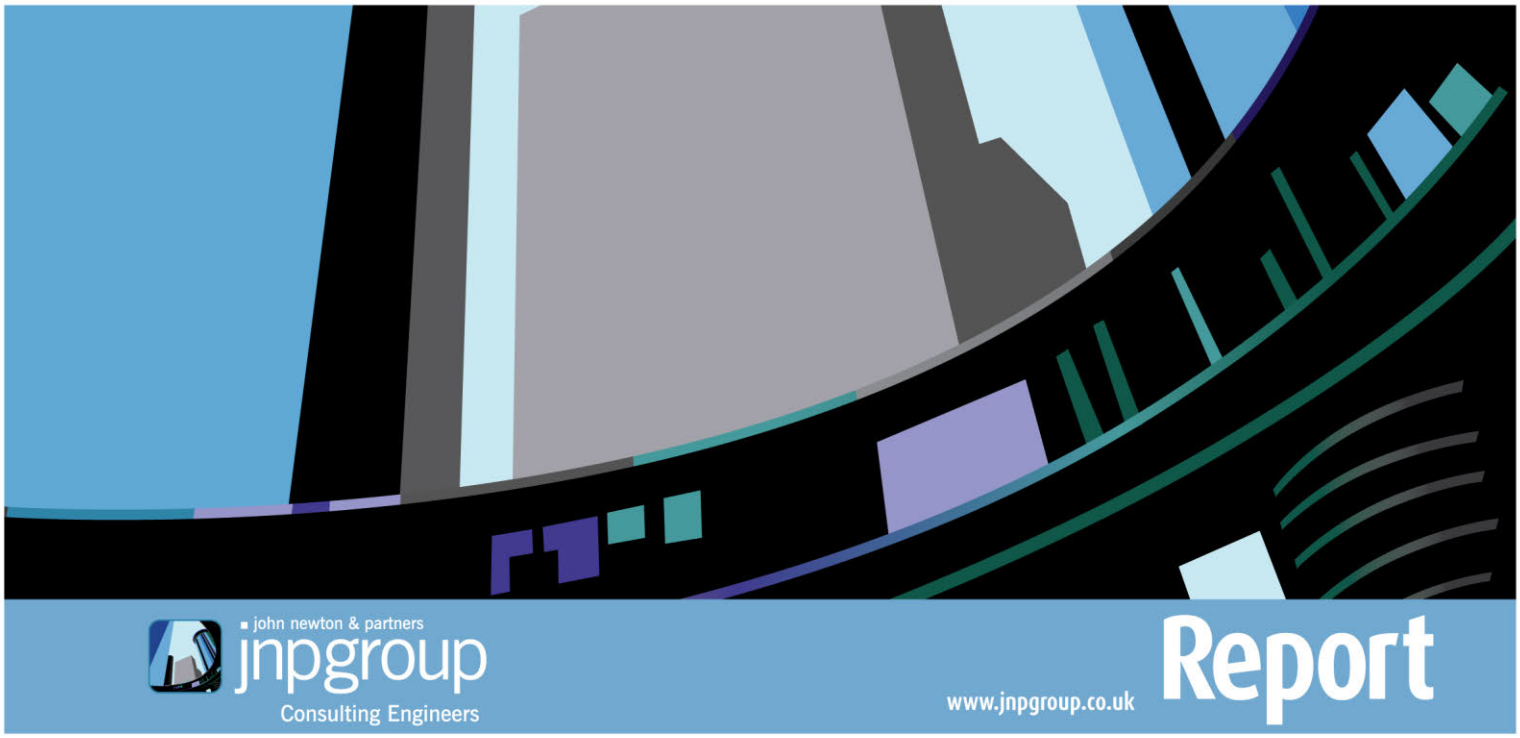

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Report

Phase II Ground Investigation Report

Project: Land Off Mill Moor Road
Meltham

Client: Pennine Developments Ltd

Reference: B21957 R002

Date: August 2018

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DOCUMENT CONTROL SHEET

Phase II Ground Investigation Report

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FOR AND ON BEHALF OF JNP GROUP

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1 INTRODUCTION

1.1 General

1.1.1 jnpgroup was instructed by Pennine Developments Ltd to undertake a ground investigation of a site known as Land off Mill Moor Road, Meltham, Holmfirth, HD9 5LW (hereinafter referred to as 'the site'). This report is subject to the limitations presented in Appendix A.

1.1.2 It is understood that the site is under consideration for development comprising the construction of 19 houses in a currently undeveloped field off Mill Moor Road. The proposed redevelopment is shown in acumen designs and architects drawing No. 2492-PH1 – 100A.

1.1.3 Any comments given are based on the understanding that the proposed redevelopment will be as detailed above.

1.2 Objectives

1.2.1 The purpose of the investigation was to address geotechnical and geo-environmental issues relating to the proposed residential end-use of the site. The scope of work comprised an intrusive investigation and laboratory testing. This report contains details of the site, the work and laboratory testing undertaken, strata encountered, geotechnical and chemical laboratory test results, and provides an interpretative assessment of the ground conditions with regard to geotechnical and contaminated land issues.

1.3 Methodology

1.3.1 This report has been compiled in accordance with the guidance given in the Environment Agency / Department of Environment, Food, and Rural Affairs (DEFRA) Contaminated Land Report 11 'Model Procedures for the Management of Land Contamination' (Environment Agency. 2004) and the Environment Agency's three reports entitled 'Guiding Principles for Land Contamination' (Environment Agency. 2010).

1.3.2 This report should be read in conjunction with a Phase I desk study report completed by jnpgroup (Ref. B21957 Mill Moor Road, June 2018) and a Combined Phase I and II investigation (B20516 Mill Moor Road, Meltham, November 2017).

2 SITE DESCRIPTION

2.1.1 The site is located off Mill Moor Road on the western outskirts of Meltham. (see Figure 1). The centre of the site is located at National Grid Reference 409087, 410651. The site covers an area of approximately 0.6 hectares.

The site is an undeveloped field that slopes downwards to the north. It is bordered to the north and south with wooden fencing and to the east and west with dry stone walls, there is a secondary fence that crosses the field in an east / west orientation dividing it in two. In the northern part of the site a pile of excavated material was observed during the site inspection. It is not known where the material originated from as no excavations were identifiable on-site. A horse was being kept in the southern portion of the site.

2.1.2 The surrounding land uses are summarised in the following table.

Table 2.1: Surrounding Land Use

Direction	Land Use
North	Predominantly undeveloped, Meltham Dyke (watercourse)
East	Residential and fields
South	Mill Moor Road, beyond which is residential
West	Residential and fields.

3 PREVIOUS WORK

3.1.1 The site has been subject to a previous desk study by jnpgroup. The findings are summarised in the following sections.

3.2 Ground Conditions

3.2.1 From publicly available information, no artificial or Made Ground was indicated to be present underlying the site. The site is also indicated to be devoid of natural superficial deposits. The underlying geology is indicated to be the Huddersfield White Rock, which is described by the BGS as "*a medium- to coarse-grained, massive to flaggy, cross-bedded, micaceous sandstone*". This is part of the Carboniferous, Millstone Grit Group. There is a geological fault, which crosses the site in a north-west / south-east orientation with a down-dip to the north east, the geology is recorded as the same, either side of the fault. Whilst there may be increased weathering within the vicinity of the fault, it is not considered to be a significant issue.

3.2.2 Site History

3.2.3 The site has been predominantly undeveloped and likely been in agricultural use.

3.2.4 There has been significant industrial activity in the immediate surroundings including several woollen mills in the immediate vicinity of the site and a dye works adjacent to the north-west (albeit all on the opposite side of the Meltham Dyke. A filter tank was formerly present adjacent to the northern site section, likely associated with the former Dye Works.

3.3 Preliminary Risk Assessment

3.3.1 From the information obtained from the desk study jnpgroup undertook a preliminary risk assessment, the results of which are summarised as follows:

Table 3.1: Preliminary Risk Assessment

Issue	Risk		Justification
LAND	LOW		Farmland or previous residential (low)
GROUNDWATER	MEDIUM		The site is located on productive strata (Secondary Aquifer) and is not within a SPZ
SURFACE WATER	MEDIUM		The nearest surface water course is located within 50 m to the north of the site.
ECOLOGY	NONE		Based on the assumption that there are no sensitive/ protected species on site (subject to any ecological survey undertaken).

3.3.2 Based on information contained within the desk study report, it was concluded that the potential site conditions provided a **MEDIUM to LOW** environmental risk and hence further investigation and assessment was required

3.3.3 Between 3% and 5% of homes in the local area are above the radon action level, therefore, basic radon protection measures are considered necessary.

4 FIELDWORK

4.1.1 The intrusive fieldwork was undertaken by jnpgroup on 13 July 2018 and comprised six mechanically-excavated trial pits. In addition, eight hand dug pits were excavated to delineate arsenic contamination identified in a previous investigation (jnpgroup B210516, November 2017). All site work was completed under the instruction and supervision of jnpgroup, with the ground investigation procedures and sample descriptions based on BS 5930 (2015) 'Code of Practice for Site Investigations' and BS 10175 (2001+A1:2013) "Investigation of potentially contaminated sites - code of practice". The locations of the exploratory holes are shown on the jnpgroup Drawing No. B21957 D301. The exploratory hole records are presented in Appendix B. The full details of the fieldwork undertaken are summarised in the following sections.

4.1.2 For sites (potentially) affected by asbestos impacted soils, the guidance given in the following publications has been followed:

- Industry Guidance on Interpretation for Managing & Working with Asbestos in Soil and Construction and Demolition Materials (CL:AIRE 2016);
- Asbestos in Soil and Made Ground: a guide to understanding and managing risks (CIRIA C733 2014).

4.2 Trial Pits

4.2.1 Six trial pits, designated TP01 to TP06 were excavated on 13 July 2018 to depths of between 1.4 m and 2.9 m below ground level (bgl), at various locations across the site. The pits were excavated using a 10 tonne excavator, with a maximum reach of 4.0 m bgl and logged by examining recovered soil samples brought to the surface.

4.2.2 TP03 was excavated to form an extended trench to attempt to locate a culverted watercourse in the north-west of the site, the watercourse was not identified.

4.2.3 For full details of the depth of each trial pit, the strata encountered, samples taken, information on groundwater encountered, results of any in-situ testing and any other relevant information, reference should be made to the logs presented in Appendix B.

4.3 Arsenic Contamination Delineation

4.3.1 Arsenic was identified in a previous investigation (jnpgroup B20516 Phase I & II Geoenvironmental Investigation) at 0.5 m bgl within the topsoil, in the south-west of the site adjacent to the south of the subject site (also under development of Pennine Developments Ltd). In order to delineate the contamination, eight hand dug pits were to be dug to 0.6 m within the topsoil in a grid formation around the previously identified area of contamination. At the time of the investigation, all topsoil on the southern site had been removed and stockpiled on the northern site. It was estimated that the ground level had been lowered by 0.8 m in the area and therefore, a grid of hand dug pits was excavated to 0.1 m bgl.

5 LABORATORY TESTING

5.1 Geotechnical

5.1.1 A programme of laboratory testing was scheduled by jnpgroup to determine the geotechnical properties of selected soil samples obtained from the investigation. The details of the geotechnical testing are summarised below:

Table 5.1: Scheduled Geotechnical Laboratory Tests

Test Description	Number of Tests
Acid and water-soluble sulphate, total sulphur and pH	4
Atterberg limits including moisture content	2
Particle Size Distribution (PSD) wet sieve	3

5.1.2 Tests were undertaken in accordance with BS1377 (1990) "Methods of test for Soils for Civil Engineering purposes". The results of the geotechnical testing are presented in Appendix C.

5.2 Environmental

5.2.1 A programme of chemical laboratory testing was scheduled by jnpgroup on selected soil samples taken from various strata and depths as recovered from the exploratory holes. There was no visible or olfactory evidence of contamination in any of the pits so representative samples were obtained for analysis. The samples were placed into suitable containers for the required chemical analysis.

5.2.2 All samples were transported, on the day of collection, to i2 Analytical Testing Services which is accredited under UKAS and MCerts. The following table summarises the contaminants scheduled:

Table 5.2: Scheduled Chemical Analyses

Determinants	No
Metals and semi-metals (arsenic, beryllium, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium and zinc)	5
Polycyclic Aromatic Hydrocarbons (PAH) 16 USEPA Speciated	3
Total Petroleum Hydrocarbons (TPH) Tri-banded	3
Soil Organic Matter	2
pH	3
Asbestos screening	5

5.2.3 The results of the laboratory chemical testing are interpreted in Section 8 and presented in full in Appendix D.

6 GROUND AND GROUNDWATER CONDITIONS

6.1 Strata Encountered

6.1.1 The ground conditions encountered during the intrusive investigation were generally consistent with the published geological data. A variable thickness of Topsoil was encountered in all trial pits from ground level, Made Ground was only encountered in TP01.Underlying these were strata of the Huddersfield White Rock Formation, which were generally found to be weathered to the consistency of granular soil.

6.1.2 A summary of the strata encountered during the investigation is presented in Table 6.1 and described in the following sections, but for full details and descriptions, reference should be made to the exploratory hole records presented in Appendix B.

Table 6.1: Strata Encountered

Stratum	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness (m)
Topsoil All exploratory holes	Ground level	0.10 – 0.35	0.10 – 0.35
Made Ground TP01	0.20	0.80	0.60
Huddersfield White Rock All exploratory holes	0.10 – 0.35	Not proven (base of holes 1.40 – 2.90)	At least 1.10 – 2.70

6.2 Topsoil

6.2.1 Topsoil was encountered in all exploratory hole locations from ground level to depths of 0.20 m – 0.3 m bgl. The Topsoil consisted of dark brown and grey sandy clay. No evidence of entrained contamination was suspected from inspection of the Topsoil encountered.

6.3 Made Ground

Made Ground was encountered in only one trial pit (TP01), between 0.20 m and 0.80 m bgl. The Made Ground consisted of grey brown sandy gravelly cobbles of sandstone, likely to be reworked natural ground. There was no visual or olfactory evidence of contamination within this stratum.

6.4 Huddersfield White Rock

6.4.1 Strata of the Huddersfield White Rock (HWR) were encountered in all exploratory holes. The top of the lithology was encountered at depths of 0.20 m – 0.80 m bgl and was proven to depths of at least 1.4 m and 2.9 m bgl (hole termination depths).

6.4.2 The HWR strata were encountered as stiff friable clay in three of the trial pits (TP01, TP05 & TP06, in the central and south-eastern portion of the site) to depths of up 1.20 m bgl, this was underlain by sandstone recovered as tabular cobbles. In the northern and western portion of the site, the HWR was granular ranging from clayey gravelly sand to clayey sandy gravel with cobbles, to a depth of at least 2.90 m bgl.

6.4.3 Groundwater inflows were not noted in any of the pits. In TP03 the clayey cobbly sand below 1.50 m bgl, was noted to be wet, indicative that the ground was saturated.

Table 6-1: Huddersfield White Rock – Geotechnical Results Summary

Property	Number of Tests	Range	Mean	Assessment
Natural Moisture Content	2	16-21	19	Low volume change potential. Intermediate plasticity.
% passing 425 sieve	2	86-89	88	
Liquid Limit %	2	37-43	40	
Plastic Limit %	2	19-25	22	
Plasticity Index %	2	18	18	
Modified Plasticity Index %	2	15 – 16	16	
Hand Shear Vane (kN/m^2)	1	75	75	
Very cource Content %	3	0 - 14	9	Variable: gravelly very clayey SAND to clayey very sandy GRAVEL with cobbles.
Gravel Content %	3	23 – 40	35	
Sand Content %	3	28 – 45	35	
Silt / Clay Content %	3	15 – 32	21	

6.4.4 Hand Vane test readings taken were limited due to the ground conditions, one reading from 0.7 m bgl from the clay in TP01 was 75 kPa, which is consistent with the description.

6.4.5 The plasticity chart is presented as Figure 2.

6.5 Contamination

6.5.1 Evidence of visual or olfactory contamination was not observed across the site.

6.6 Trees and Tree Roots

6.6.1 There were no mature trees on-site at the time of the investigation. Rootlets were encountered in shallow natural ground in TP05 (0.30 m to 0.70 m bgl).

6.7 Desiccation

6.7.1 Following laboratory testing of cohesive soil samples, two commonly accepted methods for determining the degree of desiccation (as stated in BRE 412 'Desiccation in Clay Soils') are as follows:

1. Desiccation has occurred when the moisture content is less than the Plastic Limit;
2. Significant desiccation has occurred when the moisture content is less than 0.4 x the Liquid Limit.

6.7.2 When the results of laboratory testing are compared with Method 1 and 2, the sample from TP03 at 0.40 m depth is indicated to be desiccated.

6.7.3 A plot comparing Moisture Content with the Liquid Limit and the Driscoll Limit is included as Figure 3.

6.8 Obstructions

6.8.1 Concrete or natural obstructions were not encountered in any of the pits.

7 HUMAN HEALTH QUANTITATIVE RISK ASSESSMENT

7.1.1 Qualitative assessment of risks may be sufficient in many cases to eliminate the possibility of significant pollutant linkages. However, quantitative risk assessment is formally required to determine whether there is a 'significant possibility of significant harm being caused'. Part IIA of the Environmental Protection Act 1990 recommends that 'authoritative and scientifically based guideline values for concentrations of the potential pollutants in or under the land' be used to quantify the risk posed by contamination.

7.1.2 Under the Planning Regime, a quantitative risk assessment can be used to decide whether the site is suitable for the proposed use. In addition, the National Planning Policy Framework (March 2012) also indicates that after remediation, as a minimum land should not be capable of being determined as contaminated land under Part IIA.

7.2 Current UK Screening Values

7.2.1 The UK technical guidance for assessing risks to human health is issued from various UK bodies, including the Environment Agency (EA), DEFRA, Contaminated Land: Applications in Real Environment (CL:AIRE), Chartered Institute of Environmental Health (CIEH), and Land Quality Management (LQM) Ltd (part of the University of Nottingham).

7.2.2 New and updated screening values in the form of provisional Category 4 Screening Levels (C4SL) (published in 2014), and Suitable for Use Levels (S4UL), (published 2015), have been produced by DEFRA and CIEH / LQM respectively using modified versions of the EA's Contaminated Land Exposure Assessment (CLEA) software.

C4SL

7.2.3 Provisional C4SL have been derived by CL:AIRE (project team for DEFRA's SP1010 project) following revised statutory guidance, and as a tool to assist in applying the Part IIA Category 1- 4 classifications to a site. The purpose of the C4SL is to provide a simple test for deciding that land is suitable for use, and definitely not contaminated land under Part IIA. They describe a level of risk that is above minimal, but is still low.

7.2.4 In calculating provisional C4SL some of the exposure modelling scenarios and exposure parameters used in the CLEA software have been modified. These modifications are not discussed further, but reference should be made to the original CL:AIRE / DEFRA publications should further information or clarification be required. A list of the new publications is included in the references section at the end of this report.

7.2.5 To date, six contaminants have been assigned provisional C4SL: arsenic; benzene; benzo[a]pyrene; cadmium; chromium VI, and lead, for the standard land uses (residential with, and without plant uptake, allotments, commercial, and public open space (parks and residential).

7.2.6 The C4SL are also considered suitable to be used under the planning regime, and DEFRA have confirmed this to all local authorities.

S4UL

7.2.7 The LQM / CIEH S4UL represent generic assessment criteria based on minimal or tolerable risk that are intended to be protective of human health. They have been derived in accordance with current UK legislation using a modified version of the CLEA software and are still based on many conservative assumptions. They represent values above which further assessment of the risks or remedial actions may be needed.

7.2.8 S4UL have been derived for a comprehensive list of metals, non–metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, chlorinated hydrocarbons, phenolic compounds, explosives, and

pesticides, for the standard land uses (residential with, and without plant uptake, allotments, commercial, and public open space (residential and park)).

7.2.9 For details of the exposure parameters and scenarios used to derive the S4UL the reader is reference to the original LQM / CIEH document "The LQM/CIEH S4UL for Human Health Risk Assessment" (2015).

7.2.10 Both sets of screening values can be used to undertake a generic risk assessment by comparing the data directly to the screening value which is considered a conservative approach or statistically to the screening value. Alternatively and if a sufficient dataset is available, a statistical assessment can be undertaken following the guidance given in the joint Chartered Institute of Environmental Health (CIEH) and the Contaminated Land: Applications in Real Environment (CL:AIRE) organisation publication "Guidance On Comparing Soil Contamination Data with a Critical Concentration" (CIEH / CL:AIRE May 2008).

7.3 Petroleum Hydrocarbons

7.3.1 jnpgroup has followed the guidance given in the Environment Agency publication 'The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils' (Environment Agency, 2005). LQM S4UL values have been published based on carbon banded hydrocarbons with aliphatic and aromatic split, corresponding to the TPH CWG bands. jnpgroup undertook carbon banded analysis using wider bands than used by TPH CWG without aliphatic and aromatic split.

7.3.2 jnpgroup has compared the results of carbon-banded hydrocarbon analysis with the most sensitive LQM S4UL value within the band under scrutiny. Generally, the most sensitive band comprises the lightest aromatic fraction within the carbon band under scrutiny.

7.3.3 The Society of Brownfield Risk Assessment (SoBRA) have produced some Generic Assessment Criteria for assessing chronic risks from the inhalation of vapours arising from groundwater (GAC_{gwvap}) for a short list of 66 organic contaminants (SoBRA February 2017). These are designed to a defensible screening criteria to assist in evaluating this exposure pathway. They represent concentrations below which the chronic risks from vapour migration and inhalation can be considered low / tolerable. GAC_{gwvap} have been developed in line with current UK risk assessment guidance, and CLEA v1.07 software was used for residential and commercial land use scenarios.

7.3.4 Further details of the input parameters selected for use to generate the GAC_{gwvap} can be found in the SoBRA report and have not been reproduced here. However, it should be noted that they have been derived using some conservative assumptions:

- Impacted ground / perched water is beneath the buildings;
- An infinite source term is present;
- There is no biodegradation;
- Groundwater depth is 0.65m below ground;
- Use of a sand soil type (in line with SR3)

8 SOIL ASSESSMENT RESULTS

8.1 Soil Results and Assessment of the Northern site

8.1.1 The results of chemical testing of one sample of Made Ground and four samples of natural soils from the northern site have been compared with the C4SL and the LQM S4UL for a 'residential with gardens end use'. These comparisons are summarised in Table 8.1 that follows.

8.1.2 The following determinants were recorded at concentrations less than the limit of laboratory detection, and hence have not been included in this assessment: asbestos, all PAH species, TPH C_6-C_{10} & C_{10}-C_{25}.

8.1.3 Two SOM tests were undertaken; a SOM of 1% is applicable to the soils.

Table 8.1: Comparison of Soil Chemical Test Results with Residential with plant uptake Guideline Values

Determinant	Maximum Measured Concentration	LQM/CIEH S4UL: Residential with plant uptake (mg/kg)	Number of tests	Number of exceedances
Arsenic	13	37	5	0
Beryllium	1.3	1.7	5	0
Boron	0.7	290	5	0
Cadmium	0.3	11	5	0
Chromium (total)*	31	910	5	0
Copper	24	2400	5	0
Lead	34	200**	5	0
Nickel	35	180	5	0
Selenium	1.6	250	5	0
Vanadium	28	410	5	0
Zinc	61	3700	5	0
		1%		
TPH C_{25}-C_{40} (TPH aromatic C_{21}-C_{35}***)	42	1100	3	0

*assumed all chromium on site is in trivalent form
** provisional C4SL
***most sensitive fraction within wider TPH band (specified)

8.2 Interpretation

8.2.1 The analyses did not identify any contaminants above their corresponding C4SL and the LQM S4UL threshold levels.

8.3 Summary

8.3.1 On the basis of the chemical testing undertaken, jnpgroup considers that the concentrations of contaminants with the soil do not pose significant risk to human health.

8.4 Leachate Results and Assessment

8.4.1 One sample of natural ground was submitted for leachate analysis in order to determine metal mobility.

8.4.2 The following determinants were recorded at concentrations less than the limit of laboratory detection and hence have not been included in this assessment: arsenic, beryllium, boron, cadmium, mercury, selenium and vanadium.

Table 8.2: Comparison of Leachate Chemical Test Results with Guideline Values

Determinant	Maximum Measured Concentration (µg/l)	Drinking Water Standard (µg/l)	Freshwater Environmental Quality Standard (µg/l)	No. of tests undertaken	No. of exceedances
Barium	5.7	100	n/a	1	0
Chromium (total)	2.4	50	5-50*	1	0
Copper	0.66	2000	1**	1	0
Lead	0.38	25	1.2**	1	0
Nickel	0.68	20	4**	1	0
Zinc	3.52	3000	10.9**	1	0

* Dependant on hardness, salmonid receptor
** bioavailable EQS UK TAG

1.1.1 Interpretation – Leachate Chemistry

8.4.3 No exceedances of the EQS or DWS were recorded.

8.5 Revised Conceptual Site Model

Potential On-site Sources of Contamination

- Site works including testing for a generic and targeted suite of potential contaminants has not identified any contamination on site;
- The former Dye Works to the west of the site does not appear to have had a significant impact on the site.

Receptors

8.5.1 The site is to be redeveloped for residential housing with private gardens. In addition, the site overlies a Secondary-A Aquifer (Huddersfield White Rock) and there are watercourses located close to the site. The primary receptors considered to be potentially at risk from any identified contamination are as follows:

Human Health

- Construction workers during the redevelopment phase;
- Residential end users.

Controlled Waters

- The Huddersfield White Rock beneath the site is classified as a Secondary-A Aquifer. jnpgroup considers groundwater to be a sensitive receptor;
- The nearest controlled surface water is the Meltham Dyke, located some 28 m to the north. jnpgroup considers this to be a sensitive receptor.

Ecological

- The site is not located within an environmentally designated sensitive area;
- Given the site setting, sensitive species are considered unlikely to be present at the site (subject to any ecological survey undertaken).

Property

- Buildings, in terms of below-ground concrete at risk from aggressive ground conditions (including elevated sulphates and/or acidic conditions.

Pollutant Linkages

8.5.2 A 'pollutant linkage' describes the relationship between a contaminant, a pathway and a receptor, a 'pollutant' being the contaminant in a pollutant linkage. A contaminant, pathway and receptor must all be present for a pollutant linkage to exist, which forms the basis for determination that a piece of land is Contaminated Land. Potential sources, pathways and receptors have been assessed. As potential sources of contamination have not been detected at the site and surrounding area, there are no pollutant linkages associated with the site.

8.5.3 During construction, measures should be undertaken to prevent turbid run-off from the site entering the nearby watercourses.

Revised Risk Assessment

8.5.4 From the information obtained from the ground investigation jnpgroup has undertaken a prevised risk assessment.

Table 8.2: Preliminary Risk Assessment

Issue	Risk		Justification
LAND	LOW		No contamination sources found during GI. Watching brief should be kept for unexpected ground conditions during construction.
GROUNDWATER	LOW		The site is located on a Secondary-A Aquifer, significant contamination has not been identified on-site.
SURFACE WATER	LOW		No contamination sources found during GI. Measures to prevent run-off of turbid water into nearby watercourse should be used during construction.
ECOLOGY	NONE		No contamination sources found during GI.

8.5.5 The conceptual model has been refined and the plausible pollutant linkages evaluated against generic criteria in accordance with joint DEFRA / Environment Agency publication 'Model Procedures for the Management of Land Contamination' (Environment Agency. 2004).

8.6 Soil Results and Assessment (delineation) of the Southern site

8.6.1 Eight soil samples were taken from just below the surface within the south-west of the southern site. They were all taken from a dark brown sandy topsoil.

8.6.2 The samples were all analysed for arsenic so as to delineate previously identified contamination. One sample (VS1) in the far south-east corner identified levels of arsenic above that of the recommended C4SL and the LQM S4UL threshold for residential use with gardens.

8.6.3 The sample identified 52 mg/kg which is above the threshold value of 37 mg/kg. Arsenic was detected in all of the samples, with the next highest value being in VS5 with a value of 23 mg/kg. For a plan of where samples were taken from, please refer to jnpgroup Drawing B21957 D301..

8.6.4 As arsenic has been identified during delineation in the far south-west corner of the site, it is recommended that an Options Appraisal and Remediation Strategy be carried out and submitted to the Local Authority.

9 GEOTECHNICAL ENGINEERING ASSESSMENT

9.1 Proposed Development / Redevelopment

9.1.1 It is understood that the site is proposed to be developed with 19 two-storey residential properties with associated private gardens and access roads and hardstanding for access parking and servicing.

9.2 Summary of Ground Conditions

9.2.1 The ground conditions encountered during the intrusive investigations were generally consistent with the published geological map data. In general, Topsoil was identified in all locations, underlain by Made Ground in the south-eastern section of the site. Beneath this, and directly beneath Topsoil in all other locations, are weathered strata of the HWR, found to comprise predominantly clayey sand or sandy gravel sandstone cobbles / boulders, though locally cohesive horizons were encountered near surface in the central and south eastern sections of the site.

9.3 Shallow Foundations

9.3.1 The Made Ground deposits are unsuitable to support foundation loads due to their poor engineering characteristics, and inherent variability. Ground improvement techniques may be an option for treating the Made Ground to render it suitable for use of shallow reinforced strip or pad foundations but are not considered necessary here.

9.3.2 Traditional shallow strip or pad foundations should be feasible for the proposed structures at the subject site, placed within the weathered strata of the HWR. However, such foundations may need to be deepened slightly in the south-eastern part of the site, due to the increased thickness of Made Ground encountered in TP01 (to 0.80m).

9.3.3 Foundation excavations should be taken through all Topsoil and Made Ground deposits, and foundations placed within the weathered natural strata at a minimum founding depth of 0.75 m bgl, based upon soils of low volume change potential. An allowable bearing pressure of 100 kN/m^2 would be available at 0.75 m bgl, based upon standard 0.60 m wide foundations. This allowable bearing capacity includes an overall factor of safety of 3 against bearing capacity failure, whilst ensuring total settlements are maintained at less than 25mm.

9.3.4 The competence of the ground generally improves with increasing depth; nevertheless, it is recommended that foundation excavations are inspected by a suitably qualified person to ensure that competent materials are reached, and that no soft or loose spots are present at formation level.

9.3.5 It should be noted that the ground topography reduces in level from south to north; therefore, some foundations may need to be stepped.

9.3.6 Although predominantly granular, cohesive horizons of the HWRhave been encountered in exploratory holes. Therefore, in order to control differential movements/cracking where foundations are spanning cohesive and granular strata, it is recommended that steel reinforcement mesh is incorporated into all foundations, both top and bottom.

9.3.7 Where foundations are to be constructed within the influence of existing, felled or proposed trees, they may need deepening to be founded on granular strata, and heave precautions may need to be incorporated, in accordance with National House Building Council (NHBC) Chapter 4.2 'Building Near Trees', based upon soils of low volume change potential. Consideration should be given to the use of collapsible materials between foundations and cohesive soils to reduce heave pressures.

9.3.8 jnpgroup encountered rootlets to depths of 0.70 m bgl within TP05 (only). It would be prudent for all foundation excavations to be visually inspected by an appropriate engineer in order to verify that tree roots are not present.

9.3.9 It should be noted that trench fill foundations deeper than 2.50 m would only be acceptable by the NHBC if they were designed by an engineer. This is unlikely to be a factor at the site, based on the ground conditions encountered.

9.3.10 All trial pits remained stable during excavation and therefore foundation trenches should not undergo significant collapse or spalling. In addition, groundwater was not encountered in any of the trial pits during the investigation. Hence, jnpgroup do not consider that groundwater inflow or excavation collapse will present practical difficulties during foundation excavation.

9.3.11 When the natural moisture content of a soil lies close or less than the value of the plastic limit, the soil can be considered desiccated. In addition, Driscoll (1983) suggested that desiccation is assumed to be present when the moisture content falls below a level of 40% of the liquid limit. The index tests indicate that the one cohesive sample of HWR strata is desiccated.

9.3.12 Groundwater was not encountered during the fieldwork. However, the groundwater levels may fluctuate due to seasonal or other effects, such as prolonged extreme meteorological conditions.

9.3.13 Trial pits carried out as part of this or previous investigations may represent soft spots and conduits/sumps for groundwater or surface water. In excavations, such materials may also be loose and unstable. Unless specifically stated, exploratory hole locations should be regarded as approximate. Consideration should be given to accurate location of such features where it is considered they may impact on the proposed development.

9.3.14 Conventional mechanical backhoe excavators should prove suitable for excavation through the near-surface encountered at the site. However, should more competent (less weathered) strata of the Huddersfield White Rock be locally encountered at the site, or deeper service trenches be required, larger capacity excavators and pneumatic/hydraulic breakout equipment may be necessary.

9.4 Piled Foundations

9.4.1 Piled foundations are not likely to be required for the site, are less cost effective than shallow spread foundations and hence are not considered further.

9.5 Ground Floor Slabs

9.5.1 The underlying soils are indicated to have low volume change potential but are locally desiccated and consequently could heave. In addition, Made Ground was locally encountered at the site to a depth of 0.80m. Therefore, suspended ground floor slabs should be used incorporating a suitable underfloor void, based on the recommendations in NHBC Chapter 4.2, with reference to soils of low volume change potential.

9.6 Pavement Design

California Bearing Ratio

9.6.1 It is assumed that the pavement subgrade/formation would be in near-surface soils at an approximate depth of 0.6 m below existing ground level. If cuttings were proposed, the formation level would need to be adjusted accordingly, and the specifying geotechnical engineer informed, so that an assessment of the appropriate soil layer can be made.

9.6.2 A mean Plasticity Index value of 18 % was recorded in the near surface soils, which indicates an equilibrium subgrade CBR value of 4.0 % (based upon Table 3.1 in Interim Advice Note 73/06 Rev 1 2009), assuming average construction conditions, and high water table.

9.6.3 It is recommended that the subgrade CBR value is verified immediately before placement of the pavement capping/subbase to confirm the minimum design CBR value. The design CBR value should not be increased on the basis of these tests. Should testing indicate a subgrade CBR less than the

design value, then measures should be taken to improve the subgrade before proceeding with pavement construction.

Frost Susceptibility

Cohesive Soils

9.6.4 Soils with a Plasticity Index greater than 15 % would not generally be frost-susceptible (i.e. susceptible to ice lens formation in frosty conditions) (Croney and Jacobs, 1967). Cohesive soils were locally encountered in the vicinity of TP01, TP03, TP05 & TP06. Plasticity Index tests were undertaken on cohesive soils collected from TP01 & TP03. Plasticity Indices of 18 % were recorded for these samples, which indicates that the cohesive soils are not frost-susceptible.

Granular Soils

9.6.5 However, granular soils are considered frost susceptible if the fines content is greater than 10 % (TRL RN 29). Gradings undertaken on these soils indicate that the fines content is generally greater than 10 %, hence, these soils are considered frost susceptible.

9.7 Chemical Considerations for Buried Concrete

9.7.1 Chemical analyses of three samples have been undertaken in accordance with BRE SD1 2005 "Concrete in aggressive ground" to determine their concrete classification.

Table 16.3: Concrete Classification Assessment

Strata	Details	Range	Concrete Class
Made Ground	Number of Tests	1	DS1 – AC1
	Water Soluble Sulphates (mg/l)	11.5	
	pH	6.6	
	Total Potential Sulphate %	0.017	
Huddersfield White Rock	Number of Tests	2	DS1 – AC1
	Water Soluble Sulphates (mg/l)	11-18	
	pH	6.7-8.0	
	Total Potential Sulphate %	0.027-0.03	

9.7.2 On the basis of the above assessment, and in accordance with BRE SD1 (2005) "Concrete in aggressive ground", a Design Sulphate Class of DS1, with an ACEC of AC-1, would apply for all buried concrete.

11 CONCLUSIONS AND RECOMMENDATIONS

11.1.1 jnpgroup has determined through intrusive investigation, laboratory testing, monitoring, and assessment that:

- There is no risk to future residential end users in the northern site;
- Arsenic has been identified in the south-west corner of the southern site, where gardens are planned;
- Ground gas protection measures are not required;
- Basic radon gas protection measures are required;
- Traditional shallow strip or pad foundations are considered feasible, placed within the Huddersfield White Rock. An allowable bearing pressure of 100 kN/m^2 would be available at 0.75 m bgl, based upon standard 0.60 m wide foundations. These foundations may need to be deepened in the south-east corner due to the Made Ground;
- The pavement subgrade at an approximate depth of 0.6 m below existing ground level has an equilibrium subgrade CBR value of 4.0 %. The subgrade soils are considered frost susceptible.
- In accordance with BRE SD1 (2005) a Design Sulphate Class of DS1, with an ACEC of AC1, would apply for all buried concrete at the site.

11.1.2 jnpgroup recommends the following:

- A copy of this report is submitted to the Regulatory Authorities for their approval before any further work is undertaken at the site;
- An Options Appraisal Remediation Strategy is submitted to the Local Authority regarding the arsenic in the south-west of the site.

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Figures / Drawings

Figure 1

Site Location Plan

john newton & partners jnpgroup Consulting Engineers

Project:

Land off Mill Moor Road, Meltham

Project No:

B21957

Figure 2

Plasticity Index Chart

john newton & partners jnpgroup Consulting Engineers

Project:

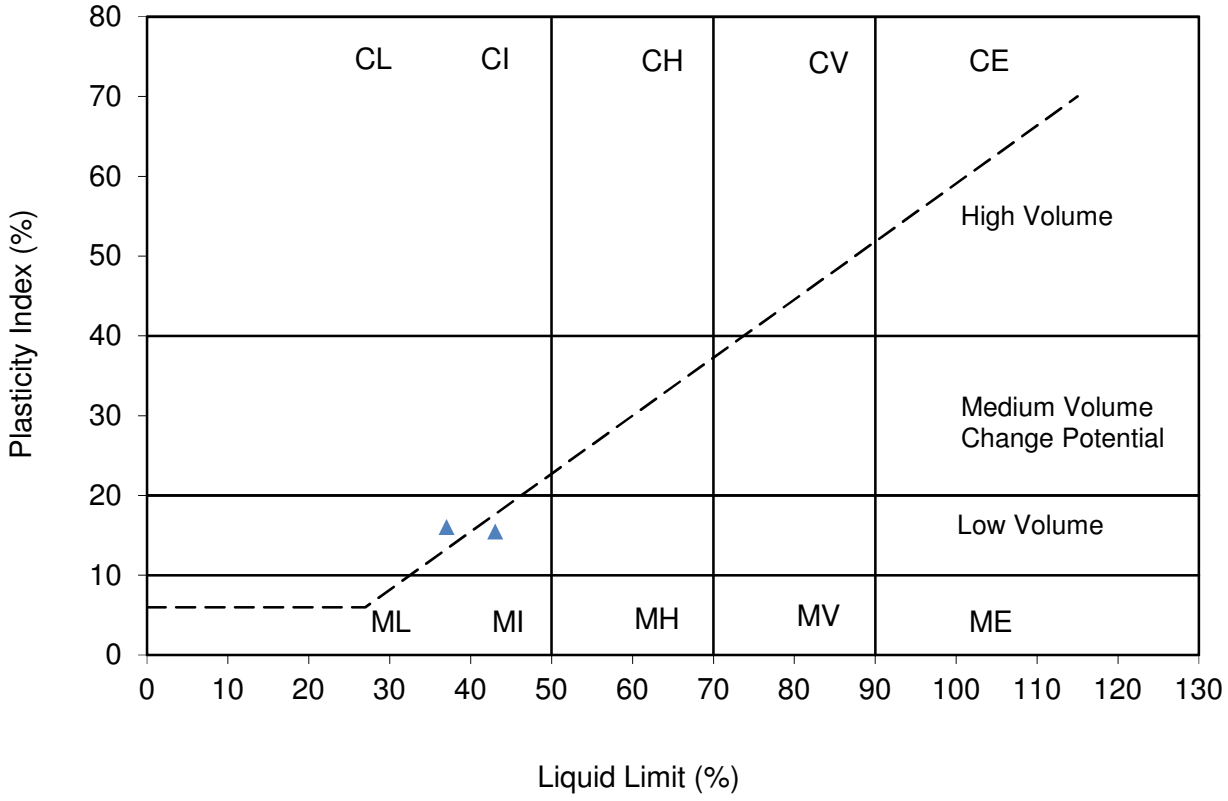
Land off Mill Moor Road, Meltham

Project No:

B21957

Key:
C Clay M Silt

L Low plasticity
I Intermediate plasticity
H High plasticity
V Very high plasticity
E Extremely high plasticity



▲ Made Ground — — — A Line

Figure 3 Moisture Content / Depth Relationship

john newton & partners jnpgroup Consulting Engineers

Project:

Land off Mill Moor Road, Meltham

Project No:

B21957

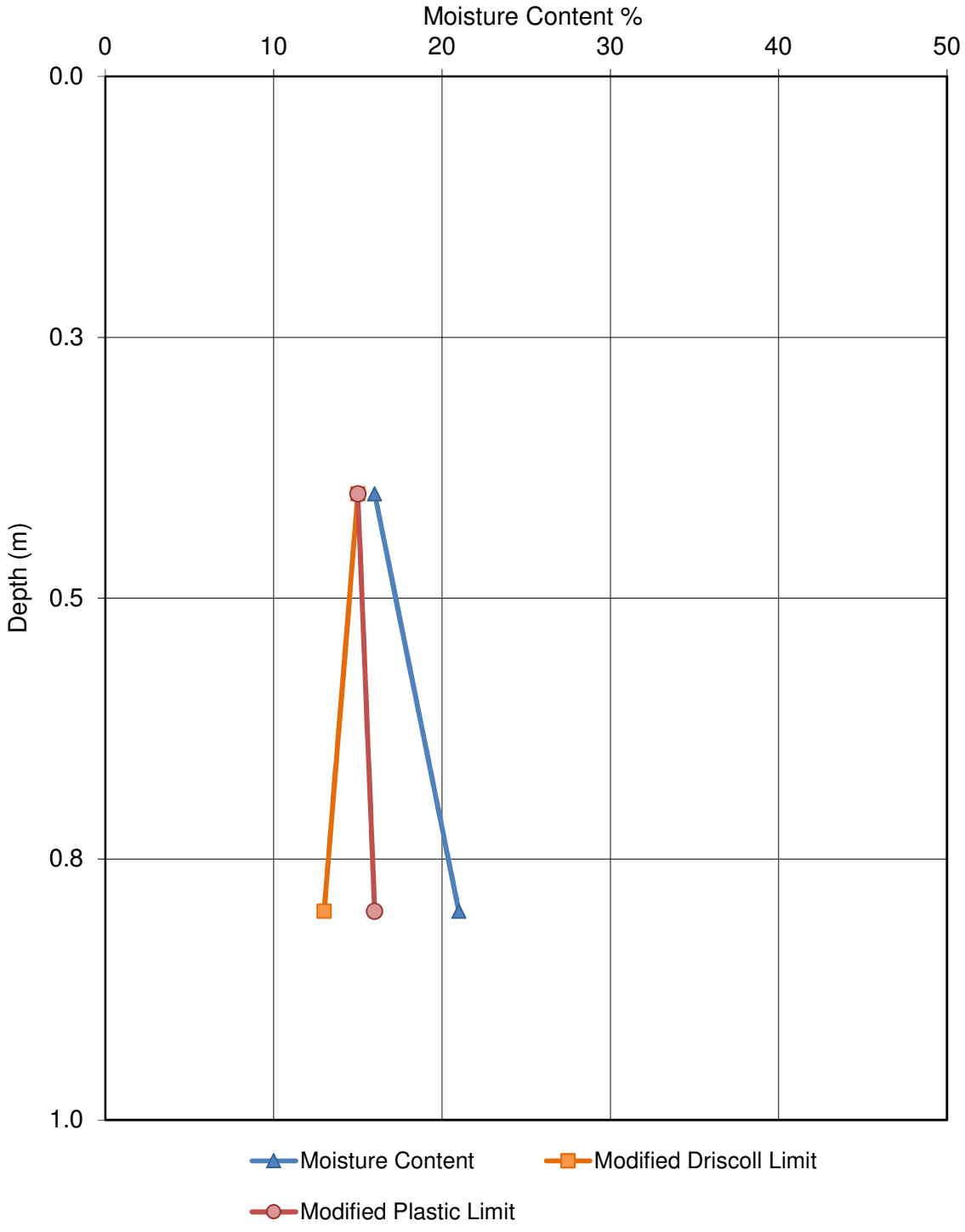


Figure 4 Particle Size Distributions

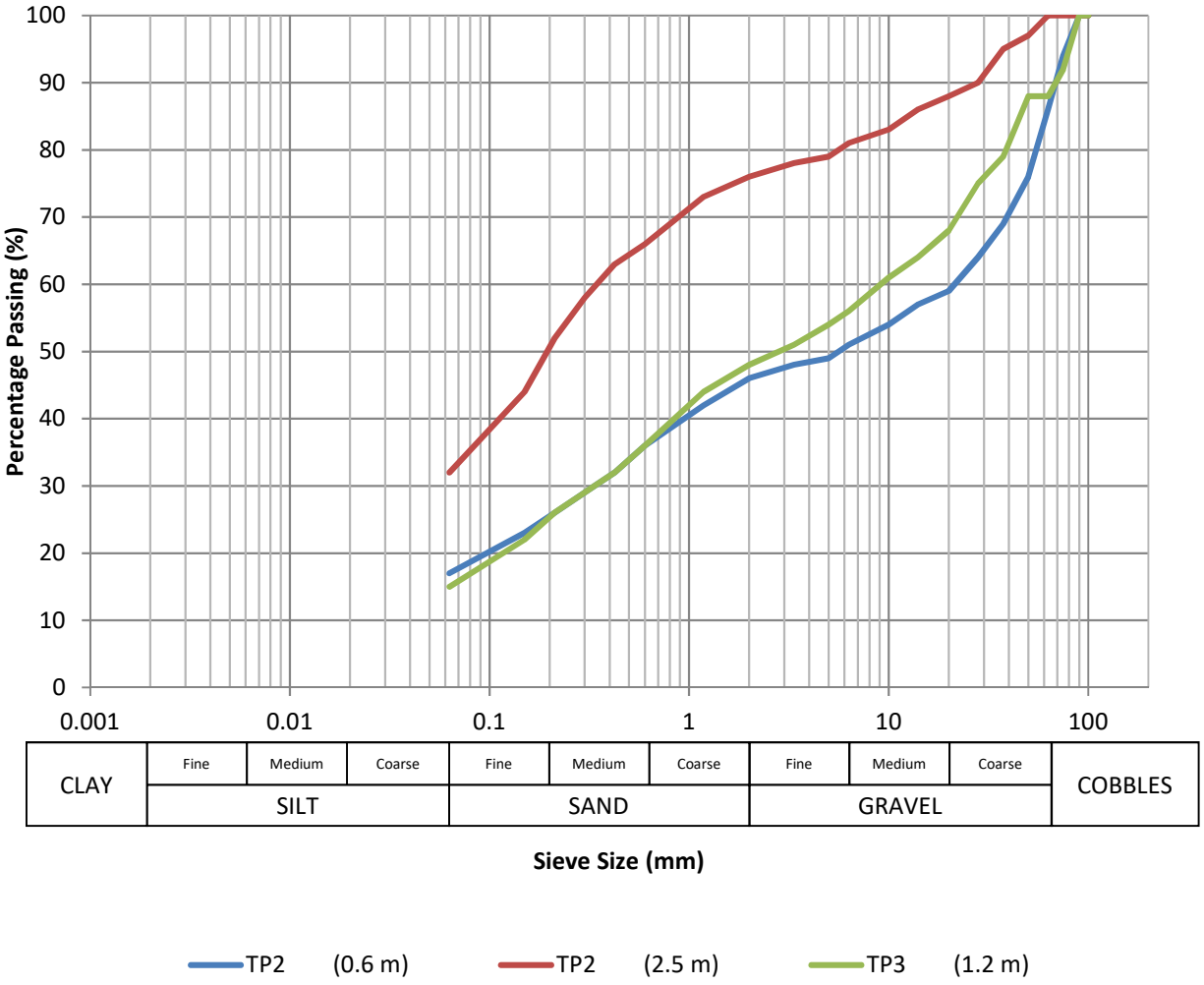
john newton & partners jnpgroup Consulting Engineers

Project:

Land off Mill Moor Road, Meltham

Project No:

B21957



Appendix A

Limitations

1 INTRODUCTION

1.1.1 This report is confidential and has been prepared solely for the benefit of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from jnpgroup; a charge may be levied against such approval. jnpgroup accepts no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned, and: this document to any third party with whom and agreement has not been executed.

1.1.2 Any comments given within this report are based on the understanding that the proposed works to be undertaken will be as described in the introduction and the information referred to and provided by others and will be assumed to be correct and will not have been checked by jnpgroup and jnpgroup will not accept any liability or responsibility for any inaccuracy in such information.

1.1.3 Any deviation from the recommendations or conclusions contained in this report should be referred to jnpgroup in writing for comment and jnpgroup reserve the right to reconsider their recommendations and conclusions contained within. jnpgroup will not accept any liability or responsibility for any changes or deviations from the recommendations noted in this report without prior consultation and our full approval.

1.1.4 The details contained within this report reflect the site conditions prevailing at the time of investigation. jnpgroup warrants the accuracy of this report up to and including that date. Additional information, improved practice or changes in legislation may necessitate this report having to be reviewed in whole or in part after that date. If necessary, this report should be referred back to jnpgroup for re-assessment and, if necessary, re-appraisal.

1.1.5 This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report. Whilst this report and the opinion made herein are correct to the best of jnpgroups' belief, jnpgroup cannot guarantee the accuracy or completeness of any information provided by third parties.

1.1.6 The report represents the finding and opinions of experience geotechnical and geo-environmental engineers. jnpgroup does not provide legal advice and the advice of lawyers may also be required.

1.1.7 It should be noted that the following were not included as part of the agreed scope of works with the client: detailed ecological surveys and assessment; groundwater monitoring and sampling; geotechnical requirements etc.

1.1.8 jnpgroup has provided advice and made recommendations based on the findings of the work undertaken, however this is subject to the approval / acceptance by the relevant Regulatory Authorities.

1.2 Objectives

1.2.1 The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, jnpgroup reserves the right to review such information and, if warranted, to modify the opinions accordingly. It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

1.3 Phase II Intrusive Investigations

1.3.1 The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made.

1.3.2 Where intrusive investigations have been undertaken they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature sampling, no investigation technique is capable of identifying all conditions present in all areas. The number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered. The risk assessment and opinions provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

1.3.3 The objectives of the investigation have been linked to establishing the risks associated with potential human targets, building materials, the environment (including adjacent land), and to surface and ground water. The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to areas unoccupied by the building(s) on the site and by buried services.

1.3.4 Gas and groundwater levels may vary from those reported due to seasonal, or other effects.

1.3.5 It should also be noted that the assessment of soil results has been undertaken using data from a previous consultant; gas monitoring and groundwater samples have been collected using existing monitoring wells not constructed by jnpgroup .

Appendix B

Exploratory Hole Records

jnpgroup Consulting Engineers

Trial Pit Log

Trialpit No **TP01**

Sheet 1 of 1

Project Name: Land off Mill Moor Road	Project No. B21957	Co-ords: - Level:	Date 13/07/2018
Location: Meltham		Dimensions (m): Depth 1.90	Scale 1:25
Client: Pennine Developments Ltd			Logged CDW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.20			Grass over dark brown / grey sandy CLAY. TOPSOIL
							Grey / brown sandy gravelly COBBLES of sandstone. MADE GROUND
	0.80	D		0.80			Stiff orange mottled grey CLAY. HUDDERSFIELD WHITE ROCK
				1.20			Yellow / grey SANDSTONE recovered as tabular cobbles and boulders. HUDDERSFIELD WHITE ROCK
	1.70	B					
				1.90			End of pit at 1.90 m

1 2 3 4 5

Remarks: Trial pit terminated on bedrock

Stability: Good

AGS

jnpgroup Consulting Engineers

Trial Pit Log

Trialpit No **TP02** Sheet 1 of 1

Project Name: Land off Mill Moor Road	Project No. B21957	Co-ords: - Level:	Date 13/07/2018
Location: Meltham		Dimensions (m): Depth 2.80	Scale 1:25
Client: Pennine Developments Ltd			Logged CDW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			Grass over grey sandy CLAY. TOPSOIL
	0.60	B		1.20			Orange / yellow clayey gravelly SAND. Gravel is medium to coarse sub-angular to rounded of sandstone. HUDDERSFIELD WHITE ROCK
	2.50	B		2.80			Brown clayey gravelly SAND with frequent cobbles of sandstone. Gravel is medium to coarse sub-angular to rounded of sandstone. HUDDERSFIELD WHITE ROCK
							End of pit at 2.80 m

1 2 3 4 5

Remarks: Trial pit terminated on bedrock

Stability: Good

AGS

jnpgroup Consulting Engineers

Trial Pit Log

Trialpit No **TP03** Sheet 1 of 1

Project Name: Land off Mill Moor Road	Project No. B21957	Co-ords: - Level:	Date 13/07/2018
Location: Meltham		Dimensions (m): Depth 2.90	Scale 1:25
Client: Pennine Developments Ltd			Logged CDW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			Grass over dark grey sandy CLAY. TOPSOIL
	0.40	ES					Orange / grey clayey SAND with frequent gravel, cobbles and boulders. Gravel is medium to coarse, rounded and of sandstone. HUDDERSFIELD WHITE ROCK
	1.00	ES					
	1.20	B					
				1.50			Wet brown clayey SAND with rounded cobbles of sandstone. HUDDERSFIELD WHITE ROCK
				2.90			End of pit at 2.90 m

Remarks: Trial pit terminated on bedrock

Stability: Good

AGS

jnpgroup Consulting Engineers

Trial Pit Log

Trialpit No **TP04**

Sheet 1 of 1

Project Name: Land off Mill Moor Road	Project No. B21957	Co-ords: - Level:	Date 13/07/2018
Location: Meltham		Dimensions (m): Depth 2.40	Scale 1:25
Client: Pennine Developments Ltd			Logged CDW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							Dark grey sandy CLAY. TOPSOIL
				0.20			
	0.60 0.60	B ES					Orange gravelly SAND. Gravel is medium to coarse sub-angular and of sandstone. Stiff friable clay pockets present throughout HUDDERSFIELD WHITE ROCK
				1.30			Orange/ brown gravelly SAND. Gravel is medium to coarsem sub-angular and of sandstone. Cobbles of sandstone present, increasing in frequency with depth. HUDDERSFIELD WHITE ROCK
				2.40			End of pit at 2.40 m

1 2 3 4 5

Remarks: Trial pit terminated on bedrock

Stability: Good

AGS

jnpgroup Consulting Engineers

Trial Pit Log

Trialpit No **TP05**

Sheet 1 of 1

Project Name: Land off Mill Moor Road	Project No. B21957	Co-ords: - Level:	Date 13/07/2018
Location: Meltham		Dimensions (m): Depth 1.40	Scale 1:25
Client: Pennine Developments Ltd			Logged CDW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Dark grey sandy CLAY. TOPSOIL
				0.70			White / grey stiff friable CLAY, rootlets present throughout. HUDDERSFIELD WHITE ROCK
				1.40			Yellow / brown SANDSTONE recovered as tabular cobbles and boulders. HUDDERSFIELD WHITE ROCK
							End of pit at 1.40 m

1 2 3 4 5

Remarks: Trial pit terminated on bedrock

Stability: Good

AGS

jnpgroup Consulting Engineers

Trial Pit Log

Trialpit No **TP06** Sheet 1 of 1

Project Name: Land off Mill Moor Road	Project No. B21957	Co-ords: - Level:	Date 13/07/2018
Location: Meltham		Dimensions (m): Depth 2.30	Scale 1:25
Client: Pennine Developments Ltd			Logged CDW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Dark grey sandy CLAY. TOPSOIL
	0.50	ES		0.60			Stiff very friable white CLAY. HUDDERSFIELD WHITE ROCK
	1.40	B		2.30			Yellow / brown SANDSTONE recovered as tabular cobbles and boulders. HUDDERSFIELD WHITE ROCK End of pit at 2.30 m

Remarks: Trial pit terminated on bedrock

Stability: Good

AGS

Appendix C

Geotechnical Test Results

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

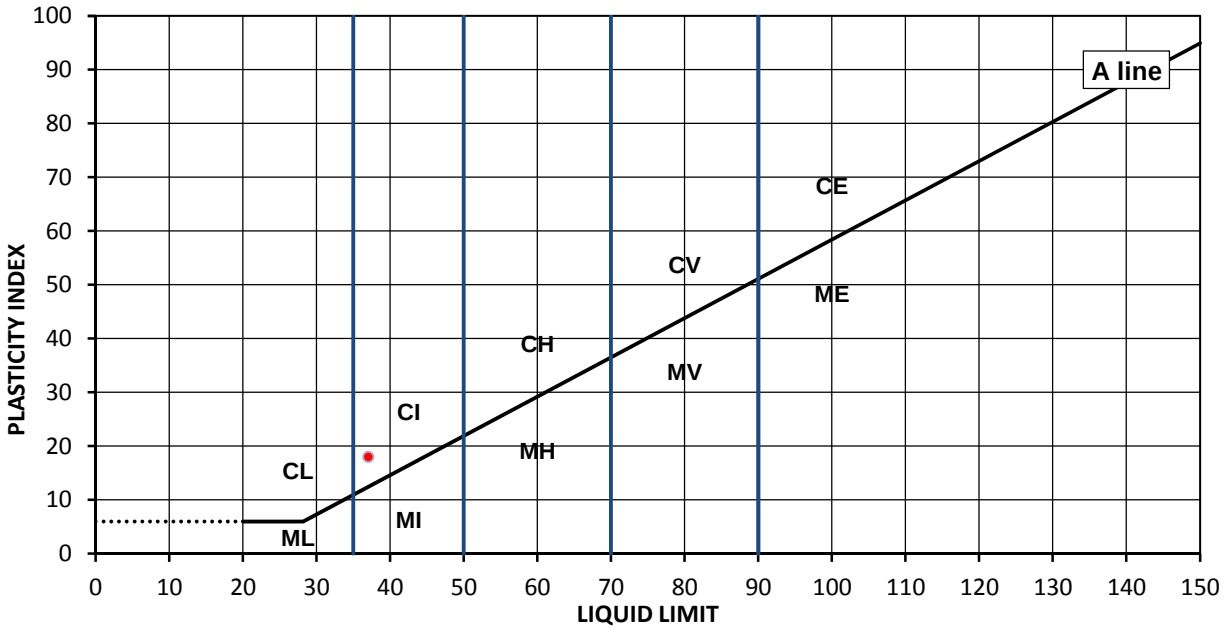
4041

Client:	JNP Midlands LLP	Client Reference:	B21957
Client Address:	Woodvale House Woodvale Road Brighouse HD6 4AB	Job Number:	18-93695
		Date Sampled:	Not Given
		Date Received:	17/07/2018
Contact:	Charley Wainwright	Date Tested:	30/07/2018
Site Name:	Mill Moor Road	Sampled By:	CDW
Site Address:	Not Given		

Test Results

Laboratory Reference:	1007733	Depth Top [m]:	0.80
Hole No.:	TP01	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Yellowish brown slightly gravelly sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
21	37	19	18	89



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 03/08/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.3 & 5: Definitive Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

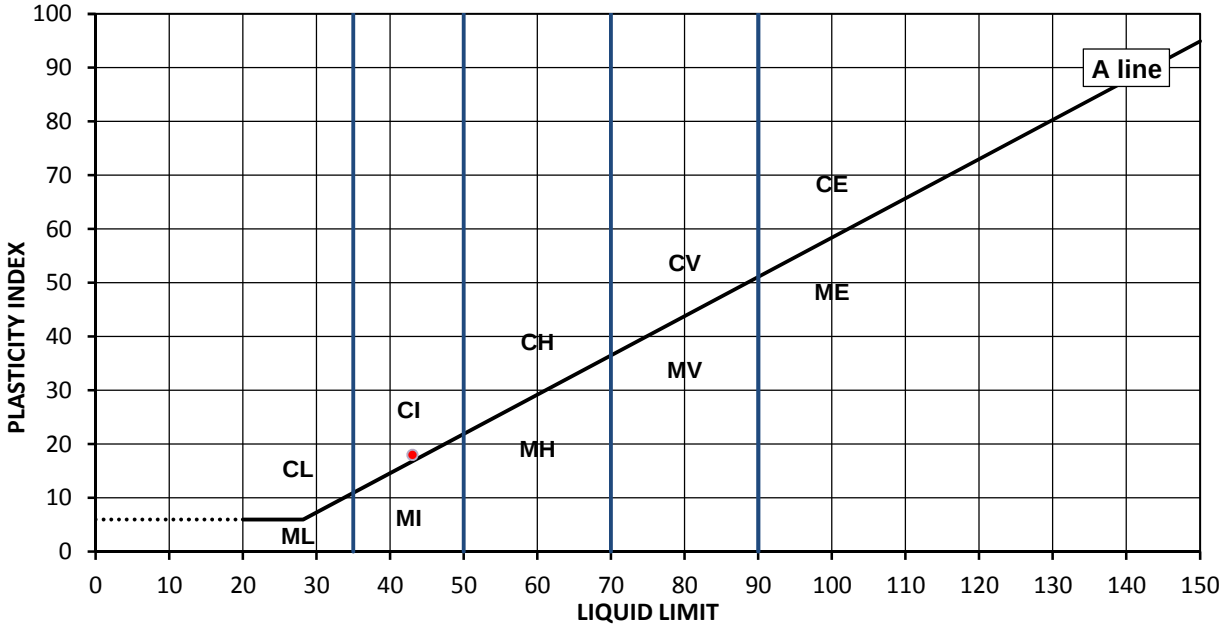
4041

Client:	JNP Midlands LLP	Client Reference:	B21957
Client Address:	Woodvale House Woodvale Road Brighouse HD6 4AB	Job Number:	18-93695
		Date Sampled:	Not Given
		Date Received:	17/07/2018
Contact:	Charley Wainwright	Date Tested:	20/07/2018
Site Name:	Mill Moor Road	Sampled By:	CDW
Site Address:	Not Given		

Test Results

Laboratory Reference:	1007737	Depth Top [m]:	0.40
Hole No.:	TP03	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brown slightly gravelly sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
16	43	25	18	86



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Date Reported: 03/08/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: JNP Midlands LLP
Client Address: Woodvale House
Woodvale Road
Brighouse
HD6 4AB
Contact: Charley Wainwright
Site Name: Mill Moor Road
Site Address: Not Given

Client Reference: B21957
Job Number: 18-93695
Date Sampled: Not Given
Date Received: 17/07/2018
Date Tested: 20/07 - 30/07/2018
Sampled By: CDW

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk	PD	
							%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3
1007733	TP01	Not Given	0.80	Not Given	D	Yellowish brown slightly gravelly sandy CLAY	21	89	37	19	18			
1007737	TP03	Not Given	0.40	Not Given	D	Brown slightly gravelly sandy CLAY	16	86	43	25	18			

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 03/08/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

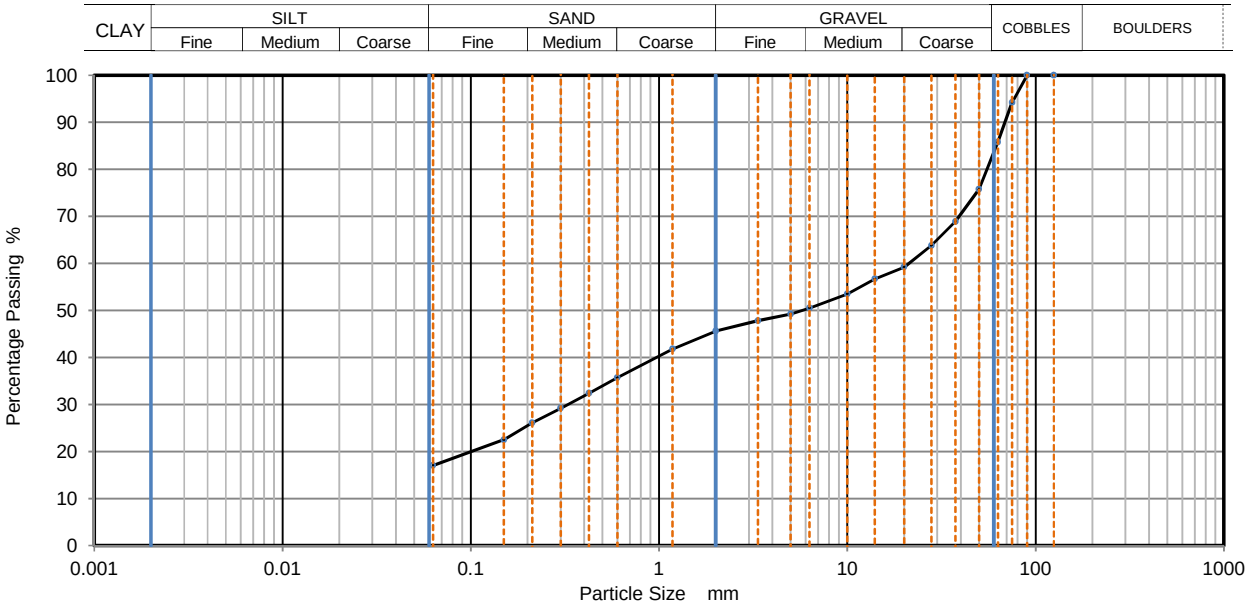
Client:	JNP Midlands LLP	Client Reference:	B21957
Client Address:	Woodvale House Woodvale Road Brighouse HD6 4AB	Job Number:	18-93695
		Date Sampled:	Not Given
		Date Received:	17/07/2018
Contact:	Charley Wainwright	Date Tested:	30/07/2018
Site Name:	Mill Moor Road	Sampled By:	CDW
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 1007734 Sample Reference: Not Given

Sample description: Brown clayey sandy GRAVEL with cobbles Sample Type: B

Location: TP02 Depth Top [m]: 0.60

Supplier: Not Given Depth Base [m]: Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	94		
63	86		
50	76		
37.5	69		
28	64		
20	59		
14	57		
10	54		
6.3	51		
5	49		
3.35	48		
2	46		
1.18	42		
0.6	36		
0.425	32		
0.3	29		
0.212	26		
0.15	23		
0.063	17		

Dry Mass of sample [g]: 8223

Sample Proportions	% dry mass
Very coarse	14.20
Gravel	40.10
Sand	28.40
Fines <0.063mm	17.20

Grading Analysis		
D100	mm	90
D60	mm	21.2
D30	mm	0.327
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below
The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 03/08/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

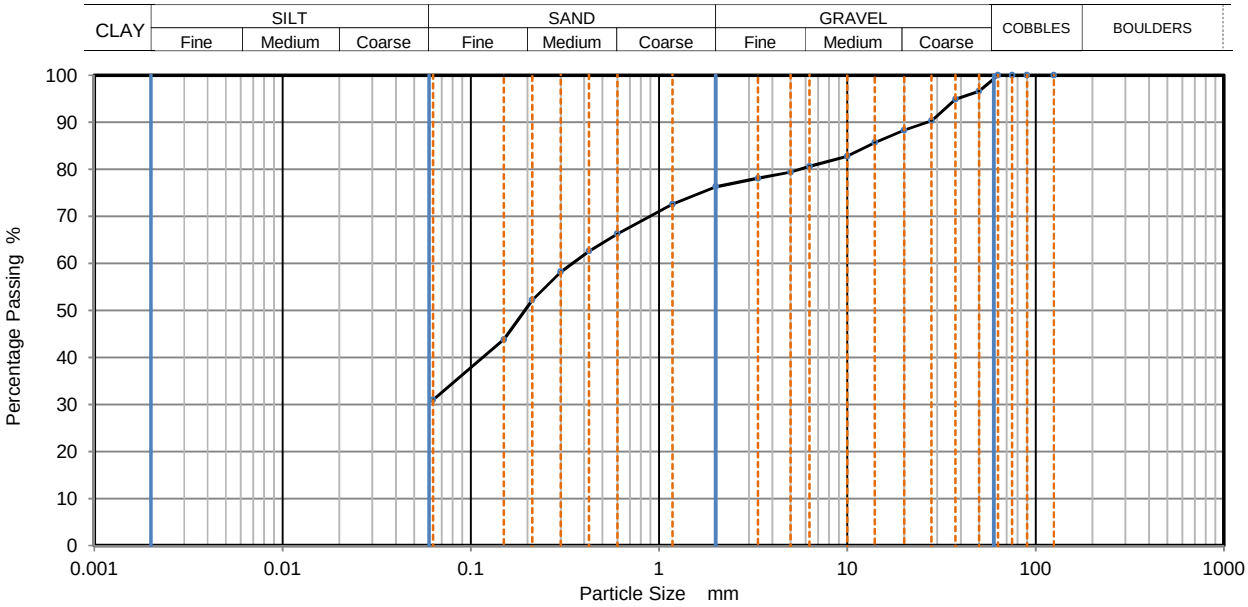
Client:	JNP Midlands LLP	Client Reference:	B21957
Client Address:	Woodvale House Woodvale Road Brighouse HD6 4AB	Job Number:	18-93695
		Date Sampled:	Not Given
		Date Received:	17/07/2018
Contact:	Charley Wainwright	Date Tested:	30/07/2018
Site Name:	Mill Moor Road	Sampled By:	CDW
Site Address:	Not Given		

TEST RESULTS Laboratory Reference: 1007735 Sample Reference: Not Given

Sample description: Brown gravelly very clayey SAND Sample Type: B

Location: TP02 Depth Top [m]: 2.50

Supplier: Not Given Depth Base [m]: Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	97		
37.5	95		
28	90		
20	88		
14	86		
10	83		
6.3	81		
5	79		
3.35	78		
2	76		
1.18	73		
0.6	66		
0.425	63		
0.3	58		
0.212	52		
0.15	44		
0.063	32		

Dry Mass of sample [g]: 5947

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	23.70
Sand	44.60
Fines <0.063mm	31.70

Grading Analysis		
D100	mm	63
D60	mm	0.346
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 03/08/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Particle Size Distribution

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

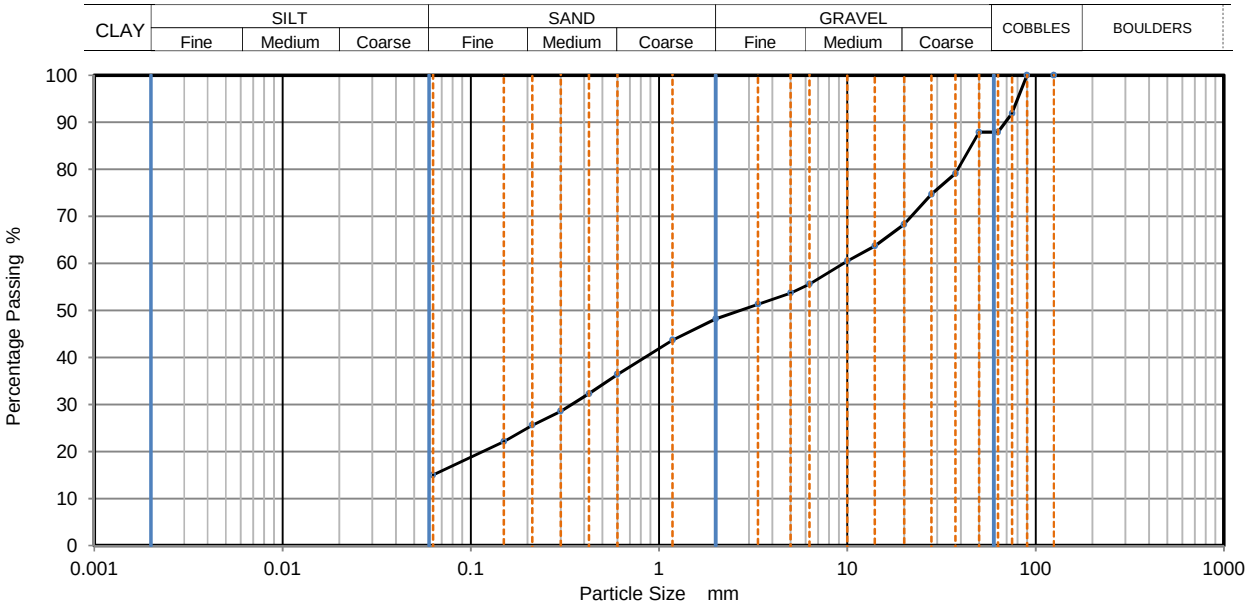
UKAS TESTING 4041

Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Client:	JNP Midlands LLP	Client Reference:	B21957
Client Address:	Woodvale House Woodvale Road Brighouse HD6 4AB	Job Number:	18-93695
		Date Sampled:	Not Given
		Date Received:	17/07/2018
Contact:	Charley Wainwright	Date Tested:	30/07/2018
Site Name:	Mill Moor Road	Sampled By:	CDW
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference:	1007736	Sample Reference:	Not Given
Sample description:	Dark brown gravelly clayey very sandy GRAVEL with cobbles	Sample Type:	B
Location:	TP03	Depth Top [m]:	1.20
Supplier:	Not Given	Depth Base [m]:	Not Given



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	92		
63	88		
50	88		
37.5	79		
28	75		
20	68		
14	64		
10	61		
6.3	56		
5	54		
3.35	51		
2	48		
1.18	44		
0.6	36		
0.425	32		
0.3	29		
0.212	26		
0.15	22		
0.063	15		

Dry Mass of sample [g]: 8382

Sample Proportions	% dry mass
Very coarse	12.10
Gravel	39.70
Sand	33.00
Fines <0.063mm	15.20

Grading Analysis		
D100	mm	90
D60	mm	9.58
D30	mm	0.341
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below
The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 03/08/2018

for and on behalf of i2 Analytical Ltd

Appendix D

Chemical Test Results

Charley Wainwright
JNP Midlands LLP
Woodvale House
Woodvale Road
Brighouse
HD6 4AB

e: charley.wainwright@jnpgroup.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Combined Report Mill Moor Road B21957

Project / Site name:	Mill Moor Road	**Samples received on:**	17/07/2018
Your job number:	B21957	**Samples instructed on:**	17/07/2018
Your order number:		**Analysis completed by:**	25/07/2018
Report Issue Number:	1	**Report issued on:**	07/08/2018
Samples Analysed:	16 soil samples, 2 leachate samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Combined Report Mill Moor Road B21957

Project / Site name: Mill Moor Road

Lab Sample Number				1001921	1001922	1001923	1001924	1001925
Sample Reference				TP01	TP03	TP03	TP04	TP06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.40	1.00	0.40	0.50
Date Sampled				13/07/2018	13/07/2018	13/07/2018	13/07/2018	13/07/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	8.7	12	10	13	5.2
Total mass of sample received	kg	0.001	NONE	0.39	0.38	0.33	0.45	0.46
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	-
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	-	-	-
Total Sulphate as SO_4	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	-
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	-	-	-	-	-
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	-	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Ammonium as NH_4	mg/kg	0.5	MCERTS	-	-	-	-	-
Organic Matter	%	0.1	MCERTS	5.8	2.1	-	-	-
Water Soluble Nitrate (2:1) as N	mg/kg	2	NONE	-	-	-	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	-	< 0.80	< 0.80	-

Combined Report Mill Moor Road B21957

Project / Site name: Mill Moor Road

Lab Sample Number				1001921	1001922	1001923	1001924	1001925
Sample Reference				TP01	TP03	TP03	TP04	TP06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.40	1.00	0.40	0.50
Date Sampled				13/07/2018	13/07/2018	13/07/2018	13/07/2018	13/07/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	6.4	4.8	6.0	4.1
Barium (aqua regia extractable)	mg/kg	1	MCERTS	40	59	86	48	17
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.53	1.1	0.89	1.3	0.09
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	0.7	0.5	0.7	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.3	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	16	14	23	31	5.0
Copper (aqua regia extractable)	mg/kg	1	MCERTS	18	8.6	24	24	6.1
Lead (aqua regia extractable)	mg/kg	1	MCERTS	34	27	13	17	8.7
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	11	35	26	2.2
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.6	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	18	15	25	28	5.7
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	27	49	50	61	7.8
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	< 0.1	-
TPH (C10 - C25)	mg/kg	10	MCERTS	< 10	-	< 10	< 10	-
TPH (C25 - C40)	mg/kg	10	NONE	42	-	< 10	< 10	-

Combined Report Mill Moor Road B21957

Project / Site name: Mill Moor Road

Lab Sample Number				1002499	1002501	1002502	1002503	1002504
Sample Reference				TP05	VS1	VS2	VS3	VS4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	0.10	0.10	0.10	0.10
Date Sampled				13/07/2018	13/07/2018	13/07/2018	13/07/2018	13/07/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	11	9.5	33	14	18
Total mass of sample received	kg	0.001	NONE	0.51	0.16	0.17	0.17	0.17
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.6	-	-	-	-
Total Sulphate as SO_4	mg/kg	50	MCERTS	170	-	-	-	-
Total Sulphate as SO_4	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.012	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	11.5	-	-	-	-
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	6.3	-	-	-	-
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	71	-	-	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Ammonium as NH_4	mg/kg	0.5	MCERTS	< 0.5	-	-	-	-
Organic Matter	%	0.1	MCERTS	-	-	-	-	-
Water Soluble Nitrate (2:1) as N	mg/kg	2	NONE	< 2.0	-	-	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	-

Combined Report Mill Moor Road B21957

Project / Site name: Mill Moor Road

Lab Sample Number				1002499	1002501	1002502	1002503	1002504
Sample Reference				TP05	VS1	VS2	VS3	VS4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	0.10	0.10	0.10	0.10
Date Sampled				13/07/2018	13/07/2018	13/07/2018	13/07/2018	13/07/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	52	10	15	19
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH (C10 - C25)	mg/kg	10	MCERTS	-	-	-	-	-
TPH (C25 - C40)	mg/kg	10	NONE	-	-	-	-	-

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Project / Site name: Mill Moor Road

Lab Sample Number				1002505	1002506	1002507	1002508	1003861
Sample Reference				VS5	VS6	VS7	VS8	TP04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.10	0.10	0.10	0.60
Date Sampled				13/07/2018	13/07/2018	13/07/2018	13/07/2018	13/07/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	14	12	19	13	5.5
Total mass of sample received	kg	0.001	NONE	0.16	0.16	0.17	0.16	0.47
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	8.0
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	-	-	300
Total Sulphate as SO_4	%	0.005	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	0.011
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	11.2
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	-	-	-	-	5.5
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	-	-	-	-	130
Total Sulphur	%	0.005	MCERTS	-	-	-	-	-
Ammonium as NH_4	mg/kg	0.5	MCERTS	-	-	-	-	1.5
Organic Matter	%	0.1	MCERTS	-	-	-	-	-
Water Soluble Nitrate (2:1) as N	mg/kg	2	NONE	-	-	-	-	< 2.0
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	-

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Project / Site name: Mill Moor Road

Lab Sample Number				1002505	1002506	1002507	1002508	1003861
Sample Reference				VS5	VS6	VS7	VS8	TP04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.10	0.10	0.10	0.60
Date Sampled				13/07/2018	13/07/2018	13/07/2018	13/07/2018	13/07/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	23	12	12	11	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	-	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH (C10 - C25)	mg/kg	10	MCERTS	-	-	-	-	-
TPH (C25 - C40)	mg/kg	10	NONE	-	-	-	-	-

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Project / Site name: Mill Moor Road

Lab Sample Number				1006935				
Sample Reference				TP01				
Sample Number				None Supplied				
Depth (m)				1.700				
Date Sampled				Deviating				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	12				
Total mass of sample received	kg	0.001	NONE	1.6				
Asbestos in Soil	Type	N/A	ISO 17025	-				
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.7				
Total Sulphate as SO_4	mg/kg	50	MCERTS	-				
Total Sulphate as SO_4	%	0.005	MCERTS	0.027				
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.018				
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-				
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	-				
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	1.5				
Total Sulphur	mg/kg	50	MCERTS	-				
Total Sulphur	%	0.005	MCERTS	0.010				
Ammonium as NH_4	mg/kg	0.5	MCERTS	-				
Organic Matter	%	0.1	MCERTS	-				
Water Soluble Nitrate (2:1) as N	mg/kg	2	NONE	-				
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0				
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-				
Acenaphthylene	mg/kg	0.05	MCERTS	-				
Acenaphthene	mg/kg	0.05	MCERTS	-				
Fluorene	mg/kg	0.05	MCERTS	-				
Phenanthrene	mg/kg	0.05	MCERTS	-				
Anthracene	mg/kg	0.05	MCERTS	-				
Fluoranthene	mg/kg	0.05	MCERTS	-				
Pyrene	mg/kg	0.05	MCERTS	-				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-				
Chrysene	mg/kg	0.05	MCERTS	-				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-				
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-				

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Project / Site name: Mill Moor Road

Lab Sample Number				1006935				
Sample Reference				TP01				
Sample Number				None Supplied				
Depth (m)				1.700				
Date Sampled				Deviating				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-				
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-				
Boron (water soluble)	mg/kg	0.2	MCERTS	-				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-				
Magnesium (water soluble)	mg/kg	5	NONE	< 5.0				
Magnesium (leachate equivalent)	mg/l	2.5	NONE	< 2.5				
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-				
TPH (C10 - C25)	mg/kg	10	MCERTS	-				
TPH (C25 - C40)	mg/kg	10	NONE	-				

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Lab Sample Number				1002498	1009319			
Sample Reference				TP02	TP04			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.60	0.60			
Date Sampled				13/07/2018	13/07/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	-	7.1			
Dissolved Organic Carbon (DOC)	mg/l	0.1	NONE	-	3.72			
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1	-			
Barium (dissolved)	µg/l	0.05	ISO 17025	5.7	-			
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	-			
Boron (dissolved)	µg/l	10	ISO 17025	< 10	-			
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	-			
Chromium (dissolved)	µg/l	0.4	ISO 17025	2.4	-			
Copper (dissolved)	µg/l	0.7	ISO 17025	9.9	-			
Lead (dissolved)	µg/l	1	ISO 17025	1.4	-			
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	-			
Nickel (dissolved)	µg/l	0.3	ISO 17025	2.0	-			
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	-			
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7	-			
Zinc (dissolved)	µg/l	0.4	ISO 17025	5.5	-			
Calcium (dissolved)	mg/l	0.012	ISO 17025	-	2.1			

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* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1001921	TP01	None Supplied	0.20	Brown loam and clay with vegetation.
1001922	TP03	None Supplied	0.40	Brown loam and sand with vegetation and gravel.
1001923	TP03	None Supplied	1.00	Brown clay and sand with gravel.
1001924	TP04	None Supplied	0.40	Brown clay and sand with gravel.
1001925	TP06	None Supplied	0.50	Brown sand with gravel and vegetation.
1002499	TP05	None Supplied	0.60	Brown sandy clay with vegetation.
1002501	VS1	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1002502	VS2	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1002503	VS3	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1002504	VS4	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1002505	VS5	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1002506	VS6	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1002507	VS7	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1002508	VS8	None Supplied	0.10	Brown loam and sand with gravel and vegetation.
1003861	TP04	None Supplied	0.60	Brown sandy clay with gravel and vegetation.
1006935	TP01	None Supplied	1.700	Brown clay and sand with gravel.

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Project / Site name: Mill Moor Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests. 2:1 extraction.	L082-PL	D	MCERTS
Dissolved Organic Carbon in leachate	Determination of dissolved organic carbon in leachate by the measurement on a non-dispersive infrared analyser of carbon dioxide released by acidification.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L023-PL	W	NONE
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

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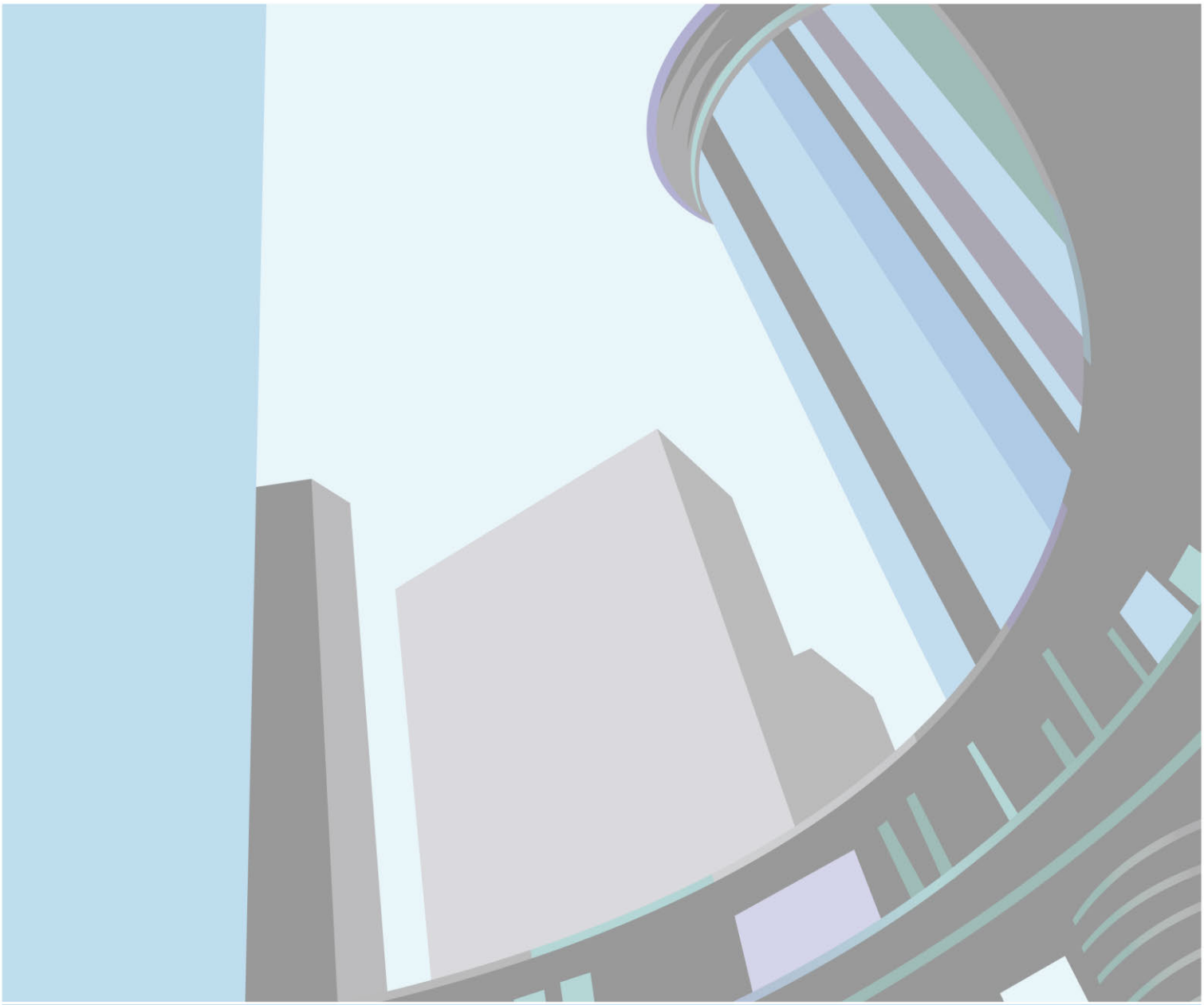
Project / Site name: Mill Moor Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L038	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method	L076-PL	D	NONE
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



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ice award 2015 — ICE Yorkshire and Humber Annual Awards
SAFEMARK — Health and Safety Approved by SMAS
CHAS — Accredited Contractor
RISQS — Audited — Supplier No: 212818
Constructionline — Part of Capita plc
BM TRADA — ISO 9001
New Civil Engineer 100 — Companies of the Year 2017 — Ranked Company