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Phase 2 Site Investigation

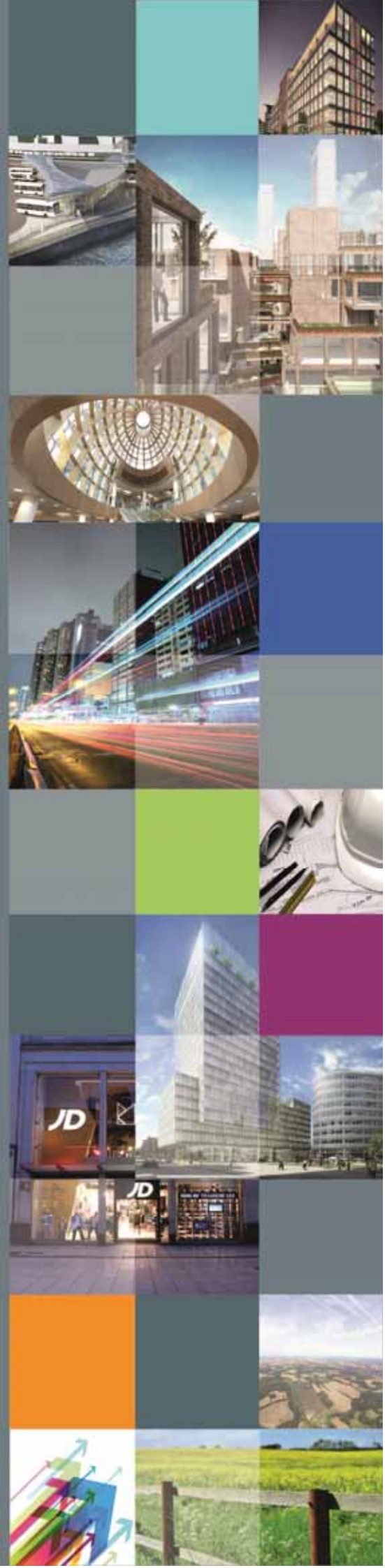
on

**10 to 12 Whitworth Street West,
Manchester**

for



April 2016



PHASE 2 SITE INVESTIGATION

on

10 to 12 Whitworth Street West, Manchester

for

INHABIT

ISSUED	DESCRIPTION	DATE	REVIEWER	AUTHOR
1	Phase 2 Site Investigation Report FINAL	15/04/2016	Jon Smith 	Alex Smiles 
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1.0 INTRODUCTION

1.1 Background

- 1.1.1 R²C Consulting have been appointed by INHABIT to conduct a Phase 2 Site Investigation across land at 10 to 12 Whitworth Street West, Manchester (the site). It is understood that the site is to be redeveloped for residential end uses comprising the construction of a 36 storey, 327 apartment building.
- 1.1.2 The following assessment has been completed to support design and planning requirements for the sites redevelopment and follows on from a number of site investigations relating to the development site; specifically:
- 1) Phase 1 Desktop Study completed by RoC Consulting dated November 2014 (ref: AS/ROC/ P1 3056).
 - 2) Phase 2 Site Investigation (Partial record) completed by WSP Ltd in 2009 (ref: 12121730/001).
- 1.1.3 It is recommended reference be made to the abovementioned report (s) when reviewing the current assessment.
- 1.1.4 The scope of the report and its assessment has been based around the site's proposed redevelopment as a 36 storey residential apartment development. It should be noted that any subsequent revision of the proposed redevelopment or site boundary away from the above mentioned drawing may result in the full or partial re-interpretation of this report and assessment.

1.2 Terms of Reference

- 1.2.1 The Phase 2 Site Investigation was carried out following receipt of an instruction from Mr Richard Sleight of Capita, acting on behalf of INHABIT



1.3 Objectives

1.3.1 The scope of works has been tailored to meet both planning and design requirements to assist with the site's redevelopment. These considerations include:

- 1) Design a program of site investigation works to establish ground conditions beneath the site and target known or suspected sources of contamination (as revealed by the Phase 1 desktop study).
- 2) Completion of site investigation field works including the formation of x3 Rotary Cored and x4 Window Sampler boreholes to establish the sites geology.
- 3) Establish the existing warehouse structures foundations by way of machine excavated trial pits within the building footprint.
- 4) Establish foundation design of adjacent Network Rail owned railway viaduct by way of hand-dug excavated trial pitting.
- 5) Completion of geo-environmental and geotechnical laboratory analysis of soil / rock samples to determine physical and chemical characteristics.
- 6) Completion of a detailed geotechnical assessment of site conditions to inform new building foundation design. The scope of this assessment will also include reference to the findings and result of previous site investigation works.
- 7) Completion of a geo-environmental assessment utilising information provided by both the current and previous phases of site investigation works sufficient in its scope to assist with the discharge of contaminated land related planning conditions.



2.0 LIMITATIONS OF STUDY ASSESSMENT

- 2.0.1 The report has been produced by R²C Consulting for the client solely for the purposes of a review of information for the above mentioned site. It may not be used by any person for any other purpose other than that specified without the express written permission of R²C Consulting. Any liability arising out of its use by a third party for purposes not wholly connected with the above shall be the responsibility of that party who shall indemnify R²C Consulting against all claims costs damages and losses arising out of such use.
- 2.0.2 The report has been produced by R²C Consulting for the client solely for the purposes of a review of information for the above mentioned site. It may not be used by any person for any other purpose other than that specified without the express written permission of R²C Consulting. Any liability arising out of its use by a third party for purposes not wholly connected with the above shall be the responsibility of that party who shall indemnify R²C Consulting against all claims costs damages and losses arising out of such use.
- 2.0.3 This report is written in the context of an agreed scope of work and should not be used in a different context. The report should be read in its entirety. Furthermore new information, improved practices and changes in legislation may require re-interpretation of this report in whole or in part after its original issue. R²C Consulting reserve the right to alter their conclusions and recommendations in the light of further information that may become available.
- 2.0.4 Ground conditions can change rapidly, especially in areas of made ground, however, it is assumed that the ground conditions observed are typical and representative of the site as a whole. The ground conditions have been determined from a limited number of exploratory holes formed across the property, therefore, only a small percentage of the total area of the property has been investigated. Interpolation between exploratory holes has enabled a general picture of the subsurface conditions to be produced. Conclusions drawn from the ground investigation should be read in this context. R²C Consulting cannot accept responsibility for any situations resulting from locally unforeseen ground conditions occurring between exploratory holes.



3.0 BACKGROUND INFORMATION

- 3.0.1 The overview below outlines the most salient points / considerations and it is recommended reference be made to the complete findings of previous site investigation reports for additional information / clarification.

3.1 Site Description

- 3.1.1 Situated between no's 10 to 12 Whitworth Street West and covering an area of 0.09ha, the site currently comprises a three storey vacant brick warehouse structure. Site boundaries are formed by Whitworth Street West and the Deansgate Locks leisure development to the north; a live electrified railway viaduct, Hewitt Street and various car repair garages to the south; a public house, Albion Street, Whitworth Street and the First Street mixed use development to the east; and Cannon Street with mixed office development to the west. Topography of the site and its surroundings is largely flat around 33.5mAOD however a slight rise in level is noted to the east at the junction with Albion Street.
- 3.1.2 The building was vacant at the time of inspection and has been for a number of years. A small alleyway is present along the site's southern boundary, reference to this feature is made within the previous WSP report noting it falls within Network Rails ownership for access to the adjacent viaduct structure.
- 3.1.3 An inspection of the building's interior (photographic records from which are provided within Appendix A) show the structure as being in a partial stage of redevelopment. The existing ground floor slab appears to have been removed and a reduced level dig completed across the entire building footprint. These excavations range between 1.5 and 2.3m below existing ground level in depth and reach their maximum toward the site's northern and south eastern extents. The partially completed construction works concluded in the early 1990's and the site has been vacant during the period thereafter.
- 3.1.5 Land use within the surrounding area comprises a mixture of light industrial, residential and commercial office development. The mixed use First Street development was under construction to the south east at the time of inspection; this development is known to be constructed across the site of the former Gaythorne Gas Works.



- 3.1.6 The Gaythorne site is known to have been significantly impacted by gas works operations and was remediated by Celtic Technologies in 2008 to the approval of the local authority and Environment Agency.

3.2 Geological Characteristics

Geological Map Records

- 3.2.1 Review of publically available BGS geological map records indicate the site is underlain by the following:

Drift Geology: Glacio-fluvial deposits, Devensian – Sand and Gravel

Solid Geology: Chester pebble beds formation – Triassic Sandstone,

- 3.2.2 The site is not located within an area affected by Coal mining, or other mineral extraction using either opencast or below ground methods.

Previous Site Investigation Works

- 3.2.3 A program of intrusive site investigations were completed by WSP Ltd in 2009 a partial copy of the report for which has been provided for review. The report is incomplete and does not include the borehole logsheets or a location plan for ground investigation works. As such the information provided can only be considered as indicative of ground conditions beneath the site.
- 3.2.4 The 2009 study comprised the formation of x3 dynamic sampler boreholes, x3 rotary cored boreholes, x4 high pressure dilatometer tests and x5 machine excavated trial pits. Ground conditions were found to comprise demolition type fill materials extending to depths ranging between 0.4 and 3.4mbgl at all borehole locations, underlain by a combination of Glacio-fluvial Sheet deposits and Sherwood Sandstone.
- 3.2.5 An absence of drift deposits was noted at the majority of borehole and trial pit locations, owing to the aforementioned basement excavations. However, where reported, the Glacio-fluvial deposits were found to comprise a brown gravelly sand.



- 3.2.6 The underlying Sandstone bedrock at these locations was found to occur a depth roughly corresponding with that noted in other boreholes, indicating little or no variation in rockhead depth beneath the site.
- 3.2.7 The underlying Sandstone bedrock was found contain a weathered fraction up to 1.3m in thickness (29.1mAOD) with the solid bedrock exhibiting a gradual improvement in quality beyond a depth of 23mAOD. Groundwater strikes and seepages were reported within the Sandstone bedrock at depths ranging between 9.8 and 10.8mbgl; resting water levels (as revealed during subsequent monitoring works) were found to range between 7.17 and 9.95mbgl (or 24.45 and 24.6mAOD). The Sherwood Sandstone formation is described as being a weak fine to medium grained laminated formation with occasional Mudstone inclusions and gravel.
- 3.2.8 A program of soil contamination testing and ground gas risk assessment was completed as part of the 2009 WSP study the results from which failed to identify any significant sources of contamination within site soils. Similarly post fieldwork monitoring results failed to identify a ground gas issue beneath the site.

3.3 Site History and Environmental Characteristics

- 3.3.1 Historical records indicate the site was previously used for terraced type residential housing before being developed into its current configuration as a warehouse circa 1908, remaining in its current configuration through until the present day.
- 3.3.2 A partially completed renovation of the warehouse was attempted during the early 1990's comprising the removal of the existing ground floor slab and partial excavation of an existing basement structure. Observations made during the site investigation indicate the presence of a now partially infilled basement across the building footprint, although the previous floor level of this feature is difficult to ascertain due to the aforementioned incomplete construction works



- 3.3.3 The Envirocheck Groundwater Vulnerability Map indicates the drift geology is classified a Secondary Aquifer A (Major Aquifer) with the underlying Sandstone bedrock classed as a Principal Aquifer. The site is also said to be located within a Zone III SPZ although no sensitive water abstraction points (Potable water supply well etc.) are noted within 1000m of the site.
- 3.3.3 The nearest surface water feature is indicated 26m to the north in the form of the Rochdale Canal. Water quality of this receptor (as indicated from a sampling point 232m to the west) indicates a GQA Grade of "A" (Very Good) and a flow rate of greater than 80 cumecs. There are no registered or historic land fill sites within a 500m radius of the site.

3.4 Preliminary Conceptual Site Model

- 3.4.1 The Phase 1 Desktop Study completed by RoC Consulting classified the site as relatively low risk owing to an absence of any significant contaminative activity (either current or historic) on site. This assessment was supported by the geo-environmental assessment completed during the 2009 WSP study the chemical testing and ground gas monitoring results which failed to identify any sources of contamination beneath the site.
- 3.4.2 However it was noted that reliance could not be placed on the 2009 WSP study owing to the fact it was commissioned by another party and was only provided to the client in a partially completed form. Also the 2009 study had been completed in support of a smaller 15-storey proposal for the site; given the marked increase in loading associated with current 36-storey structure it was considered prudent to complete additional ground investigations across the site to meet both design and planning requirements.



4.0 SITE INVESTIGATION DESIGN

General

- 4.0.1 The R²C intrusive investigation was designed and completed to further investigate geo-environmental issues identified during previous site investigations as well as provide geotechnical information to facilitate new building design. Specifically the objectives of the site investigation were as follows:
- 1) Completion of a geo-environmental assessment to assess the site's contaminative potential and support planning submission requirements.
 - 2) Completion of a detailed geotechnical investigation of ground conditions beneath the site and specifically the depth to and competency of Sandstone bedrock.
 - 3) Investigate the existing building foundations as well as the foundations for the Network Rail owned viaduct structure adjacent the site's southern boundary.
- 4.0.2 Shallow soil conditions and the geo-environmental assessment was completed by way of x4 Window Sampler Boreholes (WS101 to 104) which were extended to bedrock to confirm the depth to rock-head beneath the site. Deeper bedrock conditions were investigated by way of x3 Rotary Cored Boreholes (BH101-103) to depths ranging between 25 and 35m with rock core samples recovered and dispatched for laboratory strength testing. The existing building foundations were investigated from inside the structure by way of x6 machine excavated trail pits (FE101 to 106).
- 4.0.3 Foundation excavations along the railway viaduct (TH-1 to TH-4) were completed by hand by specialist subcontractors UDP Ltd to depths circa 3.5 to 3.9m. These works were subject to approval and monitoring from Network Rail prior to and during the completion of fieldworks to ensure no structural risks were posed to existing structures.
- 4.0.4 Samples of soil collected during the investigation works are to be analyzed for a variety of determinants associated with the pattern of current / historic industrial activity across the site as outlined within the preliminary conceptual site model.



4.0.5 Table 4.0 provided below provides location justification for each exploratory hole formed during the site investigation fieldworks. The purpose of this table is to illustrate the targeting of potential sources of contamination during the Phase 2 site investigation works.

Table 4.0: Borehole Locations & Justification

BH/WS ID.	Reason for selection
BH101	Formed to investigate bedrock properties and competency toward the proposed south eastern portion of the tower structure Install groundwater and ground gas monitoring well
BH102	Formed to investigate bedrock properties and competency toward the proposed northern portion of the tower structure
BH103	Formed to investigate bedrock properties and competency toward the proposed western portion tower structure Install groundwater and ground gas monitoring well
WS101 WS103	Investigate shallow soils Establish depth of existing building foundation footings
WS102 WS104	Investigate shallow soils Establish the depth to rockhead Provide site wide coverage and support information established from rotary cored boreholes
FE101 FE102	To establish foundation depth and construction on southern and eastern building elevation where basement excavations are at their deepest extent.
FE103	To establish foundation depth and construction along northern and eastern elevation at higher level
FE104	To establish foundation depth and construction along sites northern elevation
FE105	To establish foundation depth and construction along sites western elevation
FE106	To establish foundation depth and construction adjacent existing stair core.
TH-1	Completed on eastern most railway viaduct support to establish foundation depth and construction
TH-2	Completed on central viaduct supports to establish foundation depth and construction
TH-3	Completed on western most railway viaduct support to establish foundation depth and construction
TH-4	Completed at base of bridge structure on Cameron Street to establish foundation depth and construction.

4.0.6 Exploratory hole locations are shown on R²C Consulting drawing ES01 provided within Appendix A, records and drawings from foundation exposure works are provided on both RoC Consulting and UDP Ltd drawings within Appendix G.



5.0 SITE INVESTIGATION FIELDWORKS

- 5.0.1 Site investigation fieldworks were completed in two stages; the main phase of works were undertaken between the 11th February and 10th of March 2015 comprising the formation of window sampler and rotary boreholes within the existing warehouse building, along with foundation exposures along its internal walls. The second phase of investigations were completed in February 2016 comprising the excavation of viaduct foundations along the site's southern extent.
- 5.0.3 Window Sampler and Rotary Cored boreholes were completed by drilling contractors GSS Ltd with machine all internal foundation exposures completed using a mini digger under the supervision of RoC Consulting. As previously discussed the railway viaduct foundation exposure works were completed by UDP Ltd with real time structural monitoring of the existing viaduct provided by Datum Monitoring Ltd. Boreholes were formed using a Competitor 130 (Window Sampler Boreholes) or a Premier Compact 210 (Rotary Boreholes).
- 5.0.2 Information with respect to buried services was obtained from relevant providers prior to commencement of the investigation works. In addition a below ground utility survey was completed by Survey Operations across the site (a copy of the drawing from this survey is provided within Appendix A). However, as a precautionary measure all exploratory hole locations were scanned with a Cable Avoidance Tool prior to the commencement of works. In addition, hand dug service pits were completed to a depth of 1.2mbgl at all borehole locations deemed to fall in close proximity to the suspected location of possible buried service runs / infrastructure.
- 5.0.3 To ensure no new sources of contamination were introduced to underlying soils / bedrock during the formation of each borehole, steel casing was used throughout as well as vegetable oil as a lubrication medium for all drilling apparatus. Sampling equipment was also cleaned between sampling to reduce cross contamination risks.



- 5.0.4 Soil and rock core samples were collected for subsequent chemical and geotechnical laboratory analysis. Soil samples used for geotechnical analysis were collected in 500g plastic sample tubs, U100 wax sealed sample tubes and polythene “bulk” bags. Samples collected for chemical testing were collected in 300g glass jars and 500g plastic sample tubs. Samples were obtained from both made ground and natural strata to assess the overall quality of underlying soils. In situ soil strength was investigated using Standard Penetration Tests (SPT) within superficial deposits as well as to confirm rock head had been reached.
- 5.0.5 The shallow soils encountered during construction of the boreholes were described and logged by a suitably qualified engineer in accordance with BS 5930: Code of Practice for Site Investigations (the log sheets for which have been provided within Appendix B.
- 5.0.6 A total of 2 ground gas and ground water monitoring wells were installed within Rotary cored boreholes BH101 and BH103. Installation details are provided within Table 5.0 below, copies of ground water and gas monitoring records are provided within Appendix F.

Table 5.1: Monitoring Well Installations.

BH ID	Monitoring well depth	Response zone	Response zone strata
BH101	3.00	1.00 – 3.00	MG & Drift Deposits
BH103	3.50	1.00 – 3.50	MG & Drift Deposits



6.0 ENCOUNTERED GROUND CONDITIONS

- 6.0.1 The following ground conditions are summarised from the exploratory holes formed during the R2C Consulting site investigation. The following represents an overview of encountered ground conditions and it is recommended reference be made to the borehole and trial pit log sheets provided within Appendix B for a detailed strata description; all depths shown are given in meters below ground level (mbgl) unless otherwise stated).

6.1 Ground Conditions Overview

Made Ground

- 6.1.2 Made ground was reported at all exploratory hole locations comprising chiefly demolition type fill material associated with the excavation and partial backfilling of the existing basement structure. This fill includes intact and semi intact brick sets as well as concrete, limestone gravel slate and occasional wood inclusions. Bands of relic topsoil were also noted at several locations.
- 6.1.3 Deposits varied in thickness between 0.5 and 3.7 with a mean depth circa 1.9m, although it is noted the depth of deeper deposits may have been slightly over-estimated as a result of the limited recovery associated with the rotary boring process. In addition it is considered likely the marked variability in made ground depth can be attributed to the partial backfilling and variations in ground level within the warehouse basement structure.
- 6.1.4 SPT N Value range of 0 to 11 (Very Loose to Medium dense). The material encountered is described as very loose light brown very gravelly sand of mixed demolition type materials including brick, concrete, slate and limestone.

Glaciofluvial Deposits

- 6.1.5 Made ground deposits were underlain at 6 locations by Glaciofluvial granular deposits, predominantly comprising light brown very gravelly Sands. The depth of these deposits varied between 2.0 and 3.52m with a mean depth of 3.1m.



6.1.6 The distribution of glacial deposits varies, like made ground materials, accorded with recent basement excavation works completed during the 1990's partial development of the structure; the deeper deposits tended to be located to the northern and western extent of the structure where ground levels are higher, with the shallowest thickness noted to the south east in the area of basement excavation. Table 6.1 provided below indicates the depth at which the weathered fraction of Sandstone bedrock was reported, depths are given in mAOD to correct for surface level variance.

6.1.7 SPT N values reported from within these deposits indicate a density that ranges between loose to medium dense, although the majority of SPT results indicate a medium dense compaction.

Weathered Sandstone recovered as Sand and Gravel

6.1.6 The weathered fraction of the underlying Sandstone bedrock was reported at the base of all Window Sampler boreholes and was characterised by SPT refusal at each of the 4 locations. The weathered fraction of the Sandstone bedrock was initially recovered as a very dense reddish brown Sand with frequent Sandstone gravel inclusions, becoming gradually more cemented and competent with depth.

6.1.7 The depth of the weathered varied across the site and is displayed in mAOD Table 6.1 below

Table 6.1 Overview to weathered and solid bedrock depths

BH ID	Weathered Sandstone Depth (mAOD)	Solid Sandstone Bedrock*
BH101	Not Reported	28.01
BH102	Not Reported	28.76
BH103	29.99	29.19
WS101	30.49	Not Reported
WS102	30.00	
WS103	30.04	
WS104	30.12	

*Approximate, based on observations from rock core recovery. All depths taken to top of stratum



- 6.1.8 Generally speaking the bedrock profile beneath the site indicates a slight fall from BH103 to the west to BH101 to the south and east. The depths to the base of the weathered fraction are reported during the current investigation are broadly comparable to those noted within the 2009 WSP study which indicated solid more competent rock at levels ranging between 29.1 and 29.9mAOD.

Sherwood Sandstone Bedrock

- 6.1.9 Triassic red Sandstone was reported in all rotary borehole locations and subsequently proven to depth ranging between 25mbgl (8.69mAOD) and 35.0mbgl (-3.47mAOD). The Sandstone is described as a Weak fine to medium grained formation with occasional completely weathered bands. The formation also contained occasional Mudstone and Siltstone banding (as noted in BH101) that varied in thickness between 0.09 and 0.21m. Selected samples of rock core were taken for geotechnical laboratory testing to determine strength parameters (details of which are provided in Section 7.0).

6.2 Groundwater and Contamination Observations

- 6.2.1 No suspected sources of soil or groundwater contamination were noted within made ground or natural soil deposits during the course of site investigation fieldworks. However, a small band of hydrocarbon stained Sandstone was recovered from BH101 at a depth circa 30.0m that is likely to arise from historic gas works operations at the nearby Gaythorne works.
- 6.2.2 The band of contamination was relatively discrete (less than 5cm in thickness) and appeared within a natural jointing of bedrock (as would be expected with the flow of mobile contaminants through groundwater). The staining was not noted on any other rock core samples obtained from other boreholes completed during the site investigation works indicating any hydrocarbon plumes that extend beneath the site do not represent a site wide issue.
- 6.2.3 Ground water was not reported during the course of site investigation works or subsequent monitoring visits. Full details of monitoring results have been provided within Appendix F.



6.3 Below ground obstructions

- 6.3.1 With the exception of existing building foundations and structures no obstructions were reported within made ground or natural soil deposits during ground investigation works. However given the Glaciofluvial nature of shallow soil deposits the presence of large cobble or boulder inclusions cannot be precluded beneath the site.

6.4 Existing Warehouse Foundations

- 6.4.1 The foundation construction of the existing warehouse was investigated by way of machine excavated trial pits and Window Sampler boreholes during the first phase of ground investigation works. A total of 6 trial pits were completed 5 of which exposed the building foundations. Trial pit exposure FE05 was extended to a depth circa 31.29mAOD and did not encounter the buildings foundation; this trial pit was terminated due to spalling of topsoil from the pits sides. Diagrammatic cross sections of all encountered foundations are provided within Appendix G.
- 6.4.2 In addition WS103 was formed beneath the existing mezzanine structure (where access for the mechanical excavator was not possible) as close to the building wall as possible to establish foundation depth. Located approximately 0.5m from the internal wall this borehole did not encounter the foundation and refused on probable weathered Sandstone at a depth circa 3.9m.
- 6.4.3 The construction and depth of foundations was found to vary across the site; Table 6.2 (below)

Table 6.2 Overview to existing foundation depth & construction.

Foundation Exposure	Surface Level (mAOD)	Founding Level (mAOD)	Founding Strata
FE01	31.54	30.40	Glacial Till
FE02	31.49	29.99	Sandstone Bedrock
FE03	33.11	32.06	Glacial Till
FE04	32.07	30.37	Glacial Till
FE05	Not Encountered		
FE06	32.84	31.84	Glacial Till
WS103	Not Encountered.		

- 6.4.4 Generally speaking the existing structure is founded on well compact glacial sand and gravels with the deeper foundations located along the site's southern boundary (in the area adjacent the railway viaduct). The site's northern frontage appears to have been more recently underpinned, most likely during the partially complete internal alterations undertaken during the 1990's.

6.5 Existing Railway Viaduct Foundations

- 6.5.1 The foundation construction of the existing railway viaduct to the south of the site was investigated by way of hand dug trial pits during the second phase of ground investigation works. A total of 4 trial pits were completed to depths ranging between 4.1m (TH1) and 3.1m (TH4) 3 of which (TH1-3) were formed at the base of arches associated with the railway viaduct.
- 6.5.2 All the existing viaduct foundations were constructed within Glaciofluvial sand and gravels at depths ranging between 29.96 and 30.32mAOD; the footings were found to be straight with no kick out or variation in design at their base. A number of deep drainage runs were also noted including one at the base of the structure, although it is not clear from where these drains are fed.
- 6.5.3 Table 6.3 (below) gives an overview to encountered foundations; diagrammatic cross sections of all encountered foundations have been collated by UDP Ltd are provided within Appendix G.

Table 6.3 Overview to existing viaduct foundation depth & construction.

Foundation Exposure	Surface Level (mAOD)	Founding Depth (mAOD)	Founding Strata
TH1	33.86	29.96	Glacial Till
TH2	33.84	30.04	
TH3	33.69	30.04	
TH4**	33.39	30.13	

**formed on foundation of bridge structure over Cameron St



7.0 LABORATORY TESTING

- 7.0.1 To establish the physical and chemical properties of underlying soils a programme of laboratory analysis was completed utilising samples obtained during site investigation works. This analysis comprised the testing of soils samples to assist with the estimation of risks posed by contaminated land related concerns.

Chemical Testing

- 7.0.2 R²C Consulting submitted a total of 6 soil samples to a UKAS accredited testing facility for analysis against a range of determinands synonymous with the site's former industrial activity.

Table 7.1: Soil Chemical Testing Specification

Determinands	No. of Tests
Toxic and phytotoxic metals and metalloids	6
Total & Speciated Polycyclic Aromatic Hydrocarbons (PAH),	6
Other inorganic substances (e.g. Sulphate, Cyanide etc)	6
Asbestos ID	5
Waste Acceptance Criteria	1
Leachate Analysis (Heavy Metals etc)	1
Water Soluble Sulfate & pH	6

- 7.0.3 Copies of chemical testing results have been provided within Appendix D and a detailed Geo-environmental assessment of site conditions is provided within Section 8.0

Geotechnical Testing

- 7.0.4 A programme of geotechnical laboratory analysis was also completed on rock core samples obtained during site investigation works comprising the completion of Point Load and UCS strength testing of specimens of the Sherwood Sandstone.



7.0.5 A total of 15 UCS tests were completed on a range of rock core samples from all 3 rotary borehole locations at depths ranging between 3.3 and 31.25m. A total of 40 Point Load tests were completed to complement the UCS testing regime at depths ranging between 3.9 and 34.3m.

7.0.6 Table 7.1 (provided below) outlines the range of results obtained from the program geotechnical testing works;

Table 7.2 Overview to Geotechnical Testing Results

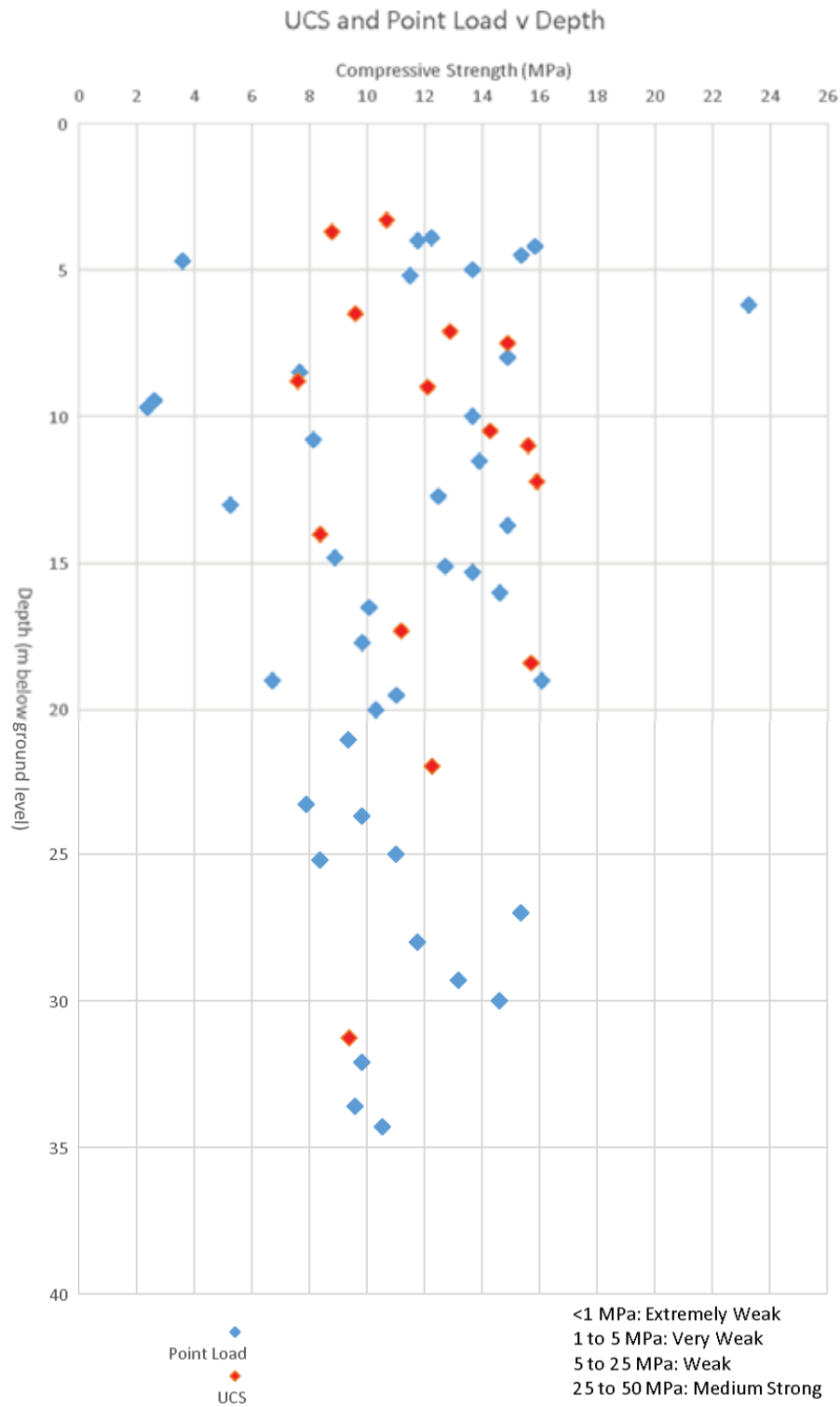
Unconfined Compressive Strength Testing Results (MPa)			
Borehole ID	Maximum	Minimum	Average
BH101	15.70	8.80	12.11
BH102	15.90	8.40	11.90
BH103	15.60	7.60	11.60
Site Wide	15.90	7.60	11.96
Point Load (Is50) Results***			
BH101	15.84	2.64	11.21
BH102	14.64	7.68	11.00
BH103	23.28	2.40	11.52
Site Wide	23.28	2.40	11.22

***IS (50) results corrected to MPA using conversion factor of 24 for Sandstone

7.0.7 With reference to the above results it is noted the Sandstone bedrock exhibits a strength range between Very Weak and Weak, although the majority of specimens of rock tested fall within the Weak range. Results from both Point Load and UCS tests have been plotted against depth and are displayed overleaf. These results indicate an initial and slight increase of strength with depth, although no marked improvement in strength is noted beyond 10m.

7.0.8 Results from geotechnical laboratory testing have been provided within Appendix E.





8.0 GEO-ENVIRONMENTAL ASSESSMENT

8.0.1 An updated geo-environmental risk assessment has been completed to quantify the risks posed to identified receptors (as outlined in the preliminary site conceptual model) using the information obtained during site investigation fieldworks. Broadly speaking this risk assessment process can be divided based on the receptor group in question between:

- 1) Risks posed to human health by soil contamination (both construction persons and future site users).
- 2) Risks posed to human health by hazardous ground gas ingress (both construction persons and future site users).
- 3) Risks posed to controlled waters by soil or groundwater contamination (both surface water features and bedrock aquifers).
- 4) Risks posed to new building construction by aggressive ground conditions (namely elevated sulphate concentrations).

8.0.2 Appropriate assessments have been completed for each of the above utilising the latest statutory and non-statutory guidance documents; for details of risks posed to human health refer to Section 8.1 (soils) and Section 8.2 (ground gas), for details of risks posed to controlled waters refer to Section 8.3 and risks posed to new structures refer to Section 8.4.



8.1 Assessment of soil contamination

Background

- 8.1.1 In order to estimate the risks posed to human health from soil contamination, a quantitative risk assessment has been completed utilising the latest Environment Agency CLEA C4SL methodology. The assessment utilises the chemical testing results obtained during the site investigation fieldworks to characterise site conditions and facilitate the completion of the risk assessment process.
- 8.1.2 For the purposes of this assessment we have assumed the site will be developed for residential led apartment type end uses with no private residential gardens or public soft landscaping proposed as part of the development. We have assumed a “Residential without plant uptake” scenario for our assessment in view of these development characteristics owing to the fact it is highly unlikely future residents will come into contact with site soils.
- 8.1.7 It is recognised that Construction personnel are at a much higher risk of exposure to contaminants as a result of excavations associated with the sites redevelopment, although the exposure period will be markedly reduced from those outlined within the C4SL / S4UL screening values and the use of PPE will go some way to mitigating risks posed.
- 8.1.7 Risks posed from soil contamination have been assessed using a Tier 1 Screen of chemical testing results for samples obtained during the site investigation. The assessment has been completed for all substances that have reported above the limits of laboratory detection for which S4ULs are available. Where screening values are not available consideration has been given to deriving site specific assessment criteria to quantify risks posed where results are reported significantly above the limits of detection.



Summary and assessment of risks posed by soil contamination

8.1.10 Results from chemical testing analysis indicate the following:

- 1) x1 sample identified containing Amosite (Brown Asbestos) fibres between 1.00m and 1.50m (WS03).
- 2) A number of elevated PAH concentrations were identified that were found to be in exceedance of screening levels, specifically:
 - x2 exceedances of S4UL value for Napthalene at **WS03** (depths 1.5 – 2.0m).
 - x2 exceedances of S4UL value for Benzo(a)anthracene at **WS03** (depths 1.5 – 2.0m).
 - x2 exceedances of S4UL value for Benzo(a)anthracene at **WS03** (depths 1.5 – 2.0m).
 - x2 exceedances of S4UL value for Benzo(b) fluoranthene at **WS03** (depths 1.5 – 2.0m).
 - x2 exceedances of S4UL value for Chrysene at **WS03** (depths 1.5 – 2.00m).
 - x2 exceedances of S4UL value for Indeno[123-cd]pyrene at **WS03** (depths 1.5 – 2.00m).
 - x3 exceedances of S4UL value for Dibenzo(ah)anthracene at **WS03** (depths 1.0 – 1.5m). and **WS01** (depth 0.5m).
- 3) No exceedances of Inorganic Substances (including Heavy Metals) were identified in the samples submitted for testing.

8.1.11 Chemical testing results detailed by individual determinands are provided within Appendix D. The above findings have been used to update the Conceptual Site Model as outlined in Section 9.0



8.2 Ground Gas Risk Assessment

- 8.2.1 The Preliminary Conceptual Site model identified a potential residual risk of ground gas generated from made ground deposits as a source. No significant sources of ground gas ingress (e.g. landfill sites) have been noted on or within close proximity to the study site and it considered unlikely the site is at risk of on-site gas ingress from sites in the local area. Similarly the site is not said to be located within in an area at risk from Radon gas ingress. It is considered the most probable exposure pathways are likely to be limited to construction workers during the sites redevelopment and future site users occupying buildings across the site.
- 8.2.2 To estimate the risks posed by ground gas generation x2 monitoring standpipes were installed at borehole locations BH101 and BH103. The purpose of these standpipes is to investigate ground gas generation potential of shallow and at depth soils and the associated implications this may have for new building design.
- 8.2.3 A total of 4 monitoring visits have been completed over a 8 month period during varying weather conditions and atmospheric pressure (refer to Appendix E for further information). The results from these monitoring works revealed a maximum Carbon Dioxide concentration of 0.46% with negligible gas flow rates. The results also indicated an absence of methane, carbon monoxide and hydrogen sulphide gases.
- 8.2.4 With reference to guidance provided in CIRIA C665 “*Assessing risks posed by hazardous ground gases to buildings*” and assuming the development comprises residential apartment type development; the above mentioned worst case gas levels and borehole flow rates equate to a gas screening value of 0.046 l/hr. This value equates to a Characteristic 1 Situation with no remedial measures envisaged to control ground gas ingress. This classification is to be expected given the relatively low volume / risk sources of gas generation noted on and adjacent to the site.



8.3 Controlled Waters

- 8.3.1 It is understood the site's drift geology (Fluvio-Glacial deposits) are classified as a Secondary Aquifer (Major Aquifer) with the underlying Sandstone bedrock classed as a Principal Aquifer. The site is also said to be located within a Zone III SPZ although no sensitive water abstraction points (Potable water supply well etc.) are noted within 1000m of the site. The nearest surface water feature is indicated 26m to the north in the form of the Rochdale Canal, and is not considered to be at risk of contaminant migration from the study site.
- 8.3.2 Site investigation fieldworks have failed to identify any significant sources of mobile contamination on site, similarly an absence of groundwater was noted during both site investigation and subsequent monitoring works. However, hydrocarbon staining was noted on rock cores at depth beneath the site at a single borehole location, indicating the possible movement of gas works contamination from the nearby Gaythorne site.
- 8.3.3 With respect of risks posed by the site toward controlled waters, it is considered highly unlikely the site in its current configuration, or previous commercial operations, will have impacted surface or groundwater quality. We have seen no evidence to suggest any mobile sources of contamination are present in significant quantities beneath the site that could have the potential to impact on controlled waters. The aforementioned residual gas works contamination represents an off-site source and it is noted the former Gaythorne works has since been remediated (to the approval of the Environment Agency). In addition the gas works contaminants were only reported in a small band at a single borehole location.
- 8.3.4 As such it is considered the site presents a low risk to controlled waters. It is noted the proposed new structure is likely to require a piled foundation solution and that the construction of these piles may create preferential pathways for contaminant migration. However, as the main source of contamination has since been remediated, and only a small quantity of contamination has been noted beneath the site at a single location, it is considered unlikely any future piling works will have a significant impact on controlled waters.



8.4 Below ground concrete construction

- 8.4.1 Peak 2:1 water soluble sulphate concentrations ranged between <dl and 970mg/l with soil pH values ranging between 7.6 and 11.1. Based on these results it is considered that well compacted buried concrete should be designed in accordance with Class DS-2 AC-2 requirements as specified in BRE Digest Special Digest 1:2005 *Concrete in aggressive ground: Version 3*.
- 8.4.2 Consideration will need to be given with regard to risks posed to below ground water supply pipe work from chemical attack. At the time of writing specific details regarding the location of below ground water supply pipework is to be confirmed and we have not been able to sample soils for chemical analysis (and completion of a United Utilities pipework risk assessment) as a result.
- 8.4.3 It is envisaged the length of supply pipework needed will be relatively short (<3m) linking the site to the mains supply in the footpath. As such it may be beneficial to allow for chemically resistant pipe work as the cost to stop up, excavate and collect soil samples for testing from the highway would be markedly more expensive than the actual cost of barrier pipework.



9.0 REFINED CONCEPTUAL SITE MODEL

9.0.1 The Environmental Protection Act Part IIA: 1990, defines contamination as land containing levels of contamination which form a risk to human health, controlled waters or other ecosystems. Therefore, contamination in exceedance of the relevant screening values is considered a source. Table 9.0 assess and summarise the sources, pathways and receptors that may exist at the site:

TABLE 9.0: REFINED CONCEPTUAL SITE MODEL		
Potential Sources		
Contamination Source	Risks Posed	Comment
Current Land Use	Low	The warehouse building is currently vacant, and there are no current operations on-site. Furthermore, there were no indication of possible relic sources of contamination (e.g. untreated above or below ground storage tanks) noted during the site investigation works or believed to be present on site.
Historical land use and operations as Residential housing and warehouse/works	Low to Medium	The site has previously comprised residential housing being developed into its current configuration as a machinery warehouse during the early 20th century. The site was last occupied in the early 1990s and has stood vacant since. Site investigation works have identified hotspots of contamination (WS03) on the site with elevated concentrations of PAH's and brown asbestos fibres However, site investigation works have failed to identify any significant or site wide sources of contamination in soils; with the remaining tested samples falling below relevant screening criteria.
Proposed land use	Very Low	Redevelopment proposals will introduce a building / surface hard standing coverage across all of the site footprint. This development will break exposure pathways between site users and soils and also prevent surface water infiltration and groundwater flows – further reducing any potential risk posed.
Off-site sources	Low	Historic A number of potentially contaminative industrial activities are known to have taken place in close proximity to the site including a large gas works, various factories and warehousing and vehicle repair garages. It is not considered that these historic adjacent operations have impacted the quality of site soils, and site investigation works have not identified any site-wide residual contamination which may have migrated on-site. Current Land use within the immediate vicinity of the site is not considered to pose a risk towards identified receptors.
Cont'd overleaf		



Potential Receptors		
Human Health– Construction Process	Construction workers and members of the public could be at risk of exposure to contaminants during the redevelopment and subsequent operation. The main exposure pathways are considered to be via direct dermal contact, ingestion and inhalation of contaminated dust. The use of full PPE and welfare facilities will be essential during the redevelopment process.	
Human Health– Operational Phase	Future site users are considered at negligible risk of exposure to soil and groundwater contamination. It is assumed that the site-specific users of the residential end uses will not be interacting with site soils and groundwater.	
Off-site properties	Current land use within the immediate vicinity of the site comprises bars, restaurants, and commercial buildings and are not considered to be at any significant risk.	
	There is a theoretical risk posed by residual contamination which may be present in the area of the former Gas works site, which has the potential to be in hydraulic connectivity with the site through the underlying groundwater table.	
Controlled waters - Surface waters & Secondary Aquifer	A theoretical risk of contaminant migration from the site to the adjacent Rochdale Canal is present, although the actual nature of risks posed is likely to be low given the sites setting and historical land uses. It is considered risks posed to surface and groundwater features are likely to be low owing to the degree of hard standing coverage and aforementioned made ground contaminant source removal.	
Below ground infrastructure & construction	All below ground concrete structures to be designed in accordance with a Class DS-2 AC-2 requirements as specified in BRE Special Digest 1:2005 <i>Concrete in aggressive ground: Version 3</i> .	
Potential Pathways		
Pathway route	Likelihood of linkage	Reason
Direct dermal contact, ingestion and inhalation of contaminated soil / dust Off-site inhalation of ground gas/vapour	Low to Medium	<u>Construction Workers:</u> It is considered the risks posed to construction personnel be sources of contamination can be adequately mitigated against via the use of full PPE and the adoption of good hygiene and site practises. Any sources of contamination uncovered during site development works should be brought to the immediate attention of RoC Consulting for consideration and comment. Appropriate personal ground gas detection equipment should be deployed by all site operatives when working in below ground or confined spaces.
	Low	<u>Future site employees / users:</u> It is considered the risks posed to future site users will be low, owing to the development characteristics and specifically the total building coverage proposed.
Ground Gas Ingress	Low	Monitoring results indicate minimal levels of ground gas are present beneath the site and the need for remedial measures to control gas ingress is not considered necessary.
Leaching of contaminated soil and impact to Aquifer beneath site	Low	It is considered the sites redevelopment will ultimately remove all sources of contamination from site soils, thereby reducing any pollutant linkages that may be present with underlying groundwater’s and bedrock aquifer.
Migration of contaminated groundwater into surface water features	Low	Any perched groundwater table beneath the site will have the potential to be in hydraulic connectivity with the adjacent Rochdale Canal.



9.0.2 Re-appraisal and reassessment of the conceptual site model has identified the following points of further consideration:

- Generally speaking soils across the site do not pose a risk to future site users or construction persons, similarly no credible sources of ground gas ingress have been noted on or adjacent the site.

- A localised hotspot of Poly Aromatic Hydrocarbon and Asbestos contamination was reported in fill materials in the area around WS103. It is considered the source of this contamination relates to previous demolition activity on site and is not representative of site wide conditions.

- No specific risks relating to groundwater or controlled waters have been noted, although residual gas works type contamination was noted at depth within the Sandstone from the nearby Gaythorne works and could be encountered during any piling works that occur.

9.0.3 In view of the above it is not considered a site wide remediation strategy is applicable for the development and that any risks posed from sources of contamination beneath the site could be adequately mitigated via the use of PPE, good site practices and welfare facilities.

9.0.4 With reference to the aforementioned PAH and Asbestos hotspot noted in WS103, it would be prudent for demolition and construction contractors to make adequate allowances to protect site workers when working with soils in this area.

9.0.8 With regard to remedial measures, it is envisaged the best possible solution for contaminated material would be to leave it in situ as it occurs at a depth within the made ground fill and does not present an immediate risk to construction persons or future site users / residents.

9.0.9 However, it is noted excavations will be required in this (and other) areas to form foundations and pile caps and it is recommended demolition / construction persons adopt the following procedures when handling made ground deposits on site.

- 1) A watching brief should be undertaken during the course of site construction works by contractors. Any sources of contamination uncovered during site development works should be brought to the immediate attention of RoC Consulting for consideration and comment.



- 2) Asbestos awareness training should be given to all site operatives working excavating or working site soils. In the event Asbestos is reported works within the affected area should cease and excavations backfilled. RoC Consulting should be informed and required to attend site to further assess the spatial distribution of contaminants and develop a strategy (in conjunction with the construction contractors) for any future works in this area.
 - 3) In such an instance, appropriate remediation measures (outside those outlined within the current report) should be discussed with and approved by the Local Planning Authority to address any additional sources of contamination that are discovered during construction works. The results from these remedial works, supporting evidence etc., should be included within the site validation report.
 - 4) The operation of plant and refuelling facilities should include appropriate provision to reduce the risk of leakage / spillage, particularly into the sites groundwater table or exposed natural soils. Similarly no bulk storage of fuel, paints, chemicals or other hazardous substances should be proposed within or in close proximity basement excavations unless appropriate spill kits and tank bunding is deployed.
 - 5) Appropriate dust mitigation measures should be deployed during basement excavation works, particularly when handling and excavating made ground deposits. All excavated materials stockpiled should be periodically dampened down to control dust release. Similarly the disposal of any material from site should be completed using covered wagons.
- 9.0.10 A validation report should be collated on completion of site earth works. This report should include information on the volumes and disposal of made ground materials from site as well as information of any sources of contamination reported during the sites development and associated remedial measures (as discussed in Points 2 & 3).



10.0 GEOTECHNICAL & FOUNDATION DESIGN ASSESSMENT

Background Information

- 10.0.1 The site is to be redeveloped for residential end use comprising the construction of a 36 storey, 327 apartment building with residential amenities located on the ground and first floor, which include a concierge, lounge area, workspace, gym, and a 'party room' located on the roof terrace. The development will occupy the entire footprint of the current site and include the demolition of the existing warehouse structure.
- 10.0.2 The site is to be redeveloped to comprise a 36 Storey tower for residential end uses and the maximum un-factored column loadings associated with this development are estimated to be between 8000kN and 16,000kN.
- 10.0.3 Site investigation works have revealed variable depths of made ground and fluvio-glacial deposits up to 3.60m in thickness overlying the Sherwood Sandstone formation. The sandstone comprises intermittent sand and marl filled fractures with bands of soft, weathered to completely weathered sandstone and marls.
- 10.0.4 Sherwood Sandstone was encountered in all the boreholes and was fine to coarse grained. The level at which the weathered sandstone was encountered across the site was consistent and ranged between 30.00 to 30.49mAOD. All the "window sampler" holes were taken to refusal in weathered Sherwood Sandstone. SPT N values for the weather sandstone ranged from 58 to 94 with an average value of 71. The weathered sandstone profile was some 1 to 3m thick indicated by relatively low Rock Quality Designation (RQD).
- 10.0.5 The rotary core holes (BH101-103) were advanced through the sandstone to depths ranging from 25m to 35m below ground level. The base of this lithology (and hence its thickness) was not proven. RQD for the sandstone generally increased with depth and ranged from 54 to 100% with an average value of 89%.



10.0.6 Design parameters have been assessed based on the results of the in-situ and laboratory tests. Table 10.1 provides a summary of the design parameters used to assess the foundations.

Table 10.1 Geotechnical Design Assumptions.

Lithology	SPT N (average)	Bulk Unit Weight, γ (kN/m ³)	Angle of Shearing Resistance (degrees)	Effective Cohesion, c' , (kPa)	UCS (MPa)	Poisson's Ratio, ν	Deformation Modulus, E' (MPa)
Made Ground	0-11(5)	18	30	0	-	0.2	5
Glaciofluvial	7-20(13)	19	34	0	-	0.2	13
Weathered Sandstone	>50(71)	20	41	0	-	0.2	71
Sandstone Bedrock	-	20	30	400-1200	4-12	-	-

10.0.7 A plot of SPT N-value against reduced level is provided within Appendix B. Angles of shearing resistance (ϕ') for the soil strata were determined based on Equations 3 and 4 in BS8002:2015 which relate peak effective angle of shearing resistance to particle angularity, grading and density index (determined from SPT N-values). The effective deformation modulus (E') has been estimated based on $E'/N=1$ (MPa) as suggested in CIRIA 143 (1995).

10.0.8 Rock mass properties for the unweathered Sherwood Sandstone have been estimated based on the relationship between unconfined compression strength (UCS) tests, rock quality designation (RQD), effective cohesion (c') and ϕ' outlined in Section 2.3.6 of Tomlinson (2001). Effective cohesion is determined based on $c'=0.1 \times \text{UCS}$ and ϕ' is given as $30 - 60^\circ$ for an RQD of $70 - 100\%$. An RQD of 70% was used to determine $\phi'=30^\circ$ which is at the lower end of the range for angle of shearing resistance and seems low when compared with the weathered rock. However, it is considered appropriate when used with effective cohesion.

10.0.9 UCS values have been determined from direct tests and point load testing. A plot of UCS against depth is included as Figure 2 which includes the design line used in the pile assessment. UCS has been taken as increasing linearly from 4MPa at 30.25mAOD to 12MPa at 27mAOD and then constant at 12MPa below 27mAOD. It is noted that there are some UCS values from point load tests which are significantly lower than the design line; these have been accounted for in the foundation design by application of partial material factors.



10.1 New building foundation design

10.1.1 It is not recommended new building foundations be constructed on top of made ground deposits. The variable composition and in situ strength of these materials is such that unacceptable levels of total and differential settlement will occur as a result.

10.1.2 The foundation options considered in this report include:

Option A. Concrete pads for the columns and a raft for the core slab; and

Option B. Piled concrete pads for columns and a piled raft for the core slab.

10.1.3 Proposed load requirements for the foundations have been indicated as follows:

- 8MN to 16MN column loads for the six external pads (no tension forces indicated);
- 10.5MN (compression) and 5.3MN (tension) for the highly-loaded core piles (**Option B**); and
- 7.6MN (compression) and 1.7MN (tension) for the less highly loaded core piles (**Option B**).

Option A: Conventional Pad / Raft Foundations

10.1.4 The allowable bearing capacity of the raft and pads has been determined based on the bearing capacity equation below

$$q_n = cN_c + \gamma \frac{B}{2} N_\gamma + \gamma D N_q$$

Where :

q_n = Allowable bearing pressure (kN/m²)

c = Effective cohesion (kN/m²)

N_c , N_γ and N_q = Bearing capacity factors

γ = Unit weight of founding material (kN/m³)

B = Width of foundation

D = Depth of foundation below rock surface (m).

10.1.5 Depth of foundation below the rock surface (D) has been taken as 0.5m to allow for the overburden component of the above equation. The allowable bearing pressure varies significantly depending on whether the foundation is excavated to weathered rock or unweathered rock.



- 10.1.6 For foundations on the weathered rock ($\phi'=41^\circ$, $c'=0\text{kPa}$) the allowable bearing pressure has been calculated as 637kPa (including a factor of safety of 3). If the foundations are excavated to unweathered rock ($\phi'=30^\circ$, $c'=400\text{kPa}$ at surface) the allowable bearing pressure would increase to 5,900kPa.
- 10.1.7 Pad sizes for the columns range from 10 to 20m² when founded in weathered sandstone and 2.5 to 5m² when founded on unweathered rock. The excavation depths to the weathered portion of the Sandstone bedrock will vary across the site in view of the partially backfilled basement structure, becoming deepest (circa 3-4m) toward the sites southern and western extent. The more competent solid Sandstone bedrock occurs at depths circa 28-29mAOD and would require excavation in excess of 5-6m to reach this stratum.
- 10.1.8 Given the constrained nature of the site it is likely foundations for the new structure will be required across the majority of the site footprint and particularly the area adjacent the live railway viaduct. The depth to the underside of the viaduct foundations is circa 30mAOD (as identified through intrusive investigation works) and it is likely excavations to construct new building foundation will temporarily undermine the viaduct structure.
- 10.1.9 Should a conventional foundation solution be pursued it will be necessary to provide temporary support for the viaduct during construction works. The extent of these retaining structures will be dependent on the location and size of new building foundations and will require approval from Network Rail prior to commencement, as well as the on-going monitoring of the viaduct structure during construction works.
- 10.1.10 Whilst theoretically possible, it is considered the excavation depths required to reach competent Sandstone bedrock (circa 5-6m) coupled with the complexity and risk associated with support a live railway viaduct, preclude the use of conventional foundations.



10.2 Piled Foundation Solution

- 10.2.1 The use of a piled foundation solution is considered suitable for the proposed development and it is recommended discussions be held with a suitable contractor to develop a design. The proximity of the live Network Rail viaduct will require careful consideration throughout piling works and it will be necessary for contractors to ensure any vibrations associated with these works remain within tolerable levels. Close liaison with Network Rail will be essential to agree the piling techniques, mitigation measures and monitoring requirements. It would also be prudent to undertake a full structural survey of the railway viaduct (and other adjacent properties such as the City Road Inn) in advance of any construction works to identify any pre-existing damage or structural issues.
- 10.2.2 Given the proposed demolition of the existing structure it may be desirable to use the associated arising's to backfill the existing basement structure, allowing piles to be constructed from ground level. It will be necessary to ensure all existing building foundations are grubbed out as part of demolition works to remove obstruction risks. Where possible all pile caps should be constructed as close to ground level as design parameters will allow with any works in close proximity to the viaduct mindful of the constraints associated with its foundations.
- 10.2.3 A preliminary pile design has been completed for initial design purposes (the details of which are provided in Table 10.2 below).

Pile Length (m)	Allowable Compression Load (kN)			Allowable Tension Forces (kN)		
	Pile Diameter (mm)			Pile Diameter (mm)		
	600	900	1200	600	900	1200
5	4300	7341	12098	4537	6805	9073
6	5349	8914	14196	5711	8567	11423
7	6398	10487	16294	6886	10329	13772
8	7447	12061	18392	8061	12091	16122
9	8496	13634	20489	9236	13853	18471
10	9545	15207	22587	10410	15616	20821
11	10594	16780	24685	11585	17378	23170

- 10.2.4 Please note this design is only indicative and we would recommend the final design for budgeting purposes be completed by specialist piling contractors. Similarly it would be prudent to enter into discussions with Network Rail regarding the proposed piling technique as early as possible in the tender process so that a piling method can be agreed upfront (and associated costs realised).

10.3 General Comments

- 10.3.1 No entry should be permitted into excavations exceeding 1.2m depth without appropriate risk assessments, shoring and support. Whilst groundwater was not encountered in significant volumes during site investigation works the presence of a perched water table cannot be precluded. Appropriate provisions should be made to dewater excavations as and when required.



11.0 CONCLUSIONS AND RECOMMENDATIONS

- 11.0.1 The site is to be redeveloped for residential led end uses comprising a 36 storey residential tower and requiring the demolition of all existing structures on site. There is no basement proposed as part of the development although it is understood excavations may need to be locally deepened in the area around the building core to accommodate lift pits and a water storage tank.
- 11.0.2 Site investigations have revealed variable depths of made ground and fluvio-glacial deposits up to 3.60m in thickness overlying the Sherwood Sandstone formation. The sandstone comprises intermittent sand and marl filled fractures with bands of soft, weathered to completely weathered sandstone and marls.
- 10.0.3 Sherwood Sandstone was encountered in all the boreholes and was fine to coarse grained. The level at which the weathered sandstone was encountered across the site was consistent and ranged between 30.00 to 30.49mAOD. All the “window sampler” holes were taken to refusal in weathered Sherwood Sandstone. SPT N values for the weather sandstone ranged from 58 to 94 with an average value of 71. The rotary core holes (BH101-103) were advanced through the sandstone to depths ranging from 25m to 35m below ground level.
- 11.0.4 Chemical assessment of site soils has revealed a localised source of Poly Aromatic Hydrocarbon and Asbestos contamination in the area around window sampler borehole “WS103” (when reviewed against a “Residential without plant uptake” end use scenario. It is recommended demolition and construction contractors take suitable precautions when handling and treating soils across the site with any suspected sources of contamination brought to the immediate attention of RoC Consulting for consideration and comment.
- 11.0.5 Ground gas monitoring works have failed to identify the need for gas protection measures within the new development. This is to be expected given an absence of significant sources of ground gas on or within close proximity to the site.



- 11.0.6 The existing building foundations have been investigated and found to rest predominantly on glaciofluvial sand and gravels at levels circa 29.99 to 30.40mAOD. Similarly the live Network Rail viaduct situated circa 1.5m to the south of the site is also founded on glaciofluvial soils at depths ranging between 29.96 and 30.40mAOD.
- 11.0.7 Although theoretically possible, the adoption of a conventional pad foundation solution is not recommended for the development owing to the excavation depths required to reach competent solid Sandstone (>5m) depths of excavation. Excavations to this level have the potential to undermine the foundations for the nearby railway viaduct and public house and will require significant temporary works, as well as prior approval from Network Rail.
- 11.0.8 In view of these considerations the adoption of a piled foundation solution is recommended and discussions should be held with piling contractors to establish the most cost effective solution. Copies of this sit investigation report should be provided along with all associated appendices. It is considered the use of an augured pile would be best suited to the site although risks posed by vibration to adjacent structures will need to be properly considered by contractors and appropriately mitigated.
- 11.0.9 Network Rail will be required to approve the piling technique in advance of piling works along with the range of monitoring works required on the viaduct. It would also be prudent to undertake a detailed structural survey of all existing structures that fall adjacent the site prior to commencement of demolition / construction works to act as a baseline for future monitoring works
- 11.0.10 Copies of the current report, along with the Phase 1 Desktop Study, should be submitted to the local planning authority for consideration and comment. As required any feedback received from the local authority should be passed back to RoC Consulting for review.



APPENDIX A

SITE DRAWINGS.



Legend

- Water Main
- Water Service
- Gas Main
- Gas Service
- Electricity Main
- Electricity Service
- Telecom Main
- Telecom Service
- Drainage Main
- Drainage Service
- Other Services

Legend

- Water Main
- Water Service
- Gas Main
- Gas Service
- Electricity Main
- Electricity Service
- Telecom Main
- Telecom Service
- Drainage Main
- Drainage Service
- Other Services

Legend

- Water Main
- Water Service
- Gas Main
- Gas Service
- Electricity Main
- Electricity Service
- Telecom Main
- Telecom Service
- Drainage Main
- Drainage Service
- Other Services

UNDERGROUND UTILITIES SERVICES DISCLAIMER

We have endeavored to locate existing services using records provided by the relevant authorities. It is not possible to guarantee the accuracy and reliability of the information provided. The information is provided as a guide only and should not be used for construction without the written approval of Survey Operations Ltd.

Where relevant, the distance has been noted for the services shown on the drawings. Other services are indicated by their color and symbol. The services are shown in the drawings as they are shown on the ground and are not shown as they are shown on the drawings.

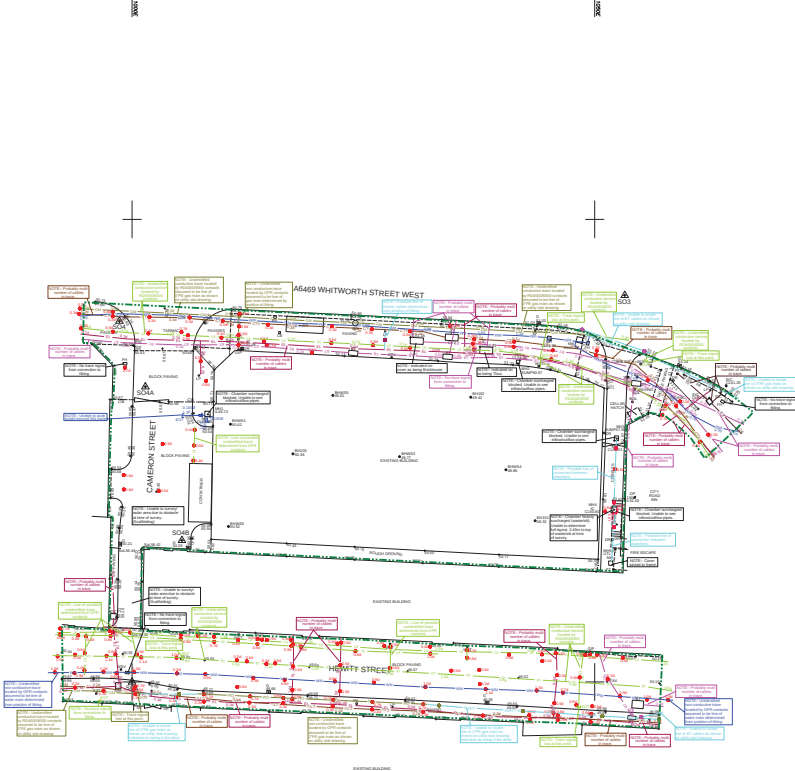
It is the responsibility of the user under health & safety legislation to verify the position of the services shown on the drawings prior to excavation of the services shown.

NOTE 1

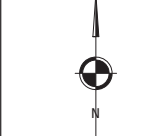
This utility survey has been undertaken using a total station (TS) & a Real Time Kinematic (RTK) GNSS receiver.

NOTE 2

Please refer to the notes on the drawings and sheets as to the accuracy of the information provided. It is not possible to guarantee the accuracy and reliability of the information provided. The information is provided as a guide only and should not be used for construction without the written approval of Survey Operations Ltd.



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Note:
Orientation to a Local Grid.
All levels relate to a Local Datum.
TBM - DBL Value 55.00m
Survey Control Markers established for Mapping purposes only and should not be used for construction without the written approval of Survey Operations Ltd.

Drainage information must be verified with local authority records before use
Utility survey added to topographical survey job number 150236.

SURVEY STATIONS			
Station	Easting	Northing	Height
1	475140.00	56110.00	55.00
2	475140.00	56110.00	55.00
3	475140.00	56110.00	55.00
4	475140.00	56110.00	55.00

Survey Operations

South Street, Salford, Greater Manchester, M6 6PU
Tel: 01695 725662 Fax: 01695 518116
Email: info@surveyops.co.uk - www.surveyops.co.uk

Client
RDC Consulting

Drawing Title
Utility Survey of Land at:
Whitworth Street West
Manchester

Scale(s)	1:200	Surveyor	SF/SC
Date	APR 15	Drawn	IT
Job Number	15C205	Checked	SF/SC/SG

Sheet Size & Dwg Number & Revision
A1 15C205/001

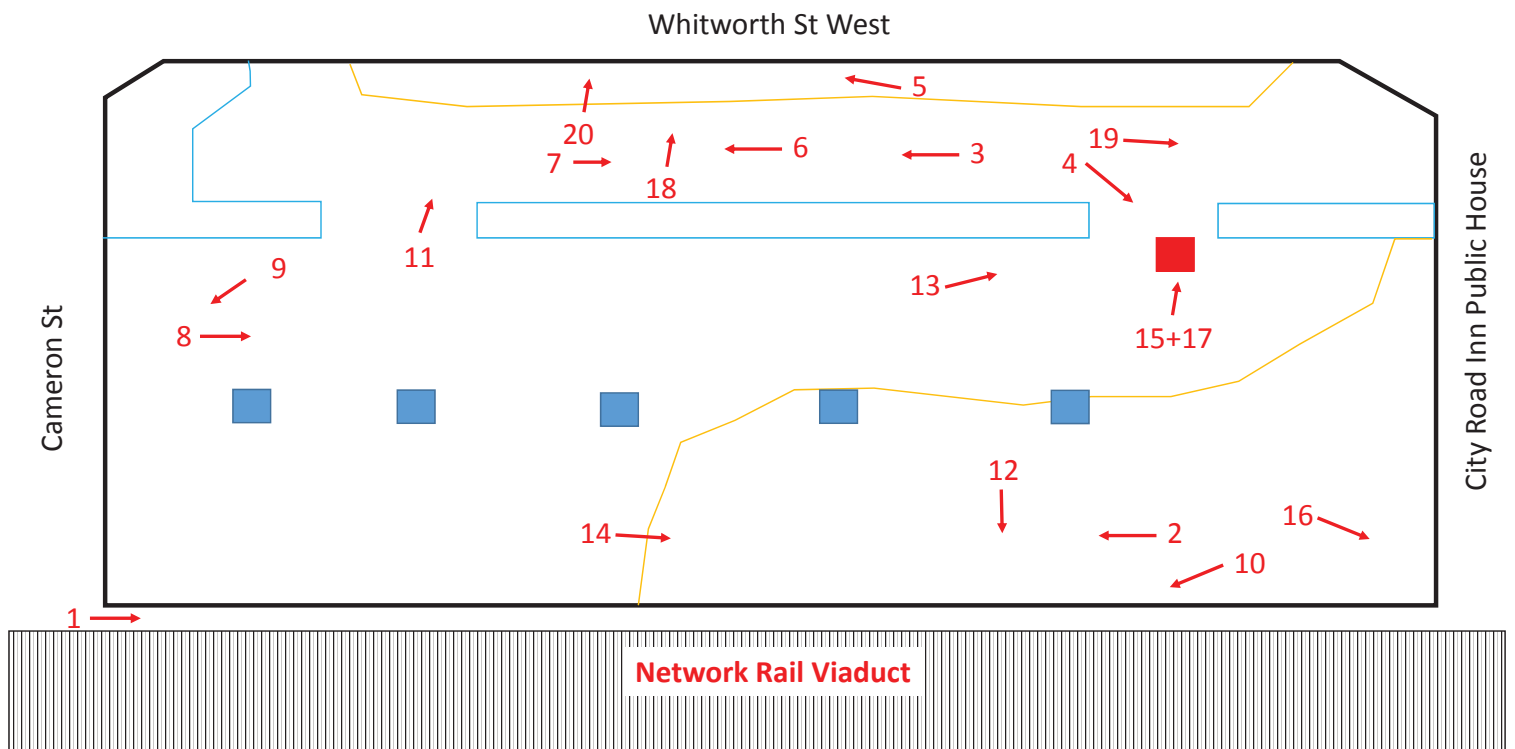


PHOTO 1



PHOTO 2



PHOTO 3



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK02
Sketch Title	Site Photograph 1 to 3
Drawn by:	AS – 12/11/14

PHOTO 4



PHOTO 5



PHOTO 6



	
EARTH SCIENCES DIV SKETCH	
INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK03
Sketch Title	Site Photograph 4 to 6
Drawn by:	AS – 12/11/14

PHOTO 7



PHOTO 8



PHOTO 9

	
EARTH SCIENCES DIV SKETCH	
INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK04
Sketch Title	Site Photograph 7 to 9
Drawn by:	AS – 12/11/14

PHOTO 12



PHOTO 11



PHOTO 10



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK05
Sketch Title	Site Photograph 10 to 12
Drawn by:	AS – 12/11/14

PHOTO 13



PHOTO 15



PHOTO 14



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK06
Sketch Title	Site Photograph 13 to 15
Drawn by:	AS – 12/11/14

PHOTO 16



PHOTO 17



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK07
Sketch Title	Site Photograph 16 & 17
Drawn by:	AS – 12/11/14

PHOTO 19



PHOTO 18



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK08
Sketch Title	Site Photograph 18 to 20
Drawn by:	AS – 12/11/14



PHOTO 20

PHOTOGRAPH NOTES

Photograph ID	Notes
One	Looking east down alleyway and boundary with Network Rail viaduct
Two	Looking west from buildings south eastern corner toward Cameron St
Three	View toward upper floors along Whitworth St Elevation
Four	Looking south east toward column foundation exposure toward eastern elevation
Five	Possible foundation exposure along Whitworth St elevation
Six	Looking west along Whitworth St frontage
Seven	Looking east along Whitworth St frontage
Eight	Looking east through building from Cameron St entrance
Nine	View toward upper floors from Cameron St entrance
Ten	Looking west along northern / Network Rail elevation from the buildings eastern extent
Eleven	Looking north through structure to Whitworth St elevation
Twelve	View toward northern elevation showing possible basement arch features, taken from lower excavated portion to north eastern extent
Thirteen	Looking north east toward internal walls from southern elevation
Fourteen	Looking east along southern elevation toward area of reduced level dig
Fifteen	View toward exposed column indicating founding stratum could possibly comprise glacial fluvial deposits
Sixteen	View toward north eastern corner
Seventeen	Close up of pad foundation shown in Photograph 15
Eighteen	View toward former entrance on Whitworth st to possible foundation exposure, circa 3.4m change in level between entrance and base of exposure
Nineteen	Looking east toward buildings north eastern corner
Twenty	Close up of possible foundation exposure along Whitworth St elevation



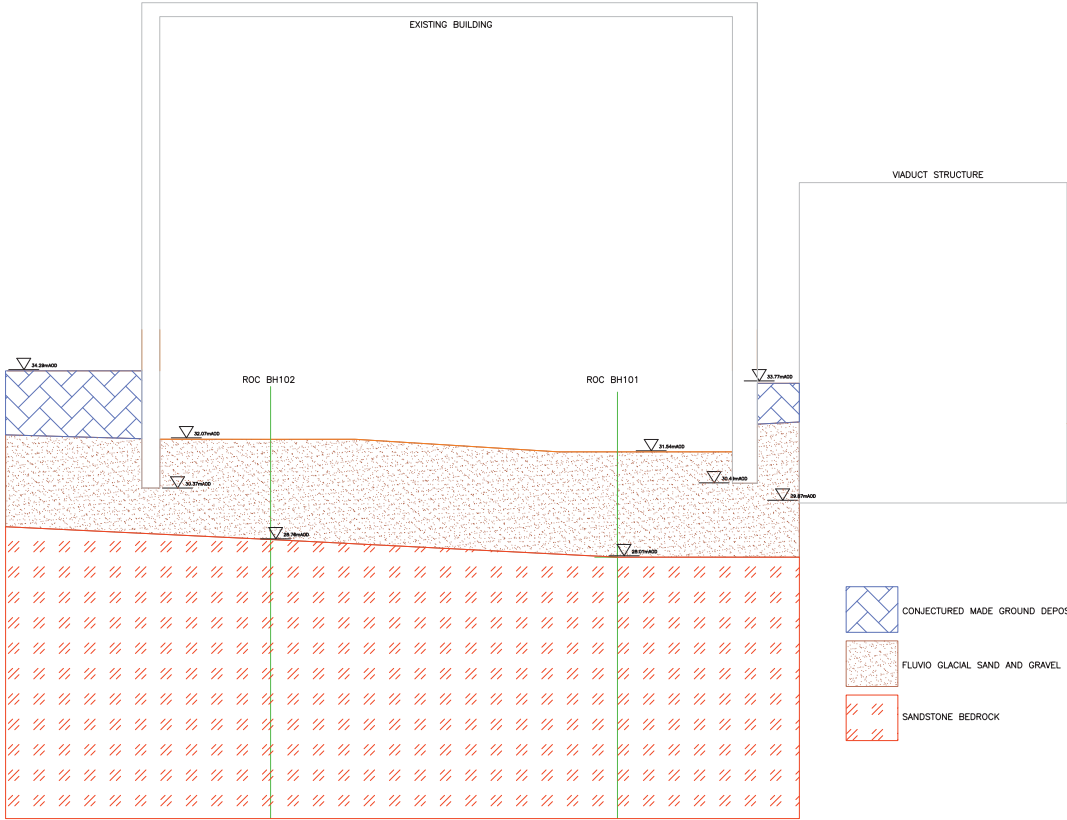
EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St,
Sketch No:	ESK09
Sketch Title	Site Photograph Notes
Drawn by:	AS – 12/11/14

WHITWORTH STREET WEST	10-12 WHITWORTH ST WEST WAREHOUSE	ALLEY	NETWORK RAIL VIADUCT	HEWITT STREET
-----------------------	-----------------------------------	-------	----------------------	---------------

50.00m AOD
49.00m AOD
48.00m AOD
47.00m AOD
46.00m AOD
45.00m AOD
44.00m AOD
43.00m AOD
42.00m AOD
41.00m AOD
40.00m AOD
39.00m AOD
38.00m AOD
37.00m AOD
36.00m AOD
35.00m AOD
34.00m AOD
33.00m AOD
32.00m AOD
31.00m AOD
30.00m AOD
29.00m AOD
28.00m AOD
27.00m AOD
26.00m AOD
25.00m AOD
24.00m AOD
23.00m AOD
22.00m AOD
21.00m AOD
20.00m AOD
19.00m AOD
18.00m AOD
17.00m AOD
16.00m AOD
15.00m AOD
14.00m AOD
13.00m AOD
12.00m AOD
11.00m AOD
10.00m AOD
9.00m AOD
8.00m AOD
7.00m AOD
6.00m AOD
5.00m AOD
4.00m AOD
3.00m AOD
2.00m AOD
1.00m AOD
0.00m AOD



ROC BH102
CONTINUED TO
2.11m AOD.
SANDSTONE REPORTED

ROC BH101
CONTINUED TO
-3.47m AOD.
SANDSTONE REPORTED

- CONJECTURED MADE GROUND DEPOSITS
- FLUVIO GLACIAL SAND AND GRAVEL DEPOSITS
- SANDSTONE BEDROCK

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- NOTES
- DRAWING NOTES
- 1) BENCHMARKS AND TRAIL PITS SHOWN AT APPROXIMATE LOCATIONS.
- 2) GROUND CONDITIONS SHOWN ON THIS DRAWING HAVE BEEN TAKEN FROM RECORDS OBTAINED DURING THE 2015 ROC CONSULTING SITE INVESTIGATION.
- 3) THE GEOLOGICAL CROSS SECTION IS INTERPOLATED BASED ON THE FINDINGS OF THESE INVESTIGATIONS. ACTUAL GROUND CONDITIONS MAY VARY LOCALLY BEYOND THE SITE AND THIS SECTION SHOULD ONLY BE CONSIDERED INDICATIVE.
- 4) DETAILS REGARDING FOUNDATION CONSTRUCTION WITHIN BOTH THE EXISTING BUILDING AND VIADUCT STRUCTURE ARE BASED ON OBSERVATIONS MADE DURING THE COURSE OF SITE INVESTIGATION FIELDWORKS.
- 5) REFER TO ROC CONSULTING DRAWING ES101 FOR GEOLOGICAL CROSS SECTION LOCATION.

REV	DATE	DETAILS	DRN	CHK
-----	------	---------	-----	-----

INFORMATION

B&B CONSULTING
Civil & Structural Engineers
6 Commercial Street, Manchester,
M2 4PZ
Tel: 0161 234 5390

OWNER	DATE	SCALE
AS	FEB 2019	MKS
CHECKED	DATE	BY
AS / JB	FEB 2019	JB
APPROV	DATE	SCALE
AS / JB	FEB 2019	MKS

CLIENT: BRIGANTES LTD

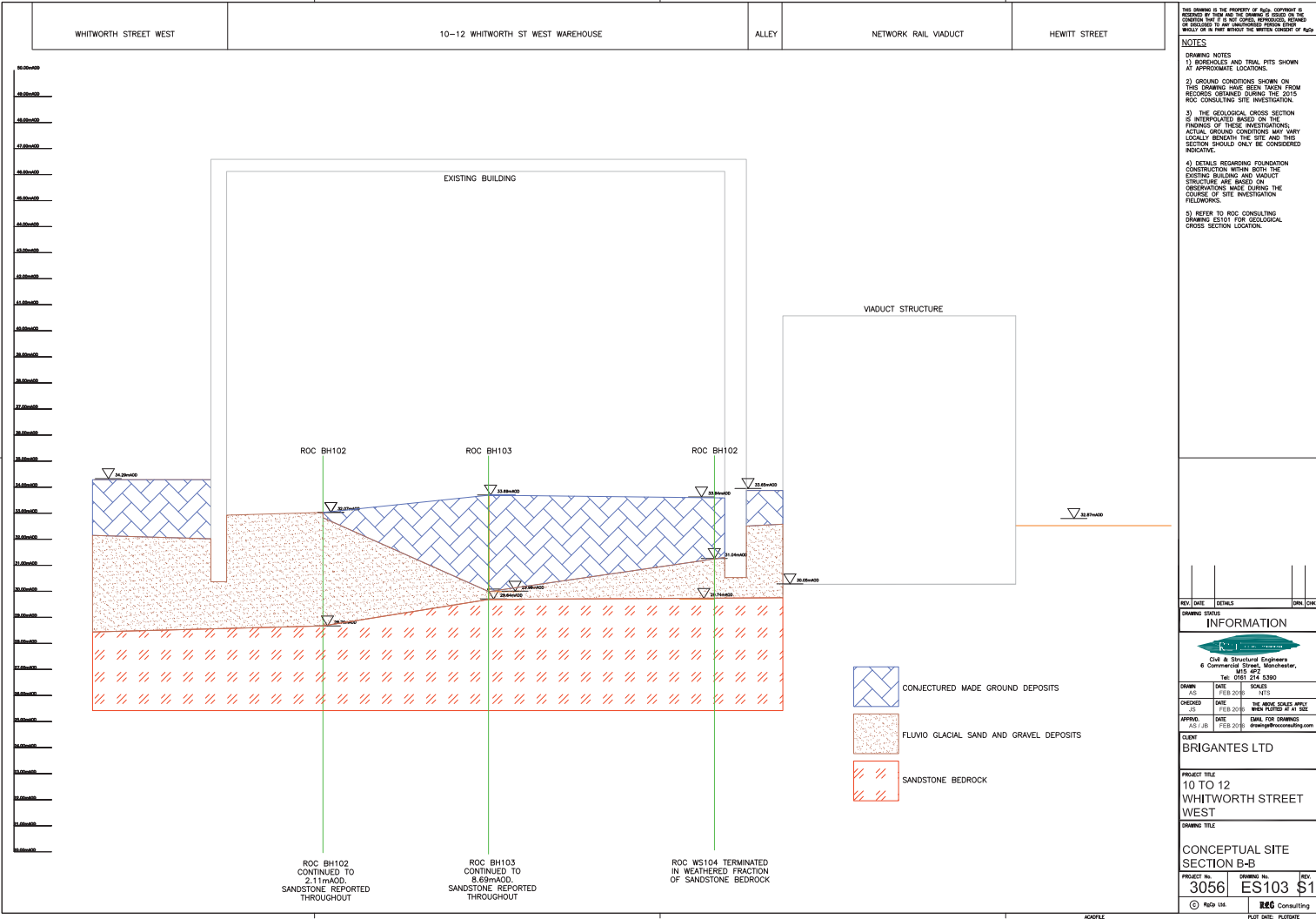
PROJECT TITLE:
10 TO 12
WHITWORTH STREET
WEST

DRAWING TITLE:
CONCEPTUAL SITE
SECTION A-A

PROJECT No.	DATE No.	REV
3056	ES102	\$1

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PLT DATE: 15/02/2019



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NOTES

DRAWING NOTES

1) BENCHMARKS AND TRUE PITS SHOWN AT APPROPRIATE LOCATIONS.

2) GROUND CONDITIONS SHOWN ON THIS DRAWING HAVE BEEN TAKEN FROM RECORDS OBTAINED DURING THE 2015 ROC CONSULTING SITE INVESTIGATION.

3) THE GEOLOGICAL CROSS SECTION IS INTERPOLATED BASED ON THE FINDINGS OF THESE INVESTIGATIONS. ACTUAL GROUND CONDITIONS MAY VARY LOCALLY BEYOND THE SITE AND THIS SECTION SHOULD ONLY BE CONSIDERED INDICATIVE.

4) DETAILS REGARDING FOUNDATION CONSTRUCTION WITHIN BOTH THE EXISTING BUILDING AND VIADUCT STRUCTURE ARE BASED ON OBSERVATIONS MADE DURING THE COURSE OF SITE INVESTIGATION FIELDWORK.

5) REFER TO ROC CONSULTING DRAWING ES101 FOR GEOLOGICAL CROSS SECTION LOCATION.

REV	DATE	DETAILS	DRN	CHK

DRAWING STATUS

INFORMATION


Civil & Structural Engineers
6 Commercial Street, Manchester, M2 4PZ
Tel: 0161 214 5300

DRAWN	DATE	SCALE
AS	FEB 2019	MKS

CHECKED	DATE	BY	THE ABOVE SCALE APPLIES WHEN PLOTTED AT 1:100
AS	FEB 2019		

APPROVED	DATE	FOR DRAWINGS
AS	FEB 2019	drawings@bconsulting.com

CUSTOMER

BRIGANTES LTD

PROJECT TITLE

10 TO 12 WHITWORTH STREET WEST

DRAWING TITLE

CONCEPTUAL SITE SECTION B-B

PROJECT No.	Drawing No.	REV
3056	ES103	\$1

©	Rev	100	B&B Consulting	PLT	DATE	PLT/DATE

APPENDIX B

EXPLORATORY HOLE LOGSHEETS.



ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH101	
Job No 3056	Date 23-02-15 26-02-15	Ground Level (m) 31.53	Co-Ordinates ()		
Contractor GSS Ltd				Sheet 1 of 5	

RUN DETAILS							STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	SPT N	Min Av	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
Date	RQD	FI (mm)	Max				Discontinuities	Detail	Main		
23-02-00				28.01		3.52					
	85.67 (72.33) 64.00	210 310 440				(1.57)	3.84 ...clayey sand filled fracture, 55deg planar 4.12 - 4.18 ...band of highly / completely weathered Sandstone, recovered as fine to coarse Sand band.		Reddish orange thickly bedded fine to coarse grained SANDSTONE. (SHERWOOD SANDSTONE)		
				26.44		5.09	4.86 ...sand filled fracture				
				26.22		5.31			Dark reddish brown MUDSTONE. (MANCHESTER MARLS)		
				26.13		5.40	5.54 ...sand filled fracture		Light grey SILTSTONE band, 60deg planar. (SILTSTONE)		
6.00							6.02 - 6.34 ...band of poorly cemented Sandstone with frequent sand filled fracturing, fractures vary from vertical to 70deg planar with occasional fine to medium subrounded gravel inclusions.		Reddish orange thickly bedded fine to coarse grained SANDSTONE. (SHERWOOD SANDSTONE)		
23-02		NI NI NI					7.05 ...sand filled fracture				
	92.33 (79.33) 79.33										
9.00											
23-02											
	95.00 (95.00) 93.33	600 1102 1900									

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	
									water	100	No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											
All dimensions in metres Scale 1:50			Client Brigantes Ltd			Method/ Plant Used Premier Compact 210				Logged By AS	

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH101	
Job No 3056	Date 23-02-15 26-02-15	Ground Level (m) 31.53	Co-Ordinates ()		
Contractor GSS Ltd				Sheet 2 of 5	

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	SPT N	Min Av	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
Date	RQD	Fl (mm)	Max				Discontinuities	Detail		
12.00 23-02							11.22 ...sand filled fracture, 63deg planar			
	89.67 (87.67) 81.00						12.86clayey sand infilled fracture 12.95 - 13.08 ...band of dark red Mudstone			
15.00 23-02							14.54 - 14.59 ...sand filled fracture			
	95.00 (83.33) 83.33						15.26 ...sand filled fracture			
18.00 23-02							16.10 - 16.17 ...band of dark red Mudstone			
		210 876 2020					18.08 ...sand filled fracture			

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
23-02-15	16.00	15.00	3.00								No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											
All dimensions in metres Scale 1:50		Client Brigantes Ltd				Method/ Plant Used Premier Compact 210					Logged By AS

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH101	
Job No 3056	Date 23-02-15 26-02-15	Ground Level (m) 31.53	Co-Ordinates ()		
Contractor GSS Ltd				Sheet 3 of 5	

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	SPT N	Min Av	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
Date	RQD	FI (mm)	Max			Discontinuities	Detail	Main		
	98.00 (94.33) 91.00					(29.60)	18.87 - 19.00 ...band of poorly cemented Sandstone with frequent sand filled fracturing, fractures vary from vertical to 90deg planar with occasional fine to medium subrounded gravel inclusions.			
21.00 23-02						20.54 ...clay filled fracture				
	95.33 (95.33) 91.67					21.82 - 21.89 ...band of dark red Mudstone				
24.00 23-02		590 1330 2100				22.68 - 22.77 ...band of poorly cemented Sandstone, recovered as clayey gravelly sand. 23.11 - 23.18 ...band of dark red Mudstone 23.33 ...sand filled fracture				
	98.33 (98.33) 92.67						26.15 - 26.30 ...band of dark red Mudstone			
27.00						26.85 ...sand filled fracture, 65deg				

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	
											No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											
All dimensions in metres Scale 1:50			Client Brigantes Ltd			Method/ Plant Used Premier Compact 210				Logged By AS	

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH101
Job No 3056	Date 23-02-15 26-02-15	Ground Level (m) 31.53	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 4 of 5

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	SPT N Fl (mm)	Min Av Max	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
							Discontinuities	Detail		
23-02							planar			
	94.00 (94.00) 89.00						28.44 - 28.54 ...sub vertical sand filled fracture, 70deg planar			
30.00										
23-02										
	97.67 (97.67) 94.67	1370 1623 2000					31.51 ...red Marl filled fracture			
33.00										
23-02										
	99.67 (99.67) 99.67									
35.00				-3.47		35.00				

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS	
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns		
24-02-15	16.00	28.00	3.00									
25-02-15	14.30	35.00	3.00								No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.	
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm												
All dimensions in metres Scale 1:50		Client Brigantes Ltd				Method/ Plant Used Premier Compact 210					Logged By AS	

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH101
Job No 3056	Date 23-02-15 26-02-15	Ground Level (m) 31.53	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 5 of 5

RUN DETAILS						STRATA		Geology	Instrument/ Backfill	
Depth	TCR (SCR) RQD	SPT N Fl (mm)	Min Av Max	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
Date							Discontinuities			Detail
							Borehole terminated at 35.0mbgl			

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
											No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											
All dimensions in metres Scale 1:50			Client Brigantes Ltd				Method/ Plant Used Premier Compact 210				Logged By AS

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3 1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH102
Job No 3056	Date 27-02-15 10-03-15	Ground Level (m) 32.11	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 1 of 4

RUN DETAILS						STRATA		Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	SPT N Fl (mm)	Min Av Max	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION		
							Discontinuities Detail Main		
10-03-00				28.76		3.35			
	99.00 (92.33) 92.33	2777 2777 2777							
6.00									
10-03		NI NI NI					6.00 - 6.15 ...band of highly / completely weathered material, recovered clayey sand		
	95.00 (95.00) 95.00								
9.00		270 1925 2730							
10-03									
	98.00 (98.00) 97.33								

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
									water	100%	No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											
All dimensions in metres Scale 1:50			Client Brigantes Ltd				Method/ Plant Used Premier Compact 210				Logged By AS

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3 1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH102
Job No 3056	Date 27-02-15 10-03-15	Ground Level (m) 32.11	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 2 of 4

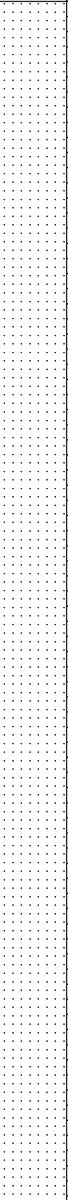
RUN DETAILS						STRATA			Geology	Instrument/ Backfill	
Depth	TCR (SCR)	SPT N	Min Av	Red'cd	Depth	DESCRIPTION					
Date	RQD	Fl (mm)	Max	Level	Legend	(Thick- ness)	Discontinuities	Detail			Main
12.00 10-03							10.90 - 11.10 ...band of red marl				
							11.95 ...marl filled fracture 12.00 - 12.05 ...band of very soft highly weathered red marl 12.35 ...band of very soft highly weathered red marl				
15.00 10-03	98.67 (98.67) 98.67										
18.00 10-03	100.00 (100.00) 100.00						(26.65)				

Drilling Progress and Water Observations								Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing		From	To	Type	Returns	
10-03-15	16.00	15.00	2.00									No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm												
All dimensions in metres Scale 1:50			Client Brigantes Ltd				Method/ Plant Used Premier Compact 210				Logged By AS	

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH102	
Job No 3056	Date 27-02-15 10-03-15	Ground Level (m) 32.11	Co-Ordinates ()		
Contractor GSS Ltd				Sheet 3 of 4	

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	SPT N	Min Av	Red'cd	Depth	DESCRIPTION				
Date	RQD	Fl (mm)	Max	Level	Legend	(Thick- ness)	Discontinuities	Detail		
	95.00 (95.00) 91.67	350 2403 3000					20.65 - 20.85 ...band of highly / completely weathered material, recovered clayey sand			
21.00										
10-03										
	99.33 (99.33) 99.33									
24.00										
10-03										
	96.67 (96.67) 96.67									
27.00							26.55 ...sand filled fracture.			

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
All dimensions in metres Scale 1:50			Client Brigantes Ltd			Method/ Plant Used Premier Compact 210				Logged By AS	

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH102
Job No 3056	Date 27-02-15 10-03-15	Ground Level (m) 32.11	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 4 of 4

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	SPT N	Min Av	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
Date	RQD	FI (mm)	Max				Discontinuities	Detail		
10-03	95.00 (93.00) 73.00						29.60 - 30.00 ...highly fractured zone			
30.00				2.11		30.00	Borehole terminated at 30.0mbgl			

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS	
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns		
11-03-15	16.00	30.00	2.00								No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.	
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm												
All dimensions in metres Scale 1:50			Client Brigantes Ltd				Method/ Plant Used Premier Compact 210				Logged By AS	

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH103	
Job No 3056	Date 11-02-15 12-03-15	Ground Level (m) 33.69	Co-Ordinates ()		
Contractor GSS Ltd				Sheet 1 of 3	

RUN DETAILS							STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	SPT N	Min Av	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
Date	RQD	FI (mm)	Max				Discontinuities	Detail	Main		
11-03-15				29.99		3.70					
	96.00 (54.00) 54.00			29.14		(0.85) 4.55			Fine to coarse orangey red gravelly SAND. Gravel is fine to coarse, subangular to angular, of Sandstone. (WEATHERED SANDSTONE)		
									Reddish orange thickly bedded fine to coarse grained SANDSTONE. (SHERWOOD SANDSTONE)		
6.00											
11-03							6.83 - 7.03 ...Band of completely weathered Sandstone				
	98.67 (92.33) 92.33						7.48 ...Sand filled fracture				
							7.75 ...Sand filled fracture				
9.00											
11-03											
			1230 1800 3000								
	98.33 (98.33) 87.00						10.65 ...sand filled fracture 45 deg planar				
							10.87 ...sand filled fracture, 60 deg planar				

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS	
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns		
11-03-15	16.00	8.00	3.50						water	100	No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.	
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm												
All dimensions in metres Scale 1:50			Client Brigantes Ltd				Method/ Plant Used Premier Compact 210				Logged By AS	

ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH103
Job No 3056	Date 11-02-15 12-03-15	Ground Level (m) 33.69	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 2 of 3

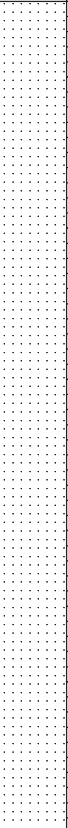
RUN DETAILS							STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	SPT N	Min Av	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
Date	RQD	Fl (mm)	Max				Discontinuities	Detail	Main		
12.00											
11-03							11.95 - 12.05 ...band of weathered Sandstone				
	98.67 (98.67) 90.00						13.23 ...Sand filled fracture 13.47 ...Sand filled fracture				
15.00						(20.45)	14.50 - 14.55 ...band of dark red Mudstone				
11-03							15.15 ...sand filled fracture				
	99.00 (99.00) 90.33						17.55 ...sand filled fracture 30 deg planar 17.75 ...sand filled fracture				
18.00							18.50 ...marl filled fracture 18.65 - 18.72 ...Band of completely weathered Sandstone				
11-03											
	99.33										

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Standing	From	To	Type	Returns	
											No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											
All dimensions in metres Scale 1:50			Client Brigantes Ltd			Method/ Plant Used Premier Compact 210				Logged By AS	

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16

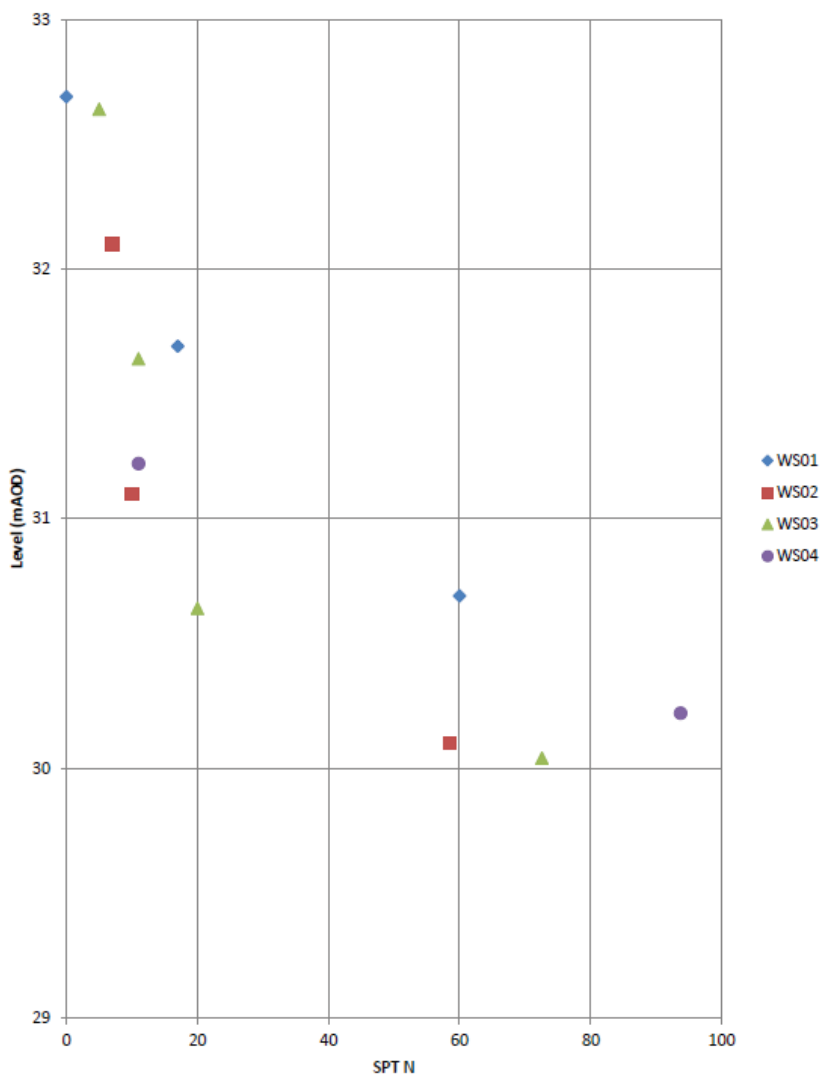
ROTARY CORE BOREHOLE LOG

Project 10-12 Whitworth St West				DRILLHOLE No BH103
Job No 3056	Date 11-02-15 12-03-15	Ground Level (m) 33.69	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 3 of 3

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR) RQD	SPT N FI (mm)	Min Av Max	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
Date							Discontinuities	Detail		
	(97.33) 94.00		500 1600 2460							
21.00 11-03										
	98.33 (98.33) 94.33									
24.00 11-03										
	96.67 (96.67) 96.67									
25.00				8.69		25.00	...Borehole terminated at 25.00mbgl			

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
12-03-15	15.30	25.00	3.50								No groundwater strikes / ingress noted during drilling. Borehole progressed to rockhead using Rotary Auger bit.
TCR, SCR and RQD shown as % of total core run Max, Ave and Min Fracture Index shown in mm											
All dimensions in metres Scale 1:50			Client Brigantes Ltd			Method/ Plant Used Premier Compact 210				Logged By AS	

AGS3 UK DH 3056 BH LOGS.GPJ AGS 3_1.GDT 15/4/16



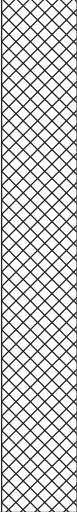
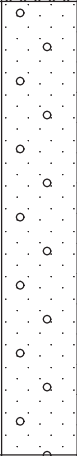
EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	GT01
Sketch Title	SPT Vrs Depth Plot
Drawn by:	AS

WINDOW SAMPLER BOREHOLE LOG

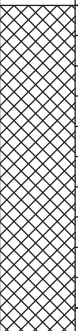
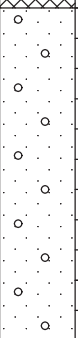
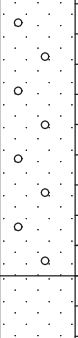
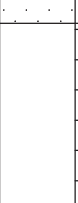
Project 10-12 Whitworth St West				BOREHOLE No WS01
Job No 3056	Date 26-02-15 26-02-15	Ground Level (m) 33.69	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.50-0.80	MG1	N0				(1.70)	Very loose light brown very gravelly SAND. Gravel is fine to coarse and subangular to angular of mixed demolition type fill material including brick, concrete and limestone. Increased topsoil content also noted. (MADE GROUND)		
1.00-1.45	SPT1			31.99		1.70			
2.00-2.45	SPT2	N17				(1.50)	Medium dense dark brown, becoming light brown with depth, gravelly SAND. Gravel is fine to coarse and subrounded to subangular of mixed fluvio-glacial type deposits. (GLACIAL TILL).		
3.00-3.45	SPT3	N50/ 375mm		30.49		3.20	Dense reddish orange SAND. (WEATHERED SANDSTONE)		
				30.19	(0.30) 3.50	Borehole terminated at 3.35m due to refusal on weathered Sandstone bedrock.			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Water Strikes Standing	Final	From	To	Hours	From	To	
											No groundwater strikes / ingress noted during drilling

WINDOW SAMPLER BOREHOLE LOG

Project 10-12 Whitworth St West				BOREHOLE No WS02	
Job No 3056	Date 26-02-15 26-02-15	Ground Level (m) 33.10	Co-Ordinates ()		
Contractor GSS Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.20-0.80	MG1					(1.10)	Very loose light brown very gravelly SAND. Gravel is fine to coarse and subangular to angular of mixed demolition type fill material including brick, concrete and limestone. Increased topsoil content also noted. (MADE GROUND)		
1.00-1.45	SPT1	N7		32.00		1.10			
2.00-2.45	SPT2	N10				(2.00)	Medium dense dark brown, becoming light brown with depth, gravelly SAND. Gravel is fine to coarse and subrounded to subangular of mixed fluvio-glacial type deposits. (GLACIAL TILL).		
3.00-3.45	SPT3	N50/ 385mm		30.00		3.10			
				29.72		(0.28) 3.38	Dense reddish orange SAND. (WEATHERED SANDSTONE)		
							Borehole terminated at 3.38m due to refusal on weathered Sandstone bedrock.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Water Strikes Standing	Final	From	To	Hours	From	To	
											No groundwater strikes / ingress noted during drilling

All dimensions in metres Scale 1:25	Client Brigantes Ltd	Method/ Plant Used Competitor WS Rig	Logged By AS
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WINDOW SAMPLER BOREHOLE LOG

Project 10-12 Whitworth St West				BOREHOLE No WS03	
Job No 3056	Date 26-02-15 26-02-15	Ground Level (m) 33.64	Co-Ordinates ()		
Contractor GSS Ltd				Sheet 1 of 1	

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)		
1.00-1.45	SPT1	N5				(2.60)		
2.00-2.45	SPT2	N11						
3.00-3.45	SPT3	N20		31.04		(1.00)		
3.60-3.91	SPT4	N50/ 310mm		30.04		(0.30)		
				29.74		3.90		

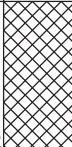
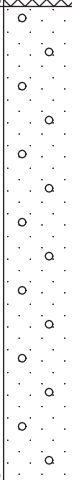
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Water Strikes Standing	Final	From	To	Hours	From	To	
											No groundwater strikes / ingress noted during drilling

All dimensions in metres Scale 1:28.125	Client Brigantes Ltd	Method/ Plant Used Competitor WS Rig	Logged By AS
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AGS3 UK WS 3056 BH LOGS.GPJ AGS 3.1.GDT 15/4/16

WINDOW SAMPLER BOREHOLE LOG

Project 10-12 Whitworth St West				BOREHOLE No WS04
Job No 3056	Date 26-02-15 26-02-15	Ground Level (m) 32.22	Co-Ordinates ()	
Contractor GSS Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
1.00-1.45	SPT1	N11		31.72		0.50 (0.50)	Very loose light brown very gravelly SAND. Gravel is fine to coarse and subangular to angular of mixed demolition type fill material including brick, concrete and limestone. (MADE GROUND)		
						(1.60)	Medium dense dark brown, becoming light brown with depth, gravelly SAND. Gravel is fine to coarse and subrounded to subangular of mixed fluvio-glacial type deposits. (GLACIAL TILL).		
2.00-2.24	SPT2	N50/ 240mm		30.12		2.10			
				29.98		2.24	Dense reddish orange SAND. (WEATHERED SANDSTONE)		
							Borehole terminated at 2.24m due to refusal on weathered Sandstone bedrock.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Water Strikes Standing	Final	From	To	Hours	From	To	
											No groundwater strikes / ingress noted during drilling

All dimensions in metres Scale 1:25	Client Brigantes Ltd	Method/ Plant Used Competitor WS Rig	Logged By AS
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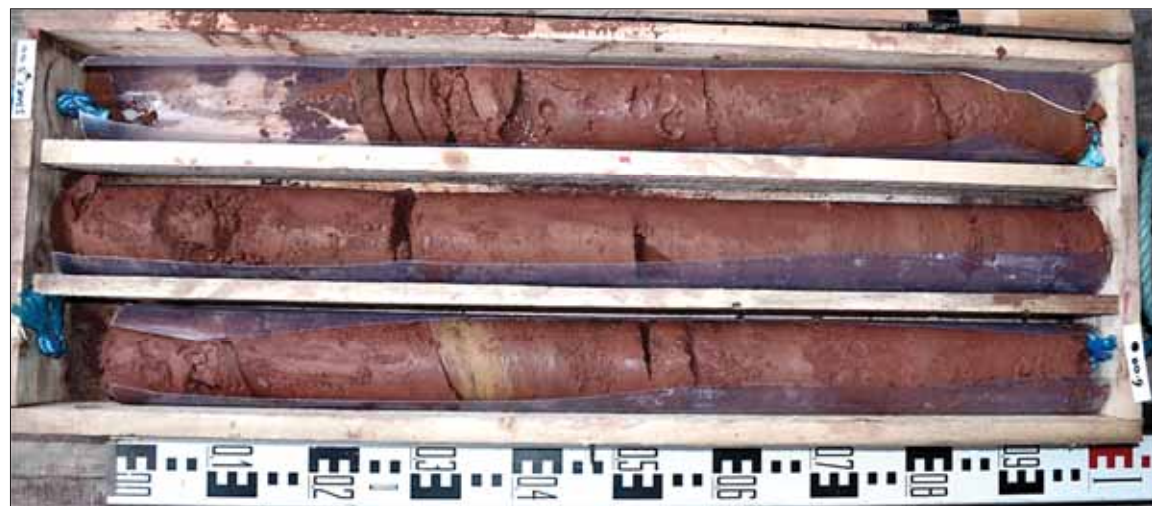
AGS3 UK WS 3056 BH LOGS.GPJ AGS 3 1.GDT 15/4/16

APPENDIX C

BH101 TO 103 ROCK CORE PHOTOGRAPHS.



BH101 Core Run 1: 3.0 to 6.0m



BH101 Core Run 2: 6.0 to 9.0m



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP101-1
Sketch Title	Rock Core Photos: Runs 1-2
Drawn by:	AS – 16/03/15

BH101 Core Run 3: 9.0 to 12.0m



BH101 Core Run 4: 12.0 to 15.0m



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP101-2
Sketch Title	Rock Core Photos: Runs 3-4
Drawn by:	AS – 16/03/15

BH101 Core Run 5: 15.0 to 18.0m



BH101 Core Run 6: 18.0 to 21.0m



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP101-3
Sketch Title	Rock Core Photos: Runs 5-6
Drawn by:	AS – 16/03/15

BH101 Core Run 7: 21.0 to 24.0m



BH101 Core Run 8: 24.0 to 27.0m



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP101-4
Sketch Title	Rock Core Photos: Runs 7-8
Drawn by:	AS – 16/03/15

BH101 Core Run 9: 27.0 to 30.0m



BH101 Core Run 10: 30.0 to 33.0m



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP101-5
Sketch Title	Rock Core Photos: Runs 9-10
Drawn by:	AS – 16/03/15

BH101 Core Run 11: 33.0 to 35.0m



	
EARTH SCIENCES DIV SKETCH	
INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP101-6
Sketch Title	Rock Core Photos: Run 11
Drawn by:	AS – 16/03/15

BH102 Core Run 1: 3.0 to 6.0m



BH102 Core Run 2: 6.0 to 9.0m



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP102-1
Sketch Title	Rock Core Photos: Runs 1-2
Drawn by:	AS – 16/03/15

BH102 Core Run 3: 9.0 to 12.0m



BH102 Core Run 4: 12.0 to 15.0m



 EARTH SCIENCES DIV SKETCH	
INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP102-2
Sketch Title	Rock Core Photos: Runs 3-4
Drawn by:	AS – 16/03/15

BH102 Core Run 5: 15.0 to 18.0m



BH102 Core Run 6: 18.0 to 21.0m



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP102-3
Sketch Title	Rock Core Photos: Runs 5-6
Drawn by:	AS – 16/03/15

BH102 Core Run 7: 21.0 to 24.0m



BH102 Core Run 8: 24.0 to 27.0m



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP102-4
Sketch Title	Rock Core Photos: Runs 7-8
Drawn by:	AS – 16/03/15

BH102 Core Run 9: 27.0 to 30.0m



	
EARTH SCIENCES DIV SKETCH	
INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP102-5
Sketch Title	Rock Core Photos: Run 9
Drawn by:	AS – 16/03/15

BH103 Core Run 1: 3.5 to 6.0m



BH103 Core Run 2: 6.0 to 9.0m



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP103-1
Sketch Title	Rock Core Photos: Runs 1-2
Drawn by:	AS – 16/03/15

BH103 Core Run 3: 9.0 to 12.0m



BH103 Core Run 4: 12.0 to 15.0m



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP103-2
Sketch Title	Rock Core Photos: Runs 3-4
Drawn by:	AS – 16/03/15

BH103 Core Run 5: 15.0 to 18.0m



BH103 Core Run 6: 18.0 to 21.0m



EARTH SCIENCES DIV SKETCH

INFORMATION

Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP103-3
Sketch Title	Rock Core Photos: Runs 5-6
Drawn by:	AS – 16/03/15

BH103 Core Run 7: 21.0 to 24.0m



BH103 Core Run 8: 24.0 to 25.0m



 EARTH SCIENCES DIV SKETCH	
INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	CP103-4
Sketch Title	Rock Core Photos: Runs 7-8
Drawn by:	AS – 16/03/15

APPENDIX D

CHEMICAL TESTING RESULTS.





Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 459380-1

Date of Report: 11-Mar-2015

Customer: RoC Consulting
Commercial Wharf
6 Commercial Street
Manchester
M15 4PZ

Customer Contact: Mr Alex Smiles

Customer Job Reference: 3056

Customer Purchase Order: 936

Customer Site Reference: 10 to 12 Whitworth St

Date Job Received at SAL: 27-Feb-2015

Date Analysis Started: 02-Mar-2015

Date Analysis Completed: 11-Mar-2015

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
Emma Spear
Project Management

Issued by :
Emma Spear
Project Management

Waste Acceptance Criteria

Customer Sample Reference : WS03

SAL Sample Reference : 459380 003

Project Site : 10 to 12 Whitworth St

Customer Reference : 3056

Bottom Depth : 1.5

Top Depth : 1.0

Date Sampled : 26-FEB-2015

Type : Sandy Soil

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
pH	Probe			M	8.1		> 6.0	
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
PCB EC7 (Sum)	Calc	0.014	mg/kg	U	⁽⁹⁾ <0.014	1.0		
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	3.2			
Coronene	GC/MS	0.1	mg/kg	N	6.5			
PAH (Sum)	Calc	1.6	mg/kg	N	1500	100.0		
Loss on Ignition	Grav	0.1	%	N	8.0			10.0
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	2800	500.0		
Total Organic Carbon	OX/IR	0.1	%	N	5.2	3.0	5.0	6.0
Data Holder for BS EN 12457-2 (10:1)	Process			N				
pH	Probe			M			> 6.0	

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	0.016	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	0.013	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	0.26	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	0.00021	0.04	1.0	5.0
Chloride	Calc (W)	10	mg/kg	N	66	800.0	15000.0	25000.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	0.021	2.0	50.0	100.0
Dissolved Organic Carbon	Calc	10	mg/kg	N	91	500.0	800.0	1000.0
Fluoride	Calc (W)	0.50	mg/kg	N	<0.50	10.0	150.0	500.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	0.073	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	0.024	0.4	10.0	40.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	0.016	0.1	0.5	7.0
Sulphate	Calc (W)	5	mg/kg	N	4200	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc WAC ICP/MS	1000	mg/kg	N	5300	4000.0	60000.0	100000.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	0.036	4.0	50.0	200.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

* Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013

SAL Reference: 459380											
Project Site: 10 to 12 Whitworth St											
Customer Reference: 3056											
Soil											
Analysed as Soil											
MCERTS Preparation											
SAL Reference		459380 001		459380 002		459380 003		459380 004		459380 005	
Customer Sample Reference		WS01		WS02		WS03		WS03		WS04	
Test Sample		AR		AR		AR		AR		AR	
Bottom Depth		0.8		0.8		1.5		2.0		1.2	
Top Depth		0.5		0.2		1.0		1.5		0.8	
Date Sampled		26-FEB-2015		26-FEB-2015		26-FEB-2015		26-FEB-2015		26-FEB-2015	
Type		Sandy Soil		Sandy Soil		Sandy Soil		Sandy Soil		Sandy Soil	
Determinand		Method		LOD		Units		Symbol			
Moisture @ 105 C		Grav (1 Dec) (105 C)		0.1		%		N		8.2	
										4.0	
										12	
										9.9	
										8.0	

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil MCERTS Preparation					
SAL Reference		459380 006			
Customer Sample Reference		WS05			
Test Sample		AR			
Bottom Depth		0.8			
Top Depth		0.2			
Date Sampled		26-FEB-2015			
Type		Sandy Soil			
Determinand	Method	LOD	Units	Symbol	
Moisture @ 105 C	Grav (1 Dec) (105 C)	0.1	%	N	3.5

SAL Reference: 459380															
Project Site: 10 to 12 Whitworth St															
Customer Reference: 3056															
Soil		Analysed as Soil													
Asbestos ID															
SAL Reference				459380 001		459380 002		459380 003		459380 005		459380 006			
Customer Sample Reference				WS01		WS02		WS03		WS04		WS05			
Test Sample				AR		AR		AR		AR		AR			
Bottom Depth				0.8		0.8		1.5		1.2		0.8			
Top Depth				0.5		0.2		1.0		0.8		0.2			
Date Sampled				26-FEB-2015		26-FEB-2015		26-FEB-2015		26-FEB-2015		26-FEB-2015			
Type				Sandy Soil		Sandy Soil		Sandy Soil		Sandy Soil		Sandy Soil			
Determinand		Method	LOD	Units	Symbol										
Asbestos ID		PLM			SU	N.D.		N.D.		Amosite Fibres Detected	-	N.D.		N.D.	

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil BTEX					
SAL Reference				459380 003	
Customer Sample Reference				WS03	
Test Sample				M105	
Bottom Depth				1.5	
Top Depth				1.0	
Date Sampled				26-FEB-2015	
Type				Sandy Soil	
Determinand	Method	LOD	Units	Symbol	
Benzene	GC/MS(Head Space)(MCERTS)	10	µg/kg	M	(13) <10
Toluene	GC/MS(Head Space)(MCERTS)	10	µg/kg	M	<10
EthylBenzene	GC/MS(Head Space)(MCERTS)	10	µg/kg	M	<10
Meta/Para-Xylene	GC/MS(Head Space)(MCERTS)	10	µg/kg	M	<10
Ortho-Xylene	GC/MS(Head Space)(MCERTS)	10	µg/kg	M	13

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil Total Petroleum Hydrocarbons					
SAL Reference				459380 003	
Customer Sample Reference				WS03	
Test Sample				AR	
Bottom Depth				1.5	
Top Depth				1.0	
Date Sampled				26-FEB-2015	
Type				Sandy Soil	
Determinand	Method	LOD	Units	Symbol	
Total Petroleum Hydrocarbons	GC/FID	1	mg/kg	M	2500
Total Petroleum Hydrocarbons (C35-C40)	GC/FID	1	mg/kg	N	310

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil PCB EC7					
SAL Reference				459380 003	
Customer Sample Reference				WS03	
Test Sample				M105	
Bottom Depth				1.5	
Top Depth				1.0	
Date Sampled				26-FEB-2015	
Type				Sandy Soil	
Determinand	Method	LOD	Units	Symbol	
Polychlorinated biphenyl BZ#28	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9) <2.0
Polychlorinated biphenyl BZ#52	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9) <2.0
Polychlorinated biphenyl BZ#101	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9) <2.0
Polychlorinated biphenyl BZ#118	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9) <2.0
Polychlorinated biphenyl BZ#153	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9) <2.0
Polychlorinated biphenyl BZ#138	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9) <2.0
Polychlorinated biphenyl BZ#180	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(9) <2.0

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil RoC Maxi Suite 1					
SAL Reference		459380 001	459380 002	459380 003	459380 004
Customer Sample Reference		WS01	WS02	WS03	WS04
Test Sample		AR	AR	AR	AR
Bottom Depth		0.8	0.8	1.5	2.0
Top Depth		0.5	0.2	1.0	1.5
Date Sampled		26-FEB-2015	26-FEB-2015	26-FEB-2015	26-FEB-2015
Type		Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	Method	LOD	Units	Symbol	
Boron (water-soluble)	ICP/OES	1	mg/kg	N	<1
Chromium (trivalent)	Calc	2	mg/kg	N	11
Chromium VI	ICP/OES	1	mg/kg	N	<1
pH	Probe			M	11.1
Sulphate(2:1)	ICP/OES	100	mg/l	N	260
Cyanide (Total)	Colorimetry (CF)	1	mg/kg	M	<1
Cyanide(free)	Colorimetry (CF)	1	mg/kg	M	<1
Phenols (Total-Mono)	Colorimetry (CF)	1	mg/kg	M	<1

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil RoC Maxi Suite 1					
SAL Reference		459380 006			
Customer Sample Reference		WS05			
Test Sample		AR			
Bottom Depth		0.8			
Top Depth		0.2			
Date Sampled		26-FEB-2015			
Type		Sandy Soil			
Determinand	Method	LOD	Units	Symbol	
Boron (water-soluble)	ICP/OES	1	mg/kg	N	<1
Chromium (trivalent)	Calc	2	mg/kg	N	12
Chromium VI	ICP/OES	1	mg/kg	N	<1
pH	Probe			M	7.6
Sulphate(2:1)	ICP/OES	100	mg/l	N	<100
Cyanide (Total)	Colorimetry (CF)	1	mg/kg	M	<1
Cyanide(free)	Colorimetry (CF)	1	mg/kg	M	<1
Phenols (Total-Mono)	Colorimetry (CF)	1	mg/kg	M	<1

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil RoC Maxi Suite 1									
SAL Reference					459380 001	459380 002	459380 003	459380 004	459380 005
Customer Sample Reference					WS01	WS02	WS03	WS03	WS04
Test Sample					M40	M40	M40	M40	M40
Bottom Depth					0.8	0.8	1.5	2.0	1.2
Top Depth					0.5	0.2	1.0	1.5	0.8
Date Sampled					26-FEB-2015	26-FEB-2015	26-FEB-2015	26-FEB-2015	26-FEB-2015
Type					Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	Method	LOD	Units	Symbol					
Antimony	ICP/OES	1	mg/kg	U	2	3	5	4	<1
Arsenic	ICP/OES	2	mg/kg	M	12	16	28	26	7
Beryllium	ICP/OES	2	mg/kg	M	<2	<2	2	<2	<2
Barium	ICP/OES	1	mg/kg	U	97	360	150	150	52
Cadmium	ICP/OES	1	mg/kg	M	<1	<1	<1	<1	<1
Copper	ICP/OES	1	mg/kg	M	61	280	190	170	29
Mercury	ICP/OES	1	mg/kg	M	10	2	2	2	<1
Molybdenum	ICP/OES	1	mg/kg	M	2	1	4	3	<1
Nickel	ICP/OES	1	mg/kg	M	14	17	35	28	12
Selenium	ICP/OES	3	mg/kg	M	<3	<3	<3	<3	<3
Vanadium	ICP/OES	1	mg/kg	M	16	24	32	29	13
Zinc	ICP/OES	1	mg/kg	M	120	310	170	210	48
Sulphate (Total)	ICP/OES	0.01	%	N	0.69	1.2	1.8	1.6	0.13
Mass Fraction of organic carbon	Calc TOC/100			N	0.020	0.032	0.052	0.037	0.0039
Chromium	ICP/OES	1	mg/kg	M	11	13	16	16	9
Lead	ICP/OES	1	mg/kg	M	110	190	240	240	44

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil RoC Maxi Suite 1					
SAL Reference					459380 006
Customer Sample Reference					WS05
Test Sample					M40
Bottom Depth					0.8
Top Depth					0.2
Date Sampled					26-FEB-2015
Type					Sandy Soil
Determinand	Method	LOD	Units	Symbol	
Antimony	ICP/OES	1	mg/kg	U	1
Arsenic	ICP/OES	2	mg/kg	M	6
Beryllium	ICP/OES	2	mg/kg	M	<2
Barium	ICP/OES	1	mg/kg	U	58
Cadmium	ICP/OES	1	mg/kg	M	<1
Copper	ICP/OES	1	mg/kg	M	13
Mercury	ICP/OES	1	mg/kg	M	<1
Molybdenum	ICP/OES	1	mg/kg	M	<1
Nickel	ICP/OES	1	mg/kg	M	14
Selenium	ICP/OES	3	mg/kg	M	<3
Vanadium	ICP/OES	1	mg/kg	M	13
Zinc	ICP/OES	1	mg/kg	M	36
Sulphate (Total)	ICP/OES	0.01	%	N	0.05
Mass Fraction of organic carbon	Calc TOC/100			N	0.0027
Chromium	ICP/OES	1	mg/kg	M	12
Lead	ICP/OES	1	mg/kg	M	13

SAL Reference: 459380									
Project Site: 10 to 12 Whitworth St									
Customer Reference: 3056									
Soil Analysed as Soil									
Total and Speciated USEPA16 PAH									
SAL Reference					459380 001	459380 002	459380 003	459380 004	459380 005
Customer Sample Reference					WS01	WS02	WS03	WS03	WS04
Test Sample					M105	M105	M105	M105	M105
Bottom Depth					0.8	0.8	1.5	2.0	1.2
Top Depth					0.5	0.2	1.0	1.5	0.8
Date Sampled					26-FEB-2015	26-FEB-2015	26-FEB-2015	26-FEB-2015	26-FEB-2015
Type					Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	Method	LOD	Units	Symbol					
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	0.7	0.5	120	220	0.2
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	0.2	0.2	12	21	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	0.6	0.3	38	74	0.2
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	0.7	0.4	49	140	0.2
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	5.4	2.9	310	670	1.7
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	1.3	0.7	82	140	0.4
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	6.1	3.0	200	480	1.6
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	6.0	2.9	240	460	1.6
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	2.7	1.4	77	210	0.8
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	2.8	1.4	75	210	0.8
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	4.0	1.9	77	260	1.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	2.5	1.2	54	170	0.7
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	1.0	0.5	44	69	0.3
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	0.4	0.2	19	28	0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	1.3	0.6	58	91	0.3
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	36	18	1500	3300	10

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Soil Analysed as Soil Total and Speciated USEPA16 PAH					
SAL Reference		459380 006			
Customer Sample Reference		WS05			
Test Sample		M105			
Bottom Depth		0.8			
Top Depth		0.2			
Date Sampled		26-FEB-2015			
Type		Sandy Soil			
Determinand	Method	LOD	Units	Symbol	
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	0.2
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	0.2
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	0.2
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	0.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	0.8

SAL Reference: 459380 Project Site: 10 to 12 Whitworth St Customer Reference: 3056 Leachate to BS EN 12457-2 (10:1) Analysed as Water Waste Acceptance Criteria					
SAL Reference				459380 003	
Customer Sample Reference				WS03	
Test Sample				10:1	
Bottom Depth				1.5	
Top Depth				1.0	
Date Sampled				26-FEB-2015	
Type				Sandy Soil	
Determinand	Method	LOD	Units	Symbol	
Arsenic (Dissolved)	ICP/MS (Filtered)	0.2	µg/l	U	1.3
Barium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	26
Molybdenum (Dissolved)	ICP/MS (Filtered)	1	µg/l	N	7
Total Dissolved Solids	Grav	100	mg/l	N	530
Phenols (Total-Mono)	Colorimetry	0.1	mg/l	U	<0.1
Dissolved Organic Carbon	OX/IR	1	mg/l	N	9
Electrical Conductivity	Probe	10	µS/cm	N	880
Antimony (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	2
Cadmium (Dissolved)	ICP/MS (Filtered)	0.02	µg/l	U	0.02
Chromium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1
Copper (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	2.1
Lead (Dissolved)	ICP/MS (Filtered)	0.3	µg/l	U	<0.3
Mercury (Dissolved)	ICP/MS (Filtered)	0.05	µg/l	U	<0.05
Nickel (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	2
Selenium (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	1.6
Zinc (Dissolved)	ICP/MS (Filtered)	2	µg/l	U	4
Fluoride	Discrete Analyser	0.05	mg/l	U	<0.05
Sulphate	Discrete Analyser	0.5	mg/l	U	420
Chloride	Discrete Analyser	1	mg/l	U	7

Index to symbols used in 459380-1

Value	Description
10:1	Leachate to BS EN 12457-2 (10:1)
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
10:1 S	Data for BS EN 12457-2 (10:1)
AR	As Received
N.D.	Not Detected
9	LOD raised due to dilution of sample
13	Results have been blank corrected.
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

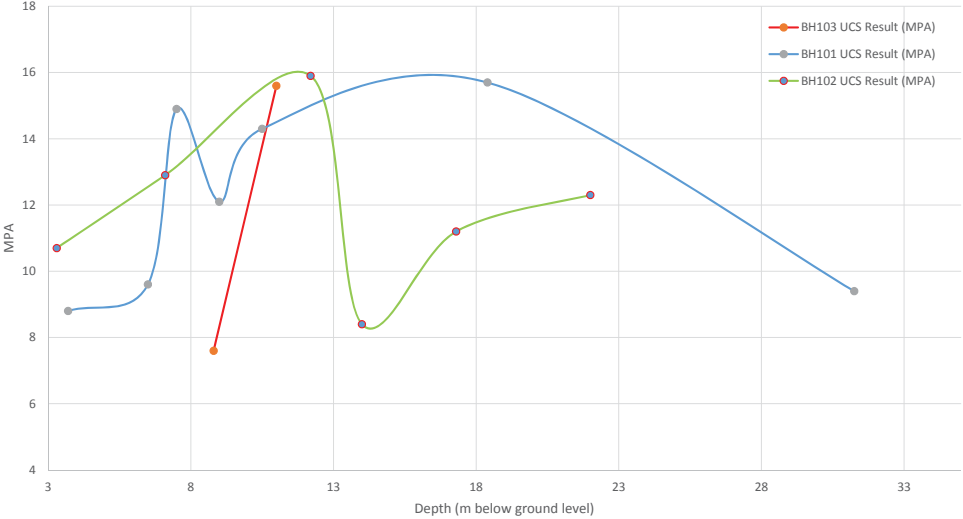
Asbestos was subcontracted to REC Asbestos.
Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.

APPENDIX E

GEOTECHNICAL TESTING RESULTS.



UCS Testing Results



Point Load I _{s(50)} Results Overview Table				
I _{s(50)} (MPa)	BH101	BH102	BH103	All Results
Maximum	15.84	14.64	23.28	23.28
Minimum	2.64	7.68	2.40	2.40
Average	11.21	11.00	11.52	11.22

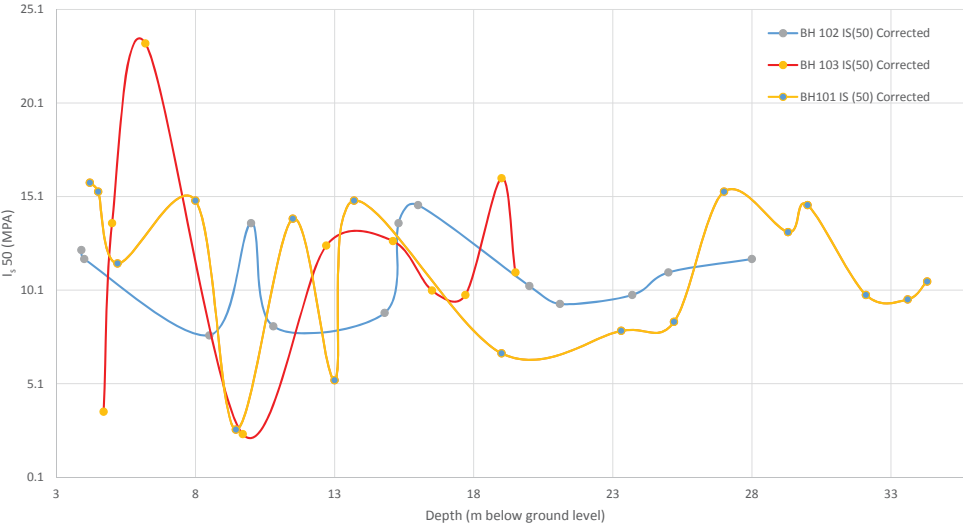
UCS Testing Results Overview Table				
	BH101	BH102	BH103	All Results
Maximum	15.70	15.90	15.60	15.90
Minimum	8.80	8.40	7.60	7.60
Average	12.11	11.90	11.60	11.96

All Results given in MPA

Refer to Appendix D for complete laboratory testing results

I_{s(50)} results corrected using Sandstone conversion factor of 24
(I_{s(50)} x 24)

Point Load Testing Results



EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St
Sketch No:	ESGT01
Sketch Title	Rock Core Testing Results
Drawn by:	AS – 13/04/2015



LABORATORY REPORT



4043

Contract Number: PSL15/1562

Client's Reference:

Report Date: 09 April 2015

Client Name: ROC Consulting
81 Chapel Street
Manchester
M3 5DF

For the attention of: Alex Smiles

Contract Title: 10-12 Whitworth Street

Date Received: 30/3/2015

Date Commenced: 30/3/2015

Date Completed: 9/4/2015

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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Checked and Approved Signatories:

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Page 1 of

SUMMARY OF POINT LOAD TEST RESULTS

POINT LOAD TEST - ISRM

Borehole Number	Depth (m)	Test Type	Orientation	Dimensions (mm)		Area	D_o^2	D_o	Failure Load (P)		I_s	Corr Fac	I_{s50}	Failure	Remarks
			Par / Perp	W	D	(mm ²)		(mm)	MPa	kN	(MPa)	F	(MPa)	Type	
BH101	4.20	A	Par	86	37	1369	4051.45	63.65	1.789	2.39	0.590	1.115	0.66	Valid	
BH101	4.50	A	Par	86	29	841	3175.46	56.35	1.443	1.93	0.607	1.055	0.64	Valid	
BH101	5.20	A	Par	86	45	2025	4927.44	70.20	1.532	2.05	0.415	1.165	0.48	Valid	
BH101	8.00	A	Par	86	28	784	3065.96	55.37	1.349	1.80	0.587	1.047	0.62	Valid	
BH101	9.45	A	Par	86	52	2704	5693.93	75.46	0.396	0.53	0.093	1.203	0.11	Valid	
BH101	11.50	A	Par	86	31	961	3394.46	58.26	1.385	1.85	0.545	1.071	0.58	Valid	
BH101	13.00	A	Par	86	44	1936	4817.94	69.41	0.672	0.90	0.186	1.159	0.22	Valid	
BH101	13.70	A	Par	86	33	1089	3613.45	60.11	1.548	2.07	0.572	1.086	0.62	Valid	
BH101	19.00	A	Par	86	48	2304	5255.93	72.50	0.946	1.26	0.240	1.182	0.28	Valid	
BH101	23.30	A	Par	86	45	2025	4927.44	70.20	1.035	1.38	0.280	1.165	0.33	Valid	
BH101	25.20	A	Par	86	39	1521	4270.45	65.35	0.991	1.32	0.310	1.128	0.35	Valid	
BH101	27.00	A	Par	86	26	676	2846.96	53.36	1.329	1.77	0.623	1.030	0.64	Valid	
BH101	29.30	A	Par	86	42	1764	4598.94	67.82	1.664	2.22	0.483	1.147	0.55	Valid	
BH101	30.00	A	Par	86	31	961	3394.46	58.26	1.444	1.93	0.568	1.071	0.61	Valid	
BH101	32.10	A	Par	86	64	4096	7007.91	83.71	1.725	2.30	0.329	1.261	0.41	Valid	
BH101	33.60	A	Par	86	58	3364	6350.92	79.69	1.538	2.05	0.323	1.233	0.40	Valid	
BH101	34.30	A	Par	86	49	2401	5365.43	73.25	1.495	2.00	0.372	1.187	0.44	Valid	
BH102	3.90	A	Par	86	37	1369	4051.45	63.65	1.394	1.86	0.459	1.115	0.51	Valid	
BH102	4.00	A	Par	86	29	841	3175.46	56.35	1.094	1.46	0.460	1.055	0.49	Valid	
BH102	8.50	A	Par	86	42	1764	4598.94	67.82	0.947	1.26	0.275	1.147	0.32	Valid	
BH102	10.00	A	Par	86	27	729	2956.46	54.37	1.217	1.62	0.550	1.038	0.57	Valid	
BH102	10.80	A	Par	86	33	1089	3613.45	60.11	0.843	1.13	0.311	1.086	0.34	Valid	
BH102	14.80	A	Par	86	52	2704	5693.93	75.46	1.317	1.76	0.309	1.203	0.37	Valid	
BH102	15.30	A	Par	86	39	1521	4270.45	65.35	1.624	2.17	0.508	1.128	0.57	Valid	
BH102	16.00	A	Par	86	36	1296	3941.95	62.78	1.631	2.18	0.552	1.108	0.61	Valid	
BH102	20.00	A	Par	86	28	784	3065.96	55.37	0.949	1.27	0.413	1.047	0.43	Valid	
BH102	21.10	A	Par	86	27	729	2956.46	54.37	0.829	1.11	0.374	1.038	0.39	Valid	
BH102	23.70	A	Par	86	42	1764	4598.94	67.82	1.218	1.63	0.354	1.147	0.41	Valid	
BH102	25.00	A	Par	86	39	1521	4270.45	65.35	1.294	1.73	0.405	1.128	0.46	Valid	
BH102	28.00	A	Par	86	66	4356	7226.91	85.01	2.076	2.77	0.384	1.270	0.49	Valid	

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

Par = parallel, Perp = perpendicular

PSL

Professional Soils Laboratory

10 - 12 WHITWORTH STREET.

Contract No:

PSL15/1562.

Client Ref:

3056

Checked By



Date

09/04/2015

Approved By



Date

09/04/2015

SUMMARY OF POINT LOAD TEST RESULTS

POINT LOAD TEST - ISRM

Borehole Number	Depth (m)	Test Type	Orientation	Dimensions (mm)		D _e ²	D _e	Failure Load (P)		I _s	Corr Fac	I _{s50}	Failure	Remarks
			Par / Perp	L	D			MPa	kN					
BH101	4.20	D	Perp		86	7396	86.00	0.688	0.92	0.124	1.276	0.16	Valid	
BH101	4.50	D	Perp		86	7396	86.00	0.459	0.61	0.083	1.276	0.11	Valid	
BH101	5.20	D	Perp		86	7396	86.00	0.554	0.74	0.100	1.276	0.13	Valid	
BH101	8.00	D	Perp		86	7396	86.00	1.002	1.34	0.181	1.276	0.23	Valid	
BH101	9.45	D	Perp		86	7396	86.00	0.584	0.78	0.105	1.276	0.13	Valid	
BH101	11.50	D	Perp		86	7396	86.00	1.008	1.35	0.182	1.276	0.23	Valid	
BH101	13.00	D	Perp		86	7396	86.00	0.259	0.35	0.047	1.276	0.06	Valid	
BH101	13.70	D	Perp		86	7396	86.00	0.661	0.88	0.119	1.276	0.15	Valid	
BH101	19.00	D	Perp		86	7396	86.00	0.551	0.74	0.099	1.276	0.13	Valid	
BH101	23.30	D	Perp		86	7396	86.00	0.429	0.57	0.077	1.276	0.10	Valid	
BH101	25.20	D	Perp		86	7396	86.00	0.392	0.52	0.071	1.276	0.09	Valid	
BH101	27.00	D	Perp		86	7396	86.00	0.684	0.91	0.123	1.276	0.16	Valid	
BH101	29.30	D	Perp		86	7396	86.00	0.824	1.10	0.149	1.276	0.19	Valid	
BH101	30.00	D	Perp		86	7396	86.00	0.562	0.75	0.101	1.276	0.13	Valid	
BH101	32.10	D	Perp		86	7396	86.00	0.891	1.19	0.161	1.276	0.21	Valid	
BH101	33.60	D	Perp		86	7396	86.00	0.719	0.96	0.130	1.276	0.17	Valid	
BH101	34.30	D	Perp		86	7396	86.00	0.631	0.84	0.114	1.276	0.15	Valid	
BH102	3.90	D	Perp		86	7396	86.00	0.542	0.72	0.098	1.276	0.12	Valid	
BH102	4.00	D	Perp		86	7396	86.00	0.339	0.45	0.061	1.276	0.08	Valid	
BH102	8.50	D	Perp		86	7396	86.00	0.332	0.44	0.060	1.276	0.08	Valid	
BH102	10.00	D	Perp		86	7396	86.00	0.442	0.59	0.080	1.276	0.10	Valid	
BH102	10.80	D	Perp		86	7396	86.00	0.229	0.31	0.041	1.276	0.05	Valid	
BH102	14.80	D	Perp		86	7396	86.00	0.553	0.74	0.100	1.276	0.13	Valid	
BH102	15.30	D	Perp		86	7396	86.00	0.771	1.03	0.139	1.276	0.18	Valid	
BH102	16.00	D	Perp		86	7396	86.00	0.772	1.03	0.139	1.276	0.18	Valid	
BH102	20.00	D	Perp		86	7396	86.00	0.518	0.69	0.094	1.276	0.12	Valid	
BH102	21.10	D	Perp		86	7396	86.00	0.212	0.28	0.038	1.276	0.05	Valid	
BH102	23.70	D	Perp		86	7396	86.00	0.441	0.59	0.080	1.276	0.10	Valid	
BH102	25.00	D	Perp		86	7396	86.00	0.444	0.59	0.080	1.276	0.10	Valid	
BH102	28.00	D	Perp		86	7396	86.00	0.715	0.95	0.129	1.276	0.16	Valid	

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

Par = parallel, Perp = perpendicular

PSL

Professional Soils Laboratory

10 - 12 WHITWORTH STREET.

Contract No:

PSL15/1562.

Client Ref:

3056

Checked By



Date

09/04/2015

Approved By



Date

09/04/2015

SUMMARY OF POINT LOAD TEST RESULTS

POINT LOAD TEST - ISRM

[illegible]

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

Par = parallel, Perp = perpendicular



Professional Soils Laboratory

10 - 12 WHITWORTH STREET.

Contract No:

PSL15/1562.

Client Ref:

3056

Checked By

Date _____

09/04/2015

Approved By

Date _____

09/04/2015

SUMMARY OF POINT LOAD TEST RESULTS

POINT LOAD TEST - ISRM

[illegible]

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

Par = parallel, Perp = perpendicular



Professional Soils Laboratory

10 - 12 WHITWORTH STREET.

Contract No:

PSL15/1562.

Client Ref:

3056

Checked By

Date _____

09/04/2015

5 Approved By

Date _____

09/04/2015



5/7 Hexthorpe Road
Hexthorpe, Doncaster, DN4 0AR
tel: +44 (0)844 8156641
fax: +44 (0)844 8156642
e-mail: awatkins@prosoils.co.uk

Date: 09-Apr-15
Contract Number: PSL15/1562
Location: 10 - 12 WHITWORTH STREET.
Sample Type: Core
Sample Preparation: Cutting & Grinding
Operator: J.Melville

Determination of Unconfined Compressive Strength.

ISRM Suggested Methods, pp 111 –116, 1981.

Borehole Number	Depth Top (m)	Depth Bottom (m)	Diameter (mm)	Length (mm)	Height: ratio	Initial mass g	Bulk Density Mg / m ³	MC %	Dry Density Mg / m ³	Load Failure	UCS(MPA)	Mode OF FAILURE	Date Tested	Remarks
BH101	3.70	-	86.00	114.00	1.3	1513	2.28	9.9	2.08	51.2	8.8	Brittle	07-Apr-15	
BH101	6.50	-	86.00	121.00	1.4	1594	2.27	10.0	2.06	55.9	9.6	Brittle	07-Apr-15	
BH101	7.50	-	86.00	130.00	1.5	1703	2.25	9.1	2.07	86.8	14.9	Brittle	07-Apr-15	
BH101	9.00	-	86.00	91.00	1.1	1175	2.22	8.8	2.04	70.4	12.1	Brittle	07-Apr-15	
BH101	10.50	-	86.00	144.00	1.7	1782	2.13	8.9	1.96	82.9	14.3	Brittle	07-Apr-15	
BH101	18.40	-	86.00	133.00	1.5	1712	2.22	8.2	2.05	91.2	15.7	Brittle	07-Apr-15	
BH101	31.25	-	86.00	116.00	1.3	1539	2.28	9.0	2.10	54.7	9.4	Brittle	07-Apr-15	
BH102	3.30	-	86.00	120.00	1.4	1501	2.15	9.5	1.97	62.3	10.7	Brittle	07-Apr-15	
BH102	7.10	-	86.00	99.00	1.2	1204	2.09	8.4	1.93	75.1	12.9	Brittle	07-Apr-15	
BH102	12.20	-	86.00	135.00	1.6	1894	2.41	10.0	2.20	92.2	15.9	Brittle	07-Apr-15	
BH102	14.00	-	86.00	110.00	1.3	1398	2.19	11.0	1.97	48.6	8.4	Brittle	07-Apr-15	
BH102	17.30	-	86.00	152.00	1.8	2021	2.29	11.0	2.06	64.9	11.2	Brittle	07-Apr-15	
BH102	22.00	-	86.00	150.00	1.7	1899	2.18	10.0	1.98	71.6	12.3	Brittle	07-Apr-15	
BH103	8.80	-	86.00	150.00	1.7	1903	2.18	10.5	1.98	44.4	7.6	Brittle	07-Apr-15	
BH103	11.00	-	86.00	146.00	1.7	1895	2.23	11.0	2.01	90.6	15.6	Brittle	07-Apr-15	

Checked by:

Date 09/04/2015

Approved by:

Date 09/04/2015

APPENDIX F

GROUND GAS / WATER MONITORING RESULTS.





Job No:	3056	Site:	Whitworth Street
Date:	05/09/2015	Client:	Brigantes Ltd.
Engineer:	AS	Equipment:	GFM 435

Weather Conditions:		Part cloudy												
Barometric Pressure Trend:		Rising												
Surface Ground Conditions:		Dry												
VISIT 1	Start							Finish						
Time:	10.00							Time:		10.30				
Barometric Pressure:	1011							Barometric Pressure:		1011				
Background Oxygen:	20.1							Background Oxygen:		20.1				
Monitoring Point	Flow Rate (l/h)	Gas Concentration										Water		
		Peak					Steady							
BH N°		CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	Depth to Water	Depth to Base	Head of water
BH101 (shallow)	0	0.00	0.46	20.60	0.00	0/0	0.00	0.46	20.60	0.00	0/0	DRY	3.00	0.00
BH103	0	0.00	0.30	20.40	0.00	0/0	0.00	0.30	20.40	0.00	0/0	DRY	3.00	0.00
Comments:														

 Civil, Structural & Environmental Engineers Commercial Wharf, 6 Commercial St, Manchester	Job No:	3056	Site:	10-12 Whitworth St
	Date:	20/05/2016	Client:	Brigantes
	Engineer:	JB	Equipment:	GFM 435

Civil, Structural & Environmental Engineers

Job No:

Date:

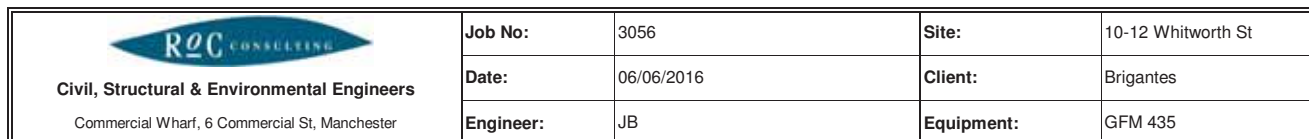
Engineer:

Site:

Client:

Equipment:

Weather Conditions:		Warm, Cloudy													
Barometric Pressure Trend:		Falling													
Surface Ground Conditions:		Dry													
VISIT 2		Start							Finish						
Time:		14.40							Time:		15.20				
Barometric Pressure:		1009							Barometric Pressure:		1009				
Background Oxygen:		20.9							Background Oxygen:		20.9				
Monitoring Point		Flow Rate (l/h)	Gas Concentration									Water			
			Peak					Steady							
BH N°		CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	Depth to Water	Depth to Base	Head of water	
BH101 (shallow)		0	0.00	0.00	20.80	0.00	0/0	0.00	0.00	20.80	0.00	0/0	DRY	3.00	0.00
BH101 (deep)													9.10	13.00	3.90
BH103		0	0.00	0.00	20.80	0.00	0/0	0.00	0.00	20.80	0.00	0/0	DRY	3.00	0.00
Comments:															



Civil, Structural & Environmental Engineers

Commercial Wharf, 6 Commercial St, Manchester

Job No:

3056

Date:

06/06/2016

Engineer:

JB

Site:

10-12 Whitworth St

Client:

Brigantes

Equipment:

GFM 435

Weather Conditions:				Very Hot											
Barometric Pressure Trend:				Rising											
Surface Ground Conditions:				Dry											
VISIT 3		Start							Finish						
Time:		15.00							Time:		15.30				
Barometric Pressure:		1019							Barometric Pressure:		1019				
Background Oxygen:		20.8							Background Oxygen:		20.9				
Monitoring Point		Flow Rate (l/h)	Gas Concentration									Water			
			Peak					Steady							
BH N°			CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	Depth to Water	Depth to Base	Head of water
BH101 (shallow)		0	0.00	0.00	20.90	0.00	0/0	0.00	0.00	20.90	0.00	0/0	DRY	3.00	0.00
BH101 (deep)													8.90	13.00	4.10
BH103		0	0.00	0.00	20.90	0.00	0/0	0.00	0.00	20.90	0.00	0/0	DRY	3.00	0.00
Comments:															



3056

14/06/2016

JB

10-12 Whitworth St

Brigantes

GFM 435

Weather Conditions:		Warm													
Barometric Pressure Trend:		Falling													
Surface Ground Conditions:		Dry													
VISIT 4		Start							Finish						
Time:		16.00							Time:		16.30				
Barometric Pressure:		998							Barometric Pressure:		998				
Background Oxygen:		20.7							Background Oxygen:		20.7				
Monitoring Point		Flow Rate (l/h)	Gas Concentration									Water			
			Peak					Steady							
BH N°			CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	CH ₄ %	CO ₂ %	O ₂ %	LEL %	H2S/CO (ppm)	Depth to Water	Depth to Base	Head of water
BH101 (shallow)		0	0.00	0.00	20.90	0.00	0/0	0.00	0.00	20.90	0.00	0/0	10.00	13.00	0.00
BH103		0	0.00	0.00	20.70	0.00	0	0.00	0.00	20.70	0.00	0	Dry	3.00	0.00
Comments:															

TEST DATE AND CONDITIONS	
Date	31/7/15
Atmospheric Pressure	1007mB
Ambient Temp	18.9°C
EnviroNics Serial No.	2518

GAS DATA LTD

Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB

Tel 02476303311 Fax 02476307711



GFM436-1 FINAL INSPECTION & CALIBRATION CHECK CERTIFICATE

INSTRUMENT DETAILS	
Serial No	Customer
12229	ROCP Ltd

INSTRUMENT CHECKS			
Keyboard	✓	Pump Flow	500cc/min
Display Contrast	✓	Pump Flow @ -200mB	300cc/min
Clock Set / Running	✓	S/W Version	G436-00.0027/0008
Labels Fitted	✓	Recalibration Date	30/7/16

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%	5.2	+/-0.3	0.0	0.0	0.0	+/-0.1
	60%	59.7	+/-3.0	0.0	0.0	0.0	+/-0.1
CO2	5%	0.0	0.0	4.9	+/-0.3	0.0	+/-0.1
	40%	0.0	0.0	39.8	+/-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		Hexane	tol. (% vol.)
		Range	5000ppm	2000ppm		2.00%	
N2	100%		0	0		0	+/- 5.0
H2S	1500ppm		1510	0			+/- 5.0
CO	1000ppm		40	996			+/- 5.0
Hexane	2.00%					1.91	+/- 10.0

PRESSURE CHECKS							
Calibration Pressure		Instrument Pressure Channels Read					
Pressure @	Applied Pressure	Atmospheric [Ap] (mB)	tol. (mB)				
All Ports	Current Atmospheric	1009	+/-2.0				
Ap Port (Internal)	+800mB(a)	800	+/-5.0				
	+1200mB(a)	1199	+/-5.0				

TEST DATE AND CONDITIONS	
Date	31/7/15
Atmospheric Pressure	1007mB
Ambient Temp	18.9°C
Enviroics Serial No.	2518

GAS DATA LTD

Pegasus House
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LB



Tel 02476303311 Fax 02476307711

GFM436-1 FINAL INSPECTION & CALIBRATION CHECK CERTIFICATE

FLOW CHECKS					
Calibration Flow		Instrument Flow Channels Read			
Applied Flow (l/hour)	Applied Pressure (Pa)	Flow [Flow] (l/hour)	tol. (l/hour)	Differential Pressure [Dp] (Pa)	tol. (Pa)
-30.0	-318	-29.4	+/-3.0	-331	+/-50
-3.0	-15	-3.0	+/-1.0	-15	+/-6
0.0	0	0.0	0.0	0	0.0
+3.0	12	3.0	+/-0.5	11	+/-3
+30.0	291	30.0	+/-3.0	290	+/-50
+60.0	860	59.6	+/-6.0	851	+/-130
+90.0	1670	90.7	+/-9.0	1681	+/-250

TEMPERATURE CHECK		
Calibration Temperature	Instrument Temperature Channel Read	
Applied Equivalent Temperature (°C)	Temperature [Temp] (°C)	tol. (°C)
-10.0	-10.5	+/- 2.0
0.0	0.0	+/- 1.0
30.0	30.0	+/- 1.0
60.0	60.0	+/- 1.0
100.0	100.0	+/- 1.0

Notes:

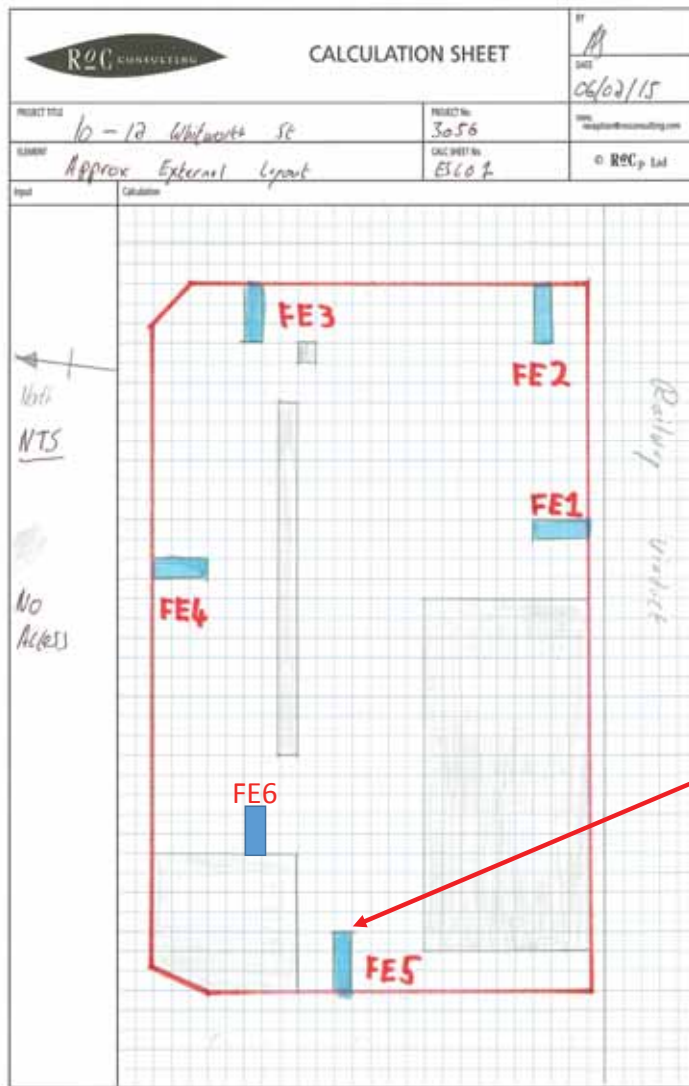
The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2008 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

Gas Data Ltd is certified to BS EN ISO9001:2008. Certificate NQA 8374. Valid until 20/03/2016

APPENDIX G

EXISTING BUILDING AND VIADUCT FOUNDATION WORKS.





FE5 : Taken to
31.29m AOD,
foundation not
encountered

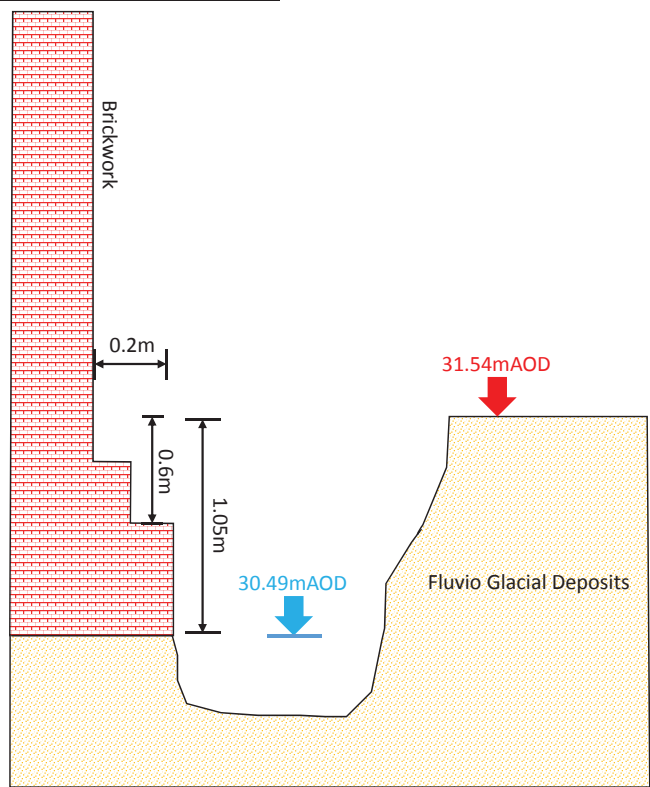


EARTH SCIENCES DIV SKETCH

INFORMATION

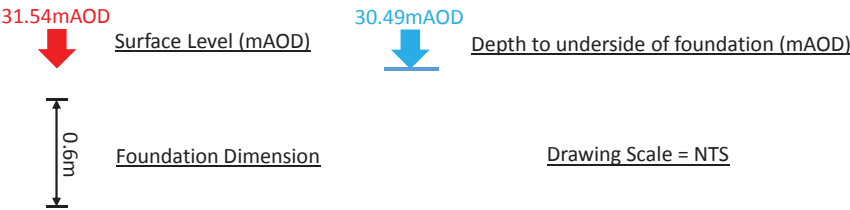
Job No:	3056
Project Title:	10-12 Whitworth St W
Sketch No:	INFE01
Sketch Title	Internal Foundation Exposure Location Plan
Drawn by:	AS - 24/02/2015

FOUNDATION EXPOSURE FE01



FE01 Photograph of exposure

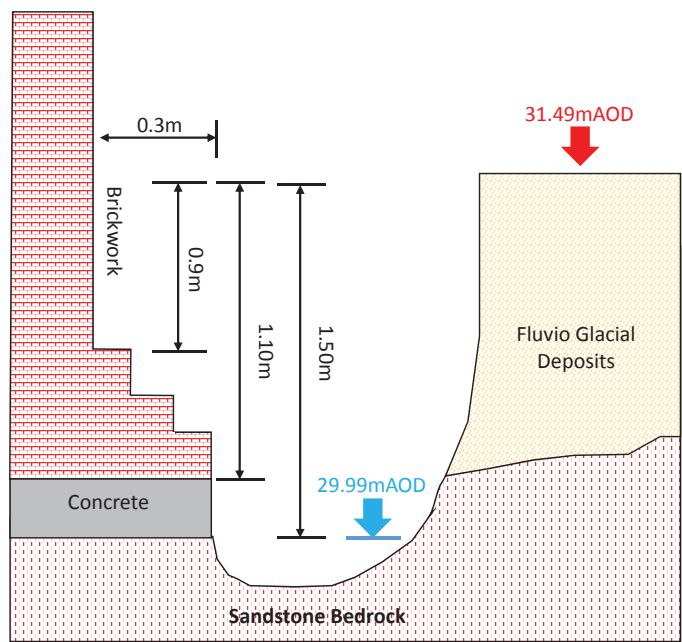
Drawing Key



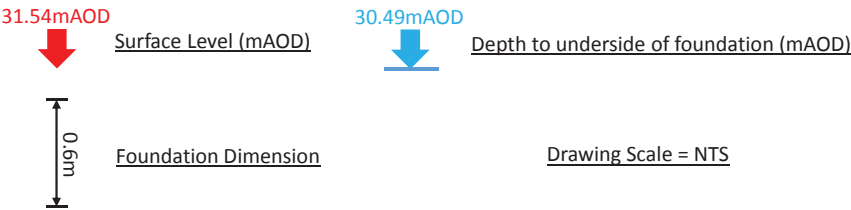
EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St W
Sketch No:	INFE02
Sketch Title	Internal Foundation Exposure "FE01"
Drawn by:	AS – 25/02/2015

FOUNDATION EXPOSURE FE02



Drawing Key



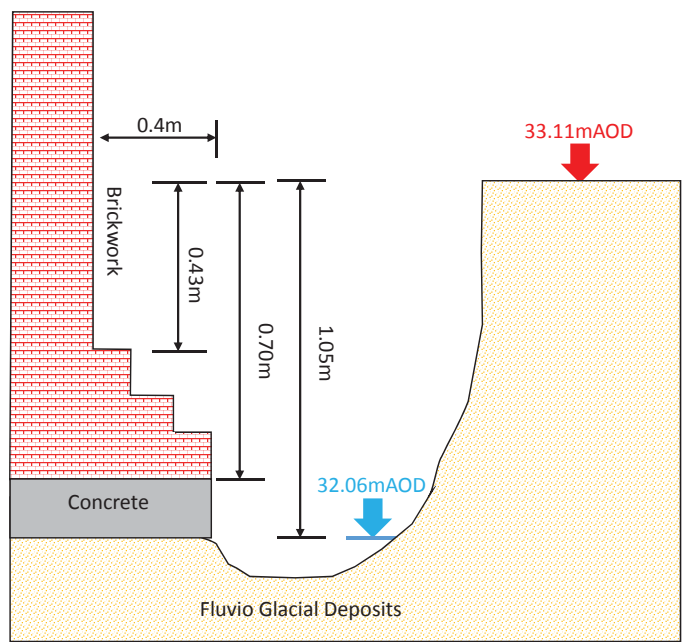
FE02 Photograph of exposure



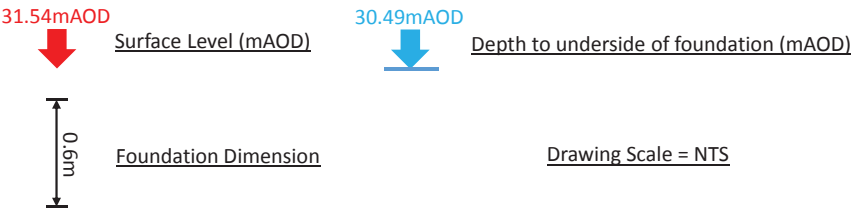
EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St W
Sketch No:	INFE03
Sketch Title	Internal Foundation Exposure "FE02"
Drawn by:	AS – 25/02/2015

FOUNDATION EXPOSURE FE03



Drawing Key



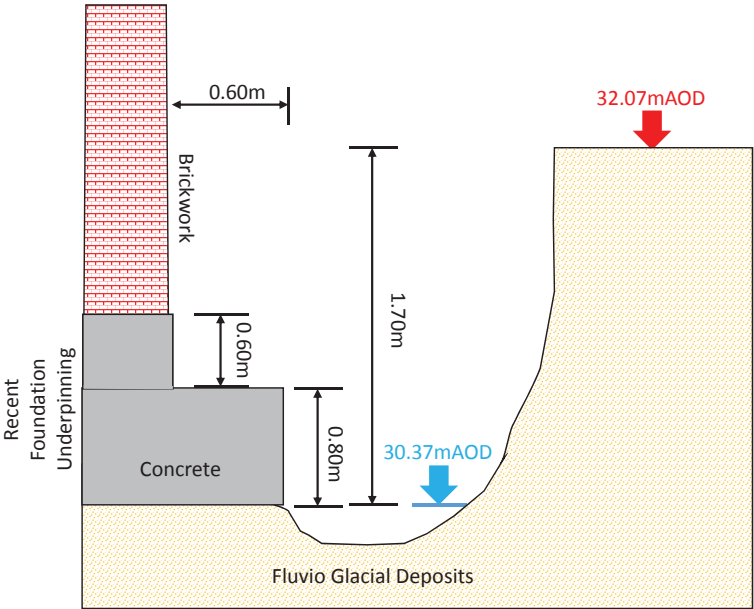
FE03 Photograph of exposure



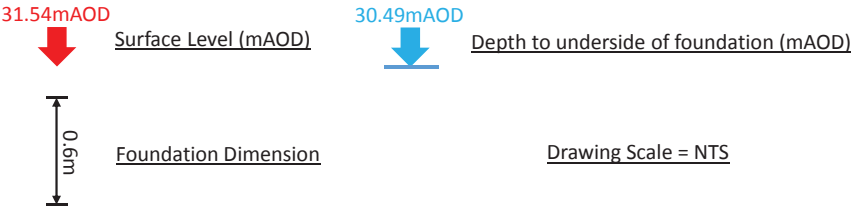
EARTH SCIENCES DIV SKETCH

INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St W
Sketch No:	INFE04
Sketch Title	Internal Foundation Exposure "FE03"
Drawn by:	AS - 25/02/2015

FOUNDATION EXPOSURE FE04



Drawing Key



Drawing Scale = NTS



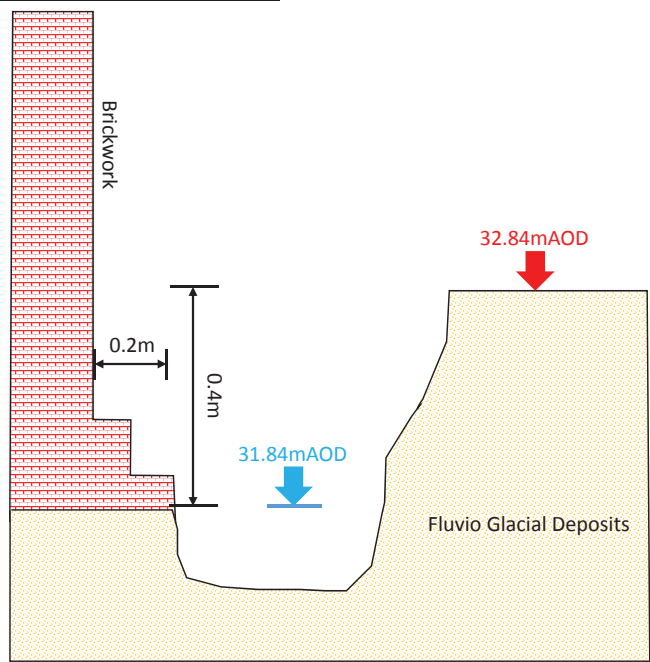
FE04 Photograph of exposure



EARTH SCIENCES DIV SKETCH

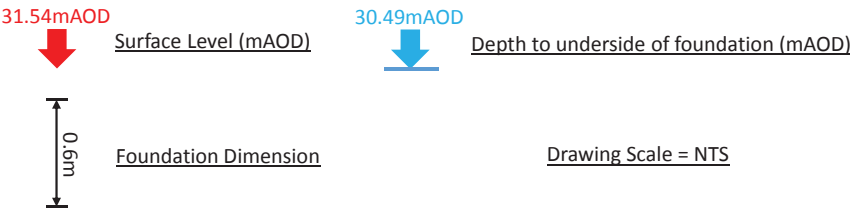
INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St W
Sketch No:	INFE05
Sketch Title	Internal Foundation Exposure "FE04"
Drawn by:	AS – 25/02/2015

FOUNDATION EXPOSURE FE06



FE06 Photograph of exposure

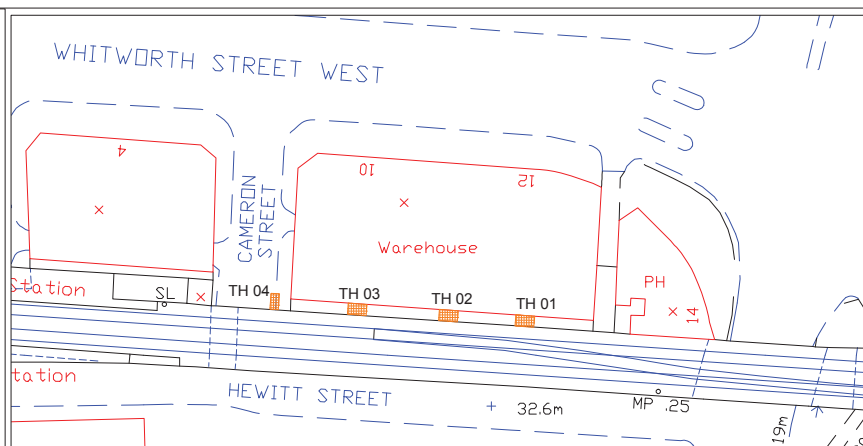
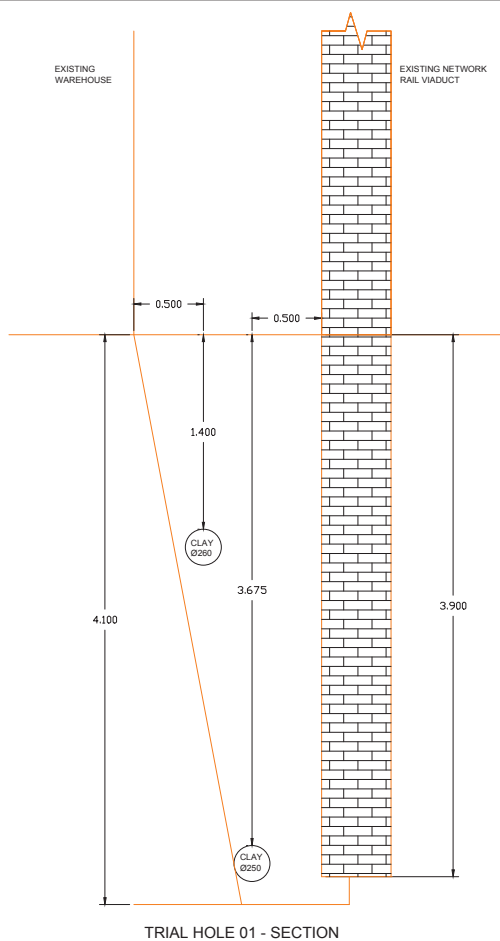
Drawing Key

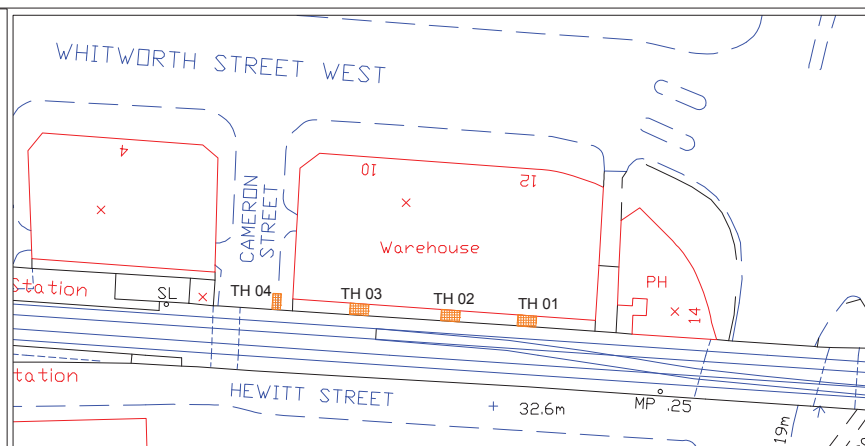
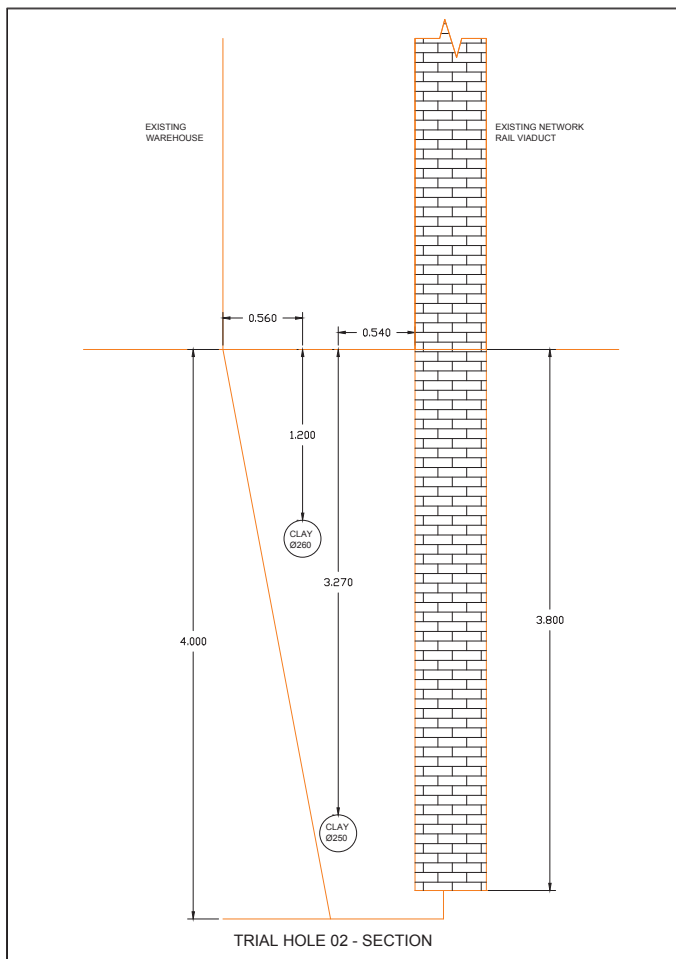


Drawing Scale = NTS



INFORMATION	
Job No:	3056
Project Title:	10-12 Whitworth St W
Sketch No:	INFE06
Sketch Title	Internal Foundation Exposure "FE06"
Drawn by:	AS – 25/02/2015





LOCATION PLAN



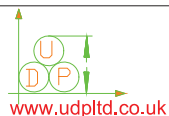
VIADUCT
ARCH
UNDERSIDE
OF
FOOTING



ARCH
FOOTING
BRICKWORK



TRIAL HOLE
PLAN VIEW



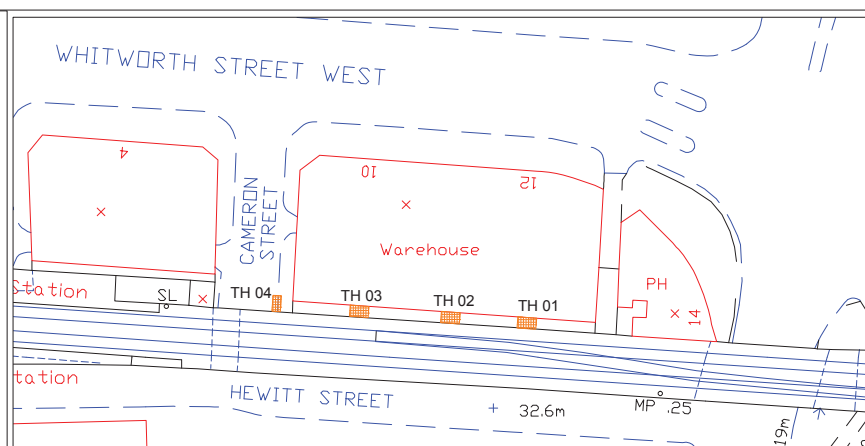
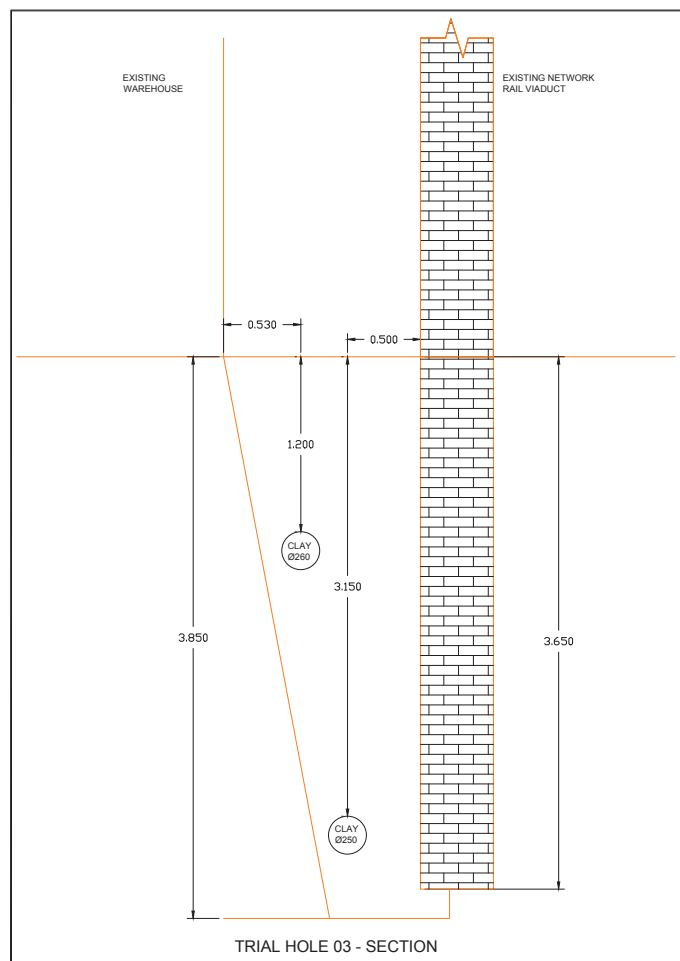
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Title WHITWORTH STREET WEST TRIAL HOLE 01
Client RDC CONSULTING
Designed by D. BOORMAN
Checked by P. REID
Date 09/03/2016
Approved by - date 00/00/00
Scale NTS

Sheet 1
Revision
0 00/00/00

NOTES
UDP- 4173
ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED
THIS DRAWING IS A RECORD OF THE CONTENTS OF THE TRIAL HOLE AS
DRAWN ON THE DATE SHOWN. NO GUARANTEE IS GIVEN THAT THE DEPTH OR
POSITION OF SERVICES OR ADDITIONAL SERVICES MAY HAVE SUBSEQUENTLY
BEEN ALTERED OR INSTALLED BY A THIRD PARTY AFTER THIS DATE.



LOCATION PLAN



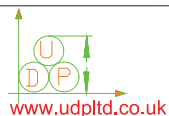
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BRICKWORK



TRIAL HOLE
PLAN VIEW



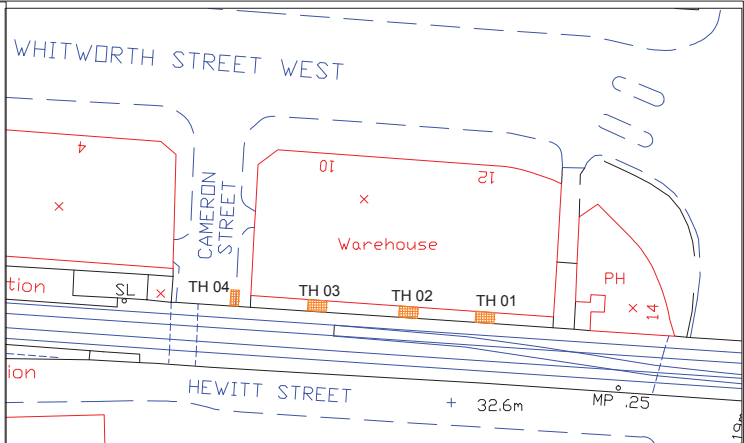
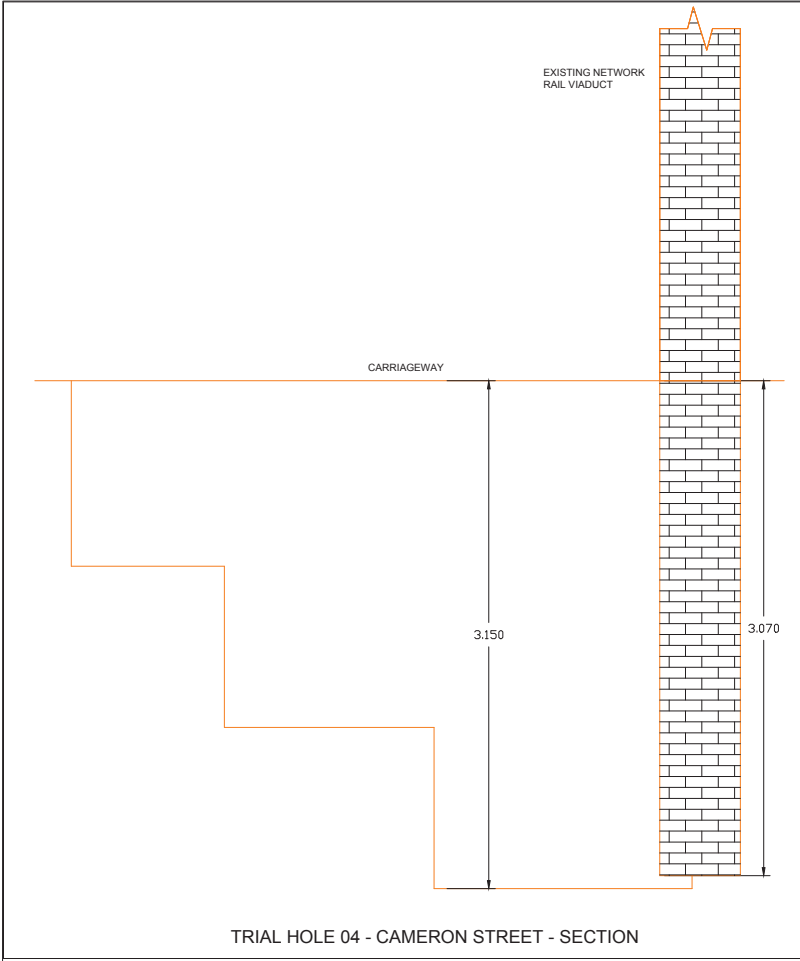
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Client RDC CONSULTING
Designed by D. BOORMAN
Checked by P. REID
Date 09/03/2016
Approved by - date 00/00/00
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Revision
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TRIAL HOLE
PLAN VIEW

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		OHSAS 18001	Designed by O. BOORMAN	Checked by P. REID			
			Date 09/03/2016	Approved by - date 00/00/00	Scale NTS	0 00/00/00	

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