


## North of Irlam Station Development Ground Investigation Report

July 2020



## Quality Management

<b>Job No</b>	CS/099254		
<b>Project</b>	North of Irlam Station Development		
<b>Location</b>	Irlam, Greater Manchester		
<b>Title</b>	Ground Investigation Report		
<b>Document Ref</b>	IRL-CAP-00-XX-RP-GE-0001	<b>Issue / Revision</b>	P02
<b>Date</b>	17/07/2020		
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## Revision Status / History

Rev	Date	Issue / Purpose/ Comment	Prepared	Checked	Authorised
P01	24/03/2020	First issue	RS	FD/GW	GW
P02	17/07/2020	Revised following client comments to add clarification for non-technical reader	PR	PR	PR

## Contents

1. Introduction	3
1.1 Appointment and Scope	3
1.2 Ground Investigation	4
2. Site Description and Proposed Development	5
2.1 Site Location and Layout	5
2.2 Description of project	6
2.3 Sources of Information	6
3. Existing Information	7
3.1 Topographic Maps	7
3.2 Geological Information	7
3.3 Records of Mines and Mineral Deposits	8
3.4 Site History	8
3.5 Land Use	10
3.6 Historical Ground Investigations	11
3.7 Hydrology and Hydrogeology	12
3.8 Contaminated Land	12
3.9 Radon	14
3.10 Other Information	14
4. Ground Investigation	15
4.2 Scope of Works	15
4.3 Laboratory Testing	16
5. Ground Conditions and Material Properties	18
5.2 Topsoil	19
5.3 Made Ground	19
5.4 Peat	19
5.5 Organic Clay	19
5.6 Sand (Glaciofluvial Sheet Deposits)	20
5.7 Clay (Glaciofluvial Sheet Deposits)	20
5.8 Wilmslow Sandstone Formation (Bedrock)	22
5.9 Groundwater	22
5.10 Soil Chemistry	23
5.11 Ground Gas	24
6. Geotechnical Conclusions and Recommendations	25
6.1 Introduction	25
6.2 Key Considerations	25
6.3 Combined thickness and distribution of peat and organic clays	25
6.4 Foundations	26
6.5 Ground Improvement	27
6.6 Buried Concrete	29
6.7 Road Pavements	29
6.8 Drainage and other buried services	29
6.9 Geo-Environmental Considerations	30
7. Geotechnical Risk Register	31
8. References	32

## Appendices

Appendix A - Drawings/Figures

Appendix B - Ground Investigation Factual Report

Appendix C - Geotechnical Risk Register

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# 1. Introduction

## 1.1 Appointment and Scope

- 1.1.1 An area of land to the north of Irlam Station (referred to as “the site”) is proposed to be allocated for housing development. Salford City Council (the Client) have appointed Urban Vision Partnership Ltd. (UV) to provide consultancy services to help determine the suitability of the site for residential development.
- 1.1.2 A Preliminary Risk Assessment (PRA) of the site has been undertaken by Urban Vision in 2019. This identified the presence of peat and ground gas as risks to the delivery of the housing development site and recommended that a ground investigation is undertaken to better understand the associated risks.
- 1.1.3 Capita Property and Infrastructure Ltd. (Capita) has been commissioned by UV to scope, procure and supervise a preliminary ground investigation for the site and to prepare a report on the findings to cover the following aspects:
1. Provide an outline indication of the peat depths across the site;
  2. Identify possible treatment/construction solutions for foundations to the development, including access roads and areas of hardstanding including indicative costs; and
  3. Monitoring of ground gas to determine whether its treatment might add further significant costs.
- 1.1.4 The purpose of this assessment is to help the city council to identify any particularly problematic parts of the site and better understand the practical issues associated with its development with a view to understanding whether the site can continue to be allocated in the GMSF. It is anticipated that a further ground investigations would be required at the planning application stage to provide a more detailed understanding of the peat depths and a more refined understanding of the likely costs associated with the ground conditions.

1.1.5 This report is presented as a Ground Investigation Report (GIR) broadly in accordance with the requirements of the Highways England Document CD 622 which sets out the requirements of such a report, this is used by national infrastructure bodies to manage geotechnical risk.

## 1.2 Ground Investigation

1.2.1 The scope for a limited ground investigation was agreed between Capita and UV. The ground investigation was undertaken by Your Geotechnical in 2019 on behalf of Capita.

## 2. Site Description and Proposed Development

### 2.1 Site Location and Layout

- 2.1.1 The site is approximately 65ha in area and is located approximately 13km southwest of Manchester city centre. A site location plan is included in Appendix A (drawing reference IRL-CAP-00-XX-DR-GE-0001). The site is approximately centred at Ordnance Survey Grid Reference, 393447N, 370869E with an indicative postcode of M44 5LJ.
- 2.1.2 A site reconnaissance was undertaken by a representative of UV which formed the basis of the site description given in the PRA [Ref 1]. A summary is provided below.
- 2.1.3 It is stated that observations were made from publicly accessible areas with no access made onto private land. The site is predominantly arable agricultural land with a series of land drains forming boundaries to fields. A nursery, Brentwood Moss Nurseries, occupies the southwestern corner.
- 2.1.4 The site is bounded to the east by Moss Road which is separated from the site by a drainage ditch running along the eastern boundary of the site. It is stated in the PRA that the fields are noticeably lower than the road (attributed to possible fill material used to create a firm foundation for the road surface on the peat). A public footpath is indicated to run eastwards from a point on Moss Lane c. 330m north of the site then intersecting the northern boundary of the site 500m to the east before following the northern boundary of the site to Astley Road. Astley Road itself transects the site in a north-westerly direction. At the point where Astley Road enters the site, it is stated in the PRA that there is significant subsidence of the road surface. Astley Road is bounded on both sides by drainage ditches. The north eastern boundary of the site is bounded by Roscoe Road.

## 2.2 Description of project

2.2.1 The site is proposed to be allocated for mainly residential development through the Greater Manchester Spatial Framework (GMSF). It is anticipated that 1,600 dwellings could be accommodated on the site, most of these dwellings would be in the form of two storey houses developed at a density of between 35 and 50 dwellings per hectare, with some three/four storey apartments generally being accommodated on the land closest to Irlam Station. The site would also be required to accommodate some community infrastructure including recreation facilities, green infrastructure and school provision. The GMSF and Salford Local Plan: Development Management Policies and Designations would require that the site is subject to masterplanning in consultation with landowners, stakeholders and the local community. The layout of development within the site will therefore be considered at a later stage in the planning process.

## 2.3 Sources of Information

2.3.1 The following sources of information have been used in the preparation of this report:

**Table 2.1 Information Sources**

Item	Title	Document Reference	Document Date	Originator	Comments
1	Preliminary Risk Assessment (Phase 1 Desk Study)	UV/0088926-01-0010	March 2019	Urban Vision Partnership Ltd.	Preliminary Risk Assessment [Ref. 1]
2	Site Investigation – Astley Road, Irlam	YG0134-19	October 2019	Your Environment	Ground Investigation Factual Report [Ref. 2]

Previous borehole logs that were summarised in the Preliminary Risk Assessment from March 2019 have been incorporated as appropriate with the current investigation.

2.3.2 This version of the GIR is based on relevant information included in the above data sources and will be reviewed and updated based on any new information received from UV and Salford City Council, as required.



## 3. Existing Information

### 3.1 Topographic Maps

- 3.1.1 A topographical survey was not available at the time of writing this report, however given the topography of the site this would not be considered necessary at this stage of the investigation; however this will be necessary once detailed planning of the site commences.

### 3.2 Geological Information

#### Geology

- 3.2.1 The site is covered by the British Geological Survey (BGS) 1:50,000 geological sheet number 85 Manchester Solid and Drift geology. Groundsure Geo-Insight information has also been referenced in the PRA [Ref. 1]. A review of the BGS GeoIndex website [Ref. 3] has been undertaken to identify the site geology and locate historical borehole records within the area of interest.

#### Made Ground

- 3.2.2 Made ground consists of any soils or other deposits that have been placed as a result of human activity, this includes materials placed as part of construction projects such as rail infrastructure but also includes materials such as landfilled waste.
- 3.2.3 BGS mapping indicates the presence of Made Ground associated with the railway infrastructure located along the southern site boundary. This is anticipated to comprise reworked natural ground and engineering fill. Whilst no other made ground is recorded within the site it is expected that isolated pockets of made ground may be present within the site.

#### Superficial Deposits

- 3.2.4 Superficial deposits consist of natural soils typically these include clay, sands, and gravels however they also include peat as found on this site.
- 3.2.5 BGS mapping shows that superficial deposits at the site comprises mainly peat. Glacial Till is indicated along the southern boundary of the site. Glaciofluvial Sheet Deposits are recorded along the eastern boundary of the site, in proximity to Irlam Station.

Solid Geology

3.2.6 Solid geology is the term used for the natural rock found beneath the superficial deposits.

3.2.7 The site is underlain by the Wilmslow Sandstone Formation. The BGS Lexicon describes this stratum as “red-brown medium-grained cross bedded sandstones with sporadic siltstones”. An inferred fault extends to the southern section of the site (in proximity to Brentwood Moss Nurseries).

**3.3 Records of Mines and Mineral Deposits**

3.3.1 The PRA [Ref. 1] determined that there are no areas of coal or mineral workings within 1km of the site. The PRA identifies several areas surrounding the site where peat is known to have been previously extracted. Peat extraction ceased in the area c.2011 and there are no records of peat extraction having taken place (in recent history) within the boundary of the study site.

**3.4 Site History**

3.4.1 The PRA [Ref. 1] identifies several potentially contaminative land uses both within and in proximity to the site. Historical land uses within the site are summarised in Table 3.1. Surrounding land uses (within 500m of the site) are summarised in Table 3.2.

**Table 3.1 Summary of historical land uses within site boundary**

Date	Scale	Information
1848	1:10,560	<ul style="list-style-type: none"> <li>Irlam Cottage and Rose Farm shown along Astley Road in the northern/central section of the site</li> <li>Tramway shown to the south of the site near Irlam Station</li> <li>Unnamed features (likely to be land drains) shown to the south-west of the site</li> <li>Unnamed building located to the south of the site (possibly farm)</li> </ul>
1876	1:2,500	<ul style="list-style-type: none"> <li>Fields depicted as farmland. Construction of a nursery in proximity to Rose Farm</li> </ul>
1891-1894	1:10,560	<ul style="list-style-type: none"> <li>Marshland shown to the north of the site</li> </ul>
1904-1905	1:10,560	<ul style="list-style-type: none"> <li>Irlam Cottage and Rose Farm no longer shown on mapping</li> </ul>
1951-1952	1:10,560	<ul style="list-style-type: none"> <li>Buildings located to the south of the site labelled as 'Railway View Farm'</li> </ul>

		<ul style="list-style-type: none"> <li>• Tramway no longer shown within site</li> </ul>
1981-1985	1:10,000	<ul style="list-style-type: none"> <li>• Tracks shown across site (assumed to be associated with former tramway)</li> <li>• Railway View Farm shown as 'Nursery'</li> <li>• Drains shown traversing site</li> <li>• Irlam Cottage no longer shown</li> <li>• Unnamed buildings constructed to the north of the site, near Roscoe Road</li> </ul>
1990-1995	1:10,000	<ul style="list-style-type: none"> <li>• Expansion of nursery located to the south of the site</li> </ul>
2002	1:10,000	<ul style="list-style-type: none"> <li>• Pond shown to the south of the site, adjacent to the railway cutting</li> </ul>

**Table 3.2 Summary of historical land uses with 500m of the site**

Date	Scale	Information	Direction and Approximate Distance
1848-1849	1:10,560	• Pond	E, 500m
		• River Mersey (diverted in 1929)	S, 450 - 500m
		• Brick field	SE, 250m
		• Brick field	S, 400m
		• Pond	S, 350m
1891-1894	1:10,560	• Pond	E, 300m
		• Smithy	SE, 250m
		• Railway (Cheshire line)	S, 0m
		• Irlam Station	S, 10m
		• Railway (Glazebrook and Godley)	S, 400-500m
1904-1905	1:10,560	• Tramway	N, 300-500m
		• Plant nursey	N, 0m
		• Rope works	SE, 200m

<b>Date</b>	<b>Scale</b>	<b>Information</b>	<b>Direction and Approximate Distance</b>
		<ul style="list-style-type: none"> <li>• Match works</li> </ul>	S, 40m
		<ul style="list-style-type: none"> <li>• Engineering works</li> </ul>	S, 40m
		<ul style="list-style-type: none"> <li>• Brick works</li> </ul>	S, 250m
1929	1:10,560	<ul style="list-style-type: none"> <li>• Soap and candle works</li> </ul>	E, 500m
		<ul style="list-style-type: none"> <li>• Tanks</li> </ul>	SE, 400-510m
		<ul style="list-style-type: none"> <li>• Partington steel and iron works</li> </ul>	SE, 500m
		<ul style="list-style-type: none"> <li>• Wallpaper works</li> </ul>	S, 40m
		<ul style="list-style-type: none"> <li>• Allotment gardens</li> </ul>	S, 15m
1981-1985	1:10,000	<ul style="list-style-type: none"> <li>• Plant nursey</li> </ul>	SE, 10m
		<ul style="list-style-type: none"> <li>• M62 motorway</li> </ul>	N, 400-500m
1990-1995	1:10,000	<ul style="list-style-type: none"> <li>• Northbank industrial park</li> </ul>	SE, 500m

### 3.5 Land Use

3.5.1 Land use within the site boundary is predominantly agricultural. Brentwood Moss Nurseries occupies the southern section of the site.

### 3.6 Historical Ground Investigations

3.6.1 A review of the BGS GeoIndex [Ref. 3] has revealed existing exploratory hole records within the site boundary. Boreholes have been drilled to depths between 6.25m and 91m below ground level. Ground conditions from available boreholes are summarised in Table 3.3. A plan showing the borehole locations is provided in the preliminary risk assessment (ref 1)

**Table 3.3 Summary of archive borehole information**

Hole ID	Year	National Grid Reference	Ground Conditions	Groundwater
SJ79SW374	1985	370800E, 393100N	0 - 3.7m- Peat 3.6m - 4.3m- Sand 4.3m – 17.7m- Clay 17.7m – 18.3m- Gravel 18.3m – 91.5m- Red Sandstone	11.5m (rest level)
SJ79SW290	1976	371240E, 393670N	0 – 0.91m – Clay and peat 0.91m – 3.2m – Clay 3.2m – 6.55m - Sand	None
SJ79SW292	1976	371360E, 393580N	0 – 1.37m- Peat 1.37m – 3.97m- Clay	None

3.6.2 The exploratory records indicate that that superficial deposits consist of varying depths of peat and clay overlying sands and gravels. The sandstone bedrock (described as a red sandstone with grey reduction zones in SJ79SW374) is located at a depth of approximately 18m.

3.6.3 Groundwater was recorded in borehole SJ79SW374. Rest level has been recorded as 11m below ground level (bgl).

### 3.7 Hydrology and Hydrogeology

- 3.7.1 Glaze Brook (a main river) is located approximately 800m west of the site. Manchester Ship Canal is located 1.2km south of the site. Several underground and open drainage ditches traverse the site, these form part of a wider drainage network for the peat bog. The drains run to open ditches at the edge of the agricultural fields.
- 3.7.2 The PRA [Ref. 1] reports that the site is located within Flood Zone 1. This is defined as an area having a 1 in 1000-year chance of flooding.
- 3.7.3 Environment Agency information indicates that bedrock is classified as a Principal aquifer. This is defined as “layers of rock or drift deposits that have high intergranular and/or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale”.
- 3.7.4 The PRA also reports that a groundwater flooding susceptibility area is located within 50m of the centre of the site, although no map has been provided. It is likely that perched water tables exist within the site, associated with peat and clay.

### 3.8 Contaminated Land

- 3.8.1 The PRA identified a number of potential sources of contamination. further details are provided in the PRA (ref 1) a summary of the sources of contamination are presented below:

Onsite:

- Potential Made Ground associated with construction of the railway and historic tramways (possibly used to transport waste);
- Use of herbicides, pesticides and fertilisers on agricultural land, including at Brentwood Moss Nurseries;
- Disposal of ‘night soil’ (human waste) and industrial waste;
- Network of underground and open drainage ditches which have the potential to transport and deposit contaminants; and
- Ground gas associated with peat deposits.

Offsite:

- Ground gas associated with nearby historic landfill (151m south-east of the site) and infilled ponds;
- Tanks potentially containing fuel / oil; and

- Irlam Iron Works, a wallpaper factory and a match factory historically located to the south of the site. Waste disposal may also have taken place in association with these industries.

Receptors which have been identified are:

- Future site users, as well as current and future neighbouring site users;
- Construction workers;
- Buildings;
- Surface water;
- Controlled waters (Glaze Brook); and
- Principal Aquifer.

3.8.2 A Preliminary Qualitative Risk Assessment (PQRA) has been carried out by UV. The PQRA reports the following:

- risk of ground gas exposure to future site users and construction workers: high;
- risk of exposure of future site users to contaminated soils / Made Ground: high;
- risk of exposure of current site users to contaminated soils / Made Ground: moderate;
- risk of plant root zone absorption of contaminants: moderate;
- risk of contaminants leaching into shallow groundwater: moderate; and
- risk of contaminants leaching into future potable water supply pipes: moderate.

3.8.3 All risks outlined above are commonly found within development plots of this nature and will require some form of mitigation to prevent harm, this is discussed further in the later chapters.

### 3.9 Radon

3.9.1 The PRA [Ref. 1] reports that the site is not within a radon affected area as less than 1% of homes are above the action level. Further action is therefore not considered to be required with respect to radon and protective measures.

### 3.10 Other Information

#### Environmental Designations

3.10.1 The PRA [Ref. 1] reports that the site is within a designated Green Belt. The south west corner of the site is within a Nitrate Vulnerable Zone (area designated as being at risk from agricultural nitrate pollution). The status as a Nitrate Vulnerable Zone affects the current agricultural practices and would have minimal impact on a housing development.



## 4. Ground Investigation

4.1.1 The scope of works was agreed between Capita and UV. Capita subsequently acted as the Investigation Supervisor which included scheduling the geotechnical laboratory tests.

### 4.2 Scope of Works

4.2.1 A preliminary ground investigation was undertaken at the site by Your Environment between 16<sup>th</sup> September and 23<sup>rd</sup> September 2019. The investigation was carried out in accordance with BS EN ISO 1997-2 [Ref. 4]. The ground investigation was required to determine ground conditions and provide geotechnical information to determine the suitability of the site for the proposed development.

4.2.2 The ground investigation comprised the following:

- 19 no. shallow boreholes, to a maximum depth of 6.45m below ground level;
- 97 no. Standard Penetration Tests (SPTs) carried out within boreholes;
- Installation of 11no. gas and groundwater monitoring wells; and
- Soil sampling for geotechnical laboratory testing.

Further details of the ground investigation including the results and interpretation of the finding is presented in chapter 5.

4.2.3 The approximate locations of the exploratory holes are shown in the site investigation factual report [Ref. 2] and on a sketch of peat and soft clay thickness contours included in Appendix A. The borehole locations were identified to provide an even distribution across the entire site whilst minimising the impact on the ongoing agricultural operations. The majority of holes are therefore placed on the edge of fields with relatively easy access. Boreholes were positioned to avoid known services and drains.

4.2.4 A summary of completed exploratory holes is provided in Table 4.1 below. Exploratory holes marked N/A indicate where installations have not taken place.

**Table 4.1: Summary of Completed Exploratory Holes**

Exploratory Hole ID	Completion Depth (m bgl)	Monitoring Installations	
		Response Zone (m bgl)	Strata
BH1	5.45	N/A	
BH2	5.45	N/A	
BH3	5.45	1.0 to 5.0	Peat/Clay

Exploratory Hole ID	Completion Depth (m bgl)	Monitoring Installations	
		Response Zone (m bgl)	Strata
BH4	5.45	1.0 to 5.0	Peat/Clay/Sand
BH5	5.45	N/A	
BH6	5.45	1.0 to 5.0	Peat/Clay/Sand
BH7	5.45	1.4 to 5.4	Peat/Clay
BH8	5.45	1.0 to 5.0	Peat/Clay
BH9	5.45	N/A	
BH10	5.45	N/A	
BH11	5.45	N/A	
BH12	5.45	N/A	
BH14	5.45	1.0 to 5.0	Peat/Clay
BH15	5.45	1.0 to 5.0	Peat/Clay
BH16	6.45	N/A	
BH17	6.45	2.0 to 6.0	Peat/Clay
BH18	5.45	1.0 to 5.0	Peat/Clay
BH19	5.45	2.0 to 5.0	Peat/Sand/Clay
BH20	5.45	N/A	

#### In situ Tests

- 4.2.5 A total of 97 Standard Penetration Tests (SPT) were undertaken within the boreholes in accordance with BS EN ISO 22476-3: 2005 'Geotechnical investigation and testing – Field testing Part 3: Standard penetration test' [Ref. 5]. The results of SPTs are discussed in Section 5 of this report. The SPT gives an indication of the strength of the soil. The results are reported as an 'N' value relating to the number of blows, an 'N' value of 0 indicates a very weak soil, an 'N' value of 50 indicates a strong soil.

### 4.3 Laboratory Testing

- 4.3.1 Geotechnical testing was scheduled by Capita and carried out by Rogers Geotechnical Service (RGS) Ltd.

Geotechnical Laboratory Testing

- 4.3.2 Geotechnical laboratory testing was undertaken in accordance with BS EN ISO 1377-2: 1990; 'Methods for testing soils for civil engineering purposes, Parts 1 to 8, unless stated otherwise. The type and number of tests undertaken are summarised below. Results are discussed in the following chapters.

**Table 4.2 Geotechnical Laboratory Testing**

Test Category	Test Type	Number of Tests Scheduled
Classification	Moisture content	10
	Atterberg determinations	7
	Particle Size Distribution (PSD)	10
Sulfate and Related Tests	Water Soluble Sulfate	10
	Total Sulfur	10
	pH	10

- 4.3.3 Copies of the geotechnical test results can be found within the Your Environment Factual Report included in Appendix B.

Geo-Environmental Laboratory Testing

- 4.3.4 No Geo-environmental sampling and testing was not undertaken as part of this investigation. This is used to determine the levels of contamination within the soil and is not considered necessary at this stage of the works as no made ground was encountered. Geo-environmental testing shall be required during the detailed design of the development.

## 5. Ground Conditions and Material Properties

- 5.1.1 The following ground summary is based on the Ground Investigation Factual Report [Ref. 2] presented in Appendix B.
- 5.1.2 The ground condition comprised Topsoil, Peat and Glaciofluvial sheet deposits. This is broadly consistent with the geological maps.
- 5.1.3 The soil stratigraphy as determined by the investigation is summarised in Table 5.1. The nature and extent of soils is described in further detail in the following paragraphs.

**Table 5.1. Summary of ground conditions**

Stratum	Depth to Top of Stratum (m)	Proven Thickness of Stratum (m)	Description	SPT 'N' Value
Topsoil	-	0.2 - 0.8	Dark brown sandy gravelly silt. Sand is fine to coarse. Gravel is fine, angular of mixed lithology. Frequent rootlets and wood fragments/pieces	-
			Dark brown slightly sandy silt. Sand is fine to coarse. Frequent rootlets and wood fragments/pieces	
Peat and Organic Clay	0.2 - 0.8	0.0 - 4.45	Dark brown plastic fibrous peat. Occasionally sandy or clayey with depth	0 - 5
			Very soft dark brown silty sandy organic clay. Organic material noted	
Clay (Glaciofluvial Sheet Deposits)	1.1 - 4.95	0.3 - 4.05	Soft to firm red brown sandy slightly gravelly clay. Sand is fine to coarse, occurring in pockets. Gravel is fine to coarse, angular to sub-angular of glauconitic sandstone	0 - 39
			Soft becoming firm red / brown / grey sandy clay. Sand is fine to medium, occurring in pockets	
Sand (Glaciofluvial Sheet Deposits)	0.4 - 4	0.1 - 3.15	Grey brown clayey silty sand. Sand is fine to medium grained	0 - 21
			Light brown silty sand. Sand is fine to medium grained	

## 5.2 Topsoil

5.2.1 Topsoil was recorded in all the exploratory holes at depths of between 0.20 and 0.80m bgl. It is mainly described as slightly sandy and/or slightly gravelly silt and noted to be dark brown. Both the sand and gravel were described as fine to coarse and rootlets and wood were noted in all the exploratory holes.

## 5.3 Made Ground

5.3.1 Made Ground was not encountered during the ground investigation, however, BGS information indicates that Worked Ground is present to the south of the site, associated with the railway cutting along the site boundary. It is unknown whether soils in this area are to be excavated as part of the development.

## 5.4 Peat

5.4.1 Peat was recorded beneath the topsoil in all the exploratory holes with the exception of BH10 located towards the eastern extent of the site where it is absent. Where present the thickness ranges from 0.70m to 4.45m; however, typically the peat thickness is between 1.0m and 2.0m, but with greater thicknesses in the northern area of the site, furthest from the railway station.

5.4.2 The peat is generally described as plastic and fibrous and noted to be dark brown. Observations of the stratum becoming clayey with depth were noted in BH14 to BH20 which were all located in the north western and northernmost areas of the site. This was occasionally found to be underlain by clay.

5.4.3 SPT 'N' values recorded within the stratum were all 0, with the exception of BH17 (2 and 4m bgl), BH11 (5m bgl) and BH04 (1m bgl) where N values of 1, 5 and 4 respectively were recorded. Although consistency terms were not included on the log descriptions, the results indicate a very soft layer which is broadly consistent with what is to be expected of the stratum.

## 5.5 Organic Clay

5.5.1 A layer of material described as organic clay was encountered below the peat in BH02 to BH07, located in the southern and southwestern areas of the site. The thickness of this layer varied between 0.20 and 1.10m and was described as dark brown, silty and sandy and noted to be very soft. The sand was described as fine to medium. Observations of the presence of fibrous organic material was noted throughout although laboratory testing was not undertaken to determine the organic content of the horizon. The SPT N values recorded in this layer in four of the holes were 0, 5 and 6

respectively.

## 5.6 Sand (Glaciofluvial Sheet Deposits)

- 5.6.1 Glacial sand was recorded beneath the peat/organic clay in BH04 (1.75 to 2.70m bgl), BH06 (2.30 to 5.45m bgl), BH19 (2.90 to 3m bgl) and BH20 (2.50 to 3.60m bgl). The sand was interbedded with clay layers in BH11 (1.50 to 2.70m bgl; 3 to 3.70m bgl; and 4 to 5.45m bgl) and BH16 (1.90 to 3.40m bgl and 4 to 6.45m bgl). The layer is generally described as a silty or silty and clayey sand and noted to be light brown to brown and/or greyish brown, although slightly gravelly sand was locally encountered (BH16). The sand is described as fine to medium.
- 5.6.2 SPT N values generally ranged from 4 to 21 with no discernible increase with depth. An N value of 0 was recorded in BH04, however, a groundwater strike was noted at 1.50m bgl and the low blow count is possibly associated with 'running sand'. Although density terms are not included on the exploratory records, the SPT values mostly suggest the stratum comprises loose sands. Derivation of the angle of internal friction ( $\phi$ ) value was carried out based on the graphical relationship provided between SPT 'N' values and  $\phi$  in 'Foundation Design and Construction' [Ref. 9] which suggests values of between 28 and 30°.
- 5.6.3 Three samples from the sand layer were subjected to particle size distribution determination. The typical proportions of each soil type were: Sand: 92 to 97%, Clay/Silt: 3 to 8%. The results indicate slightly silty/clayey sand.

## 5.7 Clay (Glaciofluvial Sheet Deposits)

- 5.7.1 Glacial clays were encountered beneath the peat/organic clay (BH01 to BH05; BH07 to BH09; BH12 to BH15, BH17 to BH19) from between 1.20 and 4.95 to the base of the hole at 5.45m or 6.45m bgl; overlain by a sand layer in BH10 (1.10 to 5.45m bgl) and BH20 (3.60 to 5.45m bgl); interbedded between sand layers in BH11 (2.70 to 3m bgl and 3.70 to 4m bgl) and BH16 (3.40 to 4m bgl) in all the boreholes except BH06. The clay is generally described as reddish brown slightly gravelly, very sandy clay and noted to be initially soft and becoming firm with depth. The sand is described as fine to medium and noted to 'occur in pockets'.
- 5.7.2 SPT N values mainly ranged from 4 to 39 which showed a degree of scatter and no coherent pattern of increase with depth. SPT N values of 0 were recorded between 2 and 4m bgl in BH12, BH18 and BH19 with a value of 1 recorded in BH17 at 3m bgl. These values are considered to be erroneous or possibly associated with 'blowing' and disturbance associated with the drilling.

- 5.7.3 Particle Size Distribution (PSD) tests by sieving and sedimentation for the fine fraction was carried out on seven samples from the clay and the results are summarised below:

**Table 5.2 Particle size distribution test results**

<b>Borehole/Sample Depth (m bgl)</b>	<b>Gravel, %</b>	<b>Sand, %</b>	<b>Silt, %</b>	<b>Clay, %</b>
BH01/5.0	2	70	16	12
BH02/4.0	2	48	33	17
BH08/4.7	2	49	28	21
BH14/4.7	2	32	34	33
BH15/4.8	2	27	30	41
BH17/5.8	1	22	34	24
BH18/5.0	3	18	36	43

- 5.7.4 Although some of the results above appear to indicate sand rather than clay, this anomaly may be due to the loss of fine grained particles in the sampling process or samples or the granular component of the layer being sampled and tested. The Atterberg Limit test results summarised below with samples taken from the same horizons as the PSDs suggests the material to be clay. On this basis, the exploratory hole log descriptions are taken to be a reflection of the *in-situ* conditions.
- 5.7.5 Seven Atterberg Limit determinations have been undertaken on samples from the clay layer encountered and the results are summarised in Table 5.3.

**Table 5.3 Summary of Index property testing**

<b>Borehole/Sample Depth (m bgl)</b>	<b>Moisture Content (%)</b>	<b>Liquid Limit (%)</b>	<b>Plastic Limit (%)</b>	<b>Plasticity Index (PI)</b>	<b>Casagrande Class</b>
BH01/5.0	15	20	9	11	CL
BH02/4.0	19	33	15	18	CL
BH08/5.0	18	36	14	22	CI
BH14/5.0	19	36	17	19	CI
BH15/5.0	22	40	17	23	CI
BH17/6.0	26	37	16	21	CI
BH18/4.5	24	40	22	18	CI

5.7.6 The results suggest clays of low (Casagrande Class CL) and intermediate plasticity (Casagrande Class CI) and broadly agree with the log descriptions.

## 5.8 Wilmslow Sandstone Formation (Bedrock)

5.8.1 The sandstone bedrock was not encountered during the ground investigation.

## 5.9 Groundwater

### Groundwater observations during fieldwork

5.9.1 Groundwater was encountered at three locations (BH04 – 1.50m bgl, BH06 – 1.10m bgl and BH08- 0.50m bgl) close to the centre of the site and along the northern boundary (BH18 -1.20m bgl) during the fieldworks. It is not stated if drilling was halted for 20 minutes following the strike to observe the water level for any rises.

### Post field work monitoring

5.9.2 Combined ground gas and groundwater monitoring standpipes were installed in a number of exploratory holes across the site. A single visit to monitor groundwater and ground gas was carried on the 24th October 2019. Where encountered, groundwater was generally located at shallow depths during the ground investigation. Monitored groundwater levels are summarised below in Table 5.3.

**Table 5.3 Groundwater monitoring results**

<b>Exploratory Hole</b>	<b>Recorded Depth (m bgl)</b>	<b>Response zone (m bgl)</b>
BH03	1.70	1.0 – 5.0
BH04	1.45	1.0 – 5.0



Exploratory Hole	Recorded Depth (m bgl)	Response zone (m bgl)
BH06	1.65	1.0 – 5.0
BH07	1.75	1.50 – 5.45
BH08	1.70	1.0 – 5.0
BH14	0.80	1.0 – 5.0
BH15	1.10	1.0 – 5.0
BH17	0.85	2.0 – 6.0
BH18	1.30	1.0 – 5.0
BH19	1.80	2.0 – 5.0

## 5.10 Soil Chemistry

5.10.1 The sulphate and pH test data from 10 No. samples has been assessed in accordance with BRE Special Digest 1:2005 “Concrete in Aggressive Ground” (SD1), 3<sup>rd</sup> Edition [Ref. 6]. This allows appropriate concrete to be selected for the proposed development.

**Table 5.4 Chemical testing results for buried concrete**

Stratum	Depth (m bgl)	pH value in soil	Water Soluble Sulphate as SO <sub>4</sub> , mg/l	Total Sulphur %	Acid soluble (%)	Total Potential Sulphate, %	Oxidisable Sulphides, %	Pyritic Ground OS % > 0.3
Clay	BH01 – 4.50	6.5	131	0.02	0.02	0.06	0.04	No
Clay	BH07 – 3.80	7.4	16	0.04	0.01	0.12	0.11	No
Clay	BH10 – 2.50	7.8	29	0.09	0.02	0.27	0.25	No
Clay	BH12 – 2.50	7.4	<10	0.04	<0.01	0.12	0.11	No
Sand	BH16 – 2.50	5.1	13	0.01	<0.01	0.03	0.02	No
Sand	BH10 – 0.50	5.4	17	<0.01	0.02	<0.03	0.01	No
Peat	BH01 – 0.70	4.2	68	0.12	<0.01	0.36	0.35	Yes

Stratum	Depth (m bgl)	pH value in soil	Water Soluble Sulphate as SO <sub>4</sub> , mg/l	Total Sulphur %	Acid soluble (%)	Total Potential Sulphate, %	Oxidisable Sulphides, %	Pyritic Ground OS % > 0.3
Peat	BH06 – 0.60	4.9	136	0.41	0.01	1.23	1.22	Yes
Peat	BH12 – 0.30	4.7	64	0.17	0.04	0.51	0.47	Yes
Peat	BH18 – 0.70	4.9	121	0.27	0.08	0.81	0.73	Yes

**Table 5.5 Characteristic values for buried concrete classification**

Stratum	Water Soluble Sulphate as SO <sub>4</sub> , mg/l	pH value in soil	Total Potential Sulphate, %	Pyritic Ground, OS%>0.3
Peat	200	4.2	1.23	Yes
Sand	100	5.1	0.03	No
Clay	200	6.5	0.27	No

## 5.11 Ground Gas

- 5.11.1 A single round of gas monitoring was carried out following the intrusive investigation. The results indicate that concentrations of Methane and Carbon Dioxide exist beneath the site, likely associated with peat and other organic material. The highest concentration of Methane was encountered where the thickest deposit of peat was recorded (BH17 in the northwest corner). It should be noted that the following assessment is based on very limited data and further monitoring should be undertaken across the site as part of the detailed design. The future gas monitoring will need to be designed once the layout of the proposed development is confirmed.
- 5.11.2 Based on a calculation of the gas screening value (GSV), the CIRIA Characteristic Situation (CS) classification is CS3 for a site with a moderate hazard of gas emissions [Ref. 7]. This classification indicates that gas protection measures will be required for any development., these measures will be conventional gas protection measures and may include venting of the underfloor or the inclusion of gas proof membranes within the foundation. This should be confirmed by additional monitoring and analysis during the detailed design stage.

## 6. Geotechnical Conclusions and Recommendations

### 6.1 Introduction

6.1.1 It is understood the proposals for the site is mixed residential with areas of soft landscaping. It is expected that the majority of the development will be two storey houses. The primary purpose of this report is to identify risks mainly associated with the presence of peat to inform the preliminary assessment of possible ground treatment options and/or foundation solutions.

### 6.2 Key Considerations

6.2.1 The ground investigation has identified a number of potential geotechnical risks at the site which relate to the presence of peat and other soft deposits. These are summarised below and also captured in the Geotechnical Risk Register [Appendix C].

- Significant thicknesses of peat and organic clays that are potentially low strength and highly compressible;
- Potential ground gas risk;
- Limited geotechnical data and information; and
- Potential contamination of soils and water in areas of as yet unidentified made ground.

### 6.3 Combined thickness and distribution of peat and organic clays

6.3.1 The data obtained from the recent ground investigation has been used to derive a contour plot of the combined thickness of peat and organic clay beneath the site. This is shown on sketch reference IRL-CAP-00-XX-SK-GE-0002 included in Appendix A. This sketch shows:

- Locations of the recent exploratory holes;
- A red-line site boundary taken from the site investigation factual report;
- Contours of the combined thickness of peat and organic clay; and
- Approximate 400m and 800m radii from Irlam Station.

- 6.3.2 With the exception of BH10, the ground investigation has indicated the presence of peat and organic clay over the entire site area. Where present, the combined thickness ranges between 0.9m and 4.45m with the greatest thickness towards the northern extent of the site furthest from the railway station.

## 6.4 Foundations

- 6.4.1 Without intervention, the near surface soils (Peat) encountered across the site are prone to large and unpredictable settlements and are therefore not considered a suitable founding strata for buildings and access roads and the like. To ensure that the proposed development can go ahead it is recommended that either the ground is stabilised prior to any development or foundations extend through the near surface weak deposits into the Clays below. Further ground investigation will need to be undertaken to identify more precisely the depth required to reach a suitable founding layer as this varies across the site. It should be noted that not all clays will form a suitable founding strata and in some locations it may be necessary to extend foundations significantly below the upper layers of Clay.
- 6.4.2 Based on the ground investigation information obtained, the thickness of the peat and organic clay is illustrated on sketch IRL-CAP-00-XX-SK-GE-0002. Although this indicates thicknesses of 2m or less in some areas, particularly the central and southern end of the site, actual depths to suitable founding strata would need to be deeper than this as the upper layers of the glacial deposits underlying the peat and organic clay appear to be weathered to a soft consistency.
- 6.4.3 Accordingly, consideration will need to be given to alternative foundation provisions as discussed below. The viability of different options across the site is dependent on the different “structure” types and associated loads. Different solutions will be applicable to each area of the site depending on the thickness of the soft and compressible material and the anticipated loading.

## 6.5 Ground Improvement

- 6.5.1 There are various means of ground improvement that could be applied to the whole site, or specific parts of the site, dependent on the intended end use. The type of ground improvement to be used will depend upon the end-use performance requirements. It is unlikely that ground improvement would be needed beneath amenity areas of landscaping and sports pitches for example.
- 6.5.2 Excavation of the unsuitable founding stratum and replacement with an engineered fill material can be regarded as a form of ground improvement. This is unlikely to be economic for this site and would have significant environmental impacts and is not considered further here.
- 6.5.3 Ground improvement is a specialist service area with many emerging innovative solutions available. Accordingly, the advice of reputable specialist contractors (experienced in the ground conditions considered here) should be sought when needed. They should be responsible for the selection of appropriate equipment and the final design of the treatment that would be best aligned to a performance specification that is verified by a site trial and or zone (load-settlement) testing. The commentary given below is preliminary guidance only.

### Soil Mixing

- 6.5.4 Soil mixing is a mix in place ground improvement technique that can enhance the strength and stiffness of natural soils, including peat and organic soils, by mechanically mixing them with a cementitious binder such as lime, cement, fly ash and other similar materials. It can be undertaken to form discreet load-bearing columns or to undertake mass stabilisation. The suitability of the technique is usually first established by laboratory trials on soil samples obtained from the site by varying the amount of binder added and then testing the mechanical properties of the stabilised material.
- 6.5.5 Soil mixing has been successfully used on sites such as this for housing developments and it is likely that this would be the preferred method for this site. Soil mixing can be used to stabilise the ground beneath residential housing, highway infrastructure and in service runs. It may not be suitable for blocks of flats/ apartments depending on the scale of any such buildings.

#### Vibrated Concrete Columns

- 6.5.6 Vibro Concrete Columns (VCCs) are an alternative form of piling technique that were developed particularly to provide enhanced bearing resistance at shallow depths often where weak organic soils overly more competent bearing soils. This is a displacement technique that avoids the need to deal with construction spoil.
- 6.5.7 VCC's can be used to support building foundations, ground beams and large area floor slabs that might otherwise need to be suspended. Their capacity is limited by the strength of the underlying bearing stratum. They are likely to be suitable for this site however given the relatively shallow depths to competent strata they may not be the most cost effective solution.
- 6.5.8 They are routinely used in highway construction, often in conjunction with a granular mattress and geosynthetic tension membrane that will limit post construction settlement to acceptable levels for an adopting authority. An engineered working platform is required for the construction plant needed for installation.
- 6.5.9 Alternative vibrated stone columns are unsuitable for this site as they rely on the strength of the surrounding soils to limit settlement.

#### Piles

- 6.5.10 Depending on the thickness of the peat and soft deposits together with the building type, piled foundations may need to be adopted in some areas. The advice of reputable piling specialists, experienced in the ground conditions considered here, should be sought. They should be responsible for the selection of appropriate piling equipment and the final design of the piles, subject to a performance specification and verification testing.
- 6.5.11 Displacement type piles may be preferable to avoid the generation of spoil. Proprietary systems of screw piles and ground beams may also be suitable, subject to compliance with NHBC/Building Regulation requirements.
- 6.5.12 Eurocode 7 recommends that the depth of investigation extends to a minimum of 5m below the toe of the deepest pile. Given the limited depth of the investigation, additional ground investigation is required to inform the design of piled foundations.
- 6.5.13 Piles may be the most appropriate foundation if there are any plans to construct larger building such as apartment blocks over several floors

## 6.6 Buried Concrete

- 6.6.1 In the consideration of sulphate attack on buried concrete, reference has been made to BRE Special Digest 1 which classifies the site as a potentially brownfield site (due to the deposition of waste referenced in the PRA) with static groundwater conditions. Additionally, as peat deposits can be pyrite bearing, it has also been necessary to assess the potential for the thaumasite form of attack. There are limited buried concrete classification tests currently available and further testing should be undertaken to inform the Design Sulphate (DS) and Aggressive Concrete Environment Class (ACEC) classification for the soils likely to be in contact with any buried concrete. For preliminary assessment purposes, DS and ACEC classes of DS-3 and AC-2s should be adopted at this stage.

## 6.7 Road Pavements

- 6.7.1 It is currently unknown whether site levels will be raised or lowered as part of the development proposals. In the absence of any ground improvement areas, paved areas are likely to settle unevenly under the action of any filling and from trafficking. This could give rise to differential settlements between the building footprints (should these be piled or otherwise supported) and the surrounding paved areas.
- 6.7.2 Soil mixing, as discussed in section 6.5 is recommended to provide a suitable sub formation for the construction of the required highway infrastructure.

## 6.8 Drainage and other buried services

- 6.8.1 Depending upon the types and extent of ground improvement measures and foundation solutions adopted for buildings, drainage and other buried services will likely be affected by settlement, including differential settlement. Accordingly, drainage should be laid with suitable falls and flexible service connections will be required in such areas. It is not likely that drainage will have to be suspended, although this will depend on the magnitude of settlements that are expected once the design has been developed further.
- 6.8.2 Infiltration tests were not undertaken as part of the initial ground investigation, however based on the observations made on site it is unlikely that the ground is relatively impermeable and soak away type drainage is likely to be unsuitable. Sustainable Drainage Systems (SuDS) in the form of green roofs, permeable paving, rain gardens, filter drains and cellular storage may be considered.

## 6.9 Geo-Environmental Considerations

- 6.9.1 Potential contamination issues at the site relating to soil, water and ground gas should be informed by incorporating soil and groundwater testing and further gas monitoring into the recommended additional ground investigation.
- 6.9.2 Based on a calculation of the gas screening value (GSV) from the data currently available, the CIRIA Characteristic Situation (CS) classification is CS3 for a site with a moderate hazard of gas emissions [Ref. 7]. This classification indicates that gas protection measures may be required for the site and this should be confirmed by additional monitoring and analysis.



## 7. Geotechnical Risk Register

- 7.1.1 A Geotechnical Risk Register is included in Appendix C. This should be reviewed and updated at subsequent project stages.

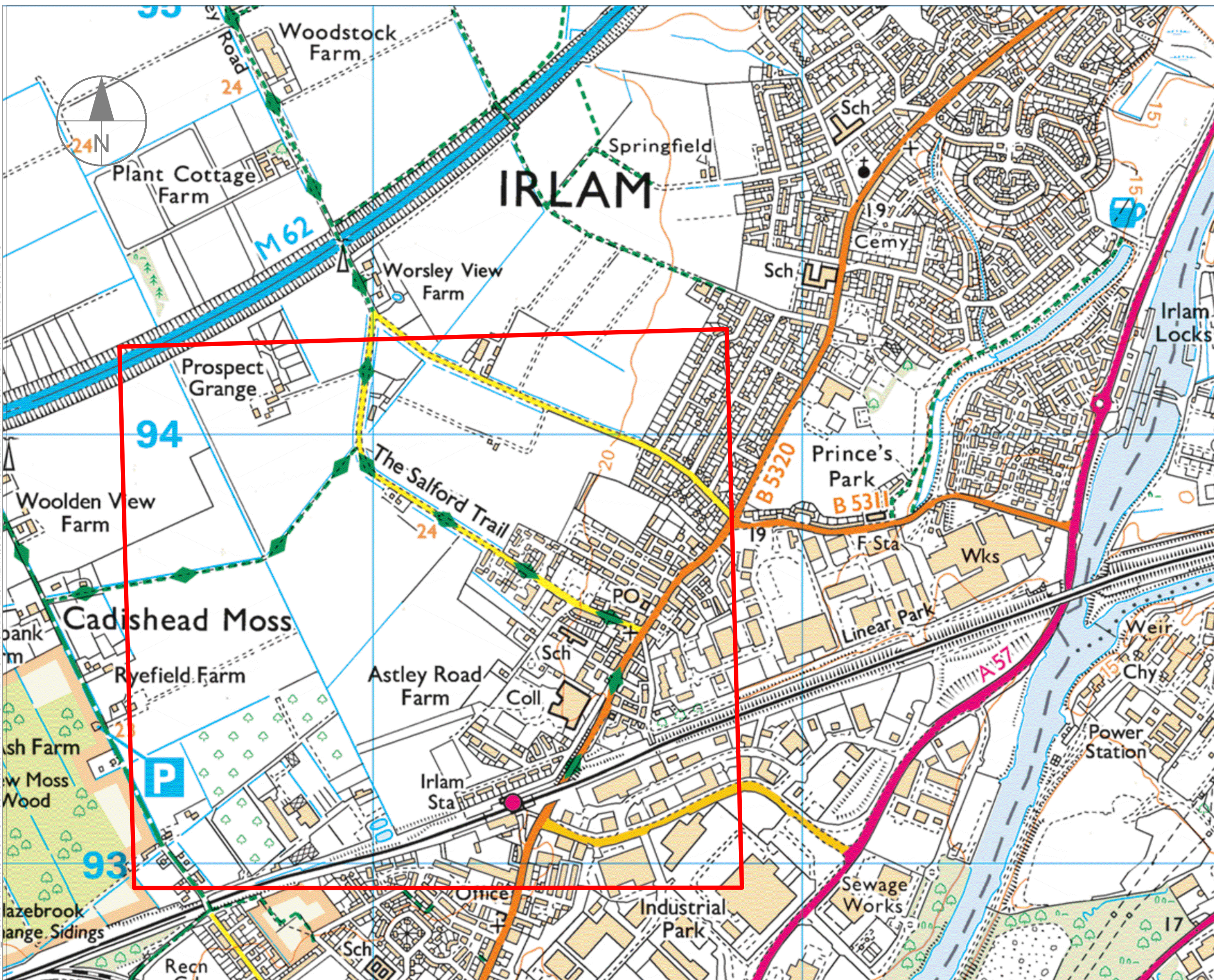
## 8. References

- 1 **Urban Vision Partnership Ltd Preliminary Risk Assessment, March 2019.**
- 2 Site Investigation – Astley Road, Irlam, document reference YG0134-19, Your Environment, October 2019.
- 3 BGS GeoIndex [www.bgs.ac.uk/GeoIndex](http://www.bgs.ac.uk/GeoIndex), viewed March 2020.
- 4 British Standards (BS) EN ISO 1997-2 '*Geotechnical Design Part 2 - Ground investigation and testing*'
- 5 British Standards (BS) EN ISO 22476-3: 2005 '*Geotechnical investigation and testing - Field testing Part 3: Standard penetration test*'.
- 6 Building Research Establishment Special Digest 1-2005 '*Concrete in Aggressive Ground*' 3<sup>rd</sup> Edition
- 7 British Standards (BS) 8485:2015 '*Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings*'
- 8 National House Building Council (NHBC) Standards 2020
- 9 Foundation Design and Construction, MJ Tomlinson, seventh edition, 2001.
- 10 NHBC Standards Part 4, Foundations

# Appendix A

## Drawings/Figures

Y:\ZTWEI04\_PROJECTS\2020\STOCKPORT\_JOBS\099254\_NORTH\_OF\_IRLAM\_STATION\_DEVELOPMENT\03\_DELIVERY\02\_GEO\02\_DRAWINGS\IRL-CAP-00-XX-DR-GE-0001.DWG



**Key**

— Site Location

Drawn	Rev	Check	Appr	Description	Date
				Purpose of Issue	
				S2 - Issued for Information	
				Classification	
				Commercial in Confidence	
				Client	
				Project	
				Irlam Development Site	
				Drawing	
				Site Location Plan	
				Scale at A3	
				1:25,000	
				Drawn	
				RJS	
				Checked	
				FD	
				Approved	
				FD	
				Project No.	
				CS/099254	
				Date	
				10/03/2020	
				Drawing Identifier	
				Project - Originator - Zone - Level - File Type - Role - Number	
				IRL-CAP-00-XX-DR-GE-0001	
				Revision	
				P01.1	

Purpose of Issue

S2 - Issued for Information

Classification

Commercial in Confidence

Client

Project

Irlam Development Site

Drawing

Site Location Plan

Scale at A3

1:25,000

Drawn

RJS

Checked

FD

Approved

FD

Project No.

CS/099254

Date

10/03/2020

Drawing Identifier

Project - Originator - Zone - Level - File Type - Role - Number

IRL-CAP-00-XX-DR-GE-0001

Revision

P01.1

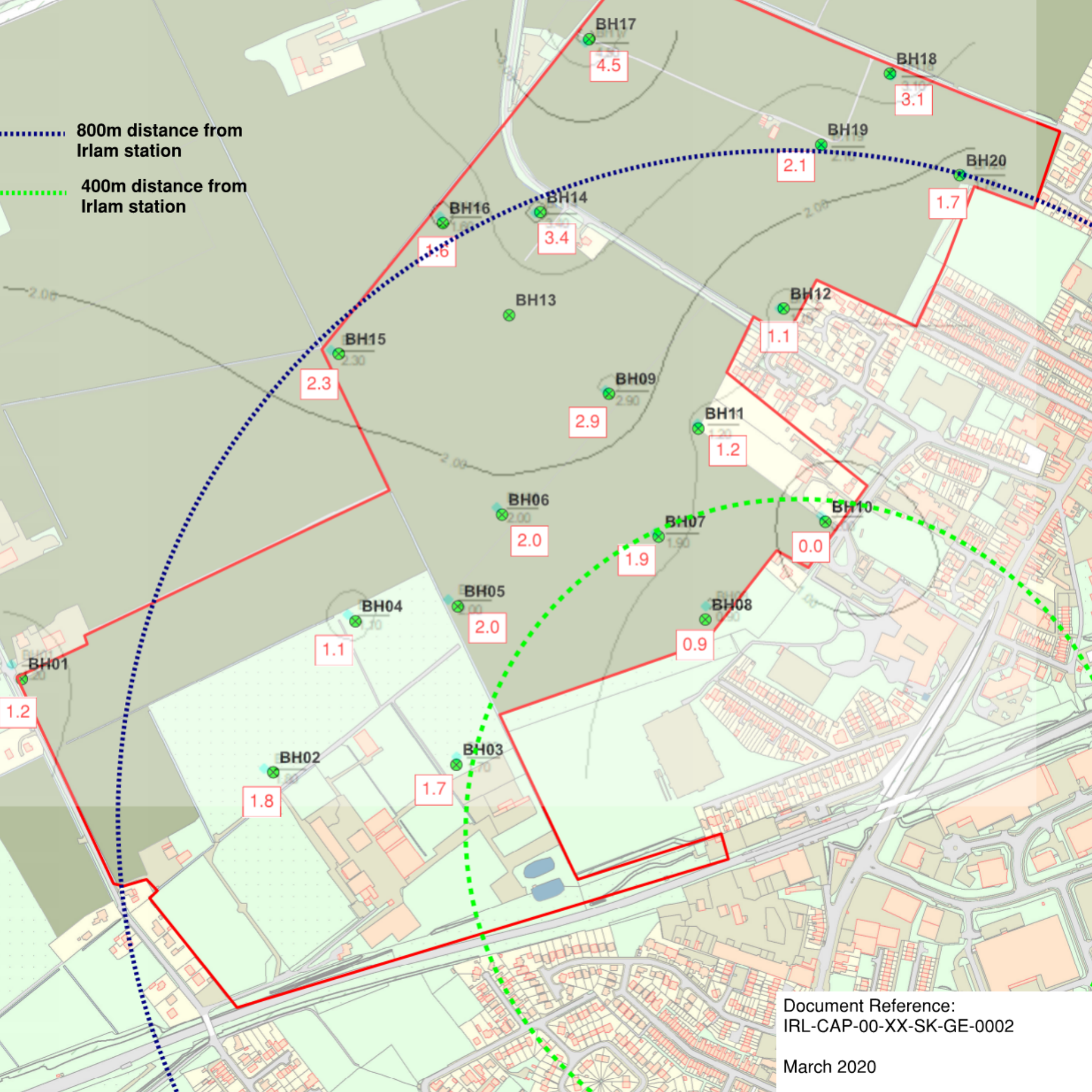
**CAPITA**

www.capitaproperty.co.uk  
Capita Property and Infrastructure Ltd.

# Peat and Other Distinct Layer Thickness Contour Map



..... 800m distance from Irlam station  
..... 400m distance from Irlam station



Document Reference:  
IRL-CAP-00-XX-SK-GE-0002  
March 2020

# Appendix B

## Ground Investigation Factual Report



# *Your* Environment

## SITE INVESTIGATION- ASTLEY ROAD, IRLAM, MANCHESTER, APPROX M44 5LH

Urban Vision

### *Your Environment*

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Report Number: YG0134-19, Date: October 2019

**Daniel Speight**  
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## Contents

1.0	Introduction.....	3
2.0	Proposed Development .....	3
3.0	Fieldworks.....	3
4.0	Laboratory Testing.....	4
5.0	Limitations.....	4

## Appendices

Appendix A:	Site investigation plan
Appendix B:	Trial pit logs
Appendix C:	Laboratory results



<b>Prepared by:</b>	Daniel Speight	Graduate Geotechnical Engineer		October 2019
<b>Reviewed and Approved by:</b>	Rob Lewis	Director		October 2019
<b>For and on behalf of YourGeotechnical</b>				

Issue	Date	Description	Prepared	Reviewed	Approved
01	31.11.2019	Final Report	DS	RL	CH

## 1.0 Introduction

YourGeotechnical (YG) was instructed by CAPITA- Urban Vision (Quote No: YG0114-19, Dated: May 9<sup>th</sup>, 2019) to conduct a Site Investigation (SI) at a site identified as Astley Road, Irlam, Manchester (approx. M44 5LH).

The purpose of this investigation was to provide a factual report on our findings in respect to works completed at the site by YG, which comprised nineteen (19no.) windowless sampler boreholes with associated geotechnical laboratory testing.

This report presents a full factual record of all site works carried out, the results of *insitu* testing and subsequent laboratory testing of selected samples obtained during these works. The report has been formulated in accordance with BS10175:2015 'Investigation into Potentially Contaminated Sites - Code of Practice' and CLR11 - 'Model Procedures for the Management of Land Contamination' and from the National Planning Policy Framework.

YG take no responsibility for conditions which have not been revealed by the windowless sampler boreholes, or which occur between borehole locations. Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative, and liability cannot be accepted for its accuracy.

The information contained in this report is intended for the use of the named client (or their approved contractors). Should a third party rely on any part of this report, that party does so wholly at its own risk and YG disclaim any liability to such parties. Should the purposes for which the report is used, or the proposed use of the site change, this report may no longer be valid and further use of reliance upon the report in those circumstances shall be at the client's sole and own risk. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. YG should in all such altered circumstances be commissioned to review and update this report accordingly.

## 2.0 Proposed Development

We understand current plans for the redevelopment of the site include:

- Construction of a housing development.

## 3.0 Fieldworks

### 3.1 Site Investigation

All SI works were completed between 16<sup>th</sup> and 23<sup>rd</sup> September 2019 under the supervision of a Geotechnical Engineer contracted from YG. In summary the investigation included:

- A two-man team ascertained the routes of any below ground services in close proximity to the proposed exploratory hole positions, using a CAT scan and lifting up of any manhole covers. Following the CAT scan, hand-dug starter pits were completed to either 1.20m or 1.50m depth.
- Twenty (20no.) windowless sampler boreholes (BH01 to BH20) were initially planned, but due to time constraints, nineteen (19no.) boreholes were completed by means of a Competitor Dart rig, with the proposed borehole BH13 not being drilled. All boreholes were completed to depths up to of 5.45 metres below ground level (mbgl),

except for boreholes BH16 and BH17 which were completed to depths of 6.45mbgl. The positions of exploratory holes were chosen to reflect those proposed during initial correspondence regarding the site investigation.

- The windowless sampler boreholes were logged, with any groundwater conditions noted and representative soil samples removed in accordance with current guidelines.
- Soil samples were collected in suitable containers, including 1kg plastic tubs and 250ml glass jars, then placed in cool boxes with cool packs prior to storage within our *in-house* laboratory fridges and subsequent forwarding to our designated laboratory for analysis.
- Ten (10no.) of the boreholes were fitted with gas monitoring installations and sealed using protective covers.
- Upon completion, all boreholes without gas monitoring installations were backfilled, compacted and made good to existing levels and finishes, with any surplus spoil bagged up and removed from site.

The positions of exploratory holes in relation to the existing site layout can be reviewed within [Appendix A](#). Exploratory logs are located in [Appendix B](#).

## 4.0 Laboratory Testing

Geotechnical testing included:

- a) Suite of contamination chemical testing.
- b) Sulphates and pH - 2:1water/soil extract.
- c) Atterberg limits and natural moisture content determination.
- d) Particle size distribution and sedimentation.

The results of the testing can be reviewed within [Appendix C](#).

## 5.0 Limitations

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

This report has been prepared solely for the use of the named client and may not be relied upon by other parties without written consent from YG. YG disclaim any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

## APPENDIX A: Proposed Redevelopment Plans





M62

Roscoe Rd

Rose Ave

Baines Ave

Francis Rd

Astley Rd

Coline St

Macdonald Rd

Wood's Rd

B5320

Tramway Rd

B5320

Cromwell Rd

Liverpool Rd

Huntsman Dr

Moss Rd

Dean Rd

600 m



## APPENDIX B: Site Investigation Plan





0 50 100 200 300 Meters



1:5,000



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## APPENDIX C: Borehole Logs





# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 16/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
		Depth (m)	Type	Results								
		0.30	ES		0.70			TOPSOIL: Dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine, angular of mixed lithology. Rootlets and wood noted.	1			
		0.70	ES					Dark brown plastic fibrous PEAT.				
		0.70 - 1.20	B					N=0 (1,1/0,0,0,0)				
		1.00	C									
		1.20 - 2.00	C									
		2.00 - 3.00	C				1.90			N=5 (0,0/1,2,1,1)	Greyish brown clayey silty SAND. Sand is fine to medium.	2
		2.00	C				2.50					Soft becoming firm reddish brown mottled grey very sandy slightly gravelly CLAY. Sand is fine to coarse, occurring in pockets. Gravel is fine to coarse, angular to sub-angular of glauconitic sandstone.
3.00 - 4.00	C		4.00	N=6 (0,0/1,1,2,2)								
3.00	C											
4.00 - 5.00	C		5.45	N=14 (2,3/3,4,3,4)								
4.00	C											
5.00	C		N=13 (2,2/3,3,3,4)	5								
							End of Borehole at 5.45m	6				
								7				
								8				
								9				
								10				

Remarks  
Hand-dug test pit to 1.50m. No groundwater encountered.



# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 16/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
Water Strikes		0.00 - 1.50	B		0.80	0.80		TOPSOIL: Dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine, angular of mixed lithology. Rootlets and wood noted.	1		
		0.30	ES							Dark brown plastic fibrous PEAT.	
		0.80	ES								
		1.00	C	N=0 (0,0/0,0,0,0)							
		1.50 - 2.00	C								
		2.00 - 3.00	C	N=0 (0,0/0,0,0,0)							
		2.00	C								Very soft dark brown silty sandy organic CLAY. Organic material noted.
		3.00 - 4.00	C	N=11 (1,2/2,3,3,3)							Soft becoming firm reddish brown mottled grey very sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is fine to coarse, angular to sub-angular of glauconitic sandstone.
	3.00	C				5					
	4.00 - 5.00	C	N=15 (1,2/3,3,4,5)				6				
	4.00	C					7				
	5.00	C	N=39 (4,6/7,8,13,11)				8				
							9				
							10				
				5.45				End of Borehole at 5.45m			

Remarks  
Hand-dug test pit to 1.20m. No groundwater encountered.



# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 16/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	ES		0.70		TOPSOIL: Dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine, angular of mixed lithology. Rootlets and wood noted.	1	
		1.00	C	N=0 (0,0/0,0,0,0)					Dark brown plastic fibrous PEAT.
		1.20	ES		1.40		Very soft dark brown silty sandy organic CLAY. Sand is fine to medium, becoming more sandy with depth. Fibrous organic material noted.	2	
		1.20 - 2.00	C						
		2.00 - 3.00	C	N=6 (2,3/2,1,2,1)	2.40		Very soft becoming firm to stiff reddish brown mottled grey very sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is fine to coarse, angular to sub-rounded of glauconitic sandstone.	3	
		2.00	C						
		3.00 - 4.00	C	N=0 (0,0/0,0,0,0)	4.00			4	
		3.00	C						
		4.00 - 5.00	C	N=14 (2,2/3,3,4,4)	5.00			5	
		4.00	C						
	5.00	C	N=25 (2,3/4,6,7,8)	5.45			6		
							End of Borehole at 5.45m	7	
								8	
								9	
								10	

Remarks  
Hand-dug test pit to 1.50m. No groundwater encountered. Installation to 5.00m.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).

Level:

Scale  
1:50

Client: CAPITA

Dates: 16/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.30	ES		0.70			TOPSOIL: Dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine, angular of mixed lithology. Rootlets and wood noted.		
		0.70	ES							
		0.70 - 1.50	B		N=4 (1,1/1,1,1,1)	1.50		Very soft dark brown silty sandy organic CLAY. Sand is fine to medium, becoming more sandy with depth. Fibrous organic material noted. Light brown silty SAND. Sand is fine to medium.		
		1.00	C							
		1.50 - 2.00	C		N=9 (1,1/2,2,2,3)	2.70		Sand is fine to medium.		
		2.00 - 3.00	C							N=14 (1,2/2,3,4,5)
		2.00	C		N=34 (7,6/8,9,8,9)	5.00		Sand is fine to medium.		
		3.00 - 4.00	C							N=34 (7,6/8,9,8,9)
		3.00	C		N=34 (7,6/8,9,8,9)	5.45		Sand is fine to medium.		
		4.00 - 5.00	C							N=34 (7,6/8,9,8,9)
4.00	C		N=34 (7,6/8,9,8,9)	5.45		Sand is fine to medium.				
5.00	C						N=34 (7,6/8,9,8,9)	5.45		Sand is fine to medium.

Remarks

Hand-dug test pit to 1.50m. Groundwater encountered at 1.50m. Installation to 5.00m.



# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 16/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.20		TOPSOIL: Dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine, angular of mixed lithology. Rootlets and wood noted. Dark brown plastic fibrous PEAT.		
		0.80 - 1.50 0.90 1.00	B ES C	N=0 (0,0/0,0,0,0)				1	
		1.50 - 2.00	C		1.50		Very soft dark brown silty sandy organic CLAY. Sand is fine to medium. Fibrous organic material noted.		
		2.00 - 3.00 2.00	C C	N=0 (0,0/0,0,0,0)	2.20		Soft becoming firm reddish brown mottled grey sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is fine, sub-rounded of glauconitic sandstone.	2	
		3.00 - 4.00 3.00	C C	N=4 (0,0/1,1,1,1)				3	
		4.00 - 5.00 4.00	C C	N=10 (2,2/2,2,3,3)				4	
		5.00	C	N=13 (3,3/3,3,3,4)				5	
				5.45			End of Borehole at 5.45m	6	
								7	
								8	
								9	
								10	

Remarks  
Hand-dug test pit to 1.20m. No groundwater encountered.



# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 18/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.30	ES		0.30		<p>TOPSOIL: Dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to angular of mixed lithology. Rootlets and wood noted. Dark brown plastic fibrous PEAT.</p>	1		
		0.60	ES							
		0.80 - 1.20	B				<p>Very soft dark brown silty sandy organic CLAY. Sand is fine to medium. Fibrous organic material noted.</p>	2		
		1.00	C	N=0 (0,0/0,0,0,0)	1.20					
		1.20 - 2.00	C							
				2.00 - 3.00	C	N=0 (1,0/0,0,0,0)	2.30	<p>Brown becoming grey clayey silty SAND. Sand is fine to medium.</p>	3	
				2.00	C					
				3.00 - 4.00	C	N=6 (1,2/1,2,1,2)				
				3.00	C					
				4.00 - 5.00	C	N=6 (1,2/1,2,1,2)			4	
		4.00	C							
		5.00	C	N=12 (1,2/2,3,3,4)			5			
					5.45	End of Borehole at 5.45m		6		
								7		
								8		
								9		
								10		

Remarks  
Hand-dug test pit to 1.20m. Groundwater encountered at 1.10m. Installation to 5.00m.



# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 17/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.50		TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.		
		0.50	ES						Dark brown plastic fibrous PEAT.
		0.80 - 1.20	B		1.50		Very soft dark brown silty sandy organic CLAY. Sand is fine to medium. Fibrous organic material noted.		
		1.00	C	N=0 (0,0/0,0,0,0)					
		1.20 - 2.00	C						
		2.00 - 3.00	C		2.40		Soft becoming firm reddish brown mottled grey sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is occasional fine to medium, angular of sandstone.		
		2.00	C	N=5 (1,1/1,1,1,2)					
		3.00 - 4.00	C		5.45		End of Borehole at 5.45m		
		3.00	C	N=8 (1,1/1,2,2,3)					
		4.00 - 5.00	C						
	4.00	C	N=15 (1,2/2,4,4,5)						
	5.00	C	N=8 (1,2/1,2,2,3)						

Remarks  
 Hand-dug test pit to 1.20m. Very wet at 3.00m but no water strike. Installation to 5.40m.



# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 18/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.30		TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.	
		0.60	ES					Dark brown plastic fibrous PEAT.
		1.00	C	N=0 (0,0/0,0,0,0)	1.20		Soft becoming firm grey becoming reddish brown sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine, sub-angular to angular of glauconitic sandstone.	
		1.20 - 2.00	C					
		2.00 - 3.00	C	N=6 (0,0/1,2,1,2)				
		3.00 - 4.00	C	N=14 (1,1/2,3,4,5)				
		4.00 - 5.00	C	N=17 (2,2/3,4,4,6)				
5.00	C	N=13 (2,3/3,3,3,4)						
				5.45		End of Borehole at 5.45m		














Remarks  
Hand-dug test pit to 1.20m. Groundwater encountered at 0.50m. Installation to 5.00m.





# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 18/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
Water Strikes		0.40	ES		0.40			TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.	
		0.70	ES					Dark brown plastic fibrous PEAT.	
		0.80 - 1.20	B						1
		1.00	C	N=0 (0,0/0,0,0,0)					
		1.20 - 2.00	C						
		2.00 - 3.00	C						2
	2.00	C	N=0 (0,0/0,0,0,0)						
	3.00 - 4.00	C			2.80			Very soft dark brown silty sandy organic CLAY. Sand is fine to medium. Fibrous organic material noted.	3
	3.00	C	N=7 (0,0/1,2,2,2)		3.25				
	4.00 - 5.00	C						Soft becoming firm reddish brown mottled grey sandy CLAY. Sand is fine to medium, occurring in pockets.	4
	4.00	C	N=10 (1,1/2,2,3,3)						
	5.00	C	N=12 (2,3/2,3,3,4)						5
					5.45				
								End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks  
Hand-dug test pit to 1.20m. No groundwater encountered.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).



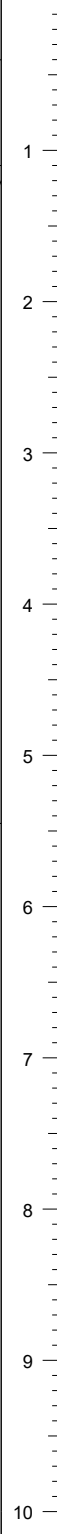
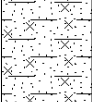
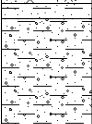
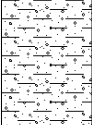
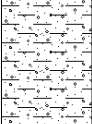
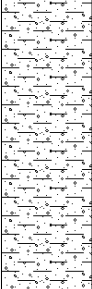
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Scale  
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Client: CAPITA

Dates: 17/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.40		TOPSOIL: Dark brown slightly clayey slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.		
		0.50	ES				Brown clayey silty SAND. Sand is fine to medium.		
		1.00	C	N=4 (0,0/1,1,1,1)	1.10		Soft brownish grey very sandy CLAY. Sand is fine to medium.		
		1.10 - 1.20	B		1.20				
		1.20 - 2.00	C						
		2.00 - 3.00	C	N=10 (1,1/2,2,3,3)			Soft becoming firm reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is occasional fine to medium, sub-rounded to sub-angular of glauconitic sandstone.		
		2.00	C						
		3.00 - 4.00	C	N=11 (1,2/2,2,3,4)					
		3.00	C						
		4.00 - 5.00	C	N=11 (2,2/2,2,3,4)					
4.00	C								
5.00	C	N=15 (2,2/3,4,4,4)							
				5.45			End of Borehole at 5.45m		

Remarks  
Hand-dug test pit to 1.20m. No groundwater encountered.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).




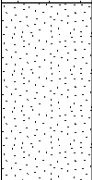


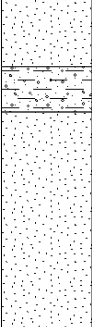
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Scale  
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Client: CAPITA

Dates: 17/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.30		TOPSOIL: Dark brown slightly clayey slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.		
		0.60	ES				Dark brown plastic fibrous PEAT, becoming slightly sandy with depth.		
		0.70 - 1.50	B	N=5 (0,0/0,1,2,2)	1.50		Brown becoming greyish brown SAND. Sand is fine to medium.		
		1.00	C						
		1.50 - 2.00	C						
				2.00 - 3.00	C	N=17 (2,2/3,4,5,5)	2.70		Soft to firm reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is fine to coarse, sub-rounded to sub-angular of sandstone.
				2.00	C				
		3.00 - 4.00	C	N=6 (1,1/1,1,2,2)	3.00		Greyish brown SAND. Sand is fine to medium.		
		3.00	C						
		4.00 - 5.00	C	N=10 (1,2/2,2,3,3)	3.70		Soft to firm reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is fine to coarse, sub-rounded to sub-angular of sandstone.		
		4.00	C						
		5.00	C	N=9 (1,2/2,2,2,3)	4.00		Greyish brown SAND, becoming slightly clayey with depth. Sand is fine to medium.		
					5.45		End of Borehole at 5.45m		

Remarks  
Hand-dug test pit to 1.50m. Very wet at 3.00m but no water strike.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).

Level:

Scale  
1:50

Client: CAPITA

Dates: 19/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
Well	Water Strikes	0.30	ES		0.30	TOPSOIL	TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.	1	
		0.70	ES				Dark brown plastic fibrous PEAT.		
		1.00	C	N=0 (0,0/0,0,0,0)	1.40	CLAY	Soft to firm grey becoming reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is fine to coarse, sub-rounded to sub-angular of sandstone and granite.	2	
		1.20 - 2.00	C						
		2.00 - 3.00	C	N=0 (0,0/0,0,0,0)	5.45	CLAY		3	
		2.00	C						
		3.00 - 4.00	C	N=10 (1,1/2,2,3,3)		CLAY		4	
3.00	C								
4.00 - 5.00	C	N=10 (1,1/2,2,3,3)		CLAY		5			
4.00	C								
5.00	C	N=7 (1,2/1,2,1,3)		CLAY		6			
End of Borehole at 5.45m								7	
								8	
								9	
								10	

Remarks  
Hand-dug test pit to 1.20m. No groundwater encountered.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).

Level:

Scale  
1:50

Client: CAPITA

Dates: 19/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.30		<p>TOPSOIL: Dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to angular of mixed lithology. Rootlets and wood noted.</p> <p>Dark brown plastic fibrous PEAT, becoming clayey with depth.</p>	
		0.60	ES					
		0.80 - 1.20	B					
		1.00	C	N=0 (0,0/0,0,0,0)				
		1.20 - 2.00	C					
		2.00 - 3.00	C					
		2.00	C	N=0 (0,0/0,0,0,0)				
		3.00 - 4.00	C					
		3.00	C	N=0 (0,0/0,0,0,0)				
		4.00 - 5.00	C		3.70			
	4.00	C	N=6 (1,1/1,1,2,2)					
	5.00	C	N=11 (1,2/2,3,3,3)					
				5.45			End of Borehole at 5.45m	

Remarks

Hand-dug test pit to 1.20m. No groundwater encountered. Installation to 5.00m.



# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 19/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.20		TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.		
		0.80	ES				Dark brown plastic fibrous PEAT, becoming clayey with depth.		
		0.90 - 1.20	B						
		1.00	C	N=0 (0,0/0,0,0,0)					
		1.20 - 2.00	C						
		2.00 - 3.00	C						
		2.00	C	N=0 (1,0/0,0,0,0)					
		2.50			2.50				
		3.00 - 4.00	C				Soft to firm grey becoming reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, angular of sandstone.		
		3.00	C	N=8 (1,1/1,2,2,3)					
		4.00 - 5.00	C						
		4.00	C	N=13 (2,2/2,3,4,4)					
		5.00	C	N=23 (3,6/6,6,6,5)					
					5.45		End of Borehole at 5.45m		

Remarks  
Hand-dug test pit to 1.20m. No groundwater encountered. Installation to 5.00m.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).




Level:

Scale  
1:50

Client: CAPITA

Dates: 19/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
Well	Water Strikes	0.30	ES	N=0 (0,0/0,0,0,0)	0.30	Legend	 <p>TOPSOIL: Dark brown slightly clayey slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.</p>	Stratum Description
		0.60	B					
		0.80	ES		1.90		 <p>Dark brown becoming light brown slightly gravelly SAND. Sand to medium. Gravel is fine to coarse, sub-rounded to sub-angular of sandstone and quartzite.</p>	
		1.00	C					
		1.20 - 2.00	C		4.00		 <p>Greyish brown SAND, becoming slightly clayey with depth. Sand is fine to coarse.</p>	
		2.00 - 3.00	C					
		2.00	C		N=6 (1,1/1,2,1,2)			
		3.00 - 4.00	C				N=10 (1,3/3,3,2,2)	
3.00	C							
4.00 - 5.00	C	N=6 (1,2/1,2,1,2)						
4.00	C							
5.00 - 6.00	B	N=13 (2,3/4,3,3,3)						
5.00	C							
6.00	C	N=21 (3,3/3,4,6,8)						

Remarks  
Hand-dug test pit to 1.20m. No groundwater encountered.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).

Level:

Scale  
1:50

Client: CAPITA

Dates: 23/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.25	ES		0.50		TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.	
		0.50	ES					
		0.70 - 1.50	B					
		1.00	C	N=0 (0,0/0,0,0,0)				
		1.50 - 2.00	C					
		2.00 - 3.00	C					
		2.00	C	N=0 (1,0/0,0,0,0)				
		3.00 - 4.00	C					
		3.00	C	N=1 (1,0/0,0,0,1)				
		4.00 - 5.00	C					
	4.00	C	N=1 (1,0/0,0,0,1)					
	5.00 - 6.00	C		4.95				
	5.00	C	N=1 (1,0/0,0,0,1)				Soft grey slightly sandy CLAY. Sand is fine to medium, occurring in pockets.	
	6.00	C	N=11 (1,2/2,3,3,3)					
				6.45			End of Borehole at 6.45m	

Remarks  
Hand-dug test pit to 1.50m. No groundwater encountered. Installation to 6.00m.





# Borehole Log

Project Name: Irlam, Astley Road.	Project No. YG0134	Co-ords:	Hole Type WLS
Location: Irlam (approx M44 5LH).	Level:		Scale 1:50
Client: CAPITA	Dates: 23/09/2019		Logged By NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.70		TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.	1	
		0.50	ES						
		0.70 - 1.50	B				Dark brown plastic fibrous PEAT, becoming clayey and slightly sandy with depth.	2	
		1.00	C	N=0 (0,0/0,0,0,0)					
		1.50 - 2.00	C						
		2.00 - 3.00	C	N=0 (0,0/0,0,0,0)					
		2.00	C						
	3.00 - 4.00	C	N=0 (1,0/0,0,0,0)	3.80		Very soft becoming soft grey slightly sandy CLAY. Sand is fine to medium, occurring in pockets.	4		
	3.00	C							
	4.00 - 5.00	C	N=0 (1,0/0,0,0,0)		5.45		End of Borehole at 5.45m	5	
	4.00	C							
	5.00	C	N=12 (2,2/2,3,3,4)					6	
								7	
								8	
								9	
								10	

Remarks  
Hand-dug test pit to 1.50m. Groundwater encountered at 1.20m. Installation to 5.00m.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).

Level:

Scale  
1:50

Client: CAPITA

Dates: 23/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.80		TOPSOIL: Dark brown slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.	
		0.60	ES					
		0.80 - 1.50	B		N=0 (0,0/0,0,0,0)		Dark brown slightly sandy plastic fibrous PEAT, becoming clayey with depth.	
		1.00	C					
		1.50 - 2.00	C		N=0 (1,0/0,0,0,0)			
		2.00 - 3.00	C					
		2.00	C		N=0 (0,0/0,0,0,0)		Grey slightly clayey silty SAND. Sand is fine to medium	
		3.00 - 4.00	C					
		3.00	C		N=7 (1,1/2,2,1,2)		Very soft becoming soft greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium, occurring in pockets. Gravel is occasional fine, sub-rounded to sub-angular of sandstone	
		4.00 - 5.00	C					
	4.00	C		N=16 (2,2/3,3,5,5)				
	5.00	C						
					5.45		End of Borehole at 5.45m	

Remarks

Hand-dug test pit to 1.50m. No groundwater encountered. Installation to 5.00m.



# Borehole Log

Project Name: Irlam, Astley Road.

Project No.  
YG0134

Co-ords:

Hole Type  
WLS

Location: Irlam (approx M44 5LH).

Level:

Scale  
1:50

Client: CAPITA

Dates: 23/09/2019

Logged By  
NC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
Water Strikes		0.30	ES		0.80		TOPSOIL: Dark brown slightly clayey slightly sandy SILT. Sand is fine to coarse. Rootlets and wood noted.	1	
		0.60	ES						
		0.80 - 1.50	B		2.50		Dark brown plastic fibrous PEAT, becoming clayey with depth.	2	
		1.00	C	N=0 (0,0/0,0,0,0)					
		1.50 - 2.00	C		3.60		Grey silty SAND. Sand is fine to medium.	3	
		2.00 - 3.00	C	N=0 (1,0/0,0,0,0)					
		2.00	C		5.45		Soft grey sandy CLAY. Sand is fine to medium, occurring in pockets.	4	
		3.00 - 4.00	C	5 (1,1/1,2,2)					
	3.00	C		5		End of Borehole at 5.45m	5		
	4.00 - 5.00	C	N=11 (1,2/2,2,3,4)						
	4.00	C		6			6		
	5.00	C	N=10 (1,2/2,2,3,3)						
				7			7		
				8			8		
				9			9		
				10			10		

Remarks  
Hand-dug test pit to 1.50m. No groundwater encountered. Installation to 5.00m.



## APPENDIX D: Geotechnical Lab Results



**Environmental  
Geotechnical  
Specialists**



# LABORATORY REPORT

GEOTECHNICAL  
ENVIRONMENTAL

job number	client ref
site address	client address
consultant	
date scheduled	date issued
issued by	job title

**Rogers Geotechnical Services Ltd Telephone 01484 607 977**  
**Email [jude.norcliffe@rogersgeotech.co.uk](mailto:jude.norcliffe@rogersgeotech.co.uk) [www.rogersgeotech.co.uk](http://www.rogersgeotech.co.uk)**  
 Offices 1 & 2, Barncliffe Business Park, Near Bank, Shelley,  
 Huddersfield, West Yorkshire HD8 8LU.





8948

Environmental  
Geotechnical  
Specialists



**Schedule of UKAS  
Accredited Laboratory Tests**

		Accredited (A)	Unaccredited (U)
<b>1. CLASSIFICATION OF SOIL</b>		<b>BS 1377-2:1990</b>	
<b>1.1 Moisture content determination</b>			
i) Oven drying	Pt 2 : 3.2	A	
ii) Saturation m/c of chalk	Pt 2 : 3.3		U
<b>1.2 Index Properties</b>			
i) Liquid limit – cone penetrometer	Pt 2 : 4.3	A	
ii) Plastic limit	Pt 2 : 5.3	A	
iii) Shrinkage limit	Pt 2 : 6.3		U
iv) Linear shrinkage	Pt 2 : 6.5	A	
<b>1.3 Particle Density</b>			
i) Gas jar	Pt 2 : 8.2		U
ii) Large pyknometer	Pt 2 : 8.3		U
iii) Small pyknometer	Pt 2 : 8.4		U
<b>1.4 Density Tests</b>			
i) Linear measurement	Pt 2 : 7.2	A	
ii) Immersion in water	Pt 2 : 7.3		U
iii) Water displacement	Pt 2 : 7.4		U
iv) Sand replacement	Pt 9 : 2.1, 2.2		U
v) Core cutter	Pt 9 : 2.4		U
<b>1.5 Particle Size Distribution</b>			
i) Dry Sieve	Pt 2 : 9.2	A	
ii) Wet Sieve	Pt 2 : 9.3	A	
iii) Sedimentation by pipette	Pt 2 : 9.4	A	
iv) Sedimentation by hydrometer	Pt 2 : 9.5		U
<b>2. CHEMICAL TESTS</b>		<b>BS 1377-3:2018</b>	
ii) Mass loss on ignition	Pt 3 : 4		U
<b>3. COMPACTION RELATED TESTS</b>		<b>BS 1377-4:1990</b>	
<b>3.1 Dry density/moisture relationship</b>			
i) 2.5kg rammer – 1 litre mould	Pt 4 : 3		U
- CBR mould	Pt 4 : 3		U
ii) 4.5kg rammer – 1 litre mould	Pt 4 : 3		U
- CBR mould	Pt 4 : 3		U
<b>3.2 Moisture Condition Value</b>			
i) Single point test	Pt 4 : 5.4		U
ii) MCV/moisture content relationship	Pt 4 : 5.5		U
<b>3.3 California Bearing Ratio</b>			
i) Undisturbed sample	Pt 5 : 7		U
ii) Recompacted sample	Pt 5 : 7		U
iii) Soaked, inc measurement of swell	Pt 5 : 7		U
<b>4. COMPRESSIBILITY OF SOIL</b>		<b>BS 1377-5:1990</b>	
i) One dimensional consolidation	Pt 5 : 3		U
ii) Swelling pressure test	Pt 5 : 3		U
<b>5. SHEAR STRENGTH OF SOIL</b>		<b>BS 1377-7:1990</b>	
i) Hand shear vane	Makers instructions		U
ii) Shear box (100mm square sample)	BS 1377 : Pt 7 : 4		U
iii) Triaxial – quick undrained	BS 1377 : Pt 7 : 8, 9		U
<b>6. PERMEABILITY</b>			
i) Falling head	K. H. Head Vol 2		U
ii) Constant head	BS 1377 : Pt 6 : 6		U
iii) Triaxial cell	BS 1377 : Pt 6 : 6		U
<b>7. ROCK TESTS</b>			
<b>7.1 Classification Tests</b>			
i) Natural moisture content	-		U
ii) Saturated moisture content	-		U
iii) Natural density	-		U
iv) Porosity	-		U
<b>7.2 Strength Tests</b>			
i) Point load index	ISRM '85		U
ii) Uniaxial compression test	ISRM '81		U

GEOTECHNICAL  
ENVIRONMENTAL



**Rogers Geotechnical Services Ltd**  
Office 1 & 2 Barncliffe Business Park,  
Near Bank, Shelley, Huddersfield, HD8 8LU

**Telephone** 0843 50 666 87  
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**Company No:** 5130864



# GEOTECHNICAL LAB RESULTS

**GEOTECHNICAL**  
**ENVIRONMENTAL**

Environmental  
Geotechnical  
Specialists



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GEOTECHNICAL  
ENVIRONMENTAL



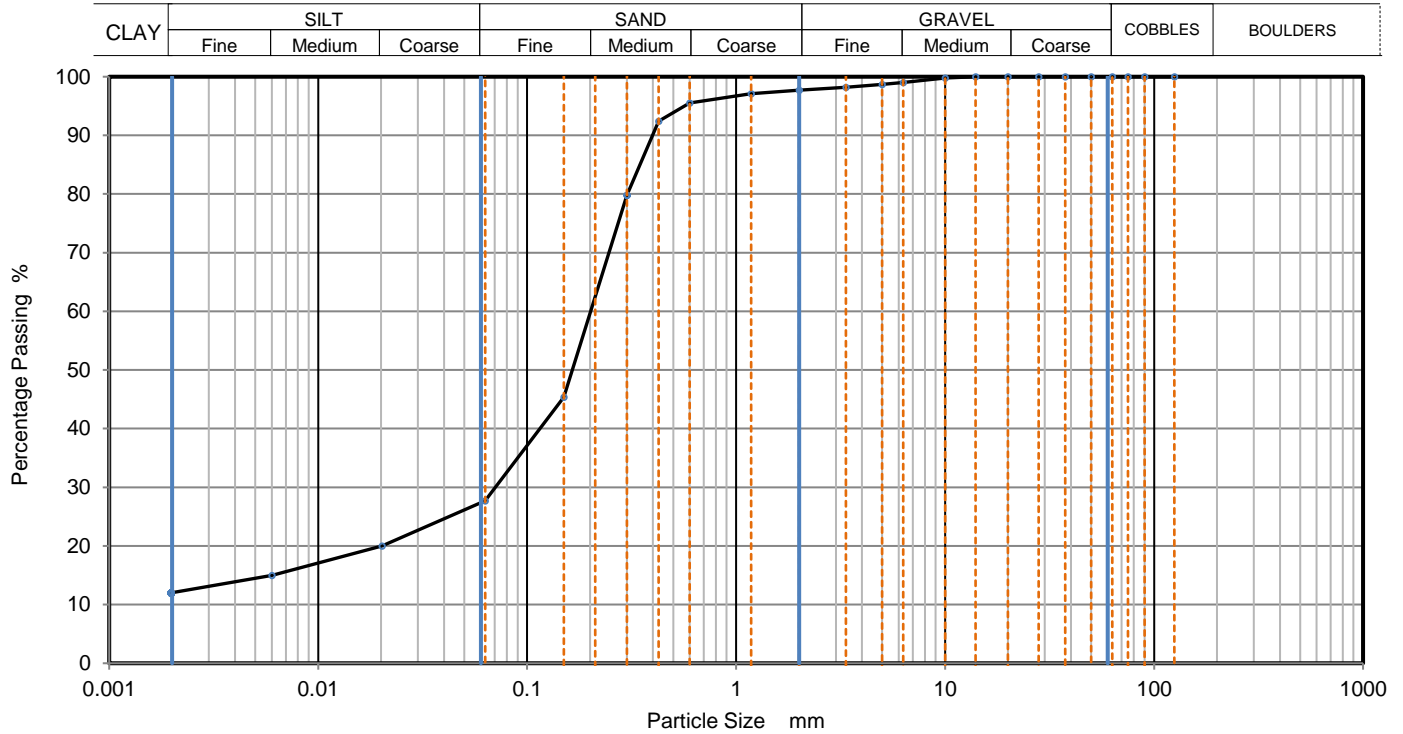
**Rogers Geotechnical Services Ltd**  
Office 1 & 2 Barncliffe Business Park,  
Near Bank, Shelley, Huddersfield, HD8 8LU

**Telephone** 01484 607977  
**Company No:** 5130864





<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH01
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	
Soil Description	Reddish brown silty SAND			Depth, m	5.00
Specimen Reference	D#	Specimen Depth	5 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.4			KeyLAB ID	RGS_201910186



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0202	20
90	100	0.0060	15
75	100	0.0020	12
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	98		
2	98		
1.18	97		
0.6	96	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	92		
0.3	80		
0.15	45		
0.063	28		

Dry Mass of sample, g

776

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	70
Silt	16
Clay	12

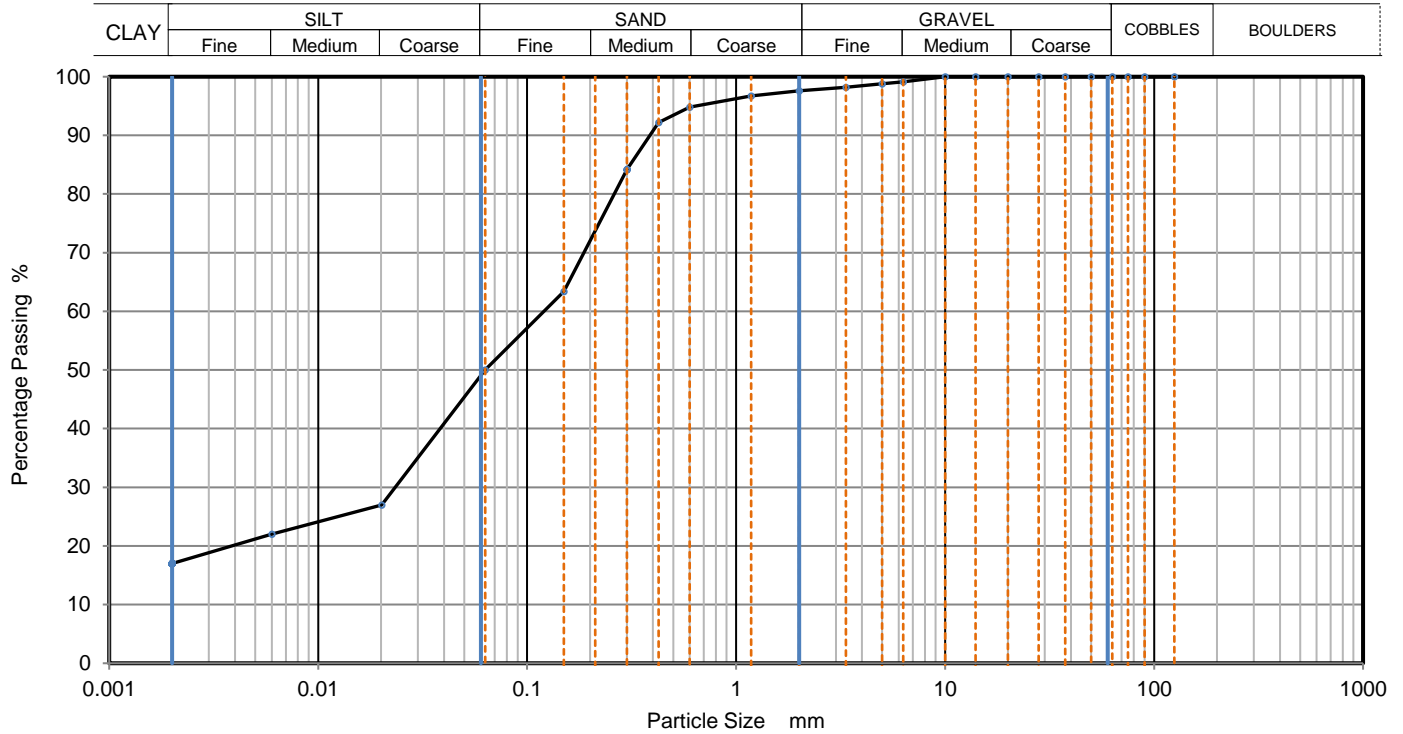
Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Harry	Jude	Harry	31/10/2019	
				Sheet 1

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH02
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Brown/reddish brown silty SAND			Depth, m	4.00
Specimen Reference	D1	Specimen Depth	4 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.4			KeyLAB ID	RGS_201910187



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0201	27
90	100	0.0060	22
75	100	0.0020	17
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	98		
2	98		
1.18	97		
0.6	95	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	92		
0.3	84		
0.15	63		
0.063	50		

Dry Mass of sample, g

724

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	48
Silt	33
Clay	17

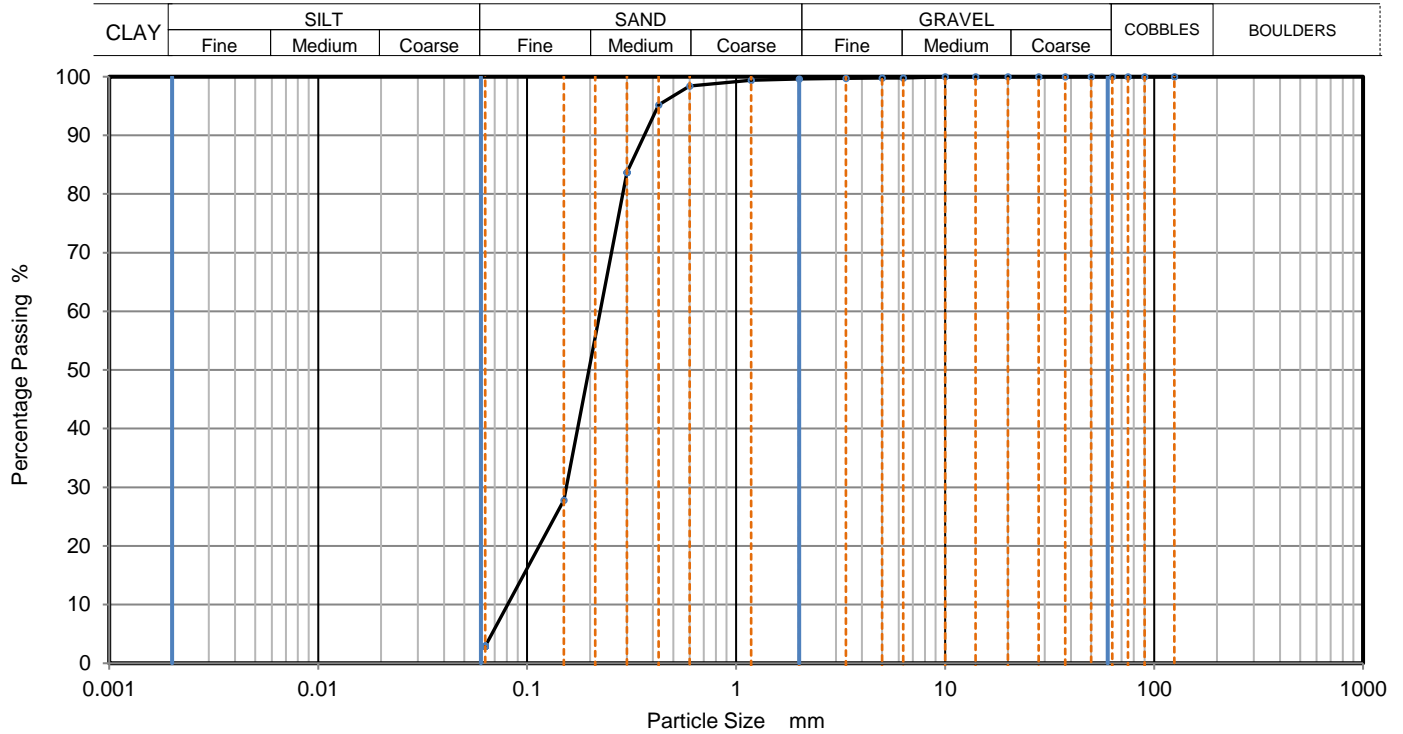
Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Harry	Jude	Harry	31/10/2019	
				Sheet 2

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH04
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Light Brown SAND			Depth, m	2.50
Specimen Reference	D1	Specimen Depth	2.5 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	RGS_201910188



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98		
0.425	95		
0.3	84		
0.15	28		
0.063	3		

Dry Mass of sample, g

1324

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	97
Fines <0.063mm	3

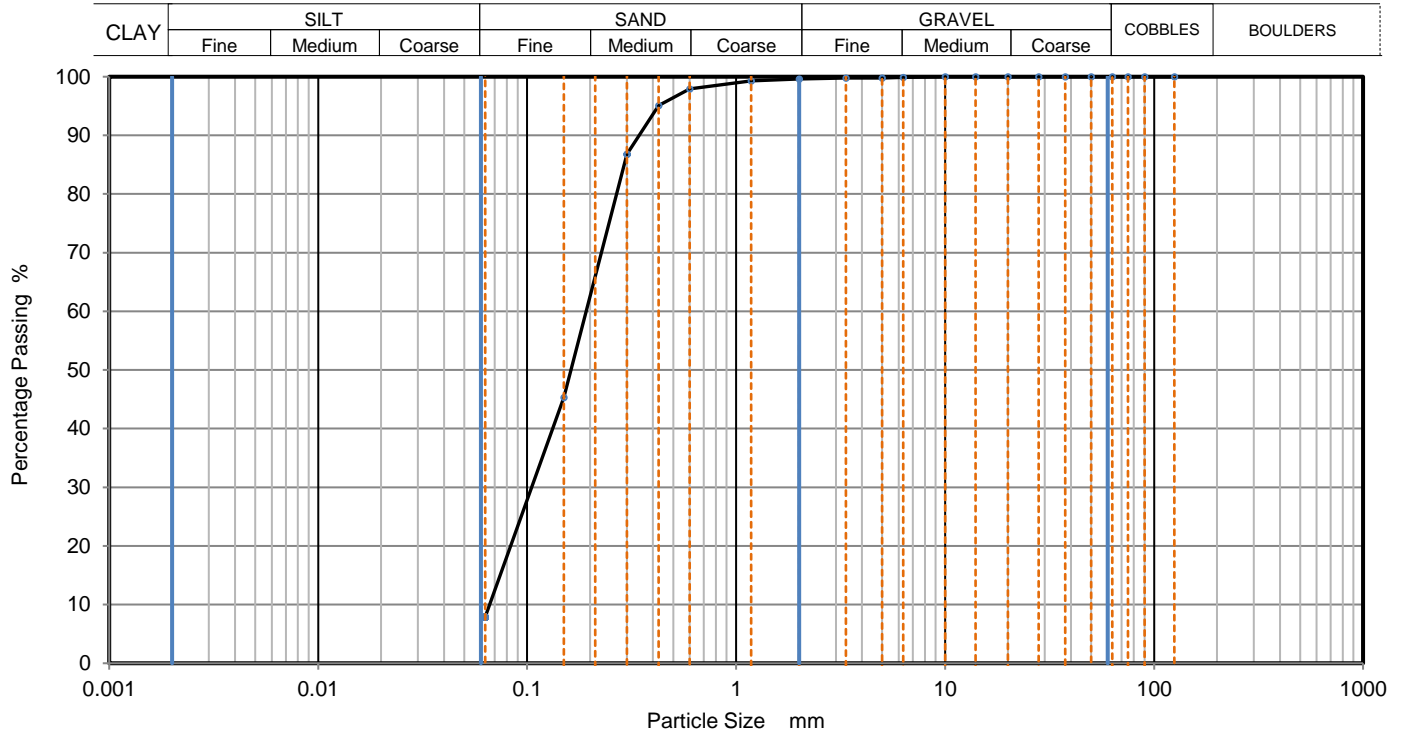
Grading Analysis		
D100	mm	
D60	mm	0.224
D30	mm	0.154
D10	mm	0.0808
Uniformity Coefficient		2.8
Curvature Coefficient		1.3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Harry	Jude	Harry	31/10/2019	
				Sheet 3

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH06
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Grey SAND			Depth, m	4.60
Specimen Reference	D	Specimen Depth	4.6 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	RGS_201910189



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98		
0.425	95		
0.3	87		
0.15	45		
0.063	8		

Dry Mass of sample, g

522

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	92
Fines <0.063mm	8

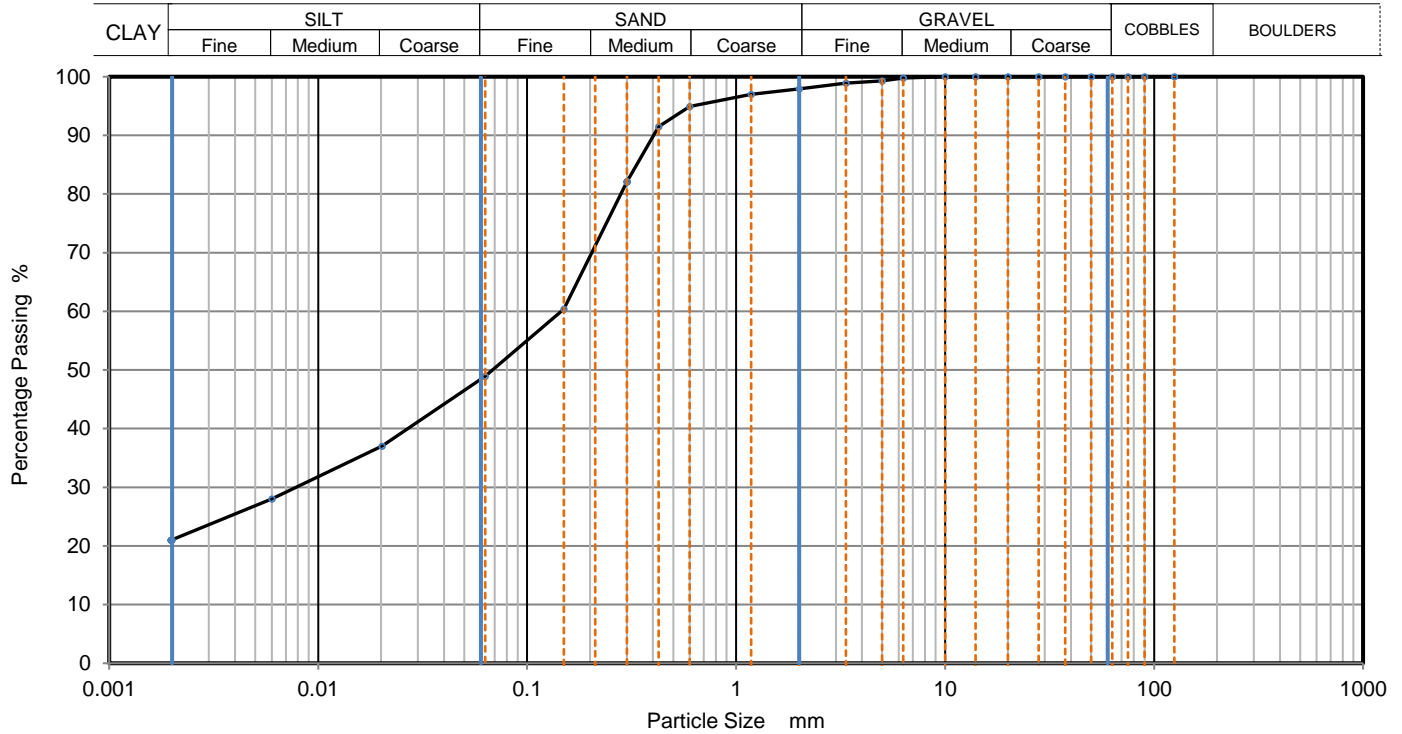
Grading Analysis		
D100	mm	
D60	mm	0.192
D30	mm	0.105
D10	mm	0.0661
Uniformity Coefficient		2.9
Curvature Coefficient		0.87

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Dev	Jude	Harry	31/10/2019	
				Sheet 4

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH08
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Brown clayey silty SAND			Depth, m	4.70
Specimen Reference	D1	Specimen Depth	4.7 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.4			KeyLAB ID	RGS_2019101810



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0202	37
90	100	0.0060	28
75	100	0.0020	21
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	98		
1.18	97		
0.6	95	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	92		
0.3	82		
0.15	60		
0.063	49		

Dry Mass of sample, g

369

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	49
Silt	28
Clay	21

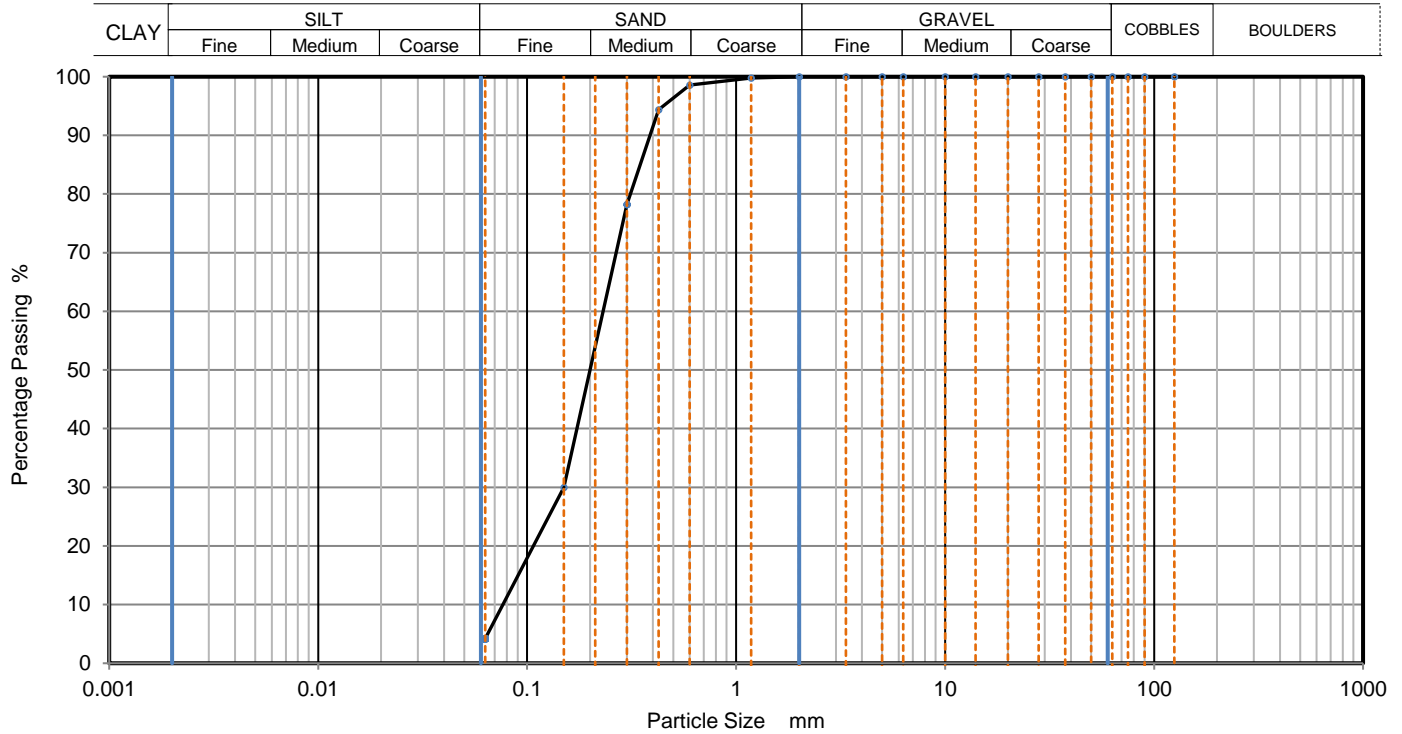
Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Harry	Jude	Harry	31/10/2019	
				Sheet 5

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH11
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Greyish light brown SAND			Depth, m	2.60
Specimen Reference	D1	Specimen Depth	2.6 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	RGS_2019101811



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	94		
0.3	78		
0.15	30		
0.063	4		

Dry Mass of sample, g

626

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	96
Fines <0.063mm	4

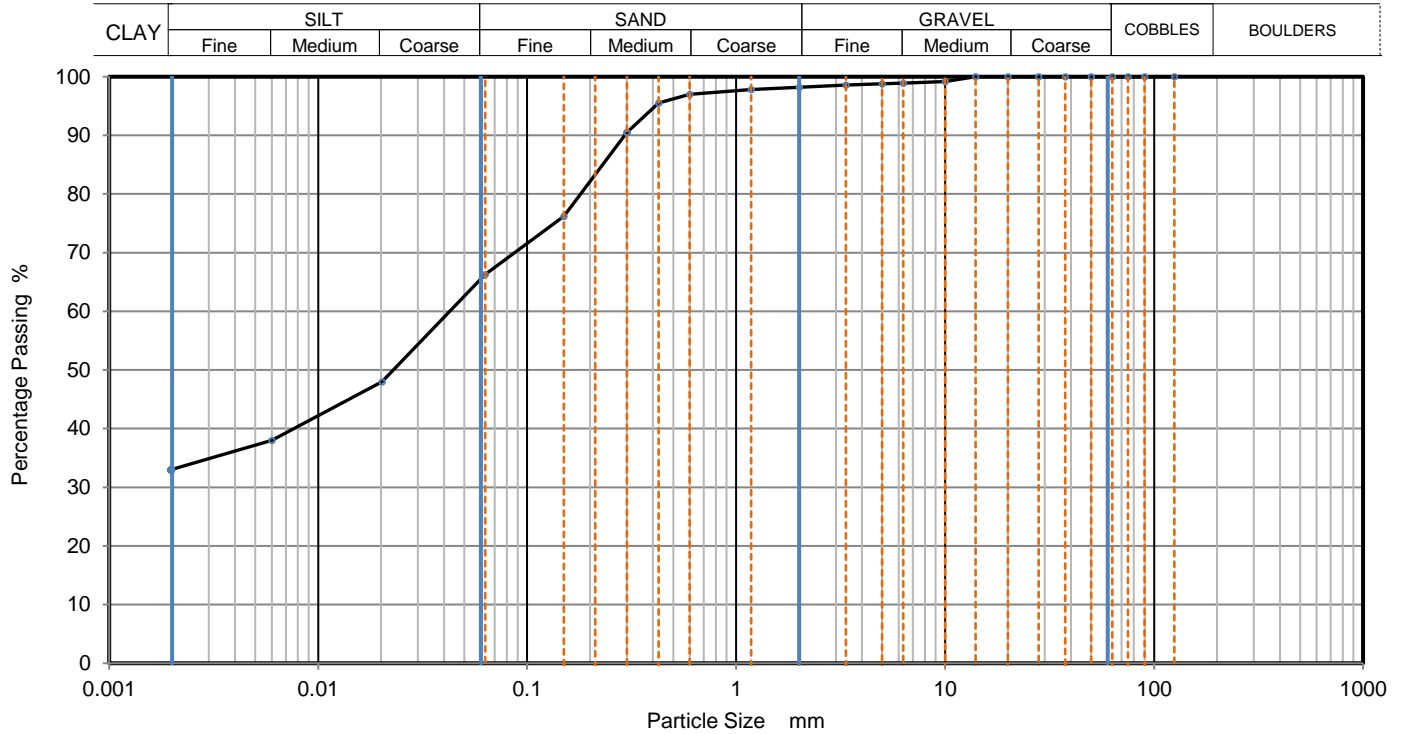
Grading Analysis	
D100	mm
D60	mm 0.231
D30	mm 0.15
D10	mm 0.0766
Uniformity Coefficient	3
Curvature Coefficient	1.3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Harry	Jude	Harry	31/10/2019	
				Sheet 6

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH14
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Dark brown sandy clayey SILT			Depth, m	4.70
Specimen Reference	D1	Specimen Depth	4.7 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.4			KeyLAB ID	RGS_2019101812



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0202	48
90	100	0.0060	38
75	100	0.0020	33
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	99		
5	99		
3.35	99		
2	98		
1.18	98		
0.6	97	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	96		
0.3	91		
0.15	76		
0.063	66		

Dry Mass of sample, g

581

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	32
Silt	34
Clay	33

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

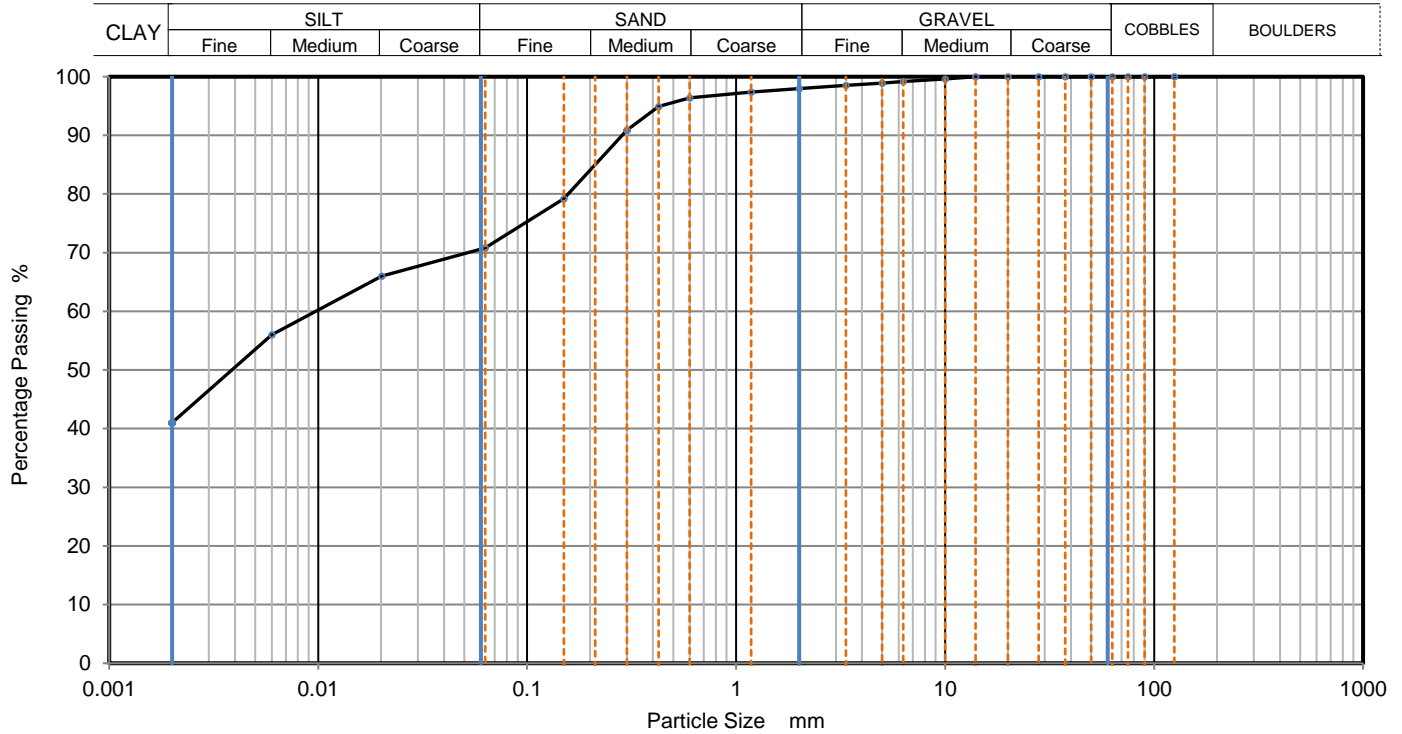
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Harry	Jude	Harry	31/10/2019	
				Sheet 7



<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH15
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Reddish brown sandy silty CLAY			Depth, m	4.80
Specimen Reference	D1	Specimen Depth	4.8 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.4			KeyLAB ID	RGS_2019101813



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0201	66
90	100	0.0060	56
75	100	0.0020	41
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	99		
2	98		
1.18	97		
0.6	96		
0.425	95	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.3	91		
0.15	79		
0.063	71		

Dry Mass of sample, g

619

Sample Proportions	% dry mass
Very coarse	0
Gravel	2
Sand	27
Silt	30
Clay	41

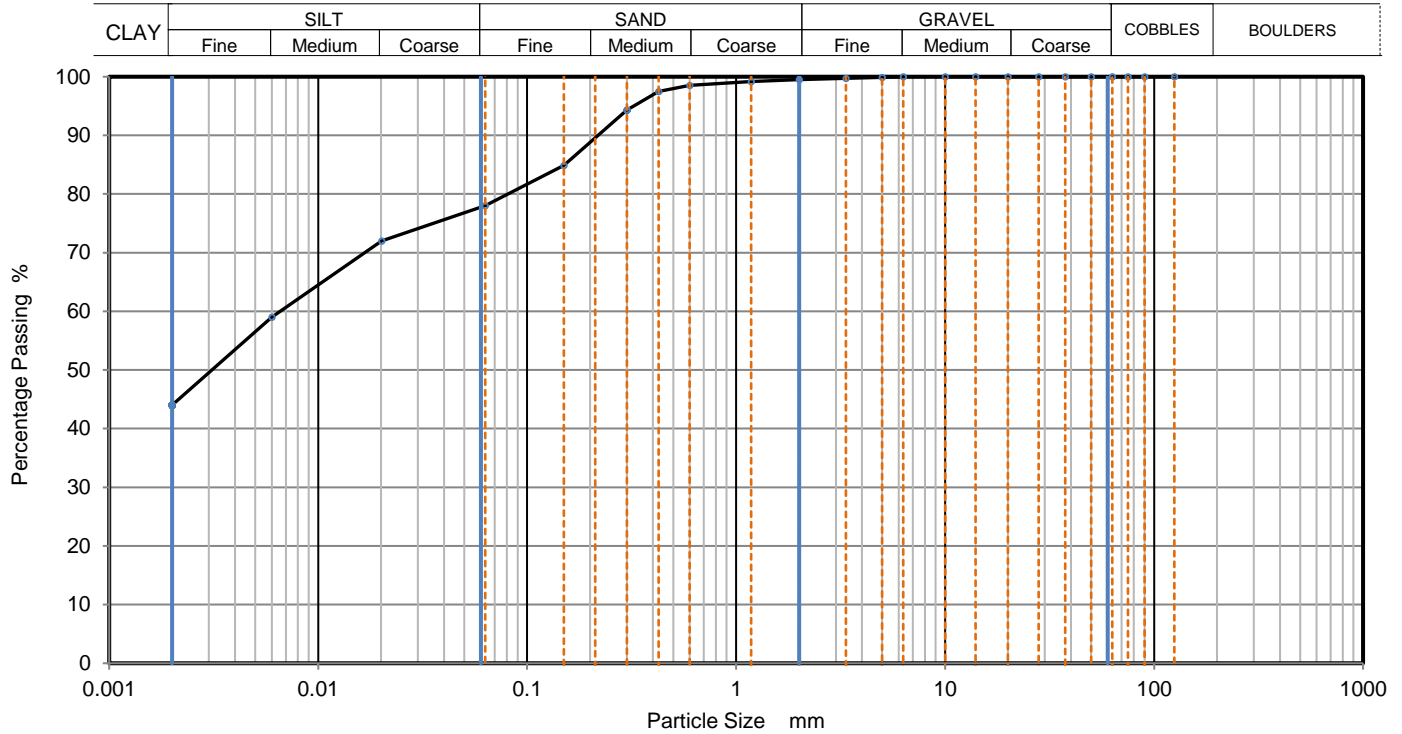
Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Dev	Jude	Harry	31/10/2019	
				Sheet 8

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH17
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Brown sandy silty CLAY			Depth, m	5.80
Specimen Reference	D1	Specimen Depth	5.8 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.4			KeyLAB ID	RGS_2019101814



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0201	72
90	100	0.0060	59
75	100	0.0020	44
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	98		
0.3	94		
0.15	85		
0.063	78		

Dry Mass of sample, g

590

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	22
Silt	34
Clay	44

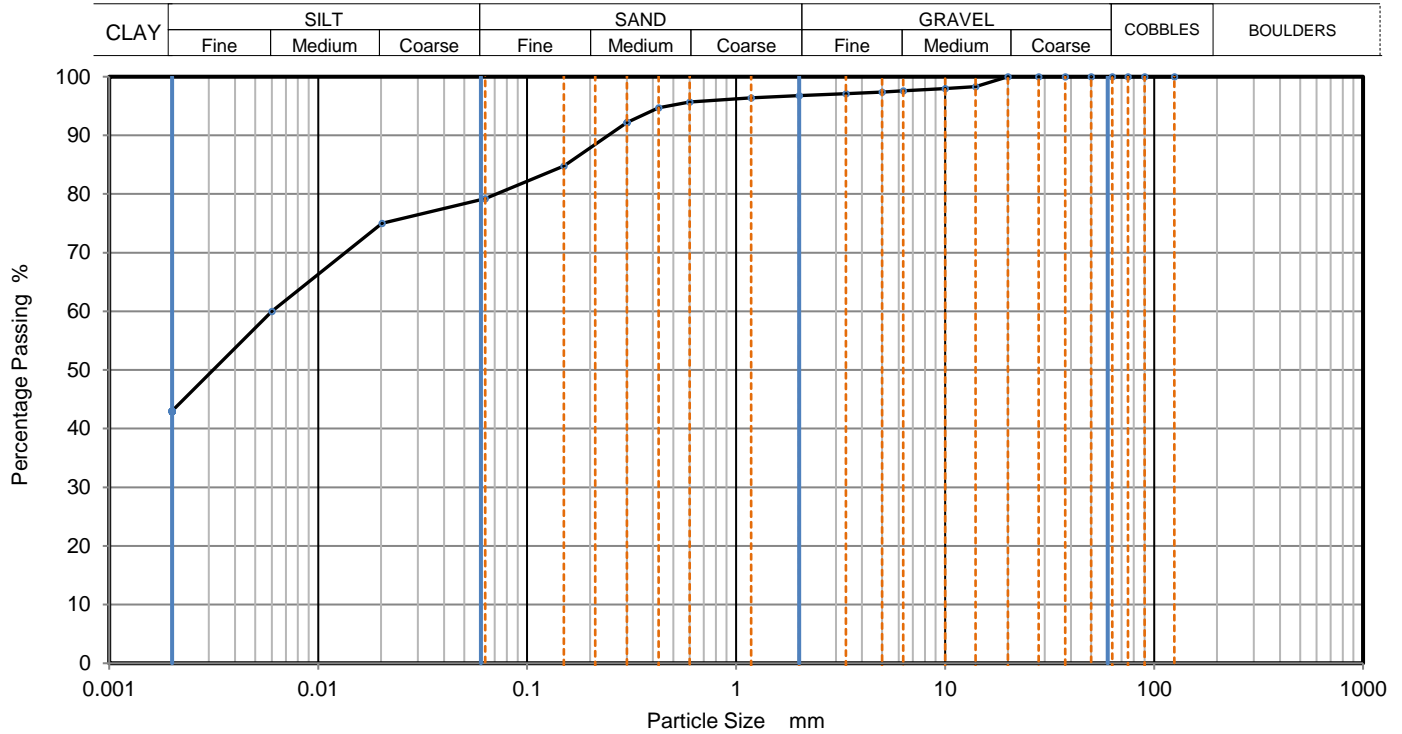
Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Dev	Jude	Harry	31/10/2019	
				Sheet 9

<b>PARTICLE SIZE DISTRIBUTION</b>				Job Ref	<b>C251/19/L/372</b>
				Borehole/Pit No.	BH18
Site Name	Irlam, Stockport (YG 0134-19)			Sample No.	1
Soil Description	Brown slightly sandy silty CLAY			Depth, m	5.00
Specimen Reference	D1	Specimen Depth	5 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.4			KeyLAB ID	RGS_2019101815



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0202	75
90	100	0.0060	60
75	100	0.0020	43
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	98		
6.3	98		
5	97		
3.35	97		
2	97		
1.18	96		
0.6	96	Particle density (assumed) 2.65 Mg/m <sup>3</sup>	
0.425	95		
0.3	92		
0.15	85		
0.063	79		

Dry Mass of sample, g

596

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	18
Silt	36
Clay	43

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

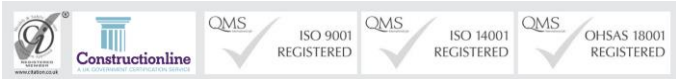
Operator	Checked	Approved	Sheet printed	<b>Fig 2</b>
Harry	Jude	Harry	31/10/2019	
				Sheet 10

Environmental  
Geotechnical  
Specialists



# End of Report

GEOTECHNICAL  
ENVIRONMENTAL



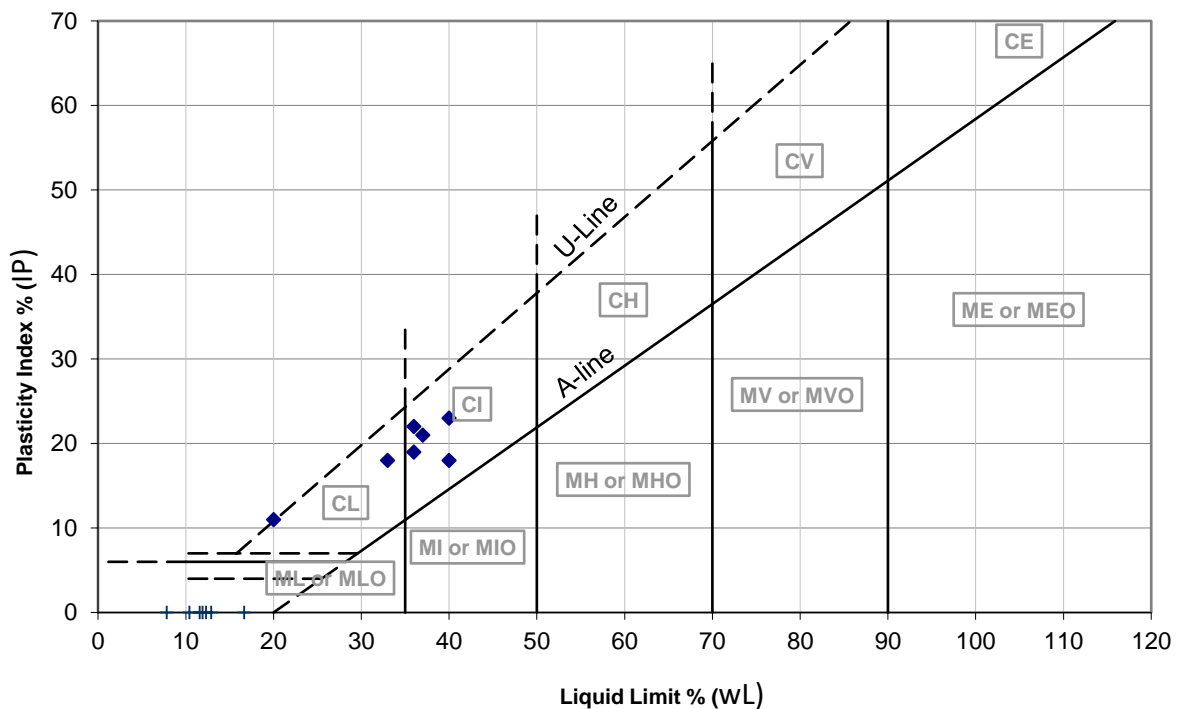
**Rogers Geotechnical Services Ltd**  
Office 1 & 2 Barncliffe Business Park,  
Near Bank, Shelley, Huddersfield, HD8 8LU

**Telephone** 01484 607977  
**Company No:** 5130864



## Interpretation of Moisture Content, Liquid and Plastic Limits

Location	Depth (m)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Retained by 0.425mm	Modified (w)	Modified (I <sub>p</sub> )	Liquidity/Consistency		Casagrande Class	N.H.B.C Class (%)
		(w) (%)	(w <sub>L</sub> ) (%)	(w <sub>P</sub> ) (%)	(I <sub>P</sub> ) (%)	(%)	(w') (%)	(I <sub>P</sub> ) (%)	(I <sub>L</sub> ) (%)	(I <sub>C</sub> ) (%)		
WS01	5.00	15	20	9	11	1	15	11	0.5	0.5	C? L	LOW
WS02	4.00	19	33	15	18	1	19	18	0.2	0.8	C L	LOW
WS08	5.00	18	36	14	22	2	18	22	0.2	0.8	C I	MEDIUM
WS14	5.00	19	36	17	19	0	19	19	0.1	0.9	C I	LOW
WS15	5.00	22	40	17	23	4	23	22	0.2	0.8	C I	MEDIUM
WS17	6.00	26	37	16	21	4	27	20	0.5	0.5	C I	MEDIUM
WS18	4.50	24	40	22	18	0	24	18	0.1	0.9	C I	LOW





## ANALYTICAL TEST REPORT

**Contract no:** 81917  
**Contract name:** Irlam Stockport  
**Client reference:** YG0134-19  
**Clients name:** YourGeotechnical  
**Clients address:** Unit 8-10 Brockholes Business Park  
Brockholes  
Holmfirth  
HD9 7BN

**Samples received:** 21 October 2019  
**Analysis started:** 21 October 2019  
**Analysis completed:** 28 October 2019  
**Report issued:** 28 October 2019

**Notes:** Opinions and interpretations expressed herein are outside the UKAS accreditation scope. Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling. All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing. Methods, procedures and performance data are available on request. Results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without prior written approval. Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

**Key:** U UKAS accredited test  
M MCERTS & UKAS accredited test  
\$ Test carried out by an approved subcontractor  
I/S Insufficient sample to carry out test  
N/S Sample not suitable for testing

**Approved by:**

Dave Bowerbank  
Customer Support Hero

# Chemtech Environmental Limited

## SAMPLE INFORMATION

### MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
81917-1	BH01	4.50	Sandy Clay with Gravel	-	-	14.0
81917-2	BH07	3.80	Clay with Gravel	-	-	16.6
81917-3	BH10	0.50	Sandy Clay with Gravel	-	-	25.6
81917-4	BH10	2.50	Clay with Gravel	-	-	16.0
81917-5	BH12	2.50	Sandy Clay	-	-	18.0
81917-6	BH16	2.50	Clayey Sand	-	-	19.3

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## SOILS

Lab number			81917-1	81917-2	81917-3	81917-4	81917-5	81917-6
Sample id			BH01	BH07	BH10	BH10	BH12	BH16
Depth (m)			4.50	3.80	0.50	2.50	2.50	2.50
Date sampled			17/10/2019	17/10/2019	17/10/2019	17/10/2019	17/10/2019	17/10/2019
Test	Method	Units						
pH	CE004 <sup>M</sup>	units	6.5	7.4	5.4	7.8	7.4	5.1
Sulphate (2:1 water soluble)	CE061 <sup>M</sup>	mg/l SO <sub>4</sub>	131	16	17	29	<10	13
Sulphate (2:1 water soluble)	CE061 <sup>M</sup>	g/l SO <sub>4</sub>	0.13	0.02	0.02	0.03	<0.01	0.01
Sulphate (total)	CE062 <sup>M</sup>	mg/kg SO <sub>4</sub>	171	111	184	165	<100	<100
Sulphate (total)	CE062 <sup>M</sup>	% w/w SO <sub>4</sub>	0.02	0.01	0.02	0.02	<0.01	<0.01
Sulphur (total)	CE119	% w/w S	0.02	0.04	<0.01	0.09	0.04	0.01



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## SOLIDS

Lab number			81917-7	81917-8	81917-9	81917-10
Sample id			BH01	BH06	BH12	BH18
Depth (m)			0.70	0.60	0.30	0.70-1.50
Date sampled			17/10/2019	17/10/2019	17/10/2019	17/10/2019
Test	Method	Units				
pH	CE004	units	4.2	4.9	4.7	4.9
Sulphate (2:1 water soluble)	CE061	mg/l SO <sub>4</sub>	68	136	64	121
Sulphate (2:1 water soluble)	CE061	g/l SO <sub>4</sub>	0.07	0.14	0.06	0.12
Sulphate (total)	CE062	mg/kg SO <sub>4</sub>	<100	108	362	832
Sulphate (total)	CE062	% w/w SO <sub>4</sub>	<0.01	0.01	0.04	0.08
Sulphur (total)	CE119	% w/w S	0.12	0.41	0.17	0.27

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## METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO <sub>4</sub>
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	0.01	g/l SO <sub>4</sub>
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	100	mg/kg SO <sub>4</sub>
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	0.01	% w/w SO <sub>4</sub>
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S

# Chemtech Environmental Limited

## METHOD DETAILS

METHOD	SOLIDS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received		-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		10	mg/l SO <sub>4</sub>
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		0.01	g/l SO <sub>4</sub>
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry		100	mg/kg SO <sub>4</sub>
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w SO <sub>4</sub>
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S

# Chemtech Environmental Limited

## DEVIATING SAMPLE INFORMATION

### Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

### Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
81917-1	BH01	4.50	N	
81917-2	BH07	3.80	N	
81917-3	BH10	0.50	N	
81917-4	BH10	2.50	N	
81917-5	BH12	2.50	N	
81917-6	BH16	2.50	N	

# Ground Gas and Groundwater Monitoring Record Sheet

**JOB DETAILS:**

Client: Capita Job No: YG134-19  
 Site: Irlam, Visit No: 1 of 1  
 Date: 24/10/2019 Operator: RE Project Manager: RL

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA				Comments	
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)		Response Zone
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS03	0.2	0.2			7.6	4.6	0	0	0	0	12.4	16.4			0.3	0.2			0.0006	0.0092	1.70	4.35			0.60m above GL	
WS04	0.2	0.2			3.3	3.3	0	0	0	0	18.2	18.2			-12.7	-10.5			0.0254	0.3465	1.46	3.52			0.60m above GL	
WS06	0.2	0.2			1.9	0.4	0	0	0	0	20.5	21.3			0.3	0.3			0.0006	0.0012	1.67	5.14			0.50m above GL	
WS07	0.2	0.2			1.5	1.5	0	0	0	0	19.7	19.7			0.3	0.3			0.0006	0.0045	1.77	3.13			0.60m above GL	
WS08	0.2	0.2			1.2	1.2	0	0	0	0	17.9	17.9			0.2	0.2			0.0004	0.0024	1.72	4.10			0.60m above GL	
WS14	0.2	0.2			3.3	0.3	0	0	0	0	18.1	21.0			0.3	0.2			0.0006	0.0006	0.80	3.98			Level cover	
WS15	0.2	0.2			0.2	0.1	0	0	0	0	21.5	21.5			0.3	0.3			0.0006	0.0003	1.10	5.87			0.50m above GL	
WS17	15.0	0.5			2.8	0.2	0	0	0	0	16.1	21.3			-18.5	-15.2			2.775	0.0304	0.84	5.90			Level cover	
WS18	0.2	0.2			1.6	1.6	0	0	0	0	19.1	19.1			0.3	0.3			0.0006	0.0048	1.30	4.92			Level cover	
WS19	0.3	0.2			1.3	0.7	0	0	0	0	19.4	20.8			-3.0	-1.9			0.009	0.0133	1.80	5.07			0.80m above GL	
																			0	0						
																			0	0						
																			0	0						
Max	15.0	0.5	ND	ND	7.6	4.6	0	0	0	0	21.5	21.5	ND	ND	0.3	0.3	ND	NA	2.7750	0.3465	1.80	5.90	NR	NR		
Min	0.2	0.2	0.0	0.0	0.2	0.1	0	0	0	0	12.4	16.4	0.0	0.0	-18.5	-15.2	0.0	0	0.0000	0.0000	0.80	3.13	0.00	0.00		

Worst-possible GSVs	
0.045	0.0228

ND - Not detected  
 NR - Not recorded  
 NA - Non applicable

MG - Made ground  
 NAT - Natural  
 C - Cohesive  
 G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

**METEOROLOGICAL AND SITE INFORMATION:**

(Select correct box with X or enter data, as applicable)

State of ground:  Dry  Moist  Wet  Snow  Frozen

Wind:  Calm  Light  Moderate  Strong

Cloud cover:  None  Slight  Cloudy  Overcast

Precipitation:  None  Slight  Moderate  Heavy

Time monitoring performed:  11AM Start  2PM End

Barometric pressure (mbar):  1013 Start  1011 End

Pressure trend (Daily):  Falling  Steady  Rising

Source:  wunderground.com

Air Temperature (Deg. C):  7 Before  10 After

**INSTRUMENTATION TECHNICAL SPECIFICATIONS:**

Ground gas meter: GA5000  
 Gas Range: CH<sub>4</sub> 0 - 100% CO<sub>2</sub> 0 - 100% O<sub>2</sub> 0 - 25%  
 Gas Flow range: +/-  
 Differential Pressure: +/- 500mbar  
 Date of last calibration:  
 Date of next calibration:

# Appendix C

## Geotechnical Risk Register

Activity, Design, Process & Material	Earthwork, Structure Location	Hazard	Cause	Initial Risk Rating See Matrix Below			Consequence	Design Options to Reduce Risk	Residual Risk Rating See Matrix Below			Control Measures Required to Reduce Risk
				P	I	R			P	I	R	
Excessive and differential settlement	Site wide	Excessive and differential settlement of structures, paved areas and buried services	Presence of extended thickness of settlement prone soils across the site	5	5	25	Long term serviceability and performance issues	Additional ground investigation to further inform design/ development considerations	3	5	15	Design solutions based on additional GI data and advice from reputable specialists regarding ground improvement; piled foundations and design of paved areas and buried services to suit ground conditions.
Ground risks	Site wide	Potentially unidentified and/or unquantified geotechnical risks	Limited ground investigation data to inform design	5	5	25	Risk of 'unforeseen ground conditions' and/or less effective/efficient design	Additional ground investigation to further inform design considerations	3	3	9	Apply design measures
Ground gas	Site wide	Potentially elevated ground gas levels	Ground gas generation from the peat and organic soils	4	5	20	Migration of gases to confined spaces/ structures	Ground gas monitoring to inform need for/otherwise of gas protection measures	2	5	10	Additional gas monitoring and assessment of results by a Geo-Environmental Consultant.
Potentially contaminated soil and water	Site wide	Potentially unidentified and/or unquantified geo-environmental hazards	Lack of geo-environmental sampling and testing	5	4	20	Health and safety risk to site end users, construction and maintenance workers	Geo-environmental sampling and testing to be included in additional ground investigation	3	3	9	Geo-environmental consultant to analyze data, quantify risks and propose measures to incorporate to reduce risks
Waste soils	Site wide	Lack of soils classification data for waste purposes	Lack of geo-environmental sampling and testing	5	5	25	Cost implications for disposal of soils to landfill	Sampling and testing to inform waste classification	3	3	9	Apply design measures

Activity, Design, Process & Material	Earthwork, Structure Location	Hazard	Cause	Initial Risk Rating See Matrix Below			Consequence	Design Options to Reduce Risk	Residual Risk Rating See Matrix Below			Control Measures Required to Reduce Risk
				P	I	R			P	I	R	
Potentially aggressive conditions for buried concrete	Site wide	Chemical attack	Peat and other organic soils can contain elevated concentrations of minerals that can be aggressive to buried concrete.	4	5	20	Structural deterioration	Chemical testing and assessment of strata in accordance with BRE SD1.	2	5	10	Additional testing to be undertaken and buried concrete to be designed as per the recommended concrete class based on test results.
Buried Services	Site wide	Encountering buried services	Location of services not established and adequate precautionary measures not undertaken	3	5	15	Injury and risk to life, damage to infrastructure, delays, cost of repairs	Establishment of location of services prior to commencement of works and consultation with utility providers	1	5	5	Use of detection equipment and service inspection pits to confirm presence/absence of services which may deviate from indicated locations on service plans during additional GI. Works to be undertaken as per approved RAMs. HSE Publication 47, Avoiding Danger from Underground Services to be consulted and adhered to as general reference.



Geotechnical risks have been assessed in accordance with the following framework

**Impact of Occurrence (I)**

Impact (I)	Score	Time	Cost (see note below)
Very high	5	>10 weeks on completion	>£10m
High	4	>1 week on completion	£1m to £10m
Medium	3	>4 weeks; < 1 week on completion	£100k to £1m
Low	2	1 to 4 weeks; none on completion	£10k to £100k
Very Low	1	1 week to activity; none on completion	<£10,000

NB. Costs are relative only and should not be interpreted as real costs to this project or proposed development.

**Probability of Occurrence (P)**

Probability (P)	
Very Likely	5
Likely	4
Probable	3
Unlikely	2
Negligible	1

**Overall Risk Rating (R)**

Risk Rating (R) =Probability (P) x Impact (I)		Impact				
		1	2	3	4	5
Probability	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

All risks need to be mitigated as far as is reasonably practicable.

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