

CCG-C-19-11344 REV.1

**COMBINED PHASE I/II
GEOENVIRONMENTAL REPORT**

**LAND AT 303 CHEETHAM HILL ROAD,
MANCHESTER,
M8 0SN**

AUGUST 2020



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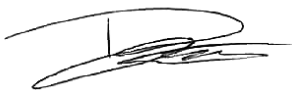
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FOR AND BEHALF OF CC GEOTECHNICAL LTD

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1.0 INTRODUCTION

CC GEOTECHNICAL LIMITED (CCG) is providing consultancy services to **Corstorphine + Wright Limited** in connection with the proposed redevelopment of a parcel of land at 303 Cheetham Hill Road, Manchester, M8 0SN.

It is proposed that the site be redeveloped by the erection of a three-storey family dwellinghouse (Use Class C3(a)), with associated boundary. Plans of the proposed development are shown in Appendix A.

The proposed development falls within the administrative jurisdiction of **MANCHESTER CITY COUNCIL**. At the time of preparation of this report submission of a planning application was pending.

A combined desk study and ground investigation report was required, to provide environmental and geotechnical data relevant to the planning, design and construction of the project.

The findings of these studies and investigations are presented hereunder.

This report should be read in conjunction with the Notes on Limitations, given in Appendix M.

2.0 PURPOSE & AIMS OF THE STUDY & INVESTIGATION

The primary aim of the Phase I Desk Study was to assess whether the site is likely to be affected by contamination, to an extent that it may pose a risk to human health and/or the built environment and/or the wider natural environment or is affected by any other natural or man-made feature which may impact on the proposed development. Specific tasks undertaken to achieve this were as follows:

- A review of available information including historical mapping, commercial environmental databases and Environment Agency Data.
- The development of a Preliminary Conceptual Model.

The main purpose of the Phase II Intrusive Investigation was to confirm the conclusions of the desk study, with reference to:

- The assessment of the nature and extent of contamination in relation to potential risks to human health for end users, construction workers, and worker occupants of adjacent properties.
- The assessment of the nature and extent of contamination in relation to potential risks to the fabric of buildings and services.
- The refinement of the Preliminary Conceptual Model confirming pollution linkages that have been demonstrated to be present.
- The identification of feasible remediation measures to remove or break the identified pollution linkages.
- The characterisation of made ground for waste disposal.
- The provision of information and interpretative comment on ground conditions in relation to foundation selection, design and construction.

3.0 SITE DATA

3.1 Site Location

The site is situated immediately West of Cheetham Hill Road, Manchester as presented in Appendix A. The Ordnance Survey coordinates for the approximate site centre are E384423, N400563.

3.2 Site Description & Walkover Observations

The site was visited during November 2019 on completion of a review of the historical mapping and environmental data presented

herein.

At the time of the visit, the site comprised a vacant disused parcel of land. It was observed to be a roughly rectangular area extending to approximate dimensions of 5m x 19m, its long axis being on a E/W axis. It extends to an area of c.95m² and stands at an approximate elevation of 62mAOD. It is set in a largely residential context.

At the north and south boundaries of the site are residential properties of Cheetham Hill Road, the site occupying with an opening between these.

The surface levels across are sensibly flat. Surface cover was seen to comprise of bituminous material. At the time of the visit, the site was undergoing trench excavations covering roughly half of the site.

Access to the site is via Cheetham Hill Road to the east of the site.

The information obtained from the visit is summarised in Table 1 hereunder.

Table 1: Summary of Walkover Observations

FEATURE		OBSERVATION
Current use of proposed development Land		Disused vacant land.
Context		Residential context.
Surface		Bituminous material.
Topography		Sensibly flat.
Area / dimensions		c.5m x 19m (c95m ²)
Access		Access to the site can be made via Cheetham Hill Road.
Buildings Adjacent to the Site		Residential properties at N, S and W.
Services		Services likely associated with former residential home.
Boundary	North	Residential properties of Cheetham Hill Road
	East	Cheetham Hill Road
	South	Residential properties of Cheetham Hill Road
	West	Alley between Cheetham Hill Road and Lytton Avenue.
Material storage		None observed
Waste disposal		None observed
Other potential contamination		None observed

4.0 SITE HISTORY

The history of the site and its immediate surrounds was investigated by consultation with a range of archive resources. Geographical information, historical mapping and environmental data were primarily based on a **GroundSure Reports (GS-5953161)** presented in Appendix L and maps reproduced with the permission of the National Library of Scotland. The site history is summarised from map extracts and within Table 2 hereunder:

Figure 1: Historical Mapping 1848



Figure 2: Historical Mapping 1891-1894



Figure 3: Historical Mapping 1909

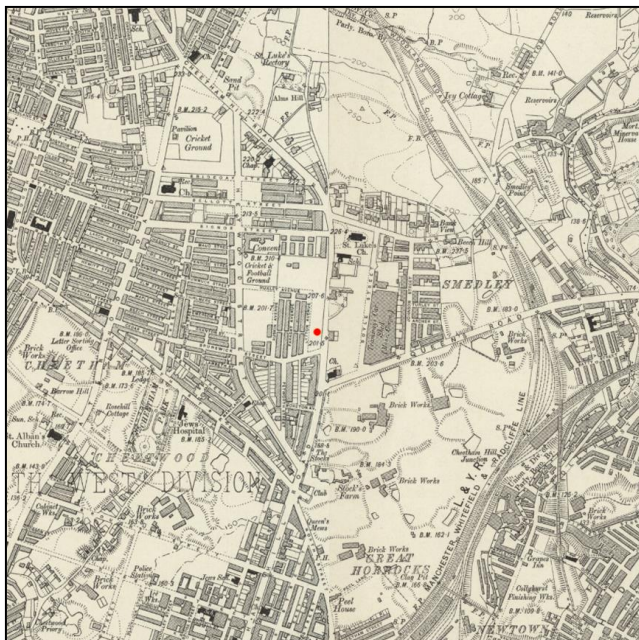


Figure 4: Historical Mapping 1923



Figure 5: Historical Mapping 1946-1947



Figure 6: Google Earth 2000

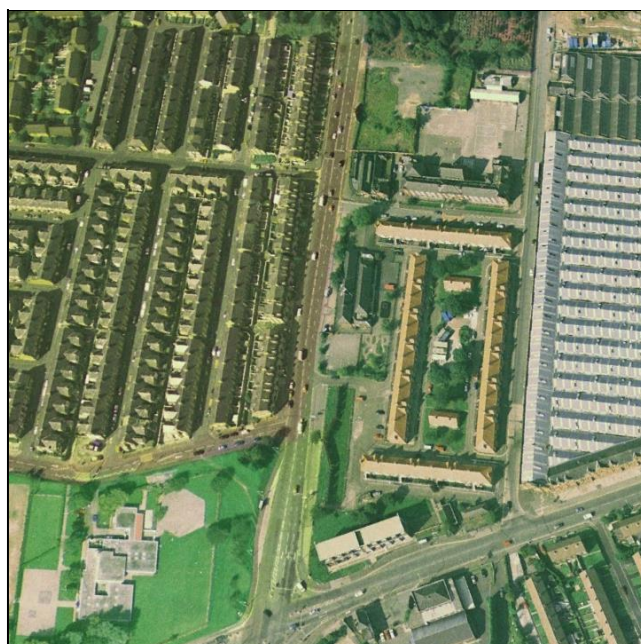


Figure 7: Google Earth 2009



Figure 8: Google Earth 2019



A summary of the historical mapping data is given hereunder:

Table 2: Historical Map Review

YEAR	ON SITE	<250M
1848	The site is occupied by fields and trees	The area is rural with a bowling green and St Luke's Church to the North East There are buildings to the North West and North East of the site.
1888-1913	The site forms part of a larger parcel of land with building to the North West.	There are rows of terraced houses directly West of the site on Lytton avenue and South of Brunswick Street. Directly East of the site is Cheetham Hill Road. There is a school to the North East on Cheetham Hill Road and a Church to the South East. The surrounding area is mainly residential, however there is a Tramsways Car Shed Company and trainline to the North East of the site. There is a cricket and football ground located to the NW of the site.
1892-1914	The site is occupied by a terraced property.	The area is more developed with rows of terraced housing to the West of Cheetham Hill Road. There are rows of terraced housing to the North of the site which are East of the cricket ground. There is a Tramway to the East of the site on Cheetham Hill Road.

1949-1968	No Significant Change	The Tramways Car Shed has been replaced by an Omnibus Depot to the East of the site. There is a school and temple square now present to the East of Cheetham Hill Road adjacent to the depot. The cricket ground to the North West is now part of Notre Dame Convent. The tramlines on Cheetham Hill Road no longer exist. The Brick Works to the South East is now disused and there is now a cinema on part of the land.
1986-1994	No Significant Change	Rows of terraced housing to the South of the site off Balmfield Street have been demolished and there is now a school and fields. There is a warehouse on the land to South East adjacent to the old Brick Works.
2000	The terraced house on the site has been demolished	The Brick Works to the South East is now covered in grassland with commercial buildings to the East of Cheetham Hill Road. The Brick Works to the South no longer exists and there are commercial buildings. The Notre Dame Convent to the North West is now a park with tennis courts.
2005-2009	No Significant Change	Manchester Fort Shopping Centre has been built to the South West and Cheetham Hill Retail Park to the South.
2019	No Significant Change	No Significant Change

5.0 ENVIRONMENTAL SETTING

5.1 Geology

The geology of the site was researched by reference to the 1:50000 scale British Geological Survey (BGS). The BGS Solid & Drift map indicates the northern section of the site is underlain with Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.

The solid geology is documented as being the Manchester Marls Formation - Mudstone. Sedimentary bedrock formed between 272.3 and 252.2 million years ago during the Permian period.

Given the history of development/demolition and the context setting of the site, it is likely that Made Ground deposits are present at the surface over some portion of the site.

The site is not in a Radon Affected Area, as less than 1% of properties are above the Action Level, hence no radon protective measures are necessary.

Geological Information obtained from the GroundSure Environmental Report is presented in Appendix L, and summarised hereunder:

Table 3: Summary of Geological Data from GroundSure Report

GEOLOGY		
Data	Distance	Comments
Artificial Ground	N/A	Given that the site does have a history of developments, artificial ground and/or reworked ground are likely to be present.
Superficial Deposits / Drift Geology	On Site	Till, Devensian - Diamicton
Permeability of Drift Deposits	On Site	Maximum Permeability – High. Minimum Permeability – Low.
Landslip	On Site	No records.
Bedrock and Solid Geology	On Site	Manchester Marls Formation - Mudstone
Permeability of Bedrock	On Site	Maximum Permeability – Low. Minimum Permeability – Low.
Faults	On Site	None recorded.
	<250m	None recorded.
Radon Affected Area	On Site	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
Radon Protection	On Site	No radon protective measures are necessary.
HISTORIC AND CURRENT GROUNDWORKINGS		
Data	Distance	Comments
Historical Surface Ground Workings	<250m	112m NW: Pond [1894] 132m N: Pond [1851] 142m SE: Pond [1891] 163m S: Brick Works [1906-33] 169m SE: Brick Works [1938]

		170m SE: Disused Brick Works [1956] 179m S: Brick Works [18914] 180m SE: Unspecified Ground Workings [1923] 193m S: Brick Works [1923] 196m SE: Unspecified Ground Workings [1938] 207m SE: Pond [1906] 208m N: Grave Yard [1851] 221-22m S: Unspecified Pit [1931-38] 223m S: Unspecified Ground Workings [1916] 225m S: Unspecified Pit [1906] 227m SE: Ponds [1923] 229m S: Unspecified Pit [1923] 235m SE: Pond [1906-21] 237m SE: Unspecified Ground Workings [1923] 243m SE: Ponds [1891] 244m E: Brick Works [1923]
Historical Underground Workings	<1000m	997m E: Railway Tunnel [1966-88]
Current Ground Workings	<1000m	370m SE: Queens Road Brickworks [Clay & Shale] – Ceased 424m SE: Baronhill Brickworks [Clay & Shale] – Ceased 470m E: Queens Road Brickworks [Clay & Shale] – Ceased 528m SW: Broughton Street Brickworks [Clay & Shale] – Ceased 543m SE: Ellison's Brickworks [Clay & Shale] – Ceased 556m N: Smedley Sand Pit [Sand] – Ceased 639m N: Almshill Sand Pit [Sand & Gravel] – Ceased 647m S: North Street Brickworks [Clay & Shale] – Ceased 712m SW: Broughton Street Brickworks [Clay & Shale] – Ceased 719m N: Alms Hill Sand Pit [Sand] – Ceased 754m W: Water Lane Brickworks [Clay & Shale] – Ceased 794m E: Smedley Road [Sandstone] – Ceased 909m NE: Collyhurst [Sandstone] – Ceased 916m SE: Collyhurst [Sandstone] – Ceased 928m SE: Collyhurst Quarry [Sandstone] – Ceased 932m SE: Red Sand Delph [Sand] 937m SE: Collyhurst Road Brickworks [Clay & Shale] - Ceased
Historical Mining	<1000m	No records
Coal mining areas	<1000m	The study site is located within the specified search distance of an identified mining area
Non-Coal Mining Activities	<500m	No records
Non-Coal Mining Cavities	<1000m	No records.
Natural Cavities	<1000m	No records.
Brine Extraction Activities	<1000m	No records.
Gypsum Extraction	<1000m	No records.
Tin Mining	<1000m	No records.
Clay Mining	<1000m	No records.
HAZARDS		
Data	Distance	Comments
Maximum Shrink-Swell hazard rating	On site	Very Low
Maximum Landslide hazard rating	On site	Very Low
Maximum Soluble Rocks hazard rating	On site	Negligible.
Maximum Compressible Deposits hazard rating	On site	Negligible
Maximum Collapsible Deposits hazard rating	On site	Very Low
Maximum Running Sands hazard rating	On site	Very Low

5.2 Mining

Geological mapping has indicated that the site is within the search distance of an identified mining area. The Coal Authority Gazetteer indicates that there are no mine entries on or within the vicinity of the site (closest approximately c.1139m). On this basis, it is concluded that the site is not at risk of surface instability associated with historical mining

5.3 Hydrology and Hydrogeology

Information on hydrology and hydrogeology obtained from a GroundSure Environmental Report is presented in Appendix L, and summarised hereunder:

Table 4: Summary of Hydrology and Hydrogeological Data from GroundSure Environmental Report

UNIT	PROPERTIES		HYDROGEOLOGICAL DESIGNATION
Made Ground	If present, likely to be generally granular and permeable and will permit vertical and lateral transmission of groundwater.		Unproductive Aquifer
Natural Drift Deposits	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.		Secondary (undifferentiated)
Bedrock Deposits	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.		Secondary B
Groundwater Abstraction licenses	<1000m	731m SE: Packaging Products Ltd. Licence No: 2569005015 917m S: Joseph Holt Ltd. Licence No: 2569004011 919m SW: Lancashire Dairies Ltd. Licence No: 2569004021	
Surface water abstraction licenses	<1000m	No Records.	
Potable Water Abstraction Licences	<1000m	919m SW: Lancashire Dairies Ltd. Licence No: 2569004021	
Source Protection Zone	<500m	No Records.	
Environment Agency information on groundwater vulnerability and soil leaching potential	<500m	119m W: Major Aquifer / High Leaching Potential (HU) 136m NW: Minor Aquifer / High Leaching Potential (HU) 220m NE: Major Aquifer / High Leaching Potential (HU) 248m E: Minor Aquifer / High Leaching Potential (HU) 297m SE: Major Aquifer / High Leaching Potential (HU)	
Nearest surface water body	<250m	No records	
EA information on river quality	<500m	No records.	
Detailed River Networks	<250m	No records.	
FLOODING			
Environment Agency Zone 2 floodplain	<250m	No records	
Environment Agency Zone 3 floodplain	<250m	No records	
Highest risk of Flooding	On site	Very Low	
Flood Defences	<250m	No.	
Areas benefiting from Flood Defences	<250m	No.	
Areas used for Flood Storage	<250m	No.	
BGS groundwater flooding susceptibility flood areas	<50m	Yes – Superficial Deposits Flooding – Limited Potential	
BGS Flood Risk Susceptibility Rating?		High	

For simplified interpretation, the geological succession underlying the site may be regarded as a series of discrete units in terms of their hydrogeological significance, as illustrated hereunder:

Table 5: Hydrogeological Interpretation

UNIT	PROPERTIES	HYDROGEOLOGICAL DESIGNATION
Made Ground	If present, likely to be generally granular and permeable and will permit vertical and lateral transmission of groundwater.	Unproductive Aquifer
Till, Devensian - Diamicton	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.	Secondary (undifferentiated)
Manchester Marls Formation	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.	Secondary B

6.0 FURTHER ENVIRONMENTAL DATA

Environmental data was researched using several sources including Environment Agency Maps and GroundSure Envirosight Report presented in Appendix L and is summarised hereunder in Table 6.

Table 6: Further Environmental Data

POTENTIALLY CONTAMINATIVE USES IDENTIFIED FROM 1:10,000 SCALE MAPPING		
Data	Distance	Comments
Records of sites with a potentially contaminative past land use	<250m	133-34m E: Omnibus Depot [1956-77] 133m E: Unspecified Depot [1985] 133m E: Tramways Car Shed [1906-38] 163m S: Brick Works [1906-33] 163m S: Unspecified Ground Workings [1906-33] 169m SE: Brick Works [1938] 170m SE: Disused Brick Works [1956] 179m S: Brick Works [1891] 180m SE: Unspecified Ground Workings [1923] 182m NE: Railway Sidings [1923] 193m S: Brick Works [1923] 196m SE: Unspecified Ground Workings [1938] 208m N: Grave Yard [1851] 221-22m S: Unspecified Pit [1931-38] 223m SE: Tramway Sidings [1938] 223m S: Unspecified Ground Workings [1916] 225m S: Unspecified Pit [1908] 226m SE: Railway Sidings [1933] 229m S: Unspecified Pit [1923] 237m SE: Unspecified Ground Workings [1923] 244m E: Brick Works [1923]
Records of historical tanks	<250m	200m SE: Unspecified Tank [1931] 245m SW: Unspecified Tank [1963]
Records of historical garage and motor vehicle repair sites	<250m	132m E: Tramway Car Shed [1908-31] 181m W: Garages [1949-63] 183m W: Garages [1949-63] 192m S: Garage [1949-51] 192m NE: Motor Bus Garage [1931] 196m S: Garage [1949-63] 198m S: Garage [1949]
Records of historical energy features	<250m	133m SE: Electric Sub-Station [1949-51] 141m SE: Electric Sub-Station [1993] 233-34m NW: Electric Sub-Station [1985-95]
Records of historical petrol stations and fuel sites	<250m	No records.
Records of Potentially Infilled Features from 1:10,000 scale mapping	<250m	112m NW: Pond [1894] 132m N: Pond [1851] 142m SE: Pond [1891] 163m S: Unspecified Ground Workings [1906-33] 163m S: Brick Works [1906-33] 169m SE: Brick Works [1938] 170m SE: Disused Brick Works [1956] 179m S: Brick Works [1891] 180m SE: Unspecified Ground Workings [1923] 193m S: Brick Works [1923] 196m SE: Unspecified Ground Workings [1938] 207m SE: Pond [1906] 208m N: Grave Yard [1851] 221-22: Unspecified Pit [1931-38] 223m S: Unspecified Ground Workings [1916] 225m S: Unspecified Pit [1906] 227m SE: Ponds [1923] 229m S: Unspecified Pit [1923] 235m SE: Pond [1906-21] 237m SE: Unspecified Ground Workings [1923] 243m SE: Ponds [1891] 244m E: Brick Works [1923]
STATUTORY AUTHORISATIONS		
Data	Distance	Comments
Records of Historical IPC Authorisations.	<250m	No records.
Records of Part 1(A) & IPPC Authorised Activities.	<250m	No records.
Records of Water Industry Referrals (potentially harmful discharges to public sewer).	<250m	No records.
Records of Red List Discharge Consents (potentially harmful discharge to controlled waters).	<250m	No records.
Records of List 1 Dangerous Substance Inventory sites.	<250m	No records.
Records of List 2 Dangerous Substance Inventory sites.	<250m	No records.

Records of Part A(2) & Part B Activities & Enforcements.	<250m	No records.
Records of Category 3 or 4 Radioactive Substance Licences.	<250m	No records.
Records of Planning Hazardous Substance Consents & Enforcements.	<250m	No records.
Records of COMAH & NIHHS sites.	<250m	No records.
Records of National Incidents Recording System, List 2.	<250m	109m N: 21/8/2001. ID: 25723.0. Pollutant: Specific Waste Materials – Commercial Waste
Records of National Incidents Recording System, List 1.	<250m	No records.
Records of Licenced Discharge Consents.	<250m	No records.
Records of sites determined as Contaminated Land under Section 78R of the EPA Act 1990.	<250m	No records.

RECORDS OF POTENTIALLY CONTAMINATIVE LAND USES

Data	Distance	Comments
Current Land Uses	<250m	110m N: Cheetham Motor Factors [Vehicle Repair, Testing and Servicing] 147m SE: Electric Sub-Station [Electrical Features] 175m SE: Bus Depot [Bus and Coach Stations, Depots and Companies] 222m NW: Electric Sub-Station [Electrical Features] 229m S: Halfords [Vehicle Parts and Accessories]
Petrol & Fuel Sites	<250m	No records.
Records of National Grid high voltage underground electricity transmission cables	<250m	No records.
Records of National Grid high pressure gas transmission pipelines	<250m	No records.

LANDFILL & OTHER WASTE SITES

Data	Distance	Comments
Records of Environment Agency/Natural Resources Wales historical Landfill data	<500m	214m SE: Queens Road TIP. Site Reference: F005.RD/LIC/241/82 400m SW: Elizabeth Street. Site Reference: F030
Records of Operational Waste Treatment, Transfer or Disposal sites	<500m	401m SW: Car Breaker's Yard 403m SW: Car Breaker's Yard 415m SW: Breaker's Yard
Records of Environmental Agency Waste sites	<500m	No records.
Records of Local Authority landfill sites	<500m	No records.
Records of Environment Agency/Natural Resources Wales Licensed Waste sites	<500m	No records.
Records of Registered Waste Transfer or Disposal sites	<500m	No records.
Records of BGS/DoE non-operational Landfill sites	<500m	No records.

DESIGNATED ENVIRONMENTALLY SENSITIVE SITES

Data	Distance	Comments
Records of SSSI	<500m	None.
Records of National Parks (NP)	<500m	None.
Records of NNR	<500m	None.
Records of SAC's	<500m	None.
Records of SPA's	<500m	None.
Records of Ramsar sites	<500m	None.
Records of LNR sites	<500m	None.
Records of World Heritage Sites	<500m	None.
Records of ESA	<500m	None.
Records of AONB	<500m	None.
Records of Nitrate Sensitive Areas	<500m	None.
Records of Nitrate Vulnerable Zones	<500m	105m NW: Existing [DEFRA] 118m E: Existing [DEFRA]
Records of Green Belt land	<500m	None.
Records of Ancient Woodlands	<500m	None.

7.0 ARCHAEOLOGICAL DATA

Examination of historical maps indicates no features of significant archaeological interest in the general vicinity of the site.

8.0 PREVIOUS SITE INVESTIGATIONS / REPORTS

Searches and consultations have not established evidence of previous site investigations having been undertaken on the subject site.

9.0 PRELIMINARY QUALITATIVE RISK ASSESSMENT (TIER 1)

9.1 Introduction

The risk assessment methodologies adopted by **CCG** are based on current available guidance from several sources and are included in Appendix M.

The Tier 1 Risk Assessment and Preliminary Conceptual Model (PCM) were formulated using the information discussed above and based on the following assumptions:

1. It is proposed that the site be redeveloped by the erection of a three-storey family dwellinghouse (Use Class C3(a)), with associated boundary
2. Drinking water will be from a mains supply.

In constructing the Preliminary Conceptual Model (PCM), **CCG** applied the guidance contained in CIRIA C552: 2001. This recommends use of a Risk Matrix which classifies risk on the basis of the product of Probability of a source being present, and the Consequence of receptors being exposed to the source. Guidance tables setting out the classifications of probability and consequence together with a risk matrix are given in Tables 7 - 9 hereunder. In using this approach **CCG** recommends actual intrusive investigation of any Risk Classification of "Moderate" or over.

Table 7: Matrix of consequences against probability to gain a risk classification [CIRIA C552, 2001]

		CONSEQUENCE			
		SEVERE	MEDIUM	MILD	MINOR
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table 8: Classification Definitions (C552 CIRIA, 2001)

CLASSIFICATION	DEFINITION
Very High	Severe harm could arise to a designated receptor, as a result of an identified potential source and credible pathway each of which have a high likelihood of being present. Or there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are highly likely to be required.
High	Severe harm could arise to a designated receptor, as a result of an identified potential source and credible pathway each of which have a likelihood of being present. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works are likely to be necessary.
Moderate	Severe harm could arise to a designated receptor, as a result of an identified potential source and credible pathway, but either the source or pathway or both have a low likelihood of being present. Investigation (if not undertaken already) is normally required to clarify the risk and to determine to potential liability. Some remedial works may be required.
Moderate / Low	Severe harm could arise to a designated receptor, as a result of an identified potential source and credible pathway, but either the source or pathway or both are unlikely to be present. Investigation (if not undertaken already) is normally required to clarify the risk and to determine to potential liability. Some remedial works may be required.
Low	Medium harm could arise to a designated receptor, as a result of an identified potential source and credible pathway, but either the source or pathway or both are unlikely to be present. Specific investigation is not normally required unless evidence of a potential risk arises during ground investigation. Some remedial works may be required.
Very Low	Mild or Medium harm could arise to a designated receptor, as a result of an identified potential source and credible pathway, but either the source or pathway or both unlikely to be present. Specific investigation is not normally required unless evidence of a potential risk arises during ground investigation. Some remedial works may be required.

9.2 Preliminary Conceptual Model

The site walkover and the historical review have not identified any significant risks of contamination affecting the site. However,

the proposed end use is of high sensitivity, and the effects of the demolition process over the developed history of the site are unknown, and hence by application of the risk assessment methodology outlined above, the following PCM was constructed.

Table 9: Preliminary Conceptual Model (PCM)

POLLUTANT LINKAGE	SOURCE	PATHWAY	RECEPTOR	PROBABILITY	CONSEQUENCE	RISK RATING
1	Heavy metal and organic contaminants in Made Ground /Imported Made Ground associated with the development of the land.	Soil and / or soil dust ingestion	Construction workers Future occupants General public	Low likelihood	Medium	Moderate / Low
2	Asbestos containing materials (ACM) in made ground soils associated with the development of the land.	Fibre Inhalation	Construction workers Future occupants General public	Likely	Severe (ACM)	High
3	Ground gases	Accumulation in buildings	Future occupants Fabric of buildings	Low likelihood	Medium	Moderate / Low
4	Organic contamination	Direct contact with water mains	Potable water supply	Unlikely	Medium	Low
5	pH & Sulphate attack on concrete	Future building	Future building	Likely	Mild	Low

The contaminants of concern associated with those risks which require intrusive investigation were researched by reference to published industry profiles, and are summarised hereunder:

Table 10: Summary of Contaminants of Concern based on PCM

LINKAGE NO.	METALS	NON-METALS	ORGANICS	GASES	OTHERS
PL1, PL2, PL4, PL5	Cd, Cr, Ni, Cu, Pb, Hg, Se, Zn	As, sulphates	TPHCWG, PAH's, BTEX, Volatiles (by PID)	-	pH Asbestos
PL3	-	-	-	CH ₄ , CO ₂ , H ₂ S	-
PL1-PL5	Cd, Cr, Ni, Cu, Pb, Hg, Se, Zn	As, sulphates	TPHCWG, BTEX PAH's, Volatiles (by PID)	CH ₄ , CO ₂ , H ₂ S	pH Asbestos

9.3 Summary of Risks

The foregoing analysis identified several potential risks, and if present, these could adversely impact on human or environmental receptors. Given the sensitivity of the proposed end use, and since no previous site investigation has been undertaken, an intrusive phase of investigation was undertaken to determine whether the postulated pollutant linkages are present on site.

10.0 SCOPE OF PHASE II INTRUSIVE INVESTIGATION

Based on the findings of the Phase I desk study and taking account of the potential presence of pollution linkages an intrusive investigation was undertaken. The Phase II Intrusive Investigation provided for exploratory boreholes to be sunk through made ground into the underlying natural strata to allow for sampling of soils and groundwater if present. The primary objectives of the investigation were to obtain enough soil and groundwater contamination data to reliably assess risks to human and environmental receptors, and to provide engineering parameters on which suitable foundation solutions could be selected.

11.0 FIELDWORK

11.1 Introduction

A programme of fieldwork investigation was undertaken in November 2019. Dynamic sampling rig access was hampered due to the

active trenching works on site, therefore the programme of works comprised:

- The sinking of 2nr boreholes by light dynamic sampling methods
- The further advancement of 2nr dynamic sampling boreholes by dynamic probing (DPSH) from 4mbgl to 9mbgl.
- The manual excavation and logging of 2nr trial pits, each extending to 1.2mbgl.
- The sinking of 3nr additional boreholes by light dynamic sampling methods for gas and groundwater monitoring installations only.

The fieldwork was planned in accordance with BS10175: 2013 and carried out in accordance with BS10175: 2013 and BS5930: 1015, and the sampling and monitoring methodologies employed by **CCG** as presented in Appendix C, insofar as they related to the scope of the investigation.

The investigation layout is as shown on **CCG Dwg No. 11344-1** contained herein.

11.2 Dynamic Sampling Boreholes

2nr boreholes (WS1 and WS4) were sunk by light dynamic sampling methods using a Dando Terrier 2000 light dynamic sampling rig at locations as annotated on **CCG Dwg No. 11344-1** appended herein.

These boreholes were advanced to depths of 4.0mbgl.

3nr boreholes (S1 -S3) were sunk by light dynamic sampling methods using a Dando Terrier 2000 light dynamic sampling rig at locations as annotated on **CCG Dwg No. 11344-1** appended herein.

The boreholes were advanced to depths of 1.6mbgl.

Each borehole was positioned clear of services and scanned using CAT service scanner before and during hand excavation of a starter pit extending to 1.2mbgl.

Boring tools were decontaminated prior to commencement.

In this method of investigation, relatively undisturbed samples of the subsoils are recovered by the driving of a series of reducing diameter steel tubes, each one carrying a perspex liner. The liners are extracted from the steel casing and split, logged and subsampled as required.

Logs of the boreholes annotated with sampling details and SPT 'N' values are given in Appendix D.

11.3 Hand Excavated Pits

2nr pits (WS2 and WS3) were excavated by manual excavation methods at locations as annotated on **CCG Dwg No.11344-1** appended herein.

Each pit location was scanned using a CAT service detector before and during manual excavation of the trial pits.

The soil arisings were carefully logged and sampled, and then returned to the excavations in the reverse sequence of their excavation to preserve, insofar as was possible, the original lithology.

Logs of the pits annotated with details of sub-sampling are given in Appendix F.

12.0 OBSERVED GROUND CONDITIONS

12.1 Stratigraphy

The stratigraphy of the boreholes was observed to be consistent with the documented geology and showed minimal variation

across the site. Individual borehole / pit observations are provided with Appendix D and Appendix F, and may be summarised as hereunder:

Bituminous surfacing material (TARMAC) extending to 0.1mbgl

overlying;

MADE GROUND deposits of brown clayey gravelly SAND with gravels of brick and concrete extending to 0.8-1.2mbgl

overlying;

NATURAL deposits of Brown slightly sandy silty CLAY proven to 4.0mbgl

There was no visual and/or olfactory evidence of contamination affecting the made ground mass at any sampling position.

12.2 Groundwater Regime

Groundwater was not present at any locations during the investigation.

13.0 LABORATORY TESTING

13.1 Soil Contamination Testing

A programme of soil chemical analyses was undertaken at a UKAS / MCERTS accredited laboratory as follows:

- 4nr subsamples of made ground soils were analysed to a broad-spectrum suite of contaminants including pH, metals, non-metals, heavy metals, speciated PAH's, speciated hydrocarbons to the TPHCWG methodology, and asbestos.
- 4nr subsamples of made ground soils were analysed for Total Organic Carbon (TOC) .
- 4nr subsamples of natural soils were analysed for pH and sulphates.

The soil contamination test results and certificates are presented in Appendix H.

13.2 Soil Engineering Testing

The following programme of soil geotechnical testing was undertaken at the **UKAS** laboratory of **CCG**.

- Determination of Moisture Content in accordance with BS 1377-2: 1990
- Determination of Plastic & Liquid Limits in accordance with BS 1377-2: 1990.

The soil engineering test results are presented in Appendix G.

14.0 RISK ASSESSMENT FOR THE PROTECTION OF HUMAN HEALTH

14.1 Generic Quantitative Risk Assessment (Tier 2 / GQRA)

An assessment of the soil analysis data was carried out in accordance with the guidance presented in CLR11 and in accordance with current guidance and legislation.

The Human Health Risk Assessment was carried out in accordance with the **CCG** methodology for assessing soil contamination data as contained in Appendix M, and since it is proposed that the site be redeveloped for Residential land use, the assessment was based on criteria contained in publication LQM/CIEH S4UL's for Human Health Risk Assessment (2015) (CCG licence S4UL3233), applicable to the "Residential with Home Grown Produce" land use scenario. This document does not provide criteria for Lead, for which the results were compared to the C4SL published by DEFRA SP1010 Development of Category 4 Screening Levels.

14.2 Assessment of Contamination Data

Based on a Soil Organic Matter content average of 1.0%, the assessment of the soil data is summarised in the tabulations hereunder, and presented on the worksheets in Appendix J.

14.2.1 Assessment of Metal Data

The assessment of the metal data is presented hereunder:

Table 11: Assessment of Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Cadmium	11	1	-	-
Chromium	910	33.9	-	-
Copper	240	70.2	-	-
Lead	200	930	930	WS4
Mercury	1.2	3.5	-	-
Nickel	180	37.8	-	-
Zinc	3700	371	-	-

The above assessment concludes that Lead is present at concentrations that exceed its respective guideline criterion and hence a risk to human health is indicated.

14.2.2 Assessment of Non-Metal Data

The assessment of the non-metal data is presented hereunder:

Table 12: Assessment of Non-Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Arsenic	37	14.7	-	-
Selenium	350	<1.0	-	-
Free Cyanide	22	<1.0	-	-

The above assessment concludes that no contaminants are present at concentrations that exceed their respective guideline criteria and hence no risk to human health is indicated.

14.2.3 Assessment of Polycyclic Aromatic Hydrocarbon [PAH's] Data

The assessment of the Polycyclic Aromatic Hydrocarbon (PAH's) data is presented hereunder:

Table 13: Assessment of PAH Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Acenaphthene	210	1.3	-	-
Acenaphthylene	170	0.4	-	-
Anthracene	2400	2.3	-	-
Benz(a)anthracene	7.2	4.8	-	-
Benzo(a)pyrene	2.2	4.3	4.3, 2.3	WS2, WS3
Benzo(b)fluoranthene	2.6	3.9	3.9	WS2
Benzo(g,h,i)perylene	320	2.8	-	-
Benzo(k)fluoranthene	77	4.1	-	-
Chrysene	15	5.8	-	-
Dibenzo(ah)anthracene	0.24	0.7	0.7, 0.4, 0.4	WS2, WS3, WS4
Fluoranthene	280	11	-	-
Fluorene	170	1.2	-	-
Indeno(1,2,3-cd)pyrene	27	2.9	-	-
Naphthalene	2.3	0.4	-	-
Phenanthrene	95	9.3	-	-
Pyrene	620	10.5	-	-

The above assessment concludes that several PAH species are present at concentrations that exceed their respective guideline criteria and hence a risk to human health is indicated.

14.2.4 Assessment of Total Petroleum Hydrocarbon [TPH's] Data

The assessment of TPH data is presented hereunder:

Table 14: Assessment of Hydrocarbon Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Aromatic EC5-EC7	70	<0.01	-	-
Aromatic EC7-EC8	130	<0.01	-	-
Aromatic EC8-EC10	34	<1.0	-	-
Aromatic EC10-EC12	74	<1.0	-	-
Aromatic EC12-EC16	140	2.8	-	-
Aromatic EC16-EC21	260	9.9	-	-
Aromatic EC21-EC35	1100	267	-	-
Aromatic EC35-EC44	1100	235	-	-
Aliphatic EC5-EC6	42	<0.01	-	-
Aliphatic EC6-EC8	100	<0.01	-	-
Aliphatic EC8-EC10	27	2.3	-	-
Aliphatic EC10-EC12	130	5.8	-	-
Aliphatic EC12-EC16	1100	22.7	-	-
Aliphatic EC16-EC35	65000	432.7	-	-
Aliphatic EC35-EC44	65000	290	-	-

The above assessment concludes that no hydrocarbon fraction is present at concentrations that exceed their respective guideline criteria and hence no risk to human health is indicated.

14.2.5 Assessment of BTEX Data

All BTEX compounds were below their limit of detection (LOD) and therefore no risk to human health is indicated.

14.2.6 Assessment of Asbestos Data

Asbestos screening confirms that asbestos containing materials (ACM) were not present in any sample analysed and therefore no risk to human health is indicated.

14.2.7 Summary of Human Health Risk Assessment

Based on the above assessment, it is concluded that Lead (WS4) and several PAH species (WS2, WS3 and WS4) in the made ground at concentrations exceeds its respective guideline criterion for Residential with Home Grown Produce land use scenario and therefore a potential risk to human health is indicated.

15.0 SPECIFICATION OF BURIED CONCRETE

The data obtained in the investigations was assessed against the guidance given in BRE Special Digest 1: 2005, as summarised hereunder:

Table 15: Design Chemical Class Based on Soil Data

CONCRETE SPECIFICATION DATA SHEET		
Is the site Brownfield or Greenfield?	Brownfield	
Is the water table static or mobile?	Static	
Highest water-soluble Sulphate results	170mg/l	Design Sulphate Class of DS-1 Class of AC-1s
Lowest pH result	8.0	
Intended Working Life	50 years	Adopt Design Chemical Classification of DC-1

On the basis of the above, concrete should be specified to conform to the compositional requirements of DC-1 as defined in BRE Special Digest 1: 2005.

16.0 GAS RISK ASSESSMENT

The potential sources of gas identified in the desk study were generally considered as sources of “Moderate / Low” generation potential, but given that the development is of high sensitivity, a programme of monitoring comprising of 6 rounds distributed over a 3-month period was adopted.

A preliminary gas risk assessment was undertaken in accordance with current UK guidelines set out in CIRIA C665 2007 “Assessing Risk Posed by Hazardous Gases to Buildings”. The CIRIA risk assessment methodology uses typical maximum soil gas concentrations and worse case borehole flow rates to define a “Characteristic Situation” for the shallow gas regime.

The volumetric gas flow rate used by the risk assessment is termed “Gas Screening Value (GSV)” in the guidance and is defined below.

$$GSV \text{ (litres/hr)} = \text{borehole flow rate (litres/hr)} \times \text{gas concentration.}$$

There are also two stages to the assessment method proposed in CIRIA C665; compliance with a GSV Threshold Value and secondly, compliance with additional factors such as maximum permissible gas concentration. A summary of the gas monitoring data is presented hereunder and presented in Appendix H.

Based on the obtained results, a Gas Screening Value (GSV) of 0.0041l/hr for CO₂ is calculated. A GSV for CH₄ could not be calculated due to the absence of gas.

Table 16: Summary of Gas Monitoring Data

Position	S1	S2	S3
No Monitoring Visits	6	6	6
Maximum CH ₄ (%)	0.0	0.0	0.0
Maximum CO ₂ (%)	3.6	4.1	0.8
Minimum O ₂ (%)	18.4	18.3	19.7
H ₂ S (ppm)	0	0	0
CO (ppm)	0	0	0
Flow (l/hr)	<0.1	<0.1	<0.1
Water Levels (m)	Dry	Dry	Dry
Depth to base (m)	1.5	1.4	1.5
PID response	-	-	-
Pressure Range (mb)	993-1014		

Based on the above data, the risk to the proposed development was assessed in line with Situation A as defined in CIRIA C665, and on this basis the site complies with Characteristic Situation 1. This classification does not require the adoption of remedial measures with respect to ground gas.

17.0 NEW WATER MAINS SUPPLY

Assessment of the soil chemical data to specify the construction of new water mains at the development site was based on the criteria specified in Paper 10/WM/03/21 ‘Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites’ January 2011 published by UK Water Industry Research (UKWIR) and the supplementary guidance UUENG/RL/V2/July 2011 published by United Utilities Water (UUW).

Concentrations of the pertinent soil contaminants were found to be above the threshold values recommended under the UKWIR and UUW guidance. On this basis, new water mains should be specified as barrier pipe (Protectaline) construction.

Pipes should be laid in accordance with BS EN 12201-2 'Plastic piping systems for water supply, and for drainage and sewerage under pressure – Polyethylene (PE) as stated in UKWIR guidance. It is a requirement that Protectaline water mains to be laid in a remediated alignment comprising of clean granular fill extending to 600mm + pipe diameter and to 300mm below the pipe underside.

Notwithstanding the above preliminary assessment, the developer should contact the local water supplier (UW) to obtain concurrence with the recommendations given above. The supplier may require the developer to return a completed UW Risk Assessment document.

18.0 WASTE CLASSIFICATION

A waste classification exercise was undertaken which entailed the assessment of the basic soil contamination data via the HAZWASTE program. The output data from this basic assessment is provided in Appendix K. This program generates the baseline 'Hazardous / Non-Hazardous' classification of soils.

The HAZWASTE report classifies soils analysed at WS4 0.5 to be classified as "Hazardous Waste" due to its exceedance of TPH (C6 to C40) petroleum group.

The HAZWASTE report classifies all other soils analysed to be "Non-Hazardous Waste".

It should be noted that the final decision on waste classification is at the discretion of the accepting landfill, and it is recommended that consultation with landfill operators be undertaken during the development of the waste management plan.

19.0 POST INVESTIGATION CONCEPTUAL MODEL

Table 17: Conceptual Model

Source	Primary Pathway	Receptor	Basis of Remediation
Elevated levels of Lead (WS4) within superficial made ground.	Ingestion of soils	Future Residents	Remediation is not required under proposed buildings or hard paving.
Elevated levels of Benzo(a)pyrene, Benzo(b)fluoranthene and Dibenzo(ah)anthracene (WS2, WS3 and WS4) within superficial made ground.	Inhalation of soil dust		In gardens, ground levels should be reduced to 600mm below finished garden level. Levels should then be restored by placement of clean imported clean topsoil placed under a regime of validation testing.
	Ingestion of contaminated produce		

20.0 FOUNDATIONS & FLOOR SLABS RECOMMENDATIONS

20.1 Introduction

It is proposed that the site be redeveloped by the erection of a three-storey family dwellinghouse with front garden and rear yard area. Plans of the proposed development are shown in Appendix A.

20.2 Foundations

The site is underlain by around 1m of made ground resting on firm clay. In these conditions traditional strip foundations may be adopted bearing on the clay at a notional depth of 1.2mbgl and may be designed on a Presumed Bearing Value of 100kN/m².

20.3 Ground Slabs

Fully suspended beam and block floors are the preferred solution.

20.4 Excavations

Excavations may be undertaken in the made ground deposits by light hydraulic excavators. Excavations in excess of 1.2mbgl will require side support.

20.5 Groundwater Management

Groundwater was not present at any locations during the investigation. Notwithstanding these observations, prudent contractors would allow for pumping to develop and maintain dry working conditions, in foundation and service trench excavations.

21.0 CONCLUSIONS & RECOMMENDATIONS

The conclusions and recommendations hereunder are based on the salient sections of the report and should not be referred to in isolation of the relevant sections of the text. All recommendations are subject to Regulatory Authority review.

Table 18: Conclusions & Recommendations

Soil Contamination / Remediation	Based on the above assessment, it is concluded that Lead (WS4) and several PAH species (WS2, WS3 and WS4) in the made ground at concentrations exceeds its respective guideline criterion for Residential with Home Grown Produce land use scenario and therefore a potential risk to human health is indicated. Remediation is not required under proposed buildings or hard paving. In gardens and communal landscaped areas, ground levels should be reduced to 600mm below finished garden level. Levels should then be restored by placement of clean imported clean topsoil placed under a regime of validation testing. It should be borne in mind that this investigation has not assessed existing topsoil quality, and should contractors recover topsoil for reuse in the project, then this must be subjected to validation analysis to demonstrate that it is free from contamination. Similar validation testing will be required for imported topsoil.
Gas Risk Assessment	Based on the obtained results, a Gas Screening Value (GSV) of 0.0041l/hr for CO₂ is calculated. A GSV for CH₄ could not be calculated due to the absence of gas. Based on the above data, the risk to the proposed development was assessed in line with Situation A as defined in CIRIA C665, and on this basis the site complies with Characteristic Situation 1. This classification does not require the adoption of remedial measures with respect to ground gas.
Concrete Specification	Concrete in the ground should be specified to conform to the compositional requirements of Design Chemical Class DC-1 , as defined in BRE Special Digest 1: 2005.
Water Mains	Assessment of the soil chemical data to specify the construction of new water mains at the development site was based on the criteria specified in Paper 10/WM/03/21 'Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites' January 2011 published by UK Water Industry Research (UKWIR) and the supplementary guidance UUENG/RL/V2/July 2011 published by United Utilities Water (UWU). Concentrations of the pertinent soil contaminants were found to be above the threshold values recommended under the UKWIR and UWU guidance. On this basis, new water mains should be specified as barrier pipe (Protectaline) construction. Pipes should be laid in accordance with BS EN 12201-2 'Plastic piping systems for water supply, and for drainage and sewerage under pressure – Polyethylene (PE) as stated in UKWIR guidance. It is a requirement that Protectaline water mains to be laid in a remediated alignment comprising of clean granular fill extending to 600mm + pipe diameter and to 300mm below the pipe underside. Notwithstanding the above preliminary assessment, the developer should contact the local water supplier (UWU) to obtain concurrence with the recommendations given above. The supplier may require the developer to return a completed UWU Risk Assessment document.
Waste Classification	A waste classification exercise was undertaken which entailed the assessment of the basic soil contamination data via the HAZWASTE program. The output data from this basic assessment is provided in Appendix K. This program generates the baseline 'Hazardous / Non-Hazardous' classification of soils. The HAZWASTE report classifies soils analysed at WS4 0.5 to be classified as "Hazardous Waste" due to its exceedance of TPH (C6 to C40) petroleum group. The HAZWASTE report classifies all other soils analysed to be "Non-Hazardous Waste". It should be noted that the final decision on waste classification is at the discretion of the accepting landfill, and it is recommended that consultation with landfill operators be undertaken during the development of the waste management plan.
Foundations & Ground Floor Slabs	See Section 20.0 for full discussion.
Excavations	Excavations may be undertaken in the made ground deposits by light hydraulic excavators. Excavations in excess of 1.2mbgl will require side support.
Groundwater Management	Groundwater was not present at any locations during the investigation. Notwithstanding these observations, prudent contractors would allow for pumping to develop and maintain dry working conditions, in foundation and service trench excavations.
Further Work	• Prepare Phase III Remediation Strategy Report. • Prepare Phase IV Validation / Completion Report.

APPENDIX A

DRAWINGS



Legend



Borehole Locations



Gas and groundwater
monitoring installations



CC GEOTECHNICAL LIMITED
UNIT 1 DELTIC WAY
KNOWSLEY INDUSTRIAL ESTATE
LIVERPOOL
L33 7BA
0151 545 2750

Client:
Corstorphine + Wright Limited

Project:
303 Cheetham Hill Road, Manchester, M8 0SN

Title:
Location Plan

Scale:
NTS

Issue:
1

Drawn by:
DE

Date:
27/08/2020

Project No.
CCG-C-19-11344

Drawing No.
11344-1

CC GEOTECHNICAL LIMITED

PROPOSED

Dimensions to suit overall existing dimensions
Applicant to confirm boundary.
Drawings to be read in conjunction.
This drawing is for the purpose of obtaining Local Authority approvals only and may not contain a full specification of the works.
Do not scale off this drawing.
All dimensions to be checked on site prior to commencing works.

Applicant should be aware that The Party Wall Act may apply where building work is on or near the boundary.



N.GEDAL
BA Hons Dip ARCH RIBA

ARCHITECT

REVISION A 14-05-16

CLIENT
Proposed New Dwelling
303 Cheetham Hill Road
Manchester
M8 0SN

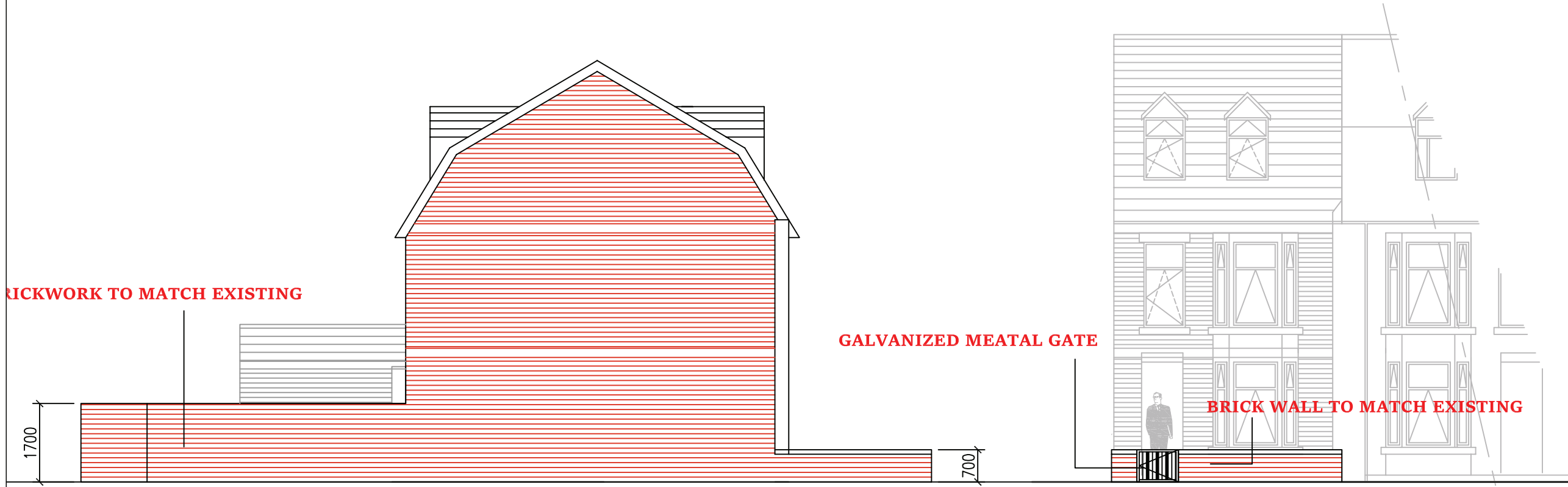
Architects
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Stockport
SK7 5AY
Tel: 0161-419 - 9757
najibgedalarchitects@hotmail.com

DRAWING TITLE

Boundary Treatment

DRAWING NO - JCH 06

SCALE	DATE
1:100@A3	18.02.16



SIDE ELEVATION BOUNDARY TREATMENT

FRONT BOUNDARY TREATMENT

PROPOSED

Dimensions to suit overall existing dimensions
Applicant to confirm boundary.
Drawings to be read in conjunction.
This drawing is for the purpose of obtaining Local Authority approvals only and may not contain a full specification of the works.
Do not scale off this drawing.
All dimensions to be checked on site prior to commencing works.

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REVISION A 14-05-16

CLIENT
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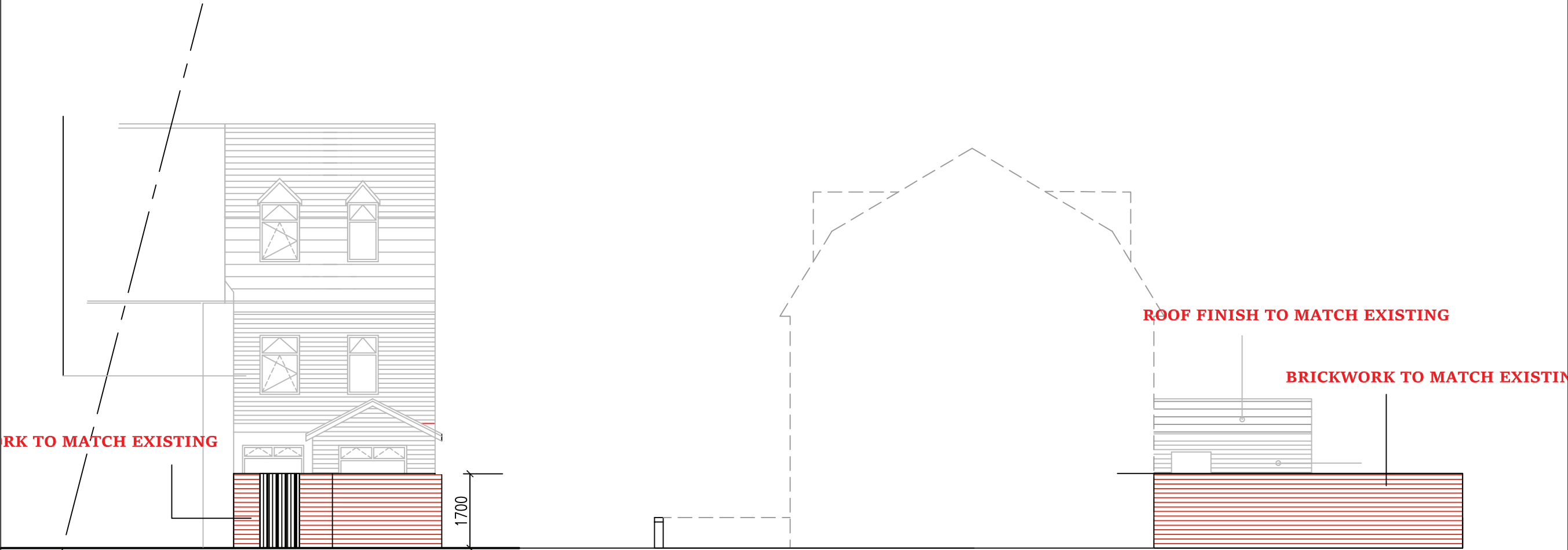
Architects
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DRAWING TITLE

Boundary Treatment

DRAWING NO - JCH 05

SCALE DATE
1:100@A3 18.02.16



REAR BOUNDARY TREATMENT

SIDE ELEVATION BOUNDARY TREATMENT

APPENDIX B

SITE PHOTOGRAPHS



Site	303 Cheetham Hill Road, Manchester
Job Number:	CCG-C-19-11344



Site

303 Cheetham Hill Road, Manchester

Job Number:

CCG-C-19-11344



Site	303 Cheetham Hill Road, Manchester
Job Number:	CCG-C-19-11344



Site	303 Cheetham Hill Road, Manchester
Job Number:	CCG-C-19-11344



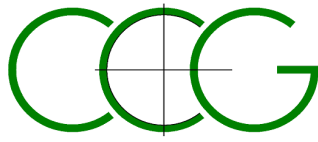
Site	303 Cheetham Hill Road, Manchester
Job Number:	CCG-C-19-11344



Site	303 Cheetham Hill Road, Manchester
Job Number:	CCG-C-19-11344

APPENDIX C

SAMPLING METHODOLOGY



SAMPLING, SAMPLE TRANSPORTATION, AND FIELD MONITORING PROTOCOLS

Soil, water and gas sampling and monitoring methodologies employed by **CC GEOTECHNICAL LTD** are presented hereunder.

SAMPLING OF SOIL FOR CHEMICAL ANALYSIS

Soil samples may be recovered from a variety of intrusive investigation methods including *inter alia* dynamic sampling boreholes, cable percussion boreholes, machine or manual excavation of trial pits.

All equipment which has the potential to introduce extraneous materials into soils – borehole casings, sampling drilling rods, borehole sampling tools, hand tools such as trowels and spades etc. – must be cleaned by jet washing before initial use and between sampling positions.

Cable Percussion Boreholes

In this method of investigation disturbed bulk and small disturbed samples are recovered at regular depth increments throughout the length of the borehole. Each bulk/small disturbed sample is uniquely labelled with the Project Name / Project No / Borehole No / Depth / Date. Where possible, samples are immediately scanned by PID.

Light Dynamic Sampling Boreholes

In this method of investigation samples are recovered in relatively undisturbed 1m long Perspex liners. Each liner is uniquely labelled with the Project Name / Project No / Borehole No / Depth / Date. The liner tubes are sealed by air tight caps fitted at each end, and are temporarily stored out of sunlight. Where possible, samples are immediately split, scanned by PID, logged and subsampled. In the event that splitting and logging on site is not practicable, then the liners are immediately transported to the laboratory where they are immediately split, scanned by PID, logged and subsampled.

Trial Pits

Samples are to be taken from the bucket of an excavator and placed in appropriate airtight containers. Each container is uniquely labelled with the Project No / Trial Pit No / Depth / Date. The samples are then immediately placed in a cool box chilled by ice packs, and the boxes are sealed for transportation to the chemical laboratory.

Sampling Containers

Containers used to store soil samples are selected dependant on the required analysis. The testing laboratory will be consulted should there be any doubt as to the correct sampling container. Typically, a minimum of 1nr 1kg plastic tub, 1nr 500g plastic tub, 1nr 250g amber glass jar and 2nr glass vials are taken at each sample depth. Samples held on site awaiting same day courier collection are stored at 4°C in a cool box. Only in circumstances where same day collection cannot be arranged are samples held overnight, and in this event all samples are refrigerated at 4 °C either on site (if a refrigerator is available) or at CC GEOTECHNICAL soil laboratory. Courier collection is then arranged for immediate pick up the following day.

Chain of Custody records

A Chain of Custody Record (CoC) is to be sent with each batch of samples submitted to the testing laboratory. A copy of the CoC will be made available for inspection by the client, their agents, or any requesting regulatory authority.

HEADSPACE ANALYSES

Duplicate subsamples of all soil samples selected for laboratory analysis may be taken for headspace analyses.

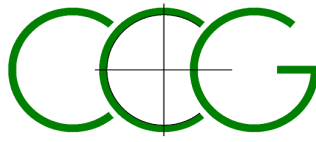
Headspace analysis is undertaken using a MiniRae 2000 Photo Ionisation Detector (PID). In the test method, an amber glass jar is half filled with soil, and the lid is sealed with aluminium foil secured by an elastic band. The jar and contents are agitated for 30 seconds and left for a minimum of 30 minutes out of direct sunlight for the headspace to achieve equilibrium. The PID then pierces the seal and the maximum reading is recorded. Prevailing weather conditions and ambient air temperature are also recorded.

The PID headspace results are recorded on the exploratory borehole or trial pit logs.

PID headspace data is then used to inform the chemical testing schedule for volatile organic compounds analyses.

SAMPLING OF GROUNDWATER FOR CHEMICAL ANALYSIS

Groundwater is sampled from standpipes or piezometers installed during borehole drilling. On completion of the construction of the standpipe, the installation is initially developed by removing up to 10 x the internal volume of the installation. The volume of water purged is recorded. The installation is then typically left for a week for hydraulic equilibrium to be restored.



Prior to sampling the standpipe, the depth to the water table, and the depth to the base of the installation are monitored using an electronic dipmeter. In circumstances where free phase product is suspected to be present, then an 'Interface Meter' is used to determine the free phase film thickness.

A minimum of 3 x the installation volume is then removed. The pH of the water is then monitored and the sample is taken when the change in pH between any two consecutive extracts is less than 10%. The volume of water removed is recorded.

A sample comprises of a minimum of 3 litres. Two litres are taken in amber glass bottles, and one litre in a plastic bottle.

To avoid cross-contamination one bailer is used per position.

The samples are uniquely labelled with Project Name / Project No / Borehole No / Depth / Date Sampled. They are placed in a cool box chilled by ice packs, and the containers are sealed for transportation to the laboratory.

Once the samples are received in the **CC GEOTECHNICAL LTD** laboratory, the samples are stored in a refrigerator and returned to the cool boxes once collected.

Water taken from the installations are taken back to the **CC GEOTECHNICAL LTD** laboratory and disposed.

Other data recorded in the sampling comprises:

- Volume of water removed during development of well
- Volume of water removed during purging of the well
- Results of on-site pH analyses
- Sample appearance – colour, suspended solids

MONITORING OF GAS

Prior to embarking on a gas-monitoring round, all equipment is checked for functionality and the calibration status is confirmed.

At the commencement of the monitoring round, the prevailing weather conditions, air temperature, barometric pressure and direction of movement of barometric pressure are recorded.

The flow meter is first attached to the standpipe valve, and the flow rate is measured (peak and steady flow) for 1 minute. The results are recorded in l.hr^{-1} . The flow meter tube is protected from the effects of wind by aligning the exhaust downwind.

Following measurement of borehole flow rate, the installation is left for a minimum of 10 minutes for the headspace to restore equilibrium.

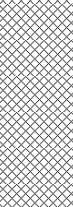
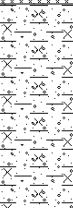
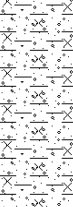
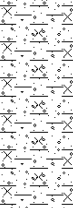
Once the gas in the installation has regained equilibrium, the gas analyser is connected and monitoring commences. The peak and steady state readings for CH_4 , CO_2 , CO , H_2S and CO are recorded. The steady state is monitored for a minimum of one minute, and possibly up to a maximum of 10 minutes where fluctuations continue.

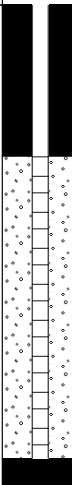
When the monitoring is complete, the depth to the water table, and the depth to the base of the well are monitored using an electronic dipmeter. In circumstances where free phase product is suspected to be present, then an 'Interface Meter' is used to determine the free phase film thickness.

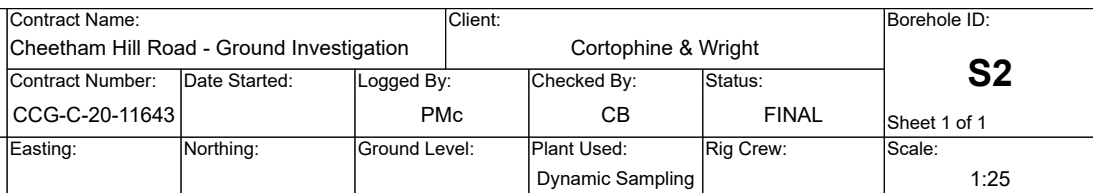
APPENDIX D

DYNAMIC SAMPLING BOREHOLE LOGS

	Contract Name: Cheetham Hill Road, Manchester				Client: Corstorphine+Wright			Borehole ID: WS1		
	Contract Number: CCG-C-19-11344		Date Started: 20/11/2019		Logged By: DE		Checked By: CB		Status: FINAL	
	Easting:		Northing:		Ground Level:		Plant Used: Dando Terrier rig		Rig Crew: SG+CC	
Dynamic Sampling Borehole Log								Scale: 1:25		
Weather: Dry				Termination:				SPT Hammer: N/R, Energy Ratio: N/R		
Samples & In Situ Testing				Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation
0.00 - 1.00	UT			0.10		TARMAC.				
				(1.10)		Brown slightly clayey slightly gravelly fine to medium grained SAND. Gravel is fine to coarse sub-angular brick and concrete (MADE GROUND).				
1.00 - 2.00	UT	SPT(S)N=9 (2,1/2,2,2,3)		1.20		Brown slightly sandy silty CLAY.			1	
2.00 - 3.00	UT	SPT(S)N=10 (2,2/2,3,2,3)		(2.80)					2	
										
3.00 - 4.00	UT	SPT(S)N=16 (3,3/4,3,4,5)		4.00		End of Borehole at 4.00m			3	
									4	
									5	
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)		
Chiselling					Installation				Water Strikes	
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)
									Time (mins)	Rose to (m)
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	Contract Name: Cheetham Hill Road, Manchester			Client: Corstorphine+Wright			Borehole ID: WS4		
	Contract Number: CCG-C-19-11344	Date Started: 20/11/2019	Logged By: DE	Checked By: CB	Status: FINAL	Sheet 1 of 1			
Dynamic Sampling Borehole Log	Easting:	Northing:	Ground Level:	Plant Used: Dando Terrier rig	Rig Crew: SG+CC	Scale: 1:25			
	Weather: Dry		Termination:		SPT Hammer: N/R, Energy Ratio: N/R				
Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description		Water Strike	Backfill/ Installation
0.00 - 1.00	UT			0.10		TARMAC.			
				(0.70)			Dark brown slightly sandy slightly clayey GRAVEL. Gravel is fine to coarse sub-angular brick, concrete and mortar (MADE GROUND).		
				0.80			Brown slightly sandy silty CLAY.		
1.00 - 2.00	UT	SPT(S)N=12 (2,2/3,2,3,4)					1		
2.00 - 3.00	UT	SPT(S)N=13 (3,3/3,4,3,3)					2		
3.00 - 4.00	UT	SPT(S)N=16 (3,4/3,4,4,5)					3		
				4.00		End of Borehole at 4.00m	4		
							5		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	
Chiselling					Installation				
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)		
Water Strikes Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks									
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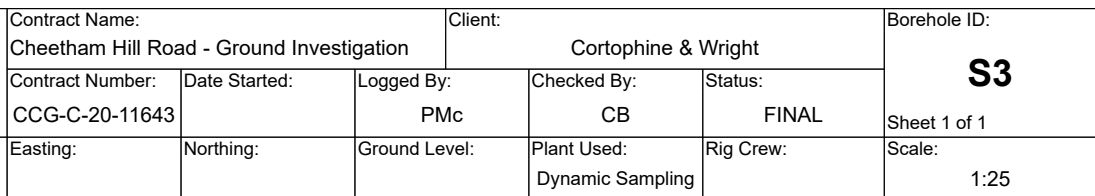
	Contract Name: Cheetham Hill Road - Ground Investigation				Client: Cortophine & Wright			Borehole ID: S1		
	Contract Number: CCG-C-20-11643		Date Started:		Logged By: PMc		Checked By: CB		Status: FINAL	
	Easting:		Northing:		Ground Level:		Plant Used: Dynamic Sampling		Rig Crew:	
Dynamic Sampling Borehole Log								Scale: 1:25		
Weather: Dry				Termination: As Instructed.						
Samples & In Situ Testing				Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation
		HVP=50		0.10		Dark grey slightly gravelly slightly sandy silty CLAY with frequent organic pockets. Gravel is fine to coarse angular to subangular brick, sandstone, and coal. (MADE GROUND) Soft to firm becoming firm brownish grey slightly gravelly slightly sandy silty CLAY with frequent organic pockets. Gravel is fine to medium angular to subrounded sandstone and coal. Firm to stiff becoming stiff brown slightly gravelly slightly sandy silty CLAY. Gravel is fine to medium subrounded sandstone and coal. End of Borehole at 1.60m			1	
		HVP=50	(0.55)							
		HVP=90	0.65							
		HVP=100	(0.95)							
		HVP=110	1.60							
									2	
									3	
									4	
									5	
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)		
Chiselling					Installation				Water Strikes	
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)
				0.00	0.50	PLAIN				
				0.50	1.50	SLOTTED				
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com										



Termination: As Instructed.

[illegible]

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00	0.50	PLAIN							
					0.50	1.50	SLOTTED							
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														



Termination: As Instructed.

[illegible]

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
									Water Strikes					
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)						
					0.00	0.50	PLAIN							
					0.50	1.50	SLOTTED							
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APPENDIX E

DYNAMIC PROBE RESULTS

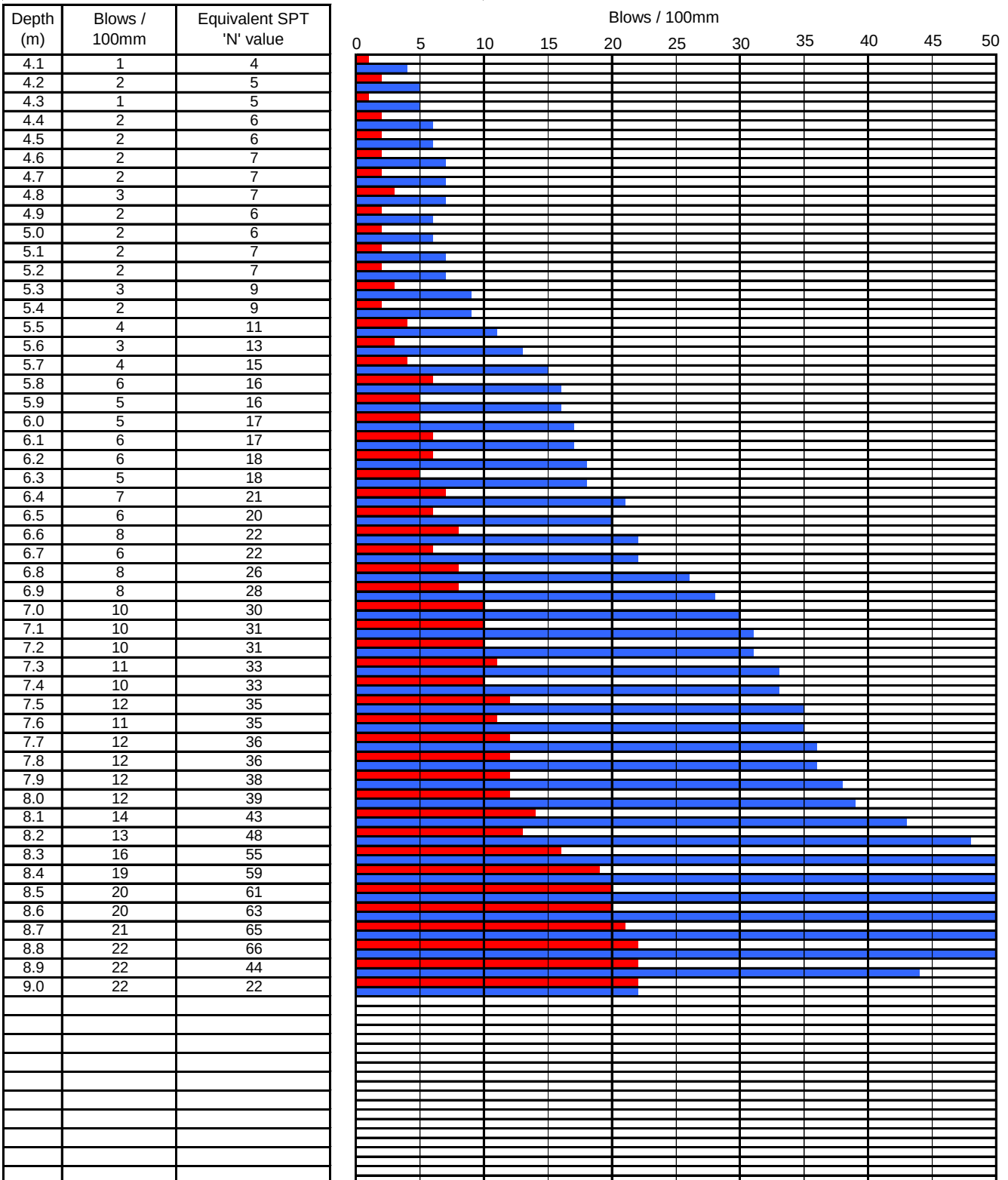


CC GEOTECHNICAL LTD
Unit 1, Deltic Way, Knowsley Industrial Estate,
L33 7BU
Tel: 0151 545 2750 Fax: 0151 548 7892

DYNAMIC PROBE TEST RESULTS SHEET

SITE: Cheetham Hill Road, Manchester
CLIENT: Corstorphine+Wright
PROBE NUMBER: WS1
DATE: 20-Nov-19

DPSH IN ACCORDANCE WITH BS 1377: PART 9: CLAUSE 3.2
CONE BURIED:
PROBE HOLE BACKFILLED:
REMARKS:



Dynamic probe value (Blows/100mm)



Equivalent SPT 'N' value

CCG-CMS-FO-066-B
Issue 4

Registered in England & Wales, Company No. 5085241. Head Office: Unit 1, Deltic Place, Deltic Way, Knowsley Industrial Estate, Liverpool, L33 7BU



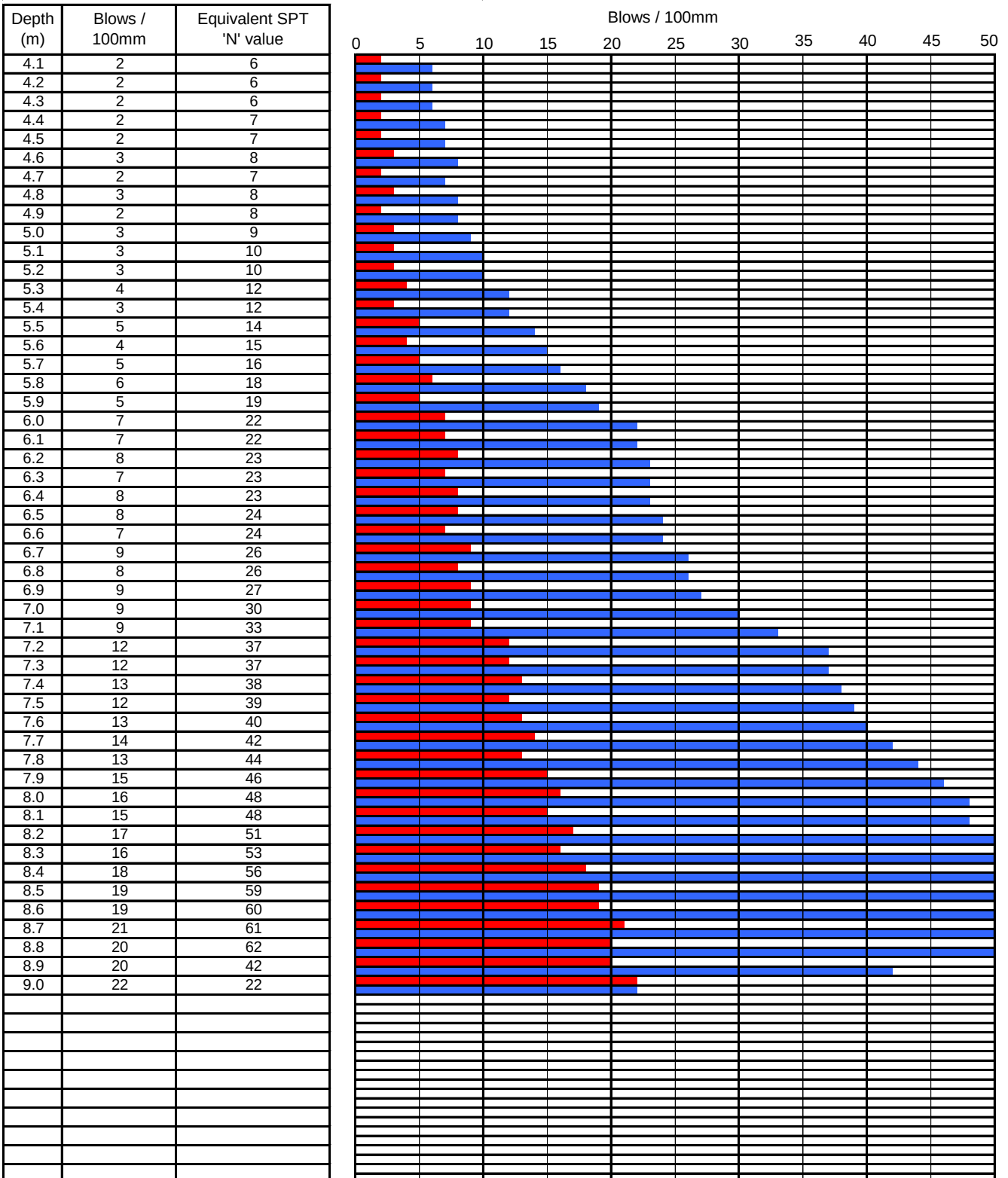


CC GEOTECHNICAL LTD
Unit 1, Deltic Way, Knowsley Industrial Estate,
L33 7BU
Tel: 0151 545 2750 Fax: 0151 548 7892

DYNAMIC PROBE TEST RESULTS SHEET

SITE: Cheetham Hill Road, Manchester
CLIENT: Corstorphine+Wright
PROBE NUMBER: WS4
DATE: 20-Nov-19

DPSH IN ACCORDANCE WITH BS 1377: PART 9: CLAUSE 3.2
CONE BURIED:
PROBE HOLE BACKFILLED:
REMARKS:



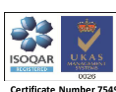
Dynamic probe value (Blows/100mm)



Equivalent SPT 'N' value

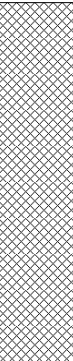
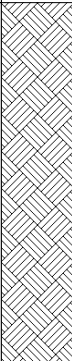
Registered in England & Wales, Company No. 5085241. Head Office: Unit 1, Deltic Place, Deltic Way, Knowsley Industrial Estate, Liverpool, L33 7BU

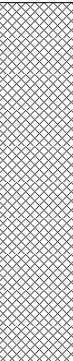
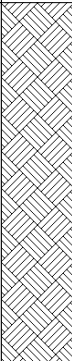
CCG-CMS-FO-066-B
Issue 4



APPENDIX F

HAND EXCAVATED PIT LOGS

	Contract Name: Cheetham Hill Road, Manchester		Client: Corstorphine+Wright			Trial Pit ID: WS2																				
	Contract Number: CCG-C-19-11344	Date Started: 20/11/2019	Logged By: DE	Checked By: CB	Status: FINAL	Sheet 1 of 1																				
Trial Pit Log	Easting:	Northing:	Ground Level:	Plant Used: Hand excavated	Date Printed: 09/12/2019	Scale: 1:25																				
	Weather: Dry		Hole Termination:		Stability:																					
Samples & In Situ Testing			Strata Details				Water	Backfill																		
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description																				
0.50	B			(1.20)		Dark brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse sub-angular brick and concrete (MADE GROUND).	1																			
0.80	B			1.20		End of Trial Pit at 1.20m			2																	
							3																			
Dimensions:			General Remarks:																							
Final Depth: 1.20m			Unable to access position to complete dynamic sampling borehole. 1.2mbgl hand excavated pit.																							
← Length (m) → m ↑ Width (m) ↓ m Orientation: ° ←																										
Inclination: °			<table><tr><th colspan="6">Water Strikes</th></tr><tr><th>Strike (m)</th><th>Casing (m)</th><th>Sealed (m)</th><th>Time (mins)</th><th>Rose to (m)</th><th>Remarks</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						Water Strikes						Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks						
Water Strikes																										
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks																					
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	Contract Name: Cheetham Hill Road, Manchester		Client: Corstorphine+Wright			Trial Pit ID: WS3																				
	Contract Number: CCG-C-19-11344	Date Started: 20/11/2019	Logged By: DE	Checked By: CB	Status: FINAL	Sheet 1 of 1																				
Trial Pit Log	Easting:	Northing:	Ground Level:	Plant Used: Hand excavated	Date Printed: 09/12/2019	Scale: 1:25																				
	Weather: Dry		Hole Termination:		Stability:																					
Samples & In Situ Testing			Strata Details				Water	Backfill																		
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description																				
0.50	B			(1.20)		Dark brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to coarse sub-angular brick and concrete (MADE GROUND).	1																			
0.80	B			1.20		End of Trial Pit at 1.20m			2																	
							3																			
Dimensions:			General Remarks:																							
Final Depth: 1.20m			Unable to access position to complete dynamic sampling borehole. 1.2mbgl hand excavated pit.																							
← Length (m) → m ↑ Width (m) ↓ m Orientation: ° ←																										
Inclination: °			<table><tr><th colspan="6">Water Strikes</th></tr><tr><th>Strike (m)</th><th>Casing (m)</th><th>Sealed (m)</th><th>Time (mins)</th><th>Rose to (m)</th><th>Remarks</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						Water Strikes						Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks						
Water Strikes																										
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks																					
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APPENDIX G

SOIL ENGINEERING TEST RESULTS