

Circle Square, Building 3

Phase 2 Ground Investigation

Curtins Project Number: 080355

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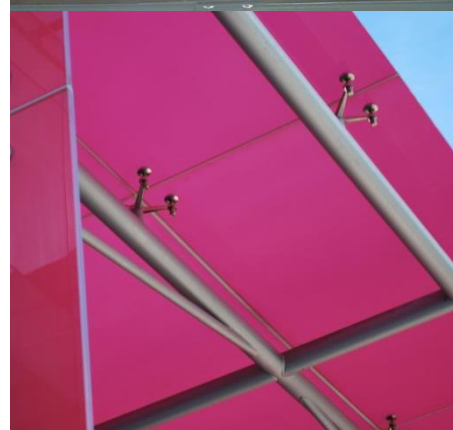
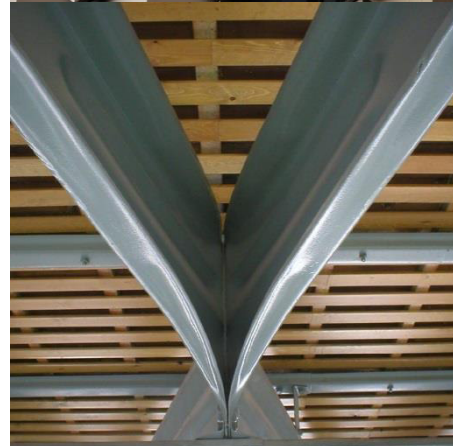
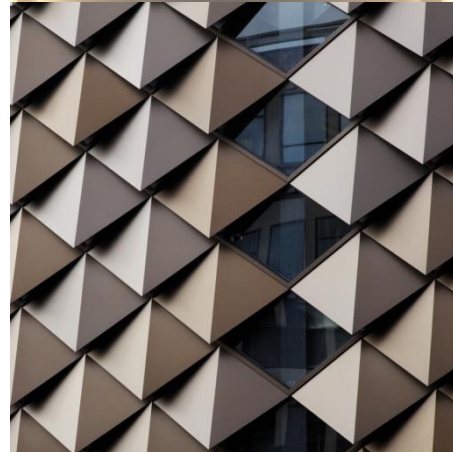
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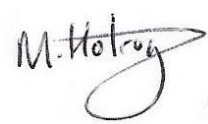
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Executive Summary

Appointment	In November 2021, Curtins were instructed by Bruntwood to undertake a Phase 2 Ground Investigation at Building 3, Circle Square (Formerly known as Plot 12), M60 7HB. The site is approximately now 1.04 Ha and centred on NGR SJ 84382 97366. The site's ground conditions has been characterised over various phases of ground investigation as summarised herein. Development proposals now include the following: the 14-storey office development with ground floor commercial uses and also includes road development on Brancaster Road, soft landscaping features west of Building 3 and car parking areas south of the existing substations.
Current Site Status	The site is located south of Brancaster Road. Part of the site (north east) was previously used as a construction site compound by John Sisk & Co, with the remainder capped with hardstanding and soft-landscaped areas. An old substation housing still exists on the north east of site. Two further substations are present to the southwest of the main site directly west of the existing NCP car park off site. The site boundary includes Brancaster Road, Cloak Street and the land west of the NCP car park and extends south of the substations which are present immediately west of the NCP car park. The site's topography is generally level, though sloping to the northeast in the northeast of the site.
Summary of Phase 1 and Previous Investigations	The earliest available historical mapping (1848) show the site was mainly occupied by terraced properties. Mapping dated 1908 shows a timber yard was present on site replacing the terraced properties with residential terraces to the southwest of the site. By 1922, a church and school are present in the southwest of the site. By 1948 the timber yard was replaced by Medlock Works (rubber footwear) and clothing factories, and the church and school have been demolished except a singular building in the southwest. By 1954, the St Augustine school is noted with two buildings to the southwest of the site. A chimney was recorded in the south of the site. By 1987, the area southwest of the factory building is undeveloped wooded area. The site was cleared by 1990 and a new unnamed building constructed with the remainder of the site is occupied by car parking relating to Armstrong House. The building was demolished circa 2017. Made Ground deposits are anticipated to be present. From BGS mapping superficial deposits are indicated as Devensian Till overlying the Chester Pebble Bed Formation. Defra data indicates that the site is underlain by a Principal Aquifer associated with the bedrock formation. The superficial deposits are designated as a Secondary A Aquifer. The site is not located within a Source Protection Zone (SPZ). The nearest surface water feature is the River Medlock less than 10m north of the site. There are no groundwater or surface water abstractions within 250m. UXO risk mapping identifies the site as Moderate risk area, however a Detailed UXO Risk Assessment raised this assessment to High risk site due to local area bomb damage. As such, UXO support was procured for the ground investigation on the site. The site is situated within a coal mining reporting area but not within a Development High Risk Area and as such the risk from coal mining to the development is Low. A ground investigation was undertaken by Ian Farmer Associates, on behalf of Curtins, in 2015 as part of master planning works for Circle Square. Works included one window sample borehole and one cable percussion borehole. Ground conditions comprised granular and cohesive made ground underlain by cohesive glacial till and sandstone bedrock. No elevated concentrations of contaminants of concern were highlighted in shallow site soils, with respect to Residential generic screening criteria. Minor exceedances of nickel and PAHs were recorded in one water sample with respect to UK Drinking Water Standards. Low concentrations of hazardous ground gases were encountered, correlating with a CS-1 Classification.
Risk from Unexploded Ordnance	The site of interest is in Manchester City Centre. Risk mapping for UXOs placed the site in a moderate risk area. A review of historical mapping and online bomb damage mapping indicated bomb damage was incurred in the south of the site and terraced properties to the south. A Detailed Unexploded Ordnance (UXO) Threat and Risk Assessment has concluded the site is High risk. The Principal Contractor must undertake their own UXO risk assessment and satisfy themselves that mitigation measures during construction works are suitable.
Fieldworks Undertaken	Prior to the building demolition, intrusive investigation was undertaken by Curtins in June 2019, comprising 4 No. window sample boreholes and 2 No. cable percussion boreholes with rotary coring follow on. Additional investigation was undertaken in August 2020 when the site was used and a contractor compound with further ground investigation in March 2022 following removal of the compound. The 2020 investigation included 2 No. cable percussion boreholes, and the 2022 investigation included 5 No. window sample boreholes. Boreholes were undertaken in positions beneath the proposed building footprint, reflecting the area not investigated in 2019 and to undertake additional soil sampling, in-situ testing, ground gas monitoring and groundwater level monitoring. In 2019, ground gas and groundwater monitoring standpipes were installed within the 2no. cable percussion boreholes and WS03, and in 2022 WS102, WS103 and WS105 were installed. Selected soil samples were subjected to laboratory analysis. Two groundwater samples were taken in 2022. A total of twelve ground gas monitoring visits have been undertaken.

Encountered Ground Conditions	Made ground typically comprises as granular or concrete surface cover, underlain by dark brown/dark grey sandy gravelly clay with cobbles. Gravels/cobbles comprise brick, concrete, sandstone. Locally, fragments of tarmac, mudstone, quartzite, siltstone, ash, charcoal and wood were also recorded. A thin layer of organic matter/vegetation was recorded in WS102 (1.70m bgl). Made ground was recorded to depths of between 1.60m to 7.50m bgl. Deeper made ground was described as 'reworked' ground, comprising soft dark brown slightly silty, gravelly clay in BHA and BHB. WS102, WS104 and WS105 recorded similar soils from depths of 2.70m to 4.50m bgl. Cohesive glacial till was recorded beneath made ground, from 1.60m to 7.50m bgl. Soils are typically recorded as firm or stiff dark brown or brown slightly gravelly silty clay. Gravels are typically recorded as fine and medium, sub-rounded sandstone, siltstone, mudstone and coal. The bedrock (Chester Formation) comprises medium strong locally weak, reddish-brown medium to coarse grained arenaceous sandstone from 9.50m to 11.00m bgl. The surface was heavily weathered in BHA (8.20m to 9.50m bgl), recovered as very dense reddish brown slightly gravelly medium and coarse sand. The quality of the rock improves with depth. Perched water was encountered within the made ground and within the cohesive glacial till. No groundwater monitoring has been undertaken within the bedrock.
Environmental Laboratory Testing	With respect to the proposed residential end-use of the site, soil testing results were compared against 'Commercial' GACs. No exceedances were recorded in any of the soil samples obtained. Made ground samples from WS03 (0.20m), WS101 (0.50m) and WS103 (1.00m) identified loose fibres of amosite at soil concentrations <0.001%. An asbestos management plan should be implemented during groundworks and construction works. A Moderate/Low risk rating is identified to site end-users, from soils and dust from inhalation and ingestion. The risk is low in the area of the proposed building footprint however additional investigation is required in uncharacterised areas of the site to assess if a plausible pollutant linkage is present in areas outside of the building footprint and if any capping is required in soft landscaped areas. A Moderate/Low risk rating is identified to construction works from soils and dust from inhalation and ingestion. As such it is recommended that construction workers are provided with appropriate PPE and sanitary facilities during construction works, with reference to the environmental testing results. An asbestos management plan should be implemented during groundworks and construction. A Low risk rating is identified to controlled waters (Groundwater and Surface Waters) on the basis that: the aquifer is protected by predominantly cohesive Glacial Till soils likely to limit migration of contamination; the River Medlock is likely of low quality, accounting for its urban setting; Water encountered in this investigation is likely perched water; and, the site is not situated within a Source Protection Zone.
Ground Gas Assessment	Six monitoring visits were undertaken in 2019, with a further six in 2022. The greatest concentrations of methane were recorded in WS102 (2022), at 4.8% v/v. WS102 was consistently >1.0% when recorded, with exception of the final visit. All other wells were <0.1% v/v. The greatest concentration of carbon dioxide was 1.1% v/v from BH02, monitored in 2022. The greatest peak air flow rates were recorded in WS102 (67.8 l/hr), however in all wells during the monitoring periods steady state air flow rates of <0.1 l/hr were recorded. Using the 'borehole' and 'worst case check' scenarios, the Q_{hg} for the site is 0.0048 l/hr for methane and 0.0011 l/hr for carbon dioxide. On the basis of the elevated concentrations of methane recorded, with the extensive made ground deposits likely to be the source, the site is characterised with a Characteristic Situation 2 (CS-2) gas regime, and as such gas protection measures will be required for the proposed building. Details of the remedial actions required should be outlined in a remediation strategy.
Geotechnical Assessment and Recommendations	It is understood that the proposed development is to consist of a 15 No. storey building. Due to the thickness of Made Ground and anticipated loads, it is considered a piled foundation solution be adopted, transferring loads to the underlying Sandstone bedrock. It is recommended a specialist piling contractor be contacted as to the suitability and carrying capacity of their piles in the ground conditions pertaining to site. As piled foundations are anticipated, a suspended slab is recommended to bear on the pile caps by a network of beams which will minimise any differential settlement between the floor slab and piled structure. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-1 and an ACEC class of AC-1 would be appropriate for the Made Ground soils and superficial soils.

Recommendations

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

- 1) Further ground investigation in uncharacterised areas of the site, outside of the proposed building footprint.
- 2) Further ground investigation/sampling beneath the electrical sub-station on eastern side, following its removal.
- 3) CS-2 Gas Protection Measures should be incorporated in the new building.
- 4) Asbestos management plan during groundworks and construction works.
- 5) 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.
- 6) A Remediation Strategy and Verification report will be required to detail and approve the above measures.
- 7) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.
- 8) Undertake piling/deep foundation risk assessment when foundation solution/design is determined.

Table of Contents

1.0	Introduction	1
1.1	Project Background	1
1.1.1	Stages of Ground Investigation	1
1.2	Scope of Services	1
2.0	Phase 1 Preliminary Site Assessment Summary	3
2.1	Current Setting	3
2.2	Previous Site Use	4
2.3	Published Geology	4
2.3.1	Made Ground Deposits	4
2.3.2	Superficial Deposits	4
2.3.3	Bedrock Deposits	5
2.3.4	BGS Recorded Borehole Logs	5
2.3.5	Mining	5
2.3.6	Radon	5
2.4	Hydrogeology and Hydrology	5
2.5	Unexploded Ordnance (UXO) Risk Assessment	6
2.6	Landfill	8
2.7	Summary of Phase 1 PCSM	8
3.0	Pre-Demolition Site Wide Site Investigation Summary	10
3.1	Ian Farmers Associates (on behalf of Curtins) Ground Investigation (September 2015).....	10
3.1.1	General	10
3.1.2	Ground Conditions	10
3.1.3	Ground Contamination and Ground Gas Assessment	11
3.1.4	Geotechnical Assessment and Considerations	11
3.1.5	Future Recommendations and Summary	12
4.0	Ground Investigation Scope of Works	13
4.1	Soil Logging and Sampling	14

4.2	Monitoring Well Installations	14
4.3	Post-Investigation Monitoring	15
4.3.1	Groundwater and Ground Gas Monitoring	15
5.0	Laboratory Analysis	16
5.1	Geo-environmental Analysis	16
5.1.1	Soil Analysis	16
5.1.2	Groundwater Analysis	17
5.2	Geotechnical Testing	17
6.0	Ground Conditions	19
6.1	Encountered Ground Conditions	19
6.2	Made Ground	20
6.2.1	Made Ground	20
6.3	Reworked Ground	20
6.4	Cohesive Glacial Till	21
6.5	Granular Glacial Till	21
6.6	Weathered Chester Formation	21
6.7	Chester Formation	21
6.8	Observed Potential Contamination	22
6.9	Obstructions Encountered	22
6.10	Groundwater	22
7.0	Ground Model	25
7.1	Made Ground	25
7.2	Reworked Ground	25
7.3	Cohesive Glacial Till	26
7.4	Granular Glacial Till	30
7.5	Chester Formation	30
7.6	Aggressive Ground Conditions	32
8.0	Ground and Groundwater Contamination Assessment	34

8.1	Human Health GQRA.....	34
8.1.1	Adopted Soil Human Health GACs Screening Methodology	35
8.1.2	Generic Assessment Criteria Screening of Soil Laboratory Results.....	35
8.1.3	Adopted Vapours within Groundwater Human Health GACs Screening Methodology	36
8.1.4	Generic Assessment Criteria Screening of Groundwater Laboratory Results.....	36
8.2	Controlled Waters GQRA.....	37
8.2.1	Adopted Controlled Waters Tier 1 Screening Values and Methodology.....	37
8.2.2	Tier 1 Screening of Groundwater Laboratory Results.....	37
9.0	Ground Gas Assessment	40
9.1	Ground Gas Monitoring Results.....	40
10.0	Revised Conceptual Site Model	43
10.1	Summary of Significant Pollutant Linkages.....	46
11.0	Geotechnical Assessment and Recommendations.....	47
11.1	Introduction.....	47
11.2	Geotechnical Considerations	47
11.3	Ground Floor Slabs	48
11.4	Chemical Attack on Buried Concrete	48
11.5	Excavation and Support	48
12.0	Conclusions & Recommendations	49
12.1	Conclusions.....	49
12.1.1	Ground and Groundwater Contamination	49
12.1.2	Ground Gas Assessment	50
12.2	Recommendations	50
12.2.1	Additional Considerations	51
13.0	References	52

Appendices

- Appendix A - Drawings
- Appendix B - Exploratory Hole Logs
- Appendix C - Chemical Laboratory Testing Results
- Appendix D - Geotechnical Analysis Results
- Appendix E - Ground Gas and Groundwater Monitoring Results
- Appendix F - GAC Screening Thresholds
- Appendix G - Risk Assessment Methodology

1.0 Introduction

1.1 Project Background

In November 2021 Curtins were instructed by Bruntwood to undertake additional ground investigation for the proposed development known as Building No.3, Circle Square.

The site is centred at National Grid Reference 384350, 397310, and covers an area of 1.04 Ha.

Development proposals include the following: 15-storey office development with ground floor commercial uses and also includes road development on Brancaster Road, soft landscaping features west of Building 3 and hardstanding areas south of the existing substations.

Proposed site development plans are presented in Appendix A.

A site location plan is presented in *Figure 2.1*.

Several phases of investigation have been undertaken by Curtins within the wider Circle Square Development site as summarised below.

1.1.1 Stages of Ground Investigation

The first stage was undertaken in 2015, as a preliminary intrusive investigation to inform proposed future development for the wider site.

The first stage of plot specific investigation undertaken in 2019. Curtins were instructed by Bruntwood in May 2019 to undertake works with the aim to provide preliminary characterisation of the geo-environmental and geotechnical conditions for the site. At this time, the site was known as 'Plot 12, Circle Square'.

Subsequent works (third stage) were undertaken by Curtins in August 2020, to further characterise the deeper ground conditions, and to provide additional information to aid pile design.

In November 2021 Curtins were instructed by Bruntwood to undertake a further (fourth stage) of investigation works, accounting for a revised plot layout, including a slightly larger surface area, and a revised development layout. The site is now known as 'Circle Square, Building No. 3'. The updated layout included a site boundary which extended north, north west and southwest of the original layout and extension of the building footprint to the west.

1.2 Scope of Services

This investigation addressed the recommendations as presented in the 2015 Phase 1 Report (Ref.1) and more recent 2022 site specific Phase 1 Report (Ref. 2).

The aims of the multiple phases of investigation (2019, 2020 and 2022) include:

- Characterise geo-environmental and geotechnical ground conditions
- Enable discharge of relevant contaminated land planning conditions
- Obtaining geotechnical information for a foundation assessment for the proposed development.

It is understood the proposed development plan comprises a fourteen-storey office block building. Development plans are included within *Appendix A*.

The Phase 2 report is specifically intended to:

- a) Collating information from previous stages of plot specific investigation (Stage 2 to Stage 4 GI) and present data from across the wider development site (Stage 1 GI).
- b) Determine if there is a risk of the proposed end-user being adversely impacted upon by potential contamination in shallow site soils, that may be present on the site due to its known current, recent and historical use;
- c) Determine if there is a risk of groundwater and/or surface water being adversely impacted upon by potential contamination that may be present on the site, due to its known current, recent and historical use;
- d) Determine if there is a risk to the end-user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide arising from site soils beneath previously existing buildings.
- e) Characterise site wide natural soils/strata to enable recommendations for the design of foundations and building ground floor slabs;
- f) Provide recommendations for the specification of sub-structure concrete

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

2.0 Phase 1 Preliminary Site Assessment Summary

A Phase 1 Preliminary Risk Assessment (PRA) was undertaken for the site by Curtins in March 2022 (Ref.1). A summary of the detailed findings of this Desk Study, comprising current site setting, history, geology and hydrogeology/hydrology is presented within this Section with reference to additional information sources.

2.1 Current Setting

The site boundary includes Brancaster Road, between Oxford Road and Princess Street, an area of derelict land, bordered by a temporary board fence, is located directly west of Princess Street and north of the recently constructed multi-storey car park. An old substation housing still exists within the hoarding.

A small road is constructed west of the fencing and south of Brancaster Road, branching into two routes around an area of grassed soft landscaping. The first branch runs adjacent to the Manchester Technology Centre, and the second as an exit route from the car park.

A small substation and two larger substation buildings are located at the southern end of the soft landscaping.

The southern portion of the site is located beneath Mancunian Way (A57(M)), currently used as a car park. Concrete pillars/columns support the overpass. Hatch, an outdoor food and drink venue, is located directly west of the southern boundary.

The site location and boundary are illustrated in *Figure 2.1*.

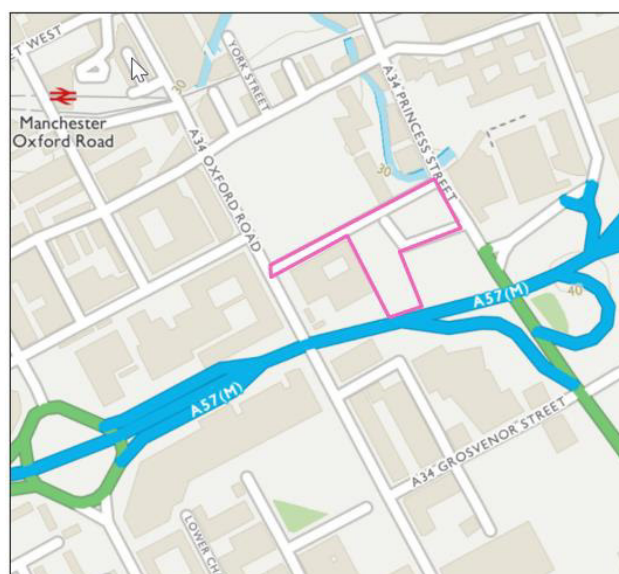


Figure 2.1 – Site Location Plan (site boundary shown in pink).

The surrounding land use generally comprises commercial and multistorey residential land use, the Mancunian Way is present south of the site with an overpass covering part of the southern boundary, Oxford Road train station is present 250m northwest of the site.

2.2 Previous Site Use

Earliest available historical mapping (1848) show the updated extended site was mainly occupied by terraced properties with a timber yard on the north east of the site. By 1923, a church and school are present in the southwest of the site.

By 1948 the timber yard was replaced by Medlock Works (rubber footwear) and clothing factories, and the church and school have been demolished except a singular building in the southwest. By 1954, the St Augustine school is noted with two buildings to the southwest of the site. A chimney was recorded in the south of the site. By 1987, the area southwest of the factory building is undeveloped wooded area. The site was cleared by 1990 and a new unnamed building constructed with the remainder of the site is occupied by car parking relating to Armstrong House. The building was demolished circa 2017.

Throughout the site's history, its local surroundings are generally occupied by industrial land use with potential for on site contaminated soils.

2.3 Published Geology

A study of the Envirocheck within the Phase 1 Preliminary Risk Assessment (Ref. 1) Report and the British Geological Survey (BGS) 1:50,000 mapping records (Solid and Drift) for Manchester (Sheet 085) dated 2010 (Ref. 2) indicates the following geological and hydrogeological succession underlying the site.

- **Superficial Deposits:** Glacial Till, Devensian; overlying
- **Solid Geology:** Chester Pebble Bed Formation

2.3.1 Made Ground Deposits

BGS mapping records do not indicate the presence of Made Ground on site, however the borehole records indicate a limited thickness is likely to be present underlying the site.

2.3.2 Superficial Deposits

Superficial deposits are recorded as Glacial Till deposits comprising a heterogenous mixture of clays, sands and gravels varying widely in size and shape.

2.3.3 Bedrock Deposits

The site is underlain by the Chester Pebble Beds Formation of Early Triassic Age, typically recorded as conglomerates and reddish-brown cross-bedded, pebbly sandstones with subordinate beds of red-brown mudstone.

2.3.4 BGS Recorded Borehole Logs

There is one BGS recorded boreholes log available for within 50m of the site.

Table 2.3.4 – Summary of BGS Recorded Borehole Logs

Record Reference	Location (NGR)	Details (bottom to top of strata/details/thickness of strata)	
SJ89NW248	50m (east) (384446, 397390)	0.00m to 3.05m bgl	Brown, CLAY (3.05m)
		3.05m to 18.29m bgl	Soft red SANDSTONE (15.24m)
		18.29m to 25.91m bgl	Red SANDSTONE with marl veins (7.62m)
		25.91m to 32.00m bgl	Hard red SANDSTONE (6.10m)
		32.00m to 64.62m bgl	Pebble bed SANDSTONE (32.61m)
		64.62m to 76.51m bgl	Hard red SANDSTONE with large pebbles (11.89m)
		76.51m bgl	Borehole complete

2.3.5 Mining

A review of the Coal Authority interactive mapping (Ref. 3) for the area indicates that the site is located within a Coal Mining Reporting Area but not within a Development High Risk Area. There are no recorded or probable surface, shallow or future coal mine workings within and as such the risk from coal mining to the development is **Low**.

A non-coal mining cavity is recorded approximately 476m southeast of the site relating to clay extraction from superficial deposits. There are no recorded BGS mineral sites within 1km of the site.

2.3.6 Radon

The site is located within a Lower Probability Radon Area (less than 1% of homes are estimated to be at or above the Action Level). No radon protective measures are necessary.

If a basement is proposed, a radon specialist should be contacted for advice.

2.4 Hydrogeology and Hydrology

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

Table 2.4 – Hydrogeology and Hydrology Summary

Geology	Associated Hydrogeological Classification
Glacial Till	Secondary A Aquifer ¹
Chester Pebble Beds 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 flows to rivers. These are generally aquifers formerly classified as Minor Aquifers.
2. Layers of rock or drift deposits that have high intergranular and/or fracture permeability meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, Principal Aquifers are aquifers previously designated as Major Aquifers.

The site is not located within a Source Protection Zone (SPZ).

There are no groundwater abstraction points within 250m of the site.

The nearest surface water feature recorded by the Envirocheck report (Ref.1) is River Medlock recorded less than 10m north of the site flowing west.

There are no surface water abstractions within 1km.

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. This process is outlined within CIRIA C681 Unexploded Ordnance: A Guide for the Construction Industry (Ref. 4).

Risk mapping (Ref. 5) for UXO's has placed the site in a **Moderate** risk area. Low-risk regions are those with a bombing density of 15 to 49 bombs per 1000 acres) and abundant potential WWII targets. As a result, further action is required to mitigate the UXO risk.

A review of historical mapping and available online bomb damage mapping (Ref. 2) for Manchester has indicated that bomb damage was incurred in the south of the site and terraced properties immediately south of the site were demolished. A fire bomb was recorded approximately 120m north west of the site.

The buildings in the south of the site are shaded pink which indicates they encountered damage during WWII, confirmed by historical mapping which indicates the presence of Medlock Works in their place. The terraced properties and St Augustine's Roman Catholic Church to the south boundary of the site are shaded red indicating they were demolished during WWII.

An extract from this mapping is presented in *Figure 2.5* on the next page.



Figure 2.5 – Map of bomb damage in Manchester from WWII (red line shows old site boundary and pink line shows new site boundary, red circles show fire bombs, pink shading shows damage buildings, red shading shows demolished buildings, blue circles show locations of high explosives) opy 2016 The University of Manchester.

Considering the above, a Detailed UXO Risk Assessment was procured and the following risk assessment has been provided.

The risk of encountering potential UXO as part of future intrusive ground investigation works is considered **High**, and the following actions were recommended for Curtins works;

All Works:

1. Operational UXO Risk Management Plan; appropriate Site Management documentation should be held onsite to guide and plan for the actions which should be undertaken in the event of a suspected or confirmed UXO discovery;
2. UXO Safety & Awareness Briefings; the briefings are essential when there is a possibility of an UXO encounter and are a vital part of the general safety requirement.

All Window Sampling and Excavations:

3. EOD Banksman Support; EOD Engineer to survey and / or supervise the window sampling and excavations for UXO and to identify any suspicious items as the work proceeds in the EOD Banksman role.

All Boreholes and Piling:

4. Intrusive Magnetometer Survey; an intrusive survey (employing down-hole magnetometer or MagCone techniques) ahead of drilling and piling is strongly recommended. Such a survey should extend to the maximum bomb penetration depth or to the maximum depth of the works, whichever is encountered first)

If unexploded ordnance is discovered, 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.

Contractors undertaking excavations should undertake their own risk assessments with reference to the information presented herein and additional information where required.

2.6 Landfill

There are no recorded landfill sites within 1km of the site.

The Phase 1 report (Ref. 1) identifies no potentially infilled land (non-water/water) within 250m of the site.

2.7 Summary of Phase 1 PCSM

A summary of potential pollutant linkages at the development site as identified in the Phase 1 Report (Ref. 1) is presented in Table 2.8. These potential pollutant linkages were identified as requiring further investigation to enable the safe redevelopment of the site.

Potential contaminants of concern associated with any Made Ground present include, amongst others; broad range aliphatic and aromatic hydrocarbons present within any fuel oils; polycyclic aromatic hydrocarbons (PAHs); inorganic compounds including heavy metals; and asbestos present in discarded building materials. Further investigation of the area around the substation on the site for poly-chlorinated biphenyls (PCBs) is yet to be undertaken.

The risks presented to controlled waters (groundwater and surface water) were identified as **Moderate** due to the site not being located in a SPZ or the presence of any groundwater abstraction licences. Water samples are therefore considered unlikely to be required unless visual or olfactory evidence of soil contamination suggests there may be a risk to controlled waters.

The risk to development from ground gas generating sources is considered to be **Moderate/Low**. However, this may be revised based on the findings of the gas monitoring schedule for the boreholes that underly the area of the previous existing Sisk compound.

Table 2.8 – Preliminary Conceptual Site Model

Source	Pathway	Receptor	Risk Rating	Action
On-site sources of potential contamination: Made Ground of unknown composition from uncontrolled deposition of materials onsite industrial land use during the construction of the properties onsite. Off-site sources of potential contamination: Uncontrolled deposition of Made Ground during the construction of roads and operations of industrial land use and demolition near and adjacent to the site's boundaries.	Direct contact, ingestion, inhalation (dust and vapours)	End-user of site (Commercial) & Construction Workers	Moderate	Undertake soil testing of shallow soils in the area of the site where the buildings are proposed to confirm risk assessment.
	Vertical migration through the superficial deposits (soils) May occur due to existing service corridors and physical processes including; capillary action and downwards flow into the natural deposits through infiltration.	Controlled Waters (Groundwater) Superficial Soils: Glacial Till (Secondary A Aquifer). Bedrock: Chester Pebble Bed Fm (Principal Aquifer) There are no potable groundwater abstraction points within 1km. The site is not within a designated Source Protection Zone.	Moderate	No action required unless gross contamination identified in site soils in GI.
	Horizontal migration over and through the superficial deposits (soils)	Controlled Waters (Surface Water) Nearest surface water feature is River Medlock, less than 10m north. No surface water abstraction points within 1km.	Moderate	No action required unless gross contamination identified in site soils in GI.
On and off-site soils with the potential to generate ground gases: Localised organically rich deposits present within the natural soils.	Vertical and horizontal migration through underlying superficial deposits into buildings and air spaces	Site End Users (Commercial)	Moderate/Low	Undertake ground gas monitoring in the area of the site where the buildings are proposed to confirm risk assessment and gas regime.

3.0 Pre-Demolition Site Wide Site Investigation Summary

This section presents a summary of the Pre-Demolition site wide Phase 2 Intrusive Investigation undertaken by IFA on behalf of Curtins in 2015 (Ref. 2). Specific reference is given to the boreholes undertaken on or in close proximity to the 'Building 3' development area, known at the time as 'Phase 2 Area'. This information is presented as background information given the time passed since investigation and known changes to the site through building demolition etc.

3.1 Ian Farmers Associates (on behalf of Curtins) Ground Investigation (September 2015)

3.1.1 General

The site works were undertaken on 29th September 2015 and between 6th and 9th October 2015 comprising: one window sample borehole (WS3/1) to a maximum depth of 2.60m bgl and one cable percussive hole to a maximum depth of 7.00m bgl (BH3/1).

A ground gas and groundwater monitoring installation (50mm) was installed within WS3/1. The response zone was 1.0m to 2.5m bgl within the Made Ground. The logs are contained within *Appendix B* for reference, with the exploratory hole location plan contained in *Appendix A*.

Selected soil samples were subjected to laboratory analysis and six return ground gas monitoring visits have been undertaken to date.

3.1.2 Ground Conditions

Made Ground was encountered in WS3/1 and BH3/1, from ground level to depths of 2.60m bgl and 7.00m bgl respectively. In WS3/1, it was recorded underlying the concrete. Made Ground generally comprised sandy, fine to coarse, angular to sub-rounded Gravels and Cobbles including sandstone, quartzite, brick, coal, concrete, slag, limestone and clinker to depths of 0.80m bgl and 1.20m bgl. The granular Made Ground was underlain by cohesive Made Ground generally comprising slightly sandy slightly gravelly Clay.

The Made Ground was underlain by Glacial Till described as stiff to very stiff brown sandy gravelly Clay. In BH3/1, a 0.70m band of very dense, brown slightly sandy Gravel with medium sub-rounded cobbles of sandstone and quartzite was recorded beneath the Glacial Till at 8.60-9.30m bgl, underlain by weathered sandstone.

Sandstone bedrock was encountered in BH3/1 at 9.30m bgl (24.03m AOD), as very weak to weak, thickly bedded, reddish brown, fine to coarse grained Sandstone. The rotary borehole was terminated at 21.00m bgl.

Groundwater was not recorded during the site investigation. Six monitoring visits were undertaken, groundwater level of between 0.60m and 1.30m bgl in WS3/1 were recorded during the return visits.

3.1.3 Ground Contamination and Ground Gas Assessment

As a part of the 2015 preliminary ground investigation, two Made Ground soil samples were tested from WS3/1 and BH3/1. The soil chemistry results were compared against a conservative '*Residential without the Consumption of Produce*' end use. No exceedances were recorded within the recovered soil samples. All soils were screened for asbestos, with no asbestos positively identified in the WS3/1 and BH3/1 samples. No suspected asbestos containing materials (ACMs) were identified in laboratory testing.

Relatively minor exceedances were identified in the groundwater sample (WS3/1) against UK Drinking Water Standards with respect to Nickel, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene and Indeno(1,2,3-cd)pyrene.

Six ground gas monitoring visits were undertaken for WS3/1 following the pre-demolition investigation. During ground gas monitoring, carbon dioxide concentrations were typically recorded in peak concentrations between 0.1% v/v and 0.7% v/v. A negative peak gas flow was recorded one occasion as -0.1l/h. No methane was recorded above the limit of detection.

No elevated concentrations of PAHs and TPHs were recorded within the Made Ground.

A **Moderate** risk rating was identified to site end-users at this stage from direct contact, inhalation and ingestion of contaminants within Made Ground soils.

The risk to controlled waters from leachable contamination in site soils through the vertical and horizontal migration was considered **Moderate** and **Low** for groundwater and surface water receptor respectively.

The risk to site end users from migration and inhalation of ground gases was assessed as **Low** in Phase 2 Area (Building 3) as the maximum carbon dioxide and gas screening values indicate CS1 gas regime.

3.1.4 Geotechnical Assessment and Considerations

The 2015 preliminary investigation proved variable Made Ground to depths of 2.60m bgl and 7.00m bgl in the area of Plot 12. The deepest Made Ground (7.00m bgl) was encountered in BH3/1, adjacent to Brancaster Rd.

It was anticipated that the buildings will be multi-storey structures resulting with anticipated high loads. As such, conventional shallow spread foundations were not anticipated to be a suitable foundation solution. It was therefore recommended that piled foundations are used to transfer

structural loads to the competent stratum. Dependent on loadings it may be necessary for piles to be embedded into the sandstone bedrock.

Due to the presence of significant thickness of Made Ground, use of suspended floor slabs bearing on the pile caps by a network of beams was recommended.

3.1.5 Future Recommendations and Summary

Post-demolition investigation was recommended to further characterise geo-environmental and geotechnical conditions with the aim of discharging relevant contaminated land planning conditions and obtaining geotechnical information for a foundation assessment for the proposed structure.

4.0 Ground Investigation Scope of Works

Plot Specific pre-demolition site investigation works were undertaken in June 2019.

Post-demolition site investigation works were undertaken by Curtins between 04 August and 05 August 2020, and on 02 March 2022.

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

- LCRM (Ref. 6);
- British Standard (BS) 10175:2011+A2:2017 (Ref. 7);
- BS5930:2015+2020 (Ref. 8);
- and BS EN1997: Part 2:2007 Eurocode 7 (Ref. 9).

The scope and rationale are summarised in *Table 4.0*.

Table 4.0 – Scope and Rationale of Fieldwork Undertaken

Stage No.	Exploratory Hole Type	Exploratory Hole Ref.	Ground level (m AOD)	Exploratory Hole Depth (m bgl)	Rationale
2019 Investigation	Window Sample Boreholes	WS01	33.90	0.30	Confirm shallow ground and groundwater conditions; Collect soil samples for chemical analysis; Collect samples for geotechnical soil testing
		WS01A	33.90	0.30	
		WS01B	33.90	0.25	
		WS02	34.40	0.75	
		WS02A	34.40	0.70	
		WS03	33.90	5.45	
		WS04	33.40	0.60	
		WS04A	33.40	0.55	
	Cable Percussive Borehole with Rotary Cored Follow On	BH01* ¹	35.89	25.50	Confirm shallow ground and groundwater conditions; Collect soil samples for chemical analysis; Collect soil and rock samples for geotechnical soil testing; and Gas and groundwater level monitoring.
		BH02* ¹	34.80	25.00	
2020 Investigation	Cable Percussive Boreholes	BHA BHB	10.10 12.10	10.10 12.10	Undertaken at the request of a prospective piling contractor to provide further information relating to the shallow and deeper ground and groundwater conditions in area which had formerly been occupied by a building.
2022 Investigation	Window Sample Boreholes	WS101 WS102* WS103* WS104 WS105*	34.20 34.00 34.00 33.80 33.85	1.47 3.00 4.45 3.45 4.45	Confirm shallow ground and groundwater conditions within area that has previously been occupied by a building and subsequently contractors compound; Collect soil samples for chemical analysis;

					Collect samples for geotechnical soil testing; and Gas and groundwater level monitoring.
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* Ground gas/water monitoring well installed within borehole.

1 Rotary cored borehole from 9.40m and 9.00m in BH01 and BH02 respectively.

Ground level at each exploratory hole location was estimated from the topographical survey obtained. The levels are presented on the exploratory hole logs which can be referred to in *Appendix B*.

For the location of the exploratory holes of Curtins 2019, Curtins 2020 and Curtins 2022 investigations refer to Curtins drawing ref: CS12-CUR-12-XX-DR-GE-80004-P01 Exploratory Hole Location Plan included in *Appendix A*.

Window sample borehole ref. WS102 (2022) was terminated at 3.00m bgl due to anomalous readings from the UXO magnetometer.

4.1 Soil Logging and Sampling

Exploratory hole arisings were logged onsite by an Engineer from Curtins and in accordance with the requirements of BS5930 (Ref. 8).

No observed visual and olfactory indications of contamination were recorded. Exploratory hole logs can be referred to *Appendix B*.

4.2 Monitoring Well Installations

Ground gas and groundwater monitoring 50mm diameter slotted pipes were installed within the cable percussion boreholes BH01 and BH02 (2019), and window sample boreholes WS03 (2019) and WS102, WS103, and WS105 (2022).

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.

The monitoring wells were designed to assess the potential for ground gas and monitor groundwater levels. The screened sections therefore focused on the more permeable deposits where encountered, where ground gas and groundwater may be encountered.

A summary of the response zone is presented in *Table 4.2*.

Table 4.2 – Monitoring Well Response Zones

Investigation Date		Borehole Ref.	Response Zone m bgl (m AOD)	Strata Description(s)
2019	BH01	6.00 – 9.00	Cohesive Glacial Till, thin sand band	

		(29.89 – 36.89)	
	BH02	3.00 – 8.00 (31.80 – 26.80)	MADE GROUND, cohesive Glacial Till and granular Glacial Till
	WS03	0.20 – 1.20 (33.70 – 32.70)	MADE GROUND
2022	WS102	1.00 – 2.00 (33.00 – 32.00)	MADE GROUND
	WS103	1.50 – 4.00 (32.50 – 30.00)	MADE GROUND
	WS105	1.00 – 3.00 (37.80 – 35.80)	MADE GROUND

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

4.3 Post-Investigation Monitoring

4.3.1 Groundwater and Ground Gas Monitoring

Six return monitoring visits were undertaken between 26th June 2019 and 30th August 2019, with six further groundwater level and ground gas monitoring visits over a fourteen week period between 17th March 2022 and 16th June 2022 to assess the groundwater levels and the ground gas conditions.

Groundwater samples have been taken from two of the window sample borehole installations as part of the 2022 investigation, to support further controlled waters assessment. Results of the groundwater testing are presented within the environmental results in *Appendix B*.

The results of the groundwater level monitoring are detailed in *Section 6.8*.

The results of the ground gas monitoring are detailed in *9.0*.

5.0 Laboratory Analysis

5.1 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.

A total of 13 No. Made Ground and 4 No. natural samples were selected for chemical testing throughout the various phases of investigation (2019–2022).

No soil samples were obtained during the 2020 Curtins investigation.

Soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical and geotechnical analysis was Envirolab. (UKAS and MCERTS accredited).

Given the lack of any obvious sources of potential contamination the sampling positions were generally located in a non-targeted, systematic array to achieve representative coverage of the sites proposed end use and the immediate environmental setting, concentrated in the near surface deposits.

5.1.1 Soil Analysis

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

The extent of the above is captured by the broad environmental testing suites listed in *Table 5.1.1*.

Table 5.1.1 – *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)	0.01-0.08 mg/kg
	TPH (Aro/Ali Split)	0.01-1 mg/kg

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

5.1.2 Groundwater Analysis

Two groundwater samples were obtained from installations within Made Ground (WS102 and WS105) as part of the 2022 investigation.

Results are presented within *Appendix B*.

5.2 Geotechnical Testing

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref. 10). The undertaken geotechnical testing is summarised in *Table 5.2.1*.

Table 5.2.1 – Geotechnical Testing

Test Type		Quantity	Standard
In Situ Testing			
Curtins 2019	Standard Penetration Testing	17	BS 5930: 2015, Clause 41
Curtins 2020	Standard Penetration Testing	20	BS 5930: 2015, Clause 41
Curtins 2022	Standard Penetration Testing	13	BS 5930: 2015, Clause 41
Laboratory Testing			
Curtins 2019	Atterberg Limit (4 Point)	11	BS1377 1990, Part 2 (Clause 4.5, 5.3 & 5.4)
	Particle Size Distribution	1	BS1377 1990, Part 2 (Clause 9.2)
	Moisture Content	11	BS1377 1990, Part 2
	Water Soluble Sulphate	21	ISO 17025 MCERTS
	pH Value	20	ISO 17025 MCERTS

Test Type		Quantity	Standard
	Point Load Test (Axial)	29	ISRM Suggested Methods: 2007
	Point Load Test (Diametral)	29	
	Uniaxial Compressive Strength	10	ISRM Suggested Methods, pp 111-116, 1981
Curtins 2022	Atterberg Limit (4 Point)	5	BS1377 1990, Part 2 (clause 4.5, 5.3 & 5.4)
	Moisture Content	5	BS1377 1990, Part 2
	Water Soluble Sulphate	4	ISO 17025 MCERTS
	pH Value	4	ISO 17025 MCERTS

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*.

6.0 Ground Conditions

The ground conditions across the site, determined during the Curtins 2019, 2020 and 2022 ground investigation works, generally comprised layers of predominantly concrete or roadstone surface cover overlying deep Made Ground, overlying cohesive glacial soils and locally deeper granular glacial soils. Glacial soils were underlain by sandstone of the Chester Formation, locally recorded as weathered material. The natural soils encountered were generally consistent across the site and will be summarised in the following sections.

6.1 Encountered Ground Conditions

A summary of the ground conditions encountered during the Curtins site investigation works is presented below, with detailed information presented on the exploratory hole logs which can be referred to in *Appendix B*.

Table 6.1 – Summary of Ground Conditions Encountered in the Curtins Investigation

Stratum	Depth to top of strata, m bgl (m AOD)	Recorded Thickness (m)		Description
		Min	Max	
Concrete (WS101, WS04, WS105)	0.00 (157.65)	0.10 ¹		Concrete.
Made Ground (all boreholes)	0.00 (34.21 - 34.02)	2.80 ²	7.50	Dark brown to dark grey sandy gravelly clay. Gravel included fine to coarse brick, ceramics, ash, and sandstone. Brown, slightly clayey gravelly sand or sandy gravel. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite.
Possible Reworked Ground (BHA, BHB, WS102, WS104 and WS105 only)	2.60 - 3.90 ³	0.30 ⁴	4.90 ⁴	Soft to firm, orangish brown, silty sandy CLAY. Sand is fine. or Soft dark brown slightly silty, gravelly clay. Gravel is fine to medium and subrounded to sub-angular of brick, sandstone and siltstone
Cohesive Glacial Till Deposits	1.60 - 7.50 (34.09 - 26.52)	0.70	4.50	Firm dark brown slightly gravelly silty CLAY. Gravel is fine to medium and sub-rounded of coal, sandstone, and siltstone.
Granular Glacial Till Deposits¹	7.10/10.50 (28.79/23.71)	0.20/0.50		Orangish brown fine to coarse sand Dense, dark grey, SAND and GRAVEL with frequent cobbles. Gravel is rounded of siltstone and sandstone. Cobbles are rounded of siltstone.
Weathered Chester Formation¹	8.20 (25.82)	1.30		Very dense reddish-brown slightly gravelly medium to coarse SAND. Gravel is fine to coarse and sub-rounded of sandstone

Stratum	Depth to top of strata, m bgl (m AOD)	Recorded Thickness (m)		Description
		Min	Max	
Chester Formation (Sandstone)	9.50 - 11.00 (24.52 - 23.21)	0.60 ⁴	1.10 ⁴	Reddish-brown SANDSTONE bedrock.

1 Where encountered

2 Logged as overlying possibly reworked material

3 Topographic levels not recorded for WS101 to WS105.

4 Base of strata not proven.

6.2 Made Ground

6.2.1 Made Ground

Made Ground across the site generally comprising Dark brown to dark grey sandy gravelly clay. WS101 to WS105 did encounter granular Made Ground comprising brown, slightly clayey gravelly sand or sandy gravel. Occasional cobbles of brick, concrete and sandstone were encountered in shallow and deeper Made Ground strata. Gravel included fine to coarse brick, ceramics, ash, and sandstone.

Deeper Made Ground from 2.60m to 7.50m bgl in BHA and BHB was recorded to be 'Reworked Ground' and is further detailed in *Section 6.3*.

WS101 encountered deeper concrete from ground level to 0.20m bgl and a buried obstruction at 1.45m bgl most likely concrete.

Made Ground strata base was confirmed in BHA and BHB as between 7.00m and 7.50m bgl (27.21m to 26.52m AOD).

Made Ground soils were encountered in all exploratory holes.

6.3 Reworked Ground

BHA and BHB recorded reworked ground comprising soft dark brown slightly silty, gravelly clay. Gravel is fine to medium and subrounded to sub-angular of brick, sandstone, and siltstone. Reworked ground was encountered from 2.60m to 7.50m bgl (31.42m to 26.52m AOD) and was recorded to be overlying the natural clay in both BHA and BHB.

WS102, W104 and WS105 recorded a cohesive soil comprising soft to firm, orangish brown, slightly silty sandy clay from 2.70m to 4.45m bgl. The contents of the soil did not contain any Made Ground material such as brick or ash. However, there was no internal structure or lamination within the clay and the depth of the soils correlate with the depth of reworked clay from the 2020 ground investigation. As such it is highly likely the clays are reworked natural ground in these areas.

The base of this stratum was not encountered in any of the window sample boreholes.

6.4 Cohesive Glacial Till

Soils indicative of cohesive Glacial Till were encountered at depths ranging between 1.60m (WS03) and 7.50m (BHA) bgl.. Soils are typically recorded as firm or stiff dark brown or brown slightly gravelly silty clay. Gravels are typically recorded as fine and medium, sub-rounded sandstone, siltstone, mudstone and coal.

Rare wood fragments were recorded in BHB from 7.00m to 8.60m bgl.

Layers of soft light brown, with grey or reddish-brown mottling, slightly gravelly clay were recorded in WS03 (1.60m – 2.20m bgl), BH01 (1.80m – 2.60m bgl).

6.5 Granular Glacial Till

BH01 recorded a thin layer (0.20m) of orangish brown fine to coarse sand from 7.10m to 7.30m bgl.

BHB recorded granular Glacial Till deposits from 10.50m to 11.00m bgl (23.71m to 23.21m AOD). The granular material comprised dense, dark grey sand and gravel with frequent cobbles. Gravel is rounded siltstone and sandstone and cobbles of siltstone.

6.6 Weathered Chester Formation

BHA recorded soils reflective of weathered bedrock deposits of the Chester Formation. These soils comprised very dense, reddish brown slightly gravelly medium to coarse sand from 8.20m to 9.50m bgl (25.82m to 24.52m AOD). Gravels of subrounded sandstone.

6.7 Chester Formation

Bedrock encountered on site typically comprised medium strong locally weak, reddish brown medium to coarse grained arenaceous sandstone. Fractures were generally fresh, with sub horizontal to 45° closely to very closely, rough and open. The rock is highly to completely weathered in places, recovered as non-intact deposits comprising slightly clayey gravelly coarse sand.

In BH01 extremely weak dark reddish brown fine-grained argillaceous mudstone was encountered at between 20.09m and 20.58m bgl recovered as stiff reddish brown clay. Weathering is described as fresh assuming extremely poor consolidation in the fresh state.

Deposits were encountered in BH01 at 10.50m bgl (25.89m AOD) and in BH02 at 9.00m bgl (25.80m AOD). The base of the sandstone was not proven during this investigation. The boreholes were terminated at a depth of 25.0m bgl.

6.8 Observed Potential Contamination

No potential olfactory contamination was observed during the intrusive investigation works. All exploratory boreholes recorded ash within the Made Ground soils.

6.9 Obstructions Encountered

A summary of obstructions encountered during the intrusive investigation are presented in *Table 6.9*.

Table 6.9 – Summary of Obstructions Encountered During the Investigation

Location Number	Depth Encountered (m bgl)	Obstruction Description
WS01	0.30	Concrete. Thickness not identified.
WS01A	0.30	Concrete. Thickness not identified.
WS01B	0.25	Concrete. Thickness not identified.
WS02	0.75	Concrete. Thickness not identified.
WS02A	0.70	Concrete. Thickness not identified.
WS04	0.60	Concrete. Thickness not identified.
WS04A	0.55	Concrete. Thickness not identified.
WS101	1.45	Concrete boulder/slab

6.10 Groundwater

Groundwater was encountered during intrusive site investigation in both cable percussive exploratory boreholes (BHA and BHB). Details of water strikes during the investigation are summarised in *Table 6.10a*.

Table 6.10a – Summary of Groundwater Strikes Recorded (2019 – 2022)

Investigation Dates	Exploratory Hole ID	Water Strike		Water Level After 20 Minutes		
		m bgl	m AOD	m bgl	m AOD	Stratum
2019	BH01	2.00	33.89	-	-	Cohesive Glacial Till
		9.50	26.39	-	-	Cohesive Glacial Till
	BH02	3.10	31.70	-	-	MADE GROUND
	WS03	0.65	33.25	-	-	MADE GROUND
2020	BHA	7.50	24.52	7.00	25.02	Cohesive Glacial Till
	BHB	3.00		3.00		

Investigation Dates	Exploratory Hole ID	Water Strike		Water Level After 20 Minutes		
		m bgl	m AOD	m bgl	m AOD	Stratum
		10.50		8.50		Granular Glacial Till
2022	WS103	3.00		-		MADE GROUND
	WS104	2.00		-		MADE GROUND
	WS105	2.00		-		MADE GROUND

A total of twelve rounds of groundwater level monitoring have been undertaken, six during the 2019 investigation and a further six in 2022.

The six visits in 2019 were undertaken between 26th June 2019 and 30th August 2019, for WS03 only. The results are summarised in Table 6.10b.

Table 6.10b – Summary of 2019 Groundwater Level Monitoring Results

Borehole Ref.	Installation Strata	Response Zone (m bgl)	Exploratory Hole Elevation (m AOD)	Depth (m bgl)					
				26/06/2019	12/07/2019	22/07/2019	30/07/2019	09/08/2019	30/08/2019
WS03	Made Ground	0.20 – 1.20	33.90	0.95	0.45	0.54	0.47	0.50	0.64

A further six rounds of groundwater monitoring were undertaken between 17th March 2022 and 16th June 2022, the results of which are presented in Table 6.10c. For the purposes of comprehensive validation of previous ground gas and groundwater regime on the site, BH02 from the Curtins 2019 ground investigation was also monitored

Table 6.10c – Groundwater Monitoring Results

Borehole Ref.	Installation Strata	Response Zone m bgl	Depth, m bgl (m AOD)					
			17/03/22	20/05/22	31/05/22	06/06/22	10/06/22	16/06/22
WS102	MADE GROUND	1.00 – 2.00	1.00	0.87	0.91	1.10	0.90	0.92
WS103	MADE GROUND	1.50 – 4.00	1.74	1.67	1.75	1.74	1.69	1.67
WS105	MADE GROUND	1.00 – 3.00	2.29	2.30	2.33	2.31	2.31	2.09
BH02	Glacial Till	3.00 – 8.00	7.70 (26.90)	7.72 (26.92)	Dry	Dry	Dry	Dry

Based upon groundwater elevations and the underlying geology, the following considerations are given to the underlying groundwater regime:

- Water levels are typically recorded within the Made Ground.
- Groundwater strikes were also recorded within the Glacial Till at various depths.
- This is considered to represent perched groundwater.
- Perched water is likely to be encountered in excavations <2m bgl, and management by pumping from sumps should be possible.

7.0 Ground Model

The ground model for the site incorporates the findings of the Curtins site investigations (2019 – 2022), including exploratory hole logs and geotechnical testing results.

7.1 Made Ground

A predominantly cohesive Made Ground material comprising of dark brown to dark grey sandy gravelly clay. Gravel included fine to coarse brick, ceramics, ash, and sandstone. In WS101 to WS105, granular Made Ground was also encountered of brown, slightly clayey gravelly sand or sandy gravel. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite.

Due to the variable nature of Made Ground in terms of strength and composition, this layer is not deemed to be a suitable founding stratum. As such, parameters have not been derived for the Made Ground.

The results of geotechnical tests undertaken on these soils are summarised in Table 7.1.

Table 7.1 – Summary of geotechnical test results – Made Ground

Parameter	No. of Tests	Results
In Situ Tests		
SPT 'N' Value	22	Min: 0 Max: 50 Average: 14.25
Laboratory Tests		
pH	26	Min: 7 Max: 12.01 Average: 9.82
Water Soluble Sulphate (mg/l)	27	Min: <10 Max: 390 Average: 109

No further geotechnical analysis was undertaken on these soils.

7.2 Reworked Ground

BHA and BHB recorded reworked ground comprising soft dark brown slightly silty, gravelly clay. Gravel is fine to medium and subrounded to sub-angular of brick, sandstone, and siltstone. Reworked ground was recorded to be overlying the natural clay in both BHA and BHB. Similar material was recorded in WS102, WS104 and WS105 and is logged as possibly reworked ground as it did not appear to have the structure of a cohesive Glacial Till.

Table 7.2 – Summary of geotechnical test results – Reworked Ground

Parameter	No. of Tests	Results
In Situ Tests		
SPT 'N' Value	8	Min: 5 Max: 10 Average: 6.75
Laboratory Tests		
pH	1	8.84
Water Soluble Sulphate (mg/l)	1	40

No further geotechnical analysis was undertaken on these soils.

7.3 Cohesive Glacial Till

Soils are generally described as soft, firm, and stiff brown mottled grey and brown sandy clay, with variable proportions of silt, sand and gravel. Occasional cobbles were encountered in WS03 from 0.70m to 1.10m bgl.

Sand bands were noted within the cohesive Glacial Till from 3.10m bgl in WS01 but could possibly have collapsed in from granular strata above. It was not possible to determine the thickness of the sand bands encountered.

The results of geotechnical tests undertaken on these soils are summarised in Table 7.3.

Table 7.3 – Summary of geotechnical test results – Cohesive Glacial Till

Parameter		No. of Tests	Results
In-Situ Tests			
SPT 'N' Value – Cohesive		16	Min: 5 Max*: 29 Average: 16
Laboratory Tests			
Atterberg Test	Liquid Limit (%)	11	Min: 28 Max: 36 Average: 32
	Plastic Limit (%)	11	Min: 12 Max: 16 Average: 14
	Plasticity Index (%)	11	Min: 15 Max: 20 Average: 18
	Modified Plasticity Index (%) ¹	11	Min: 14 Max: 18 Average: 16
Moisture Content (%)		11	Min: 14 Max: 21 Average: 18
pH		11	Min: 8.42 Max: 8.60 Average: 8.53

Parameter	No. of Tests	Results
Water Soluble Sulphate (mg/l)	11	Min: 20 Max: 140 Average: 59

(1) Modified plasticity index is the plasticity of components <425µm.

The SPT N results are presented on *Figure 7.3a*, predominantly increasing with depth.

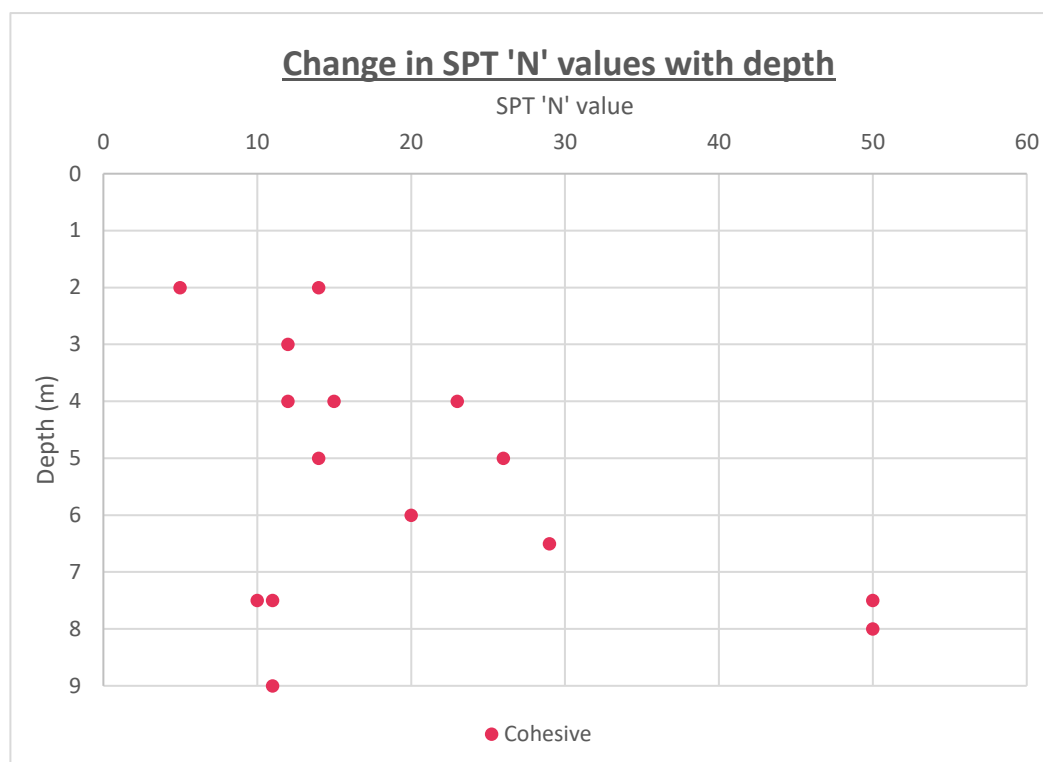


Figure 7.3a – Summary of SPT 'N' Values from Cohesive Glacial Till

A total of 11 No. Atterberg Tests were undertaken in the cohesive material, generally indicating the soils are low plasticity clay. BH02 (6.00m) and WS03 (2.40m) both recorded intermediate plasticity clay. The recorded Modified Plasticity Index indicates the soils are of low volume change potential.

A moderately conservative Undrained Shear Strength, C_u , of cohesive soils can be estimated from the correlation between Plasticity Indices (PI) and SPT N values (Ref. 11) using Equation 2:

$$C_u = f_1 \times \text{SPT N} \quad \text{Equation 2}$$

Where:

C_u is the Undrained Shear Strength

f_1 is the Stroud Factor determined from Figure 1.5 (Ref. 11)

SPT N is Characteristic Standard Penetration Test Result

Based on the Atterberg Limit results of analysis of 11 No. soil samples, a moderately conservative characteristic plasticity index of 18% was determined, correlating with an f_1 value of 5.2.

Cu values ranging between 26 and 260 kPa were determined. An average value of 94 kPa was determined. These results indicate a low to high strength clay, based on estimated values from the correlation described in Equation 2. The estimated strength of the cohesive Glacial Till appears to increase with depth.

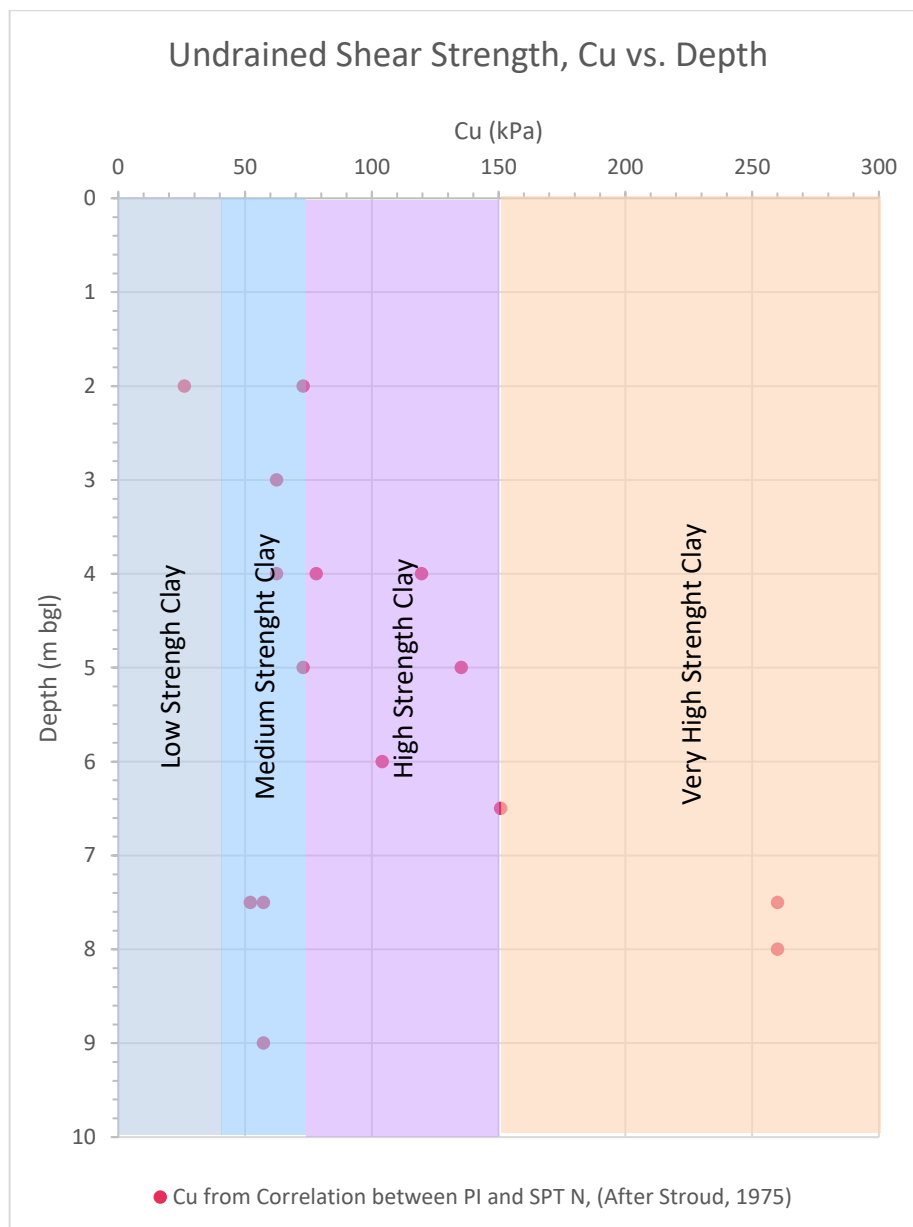


Figure 7.3b – Summary of Undrained Shear Strength of Cohesive Glacial Till

A unit weight range of 15kN/m³ to 19kN/m³ is deemed suitable for generally low strength cohesive Glacial Till, increasing to 16 kN/m³ to 20 kN/m³ for medium strength soils and 18 kN/m³ to 22 kN/m³ for high strength soils, from a review of published sources (BS8004, Ref. 12).

A moderately conservative estimate for the coefficient of volume compressibility, m_v , of cohesive soils can be estimated from the correlation between Plasticity Indices (PI) and SPT N values (Ref. 11) using Equation 3:

$$m_v = 1 / (f_2 \times \text{SPT } N)$$

Equation 3

Where:

C_u is the Undrained Shear Strength

f_2 is the Stroud Factor determined from Figure 1.5 (Ref. 11)

SPT N is Characteristic Standard Penetration Test Result

Based on the Atterberg Limit results of analysis of 11 No. soil samples, a moderately conservative characteristic plasticity index of 18% was determined. Using this value, an f_2 value of 0.525 has been selected.

Coefficients of volume compressibility, m_v , values ranging between 0.0104 and 0.104 m^2/MN were determined, with an average value of 0.0369 m^2/MN . Generally, this material is generally classified as low to medium compressibility soil. The change in Coefficient of Volume Compressibility with depth is presented in Figure 6.2d.

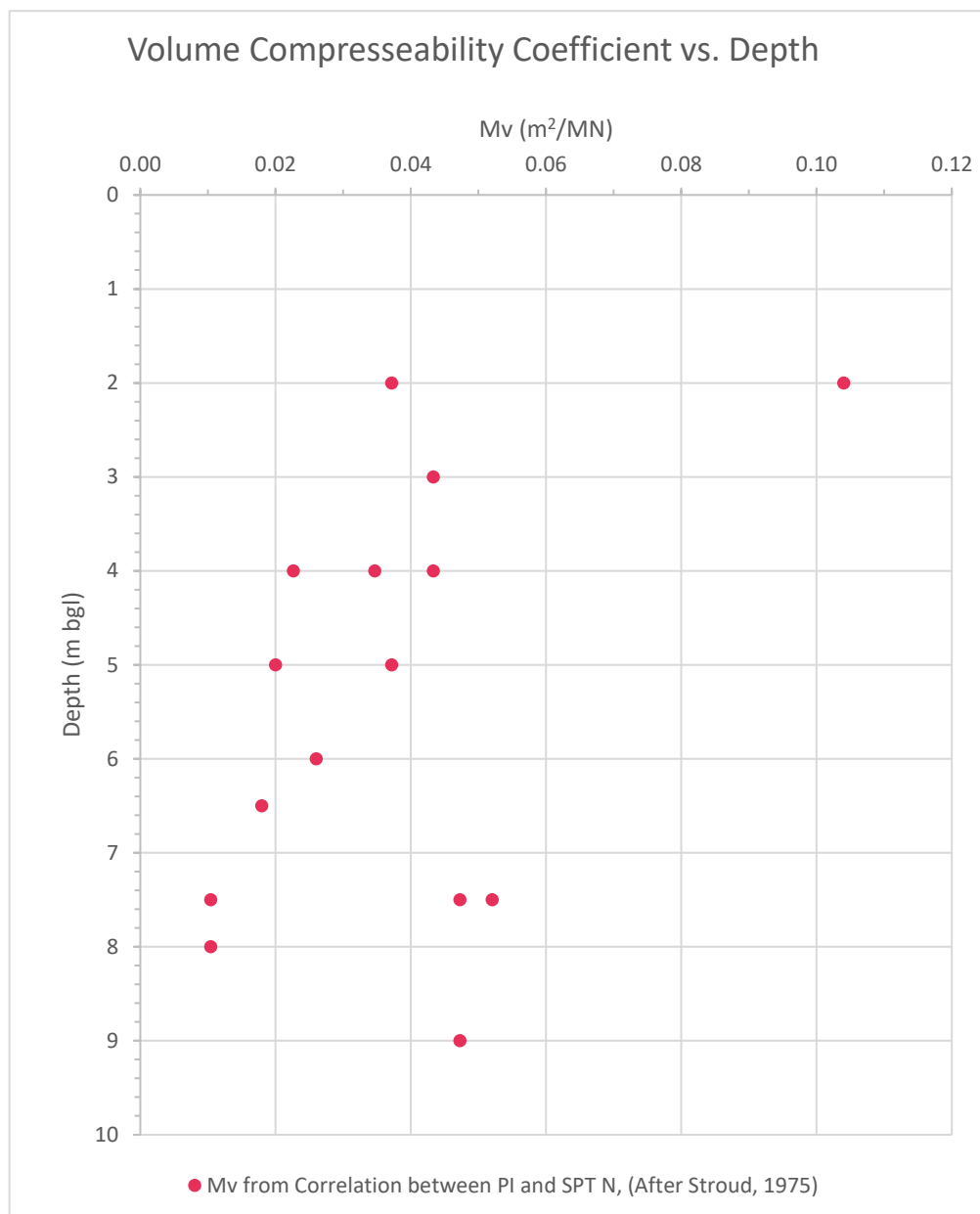


Figure 7.3c – Summary of Estimated Coefficient of Volume Compressibility of Cohesive Glacial Till

7.4 Granular Glacial Till

Accounting for the limited thickness of granular glacial till encountered, no geotechnical tests were undertaken in this stratum.

7.5 Chester Formation

Deposits typically comprised medium strong locally weak, reddish-brown medium to coarse grained arenaceous sandstone. Fractures were generally fresh, with sub horizontal to 45° closely to very closely,

rough and open. The rock is highly to completely weathered in places, recovered as non-intact deposits comprising slightly clayey gravelly coarse sand.

In BH01 extremely weak dark reddish brown fine-grained argillaceous mudstone was encountered at between 20.09m and 20.58m bgl recovered as stiff reddish-brown clay. Weathering is described as fresh assuming extremely poor consolidation in the fresh state.

Deposits were encountered in BH01 at 10.50m bgl (25.89m AOD) and in BH02 at 9.00m bgl (25.80m AOD). The base of the sandstone was not proven during this investigation. The boreholes were terminated at a depth of 25.0m bgl.

Rock Quality Designation (RQD) recorded in the cored samples ranged from 0% to 73%, averaging 39% across all of the rock core samples. This classifies the rock as being of very poor to fair. The RQD varies significantly between core runs. The total core recovery (TCR) ranged between 18% - 96% and the solid core recovery (SCR) ranged between 2.6% - 93%.

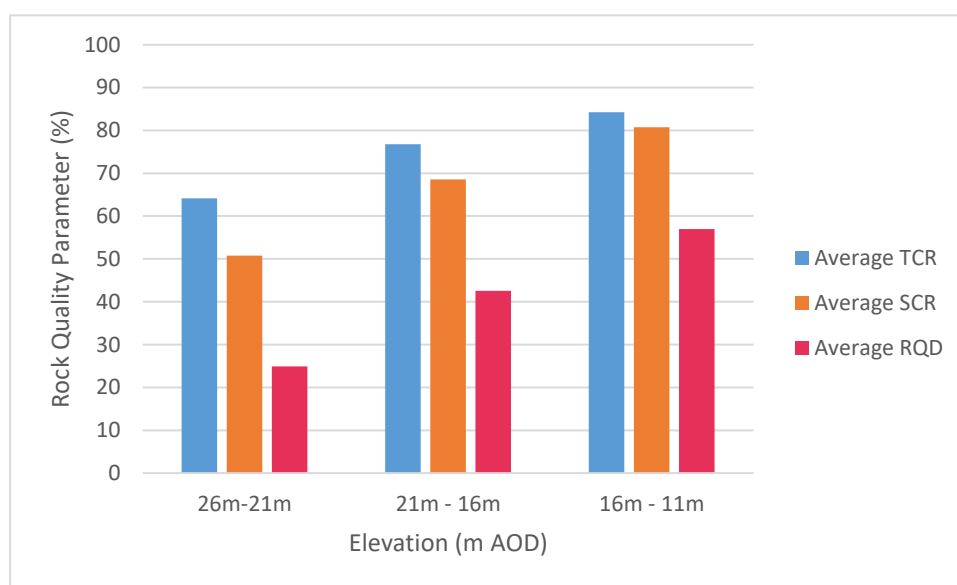


Figure 7.5a – Summary of Rock Quality Parameters, Sandstone

A summary of the geotechnical test results recorded within the bedrock are presented in *Table 7.5a*. Full details of the geotechnical results recorded are presented on the exploratory hole logs in *Appendix B* and test result certificates in *Appendix D*.

Table 7.5a – Summary of geotechnical test results – bedrock

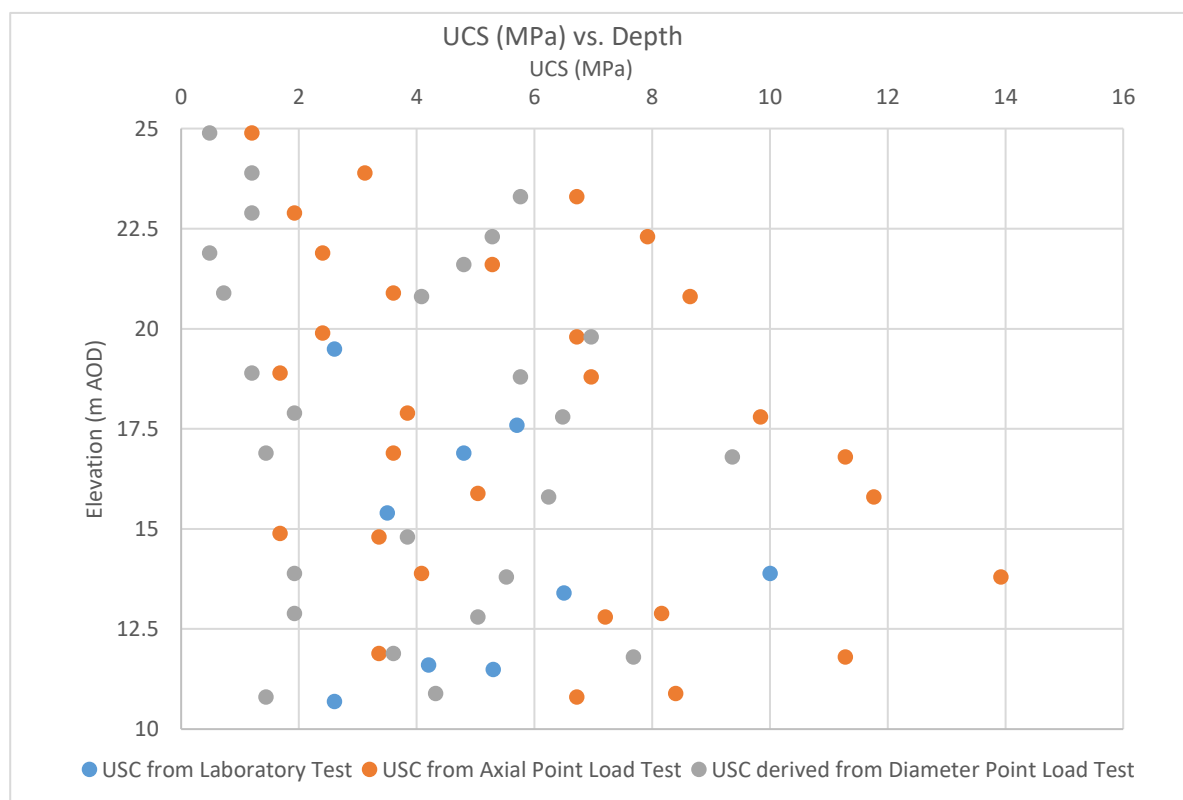
Parameter		No. of tests	Minimum	Maximum	Average
Point Load Strength Test, $I_{s(50)}$ (MPa)	Diametral	26	0.02	0.39	0.15
	Axial	29	0.05	0.58	0.24
Unconfined Compressive Strength (MPa)		9	2.6	10	5.00
Moisture Content		9	2.4	11	7.6

Parameter	No. of tests	Minimum	Maximum	Average
Bulk Density (Mg/m ³)	26	0.48	9.36	3.79

Table 7.5b – Summary of derived geotechnical parameters – bedrock

Parameter	No. of tests	Minimum	Maximum	Average
Estimated Unconfined Compressive Strength (MPa) ⁽¹⁾	29	1.2	13.92	5.94
	26	0.48	9.36	4.94

Unconfined Compressive Strength (UCS) (MPa) recorded in the cored samples ranged from 2.6 to 10 Mpa. *Figure 7.5b* indicates highly variable strength with depth, however an increase with depth can be observed. It is recommended that the UCS of the bedrock is derived on a location by location basis for the purposes of detailed design.

**Figure 7.5b** – Summary of Rock Strength Results

7.6 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. 13). A summary of the results obtained as a part of the ground investigation are summarised in *Table 7.6a* below.

Table 7.6a –Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Test Type	Range
Made Ground	pH	8.1 – 12.01
	Water Soluble Sulphate (mg/l)	<10 - 390
Cohesive Glacial Till	pH	7.79 – 8.84
	Water Soluble Sulphate (mg/l)	20 - 140

Table 7.6b –Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Made Ground	DS-1	AC-1
Cohesive Glacial Till	DS-1	AC-1

In these conditions, it is considered that deterioration of buried concrete due to sulphate or acid attack is unlikely to occur. 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 assuming mobile groundwater.

8.0 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. 14).

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 8.0* of this report.

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

8.1 Human Health GQRA

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. 15) 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.

8.1.1 Adopted Soil Human Health GACs Screening Methodology

Current development proposals indicate the construction of a 15 storey office building with independent retails, F&B units, and external soft landscaping.

Given the end-use soil chemical analysis results have been screened against 'Commercial' end use scenario GACs, accounting for the potential exposure beneath the building footprint, and the immediate surrounding area.

The assessment has been undertaken against the following GACs, in order of preference:

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

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e. the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for made ground soils ranged from 0.8% to 6.6%. The range for natural soil samples was 2.7% to 3.1%.

Accounting for a geometric mean, made ground and natural soils exhibit a SOM of 2.4% and 2.2% respectively. As such, a comparison against Generic Assessment Criteria (GAC) thresholds for a conservative SOM of 1.0% for the identified end use thresholds have been adopted for made ground and natural soils.

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

8.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

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

With respect to '*Commercial*' thresholds, no elevated concentrations of any contaminants of concern were recorded.

All soil samples were screened for asbestos. No suspected asbestos containing materials (ACMs) were identified within any of the exploratory hole logs, however WS101 (0.50m), WS103 (1.00m) and WS03 (0.20m) identified loose fibres of amosite, all at concentrations of <0.001%.

A Low risk is presented to site end users from direct contact, ingestion and inhalation beneath the proposed building footprint.

Additional soil sampling should be undertaken, including soils within the existing area of soft landscaping and beneath/in the vicinity of Mancunian Way to assess if there is a viable potential pollutant linkage outside of the proposed building footprint in soft landscaped areas remains.

A Moderate/Low risk is presented to construction workers. The risk should be managed by the contractor through the use of appropriate PPE and appropriate soil management procedures during construction.

8.1.3 Adopted Vapours within Groundwater Human Health GACs Screening Methodology

Volatile contaminants in groundwater have the potential to present a risk to human health through the volatilisation and mobilisation of vapours into overlying buildings, followed by inhalation. Detailed guidance for assessing risk presented to human health from volatile contaminants in groundwater is available within The Society of Brownfield Risk Assessment (SoBRA), Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater (Ref. 21).

A generic quantitative risk assessment (GQRA) has been carried out for the potential for the vaporisation of volatile contaminants within the groundwater, rising through porous made ground and superficial soils to cause potential chronic risk to human health. The SoBRA document is intended as a conservative screening tool and presents Generic Assessment Criteria (GAC_{gwwap}) for two site end use scenarios, Residential and Commercial, for volatile compounds.

The proposed end use of the site is *Commercial*; therefore, the assessment has been undertaken in accordance with this against the GACs outlined in the SoBRA guidance.

8.1.4 Generic Assessment Criteria Screening of Groundwater Laboratory Results

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

With respect to the proposed *Commercial* end-use of the site, no exceedances of the relevant GAC_{GWAP} were recorded.

8.2 Controlled Waters GQRA

A model for assessing the potential for pollution of controlled waters and for deriving a safe concentration in ground and groundwater is the Environment Agency's publication "Remedial Targets Methodology - Hydrogeological Risk Assessment for Land Contamination" (Ref. 22).

In relation to the standards for controlled waters, there are currently no generic groundwater standards or surface water standards that are necessarily applicable to all sites.

However, dependant on the receptor identified as being at risk, see *Section 7.2.1*, the UK Drinking Water Standards (UK DWS) (Ref. 23), and/or Water Framework Directive Environmental Quality Standards (WFD EQS) (Ref. 24) can be utilised as primary screening values in a Level 1 assessment. These can also be supplemented by World Health Organisation (WHO) guidelines (Ref. 25), where WFD or DWS water quality standards (WQS) do not exist.

8.2.1 Adopted Controlled Waters Tier 1 Screening Values and Methodology

The results of laboratory analysis of groundwater have been assessed against the UK Drinking Water Standards (DWS) due to the presence of a Principal Aquifer underlying the site within the bedrock. In the absence of UK DWS, a comparison against WHO standards has been used.

Given the proximity to the River Medlock (10m west) an assessment against the Environmental Quality Standards (EQS - Freshwater) has also been undertaken.

The adopted Level 1 Screening Values are listed in *Appendix F*.

8.2.2 Tier 1 Screening of Groundwater Laboratory Results

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

With respect to the underlying Principal Aquifer (Drinking Water Standards and WHO Guidelines) several exceedances are noted within groundwater samples, as detailed in *Table 8.2.2a*.

Table 8.2.2a – Exceedances Recorded against Drinking Water Standards (DWS) and relevant WHO Guidelines in Samples from Made Ground Perched Water

Determinant	DWS threshold (µg/l)	WHO Guideline Value (µg/l)	Concentration (µg/l)	
			WS102 0.91 – 1.50	WS105 2.33 – 2.50
Arsenic	10	-	16	N/a

Determinant	DWS threshold (µg/l)	WHO Guideline Value (µg/l)	Concentration (µg/l)	
			WS102 0.91 – 1.50	WS105 2.33 – 2.50
Phenols (Total)	0.5	-	1 ¹	1 ¹
Sum of 4 PAHs	0.1	-	0.38	-
Aliphatic C21 – C35 Hydrocarbons	-	300	1434	-
Total Petroleum Hydrocarbons (C5 – C35)	-	300	1890	-

1. Standard LOD exceeds threshold.

With respect to the nearby River Medlock (Environmental Quality Standards) several exceedances are noted within groundwater samples, as detailed in *Table 8.2.2b*.

Table 8.2.2b – Exceedances Recorded against Environmental Quality Standards (EQS) and relevant WHO Guidelines in Samples from Made Ground Perched Water

Determinant	DWS threshold (µg/l)	WHO Guideline Value (µg/l)	Concentration (µg/l)	
			WS102 0.91 – 1.50	WS105 2.33 – 2.50
Cyanide	1	-	6	1 ¹
Copper	1	-	8	5
Chromium	4.7	-	9	N/a
Lead	1.2	-	N/a	3
Nickel	4	-	158	N/a
Anthracene	0.1	-	0.16	N/a
Benzo(a)pyrene	0.00017	-	0.14	1 ¹
Naphthalene	2	-	21.58	N/a
Aliphatic C21 – C35 Hydrocarbons	-	300	1434	N/a
Total Petroleum Hydrocarbons (C5 – C35)	-	300	1890	N/a

1. Standard LOD exceeds threshold.

The assessment above is considered conservative on the basis that there are no potable groundwater abstraction points within 1km and the site is not within a designated Source Protection Zone.

Furthermore samples have been obtained from monitoring wells targeting the made ground soils only and therefore representative of perched water within made ground. It was not possible to obtain groundwater samples from within the superficial soils, as the monitoring installation within BH01 was dry throughout the 2022 monitoring period, however this demonstrates the limited infiltration capacity of the underlying natural soils, likely to limit migration of any leachable

contamination in soils. It should be further noted that no free phase contamination was noted in site soils or groundwater.

9.0 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. 21), BSI Publication (Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2015+A1:2019 (Ref. 22), NHBC Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present, Report No. 04 (Ref. 23) and other broadly accepted references such as the Ground Gas Handbook 2009 (Ref. 24).

9.1 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 three exploratory borehole locations, in 2019, and a further three borehole locations in 2022, as detailed in *Section 3.2*.

During the 2019 investigation, six gas monitoring visits have been undertaken between 26th June and 30th August 2019 with barometric pressure recorded between 989 and 1026mb. Rising barometric pressure was recorded on the 12th July 2019. Steady pressure was recorded on 26th June, 30th July and 9th August.

Due to inability to access BH01 and BH02 during those monitoring visits, no ground gas monitoring data is available for those boreholes. WS01, WS02 and WS04 were terminated prematurely due to consistently encountered a concrete obstruction. Ground gas data is therefore only available for WS03 from the 2019 intrusive investigation.

Return visits were undertaken between 17th March and 16th June 2022, including the three monitoring wells installed in 2022, and BH02, BH01 could not be located. Barometric pressures were recorded between 1010mb and 1019mb, including two visits where falling barometric state was recorded.

The results log sheets are contained within *Appendix E* and summarised in *Table 9.1a* and *Table 9.1b*.

Table 9.1a – Summary of Ground Gas Monitoring Results (2019)

Borehole Ref.	Maximum Methane Concentration (%)	Maximum Carbon Dioxide Concentration (%)	Minimum Steady Oxygen Concentration (%)	Maximum gas flow (l/hr)
WS03	<0.1	0.7	8.5	<0.1

As discussed in *Section 3.2*, similar ground gas readings were recorded over six monitoring visits in WS3/1 following the 2015 preliminary investigation.

Carbon Monoxide (CO) and Hydrogen Sulphide (H₂S) was recorded below the instrument's detection limit within all the monitoring wells throughout the 2019 monitoring period.

During the 2019 monitoring period, Methane (CH₄), was recorded below the limit of detection of the monitoring instrument. Carbon Dioxide (CO₂) was recorded in peak concentrations of up to 0.7% v/v, and no elevated air flow was recorded.

Table 9.1b – Summary of Ground Gas Monitoring Results (2022)

Borehole Ref.	Maximum Methane Concentration (%)		Maximum Carbon Dioxide Concentration (%)		Minimum Steady Oxygen Concentration (%)	Maximum gas flow (l/hr)	
	Max	SS	Max	SS		Max	SS
WS102	4.8 ¹	4.8 ¹	0.3	<0.1	7.3	67.8 ²	<0.1
WS103	<0.1	<0.1	<0.1	<0.1	3.3	3.9	<0.1
WS105	<0.1	<0.1	0.6	0.6	8.9	<0.1	<0.1
BH02 (2019)	<0.1	<0.1	1.1	0.9	14.1	<0.1	<0.1

1 – Lower Explosive Limit recorded at >99.9% on visit 4.

2 – Steady state air flow rate recorded after 1 minute.

During the 2022 investigation, CH₄ concentrations were recorded below the limit of detection in all wells, with exception of WS102, where maximum concentrations of up to 4.8% v/v were recorded. CO₂ concentrations of up to 1.1% v/v were recorded.

The greatest peak air flow rates were recorded in WS102, up to 67.8 l/hr. It is considered that the high flow rates in this flooded boreholes is likely to be linked to rising shallow groundwater in the solid section of the well installation causing an increase in internal pressure within the pipework, which is released, and subsequently equalised, when the valve tap is opened, resulting in the high observed peak flows preceding the considerably lower steady flow. This affect is detailed within BS8485:2015 (Ref. 19) and CL:AIRE Research Bulletin RB 17 (Ref. 22). In all boreholes, the peak air flow rate reduced to a steady state within 1 minute on all occasions.

Concentrations of carbon monoxide and hydrogen sulphide were recorded up to 6ppm and 4ppm respectively.

Based on the total number of monitoring visits, and data obtained from made ground and natural soils, it is considered that the dataset is representative of site conditions, and therefore the steady state air flow rate and maximum gas concentrations are to be used for calculating the gas screening value (GSV) for the site.

Evaluation of the 'borehole' scenario (highest gas flow rate in a single borehole) and 'worst case check' (highest hazardous gas flow rate that is realistically possible, i.e. in any borehole) records a maximum Q_{hg} of 0.0048 l/hr for methane and 0.0011 l/hr for carbon dioxide.

Elevated concentrations of methane were consistently recorded in WS102 throughout the 2022 monitoring period. It is likely the elevated methane is sourced from the organic matter, vegetation, ash and charcoal noted within the exploratory hole log.

On the basis of the elevated concentrations of methane recorded, the northeast of the site is characterised with a Characteristic Situation 2 (CS-2) gas regime, and as such gas protection measures will be required for the proposed building. This is further supported by the depth of made ground beneath part of proposed building footprint which contain further putrescible materials.

Details of the remedial actions required should be outlined in a remediation strategy.

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.

10.0 Revised Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented *Section 2.8* and discussed in *Section 2.0* of this report has been revised following the GQRA in *Sections 6.0* and *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. 18) 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. 19) 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. This assumption is factored into the conceptual site model. Reference should be given to the environmental testing results discussed within *Section 6.0* and presented within *Appendix C*.

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		
Asbestos in the Made Ground within WS03 (0.20m), WS101 (0.50m) and WS103 (1.00m). Amosite loose fibres were identified at <0.001%.	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation	Site End Users (Commercial)	Medium	Low	Moderate/Low	Environmental chemical analysis from the 2019 to 2022 investigations did not record any exceedances with respect to a 'Commercial' end use scenario. No significant visual or olfactory evidence of contamination in site soils. Asbestos fibres were encountered in WS03 (0.20m bgl), WS101 (0.50m) and WS103 (1.00m). The loose fibres were recorded below the limit of detection. Hardstanding will break the source-pathway-receptor linkage between the site end user and Made Ground soils in these areas.	No further action required. Additional investigation including soil sampling and GQRA in uncharacterised areas of site. Including beneath/around sub-station once demolished/decommissioned. Asbestos management plan to be put in place by contractor during groundworks/construction.
	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation	Construction and maintenance workers	Medium	Low	Moderate/Low	Assumes standard health & safety and environmental precaution.	Standard Health & Safety precautions likely to be used by workers.
Elevated metals, TPHs and PAHs within groundwater	Vapour migration through buildings, followed by inhalation	Site End Users (Commercial)	Medium	Unlikely	Low	No exceedances of SoBRA GAC _{GWVAP} screening thresholds.	No further action required.
	Vapour migration and inhalation	Construction and maintenance workers	Medium	Unlikely	Low		
	Vertical migration through the superficial deposits	Controlled Waters (groundwater) Principal Aquifer The site is not within a designated Source Protection Zone.	Medium	Unlikely	Low	No free phase contamination identified in soils or groundwater. Marginally elevated concentrations of arsenic, nickel and PAHs were recorded within the sample of shallow perched water from WS102, with respect to UK DWS. Elevated aliphatic C21-C35 TPHs (and total TPHs) were recorded in the same sample, with respect to WHO Guideline values. No deeper samples taken with BH02 recorded as dry throughout monitoring period. A layer of superficial clay (Glacial Till) is recorded beneath the Made Ground overlying the bedrock. It acts as a relatively impermeable barrier, limiting the vertical migration of groundwater below. A piling risk assessment should be undertaken to determine the most suitable piling methodology during construction. The risk of migration of contaminants to the Principal Aquifer is considered to be Low.	Piling Risk Assessment
	Vertical and horizontal migration through superficial deposits	Controlled Waters (surface water) (River Medlock)	Mild	Unlikely	Very Low	Surface water receptor expected to be reduced quality due to urban setting. No free phase contamination identified in soils or groundwater. Elevated concentrations of cyanide, copper, chromium, nickel and PAHs were recorded within a perched water sample from WS102 with respect to EQS. Marginally elevated concentrations of copper and lead were recorded in perched water within WS105, with respect to EQS.	No further action required.



Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
						Elevated aliphatic C21-C35 TPHs (and total TPHs) were recorded in the same sample, with respect to WHO Guideline values. The River Medlock is confined by a stone/concrete/brick retaining wall, limiting the likelihood of migration from perched water to the river water. On the basis that there is limited potential for the pathway to be realised, the risk to surface water features is Low.	
Organic matter within extensive made ground soils as source material for the generation of ground gas	Ground gas migration and inhalation	Site end-users	Medium	Likely	Moderate	Maximum methane concentrations of 4.8 % v/v were recorded in WS102 in 2022. Maximum carbon dioxide concentrations of 1.1% v/v were recorded in 2022. Steady state air flow rates were consistently recorded below the limit of detection of the monitoring instrument. The characteristic GSV for the site indicate a CS-1 classification, however accounting for elevated methane recorded in WS102 and the extensive made ground deposits on site this should be increased to CS-2. Gas protection measures will be required.	CS-2 Gas Protection Measures. Remedial action to be outlined in a Remediation Strategy.

10.1 Summary of Significant Pollutant Linkages

A **Moderate/Low** risk rating is identified to end-users adjacent users, and construction workers from asbestos in Made Ground soils on site. Additional investigation is required in uncharacterised areas of the site to assess if a plausible pollutant linkage is present in areas outside of the building footprint and if any capping is required in soft landscaped areas. An asbestos management plan should be implemented during groundworks and construction by the contractor to mitigate risk.

A **Low** risk rating is identified to the Principal Aquifer within the bedrock underlying the site from leachable contamination in site soils through vertical and horizontal migration due to thickness of underlying low permeable Glacial Till limiting any possible source-pathway-receptor linkage. This assessment also considers that the site is not situated within a Source Protection Zone, no gross contamination was identified in site soils.

A **Very Low** risk rating is identified to the River Medlock to the north; with the river water quality anticipated to be low due to the urban and historical industrial land use surrounding the water course. There is also limited potential for the migratory pathway to be realised given no gross contaminated was encountered in site soils and cohesive Glacial Till soils are considered to be of low permeability.

The risk to the site construction and maintenance workers from vapours from contamination within groundwater is assessed as **Low**, respectively, as no exceedances of SOBRA GAC_{GWVAP} thresholds were recorded.

A **Moderate** risk rating is identified to site end users from ground gas generation, migration and inhalation from Made Ground accounting for elevated methane concentrations recorded in WS102. This corresponds with a Characteristic Situation 2 (CIRIA) classification, requiring gas protection measures.

A remediation strategy will be required detailing the remedial action.

11.0 Geotechnical Assessment and Recommendations

11.1 Introduction

This section will discuss the ground and groundwater conditions encountered across the site and assess their associated risks for the proposed scope of the works.

Development proposals include the following: the 15-storey office development with ground floor commercial uses which now includes area previously noted as Plot 13 and also includes road development on Brancaster Road, soft landscaping features west of Building 3 and car parking areas south of the existing substations. The proposed layout is included in *Appendix A*.

At time of writing, no estimated building loads were available for review, however given the scale of the proposed development loads are anticipated to be high.

Any changes in the development of designs beyond the issue of this Ground Investigation Report to the client, should be further investigated by the Construction Designer.

11.2 Geotechnical Considerations

Variable thicknesses of made ground or reworked ground have been recorded beneath the site, underlain by generally cohesive glacial till of generally low, medium or high strength. Solid bedrock of the Chester Formation was recorded at 9.50m to 11.00m bgl (24.52m to 23.21m AOD), comprising reddish brown sandstone. A layer of granular weathered bedrock was recorded in BHA between 8.20m and 9.50m bgl (25.82m and 24.52m AOD).

Water strikes were recorded within made ground and cohesive glacial till, these are considered to be perched water. No groundwater level monitoring was undertaken within the bedrock stratum.

Given the anticipated building loads, piled foundations with suitable embedment into the intact bedrock are deemed to be a suitable solution.

It is recommended that to establish suitable pile design, specialist piling contractors are consulted. A piling risk assessment may be required based on the soil results identifying elevated concentrations in certain determinants.

A number of obstructions were encountered within the made ground, generally comprising concrete boulders or slabs within the upper 1m of made ground, with exception of a concrete boulder/slab in WS101 at 1.45m bgl. Pile design should consider the potential for presence of below ground obstructions within the Made Ground deposits.

Appropriate consideration and diligence should be given during design to the potential of creating preferential pathways for contaminant migration from Made Ground (including perched water) to the underlying Principal aquifer within the Chester Pebble Beds Formation.

11.3 Ground Floor Slabs

The design of the ground floor slab will be dependent on the foundation method adopted. Following an assessment of the ground conditions it is recommended that due to presence of the thick layer of Made Ground of variable nature consideration is given to a reinforced suspended ground floor slab. As pile foundations are anticipated, a suspended slab is recommended to bear on the pile caps by a network of beams which will minimise any differential settlement between the floor and the piled structure.

11.4 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest 1 (Ref.13) and laboratory testing undertaken accordingly in *Section 6.3*.

Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-1 with an ACEC class of AC-1 within Made Ground, a Design Sulphate Class of DS-1 with an ACEC class of AC-1 being appropriate for the Superficial deposits.

11.5 Excavation and Support

Excavations must be assessed and designed by a suitability qualified temporary works designer. Generally, shallow excavations (<1.2m bgl deep) can be unsupported if battered to a suitable grade. Excavations deeper than 1.2m may require side support due to space constraints, otherwise suitable stable slope angles could be adopted for deeper excavations, to provide stability. Plant and equipment movement across the site must be taken into consideration, when assessing the excavations stability.

Excavation through layers of Made Ground and superficial deposits should be feasible using conventional site plant. Perched water may be encountered in excavations for foundations and service runs. If groundwater is encountered, it is considered likely that it could be controlled by pumping from sumps. Although not anticipated, any potentially contaminated perched water may require removal by tanks.

12.0 Conclusions & Recommendations

12.1 Conclusions

12.1.1 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. No chemical exceedances were recorded, however loose fibres of amosite at concentrations <0.001% were recorded in WS03 (0.20m), WS101 (0.50m) and WS103 (1.00m). No further ACMs were recorded during the investigation.

A **Moderate/Low** risk rating is identified to site end-users, from soils and dust from inhalation and ingestion. The risk is low in the area of the proposed building footprint however additional investigation is required in uncharacterised areas of the site to assess if a plausible pollutant linkage is present in areas outside of the building footprint and if any capping is required in soft landscaped areas.

A **Moderate/Low** risk rating is identified to construction works from soils and dust from inhalation and ingestion. As such it is recommended that construction workers are provided with appropriate PPE and sanitary facilities during construction works, with reference to the environmental testing results. An asbestos management plan should be implemented during groundworks and construction.

A **Low** risk rating is identified to controlled waters (Groundwater) from contamination on site, accounting for marginal exceedances of arsenic and nickel within perched water. Elevated TPHs were recorded with respect to WHO Guideline Values in WS102. Given the site is not situated in a source protection zone, the presence of a significant thickness of cohesive glacial till, it is unlikely that a pathway will be realised between shallow perched water and the underlying principal aquifer. A piling risk assessment should be undertaken where piled foundations are adopted.

Compared with Environmental Quality Standards (EQS), elevated concentrations of cyanide, metals and PAHs were recorded in one perched water sample from WS102. The perched water sample from WS105 also recorded marginally elevated lead and copper. Elevated TPHs were recorded with respect to WHO Guideline Values in WS102. A Very Low risk rating is identified to controlled waters (Surface water), accounting for:

- Anticipated reduced water quality in urban setting;
- The River Medlock is confined by a stone/concrete/brick retaining wall, limiting the likelihood of migration from perched water to the river water.

- No gross contamination identified in site soils.
- Samples obtained were representative of perched shallow groundwater in made ground deposits. Low permeability glacial till will limit lateral migration.

The risk to site end users from perched water vapours is considered to be Low, as no exceedances of SOBRA GAC_{GWVAP} screening thresholds were recorded.

12.1.2 Ground Gas Assessment

Using the 'borehole Q_{hg} representative' scenario, due to a full data set within varying pressures, the calculated Q_{hg} for the site was 0.0048 l/hr for methane, with WS102 recording up to 4.8% v/v, and consistently >1.0% v/v.

For carbon dioxide, the maximum calculated Q_{hg} is 0.0011 l/hr utilising the 1.1% v/v concentration recorded in BH02.

Characteristic Gas Situation is assessed as CS2 on the basis of elevated methane concentrations in WS102 and the extensive variable made ground soils on site.

The site is located within a Lower Probability Radon Area (less than 1% of homes are estimated to be at or above the Action Level).

12.2 Recommendations

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

- 1) Further ground investigation in uncharacterised areas of the site, outside of the proposed building footprint.
- 2) Further ground investigation/sampling beneath the electrical sub-station on eastern side, following its removal.
- 3) CS-2 Gas Protection Measures should be incorporated in the new building.
- 4) Asbestos management plan during groundworks and construction works.
- 5) 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*.
- 6) A Remediation Strategy and Verification report will be required to detail and approve the above measures.
- 7) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.
- 8) Undertake piling/deep foundation risk assessment when foundation solution/design is determined.

12.2.1 Additional Considerations

The site of interest is in Manchester City Centre. Risk mapping for UXOs placed the site in a moderate risk area. A Detailed Unexploded Ordnance (UXO) Threat and Risk Assessment has concluded the site is **High** risk for the ground investigation; the recommendations are summarised within *Section 2.5*.

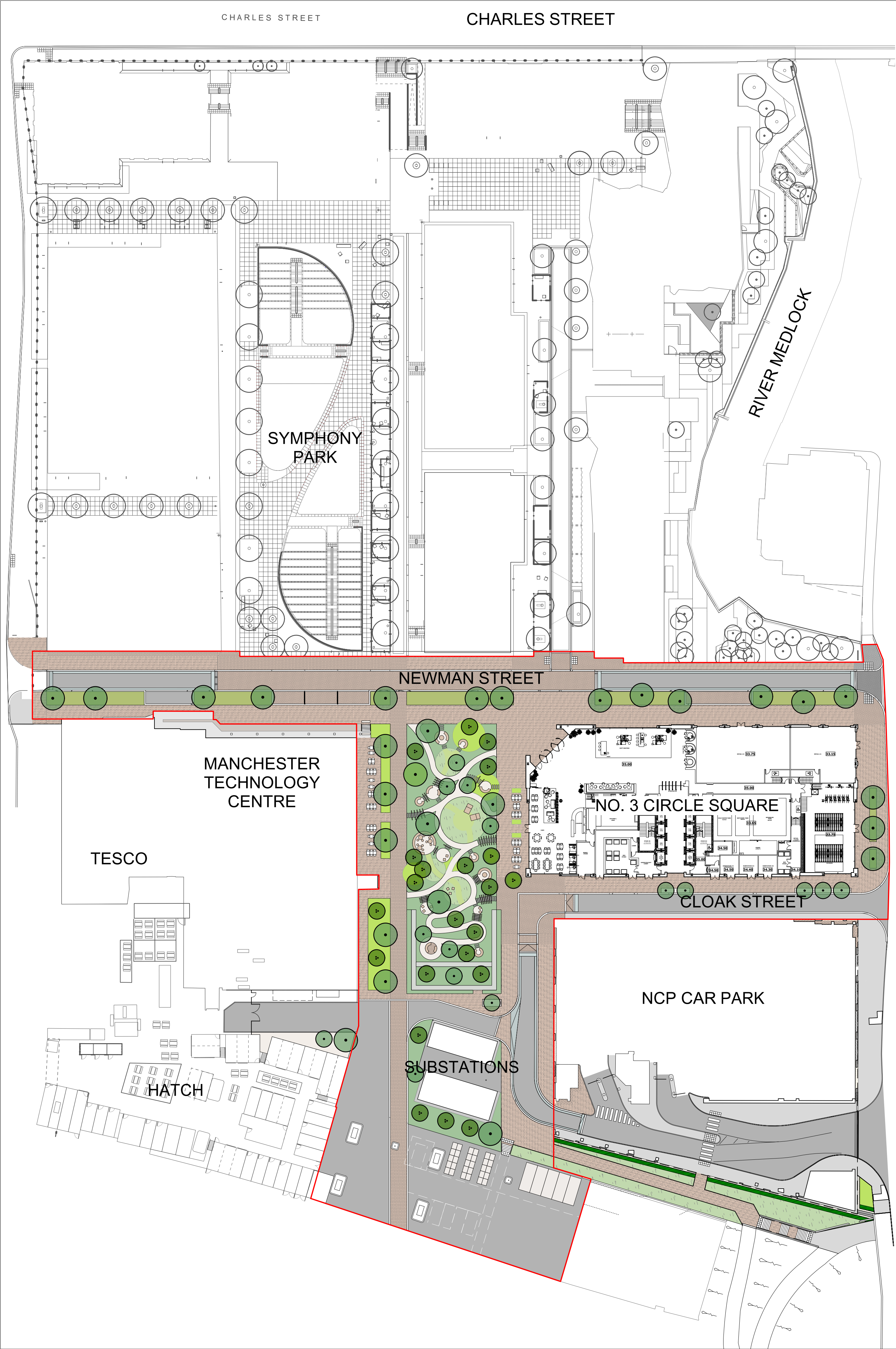
The Principal Contractor must undertake their own UXO risk assessment and satisfy themselves that mitigation measures during construction works are suitable.

13.0 References

1. Curtins (2021) Phase 1 Preliminary Risk Assessment, ref. 078016-CUR-00-XX-RP-GE-001-P01
2. Curtins (2015) Phase 2 Intrusive Investigation, Former BBC Site (ref. EB1723D/SH/6090)
3. Curtins (2019) Phase 2 Ground Investigation, Plot 12 Circle Square (ref. CS12-CUR-12-XX-RP-GE 80001)
4. British Geological Survey (BGS) 1:50,000 (Solid and Drift Edition, Sheet No. 085,) for Manchester
5. Coal Authority Interactive Map Viewer [online], <http://mapapps2.bgs.ac.uk/coalauthority/home.html> (accessed August 2021).
6. CIRIA (2009) Unexploded Ordnance: A Guide for the Construction Industry (report no. C681).
7. Zetica Regional Unexploded Bomb Risk, Risk Map, <https://zeticauxo.com/downloads-and-resources/risk-maps/> (accessed August 2021).
8. Environmental Agency (2020) Land Contamination Risk Management (LCRM)
9. British Standards Institution (2011) Investigation of Potentially Contaminated Sites: Code of Practice (report no. BS10175:2011+A2:2017).
10. British Standards Institution BSI (2015+2000) Code of Practice for Site Investigations (report no. BS5930).
11. British Standards Institution (2006) Eurocode 7: Geotechnical Design (report no. BSEN1997).
12. British Standard (2016) Methods of test for soils for civil engineering purposes. General requirements and sample preparation (report no. BS1377-1).
13. Stroud, M. a. B. F. (1975) The Standard Penetration Test and the Engineering Properties of Glacial Materials.
14. British Standard Institution BSI (2020) Code of Practice for Foundations (report no. BS8004).
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. CIRIA (2001) Contaminated Land Risk Assessment. A guide to good practice (report no. C552).
21. CITB (2015) Construction (Design and Management) Regulations.
22. CL:AIRE (2012) Research Bulletin RB 17. A Pragmatic Approach to Ground Gas Risk Assessment

Appendix A – Drawings

- Bruntwood (2021), Landscape Masterplan - wider context, ref. 1502a-PLA-XX-XX-DR-L-0001
- Curtins (2022), Exploratory Hole Location Plan, ref. CS12-CUR-12-XX-DR-GE-80004-P01



KEY - LEVELS

	PROPOSED LEVELS
	EXISTING LEVELS RETAINED
	PROPOSED GRADIENTS

KEY - HARDWORKS

	CONCRETE SETT PAVING Location: To pedestrian and occasional vehicle areas within streets Size: 300x100x80mm Laying: Reverse Stretcher Bond Type / Colour: Kellen / Volcanoo Finish: Washed finish Notes: Flexible Construction
	CONCRETE SETT PAVING Location: To pedestrian and light vehicle areas within streets Size: 100x300x80mm, 150x300x80mm, 300x200x80mm Laying: Reverse Stretcher Bond Type / Colour: Kellen / Volcanoo Finish: Washed finish Notes: Flexible Construction
	CONCRETE SETT PAVING Location: To occasional heavy vehicle areas within streets Size: 300x100x80mm Laying: 45°Herringbone - Longitudinal Type / Colour: Kellen / Volcanoo Finish: Washed finish Notes: Flexible Construction
	TARMACADAM To vehicle areas To engineers details and specification
	TARMACADAM To pedestrian areas (Cloak Street footpath) To engineers details and specification
	GRANITE SETTS Location: Edging bands within vehicular carriageway Size: 100x100x100mm setts Laying: Rigidly Laid Type / Colour: Hardscape Kobra Granite Setts, or Acceptable Equivalent Finish: Rigidly Laid
	RESIN BOUND GRAVEL Location: To Symphony Gardens paths Laying: 50mm thick Type / Colour: Sureset Mulberry Finish: As supplied Notes: Permeable
	GRANITE TACTILE CORDUROY PAVING Location: At bottom and top of steps Size: 400mm x 400mm x 80mm (D) Laying: Stack Bond Type / Colour: Kobra grey (contrasting to surrounding paving) Notes: N/A
	GRANITE TACTILE BLISTER PAVING Location: Crossings Size: 400mm x 400mm x 80mm (D) Laying: Stack Bond Type / Colour: Kobra grey (contrasting to surrounding paving) Notes: N/A
	GRANITE STEPPING STONES Location: Symphony Gardens Size: 900 x 200 x 50mm (TBC) Laying: Concrete haunching Type / Colour: Hardscape Kobra Granite (TBC) Finish: Fine Picked (TBC)
	GRANITE STEPS WITH CORTEN RETAINING EDGE Location: Symphony Gardens Size: 1000 x 200 x 50mm (TBC) Laying: Concrete haunching Type / Colour: Hardscape Kobra Granite (TBC) Finish: Fine Picked (TBC) Edging: Corten steel edge to retain levels and feather into adjacent planting. Details TBC
	UPSTAND GRANITE KERB Location: Sitewide - to vehicular carriageway Laid: 60mm upstand Size: 255 (w) x 900 (l) x 240mm Colour: Hardscape Kobra Granite Finish: Picked
	FLUSH GRANITE KERB Location: Sitewide - to vehicular carriageway Laid: Flush Size: 255 (w) x 900 (l) x 180mm Colour: Hardscape Kobra Granite Finish: Picked
	FLUSH METAL EDGING Location: Symphony Gardens Paths Laid: Flush Size: 6 (w) x 1000 (l) x 100mm Material: Corten Steel Metal Edging

KEY - FURNITURE

	BESPOKE TIMBER BENCHES Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	BESPOKE TIMBER SEATS Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	BESPOKE TIMBER TABLES AND SEATS Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	BESPOKE TIMBER SUNLOUNGERS Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	FREESTANDING METAL TABLES AND CHAIRS Location: Spill out from buildings Size: TBC Material: Powder coated steel TBC Supplier: TBC

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- NOTES:**
1. Do not scale from this drawing.
 2. Always work to noted dimensions.
 3. All dimensions are in millimetres unless otherwise stated.
 4. All setting out, levels and dimensions to be agreed on site.
 5. The dimensions of all materials must be checked on site before being laid out.
 6. This drawing must be read with the relevant specification clauses and detail drawings.
 7. Order of construction and setting out to be agreed on site.

KEY - SOFTWORKS

	MATURE TREE PLANTING Location: Sitewide Size: 45-65cm girth mature single-stem specimens. Individual trees will vary in size. Full planting plan and specification TBC
	SEMI-MATURE TREE PLANTING Location: Sitewide Size: 20-45cm girth mature single-stem specimens. Individual trees will vary in size. Full planting plan and specification TBC
	MULTI-STEM TREE PLANTING Location: Sitewide Size: Multi-stem ornamental specimens. Individual trees will vary in size. Full planting plan and specification TBC
	EXISTING HEDGE PLANTING Location: To south of MSCP
	BIODIVERSE PLANTING Location: Sitewide Notes: 300mm topsoil over 150mm subsoil Full planting plan and specification TBC
	ORNAMENTAL PLANTING Location: Sitewide Notes: 300mm topsoil over 150mm subsoil Full planting plan and specification TBC
	SUDS PLANTING Location: Newman Street and Princess Street planting beds Notes: 300mm topsoil over 150mm subsoil Full planting plan and specification TBC
	WILDFLOWER LAWN Location: Symphony Gardens Notes: Pregrown wildflower turf laid on 150mm subsoil Full planting plan and specification TBC
	MOWN PATHS THROUGH WILDFLOWER LAWN Location: Symphony Gardens Notes: Pregrown wildflower turf laid on 150mm subsoil Full planting plan and specification TBC

Revision	Date	Description	Drawn	Apprv.
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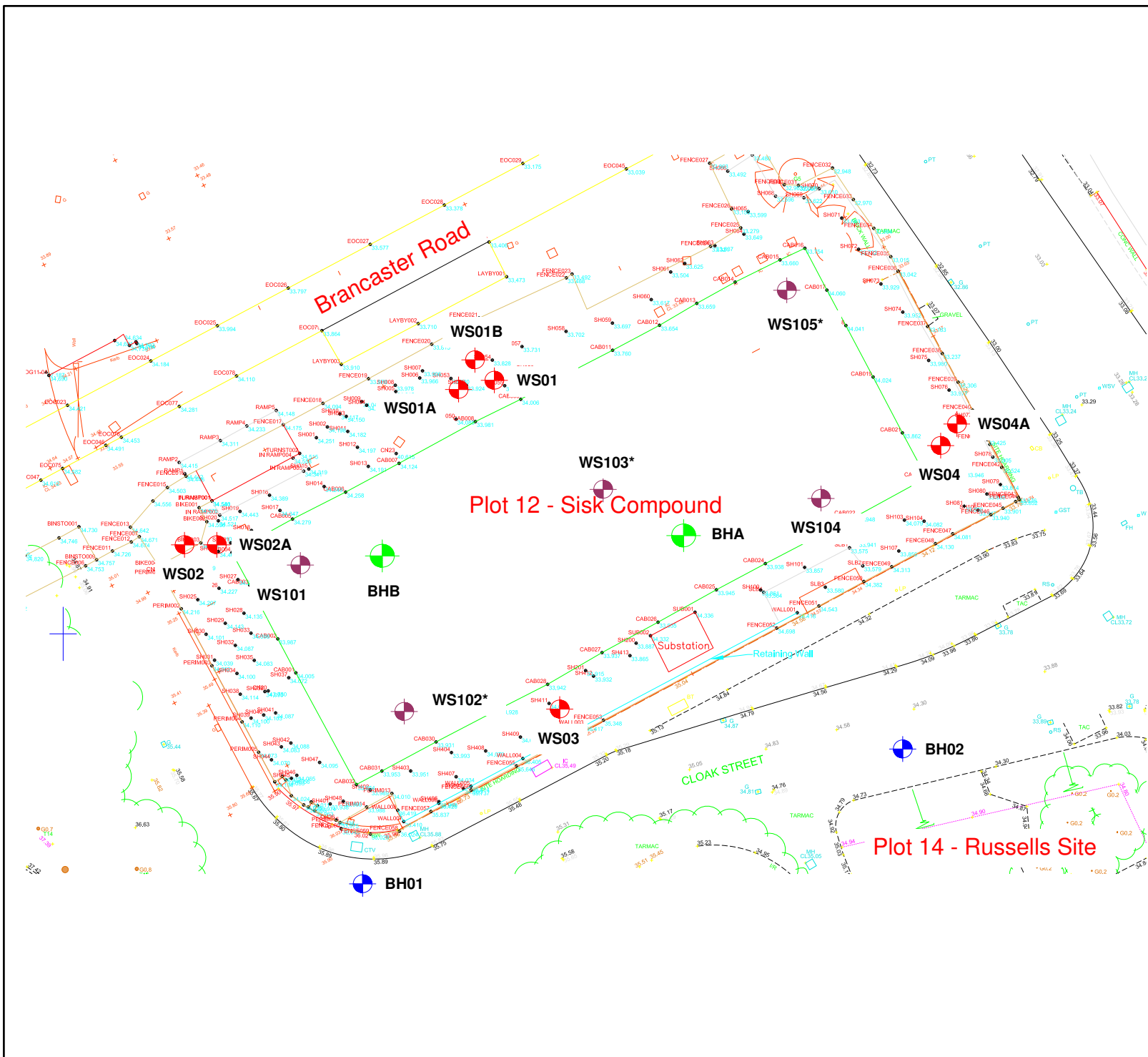
Project No 3 Circle Square, Manchester

Drg Title Landscape Masterplan wider context

Created on 15-12-21 Created by CL Approved by LH

Scale 1:500 Size A1 Workstage Information

Drg No 1502a-PLA-XX-XX-DR-L-0001 Suitability S1 Revision P01



PREVIOUS BOREHOLES



CABLE PERCUSSIVE BOREHOLE LOCATIONS
WITH ROTARY (CORED) FOLLOW ON



WINDOW SAMPLE BOREHOLE LOCATIONS



CABLE PERCUSSIVE BOREHOLE LOCATION
AUGUST 2020 INVESTIGATION

2022 INVESTIGATION BOREHOLES



WINDOW SAMPLE BOREHOLE LOCATIONS

Rev:	Description:	Date:	By:	Chkd:
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Status:

INFORMATION

Project:

CIRCLE SQUARE, PLOT 12

Drg Title:

**EXPLORATORY HOLE LOCATION PLAN
(ADDITIONAL GI)**

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	14/03/2022	PN	NF

Drg No:

CS12-CUR-12-XX-DR-GE-80004

Rev:

P01

Appendix B – Exploratory Hole Logs

- **Curtins Pre-Demo, 2019:**
 - Window Sample Borehole Logs WS01 – WS04A
 - Cable Percussive with Rotary Cored follow-on Borehole Logs BH01 – BH02
 - Rock Core Photos BH01 – BH02
- **Curtins Post-Demo, 2020:**
 - Cable Percussive Borehole Logs BHA – BH0B
- **Curtins, 2021:**
 - Window Sample Borehole Logs WS101 – WS105



Borehole Log

Borehole No.

WS01

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 33.90

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.25	ES		0.05 0.30	33.85 33.60		ASPHALT. MADE GROUND of light brown gravelly fine to medium SAND with low cobble content of brick and concrete. Gravel is angular to subangular, fine to coarse of brick, concrete and asphalt. End of borehole at 0.30 m	1 2 3 4 5 6 7 8 9 10

Remarks

Service inspection pit hand excavated from GL to 0.30m. Borehole terminated at 0.30m bgl due to concrete obstruction. No groundwater encountered.





Borehole Log

Borehole No.

WS01A

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 33.90

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	33.85		ASPHALT.	
					0.30	33.60		MADE GROUND of light brown gravelly fine to medium SAND with low cobble content of brick and concrete. Gravel is angular to subangular, fine to coarse of brick, concrete and asphalt. (SUB-BASE)	
								End of borehole at 0.30 m	1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

Service inspection pit hand excavated from GL to 0.30m. Borehole terminated at 0.30m bgl due to concrete obstruction. No groundwater encountered.





Borehole Log

Borehole No.

WS01B

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 33.90

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	33.85		ASPHALT.	
					0.25	33.65		MADE GROUND of light brown gravelly fine to medium SAND with low cobble content of brick and concrete. Gravel is angular to subangular, fine to coarse of brick, concrete and asphalt. (SUB-BASE)	
								End of borehole at 0.25 m	1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

Service inspection pit hand excavated from GL to 0.25m. Borehole terminated at 0.25m bgl due to concrete obstruction. No groundwater encountered.





Borehole Log

Borehole No.

WS02

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 34.40

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.05 0.20	34.35 34.20		ASPHALT. MADE GROUND of light brown gravelly fine to medium SAND with low cobble content of brick and concrete. Gravel is angular to subangular, fine to coarse of brick, concrete and asphalt. (SUB-BASE)	
					0.75	33.65		MADE GROUND of firm brown slightly gravelly CLAY with low cobble content of brick. Gravel is angular to subangular, fine to coarse of brick, concrete, slate and sandstone. End of borehole at 0.75 m	1 2 3 4 5 6 7 8 9 10

Remarks

Service inspection pit hand excavated from GL to 0.75m Borehole terminated at 0.75m bgl due to concrete obstruction. No groundwater encountered.





Borehole Log

Borehole No.

WS02A

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 34.40

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	34.35		ASPHALT.	
					0.15	34.25		MADE GROUND of light brown gravelly fine to medium SAND with low cobble content of brick. Gravel is angular to subangular, fine to coarse of brick, concrete, asphalt. (SUB-BASE)	
					0.70	33.70		MADE GROUND of firm brown slightly gravelly CLAY with low cobble content of brick. Gravel is angular to subangular, fine to coarse of brick, concrete, slate and sandstone. End of borehole at 0.70 m	1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

Service inspection pit hand excavated from GL to 0.70m. Borehole terminated at 0.60m bgl due to concrete obstruction. No groundwater encountered.





Borehole Log

Borehole No.

WS03

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 33.90

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES					MADE GROUND of stiff light brown grey very gravelly slightly sandy CLAY with moderate cobble content of brick. Gravel in angular to subrounded, fine to coarse of brick, concrete and slate.	1
		0.80	ES						
		1.20		N=34 (4,6/8,10,8,8)	1.60	32.30		Soft light brown mottled grey slightly gravelly CLAY. Gravel is subrounded to subangular, fine to medium of sandstone.	2
		2.00		N=5 (2,1/2,1,1,1)	2.20	31.70			
		2.40 - 2.60	D					Stiff brown slightly gravelly CLAY. Gravel is subrounded to subangular, fine to coarse of sandstone.	3
		3.00		N=12 (1,2/3,3,3,3)					
		4.00		N=12 (1,2/3,3,3,3)					
		5.00		N=14 (2,2/2,2,4,6)	5.00	28.90			
								End of borehole at 5.00 m	5
									6
									7
									8
									9
									10

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 0.65m bgl.





Borehole Log

Borehole No.

WS04

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 33.40

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.02	33.38		ASPHALT.	
					0.60	32.80		MADE GROUND of light brown gravelly fine to medium SAND. Gravel is angular to subangular, fine to coarse of brick, concrete and asphalt. (SUB-BASE)	
								End of borehole at 0.60 m	
									1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

Service inspection pit hand excavated from GL to 0.60m. Borehole terminated at 0.60m bgl due to concrete obstruction. No groundwater encountered.





Borehole Log

Borehole No.

WS04A

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
WS

Location: Manchester

Level: 33.40

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 14/06/2019 - 14/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	33.35		ASPHALT.	
					0.55	32.85		MADE GROUND of light brown gravelly fine to medium SAND. Gravel is angular to subangular, fine to coarse of brick, concrete and asphalt. (SUB-BASE) End of borehole at 0.55 m	
									1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

Service inspection pit hand excavated from GL to 0.55m. Borehole terminated due at 0.55m bgl due to concrete obstruction. No groundwater encountered.





Borehole Log

Borehole No.

BH01

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
CP

Location: Manchester

Level: 35.89

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 01/06/2019 - 01/06/2019

Logged By
ES

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	35.84		Asphalt surface slab	1
					0.20	35.69		Dark brown to black fine to coarse sub rounded to angular asphalt and concrete GRAVEL. High concrete cobble content. (Made Ground).	
		0.70	ES					Dark orangey brown sandy fine to coarse sub rounded to angular concrete and sandstone GRAVEL. Low concrete and sandstone cobble content. (Made Ground).	
		1.20		N=18 (2,3/3,4,5,6)					2
		2.00	ES		1.80	34.09		Soft to firm dark brown mottled reddy brown sandy gravelly CLAY. Gravel is fine to coarse sub rounded to angular sandstone.	
		2.00		N=14 (2,2/2,3,4,5)					
		3.00	U		2.60	33.29		Firm to stiff dary grey slightly gravelly CLAY. Gravel is fine to coarse rounded to sub angular sandstone.	3
		3.40	D						
		3.80	D						
		4.00		N=15 (2,2/3,3,4,5)					4
		4.20	ES						
		4.60	D						
		4.90	D						5
		5.00	U						
		5.40	D						
		6.00		N=20 (2,3/3,4,6,7)					6
		6.20	B						
		7.40	D		7.10	28.79		Orange brown fine to coarse sub rounded to sub angular SAND.	7
		7.50		N=50 (6,7/50 for 225mm)	7.30	28.59		Soft to firm occasionally stiff dark brown very sandy slightly gravelly CLAY. Gravel is fine to coarse sub rounded to angular sandstone.	
		7.80	D						
		8.50	D						8
							9		
					9.40	26.49	End of borehole at 9.40 m		10

Remarks

Water seepage at 2.0 m and groundwater level at 9.5 m. Refer to Geocore logs for rock logs and core recovery parameters.





Borehole Log

Borehole No.

BH02

Sheet 1 of 1

Project Name: Circle Square Plot 12

Project No.
069467

Co-ords: -

Hole Type
CP

Location: Manchester

Level: 34.80

Scale
1:50

Client: Bruntwood Circle Square 12 Ltd

Dates: 15/06/2019 - 16/06/2019

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30	34.50		ASPHALT	
		0.45	ES		0.65	34.15		MADE GROUND of light brown gravelly fine to medium SAND. Gravel is angular to subangular of concrete.	
		1.00	ES					MADE GROUND of light brown yellow gravelly medium to coarse SAND. Gravel is subangular to subrounded, fine to medium including sandstone, concrete and brick.	1
		1.20		50 (25 for 135mm/50 for 30mm)					
		2.00		N=25 (3,3/3,3,14,5)					2
		2.60			2.60	32.20		MADE GROUND of firm dark grey slightly gravelly slightly sandy CLAY with a moderate cobble content of brick. Gravel is angular to subangular, fine to coarse including brick, metal and ceramic.	
		3.00	ES	N=15 (4,5/5,3,3,4)	3.00	31.80		MADE GROUND of firm dark grey black gravelly slightly sandy CLAY. Gravel is subangular to subrounded including brick and ceramic. Strong odour noted.	3
		3.70	ES		3.60	31.20		Firm to stiff brown slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse including sandstone.	4
		4.00		N=23 (2,5/4,6,6,7)					
		4.70 - 4.80	D						
5.00			N=26 (3,5/5,5,7,9)					5	
6.00		D						6	
6.50			N=29 (3,4/6,6,8,9)					7	
7.80				7.80	27.00		Reddish brown slightly gravelly medium to coarse SAND. Gravel is subrounded, fine to coarse of sandstone (Weathered Sandstone)	8	
8.00			N=51 (11,13/51 for 228mm)						
9.00				9.00	25.80		End of borehole at 9.00 m	9	
								10	

Remarks

Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 3.10m bgl. Refer to Geocore logs for rock logs and core recovery parameters.



Rock Core Photos – BH01



Rock Core Photos – BH01



Rock Core Photos – BH01



Rock Core Photos – BH02



Rock Core Photos – BH02





Borehole Log

Borehole No.

BHA

Sheet 1 of 2

Project Name: Circle Square Plot 12

Project No.
069467.304Co-ords: 384372306.03 -
397359534.19Hole Type
CP

Location: Manchester

Level: 32.02

Scale
1:50

Client: John Sisk & Son Ltd

Dates: 04/08/2020 - 04/08/2020

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.20		N=8 (3,1/2,2,2,2)	2.60	29.42		MADE GROUND of firm dark grey very gravelly clay with occasional cobbles. Gravel is medium to coarse and sub-angular to angular of concrete, timber, brick, metal, ceramic, siltstone and sandstone. Cobbles are sub-angular of brick and concrete. <i>Grey concrete boulder along the southern side of the hand pit. Between 0.60 - 0.80m bgl.</i>	1
		2.00		N=6 (2,3/2,1,2,1)					2
		3.00		N=7 (2,1/1,2,2,2)					3
		4.00		N=5 (2,2/1,1,2,1)	7.50	24.52			4
		5.00		N=8 (2,1/2,2,1,3)					5
		6.00		N=6 (1,2/2,1,2,1)					6
		7.50		N=11 (2,2/2,3,3,3)					7
					8.20	23.82			8
		9.00		50 (8,9/50 for 170mm)	9.50	22.52			9
									10

Continued on next sheet

Remarks

Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 7.50m, strike rose to 7.00m after 20minutes. Chiseling for an hour between 9.00m to 10.00m. Borehole complete at 10.10m bgl within sandstone bedrock.





Borehole Log

Borehole No.

BHA

Sheet 2 of 2

Project Name: Circle Square Plot 12

Project No.
069467.304Co-ords: 384372306.03 -
397359534.19Hole Type
CP

Location: Manchester

Level: 32.02

Scale
1:50

Client: John Sisk & Son Ltd

Dates: 04/08/2020 - 04/08/2020

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.00		50 (25 for 60mm/50 for 50mm)	10.10	21.92		End of borehole at 10.10 m	
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Remarks

Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 7.50m, strike rose to 7.00m after 20minutes. Chiseling for an hour between 9.00m to 10.00m. Borehole complete at 10.10m bgl within sandstone bedrock.





Borehole Log

Borehole No.

BHB

Sheet 1 of 2

Project Name: Circle Square Plot 12

Project No.
069467.304Co-ords: 384393596.13 -
397356537.25Hole Type
CP

Location: Manchester

Level: 34.21

Scale
1:50

Client: John Sisk & Son Ltd

Dates: 05/08/2020 - 05/08/2020

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.20		N=14 (3,3/4,3,3,4)				MADE GROUND of firm dark grey very gravelly clay with occasional cobbles. Gravel is medium to coarse and sub-angular to angular of concrete, timber, brick, metal, ceramic, siltstone and sandstone. Cobbles are sub-angular of brick and concrete.	1
		2.00		N=12 (4,3/2,3,3,4)					2
		3.00		N=5 (2,1/2,1,1,1)	3.00	31.21		MADE GROUND of soft blackish-brown very gravelly clay. Gravel is medium to coarse and sub-angular of brick, concrete, sandstone and siltstone.	3
		4.00		N=5 (2,2/1,1,2,1)	3.80	30.41		MADE GROUND of soft dark brown gravelly clay. Gravel is fine to coarse and sub-rounded to sub-angular of brick, ash, coal, siltstone and sandstone (reworked clay).	4
		5.00		N=7 (2,2/2,1,2,2)					5
		6.00		N=10 (3,3/3,2,3,2)					6
		7.00			7.00	27.21		Firm dark brown very silty gravelly CLAY. Gravel is fine to medium and sub-rounded of coal, wood fragments, sandstone and siltstone.	7
		7.50		N=10 (3,3/2,3,3,2)					8
		8.60			8.60	25.61		Reddish-brown slightly gravelly sand. Gravel is fine to medium of sandstone. Between 8.50 - 8.60m bgl.	9
		9.00		N=11 (3,2/3,3,2,3)				Firm dark brown slightly gravelly CLAY. Gravel is fine to medium and rounded of sandstone and siltstone.	9
								Continued on next sheet	10

Remarks

Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 3.00m and 10.50m, strike at 3.00m did not rise after 20minutes, strike at 10.50m rose to 8.50m after 20minutes. Chiseling for an hour between 11.50m to 12.00m. Borehole complete at 12.10m bgl within sandstone bedrock.





Borehole Log

Borehole No.

BHB

Sheet 2 of 2

Project Name: Circle Square Plot 12

Project No.
069467.304Co-ords: 384393596.13 -
397356537.25Hole Type
CP

Location: Manchester

Level: 34.21

Scale
1:50

Client: John Sisk & Son Ltd

Dates: 05/08/2020 - 05/08/2020

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50		N=40 (6,8/9,10,11,10)	10.50	23.71		Dense dark grey SAND and GRAVEL with frequent cobbles. Gravel is rounded of siltstone and sandstone. Cobbles are rounded of siltstone. Reddish-brown SANDSTONE bedrock.	11
		11.00		50 (25 for 30mm/50 for 25mm)	11.00	23.21			12
		12.00		50 (25 for 35mm/50 for 30mm)	12.10	22.11			13
								End of borehole at 12.10 m	14
									15
									16
									17
									18
									19
									20

Remarks

Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 3.00m and 10.50m, strike at 3.00m did not rise after 20minutes, strike at 10.50m rose to 8.50m after 20minutes. Chiseling for an hour between 11.50m to 12.00m. Borehole complete at 12.10m bgl within sandstone bedrock.





Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	ES	50 (25 for 95mm/50 for 170mm)	0.10			MADE GROUND: Concrete over, light brown, compact, slightly cobbley sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE) MADE GROUND: Concrete boulder (required breaking out). MADE GROUND: Brown, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occassional cobbles of brick. (BRICK FILL) MADE GROUND: Very stiff, brown, sandy very gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone. <u>Brick cobbles present from 0.9 to 1.0m bgl.</u>	1
					0.20				
					0.40				
					1.20				
		1.20 - 1.65	D		1.47			<u>Large obstruction at 1.45m bgl which could not be advanced through.</u> End of borehole at 1.47 m	2
									3
									4

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole refused at 1.40m bgl on obstruction in Made ground, attempted re-drilling and also refused at 1.40m bgl. Borehole backfilled with arisings.





Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.10			MADE GROUND: Roadstone over, light brown, compact, slightly cobbly sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	
		1.20			0.90			MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.20 - 1.65	D	N=14 (5,6/4,3,4,3)				MADE GROUND: Firm, brown, slightly sandy very gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone.	1
					1.60			MADE GROUND: Firm, dark greyish brown, slightly gravelly very sandy clay. Sand is fine to medium. Gravel is fine to coarse, angular to subangular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone.	
					1.80			MADE GROUND: Firm, dark greyish brown, slightly gravelly very sandy clay. Sand is fine to medium. Gravel is fine to coarse, angular to subangular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone.	
		2.00		N=13 (3,3/3,4,3,3)				MADE GROUND: Firm, brown and orangish brown, andy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular to subangular brick, charcoal, sandstone and mudstone.	2
					2.70			Firm, orangish brown, slightly silty sandy CLAY. Sand is fine. (POSSIBLY REWORKED)	
		2.90	D		3.00			End of borehole at 3.00 m	3
									4

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole aborted in possibly re-worked natural soil due to anomaly readings from UXO magnetometer. Borehole installed with ground gas/water monitoring well in shallower Made Ground strata to 2.0m bgl.





Borehole Log

Borehole No.

WS103

Sheet 1 of 2

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20						MADE GROUND: Roadstone over, light brown, compact, slightly cobbly sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	
		0.50						MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.00	ES					MADE GROUND: Stiff, brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and concrete.	1
		1.20		N=15 (5,3/3,4,4,4)					
		1.50							
		1.60	ES					MADE GROUND: Medium dense, black, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
		1.70						MADE GROUND: Medium dense, orangish brown, fine to medium sand.	
		1.85						MADE GROUND: Very soft, dark greyish brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	2
		2.00		N=1 (0,0/0,1,0,0)					
		2.00 - 2.45	D					MADE GROUND: Very soft, dark grey, slightly silty sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
		2.20							
		3.00		N=0 (0,0/0,0,0,0)				MADE GROUND: Very soft, wet, dark grey, slightly silty clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular ash, charcoal, sandstone and mudstone. <i>Core barrell pushed off line and getting stuck on cobbles in Made Ground at 1.0m bgl.</i>	3
		3.60							
		4.00		N=3 (0,0/0,1,1,1)				MADE GROUND: Very soft, wet, dark grey, slightly sandy slightly gravelly silty clay. Sand is fine to medium. Gravel is fine to coarse, angular ash, charcoal, sandstone and mudstone.	4

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 3.00m bgl. Borehole terminated at 4.00m bgl after core barrell knocked off line and stuck in Made Ground at 1.00m bgl. Borehole installed with ground gas/water monitoring well in Made Ground to 4.00m bgl.





Borehole Log

Borehole No.

WS103

Sheet 2 of 2

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

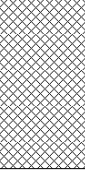
Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		4.00 - 4.45	D		4.45			End of borehole at 4.45 m	
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 3.00m bgl. Borehole terminated at 4.00m bgl after core barrell knocked off line and stuck in Made Ground at 1.00m bgl. Borehole installed with ground gas/ water monitoring well in Made Ground to 4.00m bgl.





Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES	N=50 (25 for 95mm/50 for 255mm)	0.30			MADE GROUND: Concrete over, light brown, compact, slightly cobbly sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	1
		0.70			0.70			MADE GROUND: Brown, slightly cobbly gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.00			1.00			MADE GROUND: Yellowish brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone and mudstone.	
		1.20			1.20			MADE GROUND: Very stiff, brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, concrete, sandstone and mudstone.	
		1.70	N=4 (3,2/2,1,1,0)		1.70			MADE GROUND: Very stiff, dark greyish brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	2
		2.00			2.00			Abundant ash and tarmac from 1.90 to 2.0m bgl. MADE GROUND: Loose, black, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
		2.80 - 3.00	D		2.80			Firm, orangish brown, slightly silty sandy slightly gravelly CLAY. Sand is fine. Gravel is fine to medium, subangular mudstone and siltstone. (POSSIBLY REWORKED)	3
					3.45			End of borehole at 3.45 m	4

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 2.00m bgl. Borehole collapsed twice to 2.30m bgl from 3.0m bgl despite re-drilling. Borehole backfilled with arising.





Borehole Log

Borehole No.

WS105

Sheet 1 of 2

Project Name:	Circle Square Building 3 (Formerly Plot 12)	Project No.	B080355.300	Co-ords:	-	Hole Type	WS
Location:	Circle Square, Manchester	Level:		Scale	1:20	Logged By	TW
Client:	Bruntwood Circle Square 12 Ltd	Dates:	02/03/2022 - 02/03/2022				

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			MADE GROUND: Concrete over, light brown, compact, slightly cobbley sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	
					1.00			MADE GROUND: Light brown, compact, slightly cobbley gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.20		N=29 (5,5/5,7,7,10)				MADE GROUND: Stiff, dark greyish brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone. Occasional cobbles of brick.	1
								<u>Layer of ash from 1.50 to 1.70m bgl.</u>	
		1.75	ES					<u>Green and brown sand band with white Made Ground material (unknown composition) from 1.70 to 1.80m bgl.</u>	
		2.00		N=1 (1,0/0,1,0,0)				<u>Becoming very soft at 2.0m bgl.</u>	2
					2.70			MADE GROUND: Very soft, wet, brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, charcoal, sandstone and mudstone.	
		3.00		N=3 (1,0/0,1,1,1)					3
		3.00 - 3.45	D						
					3.70			MADE GROUND: Very loose, black, wet, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
					3.90				
		4.00	ES						4

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 2.00m bgl. Borehole collapsed twice to 3.20m bgl from 4.0m bgl despite re-drilling. Borehole installed with ground gas/water monitoring well in Made Ground to 3.00m bgl.





Borehole Log

Borehole No.

WS105

Sheet 2 of 2

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

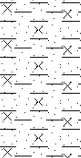
Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		4.00 4.00 - 4.45	D	N=6 (0,0/2,1,2,1)	4.45			Soft, orangish brown, slightly silty sandy CLAY. Sand is fine. (POSSIBLY REWORKED)	
								End of borehole at 4.45 m	5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 2.00m bgl. Borehole collapsed twice to 3.20m bgl from 4.0m bgl despite re-drilling. Borehole installed with ground gas/water monitoring well in Made Ground to 3.00m bgl.



Appendix C – Chemical Laboratory Testing Results

Curtins Pre-Demo, 2019:

- Envirolab, Environmental Chemistry Analysis Results, Soils
 - Final Analytical Test Report Ref. 19/05296
 - Final Analytical Test Report Ref. 19/05780

Curtins, 2021:

- Envirolab, Environmental Chemistry Analysis Results, Soils
 - Final Analytical Test Report Ref. 22-02030-1
- Envirolab, Environmental Chemistry Analysis Results, Waters
 - Final Analytical Test Report Ref. 22-05497-1

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/05296
Issue Number: 1

Date: 10 June, 2019

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

Project Manager: Siobhán Hyde
Project Name: Circle Square Plot 12
Project Ref: B069467
Order No: EBMA1891
Date Samples Received: 03/06/19
Date Instructions Received: 04/06/19
Date Analysis Completed: 10/06/19

Prepared by:



Melanie Marshall
Laboratory Coordinator

Approved by:



Iain Haslock
Analytical Consultant

Envirolab Job Number: 19/05296

Client Project Name: Circle Square Plot 12

Client Project Ref: B069467

Lab Sample ID	19/05296/1	19/05296/2	19/05296/3					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH01							
Depth to Top	0.70	2.00	4.20							
Depth To Bottom										
Date Sampled	01-Jun-19	01-Jun-19	01-Jun-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	4A	5A	5A							
% Stones >10mm _A	22.2	0.7	2.5					% w/w	0.1	A-T-044
pH _D ^{M#}	8.38	8.15	8.30					pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.02	0.04	0.05					g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1					mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2					mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	1.6	1.7	3.1					% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	4	4	2					mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	<1.0	<1.0					mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.9	0.6	<0.5					mg/kg	0.5	A-T-024s
Copper _D ^{M#}	9	16	17					mg/kg	1	A-T-024s
Chromium _D ^{M#}	15	25	23					mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1					mg/kg	1	A-T-040s
Lead _D ^{M#}	16	15	9					mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17					mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	19	29	28					mg/kg	1	A-T-024s
Selenium _D ^{M#}	2	<1	<1					mg/kg	1	A-T-024s
Zinc _D ^{M#}	37	50	48					mg/kg	5	A-T-024s

Envirolab Job Number: 19/05296

Client Project Name: Circle Square Plot 12

Client Project Ref: B069467

Lab Sample ID	19/05296/1	19/05296/2	19/05296/3					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH01							
Depth to Top	0.70	2.00	4.20							
Depth To Bottom										
Date Sampled	01-Jun-19	01-Jun-19	01-Jun-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	4A	5A	5A							
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD							A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A							

Envirolab Job Number: 19/05296

Client Project Name: Circle Square Plot 12

Client Project Ref: B069467

Lab Sample ID	19/05296/1	19/05296/2	19/05296/3					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH01							
Depth to Top	0.70	2.00	4.20							
Depth To Bottom										
Date Sampled	01-Jun-19	01-Jun-19	01-Jun-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	4A	5A	5A							
PAH-16MS										
Acenaphthene _A ^{M#}	4.17	0.57	0.10					mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.23	0.04	0.01					mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	6.87	0.86	0.17					mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	11.6	1.71	0.32					mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	9.99	1.55	0.27					mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	11.5	1.95	0.35					mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	4.89	0.76	0.13					mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	4.28	0.69	0.13					mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	12.3	1.88	0.36					mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	1.26	0.19	<0.04					mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	27	4.17	0.74					mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	4.19	0.51	0.11					mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	5.61	0.83	0.13					mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	4.34	0.42	0.11					mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	30.3	3.69	0.75					mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	24.1	3.83	0.69					mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	163	23.6	4.37					mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/05296

Client Project Name: Circle Square Plot 12

Client Project Ref: B069467

Lab Sample ID	19/05296/1	19/05296/2	19/05296/3					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH01							
Depth to Top	0.70	2.00	4.20							
Depth To Bottom										
Date Sampled	01-Jun-19	01-Jun-19	01-Jun-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	4A	5A	5A							
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	0.01					mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<5	<1	<1					mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<5	<1	<1					mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	9	2	<1					mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	9	2	<1					mg/kg	1	A-T-055s
Ali >C21-C35 _A	26	6	4					mg/kg	1	A-T-055s
Total Aliphatics _A	44	11	4					mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<5	<1	<1					mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	14	4	<1					mg/kg	1	A-T-055s
Aro >C12-C16 _A	111	22	3					mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	364	64	6					mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	661	130	13					mg/kg	1	A-T-055s
Total Aromatics _A	1150	220	22					mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	1190	230	26					mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
MTBE _A [#]	<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.

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

Project: Circle Square Plot 12

Clients Project No: B069467

Project No: 19/05296

Date Received: 04/06/2019 (am)

Cool Box Temperatures (°C): 19.4

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: 19/05780
Issue Number: 1

Date: 24 June, 2019

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

Project Manager: Siobhán Hyde
Project Name: Circle Square, Plot 12
Project Ref: 069467
Order No: EBMA1917
Date Samples Received: 17/06/19
Date Instructions Received: 18/06/19
Date Analysis Completed: 24/06/19

Prepared by:



Georgia King
Admin & Client Services Supervisor

Approved by:



Holly Neary-King
Client Manager

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/1	19/05780/2	19/05780/3	19/05780/4	19/05780/5	19/05780/6	19/05780/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03	WS03	WS02	WS04	WS01	BH02	BH02			
Depth to Top	0.20	0.80	0.10	0.05	0.25	0.45	3.00			
Depth To Bottom				0.10			3.10			
Date Sampled	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	15-Jun-19	15-Jun-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	4A	4ABE	4ABE	4AE	4AE	4ABE			
% Stones >10mm _A	<0.1	23.6	26.6	47.6	34.3	42.4	14.3	% w/w	0.1	A-T-044
pH _D ^{M#}	11.58	12.01	10.13	10.84	10.45	10.18	8.10	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.06	0.13	0.07	0.08	0.10	0.01	0.39	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1	<1	<1	3	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	1.7	1.6	2.4	3.0	1.2	4.4	4.5	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	3	4	<1	<1	<1	<1	15	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.8	1.5	1.3	0.8	0.9	0.5	2.1	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	17	20	15	6	5	5	64	mg/kg	1	A-T-024s
Chromium _D ^{M#}	15	22	18	12	14	12	16	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-040s
Lead _D ^{M#}	41	47	26	10	11	6	177	mg/kg	1	A-T-024s
Mercury _D	<0.17	0.50	<0.17	<0.17	<0.17	<0.17	1.93	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	18	18	16	10	11	10	19	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	49	59	34	24	24	18	82	mg/kg	5	A-T-024s

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/1	19/05780/2	19/05780/3	19/05780/4	19/05780/5	19/05780/6	19/05780/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03	WS03	WS02	WS04	WS01	BH02	BH02			
Depth to Top	0.20	0.80	0.10	0.05	0.25	0.45	3.00			
Depth To Bottom				0.10			3.10			
Date Sampled	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	15-Jun-19	15-Jun-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	4A	4ABE	4ABE	4AE	4AE	4ABE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	Amosite	NAD	NAD	NAD	NAD	NAD	NAD			A-T-045
Asbestos Matrix (microscope) ^o	Loose Fibres	-	-	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) ^o	<0.001	-	-	-	-	-	-	% w/w	0.001	A-T-054

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/1	19/05780/2	19/05780/3	19/05780/4	19/05780/5	19/05780/6	19/05780/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03	WS03	WS02	WS04	WS01	BH02	BH02			
Depth to Top	0.20	0.80	0.10	0.05	0.25	0.45	3.00			
Depth To Bottom				0.10			3.10			
Date Sampled	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	15-Jun-19	15-Jun-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	4A	4ABE	4ABE	4AE	4AE	4ABE			
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	2.16	0.20	0.37	<0.03	2.64	<0.03	<0.03	mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	0.27	0.03	0.02	<0.01	<0.10	<0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	2.38	0.33	0.58	0.02	4.41	0.05	0.16	mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	2.56	0.28	0.50	0.02	4.95	0.04	0.02	mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	18.4	2.51	3.30	0.19	26.4	0.47	0.12	mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	4.57	0.65	0.81	0.03	6.06	0.12	0.03	mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	20.8	3.44	3.61	0.18	19.5	0.82	0.24	mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	18.3	2.93	3.08	0.20	15.2	0.71	0.25	mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	8.18	1.30	1.34	0.09	9.23	0.35	0.08	mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	7.78	1.23	1.40	0.14	8.46	0.40	0.09	mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	7.95	1.20	1.35	0.10	6.63	0.42	0.09	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	2.96	0.42	0.51	<0.07	2.83	0.14	<0.07	mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	6.63	0.97	1.19	0.09	5.67	0.34	0.07	mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	4.00	0.58	0.80	0.07	3.69	0.24	0.05	mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.99	0.14	0.22	<0.04	0.93	0.06	<0.04	mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	3.44	0.53	0.75	0.10	3.03	0.25	<0.05	mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	111	16.7	19.8	1.23	120	4.41	1.20	mg/kg	0.03	A-T-019s

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/1	19/05780/2	19/05780/3	19/05780/4	19/05780/5	19/05780/6	19/05780/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS03	WS03	WS02	WS04	WS01	BH02	BH02			
Depth to Top	0.20	0.80	0.10	0.05	0.25	0.45	3.00			
Depth To Bottom				0.10			3.10			
Date Sampled	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	14-Jun-19	15-Jun-19	15-Jun-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	4A	4ABE	4ABE	4AE	4AE	4ABE			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<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	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<5	<1	<1	<1	<5	<1	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<5	<1	2	<1	<5	<1	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	17	6	9	3	6	2	3	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	27	9	11	5	10	5	8	mg/kg	1	A-T-055s
Ali >C21-C35 _A	93	31	154	143	116	71	10	mg/kg	1	A-T-055s
Total Aliphatics _A	136	46	176	152	132	78	22	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<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	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	76	12	2	2	6	2	2	mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	8	2	4	2	<5	<1	1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	85	8	19	3	121	2	7	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	365	25	69	8	515	7	14	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	928	68	244	101	1260	60	46	mg/kg	1	A-T-055s
Total Aromatics _A	1460	113	338	115	1900	72	72	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	1600	159	514	267	2040	151	93	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<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	<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	<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	<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	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/9							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH02									
Depth to Top	3.70									
Depth To Bottom										
Date Sampled	15-Jun-19									
Sample Type	Soil - ES									
Sample Matrix Code	5A									
% Stones >10mm _A	<0.1							% w/w	0.1	A-T-044
pH _D ^{M#}	8.62							pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.06							g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1							mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2							mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	1.9							% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	4							mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0							mg/kg	1	A-T-027s
Cadmium _D ^{M#}	3.0							mg/kg	0.5	A-T-024s
Copper _D ^{M#}	24							mg/kg	1	A-T-024s
Chromium _D ^{M#}	27							mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1							mg/kg	1	A-T-040s
Lead _D ^{M#}	22							mg/kg	1	A-T-024s
Mercury _D	<0.17							mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	33							mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1							mg/kg	1	A-T-024s
Zinc _D ^{M#}	60							mg/kg	5	A-T-024s

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/9							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH02									
Depth to Top	3.70									
Depth To Bottom										
Date Sampled	15-Jun-19									
Sample Type	Soil - ES									
Sample Matrix Code	5A									
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD									A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A									

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/9							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH02									
Depth to Top	3.70									
Depth To Bottom										
Date Sampled	15-Jun-19									
Sample Type	Soil - ES									
Sample Matrix Code	5A									
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	<0.03							mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	<0.01							mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	<0.01							mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	<0.01							mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	0.05							mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	<0.02							mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	<0.08							mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	<0.07							mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04							mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	<0.06							mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05							mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07							mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04							mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03							mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04							mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05							mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	<0.08							mg/kg	0.03	A-T-019s

Envirolab Job Number: 19/05780

Client Project Name: Circle Square, Plot 12

Client Project Ref: 069467

Lab Sample ID	19/05780/9									
Client Sample No										
Client Sample ID	BH02									
Depth to Top	3.70									
Depth To Bottom										
Date Sampled	15-Jun-19									
Sample Type	Soil - ES									
Sample Matrix Code	5A									
TPH CWG										
Ali >C5-C6 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1							mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1							mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1							mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1							mg/kg	1	A-T-055s
Ali >C21-C35 _A	6							mg/kg	1	A-T-055s
Total Aliphatics _A	6							mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01							mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	1							mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	<1							mg/kg	1	A-T-055s
Aro >C12-C16 _A	2							mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	2							mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	7							mg/kg	1	A-T-055s
Total Aromatics _A	11							mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	17							mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01							mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01							mg/kg	0.01	A-T-022s
MTBE _A [#]	<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.

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, Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	19/05780
Project:	Circle Square, Plot 12	Date Received:	18/06/2019 (am)
Clients Project No:	069467	Cool Box Temperatures (°C):	18.1

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: 22/02030
Issue Number: 1
Date: 29 March, 2022

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

Project Manager: EBMA/Niall Farnworth/Tommy Walker
Project Name: Circle Square - Plot 12
Project Ref: B069467
Order No: EBMA3266
Date Samples Received: 03/03/22
Date Instructions Received: 04/03/22
Date Analysis Completed: 29/03/22

Approved by:



Holly Neary-King
Client Services Supervisor

Envirolab Job Number: 22/02030

Client Project Name: Circle Square - Plot 12

Client Project Ref: B069467

Lab Sample ID	22/02030/1	22/02030/2	22/02030/3	22/02030/4	22/02030/5	22/02030/7	22/02030/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS102	WS103	WS103	WS104	WS105	WS103			
Depth to Top	0.50	0.20	1.00	1.60	0.80	4.00	4.00			
Depth To Bottom							4.95			
Date Sampled	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AB	5A	6AB	5A	5A	6A				
% Stones >10mm _A	<0.1	6.7	<0.1	11.6	5.7	<0.1	-	% w/w	0.1	A-T-044
pH _D ^{M#}	11.12	10.51	10.73	8.97	9.60	8.84	-	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.03	0.31	0.09	0.07	0.04	0.04	-	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1	<1	<1	-	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	NDP	5.1	NDP	6.6	0.8	2.4	-	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	4	10	3	8	2	2	-	mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	6.4	1.4	0.8	0.5	0.6	0.8	-	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	38	44	39	35	22	27	-	mg/kg	1	A-T-024s
Chromium _D ^{M#}	21	22	24	10	13	26	-	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	-	mg/kg	1	A-T-040s
Lead _D ^{M#}	82	93	152	180	46	27	-	mg/kg	1	A-T-024s
Mercury _D	0.37	1.60	0.67	0.52	0.31	<0.17	-	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	27	24	29	19	19	35	-	mg/kg	1	A-T-024s
Selenium _D ^{M#}	1	<1	<1	<1	<1	<1	-	mg/kg	1	A-T-024s
Zinc _D ^{M#}	100	68	84	50	55	57	-	mg/kg	5	A-T-024s
4 point Liquid & Plastic Limit by Cone Penetrometer _A	-	-	-	-	-	-	Appended			Subcon IFA
Moisture Content of Soil (Oven Dried Method) _A	-	-	-	-	-	-	Appended			Subcon IFA

Envirolab Job Number: 22/02030

Client Project Name: Circle Square - Plot 12

Client Project Ref: B069467

Lab Sample ID	22/02030/1	22/02030/2	22/02030/3	22/02030/4	22/02030/5	22/02030/7	22/02030/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS102	WS103	WS103	WS104	WS105	WS103			
Depth to Top	0.50	0.20	1.00	1.60	0.80	4.00	4.00			
Depth To Bottom							4.95			
Date Sampled	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AB	5A	6AB	5A	5A	6A				
Asbestos in Soil (inc. matrix)										
Asbestos in soil _D [#]	Amosite	NAD	Amosite	NAD	NAD	NAD	-			A-T-045
Asbestos Matrix (visual) _D	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) _D	Loose Fibres	-	Loose Insulation	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	-			A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	<0.001	-	<0.001	-	-	-	-	% w/w	0.001	A-T-054

Envirolab Job Number: 22/02030

Client Project Name: Circle Square - Plot 12

Client Project Ref: B069467

Lab Sample ID	22/02030/1	22/02030/2	22/02030/3	22/02030/4	22/02030/5	22/02030/7	22/02030/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS102	WS103	WS103	WS104	WS105	WS103			
Depth to Top	0.50	0.20	1.00	1.60	0.80	4.00	4.00			
Depth To Bottom							4.95			
Date Sampled	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AB	5A	6AB	5A	5A	6A				
PAH-16MS										
Acenaphthene _A ^{M#}	5.00	1.81	8.05	0.03	0.09	<0.01	-	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.36	0.06	0.28	<0.01	0.02	<0.01	-	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	8.70	2.25	9.71	0.04	0.20	<0.02	-	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	11.8	2.78	9.75	0.07	0.59	<0.04	-	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	9.67	2.62	7.47	0.09	0.68	<0.04	-	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	10.1	2.66	7.81	0.09	0.61	<0.05	-	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	4.72	1.48	3.43	0.05	0.36	<0.05	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	4.84	1.00	3.68	<0.07	0.27	<0.07	-	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	13.7	2.77	11.1	0.10	0.65	<0.06	-	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	1.53	0.42	1.04	<0.04	0.09	<0.04	-	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	32.3	8.32	29.6	0.15	1.28	<0.08	-	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	4.64	1.50	6.76	0.02	0.08	<0.01	-	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	5.69	1.85	4.33	0.05	0.44	<0.03	-	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	5.33	2.10	11.3	0.07	0.08	<0.03	-	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	37	9.09	39.1	0.20	0.82	<0.03	-	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	27.8	6.94	24	0.15	1.30	<0.07	-	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	183	47.6	177	1.11	7.56	<0.08	-	mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/02030

Client Project Name: Circle Square - Plot 12

Client Project Ref: B069467

Lab Sample ID	22/02030/1	22/02030/2	22/02030/3	22/02030/4	22/02030/5	22/02030/7	22/02030/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS102	WS103	WS103	WS104	WS105	WS103			
Depth to Top	0.50	0.20	1.00	1.60	0.80	4.00	4.00			
Depth To Bottom							4.95			
Date Sampled	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AB	5A	6AB	5A	5A	6A				
TPH CWG with Clean Up *C1										
Ali >C5-C6 _A [#]	<0.01	<0.01	<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	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<5	<20	<5	1	<1	<1	-	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	7	<20	8	1	<1	<1	-	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	27	<20	27	4	<1	<1	-	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	29	23	26	4	2	<1	-	mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	143	3550	125	18	28	4	-	mg/kg	1	A-T-055s
Total Aliphatics _A	206	3580	186	29	30	4	-	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01	<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	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	6	48	11	2	2	<1	-	mg/kg	1	A-T-055s
Aro >C10-C12 _A	18	<20	42	2	<1	<1	-	mg/kg	1	A-T-055s
Aro >C12-C16 _A	87	50	148	10	2	<1	-	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	288	114	427	18	8	<1	-	mg/kg	1	A-T-055s
Aro >C21-C35 _A	622	226	966	31	23	1	-	mg/kg	1	A-T-055s
Total Aromatics _A	1020	439	1600	63	34	1	-	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	1220	4020	1790	91	64	5	-	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01	<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	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	0.19	0.02	<0.01	<0.01	<0.01	-	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	0.13	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	<0.01	<0.01	-	mg/kg	0.01	A-T-022s

Envirolab Job Number: 22/02030

Client Project Name: Circle Square - Plot 12

Client Project Ref: B069467

Lab Sample ID	22/02030/10	22/02030/11	22/02030/12	22/02030/13	22/02030/14			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS105	WS105	WS102	WS102					
Depth to Top	2.80	3.00	4.00	1.20	2.90					
Depth To Bottom	3.00	3.45	4.45	1.65						
Date Sampled	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22	02-Mar-22					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	3A	6A		6A	3A					
% Stones >10mm _A	<0.1	<0.1	-	<0.1	<0.1			% w/w	0.1	A-T-044
pH BRE _D ^{MF}	7.95	8.11	-	10.56	7.79			pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{MF}	284	92	-	194	76			mg/l	10	A-T-026s
4 point Liquid & Plastic Limit by Cone Penetrometer _A	Appended	Appended	Appended	-	Appended					Subcon IFA
Moisture Content of Soil (Oven Dried Method) _A	Appended	Appended	Appended	-	Appended					Subcon IFA

REPORT NOTES

General

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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, 9 = INCINERATOR ASH.

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

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

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:	22/02030
Project:	Circle Square - Plot 12	Date Received:	04/03/2022 (am)
Clients Project No:	B069467	Cool Box Temperatures (°C):	6.9

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.

Envirolab Analysis Dates

Lab Sample ID	22/02030/1	22/02030/2	22/02030/3	22/02030/4	22/02030/5	22/02030/7	22/02030/9	22/02030/10	22/02030/11	22/02030/12	22/02030/13	22/02030/14
Client Sample No												
Client Sample ID/Depth	WS101 0.50m	WS102 0.20m	WS103 1.00m	WS103 1.60m	WS104 0.80m	WS105 4.00m	WS103 4.00-4.95m	WS104 2.80-3.00m	WS105 3.00-3.45m	WS105 4.00-4.45m	WS102 1.20-1.65m	WS102 2.90m
Date Sampled	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22	02/03/22
A-T-019s	09/03/2022	09/03/2022	09/03/2022	09/03/2022	09/03/2022	09/03/2022						
A-T-022s	09/03/2022	09/03/2022	09/03/2022	11/03/2022	09/03/2022	09/03/2022						
A-T-024s	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022						
A-T-026s	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022		16/03/2022	16/03/2022		16/03/2022	16/03/2022
A-T-027s	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022						
A-T-031s	10/03/2022	10/03/2022	10/03/2022	10/03/2022	10/03/2022	10/03/2022		15/03/2022	15/03/2022		15/03/2022	15/03/2022
A-T-032 OM	08/03/2022	10/03/2022	08/03/2022	10/03/2022	10/03/2022	10/03/2022						
A-T-040s	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022	11/03/2022						
A-T-042sTCN	09/03/2022	09/03/2022	09/03/2022	09/03/2022	09/03/2022	09/03/2022						
A-T-044	09/03/2022	09/03/2022	09/03/2022	09/03/2022	09/03/2022	09/03/2022		14/03/2022	14/03/2022		14/03/2022	14/03/2022
A-T-045	07/03/2022	07/03/2022	07/03/2022	07/03/2022	07/03/2022	07/03/2022						
A-T-050s	10/03/2022	10/03/2022	10/03/2022	10/03/2022	10/03/2022	10/03/2022						
A-T-054	11/03/2022		11/03/2022									
A-T-055s	09/03/2022	09/03/2022	09/03/2022	11/03/2022	09/03/2022	09/03/2022						

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/05497
Issue Number: 1
Date: 13 June, 2022

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

Project Manager: EBMA/Niall Farnworth/Tommy Walker
Project Name: Circle Square, Building 3
Project Ref: 080355
Order No: EBMA3401
Date Samples Received: 01/06/22
Date Instructions Received: 06/06/22
Date Analysis Completed: 13/06/22

Approved by:



Holly Neary-King
Client Services Supervisor

Envirolab Job Number: 22/05497

Client Project Name: Circle Square, Building 3

Client Project Ref: 080355

Lab Sample ID	22/05497/1	22/05497/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS102	WS105								
Depth to Top	0.91	2.33								
Depth To Bottom	1.50	2.50								
Date Sampled	31-May-22	31-May-22								
Sample Type	Water - EW	Water - EW								
Sample Matrix Code	N/A	N/A								
pH (w) _A [#]	11.54	7.67						pH	0.01	A-T-031w
Hardness Total _A [#]	118	331						mg/l Ca CO ₃	2	A-T-049w
Sulphate (w) _A [#]	52	261						mg/l	1	A-T-026w
Cyanide (total) (w) _A [#]	0.006	<0.005						mg/l	0.005	A-T-042wTCN
Phenols - Total by HPLC (w) _A	1.07	<0.01						mg/l	0.01	A-T-050w
Sulphide (w) _A	1.4	1.2						mg/l	0.1	A-T-043-w
DOC (w) _A [#]	93.5	4.2						mg/l	2	A-T-032w
Arsenic (dissolved) _A [#]	16	5						µg/l	1	A-T-025w
Boron (dissolved) _A [#]	69	218						µg/l	10	A-T-025w
Cadmium (dissolved) _A [#]	<0.2	<0.2						µg/l	0.2	A-T-025w
Calcium (dissolved) _A [#]	47	116						mg/l	1	A-T-049w
Copper (dissolved) _A [#]	8	5						µg/l	1	A-T-025w
Chromium (dissolved) _A [#]	9	<1						µg/l	1	A-T-025w
Lead (dissolved) _A [#]	1	3						µg/l	1	A-T-025w
Mercury (dissolved) _A [#]	<0.1	<0.1						µg/l	0.1	A-T-025w
Nickel (dissolved) _A [#]	158	2						µg/l	1	A-T-025w
Selenium (dissolved) _A [#]	2	<1						µg/l	1	A-T-025w
Zinc (dissolved) _A [#]	2	3						µg/l	1	A-T-025w

Envirolab Job Number: 22/05497

Client Project Name: Circle Square, Building 3

Client Project Ref: 080355

Lab Sample ID	22/05497/1	22/05497/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS102	WS105								
Depth to Top	0.91	2.33								
Depth To Bottom	1.50	2.50								
Date Sampled	31-May-22	31-May-22								
Sample Type	Water - EW	Water - EW								
Sample Matrix Code	N/A	N/A								
PAH 16MS (w)										
Acenaphthene (w) _A [#]	0.97	<0.01						µg/l	0.01	A-T-019w
Acenaphthylene (w) _A [#]	0.05	<0.01						µg/l	0.01	A-T-019w
Anthracene (w) _A [#]	0.16	<0.01						µg/l	0.01	A-T-019w
Benzo(a)anthracene (w) _A [#]	0.16	<0.01						µg/l	0.01	A-T-019w
Benzo(a)pyrene (w) _A [#]	0.14	<0.01						µg/l	0.01	A-T-019w
Benzo(b)fluoranthene (w) _A [#]	0.18	<0.01						µg/l	0.01	A-T-019w
Benzo(ghi)perylene (w) _A [#]	0.07	<0.01						µg/l	0.01	A-T-019w
Benzo(k)fluoranthene (w) _A [#]	0.07	<0.01						µg/l	0.01	A-T-019w
Chrysene (w) _A [#]	0.19	<0.01						µg/l	0.01	A-T-019w
Dibenzo(ah)anthracene (w) _A [#]	<0.01	<0.01						µg/l	0.01	A-T-019w
Fluoranthene (w) _A [#]	0.36	0.01						µg/l	0.01	A-T-019w
Fluorene (w) _A [#]	0.43	<0.01						µg/l	0.01	A-T-019w
Indeno(123-cd)pyrene (w) _A [#]	0.06	<0.01						µg/l	0.01	A-T-019w
Naphthalene (w) _A [#]	21.58	<0.01						µg/l	0.01	A-T-019w
Phenanthrene (w) _A [#]	0.71	<0.01						µg/l	0.01	A-T-019w
Pyrene (w) _A [#]	0.35	0.01						µg/l	0.01	A-T-019w
Total PAH 16MS (w) _A [#]	-	-						µg/l	0.01	A-T-019w

Envirolab Job Number: 22/05497

Client Project Name: Circle Square, Building 3

Client Project Ref: 080355

Lab Sample ID	22/05497/1	22/05497/2								
Client Sample No										
Client Sample ID	WS102	WS105								
Depth to Top	0.91	2.33								
Depth To Bottom	1.50	2.50								
Date Sampled	31-May-22	31-May-22								
Sample Type	Water - EW	Water - EW								
Sample Matrix Code	N/A	N/A								
TPH CWG (w) with Clean Up *C1										
Ali >C5-C6 (w) _A [#]	<1	<1						µg/l	1	A-T-022w
Ali >C6-C8 (w) _A [#]	2	<1						µg/l	1	A-T-022w
Ali >C8-C10 (w) _A [#]	<5	<5						µg/l	5	A-T-055w
Ali >C10-C12 (w) _A [#]	10	<5						µg/l	5	A-T-055w
Ali >C12-C16 (w) _A [#]	<5	<5						µg/l	5	A-T-055w
Ali >C16-C21 (w) _A [#]	11	<5						µg/l	5	A-T-055w
Ali >C21-C35 (w) _A [#]	1434	<5						µg/l	5	A-T-055w
Total Aliphatics (w) _A [#]	1460	<5						µg/l	5	A-T-055w
Aro >C5-C7 (w) _A [#]	<1	<1						µg/l	1	A-T-022w
Aro >C7-C8 (w) _A [#]	2	<1						µg/l	1	A-T-022w
Aro >C8-C10 (w) _A	184	<5						µg/l	5	A-T-055w
Aro >C10-C12 (w) _A [#]	99	<5						µg/l	5	A-T-055w
Aro >C12-C16 (w) _A [#]	62	<5						µg/l	5	A-T-055w
Aro >C16-C21 (w) _A [#]	56	<5						µg/l	5	A-T-055w
Aro >C21-C35 (w) _A	29	<10						µg/l	10	A-T-055w
Total Aromatics (w) _A	432	<10						µg/l	10	A-T-055w
TPH (Ali & Aro >C5-C35) (w) _A	1890	<10						µg/l	10	A-T-055w
BTEX - Benzene (w) _A [#]	<1	<1						µg/l	1	A-T-022w
BTEX - Toluene (w) _A [#]	2	<1						µg/l	1	A-T-022w
BTEX - Ethyl Benzene (w) _A [#]	7	<1						µg/l	1	A-T-022w
BTEX - m & p Xylene (w) _A [#]	27	<1						µg/l	1	A-T-022w
BTEX - o Xylene (w) _A [#]	25	<1						µg/l	1	A-T-022w
MTBE (w) _A [#]	<1	<1						µg/l	1	A-T-022w

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

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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.

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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, 9 = INCINERATOR ASH.

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

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

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: Circle Square, Building 3
Clients Project No: 080355

Project No: 22/05497
Date Received: 06/06/2022 (am)
Cool Box Temperatures (°C): 11.8

Lab Sample ID	22/05497/1	22/05497/2
Client Sample No		
Client Sample ID/Depth	WS102 0.91-1.50m	WS105 2.33-2.50m
Date Sampled	31/05/22	31/05/22
Deviation Code		
A9 (no H2SO4)	✓	✓

Key

A9 (no H2SO4) No H2SO4 preserved bottle provided (phenols, ammonia, DOC, COD will be deviating)

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.

Envirolab Analysis Dates

Lab Sample ID	22/05497/1	22/05497/2
Client Sample No		
Client Sample ID/Depth	WS102 0.91-1.50m	WS105 2.33-2.50m
Date Sampled	31/05/22	31/05/22
A-T-019w	10/06/2022	10/06/2022
A-T-022w	09/06/2022	09/06/2022
A-T-025w	10/06/2022	10/06/2022
A-T-026w	13/06/2022	13/06/2022
A-T-031w	08/06/2022	08/06/2022
A-T-032w	09/06/2022	09/06/2022
A-T-042wTCN	09/06/2022	09/06/2022
A-T-043-w	09/06/2022	09/06/2022
A-T-049w	09/06/2022	09/06/2022
A-T-050w	09/06/2022	08/06/2022
A-T-055w	13/06/2022	13/06/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Appendix D – Geotechnical Analysis Results

Curtins Pre-Demo, 2019:

- Structural Soils, certificate no 783967
- Professional Soils Laboratory (PSL), certificate no PSL19/4336
- Envirolab Geotechnical Analysis Results, Soils
 - Final Test Report Ref. 19-06129-1

Curtins, 2021:

- Ian Farmers Associates Geotechnical Analysis Results, Soils
 - Final Test Report Ref. 22-02030

TESTING VERIFICATION CERTIFICATE



1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **10/07/2019 16:51:42**.

Testing reported after this date is not covered by this Verification Certificate.

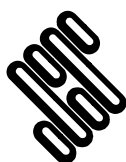
Approved Signatory
Mark Athorne (Laboratory Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU



**STRUCTURAL
SOILS LTD**

Contract:

19/06129

Job No:

783967





STRUCTURAL SOILS LTD
TEST REPORT



Report No. 783967 R1

Date 10-July-2019 Contract 19/06129

Client Envirolab Ltd
Address Units 7 & 8 Sandpits Business Park
Mottram Road
Hyde
SK14 3AR

For the Attention of Iain Haslock

Samples submitted by client 27/06/2019
Testing Started 02/07/2019
Testing Completed 10/07/2019

Client Reference 19/06129
Client Order No. P0741309
Instruction Type Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests Undertaken

Moisture Content (oven drying method) BS1377:Part 2:1990,clause 3.2
Liquid Limit (one point method) BS1377:Part 2:1990,clause 4.4
Liquid Limit (definitive method) BS1377:Part 2:1990,clause 4.3
Plastic Limit BS1377:Part 2:1990,clause 5.3
Plasticity Index Derivation BS1377:Part 2:1990,clause 5.4
Particle Size Distribution wet sieve method BS1377:Part 2:1990,clause 9.2

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.

Test were undertaken on samples 'as received' unless otherwise stated.

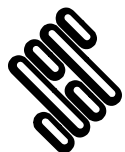
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977 552255. E-mail mark.athorne@soils.co.uk

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425um	Description of Sample
BH01	19/06129/1	D	3.40	16	33	16	17	90	Dark brown slightly sandy slightly gravelly CLAY
BH01	19/06129/2	D	3.80	19	34	15	19	80	Dark brown slightly sandy slightly gravelly CLAY
BH01	19/06129/3	D	4.60	21	32	15	17	86	Dark brown slightly sandy slightly gravelly CLAY
BH01	19/06129/4	D	4.90	15	33	14	19	86	Dark brown slightly sandy slightly gravelly CLAY
BH01	19/06129/5	D	5.40	19	33	13	20	88	Dark brown slightly sandy slightly gravelly CLAY
BH01	19/06129/7	D	7.40	18	28	13	15	87	Dark brown slightly sandy slightly gravelly CLAY
BH01	19/06129/8	D	7.80	14	28	13	15	91	Light brown/ dark brown slightly sandy slightly gravelly CLAY
BH01	19/06129/9	D	8.50	18	29	12	17	91	Dark brown sandy slightly gravelly CLAY



**STRUCTURAL
SOILS LTD**

Contract:

19/06129

Contract Ref:

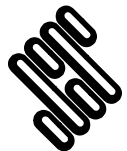
783967



SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425um	Description of Sample
BH02	19/06129/11	D	4.70	17	34	15	19	77	Dark brown slightly sandy slightly gravelly CLAY
BH02	19/06129/12	D	6.00	19	35	15	20	91	Dark brown slightly sandy slightly gravelly CLAY
WS03	19/06129/10	D	2.40	20	36	16	20	91	Dark brown slightly sandy slightly gravelly CLAY



**STRUCTURAL
SOILS LTD**

Contract:

19/06129

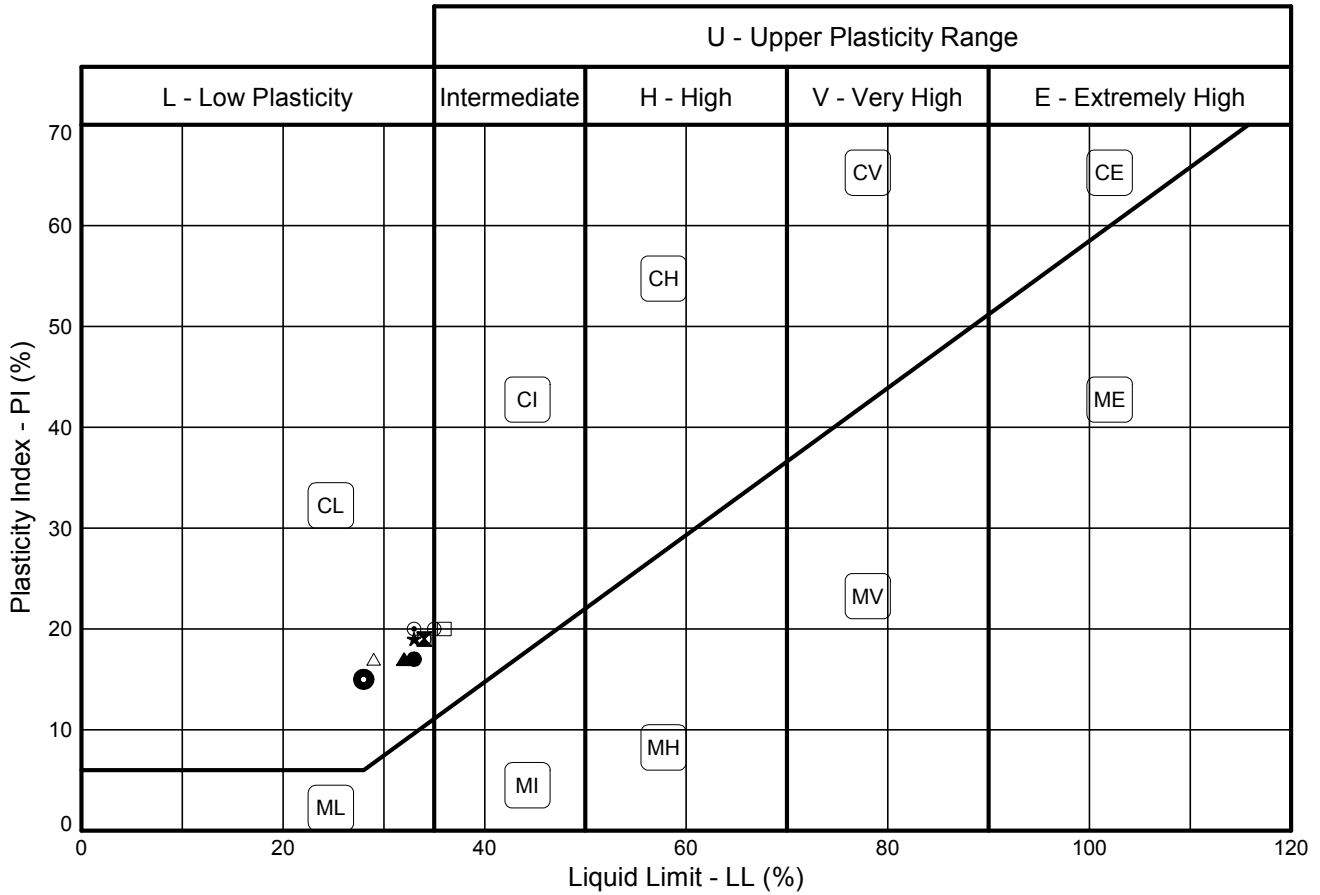
Contract Ref:

783967



PLASTICITY CHART - PI Vs LL

In accordance with BS5930:2015
Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC %	LL %	PL %	PI %	<425um %	Lab location
Exploratory Position ID	Sample	Depth (m)									
●	BH01	19/06129/10	3.40	3.2/4.3/5.3/5.4	4.2.4	16	33	16	17	90	C
⊠	BH01	19/06129/20	3.80	3.2/4.4/5.3/5.4	4.2.4	19	34	15	19	80	C
▲	BH01	19/06129/30	4.60	3.2/4.3/5.3/5.4	4.2.4	21	32	15	17	86	C
★	BH01	19/06129/40	4.90	3.2/4.3/5.3/5.4	4.2.4	15	33	14	19	86	C
⊙	BH01	19/06129/50	5.40	3.2/4.3/5.3/5.4	4.2.4	19	33	13	20	88	C
⊕	BH01	19/06129/70	7.40	3.2/4.3/5.3/5.4	4.2.4	18	28	13	15	87	C
⊗	BH01	19/06129/80	7.80	3.2/4.3/5.3/5.4	4.2.4	14	28	13	15	91	C
△	BH01	19/06129/90	8.50	3.2/4.3/5.3/5.4	4.2.4	18	29	12	17	91	C
⊗	BH02	19/06129/110	4.70	3.2/4.3/5.3/5.4	4.2.4	17	34	15	19	77	C
⊕	BH02	19/06129/120	6.00	3.2/4.3/5.3/5.4	4.2.4	19	35	15	20	91	C
□	WS03	19/06129/100	2.40	3.2/4.3/5.3/5.4	4.2.4	20	36	16	20	91	C

Tested in accordance with the following clauses of BS1377-2:1990.

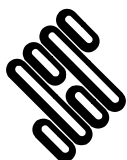
- 3.2 - Moisture Content
- 4.3 - Cone Penetrometer Method
- 4.4 - One Point Cone Penetrometer Method
- 4.6 - One Point Casagrande Method
- 5.3 - Plastic Limit Method
- 5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

- 4.2.3 - Natural State
- 4.2.4 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By

M. Fisher

MAUREEN FISHER

Date

10/07/19

Contract

19/06129

Contract Ref:

783967



PARTICLE SIZE DISTRIBUTION TEST

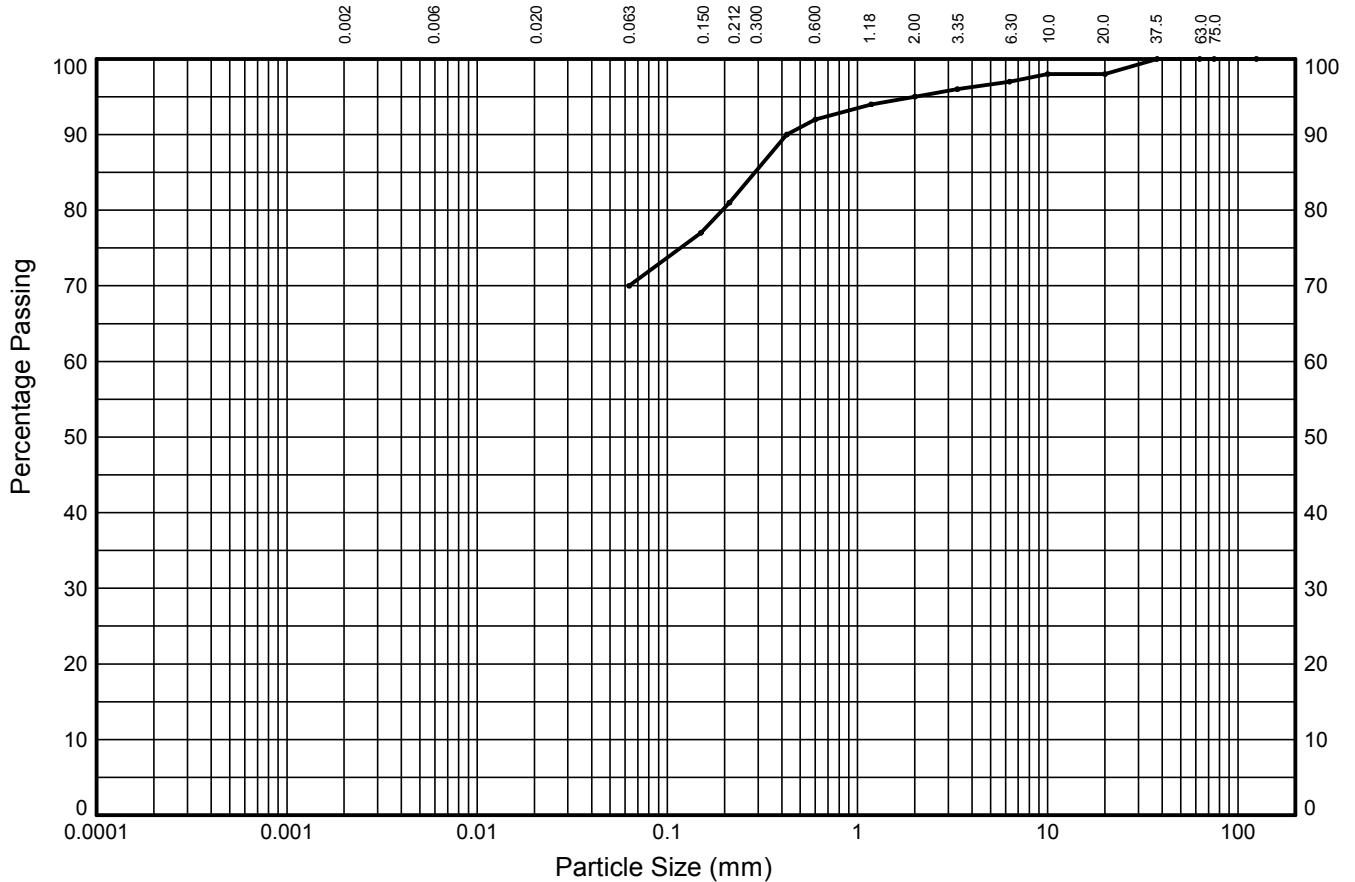
In accordance with clauses 9.2 of BS1377:Part 2:1990

Borehole: **BH01**

Sample Ref: **19/06129/6**

Sample Type: **B**

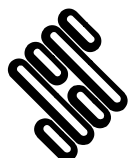
Depth (m): **6.20**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	10%	12%	3%	2%	1%	2%	
	SILT			SAND			GRAVEL			
70%				25%			5%			0%

Test Sieve (mm)	Percent Passing (%)	Particle Diameter (mm)	Percent Passing (%)	Coefficients	
125.0	100			D ₁₀ (mm)	NA
75.0	100			D ₁₅ (mm)	NA
63.0	100			D ₃₀ (mm)	NA
37.5	100			D ₅₀ (mm)	NA
20.0	98			D ₆₀ (mm)	NA
10.0	98			D ₈₅ (mm)	0.289
6.30	97			D ₉₀ (mm)	0.425
3.35	96			C _U	NA
2.00	95			C _C	NA
1.18	94			Sedimentation sample was not pre-treated Soil Description: Dark brown.grey slightly sandy slightly gravelly CLAY	
0.600	92				
0.425	90				
0.212	81				
0.150	77				
0.063	70				

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By

M. Fisher

MAUREEN FISHER

Date

10/07/19

Contract

19/06129

Contract Ref:

783967





3

LABORATORY REPORT



4043

Contract Number: PSL19/4336

Report Date: 06 August 2019
Client's Reference: RT/19/63547
Client Name: Geocore Site Investigations Ltd
Tralee Close
Kirkleatham Business Park
Redcar
Cleveland
TS10 5SG

For the attention of: Bev Grace

Contract Title: Circle Square Plot 12
Date Received: 17/7/2019
Date Commenced: 17/7/2019
Date Completed: 05/8/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)


S Eyre
(Senior Technician)

R Cowles
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
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awatkins@prosoils.co.uk

Page 1 of

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

[illegible]

Circle Square Plot 12

Contract No:

PSL19/4336

Client Ref:

RT/19/63547

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dimensions (mm)		Area (mm ²)	D _c ²	D _c (mm)	Failure Load (P)		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
					W	D				(Mpa)	(kN)					
BH01	11.00		A	Perp	70	42	2940	3743.32	61.18	-	0.16	0.04	1.095	0.05	Valid	
BH01	12.00		A	Perp	70	50	3500	4456.34	66.76	-	0.51	0.11	1.139	0.13	Valid	
BH01	13.00		A	Perp	70	42	2940	3743.32	61.18	-	0.29	0.08	1.095	0.08	Valid	
BH01	14.00		A	Perp	69	39	2691	3426.29	58.53	-	0.31	0.09	1.073	0.10	Valid	
BH01	15.00		A	Perp	70	29	2030	2584.68	50.84	-	0.38	0.15	1.008	0.15	Valid	
BH01	16.00		A	Perp	68	45	3060	3896.11	62.42	-	0.35	0.09	1.105	0.10	Valid	
BH01	17.00		A	Perp	68	36	2448	3116.89	55.83	-	0.20	0.06	1.051	0.07	Valid	
BH01	18.00		A	Perp	70	37	2590	3297.69	57.43	-	0.51	0.15	1.064	0.16	Valid	
BH01	19.00		A	Perp	70	30	2100	2673.80	51.71	-	0.39	0.15	1.015	0.15	Valid	
BH01	20.00		A	Perp	71	44	3124	3977.60	63.07	-	0.74	0.19	1.110	0.21	Valid	
BH01	21.00		A	Perp	71	35	2485	3164.00	56.25	-	0.22	0.07	1.054	0.07	Valid	
BH01	22.00		A	Perp	72	36	2592	3300.24	57.45	-	0.52	0.16	1.064	0.17	Valid	
BH01	23.00		A	Perp	71	46	3266	4158.40	64.49	-	1.27	0.31	1.121	0.34	Valid	
BH01	24.00		A	Perp	71	53	3763	4791.20	69.22	-	0.60	0.13	1.158	0.14	Valid	
BH01	25.00		A	Perp	72	48	3456	4400.32	66.33	-	1.36	0.31	1.136	0.35	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular

 4043		Circle Square Plot 12	Contract No:
			PSL19/4336
			Client Ref:

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D_c^2	D_c (mm)	Failure Load		I_s (MPa)	Corr Fac F	I_{s50} (MPa)	Failure Type	Remarks
				Par / Perp	L	D			(Mpa)	(kN)					
BH01	11.00		D	Par	-	70	4900	70.00	-	0.07	0.014	1.163	0.02	Valid	
BH01	12.00		D	Par	-	70	4900	70.00	-	0.22	0.045	1.163	0.05	Valid	
BH01	13.00		D	Par	-	70	4900	70.00	-	0.19	0.039	1.163	0.05	Valid	
BH01	14.00		D	Par	-	69	4761	69.00	-	0.07	0.015	1.156	0.02	Valid	
BH01	15.00		D	Par	-	70	4900	70.00	-	0.13	0.027	1.163	0.03	Valid	
BH01	17.00		D	Par	-	68	4624	68.00	-	0.22	0.048	1.148	0.05	Valid	
BH01	18.00		D	Par	-	70	4900	70.00	-	0.35	0.071	1.163	0.08	Valid	
BH01	19.00		D	Par	-	70	4900	70.00	-	0.27	0.055	1.163	0.06	Valid	
BH01	22.00		D	Par	-	72	5184	72.00	-	0.34	0.066	1.178	0.08	Valid	
BH01	23.00		D	Par	-	71	5041	71.00	-	0.36	0.071	1.171	0.08	Valid	
BH01	24.00		D	Par	-	71	5041	71.00	-	0.63	0.125	1.171	0.15	Valid	
BH01	25.00		D	Par	-	72	5184	72.00	-	0.81	0.156	1.178	0.18	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



Circle Square Plot 12

Contract No:

PSL19/4336

Client Ref:

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation Par / Perp	Dimensions (mm)		Area (mm ²)	D _c ²	D _c (mm)	Failure Load (P)		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
					W	D				(Mpa)	(kN)					
BH02	11.50		A	Perp	72	42	3024	3850.28	62.05	-	0.97	0.25	1.102	0.28	Valid	
BH02	12.50		A	Perp	71	51	3621	4610.40	67.90	-	1.31	0.28	1.148	0.33	Valid	
BH02	13.20		A	Perp	70	35	2450	3119.44	55.85	-	0.66	0.21	1.051	0.22	Valid	
BH02	14.00		A	Perp	70	43	3010	3832.45	61.91	-	1.26	0.33	1.101	0.36	Valid	
BH02	15.00		A	Perp	70	59	4130	5258.48	72.52	-	1.24	0.24	1.182	0.28	Valid	
BH02	16.00		A	Perp	71	45	3195	4068.00	63.78	-	1.05	0.26	1.116	0.29	Valid	
BH02	17.00		A	Perp	70	41	2870	3654.20	60.45	-	1.36	0.37	1.089	0.41	Valid	
BH02	18.00		A	Perp	72	44	3168	4033.62	63.51	-	1.71	0.42	1.114	0.47	Valid	
BH02	19.00		A	Perp	69	51	3519	4480.53	66.94	-	1.92	0.43	1.140	0.49	Valid	
BH02	20.00		A	Perp	69	42	2898	3689.85	60.74	-	0.47	0.13	1.092	0.14	Valid	
BH02	21.00		A	Perp	71	52	3692	4700.80	68.56	-	2.37	0.50	1.153	0.58	Valid	
BH02	22.00		A	Perp	70	51	3570	4545.47	67.42	-	1.19	0.26	1.144	0.30	Valid	
BH02	23.00		A	Perp	70	54	3780	4812.85	69.37	-	1.94	0.40	1.159	0.47	Valid	
BH02	24.00		A	Perp	70	38	2660	3386.82	58.20	-	0.90	0.27	1.071	0.28	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular



Circle Square Plot 12

Contract No:

PSL19/4336

Client Ref:

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods : 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimensions (mm)		D _c ²	D _c (mm)	Failure Load		I _s (MPa)	Corr Fac F	I _{s50} (MPa)	Failure Type	Remarks
				Par / Perp	L	D			(Mpa)	(kN)					
BH02	11.50		D	Par	-	72	5184	72.00	-	1.04	0.201	1.178	0.24	Valid	
BH02	12.50		D	Par	-	71	5041	71.00	-	0.96	0.190	1.171	0.22	Valid	
BH02	13.20		D	Par	-	70	4900	70.00	-	0.85	0.173	1.163	0.20	Valid	
BH02	14.00		D	Par	-	70	4900	70.00	-	0.71	0.145	1.163	0.17	Valid	
BH02	15.00		D	Par	-	70	4900	70.00	-	1.21	0.247	1.163	0.29	Valid	
BH02	16.00		D	Par	-	71	5041	71.00	-	1.04	0.206	1.171	0.24	Valid	
BH02	17.00		D	Par	-	70	4900	70.00	-	1.14	0.233	1.163	0.27	Valid	
BH02	18.00		D	Par	-	72	5184	72.00	-	1.73	0.334	1.178	0.39	Valid	
BH02	19.00		D	Par	-	69	4761	69.00	-	1.07	0.225	1.156	0.26	Valid	
BH02	20.00		D	Par	-	69	4761	69.00	-	0.67	0.141	1.156	0.16	Valid	
BH02	21.00		D	Par	-	71	5041	71.00	-	0.99	0.196	1.171	0.23	Valid	
BH02	22.00		D	Par	-	70	4900	70.00	-	0.87	0.178	1.163	0.21	Valid	
BH02	23.00		D	Par	-	70	4900	70.00	-	1.34	0.273	1.163	0.32	Valid	
BH02	24.00		D	Par	-	70	4900	70.00	-	0.24	0.049	1.163	0.06	Valid	

***Note** All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



Circle Square Plot 12

Contract No:

PSL19/4336

Client Ref:

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/06129
Issue Number: 1

Date: 11 July, 2019

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

Project Manager: Philippa Neesham/Siobhán Hyde
Project Name: Circle Square Plot 12
Project Ref: B069467
Order No: EBMA1934
Date Samples Received: 03/06/19
Date Instructions Received: 27/06/19
Date Analysis Completed: 10/07/19

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Richard Wong
Client Manager

Envirolab Job Number: 19/06129

Client Project Name: Circle Square Plot 12

Client Project Ref: B069467

Lab Sample ID	19/06129/1	19/06129/2	19/06129/3	19/06129/4	19/06129/5	19/06129/6	19/06129/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH01	BH01	BH01	BH01	BH01			
Depth to Top	3.40	3.80	4.60	4.90	5.40	6.20	7.40			
Depth To Bottom						6.50				
Date Sampled	01-Jun-19	01-Jun-19	01-Jun-19	01-Jun-19	01-Jun-19	01-Jun-19	01-Jun-19			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	5A	5A	5A	5A	5A	5A	5A			
% Stones >10mm _A	<0.1	4.1	<0.1	<0.1	<0.1	1.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	8.42	8.53	8.57	8.50	8.47	8.60	8.57	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.14	0.06	0.05	0.07	0.04	0.03	0.03	g/l	0.01	A-T-026s
1.01 % Moisture BS1377 1990 pt2 cl3.2 _D [#]	Appended	Appended	Appended	Appended	Appended	-	Appended		0.1	Subcon SS
1.02 Atterburg 4Pt BS1377 1990 pt2 cl4.4,5.3+5.4 _D [#]	Appended	Appended	Appended	Appended	Appended	-	Appended		1	Subcon SS
1.10 PSD (Grading/63um/sand fraction/wet sieve) BS1377 pt 2 1990 cl 9.2 _D [#]	-	-	-	-	-	Appended	-		0.1	Subcon SS

Envirolab Job Number: 19/06129

Client Project Name: Circle Square Plot 12

Client Project Ref: B069467

Lab Sample ID	19/06129/8	19/06129/9	19/06129/10	19/06129/11	19/06129/12			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	WS03	BH02	BH02					
Depth to Top	7.80	8.50	2.40	4.70	6.00					
Depth To Bottom			2.60	4.80						
Date Sampled	01-Jun-19	01-Jun-19	14-Jun-19	15-Jun-19	15-Jun-19					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Sample Matrix Code	6A	5AE	5A	5AE	5A					
% Stones >10mm _A	<0.1	6.5	<0.1	<0.1	<0.1			% w/w	0.1	A-T-044
pH _D ^{M#}	8.54	8.60	8.55	8.51	8.56			pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.06	0.03	0.02	0.09	0.06			g/l	0.01	A-T-026s
1.01 % Moisture BS1377 1990 pt2 cl3.2 _D [#]	Appended	Appended	Appended	Appended	Appended				0.1	Subcon SS
1.02 Atterburg 4Pt BS1377 1990 pt2 cl4.4,5.3+5.4 _D [#]	Appended	Appended	Appended	Appended	Appended				1	Subcon SS

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.

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

Project: Circle Square Plot 12

Clients Project No: B069467

Project No: 19/06129

Date Received: 27/06/2019 (am)

Cool Box Temperatures (°C): 15.6, 17.7

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 - 2280955 / 1

Site: B069467-Circle Square - Plot 12

Job Number: 2280955

Originating Client: Envirolab

Originating Reference: 20/02030

Date Sampled: Not Given

Date Scheduled: 11/03/2022

Date Testing Started: 17/03/2022

Date Testing Finished: 29/03/2022

Previous Reports		Amendments	Date Issued

Amendments:

Authorised By:



Tim Robinson
Quality Supervisor

Report Issue Date: 29/03/2022

Page: 2

Results reported relate only to the samples tested.



Final Test Report - 2280955 / 1

Site: B069467-Circle Square - Plot 12

Job Number: 2280955

Originating Client: Envirolab

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

This test report shall not be reproduced, except in full and only with the written permission of Ian Farmer Associates Ltd.

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: 29/03/2022

Appendix E – Ground Gas and Groundwater Monitoring Results

- Curtins Gas Monitoring Results Visits 1 – 6 - Plot 12 – 2019
- Curtins Gas Monitoring Results Visits 1 – 6 - Circle Sq Building 3 - Add WS

Curtins

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

Tel: 0161 236 2394

Fax: 0161 228 7902

**GAS MONITORING LOG SHEET**

Project: Circle Square Plot 12 **Date:** 26/06/2019 & 27/06/2019
Job Number: B069467 **Visit:** 1
Client: Bruntwood **Weather:** Sunny
Barometric State: Steady **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1026	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0	0	0.95	1.15	
BH01													
BH02													

Notes**Logged by**

PN

*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: Circle Square Plot 12 **Date:** 12/07/2019
Job Number: B069467 **Visit:** 2
Client: Bruntwood **Weather:** Overcast
Barometric State: Rising **Ground Conditions:** Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1010	0.0	0.0	0.0	0.0	0.0	0.0	15.7	0	1	0.47	0.99	
BH01													1
BH02													1

Notes

1 Unable to access exploratory holes due to deliveries on site.

Logged by

ZH

*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: Circle Square Plot 12 **Date:** 22/07/2019
Job Number: B069467 **Visit:** 3
Client: Bruntwood **Weather:** Sunny
Barometric State: Steady **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1009	0.0	0.0	0.0	0.0	0.0	0.0	14.6	0	0	0.54	1.00	1
BH01													
BH02													

Notes

1 Hydrogen Sulphide and Carbon Monoxide constantly fluctuating throughout.

Logged by

AHW

*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: Circle Square Plot 12 **Date:** 30/07/2019
Job Number: B069467 **Visit:** 4
Client: Bruntwood **Weather:** Overcast
Barometric State: Steady **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1000	0.0	0.0	0.0	0.0	0.7	0.7	14.4	0	0	0.47	1.00	
BH01													
BH02													

Notes**Logged by**

ZH

*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: Circle Square Plot 12 **Date:** 09/08/2019
Job Number: B069467 **Visit:** 5
Client: Bruntwood **Weather:** Dry
Barometric State: Steady **Ground Conditions:** Damp

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	989	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0	0	0.50	0.99	
BH01													
BH02													

Notes**Logged by**

PN

*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: Circle Square Plot 12 **Date:** 30/08/2019
Job Number: B069467 **Visit:** 6
Client: Bruntwood **Weather:** Overcast
Barometric State: Steady **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS03	1014	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0	0	0.64	0.99	1
BH01													
BH02													

Notes

1 Gas tap open

Logged by

PN

*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: Circle Sq Building 3 - Add W&E **Date:** 17/03/2022
Job Number: B080355 **Visit:** 1
Client: Bruntwood **Weather:** Sunny
Barometric State: Rising **Ground Conditions:** Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS102	1030										1.00	2.13	1
WS103	1030										1.74	3.45	1
WS105	1030										2.29	3.15	1
BH01													2
BH02	1030										7.70	7.73	1

Notes

- 1 Boreholes not gas monitored due to monitor malfunction.
2 BH01 could not be located.

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: Circle Sq Building 3 - Add WS **Date:** 20/05/2022
Job Number: B080355 **Visit:** 2
Client: Bruntwood **Weather:** Cloudy
Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS102	1015	0.9	0.0	1.5	1.5	0.3	0.0	20.8	0	0	0.87	2.13	1,2
WS103	1015	3.9	0.0	0.0	0.0	0.0	0.0	6.3	0	0	1.67	3.45	3
WS105	1015	0.0	0.0	0.0	0.0	0.1	0.1	13.3	0	0	2.30	3.15	2
BH01													4
BH02	1015	0.0	0.0	0.0	0.0	0.7	0.7	16.6	0	0	7.72	7.73	

Notes**Logged by**

- 1 Steady state gas flow reached after 1 min.
- 2 Developed for water sampling - bailed dry.
- 3 Steady state gas flow reached after 10 seconds.
- 4 Borehole not located.

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: Circle Sq Building 3 - Add W **Date:** 31/05/2022
Job Number: B080355 **Visit:** 3
Client: Bruntwood **Weather:** Cloudy
Barometric State: Steady **Ground Conditions:** Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS102	1011										0.91	2.13	1,2
WS103	1011	0.2	0.0	0.0	0.0	0.0	0.0	6.8	0	0	1.75	3.45	3
WS105	1011	0.0	0.0	0.0	0.0	0.5	0.5	10.5	0	0	2.33	3.15	2
BH01													4
BH02	1011	0.0	0.0	0.0	0.0	0.4	0.4	17.4	0	0	Dry	7.73	

Notes**Logged by**

- 1 Borehole flooded - unable to be gas monitored
- 2 Groundwater sample taken from borehole
- 3 Steady state gas flow reached after 10 seconds.
- 4 Borehole not located.

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: Circle Sq Building 3 - Add W **Date:** 06/06/2022
Job Number: B080355 **Visit:** 4
Client: Bruntwood **Weather:** Overcast
Barometric State: Steady **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS102	1011	67.8	0.0	4.8	4.8	0.0	0.0	7.3	4	6	1.10	2.12	1
WS103	1012	0.0	0.0	0.0	0.0	0.0	0.0	3.3	2	0	1.74	3.38	
WS105	1012	0.0	0.0	0.0	0.0	0.6	0.6	9.0	2	0	2.31	3.18	
BH01	-	-	-	-	-	-	-	-	-	-	-	-	2
BH02	1011	0.0	0.0	0.0	0.0	1.1	0.9	14.1	2	0	Dry	7.76	

Notes

1 - Steady state air flow rate recorded after 1 minute. LEL >99.9%.

2 - Borehole BH01 could not be located.

Logged by

MH

*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: Circle Sq Building 3 - Add W **Date:** 10/06/2022
Job Number: B080355 **Visit:** 5
Client: Bruntwood **Weather:** Sunny
Barometric State: Steady **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS101	1012	36.1	0.0	2.7	2.7	0.0	0.0	15.7	0	3	0.90	2.14	1
WS103	1012	0.8	0.0	0.0	0.0	0.0	0.0	4.5	0	0	1.69	3.37	2
WS105	1012	0.0	0.0	0.0	0.0	0.5	0.5	8.9	2	0	2.31	3.18	
BH01	-	-	-	-	-	-	-	-	-	-	-	-	3
BH02	1010	0.0	0.0	0.0	0.0	0.5	0.4	18.1	1	0	Dry	7.76	

Notes

- 1 - Steady state air flow rate recorded after 40 seconds.
2 - Steady state air flow rate recorded after 3 seconds.
3 - Could not located BH01.

Logged by

MH

*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: Circle Sq Building 3 - Add W **Date:** 16/06/2022
Job Number: B080355 **Visit:** 6
Client: Bruntwood **Weather:** Clear
Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS101	1019	0.0	0.0	0.6	0.6	0.0	0.0	18.9	0	3	0.92	2.17	1
WS103	1019	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0	2	1.67	3.39	1
WS105	1019	0.0	0.0	0.0	0.0	0.5	0.5	10.0	0	1	2.09	3.19	1
BH01	-	-	-	-	-	-	-	-	-	-	-	-	-
BH02	1018	0.0	0.0	0.0	0.0	0.4	0.2	19.9	0	1	dry	7.77	1

Notes

1 Steady state gas flow atchieved instantly

Logged by

RuT

*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

- Curtins GAC Thresholds for 1.0% SOM.
- Curtins Tier 1 Thresholds for Waters (WHO and DWS Guidelines).

Adopted Soil Generic Assessment Criteria
Sandy loam with 6% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130⁽¹⁰⁾	180⁽¹⁰⁾	53⁽¹¹⁾	980⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₆	160	160	3900	12000	600000	180000
EC ₅₋₆ - EC ₈	530	530	13000	40000	620000	320000
EC ₅₋₈ - EC ₁₀	150	150	1700	11000	13000	21000
EC ₁₀₋₁₀ - EC ₁₂	760	770	7300	47000	13000	24000
EC ₁₂₋₁₂ - EC ₁₆	4300	4400	13000	90000	13000	26000
EC ₅₋₁₆ - EC ₃₅	110000	110000	270000	1800000	250000	490000
EC ₃₅₋₃₅ - EC ₄₄	110000	110000	270000	1800000	250000	490000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₇	300	1400	57	86000	56000	92000
EC ₅₋₇ - EC ₈	660	3900	120	180000	56000	100000
EC ₅₋₈ - EC ₁₀	190	270	51	17000	5000	9300
EC ₁₀₋₁₀ - EC ₁₂	380	1200	74	34000	5000	10000
EC ₁₂₋₁₂ - EC ₁₆	660	2500	130	38000	5000	10000
EC ₅₋₁₆ - EC ₂₁	930	1900	260	28000	3800	7800
EC ₂₁₋₂₁ - EC ₃₅	1700	1900	1600	28000	3800	7900
EC ₃₅₋₃₅ - EC ₄₄	1700	1900	1600	28000	3800	7900
Aliph + Arom EC >44-70	1900	1900	3000	28000	3800	7900
Aromatic						
Benzene	0.33 0.87	1.0 3.3	0.07 0.18	95 98	73 140	110 230
Ethyl benzene	350	840	90	2800⁽⁸⁾ [66000]	2800⁽⁸⁾ [25000]	2800⁽⁸⁾ [27000]
Toluene	610	2700	120	4400⁽⁸⁾ [190000]	4400⁽⁸⁾ [56000]	4400⁽⁸⁾ [100000]
Xylene ⁽⁹⁾	230	290	160	2600⁽⁸⁾ [32000]	2600⁽⁸⁾ [43000]	2600⁽⁸⁾ [31000]
Phenol	420	520	280	3200⁽¹⁴⁾ (38000)	3200⁽¹⁴⁾ (10000)	3200⁽¹⁴⁾ (9300)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	13	13	24	1100	4900	3000
Acenaphthylene	920	6000	160	100000	15000	30000
Acenaphthene	1100	6000	200	100000	15000	30000
Fluorene	860	4500	160	71000	9900	20000
Phenanthrene	440	1500	90	23000	3100	6300
Anthracene	11000	37000	2200	540000	74000	150000
Fluoranthene	890	1600	290	23000	3100	6400
Pyrene	2000	3800	620	54000	7400	15000
Benz(a)anthracene	13	15	13	180	29	62
Chrysene	27	32	19	350	57	120
Benzo(b)fluoranthene	3.7	4.0	3.9	45	7.2	16.0
Benzo(k)fluoranthene	100	110	130	1200	190	440
Benzo(a)pyrene	3.0 5.0	3.2 5.3	3.5 5.7	36 77	5.7 10	13 21
Indeno(123cd)pyrene	41	46	39	510	82	180
Dibenzo(ah)anthracene	0.3	0.32	0.43	3.6	0.58	1.4
Benzo(ghi)perylene	350	360	640	4000	640	1600
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.0014	0.0015	0.0018	0.12	3.5	5.4
Trichloroethene (TCE)	0.075	0.08	0.21	5.7	120	120
1,1,1,2 Tetrachlorethane	6.4	8.2	4.4	560	1400	2100
Tetrachlorethane (PCE)	0.90	0.92	3.6	95	1400	1500
1,1,1 Trichlorethane	39	40	240	3000	140000	100000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 6% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	<u>80</u>	<u>2,300</u>	<u>630</u>	<u>1,300</u>
Mercury (elemental)	1	1	26	26	16	26 ⁽⁸⁾ [30]
Mercury (inorganic)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₆	78	78	1700	5900	590000	130000
EC ₆ - EC ₈	230	230	5600	17000	610000	220000
EC ₈ - EC ₁₀	65	65	770	4800	13000	18000
EC ₁₀ - EC ₁₂	330	330	4400	23000	13000	23000
EC ₁₂ - EC ₁₆	2400	2400	13000	82000	13000	25000
EC ₁₆ - EC ₃₅	92000	92000	270000	1700000	250000	480000
EC ₃₅ - EC ₄₄	92000	92000	270000	1700000	250000	480000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₇	140	690	27	46000	56000	84000
EC ₇ - EC ₈	290	1800	51	110000	56000	95000
EC ₈ - EC ₁₀	83	110	21	8100	5000	8500
EC ₁₀ - EC ₁₂	180	590	31	28000	5000	9700
EC ₁₂ - EC ₁₆	330	2300	57	37000	5100	10000
EC ₁₆ - EC ₂₁	540	1900	110	28000	3800	7700
EC ₂₁ - EC ₃₅	1500	1900	820	28000	3800	7800
EC ₃₅ - EC ₄₄	1500	1900	820	28000	3800	7800
Aliph + Arom EC >44-70	1800	1900	2100	28000	3800	7800
<i>Aromatic</i>						
Benzene	0.16	0.49	0.035	50	72	100
Ethyl benzene	150	380	39	1200⁽⁸⁾ [35000]	1200⁽⁸⁾ [24000]	1200⁽⁸⁾ [22000]
Toluene	270	1300	51	1900⁽⁸⁾ [110000]	1900⁽⁸⁾ [56000]	1900⁽⁸⁾ [95000]
Xylene ⁽⁹⁾	98	120	70	1200⁽⁸⁾ [14000]	1200⁽⁸⁾ [42000]	1200⁽⁸⁾ [23000]
Phenol	290	420	140	1500⁽¹⁴⁾ (35000)	1500⁽¹⁴⁾ (10000)	1500⁽¹⁴⁾ (8300)
<i>Polycyclic Aromatic Hydrocarbons (PAH)</i>						
Naphthalene	5.6	5.6	10	460	4900	1900
Acenaphthylene	420	4600	69	97000	15000	30000
Acenaphthene	510	4700	85	97000	15000	30000
Fluorene	400	3800	67	68000	9900	20000
Phenanthrene	220	1500	38	22000	3100	6200
Anthracene	5400	35000	950	540000	74000	150000
Fluoranthene	560	1600	130	23000	3100	6300
Pyrene	1200	3800	270	54000	7400	15000
Benz(a)anthracene	11	14	6.5	170	29	56
Chrysene	22	31	9.4	350	57	110
Benzo(b)fluoranthene	3.3	4.0	2.1	44	7.2	15
Benzo(k)fluoranthene	93	110	75	1200	190	410
Benzo(a)pyrene	2.7	3.2	2	35	5.7	12
Indeno(123cd)pyrene	36	46	21	510	82	170
Dibenzo(ah)anthracene	0.28	0.32	0.27	3.6	0.57	1.3
Benzo(ghi)perylene	340	360	470	4000	640	1500
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00087	0.001	0.001	0.077	3.5	5
Trichloroethene (TCE)	0.034	0.036	0.091	2.6	120	91
1,1,1,2 Tetrachlorethane	2.8	3.5	1.9	250	1400	1800
Tetrachlorethane (PCE)	0.39	0.4	1.5	42	1400	1100
1,1,1 Trichlorethane	18	18	110	1300	140000	76000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs
- Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	80	<u>2,300</u>	630	<u>1,300</u>
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
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

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Appendix 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

Phase 2 Ground Investigation

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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