

Chandos Hall / Echo Street Additional Ground Investigation, Manchester

Phase 2 Additional Ground Investigation

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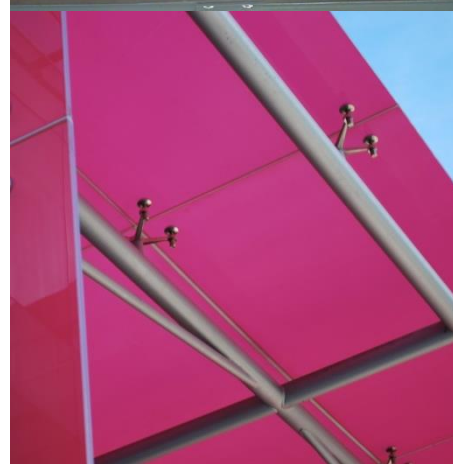
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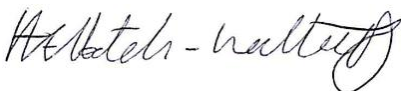
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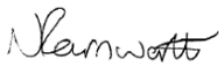


Phase 2 Additional Ground Investigation

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P02	Report updated following additional SI & Correspondence with MCC Environmental Health Department	NF	ML	08/04/2020

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Executive Summary

Appointment	In January 2019 Curtins were instructed by IQ Student Accommodation to undertake a supplementary site investigation in order to further 'de-risk' the site to assist with costings and construction design before the redevelopment as a mixed-use, (up to 25-storey) student apartment block with retail, leisure, amenity, event and children's nursery space on the ground floor along with minor soft landscaping in the courtyard areas. The site has been subject to previous desk based and intrusive ground investigations for the purpose of characterising geotechnical and environmental ground conditions on site to support respective planning application and enable substructure design. This report should be read in conjunction with these previous reports referenced herein. The site is located at Echo Street, Manchester, centred on National Grid Reference: 384670, 397700, and covers an area of approximately 0.30Ha.
Current Site Status	The site was previously occupied by buildings of various uses including: a 14-storey residential block in the western portion, formerly known as Chandos Hall, with soft landscaping and hardstanding in the centre; Echoes Day Nursery is in the northeast corner of the site; and garages in the southeast, accessed off Echo Street. Demolition of the nursery has been completed and the demolition of Chandos Hall was underway at the time of investigation. The site slopes from an elevation of approximately 41.00m AOD in the east, to approximately 38.43m AOD in the west, a retaining wall separates the higher eastern (nursery and garages) portion of the site from the lower western (residential) portion. There are also large retaining walls on the north western and western boundaries of the site separating the western (residential) portion of the site from the higher surrounding land. The site is bounded to the north by Granby Row and Lambert House residential apartments, to the east by Echo Street and retail units, a railway line (viaduct) abuts the southern boundary of the site with Altrincham Street beyond, and to the west by a Vimto Park.
Summary of Phase 1	The earliest available historical mapping, in the late 19th Century, shows most of the site is occupied by industrial/commercial buildings (Printing Works, Battery Repairs and Window Cleaner). Surrounding the site is London Road Railway Station (100m northeast) and a Fire Engine Station (90m north). By mid to late 20th Century major demolition has occurred on the site and a depot/garage with an underground petrol tank is constructed in the northeast, Chandos Hall in the west and garages in the southeast. During the 1990s to the present day the depot/garage was converted to a nursery. The site is indicated to be underlain by Made Ground, overlying Glacial Till, underlain by sandstone of the Chester Pebble Beds Formation. The superficial deposits are classified as a Secondary Undifferentiated Aquifer whilst the bedrock is classified as a Principal Aquifer. The nearest surface water feature is the River Medlock, located 200m from the southeast of site, flowing in a westerly direction. There are numerous groundwater abstractions located within 1km of the site (the nearest being 255m west), however none of which are noted as potable abstractions.
Fieldworks Undertaken	The proposed scope of additional ground investigation was recommended by Vinci Construction UK as the main contractor for the scheme. The investigation is intended to determine: an improved ground model for the site and compare conditions with previous investigations; the ground conditions on Granby Row to the north of the site; the waste classification of natural and Made Ground soils; 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; The presence and location of obstructions within proposed pile locations; The depth and type of foundations for the railway viaduct adjacent to the site, and; recommendations for the specification of sub-structure concrete and water supply pipes. Fieldworks were undertaken across various phases stages due to the phasing of demolition works on site. Site works commenced 1st July and the 11th July 2019 which consisted of three cable percussive boreholes, with rotary core follow on and sixteen trial pits. Site works continued the 22nd July 2019 for one day where three foundation trial pits were carried out next to the viaduct. Further intrusive works were undertaken between 4th and 6th September including 56 no. dynamic cone penetration tests and an additional window sample borehole. Proposed window samples in Granby Row were yet to be undertaken at the time of writing this report due to access issues. Details will be included in an updated report when undertaken. Groundwater monitoring standpipes/piezometers were installed in each cable percussive boreholes. Selected soil samples were subjected to laboratory analysis. Four groundwater level monitoring visits were undertaken over a one-month period before boreholes were lost due to construction activities.
Encountered Ground Conditions	Made ground was encountered at all exploratory hole locations from ground level to depths of 0.35-2.80m bgl. Beneath a surface covering of asphalt, concrete or grass and topsoil overlying Made Ground generally comprising varying thicknesses of Sand & Gravel (sub-base, and ash and brick fill), underlain by Made Ground of very sandy, very gravelly Clay. Anthropogenic constituents included asphalt, coal, glass, concrete, plastics, wires, ceramics, ash, tile, clinker, bitumen and brick. The Made Ground was underlain by Glacial Till deposits comprising Clay with interbedded sands and gravels. Clay is firm to very stiff, dark greyish-brown, sandy with frequent fine to coarse sub-angular gravel of mixed lithologies. Thin sand bands were locally recorded within the generally cohesive soils. Underlying this, from depths of between 6.40 and 7.45m bgl is medium-dense to very dense, reddish-brown, slightly cobbly, gravelly, fine to coarse Sand, considered to be indicative of weathered bedrock deposits. Gravel and cobbles are sub-angular to sub-rounded, fine to coarse of various lithologies including sandstone, mudstone, granite and quartzite. Competent bedrock, associated with the Chester Pebble Beds Formation, was encountered at 7.63-8.65m bgl, recorded as extremely weak to strong, reddish-brown, medium grained, arenaceous Sandstone, identified to a maximum depth of 25.50m bgl through coring. The sandstone is of very poor to fair rock quality. Of the three trial pits advanced adjacent to the railway viaduct identified the base of the wall/foundation in TP102A only. TP102A was advanced to a maximum depth of 5.00m bgl and the base of the wall/foundation proven at 3.60m bgl. The brick foundation steps out at around 2.8m bgl by approximately 170mm over 400m depth the wall then continues down another 400mm to base. A small concrete foundation was identified beneath the brick infill for the adjacent at arch at 1.45m bgl, protruding c.150mm and of c.150mm thickness.

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	No significant groundwater strikes were recorded during siteworks, Water seepages were however encountered within several exploratory holes, likely as perched water within made ground and cohesive soils. The use of water flush may have masked strikes within bedrock deposits. Subsequent monitoring has encountered groundwater at between 9.97 and 12.77m bgl (23.54-29.16m AOD).
Environmental Laboratory Testing and Ground Gas Monitoring Results	With respect to the adopted Commercial GACs, there have been minor exceedances recorded within three Made Ground samples and one Natural soil sample with respect to Lead in the Made Ground and Naphthalene in the Natural soils. The concentrations of Lead are comparable with those identified within previous phases of GI and are likely to be associated with ash and clinker within the Made Ground and may pose a risk if future site users become exposed to these soils through direct contact. Naphthalene is a semi-volatile organic compound which can present a risk to end users through volatilisation and inhalation. The elevated concentration of Naphthalene was considered likely to be associated with the location of the historic underground fuel storage tanks that were located on site in the north east corner, close to TP215 where the exceedance of Naphthalene was recorded. These tanks have since been removed and the material remaining immediately around the tanks has been validated as clean and suitable for use. Furthermore, the area has since been reduced in levels significantly by circa 1.0-1.5m to allow construction of a piling mat in preparation for construction. The excavated material has been disposed of off-site. Subsequently, validation samples were obtained the location of TP215 (WS215) in September 2019 after the fuel tank removal and the reduced level dig. Two soil samples were taken at 0.80m and 1.60m and tested for Naphthalene. Naphthalene was recorded below the limit of detection in both samples. The Naphthalene contaminated material is therefore confirmed to have been removed and the associated risk to human health now considered to be Low. Suspected asbestos containing materials (ACMs) were identified in TP202 at 0.72m bgl within made ground as asbestos tile. This was tested in the laboratory and confirmed to contain 15% asbestos. Asbestos loose fibres were identified in one sample only in Made Ground within TP201 at 0.45m bgl, identified as amosite at 0.001%.
Updated Ground Contamination and Ground Gas Assessment	A Moderate/Low risk rating is identified to end-users from direct contact, inhalation and ingestion of non-volatile contaminants within Made Ground soils due to elevated levels of Lead in Made Ground and Natural soils. A Low risk rating is identified to end-users from inhalation of volatile contaminants within Made Ground soils. A Low risk rating is identified to construction workers and adjacent residents at this stage from direct contact, inhalation and ingestion of contaminants associated with Made Ground soils. A Moderate/Low risk rating is identified to end-users from direct contact, inhalation and ingestion of asbestos fibres and ACMs within Made Ground soils present on the site. A Moderate/Low risk rating is identified to construction and maintenance workers from soil dust ingestion/inhalation produced during construction in consideration of asbestos fibres and ACMs within Made Ground soils present on the site. Risks from contamination in site soils to groundwater and from ground gases to end users have been assessed within the previous report.
Preliminary Material Classification and Soils Reuse	If soil arisings are required to be disposed offsite, an initial assessment of Made Ground was carried out using a preliminary waste characterisation assessment tool. The initial assessment revealed that of the nineteen Made Ground soils tested, fourteen have indicated to be non-hazardous with respect to Environment Agency waste classes, using the guidance given in WM3. All twelve natural samples tested were indicated to be non-hazardous. Five Made Ground samples have indicated to be hazardous waste for offsite disposal owing to the concentrations of Lead (TP204 at 0.85m, TP206 at 0.50m and TP210 at 1.50m bgl), Petrol and Diesel (TP207 at 1.20m bgl) and pH (BH203 at 0.40m and TP215 at 1.50m bgl). It should also be noted that if and where asbestos is identified above 0.1% w/w this will result in a hazardous classification. WAC testing was carried out on nine natural samples and eight Made Ground samples at the request of Vinci. WAC Testing results are enclosed in Appendix C. It should also be noted that this information is for guidance only and if soil material is to be disposed offsite, further soil contaminant testing and position specific assessments, in line with WM3, is likely to be required. The Contractors should satisfy themselves regarding the classification of any waste arisings. Confirmation of acceptability should be sought from the receiving landfill or treatment facility via the issue of laboratory chemical testing results. Excavated soils should be suitable for re-use at the site following appropriate waste management regulations and/or under a Materials Management Plan (MMP).
Geotechnical Assessment	For engineering design, it is recommended that the designer refers to not only the information presented herein but uses this information in conjunction with previous investigations Based on the ground conditions encountered during this investigation and previous ground investigations geotechnical parameters for design are outlined herein. The sites ACEC assessment in accordance with BRE Special Digest 1 remains consistent with that recommended previously. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-3 in made ground and DS-1 for natural deposits. An ACEC class of AC-3 for made ground and AC-1 in natural deposits would be appropriate for the site.
Additional Considerations	Elevated concentrations of mineral oil and GC-MS with TIC (aliphatic and aromatic) contamination with respect to the protection of water supply pipes were identified within the made ground. Therefore, it is recommended that appropriate materials for water supply pipes would comprise Barrier Pipes (PE/AL/PE). The exact requirements should be confirmed with the utility provider.

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	The site is in Manchester City Centre, which during WWII suffered bomb damage. Records obtained to date do not record the site receiving any direct bombing hits during WWII, however it is considered that the risk presented to the site from UXO is Moderate in the northeast and Low across the remainder of the site. Consequently, several recommendations have been made for the implementation of mitigation measures during intrusive works. Historic mapping indicated the presence of tanks beneath the north east corner and centre north of the site. Whilst Connell Brothers carried out a reduced level dig across the site they identified two tanks in the north east corner of the site, which were removed under Curtins supervision. Reference should be given to Curtins tank removal validation report for more information. The potential for further underground storage tanks remaining on site should not be discounted.
Recommendations	Curtins previous Phase 2 report should be read in conjunction with this report and the existing Remediation Strategy should be updated to include the results and requirements of all ground investigations to date. Based on the findings of the ground investigation, the following recommendations are made: 1. In the limited proposed areas of soft landscaping, 300mm clean and inert capping with underlying geotextile/break layer should be installed to break the source-pathway-receptor (SPR) linkage from elevated Lead concentrations and possible asbestos contaminated soils. For the remainder of the site, the building footprint and areas of hard standing will break the SPR linkage; 2. Use suitable materials for water supply pipes in accordance with utility providers requirements. 3. An appropriate asbestos management plan should be put in place for demolition/construction works to manage risk to construction workers with input from specialist where required. 4. If, during groundworks or construction works, tanks are discovered the occurrence should be noted, and procedures followed as indicated within a Remediation Strategy 5. A Piling Risk Assessment (PRA) is undertaken to determine suitable methods of piling to mitigate previously identified risks to the underlying aquifer; and 6. Construction workers are provided with appropriate PPE and sanitary facilities with reference to the environmental testing results presented herein and within Appendix C.

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1.0 Introduction

1.1 Appointment

In January 2019 Curtins were instructed by IQ Student Accommodation to undertake a supplementary site investigation in order to further 'de-risk' the site and inform costings and construction design for the proposed development at the site known as 'Echo Street' in Manchester. The site is centred on National Grid Reference: 384670, 397700, and covers an area of approximately 0.30Ha. A site location plan is presented as *Figure 2.1*.

1.2 Scope of Services

This investigation is aimed to provide additional information in order to de risk the ground conditions on site to inform construction costings and detailed design before the redevelopment as a mixed-use, (up to 25-storey) student apartment block with retail, leisure, amenity, event and children's nursery space on the ground floor along with minor soft landscaping in the courtyard areas.

The proposed scope of investigation was recommended by Vinci Construction UK as the main contractor for the scheme.

The Intrusive Investigation report is intended to determine:

- a) An improved ground model for the site and compare conditions with those of previous investigations;
- b) The ground conditions on Granby Row to the north of the site;
- c) The waste classification of natural and Made Ground soils on site;
- d) 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;
- e) The presence and location of obstructions within proposed pile locations.
- f) The depth and type of foundations for the railway viaduct adjacent to the site.
- a) Recommendations for the specification of sub-structure concrete and water supply pipes.

1.3 Previous Reports

The site has been subject to previous desk based and intrusive ground investigations for the purpose of characterising geotechnical and environmental ground conditions on site to support respective planning application and enable substructure design. This report has been prepared with reference to these reports, as summarised below, for further information the references outlined should be consulted.

- Curtins (2017) Phase 1 Preliminary Site Assessment, Chandos Hall, Granby Row, Manchester, Ref. 065374-CUR-00-XX-RP-GE-001-V01. (Reference 1);
- Curtins (2019) Phase 2 Site Investigation, Chandos Hall/Echo Street, Manchester, Ref. 065374-CUR-00-XX-RP-GE-002-V04. (Reference 2);
- Curtins (2018) Chandos Hall, Manchester, Interim Remediation Strategy, Ref. 065374-CUR-00-XX-RP-GE-003-V01. (Reference 3); and
- Curtins (2019) Underground Storage Tank Removal, Verification Letter Report, Chandos Hall/Echo Street, Manchester, Ref. 065374-CUR-00-XX-RP-GE-004-V01. (Reference 4).

1.3.1 Phase 1 Desktop Study

A Phase 1 desk study (Ref.1) was issued on the 18th May 2017 for the site which included, site history, geology, hydrogeology, hydrology, a preliminary unexploded ordnance risk assessment (UXO) along with conceptual site model and qualitative risk assessment.

Recommendations were made for undertaking an intrusive ground investigation to assess the geotechnical ground conditions on site and assess the risk from potential contamination. A detailed UXO report was also recommended to further assess risk from UXO.

1.3.2 Phase 2 Ground Investigation

A Phase 2 ground investigation (Ref.2) was undertaken to address the recommendations made in the Phase 1 report and the final report was issued on the 18th July 2019. The investigation was undertaken over various stages due to the accessibility issues and the presence of existing buildings on site which have now been demolished.

Fieldworks across the site across the various stages comprised; six cable percussive boreholes with rotary core follow-on, three micro-rotary (open-hole) boreholes, seven machine excavated trial pits, sixteen window samples holes, and five hand dug trial pits with hand-held window sample follow on. Selected soil and rock samples were subject to chemical and geotechnical analysis.

A subsequent geotechnical assessment recommended piled foundations for the proposed development end bearing into sandstone as well as a suspended ground floor slab. Recommendations were also provided with regards to excavations on site and Design Sulphate Classifications for concrete.

Generic Quantitative Risk Assessment revealed a Moderate/Low risk to the end user from direct contact, inhalation and ingestion of contaminants within Made Ground soils due to concentrations of PAHs and lead recorded above nominated GACs as well as Moderate/Low

risk to the underlying Principal aquifer. Risks to the end user from ground gas and risk from construction workers and adjacent residents from Made Ground soils were identified as Low.

The detailed UXO risk assessment (Ref. 5) identified a **Moderate** risk in the northeast and **Low** across the remainder of the site. Several recommendations have been made for the implementation of mitigation measures during intrusive works.

Further recommendations made from this Phase 2 report with respect to the contamination risk included:

- 1) In the limited proposed areas of soft landscaping, 300mm clean and inert capping is to be installed to break the source-pathway-receptor (SPR) linkage from elevated PAH and Lead concentrations. For the remainder of the site, the building footprint and areas of hard standing will break the SPR linkage;
- 2) A Piling Risk Assessment (PRA) should be undertaken determine suitable methods of piling to mitigate risk presented to underlying Principal Aquifer;
- 3) It was noted to be unknown if historic tanks are still present on site. If, during groundworks or construction works, tanks are discovered the occurrence should be noted, and procedures followed as indicated within a Remediation Strategy; and
- 4) It is recommended that construction workers are provided with appropriate PPE and sanitary facilities with reference to the environmental testing results presented herein.

1.3.3 Phase 3 Remediation Strategy

A preliminary Remediation Strategy (Ref.3) was issued ahead of completion of SI to enable commencement of demolition. The Remediation Strategy detailed early recommendations for proposed capping to soft landscaped areas. It is recommended that this document is updated on completion of all SI on site.

1.3.4 Underground Storage Tank Removal Validation

Since issue of the Phase 2 report, two Underground Storage Tanks (USTs) were identified within the north east of the site. The tanks were found to have been decommissioned through filling with concrete. The tanks and any surrounding contamination have since been removed and disposed of offsite under a watching brief from Curtins Geo-Environmental Engineer (Ref.4).

2.0 Ground Investigation Scope of Works

The ground investigation was undertaken across various stages due to the phasing of demolition works on site.

Site investigation work was undertaken between the 1st July and the 11th July 2019 which consisted of three cable percussive boreholes, with rotary core follow on and sixteen trial pits. Site works continued on the 22nd July 2019 for one day where three foundation trial pits were carried out next to the viaduct. Further intrusive works were undertaken between 4th and 6th September including 56 no. dynamic cone penetration tests and one window sample borehole.

A summary of the scope and rationale is summarised in *Table 2.0*. The scope of the ground investigation was designed in general accordance with current UK guidance including:

- CLR11 (Ref.6);
- British Standard (BS) 10175 (Ref.7);
- BS5930:2015 (Ref.8); and
- BSEN1997: Part 2:2007 Eurocode 7 (Ref.9).

Table 2.0 – Scope and Rationale of Fieldwork Undertaken

Exploratory Hole Type	Exploratory Hole Ref.	Exploratory Hole Depth (m bgl)	Exploratory Hole Depth (AOD)	Rationale
Cable Percussive Boreholes with Rotary follow-on	BH201 BH202 BH203	19.60 18.30 19.50	18.79 21.80 21.35	Confirm ground conditions; Collect soil samples for chemical & geotechnical analysis; Undertake rock coring; Determine geotechnical parameters of the superficial soils and bedrock; and Undertake in-situ testing.
Machine Excavated Trial Pits	TP201 – TP216	0.80 – 4.00	37.64 - 36.70	Confirm shallow ground conditions; and Collect soils samples for geo-environmental and WAC analysis
Machine Excavated Foundation Trial Pits	TP101A TP102A TP203A	4.85 5.00 5.00	33.57 - 34.91	Confirm shallow ground conditions; and Determine the extent of railway viaduct footings, undertaken subsequent to hand dug trial pits to gain extra depth.
Dynamic Cone Penetration Testing	DCP01-DCP57	0.80-5.00m bgl	32.90-39.24	To identify the depth of any potential obstructions underlying the site in potential pile locations.

Exploratory Hole Type	Exploratory Hole Ref.	Exploratory Hole Depth (m bgl)	Exploratory Hole Depth (AOD)	Rationale
Window Sample Boreholes	WS215	2.00	38.40	To undertake further analysis in the location of TP215 to further assess risk from Naphthalene following groundworks in area.

For information about location of the exploratory holes, refer to Curtins drawings ref. 065374-CUR-00-XX-DR-GE-006-V01, *Appendix A*. Exploratory hole logs can be found in *Appendix B*.

Only DCP locations/elevation has been surveyed, the elevation and coordinates of the other exploratory holes have been estimated from a topographic survey where possible.

2.1 Soil Logging and Sampling

Exploratory hole arisings were logged on site by a qualified Engineer. All exploratory holes were logged in accordance with the requirements of BS5930 (Ref.8). The observed visual and olfactory indications of contamination were recorded. Exploratory hole logs are provided in *Appendix B*.

2.2 Monitoring Well Installations

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

The monitoring wells within the cable percussive/rotary boreholes were installed for the purposes of groundwater monitoring and sampling. Therefore, the strata where groundwater strikes were recorded were targeted.

A summary of the response zones is presented in *Table 2.2* below.

Table 2.2 – Monitoring Well Response Zones

Borehole Ref.	Response Zone(s) (m bgl)	Strata Description(s) (Principal strata in capitals)
BH201	9.00 – 15.00	SANDSTONE
BH202	8.00 – 14.00	SANDSTONE
BH203	8.00 – 14.00	SANDSTONE

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

2.3 Post-Investigation Monitoring

2.3.1 Groundwater Monitoring & Sampling

Groundwater level monitoring was proposed to assess the groundwater conditions of the site.

Monitoring was undertaken between 29th July and 19th August 2019 for the cable percussive/rotary boreholes (BH201 - BH203).

3.0 Laboratory Analysis

3.1 Sampling Strategy for Geo-environmental Analysis

Representative soil samples were selected for laboratory chemical analysis, based on the Conceptual Site Model (CSM) and field observations and to provide a characterisation of the Made Ground and natural strata encountered. Selected soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical analysis was Envirolab (UKAS and MCERTS accredited) and for geotechnical analysis was Structural Soils (UKAS accredited).

Given the potential site-wide source of contamination (Made Ground) the sampling positions (boreholes and trial pits) were generally located in a targeted, systematic array to give adequate and representative coverage of the site accounting for the historical site use, proposed end-use, immediate environmental setting and previous investigation locations.

Sampling positions specifically targeted the eastern area of the site following demolition of existing buildings in that area comprising a nurse's quarters, garages and an estates building. At this time, the Chandos Hall building remained on site. The eastern area of the site was considered as the main target for additional stages of investigation as building cover had occupied much of this area limiting previous investigations. Furthermore, this area was considered a higher risk area due to historical uses of this area including printing works, battery repairs, car garage, depot and fuel storage tank with a higher risk of encountering volatile contamination.

That said, although considered to be lower risk, further sampling positions were also positioned across the west of the site around the existing Chandos Hall building to increase sampling density and further develop the ground model for this area. Similar ground conditions were anticipated beneath the Chandos Hall Building as immediately adjacent areas given the history of this part of the site and therefore sampling beneath the building was not considered necessary.

Curtins above sampling strategy has been agreed with in principle with Manchester City Council's Environmental Health Department, associated correspondence is included in Appendix H.

3.2 Soil Analysis

The contaminants of concern potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g. fuel/oils), heavy metals and asbestos the extent of which is captured by the broad environmental testing suite listed in *Table 3.1* below.

Table 3.1 – Environmental Chemistry Analysis Suite: Soils

Suite Ref.	Analyte	LOD
Soils Suite A	Asbestos Screen, pH and Soil Organic Matter (SOM)	-
	Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Nickel	1 mg/kg
	Zinc	5 mg/kg
	Boron (water soluble)	1 mg/kg
	Cadmium	0.5 mg/kg
	Mercury	0.17 mg/kg
	Cyanide (total)	1 mg/kg
	Phenols (screen)	0.2 mg/kg
	PAHs (USEPA 16)	0.1 – 0.8 mg/kg
	TPH (Aro/Ali Split)	0.01 to 1.00 mg/kg

A total of thirty-two soil samples were taken in total from the exploratory hole locations across the site and tested for Suite A. These comprised nineteen Made Ground soil samples and thirteen natural soil samples.

During September 2019 an additional two samples were obtained from WS215 and tested for Naphthalene only to further assess associated risk.

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

3.3 Groundwater Analysis

No Groundwater analysis was carried out due to no groundwater samples being taken.

3.4 Quality Assurance and Quality Control

Soil chemical analysis was conducted by Envirolab Laboratories (UKAS and MCERTS accredited). All samples were delivered in appropriate containers for the suites tested. Envirolab did not record any deviating samples. For geotechnical analysis Structural Soils (UKAS accredited) carried out analysis.

3.5 Geotechnical Analysis

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref.10) and representative sub-samples were taken for testing. The following tests were carried out:

- 11 No. Moisture content;
- 7 No. Atterberg Limits;
- 4 No. Particle Size Distribution by wet sieve;

- 35 No. Water soluble sulphate;
- 35 No. pH value;
- 1 No. Water content;
- 1 No. Unconsolidated Quick Undrained (Multi-Stage) Triaxial Test; and
- 3 No. One Dimensional Consolidation.

Rock samples for geotechnical testing were prepared and tested in accordance with ISRM Suggested Methods (Ref.11). The following tests were carried out:

- 53 No. Point Load Index Test (PLT);
- 4 No. Uniaxial Compressive Strength (UCS); and
- 11 No Water content.

Copies of the geotechnical testing certificates are presented in *Appendix D*.

4.0 Encountered Ground Conditions

4.1 General

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

Table 4.1 – Summary of Ground Conditions Encountered

Stratum	Depth to top of strata, m bgl (mAOD)	Thickness (m)		Description
		Min	Max	
MADE GROUND	0.00 (38.39 – 41.13)	0.35	2.80	Asphalt, concrete or TOPSOIL, overlying clayey gravelly SAND/clayey sandy ashy GRAVEL/ sandy silty ashy GRAVEL/ silty sandy GRAVEL (ash & brick fill), overlying Gravelly sandy clay and gravelly clayey fine to coarse sand. Anthropogenic constituents include asphalt, coal, wood, wire, plastic, concrete, ash, ceramic, clinker, slate and brick.
SUPERFICIAL DEPOSITS	0.35 – 2.80 (38.09 – 37.25)	4.50	5.25	Stiff to very stiff brown with some grey mottling, sandy slightly gravelly CLAY with occasional sand lenses.
WEATHERED BEDROCK	6.40 – 7.45 (33.70 – 33.40)	1.12	1.23	Very dense light brown, light reddish brown and orangish brown slightly gravelly clayey fine to coarse SAND with occasional nodules of clay. Gravel is fine to medium sub-rounded to sub-angular of sandstone, mudstone and siltstone.
BEDROCK (Chester Pebble Beds Formation)	7.63 – 8.65 (29.74 – 32.28)	10.67*	10.95*	Extremely weak to strong, orange and pink orange, fine grained SANDSTONE with infrequent round fine gravel of quartz.

* Base of deposit not proven

4.2 Made Ground

Made Ground was encountered from ground level to a maximum depth of 2.80m bgl in TP205. It generally comprised asphalt, concrete or topsoil overlying sand, gravel and ashy gravel of brick and ash fill, underlain by clayey made ground and sand and gravel. An initial layer of asphalt was encountered across the western and southern side of the site, with concrete in the east and south east with the centre of the site consisting of silty gravelly fine to medium SAND with occasional cobbles of brick.

Sub-base was encountered between 0.08m and 0.45m bgl underlying the asphalt and concrete, generally described as grey to brown, cobbly, sandy, angular to sub-angular, fine to coarse gravel of limestone, concrete and asphalt. Cobbles are fine, angular to sub-angular of limestone and concrete.

Encountered mainly in the centre of the site at ground level to 0.50m bgl was dark brown silty gravelly fine to medium SAND with occasional cobbles of brick and frequent rootlets. Along with grey sandy GRAVEL with frequent cobbles. Gravel is angular, medium to coarse of concrete. Large cobbles and blocks of concrete and occasional pieces of rebar (From demo rubble on site) at ground level to 0.34m bgl.

Further granular Made Ground (ashy gravel and sand) was encountered (within TP201 – TP208, TP211, TP213, TP216, BH201 and BH202). This comprised dark brown silty gravelly fine to coarse sand with occasional cobbles of brick and frequent rootlets. Gravel is fine to coarse, sub-rounded to angular of concrete, brick and slate. Rare pieces of re bar, wire and plastic. This was encountered between ground level and 0.10m bgl and at depths of between 0.10 and 0.50m bgl. Overlying blackish grey slightly clayey sandy ashy gravel, silty ashy gravel with rare cobbles of brick. Gravel is fine, sub-rounded to angular of mixed lithologies including ash, clinker and brick. This was encountered between 0.24m and 0.50m bgl and at depths of 0.06m and 0.40m bgl.

Granular Made Ground (silty gravelly sand and clayey gravelly sand) was encountered (within TP207 – TP210, TP213 and TP215 (east and west)) encountered at 0.14m to 1.00m bgl at depths of 0.03m to 1.35m bgl. This comprised brown, red, grey, silty gravelly sand, clayey gravelly sand and silty sand that is fine to medium. Gravel is fine to medium, sub-rounded to angular of mixed lithologies including, brick, concrete, limestone, sandstone and slate. Occasional cobbles of brick. Rare fragments of wood.

This comprised brown silty gravelly medium to coarse sand with frequent cobbles of brick. Gravel is fine to coarse sub-rounded to angular of mixed lithologies including, brick, concrete. Limestone. Rare fragments of wood and greyish brown silty gravelly fine to coarse sand. Gravel is fine to medium, sub-rounded to sub-angular and mixed lithologies. Red silty fine to medium sand.

Cohesive Made Ground was encountered (within TP201, TP202, TP204, TP205, TP207, TP213 – TP215, BH201 - BH203) encountered between 0.40m and 1.10m bgl and at depths of 0.10m to 1.90m bgl, comprising brown and grey sandy gravelly clay, gravelly clay, sandy silty clay and slightly sandy silty gravelly clay, with occasional to frequent cobbles. Gravel is fine to coarse, rounded to angular of mixed lithologies including brick, concrete, slate, sandstone, mudstone, siltstone, coal, ash. Cobbles of brick, limestone and sandstone.

In the exploratory hole locations (TP201, TP206, TP207 (East)) a hydrocarbon odour was noted at between 0.34m and 1.60m bgl in cohesive and granular Made Ground.

Across various exploratory hole locations (TP204, TP207, TP208, TP210 – TP216) brick, breeze block, concrete walls and brick/concrete footings were encountered between 0.15m to 0.85m bgl and at depths of 0.13m to 2.25m bgl. Each have been encountered in either north, east, west or south of the trial pits. Descriptions of these can be referred to in the exploratory logs in *Appendix B*.

WS215 was undertaken in September after a reduced level excavation and piling mat build up. Made Ground (gravel piling mat) was therefore encountered to 0.75m overlying natural deposits.

The geotechnical test results recorded within the Made Ground are summarised in *Table 4.2*. Full details of the geotechnical results recorded are presented on the exploratory hole logs in *Appendix B*. The test result certificates are included in *Appendix D*.

Table 4.2 – Summary of geotechnical test results – Made Ground

Parameter	No. of tests	Minimum	Maximum	Average
pH	19	6.99	13.08	8.54
Water Soluble Sulphate (mg/l)	19	40	1530	290
SPT 'N' Value	3	3	13	7

4.3 Superficial Deposits

The superficial stratum comprised Glacial Till from 0.35m to 2.80m bgl (4.50m to 5.25m thick). Deposits comprised firm becoming stiff and very stiff, dark brown with occasional grey mottling, gravelly, sandy, silty Clay. Gravel is fine to coarse, rounded to sub-angular of mixed lithologies including coal, sandstone, mudstone and siltstone. Thin sand bands were locally recorded within the generally cohesive soils.

Three particle size distribution tests (PSD) were undertaken on sample obtained from cohesive and granular superficial deposits. The distribution of particle sizes was broadly consistent with the soil descriptions provided in the exploratory hole logs.

The geotechnical test results recorded within the superficial deposits are summarised in *Table 4.3a* and *Table 4.3b*. Full details of the geotechnical results recorded are presented on the exploratory hole logs in *Appendix B*. The test result certificates are summarised in *Appendix D*.

Table 4.3a – Summary of geotechnical test results – superficial deposits

Parameter	No. of tests	Minimum	Maximum	Average
Moisture Content (%)	11	8.2	20	12
Liquid Limit (%)	7	26	37	31.86
Plastic Limit (%)	7	14	16	15
Plasticity Index (%)	7	12	21	16.86
Modified Plasticity Index (%) ⁽¹⁾	7	11.04	18.9	15.40
pH	15	6.89	9	8.07
Water Soluble Sulphate (mg/l)	15	30	260	102
Uncorrected SPT 'N' Value (full penetration) Cohesive	9	6	38	24

Parameter	No. of tests	Minimum	Maximum	Average
Coefficient of Volume Compressibility M_v (m^2/MN) ⁽³⁾	3 (5 pressures per test)	0	0.16	0.086
Undrained Shear Strength of Cohesive Soils, C_u (kPa) ⁽²⁾	1 (3 pressures)	191	237	218.67

(1) Modified plasticity index is the plasticity of components $<425\mu m$.

(2) C_u Obtained from laboratory Unconfined Triaxial Compression Test Results

(3) M_v obtained from One Dimensional Consolidation Test Results

Table 4.3b – Summary of estimated parameters – superficial deposits

Parameter	No. of tests	Minimum	Maximum	Average
Estimated Undrained Shear Strength of Cohesive Soils, C_u (kPa) ⁽¹⁾	6	88	209	137
Estimated Coefficient of Volume Compressibility of Cohesive Soils, m_v (m^2/MN) ⁽²⁾	6	0.04	0.11	0.07
Estimated Effective Angle of Shearing Resistance of Cohesive Soils, ϕ ($^\circ$) ⁽³⁾	5	28.9		
Unit Weight, γ (kN/m^3) ⁽⁴⁾	-	19		

(1) C_u estimated from SPT N value correlation with average Plasticity Index using a Factor of 5.5 (Stroud and Butler, 1975).

(2) m_v estimated from SPT N value correlation with average Plasticity Index using a factor of 0.55 (Stroud and Butler, 1975).

(3) Estimated from the relationship between typical SPT 'N' Value and angle of shearing resistance in granular soils (Peck et al, 1967).

(4) From published sources (BS8002).

Eight uncorrected, SPT 'N' Values were recorded in the clay, ranging from 16 to >50 , which generally increased with depth. The results indicate that cohesive soils are stiff to very stiff. Atterberg test results indicate low to intermediate plasticity with low to medium volume change potential clay.

Coefficient of volume compressibility and Undrained shear strength is estimated from SPT 'N' values, where full penetration was achieved. Based on published empirical relationships (Stroud and Butler, 1975), factors of 5.5 and 0.55 for a clay with a PI of 20% was chosen, resulting in estimated C_u values ranging between 88kPa and 209kPa and m_v values 0.046 kPa to 0.064 kPa. The range of C_u values indicate high to very high strength clay soils (typically high strength).

One Multi-Stage Undrained Triaxial Compression Test was undertaken on a sample from BH203 at 5.00m bgl at cell pressures of between 50 and 200kPa. The test recorded shear strengths ranging between 191kPa to 237kPa, which indicates very high strength clay.

One dimensional consolidation test was undertaken on a sample obtained from BH201 at 3m, BH202 at 4m and BH203 at 3m bgl. Tests were undertaken at cell pressure ranges between 0-30 to 480-960 kPa. Coefficient of Volume Compressibility were recorded between 0-0.16kPa.

One uncorrected SPT 'N' Values were recorded in the granular soils with values of 50 indicating dense to very dense soils. The SPT test did not reach full penetration.

SPT 'N' Values in cohesive superficial soils generally increase with depth, though are generally variable, illustrated in Figure 4.3.

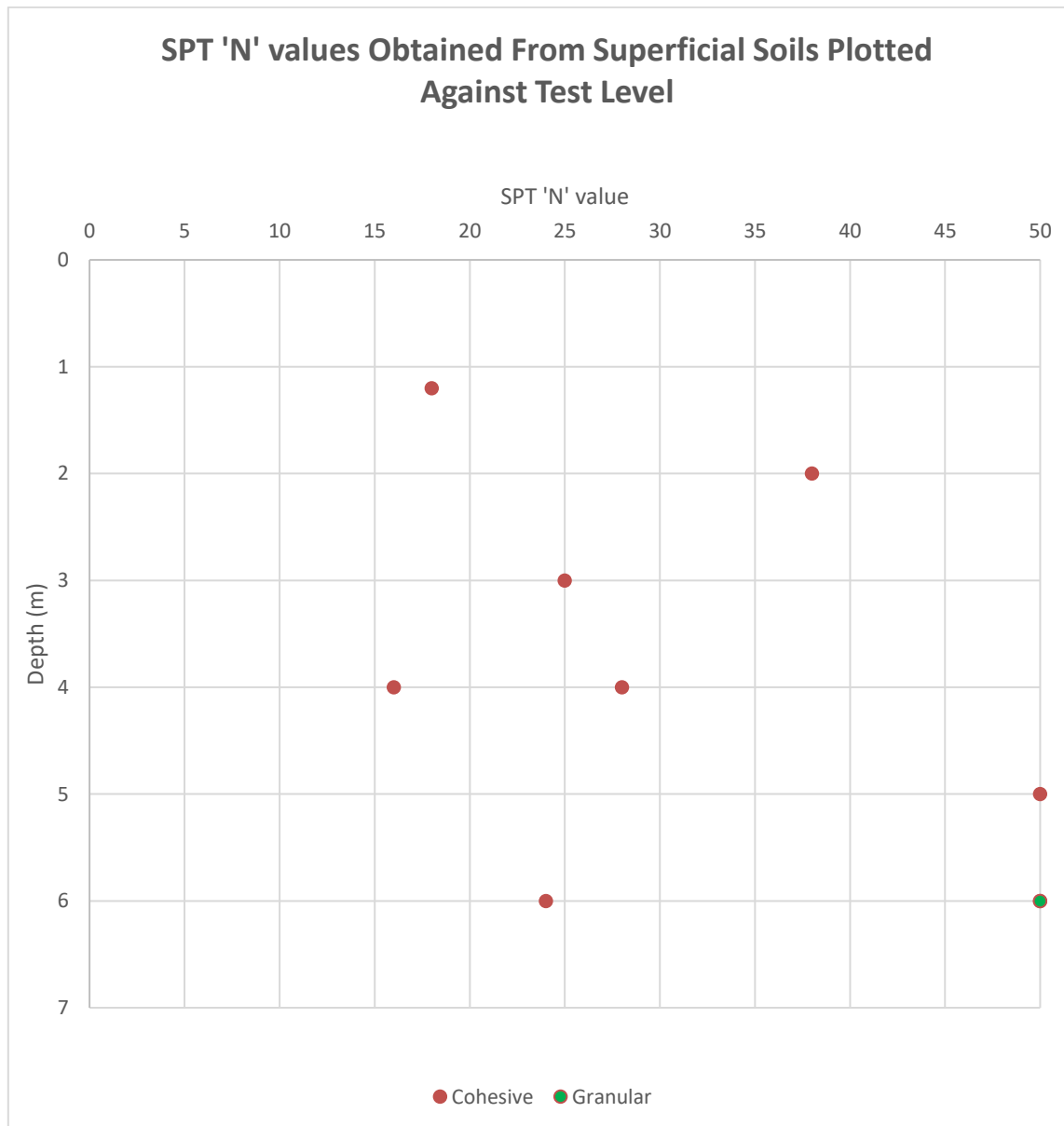


Figure 4.3 – SPT 'N' Values vs Depth

Refusals on Figure 4.3 shown as SPT N = 50 for demonstration.

4.4 Weathered Bedrock

Weathered bedrock was recorded in the cable percussive boreholes (BH201, BH202 and BH203), encountered at 6.40m to 7.45m bgl (33.70m to 33.40m AOD) and at depths of 1.12m to 1.45m bgl. The weathered bedrock was predominantly recovered as dense to very dense orangish red and reddish brown, clayey fine to medium sand with occasional fine to medium, sub-rounded to sub-angular gravel of mudstone and siltstone.

Weathered bedrock directly overlies competent sandstone bedrock, to depths of between 7.63m and 8.65m bgl (33.70 and 29.74m AOD).

Four SPT 'N' Values were recorded in the weathered bedrock. The results were recorded as 50 for all four tests, indicating the soils are generally dense to very dense.

SPT 'N' values can be used to interpret the effective angle of shearing resistance (ϕ'), using the relationship established by Peck et al (1967) for granular soils. A characteristic N value of 50 correlates to a ϕ' of 41° .

One Particle Size Distribution Test (PSD) was undertaken in the weathered bedrock deposits on a sample obtained from BH202 at 6.50m bgl. The distribution of particle sizes was broadly consistent with the soil description provided on the exploratory hole log.

The geotechnical testing results within the weathered bedrock deposits are summarised in *Table 4.4a* and *Table 4.4b*.

Table 4.4a – Summary of geotechnical test results – Weathered Bedrock deposits

Parameter	No. of tests	Minimum	Maximum	Average
pH	1		8.65	
Water Soluble Sulphate (mg/l)	1		80	
PSD (%)	1		0	
Cobbles			0	
Gravel			47	
Sand			53	
Silt/Clay				
Uncorrected SPT 'N' Value	4		50	

Table 4.4b – Summary of estimated parameters – Weathered bedrock deposits

Parameter	No. Of Tests	Value
Estimated Effective Angle of Shearing Resistance, ϕ ($^\circ$) (1)	4	41
Unit Weight, γ (kN/m ³) (2)	-	21

(1) Estimated from the relationship between typical SPT 'N' Value and angle of shearing resistance (Peck et al, 1967)

(2) From published sources (BS8002).

4.5 Bedrock Deposits

Competent Sandstone bedrock (Chester Pebble Beds Formation) was encountered within BH201 to BH203 from depths of 7.63m to 8.65m bgl (32.47m to 29.74m AOD).

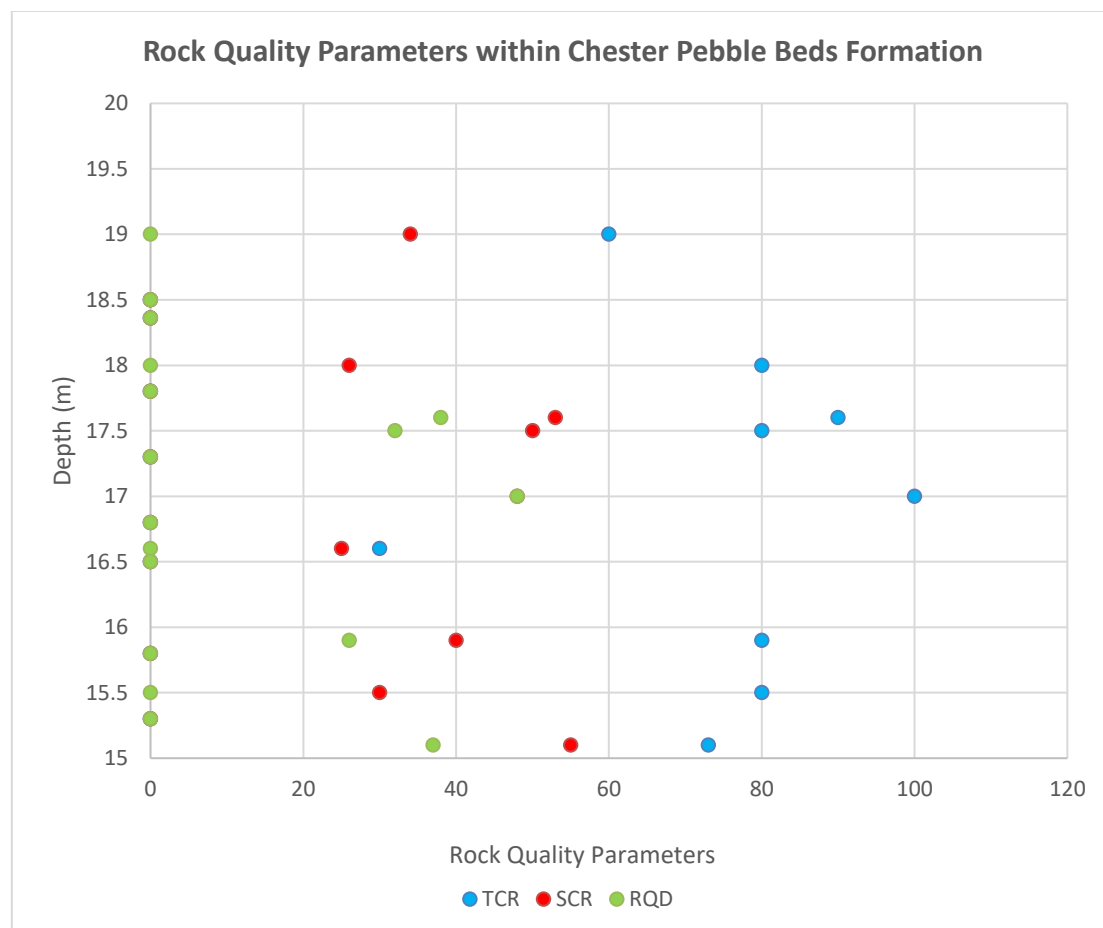
The bedrock was recorded as extremely weak to strong, orange and pinkish orange, fine grained fissile Sandstone. Occasional to frequent fine to medium, rounded to angular gravel of sandstone and quartz.

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Orange sandstone and grey limestone recovered as slightly gravelly fine sand. Gravel is fine, subangular to angular of sandstone and limestone.

The rock is highly weathered in places, recovered as non-intact deposits comprising slightly clayey silty medium sand. Orange sandstone and grey limestone recovered as slightly gravelly fine sand. Gravel is fine, subangular to angular of sandstone and limestone.

Rock Quality Designation (RQD) recorded in the cored samples ranged from 0% to 59%, averaging 5.2% across all of the rock core samples. This classifies the rock as being of very poor to fair rock mass quality. The RQD varies significantly between core runs. The total core recovery (TCR) ranged between 0% - 100% and the solid core recovery (SCR) ranged between 0% - 89%. The variability in the quality of the rock core samples recovered during this investigation is illustrated in *Figure 4.5a*.



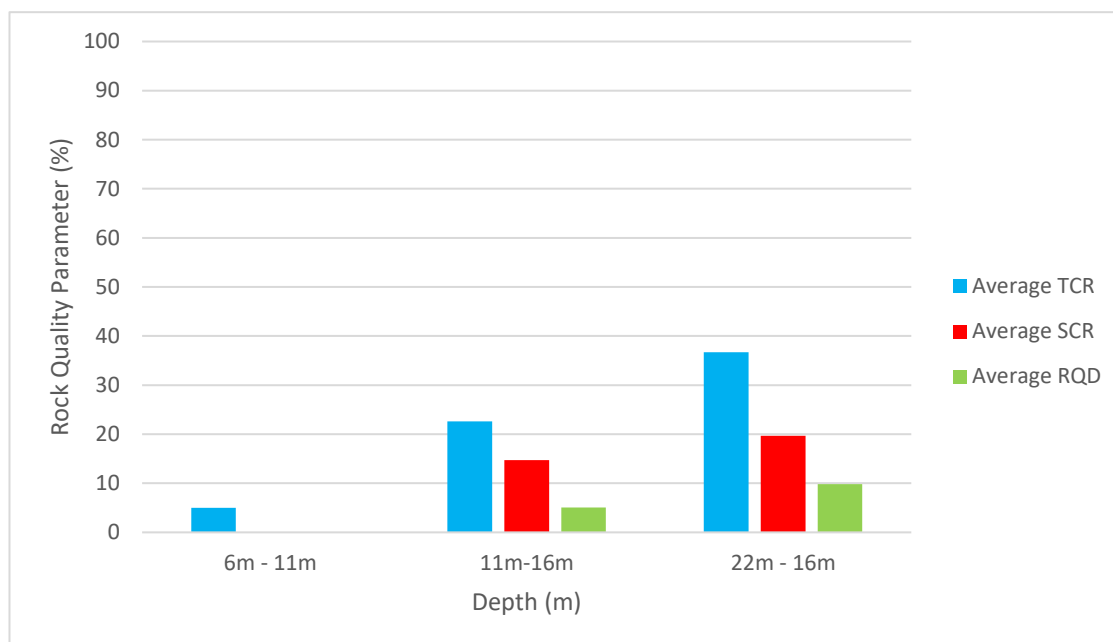


Figure 4.5a – Summary of Rock Quality Parameters within Sandstone bedrock

The base of the sandstone was not proven during this investigation. The boreholes were terminated at a maximum depth of 19.60m bgl (BH201).

A summary of the geotechnical test results levels recorded within the bedrock are presented in *Table 4.5a* and *Table 4.5b*. 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 4.5a – Summary of geotechnical test results – bedrock

Parameter		No. of tests	Minimum	Maximum	Average
Point Load Strength Test, $I_{s(50)}$ (MPa)	Diametral	16	0	0.14	0.05
	Axial	37	0	1.11	0.14
Unconfined Compressive Strength Test (MPa)		4	2.9	4.7	3.42
Water Content		11	8.8	15.1	12.10
Bulk Density (Mg/m^3)		4	2.01	2.13	2.075

Table 4.5b – Summary of estimated parameters – bedrock

Parameter		No. of tests	Minimum	Maximum	Average
Estimated Unconfined Compressive Strength (MPa) ⁽¹⁾	Diametral	16	0	2.80	1.33
	Axial	37	0	22.2	2.89

(1) Derived from correlation between PLT $I_{s(50)}$ and UCS testing results using a factor of 20.

Overall fifty-three Point Load Tests (PLT) were carried out on samples of sandstone bedrock from rotary cores. PLT $Is(50)$ values in the range 0.00 MPa to 1.11 MPa were obtained. When comparing the rock strength in different orientations the bedrock is weaker diametrically (average 1.33MPa) compared to axially (average 2.89MPa).

An approximation of the unconfined compressive strength (UCS) is derived from the relationship $PLT\ Is(50) \times 20 = UCS$. On this basis UCS values with an overall range from 0 MPa to 22.2 MPa have been derived; these values indicate extremely weak to moderately strong rock (typically extremely weak).

UCS testing on four rock samples recorded values of 2.9 to 4.7MPa indicating a weak sandstone.

The point load indices indicate that the characteristic compressive strength estimated from point load tests is lower than those derived from direct UCS testing. This is conjectured to be due to preferential selection of samples for the UCS testing which, given their more intact nature, are inherently stronger than those selected for point load tests. It must be noted that a review of the results indicates that the strength of the rock, derived from PLT $Is(50)$ results, is laterally variable. As such it is advised that a location by location assessment of the rock strength is undertaken for the purposes of design.

The combined dataset is interpreted to provide a reasonable characterisation of the range of rock strength within the boreholes; some variation beyond these limits should be anticipated.

Figure 4.5b, summarises the UCS, estimated axial UCS and estimated diametral UCS test results against depth.

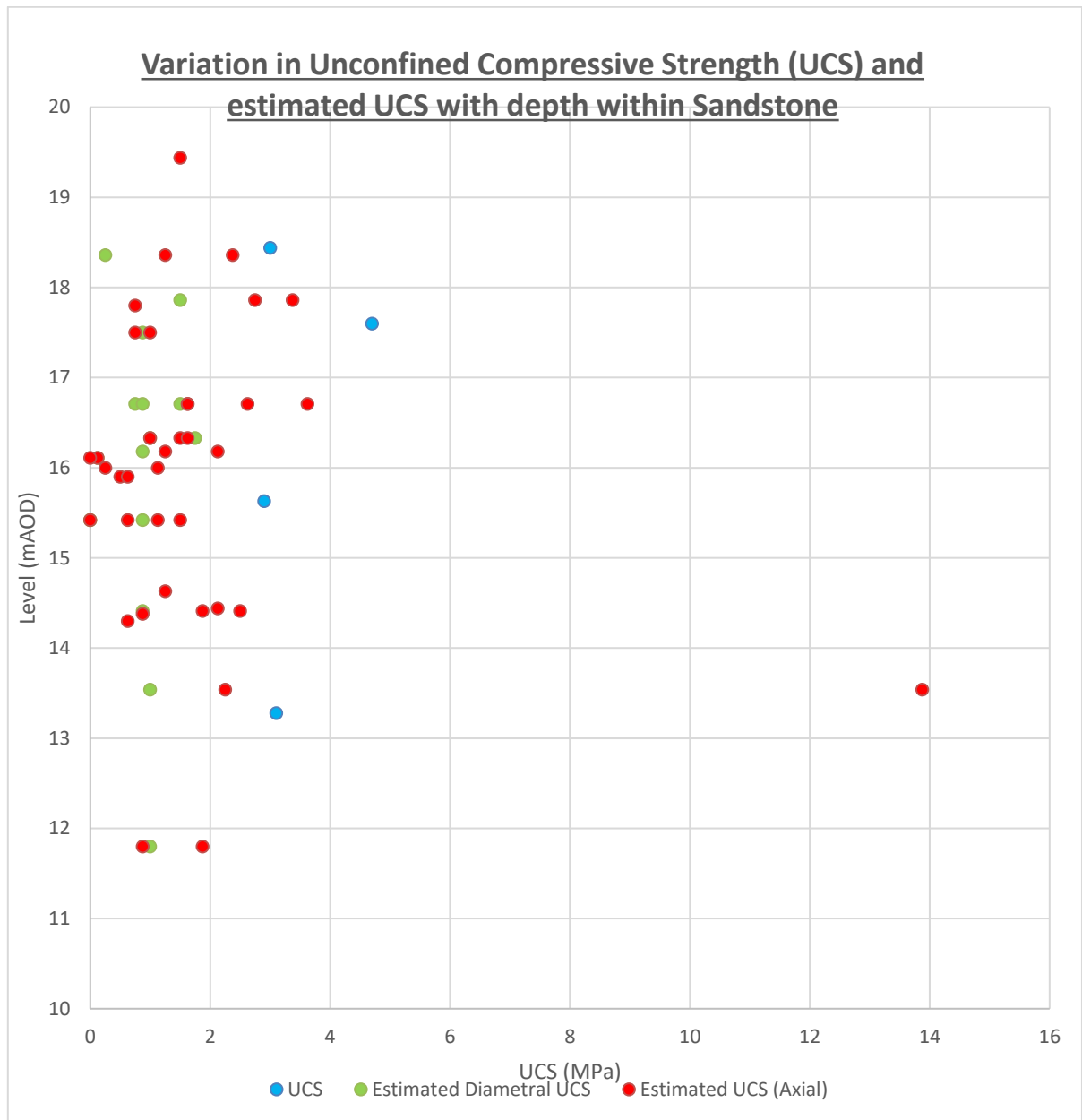


Figure 4.5b – UCS and estimated UCS vs Depth within Sandstone.

4.6 Railway Viaduct Foundation Inspection

Three trial pits (TP101-TP103) were advanced as part of previous investigations (Ref.2) adjacent to the railway viaduct's piers to determine the depth of foundations. The foundations of the viaduct were not encountered in any of the excavations. Trial pits in the same locations were re-excavated as part of this phase of works (TP101A, TP102A, TP103A) with a larger excavator to deepen excavations with the same aim of again determining the depth and type of foundations. Trial pit logs and cross section drawings are enclosed in Appendix B.

TP101A was advanced to a maximum depth of 4.85m bgl (4.20m bgl immediately adjacent to the wall) and did not identify the viaducts foundations. Reference should be given to Curtins drawing ref 065374-SK001 for excavation cross section drawing.

TP102A was advanced to a maximum depth of 5.00m bgl and the base of the wall/foundation proven at 3.60m bgl. The brick foundation steps out at around 2.8m bgl by approximately 170mm over 400m depth the wall then continues down another 400mm to base.

A small concrete foundation was identified beneath the brick infill for the adjacent t arch at 1.45m bgl, protruding c.150mm and of c.150mm thickness. Reference should be given to Curtins drawing ref 065374-SK002-004 for excavation cross section drawings and plans.

TP103 was advanced to a maximum depth of 5.00m bgl (circa 3.5m bgl immediately adjacent to wall), the base of the wall/foundation was not encountered. Reference should be given to Curtins drawing ref 065374-SK005. The trial pits could not be extended due restrictions on site, the excavator could not be moved back due to brick wall behind.

4.7 Observed Potential Contamination

Soils which exhibited potential contamination were noted during the siteworks and are detailed in *Table 4.6* as follows:

Table 4.6 – Observed Potential Contamination during Siteworks

Borehole Ref.	Observed Contamination	Depth (m bgl)
TP201	Hydrocarbon odour	0.56 – 1.33
TP206	Slight hydrocarbon odour (potentially associated with ashy strata)	0.34 – 0.70
TP207 (East)	Strong hydrocarbon odour (noted in blackish brown gravelly clay)	1.10 – 1.60
TP202	Possible asbestos tile	0.72

4.8 Obstructions Encountered

Obstructions encountered during the borehole and trial pit works are detailed in *Table 5.8* below.

Table 4.7 – Obstructions Encountered During Siteworks

Borehole Ref.	Obstruction	Outcome	Depth (m bgl)
TP201	Suspected concrete	Trial pit terminated	1.35
TP202	Suspected asbestos	Trial pit terminated	0.80
BH201	Suspected brick	Hand pit extended to the north	0.60

56 no. dynamic cone penetration tests were advanced across the site in order to identify possible obstructions within pile locations. Holes were advanced to 5m bgl or refusal (over 50 blows within 100mm penetration). All holes were undertaken at or close to the locations provided by Vinci with the final locations shown in Curtins Drawing Ref.065374-CUR-00-XX-DR-GE-009-V01 enclosed in Appendix A. Advancement of location DCP46 was not possible as this was situated on a steep slope and relocation was not possible. Obstruction type could not be identified given the technique used, however refusal depths are provided on the logs enclosed within Appendix B for Vinci's information and interpretation.

4.9 Groundwater

No groundwater strikes were recorded during siteworks. Water seepages were however encountered within several exploratory holes, likely as perched water within made ground and cohesive soils. Groundwater seepages encountered are recorded in *Table 4.8a*. No significant groundwater strike was noted within the rotary boreholes. It must be noted that water flush added during drilling may have masked the likely strikes, although the boreholes were dipped after drilling giving the groundwater level within the borehole as included in *Table 4.8a* below.

Table 4.8a – Summary of groundwater encountered during the investigation works.

Borehole Ref.	Depth (m bgl)	Strata	Description
TP205	2.30	MADE GROUND	Perched water seepage
TP210	1.60	MADE GROUND	Perched water seepage
TP211	0.55	CLAY	Perched water seepage
TP213	0.75	MADE GROUND	Perched water seepage
BH201	11.20	SANDSTONE	Groundwater dipped at end of drilling
BH203	10.20	SANDSTONE	Groundwater dipped at end of drilling

Groundwater levels in BH201-BH203 were monitored four times over a one-month period before boreholes were lost due to construction activities. A summary of the groundwater levels recorded during subsequent monitoring is presented in *Table 4.8b*. Full details of the water strikes recorded during progression of the investigation positions are presented on the exploratory hole logs included in *Appendix B* and full details of the water levels recorded during the monitoring visits are presented in *Appendix E*.

Table 4.8b – Groundwater Noted During Post Investigation Groundwater Level Monitoring

Borehole Ref.	Monitored Water Levels		
	Installation Strata	Depth (m bgl)	Depth (mAOD)
BH201	SANDSTONE	9.97 – 14.85	28.42 – 23.54
BH202	SANDSTONE	11.50 – 12.77	28.60 – 27.33
BH203	SANDSTONE	11.69 – 12.20	29.16 – 28.65

4.10 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.12). A summary of the results obtained during this investigation are summarised in *Table 4.9a* and *Table 4.9b* details the classification for each stratum.

Table 4.9a – Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Test Type	Range
Made Ground	pH	6.99 – 13.08
	Water Soluble Sulphate (mg/l)	40 - 1530
Superficial Deposits	pH	6.89 - 9
	Water Soluble Sulphate (mg/l)	30 - 260
Weathered Bedrock	pH	8.65
	Water Soluble Sulphate (mg/l)	80

Table 4.9b – Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Made Ground	DS-3	AC-3
Superficial Deposits	DS-1	AC-1
Weathered Bedrock	DS-1	AC-1

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

5.0 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.13).

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 6.0* of this report.

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

5.1 Human Health GQRA

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency and Defra. Guidance includes Contaminated Land Exposure Assessment (CLEA) v1.071 model (Ref.14), Science Report 2 (Ref.15) and Science Report 3 (Ref.16).

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

- i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. 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 1% and 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.17) 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.

5.1.1 Adopted Soil Human Health GACs Screening Methodology

The use of the site, noted as a mixed use 25-storey student apartment blocks with retail, leisure, amenity, event and children's nursery space on the ground floor; is most analogous with a *Commercial* end-use scenario and so assessment has been undertaken against the following GACs, in order of preference:

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

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e. the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for the site soils ranged significantly from 0.2% to 36.3%. The high organic content encountered in several soils is representative of the high ash/clinker content of Made Ground features tested.

With consideration for a calculated geometric average, the soils tested as part of this phase of works determine a SOM within Made Ground soils of 3.96%. A geometric average of 5.76% was calculated previously as part of the previous GI works (Ref.2). As such, a comparison against Tier 1 thresholds for a SOM of 6.0% for *Commercial* end-use has been adopted.

For natural soils, SOM contents of 1.5% was reported. As such, a comparison against Tier 1 thresholds for a conservative SOM of 1.0% for *Commercial* end-use has been adopted for natural soils. The adopted GAC's are listed in *Appendix F*.

5.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

The results of the environmental testing can be referred to in *Appendix C*, with testing undertaken on a total of thirty-two soil samples across the site.

With respect to the proposed 'Commercial' end-use of the site, lead and PAH exceedances are noted within 4no recovered soil samples as detailed below in Table 5.1.2a. Asbestos was identified in two locations as detailed in Table 5.1.2b.

Table 5.1.2 – Soil GAC Exceedances for a Commercial End-Use

Borehole Ref.	Depth (m bgl)	Stratum	Determinant	Conc. (mg/kg)	GAC (mg/kg)
TP204	0.85	Made Ground	Lead	2940	2300
TP206	0.50	Made Ground	Lead	3100	2300
TP210	1.50	Made Ground	Lead	9280	2300
TP215	1.50	Silty sandy CLAY	Naphthalene	286	190

Table 5.1.2 – Soil GAC Exceedances for a Commercial End-Use

Borehole Ref.	Depth (m bgl)	Stratum	Asbestos Type	Concentration in soil (% w/w)	Bulk Fibre % asbestos in ACM (HSG264)
TP202	0.72	Made Ground	Chrysotile cement solid fragment/tile	-	15
TP201	0.45	Made Ground	Amosite loose fibres	0.001%	-

Suspected asbestos containing materials (ACMs) were identified in TP202 at 0.72m bgl within made ground as asbestos tile. This was tested in the laboratory and confirmed to contain 15% asbestos. Asbestos loose fibres were identified were identified in one sample only in Made Ground within TP201 at 0.45m bgl, identified as amosite at 0.001%.

Minor exceedances were recorded within three Made Ground samples and one Natural soil sample with respect to Lead in the Made Ground and Naphthalene in the Natural soils.

Naphthalene is a semi-volatile organic compound which can present a risk to end users through volatilisation and inhalation. The elevated concentration of Naphthalene is considered likely to be associated with the location of the old tanks that were located on site in the north east corner, close to TP215 where the exceedance of Naphthalene was recorded. These tanks have since been removed and the material remaining immediately around the tanks has been validated as clean and suitable for use (Ref.4). Furthermore, the area has since been reduced in levels significantly by circa 1-1.5m to allow construction of a piling mat with excavated material disposed of off-site. Further sampling was recommended to ensure this exceedance has been removed through reduced level excavations and tank removal activities which has since been undertaken and is detailed below.

5.1.3 Naphthalene Delineation Additional Sampling

Validation sampling at TP215 where elevated Naphthalene was initially encountered was undertaken in September 2019, through the advancement of window sample location WS215.

Environmental samples were taken 0.80m bgl and 1.60m bgl from WS215 shown in Curtins Drawing Ref. 065374-CUR-00-DR-GE-006-V02. One sample was taken at 0.80m bgl, below the piling mat formation, within the natural soils as it was deemed to correlate with original sample depth where the exceedance was noted (c.39.5m AOD). A further sample was taken at 1.50m bgl to ensure Naphthalene had not leached into the underlying soils before the reduced level excavations and tank removal activities.

With respect to the proposed '*Commercial*' end-use of the site, no naphthalene exceedances were noted within the 2no. recovered soil samples. Naphthalene was recorded below the limit of detection in both samples.

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

5.2 Water Supply Pipe Assessment

With reference to the UKWIR Report no. 10/WM/03/21 (Ref.18) advice is given on the appropriate materials for these ground conditions. The exact requirements are to be confirmed with the relevant utility supplier.

PE and PVC pipes are unlikely to be suitable for use for water supply pipes at this site due to concentrations of C5-C10, C11-C20 and C21-40 mineral oils exceeding UKWIR guidelines.

5.3 Materials Management

5.3.1 Re-use of Site Soils

With the exception of potentially Naphthalene identified in TP215 (further testing recommended), based on the geochemical testing results presented as part of this investigation it is considered that there is no specific requirement to remove soils from site because of them presenting an unacceptable risk to human health or the environment.

The re-use of site-won soils may therefore be undertaken if the following principles are met:

- i) the geotechnical suitability of the material needs to be confirmed;
- ii) the re-use of the material needs to be covered as part of the planning approval, e.g. site levels maintained within agreed limits;
- iii) the volume of the material being re-used needs to be confirmed and traceable; and
- iv) regulatory approval from the relevant authorities has been sought.

These principles are outlined within the CL;AIRE Definition of Waste Code of Practice (v2) (Ref.19) and if and where the re-use of site-won soils is proposed as part of the development works it is recommended that a Materials Management Plan is produced in line with the Definition of Waste Code of Practice to detail and document the process.

5.3.2 Material Classification

Where any site soils are to be disposed of off-site guidance on the disposal of contaminated soils is provided within the following document published by the Environment Agency, the Guidance on the Classification and Assessment of Waste Technical Guidance WM3: 1st Edition, 2015 (Ref.20).

Guidance states that the principal contractor (or any other sub-contractor undertaking excavations) should, in conjunction with the proposed disposal facility, use where possible the relevant environmental chemistry analyses results to classify any surplus material identified for off-site disposal. However, it should be noted that this information is for guidance only and material identified for disposal should be tested and assessed in accordance with WM3 to enable classification during the works.

An initial assessment for the waste classification of the Made Ground soils encountered onsite has been carried out through a comparison of the soil testing results against the Tier 1 Thresholds and using the Waste Soils Characterisation Assessment Tool, Cat-WasteSoil, developed by McArdle and Atkins. This online tool gives a rapid assessment of contaminated soils and their classification as either hazardous or non-hazardous (stable non-reactive hazardous waste) waste, it should be noted that this tool does not classify inert waste. Persistent

Organic Pollutants (POP's) were not tested for as part of the investigation, however based on the Conceptual Site Model the risk of these being present on the site is considered Low.

The initial assessment revealed that of the nineteen Made Ground soils tested, fourteen have indicated to be non-hazardous with respect to Environment Agency waste classes, using the guidance given in WM3. All twelve natural samples tested were indicated to be non-hazardous.

Five Made Ground samples have indicated to be hazardous waste for offsite disposal owing to the concentrations of Lead (TP204 at 0.85m, TP206 at 0.50m and TP210 at 1.50m bgl), Petrol and Diesel (TP207 at 1.20m bgl) pH (BH203 at 0.40m and TP215 at 1.50m bgl). It should also be noted that if and where asbestos is identified above 0.1% w/w this will result in a hazardous classification.

WAC testing was carried out on nine natural samples and eight Made Ground samples at the request of Vinci. WAC Testing results are enclosed in Appendix C.

As discussed, preliminary waste classification is undertaken to offer indicative advice with respect to disposal requirements. Landfill operators are not obliged to accept waste and, if they were to do so, may have specific requirements beyond those outlined above prior to acceptance. Landfill operators should be contacted to confirm the above classifications or otherwise.

6.0 Revised Conceptual Site Model

The Conceptual Site Model (PCSM) presented in the Phase 2 report (Ref.2) has been revised following the GQRA in *Section 5.0* above. Only revised Potential Pollutant Linkages are shown in the Conceptual Site Model (CSM) is summarised in the table overleaf. For other Potential Pollutant Linkages the Phase 2 report should be consulted (Ref.2).

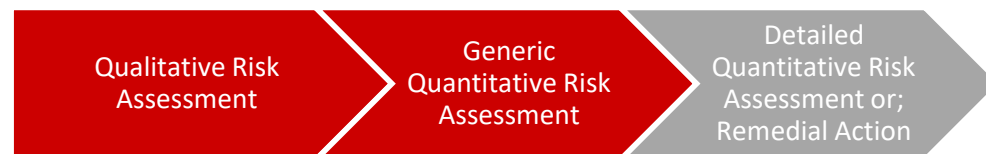
The CSM details the source-pathway-receptor linkages or potential pollutant linkages (PPL) that have been identified as relevant for the site based on current investigations. The GQRA details the associated level of risk relating to these potential pollutant linkages.

The CSM follows the framework outlined within CIRIA C552 (Ref.21) 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.

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.22) 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. Reference should be given to the environmental testing results discussed within *Section 5.0* and presented within *Appendix C*.

Phase 2 Additional Ground Investigation



- 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		
Made Ground – Contamination associated with uncontrolled deposition of construction/demolition waste materials and fill.	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation	Site end-users	Medium	Low Likelihood	Moderate/Low	Within the previous Phase 2 report minor PAH and Lead exceedances above <i>Commercial</i> end-use adopted GAC are noted although in distinct source (ash and clinker within Made Ground soils), indicative of historical uses of the site and wider area.	Provision of a suitable thickness of clean and inert cover in all areas of soft landscaping to remove pathway
	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation	Construction and maintenance workers	Medium	Unlikely (Standard Health & Safety precautions likely to be used by workers)	Low	During this investigation elevated levels of Lead were recorded above <i>Commercial</i> end-use adopted GACs in Made Ground soils at similar concentrations to those found previously.	
	Soil dust ingestion/inhalation produced during construction	Adjacent residents	Medium	Unlikely (Suitable site management and environmental controls likely to be used by principal contractor)	Low	Naphthalene was also encountered in TP215 in natural soils. The elevated concentration of Naphthalene is considered likely to be associated with the location of the old tanks that were located on site in the north east corner, close to TP215 where the exceedance of Naphthalene was recorded. These tanks have since been removed and the material remaining immediately around the tanks has been validated as clean and suitable for use (Ref.4). Furthermore, the area has since been reduced in levels significantly by circa 1-1.5m to allow construction of a piling mat. The excavated material was disposed of off-site. Subsequent sampling of natural soils at TP215/WS215 to verify the removal of Naphthalene impacted soils identified naphthalene concentrations below the limit of detection. The site is deemed to be very well characterised with 45 no. sampling locations site wide comprising 63 no. samples; 48 no. made ground and 15 no. natural samples. These were taken across the various stages of ground investigation with a sampling density of between 5m to <25m across the whole site.	
Asbestos fibres and Asbestos Containing Materials (ACM) identified in Made Ground soils in two exploratory hole locations (TP201 and TP202).	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation	Site end-users	Medium	Likely	Moderate/Low	No asbestos was encountered within previous Phase 2 report. Asbestos identified (0.001% Amosite loose fibres) in Made Ground soil sample taken within TP201 at 0.45m and within TP202 at 0.72m bgl found as a tile (Chrysotile Cement bulk ID 15%) within Made Ground soil strata.	Provision of a suitable thickness of clean and inert cover in all areas of soft landscaping to remove pathway.
	Soil dust ingestion/inhalation produced during construction	Construction and maintenance workers	Medium		Moderate/Low	TP201 is located in the western side of the site, to the north east of the building to be demolished, where contractors discovered and removed asbestos material running east to west across the north of the site. Although this was removed asbestos may still be present on site.	Appropriate asbestos management plan to be put in place for demolition/construction works to manage risk to construction workers with input from specialist where required.

6.1 Summary of Updated Relevant Pollutant Linkages

A **Moderate/Low** risk rating is identified to end-users from direct contact, inhalation and ingestion of non-volatile contaminants within Made Ground soils due to elevated levels of Lead and PAHs in Made Ground and Natural soils.

A **Low** risk rating is identified to end-users from inhalation of volatile contaminants within Made Ground soils.

A **Low** risk rating is identified to construction workers and adjacent residents at this stage from direct contact, inhalation and ingestion of contaminants associated with Made Ground soils.

A **Moderate/Low** risk rating is identified to end-users from direct contact, inhalation and ingestion of asbestos fibres and ACM within Made Ground soils present on the site.

A **Moderate/Low** risk rating is identified to construction and maintenance workers from soil dust ingestion/inhalation produced during construction in consideration of asbestos fibres and ACMs within Made Ground soils present on the site.

7.0 Conclusions & Recommendations

7.1 Conclusions

A revised tabulated revised Conceptual Site Model has been derived following the findings on the Generic Quantitative Risk Assessment risk assessment and is presented in *Section 6.0*.

7.1.1 Summary of Ground Conditions

The ground conditions at the site generally comprised Made Ground, underlain by Glacial Till (clay locally interbedded with sand and gravel), overlying the Chester Pebble Beds Formation (Sandstone). Ground conditions encountered were generally consistent with that encountered during previous investigations.

The rock is highly weathered at the top of the strata, often recovered as very dense sand.

No significant groundwater strikes were recorded during the investigation works. Several exploratory boreholes recorded seepages of perched water within made ground and shallow cohesive soils. It should be noted that water flush methods were used during the progression of rotary cored boreholes, which may have masked the groundwater conditions. On return monitoring in deep wells groundwater levels were recorded between 23.54 and 28.65m AOD.

7.1.2 Ground and Groundwater Contamination

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

With respect to the proposed end-use of the site General Assessment Criteria have been exceeded in three Made Ground samples and one Natural soil sample with respect to Lead. The concentrations of Lead are comparable with those identified within previous phases of SI and are likely to be associated with ash and clinker within the Made Ground and may pose a risk if future site users become exposed to these soils through direct contact, primarily in landscaped areas.

A single exceedance was initially recorded for Naphthalene at the north east of the site, close to the location of historic underground fuel storage tanks which have since been removed. The material remaining in-situ around the tanks has been validated as clean and suitable for use (Ref.4). Furthermore, the area has since been reduced in levels significantly by circa 1.0-1.5m to allow construction of a piling mat with the excavated material disposed of off-site. Subsequent verification sampling in the location of TP215 (WS215) was undertaken in September 2019 to confirm the naphthalene impacted soils had been removed. Two soil samples were taken for

chemical analysis and both samples recorded naphthalene below the limit of detection. The Naphthalene contaminated material is therefore confirmed to have been removed.

Asbestos was identified at (0.001% Amosite loose fibres) in a Made Ground soil sample taken within TP201 at 0.45m and within TP202 at 0.72m bgl identified as a tile (Chrysotile Cement bulk ID 15%) within Made Ground soil strata. It is also understood the demolition contractor identified, excavated and disposed of further asbestos containing material on the west of site.

It is considered that the risk presented to site end-users from lead and asbestos in Made Ground soils on site is currently **Moderate/Low**. This will be reduced to Low if a suitable thickness of 'clean and inert' capping is installed in areas of soft landscaping. The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the remainder of the site.

A **Low** risk rating is identified to end-users from inhalation of volatile contaminants within Made Ground soils.

A **Low** risk rating is identified to construction workers and adjacent residents at this stage from direct contact, inhalation and ingestion of contaminants associated with contaminants in Made Ground soils assuming appropriate PPE and environmental controls.

A **Moderate/Low** risk rating is identified to end-users from direct contact, inhalation and ingestion of asbestos fibres and ACMs within Made Ground soils present on the site.

A **Moderate/Low** risk rating is identified to construction and maintenance workers from soil dust ingestion/inhalation produced during construction in consideration of ACMs within Made Ground soils present on the site. An appropriate asbestos management plan to be put in place for demolition/construction works to manage risk to construction workers with input from specialist where required.

The site is determined to be very well characterised with 45 no. sampling locations site wide comprising 63 no. samples were obtained; 48 no. made ground and 15 no. natural soils samples. These were taken across the various stages of ground investigation with a sampling density of between 5m to <25m across the whole site meeting requirements set out in BS 10175:2011 + A2 2017. On this basis specific post demolition investigation beneath Chandos Hall is not considered necessary. This approach has been agreed in Principal with Manchester City Council's Environmental Health Officer, with correspondence enclosed in Appendix H.

7.1.3 Geotechnical Assessment

For engineering design, it is recommended that the designer refers to not only the information presented herein but uses this information in conjunction with previous investigations (Ref.2).

Based on the ground conditions encountered during this investigation and previous ground investigations the following geotechnical parameters outlined overleaf in *Table 7.1.3* are recommended for the use in design.

Table 7.1.3 – Geotechnical Parameters

Parameter	Firm/Stiff Clay	Sand (Weathered bedrock)	Sandstone
Estimated Undrained Shear Strength, C_u (kPa)	60	-	-
Estimated Effective Angle of Shearing Resistance, ϕ (°) ⁽¹⁾	-	36	38
Effective Cohesion C' (kPa) ⁽¹⁾	0	0	400
Unit Weight, γ (kN/m ³) ⁽²⁾	20	20	22
Unconfined Compressive Strength (UCS) (MPa)	-	-	5.0

(1) Determined from Foundations of Engineering Geology, P54 (Ref. 34)

(2) From published sources (BS8002) and (Hoek & Bray 1974).

The sites ACEC assessment in accordance with BRE Special Digest 1 (Ref.12) remains consistent with that recommended previously. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-3 in made ground and DS-1 for natural deposits. An ACEC class of AC-3 for made ground and AC-1 in natural deposits would be appropriate for the site.

Of the three trial pits adjacent to the railway viaduct identified the base of the wall/foundation in TP102A only. TP102A was advanced to a maximum depth of 5.00m bgl and the base of the wall/foundation proven at 3.60m bgl. The brick foundation steps out at around 2.8m bgl by approximately 170mm over 400mm depth the wall then continues down another 400mm to base. A small concrete foundation was identified beneath the brick infill for the adjacent at arch at 1.45m bgl, protruding c.150mm and of c.150mm thickness.

7.1.4 Additional Considerations

Elevated concentrations of mineral oil and GC-MS with TIC (aliphatic and aromatic) contamination with respect to the protection of water supply pipes were identified within the made ground. Therefore, it is recommended that appropriate materials for water supply pipes would comprise Barrier Pipes (PE/AL/PE). The exact requirements should be confirmed with the utility provider.

A detailed UXO risk assessment was carried out and it is considered that the risk presented to the site from UXO is **Moderate** in the northeast and **Low** across the remainder of the site. Several recommendations have been made for the implementation of mitigation measures during intrusive works.

Historic mapping indicates the presence of tanks beneath the north east corner and centre north of the site. Whilst Connell Brothers carried out a reduced level dig across the site they identified two tanks in the north east corner of the site, which were removed under Curtins supervision. Reference should be given to (Ref.4) tank removal report for more information. The potential for further underground storage tanks remaining on site should not be discounted.

7.2 Recommendations

The previous Phase 2 report (Ref.2) should be read in conjunction with this report and the existing Remediation Strategy should be updated to include the results and requirements of all ground investigations to date.

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

1. In the limited proposed areas of soft landscaping, 300mm clean capping with underlying geotextile/break layer should be installed to break the source-pathway-receptor (SPR) linkage from elevated Lead concentrations and possible asbestos contaminated soils. For the remainder of the site, the building footprint and areas of hard standing will break the SPR linkage;
2. Use suitable materials for water supply pipes in accordance with utility providers requirements.
3. An appropriate asbestos management plan should be put in place for demolition/construction works to manage risk to construction workers with input from specialist where required.
4. If, during groundworks or construction works, tanks are discovered the occurrence should be noted, and procedures followed as indicated within a Remediation Strategy
5. A Piling Risk Assessment (PRA) is undertaken determine suitable methods of piling to mitigate risks to the underlying aquifer;
6. Construction workers are provided with appropriate PPE and sanitary facilities with reference to the environmental testing results presented herein and within *Appendix C*.

8.0 References

1. Curtins (May 2017) Phase 1 Preliminary Site Assessment, Chandos Hall, Granby Row, Manchester (ref. B064987/RB/8459).
2. Curtins (July 2019) Phase 2 Ground Investigation Factual Letter Report, Chandos Hall, Manchester (ref. 065374-CUR-00-XX-RP-GE-001-V01).
3. Curtins (July 2018) Interim Remediation Strategy, Chandos Hall, Manchester (ref. 065374-CUR-00-XX-RP-GE-003-V01).
4. Curtins (September 2019), Underground Storage Tank Removal, Verification Letter Report, Chandos Hall/Echo Street (ref. 065374-CUR-00-XX-RP-004-V01).
5. 1st Line Defence (2017) Detailed Unexploded Ordnance (UXO) Risk Assessment, Chandos Hall (ref. DA4989-00).
6. Environment Agency (2004) Model Procedures for the management of land Contamination Contaminated Land Report 11 (report no. CLR11).
7. British Standards Institution (2011) Investigation of Potentially Contaminated Sites (report no. BS10175).
8. British Standards Institution BSI (2010) Code of Practice for Site Investigations (report no. BS5930).
9. British Standards Institution (2006) Eurocode 7: Geotechnical Design (report no. BSEN1997).
10. British Standard (2016) Methods of test for soils for civil engineering purposes. General requirements and sample preparation (report no. BS1377-1).
11. International Society for Rock Mechanics (2007-2014) The ISRM Suggested Methods for Rock Characterization, Testing and Monitoring.
12. Building Research Establishment (2005) Concrete in Aggressive Ground (Special Digest 1).
13. British Standards Institution (2013) Guidance on Investigations for Ground Gas, Permanent Gas and Volatile Organic Compounds (VOCs) (report no. BS8576:2013).
14. Environment Agency (2014) Contaminated Land Exposure (CLEA) Tool (version 1.071).
15. Environment Agency (2009) Human Health Toxicological Assessment of Contaminants in Soil (report no. SC050021/SR2).
16. Environment Agency (2009) Updated Technical Background to the CLEA Model (report no. SC050021/SR3).
17. Department of Environment Food and Rural Affairs (DEFRA) (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).
18. UK Water Industry Research (2010) Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (report no. 10/WM/03/21).
19. Contaminated Land: Applications in Real Environments (CL:AIRE) (2011) Definition of Waste Code of Practice (version 2).

20. Environment Agency (2015) Guidance on the Classification and Assessment of Waste Technical Guidance WM3 (1st Edition).
21. CIRIA (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings (report no. C665).
22. CITB (2015) Construction (Design and Management) Regulations

Appendix A Drawings

- Sheppard Robson, Ground Floor Plan – Stage 3, drawing ref. 5426-SRA-XX-00-DR-A-20-811-P03 (dated Nov 2017).
- Sheppard Robson, Lower Ground Floor Plan – Stage 3, drawing ref. 5426-SRA-XX-B1-DR-A-20-810-P03 (dated Nov 2017).
- Curtins, Additional SI Exploratory Hole Location Plan 065374.004-CUR-00-XX-DR-GE-001-V01 dated July 2019.
- Curtins Exploratory Hole Location Plan (Trial pits adjacent to viaduct) Ref. 065374-CUR-00-XX-DR-GE-005-V04.
- Curtins DCP Hole Location Drawing Ref.065374-CUR-00-XX-DR-GE-009-V01.



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- Ownership Boundary
- Application Boundary
- Fire Curtain
- 4.5 m Clearance from Railway Viaduct
- 2.75 m Clearance Zone from Overhead Line Equipment (OLE) taken from the Railway Viaduct

REV.	DATE	AMENDMENT
P03	14/05/17	Ground and Lower Ground rearranged following reintroduction of nursery
P04	18/08/17	Background Planning Layouts
P05	12/09/17	Coordinated with 5426-SRA-00-ZZ-SSH-A-00-906
P06	15/12/17	1st Stage Tender
P07	12/02/18	Stage 3 Frozen Layouts
P08	22/02/18	Refined Layouts to Incorporate Design Team Comments
P09	13/04/18	Stage 3 Approval
P10	19/10/18	Revised Stage 3 - Agreed VE and Client Changes (Plant HV and LV rooms moved to Ground floor, Nursery replaced with Gym, Changes to Lift Cores to KONE specifications)
P11	22/10/18	Revised Stage 3 - Fire Curtains indicated
P12	23/11/18	Ground Floor layout updated to the latest ID requests
P13	30/11/18	Stage 4a GAs - Double sliding door replaced with single in the meetings rooms; Single doors to gyms replaced with one and a half doors for access to equipment; Tea point in Co-working area relocated. Comms cabinets indicated
P14	01/03/19	Stage 4a Amendments - Bin Store slope amended. Stair Lobby Entrance Doors in Tower B recessed to locate Fire Curtain Externally

KEYPLAN	Department Legend
	Circulation
	Cleaners Store
	Co-Living Amenities
	Plant Room
	Services
	Store
	Student Amenities



CLIENT
iQ Student Accommodation

STATUS
S2

PURPOSE FOR ISSUE
FOR TENDER

SR NO.
5426

DRAWING NO.
ECHO-SRA-XX-00-DR-A-20100

REV.
P14

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Figures relate to the likely areas of the building at the current stage of the design and are calculated using one of the following (as stated in the accompanying areas schedule) IPMS1, IPMS2, IPMS 3, Gross External Area (GEA), Gross Internal Area (GIA) or Net Internal Area (NIA) methods of measurement from the RICS Property Measurement 1st edition.

- Ownership Boundary
- Application Boundary
- - - - - Fire Curtain
- - - - - 4.5 m Clearance from Railway Viaduct
- - - - - 2.75 m Clearance Zone from Overhead Line Equipment (OLE) taken from the Railway Viaduct

REV.	DATE	AMENDMENT
P03	14/05/17	Ground and Lower Ground rearranged following reintroduction of nursery
P04	18/08/17	Background Planning Layouts
P05	12/09/17	Coordinated with 5426-SRA-00-ZZ-SSH-A-00-906
P06	15/12/17	1st Stage Tender
P07	12/02/18	Stage 3 Frozen Layouts
P08	22/02/18	Refined Layouts to Incorporate Design Team Comments
P09	27/03/18	Updated in line with comments
P10	13/04/18	Stage 3 Approval
P11	19/10/18	Revised Stage 3 - Agreed VE and Client Changes (Basement below Tower C omitted, main plant room reduced in size, Core A adjusted, changes to Lift Cores to KONE specifications, FFL/SSL Raised)
P12	30/11/18	Stage 4a GAs - Laundry layout amended to specialist requirements/ Contig wall along Granby Row flattened/ Contig Wall on Vinto Gardens replaced concrete wall and layout adjacent to this area adjusted/ Room for VRF units added to main plant room
P13	01/03/19	Stage 4a Amendments - SA Laundry and Store relocated to accommodate M+E Riser. Wall on GL-12 moved to suit latest structural model

KEYPLAN
Department Legend
■ Circulation
■ Cleaners Store
■ Functional Amenities
■ Plant Room
■ Services
■ Store



CLIENT

iQ Student Accommodation



STATUS
S2

PURPOSE FOR ISSUE
FOR TENDER

SR NO.
5426

DRAWING NO.
ECHO-SRA-XX-B1-DR-A-20099

REV.
P13

SHEPPARD ROBSON

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SCALE@A1 DATE ORIGINATOR CHECKED AUTHORISED
1 : 100 03/07/17 AC ET RG

PROJECT
Echo Street
Lower Ground Floor Plan

ECHO STREET ABOVE



-  Cable Percussive with Rotary Core Follow-on
-  Machine Excavated Trial Pits
-  Denotes the borehole is installed
-  Window Sample Borehole (September 2019)

Rev:	Description:	Date:	By:	Chkd:
------	--------------	-------	-----	-------



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Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

Echo Street, Additional SI

Drg Title:

Additional SI Exploratory Hole
Location Plan

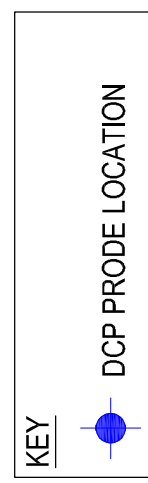
Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	07/09/2019	AHW	NF

Drg No:	Rev:
065374-CUR-00-XX-DR-GE-006-V02	/

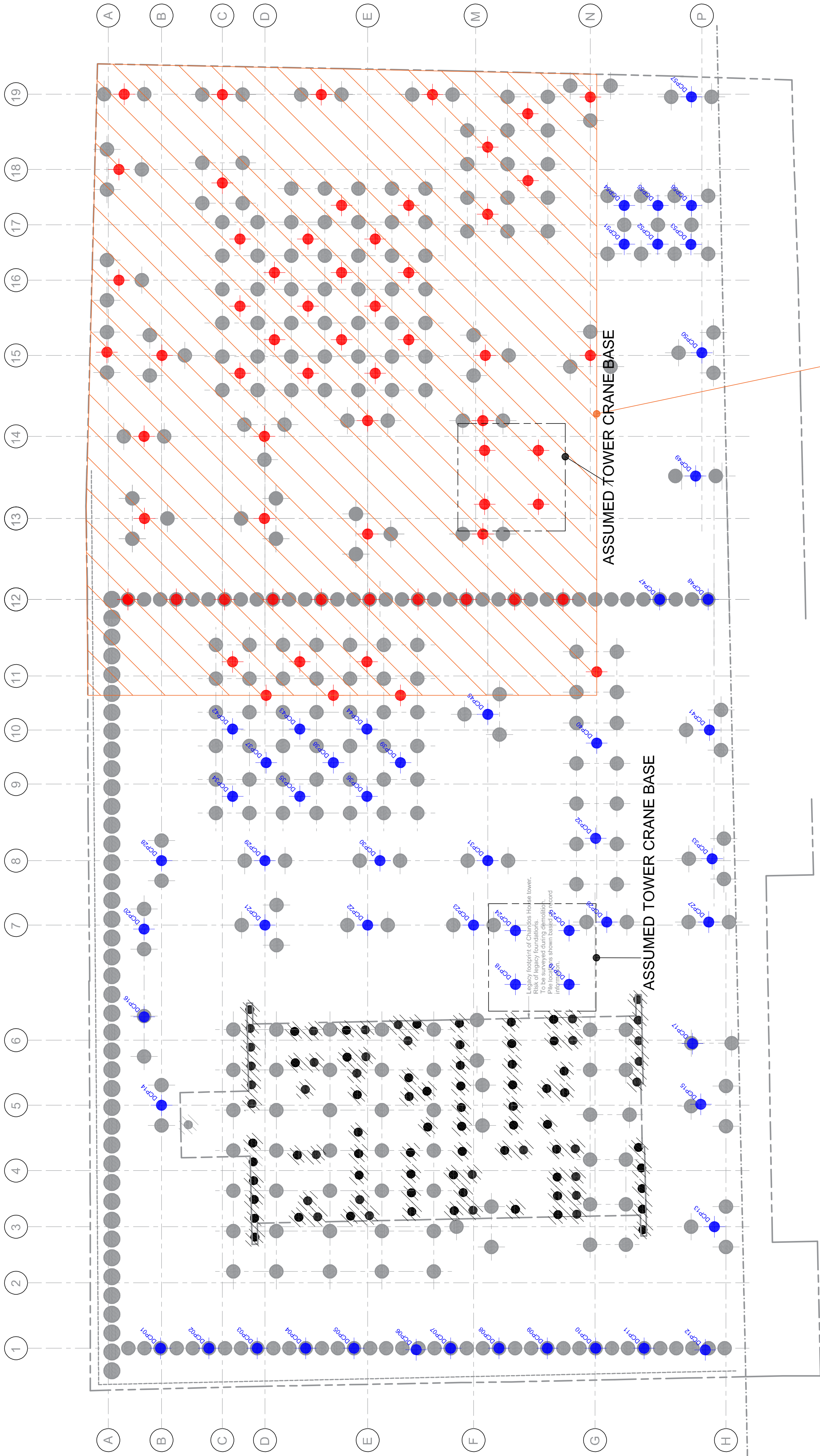
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GENERAL NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
4. FOR GENERAL NOTES REFER TO DRAWING.



NB:
**ALL EXPLORATORY HOLE LOCATIONS
HAVE BEEN SURVEYED**



ASSUMED "**MEDIUM RISK**" UXO AREA, AS PER '1ST LINE DEFENCE REPORT'

" MEDIUM RISK " UXO PROBE POSITIONS (TO BE UNDERTAKEN BY OTHERS)	- 62 Nr
PROBE POSITIONS OUTSIDE THE "MEDIUM RISK" UXO AREA (UNDERTAKEN BY CURTINS)	- 56 Nr

Project: **ECHO STREET
MANCHESTER**

OBSTRUCTION PROBING, DYNAMIC CONE PENETRATION (DCP) TESTING LOCATION PLAN

Size:	Date:	Drawn By:	Designed By:	Checked By:
A1	10/09/19			
Scale:	NTS	MH	NF	NF
Project No:	Originator:	Level:	Type:	Discipline: Category/Number:
005374 - CUR - 00 - XX - DR - GE - 009 - V01				

Appendix B Exploratory Hole Logs

- Cable Percussive & Rotary Boreholes BH201-BH203
- Trial Pits TP201-TP215
- Trial Pits TP101A, TP102A, TP103A
- B065374-SK001-005
- Dynamic Cone Penetration Logs DCP01-57
- Window Sample Borehole Log WS215



Borehole Log

Borehole No.

BH201

Sheet 1 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 38.39

Scale
1:50

Client: IQ Student Accommodation

Dates: 02/07/2019 - 04/07/2019

Logged By
AHW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.32	ES		0.09 0.30 0.40 0.56	38.30 38.09 37.99 37.83		MADE GROUND: Black ASPHALT.	1
								MADE GROUND: Brown silty sandy GRAVEL with rare cobbles. Gravel is fine to medium, sub-angular to angular of limestone and concrete. Cobbles of sandstone.	
		1.20		N=6 (1,1/1,1,2,2)	1.10	37.29		MADE GROUND: Brown slightly clayey GRAVEL with rare cobble of brick. Gravel is fine, sub-rounded to angular of mixed lithologies including, ash, clinker and brick. Cobble of brick.	2
		2.00		N=3 (1,0/1,1,0,1)				MADE GROUND: Brown slightly gravelly CLAY. Gravel is fine, sub-rounded to sub-angular of brick, mudstone, siltstone and sandstone.	
		2.40	ES					MADE GROUND: Reddish brown slightly clayey gravelly fine to coarse SAND with occasional cobbles. Gravel is fine to medium, sub-rounded to sub-angular of mixed lithologies including brick, concrete and sandstone. Cobbles of brick.	3
		3.00 - 3.45	U	Ublow=59	2.70	35.69		MADE GROUND: Brown slightly gravelly CLAY. Gravel is fine, sub-rounded to sub-angular of siltstone, mudstone, sandstone brick and concrete.	
		3.45 - 3.50	D					Firm light brown with dark brown mottling sandy CLAY. Occasional fine sub-rounded to sub-angular gravel of mudstone and siltstone.	4
		3.70	ES					Occasional specs of black.	
		4.00		N=16 (2,2/3,4,4,5)	3.90	34.49		Stiff brown with occasional grey mottling slightly gravelly silty CLAY. Gravel is fine, sub-rounded to sub-angular gravel of mudstone and siltstone. Rare specks of black.	5
		5.00 - 5.45	U	Ublow=87				Stiff CLAY with occasional sand bands.	
		5.45 - 5.50	D					Weathered sandstone recovered as very dense orangish red clayey fine to medium SAND. Occasional nodules of brown clay.	6
		6.00		N=24 (3,4/5,6,6,7)				Red weathered SANDSTONE	
		7.00	D		7.00	31.39		Assumed zone of core loss.	7
		7.20	B		7.20	31.19		Assumed zone of core loss.	
		7.50		50 (15,10/50 for 85mm)				Assumed zone of core loss.	8
		8.20	B					Assumed zone of core loss.	
		8.40		50 (25 for 45mm/50 for 40mm)	8.40	29.99		Assumed zone of core loss.	9
		8.60		50 (25 for 40mm/50 for 30mm)	8.65	29.74		Assumed zone of core loss.	
								Assumed zone of core loss.	10
								Assumed zone of core loss.	
								Assumed zone of core loss.	

Continued on next sheet

Remarks

Groundwater encountered at 11.20m bgl. Hand pit excavated to 1.20m bgl. Hand pit extended north due to obstruction of brick at 0.60m bgl.





Borehole Log

Borehole No.

BH201

Sheet 2 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 38.39

Scale
1:50

Client: IQ Student Accommodation

Dates: 02/07/2019 - 04/07/2019

Logged By
AHW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.60		50 (25 for 130mm/50 for 155mm)	10.10	28.29			
								Assumed zone of core loss.	11
								Assumed zone of core loss.	
								Weak to moderately strong orange fine SANDSTONE.	12
								Assumed zone of core loss.	
								Weak to moderately strong orange fine SANDSTONE. <i>Closely spaced pinkish orange banding, fine grain size.</i>	13
									14
									15
									16
									17
				18					
				18.60	19.79		Assumed zone of core loss.	19	
				19.60	18.79		End of borehole at 19.60 m	20	

Remarks

Groundwater encountered at 11.20m bgl. Hand pit excavated to 1.20m bgl. Hand pit extended north due to obstruction of brick at 0.60m bgl.





Rotary Core Log

Borehole No.

BH201

Sheet 1 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 38.39

Scale
1:50

Client: IQ Student Accommodation

Dates: 02/07/2019 - 04/07/2019

Logged By
AHW

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		0.32	ES				0.09	38.30		MADE GROUND: Black ASPHALT.	1
							0.30	38.09		MADE GROUND: Brown silty sandy GRAVEL with rare cobbles. Gravel is fine to medium, sub-angular to angular of limestone and concrete. Cobbles of sandstone.	
							0.40	37.99			
							0.56	37.83			
		2.40	ES				1.10	37.29		MADE GROUND: Blackish dark grey slightly clayey sandy ashy GRAVEL with rare cobble of brick. Gravel is fine, sub-rounded to angular of mixed lithologies including, ash, clinker and brick. Cobble of brick.	
							2.70	35.69		MADE GROUND: Brown slightly gravelly CLAY. Gravel is fine, sub-rounded to sub-angular of brick, mudstone, siltstone and sandstone.	
										MADE GROUND: Reddish brown slightly clayey gravelly fine to coarse SAND with occasional cobbles. Gravel is fine to medium, sub-rounded to sub-angular of mixed lithologies including brick, concrete and sandstone. Cobbles of brick.	
										MADE GROUND: Brown slightly gravelly CLAY. Gravel is fine, sub-rounded to sub-angular of siltstone, mudstone, sandstone brick and concrete.	
		3.00 - 3.45	U				3.90	34.49		Firm light brown with dark brown mottling sandy CLAY. Occasional fine sub-rounded to sub-angular gravel of mudstone and siltstone. Occasional specs of black.	
		3.45 - 3.50	D								
		3.70	ES								
		5.00 - 5.45	U							Stiff brown with occasional grey mottling slightly gravelly silty CLAY. Gravel is fine, sub-rounded to sub-angular gravel of mudstone and siltstone. Rare specks of black.	4
		5.45 - 5.50	D							Stiff brown with occasional grey mottling slightly gravelly silty CLAY. Gravel is fine, sub-rounded to sub-angular gravel of mudstone and siltstone. Rare specks of black.	5
		7.00	D							Stiff brown with occasional grey mottling slightly gravelly silty CLAY. Gravel is fine, sub-rounded to sub-angular gravel of mudstone and siltstone. Rare specks of black.	6
7.20	B				Stiff brown with occasional grey mottling slightly gravelly silty CLAY. Gravel is fine, sub-rounded to sub-angular gravel of mudstone and siltstone. Rare specks of black.	7					
8.20	B				Stiff brown with occasional grey mottling slightly gravelly silty CLAY. Gravel is fine, sub-rounded to sub-angular gravel of mudstone and siltstone. Rare specks of black.	8					
8.60 - 10.10							7.00	31.39		Stiff CLAY with occasional sand bands.	9
							7.20	31.19		Weathered sandstone recovered as very dense orangish red clayey fine to medium SAND. Occasional nodules of brown clay.	
							8.40	29.99			
										Red weathered SANDSTONE	10
										Assumed zone of core loss.	
										Continued on next sheet	

Remarks

Groundwater encountered at 11.20m bgl. Hand pit excavated to 1.20m bgl. Hand pit extended north due to obstruction of brick at 0.60m bgl.





Rotary Core Log

Borehole No.

BH201

Sheet 2 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 38.39

Scale
1:50

Client: IQ Student Accommodation

Dates: 02/07/2019 - 04/07/2019

Logged By
AHW

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		10.10 - 11.10		0	0	0	10.10	28.29		Assumed zone of core loss.	
		11.10 - 11.60		0	0	0	11.10	27.29		Assumed zone of core loss.	11
		11.60 - 12.60		40	19	0	11.60	26.79		Weak to moderately strong orange fine SANDSTONE.	12
		12.60 - 13.10		0	0	0	12.60	25.79		Assumed zone of core loss.	
		13.10 - 14.10		95	89	59	13.10	25.29		Weak to moderately strong orange fine SANDSTONE. <i>Closely spaced pinkish orange banding, fine grain size.</i>	13
		14.10 - 15.10		75	71	0					14
		15.10 - 16.60		73	55	37				<i>Orange cream mineralisation, possibly calcite</i>	15
		16.60 - 17.60		30	25	0					16
		17.60 - 18.60		90	53	38					17
		18.60 - 19.60		0	0	0	18.60	19.79		Assumed zone of core loss.	18
							19.60	18.79		End of borehole at 19.60 m	19
											20

Remarks

Groundwater encountered at 11.20m bgl. Hand pit excavated to 1.20m bgl. Hand pit extended north due to obstruction of brick at 0.60m bgl.





Borehole Log

Borehole No.

BH202

Sheet 1 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 40.10

Scale
1:50

Client: IQ Student Accommodation

Dates: 04/07/2019 - 08/07/2019

Logged By
AHW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.35	39.75		MADE GROUND: Greyish brown sandy GRAVEL with rare cobbles. Gravel is fine to coarse, sub-angular to angular of mixed lithologies including brick and concrete. Cobbles of concrete. Rare pieces of plastic and fragments of wood.	
		0.60	ES		0.80	39.30		MADE GROUND: Reddish brown clayey sandy GRAVEL. Gravel is fine to medium, sub-rounded to angular of mixed lithologies including brick and concrete.	1
		1.20		N=18 (2,2/3,4,5,6)	1.30	38.80		MADE GROUND: Brown gravelly CLAY. Gravel is fine to medium sub-rounded to angular of brick, concrete, siltstone and mudstone.	
		2.00 - 2.45	U	Ublow=91				Stiff brown slightly silty gravelly CLAY. Gravel is fine, rounded to sub-angular of mudstone and siltstone. Occasional red sand lenses.	2
		2.45 - 2.50	D						
		3.00	ES						3
		3.00		N=25 (7,8/7,7,6,5)					
		3.70	D						
		4.00 - 4.45	U	Ublow=96					4
		4.45 - 4.50	D						
		5.00		50 (9,13/50 for 155mm)	5.00	35.10		Very stiff brown gravelly very sandy CLAY. Gravel is fine to coarse, rounded to sub-angular of quartz, sandstone, mudstone and siltstone.	5
		5.20	D		5.50	34.60		Rare larger gravels of sandstone.	
		5.60	B					Very dense light brown SAND and GRAVEL. Gravel is fine to medium, rounded to sub-angular of mixed lithologies.	6
		6.00		50 (7,13/50 for 210mm)					
		6.50	B		6.40	33.70		Weathered sandstone recovered as, very dense reddish brown slightly clayey fine to medium SAND.	7
		7.50		50 (25 for 10mm/50 for 95mm)	7.50	32.60		Reddish brown slightly weathered SANDSTONE.	
		7.60		50 (25 for 10mm/50 for 20mm)	7.63	32.47		Weak pink orange fissile fine SANDSTONE.	
		7.80		50 (25 for 65mm/50 for 40mm)	7.80	32.30		Assumed zone of core loss.	8
									9
									10

Continued on next sheet

Remarks

No Groundwater encountered.





Borehole Log

Borehole No.

BH202

Sheet 2 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

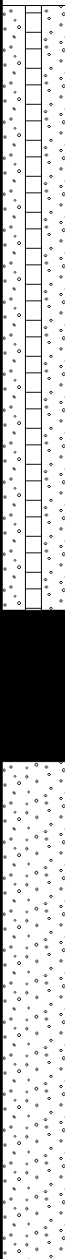
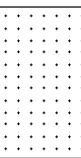
Level: 40.10

Scale
1:50

Client: IQ Student Accommodation

Dates: 04/07/2019 - 08/07/2019

Logged By
AHW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.30		50 (25 for 75mm/50 for 40mm)					11
					13.80	26.30			12
					14.80	25.30			13
								Weak pink orange fissile fine SANDSTONE.	14
								Assumed zone of core loss.	15
									16
									17
									18
		18.30		50 (25 for 60mm/50 for 45mm)	18.30	21.80		End of borehole at 18.30 m	19
									20

Remarks

No Groundwater encountered.







Rotary Core Log

Borehole No.

BH202

Sheet 2 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 40.10

Scale
1:50

Client: IQ Student Accommodation

Dates: 04/07/2019 - 08/07/2019

Logged By
AHW

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		9.80 - 10.30		0	0	0	13.80	26.30			11
		10.30 - 11.30		0	0	0					
		11.30 - 12.30		0	0	0					
		12.30 - 12.80		0	0	0					
		12.80 - 13.30		0	0	0					
		13.30 - 13.80		0	0	0					
		13.80 - 14.30		20	0	0					
		14.30 - 14.80		60	50	0					
		14.80 - 15.30		0	0	0					
		15.30 - 15.80		0	0	0					
		15.80 - 16.80		0	0	0					
		16.80 - 17.30		0	0	0					
		17.30 - 17.80		0	0	0					
		17.80 - 18.36		0	0	0					
							18.30	21.80		End of borehole at 18.30 m	18
											19
											20

Remarks

No Groundwater encountered.





Borehole Log

Borehole No.

BH203

Sheet 1 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 40.85

Scale
1:50

Client: IQ Student Accommodation

Dates: 09/07/2019 - 10/07/2019

Logged By
AHW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.16			0.16	40.69		MADE GROUND: CONCRETE with rebar and orange and black wires.	
		0.40	ES		0.60	40.25		MADE GROUND: Brownish grey sandy GRAVEL. Gravel is fine to coarse, sub-angular to angular of limestone and concrete.	1
		1.20		N=13 (6,9/5,5,2,1)				MADE GROUND: Brown sandy gravelly CLAY. Gravel is fine to medium, sub-rounded to angular of mixed lithologies including brick, concrete and sandstone.	
		1.60	ES						
		2.00		N=38 (4,6/8,9,11,10)	2.20	38.65			2
		2.30	D					Very stiff brown with occasional grey mottling sandy slightly gravelly CLAY. Gravel is fine to medium, sub-rounded to sub-angular of mudstone, siltstone and sandstone.	
		3.00 - 3.45	U	Ublow=111					3
		3.20	ES						
		3.45 - 3.50	D						
		4.00		N=28 (2,5/6,7,7,8)					4
		4.30	D						
		5.00 - 5.45	U	Ublow=102					5
		5.45 - 5.50	D						
		6.00		50 (11,17/50 for 190mm)					6
		6.70	B						
		7.00	D						7
		7.50		50 (11,20/50 for 105mm)	7.45	33.40		Weathered sandstone recovered as, very dense reddish brown silty clayey fine to medium SAND. Occasional fine to medium, sub-rounded to sub-angular gravel of mudstone and siltstone. Red weathered SANDSTONE.	8
					7.80	33.05			
		8.50		50 (25 for 50mm/50 for 25mm)	8.57	32.28		Assumed zone of core loss.	9
		8.90		50 (25 for 100mm/50 for 40mm)					
					9.40	31.45		Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	
					9.90	30.95			10

Continued on next sheet

Remarks

Groundwater encountered at 10.20m bgl. Hand pit excavated to 1.20m bgl.





Borehole Log

Borehole No.

BH203

Sheet 2 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 40.85

Scale
1:50

Client: IQ Student Accommodation

Dates: 09/07/2019 - 10/07/2019

Logged By
AHW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		19.50		50 (25 for 60mm/50 for 20mm)	19.50	21.35		Assumed zone of core loss.	11
								Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	
								Assumed zone of core loss.	12
									13
									14
									15
								Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz. <i>Becoming weak to medium strong, no gravel noted.</i>	16
								Assumed zone of core loss.	
								Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	17
									18
								Assumed zone of core loss.	
								Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	19
			End of borehole at 19.50 m	20					

Remarks

Groundwater encountered at 10.20m bgl. Hand pit excavated to 1.20m bgl.





Rotary Core Log

Borehole No.

BH203

Sheet 1 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 40.85

Scale
1:50

Client: IQ Student Accommodation

Dates: 09/07/2019 - 10/07/2019

Logged By
AHW

Well	Water Strikes	Depth (m)	Type / Fl	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		0.40	ES				0.16 0.60	40.69 40.25		MADE GROUND: CONCRETE with rebar and orange and black wires. MADE GROUND: Brownish grey sandy GRAVEL. Gravel is fine to coarse, sub-angular to angular of limestone and concrete. MADE GROUND: Brown sandy gravelly CLAY. Gravel is fine to medium, sub-rounded to angular of mixed lithologies including brick, concrete and sandstone.	1
		1.60	ES								2
		2.30	D				2.20	38.65			
		3.00 - 3.45	U								3
		3.20	ES								
		3.45 - 3.50	D								4
		4.30	D								
		5.00 - 5.45	U								5
		5.45 - 5.50	D								6
		6.70	B								
		7.00	D								7
							7.45	33.40			8
							7.80	33.05			
		8.60 - 8.90		0	0	0	8.57	32.28		Assumed zone of core loss.	9
		8.90 - 9.40		0	0	0					
		9.40 - 9.90		40	0	0	9.40	31.45		Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	10
							9.90	30.95			

Continued on next sheet

Remarks

Groundwater encountered at 10.20m bgl. Hand pit excavated to 1.20m bgl.





Rotary Core Log

Borehole No.

BH203

Sheet 2 of 2

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
CP+RC

Location: Echo Street, Manchester

Level: 40.85

Scale
1:50

Client: IQ Student Accommodation

Dates: 09/07/2019 - 10/07/2019

Logged By
AHW

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		9.90 - 10.40		0	0	0				Assumed zone of core loss.	
		10.40 - 10.90		0	0	0					
		10.90 - 11.40		0	0	0	11.40	29.45			
		11.40 - 11.90		20	0	0	11.90	28.95		Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	
		11.90 - 12.40		0	0	0				Assumed zone of core loss.	12
		12.40 - 12.90		0	0	0					
		12.90 - 13.40		0	0	0					13
		13.40 - 13.90		0	0	0					
		13.90 - 14.40		0	0	0					14
		14.40 - 14.90		0	0	0					
		14.90 - 15.50		0	0	0	15.50	25.35		Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz. <i>Becoming weak to medium strong, no gravel noted.</i>	16
		15.50 - 16.00		80	30	0					
		16.00 - 16.50		80	40	26	16.50	24.35		Assumed zone of core loss.	
		16.50 - 17.00		0	0	0					
		17.00 - 17.50		100	48	48	17.00	23.85		Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	17
		17.50 - 18.00		80	50	32					
		18.00 - 18.50		80	26	0	18.50	22.35		Assumed zone of core loss.	
		18.50 - 19.00		0	0	0					
		19.00 - 19.50		60	34	0	19.00	21.85		Extremely weak fissile fine SANDSTONE with infrequent round fine gravel of quartz.	19
							19.50	21.35		End of borehole at 19.50 m	20

Remarks

Groundwater encountered at 10.20m bgl. Hand pit excavated to 1.20m bgl.





Trial Pit Log

Trialpit No

TP201

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 38.50Date
09/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Depth
1.35

0.6

Scale
1:25Logged
AHW

Client: IQ Student Accommodation

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.08			0.08	38.42		MADE GROUND: Black ASPHALT.	
	0.45	ES		0.45	38.05		MADE GROUND: Brown silty sandy GRAVEL with occasional cobbles. Gravel is fine to medium, sub-angular to angular of limestone. Cobbles of limestone and concrete.	
	0.56			0.56	37.94		MADE GROUND: Blackish dark brown ashy GRAVEL. Gravel is fine to medium, sub-rounded to angular of mixed lithologies including ash and coal.	
	0.75	ES					MADE GROUND: Brown sandy gravelly CLAY with frequent cobbles. Gravel is fine to coarse, sub-rounded to angular of mixed lithologies including brick, concrete and sandstone. Cobbles of brick, limestone and sandstone. (Hydrocarbon odour). <i>At 0.73m fibrous (man made) wood. Timber of wood within the top of the clay.</i>	1
	1.33			1.33	37.17		MADE GROUND: CONCRETE.	
	1.35			1.35	37.15		End of pit at 1.35 m	

Remarks: No Groundwater encountered.
JCB 800 tonne excavated.
Trial pit ended at 1.35m due to concrete obstruction, (possibly the top of sewage storm water service).

Stability: Stable.





Trial Pit Log

Trialpit No

TP202

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 38.44Date
09/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Depth
0.80

0.6

Scale
1:25Logged
AHW

Client: IQ Student Accommodation

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.35	ES		0.10 0.24 0.50 0.72 0.80	38.34 38.20 37.94 37.64	    	MADE GROUND: Black ASPHALT. MADE GROUND: Brown silty sandy GRAVEL with occasional cobbles. Gravel is fine to medium, sub-angular to angular of limestone. Cobbles of limestone and concrete. MADE GROUND: Blackish grey sandy ashy GRAVEL. Gravel is fine, sub-rounded to angular of mixed lithologies including, ash and brick. MADE GROUND: Brown gravelly CLAY. Gravel is fine to coarse, sub-rounded to angular of mixed lithologies including brick, concrete and slate. Rare pieces of metal wire and potential asbestos cement. Occasional fragments of wood (fibrous). <i>At 0.50m a single layer of bricks.</i> End of pit at 0.80 m

1

2

3

4

5

Remarks:

No Groundwater encountered.
JCB 800 tonne excavated.
Trial Pit terminated at 0.80m bgl due to potential asbestos cement identified. Therefore the Environmental and WAC sample wanted by Vinci at 1.50m had to instead be taken at 0.80m bgl.
An additional environmental sample taken at 0.35m bgl as instructed by Vinci and sample taken of potential asbestos at 0.72m bgl.

Stability: Stable.





Trial Pit Log

Trialpit No

TP203

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 38.44Date
09/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

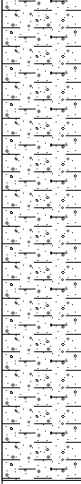
2

Client: IQ Student Accommodation

Depth
2.00

0.6

Scale
1:25Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.65	ES		0.10 0.27 0.35	38.34 38.17 38.09	  	MADE GROUND: Black ASPHALT. MADE GROUND: Brown silty sandy GRAVEL with occasional cobbles. Gavel is fine to medium, sub-rounded to angular of limestone and concrete. Cobbles of limestone. MADE GROUND: Blackish dark grey sandy ash GRAVEL. Gravel is fine, sub-rounded to angular of mixed lithologies including, brick, ash, sandstone. Occasional fragments of wood and plastic. Firm becoming very stiff brown with occasional grey mottling slightly sandy gravelly CLAY with rare cobbles. Gravel is fine to coarse, rounded to sub-rounded of mixed lithologies including siltstone, mudstone and sandstone. Cobbles of mixed lithologies. Rare sand bands.	1
				2.00	36.44		End of pit at 2.00 m	2
								3
								4
								5

Remarks: No Groundwater encountered.
JCB 800 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP204

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 41.00Date
09/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Depth
2.20

0.6

Scale
1:25Logged
AHW

Client: IQ Student Accommodation

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10	40.90		MADE GROUND: Black ASPHALT.	
				0.30	40.70		MADE GROUND: Brown silty sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of mixed lithologies including, ash, concrete and brick.	
				0.50	40.50		MADE GROUND: Blackish dark brown sandy ashy GRAVEL. Gravel is fine, sub-rounded to angular of mixed lithologies including ash, concrete and brick.	
				0.60	40.40		MADE GROUND: Brown sandy gravelly CLAY. Gravel is fine to coarse, sub-rounded to angular of brick, concrete and slate.	
	0.85	ES		0.80	40.20		MADE GROUND: BRICK (intact brick wall).	
							MADE GROUND: Brown sandy gravelly CLAY with occasional cobbles. Gravel is fine to coarse, sub-angular to angular of brick, concrete and slate. Cobbles of brick and sandstone. Occasional pieces of wood.	1
	1.35	ES		1.30	39.70		Soft to firm orangish brown slightly sandy gravelly silty CLAY. Gravel is fine to medium, sub-rounded to sub-angular gravel of mudstone, siltstone and sandstone. Rare tree roots.	2
				2.20	38.80		End of pit at 2.20 m	3
								4
								5

Remarks: No Groundwater encountered.
JCB 800 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP205

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 40.05Date
09/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

3

Scale
1:25

Client: IQ Student Accommodation

Depth
3.30Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	2.80	ES		0.50	39.55		MADE GROUND: Dark brown silty gravelly fine to medium SAND with occasional cobbles. Frequent rootlets. Cobbles of brick.	1
				0.90	39.15		MADE GROUND: Blackish grey silty ashy GRAVEL. Gravel is fine, sub-rounded to angular of mixed lithologies, including ash and brick.	
							MADE GROUND: Brown sandy gravelly CLAY. Gravel is fine to coarse, sub-rounded to angular of brick and slate. At 0.90m to 2.50m a curved brick wall present in the north side of the trial pit.	
				2.80	37.25		Soft to firm orangish brown with occasional grey mottling silty, sandy CLAY. Occasional fine to medium, sub-rounded to sub-angular gravel of mudstone, siltstone and sandstone.	3
				3.30	36.75		End of pit at 3.30 m	5

Remarks: Groundwater encountered at 2.30m bgl.
JCB 1300 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP206

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 40.00Date
09/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

3

Scale
1:25

Client: IQ Student Accommodation

Depth
2.50Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.34	39.66		MADE GROUND: Light grey sandy GRAVEL with occasional cobbles. Gravel is fine to medium, sub-angular to angular of limestone and concrete. Cobbles of brick. Rare pieces of ceramic and plastic.	
				0.70	39.30		MADE GROUND: Blackish dark grey sandy ashy GRAVEL. Gravel is fine, sub-angular to angular of ash. (Slight hydrocarbon odour).	
	2.30	ES					Firm becoming stiff brown with frequent grey mottling slightly silty gravelly CLAY. Gravel is fine to medium, rounded to sub-rounded of mixed lithologies including, siltstone sandstone and mudstone.	1
				2.50	37.50		End of pit at 2.50 m	2
								3
								4
								5

Remarks: No Groundwater encountered.
JCB 1300 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No
TP207
(East)
Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -
Level: 40.70

Date
10/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

3

Scale
1:25

Client: IQ Student Accommodation

Depth
4.00

Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	40.40		MADE GROUND: Brown silty gravelly fine to coarse SAND with occasional cobbles. Gravel is fine to coarse, sub-rounded to angular of concrete, brick and slate. Rare pieces of re bar, wire and plastic. Cobbles of brick.	
				0.55	40.15		MADE GROUND: Blackish dark grey sandy ashy GRAVEL. Gravel is fine, sub-angular to angular of mixed lithologies including, ash and brick.	
							MADE GROUND: BRICK (wall).	
							At 0.70m sandstone paving slabs.	
	1.20	ES		1.10	39.60		MADE GROUND: Blackish brown gravelly CLAY. (Strong hydrocarbon odour).	1
				1.60	39.10		Firm becoming stiff brown with occasional grey mottling slightly sandy gravelly CLAY. Gravel is fine to medium, rounded to sub-rounded of siltstone, sandstone and mudstone.	2
	4.00	ES		4.00	36.70		End of pit at 4.00 m	4
								5

Remarks: No Groundwater encountered.
JCB 1300 tonne excavated.
Trial pit logged separately in the east and west due to differing strata.

Stability: Stable.





Trial Pit Log

Trialpit No
TP207
(West)
Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -
Level: 40.70

Date
10/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

3

Scale
1:25

Client: IQ Student Accommodation

Depth
4.00

Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.25	40.45		MADE GROUND: Brown silty gravelly fine to coarse SAND, with occasional cobbles. Gravel is fine to coarse, sub-rounded to angular of concrete, brick and slate. Rare pieces of re bar, wire and plastic. Cobbles of brick.	
				0.50	40.20		MADE GROUND: Blackish dark grey sandy ashy GRAVEL. Gravel is fine, sub-angular to angular of mixed lithologies including, ash and brick.	
				0.68	40.02		MADE GROUND: BRICK.	
							MADE GROUND: Orangish brown sandy silty CLAY. <i>At 0.70m sandstone paving slabs.</i>	
				1.00	39.70		MADE GROUND: Blackish brown clayey gravelly fine to coarse SAND. Gravel is fine to medium, sub-rounded to angular of mixed lithologies including brick and ash.	1
				1.60	39.10		Firm becoming stiff brown with occasional grey mottling slightly sandy gravelly CLAY. Gravel is fine to medium, rounded to sub-rounded of siltstone, sandstone and mudstone.	2
								3
								4
								5
	4.00	ES		4.00	36.70		End of pit at 4.00 m	

Remarks: No Groundwater encountered.
JCB 1300 tonne excavated.
Trial pit logged separately in the east and west due to differing strata.

Stability: Stable.





Trial Pit Log

Trialpit No

TP208

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 41.13Date
10/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2.5

Scale
1:25

Client: IQ Student Accommodation

Depth
2.60Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10 0.14	41.03 40.99		MADE GROUND: Grey sandy GRAVEL with frequent cobbles. Gravel is angular, medium to coarse of concrete. Large cobbles and blocks of concrete. Occasional pieces of rebar.	
				0.34 0.44	40.79 40.69		MADE GROUND: Sandstone SLABS. MADE GROUND: Brown silty gravelly fine to coarse SAND. Gravel is fine to medium, sub-rounded to angular of limestone and concrete. MADE GROUND: Blackish dark grey sandy ashy GRAVEL. Gravel is fine, sub-angular to angular of mixed lithologies including ash and brick. <i>At 0.34 - 0.80m brick footing running north to south across the trial pit.</i> MADE GROUND: Orangish brown silty sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of mixed lithologies including brick. <i>At 1.00m a concrete footing.</i>	1
	1.70	ES		1.70	39.43		Firm becoming stiff brown with frequent grey mottling slightly sandy gravelly silty CLAY. Gravel is fine to medium, rounded to sub-rounded gravel of mixed lithologies including sandstone, siltstone and mudstone.	2
				2.60	38.53		End of pit at 2.60 m	3
								4
								5

Remarks: No Groundwater encountered.
JCB 1300 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP209

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 41.06Date
10/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

3

Scale
1:25

Client: IQ Student Accommodation

Depth
2.70Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.27 0.30	40.79 40.76		MADE GROUND: CONCRETE with re bar.
							MADE GROUND: Grey sandy GRAVEL. Gravel is angular, medium to coarse of concrete. MADE GROUND: Brown silty gravelly fine to coarse SAND. with occasional cobbles. Gravel is fine to coarse, sub-angular to angular of mixed lithologies, including, brick, concrete and slate. Cobbles of brick.
				1.00	40.06		Firm becoming stiff brown with frequent grey mottling slightly sandy silty CLAY.
	2.60	ES		2.70	38.36		End of pit at 2.70 m

Remarks: No Groundwater encountered.
JCB 1300 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP210

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 40.90Date
10/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

3

Scale
1:25

Client: IQ Student Accommodation

Depth
2.80Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	1.50	ES		0.15	40.75		MADE GROUND: Black ASPHALT.	1
				0.25	40.65		MADE GROUND: Grey sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of limestone.	
							MADE GROUND: Brown silty gravelly medium to coarse SAND with frequent cobbles. Gravel is fine to coarse, sub-rounded to angular of mixed lithologies including brick, concrete, limestone. Cobbles of brick. Rare fragments of wood.	
							At 0.25 - 2.50m brick wall on the north side of the trial pit.	
▼	1.60	ES		1.60	39.30		Firm becoming stiff brown with frequent grey mottling slightly sandy gravelly silty CLAY. Gravel is fine to medium rounded to sub-rounded of mudstone, siltstone and sandstone.	2
				2.80	38.10		End of pit at 2.80 m	
▼								3
								4
								5

Remarks: Groundwater encountered at 1.60m bgl.
JCB 1300 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP211

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 39.15Date
10/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Scale

1:25

Client: IQ Student Accommodation

Depth
1.30

0.6

Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.80	ES		0.13	39.02		MADE GROUND: CONCRETE.
				0.25	38.90		MADE GROUND: Brown sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of limestone.
				0.31	38.84		MADE GROUND: Blackish dark grey sandy ashy GRAVEL. Fine, sub-angular to angular gravel of mixed lithologies including brick and ash.
				0.44	38.71		At 0.25 - 0.70m a brick wall footing in the west and east of the trial pit. MADE GROUND: BRICK.
				0.80	38.35		Firm slightly gravelly CLAY. Gravel is fine to medium, sub-rounded to sub-angular gravel of mixed lithologies.
				0.90	38.25		At 0.55m a drain with slight water ingress. At 0.70 - 0.85m concrete sitting underneath the brick footing in the west and east of the trial pit.
							Soft to firm dark blackish brown CLAY.
							Firm becoming stiff brown with frequent grey mottling sandy silty gravelly CLAY. Gravel is fine to coarse, rounded to sub-angular of mudstone, siltstone and sandstone.
				1.30	37.85		End of pit at 1.30 m

1

2

3

4

5

Remarks: Groundwater encountered at 0.55m bgl.
JCB 800 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP212

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 39.16Date
10/07/2019

Location: Echo Street, Manchester

Dimensions (m): 2.5

Client: IQ Student Accommodation

Depth
1.40Scale
1:25Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	1.10	ES		0.13	39.03		MADE GROUND: CONCRETE with re bar. MADE GROUND: Brown sandy GRAVEL with occasional cobbles. Gravel is fine to coarse, sub-angular to angular of limestone. Cobbles of limestone. <i>At 0.24 - 1.10m Brick wall in the west of the trial pit.</i>
				1.40	37.76		End of pit at 1.40 m

Remarks: No Groundwater encountered.
JCB 800 tonne excavated.

Stability: Unstable.





Trial Pit Log

Trialpit No

TP213

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 40.10Date
10/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Scale
1:25

Client: IQ Student Accommodation

Depth
0.80

Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.70	ES		0.15	39.95		MADE GROUND: Cobble of CONCRETE.
				0.25	39.85		MADE GROUND: Brown sandy silty GRAVEL. Gravel is fine to coarse, sub-angular to angular of limestone.
				0.40	39.70		At 0.15 - 0.80m Brick wall in the west of the trial pit.
							MADE GROUND: Greyish brown silty gravelly fine to coarse SAND. Gravel is fine to medium, sub-rounded to sub-angular and mixed lithologies.
							At 0.35 - 0.80m Breeze block wall in the north of the trial pit.
				0.80	39.30		MADE GROUND: Brown gravelly CLAY. Gravel is fine to medium, sub-angular to angular of brick, concrete and coal.
							End of pit at 0.80 m

1

2

3

4

5

Remarks: Groundwater encountered at 0.75m bgl.
JCB 1300 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP214

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 41.00Date
11/07/2019

Location: Echo Street, Manchester

Dimensions (m): 2.5
Depth 2.15Scale
1:25Logged
AHW

Client: IQ Student Accommodation

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.15	40.85		MADE GROUND: CONCRETE with re bar and wires.
				0.45	40.55		MADE GROUND: Brownish grey sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of limestone. <i>At 0.30m clay pipe in the west side of the trial pit.</i>
				1.50	39.50		MADE GROUND: Brown sandy gravelly CLAY with occasional cobbles. Gravel is fine to coarse, sub-rounded to angular of concrete and limestone. Cobbles of brick. <i>At 0.85m Concrete wall running north to south.</i> <i>At 1.10m Disused drain.</i>
	1.85	ES		2.15	38.85		MADE GROUND: Firm becoming stiff brown with frequent grey mottling slightly sandy silty gravelly CLAY. Gravel is fine to medium, rounded to sub-rounded of mudstone, siltstone and sandstone. (Reworked Natural). <i>At 2.10 - 2.15m clay pipe running east to west.</i> End of pit at 2.15 m

Remarks: No Groundwater encountered.
JCB 800 tonne excavated.
Environmental sample taken at 1.85m bgl as instructed by Vinci.

Stability: +Stable.





Trial Pit Log

Trialpit No
TP215
(East)
Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -
Level: 40.95

Date
11/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Scale
1:25

Client: IQ Student Accommodation

Depth
1.80

Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							MADE GROUND: CONCRETE.
				0.20	40.75		
				0.27	40.68		
				0.30	40.65		MADE GROUND: Grey sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of limestone.
							MADE GROUND: Red silty fine to medium SAND.
							MADE GROUND: Brown slightly sandy CLAY.
				0.50	40.45		At 0.30m Brick wall in the north side of the trial pit.
	0.55	ES		0.60	40.35		MADE GROUND: Black ashy gravelly CLAY. Gravel is fine to medium, sub-angular to angular of coal, ash and brick.
							MADE GROUND: Brown sandy clayey GRAVEL. Gravel is fine to coarse, sub-rounded to angular of mixed lithologies including, brick, concrete, coal, slate and limestone.
							At 1.00m water encountered, coming from an old clay pipe.
				1.35	39.60		Firm becoming stiff brown with occasional grey mottling silty sandy CLAY.
	1.50	ES					
				1.80	39.15		End of pit at 1.80 m

Remarks: Groundwater encountered at 1.00m bgl.
JCB 800 tonne excavated.
Trial pit logged separately in the east and west due to differing strata.

Stability: Stable.





Trial Pit Log

Trialpit No
TP215
(West)
Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -
Level: 40.95

Date
11/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Scale
1:25

Client: IQ Student Accommodation

Depth
1.80

Logged
AHW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							MADE GROUND: CONCRETE.
				0.20	40.75		
				0.27	40.68		MADE GROUND: Grey sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of limestone.
				0.30	40.65		MADE GROUND: Red silty fine to medium SAND.
							MADE GROUND: Brown slightly sandy CLAY.
							At 0.30m Brick wall in the north side of the trial pit.
				0.55	40.40		MADE GROUND: Black ashy gravelly CLAY.
				0.60	40.35		Firm becoming stiff brown with occasional grey mottling silty sandy CLAY.
	1.50	ES					
				1.80	39.15		End of pit at 1.80 m

Remarks: Groundwater encountered at 1.00m bgl on the east of the trial pit.
JCB 800 tonne excavated.
Trial pit logged separately in the east and west due to differing strata.

Stability: Stable.





Trial Pit Log

Trialpit No

TP216

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004Co-ords: -
Level: 41.05Date
11/07/2019

Location: Echo Street, Manchester

Dimensions
(m):

2

Scale

1:25

Client: IQ Student Accommodation

Depth
1.80

Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.25 0.32	40.80 40.73		MADE GROUND: CONCRETE with rebar.
							MADE GROUND: Brown sandy GRAVEL. Gravel is fine to medium, sub-angular to angular of limestone.
							MADE GROUND: Brown silty sandy GRAVEL with occasional cobbles. Gravel is fine to medium, sub-rounded to angular of mixed lithologies including brick and concrete. Cobbles of brick.
							At 0.32 - 1.30m Brick wall in the south side of the trial pit.
							At 0.32 - 1.10m Brick wall in the north side of the trial pit.
							At 0.60m Drain.
	1.00	ES		0.90	40.15		MADE GROUND: Black ashy GRAVEL. Gravel is fine, sub-angular to angular of ash and coal.
				1.20	39.85		MADE GROUND: Firm becoming stiff brown with occasional grey mottling slightly sandy silty gravelly CLAY. Gravel is fine to medium, rounded to sub-rounded of siltstone, sandstone and mudstone. (Re worked natural).
				1.50	39.55		At 1.43m Disused sewage drain running east to west.
	1.70	ES		1.80	39.25		Firm becoming stiff brown with occasional grey mottling slightly sandy silty gravelly CLAY. Gravel is fine to medium, rounded to sub-rounded of siltstone, sandstone and mudstone.
							End of pit at 1.80 m

Remarks: No Groundwater encountered.
JCB 800 tonne excavated.

Stability: Stable.





Trial Pit Log

Trialpit No

TP101A

Sheet 1 of 1

Project Name: Echo Street Viaduct Foundation
InvestigataionProject No.
065374Co-ords: -
Level:Date
22/07/2019

Location: Echo Street, Manchester

Dimensions
(m):Depth
4.85Scale
1:25Logged
NF/MH

Client: IQ Student Accomodation

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.05			MADE GROUND: Asphalt MADE GROUND: Concrete	
				0.25			MADE GROUND: Dark brown slightly clayey slightly sandy gravel with cobbles. Gravel includes fine to coarse angular to sub-rounded ash and bricks. Cobbles are concrete and brick. Includes metal fragments. <i>Brick wall feature from 0.50m - 1.50m bgl on west side of trial pit.</i>	
				0.80			<i>Brick wall from 0.70m - 2.80m bgl on northern wall of trial pit.</i> MADE GROUND: Firm light brown mottled grey and dark brown in places, sandy slightly gravelly clay with occasional cobbles. Gravel is fine to coarse including ash, brick, coal, ceramics and white shells. Cobbles are half and hole bricks and sandstone. Sandstone sink noted.	1
				3.65			Soft and firm brown with occasional grey mottling slightly sandy slightly gravelly CLAY. Gravel is fine and medium angular to subrounded sandstone. Rare black pockets of sandy clay.	2 3 4
				4.85			End of pit at 4.85 m	5

Remarks: No groundwater encountered. See associated cross section sketch for detail of wall. No foundation identified. Narrow column of Made Ground directly adjacent to the viaduct wall to 3.65m bgl. Trial pit terminated at 4.85m bgl due to insufficient room to maneuver excavator to deepen trial pit, because of demolition scaffolding, and trial pit instability.

Stability: Unstable in made ground soils.





Trial Pit Log

Trialpit No
TP102A
Sheet 1 of 1

Project Name: Echo Street Viaduct Foundation Investigtaion

Project No.
065374

Co-ords: -
Level:

Date
22/07/2019

Location: Echo Street, Manchester

Dimensions (m):
Depth
5.00

Scale
1:25
Logged
NF/MH

Client: IQ Student Accomodation

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.05			MADE GROUND: Paving flags. MADE GROUND: Concrete. <i>Grey</i> <i>Green Grey.</i>	
				0.30			MADE GROUND: Dark Brown sandy gravel with cobbles and boulders. Gravel is fine to coarse of mixed lithologies including brick, ash, concrete, glass, clinker, mudstone as well as nails and metal fragments. Boulders and cobbles are of concrete and bricks. Metal sheeting on north side of pit which may represent a former tank, filled with scrap metal, cables and bricks. <i>Brick wall feature identified on east side of trial pit between 0.30m - 1.50m bgl.</i>	1
				2.60			Stiff to very stiff brown grey mottled slightly gravelly CLAY. Gravel is fine to coarse sub angular to sub rounded of mixed lithologies including sandstone and mudstone. <i>Made Ground appears to extend to base of hole immediately adjacent to viaduct.</i>	3
				4.60			Very dense light reddish brown medium grained SAND.	4
				5.00			End of pit at 5.00 m	5

Remarks: Significant groundwater ingress at 1.80m from north side of pit, slowed after approximately 3 minutes. Water seepage at 2.40m bgl. See associated cross section sketch for detail of wall. Base of viaduct pier identified. Narrow column of Made Ground directly adjacent to the viaduct wall to 3.60m bgl. Hole could not be extended to further depth due to reach of machine excavator.

Stability: Some side wall instability through through Made Ground deposits





Trial Pit Log

Trialpit No
TP103A
Sheet 1 of 1

Project Name: Echo Street Viaduct Foundation Investigataion

Project No.
065374

Co-ords: -
Level:

Date
22/07/2019

Location: Echo Street, Manchester

Dimensions (m):

Depth
5.00

Scale
1:25

Logged
NF/MH

Client: IQ Student Accomodation

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10			MADE GROUND: Asphalt	
				0.30			MADE GROUND: Dark brown and light brown GRAVEL. Gravel is fine to coarse, angular to sub-rounded gravel of mixed lithologies including limestone, sandstone and clinker. MADE GROUND: Dark brown slightly silty slightly gravelly clay. Gravel is fine to coarse of mixed lithologies including brick, ash, coal and sandstone. Frequent timber pieces with hydrocarbon odour noted on/around timber. <i>Drainage pipe encountered at the northwest corner of the trial pit between 0.30m - 0.40m bgl. orientated northeast to southwest.</i> <i>Polystyrene backed concrete directly adjacent to viaduct infilled wall.</i> <i>Large tree stump c.0.4-0.6m.</i>	1
				1.90			Stiff to very stiff brown grey mottled slightly gravelly CLAY. Gravel is fine to coarse sub angular to sub rounded of mixed lithologies including sandstone and mudstone. <i>Made Ground appears to extend to base of hole immediately adjacent to viaduct.</i>	2
				4.30			<i>Rare sandstone cobbles and boulders from 4.10m bgl.</i> Very dense light reddish brown medium grained SAND.	4
				5.00			End of pit at 5.00 m	5

Remarks: No groundwater ingress encountered. Narrow column of Made Ground directly adjacent to the viaduct wall to 2.60m bgl. No foundation identified. Trial pit terminated without uncovering foundation due to insufficient room to maneuver excavator.

Stability: Some side wall instability through Made Ground deposits.



Drg No:

B065374-SK001

Rev:

P01

Project: ECHO STREET VIADUCT FOUNDATION

Drg Title: TRIAL PIT 101

Drawn: MH

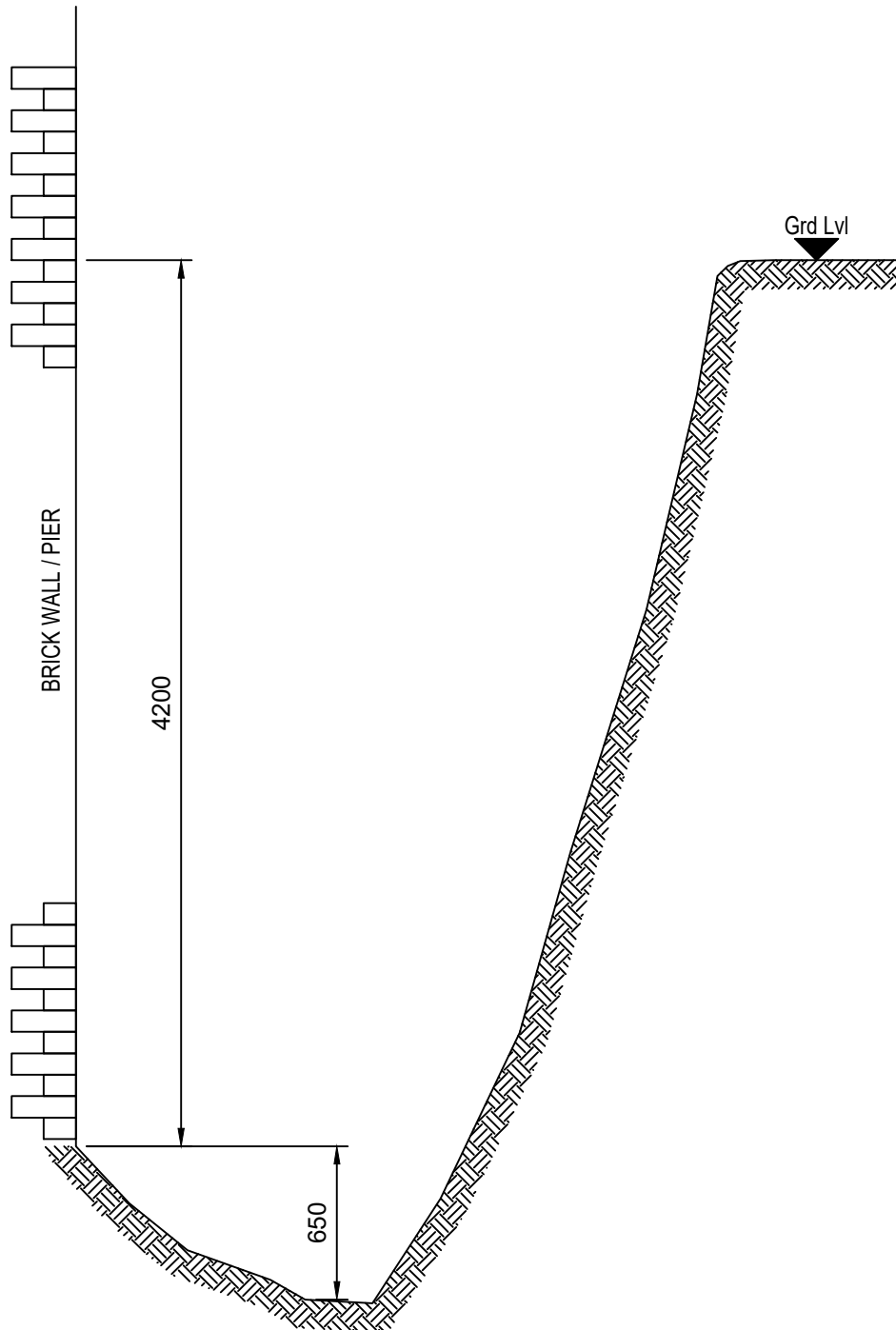
Checked: JJ

Scale: NTS



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NOTES

NO EVIDENCE OF FOUNDATIONS IDENTIFIED TO BASE OF HOLE.
REFER TO CURTINS TRIAL PIT LOG FOR STRATA DETAILS.
TRIAL PIT UNDERTAKEN AGAINST BRICK PIER.

Drg No:

B065374-SK002

Rev:

P01

Project: ECHO STREET VIADUCT FOUNDATION

Drg Title: TRIAL PIT 102 SKETCH A

Drawn: MH

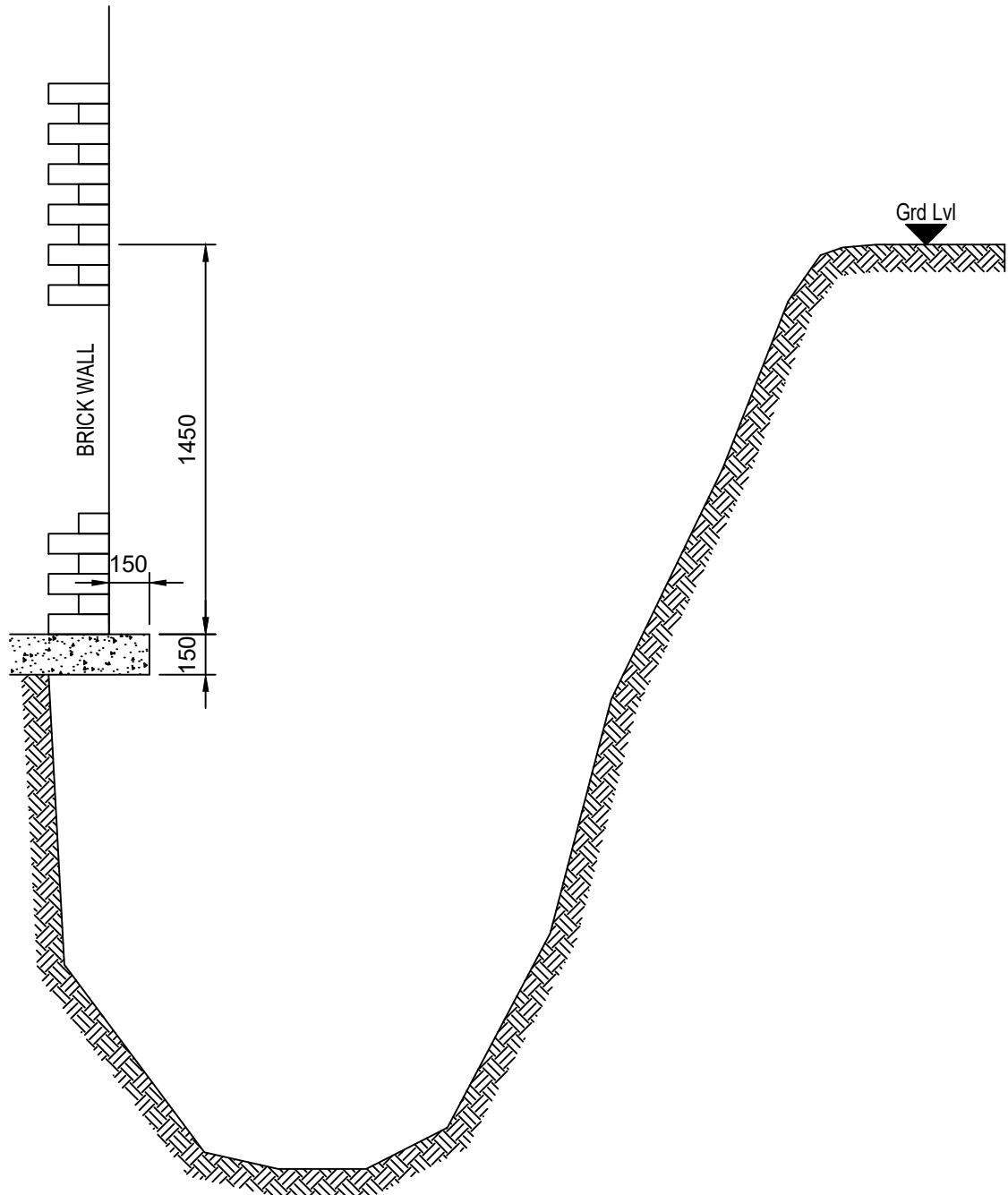
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Scale: NTS



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NOTES

BASE OF FOUNDATION IDENTIFIED NATURAL GROUND BELOW.
REFER TO CURTINS TRIAL PIT LOG FOR STRATA DETAILS.
TRIAL PIT UNDERTAKEN PARTLY AGAINST BRICK PIER AND
PARTLY AGAINST BRICK ARCH INFILL.

Drg No:

B065374-SK003

Rev:

P01

Project: ECHO STREET VIADUCT FOUNDATION

Drg Title: TRIAL PIT 102A SKETCH B

Drawn: MH

Checked: JJ

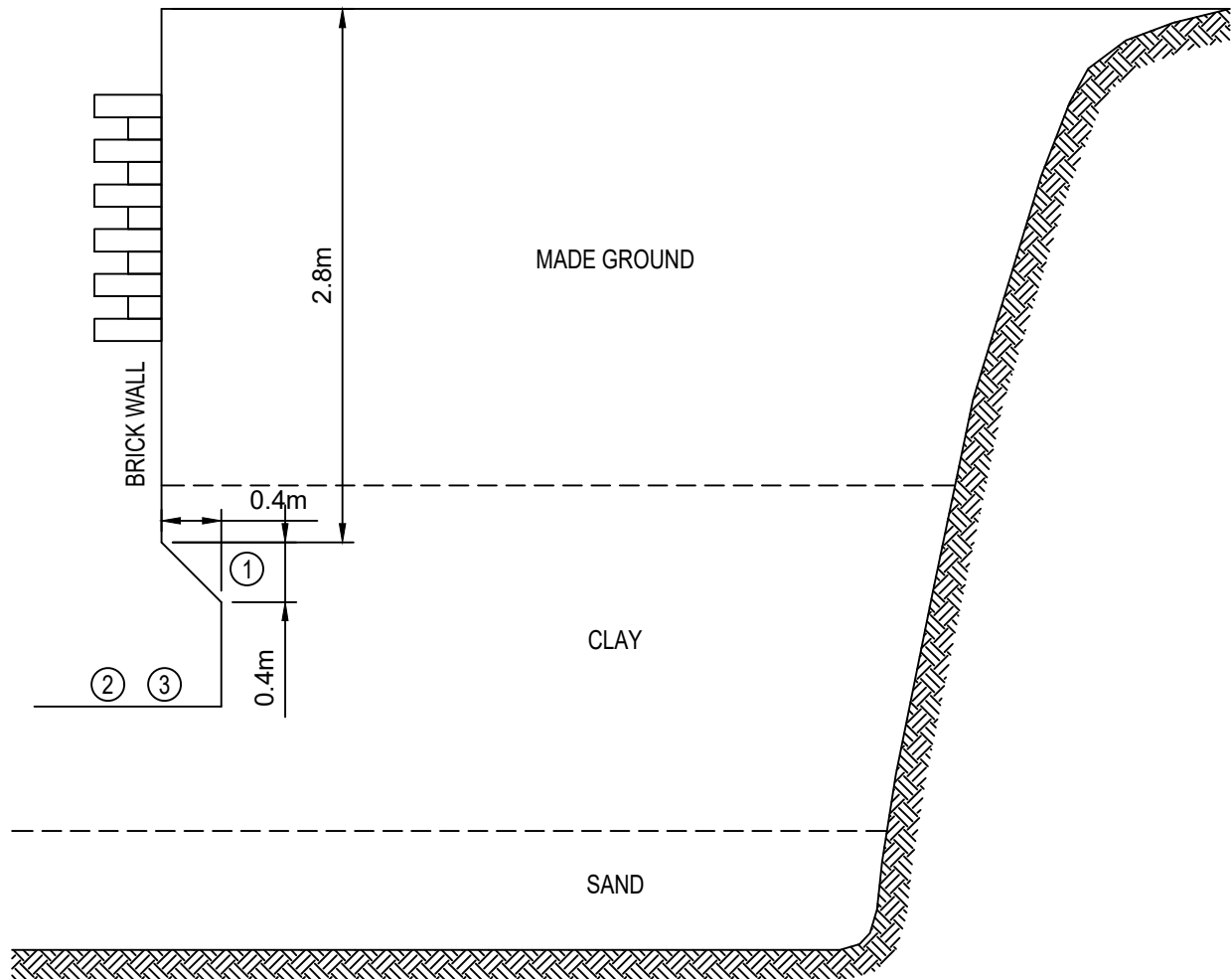
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FACING WEST



NOTES

1. BRICK WALL STEPS OUT 0.40m AT 2.80 bgl.
2. NO PROTRUDING FOUNDATION IDENTIFIED. BRICK WALL RESTS DIRECTLY ONTO UNDERLYING STIFF CLAY STRATA.
3. NO PROTRUDING FOUNDATION IDENTIFIED TO THE WEST. SEE SKETCH C FOR ADDITIONAL DETAILS.
4. REFER TO CURTINS TRIAL PIT LOG TP102A FOR STRATA DETAILS.
5. TRIAL PIT UNDERTAKEN PERPENDICULAR TO VIADUCT PIER.

Drg No:

B065374-SK004

Rev:

P01

Project: ECHO STREET VIADUCT FOUNDATION

Drg Title: TRIAL PIT 102A SKETCH C

Drawn: MH

Checked: JJ

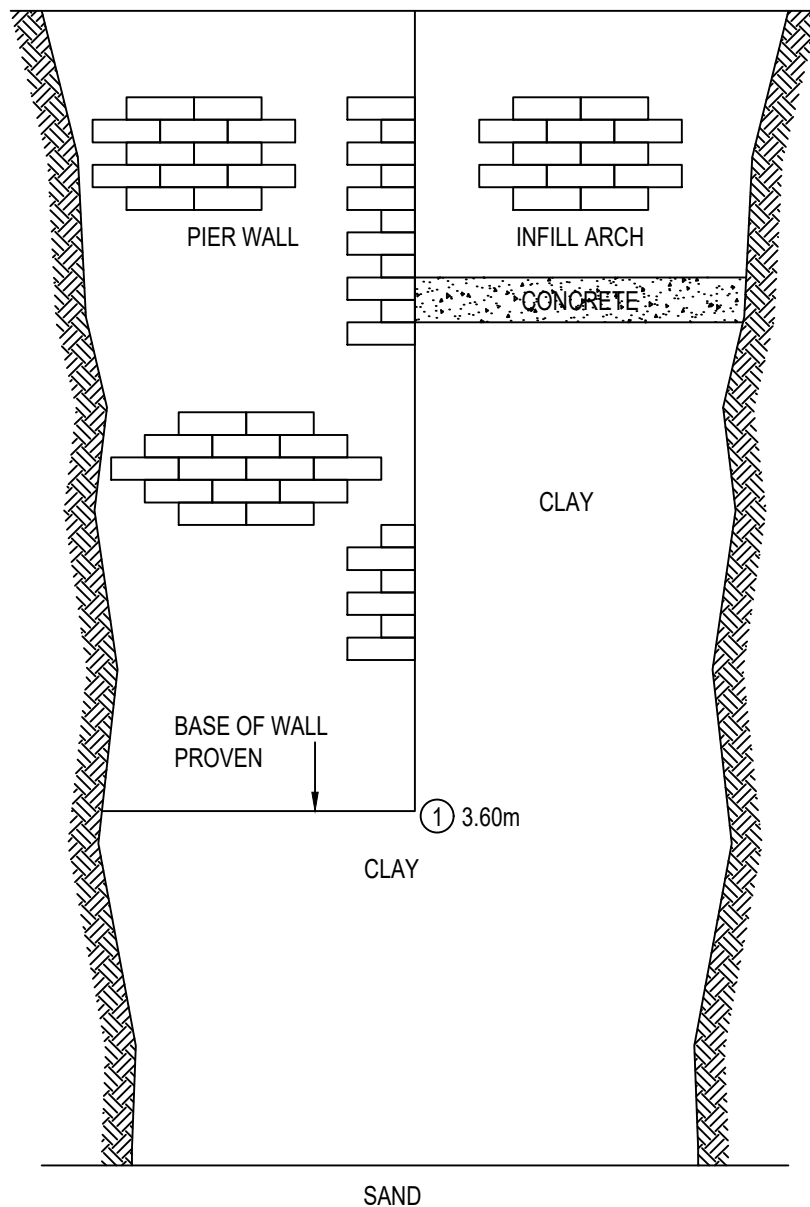
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FACING SOUTH



NOTES

1. NO FOUNDATIONS PROTRUDE WEST AT THE BASE OF THE VIADUCT PIER.
2. CONCRETE AT 1.45m bgl POTENTIALLY FOUNDATIONS OF BRICK INFILL. (ARCH).
3. REFER TO CURTINS TRIAL PIT LOG TP102A FOR STRATA DETAILS

Drg No:

B065374-SK005

Rev:

P01

Project: ECHO STREET VIADUCT FOUNDATION

Drg Title: TRIAL PIT 103A

Drawn: MH

Checked: JJ

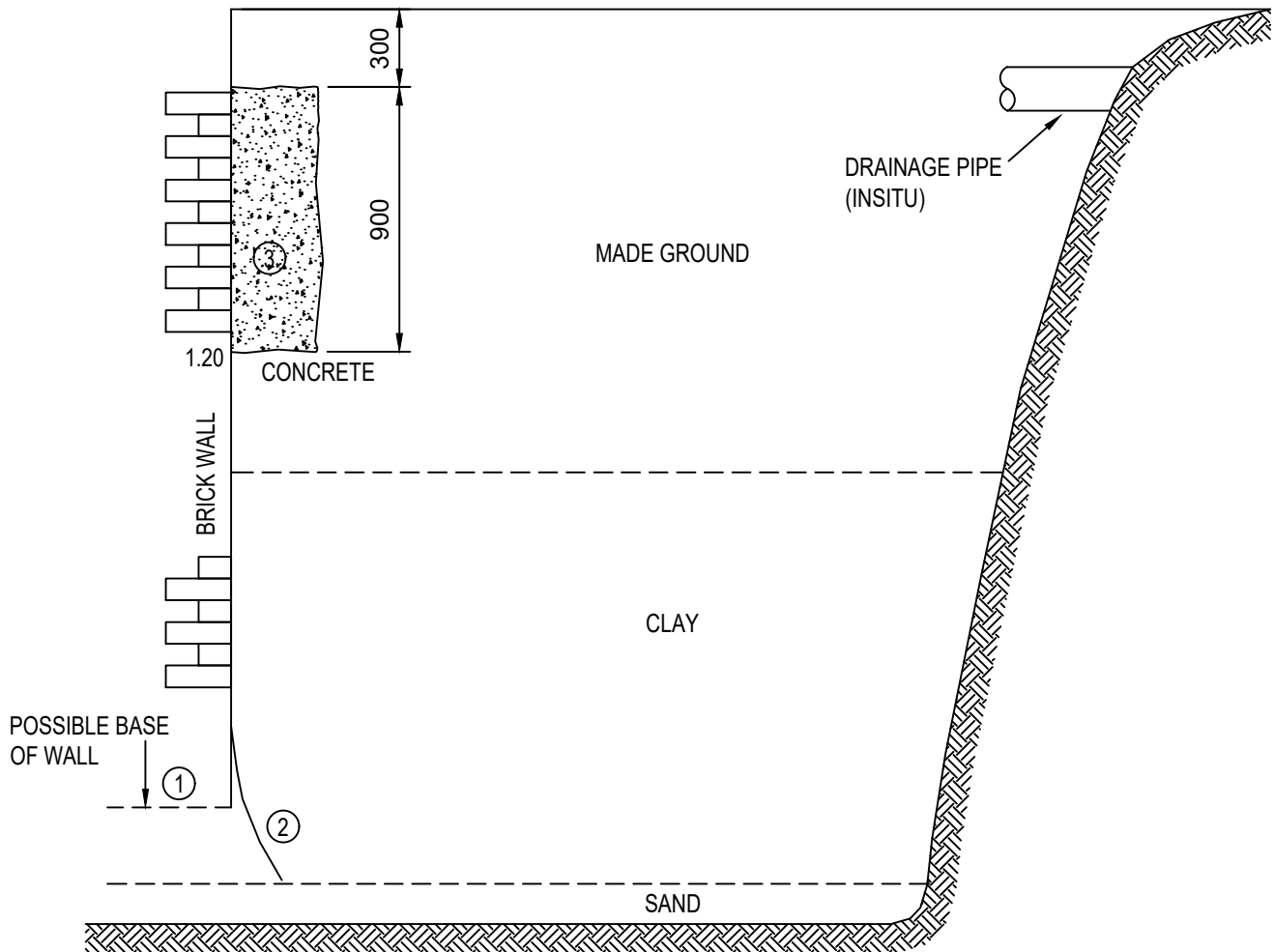
Scale: NTS



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FACING WEST



NOTES

1. BASE OF VIADUCT PIER NOT ENCOUNTERED IN THIS TRIAL PIT. STIFF CLAY ENCOUNTERED THROUGHOUT THE TRIAL PIT NOT PREVIOUSLY DISTURBED. INTERPRETTED THAT BASE OF WALL IS FOUND IN SIMILAR GROUND CONDITIONS AS TP102A, AND AS SUCH IS ASSUMED TO BEAR ONTO STIFF CLAY. NO EVIDENCE OF FOOTING PROTRUDING NORTH INTO TRIAL PIT TO 5.00 bgl.
2. DUE TO RESTRICTIONS ON SITE, IT WAS NOT POSSIBLE TO SAFELY EXCAVATE CLAY FROM BRICK WALL. THE EXCAVATOR COULD NOT BE MOVED BACK FROM THE PIT (NORTH) DUE TO ELEVATION CHANGE BEHIND IT.
3. SHALLOW CONCRETE NOT THOUGHT TO REPRESENT FOUNDATION. IT IS NOT CLEAR WHAT THE PURPOSE OF THE CONCRETE IS.
4. REFER TO CURTINS TRIAL PIT LOG TP103A FOR STRATA DETAILS.
5. TRIAL PIT UNDERTAKEN PERPENDICULAR TO BRICK PIER.



Probe Log

Borehole No.

DCP 01

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384635.48 - 397709.59

Hole Type
DP

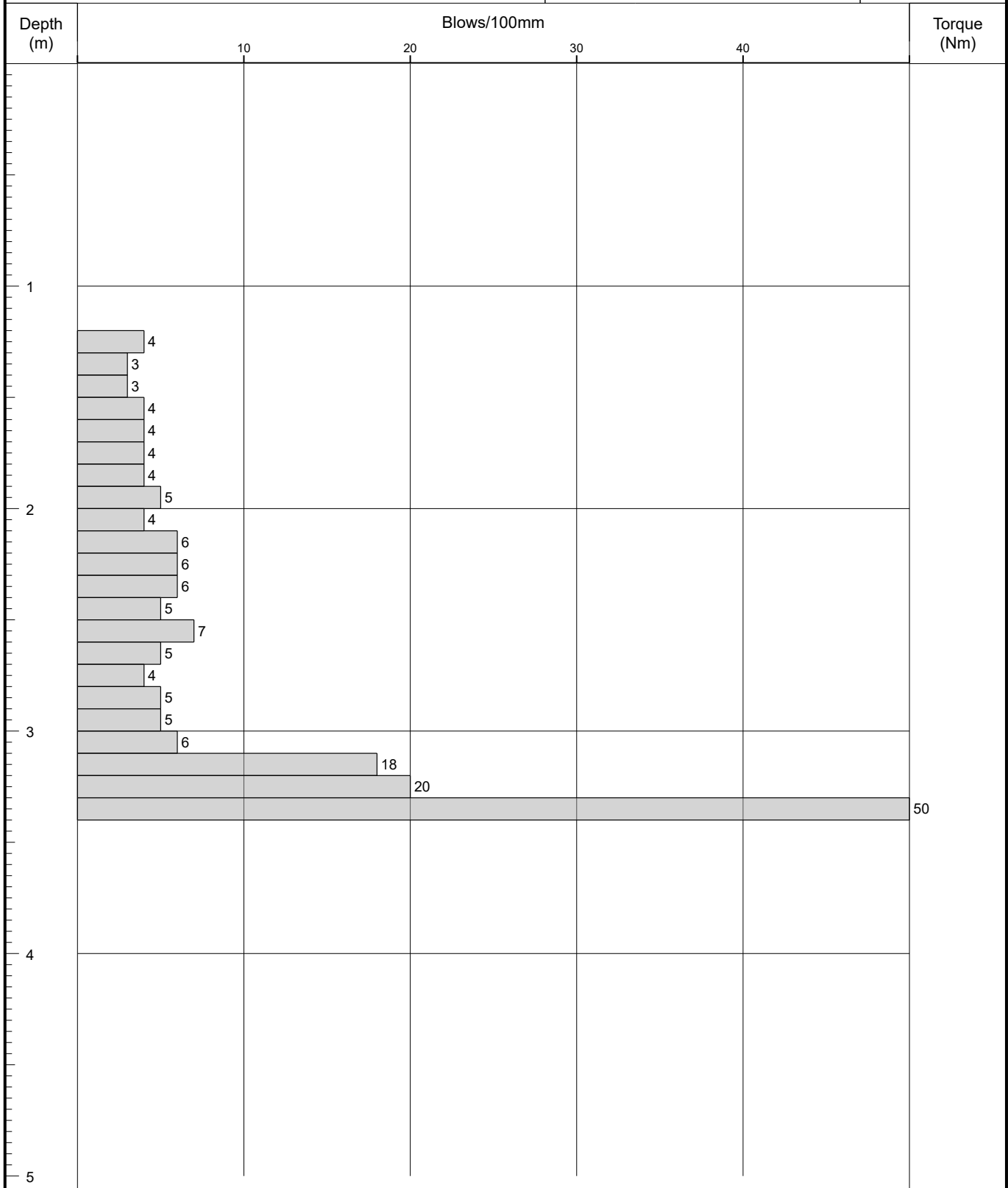
Location: Manchester

Level: 38.34

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.40

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 02

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384636.39 - 397707.05

Hole Type
DP

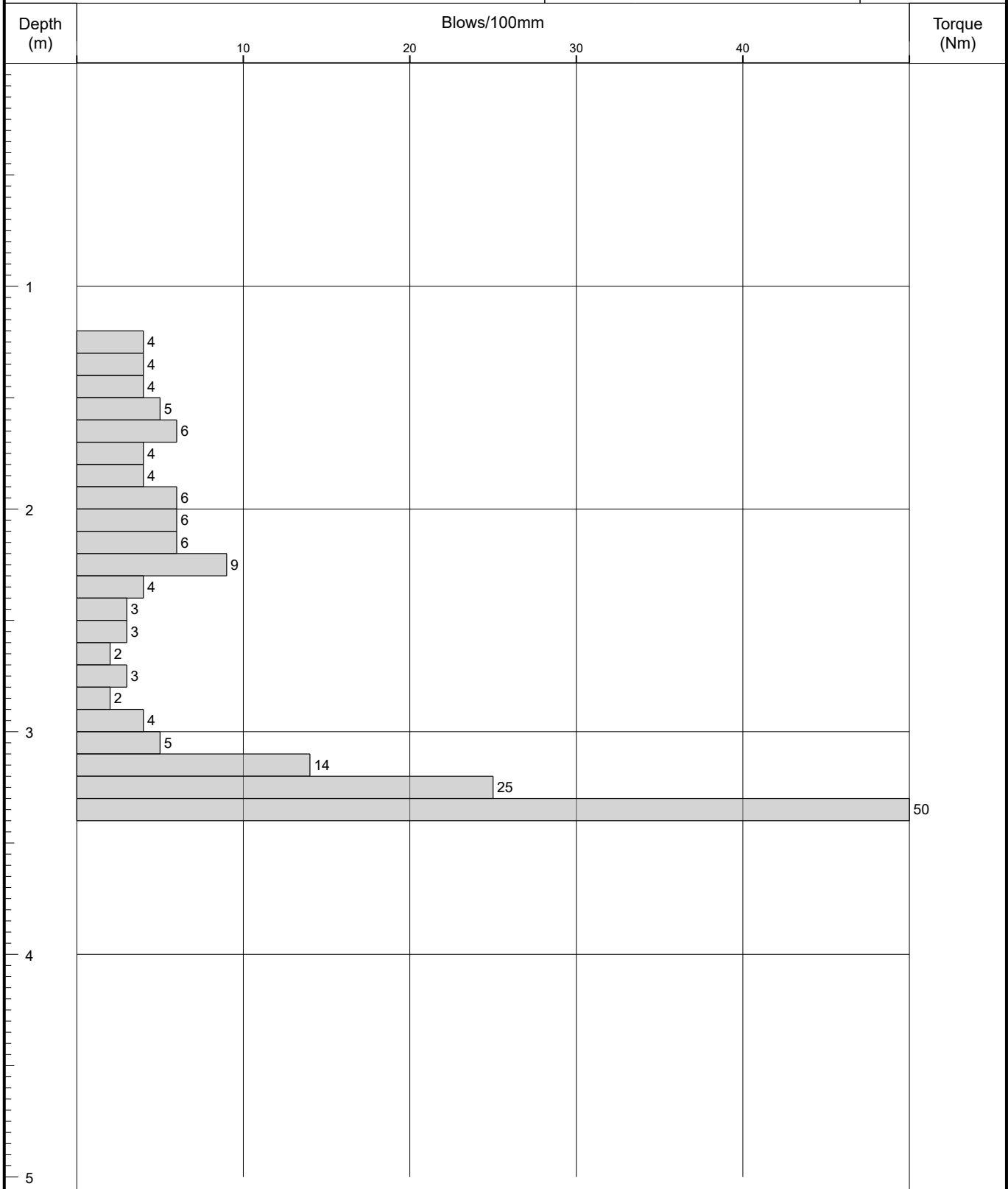
Location: Manchester

Level: 38.28

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 3.40

Log Scale 1:25





Probe Log

Borehole No.

DCP 03

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384637.29 - 397704.51

Hole Type
DP

Location: Manchester

Level: 38.20

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1					
	3				
	3				
	4				
	5				
	5				
	5				
	4				
2	5				
	3				
	3				
	3				
	3				
	3				
	3				
	4				
	3				
	3				
	3				
3	3				
	10				
			33		
					50
4					
5					

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.40

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 04

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384638.20 - 397701.96

Hole Type
DP

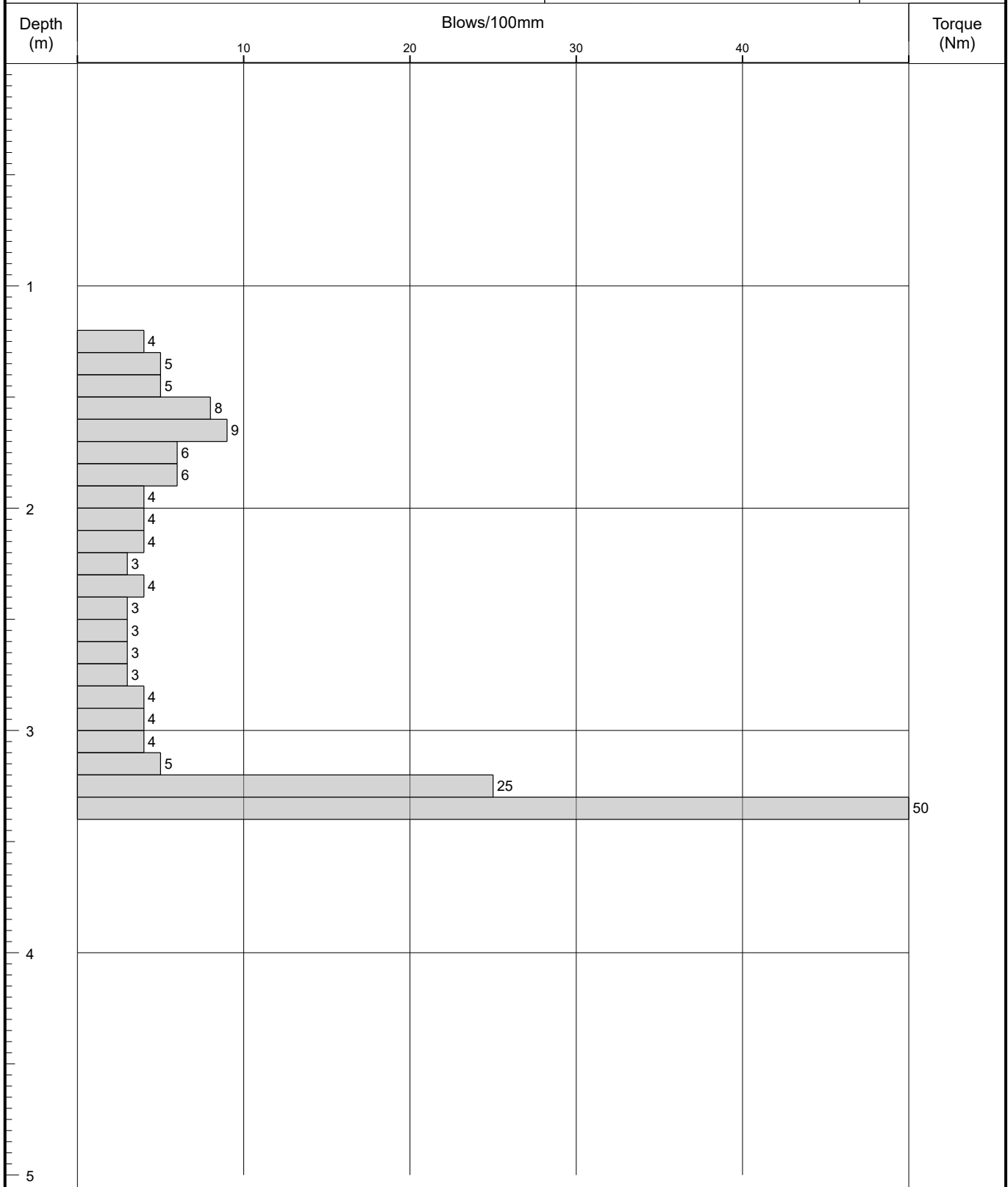
Location: Manchester

Level: 38.19

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.40

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 05

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384639.10 - 397699.42

Hole Type
DP

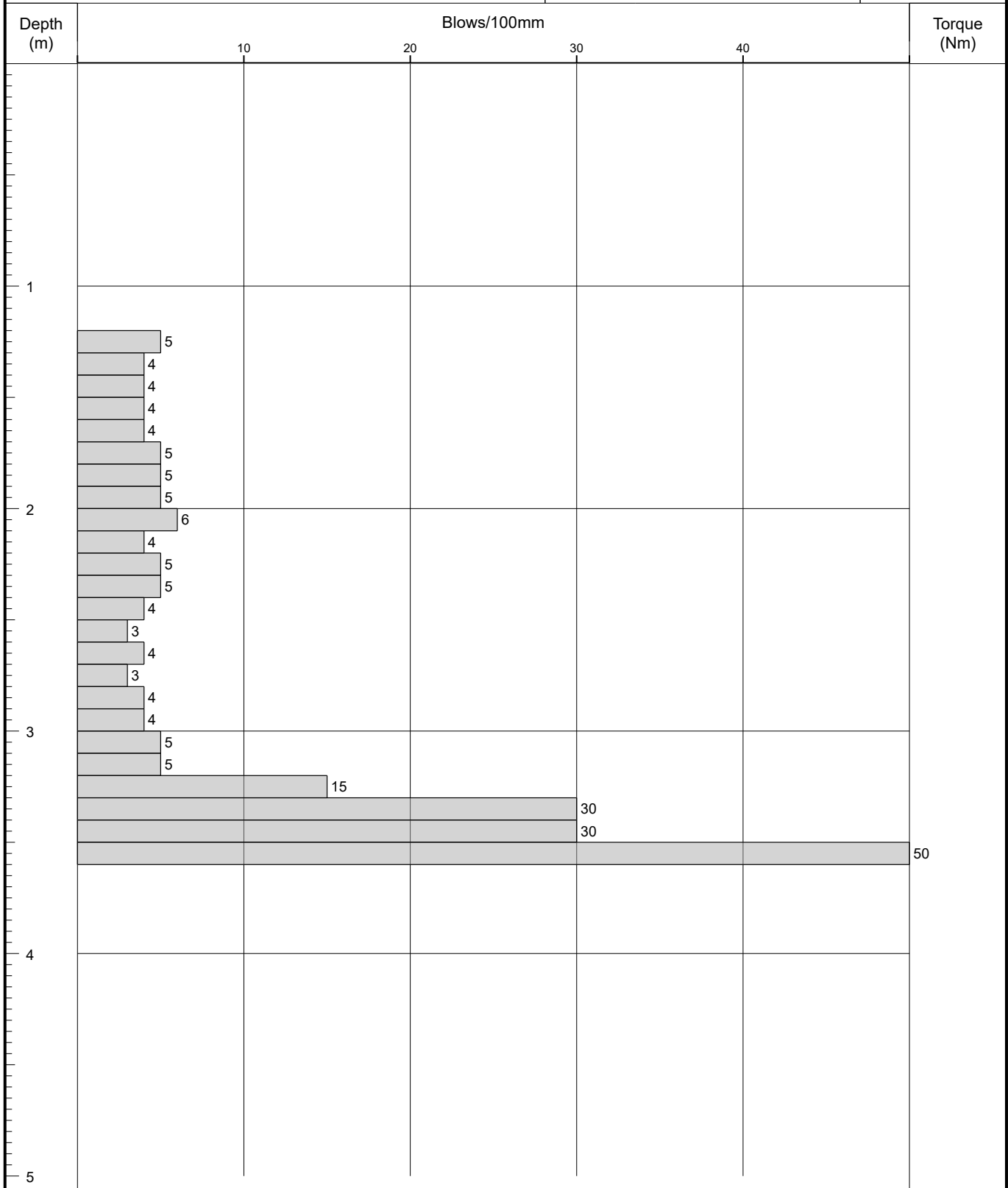
Location: Manchester

Level: 38.25

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.60

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 06

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384640.19 - 397696.12

Hole Type
DP

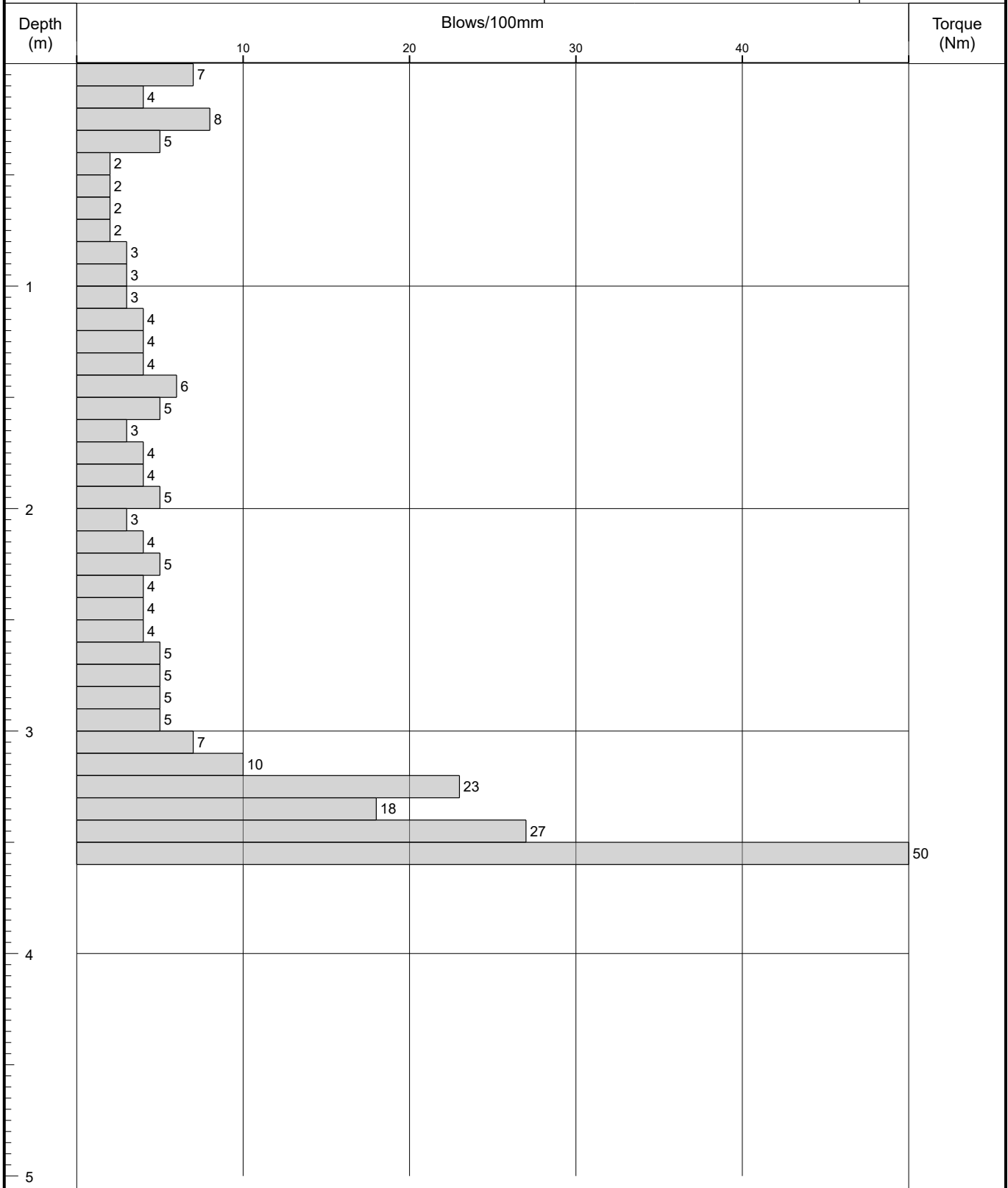
Location: Manchester

Level: 38.38

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN**Remarks**

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 3.60

Log Scale 1:25





Probe Log

Borehole No.

DCP 07

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384640.91 - 397694.33

Hole Type
DP

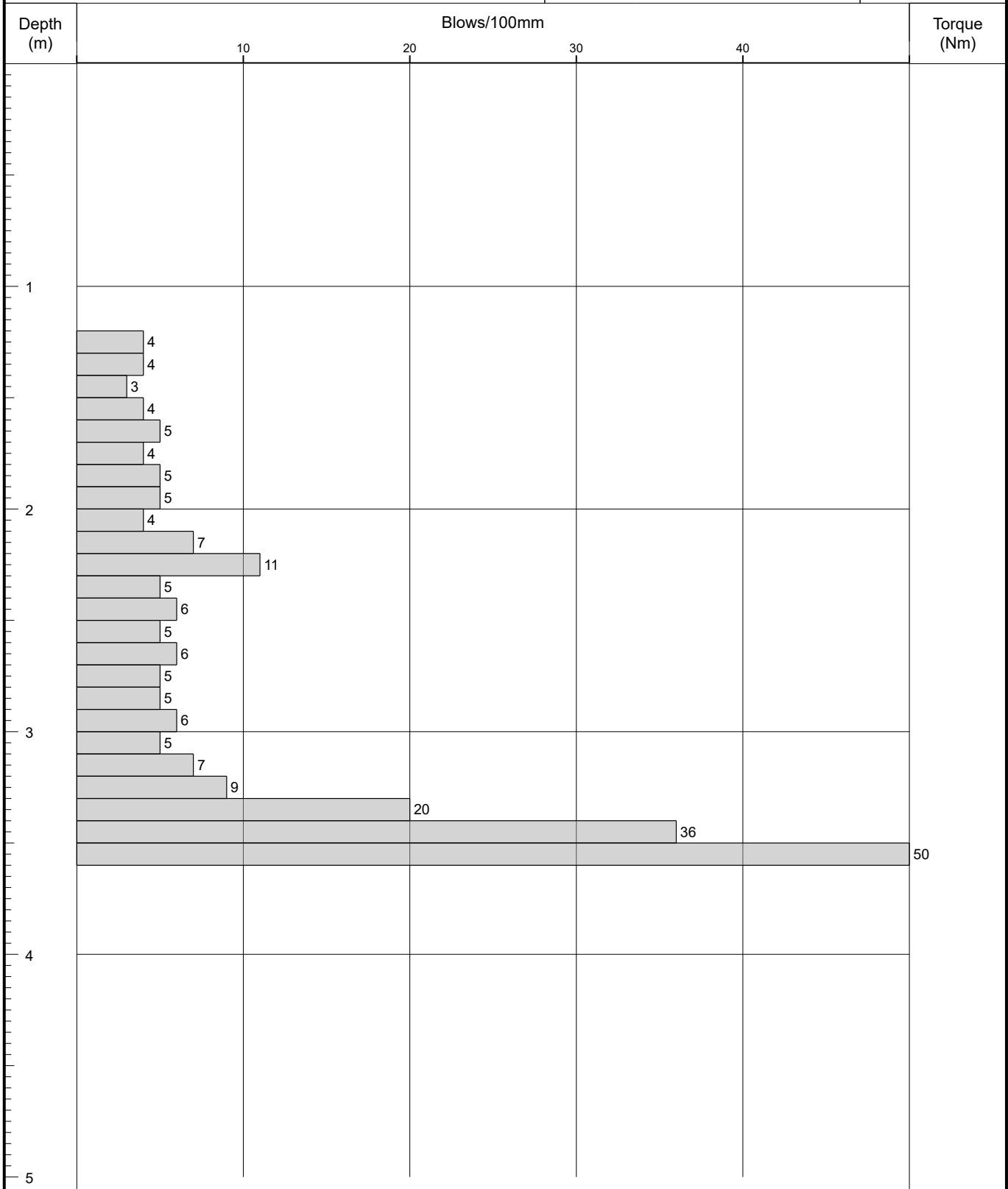
Location: Manchester

Level: 38.12

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 3.60

Log Scale 1:25





Probe Log

Borehole No.

DCP 09

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384642.73 - 397689.25

Hole Type
DP

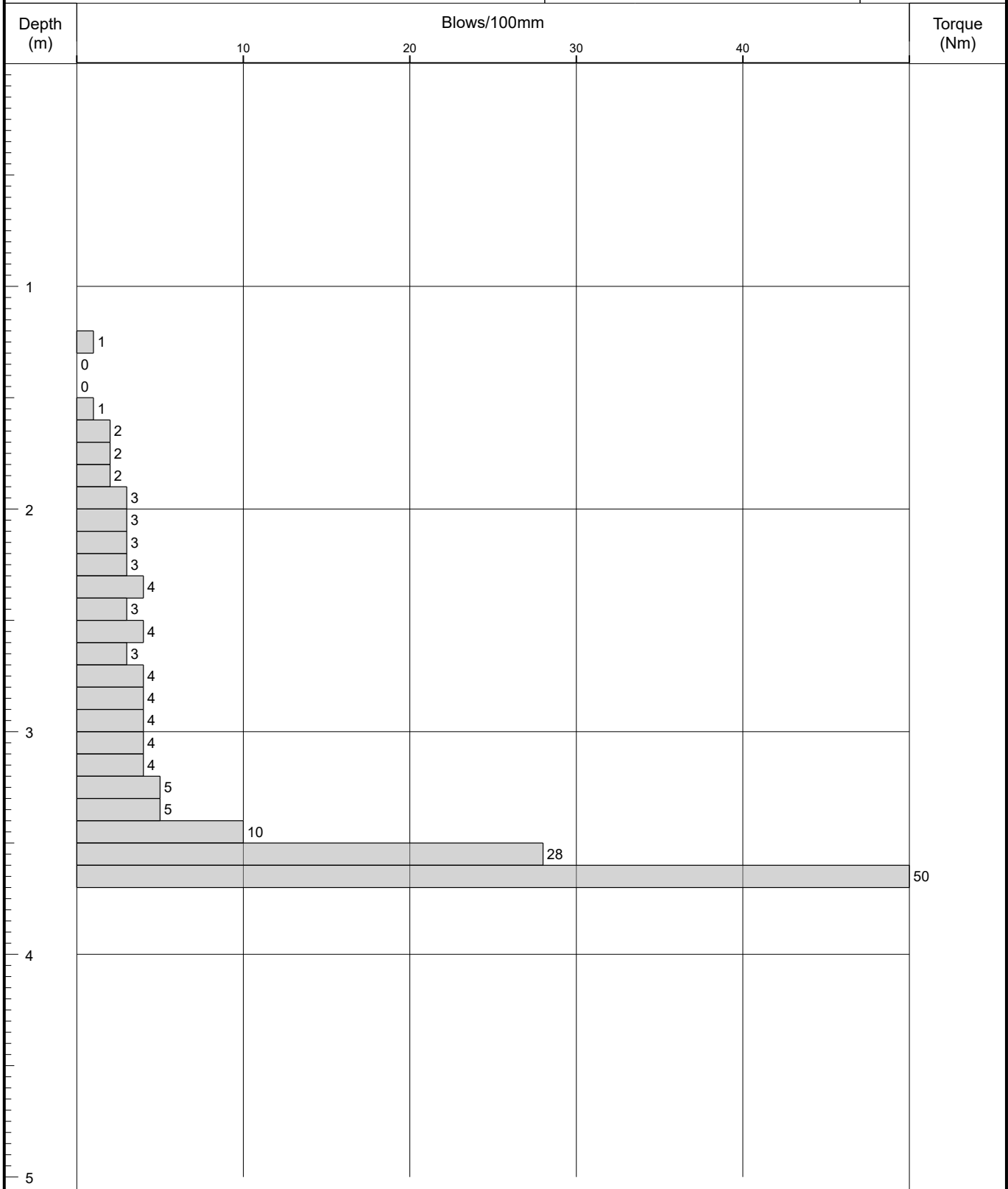
Location: Manchester

Level: 38.20

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.70

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 11

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384644.54 - 397684.16

Hole Type
DP

Location: Manchester

Level: 38.32

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1					50
2					
3					
4					
5					

Remarks

Hand auger service clearance pit to 0.90m bgl. Reduced level dig to 0.30m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 1.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 12

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384645.60 - 397680.91

Hole Type
DP

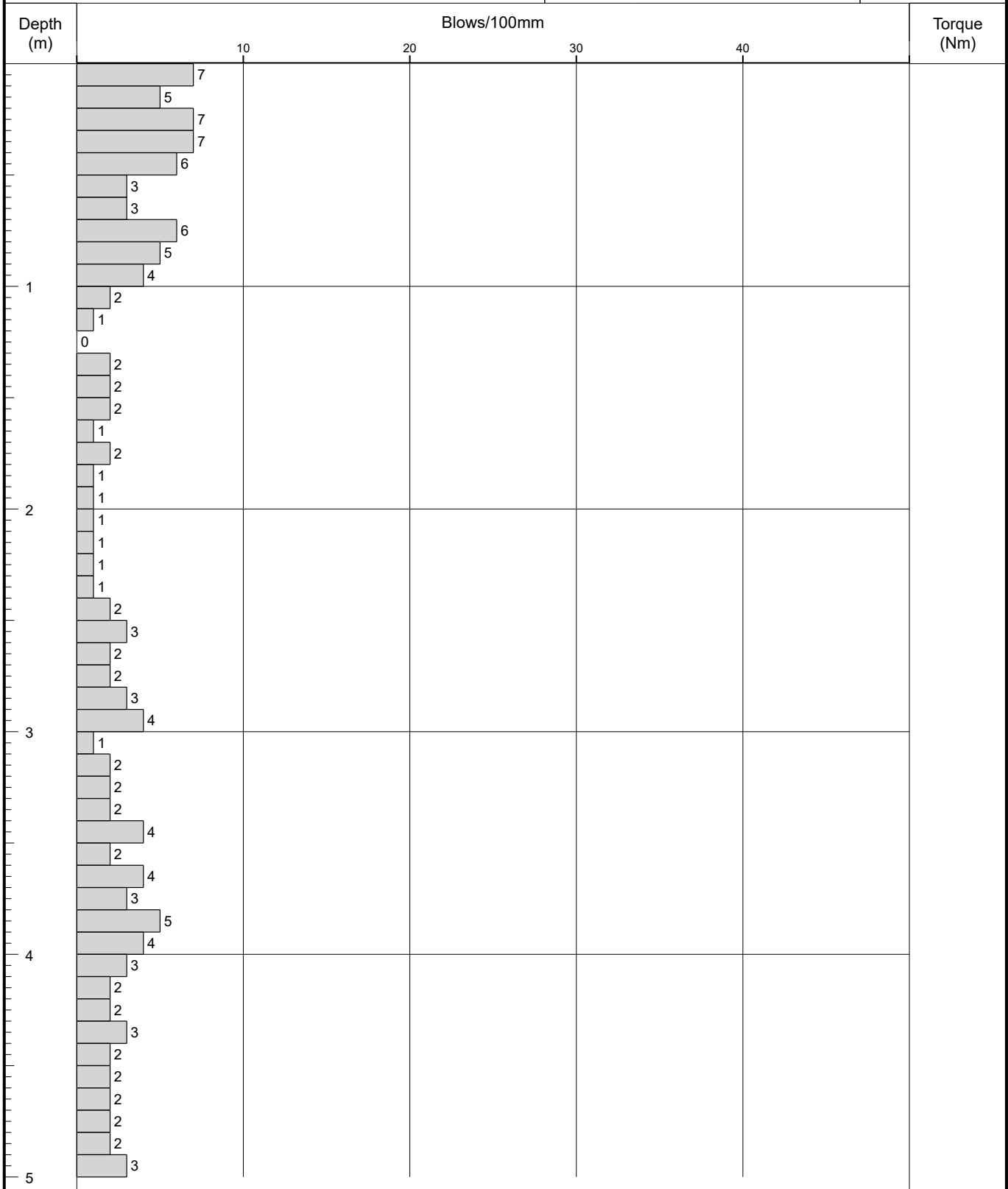
Location: Manchester

Level: 38.30

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 5.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 13

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384652.24 - 397682.73

Hole Type
DP

Location: Manchester

Level: 38.36

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1					50
2					
3					
4					
5					

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 1.30

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 14

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384648.28 - 397714.09

Hole Type
DP

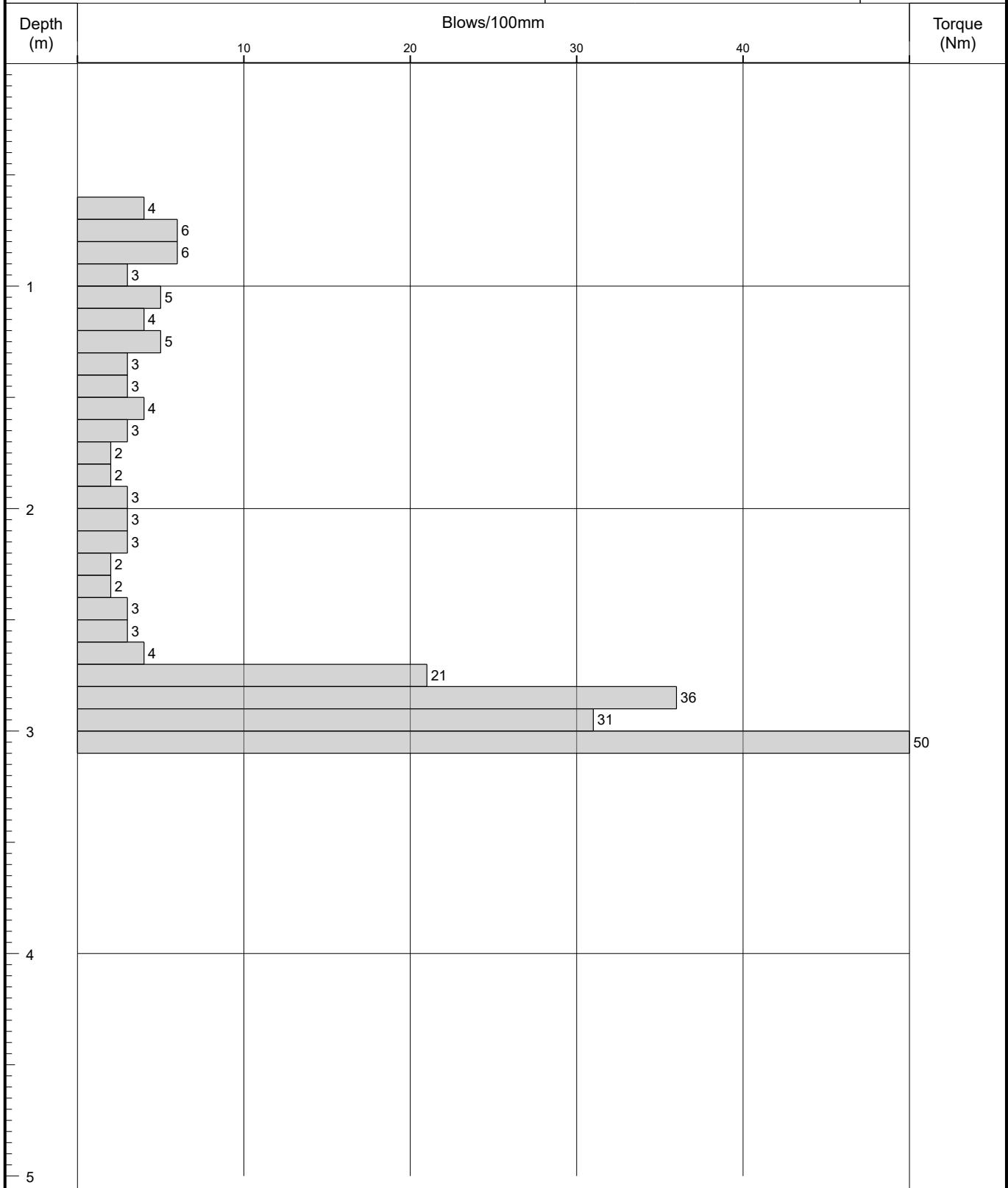
Location: Manchester

Level: 38.10

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 0.60m bgl. Reduced level dig to 0.60m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.10

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 15

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384658.43 - 397685.73

Hole Type
DP

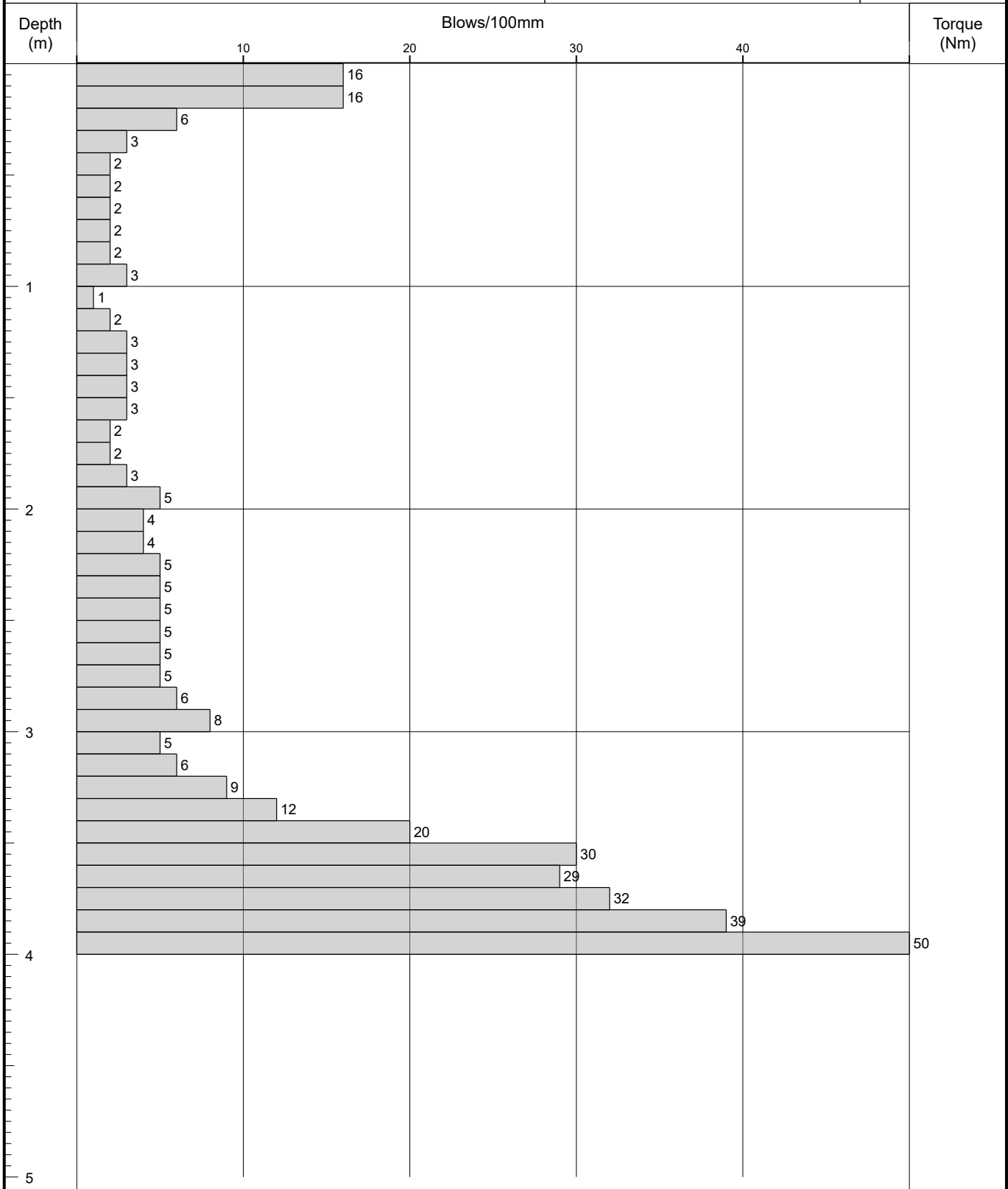
Location: Manchester

Level: 38.33

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 4.00

Log Scale 1:25





Probe Log

Borehole No.

DCP 16

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384652.60 - 397716.66

Hole Type
DP

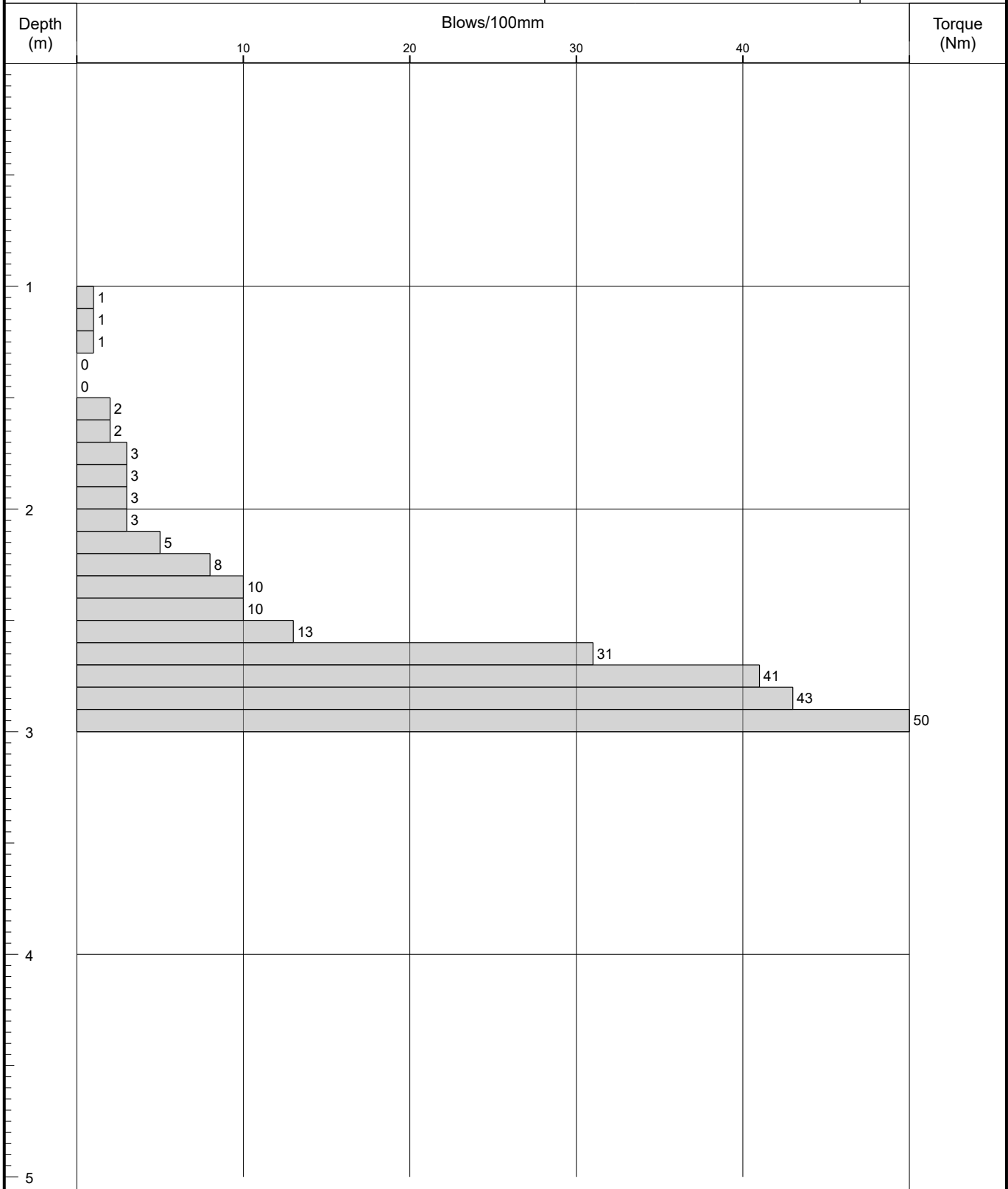
Location: Manchester

Level: 38.08

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.00m bgl. Reduced level dig to 0.20m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.00

Probe Type DPSH-B

Log Scale 1:25



Probe Log

Borehole No.

DCP 17

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384661.46 - 397687.31

Hole Type
DP

Location: Manchester

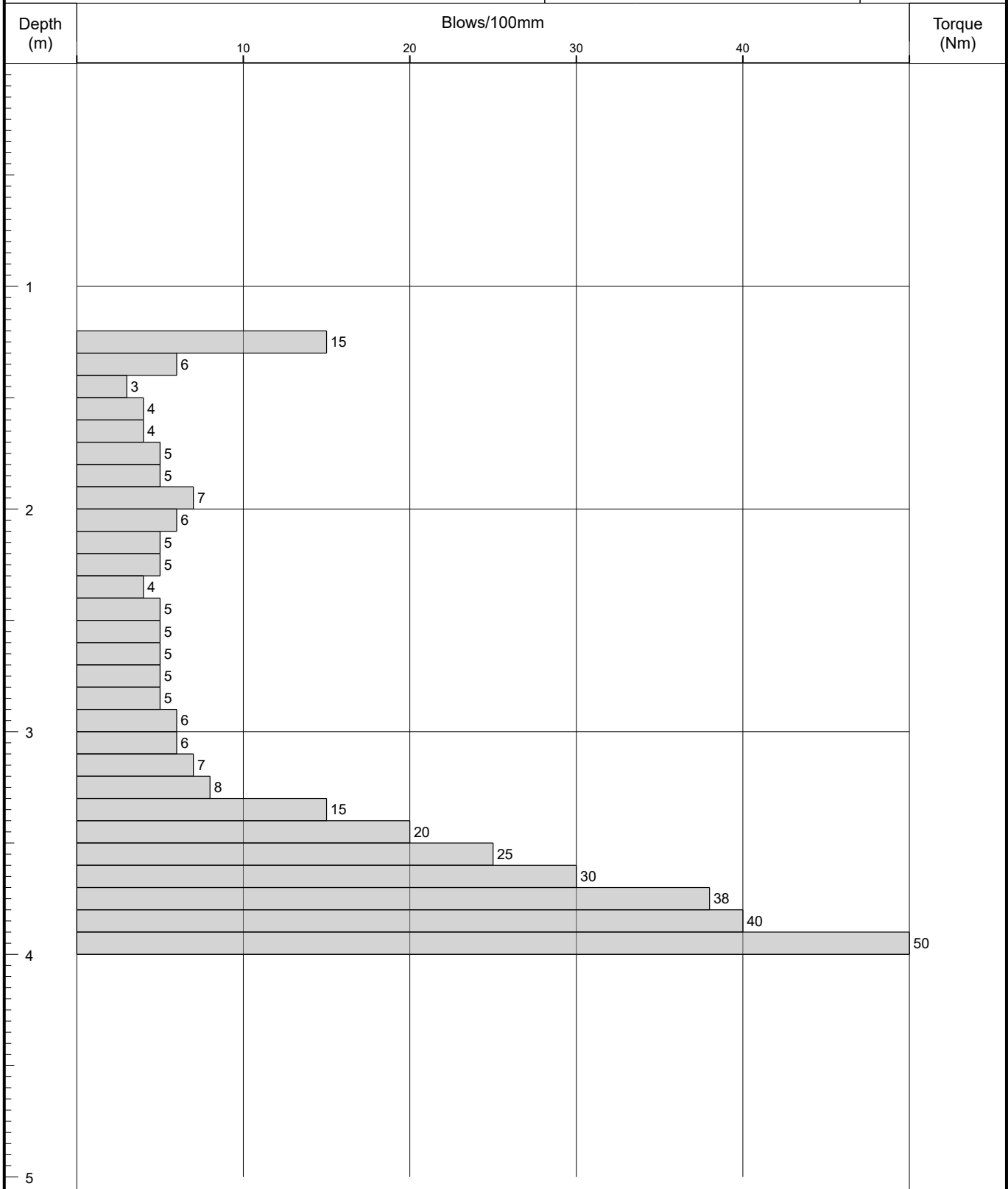
Level:	38.40
--------	-------

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN



Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height	760
-------------	-----

Hammer Wt	64
-----------	----

Probe Type	DPSH-B
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Cone Base Diameter	44
--------------------	----

Final Depth	4.00
-------------	------

Log Scale	1:25
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Probe Log

Borehole No.

DCP 18

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384661.26 - 397697.74

Hole Type
DP

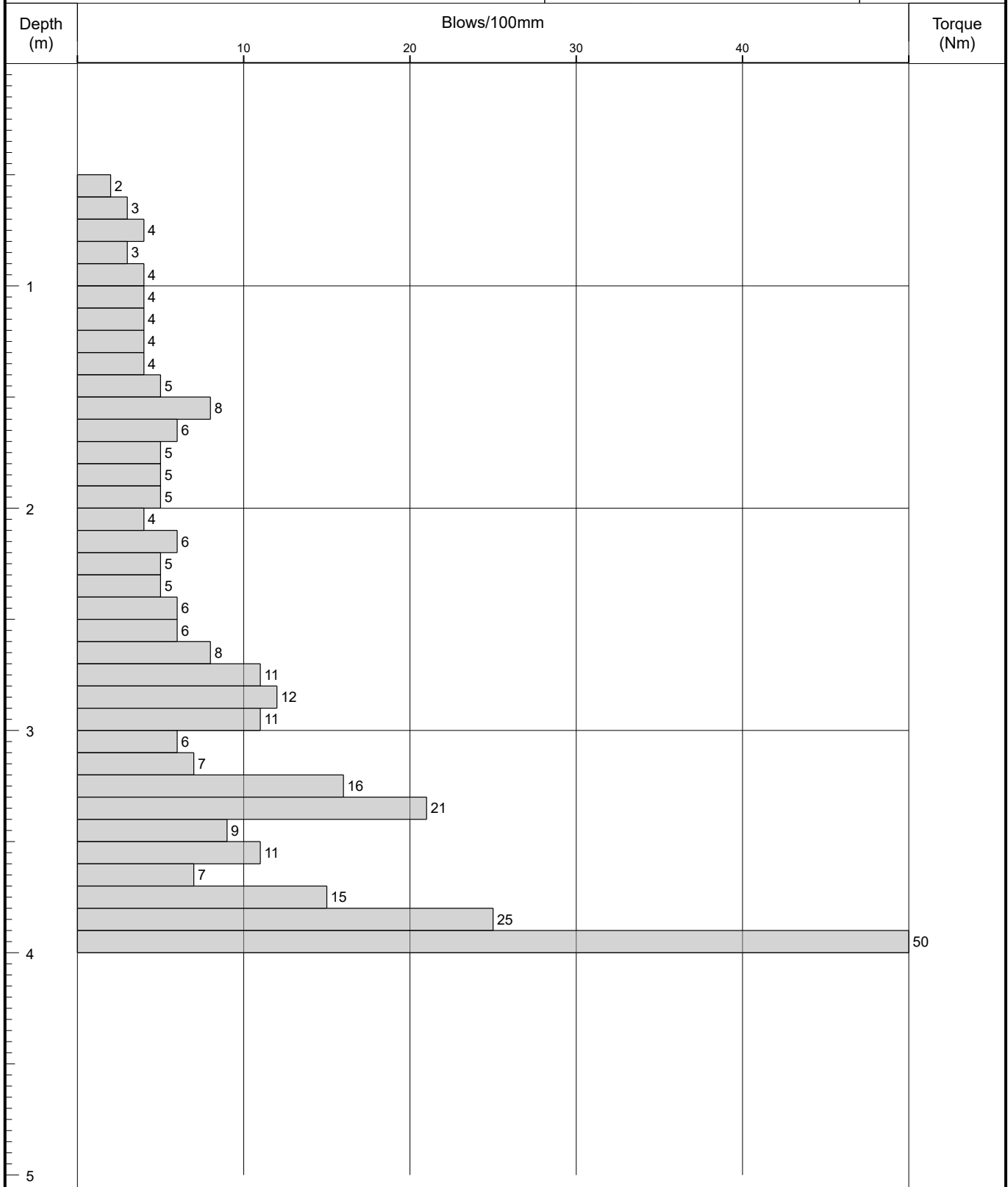
Location: Manchester

Level: 37.91

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 0.50m bgl. Reduced level dig to 0.70m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 4.00

Probe Type DPSH-B

Log Scale 1:25



Probe Log

Borehole No.

DCP 19

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384662.27 - 397694.91

Hole Type
DP

Location: Manchester

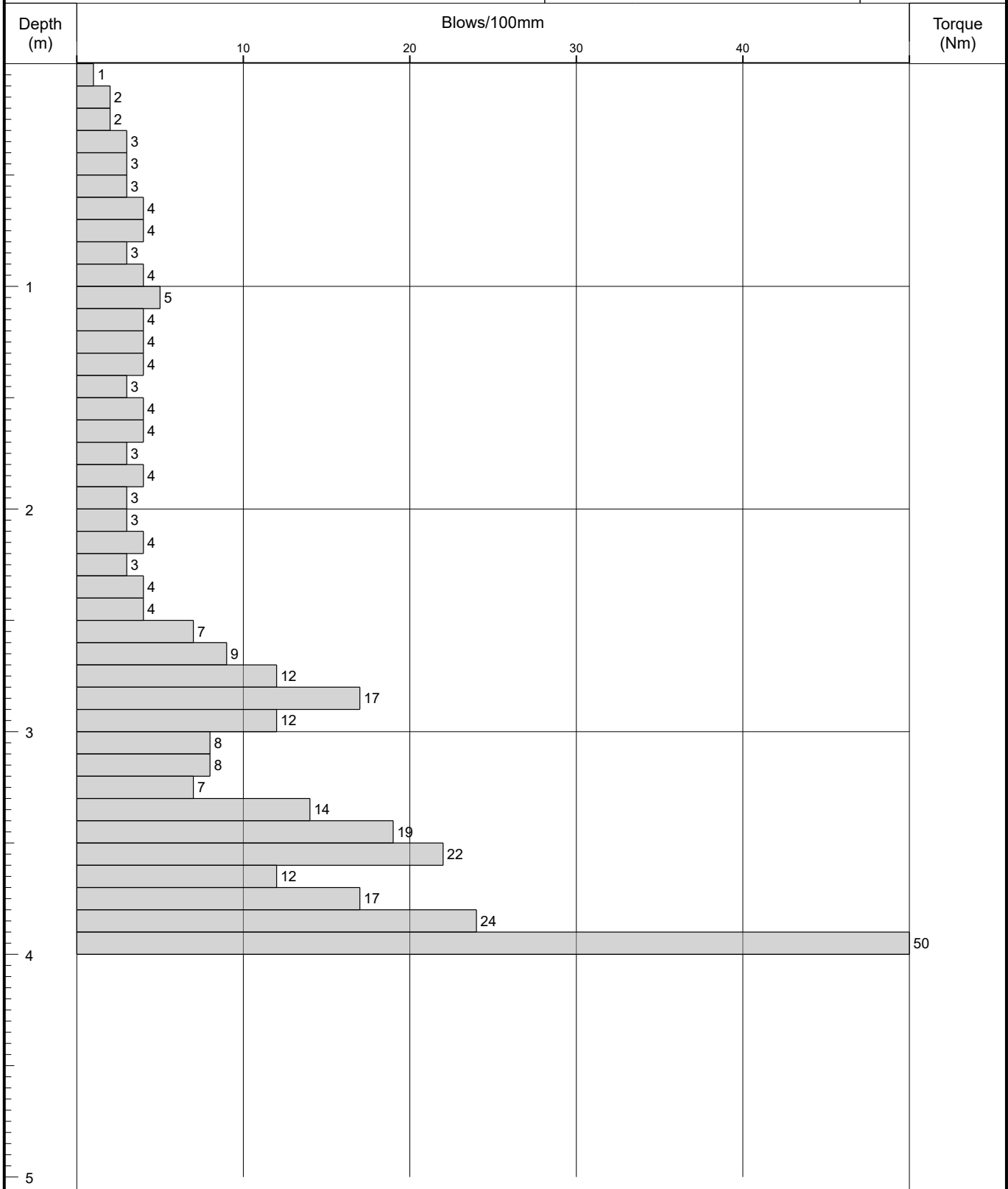
Level:	37.91
--------	-------

Scale
1:25

Client: IQ Student Accommodation

Dates: 06/09/2019 - 06/09/2019

Logged By
NF



Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height	760
-------------	-----

Hammer Wt	64
-----------	----

Probe Type	DPSH-B
------------	--------

Cone Base Diameter	44
--------------------	----

Final Depth	4.00
-------------	------

Log Scale	1:25
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Probe Log

Borehole No.

DCP 20

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384657.22 - 397718.31

Hole Type
DP

Location: Manchester

Level: 38.08

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
NF

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	1 1 3 3 3 3 3 3 3 3				
2	4 4 4 4 4 8 17 18 18 18 18				
3				40 40 40	50
4					
5					

Remarks

Hand auger service clearance pit to 1.00m bgl. Reduced level dig to 0.20m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.40

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 21

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384659.69 - 397712.02

Hole Type
DP

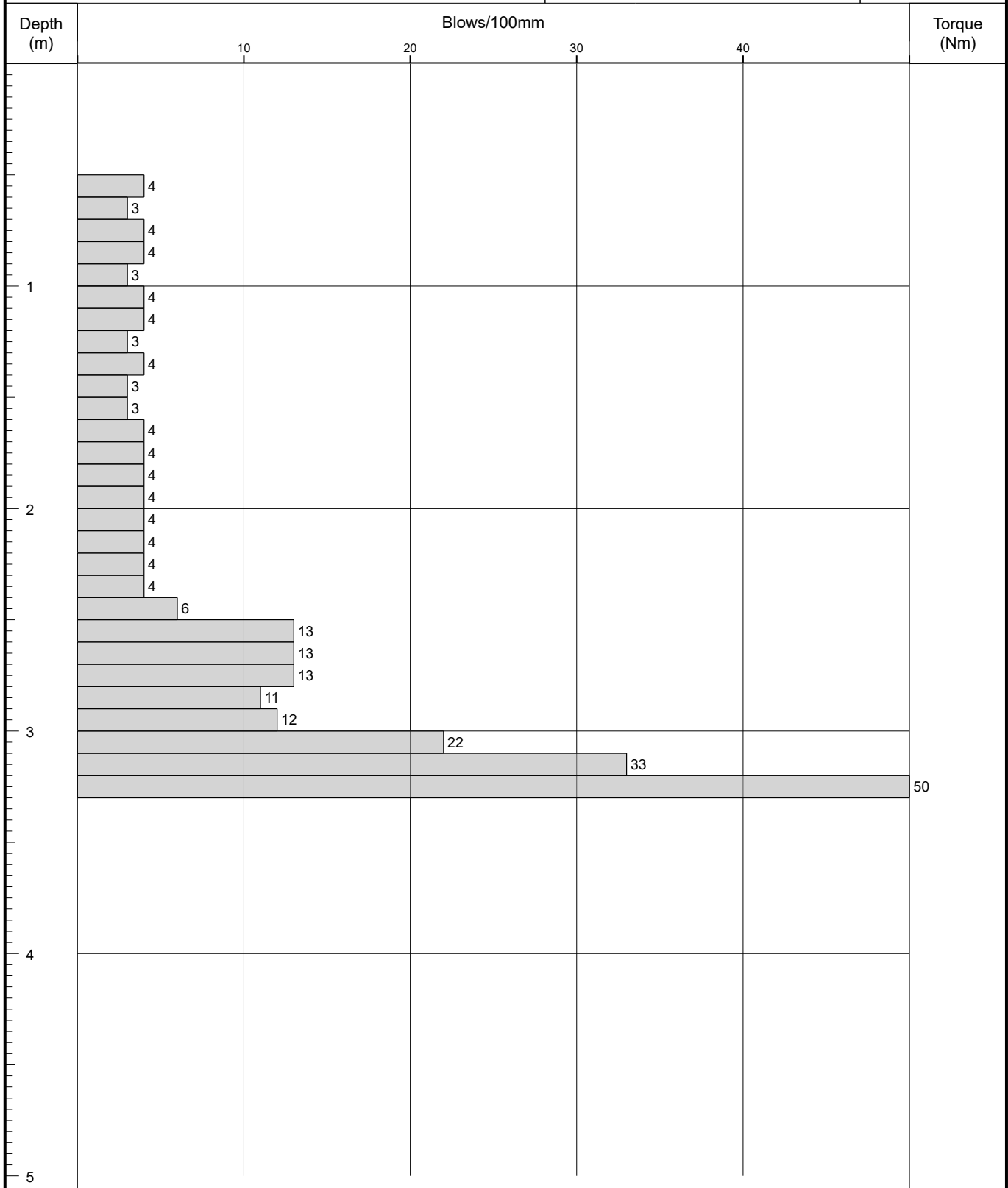
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 06/09/2019 - 06/09/2019

Logged By
NF**Remarks**

Hand auger service clearance pit to 0.50m bgl. Reduced level dig to 0.70m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.30

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 22

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384661.61 - 397706.62

Hole Type
DP

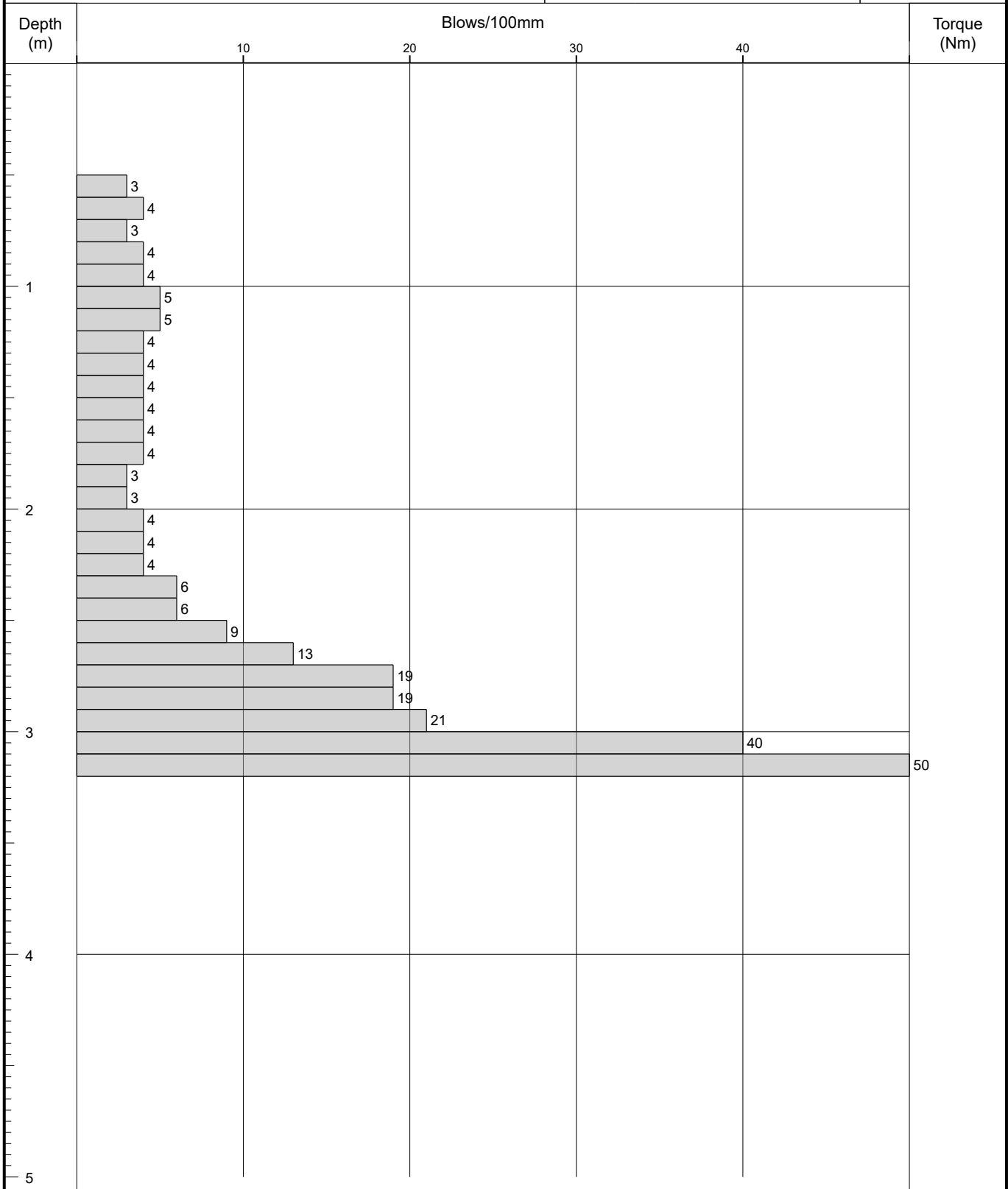
Location: Manchester

Level: 37.89

Scale
1:25

Client: IQ Student Accommodation

Dates: 06/09/2019 - 06/09/2019

Logged By
NF

Remarks

Hand auger service clearance pit to 0.50m bgl. Reduced level dig to 0.70m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.20

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 24

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384664.09 - 397698.74

Hole Type
DP

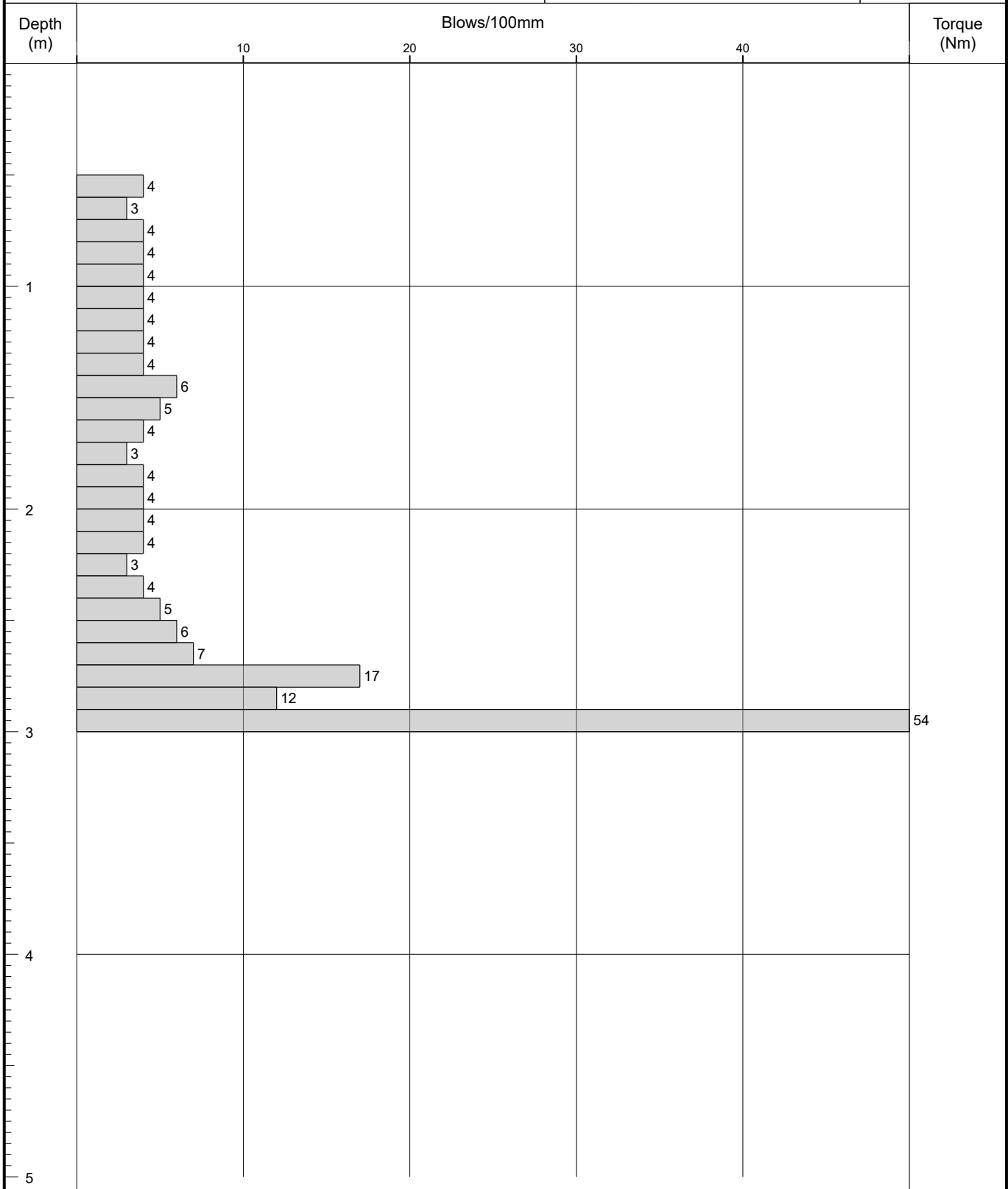
Location: Manchester

Level: 37.91

Scale
1:25

Client: IQ Student Accommodation

Dates: 06/09/2019 - 06/09/2019

Logged By
NF**Remarks**

Hand auger service clearance pit to 0.50m bgl. Reduced level dig to 0.70m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 25

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384665.10 - 397695.92

Hole Type
DP

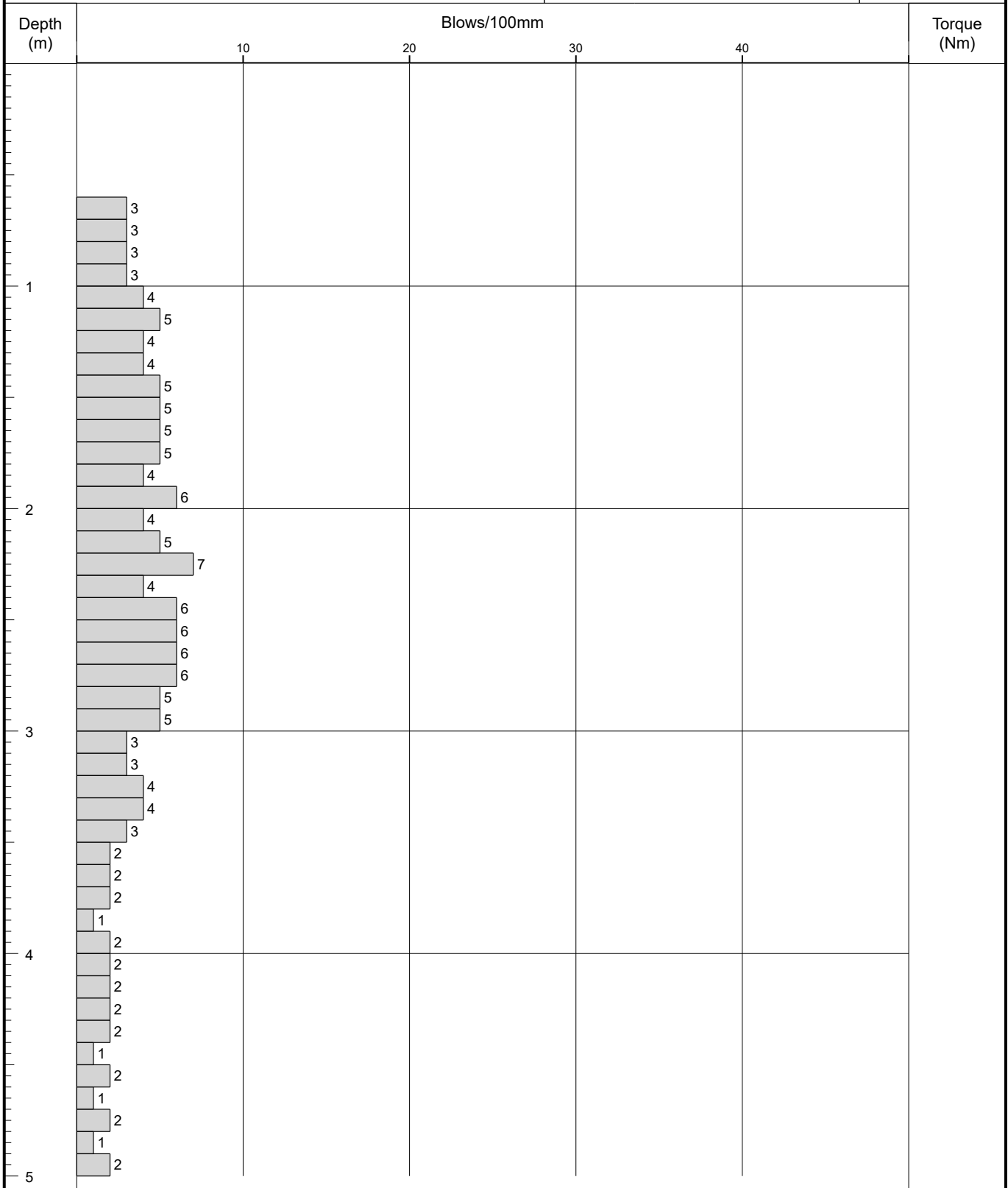
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
NF

Remarks

Hand auger service clearance pit to 0.60m bgl. Reduced level dig to 0.60m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 5.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 26

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384666.25 - 397694.10

Hole Type
DP

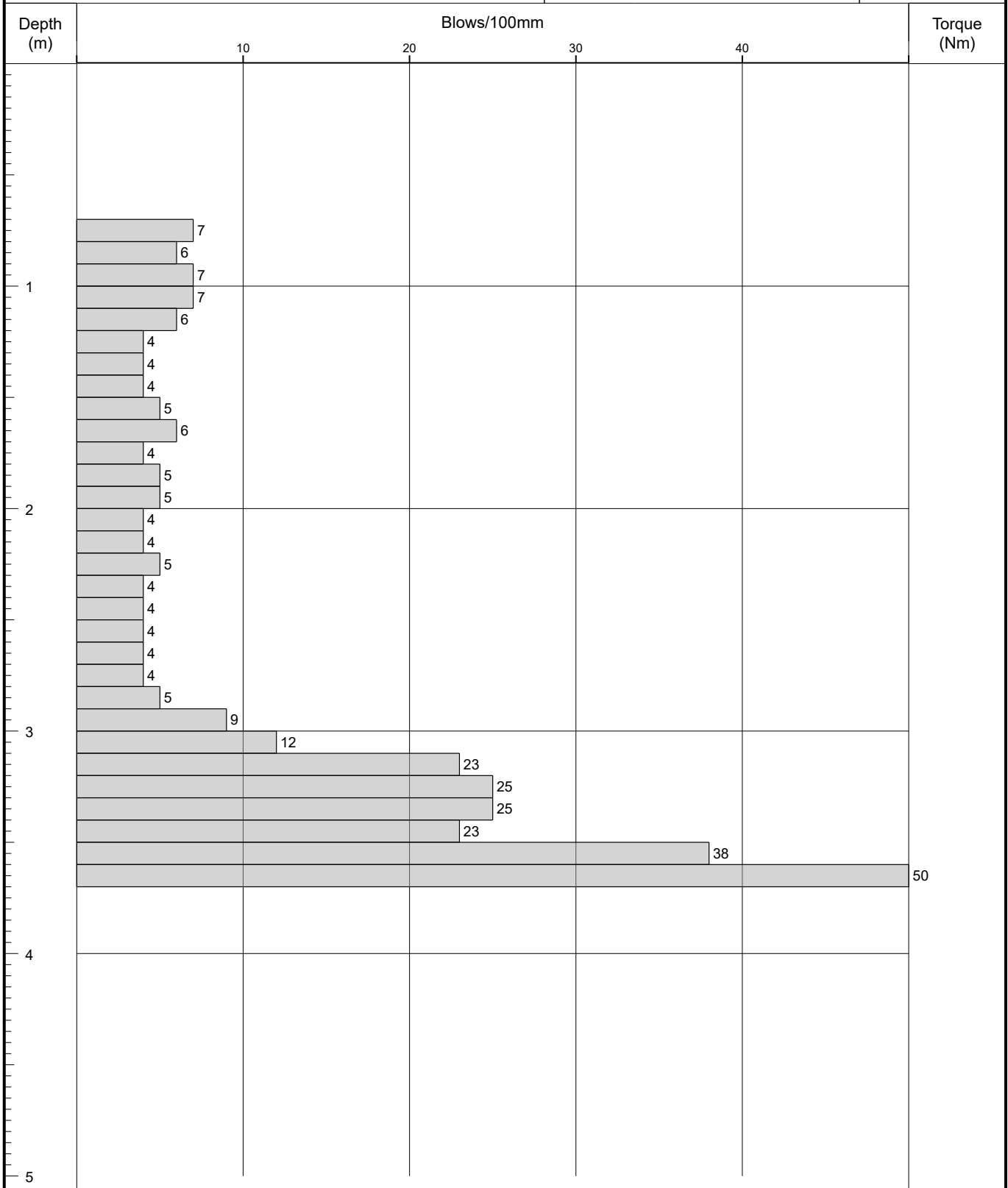
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
NF

Remarks

Hand auger service clearance pit to 0.70m bgl. Reduced level dig to 0.50m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.70

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 27

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384668.16 - 397688.73

Hole Type
DP

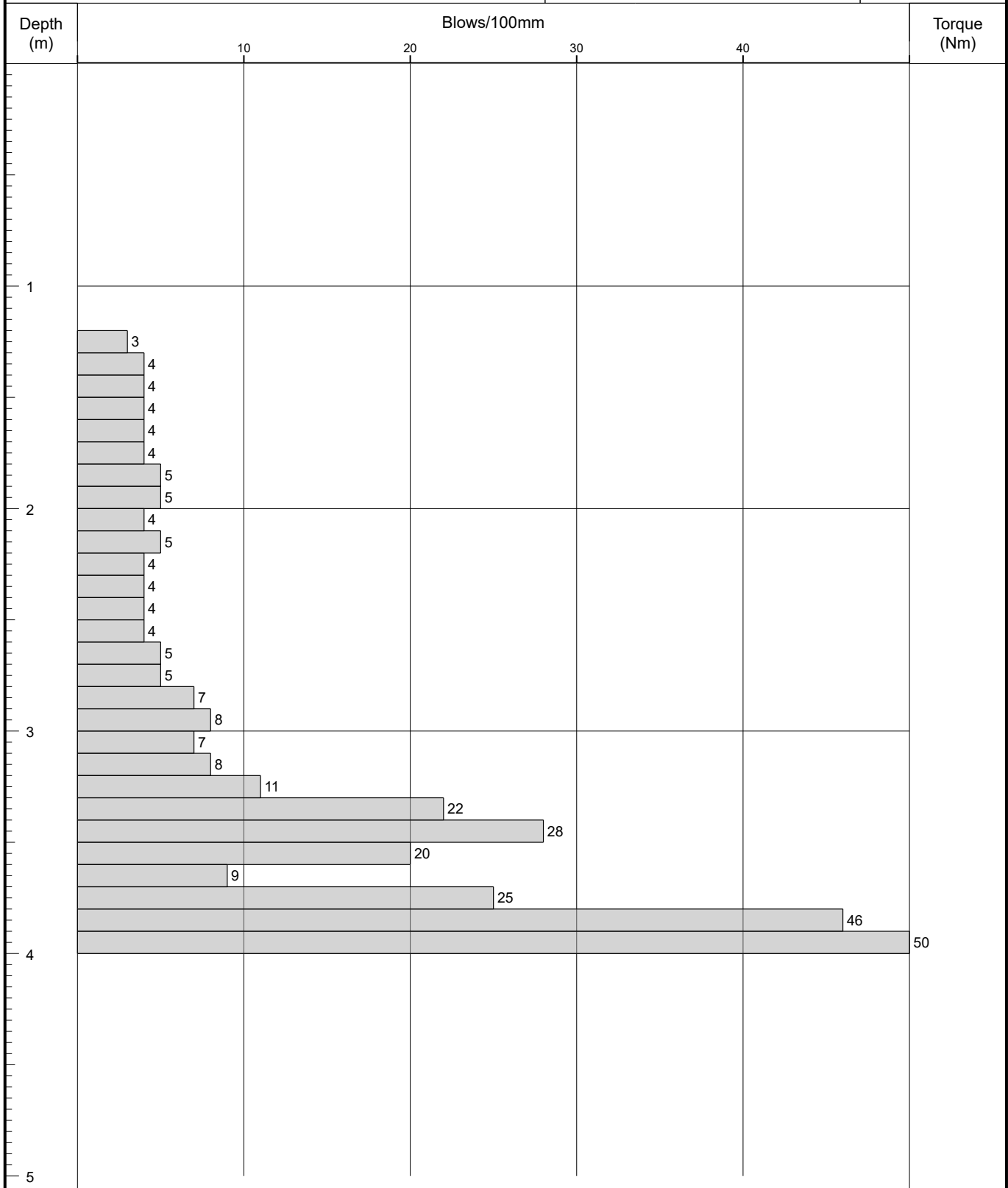
Location: Manchester

Level: 38.47

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
NF

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 4.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 28

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384661.14 - 397718.67

Hole Type
DP

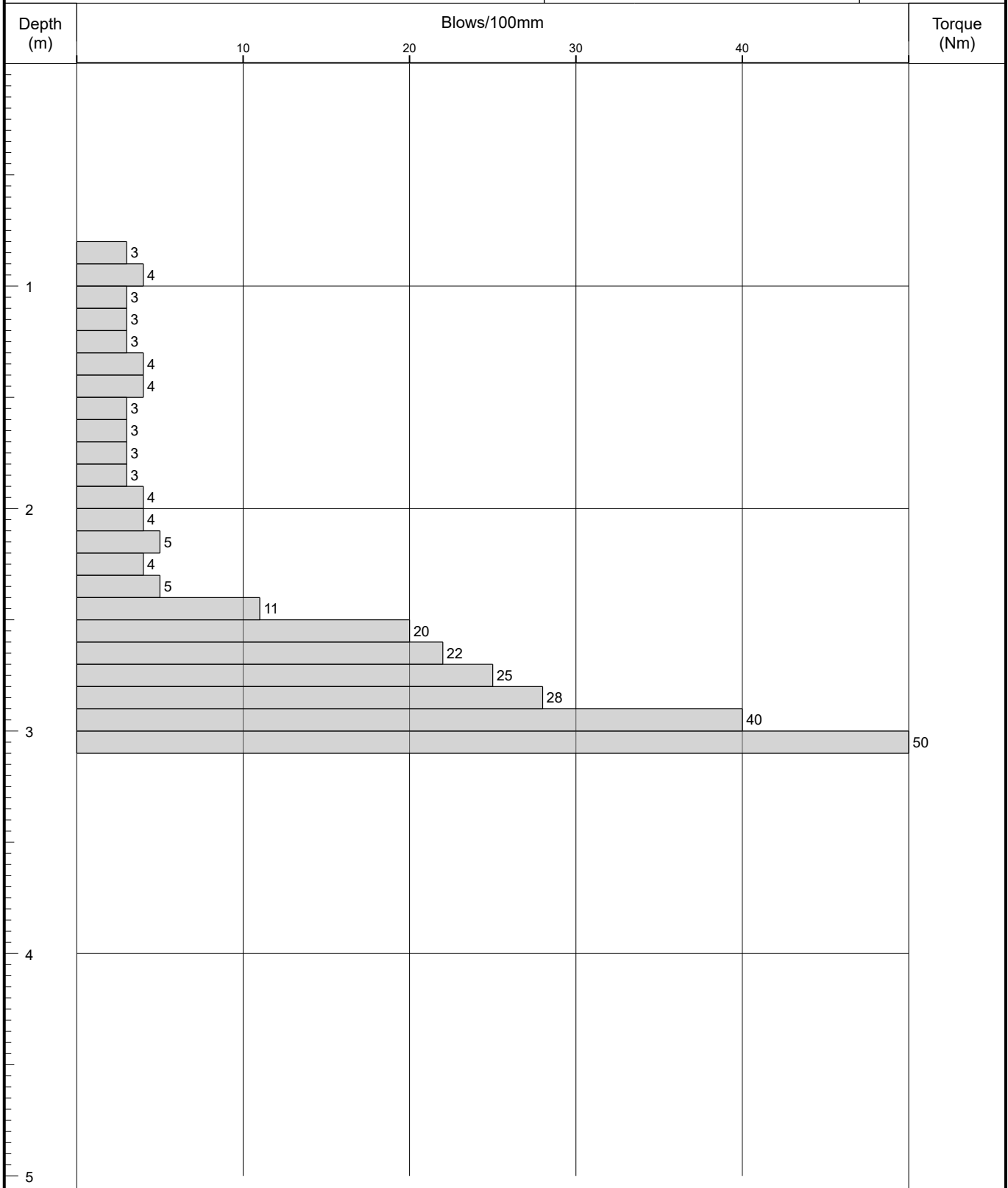
Location: Manchester

Level: 38.08

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
NF

Remarks

Hand auger service clearance pit to 0.80m bgl. Reduced level dig to 0.40m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.10

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 29

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384663.08 - 397713.23

Hole Type
DP

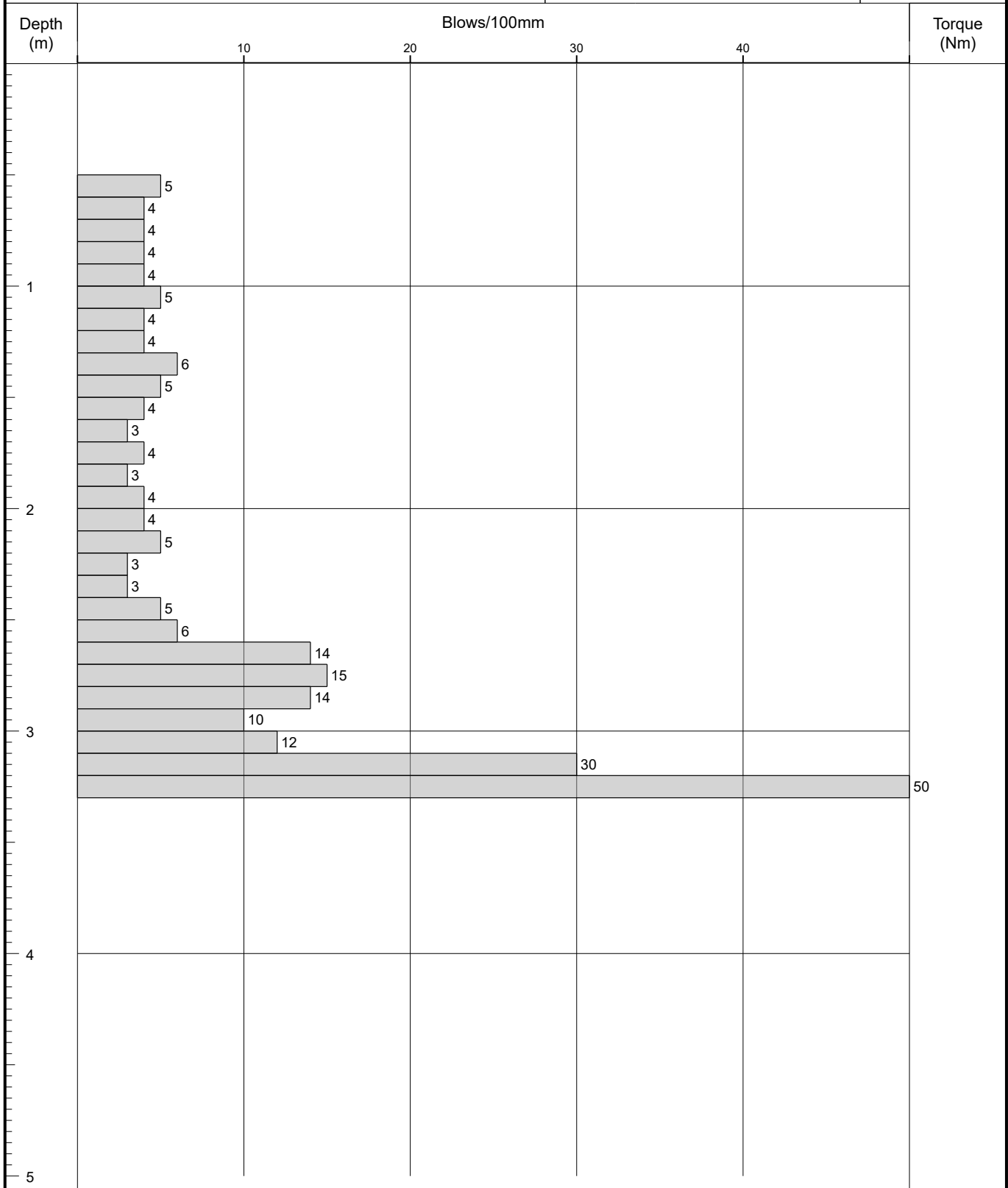
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 06/09/2019 - 06/09/2019

Logged By
NF**Remarks**

Hand auger service clearance pit to 0.50m bgl. Reduced level dig to 0.70m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.30

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 30

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384665.23 - 397707.18

Hole Type
DP

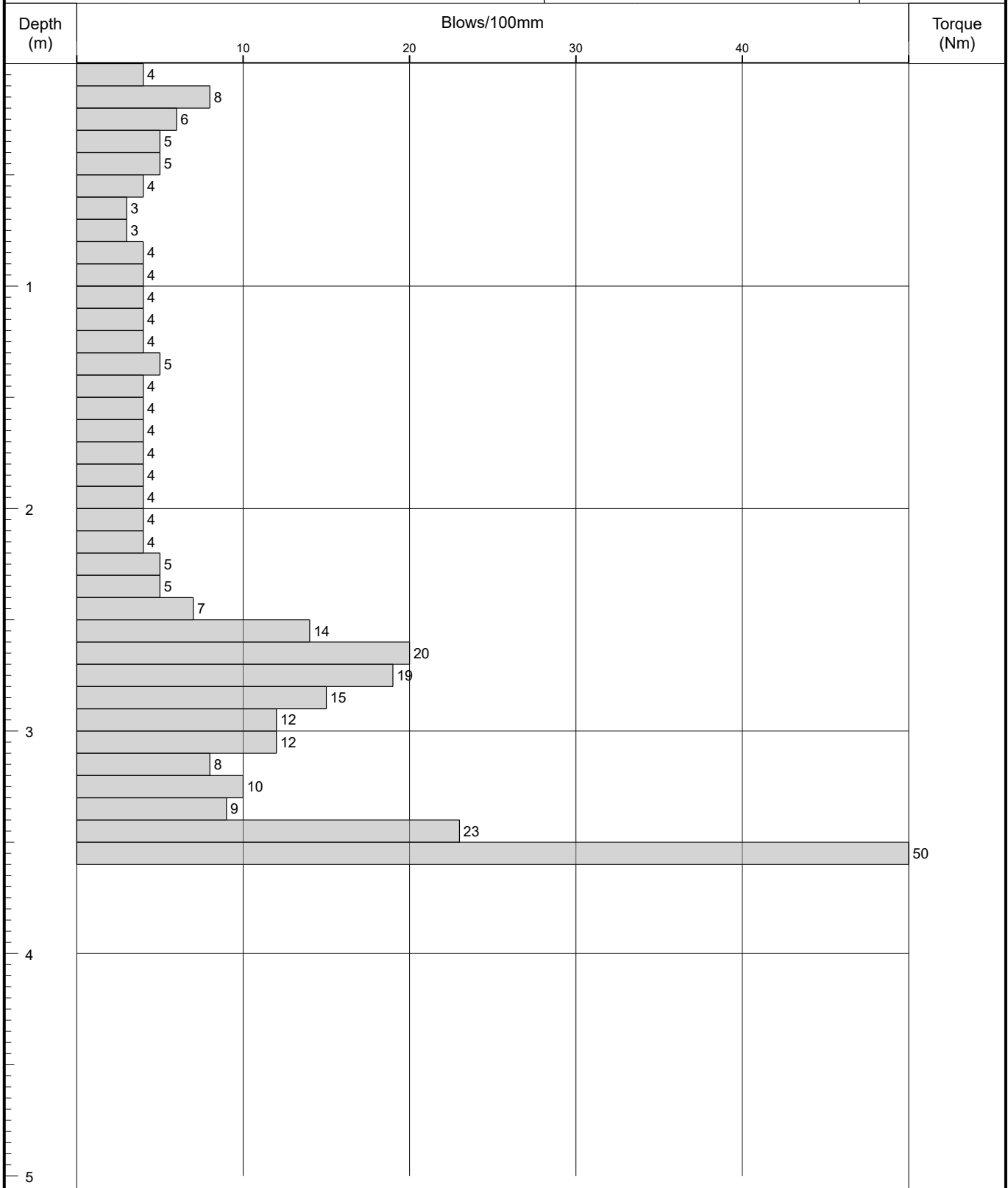
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 06/09/2019 - 06/09/2019

Logged By
NF

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 3.60

Log Scale 1:25





Probe Log

Borehole No.

DCP 32

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384670.44 - 397696.25

Hole Type
DP

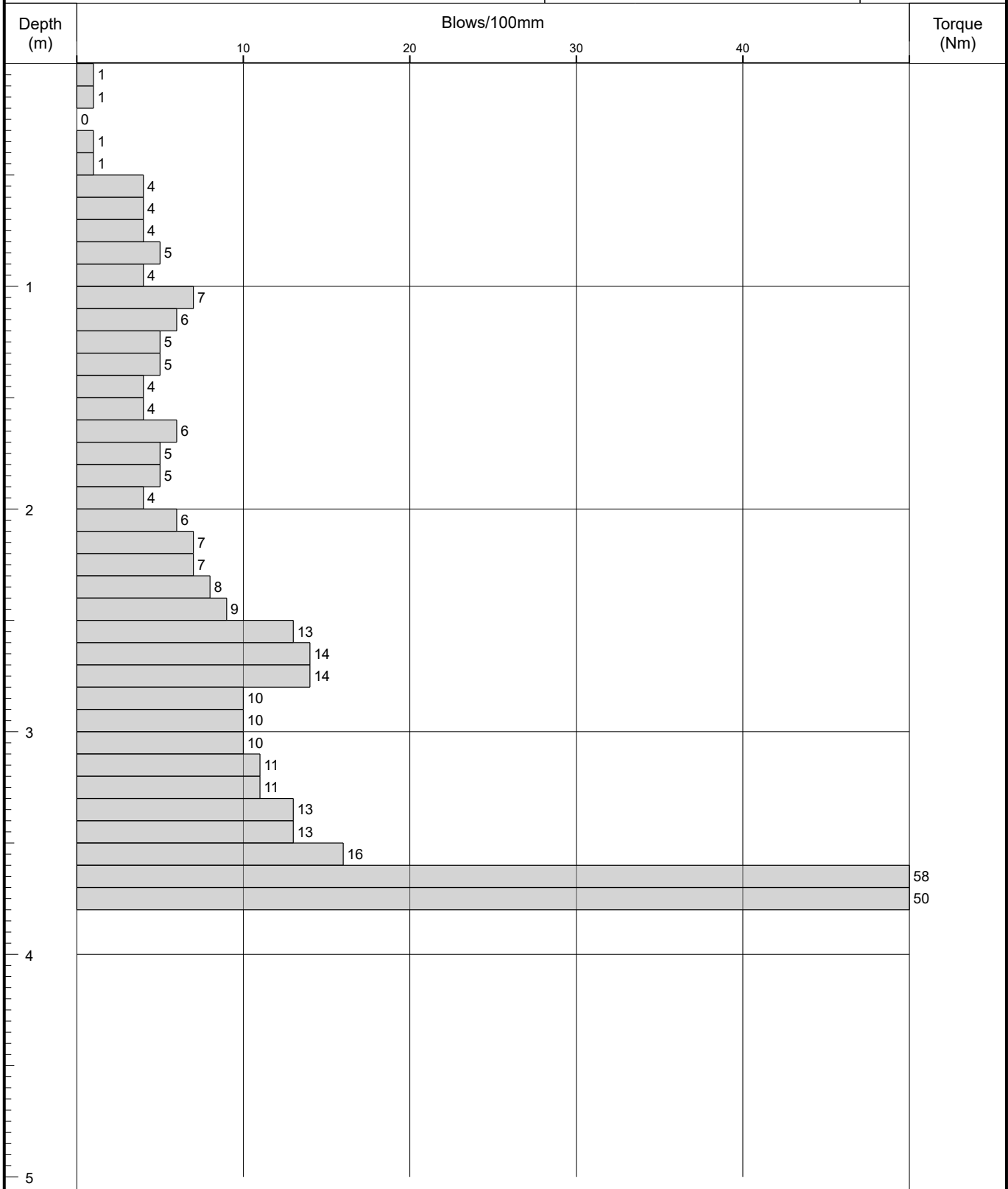
Location: Manchester

Level: 37.95

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 3.80

Log Scale 1:25





Probe Log

Borehole No.

DCP 33

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384671.55 - 397689.73

Hole Type
DP

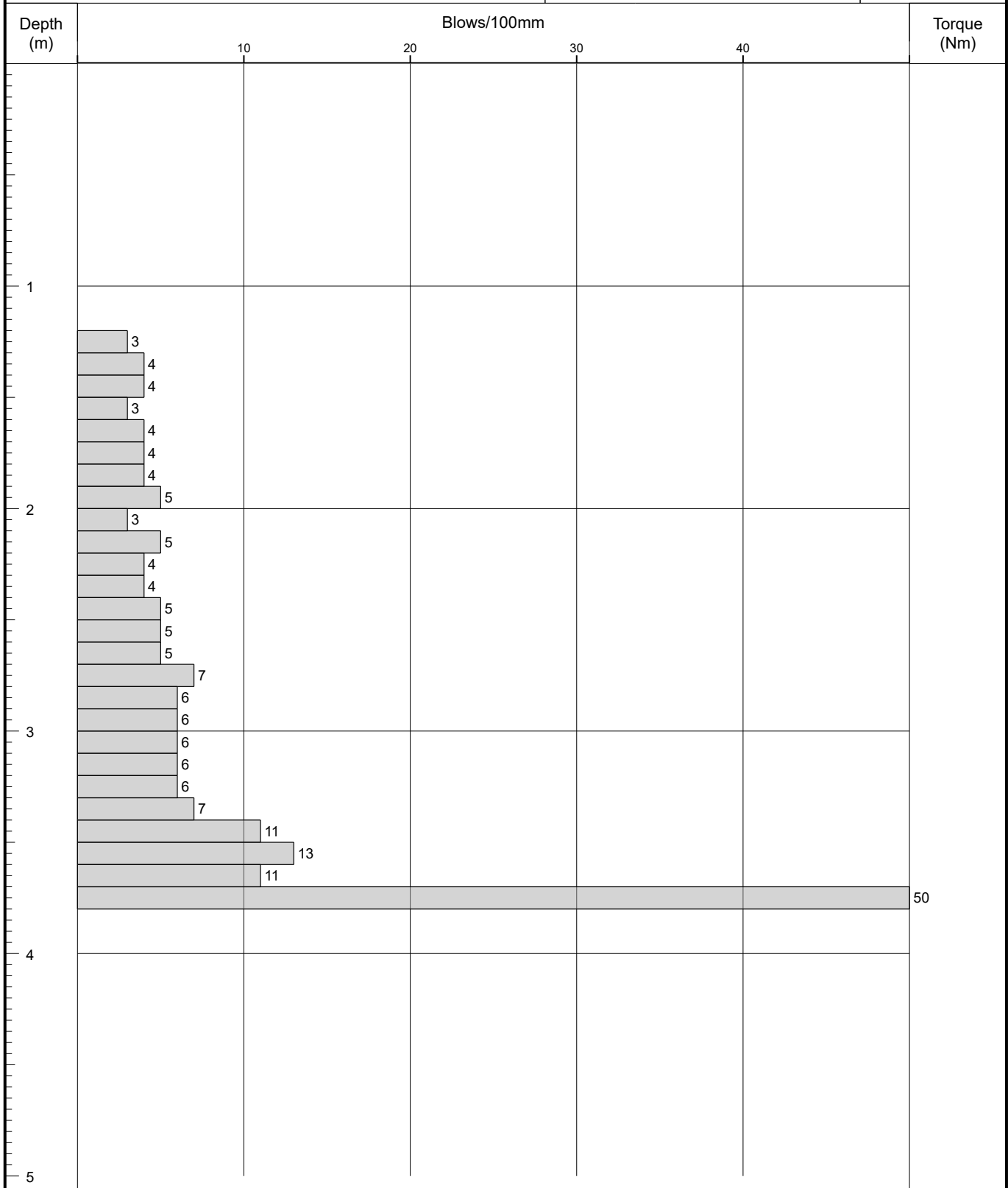
Location: Manchester

Level: 38.46

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.80

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 34

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384665.86 - 397716.13

Hole Type
DP

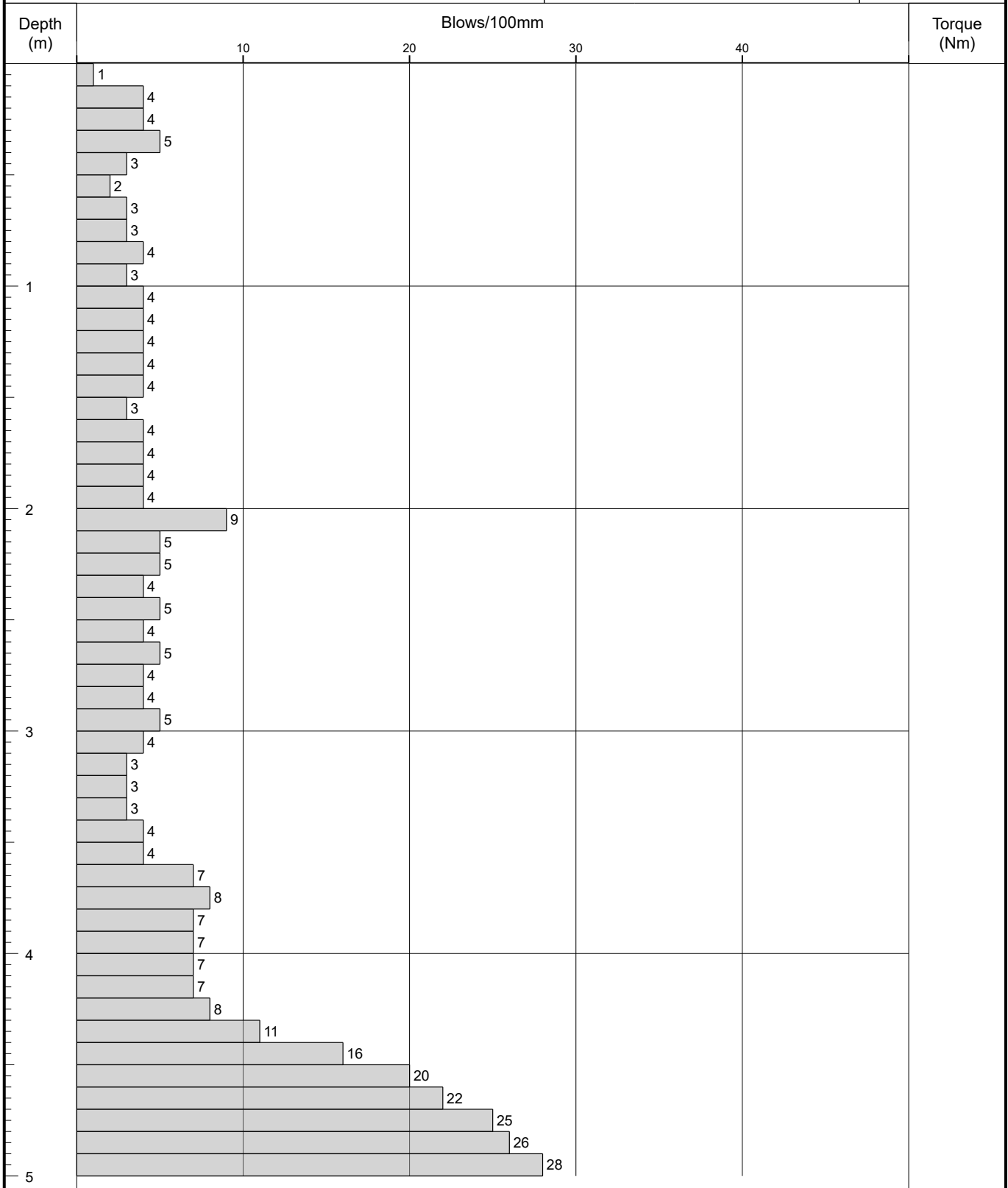
Location: Manchester

Level: 39.93

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 5.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 35

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384667.11 - 397712.60

Hole Type
DP

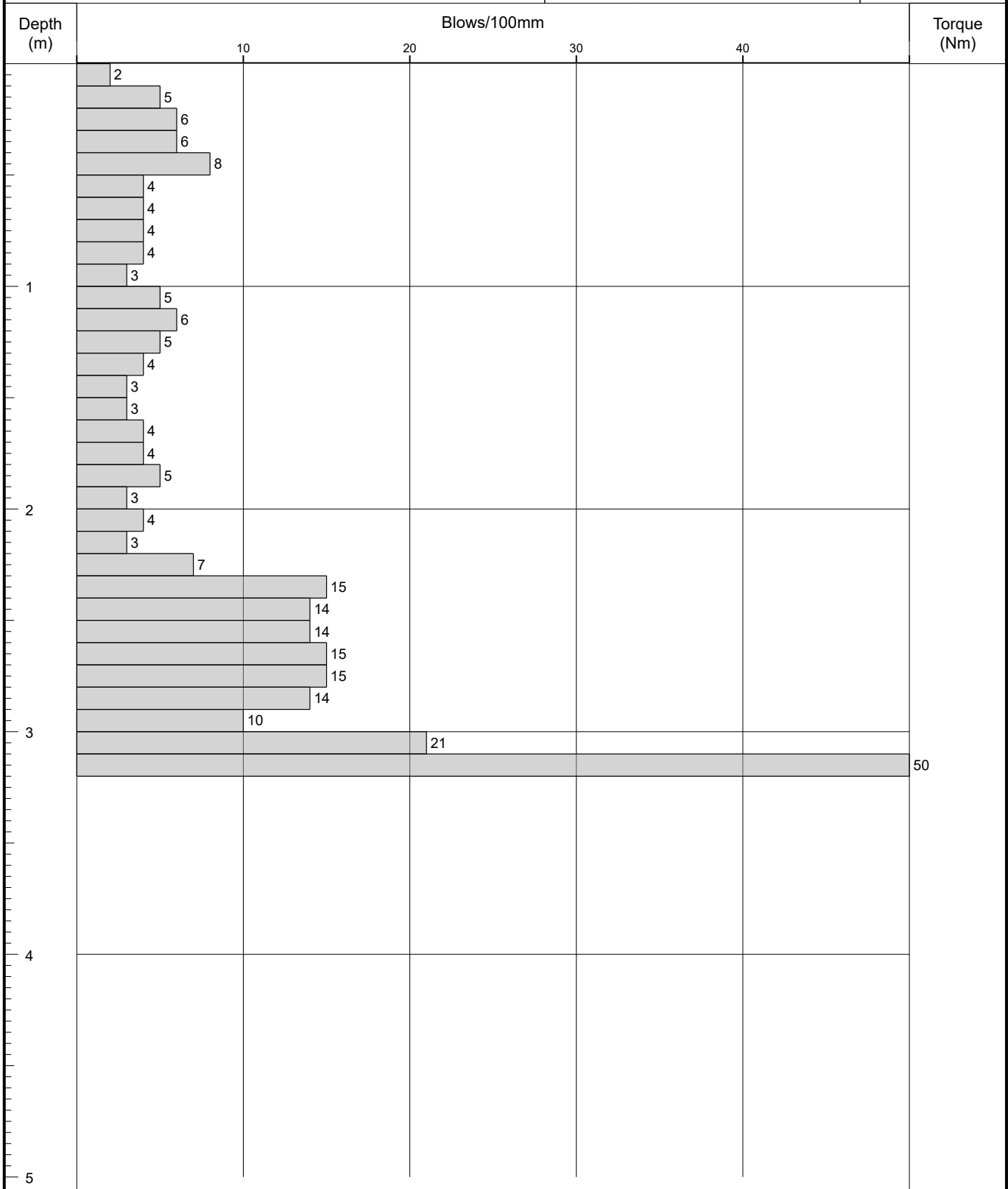
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN**Remarks**

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required. Ground level determined following completion of investigation works. Ground level should be taken as an estimate.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.20

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 36

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384668.37 - 397709.07

Hole Type
DP

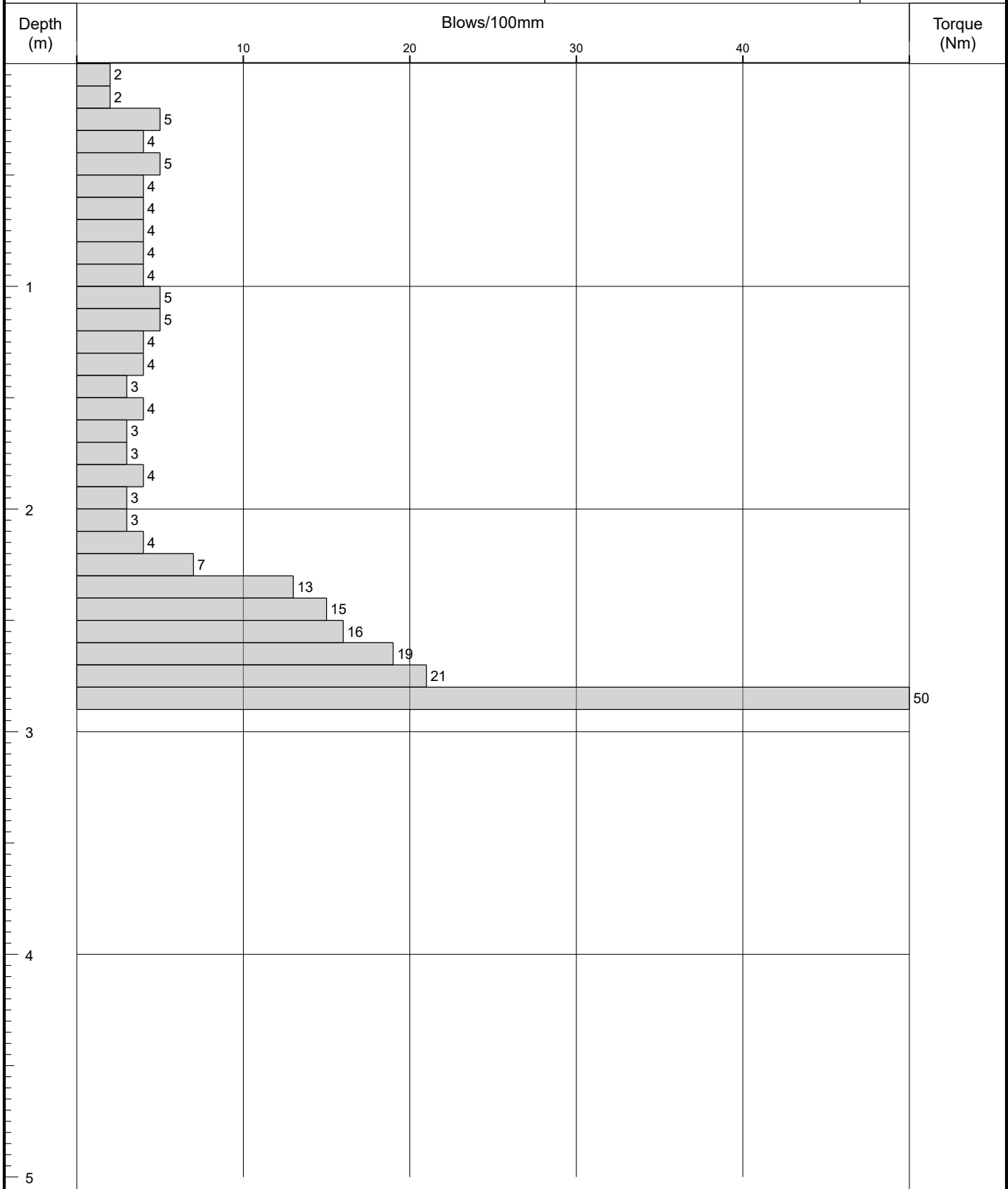
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN**Remarks**

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required. Ground level determined following completion of investigation works. Ground level should be taken as an estimate.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 2.90

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 37

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384667.46 - 397717.33

Hole Type
DP

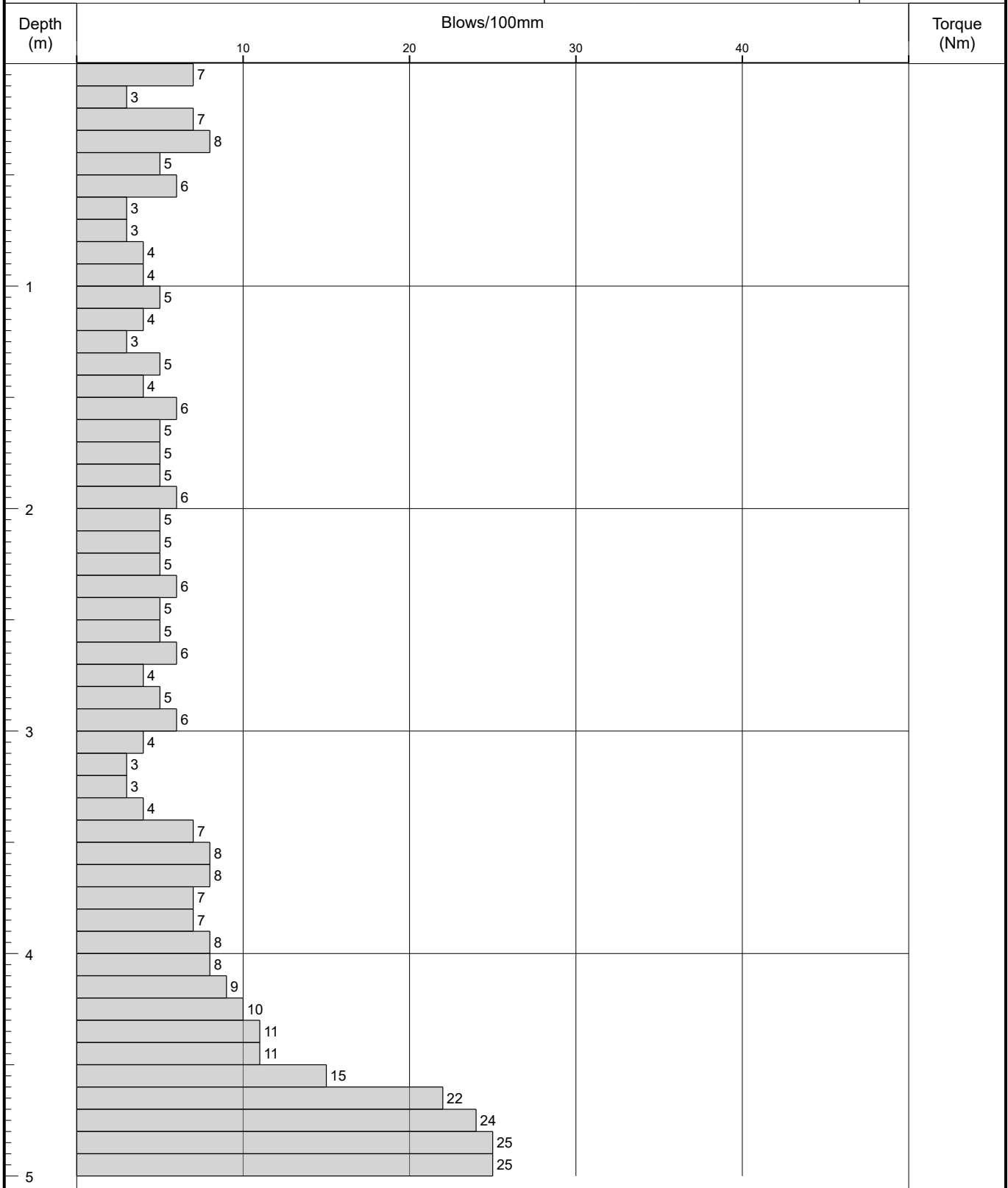
Location: Manchester

Level: 40.05

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 5.00

Log Scale 1:25





Probe Log

Borehole No.

DCP 38

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384669.51 - 397711.46

Hole Type
DP

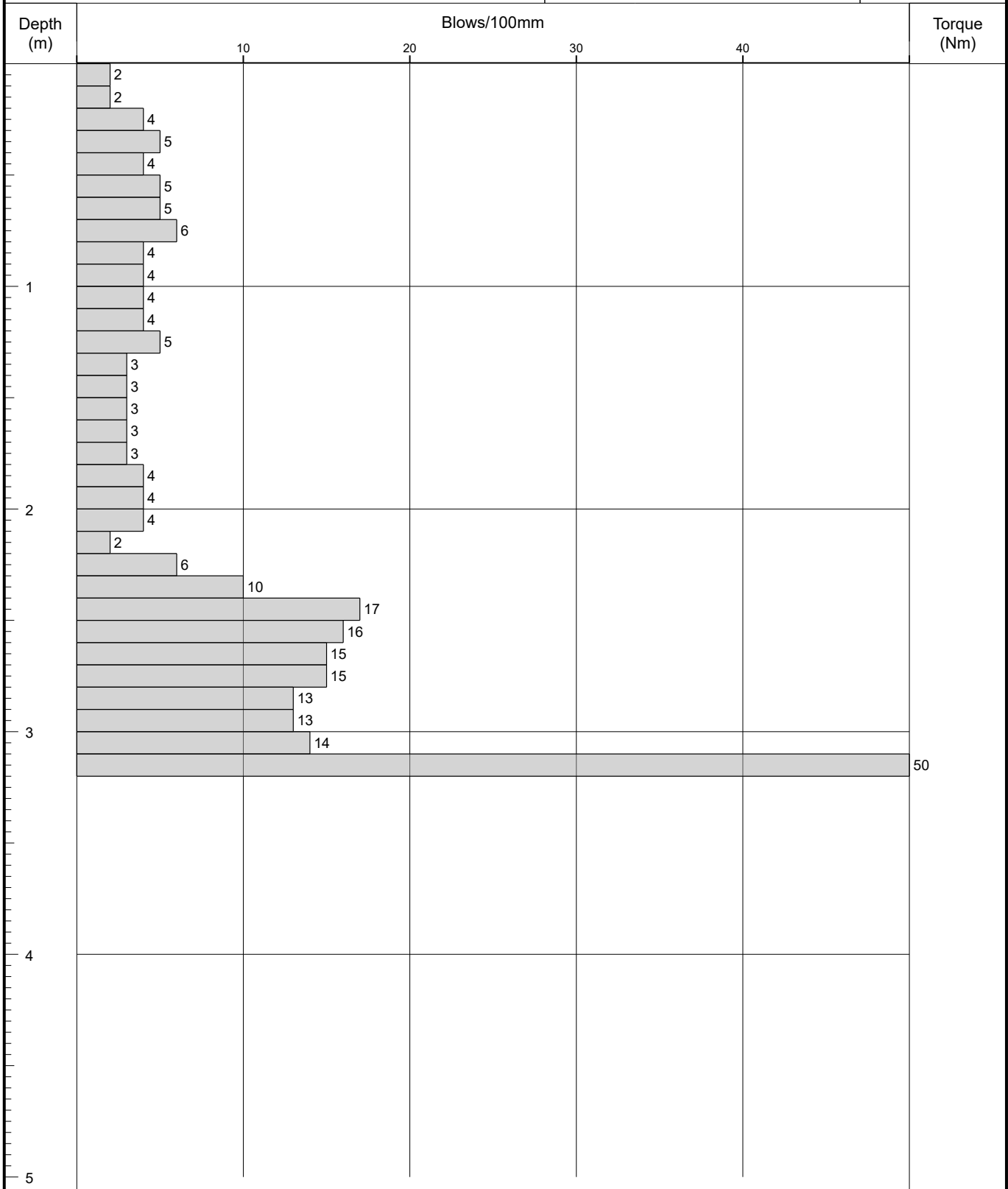
Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN**Remarks**

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required. Ground level determined following completion of investigation works. Ground level should be taken as an estimate.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.20

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 39

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384670.77 - 397707.93

Hole Type
DP

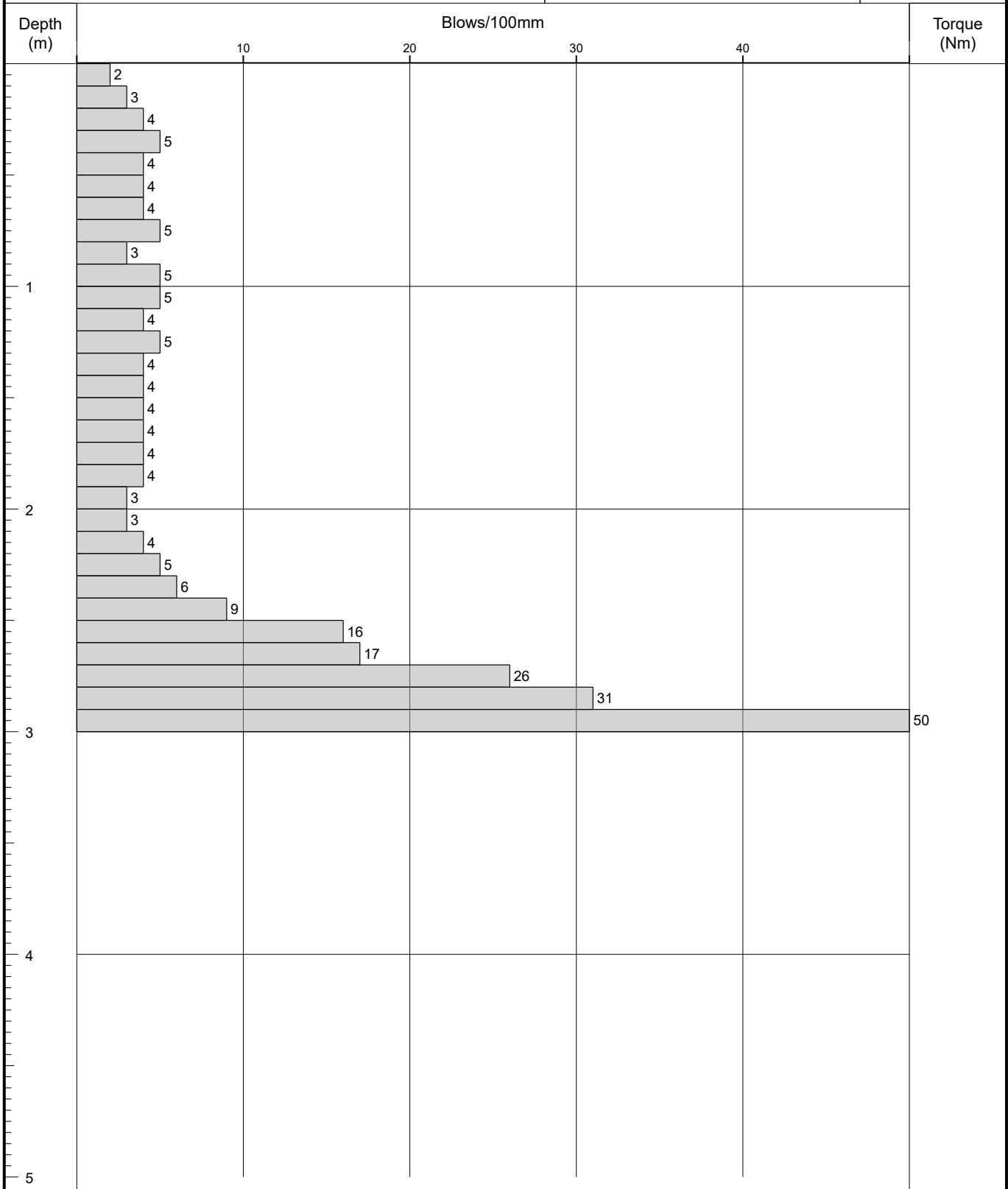
Location: Manchester

Level: 37.89

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN**Remarks**

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required. Ground level determined following completion of investigation works. Ground level should be taken as an estimate.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 3.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 40

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384675.39 - 397698.03

Hole Type
DP

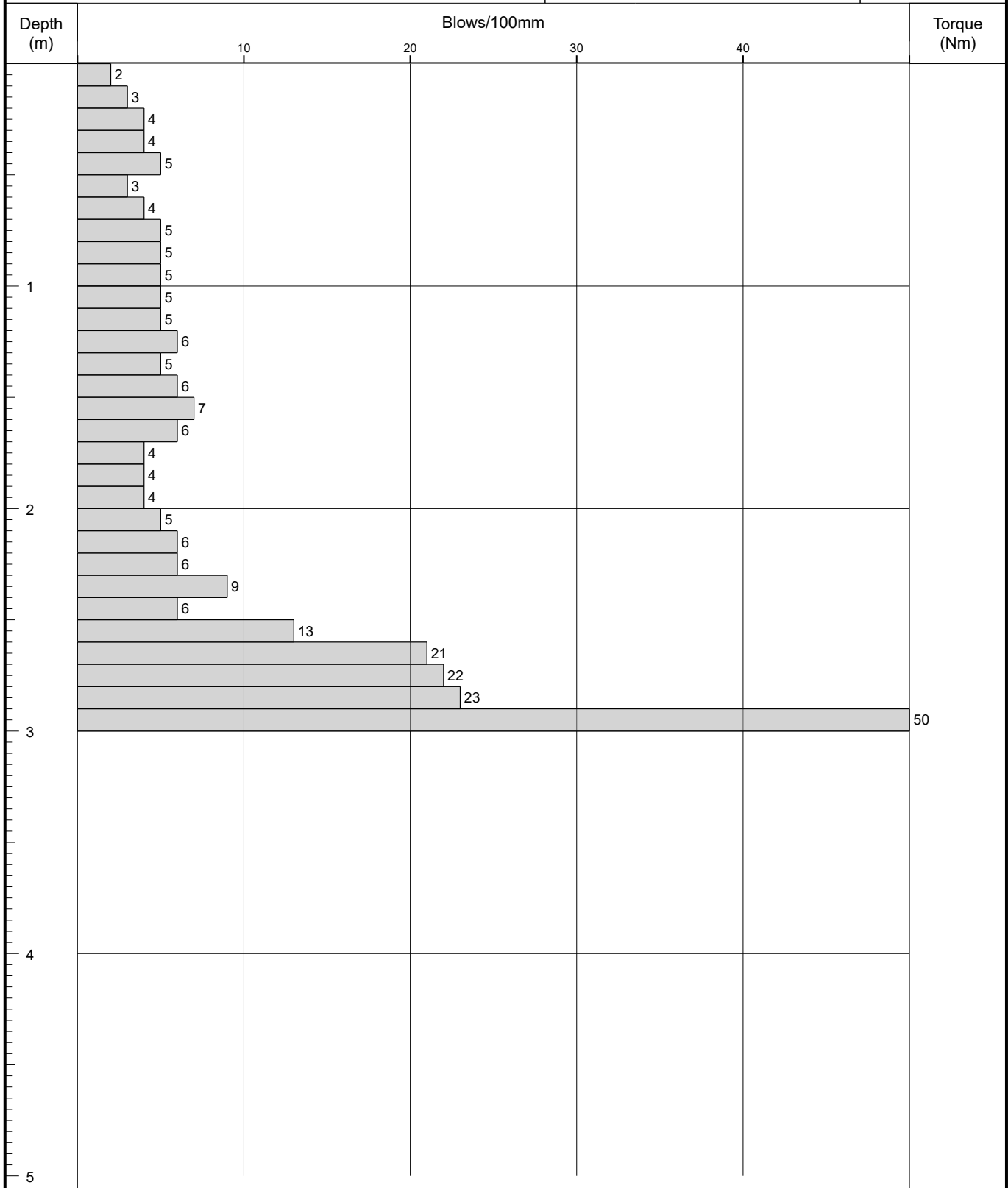
Location: Manchester

Level: 37.82

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 3.00

Log Scale 1:25





Probe Log

Borehole No.

DCP 43

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384670.65 - 397713.86

Hole Type
DP

Location: Manchester

Level: 37.90

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0	1				
0	1				
0	1				
0	1				
0	1				
0	1				
0	1				
0	2				
0	3				
0	3				
1	5				
1	4				
1	4				
1	5				
1	4				
1	4				
1	4				
1	4				
1	3				
1	3				
2	5				
2	7				
2	22				
2					50
3					
4					
5					

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required. Ground level determined following completion of investigation works. Ground level should be taken as an estimate.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 2.40

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 44

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384671.91 - 397710.33

Hole Type
DP

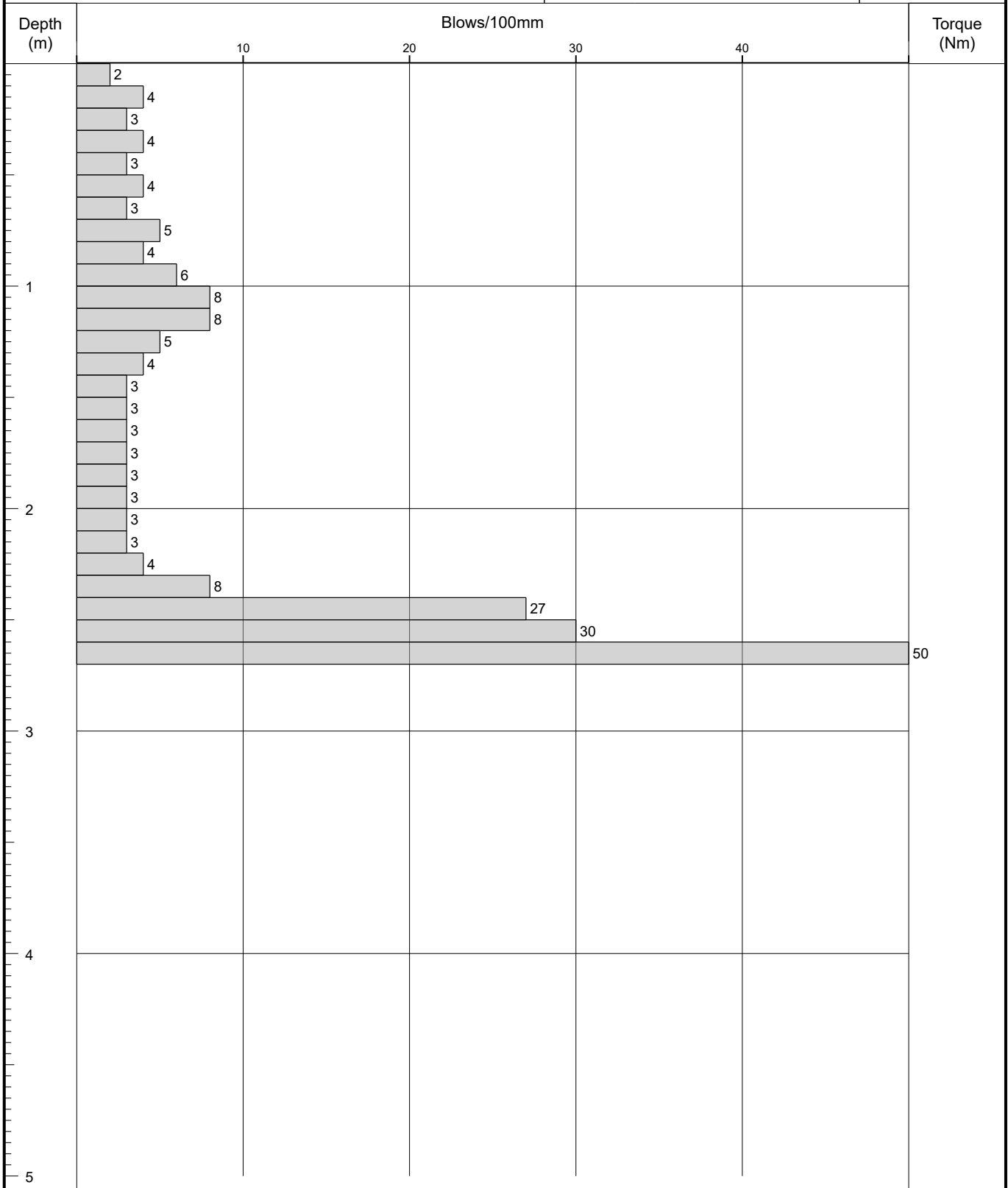
Location: Manchester

Level: 37.89

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN**Remarks**

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required. Ground level determined following completion of investigation works. Ground level should be taken as an estimate.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 2.70

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 45

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384674.94 - 397704.24

Hole Type
DP

Location: Manchester

Level: 37.89

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	2				
	5				
	4				
	4				
	4				
	4				
	4				
	4				
	5				
	5				
	6				
	4				
	4				
	5				
	4				
	5				
	5				
	6				
2	4				
	4				
	5				
	4				
	4				
					50
3					
4					
5					

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required. Ground level determined following completion of investigation works. Ground level should be taken as an estimate.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 2.40

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 47

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384684.21 - 397697.35

Hole Type
DP

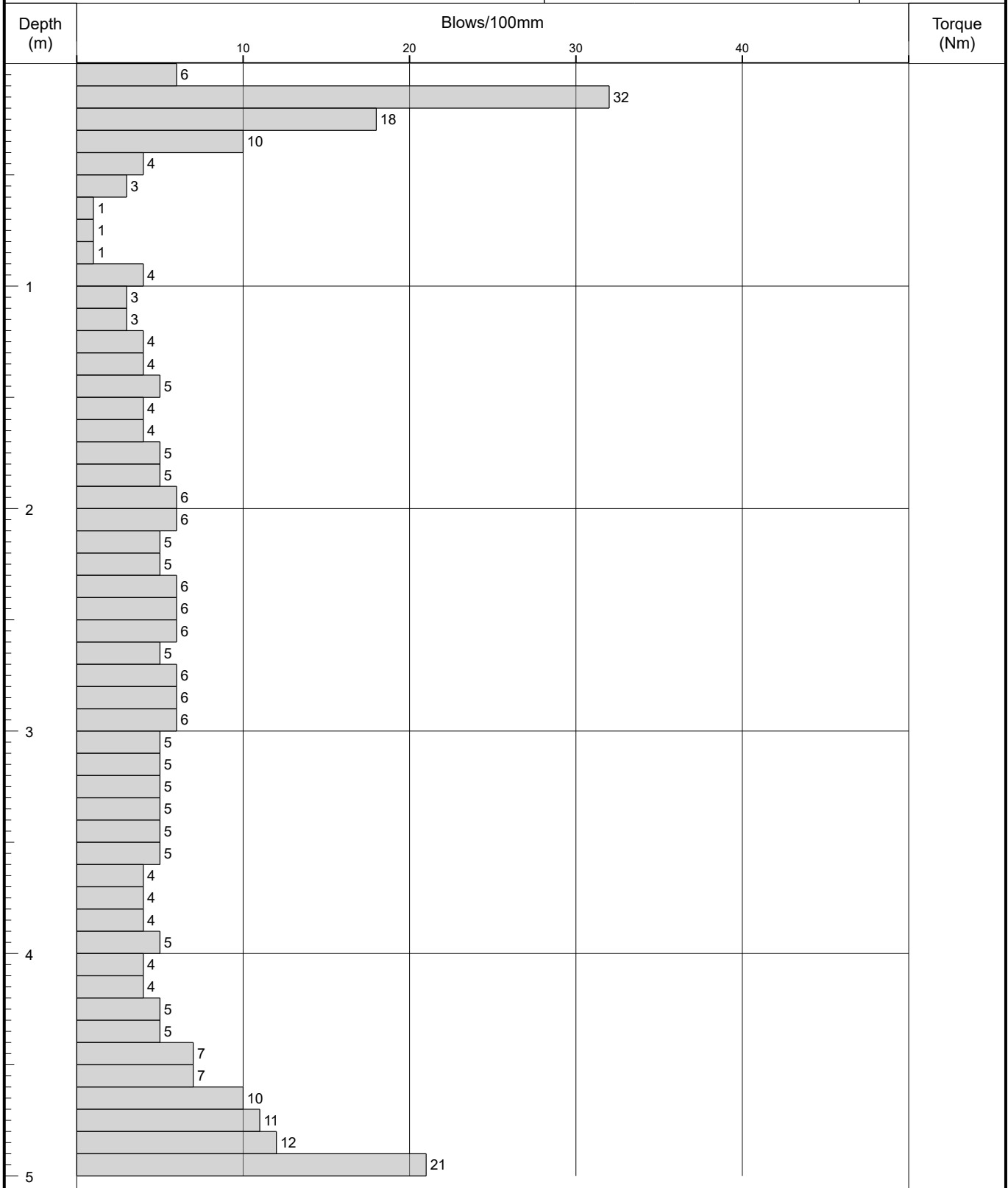
Location: Manchester

Level: 39.98

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Reduced level dig to depths >1.20m undertaken during demolition of pre-existing building and construction of the piling mat. No service clearance pit required.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 5.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 48

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384685.11 - 397694.80

Hole Type
DP

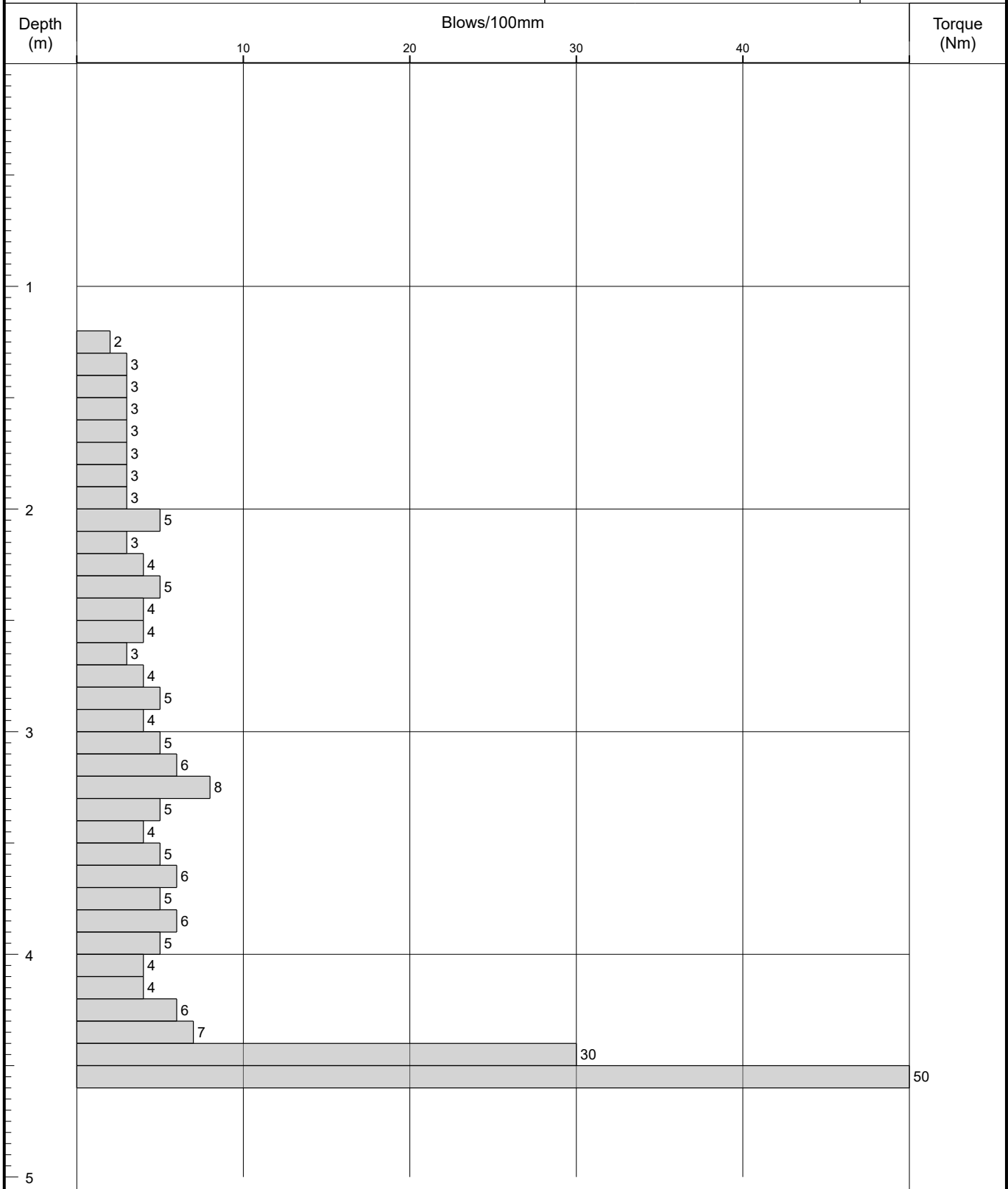
Location: Manchester

Level: 40.07

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 4.60

Log Scale 1:25





Probe Log

Borehole No.

DCP 49

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384691.36 - 397697.77

Hole Type
DP

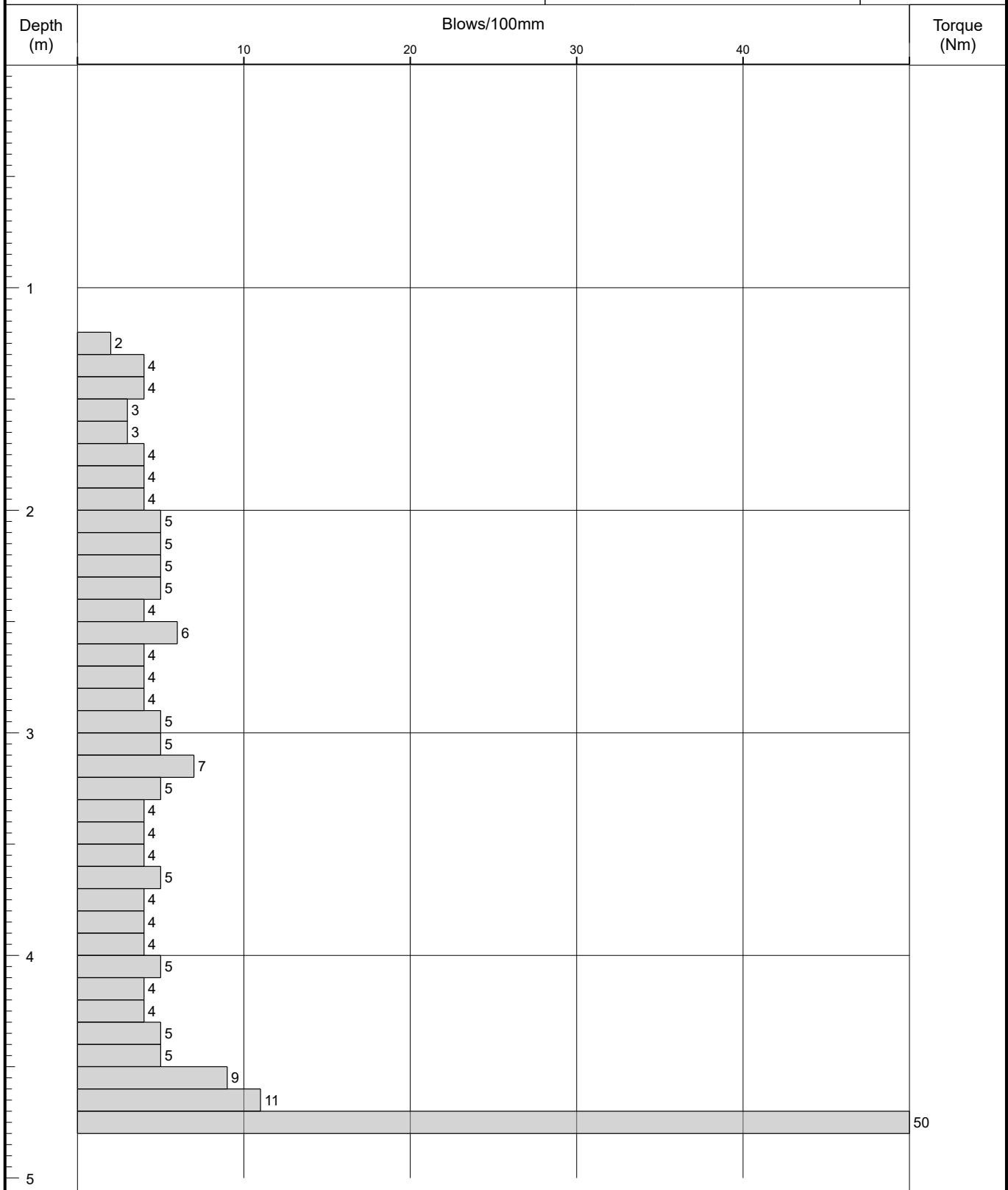
Location: Manchester

Level: 40.03

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 4.80

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 50

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384697.97 - 397699.75

Hole Type
DP

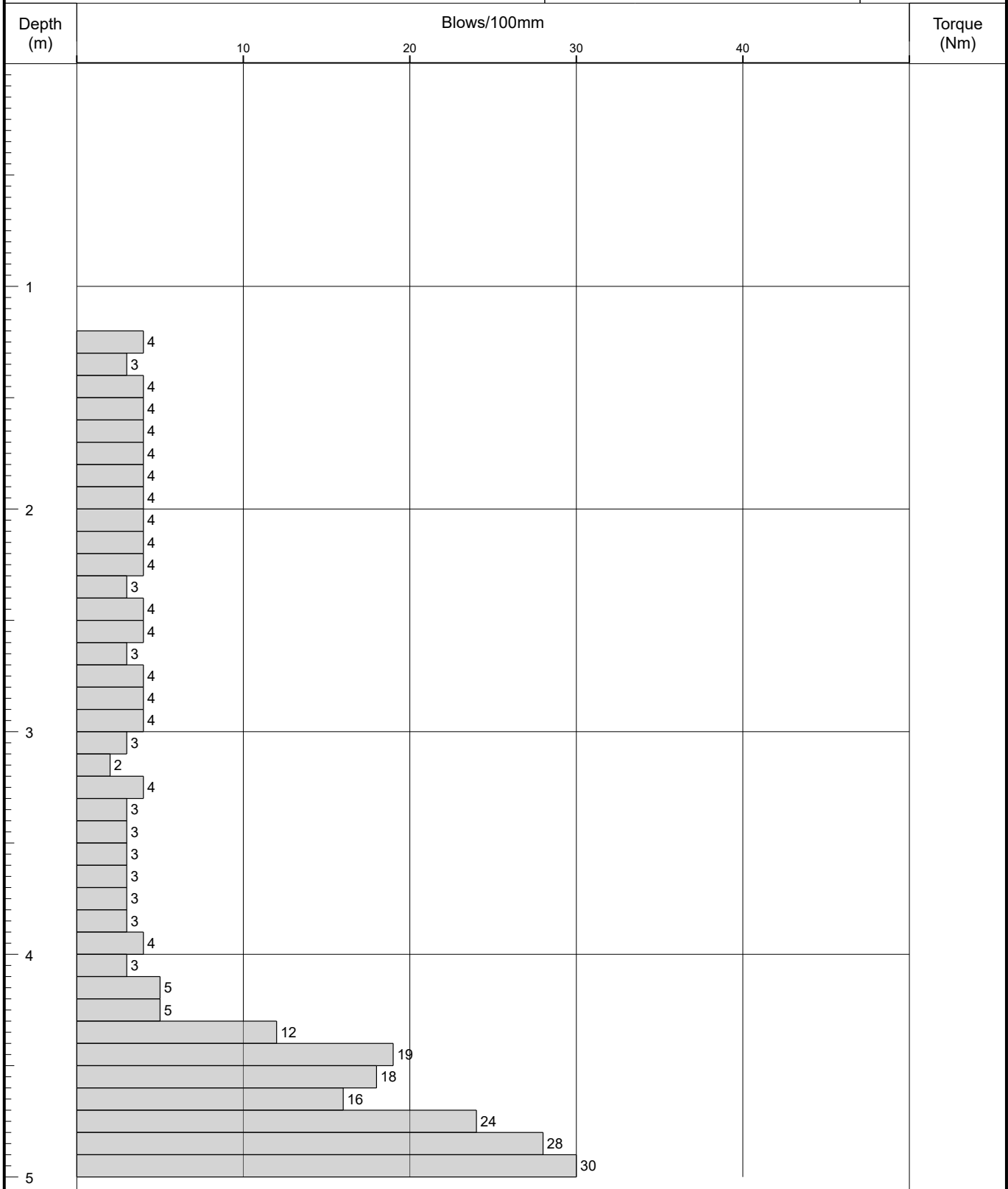
Location: Manchester

Level: 40.07

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 5.00

Log Scale 1:25





Probe Log

Borehole No.

DCP 51

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384702.23 - 397705.86

Hole Type
DP

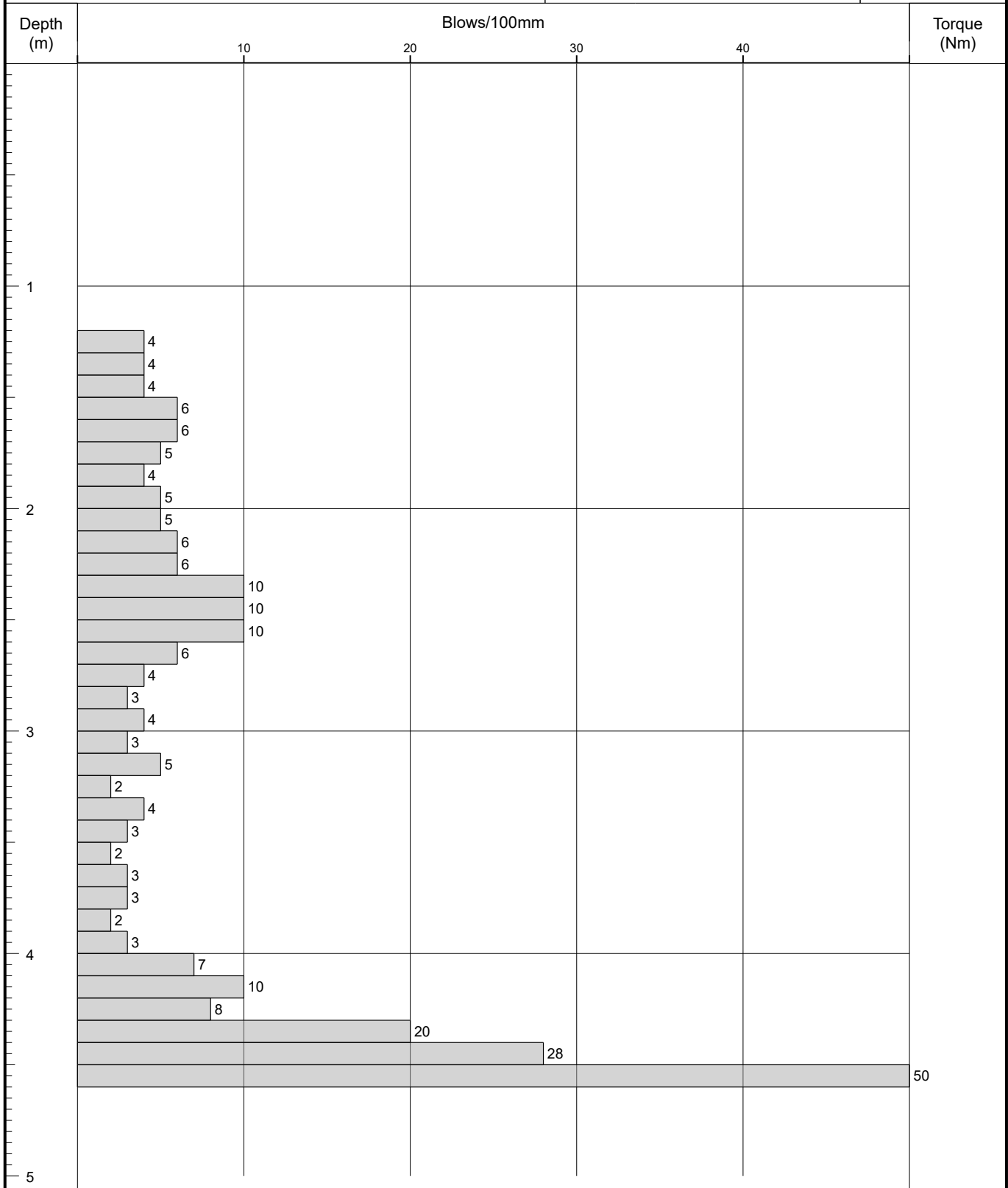
Location: Manchester

Level: 40.15

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 4.60

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 52

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384702.86 - 397704.10

Hole Type
DP

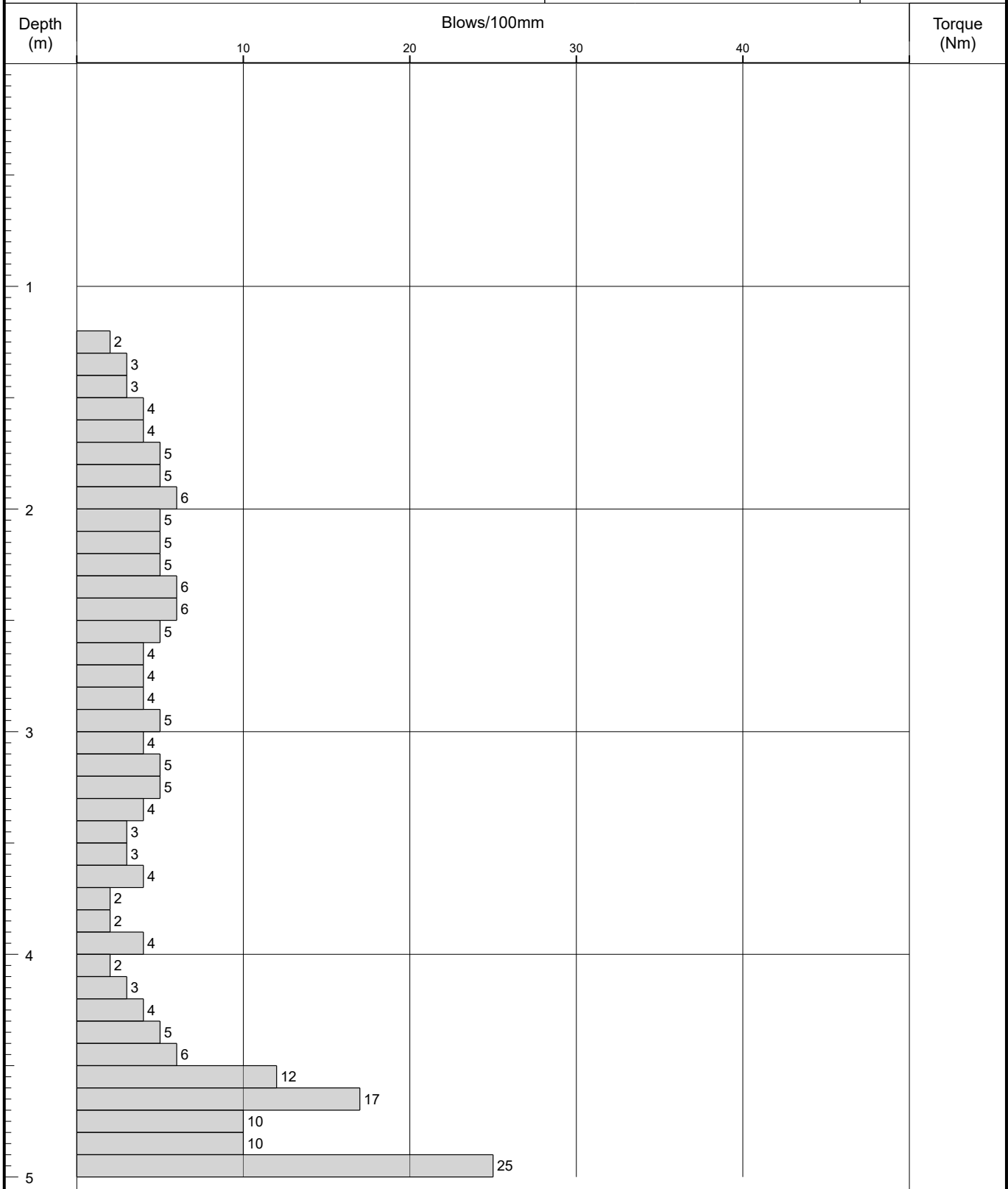
Location: Manchester

Level: 40.16

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 5.00

Log Scale 1:25





Probe Log

Borehole No.

DCP 53

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384703.46 - 397702.35

Hole Type
DP

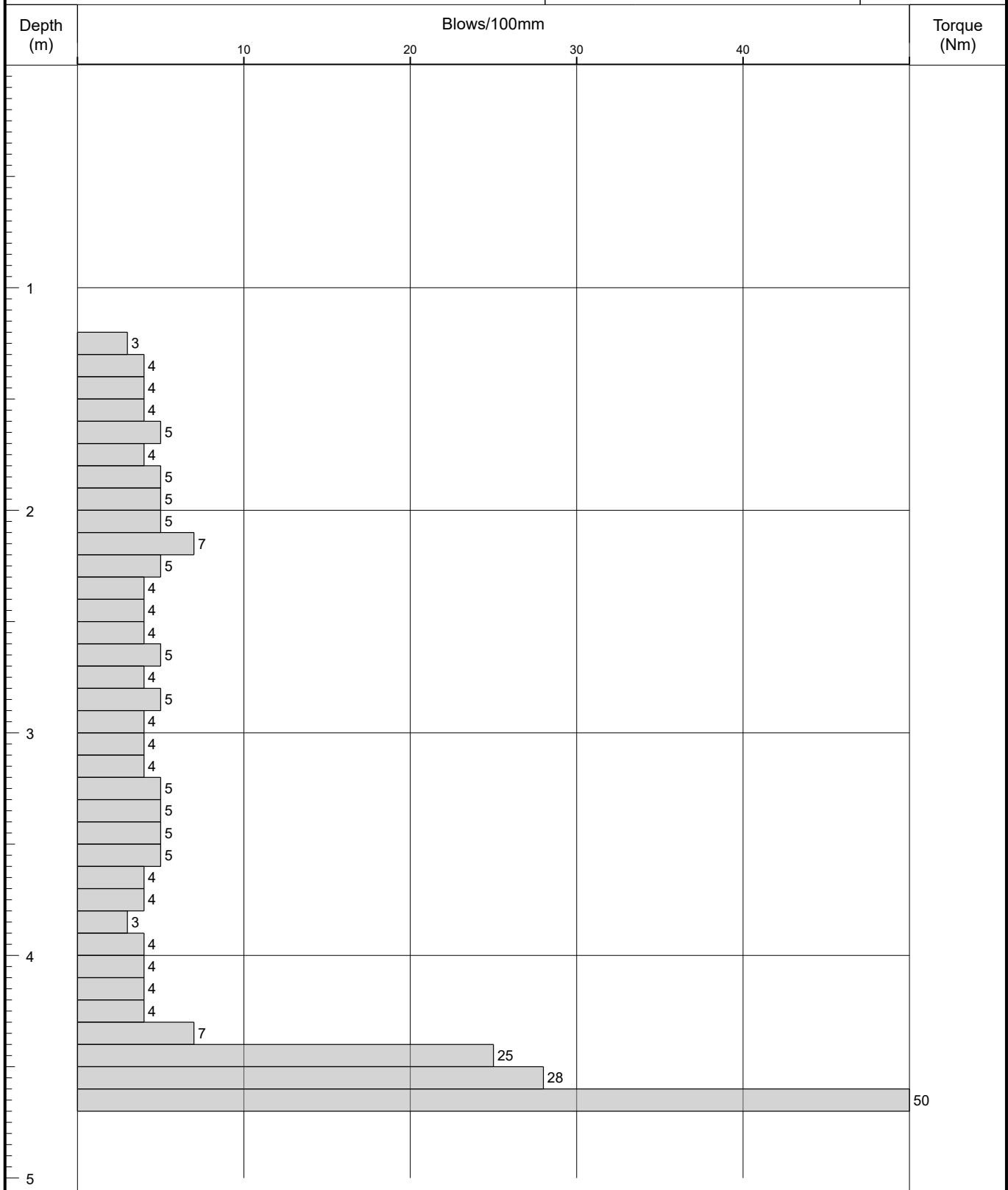
Location: Manchester

Level: 40.07

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 4.70

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 54

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384704.26 - 397706.59

Hole Type
DP

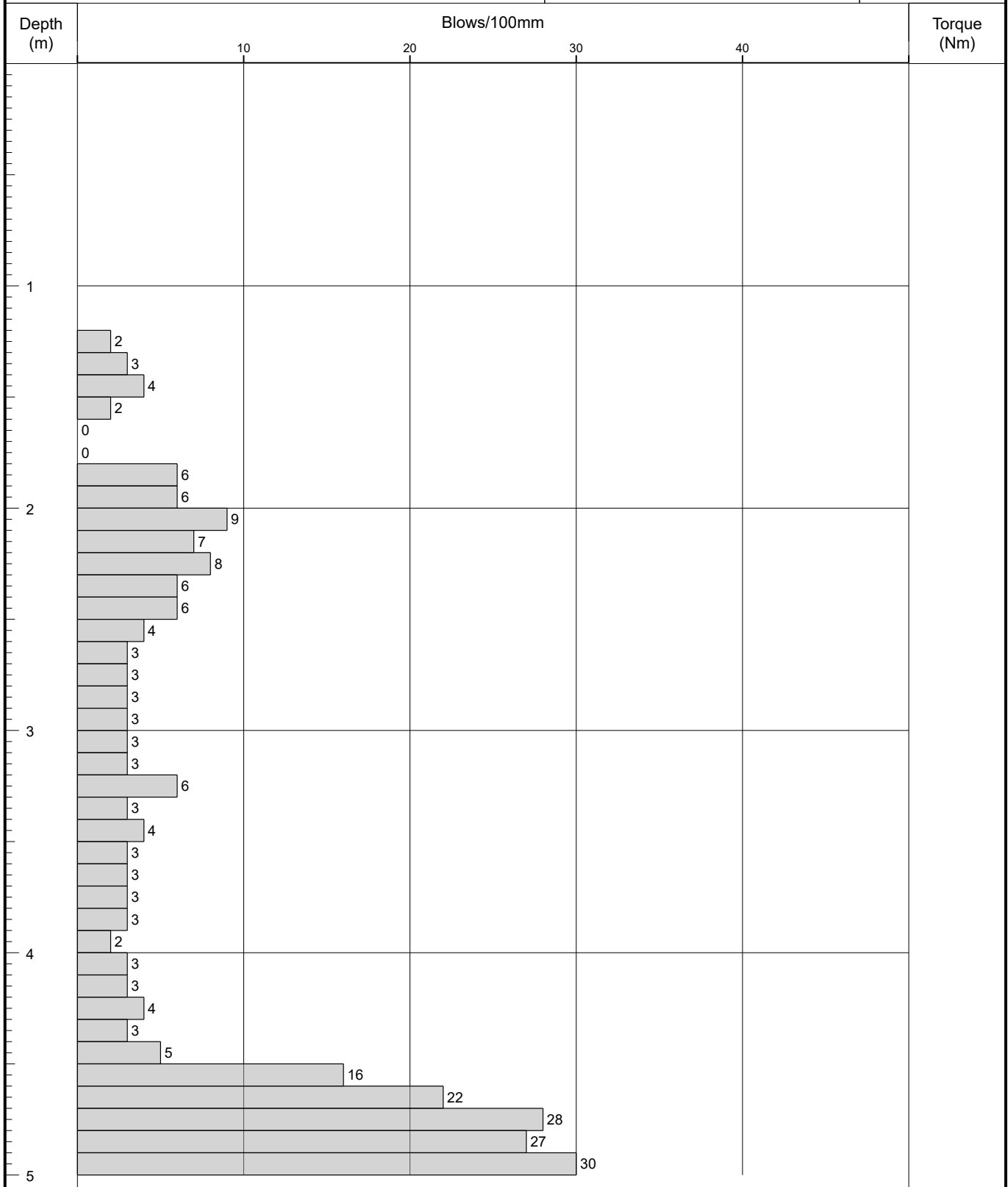
Location: Manchester

Level: 40.17

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 5.00

Log Scale 1:25





Probe Log

Borehole No.

DCP 55

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384704.89 - 397704.82

Hole Type
DP

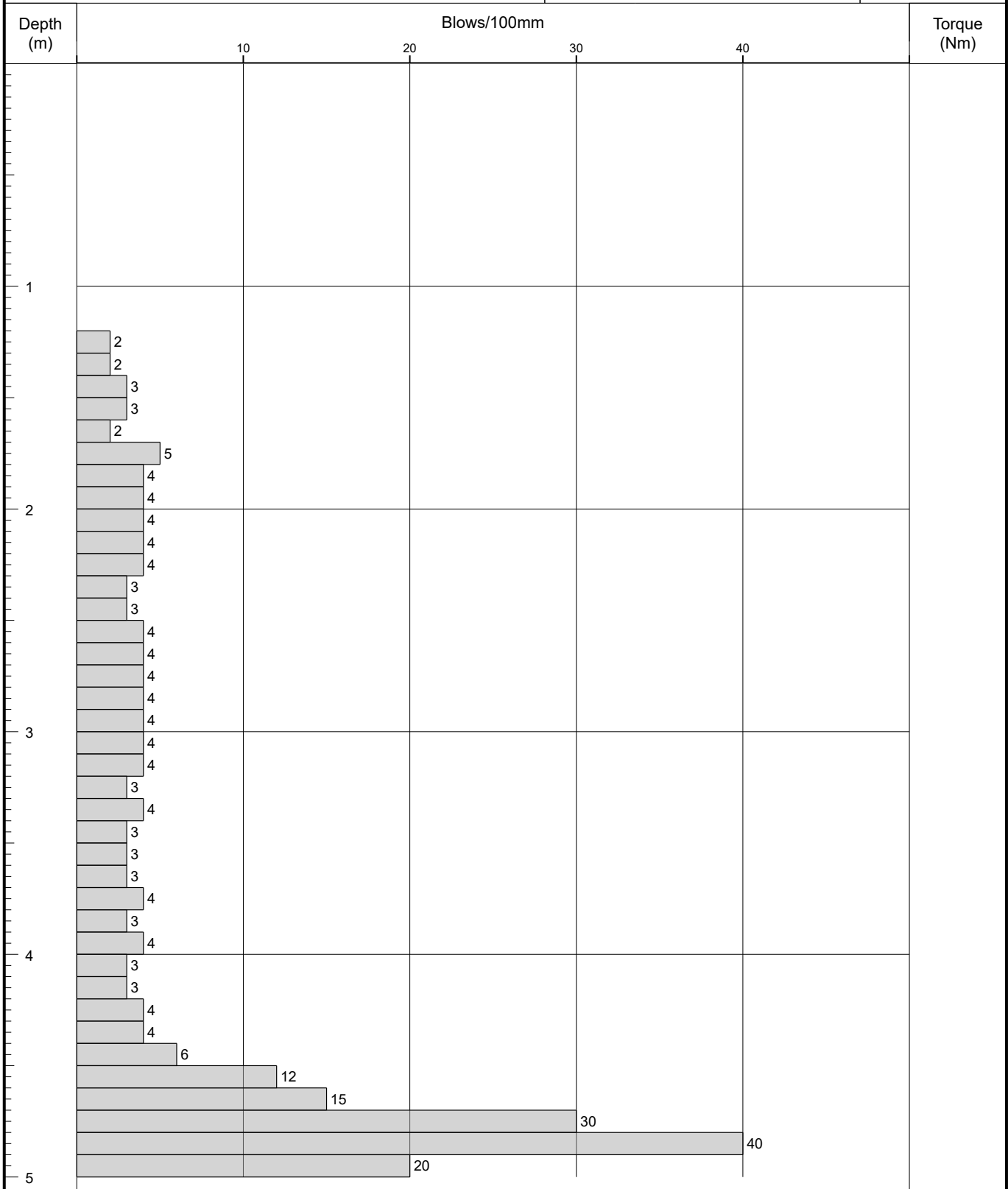
Location: Manchester

Level: 40.16

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.20m bgl.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 5.00

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 56

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384705.52 - 397703.05

Hole Type
DP

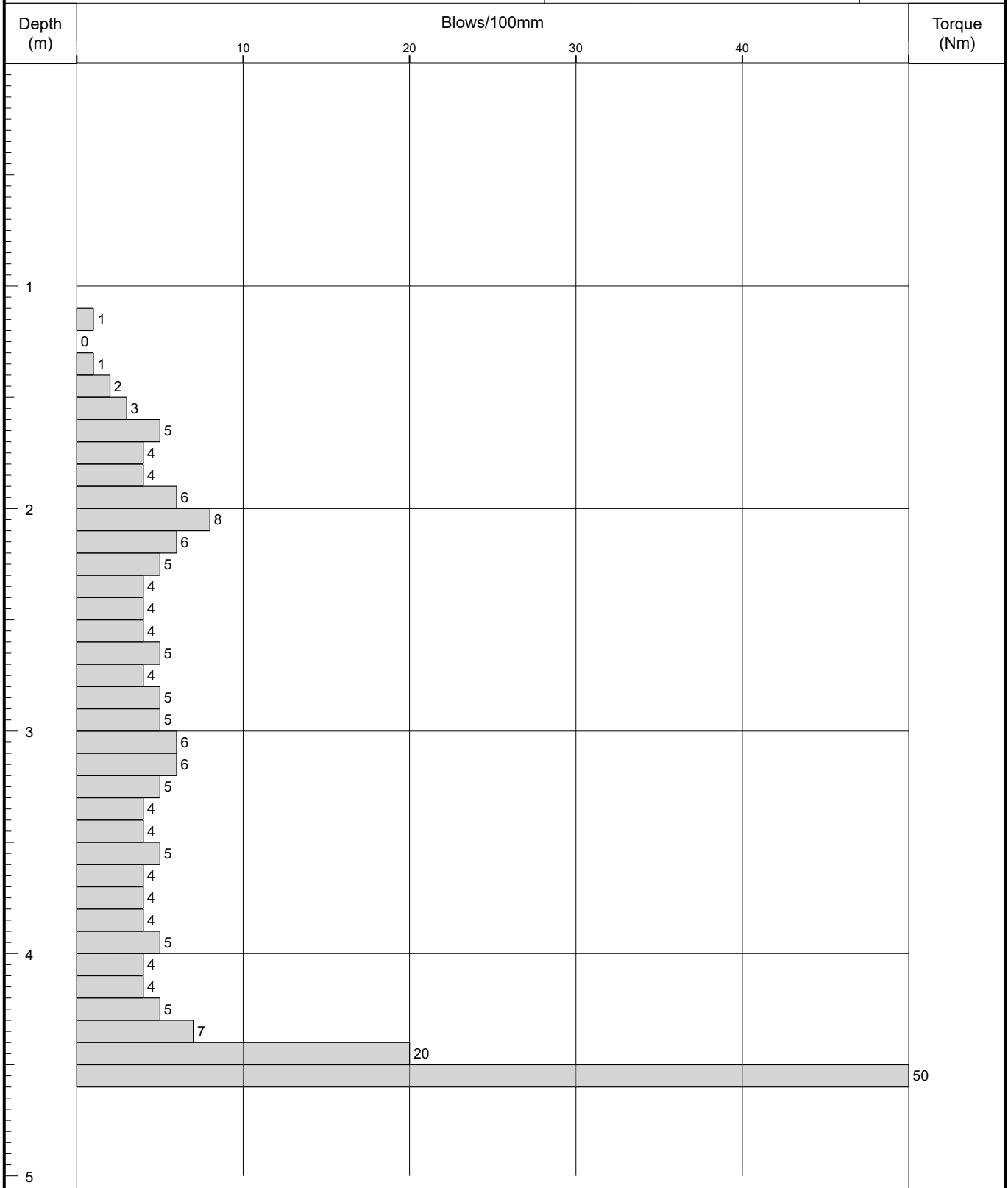
Location: Manchester

Level: 40.06

Scale
1:25

Client: IQ Student Accommodation

Dates: 04/09/2019 - 04/09/2019

Logged By
PN

Remarks

Hand auger service clearance pit to 1.10m bgl. Reduced level dig to depths 0.10m undertaken during demolition of pre-existing building and construction of the piling mat.

Fall Height 760

Cone Base Diameter 44

Hammer Wt 64

Final Depth 4.60

Probe Type DPSH-B

Log Scale 1:25





Probe Log

Borehole No.

DCP 57

Sheet 1 of 1

Project Name: Echo Street, Manchester

Project No.
065374.004

Co-ords: 384711.23 - 397705.08

Hole Type
DP

Location: Manchester

Level: 40.04

Scale
1:25

Client: IQ Student Accommodation

Dates: 05/09/2019 - 05/09/2019

Logged By
PN

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1					50
2					
3					
4					
5					

Remarks

Hand auger service clearance pit to 0.80m bgl.
Obstruction encountered at 0.80m bgl.

Fall Height 760

Hammer Wt 64

Probe Type DPSH-B

Cone Base Diameter 44

Final Depth 0.90

Log Scale 1:25





Borehole Log

Borehole No.

WS215

Sheet 1 of 1

Project Name: Echo Street, Additional SI

Project No.
B065374.004

Co-ords: -

Hole Type
WS

Location: Echo Street, Manchester

Level:

Scale
1:50

Client: IQ Student Accommodation

Dates: 06/09/2019 - 06/09/2019

Logged By
PN

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.80 - 0.85	ES		0.80			MADE GROUND: Light brown subangular medium to coarse gravel of mixed lithologies.	
		1.60	ES		2.00			Firm becoming stiff brown with occasional grey mottling silty sandy CLAY.	1
								End of borehole at 2.00 m	2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

No Groundwater encountered. Borehole terminated at 2.00m bgl.



Appendix C Chemical Laboratory Testing Results

- Envirolab, Environmental Chemistry Analysis Results (Soil)

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/06313
Issue Number: 1

Date: 24 July, 2019

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

Project Manager: Amber Hatch-Walling/Jonathan Lord/Niall Farnworth
Project Name: Echo Street
Project Ref: B065374.001
Order No: EBMA1949
Date Samples Received: 03/07/19
Date Instructions Received: 04/07/19
Date Analysis Completed: 24/07/19

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Richard Wong
Client Manager

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
% Stones >10mm _A	15.1	3.4	<0.1	-	-	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	8.64	8.20	7.87	-	-	8.55	8.65	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.08	0.26	0.10	-	-	0.11	0.08	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#}	8.7	3.4	0.8	-	-	-	-	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	11	11	4	-	-	-	-	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	1.1	<1.0	-	-	-	-	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.1	1.1	0.9	-	-	-	-	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	65	26	9	-	-	-	-	mg/kg	1	A-T-024s
Chromium _D ^{M#}	25	27	31	-	-	-	-	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	-	-	-	-	mg/kg	1	A-T-040s
Lead _D ^{M#}	25	75	16	-	-	-	-	mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	-	-	-	-	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	35	26	24	-	-	-	-	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	-	-	-	-	mg/kg	1	A-T-024s
Zinc _D ^{M#}	33	51	43	-	-	-	-	mg/kg	5	A-T-024s
1.01 % Moisture BS1377 1990 pt2 cl3.2 _D [#]	-	-	-	-	-	Appended	Appended		0.1	Subcon SS
1.02 Atterburg 4Pt BS1377 1990 pt2 cl4.4,5.3+5.4 _D [#]	-	-	-	-	-	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
4.01 Dimensional Consolidation (5 days) (75mm) BS1377:1990 Part5 cl 3 _D	-	-	-	Appended	-	-	-	N/A		Subcon SS
5.05 QUT Multistage (100mm) BS1377 1990 pt7 cl9 (Undrained Shear Strength) _D [#]	-	-	-	-	US	-	-	N/A		Subcon SS

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
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: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
PAH-16MS										
Acenaphthene _A ^{M#}	1.29	<0.01	<0.01	-	-	-	-	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.08	<0.01	<0.01	-	-	-	-	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	4.96	<0.02	<0.02	-	-	-	-	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	8.81	<0.04	<0.04	-	-	-	-	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	5.40	<0.04	<0.04	-	-	-	-	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	6.90	<0.05	<0.05	-	-	-	-	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	2.30	<0.05	<0.05	-	-	-	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	2.78	<0.07	<0.07	-	-	-	-	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	7.75	<0.06	<0.06	-	-	-	-	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.66	<0.04	<0.04	-	-	-	-	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	21.8	0.09	<0.08	-	-	-	-	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	1.14	<0.01	<0.01	-	-	-	-	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	2.84	<0.03	<0.03	-	-	-	-	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.24	<0.03	<0.03	-	-	-	-	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	20.6	0.09	<0.03	-	-	-	-	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	17.2	<0.07	<0.07	-	-	-	-	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	105	0.18	<0.08	-	-	-	-	mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	22	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	9	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	2	<1	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	6	2	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C21-C35 _A	15	8	<1	-	-	-	-	mg/kg	1	A-T-055s
Total Aliphatics _A	22	43	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	2	7	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	3	2	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C12-C16 _A	29	1	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	261	2	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	610	6	1	-	-	-	-	mg/kg	1	A-T-055s
Total Aromatics _A	906	20	1	-	-	-	-	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	928	62	1	-	-	-	-	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/9							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201									
Depth to Top	3.45									
Depth To Bottom	3.50									
Date Sampled										
Sample Type	Soil - D									
Sample Matrix Code	5A									
% Stones >10mm _A	<0.1							% w/w	0.1	A-T-044
pH _D ^{M#}	8.04							pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.08							g/l	0.01	A-T-026s
1.01 % Moisture BS1377 1990 pt2 cl3.2 _D [#]	Appended								0.1	Subcon SS
1.02 Atterburg 4Pt BS1377 1990 pt2 cl4.4,5.3+5.4 _D [#]	Appended								1	Subcon SS

REPORT NOTES

General

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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.

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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: Echo Street
Clients Project No: B065374.001

Project No: 19/06313
Date Received: 04/07/2019 (am)
Cool Box Temperatures (°C): 20.6

Lab Sample ID	19/06313/9
Client Sample No	
Client Sample ID/Depth	BH201 3.45- 3.50m
Date Sampled	
Deviation Code	
E (no date)	✓

Key
E (no date) No sampling date provided (all results affected if not provided)

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 SUPPLEMENT TO TEST REPORT 19/06313/1

Amendments: Request for Additional Analysis

Envirolab Job Number: 19/06313
Issue Number: 2

Date: 08 August, 2019

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

Project Manager: Amber Hatch-Walling/Jonathan Lord/Niall Farnworth
Project Name: Echo Street
Project Ref: B065374.001
Order No: EBMA1949
Date Samples Received: 03/07/19
Date Instructions Received: 04/07/19
Date Analysis Completed: 06/08/19

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Holly Neary-King
Client Manager

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
% Stones >10mm _A	15.1	3.4	<0.1	-	-	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	8.64	8.20	7.87	-	-	8.55	8.65	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.08	0.26	0.10	-	-	0.11	0.08	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#}	8.7	3.4	0.8	-	-	-	-	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	11	11	4	-	-	-	-	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	1.1	<1.0	-	-	-	-	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.1	1.1	0.9	-	-	-	-	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	65	26	9	-	-	-	-	mg/kg	1	A-T-024s
Chromium _D ^{M#}	25	27	31	-	-	-	-	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	-	-	-	-	mg/kg	1	A-T-040s
Lead _D ^{M#}	25	75	16	-	-	-	-	mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	-	-	-	-	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	35	26	24	-	-	-	-	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	-	-	-	-	mg/kg	1	A-T-024s
Zinc _D ^{M#}	33	51	43	-	-	-	-	mg/kg	5	A-T-024s
1.01 % Moisture BS1377 1990 pt2 cl3.2 _D [#]	-	-	-	-	-	Appended	Appended		0.1	Subcon SS
1.02 Atterburg 4Pt BS1377 1990 pt2 cl4.4,5.3+5.4 _D [#]	-	-	-	-	-	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
4.01 Dimensional Consolidation (5 days) (75mm) BS1377:1990 Part5 cl 3 _D	-	-	-	Appended	-	-	-	N/A		Subcon SS
5.02 Hand Vane Test (Natural Shear Strength by Hand Vane) (3 measurements) _D	-	-	-	-	Appended	-	-			Subcon SS
5.05 QUT Multistage (100mm) BS1377 1990 pt7 cl9 (Undrained Shear Strength) _D [#]	-	-	-	-	US	-	-	N/A		Subcon SS

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
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: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
PAH-16MS										
Acenaphthene _A ^{M#}	1.29	<0.01	<0.01	-	-	-	-	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.08	<0.01	<0.01	-	-	-	-	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	4.96	<0.02	<0.02	-	-	-	-	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	8.81	<0.04	<0.04	-	-	-	-	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	5.40	<0.04	<0.04	-	-	-	-	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	6.90	<0.05	<0.05	-	-	-	-	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	2.30	<0.05	<0.05	-	-	-	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	2.78	<0.07	<0.07	-	-	-	-	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	7.75	<0.06	<0.06	-	-	-	-	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.66	<0.04	<0.04	-	-	-	-	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	21.8	0.09	<0.08	-	-	-	-	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	1.14	<0.01	<0.01	-	-	-	-	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	2.84	<0.03	<0.03	-	-	-	-	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.24	<0.03	<0.03	-	-	-	-	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	20.6	0.09	<0.03	-	-	-	-	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	17.2	<0.07	<0.07	-	-	-	-	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	105	0.18	<0.08	-	-	-	-	mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/1	19/06313/2	19/06313/3	19/06313/4	19/06313/5	19/06313/6	19/06313/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201	BH201	BH201	BH201	BH201	BH201	BH201			
Depth to Top	0.32	2.40	3.60	3.00	5.00	7.00	7.20			
Depth To Bottom				3.45	5.45					
Date Sampled	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	01-Jul-19	02-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - U	Soil - U	Soil - ES	Soil - U			
Sample Matrix Code	4A	5AB	5A			5	4A			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	22	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	9	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	2	<1	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	6	2	<1	-	-	-	-	mg/kg	1	A-T-055s
Ali >C21-C35 _A	15	8	<1	-	-	-	-	mg/kg	1	A-T-055s
Total Aliphatics _A	22	43	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	2	7	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	3	2	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C12-C16 _A	29	1	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	261	2	<1	-	-	-	-	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	610	6	1	-	-	-	-	mg/kg	1	A-T-055s
Total Aromatics _A	906	20	1	-	-	-	-	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	928	62	1	-	-	-	-	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.05	<0.01	-	-	-	-	mg/kg	0.01	A-T-022s

Envirolab Job Number: 19/06313

Client Project Name: Echo Street

Client Project Ref: B065374.001

Lab Sample ID	19/06313/9							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH201									
Depth to Top	3.45									
Depth To Bottom	3.50									
Date Sampled										
Sample Type	Soil - D									
Sample Matrix Code	5A									
% Stones >10mm _A	<0.1							% w/w	0.1	A-T-044
pH _D ^{M#}	8.04							pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.08							g/l	0.01	A-T-026s
1.01 % Moisture BS1377 1990 pt2 cl3.2 _D [#]	Appended								0.1	Subcon SS
1.02 Atterburg 4Pt BS1377 1990 pt2 cl4.4,5.3+5.4 _D [#]	Appended								1	Subcon SS

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

Soil chemical analysis:

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

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

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

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

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

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

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

Results greater than 12900µS/cm @ 25°C / 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: Echo Street
Clients Project No: B065374.001

Project No: 19/06313
Date Received: 04/07/2019 (am)
Cool Box Temperatures (°C): 20.6

Lab Sample ID	19/06313/9
Client Sample No	
Client Sample ID/Depth	BH201 3.45-3.50m
Date Sampled	
Deviation Code	
E (no date)	✓

Key
E (no date) No sampling date provided (all results affected if not provided)

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: 19/06428
Issue Number: 1
Date: 16 July, 2019

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

Project Manager: Amber Hatch-Walling/Niall Farnworth
Project Name: Echo Street, Additional SI
Project Ref: B065374.004
Order No: EBMA1955
Date Samples Received: 05/07/19
Date Instructions Received: 08/07/19
Date Analysis Completed: 16/07/19

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Holly Neary-King
Client Manager

Envirolab Job Number: 19/06428

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06428/1	19/06428/2	19/06428/3	19/06428/4	19/06428/5	19/06428/6		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH202	BH202	BH202	BH203	BH203	BH203				
Depth to Top	0.20	0.60	3.00	0.40	1.60	3.20				
Depth To Bottom										
Date Sampled	03-Jul-19	03-Jul-19	03-Jul-19	04-Jul-19	04-Jul-19	04-Jul-19				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	4ABE	6ABE	5A	4A	5AE	5A				
% Stones >10mm _A	12.3	8.2	0.9	25.0	9.6	<0.1		% w/w	0.1	A-T-044
pH _D ^{M#}	11.29	9.22	8.65	13.08	9.67	9.00		pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.42	0.34	0.13	0.34	0.32	0.12		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	0.5	<0.2	<0.2		mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	2.3	1.7	1.8	0.7	1.4	1.4		% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	4	6	4	<1	4	4		mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	1.2	1.3	<1.0	<1.0	<1.0	<1.0		mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.0	0.7	0.9	<0.5	0.7	0.9		mg/kg	0.5	A-T-024s
Copper _D ^{M#}	18	25	18	14	18	18		mg/kg	1	A-T-024s
Chromium _D ^{M#}	17	23	23	12	17	27		mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-040s
Lead _D ^{M#}	102	61	13	15	24	13		mg/kg	1	A-T-024s
Mercury _D	0.43	0.27	<0.17	0.25	<0.17	<0.17		mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	12	18	28	8	23	29		mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-024s
Zinc _D ^{M#}	110	90	55	25	44	51		mg/kg	5	A-T-024s

Envirolab Job Number: 19/06428

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06428/1	19/06428/2	19/06428/3	19/06428/4	19/06428/5	19/06428/6		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH202	BH202	BH202	BH203	BH203	BH203				
Depth to Top	0.20	0.60	3.00	0.40	1.60	3.20				
Depth To Bottom										
Date Sampled	03-Jul-19	03-Jul-19	03-Jul-19	04-Jul-19	04-Jul-19	04-Jul-19				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	4ABE	6ABE	5A	4A	5AE	5A				
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD	NAD	NAD	NAD				A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A				

Envirolab Job Number: 19/06428

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06428/1	19/06428/2	19/06428/3	19/06428/4	19/06428/5	19/06428/6		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH202	BH202	BH202	BH203	BH203	BH203				
Depth to Top	0.20	0.60	3.00	0.40	1.60	3.20				
Depth To Bottom										
Date Sampled	03-Jul-19	03-Jul-19	03-Jul-19	04-Jul-19	04-Jul-19	04-Jul-19				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	4ABE	6ABE	5A	4A	5AE	5A				
PAH-16MS										
Acenaphthene _A ^{M#}	0.18	0.01	<0.01	1.41	0.01	0.06		mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.02	<0.01	<0.01	0.03	<0.01	<0.01		mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.36	0.03	<0.02	0.81	<0.02	<0.02		mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	1.60	0.15	<0.04	2.74	<0.04	<0.04		mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	1.65	0.14	<0.04	1.78	<0.04	<0.04		mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	1.77	0.17	<0.05	3.19	<0.05	<0.05		mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.96	0.08	<0.05	1.25	<0.05	<0.05		mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.67	<0.07	<0.07	1.08	<0.07	<0.07		mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	1.51	0.16	<0.06	2.73	<0.06	<0.06		mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.25	<0.04	<0.04	0.51	<0.04	<0.04		mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	3.31	0.32	<0.08	5.00	<0.08	<0.08		mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.15	<0.01	<0.01	0.58	<0.01	0.01		mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	1.18	0.10	<0.03	1.55	<0.03	<0.03		mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.05	<0.03	<0.03	0.04	<0.03	<0.03		mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	1.43	0.19	0.06	5.71	0.04	0.15		mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	3.16	0.28	<0.07	3.22	<0.07	<0.07		mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	18.2	1.63	<0.08	31.6	<0.08	0.22		mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/06428

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06428/1	19/06428/2	19/06428/3	19/06428/4	19/06428/5	19/06428/6		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH202	BH202	BH202	BH203	BH203	BH203				
Depth to Top	0.20	0.60	3.00	0.40	1.60	3.20				
Depth To Bottom										
Date Sampled	03-Jul-19	03-Jul-19	03-Jul-19	04-Jul-19	04-Jul-19	04-Jul-19				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	4ABE	6ABE	5A	4A	5AE	5A				
TPH CWG										
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	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	6	<1	2	<1	<1	1		mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	15	2	2	4	1	2		mg/kg	1	A-T-055s
Ali >C21-C35 _A	203	15	4	32	8	5		mg/kg	1	A-T-055s
Total Aliphatics _A	224	17	8	38	9	9		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	14	2	1	46	2	1		mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	<1	<1	<1	13	1	1		mg/kg	1	A-T-055s
Aro >C12-C16 _A	7	1	2	52	9	4		mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	39	7	5	87	19	6		mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	190	20	13	236	51	12		mg/kg	1	A-T-055s
Total Aromatics _A	252	31	23	435	82	26		mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	475	47	31	473	91	34		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	<0.01	<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		mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<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		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:	19/06428
Project:	Echo Street, Additional SI	Date Received:	08/07/2019 (am)
Clients Project No:	B065374.004	Cool Box Temperatures (°C):	14.0

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 Test Report

Envirolab Job Number: 19/06702
Issue Number: 1

Date: 19-Jul-19

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

Project Manager: Amber Hatch-Walling/Niall Farnworth
Project Name: Echo Street, Additional SI
Project Ref: B065374.004
Order No: EBMA1972

Date Samples Received: 11-Jul-19
Date Instructions Received: 12-Jul-19
Date Analysis Completed: 19-Jul-19

Notes - Soil analysis

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

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

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

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts

Superscript "M" indicates method accredited to MCERTS.

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be 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

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.

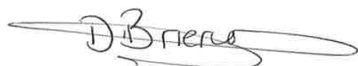
IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Superscript # indicates method accredited to ISO 17025.

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.

Please contact us if you need any further information.

Prepared by:



Danielle Brierley
Client Manager

Approved by:



Richard Wong
Client Manager



Sample Details								
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/1	Landfill Waste Acceptance Criteria Limits			
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP201				
Depth to Top				0.75				
Depth to Bottom								
Date Sampled				09/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				6AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	8.17		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.47		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.3		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	10.2		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.98		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	0.54		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	126		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	-
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	0.005	0.050	0.5	2	25
Barium	A-T-025	N	N	0.037	0.370	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.001	0.010	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.011	0.110	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	0.003	0.030	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.001	0.010	4	50	200
Chloride	A-T-026	N	N	3	32	800	15000	25000
Fluoride	A-T-026	N	N	0.5	5.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	43	434	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	80	800	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	6.5				
Conductivity (µS/cm)	A-T-037			161				
Mass Sample (kg)				0.215				
Dry Matter (%)	A-T-044	N	N	81.5				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits		
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/3			
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Client Sample ID				TP202			
Depth to Top				0.35			
Depth to Bottom							
Date Sampled				09/07/2019			
Sample Type				Soil - ES			
Sample Matrix Code				4AE			
Solid Waste Analysis							
pH (pH Units) _D	A-T-031	Y	Y	6.99	-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.17	-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.07	-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	33.1	-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	10.9	3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	271	100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	285	500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-
Eluate Analysis					Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				10:1 mg/l	10:1 mg/kg		
Arsenic	A-T-025	N	N	0.003	0.030	0.5	2
Barium	A-T-025	N	N	0.053	0.530	20	100
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10
Copper	A-T-025	N	N	0.001	0.010	2	50
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2
Molybdenum	A-T-025	N	N	0.015	0.150	0.5	10
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10
Lead	A-T-025	N	N	0.003	0.030	0.5	10
Antimony	A-T-025	N	N	0.005	0.050	0.06	0.7
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5
Zinc	A-T-025	N	N	0.012	0.120	4	50
Chloride	A-T-026	N	N	2	16	800	15000
Fluoride	A-T-026	N	N	0.4	4.0	10	150
Sulphate as SO ₄	A-T-026	N	N	27	267	1000	20000
Total Dissolved Solids	A-T-035	N	N	74	740	4000	60000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800
Leach Test Information							
pH (pH Units)	A-T-031	N	N	6.7			
Conductivity (µS/cm)	A-T-037			149			
Mass Sample (kg)				0.211			
Dry Matter (%)	A-T-044	N	N	83.1			
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation							

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/4				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP202				
Depth to Top				0.8				
Depth to Bottom								
Date Sampled				09/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				6AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.62	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.17	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.05	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	8.3	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.69	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	0.19	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.033	0.330	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	0.001	0.010	0.5	10	70
Copper	A-T-025	N	N	0.002	0.020	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.013	0.130	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.006	0.060	4	50	200
Chloride	A-T-026	N	N	2	20	800	15000	25000
Fluoride	A-T-026	N	N	1.3	13.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	18	177	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	82	820	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.0				
Conductivity (µS/cm)	A-T-037	N	N	164				
Mass Sample (kg)				0.211				
Dry Matter (%)	A-T-044	N	N	82.8				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/5				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP203				
Depth to Top				0.65				
Depth to Bottom								
Date Sampled				09/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	8.11		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.47		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.25		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	2.3		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.77		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	2.16		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	-
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.017	0.170	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.01	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.002	0.020	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.002	0.020	4	50	200
Chloride	A-T-026	N	N	<1.00	<10	800	15000	25000
Fluoride	A-T-026	N	N	0.3	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	9	86	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	54	540	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	6.9				
Conductivity (µS/cm)	A-T-037	N	N	108				
Mass Sample (kg)				0.202				
Dry Matter (%)	A-T-044	N	N	86.7				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/6				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP204				
Depth to Top				0.85				
Depth to Bottom								
Date Sampled				09/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				6AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.19	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.27	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.03	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	7.1	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	6.83	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	20	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	0.009	0.090	0.5	2	25
Barium	A-T-025	N	N	0.027	0.270	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.013	0.130	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.020	0.200	0.5	10	30
Nickel	A-T-025	N	N	0.001	0.010	0.4	10	40
Lead	A-T-025	N	N	0.017	0.170	0.5	10	50
Antimony	A-T-025	N	N	0.004	0.040	0.06	0.7	5
Selenium	A-T-025	N	N	0.001	0.010	0.1	0.5	7
Zinc	A-T-025	N	N	0.011	0.110	4	50	200
Chloride	A-T-026	N	N	3	25	800	15000	25000
Fluoride	A-T-026	N	N	0.8	8.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	12	120	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	71	710	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.0				
Conductivity (µS/cm)	A-T-037	N	N	142				
Mass Sample (kg)				0.209				
Dry Matter (%)	A-T-044	N	N	83.9				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/7				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP204				
Depth to Top				1.35				
Depth to Bottom								
Date Sampled				09/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				6AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	6.89		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.12		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.03		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	6		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.79		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	-
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.027	0.270	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.002	0.020	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.005	0.050	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	0.012	0.120	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.008	0.080	4	50	200
Chloride	A-T-026	N	N	4	37	800	15000	25000
Fluoride	A-T-026	N	N	0.6	6.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	35	354	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	62	620	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	6.7				
Conductivity (µS/cm)	A-T-037	N	N	124				
Mass Sample (kg)				0.197				
Dry Matter (%)	A-T-044	N	N	88.9				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/8				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP205				
Depth to Top				2.8				
Depth to Bottom								
Date Sampled				09/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.91	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.52	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.22	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	4.7	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.81	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.024	0.240	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.002	0.020	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.001	0.010	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.008	0.080	4	50	200
Chloride	A-T-026	N	N	2	20	800	15000	25000
Fluoride	A-T-026	N	N	0.3	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	19	192	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	73	730	4000	60000	100000
Phenol Index	A-T-050	N	N	0.06	0.60	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.1				
Conductivity (µS/cm)	A-T-037	N	N	147				
Mass Sample (kg)				0.212				
Dry Matter (%)	A-T-044	N	N	82.7				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/9				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP206				
Depth to Top				2.3				
Depth to Bottom								
Date Sampled				09/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				6AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.65	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.3	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.1	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	4.4	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.82	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	15	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.009	0.090	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.01	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.002	0.020	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.002	0.020	4	50	200
Chloride	A-T-026	N	N	1	11	800	15000	25000
Fluoride	A-T-026	N	N	0.3	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	22	221	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	66	660	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.2				
Conductivity (µS/cm)	A-T-037	N	N	131				
Mass Sample (kg)				0.199				
Dry Matter (%)	A-T-044	N	N	88.1				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details								
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/12	Landfill Waste Acceptance Criteria Limits			
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP207				
Depth to Top				4				
Depth to Bottom								
Date Sampled				10/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				6AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.99		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.17		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.05		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	4.2		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.02		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	-
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.028	0.280	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	0.002	0.020	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.01	2	50	100
Mercury	A-T-025	N	N	0.0017	0.0170	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.002	0.020	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.004	0.040	4	50	200
Chloride	A-T-026	N	N	3	34	800	15000	25000
Fluoride	A-T-026	N	N	0.3	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	15	146	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	62	620	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.1				
Conductivity (µS/cm)	A-T-037	N	N	125				
Mass Sample (kg)				0.204				
Dry Matter (%)	A-T-044	N	N	85.6				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/13				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP208				
Depth to Top				1.7				
Depth to Bottom								
Date Sampled				10/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.82	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.4	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.03	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	24.4	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.62	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	0.002	0.020	0.5	2	25
Barium	A-T-025	N	N	0.032	0.320	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	0.001	0.010	0.5	10	70
Copper	A-T-025	N	N	0.002	0.020	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.009	0.090	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	0.002	0.020	0.5	10	50
Antimony	A-T-025	N	N	0.001	0.010	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.005	0.050	4	50	200
Chloride	A-T-026	N	N	2	20	800	15000	25000
Fluoride	A-T-026	N	N	1.1	11.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	14	140	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	76	760	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.0				
Conductivity (µS/cm)	A-T-037	N	N	152				
Mass Sample (kg)				0.212				
Dry Matter (%)	A-T-044	N	N	82.6				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits		
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/14			
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Client Sample ID				TP209			
Depth to Top				2.6			
Depth to Bottom							
Date Sampled				10/07/2019			
Sample Type				Soil - ES			
Sample Matrix Code				5AE			
Solid Waste Analysis							
pH (pH Units) _D	A-T-031	Y	Y	8.25	-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.32	-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.14	-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	4	-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.71	3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	11	500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-
Eluat Analysis					Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				10:1 mg/l	10:1 mg/kg		
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2
Barium	A-T-025	N	N	0.013	0.130	20	100
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10
Copper	A-T-025	N	N	<0.001	<0.01	2	50
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2
Molybdenum	A-T-025	N	N	0.001	0.010	0.5	10
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5
Zinc	A-T-025	N	N	0.009	0.090	4	50
Chloride	A-T-026	N	N	5	48	800	15000
Fluoride	A-T-026	N	N	0.3	3.0	10	150
Sulphate as SO ₄	A-T-026	N	N	14	135	1000	20000
Total Dissolved Solids	A-T-035	N	N	299	2990	4000	60000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800
Leach Test Information							
pH (pH Units)	A-T-031	N	N	7.1			
Conductivity (µS/cm)	A-T-037			598			
Mass Sample (kg)				0.202			
Dry Matter (%)	A-T-044	N	N	86.8			
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation							

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/15				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP210				
Depth to Top				1.5				
Depth to Bottom								
Date Sampled				10/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				4ABE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	8.61		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.6		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.09		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	5.3		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	2.92		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	11.8		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	258		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	-
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.004	0.040	0.5	2	25
Barium	A-T-025	N	N	0.025	0.250	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.002	0.020	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.009	0.090	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	0.014	0.140	0.5	10	50
Antimony	A-T-025	N	N	0.615	6.150	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.006	0.060	4	50	200
Chloride	A-T-026	N	N	2	25	800	15000	25000
Fluoride	A-T-026	N	N	0.9	9.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	270	2698	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	70	700	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.9				
Conductivity (µS/cm)	A-T-037	N	N	140				
Mass Sample (kg)				0.195				
Dry Matter (%)	A-T-044	N	N	89.7				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/16				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP211				
Depth to Top				0.8				
Depth to Bottom								
Date Sampled				10/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5ABE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	8.29	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.35	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.1	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	5.3	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.28	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	0.001	0.010	0.5	2	25
Barium	A-T-025	N	N	0.028	0.280	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.003	0.030	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.016	0.160	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.005	0.050	4	50	200
Chloride	A-T-026	N	N	1	15	800	15000	25000
Fluoride	A-T-026	N	N	1.2	12.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	12	124	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	27	270	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.5				
Conductivity (µS/cm)	A-T-037	N		54				
Mass Sample (kg)				0.22				
Dry Matter (%)	A-T-044	N	N	79.5				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/17				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP212				
Depth to Top				1.1				
Depth to Bottom								
Date Sampled				10/07/2019				
Sample Type				Solid				
Sample Matrix Code				7				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	8.89	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	3.35	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.88	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	2.3	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	0.09	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.273	2.730	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.01	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.001	0.010	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.005	0.050	4	50	200
Chloride	A-T-026	N	N	<1.00	<10	800	15000	25000
Fluoride	A-T-026	N	N	0.3	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	5	49	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	109	1090	4000	60000	100000
Phenol Index	A-T-050	N	N	0.03	0.30	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.3				
Conductivity (µS/cm)	A-T-037	N	N	217				
Mass Sample (kg)				0.193				
Dry Matter (%)	A-T-044	N	N	90.5				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/18				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP213				
Depth to Top				0.7				
Depth to Bottom								
Date Sampled				10/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5A				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.96	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.19	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.15	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	Y	Y	5.5	-	-	10	
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.59	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08	100	-	-	
Mineral Oil (mg/kg) _A	A-T-007	N	N	16	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using		
				mg/l	mg/kg	BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.015	0.150	0.5	2	25
Barium	A-T-025	N	N	0.009	0.090	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	0.010	0.100	0.5	10	70
Copper	A-T-025	N	N	0.003	0.030	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.009	0.090	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	0.006	0.060	0.5	10	50
Antimony	A-T-025	N	N	0.004	0.040	0.06	0.7	5
Selenium	A-T-025	N	N	0.001	0.010	0.1	0.5	7
Zinc	A-T-025	N	N	0.008	0.080	4	50	200
Chloride	A-T-026	N	N	3	34	800	15000	25000
Fluoride	A-T-026	N	N	1.9	19.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	54	537	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	75	750	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.5				
Conductivity (µS/cm)	A-T-037	N	N	150				
Mass Sample (kg)				0.218				
Dry Matter (%)	A-T-044	N	N	80.5				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/20				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP214				
Depth to Top				1.85				
Depth to Bottom								
Date Sampled				11/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	8.23		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.28		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.15		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	4.8		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.24		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	<0.08		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	<10		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	-
Eluate Analysis				10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				mg/l	mg/kg			
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.034	0.340	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.001	0.010	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.005	0.050	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	0.001	0.010	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.012	0.120	4	50	200
Chloride	A-T-026	N	N	1	12	800	15000	25000
Fluoride	A-T-026	N	N	4.1	41.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	12	117	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	92	920	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.3				
Conductivity (µS/cm)	A-T-037	N	N	184				
Mass Sample (kg)				0.202				
Dry Matter (%)	A-T-044	N	N	86.7				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/21				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP215				
Depth to Top				1.5				
Depth to Bottom								
Date Sampled				11/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	7.98		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.5		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.15		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	5.2		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.13		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	1330		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	68		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	0.09		6	-	-
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.052	0.520	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.002	0.020	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.004	0.040	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.003	0.030	4	50	200
Chloride	A-T-026	N	N	2	21	800	15000	25000
Fluoride	A-T-026	N	N	0.5	5.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	21	209	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	80	800	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.5				
Conductivity (µS/cm)	A-T-037	N	N	160				
Mass Sample (kg)				0.218				
Dry Matter (%)	A-T-044	N	N	80.2				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details								
Lab Sample ID	Method	ISO17025	MCERTS	19/06702/23	Landfill Waste Acceptance Criteria Limits			
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				TP216				
Depth to Top				1.7				
Depth to Bottom								
Date Sampled				11/07/2019				
Sample Type				Soil - ES				
Sample Matrix Code				5AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	Y	Y	8.06		-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.25		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.1		-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	Y	Y	5		-	-	10
Total Organic Carbon (%) _D	A-T-032	Y	Y	1.78		3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	1.14		100	-	-
Mineral Oil (mg/kg) _A	A-T-007	N	N	34		500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007		1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01		6	-	-
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	<0.001	<0.01	0.5	2	25
Barium	A-T-025	N	N	0.021	0.210	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.001	<0.01	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.004	0.040	0.5	10	30
Nickel	A-T-025	N	N	<0.001	<0.01	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.004	0.040	4	50	200
Chloride	A-T-026	N	N	2	17	800	15000	25000
Fluoride	A-T-026	N	N	0.5	5.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	29	287	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	80	800	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	6.9				
Conductivity (µS/cm)	A-T-037	N	N	160				
Mass Sample (kg)				0.206				
Dry Matter (%)	A-T-044	N	N	85.2				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/06702
Issue Number: 1

Date: 19 July, 2019

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

Project Manager: Amber Hatch-Walling/Niall Farnworth
Project Name: Echo Street, Additional SI
Project Ref: B065374.004
Order No: EBMA1972
Date Samples Received: 11/07/19
Date Instructions Received: 12/07/19
Date Analysis Completed: 19/07/19

Prepared by:



Gill Walker
Director/Laboratory Manager

Approved by:



John Gustafson
Managing Director

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/1	19/06702/2	19/06702/3	19/06702/4	19/06702/5	19/06702/6	19/06702/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP201	TP201	TP202	TP202	TP203	TP204	TP204			
Depth to Top	0.75	0.45	0.35	0.80	0.65	0.85	1.35			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AE	4AE	4AE	6AE	5AE	6AE	6AE			
% Stones >10mm _A	<0.1	<0.1	15.4	<0.1	<0.1	3.4	5.0	% w/w	0.1	A-T-044
pH _D ^{M#}	8.17	7.39	6.99	7.62	8.11	7.19	6.89	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.17	0.07	0.10	0.07	0.03	0.04	0.26	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<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	<0.2	mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	3.4	10.0	18.9	1.2	1.3	7.1	1.3	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	12	27	8	5	4	19	4	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	3.6	1.8	<1.0	1.3	<1.0	1.8	1.3	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.8	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	28	17	28	21	19	71	15	mg/kg	1	A-T-024s
Chromium _D ^{M#}	27	8	11	33	24	21	30	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#}	96	17	40	22	16	2940	19	mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	1.08	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	30	18	16	34	30	27	29	mg/kg	1	A-T-024s
Selenium _D ^{M#}	1	1	<1	1	<1	<1	2	mg/kg	1	A-T-024s
Zinc _D ^{M#}	65	23	39	55	65	76	49	mg/kg	5	A-T-024s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/1	19/06702/2	19/06702/3	19/06702/4	19/06702/5	19/06702/6	19/06702/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP201	TP201	TP202	TP202	TP203	TP204	TP204			
Depth to Top	0.75	0.45	0.35	0.80	0.65	0.85	1.35			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AE	4AE	4AE	6AE	5AE	6AE	6AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	Amosite	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: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/1	19/06702/2	19/06702/3	19/06702/4	19/06702/5	19/06702/6	19/06702/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP201	TP201	TP202	TP202	TP203	TP204	TP204			
Depth to Top	0.75	0.45	0.35	0.80	0.65	0.85	1.35			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AE	4AE	4AE	6AE	5AE	6AE	6AE			
PAH-16MS										
Acenaphthene _A ^{M#}	0.02	1.19	4.16	<0.01	0.03	<0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.10	0.14	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.04	2.61	9.10	<0.02	0.09	<0.02	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	2.80	21.4	<0.04	0.16	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	1.25	15	<0.04	0.09	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	1.72	19.5	<0.05	0.14	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.50	7.55	<0.05	0.06	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.70	7.44	<0.07	<0.07	<0.07	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	<0.06	2.81	25.4	<0.06	0.17	<0.06	<0.06	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.40	1.70	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.13	8.56	53.3	0.11	0.39	<0.08	<0.08	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.02	1.66	4.21	<0.01	0.03	<0.01	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	0.39	8.62	<0.03	0.06	<0.03	<0.03	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.30	0.68	<0.03	0.05	<0.03	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.22	13.9	44.6	<0.03	0.57	0.07	<0.03	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.11	6.75	46.8	0.10	0.31	<0.07	<0.07	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	0.54	43.6	270	0.21	2.15	<0.08	<0.08	mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/1	19/06702/2	19/06702/3	19/06702/4	19/06702/5	19/06702/6	19/06702/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP201	TP201	TP202	TP202	TP203	TP204	TP204			
Depth to Top	0.75	0.45	0.35	0.80	0.65	0.85	1.35			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19	09-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	6AE	4AE	4AE	6AE	5AE	6AE	6AE			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	21	108	<5	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	120	301	13	<1	<1	1	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	213	418	84	<1	2	5	<1	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	16	49	99	<1	1	5	<1	mg/kg	1	A-T-055s
Ali >C21-C35 _A	18	46	86	1	2	7	<1	mg/kg	1	A-T-055s
Total Aliphatics _A	386	921	282	1	6	18	<1	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	4	16	7	<1	2	2	<1	mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	11	32	11	<1	1	2	<1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	31	62	55	<1	5	6	<1	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	33	32	229	<1	7	17	<1	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	44	23	634	2	10	45	<1	mg/kg	1	A-T-055s
Total Aromatics _A	125	164	936	2	24	73	<1	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	510	1090	1220	5	30	91	<1	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.05	<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	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/8	19/06702/9	19/06702/10	19/06702/11	19/06702/12	19/06702/13	19/06702/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP205	TP206	TP206	TP207	TP207	TP208	TP209			
Depth to Top	2.80	2.30	0.50	1.20	4.00	1.70	2.60			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	6AE	4ABE	6AE	6AE	5AE	5AE			
% Stones >10mm _A	<0.1	<0.1	0.4	1.6	<0.1	<0.1	14.9	% w/w	0.1	A-T-044
pH _D ^{M#}	7.91	7.65	7.34	7.85	7.99	7.82	8.25	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.12	0.07	0.32	0.11	0.05	0.06	0.06	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<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	<0.2	mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	1.4	1.4	36.3	2.9	1.8	1.1	1.2	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	3	3	38	9	3	4	6	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	<1.0	1.4	1.1	<1.0	<1.0	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	23	19	267	69	17	21	17	mg/kg	1	A-T-024s
Chromium _D ^{M#}	28	21	45	22	20	32	20	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#}	42	28	3100	148	11	15	12	mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	2.14	0.46	<0.17	<0.17	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	30	27	38	27	25	34	26	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#}	65	53	312	152	46	59	47	mg/kg	5	A-T-024s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/8	19/06702/9	19/06702/10	19/06702/11	19/06702/12	19/06702/13	19/06702/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP205	TP206	TP206	TP207	TP207	TP208	TP209			
Depth to Top	2.80	2.30	0.50	1.20	4.00	1.70	2.60			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	6AE	4ABE	6AE	6AE	5AE	5AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A	N/A			

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/8	19/06702/9	19/06702/10	19/06702/11	19/06702/12	19/06702/13	19/06702/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP205	TP206	TP206	TP207	TP207	TP208	TP209			
Depth to Top	2.80	2.30	0.50	1.20	4.00	1.70	2.60			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	6AE	4ABE	6AE	6AE	5AE	5AE			
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	<0.01	0.04	0.37	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	0.01	0.11	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	0.09	0.92	<0.02	<0.02	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	0.44	2.65	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	0.38	2.11	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	0.47	2.48	<0.05	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	0.23	1.68	<0.05	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	0.17	0.86	<0.07	<0.07	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	0.54	2.73	<0.06	<0.06	<0.06	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	0.23	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	1.01	6.51	<0.08	<0.08	<0.08	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	0.03	0.66	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	0.26	1.57	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.05	0.08	0.46	0.78	0.06	0.05	0.06	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	0.90	5.82	<0.07	<0.07	<0.07	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	0.08	5.08	29.5	<0.08	<0.08	<0.08	mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/8	19/06702/9	19/06702/10	19/06702/11	19/06702/12	19/06702/13	19/06702/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP205	TP206	TP206	TP207	TP207	TP208	TP209			
Depth to Top	2.80	2.30	0.50	1.20	4.00	1.70	2.60			
Depth To Bottom										
Date Sampled	09-Jul-19	09-Jul-19	09-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	6AE	4ABE	6AE	6AE	5AE	5AE			
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	0.10	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	1	278	<1	4	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	1	1	1920	<1	4	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	2	3	5	7100	2	4	2	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	1	2	30	7100	2	1	<1	mg/kg	1	A-T-055s
Ali >C21-C35 _A	2	3	153	4510	3	4	3	mg/kg	1	A-T-055s
Total Aliphatics _A	6	10	191	20800	8	15	5	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	2	2	4	272	2	4	2	mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	1	1	4	2190	1	4	<1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	2	3	9	7490	5	5	2	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	4	5	25	6320	6	2	2	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	8	8	78	9730	10	7	4	mg/kg	1	A-T-055s
Total Aromatics _A	18	20	119	26000	24	21	11	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	24	30	309	46900	31	37	15	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: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/15	19/06702/16	19/06702/17	19/06702/18	19/06702/19	19/06702/20	19/06702/21	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP210	TP211	TP212	TP213	TP202	TP214	TP215			
Depth to Top	1.50	0.80	1.10	0.70	0.72	1.85	1.50			
Depth To Bottom										
Date Sampled	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	09-Jul-19	11-Jul-19	11-Jul-19			
Sample Type	Soil - ES	Soil - ES	Solid	Soil - ES	Solid - Fragment / Tile	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	5ABE	7	5A	8	5AE	5AE			
% Stones >10mm _A	8.1	<0.1	<0.1	2.8	-	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	8.61	8.29	8.89	7.96	-	8.23	7.98	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	1.05	0.04	0.06	0.13	-	0.04	0.10	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#}	5.1	2.2	0.2	2.7	-	2.1	2.0	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	30	6	3	11	-	3	6	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	1.6	<1.0	<1.0	1.5	-	<1.0	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.6	<0.5	1.5	0.6	-	<0.5	0.5	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	101	24	12	36	-	20	78	mg/kg	1	A-T-024s
Chromium _D ^{M#}	17	24	18	26	-	21	41	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	-	<1	<1	mg/kg	1	A-T-040s
Lead _D ^{M#}	9280	39	53	87	-	13	294	mg/kg	1	A-T-024s
Mercury _D	0.28	<0.17	0.98	<0.17	-	<0.17	0.99	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	20	30	20	29	-	27	36	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	1	<1	<1	-	<1	2	mg/kg	1	A-T-024s
Zinc _D ^{M#}	172	52	89	104	-	51	65	mg/kg	5	A-T-024s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/15	19/06702/16	19/06702/17	19/06702/18	19/06702/19	19/06702/20	19/06702/21	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP210	TP211	TP212	TP213	TP202	TP214	TP215			
Depth to Top	1.50	0.80	1.10	0.70	0.72	1.85	1.50			
Depth To Bottom										
Date Sampled	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	09-Jul-19	11-Jul-19	11-Jul-19			
Sample Type	Soil - ES	Soil - ES	Solid	Soil - ES	Solid - Fragment / Tile	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	5ABE	7	5A	8	5AE	5AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD	NAD	-	NAD	NAD			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	-	N/A	N/A			
Bulk Fibre ID (inc. matrix) ^										
Bulk Fibre Identification [#]	-	-	-	-	Chrysotile	-	-			A-T-045
Bulk Fibre Identification Matrix (visual) ₀	-	-	-	-	Cement	-	-			A-T-045
Bulk Fibre Identification - Suitable for Water Absorption Test? ₀	-	-	-	-	Yes	-	-			Gravimetry
Bulk Fibre Quantification % Asbestos in ACM										
Bulk Fibre - % Asbestos in ACM (HSG264) ₀	-	-	-	-	15	-	-	% w/w	0.001	A-T-054

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/15	19/06702/16	19/06702/17	19/06702/18	19/06702/19	19/06702/20	19/06702/21	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP210	TP211	TP212	TP213	TP202	TP214	TP215			
Depth to Top	1.50	0.80	1.10	0.70	0.72	1.85	1.50			
Depth To Bottom										
Date Sampled	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	09-Jul-19	11-Jul-19	11-Jul-19			
Sample Type	Soil - ES	Soil - ES	Solid	Soil - ES	Solid - Fragment / Tile	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	5ABE	7	5A	8	5AE	5AE			
PAH-16MS										
Acenaphthene _A ^{M#}	0.08	<0.01	<0.01	<0.01	-	<0.01	68.1	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.19	<0.01	<0.01	<0.01	-	<0.01	0.97	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.19	<0.02	<0.02	<0.02	-	<0.02	62.9	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	1.02	<0.04	<0.04	<0.04	-	<0.04	55.5	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	1.16	<0.04	<0.04	<0.04	-	<0.04	23.6	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	1.37	<0.05	<0.05	<0.05	-	<0.05	27.2	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.93	<0.05	<0.05	<0.05	-	<0.05	7.88	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.49	<0.07	<0.07	<0.07	-	<0.07	15.3	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	1.01	<0.06	<0.06	<0.06	-	<0.06	87.3	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.16	<0.04	<0.04	<0.04	-	<0.04	2.79	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	1.34	<0.08	<0.08	<0.08	-	<0.08	121	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.08	<0.01	<0.01	<0.01	-	<0.01	60.7	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.97	<0.03	<0.03	<0.03	-	<0.03	11.6	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.05	<0.03	<0.03	<0.03	-	<0.03	286	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.69	0.05	<0.03	0.05	-	0.07	371	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	1.83	<0.07	<0.07	<0.07	-	<0.07	127	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	11.6	<0.08	<0.08	<0.08	-	<0.08	1330	mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/15	19/06702/16	19/06702/17	19/06702/18	19/06702/19	19/06702/20	19/06702/21	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP210	TP211	TP212	TP213	TP202	TP214	TP215			
Depth to Top	1.50	0.80	1.10	0.70	0.72	1.85	1.50			
Depth To Bottom										
Date Sampled	10-Jul-19	10-Jul-19	10-Jul-19	10-Jul-19	09-Jul-19	11-Jul-19	11-Jul-19			
Sample Type	Soil - ES	Soil - ES	Solid	Soil - ES	Solid - Fragment / Tile	Soil - ES	Soil - ES			
Sample Matrix Code	4ABE	5ABE	7	5A	8	5AE	5AE			
TPH CWG										
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	<1	<1	<1	<1	-	<1	<10	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<1	-	<1	<10	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	3	<1	<1	<1	-	2	12	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	19	<1	<1	<1	-	2	21	mg/kg	1	A-T-055s
Ali >C21-C35 _A	117	4	3	2	-	3	106	mg/kg	1	A-T-055s
Total Aliphatics _A	139	4	3	2	-	7	139	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	4	2	2	2	-	2	23	mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	2	<1	<1	<1	-	1	334	mg/kg	1	A-T-055s
Aro >C12-C16 _A	5	1	1	1	-	2	863	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	21	1	1	1	-	3	2590	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	91	5	5	5	-	7	4290	mg/kg	1	A-T-055s
Total Aromatics _A	124	11	9	9	-	16	8100	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	263	13	12	11	-	24	8250	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	<0.01	<0.01	<0.01	-	<0.01	0.04	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	-	<0.01	0.02	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	-	<0.01	0.02	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: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/22	19/06702/23	19/06702/24					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP215	TP216	TP216							
Depth to Top	0.55	1.70	1.00							
Depth To Bottom										
Date Sampled	11-Jul-19	11-Jul-19	11-Jul-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	4AB							
% Stones >10mm _A	4.9	<0.1	5.3					% w/w	0.1	A-T-044
pH _D ^{M#}	7.76	8.06	8.27					pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.06	0.20	1.53					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#}	16.7	3.1	32.2					% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	11	4	32					mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	1.8	<1.0	1.7					mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.6	<0.5	0.8					mg/kg	0.5	A-T-024s
Copper _D ^{M#}	85	36	106					mg/kg	1	A-T-024s
Chromium _D ^{M#}	28	29	13					mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1					mg/kg	1	A-T-040s
Lead _D ^{M#}	1740	132	846					mg/kg	1	A-T-024s
Mercury _D	0.68	0.56	1.39					mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	29	31	19					mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	1	<1					mg/kg	1	A-T-024s
Zinc _D ^{M#}	91	75	113					mg/kg	5	A-T-024s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/22	19/06702/23	19/06702/24					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP215	TP216	TP216							
Depth to Top	0.55	1.70	1.00							
Depth To Bottom										
Date Sampled	11-Jul-19	11-Jul-19	11-Jul-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	4AB							
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: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/22	19/06702/23	19/06702/24					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP215	TP216	TP216							
Depth to Top	0.55	1.70	1.00							
Depth To Bottom										
Date Sampled	11-Jul-19	11-Jul-19	11-Jul-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	4AB							
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	<0.01	0.11					mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	0.02					mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	0.26					mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.06	0.11	1.18					mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.05	0.10	1.00					mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.07	0.13	1.32					mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	0.55					mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	0.50					mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.10	0.16	1.03					mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	0.11					mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.11	0.18	1.97					mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.01	<0.01	0.07					mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	0.07	0.58					mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	0.14					mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.12	0.16	1.33					mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.12	0.20	1.99					mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	0.64	1.11	12.2					mg/kg	0.01	A-T-019s

Envirolab Job Number: 19/06702

Client Project Name: Echo Street, Additional SI

Client Project Ref: B065374.004

Lab Sample ID	19/06702/22	19/06702/23	19/06702/24					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP215	TP216	TP216							
Depth to Top	0.55	1.70	1.00							
Depth To Bottom										
Date Sampled	11-Jul-19	11-Jul-19	11-Jul-19							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	4AB							
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	<1	<1	3					mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	2					mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1	6					mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	2	9					mg/kg	1	A-T-055s
Ali >C21-C35 _A	2	5	32					mg/kg	1	A-T-055s
Total Aliphatics _A	2	7	52					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	1	3	7					mg/kg	1	A-T-055s
Aro >C10-C12 _A ^{M#}	<1	2	6					mg/kg	1	A-T-055s
Aro >C12-C16 _A	2	3	15					mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	2	3	25					mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	9	11	103					mg/kg	1	A-T-055s
Total Aromatics _A	15	23	155					mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	17	29	208					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: Echo Street, Additional SI

Clients Project No: B065374.004

Project No: 19/06702

Date Received: 12/07/2019 (am)

Cool Box Temperatures (°C): 17.7 - 19.3

NO DEVIATIONS IDENTIFIED

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

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/08449
Issue Number: 1

Date: 13 September, 2019

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

Project Manager: Niall Farnworth
Project Name: Chandos 1 Echo Street
Project Ref: 065374
Order No: EBMA2047
Date Samples Received: 06/09/19
Date Instructions Received: 09/09/19
Date Analysis Completed: 13/09/19

Prepared by:



Melanie Marshall
Laboratory Coordinator

Approved by:



Danielle Brierley
Client Manager

Envirolab Job Number: 19/08449

Client Project Name: Chandos 1 Echo Street

Client Project Ref: 065374

Lab Sample ID	19/08449/1	19/08449/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS215	WS215								
Depth to Top	0.80	1.60								
Depth To Bottom										
Date Sampled	05-Sep-19	05-Sep-19								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	5A	5A								
% Stones >10mm _A	<0.1	<0.1						% w/w	0.1	A-T-044
Naphthalene _A ^{M#}	<0.03	<0.03						mg/kg	0.03	A-T-019s

REPORT NOTES

General

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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.

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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.

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

E = contains roots/twigs.

Key:

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NDP indicates No Determination Possible.

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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: Chandos 1 Echo Street

Clients Project No: 065374

Project No: 19/08449

Date Received: 09/09/2019 (am)

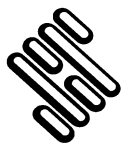
Cool Box Temperatures (°C): 20.1

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.

Appendix D Geotechnical Laboratory Testing Results

- Structural Soils/Envirolab Geotechnical Analysis Reports



STRUCTURAL SOILS LTD

TEST REPORT



Report No. 784000 R1

Date 29-July-2019 Contract Echo Street, Liverpool

Client Curtins Consulting Limited
Address 51-55 TITHEBARN STREET
LIVERPOOL
L2 2SB

For the Attention of Jonathan Lord

Order received	25-July-2019
Testing Started	26-July-2019
Testing Completed	29-July-2019

Client Reference	
Client Order No.	
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

Water content (oven drying method) BS EN ISO 17892-1:2014
Point Load Index ISRM:2007
Unconfined compressive strength - Load controlled method ISRM:2007

* 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.

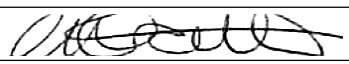
Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977 552255. E-mail mark.athorne@soils.co.uk

SUMMARY OF WATER CONTENT TESTS

In accordance with BS EN ISO 17892-1 : 2014

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Water Content (%)	Drying Temperature (degC)	Description	Lab location
BH201	2	C	11.80	8.8	105	Brown SANDSTONE	C
BH201	5	C	14.41	10.3	105	Brown SANDSTONE	C
BH201	7	C	15.42	12.8	105	Brown SANDSTONE	C
BH201	11	C	17.86	10.7	105	Brown SANDSTONE	C
BH202	3	C	14.30	12.8	105	Brown SANDSTONE	C
BH202	5	C	14.44	12.6	105	Brown SANDSTONE	C
BH203	2	C	9.40	13.2	105	Brown slightly gravelly SANDSTONE	C
BH203	3	C	11.40	15.1	105	Brown slightly gravelly SANDSTONE	C
BH203	4	C	15.90	12.8	105	Brown SANDSTONE	C
BH203	7	C	16.18	11.2	105	Brown SANDSTONE	C
BH203	10	C	17.80	12.9	105	Brown SANDSTONE	C

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		Date	Contract Ref: 784000 	
			LORNA WHITWOTH		29.07.19
	Contract:				
Echo Street, Liverpool					

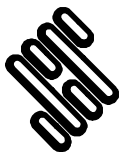
DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]

$I_s(50)$ Mean Axial tests = **0.11** MN/m²
 $I_s(50)$ Mean Diametral tests = **0.08** MN/m²
 $I_a(50)$ Strength Anisotropy Index = **1.48** (calculated from highest and lowest diametral and axial $I_s(50)$ ratio)
 Note: Size Correction Factor (F) calculated using $F = (D_p/50)^{0.45}$ (where D_p is equivalent core diameter).

Key
Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations
 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 1N

Compiled By

LORNA WHITWOTH

Date _____

29.07.19

Contract Ref:

784000



DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.16 \text{ MN/m}^2$$

$I_s(50)$ Mean Diametral tests = **0.08** MN/m²

$I_a(50)$ Strength Anisotropy Index = **2.05** (calculated from highest and lowest diametral and axial $I_s(50)$ ratio)

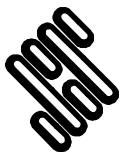
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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

Date _____

Contract Ref:

LORNA WHITWOTH

29.07.19

Contract

Echo Street, Liverpool

784000



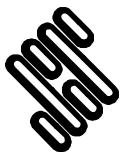
DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]

$I_s(50)$ Mean Axial tests = **0.17** MN/m²
 $I_s(50)$ Mean Diametral tests = **0.07** MN/m²
 $I_a(50)$ Strength Anisotropy Index = **2.53** (calculated from highest and lowest diametral and axial $I_s(50)$ ratio)
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key
Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations
 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 1N

Compiled By

LORNA WHITWOTH

Date _____

29.07.19

Contract Ref:

784000



DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]

Results

$$I_s(50) \text{ Mean Axial tests} = 0.1 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

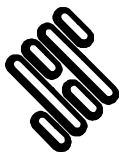
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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 1N

Compiled By

Date _____

Contract Ref:

Contract:

LORNA WHITWOTH

29.07.19

Echo Street, Liverpool

784000



DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

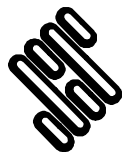
Exploratory Position ID	Sample Ref	Depth (m)	Type of Test	Width or Length (W or L) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D _e) (mm)	Point Load (I _s) (MN/m ²)	Size Factor (F)	Point Load Index (I _{s(50)}) (MN/m ²)	Water Content (%)	Rock Type	Lab location
BH201	7	15.42	D	155.49	68.7	0.015	69	0.00	1.15	0.00 (✓)	13	SANDSTONE	C
BH201	7	15.42	D	81.23	62.46	0.233	62	0.06	1.11	0.07 (✓)	13	SANDSTONE	C
BH201	7	15.42	D	75.62	69.56	0.016	70	0.00	1.16	0.00 (✓)	13	SANDSTONE	C
BH201	7	15.42	A	72.67	35.56	0.382	57	0.12	1.06	0.12 (✗)	13	SANDSTONE	C
BH201	7	15.42	A	72.65	41.78	0.326	62	0.08	1.10	0.09 (✓)	13	SANDSTONE	C
BH201	7	15.42	A	71.55	33.98	0.014	56	0.00	1.05	0.00 (✗)	13	SANDSTONE	C
BH201	7	15.42	A	71.51	30.61	0.146	53	0.05	1.02	0.05 (✓)	13	SANDSTONE	C

Results

I_s(50) Mean Axial tests = **0.07** MN/m²
I_s(50) Mean Diametral tests = **0.02** MN/m²
I_a(50) Strength Anisotropy Index = **2.99** (calculated from highest and lowest diametral and axial I_s(50) ratio)
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, (NS) denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations
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

[Signature]

LORNA WHITWOTH

Date

29.07.19

Contract Ref:

784000



Contract:

Echo Street, Liverpool

DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

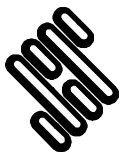
Exploratory Position ID	Sample Ref	Depth (m)	Type of Test	Width or Length (W or L) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D _e) (mm)	Point Load (I _s) (MN/m ²)	Size Factor (F)	Point Load Index (I _{s(50)}) (MN/m ²)	Water Content (%)	Rock Type	Lab location
BH201	9	16.71	D	203.58	72.35	0.272	72	0.05	1.18	0.06 (✓)	13	SANDSTONE	C
BH201	9	16.71	D	116.68	64.32	0.439	64	0.11	1.12	0.12 (✓)	13	SANDSTONE	C
BH201	9	16.71	D	92.24	73.17	0.318	73	0.06	1.19	0.07 (✓)	13	SANDSTONE	C
BH201	9	16.71	A	71.72	45.9	1.099	65	0.26	1.12	0.29 (✗)	13	SANDSTONE	C
BH201	9	16.71	A	71.87	38.6	0.690	59	0.20	1.08	0.21 (✓)	13	SANDSTONE	C
BH201	9	16.71	A	73.13	39.65	0.451	61	0.12	1.09	0.13 (✗)	13	SANDSTONE	C
BH201	9	16.71	A	72.8	38.43	0.419	60	0.12	1.08	0.13 (✗)	13	SANDSTONE	C

Results

I_s(50) Mean Axial tests = **0.11** MN/m²
I_s(50) Mean Diametral tests = **0.08** MN/m²
I_a(50) Strength Anisotropy Index = **1.37** (calculated from highest and lowest diametral and axial I_s(50) ratio)
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, (NS) denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations
Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

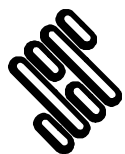
Exploratory Position ID	Sample Ref	Depth (m)	Type of Test	Width or Length (W or L) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D _e) (mm)	Point Load (I _s) (MN/m ²)	Size Factor (F)	Point Load Index (I _{s(50)}) (MN/m ²)	Water Content (%)	Rock Type	Lab location
BH201	11	17.86	D	130.52	71.78	0.513	72	0.10	1.18	0.12 (✓)	11	SANDSTONE	C
BH201	11	17.86	A	71.93	65.69	1.314	78	0.22	1.22	0.27 (✓)	11	SANDSTONE	C
BH201	11	17.86	A	72.1	51.14	0.895	69	0.19	1.15	0.22 (✓)	11	SANDSTONE	C

Results

I_s(50) Mean Axial tests = **0.24** MN/m²
I_s(50) Mean Diametral tests = **0.12** MN/m²
I_a(50) Strength Anisotropy Index = **2.07** (calculated from highest and lowest diametral and axial I_s(50) ratio)
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, (NS) denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations
Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.15 \text{ MN/m}^2$$

$I_s(50)$ Mean Diametral tests = **0.02** MN/m²

$I_a(50)$ Strength Anisotropy Index = **5.84** (calculated from highest and lowest diametral and axial $I_s(50)$ ratio)

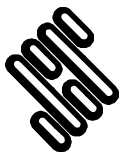
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]

Results

$$I_s(50) \text{ Mean Axial tests} = 0.05 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

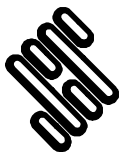
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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DETERMINATION OF POINT LOAD STRENGTH

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[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.07 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

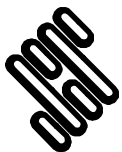
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.17 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

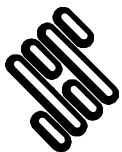
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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DETERMINATION OF POINT LOAD STRENGTH

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[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.05 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

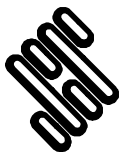
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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DETERMINATION OF POINT LOAD STRENGTH

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[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.06 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

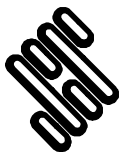
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

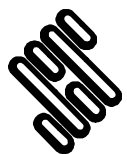
Exploratory Position ID	Sample Ref	Depth (m)	Type of Test	Width or Length (W or L) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D _e) (mm)	Point Load (I _s) (MN/m ²)	Size Factor (F)	Point Load Index (I _{s(50)}) (MN/m ²)	Water Content (%)	Rock Type	Lab location
BH203	6	16.11	D	77.5	63.59	0.021	64	0.01	1.11	0.01 (✓)	13	SANDSTONE	C
BH203	6	16.11	A	70.01	38.3	0.044	58	0.01	1.07	0.01 (✓)	13	SANDSTONE	C
BH203	6	16.11	A	69.67	35.9	0.001	56	0.00	1.06	0.00 (✓)	13	SANDSTONE	C

Results

I_s(50) Mean Axial tests = **0.01** MN/m²
I_s(50) Mean Diametral tests = **0.01** MN/m²
I_s(50) Strength Anisotropy Index = **1.22** (calculated from highest and lowest diametral and axial I_s(50) ratio)
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, (NS) denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (x) = excluded from mean calculations
Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.14 \text{ MN/m}^2$$

$I_s(50)$ Mean Diametral tests = **0.07** MN/m²

$I_a(50)$ Strength Anisotropy Index = **1.86** (calculated from highest and lowest diametral and axial $I_s(50)$ ratio)

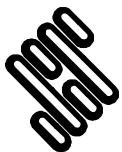
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



STRUCTURAL SOILS

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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

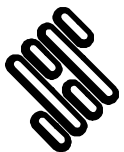
Exploratory Position ID	Sample Ref	Depth (m)	Type of Test	Width or Length (W or L) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D _e) (mm)	Point Load (I _s) (MN/m ²)	Size Factor (F)	Point Load Index (I _{s(50)}) (MN/m ²)	Water Content (%)	Rock Type	Lab location
BH203	8	16.33	D	144.52	68.49	0.572	68	0.12	1.15	0.14 (✓)	12	SANDSTONE	C
BH203	8	16.33	A	72.05	61.53	0.395	75	0.07	1.20	0.08 (✓)	12	SANDSTONE	C
BH203	8	16.33	D	80.7	66.88	0.296	67	0.07	1.14	0.08 (✓)	12	SANDSTONE	C
BH203	8	16.33	A	70.88	33.55	0.347	55	0.11	1.04	0.12 (✓)	12	SANDSTONE	C
BH203	8	16.33	A	72.47	29.48	0.347	52	0.13	1.02	0.13 (✓)	12	SANDSTONE	C

Results

I_s(50) Mean Axial tests = **0.11** MN/m²
I_s(50) Mean Diametral tests = **0.11** MN/m²
I_a(50) Strength Anisotropy Index = **1.03** (calculated from highest and lowest diametral and axial I_s(50) ratio)
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, (NS) denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (x) = excluded from mean calculations
Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



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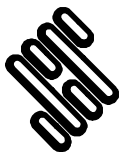
DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]

$I_a(50)$ Mean Axial tests = **0.07** MN/m²
 $I_s(50)$ Mean Diametral tests = **0.07** MN/m²
 $I_a(50)$ Strength Anisotropy Index = **1.07** (calculated from highest and lowest diametral and axial $I_s(50)$ ratio)
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key
Type of Test column: A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.
Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations
 Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]
$$I_s(50) \text{ Mean Axial tests} = 0.06 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

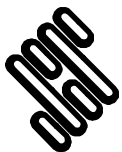
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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DETERMINATION OF POINT LOAD STRENGTH

In accordance with ISRM 1974-2006

[illegible]

Results

$$I_s(50) \text{ Mean Axial tests} = 0.12 \text{ MN/m}^2$$

Unable to calculate $I_a(50)$ Strength Anisotropy Index from this dataset.

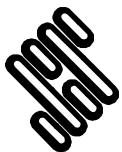
Note: Size Correction Factor (F) calculated using $F = (D_e/50)^{0.45}$ (where D_e is equivalent core diameter).

Key

Type of Test column:, A = Axial, D = Diametral, I = Irregular, B = Block, L = Parallel, P = Perpendicular, [NS] denotes Non-standard Test.

Point Load Index column: (✓) = included in mean calculations, (✗) = excluded from mean calculations

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



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UNIAXIAL COMPRESSIVE STRENGTH

Preparation in accordance with ASTM D4543-08
Testing in accordance with ISRM 1974-2006

Borehole: **BH201**

Sample Ref: **3**

Sample Type: **C**

Depth (m): **13.28**

Bulk Density (Mg/m^3): **2.10**

Dry Density (Mg/m^3): **1.87**

Moisture Content (%): **12**

Length (mm): **157.51**

Diameter (mm): **71.42**

Length/Diameter Ratio: **2.21**

Test Duration (mins:secs): **0:57**

Stress Rate (kN/min): **3.0**

Load at Failure (kN): **12.3**

UCS (MPa): **3.1**

Failure Type: **Shear**

Note: **Axis of loading parallel to core axis**

Description: **Brown SANDSTONE**

Specimen Preparation: **Specimen was not recored.**

Sample tolerance checks: Straightness: **PASS**. Flatness: **PASS**. Perpendicularity: **PASS**.



Front view (pre-test)



Rear view (pre-test)



Front view (post-test)



Rear view (post-test)

Samples delivered from site to storage facility. Samples are stored in a frost free environment, at temperatures $>4^{\circ}\text{C}$
Compression machine: Impact CT340 2000kN Auto Compression Machine Serial No. CT340-22. SSL No. 011076



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

Compiled By

Date

LORNA WHITWOTH

29/07/19

Contract

Job No

Echo Street, Liverpool

784000



UNIAXIAL COMPRESSIVE STRENGTH

Preparation in accordance with ASTM D4543-08
Testing in accordance with ISRM 1974-2006

Borehole: **BH201**

Sample Ref: **8**

Sample Type: **C**

Depth (m): **15.63**

Bulk Density (Mg/m^3): **2.01**

Dry Density (Mg/m^3): **1.75**

Moisture Content (%): **15**

Length (mm): **98.41**

Diameter (mm): **72.20**

Length/Diameter Ratio: **1.36**

Test Duration (mins:secs): **0:18**

Stress Rate (kN/min): **3.0**

Load at Failure (kN): **11.9**

UCS (MPa): **2.9**

Failure Type: **Shear**

Note: **Axis of loading parallel to core axis**

Description: **Brown SANDSTONE**

Specimen Preparation: **Specimen was not recored.**

Sample tolerance checks: Straightness: **PASS**. Flatness: **PASS**. Perpendicularity: **FAIL**.



Front view (pre-test)



Rear view (pre-test)



Front view (post-test)



Rear view (post-test)

Samples delivered from site to storage facility. Samples are stored in a frost free environment, at temperatures $>4^{\circ}\text{C}$
Compression machine: Impact CT340 2000kN Auto Compression Machine Serial No. CT340-22. SSL No. 011076



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

Compiled By

Date

LORNA WHITWOTH

29/07/19

Contract

Job No

Echo Street, Liverpool

784000



UNIAXIAL COMPRESSIVE STRENGTH

Preparation in accordance with ASTM D4543-08
Testing in accordance with ISRM 1974-2006

Borehole: **BH201**

Sample Ref: **10**

Sample Type: **C**

Depth (m): **17.60**

Bulk Density (Mg/m^3): **2.13**

Dry Density (Mg/m^3): **1.92**

Moisture Content (%): **11**

Length (mm): **96.29**

Diameter (mm): **71.94**

Length/Diameter Ratio: **1.34**

Test Duration (mins:secs): **2:18**

Stress Rate (kN/min): **3.0**

Load at Failure (kN): **19.3**

UCS (MPa): **4.7**

Failure Type: **Plastic**

Note: **Axis of loading parallel to core axis**

Description: **Brown SANDSTONE**

Specimen Preparation: **Specimen was not recored.**

Sample tolerance checks: Straightness: **PASS**. Flatness: **PASS**. Perpendicularity: **FAIL**.



Front view (pre-test)



Rear view (pre-test)



Front view (post-test)



Rear view (post-test)

Samples delivered from site to storage facility. Samples are stored in a frost free environment, at temperatures $>4^{\circ}\text{C}$
Compression machine: Impact CT340 2000kN Auto Compression Machine Serial No. CT340-22. SSL No. 011076



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

Compiled By

Date

LORNA WHITWOTH

29/07/19

Contract

Job No

Echo Street, Liverpool

784000



UNIAXIAL COMPRESSIVE STRENGTH

Preparation in accordance with ASTM D4543-08
Testing in accordance with ISRM 1974-2006

Borehole: **BH201**

Sample Ref: **13**

Sample Type: **C**

Depth (m): **18.44**

Bulk Density (Mg/m^3): **2.06**

Dry Density (Mg/m^3): **1.86**

Moisture Content (%): **11**

Length (mm): **128.38**

Diameter (mm): **72.11**

Length/Diameter Ratio: **1.78**

Test Duration (mins:secs): **0:31**

Stress Rate (kN/min): **3.0**

Load at Failure (kN): **12.1**

UCS (MPa): **3.0**

Failure Type: **Shear**

Note: **Axis of loading parallel to core axis**

Description: **Brown SANDSTONE**

Specimen Preparation: **Specimen was not recored.**

Sample tolerance checks: Straightness: **PASS**. Flatness: **PASS**. Perpendicularity: **PASS**.



Front view (pre-test)



Rear view (pre-test)

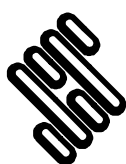


Front view (post-test)



Rear view (post-test)

Samples delivered from site to storage facility. Samples are stored in a frost free environment, at temperatures $>4^{\circ}\text{C}$
Compression machine: Impact CT340 2000kN Auto Compression Machine Serial No. CT340-22. SSL No. 011076



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

Compiled By

Date

LORNA WHITWOTH

29/07/19

Contract

Job No

Echo Street, Liverpool

784000



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: **30/07/2019 08:32:32**.

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

Approved Signatory
Luke Fisher (Materials 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**

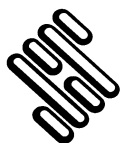
Contract:

Echo Street, Liverpool

Job No:

784000





STRUCTURAL SOILS LTD
TEST REPORT



Report No. 783979 R1

Date 17-July-2019 Contract 19/06313

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 04/07/2019
Testing Started 08/07/2019
Testing Completed Interim

Client Reference 19/074132
Client Order No. P0741342
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 (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
Water Content BSEN ISO 17892-1:2014
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

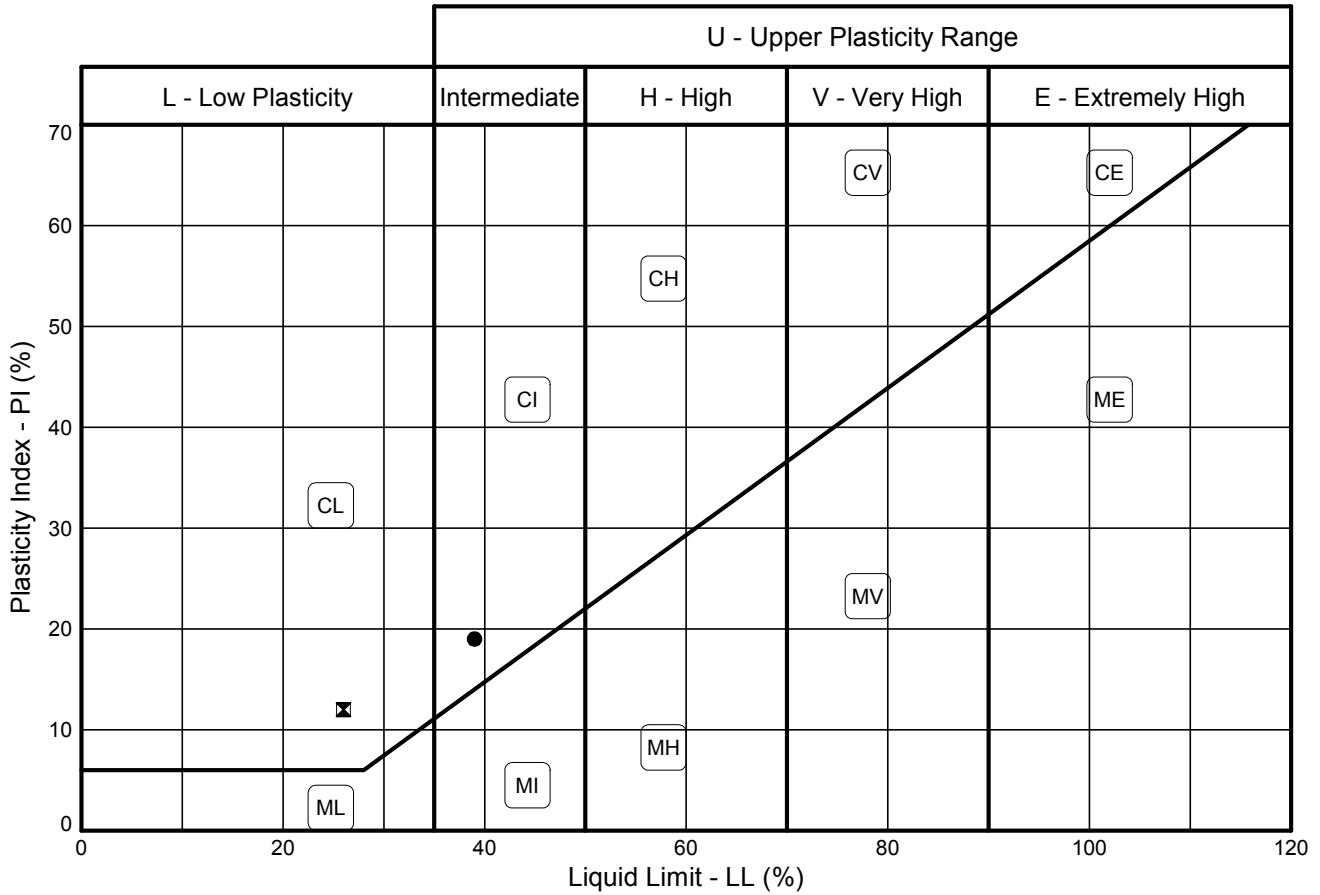
SUMMARY OF SOIL CLASSIFICATION TESTS

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
BH201	19/06313/9	D	3.45	19	39	20	19	90	Brown orange slightly sandy slightly gravelly CLAY
BH201	19/06313/6	D	7.00	20	26	14	12	92	Brown orange slightly sandy CLAY

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)										
●	BH201	19/06313/9D	3.45	3.2/4.3/5.3/5.4	4.2.4	19	39	20	19	90		C
⊠	BH201	19/06313/6D	7.00	3.2/4.3/5.3/5.4	4.2.4	20	26	14	12	92		C

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

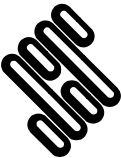
- 3.2 - Moisture Content
- 4.3 - Cone Penetrometer Method
- 4.4 - One Point Cone Penetrometer Method
- 4.6 - One Point Casagrande Method
- 5.3 - Plastic Limit Method
- 5.4 - Plasticity Index

+ 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

Contract
19/06313

Date
17/07/19

Contract Ref:
783979

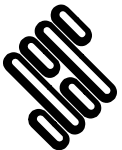


SUMMARY OF WATER CONTENT TESTS

In accordance with BS EN ISO 17892-1 : 2014

[illegible]

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

Date _____

Contract Ref:

M. Fisher.

MAUREEN FISHER

17.07.19

Contract:

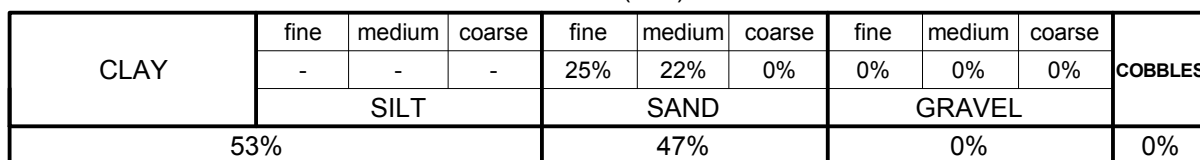
19/06313

783979



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

Depth (m): **7.20**



Coefficients	
D_{10} (mm)	NA
D_{15} (mm)	NA
D_{30} (mm)	NA
D_{50} (mm)	NA
D_{60} (mm)	0.094
D_{85} (mm)	0.252
D_{90} (mm)	0.300
C_u	NA
C_c	NA

Soil Description:
Brown sandy CLAY



Compiled By

M. Fisher

Contract

19/06313

MAUREEN FISHER

Contract Ref:

783979

Date

17/07/19



ONE DIMENSIONAL CONSOLIDATION TEST

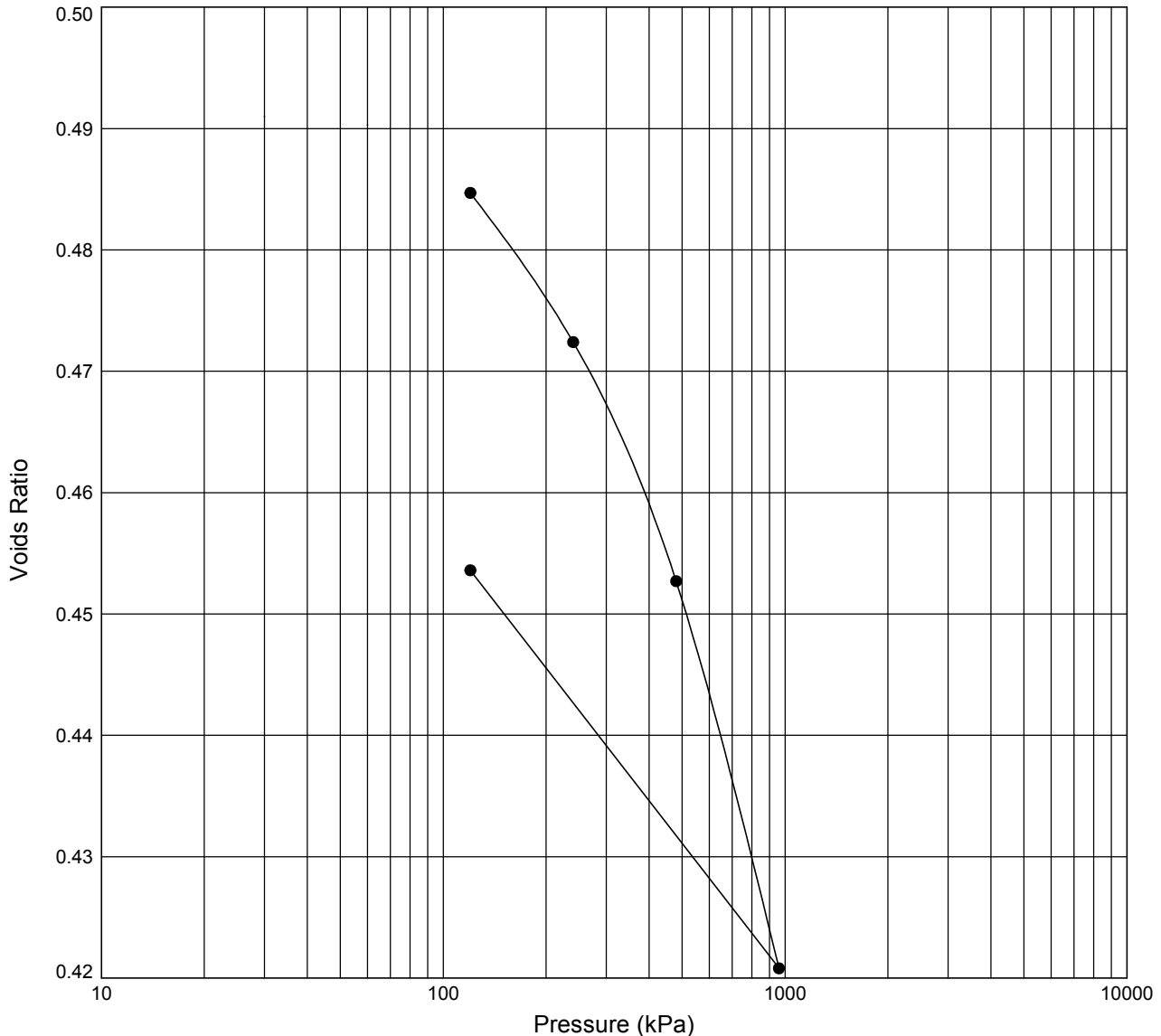
In accordance with BS1377:Part 5:1990

Borehole: **BH201**

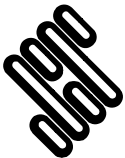
Sample Ref: **19/06313/4**

Sample Type: **B**

Depth (m): **3.00**



Initial Specimen Condition		Final Specimen Condition		Test Results			
Moisture Content (%)	: 18	Moisture Content (%)	: 19	Pressure Range (kPa)	Mv (m²/MN)	Cv (m²/yr)	Voids Ratio
Bulk Density (Mg/m³)	: 2.10	Bulk Density (Mg/m³)	: 2.17	0 - 30 30 - 60 60 - 120 120 - 240 240 - 480 480 - 960 960 - 120	Sample Sample 0.064 0.069 0.056 0.046 NA	Swelling Swelling 56 22 21 17 NA	0.4910 0.4903 0.4847 0.4724 0.4527 0.4208 0.4536
Dry Density (Mg/m³)	: 1.77	Dry Density (Mg/m³)	: 1.82				
Void Ratio	: 0.4931	Void Ratio	: 0.4536				
Specimen Details							
Description	Height (mm) : 18.92						
Brown slightly gravelly sandy CLAY	Diameter (mm) : 74.94						
	Particle Density (Mg/m³) : 2.65 (assumed)						
	Swelling Pressure (kPa) : NA						
Notes: Method of time-setting used: T90. Temperature range during test (degC): 20.4 - 22.4.							

 STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By		Date
	<i>Francesca Bennett</i>		24/07/19
	Contract	Contract Ref:	
19/06313		783979	

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: **24/07/2019 10:26:45**.

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

Approved Signatory
Luke Fisher (Materials 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:

19/06313

Job No:

783979



Appendix E Ground Gas and Groundwater Monitoring Results & Calibration Certificate

- Groundwater level monitoring visits 3A-6A.
- Gas monitor calibration certificate for monitoring period during main Phase 2 SI.

Curtins Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	26/01/2018
Job Number:	B065374.001	Visit:	1
Client:	IQ Student Accommodation	Weather:	Clear
Barometric State:	Rising	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						
WS01	1016	0.0	0.0	0.0	0.0	0.9	0.9	18.7	0	0	3.00	3.00	
WS02A	1015	0.0	0.0	0.0	0.0	2.4	2.4	14.4	0	0	Dry	4.00	
WS03	1016	-1.0	0.0	0.0	0.0	0.4	0.4	11.2	0	0	Dry	3.00	
WS07	1015	-0.6	-0.6	0.0	0.0	0.4	0.5	19.7	0	10	1.21	2.60	
WS08	1014	0.0	0.0	0.0	0.0	0.8	0.8	18.4	0	36	1.81	2.50	
WS09	1014	0.0	0.0	0.0	0.0	0.0	0.0	20.4	0	1	0.40	3.40	
WS10	1014	0.0	0.0	0.0	0.0	0.6	0.6	19.8	0	1	1.10	1.40	
WS11	1015	-3.0	-2.1	0.0	0.0	0.5	0.5	17.5	0	3	Dry	2.13	
BH03	1014	0.0	0.0	0.0	0.0	0.0	0.0	15.6	40	750	Dry	10.40	

Notes**Logged by**

ST

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	07/02/2018
Job Number:	B065374.001	Visit:	2
Client:	IQ Student Accommodation	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						
WS01	1013	0.1	0.0	0.0	0.0	0.0	0.0	20.10	0	3	3.00	3.00	
WS02A	1013	0.0	0.0	0.0	0.0	2.2	2.2	15.40	0	1	Dry	3.90	
WS03	1012	0.0	0.0	0.0	0.0	0.2	0.2	12.00	0	1	3.00	3.00	
WS07	1014	0.0	0.0	0.0	0.0	0.2	0.2	20.20	0	3	1.17	2.60	
WS08	1013	-0.2	0.0	0.0	0.0	0.8	0.8	18.80	0	1	1.85	3.50	
WS09	1013	0.0	0.0	0.0	0.0	0.2	0.2	19.2	0	1	0.60	3.40	
WS10	1013	0.0	0.0	0.0	0.0	0.9	0.9	19.5	0	0	1.17	1.50	
WS11	1014	0.0	0.0	0.0	0.0	0.6	0.6	15.2	0	1	2.15	2.15	
BH03	1012	0.1	0.1	0.0	0.0	1.0	1.0	15.8	0	6	Dry	10.30	

Notes**Logged by**

ST

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	16/02/2018
Job Number:	B065374.001	Visit:	3
Client:	IQ Student Accommodation	Weather:	Clear
Barometric State:	Falling	Ground Conditions:	Mostly 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						
WS01	1013	0.0	0.0	0.0	0.0	0.7	0.7	19.1	0	0	3.00	3.10	
WS02A	1013	0.0	0.0	0.0	0.0	2.3	2.3	15.2	0	0	Dry	3.90	
WS03	1013	0.0	0.0	0.0	0.0	0.1	0.1	11.7	0	0	2.33	3.00	
WS07	1013	0.0	0.0	0.0	0.0	0.4	0.5	19.0	0	3	1.10	2.60	
WS08	1013	0.0	0.0	0.0	0.0	0.7	0.7	19.7	0	5	1.83	3.50	
WS09	1016	0.0	0.0	0.0	0.0	0.1	0.1	20.6	0	1	0.43	3.40	
WS10	1014	0.0	0.0	0.0	0.0	0.5	0.5	20.2	0	5	1.00	1.40	
WS11	1013	0.0	0.0	0.0	0.0	0.0	0.0	19.0	0	0	Dry	2.15	
BH03	1013	0.0	0.0	0.0	0.0	1.7	1.7	16.0	0	5	Dry	10.30	

Notes**Logged by**

ST

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	05/03/2018
Job Number:	B065374.001	Visit:	4
Client:	IQ Student Accommodation	Weather:	Overcast
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						
WS01	980	0.0	0.0	0.0	0.0	0.6	0.6	19.8	0	0	2.97	3.00	
WS02A	980	0.0	0.0	0.0	0.0	2.3	2.3	14.9	0	0	Dry	3.90	
WS03	980	0.0	0.0	0.0	0.0	0.2	0.2	14.4	0	3	3.00	3.00	
WS07	980	0.1	0.1	0.0	0.0	0.2	0.2	20.1	0	1	1.16	2.50	
WS08	981	0.0	0.0	0.0	0.0	0.5	0.5	20.2	0	0	1.85	2.50	
WS09	982	0.0	0.0	0.0	0.0	0.2	0.1	20.2	0	1	0.50	3.40	
WS10	981	0.0	0.0	0.0	0.0	0.6	0.6	20.1	0	1	1.22	1.40	
WS11	980	6.4	0.0	0.0	0.0	0.7	0.7	10.6	0	0	2.01	2.15	1
BH03	981	0.0	0.0	0.0	0.0	0.6	0.5	19.4	0	0	Dry	10.40	

Notes

1 - Steady state flow rate achieved after 1 minute and 30 seconds.

Logged by

ST

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	14/03/2018
Job Number:	B065374.001	Visit:	5
Client:	IQ Student Accommodation	Weather:	Overcast
Barometric State:	Falling	Ground Conditions:	Damp

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS01	990	0.0	0.0	0.0	0.0	0.7	0.7	19.2	0	0	2.95	5.00	
WS02A	990	0.0	0.0	0.0	0.0	2.0	2.0	16.1	0	1	Dry	3.90	
WS03	990	0.0	0.0	0.0	0.0	0.7	0.7	12.8	0	3	2.12	3.00	
WS07	990	0.0	0.0	0.0	0.0	0.2	0.2	20.1	0	3	2.00	2.20	
WS08	991	0.0	0.0	0.0	0.0	0.5	0.4	20.0	0	0	1.81	2.50	
WS09	991	0.0	0.0	0.0	0.0	0.0	0.0	16.1	0	1	0.40	3.40	
WS10	991	0.0	0.0	0.0	0.0	0.4	0.4	19.9	0	3	1.10	1.40	
WS11	990	0.0	0.0	0.0	0.0	0.8	0.7	10.6	0	0	2.00	2.20	
BH03	992	0.0	0.0	0.0	0.0	0.5	0.5	19.6	0	0	Dry	10.40	

Notes**Logged by**

ST

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	03/04/2018
Job Number:	B065374.001	Visit:	6
Client:	IQ Student Accommodation	Weather:	Light cloud
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						
WS01	983	0.0	0.0	0.0	0.0	0.0	0.0	20.9	3	1	2.92	3.04	1
WS02A	984	0.0	0.0	0.0	0.0	0.0	0.0	20.9	3	1	Dry	3.90	
WS03	984	0.1	0.0	0.0	0.0	0.0	0.0	20.9	3	1	2.83	2.96	
WS07	-	-	-	-	-	-	-	-	-	-	-	-	
WS08	983	0.0	0.0	0.0	0.0	0.0	0.0	21.1	3	1	1.74	2.50	
WS09	983	0.0	0.0	0.0	0.0	0.0	0.0	20.8	4	1	0.45	3.40	
WS10	982	0.0	0.0	0.0	0.0	0.0	0.0	20.8	3	0	1.10	1.45	
WS11	983	0.0	0.0	0.0	0.0	0.0	0.0	20.8	4	0	1.85	2.15	
BH03	983	0.0	0.0	0.0	0.0	0.0	0.0	20.7	4	0	Dry	10.40	

Notes

1 - Monitoring well could not be accessed.

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 Consulting

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

Tel: 0161 236 2394

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GAS MONITORING LOG SHEET

Project: Chandos Hall**Date:** 29/07/2019**Job Number:** B065374.001**Visit:** 3A**Client:** IQ Student Accommodation**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						
BH401											9.97	9.97	1
BH402											12.77	18.01	
BH403											12.66	20.05	
BH201											10.11	14.77	
BH202											12.77	17.81	
BH203											-	-	

Notes

1 - Monitoring well could not be accessed.

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902

**GAS MONITORING LOG SHEET****Project:** Chandos Hall**Date:** 06/08/2019**Job Number:** B065374.001**Visit:** 4A**Client:** IQ Student Accommodation**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						
BH401											8.97	9.85	
BH402											12.65	17.92	
BH403											12.72	19.89	
BH201											9.97	14.73	
BH202											11.50	17.81	
BH203											11.69	11.99	1

Notes

1 - Monitoring well could not be accessed.

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	12/08/2019
Job Number:	B065374.001	Visit:	5A
Client:	IQ Student Accommodation	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						
BH401											-	-	1
BH402											12.76	16.69	
BH403											12.62	20.40	
BH201											14.85	10.07	
BH202											12.60	11.56	
BH203											12.20	11.69	

Notes

1	Unable to dip due to folded plastic surrounding installation
---	--

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	19/08/2019
Job Number:	B065374.001	Visit:	6A
Client:	IQ Student Accommodation	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						
BH401											-	-	1
BH402											12.64	16.50	
BH403											12.54	19.99	
BH201											9.99	14.60	2
BH202													
BH203													3

Notes

- 1 Unable to dip due to folded plastic surrounding installation
- 2 Unable to find borehole
- 3 Unable to find borehole

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 Consulting

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project:	Chandos Hall	Date:	30/08/2019
Job Number:	B065374.001	Visit:	7A
Client:	IQ Student Accommodation	Weather:	Cloudy
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						
BH401											-	-	1
BH402											-	-	2
BH403											-	-	3
BH201											10.07	14.57	
BH202													4
BH203													5

Notes

- 1 Unable to dip due to folded plastic surrounding installation
- 2 Borehole destroyed
- 3 Borehole destroyed
- 4 Borehole destroyed
- 5 Borehole destroyed

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

TEST DATE AND CONDITIONS	
Date	15/05/2017
Atmospheric Pressure	1003 mB
Ambient Temp	24.6 °C
EnviroNics Serial No.	5089
Gas Cylinder Certification No.	53484/5016

GAS DATA LTD	
Pegasus House	
Seven Stars Estate	
Wheler Rd	
Coventry	
CV3 4LB	
Tel 02476303311 Fax 02476307711	

GFM430-1 / 2 FINAL INSPECTION & CALIBRATION CHECK CERTIFICATE

INSTRUMENT DETAILS	
Serial No	Customer
10327	Curtins Consultants

INSTRUMENT CHECKS			
Keyboard	✓	Pump Flow	400 cc/min
Display Contrast	✓	Pump Flow @ -200mB	400 cc/min
Clock Set / Running	✓	S/W Version	G430.0024/0013
Labels Fitted	✓	Recalibration Date	15/05/2018

GAS CHECKS							
Calibration Gas		Instrument Gas Channels Read					
Gas Type	Applied Conc.	CH4 (%)	tol. (% vol.)	CO2 (%)	tol. (% vol.)	O2 (%)	tol. (% vol.)
N2	100%	0.0	0.0	0.0	0.0	0.0	+/-0.1
CH4	5%	4.8	+/-0.3	0.0	0.0	0.0	+/-0.1
	60%	59.8	+/-3.0	0.0	0.0	0.0	+/-0.1
CO2	5%	0.0	0.0	4.8	+/-0.3	0.0	+/-0.1
	40%	0.0	0.0	40.1	+/-3.0	0.0	+/-0.1
O2	20.9%	0.0	0.0	0.0	+0.1	20.9	+/-0.5

OPTIONAL GAS CHECKS							
Calibration Gas		Instrument Gas Channels Read					
Gas Type	Applied Conc.	Label	H2S	CO			tol. (% vol.)
		Range	5000ppm	2000ppm			
N2	100%		0	0			0
H2S	1500ppm		1500	0			+/- 5.0
CO	1000ppm		76	1002			+/- 5.0
							+/- 5.0
							+/- 5.0
							+/- 5.0
							+/- 5.0

TEST DATE AND CONDITIONS	
Date	15/05/2017
Atmospheric Pressure	1003 mB
Ambient Temp	24.6 °C
Environics Serial No.	5089
Gas Cylinder Certification No.	53484/5016

GAS DATA LTD

Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB
Tel 02476303311 Fax 02476307711



GFM430-1 / 2 FINAL INSPECTION & CALIBRATION CHECK CERTIFICATE

PRESSURE CHECKS							
Calibration Pressure		Instrument Pressure Channels Read					
Pressure @	Applied Pressure	Atmospheric [Ap] (mB)	tol. (mB)	Static [Sp] (mB)	tol. (mB)		
All ports	current atmospheric	1003	+/-2.0	0.0	0.0		
Ap port (internal)	+800mB(a)	798	+/-5.0	0.0	0.0		
	+1200mB(a)	1199	+/-5.0	0.0	0.0		
Gas IN Port	+50mB(g)			0.0	+/-2.0		
	-100mB(g)			0.0	+/-2.0		

FLOW CHECKS					
Calibration Flow		Instrument Flow Channels Read			
Applied Flow	Applied Pressure (Pa)	Flow [Flow] (l/hour)	tol. (l/hour)	Differential Pressure [Dp] (Pa)	tol. (Pa)
-30.0 l/hour	-267	-29.2	+/-3.0	-265	+/-50
-3.0 l/hour	-13	-3.1	+/-1.0	-14	+/-6
0.0 l/hour	0.0	0.0	0.0	0.0	+/-0.5
+3.0 l/hour	13	2.8	+/-0.5	14	+/-3
+30.0 l/hour	273	27.5	+/-3.0	252	+/-50
+60.0 l/hour	807	55.8	+/-6.0	739	+/-130
+90.0 l/hour	1574	89.4	+/-9.0	1567	+/-250

TEMPERATURE CHECK		
Calibration Temperature	Instrument Temperature Channel Read	
Applied Equivalent Temperature	Temperature [Temp] (°C)	tol. (°C)
-10.0 °C	-10.0	+/- 2.0
0.0 °C	0.0	+/- 1.0
30.0 °C	30.0	+/- 1.0
60.0 °C	60.0	+/- 1.0
100.0 °C	100.0	+/- 1.0

Appendix F GAC Screening Thresholds

- Curtins, Soil GAC Thresholds for 6.0%, 2.5% and 1.0% SOM.

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 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
Aliphatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₆	42	42	730	3200	570000	95000
EC ₆₋₆ - EC ₈	100	100	2300	7800	600000	150000
EC ₈₋₈ - EC ₁₀	27	27	320	2000	13000	14000
EC ₁₀₋₁₀ - EC ₁₂	130	130	2200	9700	13000	21000
EC ₁₂₋₁₂ - EC ₁₆	1100	1100	11000	59000	13000	25000
EC ₁₆₋₁₆ - EC ₃₅	65000	65000	260000	1600000	250000	450000
EC ₃₅₋₃₅ - EC ₄₄	65000	65000	260000	1600000	250000	450000
Aromatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₇	70	370	13	26000	56000	76000
EC ₇₋₇ - EC ₈	130	860	22	56000	56000	87000
EC ₈₋₈ - EC ₁₀	34	47	8.6	3500	5000	7200
EC ₁₀₋₁₀ - EC ₁₂	74	250	13	16000	5000	9200
EC ₁₂₋₁₂ - EC ₁₆	140	1800	23	36000	5100	10000
EC ₁₆₋₁₆ - EC ₂₁	260	1900	46	28000	3800	7600
EC ₂₁₋₂₁ - EC ₃₅	1100	1900	370	28000	3800	7800
EC ₃₅₋₃₅ - EC ₄₄	1100	1900	370	28000	3800	7800
Aliph + Arom EC >44-70	1600	1900	1200	28000	3800	7800
Aromatic						
Benzene	0.08	0.3	0.017	28	72	90
Ethyl benzene	65	170	16	520⁽⁸⁾ [17000]	520⁽⁸⁾ [24000]	520⁽⁸⁾ [17000]
Toluene	120	610	22	860⁽⁸⁾ [59000]	860⁽⁸⁾ [56000]	860⁽⁸⁾ [87000]
Xylene ⁽⁹⁾	41	53	28	480⁽⁸⁾ [69000]	480⁽⁸⁾ [41000]	480⁽⁸⁾ [17000]
Phenol	180	310	66	760⁽¹⁴⁾ (31000)	760⁽¹⁴⁾ (10000)	760⁽¹⁴⁾ (7600)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	2.3	2.3	4.1	190	4900	1200
Acenaphthylene	170	2900	28	83000	15000	29000
Acenaphthene	210	3000	34	84000	15000	29000
Fluorene	170	2800	27	63000	9900	20000
Phenanthrene	95	1300	15	22000	3100	6200
Anthracene	2400	31000	380	520000	74000	150000
Fluoranthene	280	1500	52	23000	3100	6300
Pyrene	620	3700	110	54000	7400	15000
Benz(a)anthracene	7.2	11	2.9	170	29	49
Chrysene	15	30	4.1	350	57	93
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	13
Benzo(k)fluoranthene	77	110	37	1200	190	370
Benzo(a)pyrene	2.2	3.2	0.97	35	5.7	11
Indeno(123cd)pyrene	27	45	9.5	500	82	150
Dibenzo(ah)anthracene	0.24	0.31	0.14	3.5	0.57	1.1
Benzo(ghi)perylene	320	360	290	3900	640	1400
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00064	0.00077	0.00055	0.059	3.5	4.8
Trichloroethene (TCE)	0.016	0.017	0.041	1.2	120	70
1,1,1,2 Tetrachlorethane	1.2	1.5	0.79	110	1400	1500
Tetrachlorethane (PCE)	0.18	0.18	0.65	19	1400	810
1,1,1 Trichlorethane	8.8	9	48	660	140000	57000

Notes

- 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
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- 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 Additional 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.

Phase 2 Additional Ground Investigation

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.

Appendix H Detailed UXO Risk Assessment

- 1st Line Defence (2017) Detailed Unexploded Ordnance Risk Assessment, Chandos Hall (report np. DA4989-00).

1ST LINE DEFENCE

UXO SOLUTIONS



Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Chandos Hall
Client	Curtins
Site Address	Chandos Hall, Granby Row, Manchester, M1 3QJ
Report Reference	DA4989-00
Date	14 th July 2017
Originator	CB



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Executive Summary

Site Location and Description

The site is located in the county borough of Manchester in Lancashire, north-west England. It is bordered by Granby Row to the north, Echo Street to the east, a section of railway and Altrincham Road to the south and Granby Row/Cobourgh Street to the west. The site is located approximately 210m south-west of Manchester Piccadilly station and approximately 870m south-east of Manchester city centre.

The site is currently occupied by a high-rise apartment building and a single level building of an unknown purpose, possibly a day care centre, which is accompanied by a small section of open greenspace in the form of a playground.

The site is approximately centred on the OS grid reference: **SJ 8466597703**.

Proposed Works

The proposed works are understood to involve an intrusive ground investigation (drilling and excavating) for the pile design of a proposed multi storey student accommodation block.

Geology and Bomb Penetration Depth

Site specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is a **Low Risk** from UXO across the majority of the site area, with a **Medium Risk** in the north-west of the site. This assessment is based on the following factors:

- The County Borough of Manchester was subject to a **Moderate** density of bombing with 27.1 bombs recorded per 1,000 acres. Manchester bomb plot and damage mapping indicates the presence of bombing incidents in the surrounding area of the proposed site, but none within the site boundary. However, the mapping only covers raids in 1940 so does not record any bombs which fell from 1941 to 1944. Furthermore, no written bomb incident records are available for Manchester. It is understood from the local archive that they were destroyed during/post-war. It has therefore not been possible to ascertain with certainty whether or not the site was bombed.
- At the start of the war, the site was almost entirely occupied by structures of a residential and commercial nature. Across the majority of the site, it is considered that ground cover should have been such that evidence of UXBs should have been noted and reported. However, an area of clearance is noted in the north-eastern corner of the site. It is thought possible that this was as a result of a bomb strike/fire damage. If rubble and debris was present in this area, there is a risk that evidence of UXO could easily have been overlooked. UXBs falling into 'bomb sites' was one of the most common scenarios for this going unnoticed and unrecorded.
- The proposed site was a housing and commercial entity. Should the site have suffered no damage throughout the war, it is anticipated that access levels would have been regular and frequent, and that post-raid checks for evidence of UXO would have been undertaken. Of concern is the north-eastern corner of the site where an area of cleared housing is noted post-war. It is not likely that access was reduced across the entirety of the site. However it cannot be discounted that potential bomb damage occurred in the north-eastern corner therefore lowering access levels and meaning UXO could have potentially fallen unnoticed.

**UXO Risk Assessment**

- It is a distinct possibility that damage may have occurred on site due to the area of cleared housing in the north-eastern corner in post-war photography. If rubble and debris were present in this area, there is a risk that evidence of UXO could easily have been unnoticed. The rest of the site appears to have survived the war intact.
- Given that the majority of the site appears to have survived the war, shows no signs of damage and likely accessed frequently, this part of the site has been given a **Low Risk**. The area within the north-west of the site is shown as cleared on post-war aerial photography. Given the poor quality of the record set for Manchester, it has not proved possible to prove that this clearance was not due to bombing. Thus, this area, with a small buffer to account for the 'J-curve' effect, has been given a **Medium Risk**.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Chandos Hall site:

All Works

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Medium Risk Areas**Open Intrusive Works (trial pits, service pits, open excavations, shallow foundations etc.)**

- UXO Specialist On-site Support and Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Boreholes and Piled Foundations

- Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth



Risk Map



For indicative purposes – not to scale



Medium Risk



Low Risk

Low Risk Areas:

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Medium Risk Areas:

- Unexploded Ordnance (UXO) Specialist presence on site to support open intrusive works
- Intrusive Magnetometer Survey of any borehole or pile locations/clusters down to an assessed maximum bomb penetration depth

Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AAA	Anti-Aircraft Ammunition
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
AWAS	Air Warfare Analysis Section
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti Air
HE	High Explosive
IB	Incendiary Bomb
LAA	Light Anti Air
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
MOL	Molotov (Incendiary Bomb)
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD1000	1000kg high explosive bomb
SD2	2kg incendiary
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti Air
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V1	Vengeance Weapon 1
V2	Vengeance Weapon 2
WAAF	Women's Auxiliary Air Force
X	Exploded

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1st Line Defence Limited

Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Chandos Hall, Manchester
Client: Curtins

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Curtins to produce a Detailed Unexploded Ordnance (UXO) Risk Assessment for the proposed works at Chandos Hall.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspected device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions deposited as a result of military training and exercises.
2. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.
3. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.

This report will assess the collective factors that may contribute to the risk of UXO contamination. If a potential risk is identified, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to enable the client to understand the basis for the assessed risk level and any recommendations.

This report follows the guidelines outlined in CIRIA C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry'.

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at Chandos Hall. Every reasonable effort has been made to ensure that all available historical information has been accessed and checked. Where possible, evidence has been included in the report to enable the client to understand the basis of the risk assessment.

The report will recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The risk that the site was contaminated with UXO.
2. The risk that UXO remains on the site.
3. The risk that UXO may be encountered during the proposed works.
4. The risk that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German air-delivered bombing and the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

To produce a thorough assessment of UXO risk, military records and archive material held in the public domain have been accessed. The following sources have been consulted for this report:

- The National Archives, Kew, and Greater Manchester County Record Office, Manchester.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Curtins.
- Available material from 33 Engineer Regiment (EOD) Archive.
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to The National Archives.

2.4. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate significant and pertinent information, and the sources consulted have been presented in this report. 1st Line Defence cannot be held accountable for any changes to the assessed level of risk or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence at the time of the report's production.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are to a degree subjective. To counter this, a range of many sources and types of information have been consulted, analysed and presented. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for inaccuracies or gaps in the available historical information.

3. Background to Bombing Records

During WWII bombing records were gathered by the police, Air Raid Precaution (ARP) wardens and military personnel. Records were maintained in the form of local and regional written records, maps depicting the locations of individual strikes, and maps indicating the levels of damage sustained by structures. Records typically noted when, where and what types of bombs had fallen during an air raid. Records of bomb strikes were made either through direct observation or by post-raid surveys. The immediate priority was frequently focussed on assisting casualties and minimising damage. As a result some records were incomplete and contradictory.

The quality, detail and nature of record keeping could vary considerably between boroughs and towns. No two areas were collated or recorded data in the same way. Some areas maintained bomb and damage mapping, some provided grid references of strikes, and some are too vague in detail to be able to ascertain exactly where bombs fell. Many records were even damaged or destroyed in subsequent bombing raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Furthermore, records of attacks on military or strategic targets were often maintained separately from the general records and have not always survived.

4. Background to Allied Records

During WWII considerable areas of land were requisitioned by the army for the purpose of defence, training, and the construction of airfields and facilities for munitions production. Records relating to military features vary and some areas may remain censored. Within urban environments datasets will be consulted detailing the location of munitions works and air and land defences. In rural locations it may be possible to obtain plans of airfields and military establishments, as well as training logs, personal memoirs, and operational plans.

5. UK Regulatory Environment

5.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

5.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation on parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

5.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

5.4. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

6. Role of Commercial UXO Contractors and The Authorities

6.1. Commercial UXO Contractors

In the event that a risk of UXO contamination is detected at the proposed site, the support of a UXO specialist may be recommended. A UXO specialist may be able to avoid unnecessary call-outs to the authorities through the disposal or removal of low risk items. In addition a specialist will assist in the swift recognition of high risk items, and will thereafter co-ordinate with the local authority with the objective of causing minimal levels of disruption to site operations, whilst putting in place safe and appropriate measures.

For more information on the role of commercial UXO specialists, see *CIRIA C681*.

6.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal (JSEOD) to arrange for investigation and/or disposal. In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on JSEOD's judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. They may respond immediately or it can take 1-2 days and often longer for the authorities to respond and deal with a UXB.

Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion. The latter process is lengthy and may necessitate the establishment of additional cordons and evacuations.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high risk situations. If there are regular UXO finds on a site the JSEOD may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

7. The Site

7.1. Site Location

The site is located in the county borough of Manchester in Lancashire, north-west England. It is bordered by Granby Row to the north, Echo Street to the east, a section of railway and Altrincham Road to the south and Granby Row/Cobourg Street to the west. The site is located approximately 210m south-west of Manchester Piccadilly station and approximately 870m south-east of Manchester city centre.

The site is approximately centred on the OS grid reference: **SJ 8466597703**.

Site location maps are presented in **Annex A**.

7.2. Site Description

The site is currently occupied by a high-rise apartment building and a single level building of an unknown purpose, possibly a day care centre, which is accompanied by a small section of open greenspace in the form of a playground.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

8. Scope of the Proposed Works

8.1. General

The proposed works are understood to involve an intrusive ground investigation (drilling and excavating) for the pile design of a proposed multi storey student accommodation block.

9. Ground Conditions

9.1. General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the Chester Pebble Beds Formation – sandstone, of the Early Triassic Epoch. The superficial deposits are comprised of Till, Devansian – Diamicton.

9.2. Site Specific Geology

Site specific geotechnical data was not available at the time of the production of this report.

10. Site History

10.1. Ordnance Survey Historical Maps

Historical maps were obtained for this report and are presented in **Annex D**. These maps provide an indication of the composition of the site pre and post- WWII. See below for a summary of the site history on various mapping editions.

Pre-WWI		
Date	Scale	Description
1908	1:2,500	This map indicates the presence of several residential properties within the site boundary. A road intersects the western half of the site. There are some small areas of open ground, assumed to be hard standing in nature.

Pre-WWII		
Date	Scale	Description
1922	1:2,500	This map shows no significant change since the previous edition. The site remains occupied by residential properties.

Post-WWII		
Date	Scale	Description
1948	1:1,250	There is no significant change since the previous map edition across the majority of the site area. There is an area of clearance to the north-west of the site on the opposite side of Granby Row, and a row of missing houses in the north-eastern corner of the site.
1965	1:2,500	This map edition shows the site to have been cleared of the residential properties and is now occupied by a 'depot' and a structure of an unknown purpose. The road intersecting the site is now gone.

10.2. Goad Fire Insurance Mapping

Available pre and post-WWII fire insurance plans for the site were obtained by 1st Line Defence. These are comprehensive street plans detailing the structure and uses of individual buildings. The plans were originally designed to assist the fire insurance industry. See **Annex E** for the mapping with the site boundary outlined accordingly.

WWII Period	
Date	Description
1942	This plan shows the majority of the buildings within the site footprint to be made of brick, stone or concrete. There is one wooden structure to the south. Some skylights are visible to the south-east. The majority of the buildings are marked as having been commercial units.

Post-WWII	
Date	Description
1962	This plans shows the majority of the buildings from the previous edition to have been demolished, save for the buildings on the far east of the site. A single structure labelled as 'College of Technology', built from brick, stone or concrete, has been erected in place of the former buildings.

10.3. Historical Aerial Photographs of the Site

Historical aerial photographs have been consulted from the Aerofilms collection available from Britain From Above. 1st Line Defence have inquired about obtaining historical air photographs of the site area from the Aerofilms collection. Unfortunately no relevant records could be found.

11. Aerial Bombing Introduction

11.1. General

During WWI and WWII, many towns and cities across the UK were subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and bombing techniques often resulted in neighbouring areas to specific targets being bombed.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place – notably the London ‘Blitz’, but also affecting many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this report will concern air delivered weapons dropped during WWII, although WWI bombing will also be considered.

11.2. Generic Types of WWII German Air-delivered Ordnance

An understanding of the type and characteristics of the ordnance used by the Luftwaffe during WWII allows an informed assessment of the hazards posed by any unexploded items that may remain in situ on a site. A brief summary of these characteristics is given in the table below. Examples of German air delivered ordnance are presented in **Annex F**.

Generic Types of WWII German Air Delivered Ordnance				
Type	Description	Size/Weight	Frequency	Likelihood of detecting Unexploded
High Explosive (HE) Bombs	A HE bomb typically has a strong metal casing, which provides a ‘thick skin’ that is designed to fragment on detonation. HE bombs possess a sufficient mass and velocity to enable penetration of the ground if they failed to explode. In addition the shape and fins are aerodynamic to keep the tip end of the bomb facing downward.	Most bombs were 50kg, 250kg or 500kg, although larger bombs of up to 1,800kg were also used. About half the weight of HE bombs comprised of explosive TNT or Amatol.	In terms of weight of ordnance dropped, HE bombs were the most frequent weapon deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following a raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see Annex G). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded 50kg bomb. UXBs therefore present the greatest risk to present-day intrusive works.
Aerial or Parachute Mines (PM)	Luftmines (LMA-500kg and LMB-1000kg) were magnetic sea mines which were thin walled, cylindrical in shape with a hemispherical nose, deployed by parachute. For use on land, the mines were armed with a clockwork bomb fuze which caused the bomb to explode after impact. When operating as designed they caused considerable damage due to the high weight of explosive and their detonation at or near the surface.	PMs either weighed 500kg or 1000kg (approximately 2/3 of the overall weight was explosives) depending on the type of mine. Their length ranged from 1.73-2.64m.	PMs were deployed less frequently than HE and Incendiary bombs due to their size, cost and the difficulty of their deployment.	If functioning correctly, PMs generally would have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
1kg Incendiary Bombs (IB)	1kg IB devices had a magnesium shell and were filled with thermite; both components were designed to burn after igniting on impact. They were jettisoned from air-dropped containers.	1kg in weight and approximately 14 inches long.	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these weapons	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft

	Some variants had explosive heads presenting an increased risk if encountered during works.		were dropped throughout the war.	vegetated ground, or bomb rubble, they could have gone unnoticed.
Large Incendiary Bombs (IB)	Large IBs had various flammable fill materials (including oil and white phosphorus), and a small explosive charge. They were designed to explode and burn close to the surface. Although they were often the same shape as HE bombs, they were thin-skinned and did not generally penetrate the surface.	Large IBs Weighed up to 350kg.	Large IBs were not as common as the 1kg IBs, although they were more frequently deployed than the Parachute Mines and Anti-Personnel Bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Anti-personnel (AP) Bomblets	The SD2 'Butterfly Bomb' had an 8cm long, thin, cylindrical shaped, cast iron outer shell which hinged open when the bomblet deployed. A 15cm long steel cable was attached via a spindle to an aluminium fuze. They were generally lethal to anyone within a radius of 10 metres (33 ft) and could inflict serious shrapnel injuries.	The size and weight ranged depending on the type used. The SD2 weighed 2kg and contained 225 grams of TNT.	AP Bomblets were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

11.3. Failure Rate of German Air-Delivered Ordnance

It has been estimated that 10% of the German HE bombs dropped during WWII failed to explode as designed. There are a number of reasons why an air-delivered weapon might fail to function as designed:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many German bombs were fitted with a clockwork mechanism that could jam on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning of the bomb before it was armed or from a very low altitude. This was most likely if the bomber was under attack or crashing.

From 1940 to 1945 bomb disposal teams dealt with a total of 50,000 explosive items of 50kg, over, 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, especially in London; see press articles in **Annex H**.

11.4. V-Weapons

From mid-1944, Hitler's 'V-weapon' campaign began. It used newly developed unmanned cruise missiles and rockets. The V-1 known as the *Flying Bomb* or *Pilotless Aircraft* and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their range was limited by their position of deployment across Europe and as a result the vast majority of V-weapon strikes were directed against targets in the south-east of England, predominantly in the London Boroughs and Home Counties. This limitation of capability meant targets in Manchester and north-west England were generally too far to be considered for V-weapon strikes by the Luftwaffe.

The risk from V-weapons in Manchester is therefore considered negligible and will not be further addressed in this report.

12. UXB Ground Penetration

12.1. General

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb
- Height of release
- Velocity and angle of bomb
- Nature of the ground cover
- Underlying geology

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

12.2. The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an air-delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly however is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be up to 15m.

12.3. WWII UXB Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by Bomb Disposal. Conclusions were made as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

12.4. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters have been used:

- WWII geology – Chester Pebble Beds Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the lack of site specific borehole geotechnical information. An assessment can be made once such information becomes available or by an UXO Specialist on-site.

13. **Initiation of Unexploded Ordnance**

13.1. **General**

Unexploded ordnance does not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur. In the case of unexploded German bombs discovered within the construction site environment, there are a number of potential initiation mechanisms.

13.2. **UXB Initiation Mechanisms**

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

Annex H details UXB incidents where intrusive works have caused UXBs to detonate, resulting in death or injury and damage to plant.

13.3. **Effects of Detonation**

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

14. The Risk from German Air Delivered UXBs

14.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. A WWI map of air raids and naval bombardments across England is presented in **Annex I**.

Manchester escaped WWI bombing, with the only Zeppelin attack getting close to Manchester occurring on 25th September 1916. Damage was caused to buildings in the villages of Holcombe and Greenmount, north of Bury, and there were a number of civilian deaths in Bolton. There was one further, unsuccessful Zeppelin foray on Northwest England in April 1918 which reached the Widnes and Wigan area but not Manchester. Zeppelins more often than not did not have great navigational skills; one 1915 attack, claimed to have been on the port of Liverpool, in fact dropped its bombs on the very inland Black Country.

WWI bombs were generally smaller than those used in WWII and were dropped from a lower altitude. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density the risk from WWI UXBs is considered low and will not be further addressed in this report.

14.2. World War II Bombing of Manchester

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the County Borough of Manchester, which sustained a moderate density of bombing as represented by bomb density data figures and maps. Manchester was not as targeted as other major northern British cities such as Liverpool and Coventry, but was still subject to numerous major raids. These raids tended to focus on Salford and Stretford, where the majority of Manchester industrial and dockland areas were found. The site was located approximately 4km south-east of Salford.

Manchester and Salford were mapped by the Luftwaffe when preparing for air raids. The mapping is presented in **Annex J**. The map obtained by 1st Line Defence covers Clayton, east Manchester, and highlights targets such as the gas works along Ashton New Road amongst others. Other specific Luftwaffe targets in the city included areas such as Spinningfields, Castlefield, and Ordsall, which lay west of the site. The targets in these areas were predominantly contained on the railway, which proved vital to the war efforts.

Manchester London Road station, or Manchester Piccadilly as it is known today, was marked as a target by the Luftwaffe. WWII bomb accuracy was inconsistent, meaning bombs often missed their targets causing destruction elsewhere. 'Tip and run' raids were frequent, whereby German pilots would empty their aircraft of any remaining bombs before returning to base. It is likely that the Luftwaffe would have used Manchester canal as a source of navigation, of which the nearest point to the site is approximately 1.3km north, and therefore it is probable that the area in general would have endured heavy bombing.

Records of bombing incidents in the civilian areas of Manchester were collected by the Air Raid Precautions warden and collated by the Civil Defence Office. Some other organisations, such as the London Port Authority and railways, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents for Manchester are presented in the following sections.

14.3. Second World War Bombing Statistics

The following table summarises the quantity of German bombs (excluding 1kg incendiaries and anti-personnel bombs) falling on the County Borough of Manchester between 1940 and 1945.

Record of German Ordnance Dropped on the County Borough of Manchester		
Area Acreage		27,321
Weapons	High Explosive Bombs (all types)	712
	Parachute Mines	18
	Oil Bombs	7
	Phosphorus Bombs	0
	Fire Pot	0
	Pilotless Aircraft (V-1)	1
	Long Range Rockets (V-2)	0
Total		738
Number of Items per 1,000 acres		27.1

Source: Home Office Statistics

This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were designed to inflict damage and injury and should therefore not be dismissed. Therefore, they should not be overlooked in assessing the general risk to personnel and equipment. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous.

14.4. Manchester Blitz Air Raid Precautions Bomb Census and Damage Map

A local bomb census map compiled by Manchester City Council showing High Explosive (HE) and Incendiary Bomb strikes on the borough was obtained from Manchester Archives. The section showing the area of the site is described in the table below and presented in **Annex K**.

Manchester Consolidated Bomb Map – Annex K	
Date Range	Comments
Consolidated Bomb Plot Map: 1940 - 1945	This map was compiled post-war and depicts all of the strikes that occurred in Manchester during the 1940 Blitz. No strikes were recorded within the site boundary during these raids. No damage is recorded within the site boundary. The nearest damaged area is approximately 170m west of the site. It should be noted that this bomb mapping only covers the 1940 Manchester Blitz and not any subsequent bombing.

14.5. Quality of Historical Record

The quality of the extant historical record set for Manchester is overall poor, with limited resources available. These limitations hinder the possibility of accurately determining a risk level of UXO being discovered on a site. Whilst more densely bombed areas such as Stretford and Salford have superior record sets, the records for Manchester are lacking in diversity and quality.

No complete written incident records could be found for Manchester. This could be due to them being lost or damaged since the end of WWII. Only one bomb plot map could be found which makes it problematic when attempting to corroborate incidents across several sources. Confirming dates and the extent of damage suffered is likely to be more accurate when done across more than one resource. Furthermore the available record, the Architect's Department map detailed above, has many issues. The mapping only covers a period of the war, 1940-1941, rather than the entirety, meaning that several bombing incidents that occurred in the later war years within the city aren't covered. Moreover, the dates presented next to the strikes are not known to correspond with the incidents. It is therefore incredibly difficult to confirm the exactness or presence of said incidents.

14.6. WWII-Era Aerial Photographs

A high resolution scan of WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). This photograph is dated 16th May 1948 and provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (**see Annex M**).

On the whole the site appears to be in good condition, with the majority of the buildings remaining intact. However, an area of clearance is noted in the north-east of the site. The properties are apparent in 1942 GOAD mapping but are gone in the 1948 OS mapping edition. There is no evidence to suggest that bombing occurred on site during the war; however, it is a distinct possibility as the records available to 1st Line Defence were limited at the time of writing as the only bomb map available only covered the Manchester Blitz of 1940. Also, there is an area of lighter coloured earth/structures immediately north-west of the site which may be a sign of bomb damage. However the bomb map available to 1st Line Defence does not indicate any bombing in that particular area.

A view of the wider area is located in **Annex M2**.

14.7. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'Abandoned Bomb'.

Given the inaccuracy of WWII records and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

14.8. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) is currently facing considerable delay. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date Curtins will be advised.

14.9. Evaluation of German Air Delivered UXB Risk

Factors	Conclusion
Density of Bombing <i>It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High levels of bombing density could allow for error in record keeping due to extreme damage caused to the area.</i>	The County Borough of Manchester was subject to a Moderate density of bombing with 27.1 bombs recorded per 1,000 acres. Manchester bomb plot and damage mapping indicates the presence of bombing incidents in the surrounding area of the proposed site, but none within the site boundary. However, the mapping only covers raids in 1940 so does not record any bombs which fell from 1941 to 1944. Furthermore, no written bomb incident records are available for Manchester. It is understood from the local archive that they were destroyed during/post-war. It has therefore not been possible to ascertain with certainty whether or not the site was bombed.
Ground Cover <i>The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.</i>	At the start of the war, the site was almost entirely occupied by structures of a residential and commercial nature. Across the majority of the site, it is considered that ground cover should have been such that evidence of UXBs should have been noted and reported. However, an area of clearance is noted in the north-eastern corner of the site. It is thought possible that this was as a result of a bomb strike/fire damage. If rubble and debris was present in this area, there is a risk that evidence of UXO could easily have been overlooked. UXBs falling into 'bomb sites' was one of the most common scenarios for this going unnoticed and unrecorded.
Access Frequency <i>UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.</i>	The proposed site was a housing and commercial entity. Should the site have suffered no damage throughout the war, it is anticipated that access levels would have been regular and frequent, and that post-raid checks for evidence of UXO would have been undertaken. Of concern is the north-eastern corner of the site where an area of cleared housing is noted post-war. It is not likely that access was reduced across the entirety of the site. However it cannot be discounted that potential bomb damage occurred in the north-eastern corner therefore lowering access levels and meaning UXO could have potentially fallen unnoticed.
Damage <i>If buildings or structures on a site sustained bomb or fire damage any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same, or later, raids. Similarly, a High Explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked</i>	There is a distinct possibility that damage may have occurred on site due to the area of cleared housing in the north-eastern corner in post-war photography. If rubble and debris were present in this area, there is a risk that evidence of UXO could easily been unnoticed. The rest of the site appears to have survived the war intact.

Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1 st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1 st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1 st Line Defence could find no evidence of Bomb Disposal tasks within the site boundary and immediate area.

15. The Risk from Allied Ordnance

15.1. General

The potential risk of encountering Allied ordnance on construction sites is particularly elevated in areas previously associated with military activity. This includes munitions deposited by military training exercises, dumped as a result of poor working practices, or deliberately placed to prevent adversary occupation and from other home defence activities. For example, contamination from items of Land Service (LSA) and Small Arms Ammunition (SAA) may result from historic occupation of an area or its use for military training.

Urban areas, such as the location of the site, can be at risk from buried unexploded Anti-Aircraft projectiles fired during WWII – see below.

15.2. Defending Manchester from Aerial Attack

Both passive and active defences were deployed against enemy bombers attacking targets in the Manchester region.

Passive Defences	Active Defences
These included defence tactics: - To hinder the identification of targets, by using lighting blackouts at night and camouflaging strategic installations. - To mislead bomber pilots into attacking decoy sites located away from the city with the use of dummy buildings or lighting to replicate that of the city under attack. - To force attacking aircraft to higher altitudes with the use of barrage balloons.	These relied on a coordinated combination of a number of installations in order to actively engage and oppose attacking aircraft. Some of these installations were: - Fighter aircraft to act as interceptors. - Anti-aircraft gun batteries. - The use of rockets and missiles (later during WWII).

15.3. Anti-Aircraft Artillery (AAA) and Projectiles

At the onset of WWII two types of Anti-Aircraft Artillery (AAA) guns were deployed:

- Heavy Anti-Aircraft Artillery (HAA), using large calibre weapons, such as the 3.7" QF (Quick Firing) gun
- Light Anti-Aircraft Artillery (LAA) using smaller calibre weapons, such as 40mm Bofors gun.

During the early war period there was a severe shortage of AAA available. Older WWI 3" and modified naval 4.5" guns were deployed alongside those available 3.7" weapons.

The maximum ceiling height of fire at that time was around 11,000m for the 3.7" gun and less for other weapons. As the war progressed improved variants of the 3.7" gun were introduced. From 1942, large 5.25" weapons were brought into service. These had significantly improved ceiling heights of fire reaching over 18,000m.

The LAA batteries were intended to engage fast, low flying aircraft and were typically deployed around airfields or strategic installations. These batteries were mobile and could be moved to new positions with relative ease when required. The most numerous of these were the 40mm Bofors gun, which could fire up to 120 x 40mm HE shells per minute to over 1,800m.

The HAA projectiles were high explosive shells, usually fitted with a time delay or a barometric pressure fuze to make them explode at a pre-determined height. If they failed to explode or strike an aircraft they would eventually descend back to earth. Details of the most commonly deployed WWII AAA projectiles are shown below:

Gun type	Calibre	Shell Weight	Shell Dimensions
3.0 Inch	76mm	7.3kg	76mm x 356mm
3.7 Inch	94mm	12.7kg	94mm x 438mm
4.5 Inch	114mm	24.7kg	114mm x 578mm
40mm	40mm	0.9kg	40mm x 311mm

Although the larger unexploded projectiles could enter beneath the ground surface, they did not have a great penetration ability and are therefore likely to be found close to WWII ground level. Frequently, these shells are sometimes mistakenly identified as small German air-delivered bombs but are differentiated by the copper driving band found in front of the base. If encountered, the high explosive fill and fragmentation hazard of these items of UXO would present a significant risk.

The smaller 40mm projectiles are similar in appearance and effect to SAA and, although still dangerous, present a lower hazard due to its decreased explosive content. They are still dangerous because they were fitted with an impact initiated fuze, which was also a spin-decay self-destruct mechanism.

Numerous unexploded AAA shells were recovered during and following WWII and are still occasionally encountered on sites today.

The closest recorded HAA battery to the site was situated approximately 2.6km north in the vicinity of Cheetham Hill. It should be noted that the positions of mobile LAA gun batteries were generally not well recorded, if at all.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Annex N**.

15.4. Evaluation of Allied Ordnance Risk

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Sources of Contamination	Conclusion
Military Camps	1 st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences	1 st Line Defence could find no evidence of Anti-Aircraft defences in the site proximity.
Home Guard Activity	Evidence of Home Guard training areas and activities is difficult to obtain. 1 st Line Defence has no evidence of any Home Guard activities on the site.
Defensive Positions	There is no evidence of any defensive structures in the vicinity of the site.
Training or firing ranges	No evidence of these could be found.
Defensive Minefields	No evidence of these could be found.
Ordnance Manufacture	No evidence of ordnance manufacture could be found.
Military Related Airfields	The site was not situated within the vicinity of a military airfield.
Explosive Ordnance Clearance Tasks	1 st Line Defence holds no records of EOC operations on the site.

16. Ordnance Clearance and Post-WWII Ground Works

16.1. General

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

16.2. UXO Clearance

1st Line Defence has no evidence that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from 33 EOD Regiment.

16.3. Post war Redevelopment

Development has taken place on site post-war. The structures that remained on the western half of the site immediately following the war were demolished sometime before 1962 to make way for a technology college. In later years all structures were demolished and Chandos Hall was built along with another structure.

The development of any hard standing ground would have involved minimal excavation work. Where this development has taken place the risk of encountering shallow buried UXO, especially 1kg incendiaries and anti-aircraft projectiles will have been partly mitigated.

Construction of the structures on site will have most likely required some deeper foundations. The risk from deep-buried unexploded bombs is only considered mitigated at locations where post war piling or deep foundations have taken place.

17. 1st Line Defence Risk Assessment

17.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

UXO Risk Assessment	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, GOAD Fire Insurance mapping, WWI maps of air raids, Luftwaffe target imagery, Manchester Blitz bomb mapping, an interactive Manchester bomb map, high resolution post-war RAF aerial photography and comparative bombing statistics. The record sets available are of generally good quality. However, overall the quality of the historical record is poor due to its limited resources.
The Risk that the Site was Contaminated with UXO	1st Line Defence has assessed that there is a Low Risk that items of unexploded German air-delivered ordnance could have fallen unrecorded across the majority of the site area, with a Medium Risk in the north-west of the site. • The County Borough of Manchester was subject to a Moderate density of bombing with 27.1 bombs recorded per 1,000 acres. Manchester bomb plot and damage mapping indicates the presence of bombing incidents in the surrounding area of the proposed site, but none within the site boundary. However, the mapping only covers raids in 1940 so does not record any bombs which fell from 1941 to 1944. Furthermore, no written bomb incident records are available for Manchester. It is understood from the local archive that they were destroyed during/post-war. It has therefore not been possible to ascertain with certainty whether or not the site was bombed. • At the start of the war, the site was almost entirely occupied by structures of a residential and commercial nature. Across the majority of the site, it is considered that ground cover should have been such that evidence of UXBs should have been noted and reported. However, an area of clearance is noted in the north-eastern corner of the site. It is thought possible that this was as a result of a bomb strike/fire damage. If rubble and debris was present in this area, there is a risk that evidence of UXO could easily have been overlooked. UXBs falling into 'bomb sites' was one of the most common scenarios for this going unnoticed and unrecorded. • The proposed site was a housing and commercial entity. Should the site have suffered no damage throughout the war, it is anticipated that access levels would have been regular and frequent, and that post-raid checks for evidence of UXO would have been undertaken. Of concern is the north-eastern corner of the site where an area of cleared housing is noted post-war. It is not likely that access was reduced across the entirety of the site. However it cannot be discounted that potential bomb damage occurred in the north-eastern corner therefore lowering access levels and meaning UXO could have potentially fallen unnoticed. • It is a distinct possibility that damage may have occurred on site due to the area of cleared housing in the north-eastern corner in post-war photography. If rubble



	and debris were present in this area, there is a risk that evidence of UXO could easily been unnoticed. The rest of the site appears to have survived the war intact. Given that the majority of the site appears to have survived the war, shows no signs of damage and likely accessed frequently, this part of the site has been given a Low Risk. The area within the north-west of the site is shown as cleared on post-war aerial photography. Given the poor quality of the record set for Manchester, it has not proved possible to prove that this clearance was not due to bombing. Thus, this area, with a small buffer to account for the 'J-curve' effect, has been given a Medium Risk.
The Risk that UXO Remains on Site	Post-war development has occurred on site – between the 1942 and 1962 GOAD mapping editions the majority of the structures within the site footprint were demolished, leaving only a handful of structures in the western half of the site, with a <i>College of Technology</i> erected in place. More development took place in later years with the college being demolished and Chandos Hall erected in its place, along with another structure constructed in the west of the site. The risk of UXO remaining is considered to have been mitigated at the location of and down to the depth of post-war foundations and excavations.
The Risk that UXO may be Encountered during the Works	The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The risk of encountering will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations. An air-dropped bomb may come to rest at any depth between just below ground level and its maximum penetration depth. Consequently there is also a chance that such an item could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level.
The Risk that UXO may be Initiated	The risk that UXO could be initiated if encountered will depend on its condition, how it is found, and the energy with which it is struck. Certain construction activities such as piling and percussive drilling pose a greater risk of initiating UXO in comparison to machine excavation, where the force of impact is generally lower and the item more likely to be observed. If a UXB is struck by piling or percussive drilling equipment, the force of the impact can be sufficient to detonate the main high explosive charge irrespective of the condition of the fuze or other components. Violent vibration might also impart enough energy to a chemical detonator for it to function, and there is a potential risk that clockwork fuzes could restart. If piling works are planned at Chandos Hall, there is a potential risk that a UXB, if present, could be initiated. The risk of initiation is assessed to be lower for any shallow intrusive works planned.
The Consequences of Encountering or Initiating Ordnance	The repercussions of the inadvertent detonation of UXO during intrusive ground works are potentially severe, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. If appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low. The primary consequence of encounter of UXO will therefore be economic. This would be particularly notable in the case of a high-profile site and sites where it is necessary to evacuate the public from the surrounding area. A site may be closed from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve loss of

	production. Generally, the first action of the police in most cases will be to isolate the locale whilst awaiting military assistance, even if this turns out to have been unnecessary.
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17.2. Assessed Risk Level

Taking into consideration the findings of this study, 1st Line Defence has assessed that there is a **Low-Medium Risk** from unexploded ordnance at the site of proposed works.

Low Risk

This area of the site was occupied by undamaged structures and showed no obvious signs of ground disturbance. It is considered likely that this property and its surrounds would have been accessed throughout WWII and that checks would have been made for evidence of UXO.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded Bombs		✓		
German 1kg Incendiary Bombs		✓		
Anti-Aircraft Artillery Projectiles		✓		
Allied Military Land Service Ammunition (Grenades, Mortars etc.)	✓			

Medium Risk

The small area of cleared structures is a cause for concern, as there is no evidence to suggest it was not a bomb strike that caused the clearance. Therefore this area has been given a medium risk due to the potential for conditions to have been such in this area that evidence of a UXB could easily have been overlooked.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded Bombs			✓	
German 1kg Incendiary Bombs			✓	
Anti-Aircraft Artillery Projectiles			✓	
Allied Military Land Service Ammunition (Grenades, Mortars etc.)	✓			

18. Proposed Risk Mitigation Methodology

18.1. General

The following risk mitigation measures are recommended to support the proposed works at Chandos Hall:

Type of Work	Recommended Mitigation Measure
All Works	Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works. As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event that a suspect item is encountered. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.
Shallow Intrusive Works/Open Excavations in Medium Risk Areas	Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works: When on site the role of the UXO Specialist would include - Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. - Providing UXO awareness briefings to any staff that have not already received them and advise staff of the need to modify working practices to take account of the ordnance risk. - To aid Incident Management which would involve liaison with the local authorities and Police should ordnance be identified and present an explosive hazard. UXO Safety and Awareness briefings will be provided to all ground personnel by the UXO Specialist once on site.
Borehole/Piles in Medium Risk Areas	Intrusive Magnetometer Survey of all borehole and pile locations down to a maximum bomb penetration depth: 1st Line Defence can deploy a range of intrusive magnetometer techniques to clear pile locations. The appropriate technique is influenced by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed.

In making this assessment and recommending these risk mitigation measures, if known, the proposed works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited

14th July 2017

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

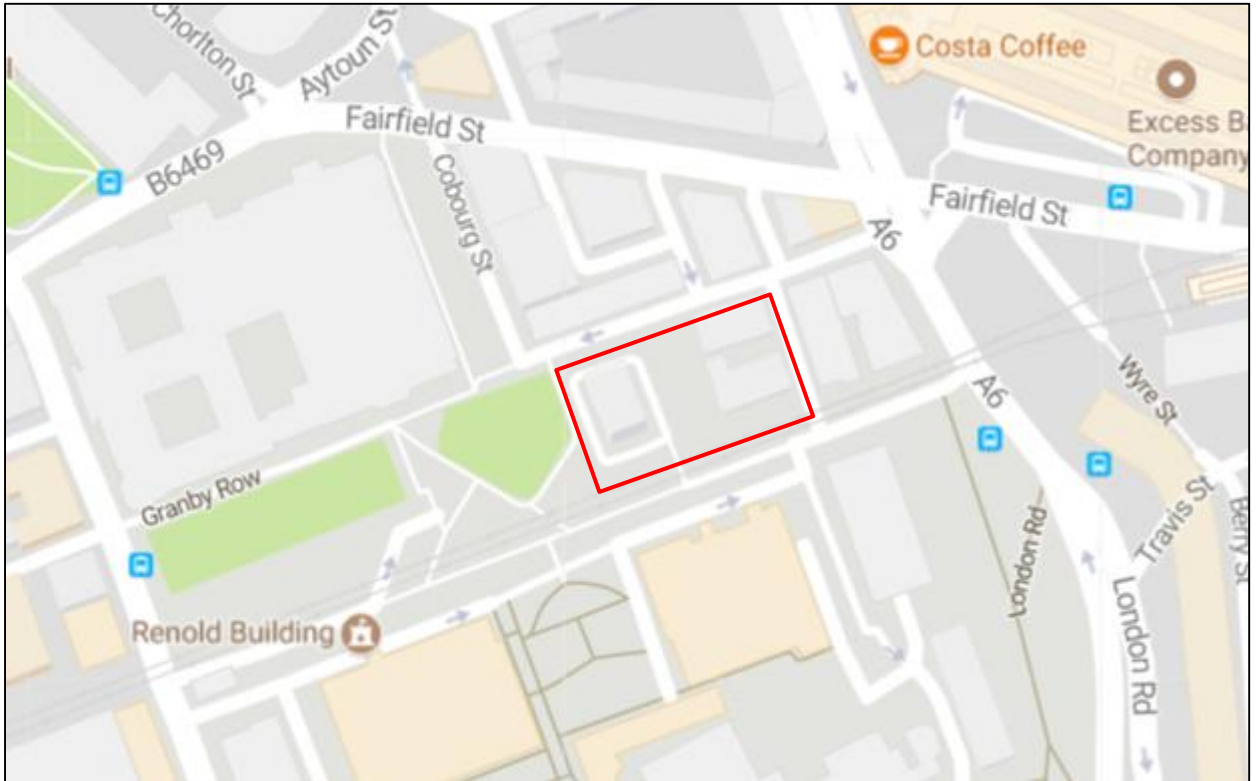
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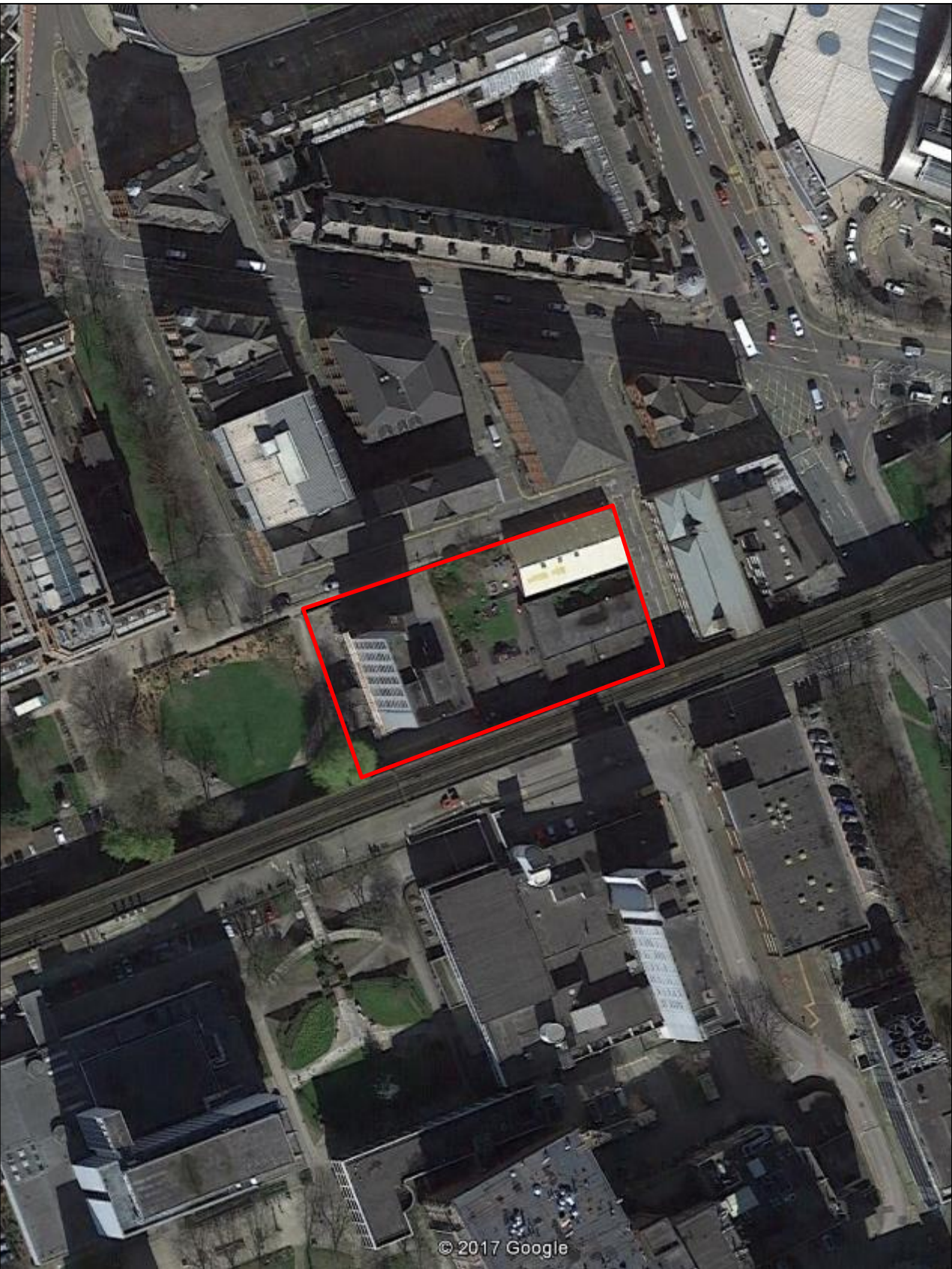
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Ref: **DA4989-00**

Source: Google Maps

 **Approximate site boundary**





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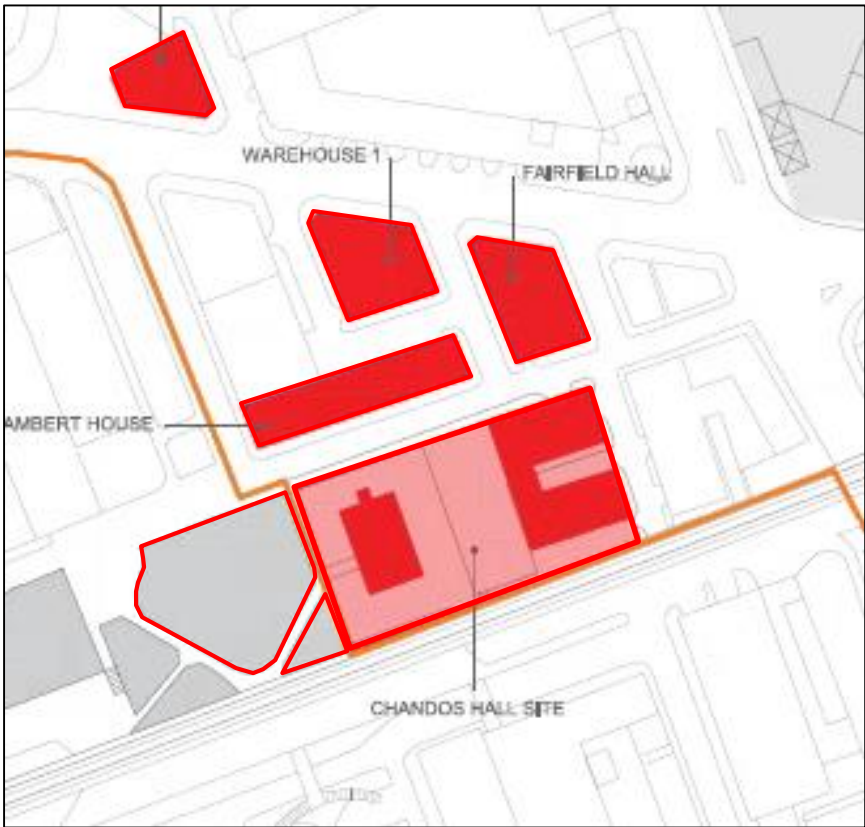
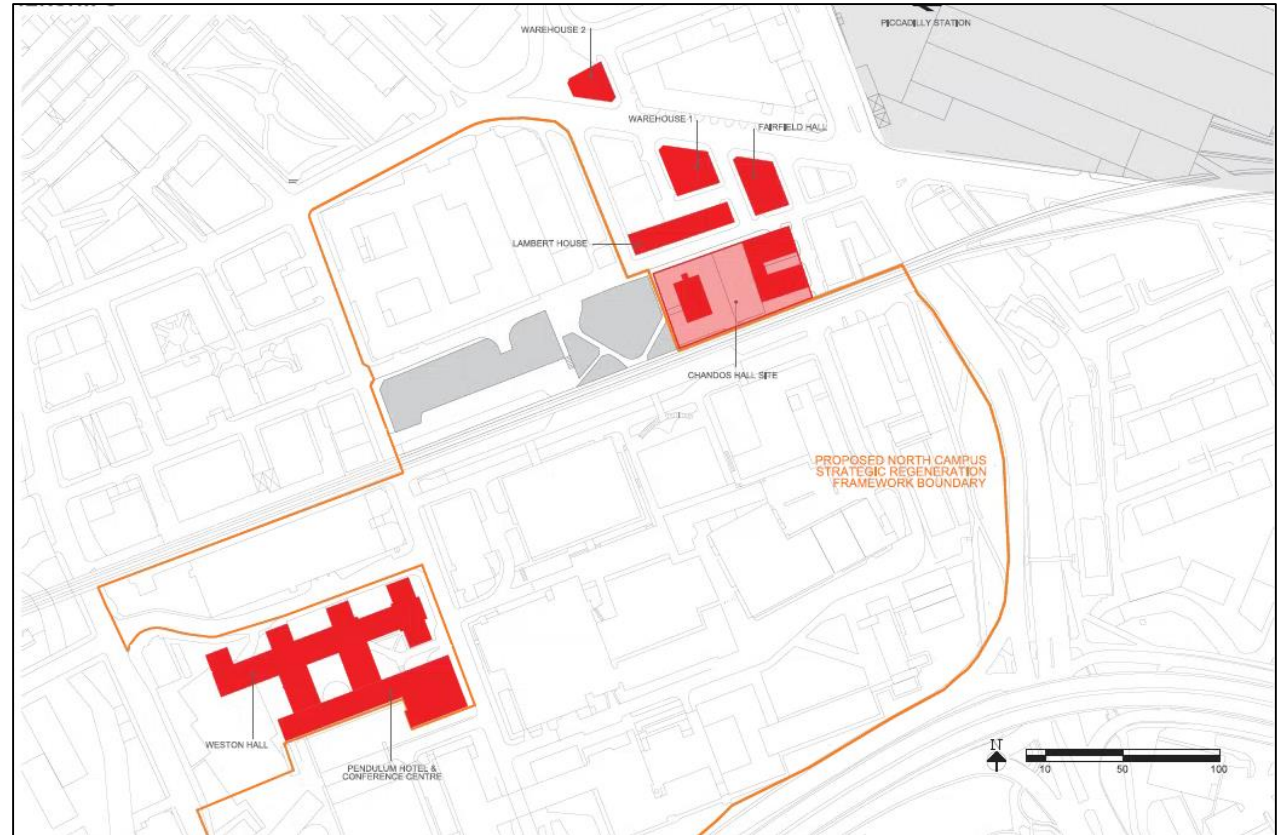
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Source: Google Earth™ Mapping Services

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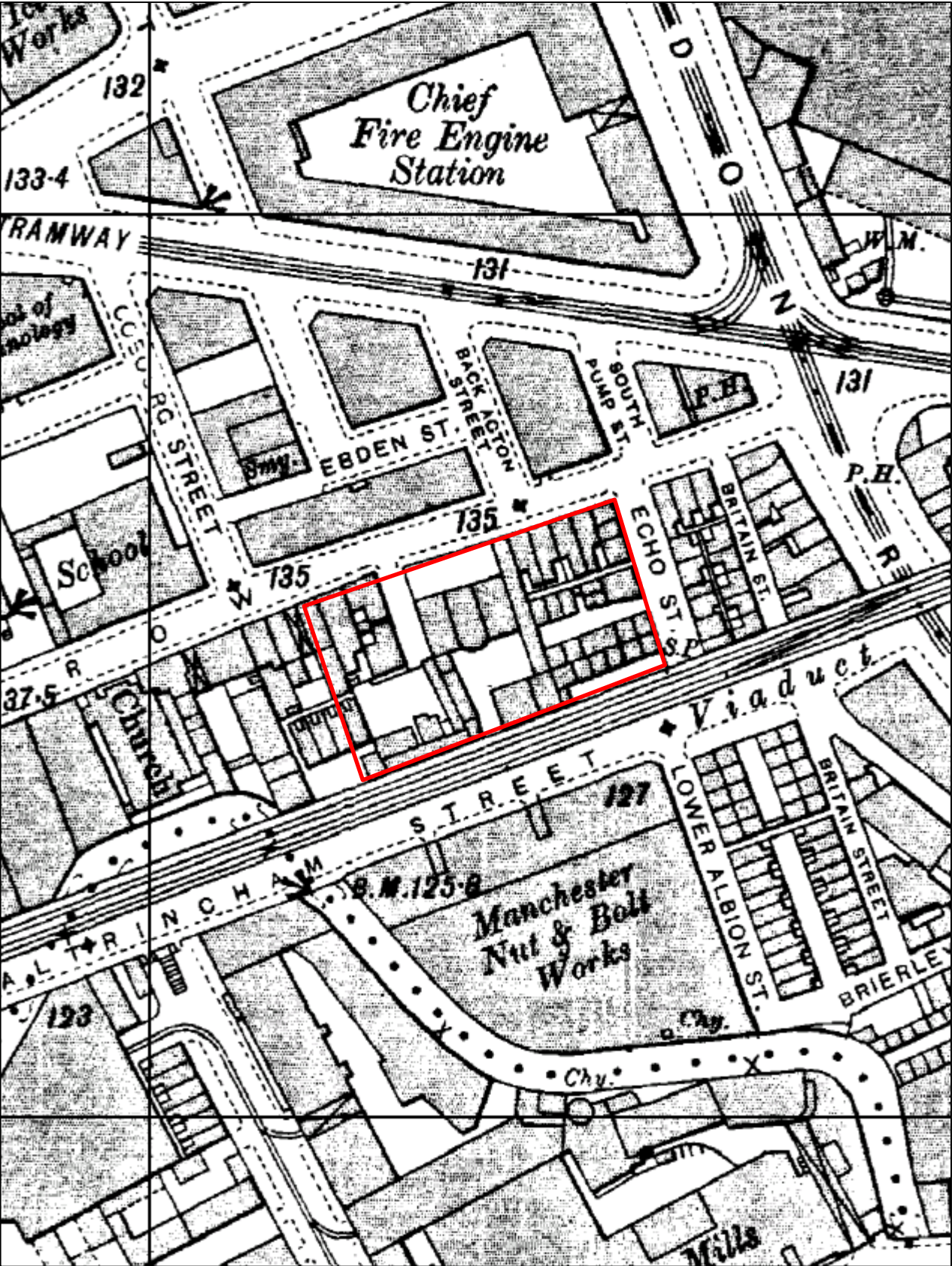
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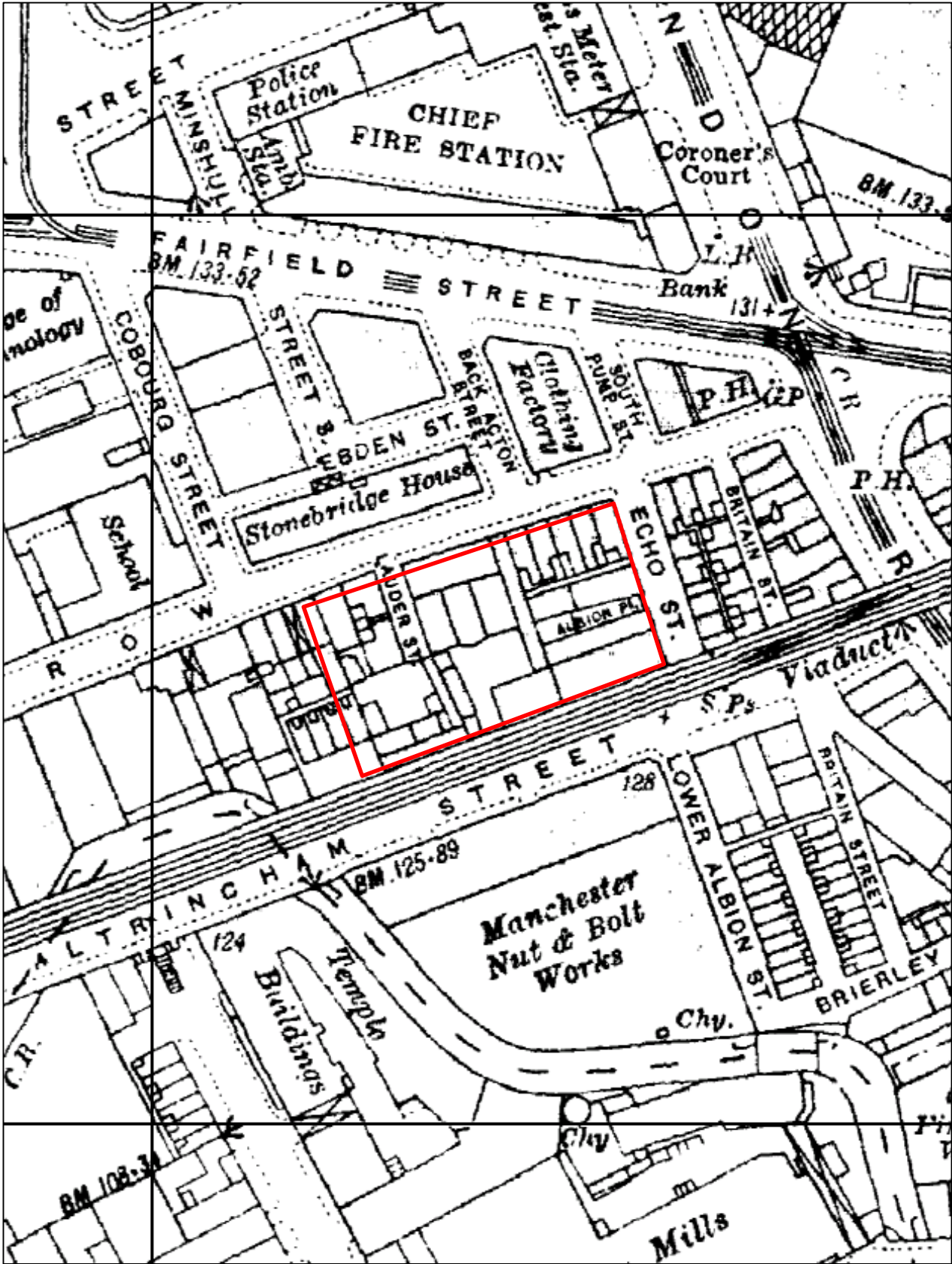
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Source: **Landmark Maps**

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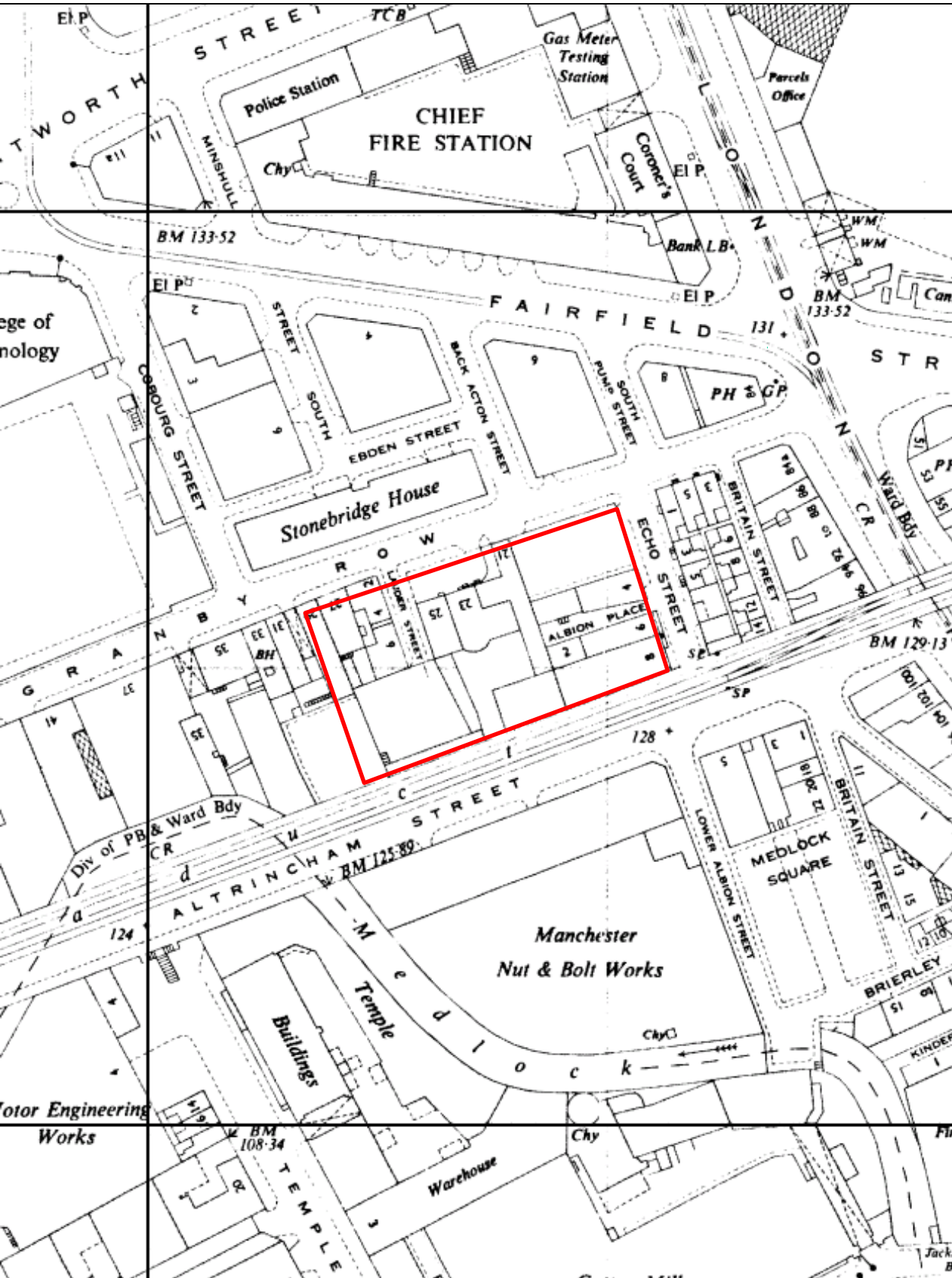
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Ref: DA4989-00

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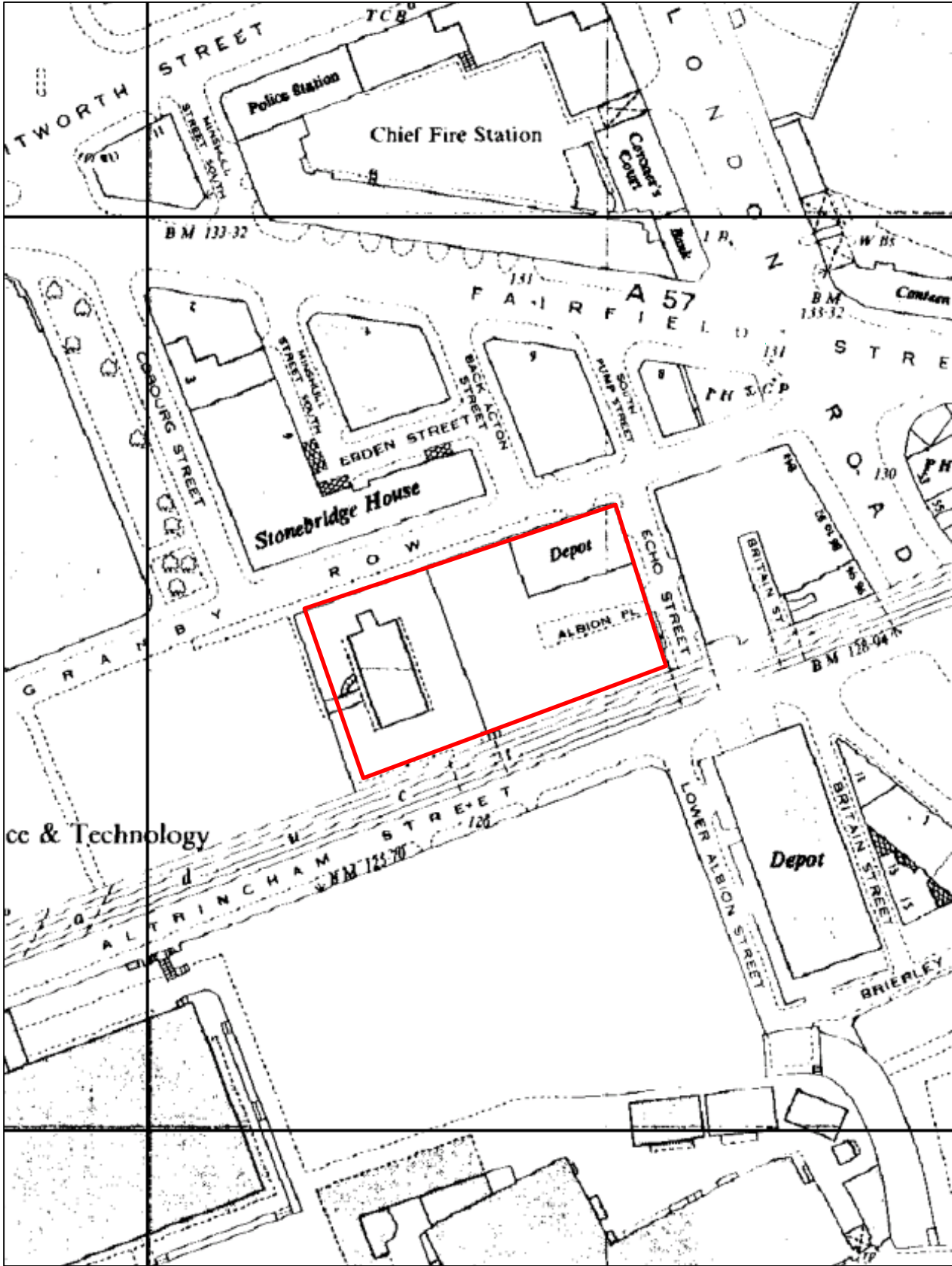
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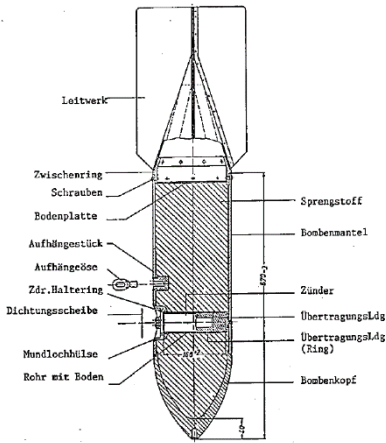


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Examples of German Air-Delivered Ordnance

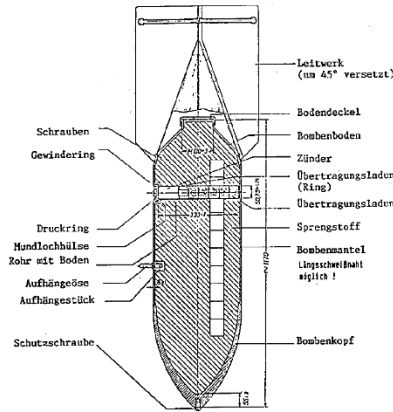
SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	c25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



SC 250kg High Explosive Bomb

Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).

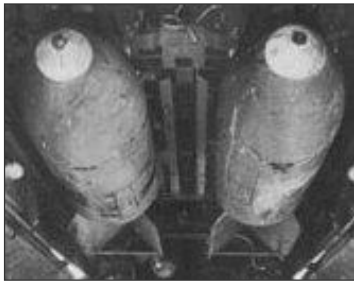
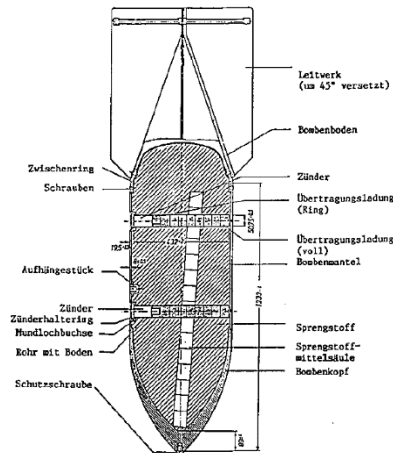


SC250 bomb being loaded onto German bomber



SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, trialene. Bombs recovered with Trialene filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming



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Client: Curtins

Project: Chandos Hall, Manchester

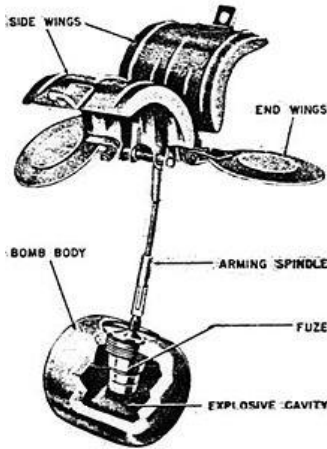
Ref: DA4989-00

Source: Various sources

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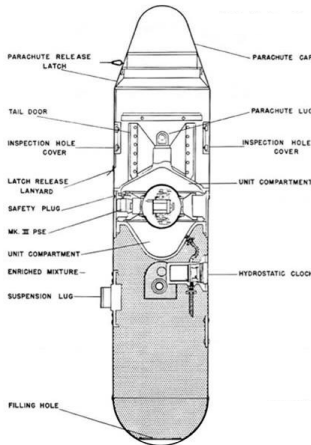
SD2 Anti-Personnel ‘Butterfly Bomb’

Bomb Weight	2kg (4.41lb)
Explosive Weight	7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/ fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Very rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open by springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane which armed the device as it span.



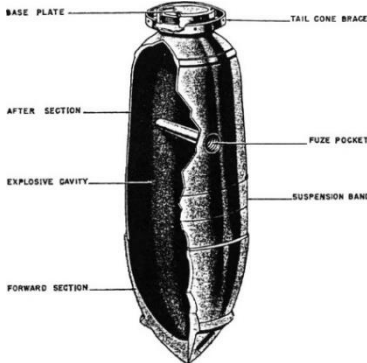
Parachute Mine (Luftmine B / LMB)

Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to destroy a whole street of housing in a 100m radius.



SC 1000kg

Bomb Weight	993-1027kg (2,189-2,264lb)
Explosive Weight	530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction



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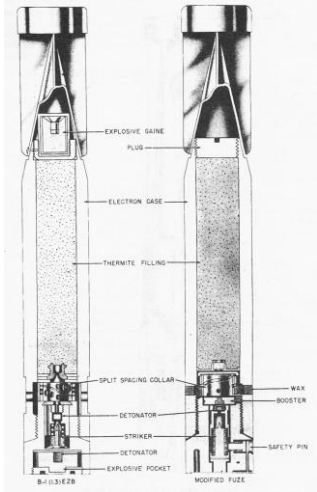
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German Incendiary Bombs

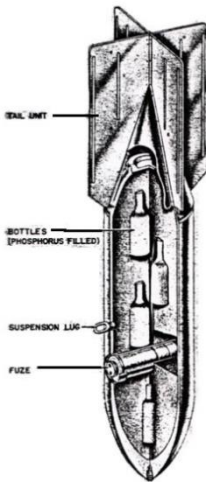
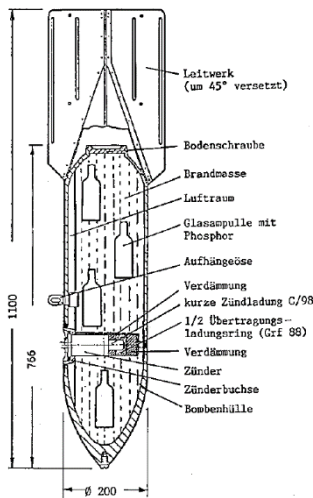
1kg Incendiary Bomb

Bomb Weight	1.0 and 1.3kg (2.2 and 2.9lb)
Explosive Weight	680g (1.3lb) Thermite 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters against towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



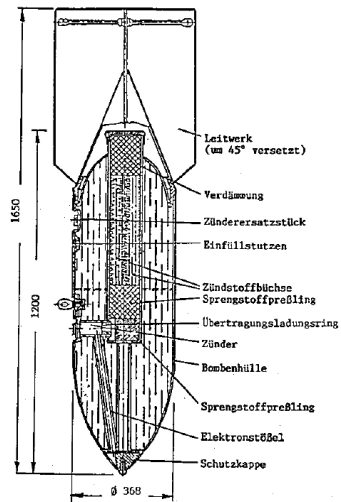
C50 A Incendiary Bomb

Bomb Weight	c41kg (90.4lb)
Explosive Weight	0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzene 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against all targets where an incendiary effect is required
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture



Flam C-250 Oil Bomb

Bomb Weight	125kg (276lb)
Explosive Weight	1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on ground troops, against troop barracks and industrial installations. Thin casing – not designed for ground penetration



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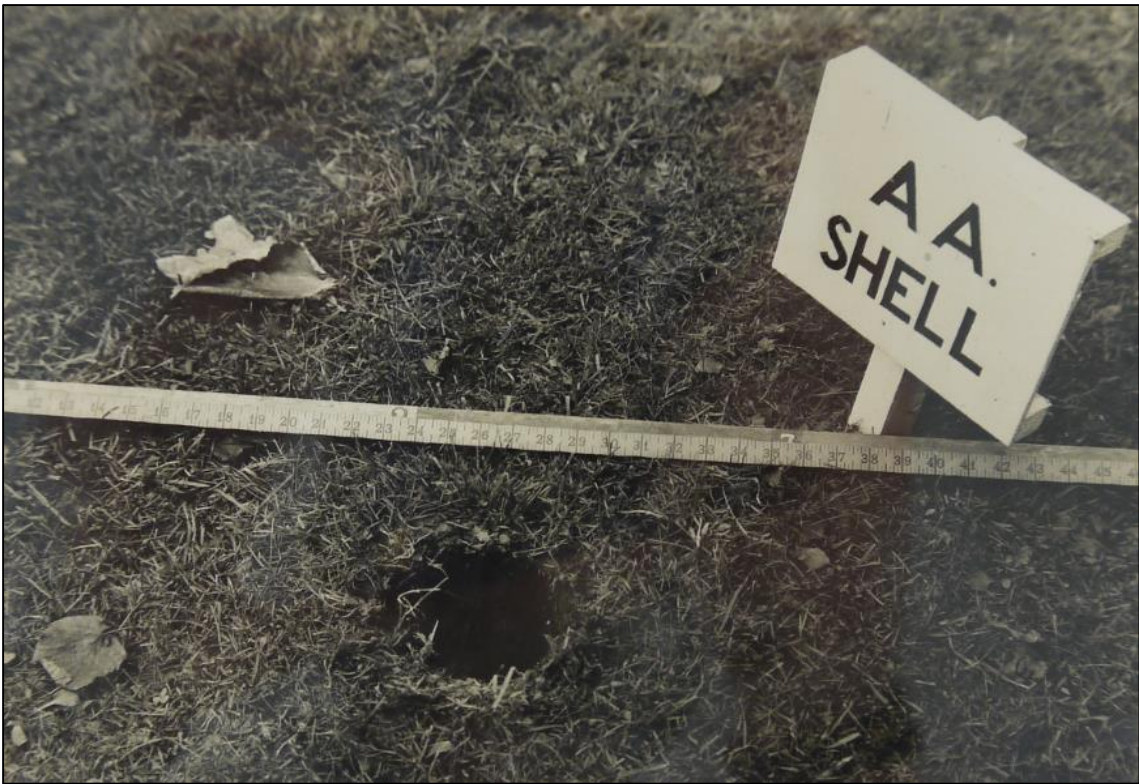
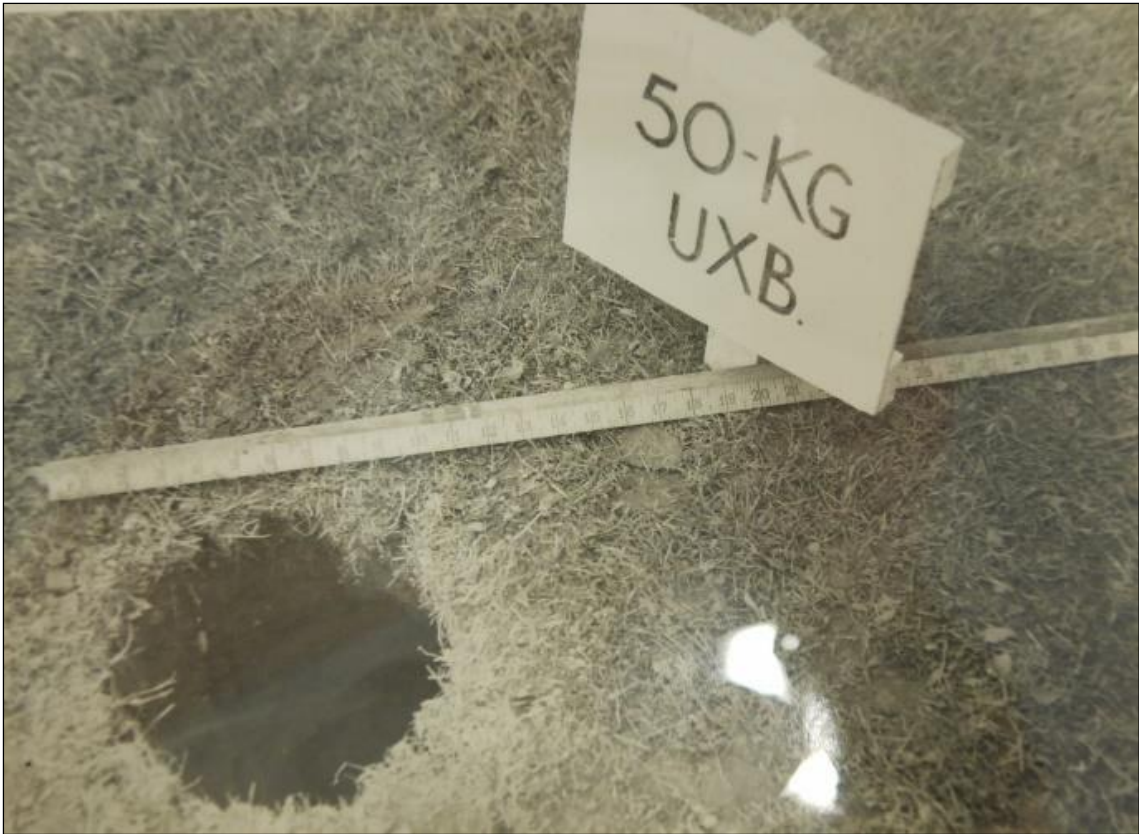
Client: Curtins

Project: Chandos Hall, Manchester

Ref: DA4989-00

Source: Various sources

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Client: **Curtins**

Project: **Chandos Hall, Manchester**

Ref: **DA4989-00** Source: The National Archives

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Examples of Unexpected Detonation of WWII Bombs

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF is expanding their its Ludwigshafen location by expanding several plants and building a TDI plant, which was the site of an explosion on Tuesday (Feb. 26). One person was injured in the blast, which BASF believes was caused when excavation work detonated a bomb.

Early reports had speculated that excavation work had detonated a bomb from World War II. While the age of the bomb has not been confirmed, BASF has said that an explosive device was detonated.

BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.

Tweet 0

Recommend 1



A cutting machine lies wrecked by the side of the A3 motorway next to a small crater left by the explosion.

A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

The A3 Autobahn linking the cities of Frankfurt and Würzburg has been blocked in both directions.

More than 60 years since the end of World War II, construction workers still frequently unearth unexploded bombs and it is not uncommon for whole city districts to be cordoned off and even evacuated while bomb disposal experts defuse them.

Indeed, just last week, some 22,000 people were evacuated from their homes in Hanover when three World War II bombs were discovered.

Allied pilots rained nearly 2 million tons of explosives on Germany during the war. Landmines, hand grenades, mortar bombs and anti-tank devices from the fighting on German soil at the end of the war are also found, and authorities say it will take decades before the country is cleared of duds.

Between 400 and 600 bombs are discovered a year in the state of North Rhine-Westphalia alone, where the heavily industrialized Ruhr region was a major target for Allied bombers.



WWII bomb injures 17 at Hattingen construction site

Published: 19 Sep 08 16:53 CET

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Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

- [Liberals grit teeth ahead of May state election](#) (17 Mar 12)
- [Nazi death camp guard Demjanjuk dies](#) (17 Mar 12)
- [Stupid stunt causes bomb scare chaos](#) (16 Mar 12)

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."



World War II bomb kills three in Germany

Three people have been killed and six injured trying to defuse a World War II bomb in central Germany.

Workers building a sports stadium had earlier unearthed the bomb in the town of Goettingen.

It was not immediately clear why the bomb, reportedly weighing 500kg (1,100lb), had detonated.

Unexploded WWII bombs dropped by Allied planes are frequently found in Germany, though it is unusual for them to explode unexpectedly.

A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.



All the victims were involved in an operation to defuse the bomb



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Project: **Chandos Hall, Manchester**

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Source: Various news sources

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Bermondsey bomb: World War Two device safely removed

24 March 2015London



RUPERT FRERE

The bomb measured about 5ft (1.5m) in length

An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

250kg HE bomb found in Bermondsey March 2015

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Bethnal Green WW2 bomb: Experts remove unexploded device

11 August 2015London



CROWN COPYRIGHT

The MoD said the German WW2 air delivered bomb could have caused "mass destruction" if it had detonated

An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

250kg HE bomb found in Bethnal Green, Aug 2016

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Bath WW2 bomb scare: Device defused, police say

13 May 2016Somerset



EPA

The bomb was found on the site of a former school on Thursday

A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

250kg HE bomb found in Bath, May 2016

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Wembley WW2 live bomb posed 'risk to life'

22 May 2015London



SERGEANT RUPERT FRERE RLC

A blast wall was put up around the bomb to minimise damage if it exploded

An unexploded World War Two bomb uncovered by builders near Wembley Stadium posed "a genuine risk to life", the Army has said.

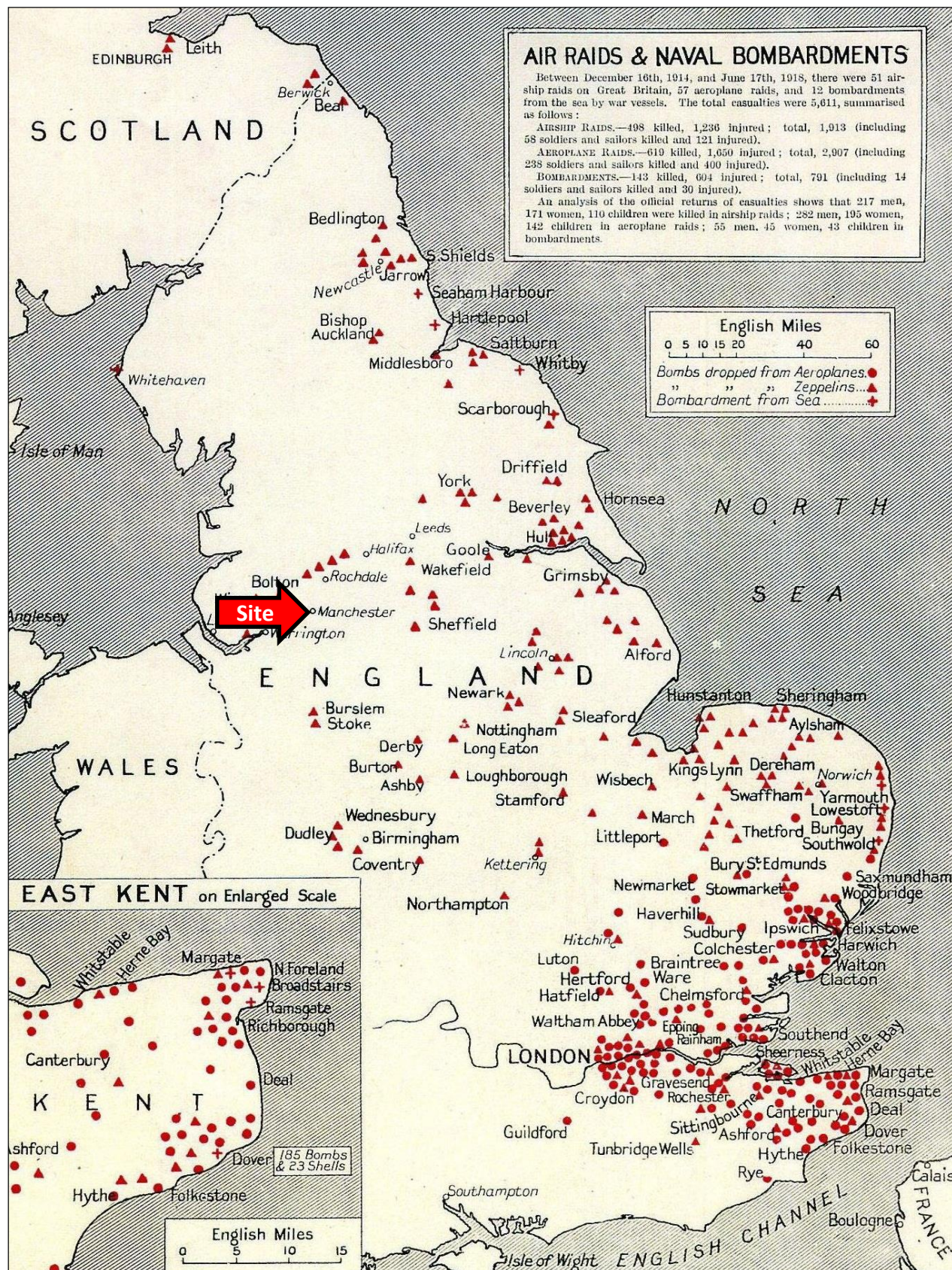
50kg HE bomb found in Wembley, May 2015



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Project: **Chandos Hall, Manchester**

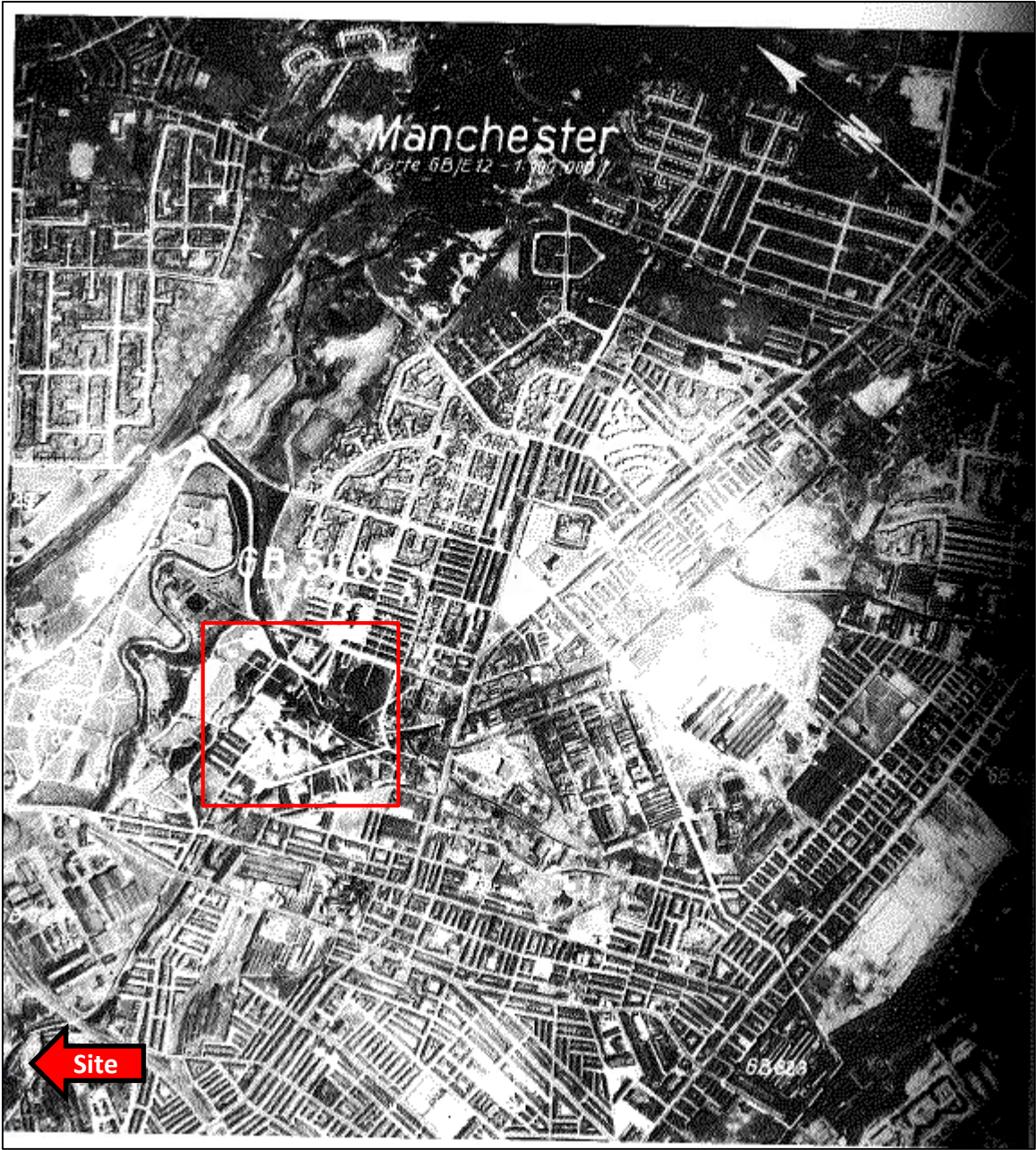
Ref: **DA4989-00**

Source: **J. Morris, German Air Raids on Britain**

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Luftwaffe Photograph, 1st October 1940



Manchester - Clayton
Red boxed area – gas works
GB 823 & GB 5083 – Designated Luftwaffe targets

The site located approximately 2.5km north-east of the arrow.



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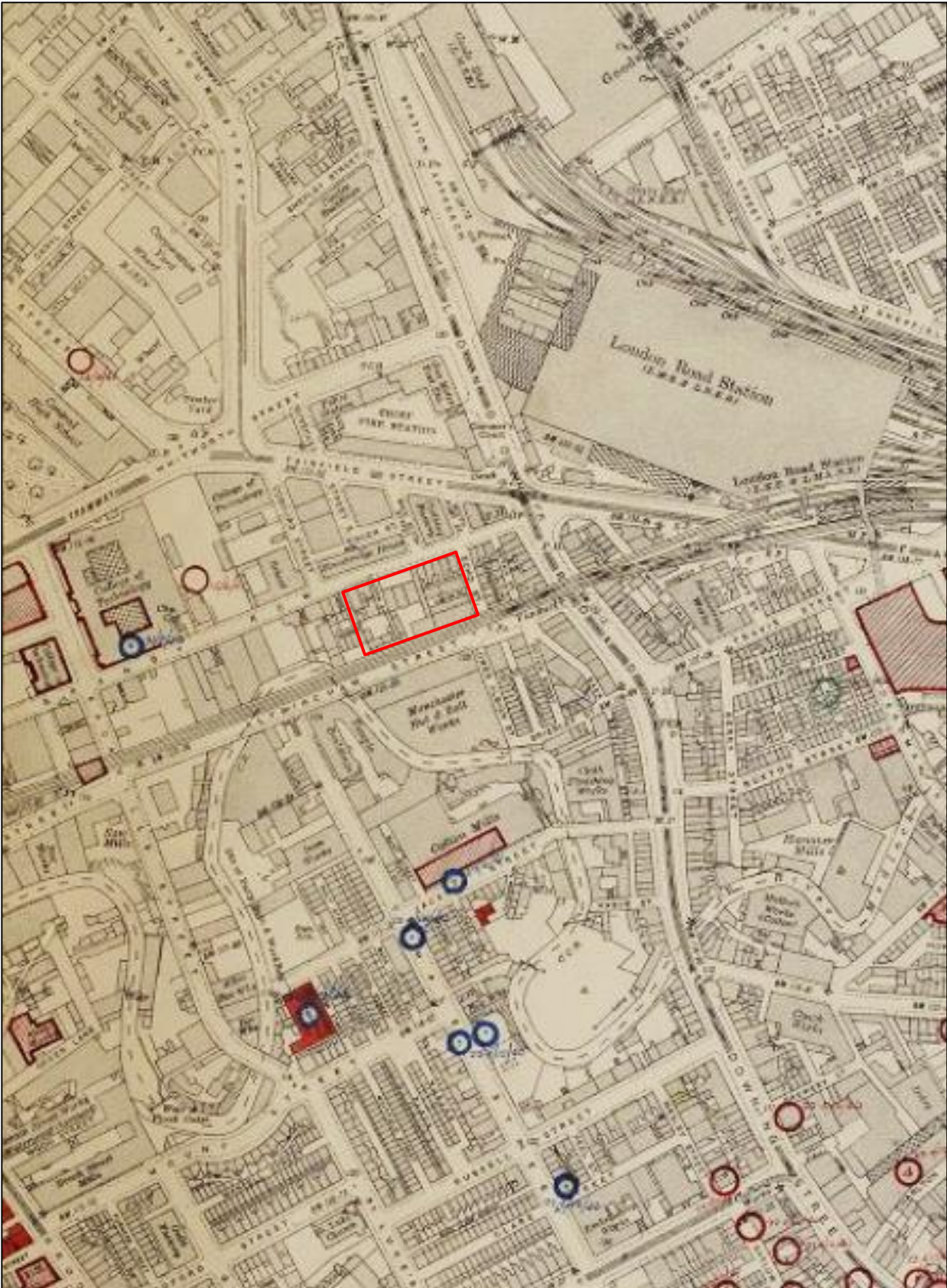
Project: **Chandos Hall, Manchester**

Ref: **DA4989-00**

Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"

 **Approximate site boundary**





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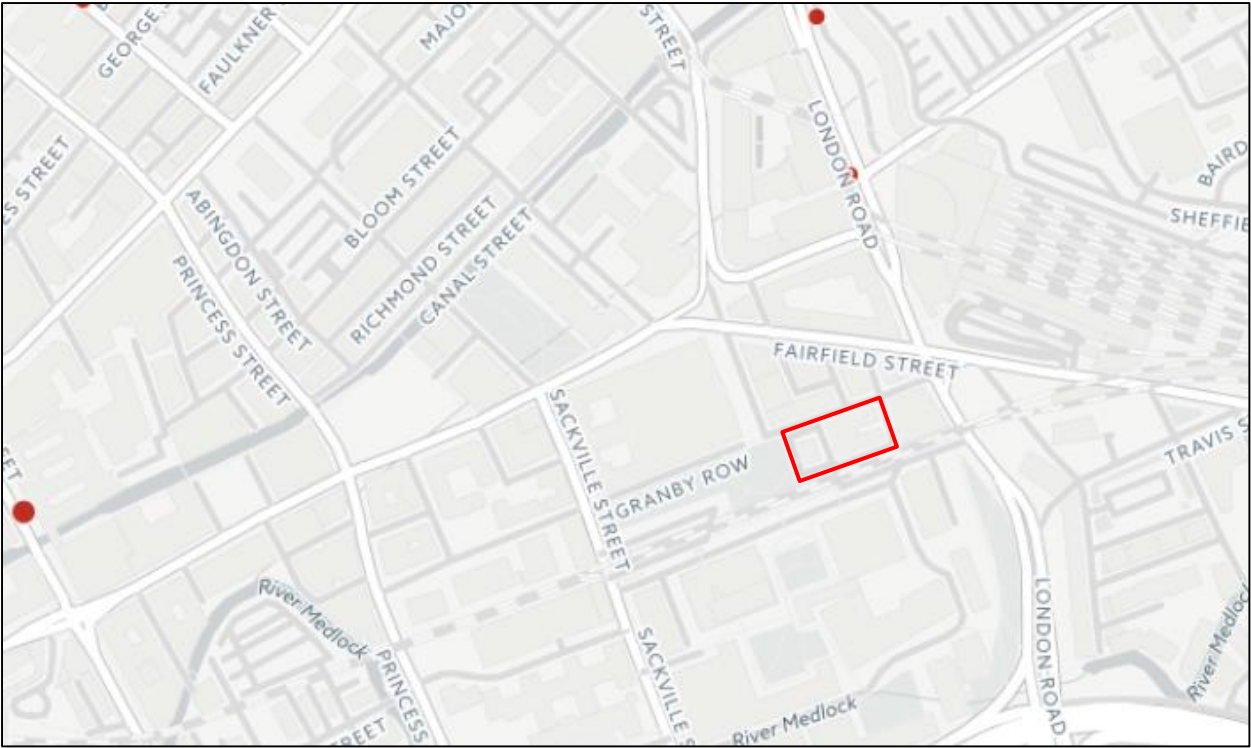
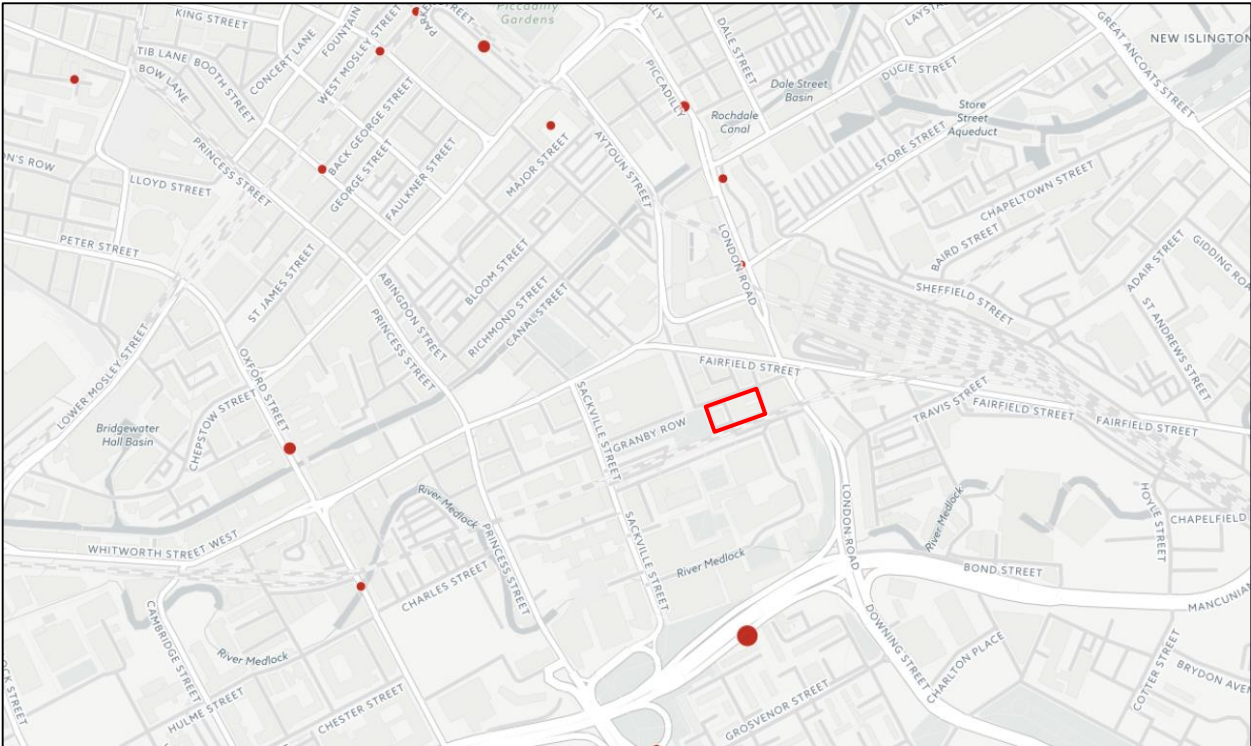
Ref: DA4989-00

Source: The National Archives, Kew

— Approximate site boundary



Night Bombing up to 7th October 1940



- 

Recorded HE bomb strike
(colour refers to day of the week)
- 

Recorded UXB strike
(colour refers to day of the week)
- 

Incendiary bomb shower
- 

Oil Bomb



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Project: Chandos Hall, Manchester

Ref: DA4989-00

Source: Manchester Evening News

Approximate site boundary





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 **Approximate site boundary**



Project: **Chandos Hall, Manchester**

Ref: **DA4989-00**

Source: National Monuments Record Office (Historic England)

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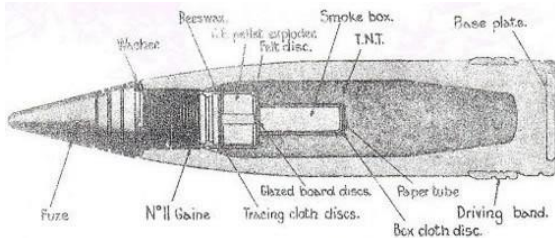
Source: National Monuments Record Office (Historic England)

Approximate site boundary



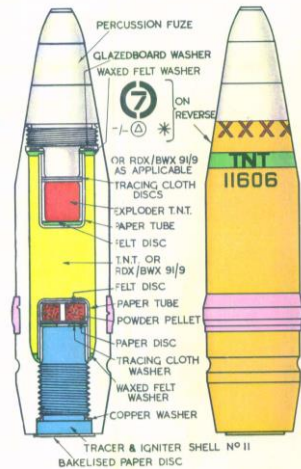
3.7 Inch QF Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mk 1-3 were the standard Heavy Anti-Aircraft guns of the British Army.
Ceiling	30,000ft to 59,000ft



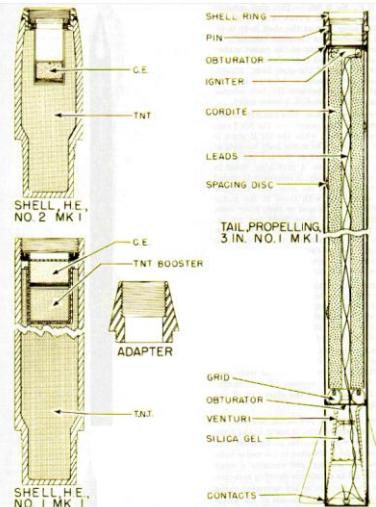
40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft



3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor



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Source: Various sources

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-  Medium Risk
-  Low Risk

- Low and Medium Risk Areas:**
- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works
- Medium Risk Area:**
- Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works
 - Intrusive Magnetometer Survey of all Borehole and pile locations down to a maximum bomb penetration depth

For indicative purposes – not to scale



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Client: Curtins		 Approximate site boundary	
Project: Chandos Hall, Manchester			
Ref: DA4989-00	Source: 1 st Line Defence		



-  Medium Risk
-  Low Risk

- Low and Medium Risk Areas:**
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- Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works
 - Intrusive Magnetometer Survey of all Borehole and pile locations down to a maximum bomb penetration depth

For indicative purposes – not to scale

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Appendix H MCC Correspondence

Our Ref: 065374-CUR-00-XX-GE-CO-0001-P01

01 April 2020

FAO Laura Miller
Contaminated Land Department
Environmental Health
Manchester City Council

Response to Consultation on Planning Application Ref. 118267/FO/2017- Echo Street Development, Manchester

Introduction

We have recently been in receipt of MCC's memorandum for consultation on planning application Ref. 118267/FO/2017 dated 17 March Ref. 660328, relating to review of environmental reports provided to date.

Curtins carried out the aforementioned geo-environmental investigations at for the Echo Street, Manchester city centre development. We write to provide a response to your comments including clarification behind the scoping and strategy of our ground investigation, proposed updates to our reports and to agree an approach moving forward to meet planning requirements.

Section 2- The Adequacy of the Site Investigation

With regards your comments in Section 2- 'The adequacy of the site investigation' we note MCC comments were as follows:

The exploratory locations to date do not provide adequate site coverage and further site investigation is deemed necessary – no investigation has been undertaken within the footprint of the former Chandos Hall building {Comment 1}.

Provision of the calibration certificates for the ground gas monitoring equipment to cover the period of monitoring {Comment 2}.

With regards to Comment 1 above our rationale and strategy for the post demolition site investigation is provided below.

The site as a whole has been very well characterised through various stages of pre demolition and post demolition investigation with 45 sampling locations in total across the 0.3 Ha site with a total of 63 soil samples analysed. This results in a very high sampling density of between 5m to <25m across the whole site meeting requirements set out in BS 10175:2011 + A2 2017.

June and July 2019 investigations were undertaken after demolition of buildings on the eastern side of the site (nursery/garages/estates building), at this time the Chandos Hall building still remained on site. The eastern extent of the site was considered the main target for additional stages of investigation as building cover had previously occupied much of this area limiting previous investigation. Furthermore, this area was considered a higher risk due to the historical uses in this area (including printing works, battery repairs, car garage, depot, fuel storage tanks).

Further investigation was undertaken at the west of the site around Chandos Hall in June and July to increase sampling density and further develop the ground model for this area. Similar ground conditions were anticipated beneath the Chandos Hall Building as immediately adjacent areas given

the history of this part of the site; Chandos Hall and surrounding external hardstanding present since late 1950s/early 1960s and various small commercial properties prior to this off Lauder street, including a cloth store. Furthermore, the Chandos Hall building formed less than 20% of total site area.

Exceedances for non-volatile PAH species and lead as well as asbestos fibres/containing materials were identified across the site within the various ground investigations, whilst a single exceedance for Naphthalene was identified on the north east of the site, recommendations have been made for the provision of suitable thickness of clean cover in any soft landscaped areas to break any source pathway receptor linkages between contaminated soils and end users. If any low levels of non-volatile contamination existed beneath the Chandos Hall building it was considered that the recommended measures would be sufficient in protecting human health. The potential for volatile contamination on this part of the site is considered low whereas potential for volatile contamination was considered to be higher on the east of the site adjacent to historic fuel tanks. On this basis further investigation beneath Chandos Hall was not deemed necessary.

We therefore believe adequate site coverage has been achieved and for this reason we do not see further sampling beneath the Chandos Hall building as necessary or beneficial as this is unlikely to change the recommendations of our report. Instead we propose to update our Phase 2 Ground Investigation report accordingly and include the above justification and rationale for our investigation locations and strategy. We will also ensure a watching brief is undertaken during remediation with regards to dealing with any unexpected contamination.

With regards to Comment 2 our ground gas monitor calibration certificates is attached and we will ensure it is included within our updated report.

Section 3 The Adequacy of the Final Risk Assessment

With regards your comments in Section 3- 'The adequacy of the final risk assessment site investigation' we note your comments were as follows:

The final risk assessment provided for this development is inadequate. The report recommends that further investigation and testing be performed on the site. Consequently, the data obtained from this investigation may require changes to be made to the current risk assessment. This Section will require submission of the additional site investigation report and, if necessary, an updated final risk assessment for approval {Comment 3}.

With regards to Comment 3 I can confirm the additional sampling recommended within Curtins Additional GI report (Dated September 2019), has since been undertaken confirming a low risk from Naphthalene contamination in the north east of the site. We propose to update our Ground Investigation Report and final risk assessment accordingly.

Section 4 - The Acceptability of the Proposed Remediation Strategy

Following the above we then propose to update our Remediation Strategy to include appraisal of the final risk assessment, address the remaining potential contaminant linkages and address your associated comments in MCC memo Section 4- The Acceptability of the proposed Remediation Strategy.

Closure

We trust you will see the above measures to be acceptable in principal but would be grateful if you could confirm by response.

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e: manchester@curtins.com
w: www.curtins.com



Please don't hesitate to contact the undersigned should you have any queries.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'N Farnworth'.

Niall Farnworth (E: niall.farnworth@curtins.com T: 079712267263)
Senior Geo-Environmental Engineer

For and on behalf of
Curtins Consulting Ltd

Niall Farnworth

From: Laura Miller <l.miller@manchester.gov.uk>
Sent: 02 April 2020 15:30
To: Olivia Carr
Cc: Anthony Mitchell; Mark Worcester; Niall Farnworth
Subject: Re: Echo St - Response to EHO CDN/20/0043

Hi Olivia and Niall.

I was in the process of reading Niall's email when yours came in. I am slowly catching up on emails after being on leave last week (sorry Niall for the delay replying).

Based on the supplementary information from Curtins I am happy with their approach to investigating the site and can recommend discharge of part a) of the condition.

Kind Regards

Laura

Laura Miller (MRes, MA, BSc(Hons))
Environmental Protection Section

Neighbourhoods Directorate
Community Safety, Compliance and Enforcement
Manchester City Council
1 Hammerstone Road
Gorton
Manchester
M18 8EQ

External: 0161 234 5004
Internal: 31742
email: l.miller@manchester.gov.uk
website: www.manchester.gov.uk

Please note that due to working compressed hours Wednesdays are a non-working day for me, I will respond to your email when I return to the office

We are now on Twitter, for latest news and updates follow us [@EnvHealthMcr](https://twitter.com/EnvHealthMcr)

For the latest support and information about the coronavirus visit www.manchester.gov.uk/coronavirus



I ❤️ MCR

Please consider the environment before printing an e-mail

On Thu, 2 Apr 2020 at 15:16, Olivia Carr <olivia.carr@turley.co.uk> wrote:

Hi Tony,

I hope you are keeping well and safe.

Thank you for forwarding on the consultation response from the Environmental Health Team in relation to condition 5 on CDN/20/0043 (Echo St).

Niall Farnworth of Curtins has already been in touch with Laura Miller with regards to our response to this and justification for the methodology undertaken.

In the absence of a response as of yet, I provide a formal letter from Curtins responding to these comments.

I trust this is helpful and an agreement can be reached.

However, should you have any queries, please do not hesitate to get in touch.

Kind Regards

Olivia

Olivia Carr
Senior Planner

Turley
1 New York Street
Manchester M1 4HD
T 0161 233 7676
M 07786198330
D 0161 233 7673

All Turley teams are now [remote working](#) wherever possible in line with Government guidance.

Our co-owners are contactable in the usual ways and we suggest using mobile numbers in the first instance. We are doing all we can to maintain client service during this challenging time.

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From: Anthony Mitchell [mailto:a.mitchell@manchester.gov.uk]

Sent: 17 March 2020 15:40

To: Olivia Carr

Subject: echo street mmp

fyi

Anthony Mitchell
Principal Planner,
City Centre Group,
Manchester City Council,
Planning,
PO Box 532
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Manchester
M60 2LA

Tel 0161 234 4776

Fax 0161 274 7000

email a.mitchell@manchester.gov.uk

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