GEO-ENVIRONMENTAL & GEOTECHNICAL ASSESSMENT (GROUND INVESTIGATION) & BASEMENT IMPACT ASSESSMENT REPORT

FOR

138-140 HIGHGATE ROAD
HIGHGATE
LONDON
NW5 1PB

JOMAS ASSOCIATES LTD

SITE INVESTIGATION & SURVEYS
LAND DEVELOPMENT SUPPORT

Tel: 0843-289-2187

www.jomasassociates.com info@jomasassociates.com

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Prepared by: JOMAS ASSOCIATES LTD For: DESIGN VENTURES HIGHGATE LTD

Prepared by
Shaw Carter BSc (Hons), FGS
Geotechnical Engineer

.....

Reviewed by
Peter Swettenham BSc (Hons) MSc PgCert CEnv MoIES
Principal Geotechnical Engineer

.....

Approved by
Suneel Law BSc (Hons), MSc, FGS
Prinicipal Geo-environmental Engineer

and

Roni Savage BEng (Hons), MSc, SiLC, CGeol, MCIWM, FGS
Technical Director

Should you have any queries relating to this report, please contact

Jomas Associates Ltd

www.jomasassociates.com

☎ 0843 289 2187

✉ info@jomasassociates.com

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EXECUTIVE SUMMARY

Design Ventures Highgate Ltd commissioned Jomas Associates Ltd to undertake a Geo-environmental and Geotechnical ground investigation at the site 138-140 Highgate Road, Highgate, London, NW5 1PB.

The principle objectives of the study were as follows:

- To determine the nature and where possible, the extent of contaminants potentially present at the site;
- To establish the presence of significant pollutant linkages, in accordance with the procedures set out within the Environment Agency (EA) report R&D CLR11 and relevant guidance within the National Planning Policy Framework (NPPF);
- To assess whether the site is safe and suitable for the purpose for which it is intended, or can be made so by remedial action; and,
- To obtain geotechnical parameters to inform preliminary foundation design;
- To utilise the information from this investigation and the previously undertaken Desk Study / Preliminary Risk Assessment to carry out a Basement Impact Assessment,

It should be noted that the table below is an executive summary of the findings of this report and is for briefing purposes only. Reference should be made to the main report for detailed information and analysis.

Site History and Ground Investigation	
Current Site Use	The site is currently utilised as an operational fuel filling station and MOT test centre.
Proposed Site Use	It is understood that the proposed development will involve the demolition of the existing building and construction of a new four-storey residential development. The new development will include a lower ground floor (half of which is basement due to slope of ground) and a full single-storey basement below.
Desk Study Overview	A Desk Study report has been produced for the site and issued separately (Jomas – March 2018). A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information. Earliest historical maps (1872) indicate that the site consists of an undeveloped agricultural field. Few major changes occur to the site until 1936 when an industrial-style unit was constructed on site, in the NW boundary of the site. By 1952 the industrial-style unit on site was identified as a garage which was demolished by 1970. By 1974 another garage was constructed in the NE of the site. The canopy above the forecourt are also appears to have been constructed at this time. The site appears to have remained in this configuration until present-day. The surrounding area has been utilised predominantly for residential use with limited industrial uses noted including railway, garages, various works and manufactories and an oil processing plant. The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial deposits are reported within the site. A review of the EnviroInsight Report indicates that there are no source protection zones within 500m of the site. There are no groundwater, surface water or potable water abstractions reported within 500m of the site. There are 2No. surface water features within 250m of the site, the nearest identified 182m east.

Site History and Ground Investigation	
	There is a culvert 271m south-west of the site identified as a detailed river network.
Intrusive Investigation	The ground investigation was undertaken on 12th & 13th February 2018, and consisted of the following: • 7No. window sampling boreholes, drilled up to 5.45m below ground level (bgl), with associated in situ testing and sampling; • 2No. cable percussive boreholes, drilled up to 24.95mbgl, with associated in situ testing and sampling; • Laboratory analysis for chemical and geotechnical purposes, • 4No. return visits to monitor ground gas concentrations and groundwater levels have been completed.
Ground Conditions	The results of the ground investigation revealed a ground profile comprising Made Ground up to 1.20mbgl overlying London Clay Formation to the base of the borehole at 24.95mbgl. Groundwater was not encountered during drilling of any of the exploratory holes, though water was noted to seep into WS2 at 1.1mbgl and WS4 at 4.5mbgl. During return monitoring groundwater was reported at depths of between 1.64m and 4.66m bgl within WS2, WS3, WS4 and WS5. No water was reported within WS1 or BH1 during any monitoring visit. Such variance suggests the water may be surface water ingress as oppose to groundwater.
Environmental Considerations	Following generic risk assessments, elevated concentrations of lead, naphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene and C21-C35 aromatic hydrocarbons were detected in soils in excess of generic assessment criteria for the protection of human health within a 'residential with plant uptake' end-use scenario. Asbestos in the form of chrysotile and amosite - loose fibres were detected in 3No. samples analysed in the laboratory. These were quantified to <0.001%, less than the 0.1% fibre content where arisings are considered hazardous for the purpose of disposal. Given the locations of the soil exceedances in relation to the location of suspected underground fuel tanks, it is considered likely that underground tanks are the source of the contamination in soil. Removal of these tanks and associated impacted soil will be required to partly address these risks. A basement is proposed under the majority of the site. As a result, soils will be removed down to approximately 3.5-4.0m bgl. This removal of soil is likely to also remove any contaminated soils too. Due to the presence of asbestos, any areas of proposed soft landscaping should comprise at least 6000mm of clean imported soil placed on a marker layer. A 200mm break layer may form part of this cover. Groundwater analysis has reported no concentrations of contaminants above the laboratory detection limit. Due to several installations reported as 'dry' and the underlying geology (London Clay - unproductive strata) it is considered that the water encountered represents surface water ingress as oppose to groundwater. Of greater concern is the "free product" reported to be floating on the surface of the water within WS2 and WS5. The source of this product is likely to be water migrating though the contaminated Made Ground. Any product encountered during the tank removal works will also have to be removed. Due to the underlying London Clay, identified as unproductive

Site History and Ground Investigation	
	strata, the product and contaminants within soil are unlikely to migrate to impact off-site controlled waters receptors. Calculating the Gas Screening Value using worst case results indicates Characteristic Situation 1. However, concentrations of methane are raised in a single well (WS5) in close proximity to the underground tank locations, with product also reported within the installation. Although raising the site to CS2 must be considered it is possible that following remediation of the site and removal of the underground tanks, future monitoring may be able to reduce the level of gas protection required. Given the levels of potentially volatile contaminants identified within soil, a vapour resistant membrane may be required within the proposed structures. A remediation strategy and subsequent verification report will be required. As with any ground investigation, the presence of further hotspots between sampling points cannot be ruled out, and caution must be exercised during construction works. Should any contamination be encountered, a suitably qualified environmental consultant should be informed immediately, so that adequate measures may be recommended.
Geotechnical Considerations	Based upon the information obtained to date, it is considered that a cantilever retaining wall installed may be constructed with an allowable bearing pressure of 80kPa at 4.0mbgl If a greater allowable bearing capacity is required then a piled foundation solution within the underlying London Clay should be considered. If a cantilever retaining wall is utilised, then a well reinforced ground bearing floor slab could be used. Such a slab would prop the retaining walls and prevent buckling from the lateral pressures imposed by the cantilever retaining walls. The wall would need to be constructed on a suitable thickness of engineered granular material. Any groundwater encountered during construction works could be addressed by conventional pumping from a sump. It is recommended that the stability of all excavations should be assessed during construction. Attention is also drawn to the provisions of the Health and Safety at Work Regulations, which state that the sides of any excavations greater than 1.2m depth, into which personnel are required to enter, should be fully supported or battered back to a safe angle. Based on the results of chemical testing, the required concrete class for the site is DS-5 assuming an Aggressive Chemical Environment for Concrete classification of AC-4s in accordance with the procedures outlined in BRE Special Digest 1.

Basement Impact Assessment	
Impact Assessment	The overall assessment of the site is that the creation of a basement for the existing development will not adversely impact the site or its immediate environs, providing measures are taken to protect surrounding land and properties during construction. The proposed basement excavation will be within 5m of a public pavement. Unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground and any associated services. From the studies that have been undertaken so far it is concluded that the construction of the building will not present a problem for ground water. It is concluded that this site can be successfully developed without causing any problems to the subterranean drainage.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 Design Ventures Highgate Ltd ("The Client") has commissioned Jomas Associates Ltd, to assess the risk of contamination posed by the ground conditions at a site referred to as 138-140 Highgate Road, Highgate, London, NW5 1PB and to provide indicative recommendations for foundation design prior to the redevelopment of the site.

1.1.2 To this end a Desk Study has been produced for the site and issued separately (Jomas, March 2018), followed by an intrusive investigation (detailed in this report).

1.1.3 A full list of previous reports undertaken for the site by Jomas are detailed in Table 1.1:

Table 1.1: Previous Reports - Jomas

Title	Author	Reference	Date
Geo-environmental Desk Study and Basement Impact Assessment (screening & Scoping) Report for 138-140 Highgate Road, Highgate, London, NW5 1PB	Jomas	P1323J1303, Finalv1.0	March 2018

1.1.4 The intrusive investigation was undertaken in accordance with Jomas proposal dated 10th January 2018.

1.2 Proposed Development

1.2.1 It is understood that the proposed development will involve the demolition of the existing building and construction of a new four-storey residential development. The new development will include a lower ground floor (half of which is below ground due to slope of ground) and a full single -storey basement below. The new building will be located in approximately the same footprint as the existing building, but the basement level will extend out to under most of the site. Proposed plans indicate that private garden will be included.

1.2.2 For the purposes of the contamination risk assessment, the proposed development is classified as 'Residential with plant uptake'.

1.2.3 For the purpose of geotechnical assessment, it is considered that the project could be classified as a Geotechnical Category (GC) 2 site in accordance with BS EN 1997. GC 2 projects are defined as involving:

- Conventional structures.
- Quantitative investigation and analysis.
- Normal risk.
- No difficult soil and site conditions.
- No difficult loading conditions.
- Routine design and construction methods.

1.3 Objectives

1.3.1 The objectives of Jomas' investigation were as follows:

- To present a description of the present site status, based upon the published geology, hydrogeology and hydrology of the site and surrounding area;
- To provide an assessment of the environmental sensitivity at the site and the surrounding area, in relation to any suspected or known contamination which may significantly affect the site and the proposed development;
- To conduct an intrusive investigation, to determine the nature and extent of contaminants potentially present at the site;
- To establish the presence of significant pollutant linkages, in accordance with the procedures set out within Part IIA of the Environmental Protection Act 1990, associated statutory guidance and current best practice including the EA report R&D CLR 11;
- To obtain geotechnical parameters to inform preliminary foundation design; and
- To assess the potential impacts that the proposal may have on ground stability, the hydrogeology and hydrology on the site and its environs.

1.4 Scope of Works

1.4.1 The following tasks were undertaken to achieve the objectives listed above:

- Intrusive ground investigation to determine shallow ground conditions, and potential for contamination at the site;
- Undertaking of laboratory chemical and geotechnical testing upon samples obtained;
- The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations;
- A basement impact assessment.

1.5 Scope of Basement Impact Assessment (BIA)

1.5.1 The Jomas' BIA has been undertaken in accordance with "Camden Planning Guidance – Basements and Lightwells, CPG4" (CPG4) dated July 2015.

1.5.2 The Jomas BIA covers most items required under CPG4, with the exception of;

- Plans and sections to show foundation details of adjacent structures;
- Programme for enabling works, construction and restoration
- Evidence of consultation with neighbours
- Construction Sequence Methodology
- Proposals for monitoring during construction.
- Drainage Assessment

1.6 Limitations

1.6.1 Jomas Associates Ltd has prepared this report for the sole use of Design Ventures Highgate Ltd, in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas Associates Limited. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.6.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas Associates Limited has actual knowledge to the contrary, information obtained from public sources or provided to Jomas Associates Limited by site personnel and other information sources, have been assumed to be correct. Jomas Associates Limited does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.

1.6.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

1.6.4 Any reports provided to Jomas Associates Limited have been reviewed in good faith. Jomas Associates Limited cannot be held liable for any errors or omissions in these reports, or for any incorrect interpretation contained within them.

1.6.5 This investigation and report has been carried out in accordance with the relevant standards and guidance in place at the time of the works. Future changes to these may require a re-assessment of the recommendations made within this report.

1.6.6 This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.

2 SITE SETTING

2.1 Site Information

2.1.1 The site location plan is appended to this report in Appendix 1.

Table 2.1: Site Information

Name of Site	-
Address of Site	138-140 Highgate Road, Highgate, London, NW5 1PB
Approx. National Grid Ref.	528629, 185800
Site Area (Approx)	0.07ha
Site Occupation	Petrol station and MOT test centre
Local Authority	London Borough of Camden
Proposed Site Use	Residential with plant uptake inclusive of single-storey basement

2.2 Desk Study Overview

2.2.1 A Desk Study report has been produced for the site and issued separately (Jomas – March 2018). A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information.

2.2.2 Earliest historical maps (1872) indicate that the site consists of an undeveloped agricultural field. Few major changes occur to the site until 1936 when an industrial-style unit was constructed on site, in the NW boundary of the site. By 1952 the industrial-style unit on site was identified as a garage which was demolished by 1970. By 1974 another garage was constructed in the NE of the site. The canopy above the forecourt are also appears to have been constructed at this time. The site appears to have remained in this configuration until present-day.

2.2.3 The surrounding area has been utilised predominantly for residential use with limited industrial uses noted including railway, garages, various works and manufactories and an oil processing plant.

2.2.4 The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial deposits are reported within the site.

2.2.5 A review of the EnviroInsight Report indicates that there are no source protection zones within 500m of the site.

2.2.6 There are no groundwater, surface water or potable water abstractions reported within 500m of the site.

2.2.7 There are 2No. surface water features within 250m of the site, the nearest identified 182m east.

2.2.8 There is 1No. detailed river network reported within 500m of the site; identified as a culvert 271m south-west of the site.

2.2.9 The conceptual site model provided within the report identifies the following potential sources, pathways and receptors. The report indicates the following potential sources of contamination:

- Potential for hydrocarbon contaminated ground associated with previous site use as fuel station/garage – on site (S1)
- Potential for Made Ground associated with previous development operations – on site (S2)
- Potential buried tanks associated with former use as a fuel station/garage – on site (S3)
- Current and previous industrial use – off site (S4)
- Potential asbestos containing materials within existing buildings – on site (S5)
- Potential asbestos impacted soils from demolition of previous buildings – on site (S6)
- Potential ground gas generation associated with hydrocarbon impacted soils from historic use as fuel station - on site (S7)

2.2.10 The conceptual site model identifies the following potential pathways:

- Ingestion and dermal contact with contaminated soil (P1)
- Inhalation or contact with potentially contaminated dust and vapours (P2)
- Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hard standing or via service pipe/corridors and surface water runoff. (P3)
- Horizontal and vertical migration of contaminants within groundwater (P4)
- Accumulation and migration of soil gases (P5)
- Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)

2.2.11 The conceptual site model identifies the following potential receptors:

- Construction workers (R1)
- Maintenance workers (R2)
- Neighbouring site users (R3)
- Future site users (R4)
- Building foundations and on site buried services (water mains, electricity and sewer) (R5)
- Controlled Waters (Culvert) (R6)

3 GROUND INVESTIGATION

3.1 Rationale for Ground Investigation

3.1.1 The site investigation has been undertaken generally in accordance with Contaminated Land Report 11, BS10175, NHBC Standards Chapter 4.1, and other associated Statutory Guidance. If required, further targeted investigations and remedial option appraisal would be dependent on the findings of this site investigation.

3.1.2 The soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).

3.1.3 The sampling proposal was designed in order to gather data representative of the site conditions; to target identified sources (see Table 3.1) and to aid the preparation of the BIA with reference to the scoping and screening assessment.

3.2 Scope of Ground Investigation

3.2.1 The ground investigation was undertaken on 12th & 13th February 2018.

3.2.2 The work was undertaken in accordance with BS5930 'Code of Practice for Site Investigation' and BS10175 'Investigation of Potentially Contaminated Sites'. All works were completed without incident.

3.2.3 The investigation focused on collecting data on the following:

- Quality of Made Ground/ natural ground within the site boundaries;
- Presence of groundwater beneath the site (if any), perched or otherwise;
- Determination of the presence or absence of hazardous ground gases;
- Obtaining geotechnical parameters to allow initial design to take place.
- To aid the preparation of the BIA

3.2.4 A summary of the fieldwork carried out at the site, with justifications for exploratory hole positions, are offered in Table 3.1 below.

Table 3.1: Scope of Intrusive Investigation

Investigation Type	Number of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved (m BGL)	Justification
Window Sample Boreholes	7	WS1 - 7	Up to 5.45mbgl	Obtain shallow samples for laboratory contamination and geotechnical testing. To allow in-situ geotechnical testing. WS1 & BH2 - Targeting 2No. abandoned tanks WS2 - Targeting petrol interceptor

Investigation Type	Number of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved (m BGL)	Justification
				WS3, WS7, & WS8 - Targeting existing buried fuel tanks. WS4 & WS6 - Targeting internal area of existing workshop/MOT test centre. WS5 - Targeting 2No. former kerosene and diesel tanks.
Cable Percussion Boreholes	2	BH1 - 2	Up to 24.95mbgl	Obtain deeper samples for laboratory contamination and geotechnical testing. To allow in-situ geotechnical testing.
Monitoring Wells	6	WS1 - WS5, BH1	Up to 5.00mbgl	Combined soil gas and groundwater monitoring wells. WS1 - response zone in clay WS2 - response zone in Made Ground and clay WS3 - response zone in clay WS4 - response zone in clay WS5 - response zone in Made Ground and clay BH1 - response zone in clay

3.2.5 The exploratory holes were completed to allow soil samples to be taken in the areas of interest identified in Table 3.1 above. In all cases, all holes were logged in accordance with BS:5930 (2015).

3.2.6 Exploratory hole positions were located approximately with reference to known features on site as shown in the exploratory hole location plan presented in Appendix 1. The exploratory hole records are included in Appendix 2.

3.2.7 Where monitoring well installations were not installed, the exploratory holes were backfilled with the arisings (in the reverse order in which they were drilled) and the ground surface was reinstated so that no depression was left.

3.3 In-situ Geotechnical Testing

3.3.1 In-situ geotechnical testing included Standard Penetration Tests. The determined 'N' values have been used to determine the relative density of granular materials and have been used with standard correlations to infer various other derived geotechnical parameters including the undrained shear strength of the cohesive strata. The results of the individual tests are on the appropriate exploratory hole logs in Appendix 2.

3.4 Sampling Rationale

3.4.1 Our soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).

3.4.2 The exploratory holes were positioned by applying a combined non-targeted sampling strategy, as well as sample locations positioned with reference to sources identified from the desk study.

3.4.3 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs.

3.4.4 Jomas Associates Limited's engineers normally collect samples at appropriate depths based on field observations such as:

- appearance, colour and odour of the strata and other materials, and changes in these;
- the presence or otherwise of sub-surface features such as pipework, tanks, foundations and walls; and,
- areas of obvious damage, e.g. to the building fabric.

3.4.5 A number of the samples were taken from the top 0-1m to aid in the assessment of the pollutant linkages identified at the site. In addition, some deeper samples were taken to aid in the interpretation of fate and transport of any contamination identified.

3.4.6 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs (copies of which are provided in Appendix 2). The methodology used and type of samples taken were chosen to allow the Sampling category to be A or B according to EN ISO 22475-1. This in turn allows suitable geotechnical testing to be carried out.

3.4.7 During return groundwater monitoring visits, where groundwater samples are taken, all boreholes were purged of three well volumes prior to obtaining the sample for testing. This removes stagnant groundwater from the monitoring well.

3.4.8 Groundwater strikes noted during drilling, are recorded within the exploratory hole records in Appendix 2.

3.4.9 Samples were stored in cool boxes (<4^{o}C) and preserved in accordance with laboratory guidance.

3.5 Sampling Limitations

3.5.1 WS1 and BH1 were moved slightly from where initially positioned, due to the presence of parked cars.

3.5.2 WS2 was moved slightly from where initially positioned, to avoid services. WS2 did not recover any material from 1.1m to 4.0m bgl.

3.5.3 WS6 terminated on reinforced concrete at 0.60mbgl.

3.5.4 The remaining boreholes were drilled at the proposed locations and to the proposed depths.

3.6 Laboratory Analysis

3.6.1 A programme of aboratory testing, scheduled by Jomas Associates Limited, was carried out on selected samples of Made Ground and natural strata.

Chemical Testing

3.6.2 Soil samples were submitted to i2 Analytical (a UKAS and MCerts accredited laboratory), for analysis.

3.6.3 The samples were analysed for a wide range of contaminants as shown in Table 3.2 below:

Table 3.2: Chemical Tests Scheduled

	No. of tests	
Test Suite	**Made Ground / Topsoil**	**Natural**
Jomas Suite S3	2	0
Total Organic Carbon	3	1
Asbestos Screen & ID	6	1
Jomas Reduced Suite S5	4	3
Hydrocarbon Suite	4	3
VOC Suite	1	0
WAC	3	0
Water Soluble Sulphate	6*	9*

**Including samples tested for as part of Jomas Suites S3 and S5*

3.6.4 The determinands contained in the basic suite are as detailed in Table 3.3 below:

Table 3.3: Basic Suite of Determinands

DETERMINAND	LIMIT OF DETECTION (mg/kg)	UKAS ACCREDITATION	TECHNIQUE
Arsenic	1	Y (MCERTS)	ICPMS
Cadmium	0.2	Y (MCERTS)	ICPMS
Chromium	1	Y (MCERTS)	ICPMS
Chromium (Hexavalent)	4	Y (MCERTS)	Colorimetry
Lead	1	Y (MCERTS)	ICPMS
Mercury	0.3	Y (MCERTS)	ICPMS
Nickel	1	Y (MCERTS)	ICPMS
Selenium	1	Y (MCERTS)	ICPMS
Copper	1	Y (MCERTS)	ICPMS
Zinc	1	Y (MCERTS)	ICPMS
Boron (Water Soluble)	0.2	Y (MCERTS)	ICPMS
pH Value	0.1 units	Y (MCERTS)	Electrometric
Sulphate (Water Soluble)	0.0125g/l	Y (MCERTS)	Ion Chromatography
Total Cyanide	1	Y (MCERTS)	Colorimetry
Speciated/Total PAH	0.05/0.80	Y (MCERTS)	GCFID
Phenols	1	Y (MCERTS)	HPLC
Total Petroleum Hydrocarbons (banded)	-	N Y (MCERTS)	Gas Chromatography

3.6.5 To support the selection of appropriate tier 1 screening values, 4No. samples were analysed for total organic carbon.

3.6.6 Laboratory test results are summarised in Section 6, with raw laboratory data included in Appendix 3.

Geotechnical Laboratory Testing

3.6.7 In addition to the contamination assessment, soil samples were submitted to the UKAS Accredited laboratory of i2 Analytical Ltd. for a series of analysis.

3.6.8 This testing was specifically designed to:

- to classify the samples; and
- to obtain parameters (either directly or sufficient to allow relevant correlations to be used) relevant to the technical objectives of the investigation.

3.6.9 The following laboratory geotechnical testing (as summarised in Table 3.4) was carried out:

Table 3.4 Laboratory Geotechnical Analysis

BS 1377 (1990) Test Number	Test Description	Number of tests
Part 2		
3.2	Moisture Content Determination	5
4.3 and 5.3	Liquid and Plastic Limit Determination (Atterberg Limits)	8
Part 7		
8	Determination of the undrained shear strength in triaxial compression with single stage loading and without measurement of pore pressure	8

3.6.10 The water soluble sulphate and pH results obtained as part of the chemical analysis was used in combination with BRE Special Digest 1 to allow buried concrete to be designed.

3.6.11 The results of the geotechnical laboratory testing are presented as Appendix 4 and discussed in Section 9 of this report.

4 GROUND CONDITIONS

4.1 Soil

4.1.1 Ground conditions were logged in accordance with the requirements of BS: 5930 (2015). Detailed exploratory hole logs are provided in Appendix 2. The ground conditions encountered are summarised in Table 4.1 below, based on the strata observed during the investigation.

Table 4.1: Ground Conditions Encountered

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
Reinforce concrete over dark brown sandy gravelly clay. Gravel consists of fine to coarse sub-angular to sub-rounded flint, brick and concrete. (MADE GROUND)	0.00	0.30 - 1.20	0.30 - 1.20
Brown mottled grey medium increasing to very high strength silty CLAY (LONDON CLAY FORMATION)	0.30 - 1.20	>4.45 - >24.95	>3.45 - >24.65

4.1.2 It should be noted that the Made Ground was encountered to base of WS6 (reinforced concrete) and that the exact depth of the Made Ground in WS2 could not be determined as there was no recovery from 1.10mbgl.

4.1.3 In the remaining locations materials considered to represent the London Clay Formation was noted to the base of the exploratory holes.

4.1.4 Where buried tanks and petrol interceptors are located, the depth of Made ground will be greater.

4.2 Hydrogeology

4.2.1 Groundwater was not observed during drilling of the exploratory holes, though water was noted to seep into WS2 at 1.1mbgl and WS4 at 4.5mbgl.

4.2.2 Within WS2 this may represent a perched water table at the boundary between the Made Ground and the underlying London Clay Formation.

4.2.3 Groundwater strikes and groundwater monitoring are summarised below in Table 4.2, In addition, during groundwater monitorin,g product was detected in some installations, this was measured using an interface probe. The depths are also shown below.

Table 4.2: Groundwater Monitoring Records

Exploratory Hole ID	Depth to product (m bgl)	Depth to water (m bgl)	Depth to Base of Well (m bgl)	Stratum
WS1	-	Dry	5.00 - 5.02	-
WS2	1.49 - 1.56	2.23 - 3.41	3.42	London Clay Formation
WS3	-	4.66 - Dry	4.86 - 4.89	London Clay Formation
WS4	-	4.37 - Dry	4.93 - 4.94	London Clay Formation
WS5	1.48 - 1.54	1.64 - 1.85	4.92 - 4.95	London Clay Formation
BH1	-	Dry	5.07 - 5.10	-

4.2.4 It should be noted that the difference in ground water levels, and the encountered ground conditions suggest that the water encountered may be surface water ingress that has been unable to egress through the London Clay Formation.

4.2.5 It should also be noted that significant thickness of product was detected using the interface probe. These noted thickness of product may not be fully representative as the limitations of the equipment mean that it can often measure an emulsion of oil and water (i.e. oily water) as free product. In addition product can “stick” to the probe whilst it is being lowered down the hole, thus making the thickness appear greater.

4.3 Physical and Olfactory Evidence of Contamination

4.3.1 Water seepage into WS2 at 1.10mbgl was described as “black” and “oily”. Although there was no recovery from 1.10mbgl in WS2, a single vial sample of soil was obtained at approximately 2.50mbgl. A hand-held photo-ionisation detector was used on this sample; giving a VOC reading of 18ppm.

4.3.2 Made Ground recovered from WS5 (0.30m - 1.20m bgl) had some evidence of black staining and a hydrocarbon odour. Clay recovered from WS5 at 1.50m to 2.00m bgl had black staining and a “strong” hydrocarbon odour.

4.3.3 It should be noted that during the groundwater monitoring, an interface probe detected significant thickness of free product at these two locations (see above).

4.3.4 Visual or olfactory evidence of contamination was not reported in the other exploratory holes.

5 RISK ASSESSMENT – ANALYTICAL FRAMEWORK

5.1 Context and Objectives

5.1.1 This section seeks to evaluate the level of risk pertaining to human health and the environment which may result from both the existing use and proposed future use of the site. It makes use of the site investigation findings, as described in the previous sections, to evaluate further the potential pollutant linkages identified in the desk study. A combination of qualitative and quantitative techniques is used, as described below.

5.1.2 The purpose of generic quantitative risk assessment is to compare concentrations of contaminants found on site against screening level generic assessment criteria (GAC) to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed assessment is required. The approaches detailed all broadly fit within a tiered assessment structure in line with the framework set out in the Department of Environment, Food and Rural Affairs (DEFRA), EA and Institute for Environment and Health Publication, Guidelines for Environmental Risk Assessment and Management.

5.1.3 It should be noted that the statistical tests carried out in this report in accordance with CL:AIRE and CIEH (2008) recommendations, are for guidance purposes only and the conclusions of this report should be approved by the local authority prior to any redevelopment works being undertaken.

5.2 Analytical Framework – Soils

5.2.1 There is no single methodology that covers all the various aspects of the assessment of potentially contaminated land and groundwater. Therefore, the analytical framework adopted for this investigation is made up of a number of procedures, which are outlined below. All of these are based on a Risk Assessment methodology centred on the identification and analysis of Source – Pathway – Receptor linkages.

5.2.2 The CLEA model provides a methodology for quantitative assessment of the long term risks posed to human health by exposure to contaminated soils. Toxicological data have been used to calculate Soil Guideline Values (SGV) for individual contaminants, based on the proposed site use; these represent minimal risk concentrations and may be used as screening values.

5.2.3 In the absence of any published SGVs for certain substances, or where the assumptions made in generating the SGVs do not apply to the site, Jomas Associates Limited have obtained Tier 1 screening values for initial assessment of the soil, based on available current UK guidance including the LQM/CIEH S4ULs and DEFRA C4SL. Site-specific assessments are undertaken wherever possible and/or applicable. All assessments are carried out in accordance with the CLEA protocol.

5.2.4 CLEA requires a statistical treatment of the test results to take into account the normal variations in concentration of potential contaminants in the soil and allow comparisons to be made with published guidance.

5.2.5 The assessment criteria used for the screening of determinands within soils are identified within Table 5.1.

Table 5.1: Selected Assessment Criteria – Contaminants in Soils

Substance Group	Determinand(s)	Assessment Criteria Selected
Organic Substances		
Non-halogenated Hydrocarbons	Total Petroleum Hydrocarbons (TPHCWG banded)	S4UL
	Total Phenols	S4UL
Polycyclic Aromatic Hydrocarbons (PAH-16)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(ghi)perylene	S4UL
Volatile Organic Compounds (VOCs/sVOCs).	Toluene, Ethylbenzene, Benzene, Xylenes	S4UL
Inorganic Substances		
Heavy Metals and Metalloids	Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, Copper, Zinc	S4UL
	Copper, Zinc, Nickel	BS: 3882 (2015).
Cyanides	Free Cyanide	CLEA v1.06
Sulphates	Water Soluble Sulphate	BRE Special Digest 1:2005

5.3 BRE

5.3.1 The BRE Special Digest 1:2005, 'Concrete in Aggressive Ground' is used with soluble sulphate and pH results to assess the aggressive chemical environment of future underground concrete structures at the site.

5.4 Analytical Framework – Groundwater and Leachate

5.4.1 The requirement to protect groundwater from pollution is outlined in Groundwater protection: Principles and practice (GP3, EA, August 2013, v1.1).

5.4.2 Where undertaken, the groundwater quality analysis comprises a Level 1 assessment in accordance with the EA Remedial Targets Methodology Document (EA, 2006).

5.4.3 The criteria used by Jomas' in the Level 1 assessment of groundwater and leachate quality are shown in Table 5.2.

Table 5.2: Selected Assessment Criteria – Contaminants in Water

Substance Group	Determinand(s)	Assessment Criteria Selected
Metals	Arsenic, Copper, Cyanide, Mercury, Nickel, Lead, Zinc, Chromium	EQS/DWS
	Selenium	DWS
PAHs	Sum of Four – benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene	DWS
PAHs	Benzo(a)pyrene,	DWS
PAHs	Remainder	LEC
Total Petroleum Hydrocarbons	Aliphatic C5-C6, Aliphatic >C6-C8, Aliphatic >C8-C10. Aliphatic >C10-C12, Aliphatic >C12-C16, Aliphatic >C16-C21, Aromatic C5-C7, Aromatic >C7-C8, Aromatic >C8-C10, Aromatic >C10-C12, Aromatic >C12-C16, Aromatic >C16-C21, Aromatic> C21-C35	DWS/WHO
Benzene	Benzene	DWS
Toluene	Toluene	EQS
Ethylbenzene	Ethylbenzene	EQS
Xylene	Xylene	EQS
Oxygen Demand	Chemical Oxygen Demand and Biological Oxygen Demand	Urban Waste Water Treatment (England and Wales) Regulations

Environmental Quality Standards EQS

Environmental Quality Standards (EQS) have been released by the EA for dangerous substances, as identified by the EC Dangerous Substances Directive. EQS can vary for each substance, for the hardness of the water and can be different for fresh, estuarine or coastal waters.

Lowest Effect Concentration (LEC)

These criteria relate to the concentration of PAHs in groundwater. They are taken from the EA R&D Technical Report P45 – Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environmental Quality Standard Development (2001).

WHO Health

These screening criteria have been taken from the World Health Organisation Guidelines for Drinking Water Quality (1984). The health value is a guideline value representing the concentration of a contaminant that does not result in any significant risk to the receptor over a lifetime of exposure.

Further criteria have been obtained from 'Petroleum Products in Drinking-water' - Background document for development of WHO Guidelines for Drinking-water Quality (2005).

UK Drinking Water Standards (DWS)

These comprise screening criteria provided by the Drinking Water Inspectorate (DWI) in the Water Supply (Water Quality) Regulations 2006,

Urban Waste Water Treatment (England and Wales) Regulations - UWWT Regs
The Urban Waste Water Treatment (England and Wales) Regulations SI/1994/2841 as amended by SI/2003/1788 sets down minimum standards for the discharge of treated effluent from waste water treatment works to inland surface waters, groundwater, estuaries or coastal waters. Standards of (125mg/L) COD and (25mg/L) BOD have been set.

5.5 Site Specific Criteria

5.5.1 The criteria adopted in the selection of correct screening criteria from published reports as previously described, are provided within Tables 5.3.

Table 5.3: Site Specific Data

Input Details	Value
Land Use	Residential with plant uptake
Soil Organic Matter	1%

5.5.2 As the published reports only offer the option of selecting an SOM value of 1%, 2.5% or 6%, an SOM value of 1% has been used for the generation of generic assessment criteria, as 1.33% was the mean value obtained from laboratory analysis.

5.5.3 It is understood that the existing buildings on site are to be demolished and a new four-storey residential development will be constructed. Private gardens are proposed. As a result, the site has been assessed as residential with plant uptake.

6 GENERIC QUANTITATIVE RISK ASSESSMENT

6.1 Screening of Soil Chemical Analysis Results – Human Health Risk Assessment

6.1.1 To focus on the contaminants of potential concern (COPC), the results have been compared with the respective SGV/GAC. Those contaminants which exceed the SGV/GAC are considered to be the COPC. Those which do not exceed the respective SGV/GAC are not considered to be COPC and as such do not require further assessment in relation to the proposed development of the site.

6.1.2 Laboratory analysis for soils are summarised in Tables 6.1 to 6.4. Raw laboratory data is included in Appendix 3.

Table 6.1: Soil Laboratory Analysis Results – Metals, Metalloids, Phenol, Cyanide

Determinand	Unit	No. samples tested	Screening Criteria		Min	Max	No. Exceeding
Arsenic	mg/kg	8	S4UL	37	9.5	22	0
Cadmium	mg/kg	8	S4UL	11	<0.2	0.4	0
Chromium	mg/kg	8	S4UL	910	25	64	0
Lead	mg/kg	8	C4SL	200	19	760	2No.; WS1 at 0.25mbgl WS7 at 0.40mbgl
Mercury	mg/kg	8	S4UL	40	<0.3	<0.3	0
Nickel	mg/kg	8	S4UL	180	24	51	0
Copper	mg/kg	8	S4UL	2400	22	270	0
Zinc	mg/kg	8	S4UL	3700	78	240	0
Total Cyanide [A]	mg/kg	8	CLEA v 1.06	33	<1	2	0
Selenium	mg/kg	8	S4UL	250	<1.0	<1.0	0
Boron Water Soluble	mg/kg	8	S4UL	290	2.2	16	0
Phenols	mg/kg	8	S4UL	120	<1.0	<1.0	0

Notes: [A] Generic assessment criteria derived for free inorganic cyanide.

Table 6.2: Soil Laboratory Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs)

Determinand	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeding
Naphthalene	mg/kg	8	S4UL	2.3	<0.05	3.6	1No.; WS2 at 0.50mbgl
Acenaphthylene	mg/kg	8	S4UL	170	<0.05	0.49	0
Acenaphthene	mg/kg	8	S4UL	210	<0.05	2.1	0
Fluorene	mg/kg	8	S4UL	170	<0.05	1.6	0
Phenanthrene	mg/kg	8	S4UL	95	<0.05	18	0

Determinand	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeding
Anthracene	mg/kg	8	S4UL	2400	<0.05	4.7	0
Fluoranthene	mg/kg	8	S4UL	280	<0.05	21	0
Pyrene	mg/kg	8	S4UL	620	<0.05	17	0
Benzo(a)anthracene	mg/kg	8	S4UL	7.2	<0.05	13	3No.; WS1 at 0.25mbgl WS2 at 0.50mbgl WS7 at 0.40mbgl
Chrysene	mg/kg	8	S4UL	15	<0.05	8.0	0
Benzo(b)fluoranthene	mg/kg	8	S4UL	2.6	<0.05	10	3No.; WS1 at 0.25mbgl WS2 at 0.50mbgl WS7 at 0.40mbgl
Benzo(k)fluoranthene	mg/kg	8	S4UL	77	<0.05	4.5	0
Benzo(a)pyrene	mg/kg	8	S4UL	2.2	<0.05	10	3No.; WS1 at 0.25mbgl WS2 at 0.50mbgl WS7 at 0.40mbgl
Indeno(123-cd)pyrene	mg/kg	8	S4UL	27	<0.05	4.6	0
Dibenzo(ah)anthracene	mg/kg	8	S4UL	0.24	<0.05	0.94	3No.; WS1 at 0.25mbgl WS2 at 0.50mbgl WS7 at 0.40mbgl
Benzo(ghi)perylene	mg/kg	8	S4UL	320	<0.05	4.2	0
Total PAH	mg/kg	8	-	-	<0.80	124	-

Table 6.3: Soil Laboratory Analysis Results – Total Petroleum Hydrocarbons (TPH)

TPH Band	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeding
C_8-C_{10}	mg/kg	2	S4UL	27	<0.1	<0.1	0
>C_{10}-C_{12}	mg/kg	2	S4UL	74	<2.0	6.6	0
>C_{12}-C_{16}	mg/kg	2	S4UL	140	11	27	0
>C_{16}-C_{21}	mg/kg	2	S4UL	260	83	190	0
>C_{21}-C_{35}	mg/kg	2	S4UL	1100	220	690	0
Total TPH	mg/kg	2	-	-	316.1	913.7	-

Note: *The lower value of guidelines for Aromatic/Aliphatics has been selected

Table 6.4: Soil Laboratory Analysis Results – Total Petroleum Hydrocarbons (TPHCWG)

TPH Band	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeding
>C_5-C_6 Aliphatic	mg/kg	7	S4UL	42	<0.001	<0.001	0
>C_6-C_8 Aliphatic	mg/kg	7	S4UL	100	<0.001	<0.001	0
>C_8-C_{10} Aliphatic	mg/kg	7	S4UL	27	<0.001	<0.001	0
>C_{10}-C_{12} Aliphatic	mg/kg	7	S4UL	130	<1.0	42	0
>C_{12}-C_{16} Aliphatic	mg/kg	7	S4UL	1100	<2.0	130	0
>C_{16}-C_{35} Aliphatic	mg/kg	7	S4UL	65000	<16.0	4290	0
>C_5-C_7 Aromatic	mg/kg	7	S4UL	70	<0.001	<0.001	0
>C_7-C_8 Aromatic	mg/kg	7	S4UL	130	<0.001	<0.001	0
>C_8-C_{10} Aromatic	mg/kg	7	S4UL	34	<0.001	<0.001	0
>C_{10}-C_{12} Aromatic	mg/kg	7	S4UL	74	<1.0	5.8	0
>C_{12}-C_{16} Aromatic	mg/kg	7	S4UL	140	<2.0	50	0
>C_{16}-C_{21} Aromatic	mg/kg	7	S4UL	260	<10	160	0
>C_{21}-C_{35} Aromatic	mg/kg	7	S4UL	1100	<10	2000	1No.; WS5 at 1.60mbgl
Total TPH (Ali/Aro)	mg/kg	7	-	-	<20	6700	-

6.2 Volatile Organic Compounds

6.2.1 In addition to the suites outlined previously, 7No. samples were tested for the presence of volatile organic compounds including BTEX compounds (benzene, toluene, ethylbenzene, xylene). No VOCs were reported above the laboratory detection limit within tested samples.

6.3 Soil Source Vapour Assessment

6.3.1 As outlined in the tables above, a number of compounds have been found in excess of their generic screening criteria for the protection of human health within a 'residential with plant uptake' end-use scenario. The generic screening criteria considers all possible pathways between the source and the receptor. In order to assess potential risks from inhalation of vapour, each compound that has been found in excess of its GAC will be assessed in terms of the contribution to total exposure from vapour inhalation inside a structure as reported within the LQM/CIEH S4UL document. Where a significant proportion of the total exposure is reported from vapour inhalation, there could be a potential risk from vapour inhalation.

Table 6.5: Soil Laboratory Analysis Results – Contribution to Total Exposure from Vapour Inhalation (Indoor)

Compound	Contribution of Vapour Inhalation to Total Exposure (%)	Screening Criteria (mg/kg)	Maximum recorded value (mg/kg)	Potential Vapour Risk?
Naphthalene	64.7	2.3	3.6	✓
Benzo(a)anthracene	0.1	11	13	X
Benzo(b)fluoranthene	<0.1	3.9	10	X
Benzo(a)pyrene	0.0	3.2	10	X
Dibenzo(ah)anthracene	<0.1	0.31	0.94	X
Aromatic C21-C35	0.0	1900	2000	X

6.3.2 As shown in the table above, naphthalene has significant proportion of its total exposure from vapour inhalation and has been reported in excess of the screening criteria, and therefore a potential vapour risk must be assumed to exist.

6.3.3 The well showing the highest levels of these contaminants (WS2) was positioned to target an underground petrol interceptor, and therefore removal of this feature and impacted soils may remove the source of contamination and therefore mitigate the vapour risks described above.

6.4 Asbestos in Soil

6.4.1 7No. samples of the Made Ground were screened in the laboratory for the presence of asbestos. The results of the analysis is summarised below in Table 6.6 below

Table 6.6: Asbestos Analysis – Summary

Sample	Screening result.	Quantification result (%)	Comments
WS1 – 0.25mbgl	None Detected	N/A	N/A
WS2 – 0.50mbgl	Detected	<0.001	Chrysotile, amosite - loose fibres
WS3 – 0.40mbgl	Detected	<0.001	Chrysotile - loose fibres
WS4 – 0.70mbgl	None Detected	N/A	N/A
WS5 – 1.00mbgl	None Detected	N/A	N/A
WS5 – 0.50mbgl	None Detected	N/A	N/A
WS7 – 0.40mbgl	Detected	<0.001	Chrysotile - loose fibres

6.4.2 The results reported an asbestos content of below 0.1%, the fibre content at which arisings are considered hazardous for the purpose of disposal.

6.4.3 It should be noted that for the purposes of human health assessment there is no level of asbestos below which it is deemed the materials are “safe”.

6.5 Statistical Analysis

6.5.1 Given the likely point sources of contamination, i.e. former and existing buried tanks and petrol interceptors, it is considered that undertaking statistical analysis would be of little benefit for the samples showing elevated hydrocarbons and PAHs.

6.5.2 In the case of Lead, as can be seen above asbestos was noted in one of the samples that exhibited elevated lead concentrations. Consequently even if statistical analysis showed that the recorded concentrations were not of concern, some remedial action would be required.

6.6 Screening of Groundwater Chemical Analysis Results

6.6.1 A sample of groundwater obtained from the borehole installation WS4 was submitted for chemical analysis. The sample was obtained using “low flow” methodology, which allows for reduced sediment sampling relative to traditional bailers, and produces the most representative samples.

6.6.2 Samples could not be obtained from WS1, WS3 or BH1 because no water was reported in the wells.

6.6.3 The results of the laboratory testing are summarised in Tables 6.7 and 6.8 below, with the raw chemical testing data presented in Appendix 3.

Table 6.7: Groundwater Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs)

Determinand	Unit	No. samples tested	Screening Criteria		Result	No. of Exceedances
Naphthalene	µg/l	1	EQS	2.4	<0.01	0
Acenaphthylene	µg/l	1	-	-	<0.01	0
Acenaphthene	µg/l	1	-	-	<0.01	0
Fluorene	µg/l	1	-	-	<0.01	0
Phenanthrene	µg/l	1	-	-	<0.01	0
Anthracene	µg/l	1	EQS	0.1	<0.01	0
Fluoranthene	µg/l	1	EQS	0.0063	<0.01	0
Pyrene	µg/l	1	-	-	<0.01	0
Benzo(a)anthracene	µg/l	1	-	-	<0.01	0
Chrysene	µg/l	1	-	-	<0.01	0
Sum of four Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(ghi)perylene Indeno(123-cd)pyrene	µg/l	1	DWS	0.1	<0.04	0
Benzo(a)pyrene	µg/l	1	DWS	0.01	<0.01	0
	µg/l	1	EQS	0.00017	<0.01	0
Dibenzo(ah)anthracene	µg/l	1	-	-	<0.01	0

***** *Laboratory method detection limit exceeds the EQS.*

Table 6.8: Groundwater Analysis Results – TPHCWG & BTEX compounds– Controlled Waters

Determinand	Unit	No. Samples tested	Screening Criteria		Result	No. of Exceedances
Benzene	µg/l	1	EQS	10	<1.0	0
	µg/l	1	DWS	1	<1.0	0
Toluene	µg/l	1	DWS	700	<1.0	0
	µg/l	1	EQS	74	<1.0	0
Ethyl benzene	µg/l	1	DWS	300	<1.0	0
Xylenes	µg/l	1	DWS	500	<2.0	0
MTBE	µg/l	1	DWS	15	<1.0	0
>C5-C6 Aliphatic	µg/l	1	WHO	15000	<1.0	0
>C6-C8 Aliphatic	µg/l	1	WHO	15000	<1.0	0
>C8-C10 Aliphatic	µg/l	1	WHO	300	<1.0	0
>C10-C12 Aliphatic	µg/l	1	WHO	300	<10	0
>C12-C16 Aliphatic	µg/l	1	WHO	300	<10	0
>C16-C21 Aliphatic	µg/l	1	WHO	-	<10	0
>C21-C35 Aliphatic	µg/l	1	WHO	90	<10	0
>C5-C7 Aromatic	µg/l	1	WHO	10	<1.0	0
>C7-C8 Aromatic	µg/l	1	WHO	700	<1.0	0
>C8-C10 Aromatic	µg/l	1	WHO	300	<1.0	0
>C10-C12 Aromatic	µg/l	1	WHO	90	<10	0
>C12-C16 Aromatic	µg/l	1	WHO	90	<10	0
>C16-C21 Aromatic	µg/l	1	WHO	90	<10	0
>C21-C35 Aromatic	µg/l	1	WHO	90	<10	0

6.6.4 In addition to the suites outlined above, the water sample was also analysed for a suite of volatile organic compounds. None of the compounds analysed for were reported above the laboratory method detection limit.

6.7 Light Non-Aqueous Phase Liquid (LNAPL)

6.7.1 Water was not obtained from WS2 or WS5 but a sample of Light Non-Aqueous Phase Liquid (LNAPL) was obtained for chemical testing.

6.7.2 2No. samples of LNAPL obtained from WS2 and WS5 were submitted to the laboratory for TPH chromatogram and product ID analysis. For both samples tested, the Total Ion Count (TIC) trace shows a carbon range from C10 to >C40 with both aromatic and aliphatic product sources. The traces do not match any standard product profiles but are indicative of lube oil.

6.8 Screening of Soil Chemical Analysis Results – Potential Risks to Plant Growth

6.8.1 Zinc, copper and nickel are phytotoxins and could therefore inhibit plant growth in soft landscaped areas. Concentrations measured in soil for these determinands have been compared with the pH dependent values given in BS: 3882 (2015).

6.8.2 Adopting a pH value of greater than 7, as indicated by the results of the laboratory analysis, the following is noted;

Table 6.9: Soil Laboratory Analysis Results – Phytotoxic Determinands

Determinand	Threshold level (mg/kg)	Min (mg/kg)	Max (mg/kg)	No. Exceeding
Zinc	300	78	240	0
Copper	200	22	270	0
Nickel	110	24	51	0

6.9 Screening for Water Pipes

6.9.1 The results of the analysis have been assessed for potential impact upon water supply pipes. Table 6.10 below summarises the findings of the assessment:

Table 6.10: Screening Guide for Water Pipes

Determinand	Threshold adopted for PE (mg/kg)	Min Value for site data (mg/kg)	Max Value from site data (mg/kg)
Total VOCs	0.5	<0.056*	<0.056*
BTEX	0.1	<0.005*	<0.005*
MTBE	0.1	<0.001*	<0.001*
EC5-EC10	1	<0.006*	<0.1*
EC10-EC16	10	<6.0*	227.4
EC16-EC40	500	<36.0*	6420
Naphthalene	5	<0.05*	3.6
Phenols	2	<1.0*	<1.0*

*Laboratory detection limit

6.9.2 The above results indicate that upgraded pipework will be required.

6.9.3 However, it should be noted that following remediation of the site this assessment may change.

6.9.4 The water supply pipe requirements for this site should be discussed at an early stage with the relevant Utility provider.

6.10 Waste Characterisation and Disposal

6.10.1 The following comments are given as guidance and should be confirmed by the waste disposal facility accepting the waste. The waste disposal facility may have their own classification methodology and are under no obligation to honour the comments given below.

6.10.2 3No. soil samples were submitted to a UKAS and MCERTS accredited laboratory for Waste Acceptance Criteria testing. The WAC results indicate that soil arisings from WS4 at 0.70mbgl and WS7 at 0.90mbgl meet the criteria for disposal at an “inert waste landfill”. The results indicate that soil arisings from WS5 at 0.50mbgl meet the criteria for disposal as “stable non-reactive hazardous waste in non-hazardous landfill”.

6.10.3 In addition to the above, the accepting waste disposal facility must be provided with all chemical results (Tables 6.1 - 6.6 and Appendix 3) for review.

7 SOIL GAS RISK ASSESSMENT

7.1 Soil Gas Results

7.1.1 Four return monitoring visits have been undertaken from 21st February to 15th March 2018, to monitor wells installed within boreholes at the site for soil gas concentrations and groundwater levels.

7.1.2 During these visits atmospheric pressure ranged between 985mb and 1026mb.

7.1.3 The results of the monitoring undertaken are summarised in Table 7.1 below, with the monitoring records presented in Appendix 5.

Table 7.1: Summary of Gas Monitoring Data

Hole No.	CH_4 (%)	CO_2 (%)	O_2 (%)	H_2S (ppm)	VOCs (ppm)	Peak Flow Rate (l/hr)	Depth to product (mbgl)	Depth to water (mbgl)	Depth of installation (mbgl)
WS1	0.0	2.1 - 3.5	18.7 - 20.3	0	0 - 8	0.0 - +0.1	-	Dry	5.00 - 5.02
WS2	0.0 - 0.1	0.2 - 0.7	20.1 - 21.6	0	6 - 21	-0.1 - +0.1	1.49 - 1.56	2.23 - 3.41	3.42
WS3	0.0	0.3 - 1.3	20.3 - 20.9	0	0 - 4	0.0 - +0.1	-	4.66 - Dry	4.86 - 4.89
WS4	0.0	0.5 - 2.3	16.4 - 20.3	0	0 - 5	0.0 - +0.4	-	4.37 - Dry	4.93 - 4.94
WS5	3.0 - 4.9	0.8 - 1.0	0.4 - 4.4	0 - 1	27 - 145	-0.4 - 0.0	1.48 - 1.54	1.64 - 1.85	4.92 - 4.95
BH1	0.0	1.1 - 1.9	18.9 - 19.5	0	0 - 5	+0.1 - +0.2	-	Dry	5.07 - 5.10

7.2 Screening of Results

7.2.1 As shown in Table 7.1, methane has been reported to a maximum concentration of 4.9% v/v. Carbon dioxide has been reported to a maximum concentration of 3.5% v/v. Screening of the monitoring well headspaces with a photo-ionisation detector (PID) has detected maximum Volatile organic compound (VOC) concentration to a maximum level of 145 ppm. A maximum flow rate of +0.4l/hr has been reported.

7.2.2 In the assessment of risks posed by hazardous ground gases and selection of appropriate mitigation measures, BS: 8485 (2015) identifies four types of development, termed Type A to Type D. Type A buildings are defined as

"Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises."

7.2.3 Type A has been adopted as the relevant category for the proposed development.

7.2.4 The soil gas assessment method is based on that proposed by Wilson & Card (1999), which was a development of a method proposed in CIRIA publication R149 (CIRIA, 1995). The method uses both gas concentrations and borehole flow rates to define a characteristic situation based on the limiting borehole gas volume flow for methane and carbon dioxide. In both these methods, the limiting borehole gas volume flow is renamed as the Gas Screening Value (GSV).

7.2.5 The Gas Screening Value (litres of gas per hour) is calculated by using the following equation

GSV = (Concentration/100) X Flow rate

Where concentration is measured in percent (%)
and flow rate is measured in litres per hour (l/hr)

7.2.6 The Characteristic Situation is then determined from Table 8.5 of CIRIA C665.

7.2.7 To accord with C665, worst case conditions are used in the calculation of GSVs for the site.

7.2.8 A worst case flow rate of 0.4l/hr (maximum reported) will be used in the calculation of GSVs for the site. The Characteristic Situation is then determined from Table 8.5 of CIRIA C665.

7.2.9 To accord with C665, worst case conditions are used in the calculation of GSVs for the site. These have been summarised below in Table 7.2

Table 7.2: Summary of Gas Monitoring Data

Gas	Concentration (v/v %)	Peak Flow Rate (l/hr)	GSV (l/hr)	Characteristic Situation (after CIRIA C665)
CO_2	3.5	0.4	**0.014**	**1**
CH_4	4.9	0.4	**0.0196**	**1**

7.2.10 The methodology set out in BS 8485 (2015) has been used for determining the required gas protection measures. Although the site is a CS1 based on GSV calculations, concentrations of CH_4 were reported greater than 1.0% v/v, and therefore consideration must be given to increasing this to CS2. Specialist ground gas risk assessments may prove that this is not necessary.

7.2.11 Elevated methane was only detected in WS5 which was positioned to target two former kerosene and diesel tanks. Product was also noted within the well. Therefore, it is assumed that the source of ground gas is due to hydrocarbon contamination from these tanks. A course of ground gas monitoring should be undertaken following removal of tanks and any remedial work undertaken at the site to remove the potential source of elevated methane.

7.2.12 A CS2 site on a Type A development requires a minimum of 3.5 protection points in accordance with B8485.

7.2.13 A basement is to be formed under approximately half of the building due to the topography. Assuming the basement floor and walls conform to BS 8102:2009 - Grade 2 waterproofing, then this will provide the site with 2 protection points. If basement floor and walls conform to BS 8102:2009 - Grade 3 waterproofing, this will provide 2.5 protection points.

7.2.14 This can be achieved in a number of ways, within BS8485 it is recommended that a range of protection measures are utilised with a minimum of two separate methods chosen from the three groupings (Structural, Ventilation and Barrier).

Table 7.3: Recommended Gas Protection Measures

Protection Measures	BS 8485 Score
Structural Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations	**1.5**
Ventilation Active positive pressurization by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket	**2.5**
Barrier Gas/hydrocarbon vapour resistant membrane meeting all of the following criteria: • sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); • sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); • sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • verified in accordance with CIRIA C735	**2**
MINIMUM REQUIRED TOTAL	**3.5**

7.2.15 During construction where personnel are required to enter excavations of greater than 1.2m the air quality (Carbon Dioxide, Methane and Oxygen as a minimum) should be regularly checked prior and during person entry. Appropriate precautions, including but not limited to, venting, PPE and gas alarms should be undertaken

7.2.16 Any permanent excavations such as manholes, inspection chambers or other void spaces formed beneath the sites ground surface are potential ground gas traps and precautions, as per above, are considered the minimum necessary prior to person entry.

7.2.17 BS 8576:2013 has been used to derived threshold levels for Carbon Monoxide and Volatile Organic Compounds.

7.2.18 Given the recorded levels it is not considered that additional protection measures need to be incorporated to protect end users from the recorded Carbon Monoxide concentrations.

7.2.19 PID screening of the monitoring well headspace has revealed maximum concentrations of VOCs of 145ppm. No VOCs were detected in soils or water tested in the laboratory. The likely source of elevated VOCs is the identified LNAPL encountered within WS5. It is considered that the PID screening of monitoring well confirms the assessment that risks to human health receptors via vapour inhalation pathways require further evaluation once remedial works are undertaken.

8 SUMMARY OF RESULTS

8.1 Land Quality Impact Summary

8.1.1 Following the ground investigation, the following is noted:

- It is understood that the proposed development will involve the demolition of the existing building and construction of a new four-storey residential development. The new development will include a lower ground floor (half of which is below ground due to slope of ground) and a full single -storey basement below. The new building will be located in approximately the same footprint as the existing building, but the basement level will extend out to under most of the site. Proposed plans indicate that private garden will be included.

- Following generic risk assessments, elevated concentrations of lead, naphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene and C21-C35 aromatic hydrocarbons were detected in soils in excess of generic assessment criteria for the protection of human health within a 'residential with plant uptake' end-use scenario.

- Asbestos in the form of chrysotile and amosite - loose fibres were detected in 3No. samples analysed in the laboratory. These were quantified to <0.001%, lesser than the 0.1% fibre content where arisings are considered hazardous for the purpose of disposal.

- Given the locations of the soil exceedances in relation to the location of suspected underground fuel tanks, it is considered likely that underground tanks are the source of the hydrocarbon contamination in soil. Removal of these tanks and associated impacted soil will be required to partly address these risks.

- A basement is proposed under the majority of the site. As a result, soils will be removed down to approximately 3.5-4.0m bgl. This removal of soil would also remove significant amounts of (if not all of) the contaminated soils.

- Due to the presence of asbestos, any areas of proposed soft landscaping should comprise at least 600mm of clean imported soil placed on a break layer. Where crush concrete is used as a break layer, a 200mm thick layer may be installed as part of the 600mm cover.

- Groundwater analysis has reported no concentrations of contaminants above the laboratory detection limit. Due to several installations reported as 'dry' and the underlying geology (London Clay - unproductive strata) it is considered that the water encountered represents surface water ingress as oppose to groundwater. Of greater concern is the "free product" reported to be floating on the surface of the water within WS2 and WS5. The source of this product is likely to be water migrating though the contaminated Made Ground. Any product encountered during the tank removal works must also removed. Due to the underlying London Clay, identified as unproductive strata, the product and contaminants within soil are unlikely to migrate to impact off-site controlled waters receptors.

- Calculating the Gas Screening Value using worst case results indicates Characteristic Situation 1. However, concentrations of methane are raised at

the site, with corresponding depleted oxygen, meaning raising the site to CS2 must be considered.

- It is noted that the elevated levels were only recorded in a single well (WS5) in close proximity to the underground tank locations, with product also reported within the installation. The other wells on site reported significantly reduced gas readings. It is possible that following remediation of the site, including the removal of the underground tanks and associated contaminated soils and free product, future monitoring may be able to reduce the level of gas protection required. Given the levels of potentially volatile contaminants identified within soil, a vapour resistant membrane may be required within the proposed structures.

- As with any ground investigation, the presence of further hotspots between sampling points cannot be ruled out.

- A remediation strategy and subsequent verification report will be required.

8.1.2 The above conclusions are made subject to approval by the statutory regulatory bodies.

8.2 Review of Pollutant Linkages Following Site Investigation

8.2.1 The site CSM has been revised and updated from that suggested in the desk study in view of the ground investigation data, including soil laboratory analysis results. Table 8.1 highlights whether pollutant linkages identified in the original CSM are still relevant following the risk assessment, or whether pollutant linkages, not previously identified, exist.

Table 8.1: Plausible Pollutants Linkages Summary (Pre Remediation)

Potential Source (from desk study)	Pathway	Receptor	Relevant Pollutant Linkage?	Comment
• Potential for hydrocarbon contaminated ground associated with previous site use as fuel station/garage – on site (S1) • Potential for Made Ground associated with previous development operations – on site (S2) • Potential buried tanks associated with former use as a fuel station/garage – on site (S3) • Current and previous industrial use – off site (S4) • Potential asbestos containing materials within existing buildings – on site (S5) • Potential asbestos impacted soils from demolition of previous buildings – on site (S6) • Potential ground gas generation associated with hydrocarbon impacted soils from historic use as fuel station - on site (S7)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	✓	see 8.1 above for remedial measures. A remediation strategy and subsequent verification report will be required. The findings of this report should be included in the construction health and safety file, with adequate measures put in place for the protection of construction and maintenance workers.
	• Accumulation and migration of soil gases (P5)		✓	Gas Protection measures are required. However, additional monitoring undertaken post-remediation may reduce this or prove otherwise.
	• Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4)	• Neighbouring site users (R3) • Building foundations and on site buried services (water mains, electricity and sewer) (R5) • Controlled Waters (Culvert) (R6)	✓	Remedial measures required and set out in Section 8.1. All free product should be removed form site. Contact should be made with relevant utility providers to confirm if upgraded materials are required. It should be noted that remediation may negate the requirement for this.

9 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

9.1 Ground Investigation Summary

9.1.1 No detailed structural engineering design information, with respect to the type of construction and associated structural loadings, was provided at the time of preparing this report. Consequently, a detailed discussion of all the problems that may arise during the proposed redevelopment scheme is beyond the scope of this report.

9.1.2 Practical solutions to the difficulties encountered, both prior to, and during construction, are frequently decided by structural constraints or economic factors. For these reasons, this discussion is predominantly confined to remarks of a general nature, which are based on site conditions encountered during the intrusive investigations.

9.1.3 It is understood that the proposed development will involve the demolition of the existing building and construction of a new four-storey residential development. The new development will include a lower ground floor (half of which is below ground due to slope of ground) and a full single -storey basement below. The new building will be located in approximately the same footprint as the existing building, but the basement level will extend out to under most of the site. Proposed plans indicate that private garden will be included.

9.2 Geotechnical Classification

9.2.1 At the Desk Study stage this development was deemed to be a GC2 development in accordance with BS: 1997.

9.2.2 The findings of the investigation undertaken and discussed previously does not change this assessment.

9.3 Data Summary

9.3.1 The results of the ground investigation revealed a ground profile comprising a variable thickness of Made Ground up to 1.20mbgl overlying London Clay Formation to the base of the borehole at 24.95mbgl.

9.3.2 A summary of ground conditions obtained from the ground investigation and the derived geotechnical parameters, is provided in Table 9.1 below.

Table 9.1: Ground Conditions and Derived Geotechnical Parameters

Strata	Depth Encountered (from-to) (mbgl)	SPT 'N' Value	Inferred Shear Strength (kPa)	Measured Shear Strength (kPa)	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (corrected plasticity) (%)	NHBC Volume Change Classification
Reinforce concrete over dark brown sandy gravelly clay. Gravel consists of fine to coarse sub-angular to sub-rounded flint, brick and concrete. (MADE GROUND) Encountered to base of WS6. No recovery from 1.10mbgl in WS2.	0.00 to 0.30 - 1.20	-	-	-	-	-	-	-	-
Brown mottled grey CLAY (LONDON CLAY FORMATION) Encountered to the base of WS1, WS3, WS4, WS5, WS7, BH1 & BH2	0.30 - 1.20 to >4.45 - >24.95	0 - 41	0 - 184.5	72 - 160	26 - 34	72 - 80	26 - 32	44 - 52 (43.56 - 52)	High

9.4 Undrained Shear Strength

9.4.1 Standard Penetration Tests were undertaken at regular intervals throughout the window sampler holes and cable percussive boreholes within the London Clay Formation. Due to the shallow nature of the Made Ground no tests were carried out with those materials.

9.4.2 The N values recorded in the London Clay Formation varies with depth, this infers that the undrained shear strength of the clay similarly varies. Figure 9.1 below shows the undrained shear strength inferred by the correlation suggested by Stroud (1974),

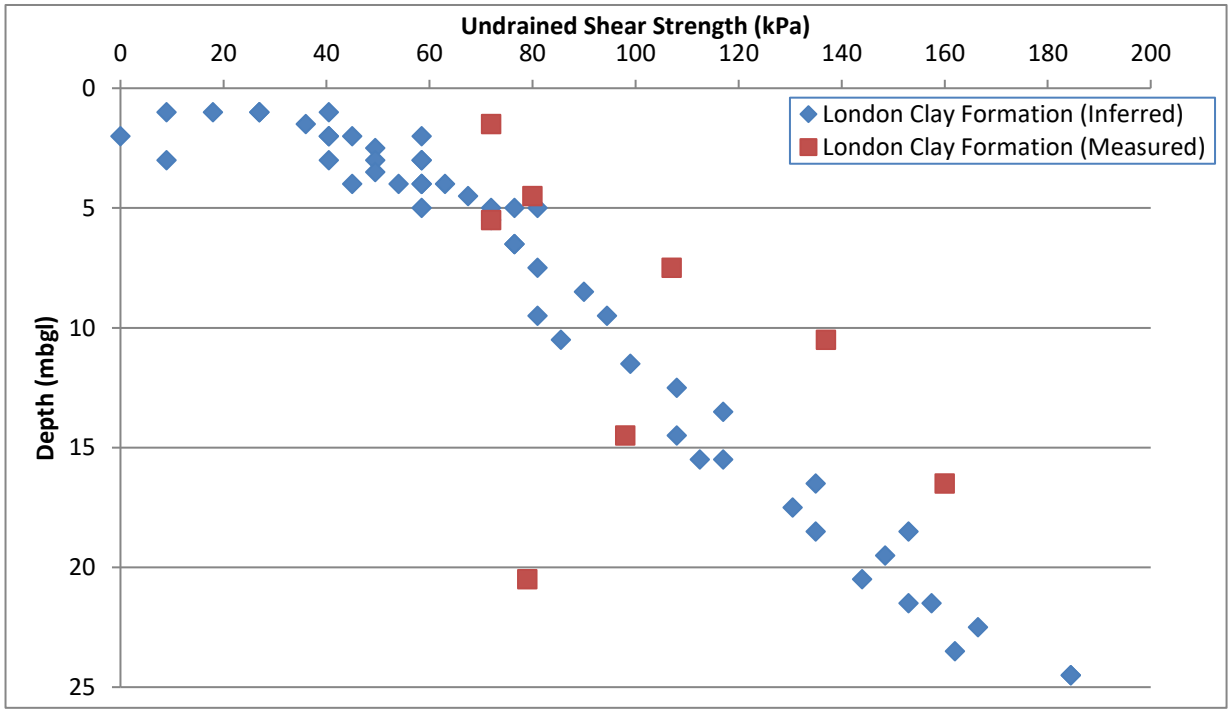
$c_u = f_1 \times N$ can be applied,

in which
c_u= mass shear strength (kN)
f_1 = constant
N= SPT Value achieved during boring operations

9.4.3 In the above equation f_1 is dependent on the plasticity of the material that the SPT is being carried out in. As the plasticity indices were shown to be greater than 27% a value for f_1 of 4.5 has been adopted after Tomlinson (2001).

9.4.4 The graph below shows the shear strength profile of the London Clay Formation encountered at the site, based on the SPT to shear strength correlation described above, as well as the results of undrained triaxial tests on undisturbed samples taken from the boreholes.

Figure 9.1: Undrained Shear Strength v Depth



9.4.5 As can be seen from above using a f_1 of 4.5 provided a generally good correlation between the inferred undrained shear strengths and the measured results. A f_1 of 5 could be used but due to the conservative nature of using 4.5 this value has been kept.

9.4.6 It should be noted that some very low strengths were inferred at 1m - 3m in WS5. This location was located in close proximity to a known tank and at 4m the recorded SPT 'N' values (and thus the inferred undrained shear strengths) jump up to levels noted elsewhere. It is possible that the materials noted between 1m and 3m in WS5 are actually materials disturbed to allow the installation of the known tanks.

9.5 Coefficient of Compressibility

9.5.1 Stroud and Butler (1974) developed a relationship between the coefficient of compressibility (m_v) and SPT 'N' value.

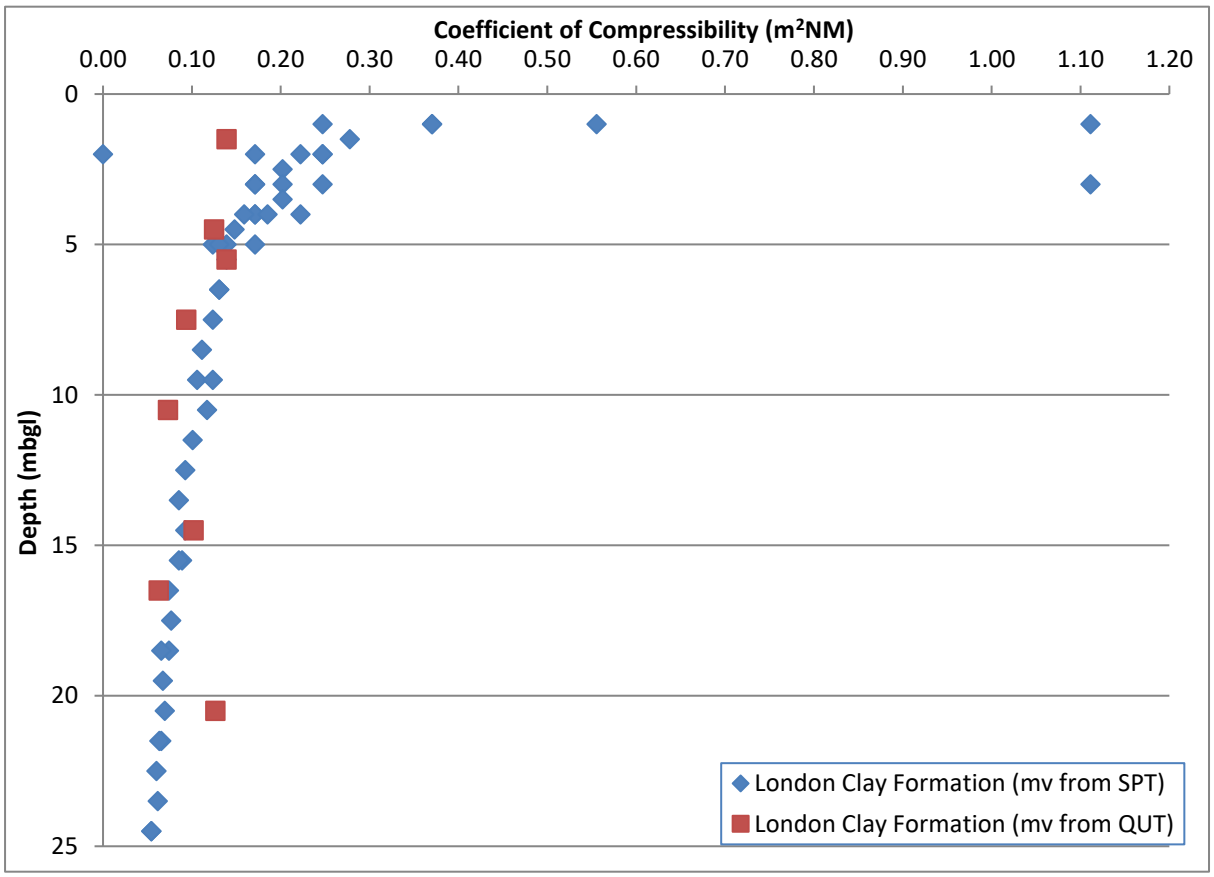
$m_v = 1 / (f_2 \times N)$ can be applied,

in which
m_v = coefficient of compressibilty (m^2/MN)
f_2 = constant dependant on the plasticity index
N = SPT Value achieved during boring operations

9.5.2 Using the plasticity indices obtained (See Table 9.1) and the graphs provided in Tomlinson (2001) a value of f_2 of 0.45 has been taken and used with the SPT 'N' values to infer coefficient of compressibility (m_v).

9.5.3 Where the undrained shear strength of the clays was obtained using the quick undrained triaxial methodology the m_v value was used by rearranging the equations for f_1 and f_2 and the measured undrained shear strength.

Figure 9.2: of Coefficient of Volume Compressibility (m_v) v Depth



9.5.4 As would be expected, the results reduce with depth as the clay increases in strength and the over burden increases, reducing the potential for compressibility.

9.5.5 As would be expected the results from of the London Clay are generally of “low” to “medium” compressibility. A number of near surface clays are noted to be of “high” compressibility. However this is considered to be due to the lack of overburden pressure allowing the clays to relax and so compress slightly as well as the potential for these materials to be disturbed / Made Ground.

9.6 Building Near Trees

9.6.1 The underlying soil conditions have been shown to be of high volume change potential.

9.6.2 Using the geotechnical testing obtained (summarised in Table 9.1) and with reference to NHBC Chapter 4.2 it can be seen that a minimum founding depth of 1.50m will be required. This would allow for restricted new planting.

9.6.3 As a basement is proposed, the foundations are likely to be formed at a depth greater than the 1.50m minimum founding depth.

9.6.4 Presence of existing and proposed trees may increase this minimum depth. It is recommended that a tree survey that should include: location, species and height of all trees on and near to the proposed development is recommended.

9.6.5 Guidance is also given in relation to other aspects of construction where the shrink / swell potential of the soils may be needed to take into consideration. This guidance is summarised in the appropriate sections below.

9.7 Foundations

9.7.1 Foundations should not be formed in either the Made Ground or Topsoil due to the unacceptable risk of total and differential settlement. It should be noted that the demolition and removal of existing structures including, foundations, services, tanks etc may increase the depth of Made Ground on the site.

9.7.2 It is considered likely that an excavation circa 4.0m deep, below the ground level at the front of the site, would be required to form the basement.

9.7.3 The topography of the site means that the finished floor level would be at significantly different levels below local ground level, increasing towards the rear (north-east) of the site.

9.7.4 Based upon the information obtained to date, it is considered that a cantilever retaining wall installed may be constructed with an allowable bearing pressure of 80kPa at 4.0m below the ground level adjacent to Highgate Road.

9.7.5 The exact allowable bearing capacity that could be achieved would need to be reviewed on receipt of foundation design details. This would include a check against sliding failure would need to be made to the retaining wall design. This may alter the above recommendations

9.7.6 If a greater allowable bearing capacity is required and towards the rear of the site where there could be upto two storeys of basement, then it is considered that conventional foundations would be unsuitable for the proposed development and a piled foundation solution within the underlying London Clay should be considered.

9.7.7 The piled foundations will carry their working load in a combination of skin friction along the sides of the pile and end bearing at the base of the pile. The piles should be designed by a suitably qualified and experienced piling specialist using a suitable factor of safety with the settlement at working load specified to meet any structural requirements. Table 9.2 provides some indicative capacities for a single pile for the diameter and depths shown.

Table 9.2: Indicative Piles Capacities (kN)

Pile toe depth (m bgl)	Pile diameter (m)					
	0.30	0.45	0.60	0.75	0.90	1.20
	Indicative Allowable Pile Capacity (kN)					
10	140	220	315	415	530	785
12	190	300	425	555	700	1025
14	250	390	545	715	895	1295
16	315	490	680	885	1105	1585
18	385	600	830	1075	1340	1910
20	465	605	840	1095	1365	1955

9.7.8 The above assumes a bored piling system. Other methods of piling and equipment may provide different results.

9.7.9 Should any loading be placed directly on the ground which cause the ground to settle relative to the piles then additional negative skin friction loads could be imposed on the piles.

9.7.10 If piling is used then an engineered granular piling mat designed and constructed to BRE 470 would need to be constructed to support the rig to prevent it overturning and / or sinking into the ground.

9.7.11 Once structural loads have been fully determined a full design check in accordance with BS EN 1997 should be undertaken to confirm suitability of foundation choice.

9.7.12 Alternatively, a fully embedded retaining wall consisting of a contiguous or secant piled box could be utilised to form the basement. Such a retaining wall would also need to be designed to carry structural loadings. The piles should be designed to withstand the earth pressures, and still meet the required structural requirements regarding issues such as deflection, deformation and bending.

9.7.13 The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably qualified Engineer. Once structural loads have been fully determined a full design check in accordance with BS EN 1997 should be undertaken to confirm suitability of foundation choice.

9.8 Concrete in the Ground

9.8.1 Sulphate attack on building foundations occurs where sulphate solutions react with the various products of hydration in Ordinary Portland Cement (OPC) or converted High-Alumina Cement (HAC). The reaction is expansive, and therefore disruptive, not only due to the formation of minute cracks, but also due to loss of cohesion in the matrix.

9.8.2 In accordance with BRE Special Digest 1, as there are less than 10 results in the data set the highest value has been taken.

9.8.3 Table 9.3 summarises the analysis of the aggressive nature of the ground for each of the strata encountered within the ground investigation.

Table 9.3: Concrete in the Ground Classes

Stratum	No. Samples	pH range	Highest WS Sulphate (mg/l)	Design Sulphate Class	ACEC Class
Made Ground	5	8.6 - 10.7	1780	DS-3	AC-2s
London Clay Formation	9	6.6 - 9.0	6100	DS-5	AC-4s

9.8.4 It should be noted that within the BRE SD-1 where there are results from 10 or more samples from a strata the mean of the top 20% is taken as the design value. The highest value noted and used in the above assessment is approximately twice as high as the next value and is considered likely to be due to the disseminated pyrite noted to exist in the London Clay Formation.

9.8.5 Taking the mean of the two highest results obtained would mean that concrete could be designed to designed to design sulphate DS4 and ACEC Class AC-3s.

9.9 Ground Floor Slabs

9.9.1 Given that there is to be a basement formed on the site, it is expected that the finished floor level would be approximately 4.5m below current ground level.

9.9.2 If a cantilever retaining wall is utilised, then a ground bearing floor slab could be used. Such a slab would need to be constructed on a suitable thickness of engineered granular material.

9.9.3 In this case, formations of the structures should be inspected by a competent person. Any loose or soft material should be removed and replaced with well-graded, properly compacted granular fill or lean mix concrete. The formation should be blinded if left exposed for more than a few hours or if inclement weather is experienced.

9.9.4 Such a floor slab would also need to be suitably reinforced, not only to distribute the structural loading but also to ensure that the floor slab can prop the retaining walls and does not buckle from the lateral pressures imposed by the cantilever retaining walls.

9.9.5 Such a floor slab could also be used for a fully embedded retaining wall (secant or contiguous piled retaining wall) however the floor would need to be independent of the walls. In normal circumstances such a retaining wall would use a suspended floor slab, in which case the piles would need to be designed to carry the floor loads as well as the structural loads. The void beneath such a suspended floor slab would require a clear void or equivalent compressible material to provide an equivalent of 150mm void.

9.9.6 The floor slab (and basement walls) would need to be constructed to conform to BS: 8102 (2009).

9.10 Excavations

9.10.1 It is likely that some shallow excavations will be required at the site for services etc, in addition to larger excavations during the remediation and construction works. These are anticipated to remain stable for the short term only.

9.10.2 The stability of all excavations should be assessed during construction. The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported or battered back to a safe angle.

9.10.3 Due to the requirement to remove former fuel tanks from the site and the location of these tanks in relation to the site boundary and specifically the highway, it may not be possible to batter back, and additional support will be required.

9.10.4 As these excavations need to be undertaken to remediate the site it would make sense to attempt to schedule the remedial and construction works so that retaining walls / foundations etc could be formed directly into the remedial excavations rather than having to back fill and then re-excavate.

9.10.5 For the north-east of the site where there is likely to be upto two storeys of basement and a fully embedded retaining wall is likely to be required, it would be prudent to install the piles first to act as the retaining wall to support the excavations to form the basement.

9.10.6 Given the noted ground gas conditions, protective precautions and monitoring of the gas levels within excavations of 1.2m or deeper prior to persons entering the excavations.

9.11 Retaining Walls

9.11.1 At the current time, it is not known how the retaining walls to the basement will be constructed. It is assumed that the retaining walls will be of the cast in-situ cantilever type and formed in short sections to help prevent instability issues.

9.11.2 These walls would need to be designed to both withstand the earth pressures and to be able to transfer the above loading successfully i.e. the retaining wall should be designed to act as a foundation for the structure.

9.11.3 A check against sliding failure would need to be made to the retaining wall design. This may alter the above recommendations regarding allowable bearing capacities.

9.11.4 At the current time, insufficient structural information is available to allow details of the retaining wall to be determined. Given the obtained information it is considered that a friction angle for the materials could be taken as 0° in its undrained state.

9.11.5 Given the proposed depth of the basement, it is considered that heave precautions will not be required at the base of the underpinned walls. However, where underpinning extends up above 3mbgl, it would be recommended that heave precautions are included. Given the high-volume change potential of the underlying clays these should consist of 35mm void or the equivalent thickness of compressible material adjacent to the foundation.

9.12 Groundwater Control

9.12.1 Groundwater was not encountered during drilling of any of the exploratory holes, though water was noted to seep into WS2 at 1.1mbgl and WS4 at 4.5mbgl.

9.12.2 During return monitoring groundwater was reported at depths of between 1.64m and 4.66m bgl within WS2, WS3, WS4 and WS5. No water was reported within WS1 or BH1 during any monitoring visit. Such variance suggests the ingress of surface water, as opposed to the natural groundwater table.

9.12.3 Subject to seasonal variations, any groundwater encountered during site works could be readily dealt with by conventional pumping from a sump used to collate waters. Surface water or rainfall ingress could be similarly dealt with.

10 BASEMENT IMPACT ASSESSMENT

10.1 Basement Impact Assessment (BIA)

10.1.1 The BIA uses information produced as part of the Desk Study (Jomas - March 2018). The full report should be referred to in conjunction with the below.

10.2 Flood Resilience

10.2.1 In accordance with general basement flood policy and basement design, the proposed development will utilize the flood resilient techniques recommended in the NPPF Technical Guidance where appropriate and also the recommendations that have previously been issued by various councils.

10.2.2 These include:

- Basement to be fully waterproofed (tanked) and waterproofing to be tied in to the ground floor slab as appropriate: to reduce the turnaround time for returning the property to full operation after a flood event.
- Plasterboards will be installed in horizontal sheets rather than conventional vertical installation methods to minimise the amount of plasterboard that could be damaged in a flood event
- Wall sockets will be raised to as high as is feasible and practicable in order to minimise damage if flood waters inundate the property
- Any wood fixings on basement / ground floor will be robust and/or protected by suitable coatings in order to minimise damage during a flood event
- The basement waterproofing where feasible will be extended to an appropriate level above existing ground levels.
- The concrete sub floor as standard will likely be laid to fall to drains or gullies which will remove any build-up of ground water to a sump pump where it will be pumped into the mains sewer. This pump will be fitted with a non-return valve to prevent water backing up into the property should the mains sewer become full.

10.2.3 Insulation to the external walls will be specified as rigid board which has impermeable foil facings that are resistant to the passage of water vapour and double the thermal resistance of the cavity.

10.3 Proposed Changes to Areas of External Hardstanding

10.3.1 The proposed basement is beneath an existing building and beneath areas of hard paving.

10.3.2 The site has been shown to lie directly on very low permeability London Clay Formation.

10.3.3 It is not considered likely that additional areas of hardstanding will be created. Small additional areas of hardstanding are not considered likely to significantly change the ingress of the surface water into the ground.

10.4 Past Flooding

10.4.1 The National Planning Policy Framework sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow.

10.4.2 When assessing the site-specific flood risk and the potential for historic flooding to reoccur, the above guidance recommends that historic flooding records and any other relevant and available information including flood datasets (e.g. flood levels, depths and/or velocities) and any other relevant data, which can be acquired are assessed.

10.4.3 The BGS does not consider the area to be prone to groundwater flooding based on rock type. Furthermore, groundwater was not reported during intrusive works at the site and water reported during monitoring is considered to represent surface water ingress unable to drain out of the well, rather than groundwater.

10.4.4 The SFRA produced by URS for London Borough of Camden includes several maps regarding flood risks within the local authority. The site is not shown to be at risk from groundwater or sewer flooding. The site is shown to be at 'low' risk of surface water flooding and has a 'low' flood hazard rating (<0.75m).

10.5 Geological Impact

10.5.1 The published geological maps indicate that the site is directly underlain by solid deposits of the London Clay Formation. This was confirmed by the intrusive investigation.

10.5.2 At the depths that the basement would be constructed at, the London Clay is unlikely to be prone to seasonal shrinkage and swelling that arises due to changing water content in the soil. This is due to a lack of significant vegetation capable of removing water within the zone of influence; the hard cover minimising the amount of water entering the ground and the lack of proven groundwater. The measured groundwater is considered to represent surface water that has percolated through the near surface soils into the well and then not been able to drain away.

10.6 Hydrology and Hydrogeology Impact

10.6.1 Based on the information available at the time of writing, the risk of flooding from groundwater is considered to be low. The proposed basement is unlikely to have a detectable impact on the local groundwater regime. Appropriate water proofing measures should be included within the whole of the proposed basement wall/floor design as a precaution.

10.6.2 The proposed dwelling will lie outside of flood risk zones and is therefore assessed as being at a very low probability of fluvial flooding.

10.6.3 There are no surface water features on or in the immediate vicinity of the site. It is therefore not anticipated that the site will make any impact upon the hydrology of the area.

10.6.4 The information available suggests that the site lies in an area that is not at significant risk of surface water flooding. Flooding via this source is therefore considered to be low.

10.6.5 The proposed basement construction is considered unlikely to create a reduction of impermeable area in the post development scenario.

10.6.6 No risk of flooding to the site from artificial sources has been identified.

10.7 Impacts of Basement on Adjacent Properties and Pavement

10.7.1 The proposed basement excavation will be within 5m of a public pavement.

10.7.2 Unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground, any associated services and structures.

10.7.3 It is recommended that the site is supported by suitably designed temporary support with cast-in-situ cantilever retaining walls or a fully embedded piled retaining wall that is likely to require propping during construction. This will ensure that the adjacent land is adequately supported in the temporary and permanent construction. Alternatively, the excavation should proceed in a manner that maintains the integrity of the ground on all sides.

10.7.4 Careful and regular monitoring of the structure will need to be undertaken during the construction phase to ensure that vertical movements do not adversely affect the above property with the “flying freehold”. If necessary the works may have to be carried out in stages with the above structure suitably propped and supported. It is understood that sacrificial bearing piles will be utilised during construction.

10.7.5 It will be necessary to ensure that the basements are designed in accordance with the NHBC Standards and take due cognisance of the potential impacts highlighted above. This may be achieved by ensuring best practice engineering and design of the proposed scheme by competent persons and in full accordance with the Construction (Design and Management) Regulations. This will include:

- Establishment of the likely ground movements arising from the temporary and permanent works and the mitigation of excessive movements;
- Assessment of the impact on any adjacent structures (including adjacent properties and the adjacent pavement with potential services);
- Determination of the most appropriate methods of construction of the proposed basements;
- Undertake pre-condition surveys of adjacent structures;
- Monitor any movements and pre-existing cracks during construction;
- Establishment of contingencies to deal with adverse performance;
- Ensuring quality of workmanship by competent persons.

10.7.6 Full details of the suitable engineering design of the scheme in addition to an appropriate construction method statement should be submitted by the Developer to London Borough of Camden.

11 REFERENCES

BRE Report BR211: Radon: Protective measures for new dwellings, 2007

BRE Special Digest 1: Concrete in Aggressive Ground, 2005

British Standards Institution (2007) BS 3882:2007 *Specification for topsoil and requirements for use.* Milton Keynes: BSI

British Standards Institution (2011) BS 10175:2011 *Code of practice for the investigation of potentially contaminated sites*. Milton Keynes: BSI

British Standards Institution (2015) BS 5930:2015 *Code of practice for site investigations*. Milton Keynes: BSI

CIEH & CL:AIRE (2008) *Guidance on comparing soil contamination data with a critical concentration*. London: Chartered Institute of Environmental Health (CIEH) and CL:AIRE

Environment Agency (2004) *Model procedures for the management of land contamination*. CLR11. Bristol: Environment Agency

Environment Agency, NHBC & CIEH (2008) *Guidance for the safe development of housing on land affected by contamination*. R & D Publication 66. London: Environment Agency

Environment Agency (2006) *Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination* Environment Agency

LQM/CIEH S4ULs. LQM, 2014

National Planning Policy Framework. Department for Communities and Local Government, March 2012

CIRIA C665 (2007) *Assessing risks posed by hazardous ground gases to buildings London,* CIRIA

British Standards Institution (2015) BS 8485:2015 Incorporating corrigendum No.1 *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* Milton Keynes: BSI

British Standards Institution (2013) BS 8576:2013 *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOC's),* Milton Keynes: BSI

London Borough of Camden Strategic Flood Risk Assessment - 47070547. URS, July 2014

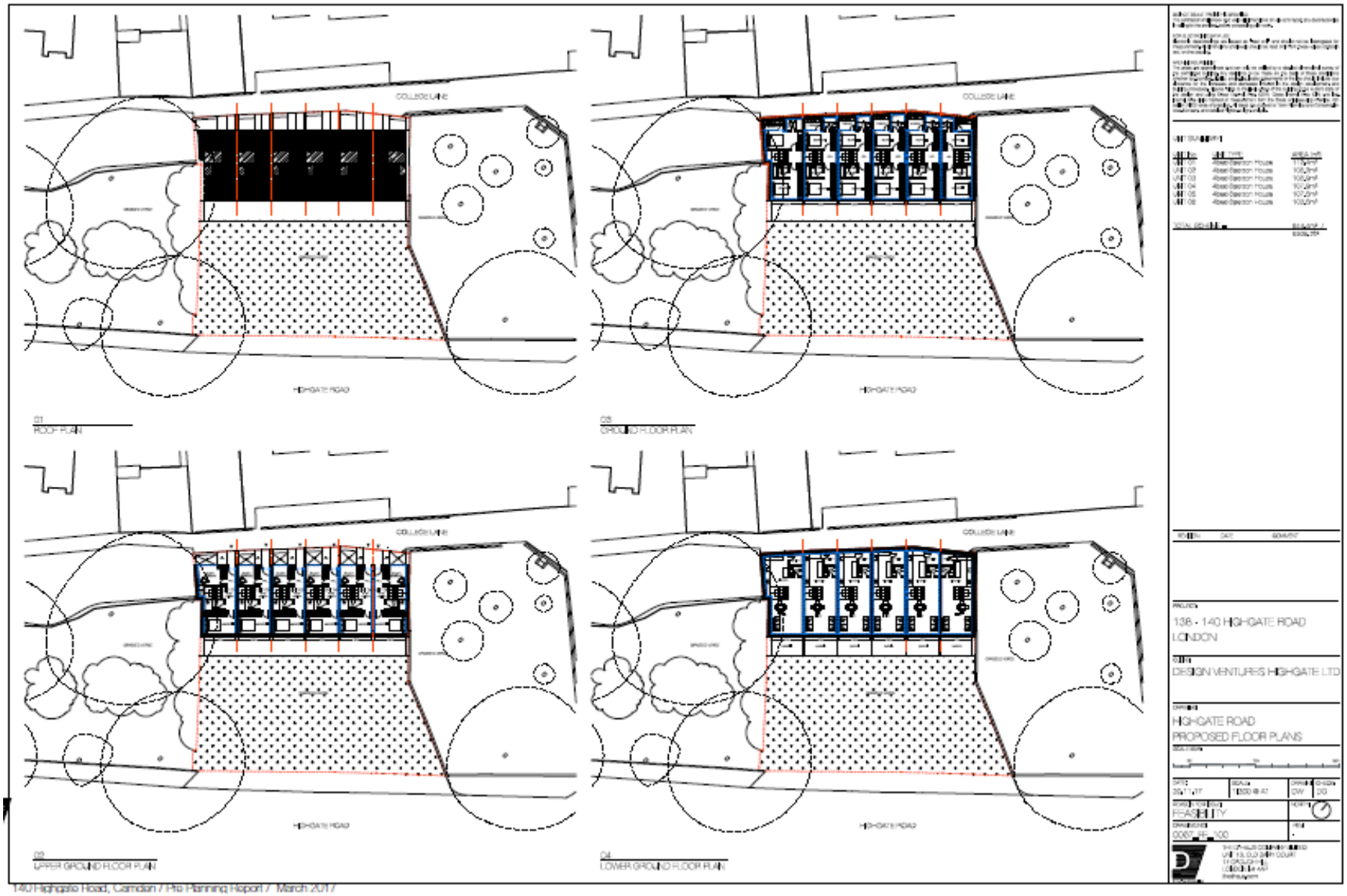
APPENDICES

APPENDIX 1 – FIGURES

Project Name:	38-140 Highgate Road, Highgate	**Client:**	Design Ventures Highgate Ltd
Title:	Site Location Plan	**Project No.**	P1323J1303

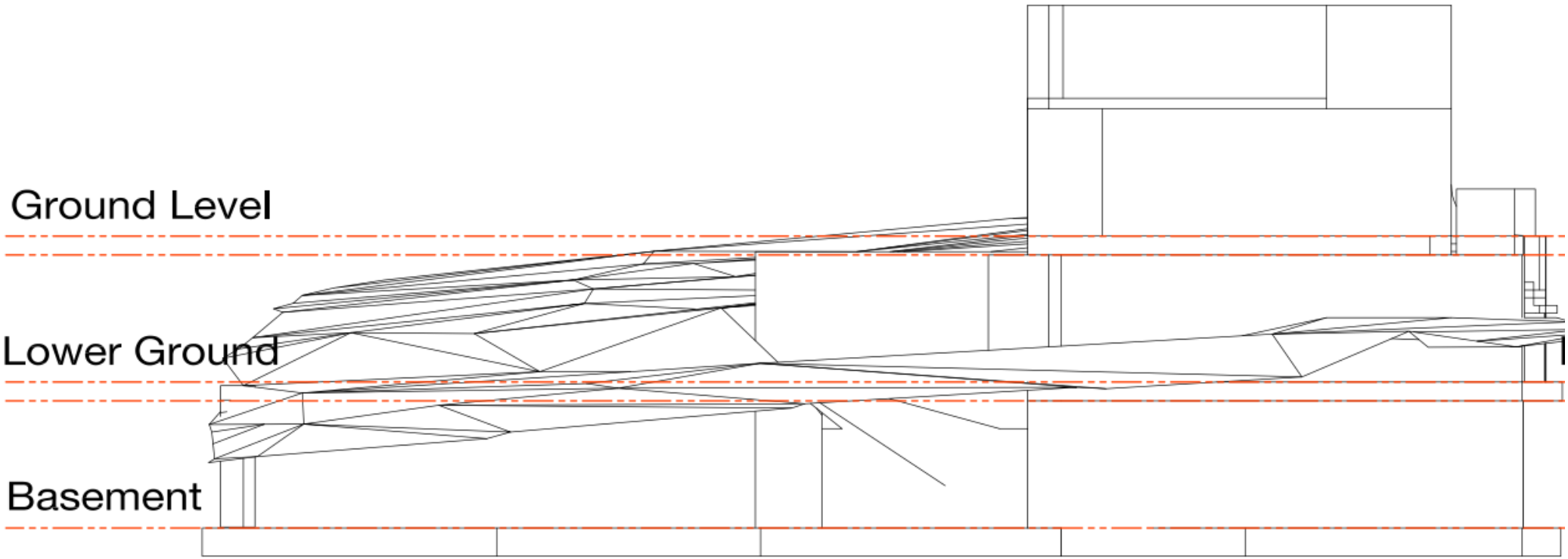
JOMAS ASSOCIATES LTD
T: 0843 289 2187

Project Name:	38-140 Highgate Road, Highgate	**Client:**	Design Ventures Highgate Ltd
Title:	Proposed Development Plan	**Project No.**	P1323J1303
Date	08/02/18		



JOMAS ASSOCIATES LTD
T: 0843 289 2187

Project Name:	38-140 Highgate Road, Highgate	**Client:**	Design Ventures Highgate Ltd
Title:	Proposed Development - Elevations	**Project No.**	P1323J1303
Date	March 2018		



JOMAS ASSOCIATES LTD
T: 0843 289 2187

Project Name	140 Highgate Road	**Client**	Design Ventures Highgate Ltd
Project No.	P1323J1303	**Date**	15/2/18
Title	GI Plan		

JOMAS ASSOCIATES LTD

Project Name	Highgate Road	**Client**	Design Ventures Highgate Ltd
Title	WS Drilling Photographic Log	**Project No.**	P1323J1303

Photo 1: WS1

Photo 2: WS2

Project Name	Highgate Road	**Client**	Design Ventures Highgate Ltd
Title	WS Drilling Photographic Log	**Project No.**	P1323J1303

Photo 3: WS3

Photo 4: WS5

Project Name	Highgate Road	**Client**	Design Ventures Highgate Ltd
Title	WS Drilling Photographic Log	**Project No.**	P1323J1303

Photo 5:

APPENDIX 2 – EXPLORATORY HOLE RECORDS

WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS1		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	JT	Date Commenced:	12/02/2018
Checked By:		Date Completed:	12/02/2018
Type and diameter of equipment:	Window Sampler	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: *Field description.
2: No water reported.
3: VOC readings of each sample given in ppm.
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
P+J D	0.25								0.00				Soft* consistency dark brown sandy gravelly clay. Gravel consists of fine to coarse sub-angular to sub-rounded brick, concrete and flint. Contains frequent rootlets. No black staining or hydrocarbon odour noted. (MADE GROUND).	
	0ppm													
P+J D	0.50								0.50		0.60			
	0ppm												Very stiff* mottled brown-grey CLAY. No black staining or hydrocarbon odour noted. (LONDON CLAY).	
P+J D	1.00								1.00					
	0ppm													
SPT		1	1	2	3	2	2	9	1.50					
P+J	2.00								2.00					
	0ppm													
SPT		1	2	2	3	2	3	10	2.50					
P+J	3.00								3.00					
	0ppm													
SPT		1	2	3	4	3	3	13	3.50					
P+J	4.00								4.00					
	0ppm													
SPT		1	2	3	3	3	4	13	4.50					
P+J	5.00								5.00		5.00			
	0ppm													
SPT		2	2	4	4	4	4	16						

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS2		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	JT	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Window Sampler	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: *Field description.

2: Metal bar (approx. 15mm in diameter) hit at approx. 1.05m bgl.

3: Seepage of black oily water at approx. 1.10m bgl.

4: VOC readings of each sample given in ppm.

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00					
											0.20		Reinforced concrete. (MADE GROUND).	
P+J D	0.50								0.50				Soft* consistency dark brown sandy gravelly clay. Gravel consists of fine to coarse sub-angular to sub-rounded brick, concrete and flint. No black staining or hydrocarbon odour noted. (MADE GROUND).	
	0ppm													
P+J D	1.00								1.00		1.10			
	0ppm												No recovery from 1.00-4.00m bgl (except one vial from approx. 2.50m bgl).	
									1.50					
									2.00					
VIAL ONLY	2.50								2.50					
	18ppm													
									3.00					
									3.50					
									4.00		4.00			
									4.50					
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS3		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	JT	Date Commenced:	12/02/2018
Checked By:		Date Completed:	12/02/2018
Type and diameter of equipment:	Window Sampler	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: *Field description.
2: No water reported.
3: VOC readings of each sample given in ppm.
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00					
											0.20		Reinforced concrete. (MADE GROUND).	
P+J D	0.40												Soft* consistency mid to dark brown sandy gravelly clay. Gravel consists of fine to coarse sub-angular to sub-rounded brick, concrete and flint. No black staining or hydrocarbon odour noted. (MADE GROUND).	
	0ppm								0.50					
P+J D	0.80													
	0ppm										0.90			
SPT	1.00	1	1	1	2	2	1	6	1.00				Very stiff* mottled brown-grey CLAY. No black staining or hydrocarbon odour noted. (LONDON CLAY).	
									1.50					
P+J D	2.00								2.00					
	0ppm													
SPT		1	1	2	2	2	3	9						
									2.50					
P+J	3.00								3.00					
	0ppm													
SPT		1	1	2	2	2	3	9						
									3.50					
P+J	4.00								4.00					
	0ppm													
SPT		1	2	2	3	4	4	13						
									4.50					
P+J	5.00										5.00			
	0ppm								5.00					
SPT		2	4	3	5	4	6	18						

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

		Exploratory Hole No:	WS4
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	JT	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Window Sampler	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: Field description.
2: Water seepage at approx. 4.50m bgl.
3: VOC readings of each sample given in ppm.
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00				Reinforced concrete. (MADE GROUND).	
											0.50			
P+J D	0.70								0.50				Very stiff* mottled brown-grey CLAY. No black staining or hydrocarbon odour noted. (LONDON CLAY).	
	0ppm													
P+J D	1.00								1.00					
	0ppm													
SPT		1	0	1	0	1	2	4	1.50					
P+J D	2.00								2.00					
	0ppm													
SPT		1	2	2	3	4	4	13	2.50					
P+J	3.00								3.00					
	0ppm													
SPT		1	2	2	3	4	4	13	3.50					
P+J	4.00								4.00					
	0ppm													
SPT		1	2	3	3	4	4	14	4.50					
SPT	5.00	1	2	4	4	5	4	17	5.00		5.00			

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

		Exploratory Hole No:	WS5
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	JT	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Window Sampler	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: *Field description.
2: No water reported.
3: VOC readings of each sample given in ppm.
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00					
											0.08		Concrete. (MADE GROUND).	
													Concrete. (MADE GROUND).	
											0.30			
P+J D	0.50								0.50				Soft* consistency mid to dark brown sandy gravelly clay. Gravel consists of fine to coarse sub-angular to sub-rounded brick, concrete and flint. Some black staining and a moderate hydrocarbon odour noted throughout. (MADE GROUND).	
	2ppm													
P+J D	1.00								1.00					
	8ppm													
SPT		1	1	0	1	0	1	2			1.20			
P+J D	1.60								1.50				Very stiff* mottled brown-grey CLAY. Dark black staining and a strong hydrocarbon odour noted from approx. 1.50m-2.00m bgl. Softer consistency and wetter from approx. 2.00m-3.00m bgl. (LONDON CLAY).	
	24ppm													
SPT	2.00	0	0	0	0	0	0		2.00					
P+J	2.50								2.50					
	1ppm													
SPT	3.00	0	1	0	0	1	1	2	3.00					
P+J	3.50								3.50					
	0ppm													
SPT	4.00	1	2	2	3	2	3	10	4.00					
P+J	4.50								4.50					
	0ppm													
SPT	5.00	2	2	2	3	4	4	13	5.00		5.00			

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

		Exploratory Hole No:	WS6
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	JT	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Window Sampler	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: Concrete corer refused at 0.60m due to presence of vertical rebar.
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00				Reinforced concrete. (MADE GROUND).	
									0.50		0.60			
									1.00					
									1.50					
									2.00					
									2.50					
									3.00					
									3.50					
									4.00					
									4.50					
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS7		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	JT	Date Commenced:	12/02/2018
Checked By:		Date Completed:	12/02/2018
Type and diameter of equipment:	Window Sampler	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: *Field description.

2: No water reported.

3: VOC readings of each sample given in ppm.

4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
P+J D	0.40								0.00		0.25		Reinforced concrete. (MADE GROUND).	
	0ppm								0.50				Soft* consistency mid brown sandy gravelly clay. Gravel consists of fine to coarse sub-angular to sub-rounded brick, concrete and flint. No black staining or hydrocarbon odour noted. (MADE GROUND).	
P+J D	0.90													
SPT	0ppm1.00	1	1	1	2	1	2	6	1.00		1.00			
P+J D	1.50								1.50				Very stiff* mottled brown-grey CLAY. No black staining or hydrocarbon odour noted. (LONDON CLAY).	
	0ppm													
SPT	2.00	1	2	2	2	3	2	9	2.00					
									2.50					
P+J	3.00								3.00					
	0ppm													
SPT		1	2	3	2	3	3	11						
									3.50					
P+J	4.00										4.00			
	0ppm								4.00					
SPT		1	2	3	3	3	3	12						
									4.50					
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

		Exploratory Hole No:	BH1
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RD	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	1 Of 5

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00				Concrete. (MADE GROUND)	
											0.30			
D	0.40								0.50				Brown medium to high strength silty CLAY.	
D	1.00								1.00					
U	1.50								1.50					
									2.00					
D	2.50								2.50					
S		2	2	2	3	3	3	11						
									3.00					
D	3.50								3.50					
									4.00					
U	4.50								4.50					
	45 blows for 100% recovery													
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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T: 0843 289 2187 E: info@jomasassociates.com W: www.jomasassociates.com

CABLE PERCUSSION BOREHOLE RECORD

		Exploratory Hole No:	BH1
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RD	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	2 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported

2:

3:

4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									5.00				Brown medium to high strength silty CLAY.	
D	5.50								5.50					
S		2	4	4	4	4	4	16						
									6.00					
D	6.50								6.50					
S		2	4	4	4	4	5	17						
									7.00					
U	7.50								7.50					
	60 blows for 100% recovery													
									8.00					
D	8.50								8.50					
S		3	4	4	5	5	6	20						
									9.00					
D	9.50								9.50					
S		3	4	5	5	5	6	21						
									10.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

		Exploratory Hole No:	BH1
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RD	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	3 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									10.00				Brown medium to high strength silty CLAY.	
U	10.50								10.50					
	80 blows for 100% recovery													
									11.00					
D	11.50								11.50					
S		4	5	5	5	6	6	22						
									12.00					
											12.40			
D	12.50								12.50				Grey high to very high strength CLAY. (LONDON CLAY)	
S		3	4	5	6	6	7	24						
									13.00					
U	13.50								13.50					
	80 blows for 100% recovery													
									14.00					
D	14.50								14.50					
S		3	4	5	6	6	7	24						
									15.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

		Exploratory Hole No:	BH1
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RD	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	4 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported

2:

3:

4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									15.00				Grey high to very high strength CLAY. (LONDON CLAY)	
D	15.50								15.50					
S		3	4	5	6	7	7	25						
									16.00					
U	16.50								16.50					
	70 blows for 100% recovery													
									17.00					
D	17.50								17.50					
S		4	5	6	7	7	9	29						
									18.00					
D	18.50								18.50					
S		4	5	6	7	8	9	30						
									19.00					
U	19.50								19.50					
	80 blows for 100% recovery													
									20.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

CABLE PERCUSSION BOREHOLE RECORD

		Exploratory Hole No:	BH1
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RD	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	5 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N	20.00				Grey high to very high strength CLAY. (LONDON CLAY)	
D	20.50								20.50					
S		4	5	7	7	8	10	32						
									21.00					
D	21.50								21.50					
S		5	7	8	8	9	9	34						
									22.00					
U	22.50								22.50					
	150 blows for 55% recovery													
									23.00					
D	23.50								23.50					
S		4	7	8	8	9	11	36						
D	24.00								24.00					
S	24.50	7	8	9	10	10	12	41	24.50					
											24.95			
									25.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

Exploratory Hole No:	BH2		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RS	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	1 Of 5

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N	0.00				Concrete. (MADE GROUND)	
											0.30			
D	0.40								0.50				Brown medium to high strength silty CLAY.	
D	1.00								1.00					
S	1.50	2	2	2	2	2	2	8	1.50					
D	2.00								2.00					
U	2.50								2.50					
	60 blows for 100% recovery													
									3.00					
D	3.50								3.50					
S		2	3	2	3	3	3	11						
									4.00					
D	4.50								4.50					
S		2	3	3	4	4	4	15						
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

Exploratory Hole No:	BH2		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RS	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	2 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									5.00				Brown medium to high strength silty CLAY.	
U	5.50								5.50					
	60 blows for 100% recovery													
									6.00					
D	6.50								6.50					
S		3	3	4	4	4	5	17						
									7.00					
D	7.50								7.50					
S		3	3	4	4	5	5	18						
									8.00					
U	8.50								8.50					
	70 blows for 100% recovery													
									9.00					
D	9.50								9.50					
S		2	3	4	4	4	6	18						
									10.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

Exploratory Hole No:	BH2		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RS	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	3 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									10.00				Brown medium to high strength silty CLAY.	
D	10.50								10.50					
S		3	4	4	4	5	6	19						
									11.00					
U	11.50								11.50					
	70 blows for 100% recovery										11.60			
													Grey high to very high strength CLAY. (LONDON CLAY)	
									12.00					
D	12.50								12.50					
S														
									13.00					
D	13.50								13.50					
S		3	4	6	6	7	7	26						
									14.00					
U	14.50								14.50					
	65 blows for 100% recovery													
									15.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

Exploratory Hole No:	BH2		
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RS	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	4 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported

2:

3:

4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									15.00				Grey high to very high strength CLAY. (LONDON CLAY)	
D	15.50								15.50					
S		4	4	5	6	7	8	26						
									16.00					
D	16.50								16.50					
S		4	5	6	7	8	9	30						
									17.00					
U	17.50								17.50					
	70 blows for 100% recovery													
									18.00					
D	18.50								18.50					
S		4	7	7	8	8	11	34						
									19.00					
D	19.50								19.50					
S		4	5	6	8	9	10	33						
									20.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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CABLE PERCUSSION BOREHOLE RECORD

		Exploratory Hole No:	BH2
Site Address:	140 Highgate Road, Highgate, London, NW5 1PB	Project No:	P1323J1303
Client:	Design Ventures Highgate Ltd	Ground Level:	
Logged By:	RS	Date Commenced:	13/02/2018
Checked By:		Date Completed:	13/02/2018
Type and diameter of equipment:	Dando 4000	Sheet No:	5 Of 5

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: No water reported
2:
3:
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									20.00				Grey high to very high strength CLAY. (LONDON CLAY)	
U	20.50								20.50					
	70 blows for 100% recovery													
									21.00					
D	21.50								21.50					
S		4	7	8	8	9	10	35						
									22.00					
D	22.50								22.50					
S		4	8	8	9	10	10	37						
									23.00					
U	23.50								23.50					
	80 blows for 100% recovery													
									24.00					
D	24.50								24.50		24.50			
S		4	8	9	10	11	11	41						
									25.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

Jomas Associates Ltd - Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD
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APPENDIX 3 – CHEMICAL LABORATORY TEST RESULTS

Emma Hucker
Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

e: Jomas Associates

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

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

Analytical Report Number : 18-76317

Replaces Analytical Report Number : 18-76317, issue no. 1

Project / Site name:	138-140 Highgate Road, Highgate, London, NW5 1PB	**Samples received on:**	14/02/2018
Your job number:	JJ1303	**Samples instructed on:**	16/02/2018
Your order number:	P1323JJ1303.10	**Analysis completed by:**	16/03/2018
Report Issue Number:	2	**Report issued on:**	16/03/2018
Samples Analysed:	12 soil samples		

Signed:

Nicole Fay
Quality Assistant
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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Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB
Your Order No: P1323JJ1303.10

Lab Sample Number				909736	909737	909738	909739	909740
Sample Reference				WS1	WS2	WS2	WS3	WS3
Sample Number				tjv	tjv	tjv	tjv	tjv
Depth (m)				0.25	2.50	0.50	0.40	2.00
Date Sampled				12/02/2018	13/02/2018	13/02/2018	12/02/2018	12/02/2018
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	16	16	12	16	21
Total mass of sample received	kg	0.001	NONE	1.2	-	1.4	1.2	1.4
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile & Amosite	Chrysotile	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Detected	Detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	< 0.001	< 0.001	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	< 0.001	< 0.001	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.6	-	9.2	10.1	8.3
Total Cyanide	mg/kg	1	MCERTS	< 1	-	< 1	< 1	2
Total Sulphate as SO_4	mg/kg	50	MCERTS	1300	-	11000	2000	1800
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.067	-	1.8	0.32	0.85
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	67.2	-	1780	318	851
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.6	-	1.2	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	3.6	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.49	-	0.25	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.45	-	2.1	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.42	-	1.6	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	6.1	-	18	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	1.3	-	4.7	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	15	-	21	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	13	-	17	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	9.5	-	13	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	5.7	-	8.0	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	7.7	-	10	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	3.8	-	4.5	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	8.0	-	10	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	3.8	-	4.6	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.71	-	0.94	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.4	-	4.2	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	79.6	-	124	< 0.80	< 0.80
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	-	15	10	10
Boron (water soluble)	mg/kg	0.2	MCERTS	3.9	-	7.2	4.2	3.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	-	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	25	-	28	53	64
Copper (aqua regia extractable)	mg/kg	1	MCERTS	35	-	37	32	29
Lead (aqua regia extractable)	mg/kg	1	MCERTS	280	-	160	90	69
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	-	24	40	51
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	210	-	190	78	91

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB
Your Order No: P1323JJ1303.10

Lab Sample Number				909736	909737	909738	909739	909740
Sample Reference				WS1	WS2	WS2	WS3	WS3
Sample Number				tjv	tjv	tjv	tjv	tjv
Depth (m)				0.25	2.50	0.50	0.40	2.00
Date Sampled				12/02/2018	13/02/2018	13/02/2018	12/02/2018	12/02/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	7.6	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	29	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	150	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	190	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	5.8	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	20	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	160	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	440	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	620	< 10	< 10
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	-	6.6	-	-
TPH (C12 - C16)	mg/kg	4	MCERTS	11	-	27	-	-
TPH (C16 - C21)	mg/kg	1	MCERTS	83	-	190	-	-
TPH (C21 - C40)	mg/kg	10	MCERTS	220	-	690	-	-

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB
Your Order No: P1323JJ1303.10

Lab Sample Number				909736	909737	909738	909739	909740
Sample Reference				WS1	WS2	WS2	WS3	WS3
Sample Number				tjv	tjv	tjv	tjv	tjv
Depth (m)				0.25	2.50	0.50	0.40	2.00
Date Sampled				12/02/2018	13/02/2018	13/02/2018	12/02/2018	12/02/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	µg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Trichloromethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	5.7	< 1.0	< 1.0	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	-	42	< 1.0	< 1.0	< 1.0
Styrene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/kg	1	MCERTS	-	20	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	15	< 1.0	< 1.0	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	-	4.6	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	35	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1P
Your Order No: P1323JJ1303.10

Lab Sample Number				909741	909742	909743	909744	909745
Sample Reference				WS4	WS5	WS5	WS5	WS7
Sample Number				tjv	tjv	tjv	tjv	tjv
Depth (m)				0.70	1.00	0.50	1.60	0.40
Date Sampled				13/02/2018	13/02/2018	13/02/2018	13/02/2018	12/02/2018
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
Moisture Content	%	N/A	NONE	24	23	-	23	12
Total mass of sample received	kg	0.001	NONE	1.6	1.2	-	1.2	1.3
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	-	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	< 0.001
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	< 0.001
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	9.0	10.7	-	8.7	9.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	1300	3400	-	1200	4100
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.57	0.93	-	0.54	0.99
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	574	931	-	538	987
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.4	-	-	-	1.1
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.23	0.80
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	1.2	0.49
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.42	6.4
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.47	2.2
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.42	-	1.4	15
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.69	-	3.1	13
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.78	8.1
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.69	6.1
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.45	8.2
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.27	2.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.38	7.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.25	3.6
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	0.63
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.74	3.4
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	1.11	-	10.4	78.7
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.7	12	-	9.5	22
Boron (water soluble)	mg/kg	0.2	MCERTS	3.3	16	-	2.2	4.0
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	< 0.2	0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	-	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	58	52	-	43	31
Copper (aqua regia extractable)	mg/kg	1	MCERTS	130	38	-	22	270
Lead (aqua regia extractable)	mg/kg	1	MCERTS	19	68	-	140	760
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	49	40	-	35	41
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	83	81	-	85	240

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1P
Your Order No: P1323JJ1303.10

Lab Sample Number				909741	909742	909743	909744	909745
Sample Reference				WS4	WS5	WS5	WS5	WS7
Sample Number				tjv	tjv	tjv	tjv	tjv
Depth (m)				0.70	1.00	0.50	1.60	0.40
Date Sampled				13/02/2018	13/02/2018	13/02/2018	13/02/2018	12/02/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	7.8	-	42	1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	13	-	130	9.6
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	40	-	190	15
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	46	980	-	4100	120
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	48	1000	-	4500	140
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	4.2	-	5.4	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	11	-	50	9.6
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	36	-	130	47
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	580	-	2000	94
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	630	-	2200	150
TPH (C10 - C12)	mg/kg	2	MCERTS	-	-	-	-	-
TPH (C12 - C16)	mg/kg	4	MCERTS	-	-	-	-	-
TPH (C16 - C21)	mg/kg	1	MCERTS	-	-	-	-	-
TPH (C21 - C40)	mg/kg	10	MCERTS	-	-	-	-	-

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1P
Your Order No: P1323JJ1303.10

Lab Sample Number				909741	909742	909743	909744	909745
Sample Reference				WS4	WS5	WS5	WS5	WS7
Sample Number				tjv	tjv	tjv	tjv	tjv
Depth (m)				0.70	1.00	0.50	1.60	0.40
Date Sampled				13/02/2018	13/02/2018	13/02/2018	13/02/2018	12/02/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Chloroethane	µg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
Bromomethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Vinyl Chloride	µg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Trichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Trichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Dibromomethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Tetrachloroethene	µg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Styrene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Tribromomethane	µg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
o-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Bromobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	-	< 1.0	< 1.0

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1P
Your Order No: P1323JJ1303.10

Lab Sample Number				909748	909749			
Sample Reference				WS4	WS5			
Sample Number				tjv	tjv			
Depth (m)				2.00	4.50			
Date Sampled				13/02/2018	13/02/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	23	20			
Total mass of sample received	kg	0.001	NONE	1.4	0.90			
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-			
Asbestos in Soil	Type	N/A	ISO 17025	-	-			
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-			
Asbestos Quantification Total	%	0.001	ISO 17025	-	-			
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.9	7.9			
Total Cyanide	mg/kg	1	MCERTS	-	-			
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	1.8	2.3			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-			
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-			
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-			
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	-	-			
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-			
Chromium (hexavalent)	mg/kg	4	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	-	-			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-			

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1P
Your Order No: P1323JJ1303.10

Lab Sample Number				909748	909749			
Sample Reference				WS4	WS5			
Sample Number				tjv	tjv			
Depth (m)				2.00	4.50			
Date Sampled				13/02/2018	13/02/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-			
Toluene	µg/kg	1	MCERTS	-	-			
Ethylbenzene	µg/kg	1	MCERTS	-	-			
p & m-xylene	µg/kg	1	MCERTS	-	-			
o-xylene	µg/kg	1	MCERTS	-	-			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-			
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			
TPH (C10 - C12)	mg/kg	2	MCERTS	-	-			
TPH (C12 - C16)	mg/kg	4	MCERTS	-	-			
TPH (C16 - C21)	mg/kg	1	MCERTS	-	-			
TPH (C21 - C40)	mg/kg	10	MCERTS	-	-			

Analytical Report Number: 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1P
Your Order No: P1323JJ1303.10

Lab Sample Number				909748	909749			
Sample Reference				WS4	WS5			
Sample Number				tjv	tjv			
Depth (m)				2.00	4.50			
Date Sampled				13/02/2018	13/02/2018			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-			
Chloroethane	µg/kg	1	NONE	-	-			
Bromomethane	µg/kg	1	ISO 17025	-	-			
Vinyl Chloride	µg/kg	1	NONE	-	-			
Trichlorofluoromethane	µg/kg	1	NONE	-	-			
1,1-Dichloroethene	µg/kg	1	NONE	-	-			
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-			
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-			
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-			
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-			
Trichloromethane	µg/kg	1	MCERTS	-	-			
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-			
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-			
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-			
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-			
Benzene	µg/kg	1	MCERTS	-	-			
Tetrachloromethane	µg/kg	1	MCERTS	-	-			
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-			
Trichloroethene	µg/kg	1	MCERTS	-	-			
Dibromomethane	µg/kg	1	MCERTS	-	-			
Bromodichloromethane	µg/kg	1	MCERTS	-	-			
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-			
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-			
Toluene	µg/kg	1	MCERTS	-	-			
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-			
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-			
Dibromochloromethane	µg/kg	1	ISO 17025	-	-			
Tetrachloroethene	µg/kg	1	NONE	-	-			
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-			
Chlorobenzene	µg/kg	1	MCERTS	-	-			
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-			
Ethylbenzene	µg/kg	1	MCERTS	-	-			
p & m-Xylene	µg/kg	1	MCERTS	-	-			
Styrene	µg/kg	1	MCERTS	-	-			
Tribromomethane	µg/kg	1	NONE	-	-			
o-Xylene	µg/kg	1	MCERTS	-	-			
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-			
Isopropylbenzene	µg/kg	1	MCERTS	-	-			
Bromobenzene	µg/kg	1	MCERTS	-	-			
n-Propylbenzene	µg/kg	1	ISO 17025	-	-			
2-Chlorotoluene	µg/kg	1	MCERTS	-	-			
4-Chlorotoluene	µg/kg	1	MCERTS	-	-			
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-			
tert-Butylbenzene	µg/kg	1	MCERTS	-	-			
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-			
sec-Butylbenzene	µg/kg	1	MCERTS	-	-			
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-			
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-			
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-			
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-			
Butylbenzene	µg/kg	1	MCERTS	-	-			
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-			
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-			
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-			
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-			

Analytical Report Number: 18-76317
Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB
Your Order No: P1323JJ1303.10

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
909738	WS2	0.50	178	Loose Fibres	**Chrysotile & Amosite**	< 0.001	**< 0.001**
909739	WS3	0.40	161	Loose Fibres	**Chrysotile**	< 0.001	**< 0.001**
909745	WS7	0.40	170	Loose Fibres	**Chrysotile**	< 0.001	**< 0.001**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

* 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 *
909736	WS1	tjv	0.25	Brown loam and clay with gravel and vegetation.
909737	WS2	tjv	2.50	Light brown clay and sand with gravel.
909738	WS2	tjv	0.50	Brown sand with rubble and brick.
909739	WS3	tjv	0.40	Grey clay and sand with rubble and brick.
909740	WS3	tjv	2.00	Brown clay.
909741	WS4	tjv	0.70	Brown clay.
909742	WS5	tjv	1.00	Brown clay.
909743	WS5	tjv	0.50	-
909744	WS5	tjv	1.60	Grey clay and sand.
909745	WS7	tjv	0.40	Brown sand with gravel and rubble.
909748	WS4	tjv	2.00	Brown clay.
909749	WS5	tjv	4.50	Brown clay.

Analytical Report Number : 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

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
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
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	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
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
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
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 cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS

Analytical Report Number : 18-76317

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

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
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-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
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding.	L076-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

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.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS4	tjv	S	18-76317	909741	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS4	tjv	S	18-76317	909741	b	TPHCWG (Soil)	L088/76-PL	b
WS4	tjv	S	18-76317	909741	b	Volatile organic compounds in soil	L073B-PL	b

Key: a - No sampling date b - Incorrect container
c - Holding time d - Headspace e - Temperature

Emma Hucker
Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

e: Jomas Group

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

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

Analytical Report Number : 18-76460

Project / Site name:	138-140 Highgate Road, Highgate, London	**Samples received on:**	15/02/2018
Your job number:	JJ1303	**Samples instructed on:**	16/02/2018
Your order number:	P1323JJ1303.13	**Analysis completed by:**	26/02/2018
Report Issue Number:	1	**Report issued on:**	26/02/2018
Samples Analysed:	4 soil 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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Analytical Report Number: 18-76460

Project / Site name: 138-140 Highgate Road, Highgate, London
Your Order No: P1323JJ1303.13

Lab Sample Number				910620	910621	910622	910623	
Sample Reference				BH1	BH1	BH2	BH2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				5.50	15.00	7.50	24.50	
Date Sampled				14/02/2018	14/02/2018	14/02/2018	14/02/2018	
Time Taken				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	
Moisture Content	%	N/A	NONE	20	18	19	18	
Total mass of sample received	kg	0.001	NONE	1.0	0.75	0.85	1.0	
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.6	8.1	7.5	8.9	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	3.2	0.84	6.1	0.43	

Analytical Report Number : 18-76460

Project / Site name: 138-140 Highgate Road, Highgate, London

* 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 *
910620	BH1	None Supplied	5.50	Brown clay.
910621	BH1	None Supplied	15.00	Brown clay.
910622	BH2	None Supplied	7.50	Light brown clay.
910623	BH2	None Supplied	24.50	Brown clay.

The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 18-76460

Project / Site name: 138-140 Highgate Road, Highgate, London

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
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
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
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
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

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.

Emma Hucker
Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

e: Jomas Group

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

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

Analytical Report Number : 18-76323

Project / Site name:	138-140 Highgate Road, Highgate, London, NW5 1PB	**Samples received on:**	14/02/2018
Your job number:	JJ1303	**Samples instructed on:**	16/02/2018
Your order number:	P1323JJ1303.11	**Analysis completed by:**	23/02/2018
Report Issue Number:	1	**Report issued on:**	23/02/2018
Samples Analysed:	3 WAC 10:1 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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i2 Analytical
7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**18-76323**						
					Client:	**JOMASASSOC**	
Location	**138-140 Highgate Road, Highgate, London, NW5 1PB**						
Lab Reference (Sample Number)	909812 / 909813				**Landfill Waste Acceptance Criteria**		
					Limits		
Sampling Date	12/02/2018				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS5 tjv						
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	0.4				3%	5%	6%
Loss on Ignition (%) **	1.8				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	370				500	--	--
Total PAH (WAC-17) (mg/kg)	4.6				100	--	--
pH (units)**	10.1				--	>6	--
Acid Neutralisation Capacity (mol / kg)	39				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0119			0.0814	0.5	2	25
Barium *	0.0239			0.164	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0004			< 0.0040	0.5	10	70
Copper *	0.0038			0.026	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0123			0.0844	0.5	10	30
Nickel *	0.0019			0.013	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0094			0.065	4	50	200
Chloride *	95			650	800	4000	25000
Fluoride	0.41			2.8	10	150	500
Sulphate *	430			3000	1000	20000	50000
TDS	230			1600	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	7.60			52.1	500	800	1000
Leach Test Information							
Stone Content (%)	26						
Sample Mass (kg)	1.4						
Dry Matter (%)	82						
Moisture (%)	18						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
*= UKAS accredited (liquid eluate analysis only)
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation
** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**18-76323**						
					Client:	**JOMASASSOC**	
Location	**138-140 Highgate Road, Highgate, London, NW5 1PB**						
Lab Reference (Sample Number)	909814 / 909815				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	12/02/2018				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS4 tjv						
Depth (m)	0.70						
Solid Waste Analysis							
TOC (%)**	0.3				3%	5%	6%
Loss on Ignition (%) **	1.9				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	60				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	8.9				--	>6	--
Acid Neutralisation Capacity (mol / kg)	8.7				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0024			0.0167	0.5	2	25
Barium *	0.0023			0.0155	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	< 0.0004			< 0.0040	0.5	10	70
Copper *	0.0097			0.066	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0023			0.0155	0.5	10	30
Nickel *	0.0003			< 0.0030	0.4	10	40
Lead *	0.0021			0.014	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0055			0.038	4	50	200
Chloride *	6.4			43	800	4000	25000
Fluoride	0.29			2.0	10	150	500
Sulphate *	91			620	1000	20000	50000
TDS	150			1000	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	4.52			30.8	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.6						
Dry Matter (%)	76						
Moisture (%)	24						

Results are expressed on a dry weight basis, after correction for moisture content where applicable. *= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepencies with current legislation ** = MCERTS accrediited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
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i2 Analytical
7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**18-76323**						
					Client: JOMASASSOC		
Location	**138-140 Highgate Road, Highgate, London, NW5 1PB**						
Lab Reference (Sample Number)	909816 / 909817				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	12/02/2018				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS7 tjv						
Depth (m)	0.90						
Solid Waste Analysis							
TOC (%)**	0.9				3%	5%	6%
Loss on Ignition (%) **	3.1				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	190				500	--	--
Total PAH (WAC-17) (mg/kg)	3.1				100	--	--
pH (units)**	8.2				--	>6	--
Acid Neutralisation Capacity (mol / kg)	14				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0011			< 0.0110	0.5	2	25
Barium *	0.0126			0.0845	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0008			0.0056	0.5	10	70
Copper *	0.0056			0.038	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0221			0.148	0.5	10	30
Nickel *	0.0003			< 0.0030	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0033			0.022	4	50	200
Chloride *	13			86	800	4000	25000
Fluoride	1.5			9.9	10	150	500
Sulphate *	48			320	1000	20000	50000
TDS	120			830	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	10.5			70.2	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.1						
Dry Matter (%)	83						
Moisture (%)	17						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
*= UKAS accredited (liquid eluate analysis only)
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** = MCERTS accrediited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Analytical Report Number : 18-76323

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

* 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 *
909812	WS5	tjv	0.50	Light brown clay and sand with stones.
909814	WS4	tjv	0.70	Brown clay.
909816	WS7	tjv	0.90	Light brown clay and sand with gravel.

Analytical Report Number : 18-76323

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

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
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-UK	W	NONE
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in leachate by ICP-OES	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
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	in-house method	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS

Analytical Report Number : 18-76323

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

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
Speciated WAC-17 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	NONE
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
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS

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.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS4	tjv	S	18-76323	909814	b	BTEX in soil (Monoaromatics)	L073B-PL	b
WS4	tjv	S	18-76323	909814	b	Total BTEX in soil (Poland)	L073-PL	b

Key: a - No sampling date b - Incorrect container
c - Holding time d - Headspace e - Temperature

Emma Hucker
Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

e: Jomas Group

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

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

Analytical Report Number : 18-77141

Project / Site name:	138-140 Highgate Road, Highgate, London, NW5 1PB	**Samples received on:**	22/02/2018
Your job number:	JJ1303	**Samples instructed on:**	23/02/2018
Your order number:	P1323JJ1303.14	**Analysis completed by:**	02/03/2018
Report Issue Number:	1	**Report issued on:**	02/03/2018
Samples Analysed:	3 water 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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Analytical Report Number: 18-77141

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

Your Order No: P1323JJ1303.14

Lab Sample Number				914716	914717	914718		
Sample Reference				WS2	WS5	WS4		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				21/02/2018	21/02/2018	21/02/2018		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Total Phenols								
Total Phenols (monohydric)	µg/l	10	ISO 17025	-	-	< 10		
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Acenaphthylene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Acenaphthene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Fluorene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Phenanthrene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Anthracene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Fluoranthene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Pyrene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Benzo(a)anthracene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Chrysene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Benzo(a)pyrene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	-	-	< 0.01		
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	-	-	< 0.16		

Analytical Report Number: 18-77141

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

Your Order No: P1323JJ1303.14

Lab Sample Number				914716	914717	914718		
Sample Reference				WS2	WS5	WS4		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				21/02/2018	21/02/2018	21/02/2018		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/l	1	ISO 17025	-	-	< 1.0		
Toluene	µg/l	1	ISO 17025	-	-	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
p & m-xylene	µg/l	1	ISO 17025	-	-	< 1.0		
o-xylene	µg/l	1	ISO 17025	-	-	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	-	-	< 1.0		
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	-	-	< 1.0		
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	-	-	< 1.0		
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	-	-	< 1.0		
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	-	-	< 1.0		
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	-	-	< 1.0		
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	-	-	< 1.0		
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	-	-	< 10		
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	-	-	< 10		

Analytical Report Number: 18-77141

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

Your Order No: P1323JJ1303.14

Lab Sample Number				914716	914717	914718		
Sample Reference				WS2	WS5	WS4		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				21/02/2018	21/02/2018	21/02/2018		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/l	1	ISO 17025	-	-	< 1.0		
Chloroethane	µg/l	1	ISO 17025	-	-	< 1.0		
Bromomethane	µg/l	1	ISO 17025	-	-	< 1.0		
Vinyl Chloride	µg/l	1	NONE	-	-	< 1.0		
Trichlorofluoromethane	µg/l	1	NONE	-	-	< 1.0		
1,1-Dichloroethene	µg/l	1	ISO 17025	-	-	< 1.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	-	-	< 1.0		
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	-	-	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	-	-	< 1.0		
1,1-Dichloroethane	µg/l	1	ISO 17025	-	-	< 1.0		
2,2-Dichloropropane	µg/l	1	ISO 17025	-	-	< 1.0		
Trichloromethane	µg/l	1	ISO 17025	-	-	< 1.0		
1,1,1-Trichloroethane	µg/l	1	ISO 17025	-	-	< 1.0		
1,2-Dichloroethane	µg/l	1	ISO 17025	-	-	< 1.0		
1,1-Dichloropropene	µg/l	1	ISO 17025	-	-	< 1.0		
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	-	-	< 1.0		
Benzene	µg/l	1	ISO 17025	-	-	< 1.0		
Tetrachloromethane	µg/l	1	ISO 17025	-	-	< 1.0		
1,2-Dichloropropane	µg/l	1	ISO 17025	-	-	< 1.0		
Trichloroethene	µg/l	1	ISO 17025	-	-	< 1.0		
Dibromomethane	µg/l	1	ISO 17025	-	-	< 1.0		
Bromodichloromethane	µg/l	1	ISO 17025	-	-	< 1.0		
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	-	-	< 1.0		
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	-	-	< 1.0		
Toluene	µg/l	1	ISO 17025	-	-	< 1.0		
1,1,2-Trichloroethane	µg/l	1	ISO 17025	-	-	< 1.0		
1,3-Dichloropropane	µg/l	1	ISO 17025	-	-	< 1.0		
Dibromochloromethane	µg/l	1	ISO 17025	-	-	< 1.0		
Tetrachloroethene	µg/l	1	ISO 17025	-	-	< 1.0		
1,2-Dibromoethane	µg/l	1	ISO 17025	-	-	< 1.0		
Chlorobenzene	µg/l	1	ISO 17025	-	-	< 1.0		
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	-	-	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
p & m-Xylene	µg/l	1	ISO 17025	-	-	< 1.0		
Styrene	µg/l	1	ISO 17025	-	-	< 1.0		
Tribromomethane	µg/l	1	ISO 17025	-	-	< 1.0		
o-Xylene	µg/l	1	ISO 17025	-	-	< 1.0		
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	-	-	< 1.0		
Isopropylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
Bromobenzene	µg/l	1	ISO 17025	-	-	< 1.0		
n-Propylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
2-Chlorotoluene	µg/l	1	ISO 17025	-	-	< 1.0		
4-Chlorotoluene	µg/l	1	ISO 17025	-	-	< 1.0		
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
tert-Butylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
sec-Butylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
1,3-Dichlorobenzene	µg/l	1	ISO 17025	-	-	< 1.0		
p-Isopropyltoluene	µg/l	1	ISO 17025	-	-	< 1.0		
1,2-Dichlorobenzene	µg/l	1	ISO 17025	-	-	< 1.0		
1,4-Dichlorobenzene	µg/l	1	ISO 17025	-	-	< 1.0		
Butylbenzene	µg/l	1	ISO 17025	-	-	< 1.0		
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	-	-	< 1.0		
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	-	-	< 1.0		
Hexachlorobutadiene	µg/l	1	ISO 17025	-	-	< 1.0		
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	-	-	< 1.0		

Analytical Report Number: 18-77141

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

Your Order No: P1323JJ1303.14

Lab Sample Number				914716	914717	914718		
Sample Reference				WS2	WS5	WS4		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				21/02/2018	21/02/2018	21/02/2018		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Miscellaneous Organics								
Product ID		N/A	NONE	See Attached	See Attached	-		

U/S = Unsuitable Sample I/S = Insufficient Sample

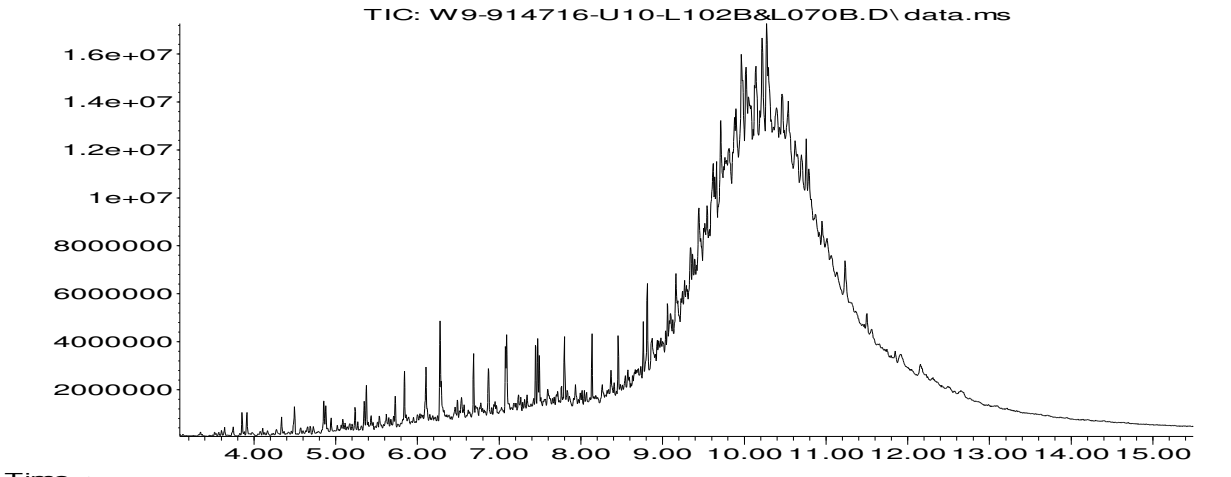
Analytical Report Number : 18-77141

Project / Site name: 138-140 Highgate Road, Highgate, London, NW5 1PB

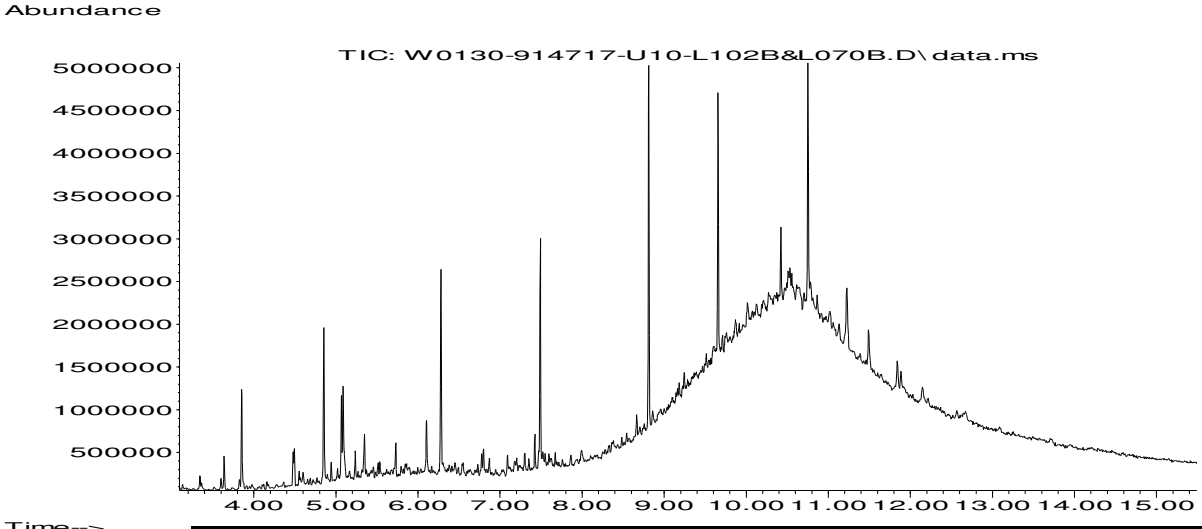
Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Product ID	Determination of product ID by interpretation against standard chromatograms - Water.	In-house method	L070-PL/UK	W	NONE
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
TPH Chromatogram	TPH Chromatogram.	In-house method	L070-PL	W	NONE
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025

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.



The total ion count (TIC trace) shows a carbon range from C10 to greater than C40
The sample TIC trace is complex, showing aromatic and aliphatic product sources.
The trace does not match the standard product profiles but is suggestive of lube oil.



The total ion count (TIC trace) shows a carbon range from C10 to greater than C40
The sample TIC trace is complex, showing aromatic and aliphatic product sources.
The trace does not match the standard product profiles but is suggestive of lube oil.

APPENDIX 4 – GEOTECHNICAL LABORATORY TEST RESULTS

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

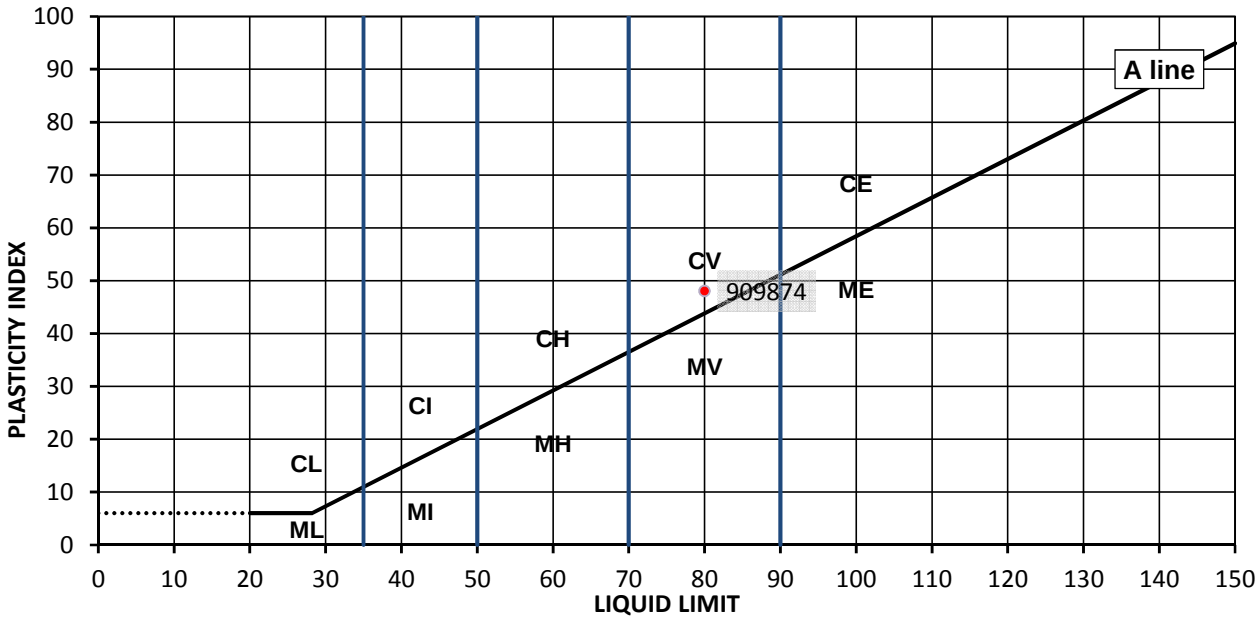
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	23/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909874
Sample Reference: Not Given

Description:	Brown CLAY	Sample Type:	B
Location:	BH1	Depth Top [m]:	2.50
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
33	80	32	48	100



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 Geotechnical Section
Date Reported: 01/03/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

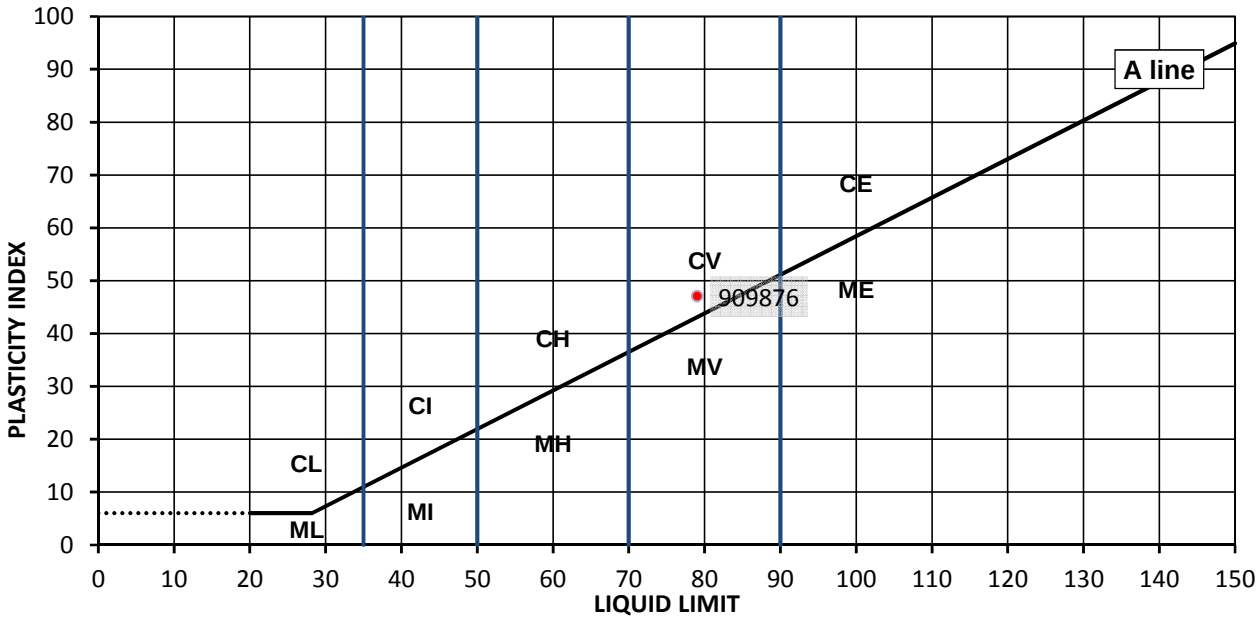
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	23/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909876
Sample Reference: Not Given

Description:	Yellowish brown CLAY	Sample Type:	B
Location:	BH1	Depth Top [m]:	3.50
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
32	79	32	47	100



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 Geotechnical Section
Date Reported: 01/03/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

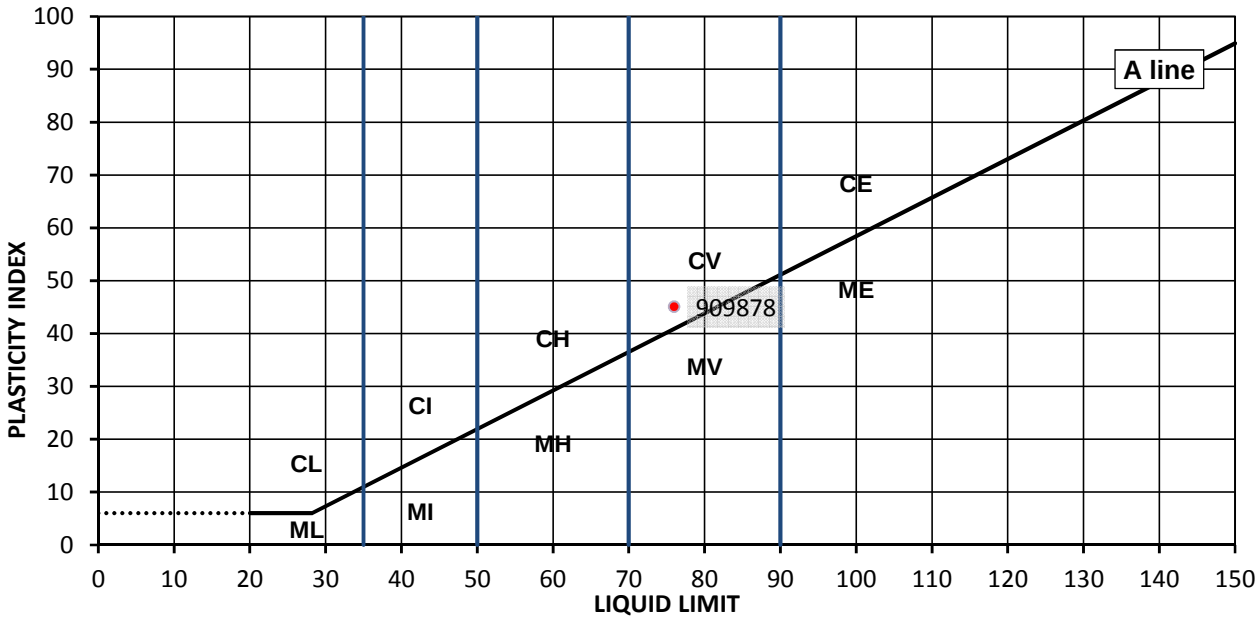
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909878
Sample Reference: Not Given

Description:	Dark brown CLAY	Sample Type:	U
Location:	BH1	Depth Top [m]:	10.50
Sample Preparation:	Tested in natural condition	Depth Base [m]:	10.95

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	76	31	45	100



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 Geotechnical Section
Date Reported: 01/03/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

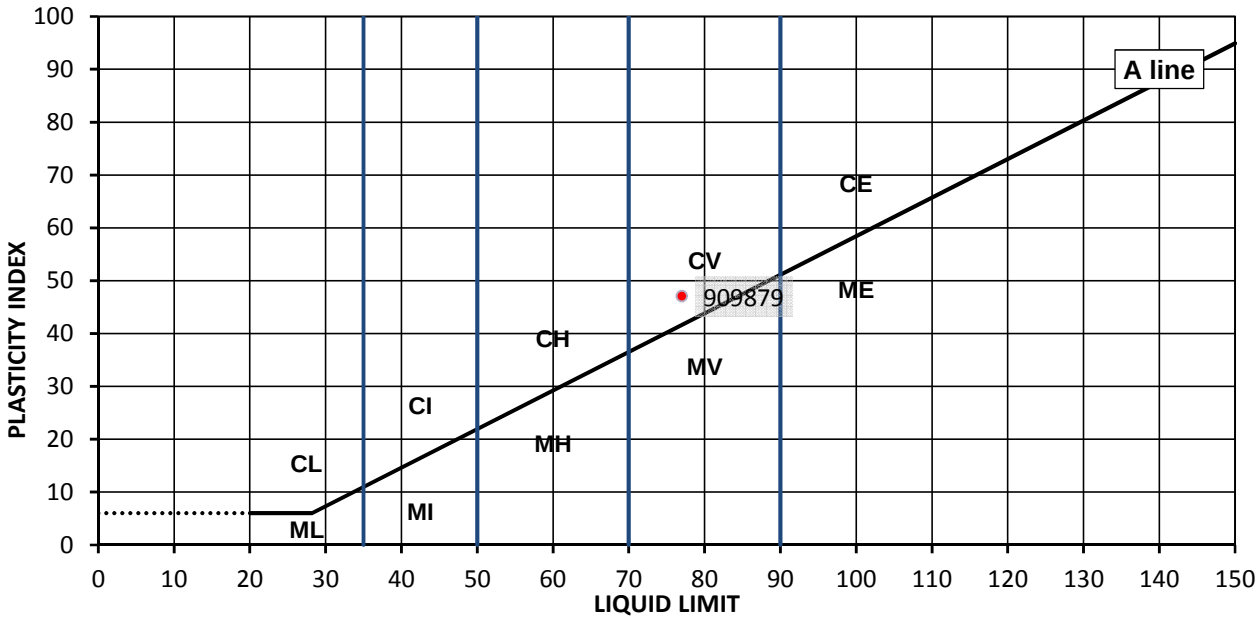
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	23/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909879
Sample Reference: Not Given

Description:	Dark brown CLAY	Sample Type:	D
Location:	BH1	Depth Top [m]:	12.50
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	77	30	47	100



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:

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PL Laboratory Manager Geotechnical Section
Date Reported: 01/03/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

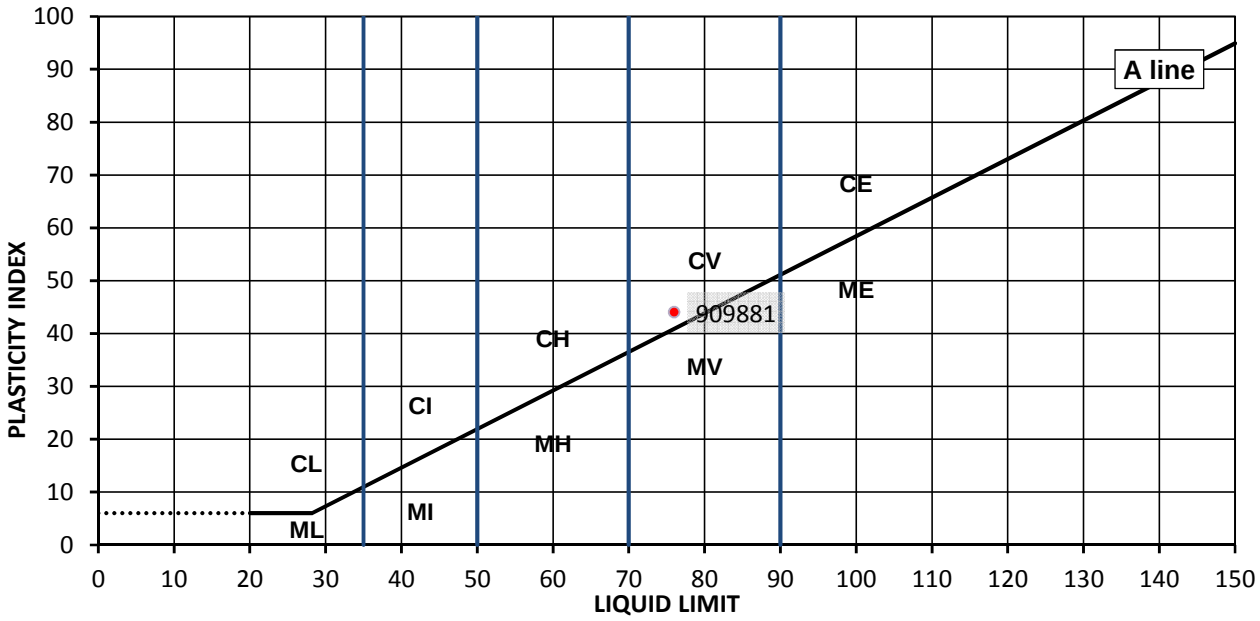
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909881
Sample Reference: Not Given

Description:	Dark brown slightly gravelly CLAY	Sample Type:	U
Location:	BH1	Depth Top [m]:	23.50
Sample Preparation:	Tested after >425um removed by hand	Depth Base [m]:	23.95

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	76	32	44	99



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:

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PL Laboratory Manager Geotechnical Section
Date Reported: 01/03/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

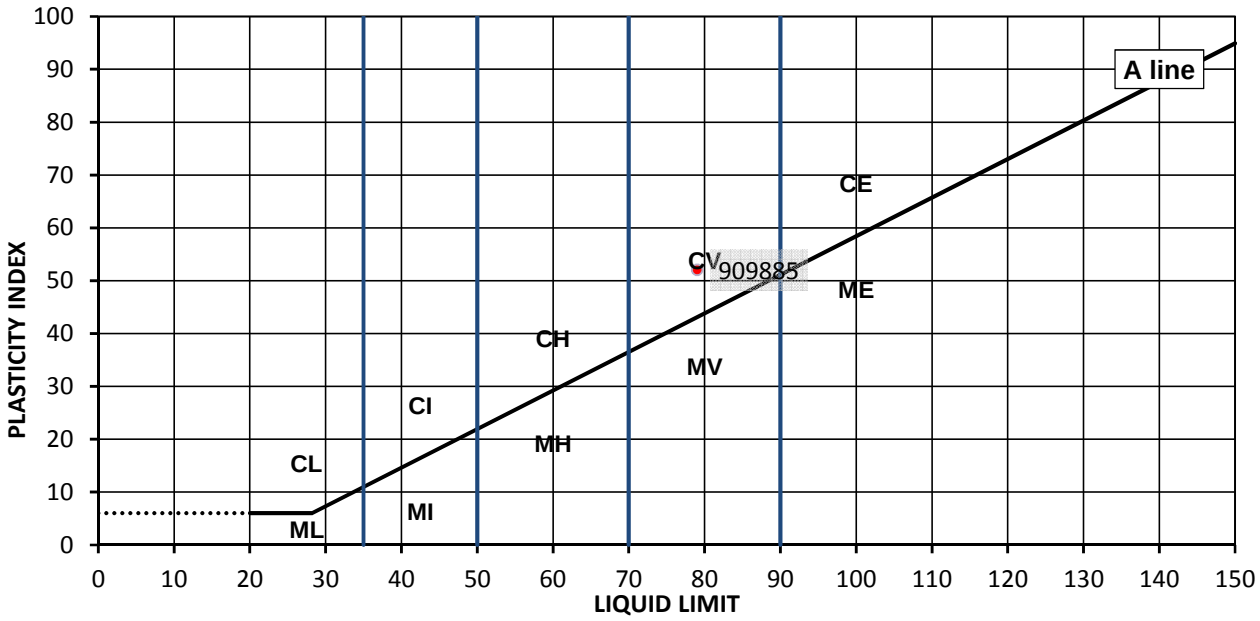
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	23/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909885
Sample Reference: Not Given

Description:	Dark brown CLAY	Sample Type:	B
Location:	BH2	Depth Top [m]:	18.50
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	79	27	52	100



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 Geotechnical Section
Date Reported: 01/03/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

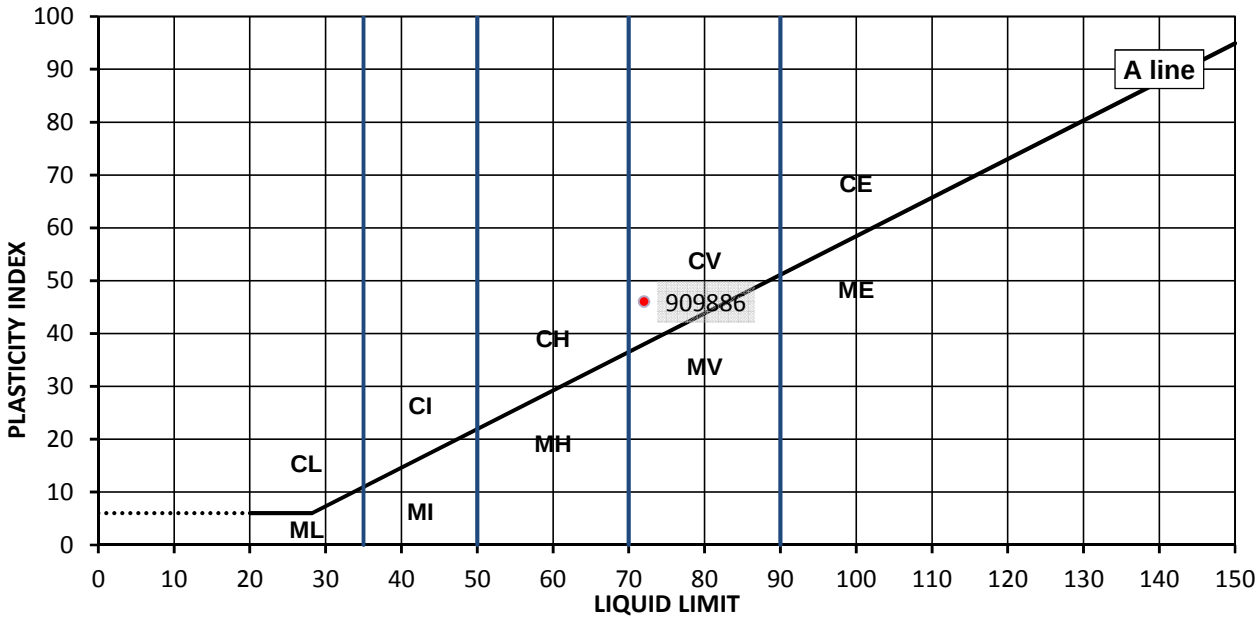
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	23/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909886
Sample Reference: Not Given

Description:	Dark brown CLAY	Sample Type:	D
Location:	BH2	Depth Top [m]:	9.50
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
27	72	26	46	100



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

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PL Laboratory Manager Geotechnical Section
Date Reported: 01/03/2018

Signed:

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Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

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

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

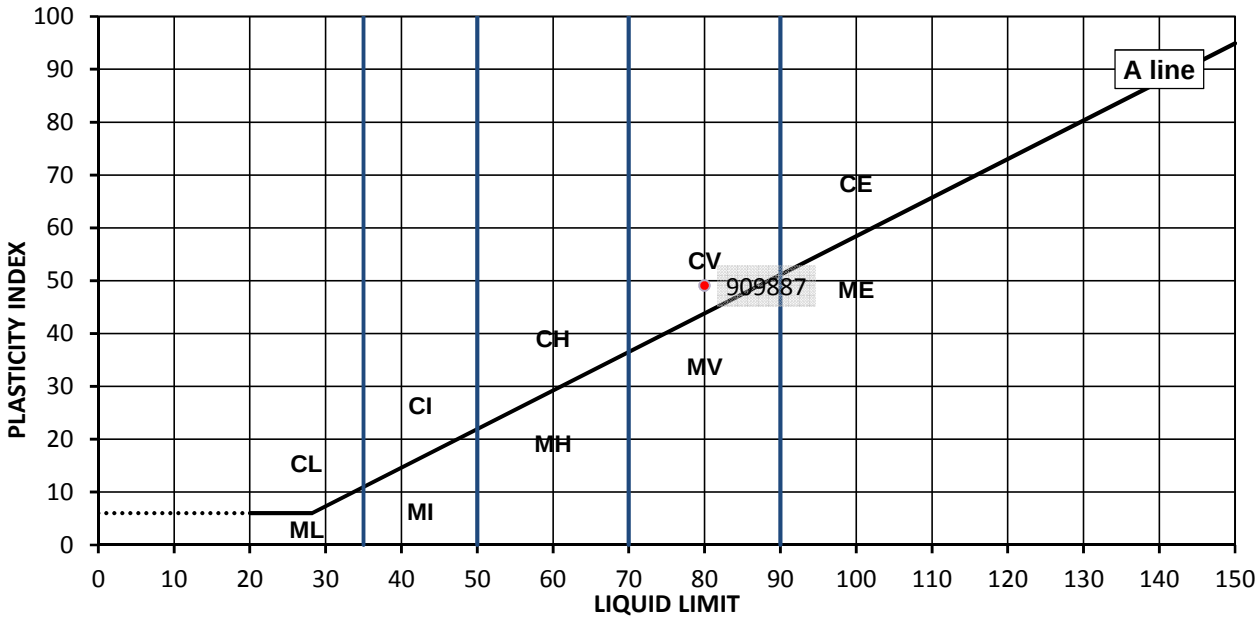
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	23/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

TEST RESULTS

Laboratory Reference: 909887
Sample Reference: Not Given

Description:	Brown CLAY	Sample Type:	D
Location:	BH2	Depth Top [m]:	2.00
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
34	80	31	49	100



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 Geotechnical Section
Date Reported: 01/03/2018

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: Jomas Associates Ltd
Client Address: Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD
Contact: Emma Hucker
Site Name: 138-140 Highgate Road, Highgate, London NW5 1PB
Site Address: 138-140 Highgate Road, Highgate, London NW5 1PB

Client Reference: JJ1303
Job Number: 18-76333
Date Sampled: Not Given
Date Received: 15/02/2018
Date Tested: 23/02 - 26/02/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Atterberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
909874	BH1	Not Given	2.50	Not Given	B	Brown CLAY			33	100	80	32	48	
909876	BH1	Not Given	3.50	Not Given	B	Yellowish brown CLAY			32	100	79	32	47	
909878	BH1	Not Given	10.50	10.95	U	Dark brown CLAY			27	100	76	31	45	
909879	BH1	Not Given	12.50	Not Given	D	Dark brown CLAY			26	100	77	30	47	
909881	BH1	Not Given	23.50	23.95	U	Dark brown slightly gravelly CLAY			27	99	76	32	44	
909887	BH2	Not Given	2.00	Not Given	D	Brown CLAY			34	100	80	31	49	
909886	BH2	Not Given	9.50	Not Given	D	Dark brown CLAY			27	100	72	26	46	
909885	BH2	Not Given	18.50	Not Given	B	Dark brown CLAY			26	100	79	27	52	

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 01/03/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

4041

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

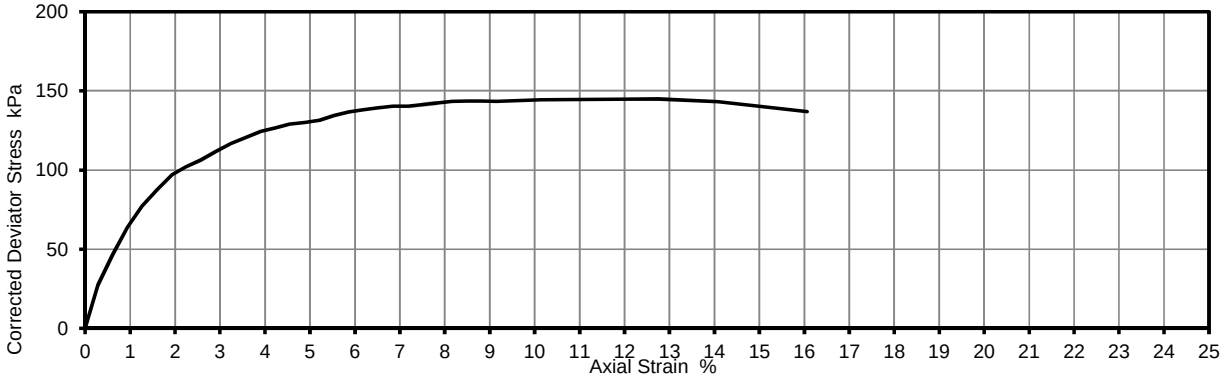
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

Test Result

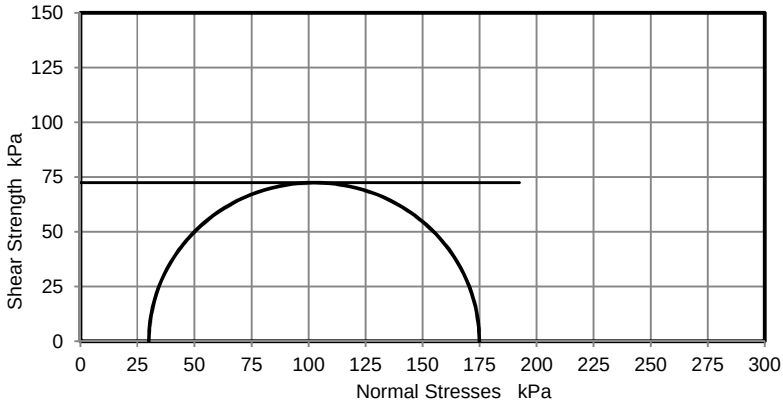
Laboratory Reference:	909873	Depth Top [m]:	1.50
Hole No.:	BH1	Depth Base [m]:	1.95
Sample Reference:	Not Given	Sample Type:	U
Sample Description:	Yellowish brown CLAY		

Test Number	1		Rate of Strain	2.00	%/min	
Length	193.07	mm	Cell Pressure	30	kPa	
Diameter	101.23	mm	Axial Strain at failure	12.8	%	
Bulk Density	1.88	Mg/m3	Deviator Stress, (σ1 - σ3)f	145	kPa	
Moisture Content	30	%	Undrained Shear Strength, cu	72	kPa	½(σ1 - σ3)f
Dry Density	1.44	Mg/m3	Mode of Failure	Brittle		
			Membrane thickness	0.30	mm	

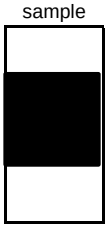
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 01/03/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

UKAS TESTING 4041

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

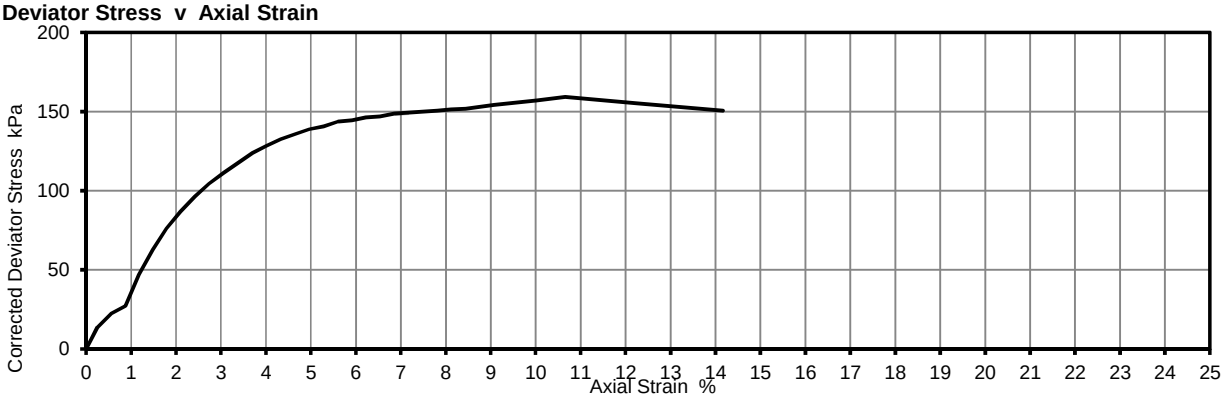
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

Test Result

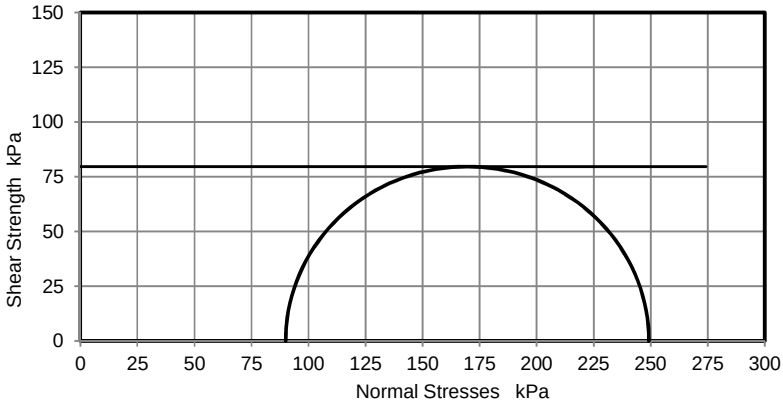
Laboratory Reference:	909875	Depth Top [m]:	4.50
Hole No.:	BH1	Depth Base [m]:	4.95
Sample Reference:	Not Given	Sample Type:	U
Sample Description:	Brown CLAY		

Test Number	1		Rate of Strain	1.94	%/min
Length	206.42	mm	Cell Pressure	90	kPa
Diameter	100.86	mm	Axial Strain at failure	10.7	%
Bulk Density	1.98	Mg/m3	Deviator Stress, (σ1 - σ3)f	159	kPa
Moisture Content	32	%	Undrained Shear Strength, cu	80	kPa ½(σ1 - σ3)f
Dry Density	1.50	Mg/m3	Mode of Failure	Brittle	
			Membrane thickness	0.29	mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample

Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 01/03/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

4041

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

Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

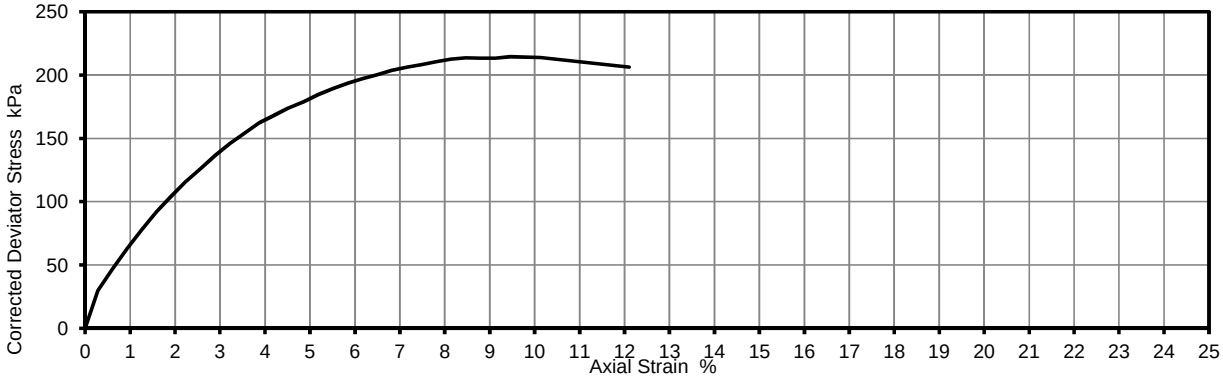
Test Result

Laboratory Reference:	909877
Hole No.:	BH1
Sample Reference:	Not Given
Sample Description:	Brown CLAY

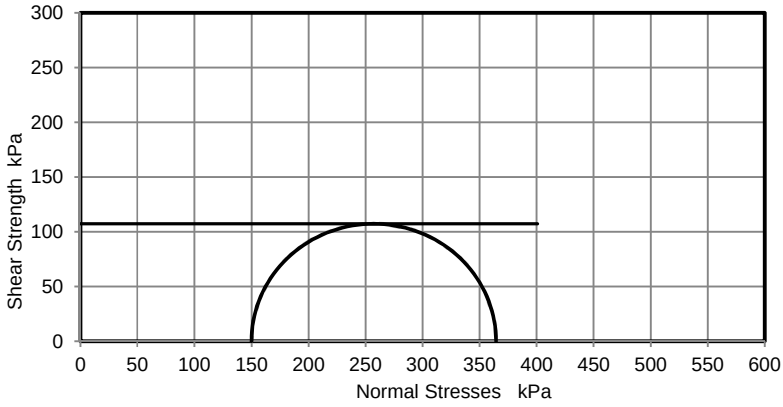
Depth Top [m]:	7.50
Depth Base [m]:	7.95
Sample Type:	U

Test Number	1		Rate of Strain	2.00	%/min
Length	198.66	mm	Cell Pressure	150	kPa
Diameter	102.32	mm	Axial Strain at failure	9.5	%
Bulk Density	1.90	Mg/m3	Deviator Stress, (σ1 - σ3)f	214	kPa
Moisture Content	29	%	Undrained Shear Strength, cu	107	kPa ½(σ1 - σ3)f
Dry Density	1.47	Mg/m3	Mode of Failure	Brittle	
			Membrane thickness	0.29	mm

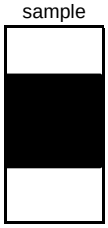
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 01/03/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

4041

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

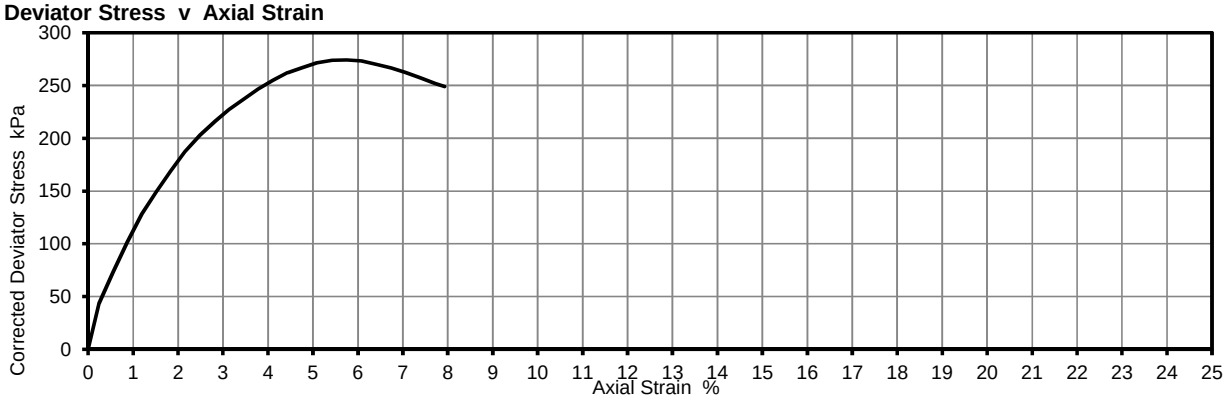
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

Test Result

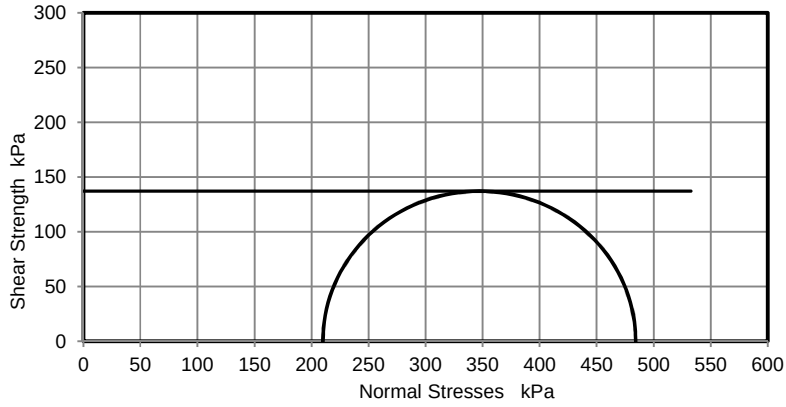
Laboratory Reference:	909878	Depth Top [m]:	10.50
Hole No.:	BH1	Depth Base [m]:	10.95
Sample Reference:	Not Given	Sample Type:	U
Sample Description:	Dark brown CLAY		

Test Number	1		Rate of Strain	2.00	%/min	
Length	184.76	mm	Cell Pressure	210	kPa	
Diameter	102.83	mm	Axial Strain at failure	5.8	%	
Bulk Density	1.93	Mg/m3	Deviator Stress, (σ1 - σ3)f	274	kPa	
Moisture Content	27	%	Undrained Shear Strength, cu	137	kPa	½(σ1 - σ3)f
Dry Density	1.52	Mg/m3	Mode of Failure	Brittle		
			Membrane thickness	0.28	mm	

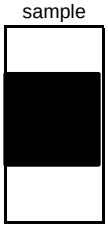
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 01/03/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

4041

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

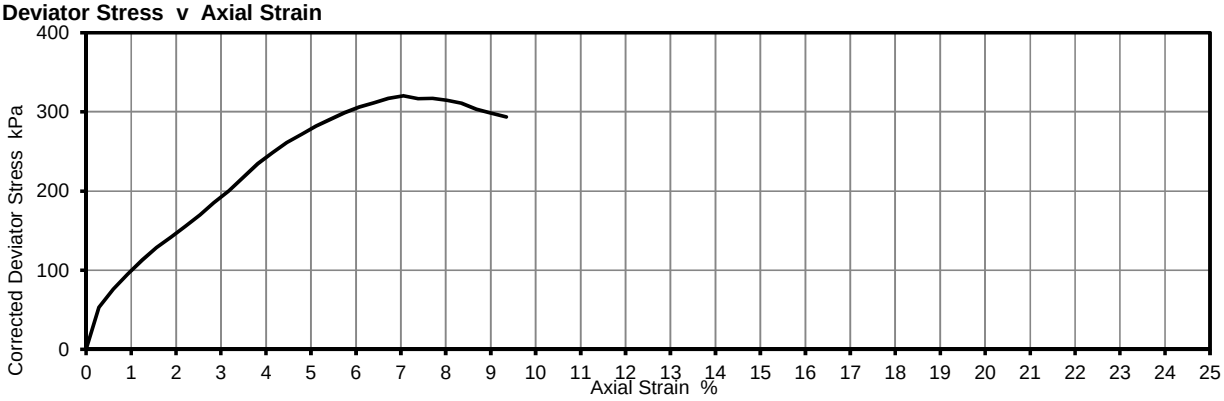
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

Test Result

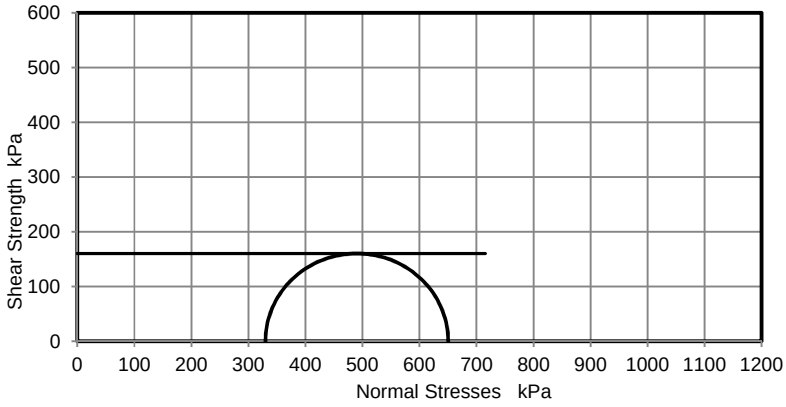
Laboratory Reference:	909880	Depth Top [m]:	16.50
Hole No.:	BH1	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	U
Sample Description:	Dark grey CLAY		

Test Number	1		Rate of Strain	1.98	%/min
Length	202.53	mm	Cell Pressure	330	kPa
Diameter	103.13	mm	Axial Strain at failure	7.1	%
Bulk Density	1.96	Mg/m3	Deviator Stress, (σ1 - σ3)f	320	kPa
Moisture Content	26	%	Undrained Shear Strength, cu	160	kPa ½(σ1 - σ3)f
Dry Density	1.55	Mg/m3	Mode of Failure	Brittle	
			Membrane thickness	0.29	mm

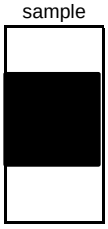
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 01/03/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

4041

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

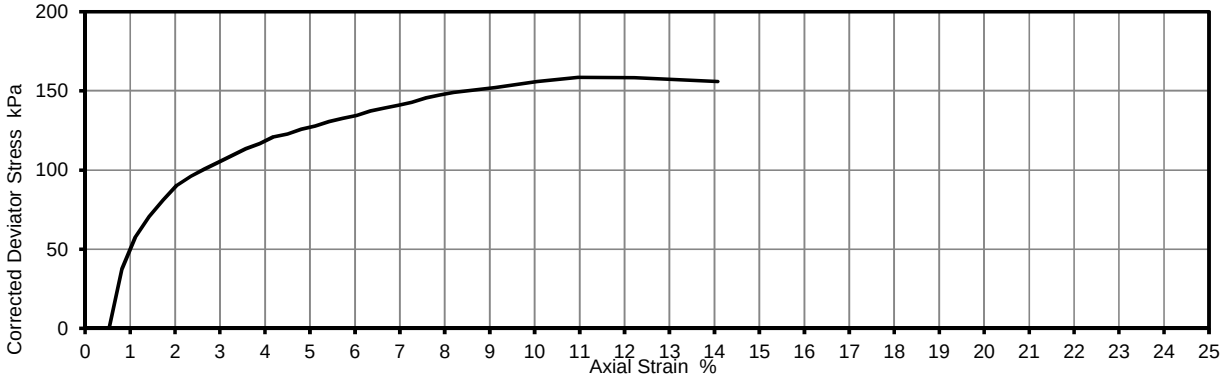
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

Test Result

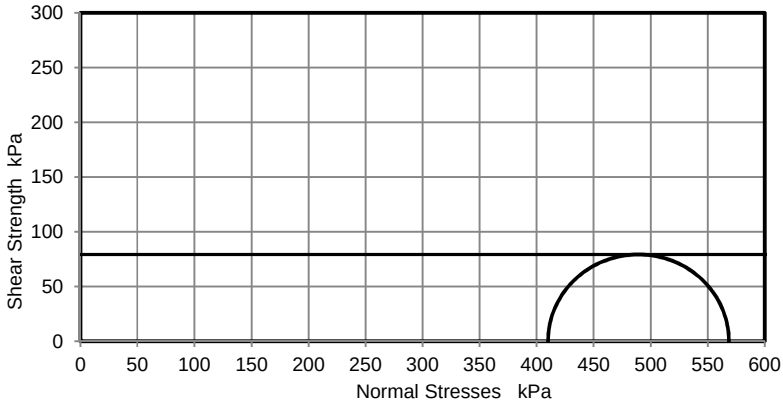
Laboratory Reference:	909882	Depth Top [m]:	20.50
Hole No.:	BH2	Depth Base [m]:	20.95
Sample Reference:	Not Given	Sample Type:	U
Sample Description:	Dark grey CLAY		

Test Number	1		Rate of Strain	1.88	%/min	
Length	212.21	mm	Cell Pressure	410	kPa	
Diameter	102.31	mm	Axial Strain at failure	11.0	%	
Bulk Density	1.81	Mg/m3	Deviator Stress, (σ1 - σ3)f	159	kPa	
Moisture Content	29	%	Undrained Shear Strength, cu	79	kPa	½(σ1 - σ3)f
Dry Density	1.40	Mg/m3	Mode of Failure	Brittle		
			Membrane thickness	0.28	mm	

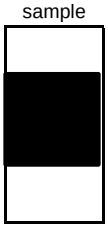
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 01/03/2018

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Unconsolidated Undrained Triaxial Compression

Tested in Accordance with BS1377: Part 7: 1990, clause 8, single specimen

4041

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

Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

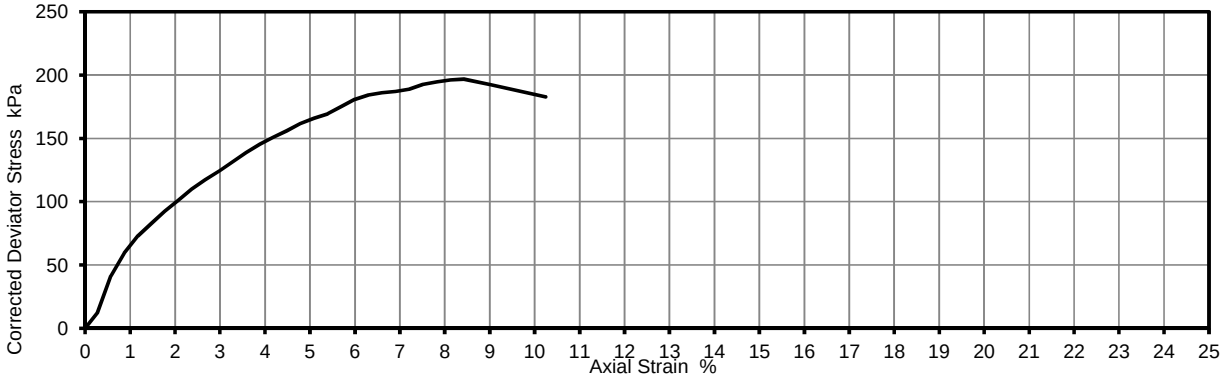
Test Result

Laboratory Reference:	909883
Hole No.:	BH2
Sample Reference:	Not Given
Sample Description:	Dark grey CLAY

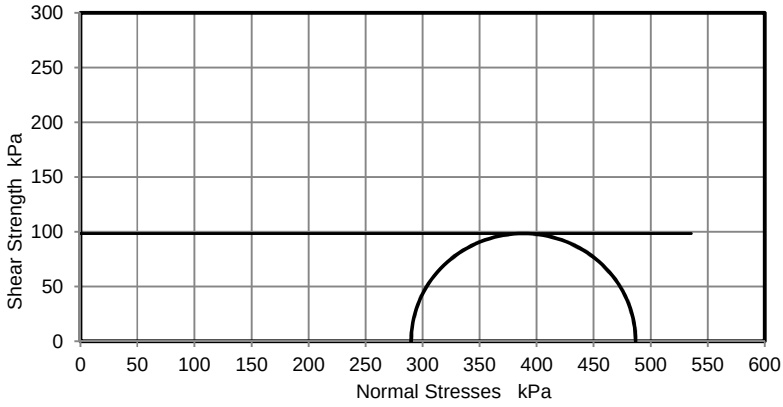
Depth Top [m]:	14.50
Depth Base [m]:	14.95
Sample Type:	U

Test Number	1		Rate of Strain	1.84	%/min
Length	217.26	mm	Cell Pressure	290	kPa
Diameter	102.28	mm	Axial Strain at failure	8.4	%
Bulk Density	1.99	Mg/m3	Deviator Stress, (σ1 - σ3)f	197	kPa
Moisture Content	26	%	Undrained Shear Strength, cu	98	kPa ½(σ1 - σ3)f
Dry Density	1.58	Mg/m3	Mode of Failure	Brittle	
			Membrane thickness	0.27	mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample

Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

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Dariusz Piotrowski
PL Laboratory Manager
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Date Reported: 01/03/2018

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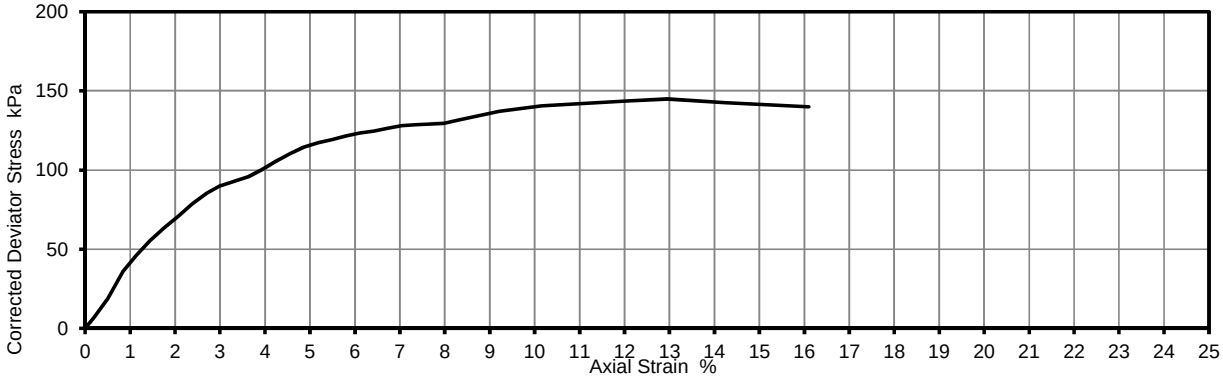
Client:	Jomas Associates Ltd	Client Reference:	JJ1303
Client Address:	Lakeside House 1 Furzeground Way Stockley Park UB11 1BD	Job Number:	18-76333
		Date Sampled:	Not Given
		Date Received:	15/02/2018
Contact:	Emma Hucker	Date Tested:	26/02/2018
Site Name:	138-140 Highgate Road, Highgate, London NW5 1PB	Sampled By:	Not Given
Site Address:	138-140 Highgate Road, Highgate, London NW5 1PB		

Test Result

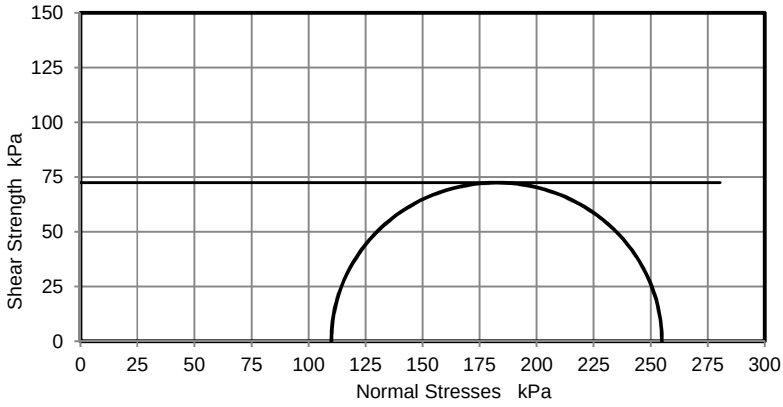
Laboratory Reference:	909884	Depth Top [m]:	5.50
Hole No.:	BH2	Depth Base [m]:	5.95
Sample Reference:	Not Given	Sample Type:	U
Sample Description:	Yellowish brown CLAY		

Test Number	1		Rate of Strain	1.90	%/min	
Length	210.47	mm	Cell Pressure	110	kPa	
Diameter	103.15	mm	Axial Strain at failure	13.0	%	
Bulk Density	1.86	Mg/m3	Deviator Stress, (σ1 - σ3)f	145	kPa	
Moisture Content	33	%	Undrained Shear Strength, cu	72	kPa	½(σ1 - σ3)f
Dry Density	1.39	Mg/m3	Mode of Failure	Brittle		
			Membrane thickness	0.27	mm	

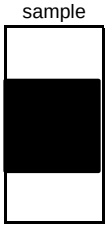
Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Notes:

Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Remarks:

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Signed:

Darren Berrill
Geotechnical General Manager

Date Reported: 01/03/2018

for and on behalf of i2 Analytical Ltd

APPENDIX 5 – SOIL GAS MONITORING TEST RESULTS

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Highgate Road	**Operative(s):** AJH	**Date:** 21/02/18	**Time:** 09:00	**Round: 1**	**Page:**

MONITORING EQUIPMENT

Instrument Type	**Instrument Make**	**Serial No.**	**Date Last Calibrated**
Analox	GA5000	G501805	10/01/2018
PID	Phocheck tiger	T-106448	03/10/2017
Dip Meter	GeoTech		

MONITORING CONDITIONS

Weather Conditions: Overcast	**Ground Conditions:** Dry	**Temperature**: 7°C
Barometric Pressure (mbar): 1023	**Barometric Pressure Trend (24hr):** Steady	**Ambient Concentration: 0.0** %CH_4, 0.2 %CO_2, 21.0%O_2

MONITORING RESULTS

Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH_4 %	CH_4 % LEL	CO_2 %	O_2 %	VOC (ppm)		H_2S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	steady					
BH1	+0.1	+0.1	1023	0.0	/	1.1	19.5	5	5	0	17	/	Dry	5.10
WS1	0.0	0.0	1023	0.0	/	2.1	20.3	0	0	0	0	/	Dry	5.00
WS2**	0.0	0.0	1024	0.0	/	0.2	21.6	6	6	0	0	1.56	3.41	3.42
WS3*	0.0	0.0	1024	0.0	/	0.6	20.9	1	1	0	0	/	4.88	4.88
WS4	+0.2	+0.2	1024	0.0	/	0.5	20.3	0	0	0	4	/	4.67	4.93
WS5**	0.0	0.0	1023	4.9	/	0.8	4.4	54	54	0	8	1.52	1.77	4.95

* Open tap

** Oil layer, HC odour noted

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Highgate Road	**Operative(s):** AJH	**Date:** 26/02/18	**Time:** 12:00	**Round: 2**	**Page:**

MONITORING EQUIPMENT

Instrument Type	**Instrument Make**	**Serial No.**	**Date Last Calibrated**
Analox	GA5000	G501805	10/01/2018
PID	Phocheck tiger	T-106448	03/10/2017
Dip Meter	GeoTech		

MONITORING CONDITIONS

Weather Conditions: Clear	**Ground Conditions:** Dry	**Temperature**: 1°C
Barometric Pressure (mbar): 1026	**Barometric Pressure Trend (24hr):** Steady then falling	**Ambient Concentration: 0.0** %CH_4, 0.3 %CO_2, 20.7%O_2

MONITORING RESULTS

Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH_4 %	CH_4 % LEL	CO_2 %	O_2 %	VOC (ppm)		H_2S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	steady					
BH1	+0.1	+0.1	1026	0.0	/	1.9	18.9	2	2	0	7	/	Dry	5.07
WS1	+0.1	+0.1	1027	0.0	/	3.4	19.2	0	0	0	0	/	Dry	5.02
WS2*	0.0	0.0	1027	0.0	/	0.2	21.0	18	18	0	0	1.55	2.23	3.42
WS3	+0.1	+0.1	1027	0.0	/	1.1	20.3	0	0	0	0	/	4.86	4.89
WS4	0.0	0.0	1026	0.0	/	1.1	19.0	1	1	0	0	/	4.90	4.94
WS5*	-0.1	-0.1	1026	3.5	/	1.0	4.1	145	145	0	1	1.54	1.85	4.95

* Oil layer, HC odour noted

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Highgate Road	**Operative(s):** JWT	**Date:** 26/02/18	**Time:** 09:30	**Round: 3**	**Page:**

MONITORING EQUIPMENT

Instrument Type	**Instrument Make**	**Serial No.**	**Date Last Calibrated**
Analox	GA5000	G501805	10/01/2018
PID	Phocheck tiger	T-106448	03/10/2017
Dip Meter	GeoTech		

MONITORING CONDITIONS

Weather Conditions: Sunny	**Ground Conditions:** Wet	**Temperature**: 6°C
Barometric Pressure (mbar): 986	**Barometric Pressure Trend (24hr):** Steady then falling	**Ambient Concentration: 0.0** %CH_4, 0.2 %CO_2, 21.0%O_2

MONITORING RESULTS

Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH_4 %	CH_4 % LEL	CO_2 %	O_2 %	VOC (ppm)		H_2S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	steady					
BH1	+0.2	+0.2	987	0.0	/	1.6	19.2	0	0	0	0	/	Dry	5.07
WS1	0.0	0.0	987	0.0	/	3.4	19.2	0	0	0	0	/	Dry	5.02
WS2*	-0.1	-0.1	987	0.0	/	0.3	20.7	16	16	0	1	1.52	2.62	3.42
WS3	+0.1	+0.1	987	0.0	/	0.3	20.9	2	1	0	0	/	4.81	4.89
WS4	+0.2	+0.2	987	0.0	/	1.6	18.4	3	3	0	0	/	Dry	4.94
WS5*	-0.4	-0.4	987	3.0	/	0.9	0.4	27	27	1	2	1.49	1.64	4.95

* Oil layer, HC odour noted

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Highgate Road	**Operative(s):** JWT	**Date:** 15/03/18	**Time:** 09:40	**Round: 4**	**Page:**

MONITORING EQUIPMENT

Instrument Type	**Instrument Make**	**Serial No.**	**Date Last Calibrated**
Analox	GA5000	G501805	10/01/2018
PID	Phocheck tiger	T-106448	03/10/2017
Dip Meter	GeoTech		

MONITORING CONDITIONS

Weather Conditions: Overcast	**Ground Conditions:** Wet	**Temperature**: 10°C
Barometric Pressure (mbar): 985	**Barometric Pressure Trend (24hr):** Steady then falling	**Ambient Concentration: 0.0** %CH_4, 0.2 %CO_2, 20.8%O_2

MONITORING RESULTS

Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH_4 %	CH_4 % LEL	CO_2 %	O_2 %	VOC (ppm)		H_2S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	steady					
BH1*	/	/	/	/	/	/	/	/	/	/	/	/	/	/
WS1	0.0	0.0	985	0.0	/	3.5	18.7	8	8	0	0	/	Dry	5.01
WS2**	+0.1	+0.1	986	0.1	/	0.7	20.1	21	21	0	2	1.49	**	3.42
WS3	0.0	0.0	986	0.0	/	1.3	20.3	4	2	0	0	/	4.66	4.86
WS4	+0.4	+0.4	986	0.0	/	2.3	16.4	5	4	0	0	/	4.37	4.93
WS5**	-0.3	-0.3	985	4.3	/	0.9	1.2	76	76	1	2	1.48	**	4.92

*Could not be accessed due to parked vehicle
**No interface probe to measure difference in product/water. Dip-meter used to measure depth to product.