	
								ES	1.60 - 1.80	
								N	2.00 - 2.45	44
								B	2.00 - 3.00	
								C	3.00 - 3.45	48
								D	3.70 - 3.80	Ref
			3.80 3.90 3.91	Very stiff brown CLAY (0.10) Red SANDSTONE, Bedrock? (0.01) Base of Borehole				C	3.90	

Symbols U - undisturbed sample J - jar sample B - bulk sample W - water sample N - Standard Penetration Test Δ - Water entry ▲ - Water level									
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Ground Water Entry	Estimated Rate of Entry	Observation Time (mins)	Water Level Rising to	Depth of Casing at Entry	Depth of Casing to Seal	Date	Standing Water Level	Condition of Borehole Cased / Open
DRY								

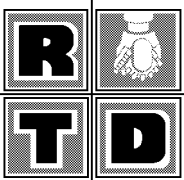
Remarks c/cored, clear services De-mob from carpark/basement - 2.0Hrs	
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ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543					Site The Island Site, Manchester (Bow Street)			Job No. 08/21	
					Client Curtins			Borehole BH2 Page 1 of 1	
					Date 22/03/21 - 23/03/21		O.D. Level		

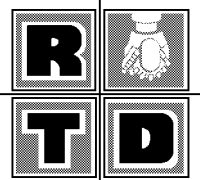
Day	Water Level	Casing Depth	Strata Depth	Description of Strata	Leg-end	Inst.	Reduced Level	Sample Type	Sample Depth	'N' Value		
			G.L. 0.05	CONCRETE Screed MADE GROUND (0.05)								
			0.45 0.60	CONCRETE with brick aggregate MADE GROUND (0.40)								
			0.80	Dense GRAVEL/cobbles of brick/concrete MADE GROUND (0.15)								
			1.30	Brickwork/concrete intact, MADE GROUND (cored) (0.20)								
				Very dense grey/brown very sandy(f-c) fine to coarse GRAVEL of mixed lithology and brick MADE GROUND (0.50)				ES C	1.20 - 1.50 1.00 - 1.45	40		
				Very dense red/brown very sandy(f-m) fine to medium, subangular to subrounded GRAVEL of mixed lithology, occasional COBBLES (2.45)								
										C	2.00 - 2.45	47
										C	3.00 - 3.45	Ref
			3.75 3.80	Red SANDSTONE, poss bedrock? (0.05)				C	3.80	Ref		
				Base of Borehole								

Symbols U - undisturbed sample J - jar sample B - bulk sample W - water sample N - Standard Penetration Test ∇ - Water entry ▲ - Water level									
---	--	--	--	--	--	--	--	--	--

Ground Water Entry	Estimated Rate of Entry	Observation Time (mins)	Water Level Rising to	Depth of Casing at Entry	Depth of Casing to Seal	Date	Standing Water Level	Condition of Borehole Cased / Open
DRY								

Remarks C/c location, clear services	
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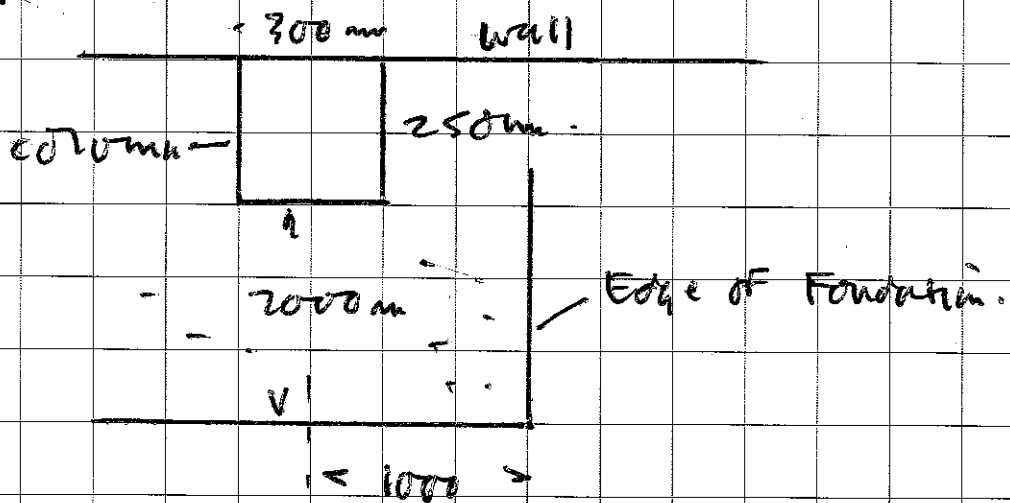
ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543					Site The Island Site, Manchester (Bow Street)			Job No. 08/21		
					Client Curtins			Borehole BH3 Page 1 of 1		
					Date 22/03/21		O.D. Level			
Day	Water Level	Casing Depth	Strata Depth	Description of Strata	Leg-end	Inst.	Reduced Level	Sample Type	Sample Depth	'N' Value
			G.L. 0.24	Timber flooring over CONCRETE, over plastic terram MADE GROUND (0.24)						
				Very dense red/brown very gravelly fine to medium SAND. Gravel is fine to coarse, subrounded of mixed lithology (1.36)				ES	0.50	
								D	1.00	
								C	1.00 - 1.45	37
			1.60	Very dense very sandy(fine to medium) fine to coarse, subrounded GRAVEL of mixed lithology, very slow progress (2.10)				N	2.00 - 2.45	66
								B	2.50 - 3.70	
								N	3.00 - 3.45	64
			3.70 3.71	Refusal/no progress, possible SANDSTONE/Bedrock? (0.01) Base of Borehole				C	3.90	Ref
Symbols U - undisturbed sample J - jar sample B - bulk sample W - water sample N - Standard Penetration Test ∇ - Water entry ▲ - Water level										
Ground Water Entry	Estimated Rate of Entry	Observation Time (mins)	Water Level Rising to	Depth of Casing at Entry	Depth of Casing to Seal	Date	Standing Water Level	Condition of Borehole Cased / Open		
DRY										
Remarks Mob/set up remote drilling system to BH location Demob remote drilling system, install BH SPT Blows Recorded - C1.0 - 1.45m = 8/9/9/8/10/10, C2.0 - 2.45m = 4/11/15/16/16/16, N3.0 - 3.45 = 10/11/22/20/11/11, C3.7 = 50/No progress										



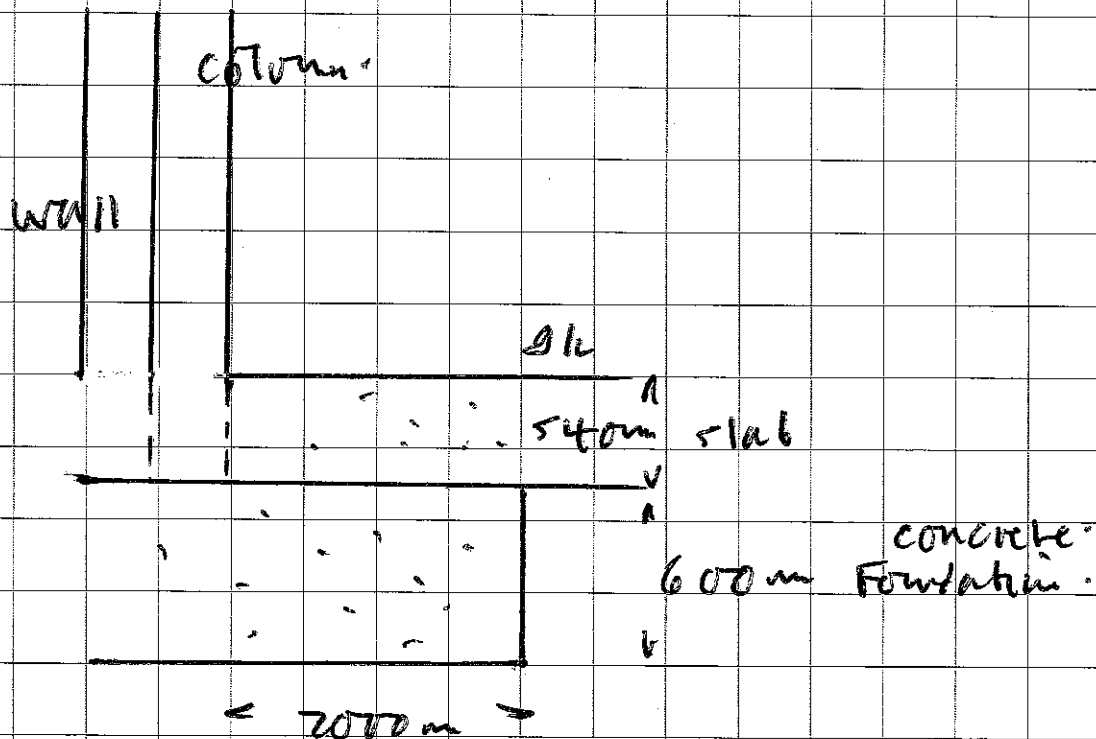
ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543					Site The Island Site, Manchester (Bow Street)				Job No. 08/21	
					Client Curtins				Borehole BH4 Page 1 of 1	
					Date 25/03/21		O.D. Level			
Day	Water Level	Casing Depth	Strata Depth	Description of Strata	Leg-end	Inst.	Reduced Level	Sample Type	Depth	'N' Value
			G.L. 0.19	Ceramic tiles over CONCRETE MADE GROUND (0.19) Dense/very dense orange/brown very sandy(f-c) fine to coarse, subrounded to elliptical GRAVEL/Cobbles of mixed lithology (1.01)						
			1.20 1.21	REFUSAL/No progress (0.01) Base of Borehole				ES	1.10 - 1.20	
Symbols U - undisturbed sample J - jar sample B - bulk sample W - water sample N - Standard Penetration Test Δ - Water entry ▲ - Water level										
Ground Water Entry	Estimated Rate of Entry	Observation Time (mins)	Water Level Rising to	Depth of Casing at Entry	Depth of Casing to Seal	Date	Standing Water Level	Condition of Borehole Cased / Open		
DRY										
Remarks Access to location via spiral stairs Hand Held dynamic window sampling methods C/c location										
R T D										

RTO 82/21. The Island site, Manchester (Barst).
 26 + 27th/3/21.

TP 1. plan. N.T.S.

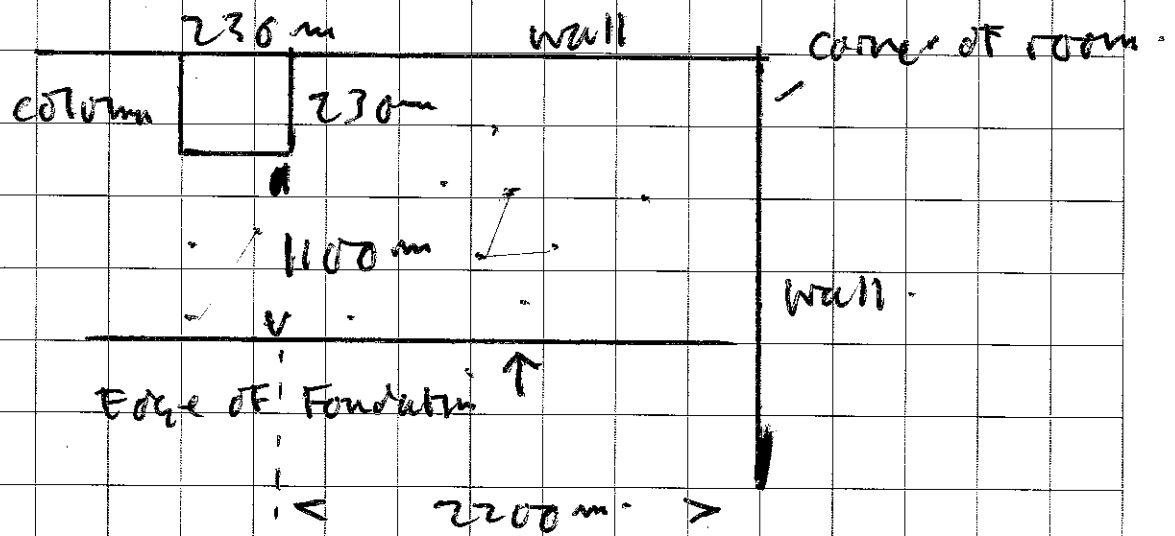


TP 1. section. N.T.S.

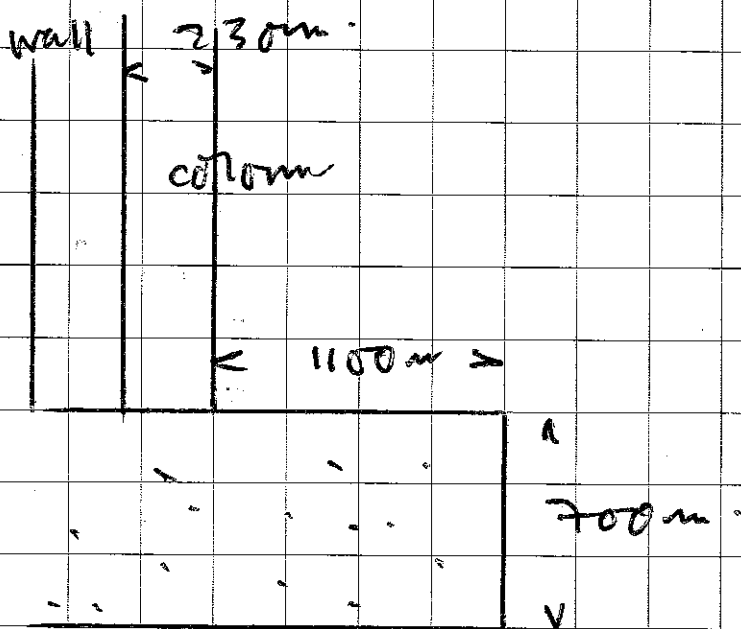


P.T.O. 08/21 The blind side, Manchester (Bow st.)
26/03/21 + 27/03/21.

TP 2. plan N.T.S.

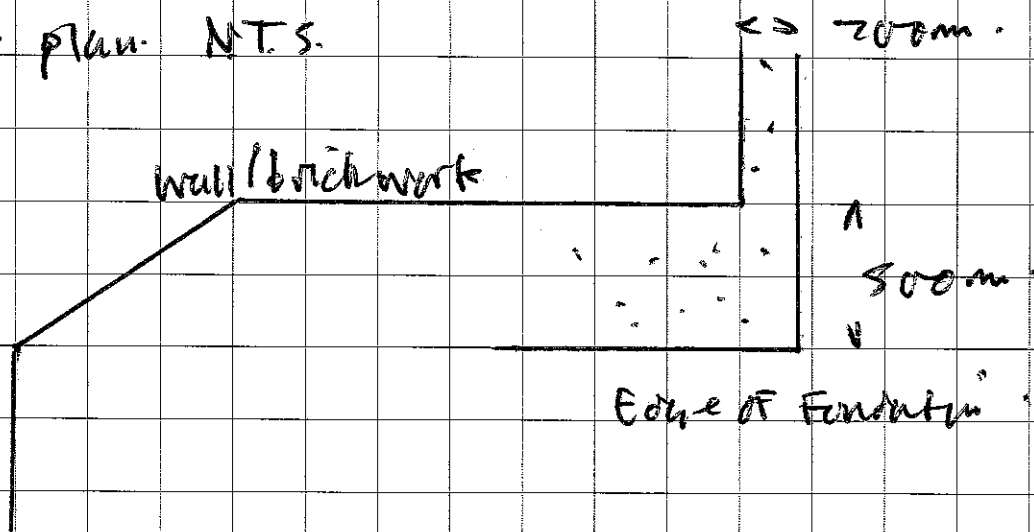


TP 2. section N.T.S.

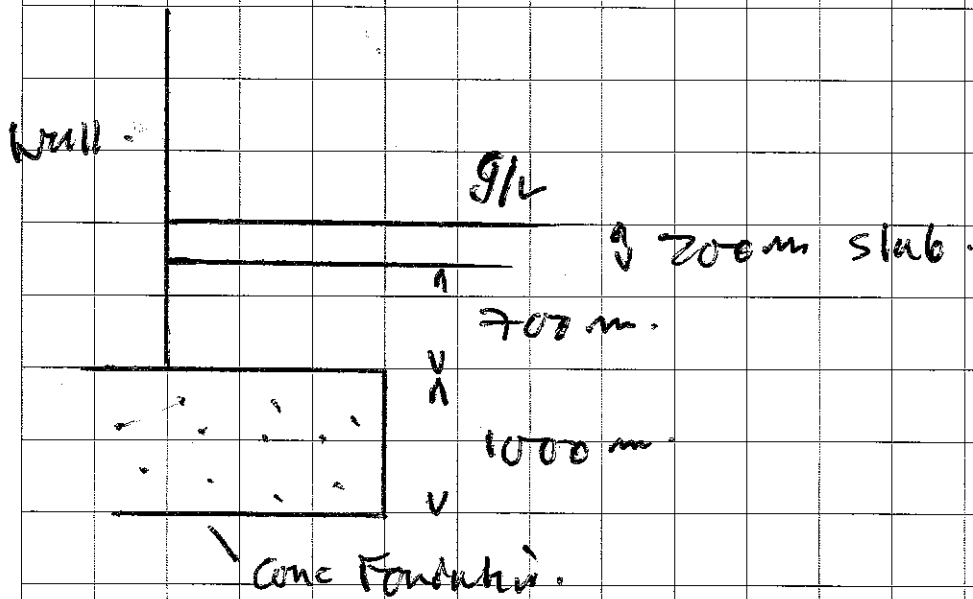


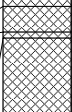
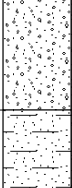
P.T.O. 08/21. The Island site. Manchester (Bow & F.)

TP 3. plan. N.T.S.



TP 3 Section. N.T.S.



Samples & In Situ Testing				Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation	
0.27 - 0.31 0.28 0.28 0.31 - 1.15 0.50 0.50	B1 D3 ES2 B4 D6 ES5	SPT(C) N=8 (2,1/2,3,2,1)		0.10	MADE GROUND: TARMACADAM.				
				0.37	MADE GROUND: Granite COBBLE layer.				
				0.84	MADE GROUND: Black, gravelly, medium and coarse SAND. Gravel is angular to subangular, fine and medium including brick, concrete, tarmacadam and sandstone. Sand includes ash.				
				1.15	MADE GROUND: Greyish brown, very gravelly, slightly clayey, fine to coarse SAND with abundant angular to subrounded cobbles. Gravel is angular to subrounded, fine to coarse including brick, concrete, tarmacadam, clinker, sandstone, mudstone and coal. Cobbles are subangular to subrounded including brick and sandstone.				
1.50	D7			1.40	MADE GROUND: COBBLES (former road).				
				2.00	MADE GROUND: Very soft, dark grey, gravelly, slightly sandy SILT with cobbles. Gravel is angular to subangular, fine to coarse including brick, clinker, sandstone and mudstone. Cobbles are subangular to subrounded including brick and sandstone.				
2.00 - 3.00 2.10	B8 D9			2.00	Loose, orange brown, very gravelly, slightly clayey, medium and coarse SAND. Gravel is subangular to subrounded, fine to coarse including sandstone, quartzite and mudstone.				
				3.00	Very dense, orange brown, slightly clayey, medium and coarse SAND and angular to subrounded, fine to coarse GRAVEL including sandstone, mudstone and quartzite.				
3.00 - 4.00 3.10	B10 D11			3.00					
				4.00	Very dense, sandy GRAVEL and COBBLES (Driller's Description). Rotary open hole drilling technique used.				
4.00		SPT(C) 50 (75 for 0mm/50 for 10mm)		4.00					
				6.00	Extremely weak, destructured, distinctly weathered, micaceous, reddish brown, fine and medium SANDSTONE recovered as very gravelly, fine and medium sand. Gravel is subangular to subrounded, fine and medium including quartzite and basalt. Traces of organic material present.				
				6.20					
				7.00	Extremely weak to very weak, reddish brown, very thinly bedded, fine to coarse SANDSTONE. Rare angular to rounded, fine, gravels of quartzite present. Discontinuities are orientated 1) 0-10 degrees, closely spaced, planar, rough, clean with local clay infill; and 2) 80-90 degrees, planar, rough and clean.				
				7.40	At 7.10m: carbonaceous layer.				
					No core recovery.				
				8.50					
				8.70	Weak, reddish brown, destructured, fine to coarse SANDSTONE recovered as sandy, subangular to subrounded, fine to coarse gravel including sandstone, quartzite and basalt, mainly fine and subrounded to subangular.				
					Very weak to weak, very thinly bedded, reddish brown, fine to coarse SANDSTONE occasionally carbonaceous and rare, subrounded to rounded, fine an medium gravel of quartzite. Discontinuities are orientated 1) 0-10 degrees, closely spaced, planar, rough, clean with occasional clay infill; and 2) 80-90 degrees, undulating, rough and clean.				



Plant used:	Project:		Location ID: BH101		
Dates: 11/08/2021 - 18/08/2021	The Island, John Dalton Street Client: Curtins Consulting				
Rotary Boring Log	Location:	Ground level:	Logged by: MP/SO	Vertical scale: 1:50	Sheet 2 of 3 Project ID: 2230477

Coring, Samples & In Situ Testing				Strata Details				Groundwater	
Depth	TCR/SCR/ RQD	FI	Samples & Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
10.00 - 11.50	100 100 45	9	10.56m - C17		(4.80)	Very weak to weak, very thinly bedded, reddish brown, fine to coarse SANDSTONE occasionally carbonaceous and rare, subrounded to rounded, fine an medium gravel of quartzite. Discontinuities are orientated 1) 0-10 degrees, closely spaced, planar, rough, clean with occasional clay infill; and 2) 80-90 degrees, undulating, rough and clean.			
			11.12m - C18						
11.50 - 13.00	83 83 28		12.04m - C19						
		AZCL							
13.00 - 14.50	100 100 29	18	13.19m - C20		13.50	Between 13.00m and 13.50m: discontinuities are orientated 1) 0-10 degrees, closely spaced, planar, rough and clean; 2) 80-90 degrees, planar, rough and clean; and 3) 50-60 degrees, planar, rough and clean.			
		6	14.60m - D21 14.70m - C22			Weak, very thinly bedded, reddish brown, fine to coarse SANDSTONE occasionally carbonaceous and rare, subrounded to rounded, fine an medium gravel of quartzite. Discontinuities are orientated 0-10 degrees, closely spaced, planar, rough, clean with occasional clay infill.			
14.50 - 16.00	100 100 72		15.50m - C23			Between 15.20m and 15.25m: Single discontinuity orientated approximately 45 degrees with clay infill.			
16.00 - 17.50	100 100 75	10	16.71m - C24		(7.00)				
			17.50m - C25						
17.50 - 19.00	100 100 74		18.00m - C26						
19.00 - 20.50	97 97 66	8	19.76m - C27			Between 18.76m and 19.35m: discontinuities are orientated 0-30 degrees, planar, undulating, rough and partially clay infilled.			
Continued next sheet									

Flush Details				Borehole Diameter		Boring Progress				Remarks:					
Top (m)	Base (m)	Flush Type	Flush Return %	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)					
										SPT Hammer: AR3141 Energy Ratio: 70%					
				Casing Diameter		Water Strikes				Monitoring Installations					
				Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)
Checked by:	RC	IFA RC													
Log status:	DRAFT	v01.01													

	Plant used:		Project:		Location ID:										
	Dates:		Client:		BH101										
	11/08/2021 - 18/08/2021		Curtins Consulting		Sheet 3 of 3										
Rotary Boring Log		Location:		Ground level:	Logged by:	Vertical scale:	Project ID:								
					MP/SO	1:50	2230477								
Coring, Samples & In Situ Testing				Strata Details			Groundwater								
Depth	TCR/SCR/ RQD	FI	Samples & Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation						
			20.07m - C28		20.50	Weak, very thinly bedded, reddish brown, fine to coarse SANDSTONE occasionally carbonaceous and rare, subrounded to rounded, fine an medium gravel of quartzite. Discontinuities are orientated 0-10 degrees, closely spaced, planar, rough, clean with occasional clay infill.									
						End of Borehole at 20.50m									
								21							
								22							
								23							
								24							
								25							
								26							
								27							
								28							
								29							
								30							
Flush Details			Borehole Diameter		Boring Progress			Remarks:							
Top (m)	Base (m)	Flush Type	Flush Return %	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)					
									SPT Hammer: AR3141 Energy Ratio: 70%						
				Casing Diameter		Water Strikes				Monitoring Installations					
				Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)
Checked by:		RC		IFA RC											
Log status:		DRAFT		v01.01											

BH101 Core Photographs



BH101 Core Photographs



BH101 Core Photographs



BH101 Core Photographs



BH101 Core Photographs



Plant used:

Dates:

Project:

Client:

Location ID:

Sheet 1 of 3

Dynamic Sampling and Rotary Boring Log

Location:

Ground level:

Logged by:

Vertical scale:

Project ID:

11/08/2021 - 20/08/2021

The Island, John Dalton Street

Curtins Consulting

MP/CG

1:50

2230477

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
0.26 - 0.50	B1	SPT(S) N=6 (1,1/1,1,2,2)		0.05	MADE GROUND: TARMACADAM.	1		
0.30	ES2		0.26	MADE GROUND: CONCRTE slab.				
0.50 - 1.40	B3		0.50	MADE GROUND: Dark brown, very gravelly, slightly clayey, medium and coarse SAND with medium cobble content. Gravel is angular to subrounded, fine to coarse including brick, clinker, concrete, sandstone and tarmacadam. Cobbles are angular including brick, clinker and sandstone.				
0.60	ES4		(0.90)	MADE GROUND: Greyish brown, very gravelly, clayey, medium and coarse SAND. Gravel is angular to subangular, fine to coarse including brick, clinker, concrete, tarmacadam, sandstone and mudstone.				
1.40 - 1.80	B5	SPT(S) N=56 (9,12/14,15,13,14)		1.40	MADE GROUND: Dark brown, very gravelly, very clayey, fine to coarse SAND with low cobble content. Gravel is angular to rounded, fine to coarse including brick, clinker, mudstone, sandstone and slate. Cobbles are angular including brick and clinker.	2		
1.50	ES6		(0.60)	Orangish brown, very gravelly, slightly silty, fine to coarse SAND with medium cobble content. Gravel is subangular to rounded, fine to coarse including sandstone, quartzite and mixed lithologies. Cobbles are subangular to subrounded including sandstone, quartzite and mixed lithologies.				
1.80	B7	SPT(S) N=16 (4,5/4,3,4,5)		2.00		3		
2.00 - 3.00			(2.00)					
2.80	B8	SPT(C) 50 (25 for 100mm/50 for 5mm)			4			
3.00 - 4.00								
3.80	D9		4.00	Sandy GRAVEL and COBBLES (Driller's Description). Rotary open hole technique used.				
3.80			(1.00)					
5.00	D10	SPT(C) 50 (25 for 0mm/50 for 10mm)		5.00	5			
5.00			(0.80)	COBBLES advanced with hole.				
5.80	B11	SPT(C) 50 (25 for 0mm/50 for 10mm)		5.80	6			
5.80 - 6.30			(0.50)	Multicoloured, subangular to subrounded, fine to coarse GRAVEL with high cobble content. Gravel includes sandstone and mixed lithologies. Cobbles are subangular to subrounded including sandstone and mixed lithologies.				
			6.30	GRAVEL and COBBLES (Driller's Description). Rotary open hole technique used.				
			(0.70)					
7.00 - 8.00	70	NA		7.00	7			
	65	6	7.30	Light greyish, subangular to subrounded, fine to coarse GRAVEL including siltstone, quartz, flint and mixed lithologies.				
	30							
		NI						
		21			8			
8.00 - 9.20	100							
	100	8	(5.05)	Very weak to weak, dark reddish brown, fine to coarse SANDSTONE with rare subrounded, fine and medium grained clasts of quartz. Discontinuities are orientated 0-8 degrees, very closely spaced, undulating, rough with common infilling by sandy clay.				
	60			At 8.51m: extremely weak				
9.20 - 10.20	100	24			9			
	100							
	60	10		Between 9.20m and 9.50m: weathered, crumbles easily.				
		FI			10			

Dynamic Sample Recovery

Top (m)

Base (m)

Dia (mm)

Recovery %

Remarks

TCR/SCR/ROD

Samples & Tests

Continued next sheet

Remarks:

Location cleared of buried services. No groundwater strike recorded. Terminated at target depth.

SPT Hammer: AR3141 Energy Ratio: 70%

Water Strikes

Strike (m)

Cased (m)

Sealed (m)

Time (mins)

Rose to (m)

Remarks

Monitoring Installations

Top (m)

Base (m)

Pipe Type

Dia (mm)

Checked by:

RC

IFA DS

Log status:

DRAFT

v01.01

0.00

19.20

Plain

19

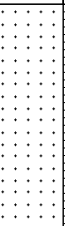
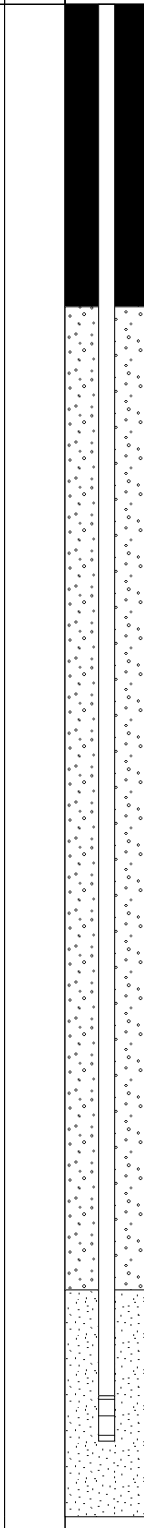
19.20

19.50

Piezo tip

19

	Plant used:		Project:			Location ID:	
	Dates: 11/08/2021 - 20/08/2021		Client: Curtins Consulting			BH102 Sheet 2 of 3	
Rotary Boring Log		Location:		Ground level:	Logged by:	Vertical scale:	Project ID:
					MP/CG	1:50	2230477

Coring, Samples & In Situ Testing				Strata Details				Groundwater	
Depth	TCR/SCR/ RQD	FI	Samples & Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
10.20 - 11.70	100 100 80	4	10.23m - C16	(7.80)	12.35 (0.30) 12.65	Very weak to weak, dark reddish brown, fine to coarse SANDSTONE with rare subrounded, fine and medium grained clasts of quartz. Discontinuities are orientated 0-8 degrees, very closely spaced, undulating, rough with common infilling by sandy clay. <i>Below 10.88m: weak</i> <i>Between 11.70m and 11.90m: non intact, recovered as subangular, fine to coarse GRAVEL with common rounded, fine to coarse gravel of quartzite and quartz.</i> Weak, dark reddish brown, fine to coarse SANDSTONE recovered as soft reddish, sandy, gravelly clay. Gravel is subrounded to rounded, fine grained of various lithologies including quartz, quartzite and igneous. <i>Between 12.35m and 12.65m: non intact, recovered as sandy, clayey, angular to subangular, fine to coarse GRAVEL.</i> Very weak to weak, dark reddish brown, fine to coarse SANDSTONE with rare rounded gravel sized clasts of quartz and quartzite. Discontinuities are orientated 1) 0-11 degrees, very closely spaced, undulating rough, open with rare infilling off fine to coarse sand and soft sandy clay; and 2) 11-24 degrees widely spaced, tight, clean. <i>Between 13.10m and 13.50m: non intact, recovered as sandy, angular to subangular, fine to coarse GRAVEL.</i> <i>Between 16.15m and 16.20m: recovered as sandy, angular to subangular, fine to coarse GRAVEL.</i> <i>Between 18.85m and 20.00m: non intact, recovered as sandy, angular</i>			
		8	10.88m - C17						
		11.22m - C18							
11.70 - 13.20	NI	12.00m - C19							
	7								
	NI	12.64m - C20							
	5								
13.20 - 14.70	100 90 65	NI	13.69m - C21						
		4	14.45m - C22						
		15	14.90m - C23						
14.70 - 16.20	100 95 55	8	15.20m - C24						
		NI							
16.20 - 17.70	100 100 95	4	16.88m - C25						
		6	17.48m - C26						
17.70 - 19.20	100 100 80	4	17.84m - D27						
		15	18.39m - C28						
		4	18.61m - C29						
19.20 - 20.45	100 85 55	4	19.30m - C30						
		17							
		NI							

Continued next sheet

Flush Details				Borehole Diameter		Boring Progress			Remarks:		
Top (m)	Base (m)	Flush Type	Flush Return %	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)	
									SPT Hammer: AR3141 Energy Ratio: 70%		
				Casing Diameter		Water Strikes				Monitoring Installations	
				Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
Checked by:		RC	IFA RC								
Log status:		DRAFT	v01.01								

 IAN FARMER ASSOCIATES	Plant used:		Project:		Location ID:										
	Dates: 11/08/2021 - 20/08/2021		Client: Curtins Consulting		BH102										
	Rotary Boring Log		Location:		Ground level:	Logged by: MP/CG	Vertical scale: 1:50	Sheet 3 of 3 Project ID: 2230477							
Coring, Samples & In Situ Testing				Strata Details				Groundwater							
Depth	TCR/SCR/ RQD	FI	Samples & Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation						
		4	20.37m - C31		20.45	Very weak to weak, dark reddish brown, fine to coarse SANDSTONE with rare rounded gravel sized clasts of quartz and quartzite. Discontinuities are orientated 1) 0-11 degrees, very closely spaced, undulating rough, open with rare infilling off fine to coarse sand and soft sandy clay; and 2) 11-24 degrees widely spaced, tight, clean. <i>Between 18.85m and 20.00m: non intact, recovered as sandy, angular to subangular, fine to coarse GRAVEL.</i> End of Borehole at 20.45m									
								21							
								22							
								23							
								24							
								25							
								26							
								27							
								28							
								29							
								30							
Flush Details				Borehole Diameter		Boring Progress		Remarks:							
Top (m)	Base (m)	Flush Type	Flush Return %	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)					
								SPT Hammer: AR3141 Energy Ratio: 70%							
				Casing Diameter		Water Strikes				Monitoring Installations					
				Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)
Checked by:				RC		IFA RC									
Log status:				DRAFT		v01.01									

BH102 Core Photographs



BH102 Core Photographs



BH102 Core Photographs



BH102 Core Photographs



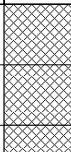
BH102 Core Photographs



Termination: Terminated on instruction of Curtins				Stability: Walls remained stable during excavation.	Remarks: Location cleared of buried services. Inspection pit only.						
Dimensions (Length m x Width m): 1.20 x 1.00											
Water Strikes											
Strike (m)	Time (mins)	Rose to (m)	Remarks								
								Checked by:	RC	IFA TP v01.01	
								Status:	DRAFT		



Plant used: Hand Tools	Project: The Island, John Dalton Street	Location ID: TP101			
Dates: 09/08/2021 - 11/08/2021	Client: Curtins Consulting				
Trial Pit Log	Location:	Ground level:	Logged by: MP	Vertical scale: 1:25	Sheet 1 of 1 Contract ID: 2230477

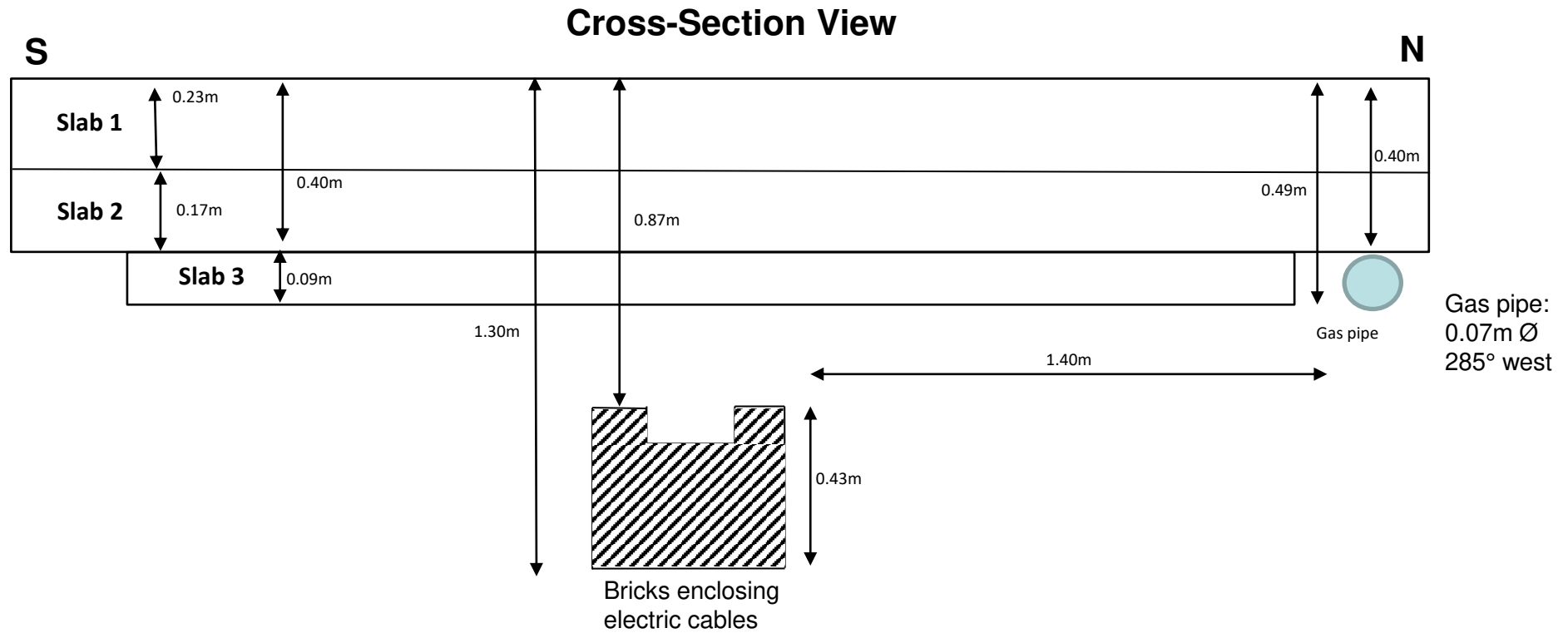
Samples & In Situ Testing			Strata Details													
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation							
				0.20	MADE GROUND: CONCRETE. (Slab 1).		1									
					MADE GROUND: CONCRETE. (Slab 2).											
					MADE GROUND: CONCRETE. (Slab 3).											
					MADE GROUND: Pre-existing BRICK wall.											
				(0.91)												
				1.40	End of Trial Pit at 1.40m											
														2		
	4															
								5								

Termination:	Stability:	Remarks: Please refer to sketch for further details.
Target depth	Walls remained stable.	
Dimensions (Length m x Width m): 5.00 x 0.40		
Water Strikes		
Strike (m)	Time (mins)	
Rose to (m)	Remarks	
		Checked by: RC
		Status: DRAFT
		IFA TP v01.01

 IAN FARMER ASSOCIATES	Plant used: Hand Tools	Project: The Island, John Dalton Street		Location ID: TP101 - South Section	
	Dates: 09/08/2021 - 11/08/2021	Client: Curtins Consulting		Sheet 1 of 1	
Trial Pit Log	Location:	Ground level:	Logged by: MP	Vertical scale: 1:25	Contract ID: 2230477

Samples & In Situ Testing			Strata Details					Scale	Water Strike	Backfill/ Installation
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend				
				0.23	MADE GROUND: CONCRETE. (Slab 1).		1			
				0.40	MADE GROUND: CONCRETE. (Slab 2).					
				0.49	MADE GROUND: CONCRETE. (Slab 3).					
				(0.91)	MADE GROUND: Dark greyish brown, very gravelly, slightly silty, fine to coarse SAND. Gravel is angular to subangular, fine to coarse including brick, concrete, tarmacadam, metal, plastic, flint, tile, coal, sandstone and mudstone. Possible asbestos containing material.					
				1.40	End of Trial Pit at 1.40m					
							2			
							3			
							4			
							5			

Termination:			Stability:		Remarks: Please refer to sketch for further details.
Target depth			Walls remained stable.		
Dimensions (Length m x Width m): 5.00 x 0.40					
Water Strikes					
Strike (m)	Time (mins)	Rose to (m)	Remarks		
					Checked by: RC Status: DRAFT IFA TP v01.01

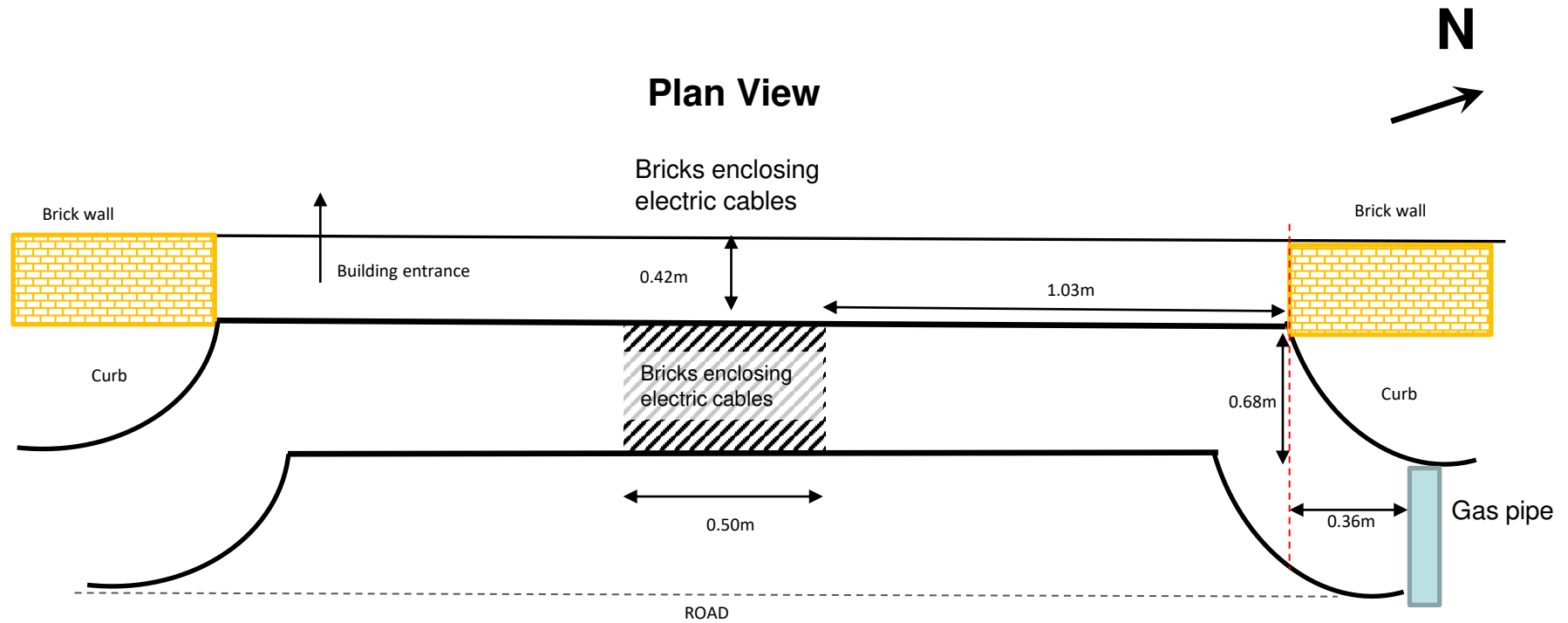


Bow Street Island Slit Trench

Scale: NTS

Figure 2.1



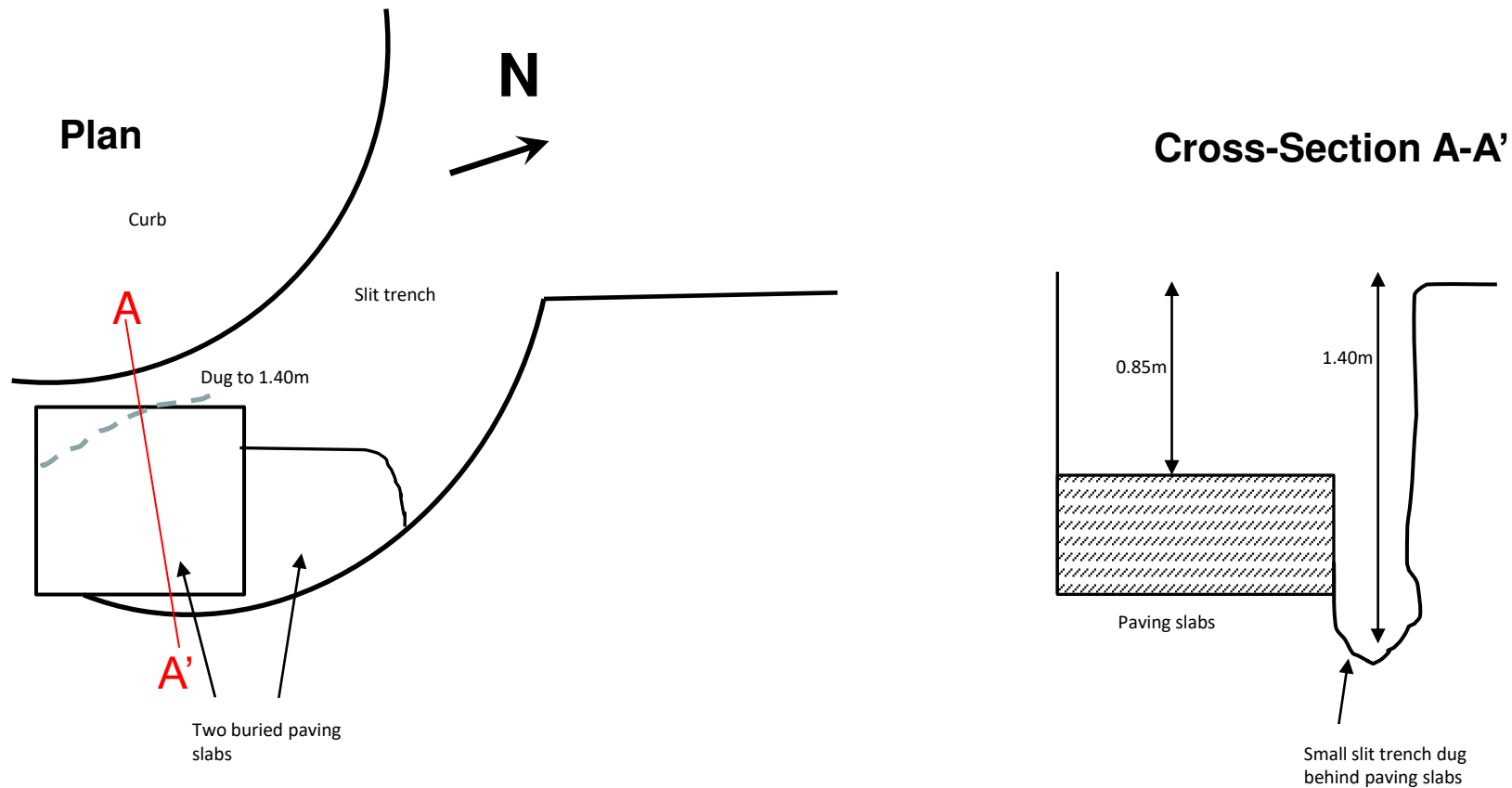


Bow Street Island Slit Trench

Scale: NTS

Figure 2.1

Plan and Section of southern end of trench



Bow Street Island Slit Trench

Scale: NTS

Figure 2.1





Curb to the south – facing South



Southern curb section showing section excavated to 1.40 m – facing South



Curb to the north with gas pipe – facing West

Bow Street Island Slit Trench

Scale: NTS

Figure 2.1





In-situ bricks encasing services – facing South



In-situ bricks encasing services – facing North

Bow Street Island Slit Trench

Scale: NTS

Figure 2.1





West wall of trench – facing West



West wall of trench – facing West

Bow Street Island Slit Trench

Scale: NTS

Figure 2.1



Appendix C – Chemical Laboratory Testing Results

- Envirolab, Environmental Chemistry Analysis Results, Soils
 - Final Analytical Test Report Ref. 20/03193-1
 - Final Analytical Test Report Ref. 20/03338-1

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/03193
Issue Number: 1
Date: 08 April, 2021

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: EBMA/Siobhán Hyde
Project Name: The Island Site
Project Ref: 070298
Order No: EBMA2756
Date Samples Received: 25/03/21
Date Instructions Received: 26/03/21
Date Analysis Completed: 08/04/21

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Sophie France
Client Service Manager

Envirolab Job Number: 21/03193

Client Project Name: The Island Site

Client Project Ref: 070298

Lab Sample ID	21/03193/2	21/03193/3	21/03193/4	21/03193/5				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS03	WS03						
Depth to Top	1.60	1.20	0.50	2.80						
Depth To Bottom	1.80	1.50		3.00						
Date Sampled	23-Mar-21	22-Mar-21	22-Mar-21	22-Mar-21						
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES						
Sample Matrix Code	4AB	4A	4A	2A						
% Stones >10mm _A	39.8	29.6	12.3	29.9				% w/w	0.1	A-T-044
pH _D ^{M#}	7.20	8.43	8.33	6.04				pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.04	0.01	0.12	0.05				g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1				mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2				mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	0.3	0.2	0.8	1.1				% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	2	1	3	<1				mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0	<1.0	<1.0	<1.0				mg/kg	1	A-T-027s
Cadmium _D ^{M#}	<0.5	<0.5	0.5	1.6				mg/kg	0.5	A-T-024s
Copper _D ^{M#}	7	7	12	15				mg/kg	1	A-T-024s
Chromium _D ^{M#}	7	6	9	12				mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1				mg/kg	1	A-T-040s
Lead _D ^{M#}	4	6	22	11				mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17				mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	7	8	9	17				mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1				mg/kg	1	A-T-024s
Zinc _D ^{M#}	16	18	25	46				mg/kg	5	A-T-024s

Envirolab Job Number: 21/03193

Client Project Name: The Island Site

Client Project Ref: 070298

Lab Sample ID	21/03193/2	21/03193/3	21/03193/4	21/03193/5				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS03	WS03						
Depth to Top	1.60	1.20	0.50	2.80						
Depth To Bottom	1.80	1.50		3.00						
Date Sampled	23-Mar-21	22-Mar-21	22-Mar-21	22-Mar-21						
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES						
Sample Matrix Code	4AB	4A	4A	2A						
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD	NAD						A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A						A-T-045

Envirolab Job Number: 21/03193

Client Project Name: The Island Site

Client Project Ref: 070298

Lab Sample ID	21/03193/2	21/03193/3	21/03193/4	21/03193/5				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS03	WS03						
Depth to Top	1.60	1.20	0.50	2.80						
Depth To Bottom	1.80	1.50		3.00						
Date Sampled	23-Mar-21	22-Mar-21	22-Mar-21	22-Mar-21						
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES						
Sample Matrix Code	4AB	4A	4A	2A						
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02				mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08				mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07				mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06				mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05				mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07				mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05				mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	<0.08	<0.08	<0.08	<0.08				mg/kg	0.03	A-T-019s

Envirolab Job Number: 21/03193

Client Project Name: The Island Site

Client Project Ref: 070298

Lab Sample ID	21/03193/2	21/03193/3	21/03193/4	21/03193/5				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS03	WS03						
Depth to Top	1.60	1.20	0.50	2.80						
Depth To Bottom	1.80	1.50		3.00						
Date Sampled	23-Mar-21	22-Mar-21	22-Mar-21	22-Mar-21						
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES						
Sample Matrix Code	4AB	4A	4A	2A						
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1	<1				mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<1				mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1	<1	<1				mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	<1	<1	<1				mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	2	<1	<1	5				mg/kg	1	A-T-055s
Total Aliphatics _A	2	<1	<1	5				mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	<1	<1	<1				mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1	<1	<1				mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	<1	<1	<1				mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	<1	<1	<1	<1				mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	<1	<1	<1	<1				mg/kg	1	A-T-055s
Total Aromatics _A	<1	<1	<1	<1				mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	2	<1	<1	5				mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-022s

REPORT NOTES

General

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

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	21/03193
Project:	The Island Site	Date Received:	26/03/2021 (am)
Clients Project No:	070298	Cool Box Temperatures (°C):	10.9 & 11.3

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/03338
Issue Number: 1
Date: 10 April, 2021

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: Siobhán Hyde
Project Name: The Island Site
Project Ref: 70298
Order No: EBMA2766
Date Samples Received: 29/03/21
Date Instructions Received: 30/03/21
Date Analysis Completed: 10/04/21

Prepared by:



Michael Knight
Laboratory Manager

Approved by:



Holly Neary-King
Client Services Supervisor

Envirolab Job Number: 21/03338

Client Project Name: The Island Site

Client Project Ref: 70298

Lab Sample ID	21/03338/1	21/03338/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	TP01								
Depth to Top	1.10	0.30								
Depth To Bottom	1.20	0.40								
Date Sampled	23-Mar-21	26-Mar-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	4ABE	4A								
% Stones >10mm _A	9.5	9.5						% w/w	0.1	A-T-044
pH _D ^{M#}	8.80	9.69						pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.17	0.10						g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1						mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2						mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	3.0	1.9						% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	5	8						mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0	<1.0						mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.4	3.2						mg/kg	0.5	A-T-024s
Copper _D ^{M#}	21	43						mg/kg	1	A-T-024s
Chromium _D ^{M#}	11	13						mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1						mg/kg	1	A-T-040s
Lead _D ^{M#}	91	126						mg/kg	1	A-T-024s
Mercury _D	1.45	0.53						mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	14	15						mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1						mg/kg	1	A-T-024s
Zinc _D ^{M#}	47	224						mg/kg	5	A-T-024s

Envirolab Job Number: 21/03338

Client Project Name: The Island Site

Client Project Ref: 70298

Lab Sample ID	21/03338/1	21/03338/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	TP01								
Depth to Top	1.10	0.30								
Depth To Bottom	1.20	0.40								
Date Sampled	23-Mar-21	26-Mar-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	4ABE	4A								
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD								A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A								A-T-045

Envirolab Job Number: 21/03338

Client Project Name: The Island Site

Client Project Ref: 70298

Lab Sample ID	21/03338/1	21/03338/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	TP01								
Depth to Top	1.10	0.30								
Depth To Bottom	1.20	0.40								
Date Sampled	23-Mar-21	26-Mar-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	4ABE	4A								
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	<0.03	0.84						mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	0.04						mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	0.02	0.37						mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	0.03	0.43						mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	0.27	3.69						mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	0.06	0.66						mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	0.25	2.58						mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	0.25	2.46						mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.13	0.96						mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	0.15	0.96						mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.10	0.58						mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	0.23						mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.12	0.65						mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.07	0.30						mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	0.06						mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.07	0.24						mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	1.52	15.1						mg/kg	0.03	A-T-019s

Envirolab Job Number: 21/03338

Client Project Name: The Island Site

Client Project Ref: 70298

Lab Sample ID	21/03338/1	21/03338/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS04	TP01								
Depth to Top	1.10	0.30								
Depth To Bottom	1.20	0.40								
Date Sampled	23-Mar-21	26-Mar-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	4ABE	4A								
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1						mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1						mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1						mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	<1						mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	4	4						mg/kg	1	A-T-055s
Total Aliphatics _A	4	4						mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	1						mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1						mg/kg	1	A-T-055s
Aro >C12-C16 _A	2	5						mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	5	22						mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	12	69						mg/kg	1	A-T-055s
Total Aromatics _A	20	98						mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	24	102						mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s

REPORT NOTES

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The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 1155µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

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US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

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Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG
Project: The Island Site
Clients Project No: 70298
Project No: 21/03338
Date Received: 30/03/2021 (am)
Cool Box Temperatures (°C): 11.2

Lab Sample ID	21/03338/1
Client Sample No	
Client Sample ID/Depth	WS04 1.10-1.20m
Date Sampled	23/03/21
Deviation Code	
F	✓

Key

F Maximum holding time exceeded between sampling date and analysis for analytes listed below

HOLDING TIME EXCEEDANCES

Lab Sample ID	21/03338/1
Client Sample No	
Client Sample ID/Depth	WS04 1.10-1.20m
Date Sampled	23/03/21
VPHCWG	✓

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Appendix D – Geotechnical Laboratory Testing Results

- Envirolab, Environmental Chemistry Analysis Results, Soils
 - Final Analytical Test Report Ref. 20/03195-1
- Ian Farmer Associates,
 - Final Test Report Ref. 2280469/1
 - Final Test Report Ref. 2230477R/1

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/03195
Issue Number: 1
Date: 10 April, 2021

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: EBMA/Siobhán Hyde
Project Name: The Island Site
Project Ref: 070298
Order No: EBMA2758
Date Samples Received: 25/03/21
Date Instructions Received: 26/03/21
Date Analysis Completed: 09/04/21

Prepared by:



Michael Knight
Laboratory Manager

Approved by:



Holly Neary-King
Client Services Supervisor

Envirolab Job Number: 21/03195

Client Project Name: The Island Site

Client Project Ref: 070298

Lab Sample ID	21/03195/2	21/03195/3	21/03195/4	21/03195/5	21/03195/7	21/03195/8	21/03195/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS02	WS03	WS03			
Depth to Top	2.00	3.70	2.50	3.20	3.80	1.20	2.00			
Depth To Bottom	3.00	3.80	2.80	3.40		1.50	3.70			
Date Sampled	23-Mar-21	23-Mar-21	23-Mar-21	23-Mar-21	23-Mar-21	22-Mar-21	22-Mar-21			
Sample Type	Soil - B	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - B			
Sample Matrix Code		6A	6A	4A	4A	6A				
% Moisture at <40C _A	-	10.9	9.6	9.5	11.3	8.1	-	% w/w	0.1	A-T-044
% Stones >10mm _A	-	4.0	36.2	24.3	<0.1	32.9	-	% w/w	0.1	A-T-044
pH _D ^{M#}	-	4.94	6.59	6.58	6.17	6.71	-	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	-	0.04	0.01	0.03	0.03	0.01	-	g/l	0.01	A-T-026s
Particle Size Distribution (Wet Sieving Method) _A [#]	Appended	-	-	-	-	-	Appended			Subcon IFA

REPORT NOTES

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Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	21/03195
Project:	The Island Site	Date Received:	26/03/2021 (am)
Clients Project No:	070298	Cool Box Temperatures (°C):	10.9 & 11.3

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

F.A.O.

Final Test Report - 2280469 / 1

Site: The Island Site

Job Number: 2280469

Originating Client: Envirolab

Originating Reference: 21/03195

Date Sampled: Not Given

Date Scheduled: 29/03/2021

Date Testing Started: 30/03/2021

Date Testing Finished: 08/04/2021

Previous Reports		Amendments	Date Issued

Amendments:

Authorised By:



Paul Cathcart
Laboratory Manager

Report Issue Date: 08/04/2021



Site: The Island Site

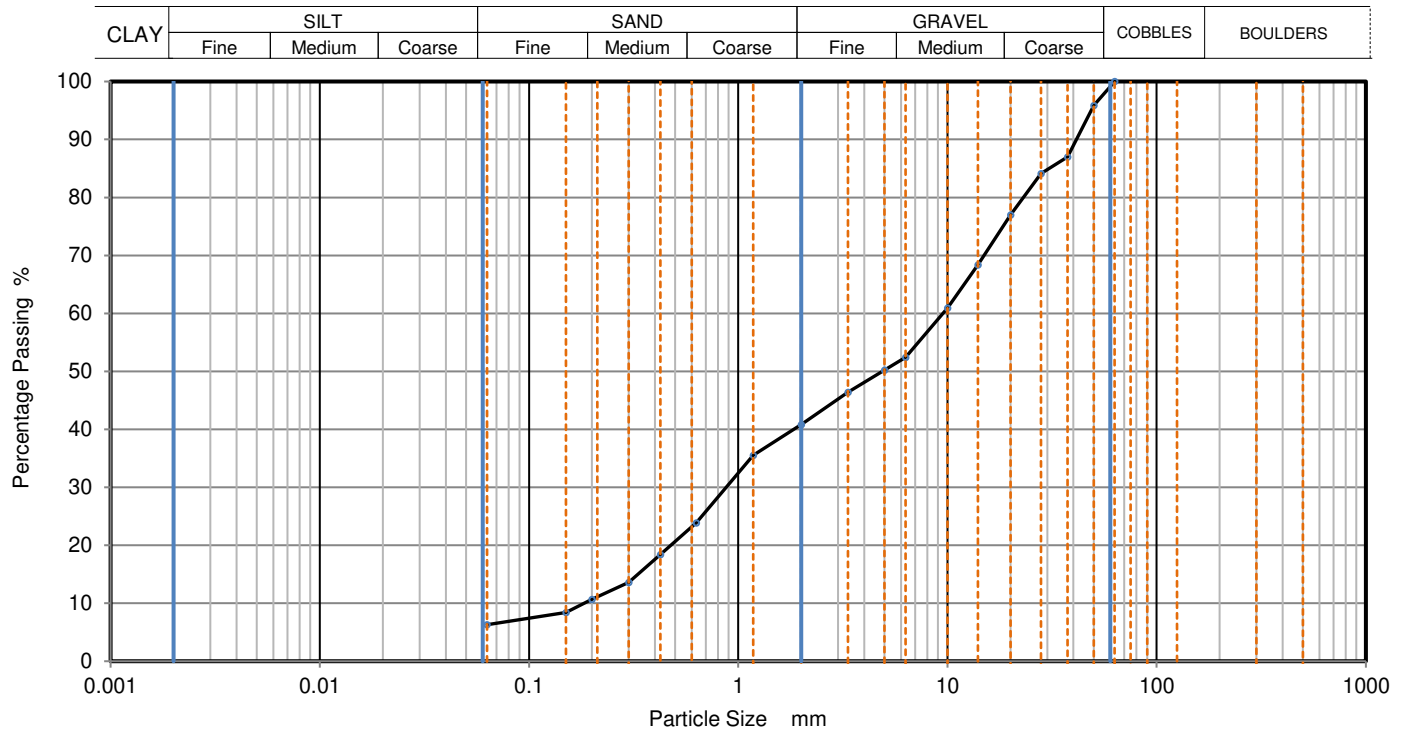
Job Number: 2280469

Client: Envirolab

Page: 2

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
WS01	2.00	B	Wet Sieve	Brown slightly silty, very sandy GRAVEL



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
63	100		
50	96		
37.5	87		
28	84		
20	77		
14	68		
10	61		
6.3	52		
5	50		
3.35	46		
2	41		
1.18	36		
0.63	24		
0.425	18		
0.3	14		
0.2	11		
0.15	8		
0.063	6		

Dry Mass of sample, g

5272

Sample Proportions	% dry mass
Very coarse	0
Gravel	59
Sand	35
Fines <0.063mm	6

Grading Analysis		
D100	mm	63
D60	mm	9.52
D30	mm	0.878
D10	mm	0.183
Uniformity Coefficient		52
Curvature Coefficient		0.44

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7.3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method



Site: The Island Site

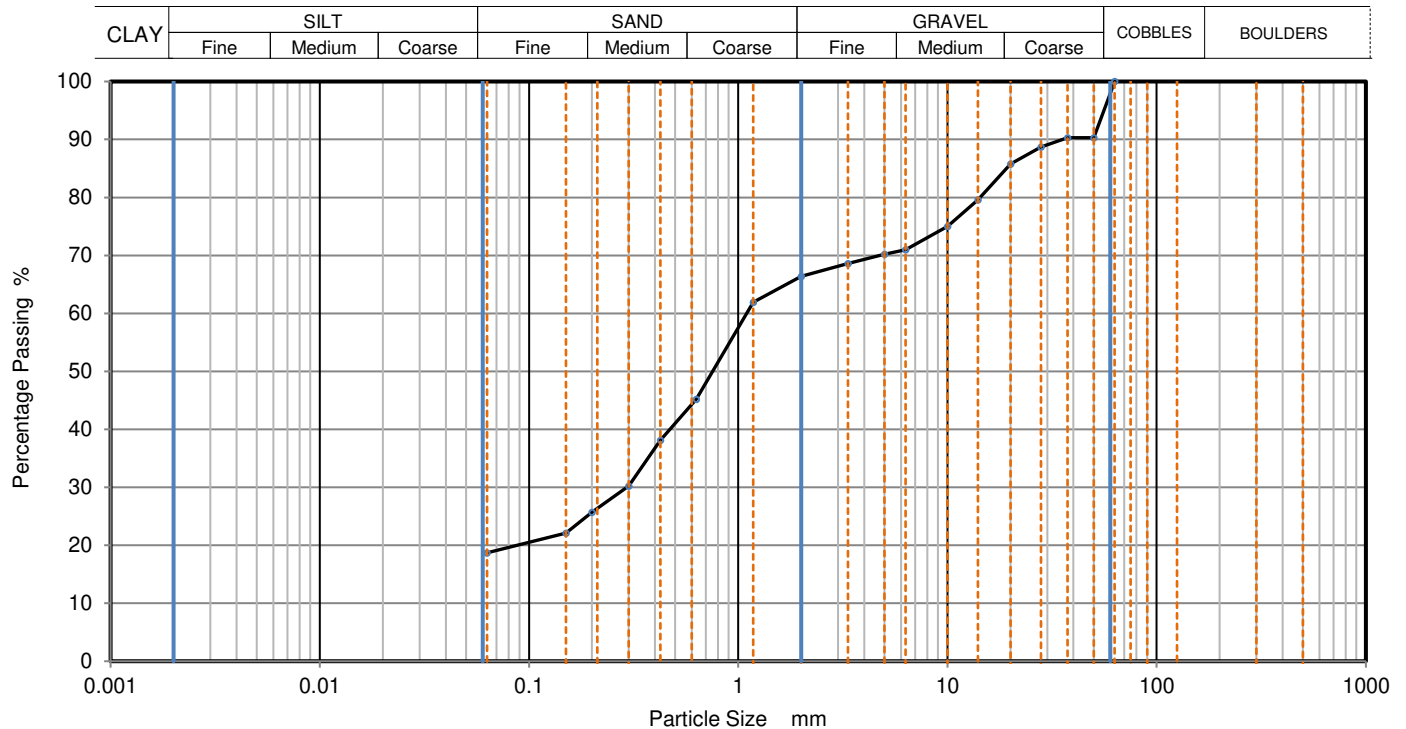
Job Number: 2280469

Client: Envirolab

Page: 3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
WS03	2.00	B	Wet Sieve	Brown silty, very gravelly SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
63	100		
50	90		
37.5	90		
28	89		
20	86		
14	80		
10	75		
6.3	71		
5	70		
3.35	69		
2	66		
1.18	62		
0.63	45		
0.425	38		
0.3	30		
0.2	26		
0.15	22		
0.063	19		

Dry Mass of sample, g

4114

Sample Proportions	% dry mass
Very coarse	0
Gravel	34
Sand	48
Fines <0.063mm	19

Grading Analysis		
D100	mm	63
D60	mm	1.1
D30	mm	0.294
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7.3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method



Final Test Report - 2280469 / 1

Site: The Island Site

Job Number: 2280469

Originating Client: Envirolab

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Samples will be retained for 28 days from date of issue of the final test report before being disposed of, unless we receive written instruction to the contrary.

Report Issue Date: 08/04/2021

Merchant Exchange,
17-19 Whitworth Street West,
Manchester,
M1 5WG

F.A.O.

Final Test Report - 2230477R / 1

Site: The Island Site

Job Number: 2230477R

Originating Client: Curtins Consulting

Originating Reference: 2230477

Date Sampled: Not Given

Date Scheduled: 17/09/2021

Date Testing Started: 23/09/2021

Date Testing Finished: 29/09/2021

Previous Reports		Amendments	Date Issued

Amendments:

Authorised By:



Tim Robinson
Quality Supervisor

Report Issue Date: 29/09/2021



Site: The Island Site

Job Number: 2230477R

Client: Curtins Consulting

Page: 2

UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

Hole No.	Depth m	Sample	Rock Type	Specimen Dimensions ²			Bulk Density ² Mg/m ³	Water Content 1 %	Uniaxial Compression ³				Remarks
				Dia. mm	Length mm	H/D			Condition	Stress Rate MPa/s	Mode of failure	UCS MPa	
BH101	10.56	C17	Brown SANDSTONE	88.9	133.6	*1.5	2.02	7.9	as received	0.4896	MS	9.7	
BH101	14.70	C22	Brown SANDSTONE	89.4	157.1	*1.8	2.14	9.5	as received	0.5064	MS	14.4	
BH101	16.71	C24	Brown SANDSTONE	89.3	215.4	*2.4	2.19	6.6	as received	0.5077	MS	20.6	
BH101	19.76	C27	Brown SANDSTONE	89.6	257.1	2.9	2.17	11.4	as received	0.5041	S	23.0	
BH102	9.52	C15	Brown SANDSTONE	87.1	127.4	*1.5	2.07	11.7	as received	0.5101	S	10.0	
BH102	10.88	C17	Brown SANDSTONE	88.8	217.8	2.5	2.12	15.0	as received	0.5136	MS	12.1	
BH102	11.22	C18	Brown SANDSTONE	88.8	173.1	*1.9	2.19	13.4	as received	0.5137	MS	10.4	
BH102	12.64	C20	Brown SANDSTONE	88.2	161.8	*1.8	2.18	10.3	as received	0.4976	MS	10.9	
BH102	13.69	C21	Brown SANDSTONE	86.8	202.4	*2.3	2.25	11.9	as received	0.5136	MS	22.1	
BH102	14.90	C23	Brown SANDSTONE	88.8	238.3	2.7	2.19	13.1	as received	0.4912	S	16.6	
BH102	15.20	C24	Brown SANDSTONE	89.3	240.0	2.7	2.31	9.4	as received	0.5081	S	23.0	
BH102	17.48	C26	Brown SANDSTONE	89.3	224.7	2.5	2.18	13.4	as received	0.4852	S	18.0	
BH102	18.61	C29	Brown SANDSTONE	88.6	238.1	2.7	2.21	10.8	as received	0.4933	MS	16.1	

Notes 1 ISRM p87 test 1, water content at 105 ± 3 °C, specimen as tested for UCS

*Denotes length diameter ratio outside ISRM specification

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

Mode of failure :

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

S - Single shear MS - multiple shear

above notes apply unless annotated otherwise in the remarks

AC - Axial cleavage F - Fragmented

Method of Preparation: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

Method of Test: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

Results reported relate only to the samples tested.

Site: The Island Site

Job Number: 2230477R

Client: Curtins Consulting

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Point Load Strength Index Tests Summary of Results

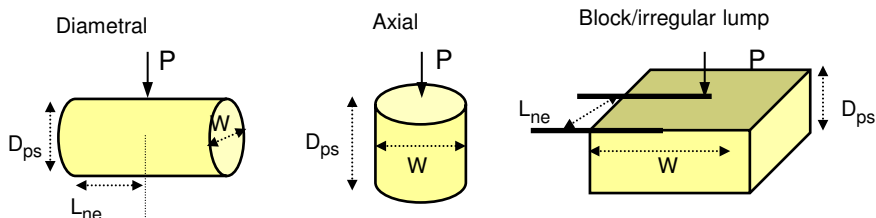
Borehole No.	Depth m	Sample	Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P kN	Equivalent diameter, De mm	Point Load Strength Index		Remarks (including water content if measured)
				Type (D, A, I, B)	Direction (PL, PD or U)		Lne mm	W mm	Dps mm	Dps' mm			Is MPa	Is (50) MPa	
BH101	6.57	C13	Brown SANDSTONE As received	A	U	YES		88.9	35.4	33.4	0.2	63.3	0.04	0.05	
BH101	6.57	C13	Brown SANDSTONE As received	A	U	YES		88.3	23.9	22.9	0.2	51.9	0.06	0.07	
BH101	7.32	C14	Brown SANDSTONE As received	D	PL	YES	47.5	86.5	86.5	84.5	0.6	86.5	0.08	0.11	
BH101	7.32	C14	Brown SANDSTONE As received	A	PD	YES		48.2	41.3	38.3	0.7	50.3	0.28	0.28	
BH101	8.8	C15	Brown SANDSTONE As received	D	U	YES	58.4	81.9	81.9	79.9	0.7	81.9	0.10	0.12	
BH101	8.8	C15	Brown SANDSTONE As received	A	U	YES		81.8	60.7	54.7	1.1	79.5	0.17	0.21	
BH101	9.2	C16	Brown SANDSTONE As received	D	PL	YES	45.2	80.2	80.2	79.2	0.5	80.2	0.07	0.09	
BH101	9.2	C16	Brown SANDSTONE As received	A	PD	YES		49.3	45.8	44.8	1.2	53.6	0.42	0.43	
BH101	11.12	C18	Brown SANDSTONE As received	D	PL	YES	55.9	81.3	81.3	80.3	1.1	81.3	0.17	0.21	
BH101	11.12	C18	Brown SANDSTONE As received	A	PD	YES		88.3	60.3	58.3	1.8	82.3	0.26	0.33	
BH101	12.04	C19	Brown SANDSTONE As received	D	U	YES	41.4	88.1	88.1	86.1	0.8	88.1	0.10	0.13	
BH101	12.04	C19	Brown SANDSTONE As received	A	U	YES		88.8	43.1	40.1	0.8	69.8	0.17	0.20	
BH101	13.19	C20	Brown SANDSTONE As received	D	PL	YES	47.0	88.2	88.2	86.2	1.4	88.2	0.18	0.23	
BH101	13.19	C20	Brown SANDSTONE As received	A	PD	YES		88.4	48.2	47.2	2.3	73.7	0.42	0.50	
BH101	15.5	C23	Brown SANDSTONE As received	D	PL	YES	44.6	88.2	88.2	87.2	0.9	88.2	0.11	0.14	
BH101	15.5	C23	Brown SANDSTONE As received	A	PD	YES		89.1	35.2	31.2	2.1	63.2	0.52	0.58	
BH101	17.5	C25	Brown SANDSTONE As received	D	PL	YES	68.5	87.9	87.9	86.9	1.8	87.9	0.23	0.29	
BH101	17.5	C25	Brown SANDSTONE As received	A	PD	YES		88.8	63.1	59.1	2.0	84.5	0.28	0.36	
BH101	18	C26	Brown SANDSTONE As received	D	PL	YES	42.5	87.8	87.8	86.8	0.9	87.8	0.12	0.15	
BH101	18	C26	Brown SANDSTONE As received	A	PD	YES		85.1	41.6	38.6	1.9	67.1	0.42	0.48	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block

Direction
PL - Parallel to planes of weakness
PD - Perpendicular to planes of weakness
U - Unknown or random

Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P
Size factor, F = (De/50)0.45 for all tests.

Detailed legend for test and dimensions, based on ISRM



Method of Preparation: ISRM 2007 Suggested method for point load strength index (pages 125 - 132)

Method of Test: ISRM 2007 Suggested method for point load strength index (pages 125 - 132)

Results reported relate only to the samples tested.

Site: The Island Site

Job Number: 2230477R

Client: Curtins Consulting

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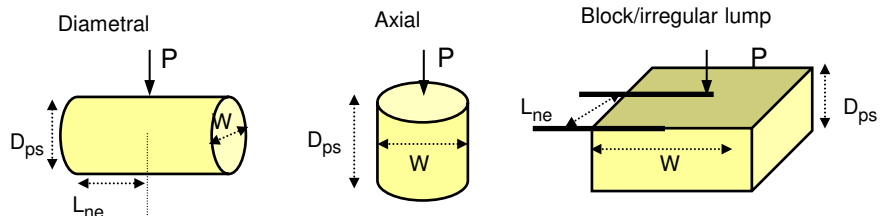
Point Load Strength Index Tests Summary of Results

Borehole No.	Depth m	Sample	Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P kN	Equivalent diameter, De mm	Point Load Strength Index		Remarks (including water content if measured)
				Type (D, A, I, B)	Direction (PL, PD or U)		Lne mm	W mm	Dps mm	Dps' mm			Is MPa	Is (50) MPa	
BH101	20.07	C28	Brown SANDSTONE As received	D	PL	YES	55.1	85.1	85.1	84.1	1.6	85.1	0.22	0.27	
BH101	20.07	C28	Brown SANDSTONE As received	A	PD	YES		87.1	53.2	50.2	1.5	76.8	0.25	0.30	
BH102	7.4	C12	Brown SANDSTONE As received	D	PL	YES	44.9	82.1	82.1	81.1	0.8	82.1	0.13	0.16	
BH102	7.4	C12	Brown SANDSTONE As received	A	PD	YES		84.2	41.4	40.4	1.0	66.6	0.22	0.25	
BH102	8.51	C14	Brown SANDSTONE As received	D	PL	YES	43.3	87.2	87.2	86.2	0.2	87.2	0.02	0.03	
BH102	8.51	C14	Brown SANDSTONE As received	A	PD	YES		87.2	46.8	44.8	0.6	72.1	0.11	0.13	
BH102	10.23	C16	Brown SANDSTONE As received	D	PL	YES	53.1	87.2	87.2	86.2	0.9	87.2	0.12	0.15	
BH102	10.23	C16	Brown SANDSTONE As received	A	PD	YES		89.1	44.0	43.0	1.4	70.7	0.28	0.33	
BH102	12	C19	Brown SANDSTONE As received	D	PL	YES	76.2	88.6	88.6	87.6	1.2	88.6	0.15	0.20	
BH102	12	C19	Brown SANDSTONE As received	A	PD	YES		88.0	51.6	48.6	1.9	76.0	0.32	0.39	
BH102	14.45	C22	Brown SANDSTONE As received	D	PL	YES	96.8	88.1	88.1	87.1	0.5	88.1	0.07	0.08	
BH102	14.45	C22	Brown SANDSTONE As received	A	PD	YES		88.3	65.0	57.0	1.2	85.5	0.16	0.21	
BH102	16.88	C25	Brown SANDSTONE As received	D	PL	YES	74.2	88.9	88.9	86.9	1.8	88.9	0.23	0.29	
BH102	16.88	C25	Brown SANDSTONE As received	A	PD	YES		88.6	71.1	66.1	2.8	89.5	0.35	0.46	
BH102	18.39	C28	Brown SANDSTONE As received	D	PL	YES	74.3	88.2	88.2	87.2	1.5	88.2	0.19	0.25	
BH102	18.39	C28	Brown SANDSTONE As received	A	PD	YES		88.9	75.1	62.1	2.6	92.2	0.30	0.40	
BH102	19.3	C30	Brown SANDSTONE As received	D	PL	YES	46.2	88.0	88.0	87.0	1.7	88.0	0.22	0.28	
BH102	19.3	C30	Brown SANDSTONE As received	A	PD	YES		89.5	43.2	37.2	1.8	70.2	0.37	0.43	
BH102	20.37	C31	Brown SANDSTONE As received	D	PL	YES	40.2	92.8	92.8	90.8	1.3	92.8	0.16	0.21	
BH102	20.37	C31	Brown SANDSTONE As received	A	PD	YES		99.6	53.3	51.3	1.7	82.2	0.25	0.31	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
PL - Parallel to planes of weakness
PD - Perpendicular to planes of weakness
U - Unknown or random

Detailed legend for test and dimensions, based on ISRM

Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P
Size factor, F = (De/50)0.45 for all tests.



Method of Preparation: ISRM 2007 Suggested method for point load strength index (pages 125 - 132)

Method of Test: ISRM 2007 Suggested method for point load strength index (pages 125 - 132)

Results reported relate only to the samples tested.



Final Test Report - 2230477R / 1

Site: The Island Site
Job Number: 2230477R
Originating Client: Curtins Consulting

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Report Issue Date: 29/09/2021

Appendix E – Ground Gas Monitoring Results

- Ground Gas Monitoring, Visits 1 – 6

Curtins

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG

Tel: 0161 236 2394

Fax: 0161 228 7902

**GAS MONITORING LOG SHEET**

Project: The Island Site **Date:** 08/04/2021
Job Number: B070298 **Visit:** 1
Client: Henry Boot Developments **Weather:** Overcast / Sunny
Barometric State: Falling **Ground Conditions:** Dry (Indoors)

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						
BH01	1014	0.0	0.0	0.0	0.0	0.0	0.0	21.1	0	0	Dry	3.58	1
BH02	1013	0.0	0.0	0.0	0.0	0.0	0.0	21.1	0	0	Dry	2.78	
BH03	1013	0.0	0.0	0.0	0.0	0.1	0.1	20.9	0	0	Dry	3.32	
BH04	-	-	-	-	-	-	-	-	-	-	Dry	0.83	

Notes

1 - Bung loose from pipe, unable to monitor

Logged by

EM

*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: The Island Site **Date:** 23/04/2021
Job Number: B070298 **Visit:** 2
Client: Henry Boot Developments **Weather:** Sunny
Barometric State: Falling **Ground Conditions:** Dry (Indoors)

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						
BH01	1017	0.0	0.0	0.0	0.0	0.0	0.0	21.1	0	0	Dry	3.55	
BH02	1017	0.0	0.0	0.0	0.0	0.0	0.0	21.1	0	0	Dry	2.80	
BH03	-	-	-	-	-	-	-	-	-	-	-	-	1
BH04	-	-	-	-	-	-	-	-	-	-	-	-	1

Notes

1 - Bung loose from pipe, unable to monitor

Logged by

EM

*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: The Island Site **Date:** 04/06/2021
Job Number: B070298 **Visit:** 3
Client: Henry Boot Developments **Weather:** Sunny + warm
Barometric State: Steady **Ground Conditions:** Dry (indoors)

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						
BH01	1020	0.0	0.0	0.0	0.0	0.0	0.0	21.5	0	0	3.06	3.30	
BH02	1020	0.0	0.0	0.0	0.0	0.1	0.1	21.4	0	0	Dry	2.82	
BH03	-	-	-	-	-	-	-	-	-	-	-	-	1
BH04	-	-	-	-	-	-	-	-	-	-	-	-	1

Notes

1 Borehole inaccessible

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

GAS MONITORING LOG SHEET

Project: The Island Site **Date:** 11/06/2021
Job Number: B070298 **Visit:** 4
Client: Henry Boot Developments **Weather:** Sunny, warm
Barometric State: Rising **Ground Conditions:** Dry (indoors)

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						
BH01	1013	0.0	0.0	0.0	0.0	0.0	0.0	21.2	0	0	3.41	3.50	1
BH02	1013	0.0	0.0	0.0	0.0	0.1	0.1	21.0	0	0	Dry	2.82	
BH03	-	-	-	-	-	-	-	-	-	-	-	-	
BH04	1013	0.0	0.0	0.0	0.0	0.0	0.0	21.4	0	0	Dry	0.82	

Notes

1 Borehole inaccessible

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

GAS MONITORING LOG SHEET

Project: The Island Site **Date:** 17/06/2021
Job Number: B070298 **Visit:** 5
Client: Henry Boot Developments **Weather:** Sunny, warm
Barometric State: Steady **Ground Conditions:** Dry (indoors)

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						
BH01	1007	0.0	0.0	0.0	0.0	0.0	0.0	21.3	0	0	Dry	3.50	1
BH02	1007	0.0	0.0	0.0	0.0	0.1	0.1	21.0	0	0	Dry	2.82	
BH03	-	-	-	-	-	-	-	-	-	-	-	-	
BH04	1008	0.0	0.0	0.0	0.0	0.0	0.0	21.2	0	0	Dry	0.82	

Notes

1 Borehole inaccessible

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

Curtins

Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG

Tel: 0161 236 2394

Fax: 0161 228 7902

**GAS MONITORING LOG SHEET**

Project: The Island Site **Date:** 23/06/2021
Job Number: B070298 **Visit:** 6
Client: Henry Boot Developments **Weather:** Sunny
Barometric State: Steady **Ground Conditions:** Dry (indoors)

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						
BH01	1013	0.0	0.0	0.0	0.0	0.0	0.0	21.5	0	0	Dry	3.30	1
BH02	1013	0.0	0.0	0.0	0.0	0.1	0.1	21.4	0	0	Dry	2.82	
BH03	-	-	-	-	-	-	-	-	-	-	-	-	
BH04	1013	0.0	0.0	0.0	0.0	0.0	0.0	21.4	0	0	Dry	0.82	

Notes

1 Borehole inaccessible

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

Appendix F – GAC 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

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- 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 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						
Aliphatic risk banded hydrocarbons - TPHCWG method						
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
Aromatic risk banded hydrocarbons - TPHCWG method						
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

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- 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 G – 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 or medium or 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.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
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.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

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> .
Very Low 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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