GEO-ENVIRONMENTAL AND GEOTECHNICAL GROUND INVESTIGATION

FOR

254 KILBURN HIGH ROAD, LONDON NW6 2BS

Specialists in the investigation & reclamation of brownfield sites

Report Title	**: Geo-environmental and Geotechnical Ground Investigation for 254 Kilburn High Road, London**
Report Status	**: Final v1.0**
Job No	**: P8591J338**
Date	**: November 2014**

Quality Control: Previous Release

Version	*Date*	*Issued By*

Prepared by: JOMAS ASSOCIATES LTD For: AITCH GROUP

Prepared by Marc Williams BSc (Hons), AIEMA, FGS
Principal Consultant

Checked by Andrew Garnham BSc (Hons) MSc FGS
Senior Engineer

Approved by Roni Savage BEng (hons), MSc, SiLC, CGeol, MCIWM, FGS
Technical Director

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

Roni Savage

Jomas Associates Ltd

www.jomasassociates.com

☎ 0843 289 2187

✉info@jomasassociates.com

CONTENTS

Page

EXECUTIVE SUMMARY

Aitch Group (the client) commissioned Jomas Associates Ltd ('JAL') to undertake a Geo-environmental and Geotechnical ground investigation at a site on site 254 Kilburn High Road, London.

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 obtain documentary or other information to assess whether the land appears to be contaminated land, under the definition set out in Part IIA of the Environmental Protection Act 1990;
- 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.

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	
Site History Overview	A Desk Study report produced for the site has been issued separately. A review of historical maps indicates that the site was originally (1866) occupied by gardens to the rear of a row of properties on Edgware Road, with a building noted as Stanmore terrace encroaching on the south-eastern edge of the site. A further building is present in the north-eastern part of the site in 1866. Further buildings are constructed on site by 1893. The structures on site are subsequently modified over the years, with the site appearing similar to the present day by 1995. The site is labelled as a Timber yard in 1935, a Motor Units Factory in 1953, and a Warehouse from 1976. Historically, the surrounding area has been utilised for a variety of uses, with several industrial uses noted from 1871. Notable industrial uses within the surrounding area include railway lines, garage (60m SE and 220m NW), engineering works (150m N, 175m E), gas works (125m NW). Information provided by the British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial or superficial deposits are reported within the site. The deposits directly underlying the site are identified as Unproductive. There is no groundwater abstraction license within 500m. The nearest borehole is reported 1794m east of the site for spray irrigation sourced from Thames Groundwater. There are no surface water abstractions reported within 2km of the site. The site is not reported to lie within a Zone 2 or 3 floodplain.
Intrusive Investigation	The ground investigation was undertaken on 09 - 16 October 2014, and consisted of the following: • 5No. window sampling boreholes, drilled up to 4.45m below ground level (bgl), with associated in situ testing and sampling; • 2No. cable percussive boreholes, drilled up to 25m bgl with associated in situ testing and sampling; • 7No. hand excavated trial pits, excavated up to 1.7m bgl, with associated in situ testing and sampling • 3No. in situ CBR measurements undertaken to depths of up to 0.9m bgl; • Laboratory analysis for chemical and geotechnical purposes,
Ground Conditions	The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay), encountered to the base of the boreholes at up to 25m bgl. No obvious evidence of contamination was observed during the investigation. Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was note recorded during return monitoring.

Environmental Considerations	It is understood that the proposed development comprises demolition of the existing building and construction of a new mixed use development, with commercial ground floor units and residential apartments on upper floors. No private gardens or significant areas of soft landscaping are anticipated. Following generic risk assessments and statistical analysis, the upper ninety fifth percentile values for Lead, Mercury and Naphthalene were found to exceed their respective criteria, with the presence of statistical outliers or isolated hotspots of contamination indicated in the case of Mercury and Naphthalene. Individual exceedances of Benzo(a)pyrene and Arsenic were reported, although the upper ninety fifth percentile value for these contaminants did not exceed the respective criteria. No other contaminants were reported above their respective criteria, and no asbestos fibres were detected. Where the site is to be overlain by either proposed building footprint or areas of hardstanding, these concentrations are no considered to pose a significant risk to human health, as the building / surfacing will provide a suitable barrier to potential receptors. Where areas of soft landscaping are proposed, the risks to end users will be controlled by use of a capping layer. This should comprise a minimum 300mm thickness of imported clean topsoil. The desk study identified the site to be directly underlain by unproductive deposits (London Clay), with no significant controlled water receptors identified. As a result these concentrations are not considered to pose a potential risk to controlled waters. The results of waste acceptance criteria testing indicated the Made Ground to be acceptable for disposal as a non-hazardous material, with the underlying natural ground suitable for disposal as inert material. The results of soil gas monitoring undertaken to date indicate the site to be classified as Characteristic Situation 2, where basic gas protection measures are required. It will be necessary to complete the proposed monitoring in order to confirm this assessment. 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. The above conclusions are made subject to approval by the statutory regulatory bodies.
Geotechnical Considerations	The desk study report indicates that the site is directly underlain by solid deposits of the London Clay Formation. The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay), encountered to the base of the boreholes at up to 25m bgl. Based upon the information obtained to date, it is considered that deep trench fill foundations, constructed at a depth of 3.0m bgl within the underlying London Clay may be designed with an allowable bearing capacity of 120kPa. Alternatively a piled foundation solution within the underlying London Clay should be devised for the proposed development. The London Clay deposits have been identified as being of moderate to high volume

	change potential, and this will require consideration when designing foundations for the proposed development, in conjunction with the presence of any existing or proposed trees. Potential for heave should be considered. The results of in situ CBR testing provided indicative measurements of between 1.2% and 28.4%. Based on the results the required concrete class for the site is DS-2 assuming an Aggressive Chemical Environment for Concrete classification of AC-2 in accordance with the procedures outlined in BRE Special Digest 1. To allow for potential volume change within the underlying London Clay, and due to the thickness of Made Ground deposits encountered, all floor slabs should be designed as suspended floors. Deep excavations will be required at the site during the construction works. These are anticipated to remain stable for the short term only. It is recommended that 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. Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was note recorded during return monitoring. Any groundwater encountered should be readily dealt with by conventional pumping from a sump or other suitable method. The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably qualified Engineer.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 Aitch Group ("The Client") has commissioned Jomas Associates Ltd ('JAL'), to assess the risk of contamination posed by the ground conditions at a site on 254 Kilburn High Road, London, and to provide indicative recommendations for foundation design prior to the redevelopment of the site. It is understood that the redevelopment of the site is to comprise construction of a new mixed use development, with ground floor commercial units and residential apartments on upper floors. No private gardens or significant areas of soft landscaping are anticipated.

1.1.2 To this end a Desk Study has been produced for the site and issued separately, followed by an intrusive investigation (detailed in this report). The scope of works is defined in Jomas' fee proposal dated 09 October 2014.

1.2 Objectives

1.2.1 The objectives of JAL's 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; and,
- To obtain geotechnical parameters to inform preliminary foundation design.

1.3 Scope of Works

1.3.1 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.

1.4 Limitations

1.4.1 Jomas Associates Ltd ('JAL') has prepared this report for the sole use of Aitch Group 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 JAL. 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.

1.4.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless JAL has actual knowledge to the contrary, information obtained from public sources or provided to JAL by site personnel and other information sources, have been assumed to be correct. JAL 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.

1.4.3 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.

1.4.4 ***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 as Figure 1.

Table 2.1: Site Information

Name of Site	-
Address of Site	254 Kilburn High Road, London, NW6 2BS
Approx. National Grid Ref.	524975, 184276
Site Ownership	Unknown
Site Occupation	Office accommodation with associated warehouse and vehicle parking
Local Authority	London Borough of Camden
Proposed Site Use	Mixed use development with commercial ground floor units and residential apartments on upper floors. No private gardens or significant areas of soft landscaping anticipated.

2.2 Desk Study Overview

2.2.1 A Desk Study report has been produced for the site and issued separately. 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 A review of historical maps indicates that the site was originally (1866) occupied by gardens to the rear of a row of properties on Edgware Road, with a building noted as Stanmore Terrace encroaching on the south-eastern edge of the site. A further building is present in the north-eastern part of the site. Further buildings are constructed on site by 1893. The structures on site are subsequently modified over the years, with the site appearing similar to the present day by 1995. The site is labelled as a Timber yard in 1935, a Motor Units Factory in 1953, and a Warehouse from 1976.

2.2.3 Historically, the surrounding area has been utilised for a variety of uses, with several industrial uses noted from 1871. Notable industrial uses within the surrounding area include railway lines, garage (60m SE and 220m NW), engineering works (150m N, 175m E), gas works (125m NW), etc.

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

2.2.5 The deposits directly underlying the site are identified as Unproductive.

2.2.6 There is no groundwater abstraction license within 500m. The nearest borehole is reported 1794m east of the site for spray irrigation sourced from Thames Groundwater. There are no surface water abstractions reported within 2km of the site.

2.2.7 The site is not reported to lie within a Zone 2 or 3 floodplain.

2.2.8 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 Made Ground associated with previous developments – on and off site
- Potential for asbestos in soil from demolition of previous buildings – on site (S2)
- Former Timber Yard – on site (S3)
- Former Motor Units Factory – on site (S4)
- Current industrial use – on site (S5)
- Current and previous industrial sites and consents/depots/works – off site (S6)

2.2.9 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 hardstanding 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)

2.2.10 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)

2.2.11 Depending on ground conditions encountered i.e., thickness of made ground and depth to London clay deposits, a programme of soil gas monitoring may be required in accordance with CIRIA C665:2007.

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.

3.2 Scope of Ground Investigation

3.2.1 The ground investigation was undertaken on 09 – 16 October 2014.

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;

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	5	WS1 - 5	Up to 4.45m bgl	Assess ground conditions and obtain samples for contamination testing and geotechnical analysis.
Cable Percussive boreholes	2	BH1 - 2	Up to 25m bgl	Obtain deeper ground profile and samples for geotechnical analysis
Hand Excavated trial pits	7	TP1 - 7	Up to 1.7m bgl	Obtain shallow samples from areas of restricted access
In Situ CBR Measurements	3	CBR1 - 3	Up to 0.9m bgl	Provide initial value for road pavement design
Installation of combined gas and groundwater monitoring wells	2	BH2, WS3	Up to 20m bgl	Permit return visits to site to monitor soil gas and groundwater levels.

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 BS5930:1999.

3.2.6 Exploratory hole positions were measured in using tape and reel, 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 no monitoring wells were 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 Standard Penetration Tests (SPTs)

3.3.1 In-situ standard/cone penetration tests were undertaken in the boreholes in accordance with BS EN ISO 22476-2 'Methods of Test on Soils for Engineering Purposes (Part 9)'; to determine the relative density of the underlying , and therefore give an indication of soil 'strength'.

3.3.2 The results are presented on the individual exploratory hole records in Appendix 2.

3.4 In Situ CBR Measurements

3.4.1 A total of 3No. in situ CBR measurements were undertaken to provide indicative CBR values for pavement design.

3.4.2 The results are presented as Appendix 7, and discussed in Section 9 of this report.

3.5 Sampling Rationale

3.5.1 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).

3.5.2 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.

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

3.5.4 JAL'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.

3.5.5 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.

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

3.5.7 Bulk samples were collected for geotechnical analysis.

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

3.6 Laboratory Analysis

3.6.1 A programme of chemical laboratory testing, scheduled by JAL, was carried out on selected samples of Made Ground and natural strata.

Chemical Testing

3.6.2 Soil samples were submitted to The Environmental Laboratory Ltd, East Sussex (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

Test Suite	No. of tests	
	Made Ground	Natural
Basic Suite 2	9	1
Total Organic Carbon	4	2
Water Soluble Sulphate	9	9
Asbestos Screen	4	-

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	5	Y (MCERTS)	ICPMS
Cadmium	0.5	Y	ICPMS
Chromium	1	Y (MCERTS)	ICPMS
Chromium (Hexavalent)	2	N	Colorimetry
Lead	1	Y (MCERTS)	ICPMS
Mercury	0.5	Y	ICPMS
Nickel	1	Y (MCERTS)	ICPMS
Selenium	1	PENDING	ICPMS
Copper	1	Y (MCERTS)	ICPMS
Zinc	1	Y (MCERTS)	ICPMS
Boron (Water Soluble)	0.5	PENDING	ICPMS
pH Value	0.1 units	Y (MCERTS)	Electrometric
Sulphate (Water Soluble)	0.01ug/l	Y	Ion Chromatography
Total Cyanide	1	Y (MCERTS)	Colorimetry
Speciated PAH	0.5	Y (MCERTS)	GCFID
Phenols	1	Y (MCERTS)	HPLC
Total Petroleum Hydrocarbons (banded)	5	Y (MCERTS)	Gas Chromatography

3.6.5 To support the derivation of appropriate tier 1 screening values, 6 No. samples were also 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 PSL for the following assessment.

- 5No. samples for Moisture Content and Atterberg Limit Determination in accordance with BS 1377
- 11No. sample for Quick Undrained Triaxial Compression Tests in accordance with BS 1377

3.6.8 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 BS5930:1999. 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)
TARMAC and CONCRETE over MADE GROUND – Brown/black/orange sandy gravelly clay to clayey gravelly sand. Gravel is of brick, concrete, flint, mortar, ash and glass.	0.0	0.7 – 2.1	0.7 – 2.1
Orange brown sandy to silty patched blue grey CLAY with occasional flints, becoming predominantly blue grey with depth Encountered to base of window sample and cable percussive boreholes.	0.7 – 2.1	>25.0	>24.3

4.2 Hydrogeology

4.2.1 Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was not recorded during return monitoring.

4.3 Physical and Olfactory Evidence of Contamination

4.3.1 No visual or olfactory evidence of potential contamination was reported during the course of the investigation.

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, JAL have derived Tier 1 screening values for initial assessment of the soil, based on available current UK guidance including the LQM/CIEH generic assessment criteria. 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)	LQM/CIEH
	Total Phenols	CLEA v1.06
Polycyclic Aromatic Hydrocarbons (PAH-16)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene	LQM/CIEH
Volatile Organic Compounds (VOCs/sVOCs).	Toluene, Ethylbenzene	CLEA v1.06
	Benzene, Xylenes	CLEA v1.06
Inorganic Substances		
Heavy Metals and Metalloids	Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium	CLEA v1.06
	Copper, Zinc	LQM/CIEH
Cyanides	Free Cyanide	CLEA v1.06
Sulphates	Water Soluble Sulphate	BRE Special Digest 1:2005

BRE

5.2.6 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.

5.3 Analytical Framework – Groundwater and Leachate

5.3.1 The groundwater quality assessment is undertaken in accordance with the EA P20 Document.

5.3.2 The criteria used by JAL in the 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/WHO
PAHs	(Sum of Four – benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene)	DWS
PAHs	Anthracene, Benzo(a)pyrene, Fluoranthene, Naphthalene	EQS
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	Dutch Intervention Values/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,

Dutch Intervention Values (DIV)
The Dutch Institute and Human Toxicology data are used for speciated TPH. Whilst they do not have force of law in the UK, they are recognised as a valid source of information by the EA. For example, they are recommended in the EA document 'Biological Test Methods for Assessing Contaminated Land'.

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 wastewater treatment works to inland surface waters, groundwater, estuaries or coastal waters. Standards of (125mg/L) COD and (25mg/L) BOD have been set.

Site Specific Criteria

5.3.3 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 without plant uptake
Soil Type	Clay
pH	8
Soil Organic Matter	2.5%

5.3.4 A pH value of '8' has been used for the derivation of generic screening criteria as 8.11 was the mean pH value of samples analysed.

5.3.5 As the published reports only offer the option of selecting an SOM value of 1%, 2.5% or 6%, an SOM value of 2.5% has been used for the generation of generic assessment criteria, as 2.09% was the mean value obtained from laboratory analysis.

5.3.6 It is understood that the redevelopment of the site is to comprise a mixed use development, with commercial ground floor units and residential apartments on upper floors. No private gardens or significant areas of soft landscaping are anticipated. Consequently, the site has been assessed as Residential without 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 6.3. Raw laboratory data is included in Appendix 3.

Table 6.1: Soil Laboratory Analysis Results – Metals, Metalloids, TPH

Determinand	Unit	No. samples tested	Screening Criteria		Min	Max	No of Exceedences
Arsenic	mg/kg	10	32	CLEA v1.06	10.6	33.7	1 (WS4 @1.0m bgl)
Cadmium	mg/kg	10	10	CLEA v1.06	<0.5	1.3	0
Chromium	mg/kg	10	35	CLEA v1.06	15.9	48.4	0
Hexavalent Chromium	mg/kg	10			<0.8	<0.8	0
Lead [A]	mg/kg	10	400	CLEA v1.06	38.4	2530	6
Mercury	mg/kg	10	1	CLEA v1.06	<0.5	2.3	5
Nickel	mg/kg	10	130	CLEA v1.06	15.7	36	0
Copper	mg/kg	10	1570	CLEA v1.06	21.2	204	0
Zinc	mg/kg	10	1915	CLEA v1.06	54.5	837	0
Total Cyanide [B]	mg/kg	10	33	CLEA v1.06	<1	<1	0
Selenium	mg/kg	10	350	CLEA v1.06	<1	2.2	0
Boron Water Soluble	mg/kg	10	291	CLEA v1.06	1.4	5.1	0
Phenols	mg/kg	10	389	CLEA v1.06	<5	<5	0

Notes: [A] SGV screening criteria for Lead using the SEGH model.
[B] 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. Exceeded
Naphthalene	mg/kg	10	LQM GAC	3.7	<0.5	10.7	1 (WS1 @1.0m)
Acenaphthylene	mg/kg	10	LQM GAC	400	<0.5	<0.5	0
Acenaphthene	mg/kg	10	LQM GAC	480	<0.5	1.9	0
Fluorene	mg/kg	10	LQM GAC	380	<0.5	0.6	0
Phenanthrene	mg/kg	10	LQM GAC	200	<0.5	2.2	0
Anthracene	mg/kg	10	LQM GAC	4900	<0.5	1.6	0
Fluoranthene	mg/kg	10	LQM GAC	460	<0.5	2.5	0
Pyrene	mg/kg	10	LQM GAC	1000	<0.5	2.2	0
Benzo(a)anthracene	mg/kg	10	LQM GAC	4.7	<0.5	1.7	0
Chrysene	mg/kg	10	LQM GAC	8.0	<0.5	1.9	0
Benzo(b)fluoranthene	mg/kg	10	LQM GAC	6.5	<0.5	1.1	0
Benzo(k)fluoranthene	mg/kg	10	LQM GAC	9.6	<0.5	1.8	0
Benzo(a)pyrene	mg/kg	10	LQM GAC	0.94	<0.5	1.7	2 (WS4 @0.5m & 1.0m)
Indeno(123-cd)pyrene	mg/kg	10	LQM GAC	3.9	<0.5	0.9	0
Dibenz(ah)anthracene	mg/kg	10	LQM GAC	0.86	<0.5	<0.5	0
Benzo(ghi)perylene	mg/kg	10	LQM GAC	46	<0.5	0.8	0
Total PAH	mg/kg	10	-		<2.0	18.0	

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

TPH Band	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeded
C_8-C_{10}	mg/kg	10	LQM GAC	46	<1.0	8.1	0
>C_{10}-C_{12}	mg/kg	10	LQM GAC	118	<1.0	55.6	0
>C_{12}-C_{16}	mg/kg	10	LQM GAC	59	<1.0	135	1 (WS1 @1.0m)
>C_{16}-C_{21}	mg/kg	10	LQM GAC	480	<1.0	77.8	0
>C_{21}-C_{35}	mg/kg	10	LQM GAC	1100	2.1	32.8	0
Total TPH	mg/kg	10	-	-	2.1	314	-

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

6.2 Statistical Analysis

6.2.1 Where samples tested exceeded the selected screening criteria, and the minimum numbers of samples were more than six, statistical analyses of the dataset are undertaken.

6.2.2 The CL:AIRE/CIEH Guidance 'Guidance on Comparing Soil Contamination Data with a Critical Concentration' (2008) describes the new approach to statistical analysis of datasets generated through the investigation of contaminated land. This includes differing statistical methodologies for the analysis of normally and non-normally distributed data. Different approaches to datasets being analysed under Part IIA and under the planning regime are also presented.

6.2.3 Chemical data from the laboratory testing has been assessed in accordance with the CL:AIRE/CIEH Guidance under a planning scenario. The purpose of the assessment is to determine if the land is suitable for the proposed development. Under the planning scenario, the key question is 'is there sufficient evidence that the true mean concentration of the contaminant within the data set (μ) is less than the critical concentration (Cc, in this instance the derived GAC). This is assessed by calculation of the upper confidence limit (UCL). The statistical test assesses the 95th percentile of contaminant populations across a site, and compares this value against the relevant GAC. Furthermore, the test determines statistically whether contaminants exceeding the soil guideline value could be regarded as outliers. Outliers are contaminant values which indicate a localised area of contamination or error in sampling, and may not be a member of the underlying population.

6.2.4 The statistical tests were run for:

- Arsenic
- Lead
- Mercury
- Naphthalene
- Benzo(a)pyrene

6.2.5 The results of statistical tests are presented in Appendix 5. Table 6.4 below provides the summary of statistical tests.

Table: 6.4 Statistical Test Results

Determinand	95% UCL	Cc/GAC	GAC Exceeded
Arsenic	23.7	32	N
Lead	1561	400	Y
Mercury	1.507	1	Y
Napthalene	5.96	3.7	Y
Benzo(a)pyrene	0.916	0.94	N

6.3 Asbestos in Soil

6.3.1 4No. random samples of the made ground were screened in the laboratory for the presence of asbestos. These comprised samples taken from;

- WS1 – 0.50m bgl
- WS3 – 0.50m bgl
- WS3 – 1.50m bgl
- WS4 – 0.50m bgl

6.3.2 No asbestos fibres were detected.

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

6.4.1 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 BS3882:2007.

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

- Zinc concentrations revealed by this investigation ranged from 54.5mg/kg to 837mg/kg, with 3No. samples exceeding the threshold of 300mg/kg.
- Copper concentrations revealed by this investigation ranged from 21.2mg/kg to 204mg/kg, with 1No. sample (WS1 @0.5m bgl) exceeding the threshold of 200mg/kg.
- Nickel concentrations revealed by this investigation ranged from 15.7mg/kg to 36mg/kg, below the threshold of 110mg/kg.

6.5 Waste Disposal

6.5.1 In order to provide an assessment of likely disposal requirements for site spoil, 1No. sample of the Made Ground and 1No. sample of the underlying natural ground were submitted for Waste Acceptance Criteria testing.

6.5.2 The results of the testing would indicate the underlying natural ground to be classified as Inert for the purposes of disposal, with the Made Ground classified as Non-hazardous.

7 SOIL GAS RISK ASSESSMENT

7.1 Soil Gas Results

7.1.1 A total of 3No. return monitoring visits to site have been undertaken to the site.

7.1.2 The results of the monitoring undertaken to date are summarised in Table 7.1 below, with the monitoring records presented in Appendix 6.

Table 7.1 : Summary of Gas Monitoring Data

Hole Nr.	CH4 (%)	CO2 (%)	O2(%)	H2S (ppm)	Atmospheric Pressure (mb)	VOCs	Flow Rate (l/hr)	Depth to water	Depth of hole
WS3	<0.1	8.4 – 9.4	9.9 – 11.0	<0.1	983 - 1009	<0.1 – 0.3	0.2 – 0.8	Dry	2.54
BH2	<0.1	0.5 – 0.7	20.0 – 20.5	<0.1	983 - 1009	<0.1 – 0.3	0.2 – 0.4	Dry	18.54

7.2 Screening of Results

7.2.1 As shown in Table 7.1, no methane has been recorded to date. Carbon dioxide has been reported to a maximum concentration of 9.4% v/v. Oxygen concentrations varied between 9.9% and 20.5%, with volatile organic compounds reported to a maximum concentration of 0.3ppm. A maximum flow rate of 0.8l/hr has been reported.

7.2.2 In the assessment of risks posed by hazardous ground gases and selection of appropriate mitigation measures, CIRIA document C665 (2007) identifies two types of development, termed Situation A and Situation B.

7.2.3 Situation A relates to all development types except low rise housing. Situation B relates to low rise housing with gardens. Situation 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 0.8l/hr (maximum reported) will be used in the calculation of GSVs for the site.

For carbon dioxide and methane, the worst-case conditions and the corresponding GSV is presented below.

- **Conservative flow rate:** **0.8 l/hr flow rate**

- **Highest CO_2 concentration:** **9.4% v/v**
- **GSV Value:** **0.0752l/hr i.e. CS2**

- **Highest CH_4 concentration:** **0.1% v/v**
- **GSV Value:** **0.0008l/hr i.e. CS1**

7.2.9 The result of the calculation would indicate that the site may be classified as Characteristic Situation 2, where basic gas protection measures are required.

7.2.10 The basic gas protection measures may comprise

a. Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g damp proof membrane and underfloor venting; or
b. Beam and block or pre-cast concrete and 2000 g DPM/reinforced gas membrane and underfloor venting.

All joints and penetrations must be sealed.

8 SUMMARY OF RESULTS

8.1 Risk Assessment - Land Quality Impact Summary

8.1.1 Following the quantitative risk assessments, the following is noted:

- It is understood that the proposed development comprises demolition of the existing building and construction of a new mixed use development, with commercial ground floor units and residential apartments on upper floors. No private gardens or significant areas of soft landscaping are anticipated.

- Following generic risk assessments and statistical analysis, the upper ninety fifth percentile values for Lead, Mercury and Naphthalene were found to exceed their respective criteria, with the presence of statistical outliers or isolated hotspots of contamination indicated in the case of Mercury and Naphthalene. Individual exceedances of Benzo(a)pyrene and Arsenic were reported, although the upper ninety fifth percentile value for these contaminants did not exceed the respective criteria.

- No other contaminants were reported above their respective criteria and no asbestos fibres were detected.

- Where the site is to be overlain by either proposed building footprint or areas of hardstanding, these concentrations are no considered to pose a significant risk to human health, as the building / surfacing will provide a suitable barrier to potential receptors. Where areas of soft landscaping are proposed, the risks to end users will be controlled by use of a capping layer. This should comprise a minimum 300mm thickness of imported clean topsoil.

- The desk study identified the site to be directly underlain by unproductive deposits (London Clay), with no significant controlled water receptors identified. As a result these concentrations are not considered to pose a potential risk to controlled waters.

- The results of waste acceptance criteria testing indicated the Made Ground to be acceptable for disposal as a non-hazardous material, with the underlying natural ground suitable for disposal as inert material.

- The results of soil gas monitoring undertaken to date indicate the site to be classified as Characteristic Situation 2, where basic gas protection measures are 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.

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

Potential Source (from desk study)	Pathway	Receptor	Relevant Pollutant Linkage?	Comment
• Potential Made Ground associated with previous developments – on and off site • Potential for asbestos in soil from demolition of previous buildings – on site (S2) • Former Timber Yard – on site (S3) • Former Motor Units Factory – on site (S4) • Current industrial use – on site (S5) • Current and previous industrial sites and consents/depots/works – off site (S6)	• 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 hardstanding 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)	• 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)	**X** (if measures are implemented)	See 8.1.1 above The findings of this report should be included in the construction health and safety plan, so that adequate measures can be taken for the protection of construction and maintenance workers. Based on the results the required concrete class for the site is DS-2 assuming an Aggressive Chemical Environment for Concrete classification of AC-2 in accordance with the procedures outlined in BRE Special Digest 1.

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.

9.1.2 Consequently, a detailed discussion of all the problems that may arise during the proposed redevelopment scheme is beyond the scope of this report. Practical solutions to the difficulties encountered, both prior to, and during construction, are frequently decided by structural constraints or economical 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 comprise demolition of the existing buildings and construction of a new mixed use development, with commercial ground floor units and residential apartments on upper floors. No private gardens or significant areas of soft landscaping are anticipated.

9.1.4 The desk study report indicates that the site is directly underlain by solid deposits of the London Clay Formation. The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay), encountered to the base of the boreholes at up to 25m bgl.

9.1.5 A summary of ground conditions obtained from the ground investigation and subsequent laboratory testing, is provided in Table 9.1 and 9.2 overleaf.

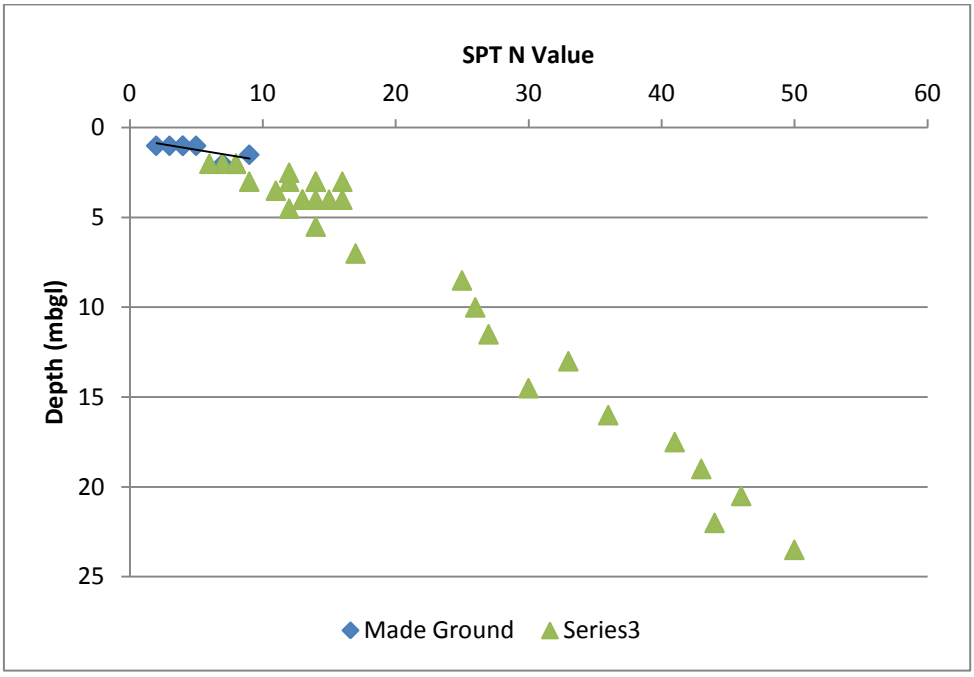
Table 9.1 : Ground Conditions Encountered

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
TARMAC and CONCRETE over MADE GROUND – Brown/black/orange sandy gravelly clay to clayey gravelly sand. Gravel is of brick, concrete, flint, mortar, ash and glass.	0.0	0.7 – 2.1	0.7 – 2.1
Orange brown sandy to silty patched blue grey CLAY with occasional flints, becoming predominantly blue grey with depth Encountered to base of window sample and cable percussive boreholes.	0.7 – 2.1	>25.0	>24.3

Table 9.2 – Preliminary Geotechnical Parameters

Strata	SPT 'N' Value	Shear Strength (kPa)	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (plasticity term)	Particle Size Distribution (% passing 0.425mm)	NHBC Volume Change Classification
TARMAC and CONCRETE over MADE GROUND – Brown/black/orange sandy gravelly clay to clayey gravelly sand. Gravel is of brick, concrete, flint, mortar, ash and glass.	2 - 9	-	-	-	-	-	-	-
Orange brown sandy to silty patched blue grey CLAY with occasional flints, becoming predominantly blue grey with depth Encountered to base of window sample and cable percussive boreholes.	6 - >50	27 - 225	26 - 31	54 - 77	25 - 30	29 - 47	100	Moderate - High

9.1.6 The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay), encountered to the base of the boreholes at up to 25m bgl.

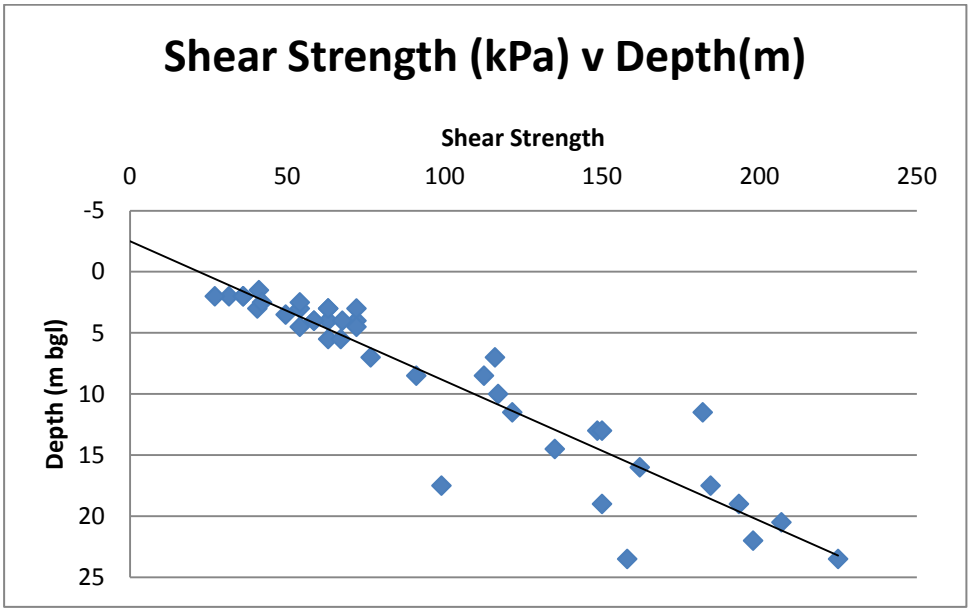


9.1.7 The shear strength of the London Clay varies with depth, and is shown in Figure below. This shows the results of the triaxial testing and the undrained shear strength inferred by the correlation suggested by Stroud (1974),

c_u = f1 x N can be applied,

in which
c_u= mass shear strength (kN)
f1 = constant (use value of 4.5 for London Clay Formation)
N = SPT Value achieved during boring operations

9.1.8 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.



9.2 Hand Excavated Trial Pits

9.2.1 Hand pits excavated to expose the existing foundations of the building on site, revealed traditional foundations extending up to 1.6mbgl.

9.3 Foundations

9.3.1 Based upon the information obtained to date, an allowable bearing capacity in the order of 120kPa has been calculated for foundations constructed at a depth of 3.0m bgl within the underlying London Clay. A piled foundation end bearing in the Clay is anticipated for the proposed development.

9.3.2 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, with the former likely to provide the greater part of the allowable load. The piles should be designed by a specialist piling contractor using a factor of safety of 3.0 and with the settlement at working load specified to meet any structural requirements. Table 11.3 below provides some indicative capacities for a single pile for the diameter and depths shown.

Table 11.3 – Indicative Piles Capacities (kN)

Pile diameter (m)	0.45	0.6	0.9
Pile length (m)			
15m	330	470	800
20m	530	760	1260
25m	760	1070	1750

9.3.3 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.

9.3.4 The London Clay deposits have been identified as being of moderate to high volume change potential, and this will require consideration when designing foundations for the proposed development, in conjunction with the presence of any existing or proposed trees. The potential for heave should be considered.

9.3.5 The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably qualified Engineer.

9.4 In Situ CBR Measurements

9.4.1 In order to provide indicative CBR measurements for road pavement design, a total of 3No. in situ CBR measurements were taken across the site at depths of up to 0.9m bgl.

9.4.2 The results of the testing provided indicative measurements of between 1.2% and 28.4%.

9.5 Concrete in the Ground

9.5.1 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.

9.5.2 In accordance with BRE Special Digest 1, in a data set where there are more than 10No. results available, assessment should be made against the mean value of the maximum 20% of concentrations obtained.

9.5.3 18No. samples were analysed for water soluble sulphate concentration, with a mean 20% concentration of 537.5mg/l calculated. Associated pH concentrations ranged from 7.1 to 11.1.

9.5.4 Based on the results the required concrete class for the site is DS-2 assuming an Aggressive Chemical Environment for Concrete classification of AC-2 in accordance with the procedures outlined in BRE Special Digest 1.

9.6 Ground Bearing Slabs

9.6.1 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.

9.6.2 To allow for potential volume change within the underlying London Clay, and due to the thickness of Made Ground deposits encountered, suspended floor slabs are recommended.

9.7 Excavations

9.7.1 Deep excavations will be required at the site during the construction works. These are anticipated to remain stable for the short term. It is recommended that the stability of all excavations should be assessed during construction.

9.7.2 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.

9.8 Groundwater Control

9.8.1 Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was not recorded during return monitoring.

9.8.2 Any groundwater encountered should be readily dealt with by conventional pumping from a sump.

10 REFERENCES

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

BRE Special Digest 1: Concrete in Aggressive Ground, 2005

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

British Standards Institution (1999) BS 5930:1999 *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

Jeffries, J. (2009) *CLEA Software (Version 1.05) handbook*. Science report: SC050021/SR4. Bristol: Environment Agency

Jeffries, J. & Martin, I. (2009) *Updated Technical Background to the CLEA Model*. Science Report No. SC050021/SR3. Bristol: Environment Agency.

Environment Agency Technical Report P45 "Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environment Quality Standard Development

Gething, J. Tetramethyl lead absorption: a report of human exposure to a high level of tetramethyl lead.1: Br J Ind Med. 1975 Nov; 32(4): 329-33

Grubb, F. E. et al, Extension of Samples Sizes and Percentage Points for Significance Tests of Outlying Observation. Technometrics, Vol 14, No. 4, November 1972

http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_9801 - USEPA online toxicity and chemical parameters database

LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment 2nd Edition. LQM, 2009

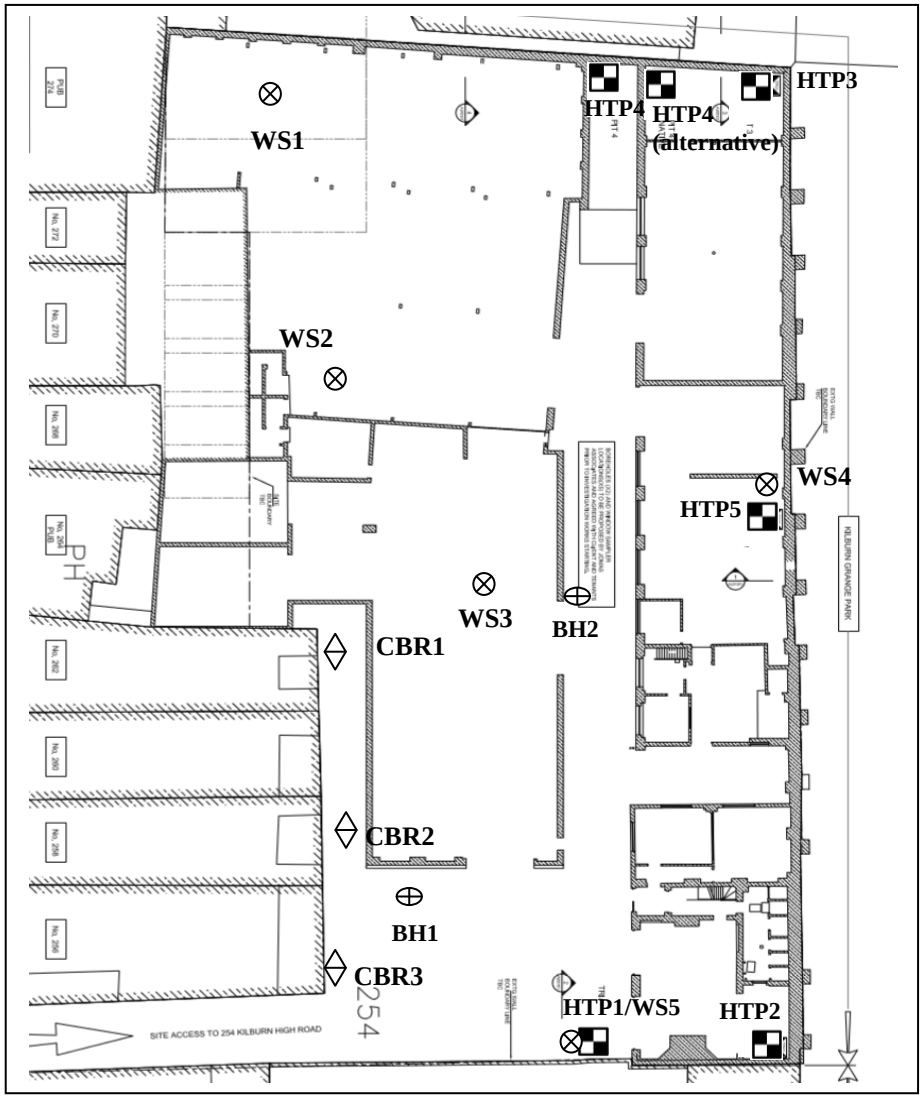
National Planning Policy Framework. Department for Communities and Local Government, March 2012

APPENDICES

APPENDIX 1 – FIGURES

JOMAS ASSOCIATES LTD

Project Name	Kilburn High Road, London	**Client**	Aitch Group
Title	Exploratory Holes	**Dwg No.**	P8591J338 - October 2014



Project Name	254 Kilburn High Road	**Client**	Aitch Group
Title	TP & WS Photo log	**Dwg No.**	P8591J338

Photo 1: TP1

Photo 2 TP2

Photo 3: TP2

Photo 4: TP3

Project Name	254 Kilburn High Road	**Client**	Aitch Group
Title	TP & WS Photo log	**Dwg No.**	P8591J338

Photo 5: TP4

Photo 6: TP6

Photo 7: TP6

Photo 8: TP7

Project Name	254 Kilburn High Road	**Client**	Aitch Group
Title	TP & WS Photo log	**Dwg No.**	P8591J338

Photo 9: WS1

Photo 10: WS2

Photo 11: WS3

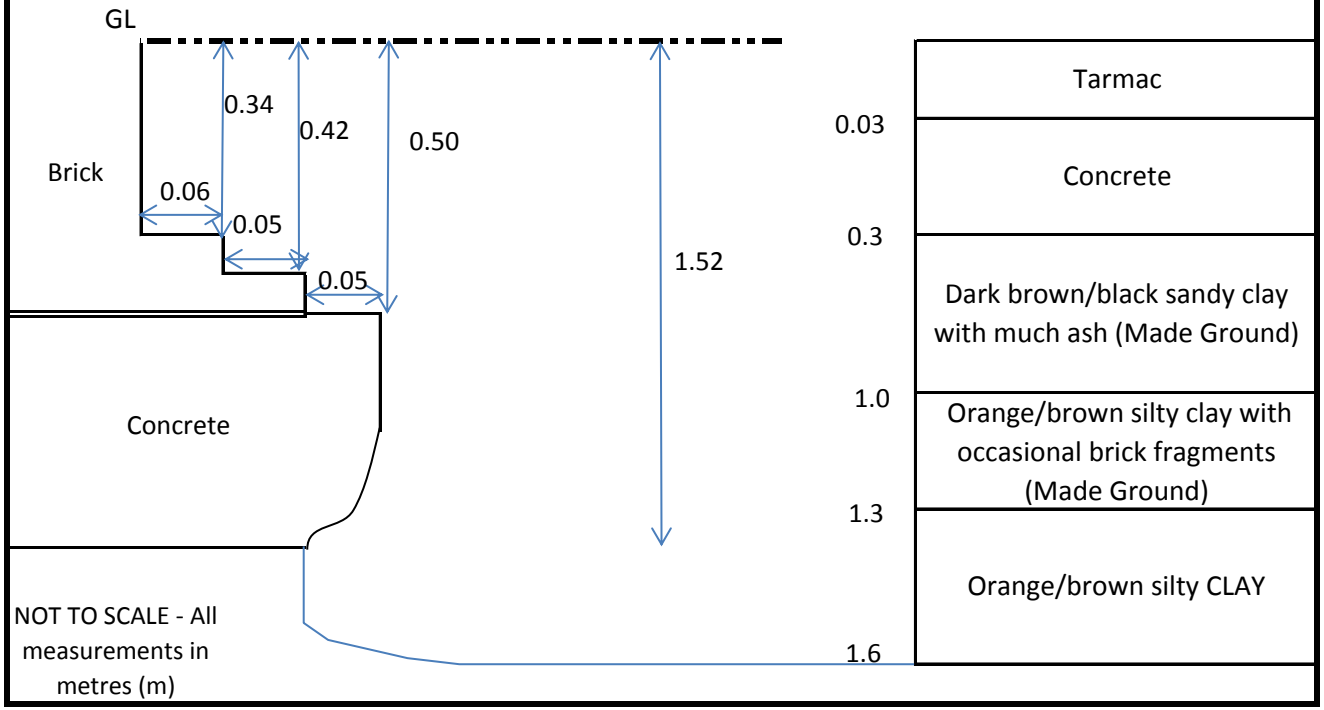
Photo 12: WS4

Project Name	254 Kilburn High Road	**Client**	Aitch Group
Title	TP & WS Photo log	**Dwg No.**	P8591J338

Photo 13: WS5

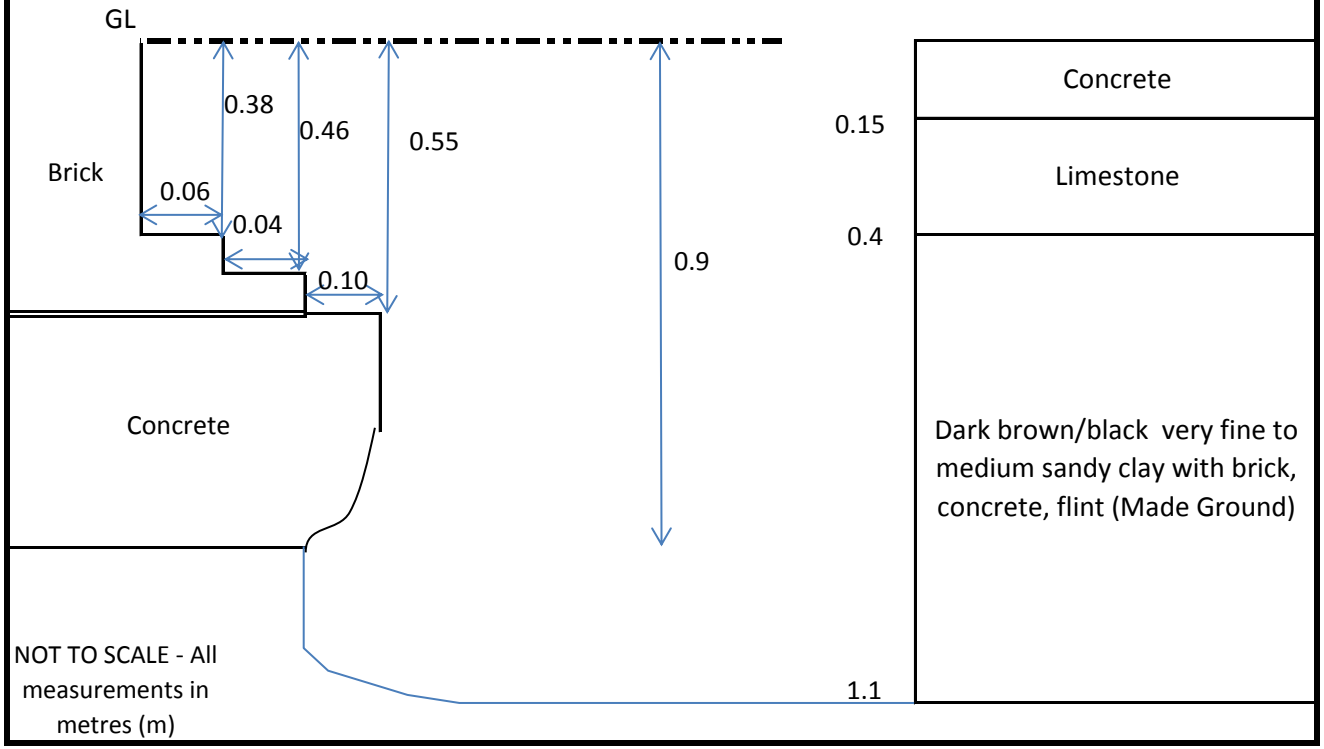
Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP1

Date: 9.10.14



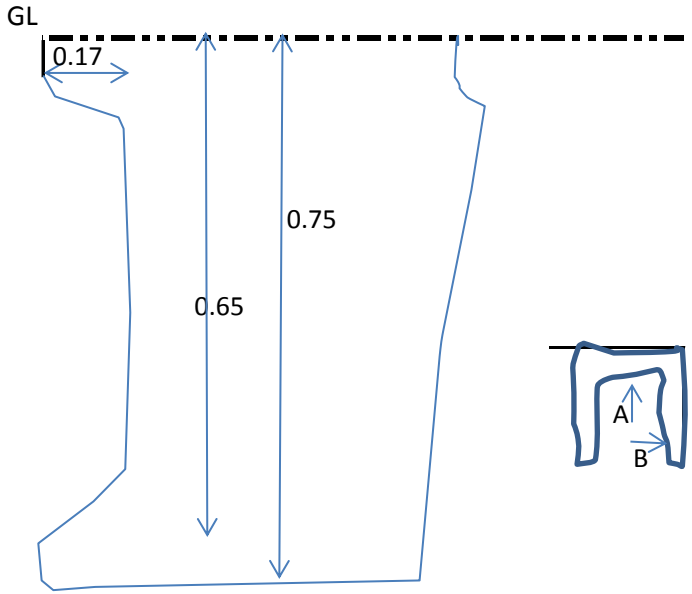
Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP2

Date: 9.10.14



Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP3 - Plan A

Date: 9.10.14

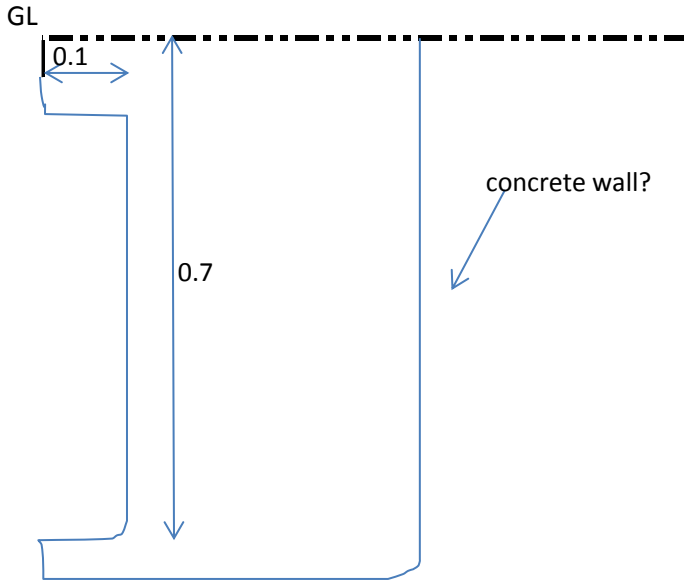


	Screed
0.05	
	Concrete with 6m rebar
0.2	
	Dark brown/grey clayey sand wtih abundant concrete, and brick (MADE GROUND)
0.75	

NOT TO SCALE - All measurements in metres (m)

Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP3 - Plan B

Date: 9.10.14

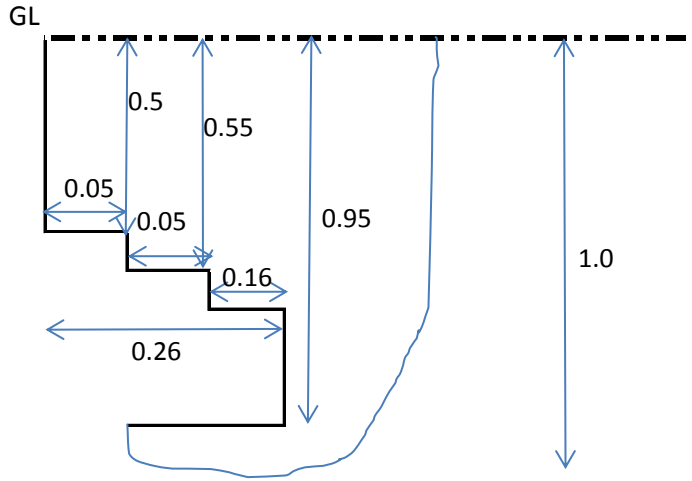


	Screed
0.05	Concrete with 6m rebar
0.2	Dark brown/grey clayey sand wtih abundant concrete, and brick (MADE GROUND)
0.75	

NOT TO SCALE - All measurements in metres (m)

Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP4

Date: 9.10.14

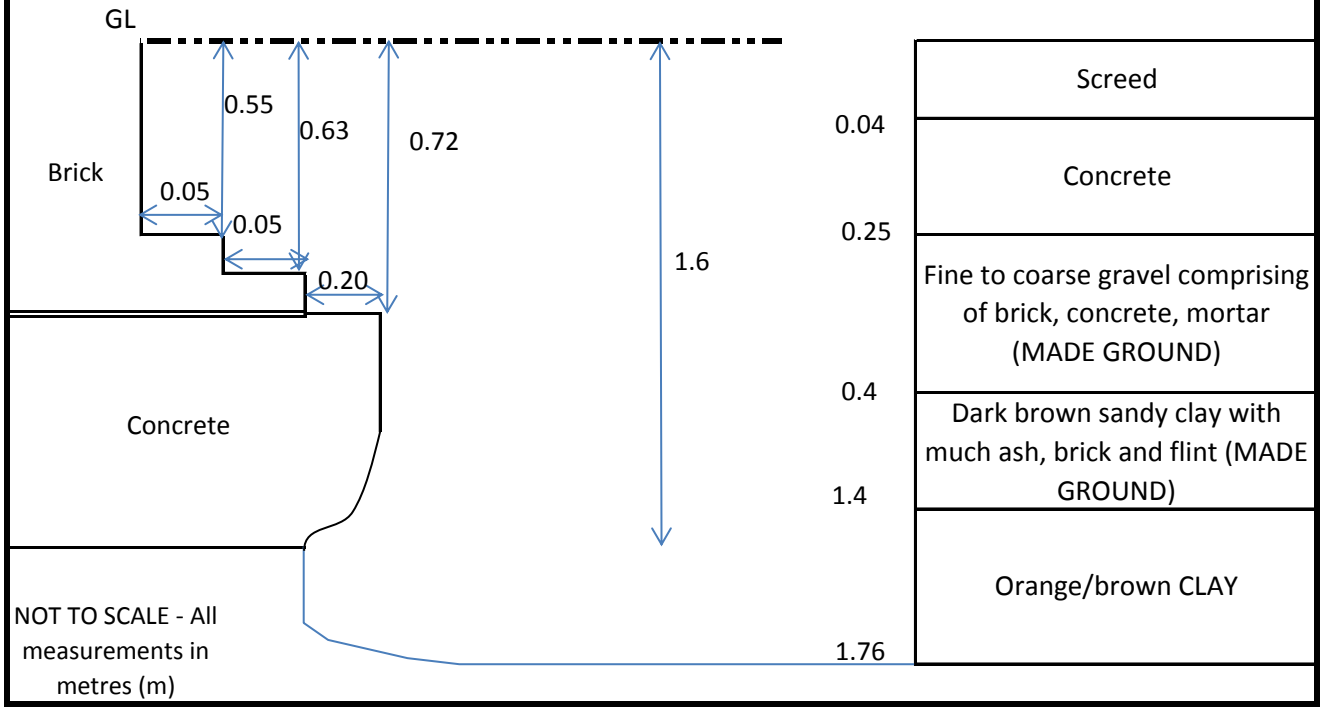


	Screed
0.05	Concrete - 6m rebar
0.3	Dark reddish brown slightly clayey sand with abundant brick, flint (MADE GROUND)
0.8	Dark brown black very sandy clay wtih frequent brick and flint and occ. glass
1.0	

NOT TO SCALE - All measurements in metres (m)

Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP5

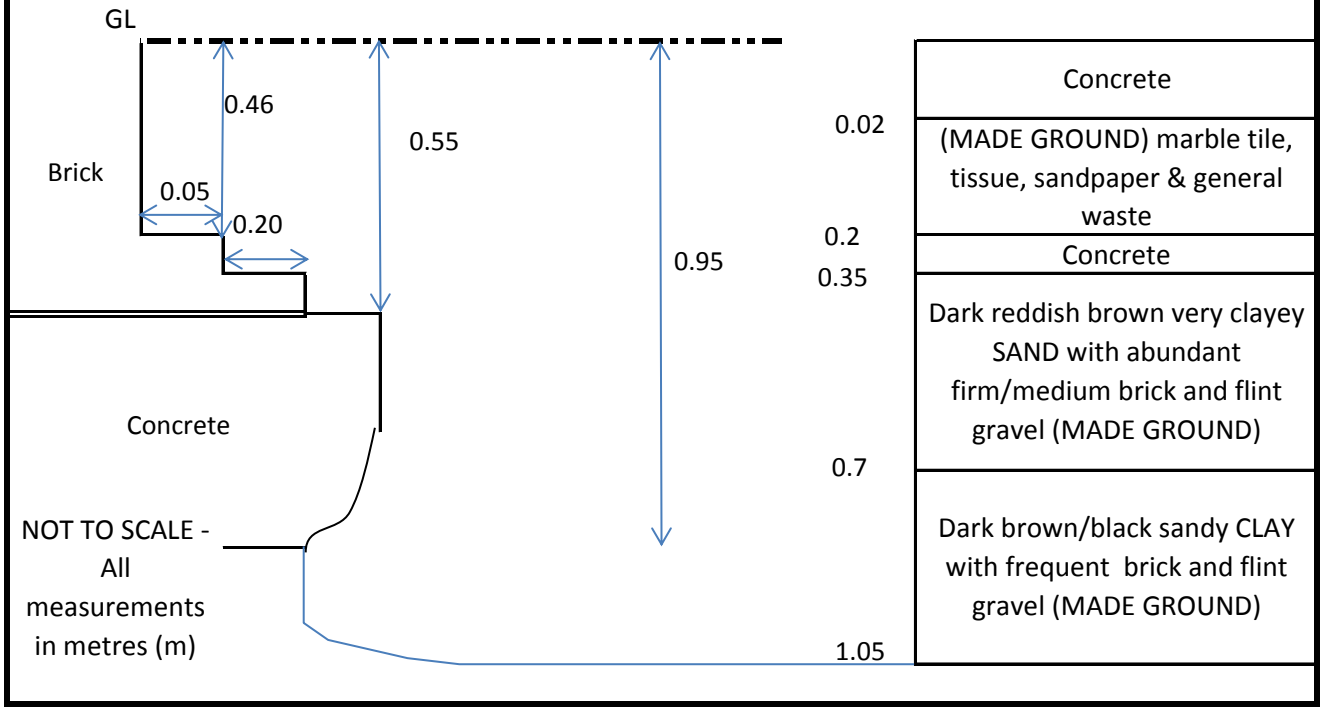
Date: 9.10.14



0.04	Screed
	Concrete
0.25	Fine to coarse gravel comprising of brick, concrete, mortar (MADE GROUND)
0.4	Dark brown sandy clay with much ash, brick and flint (MADE GROUND)
1.4	Orange/brown CLAY
1.76	

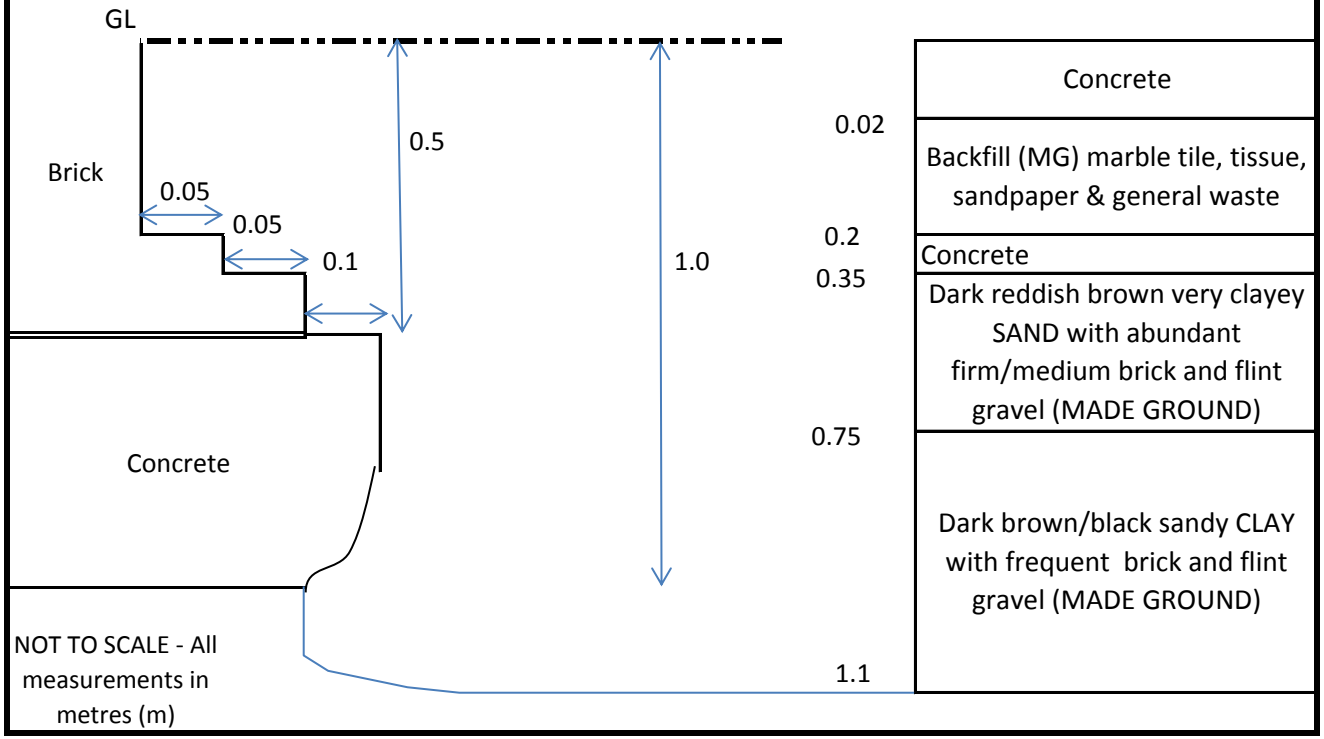
Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP6

Date: 9.10.14



Kilburn - Jomas Associates Ltd - Hand Dug TP Section	TP7

Date: 9.10.14



APPENDIX 2 – EXPLORATORY HOLE RECORDS

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Exploratory Hole No	**BH1**		
Site Address	Kilburn High Road	Project No	P8591J338
Client	Aitch Group	Ground Level	
Site Personnel	SK BD	Commenced	15/10/2014
		Completed	16/10/2014

Type and diameter of equipment: DANDO 175

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1. 150m diameter borehole to 25mbgl
2.
3.
4

Samples or Tests									Strata			Strata Description
Type	Depth (m)	Results							Depth (m)		Legend	
		75	75	75	75	75	75	N				
									0.20			CONCRETE
									0.70			MADE GROUND - Brick
												Firm to stiff brown grey CLAY
U	1.5-1.95	35										
S	2.5-2.95	2	3	3	3	3	3	12				
D	3.2											
U	3.5-3.95	40										
S	4.5-4.95	2	3	3	3	3	3	12				
D	5.2											
U	5.5-5.95	50										
S	7-7.45	3	3	4	4	4	5	17				
D	8.0											
U	8.5-8.95	60										
S	10-10.45	4	5	6	6	7	7	26				

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Exploratory Hole No	BH1		
Site Address	Kilburn High Road	Project No	P8591J338
Client	Aitch Group	Ground Level	
Site Personnel	SK BD	Commenced	15/10/2014
		Completed	16/10/2014

Type and diameter of equipment: DANDO 175

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata			Strata Description
Type	Depth (m)	Results							Depth (m)		Legend	
		75	75	75	75	75	75	N				
D	11.0								11.30			Continued from previous page
U	11.5-11.95	55										Stiff blue grey CLAY
S	13-13.95	5	7	8	8	8	9	33				
D	14											
U	14.5-14.95	65										
S	16-16.45	7	7	8	9	9	10	36				
D	17											
U	17.5-17.95	85										
S	19-19.45	8	9	10	10	11	12	43				
D	20.0											

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Exploratory Hole No	**BH1**		
Site Address	Kilburn High Road	Project No	P8591J338
Client	Aitch Group	Ground Level	
Site Personnel	SK BD	Commenced	15/10/2014
		Completed	16/10/2014

Type and diameter of equipment: DANDO 175

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata		Strata Description
Type	Depth (m)	Results							Depth (m)	Legend	
		75	75	75	75	75	75	N			
											Continued from previous page
U	20.5-20.95	120	NR								
S	22-22.45	10	10	10	11	11	12	44			
D	23.0										
U	23.5-23.95	140									
D	25.0										

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Exploratory Hole No	**BH2**		
Site Address	Kilburn High Road	Project No	P8591J338
Client	Aitch Group	Ground Level	
Site Personnel	SK BD	Commenced	15/10/2014
		Completed	16/10/2014

Type and diameter of equipment: DANDO 175

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1. Monitoring well installed to 20mbgl. Plain with bentonite surround to 1mbgl, slotted to 20m with gravel surround
2.
3.
4

Samples or Tests									Strata			
Type	Depth (m)	Results							Depth (m)		Legend	Strata Description
		75	75	75	75	75	75	N				
									0.30			CONCRETE
S	1.5-1.95	2	3	2	2	3	2	9				Sand, Gravel of brick (MADE GROUND)
D	2-2.2								2.00			
U	2.5-2.95	30										Firm to stiff brown grey CLAY
S	3.5-3.95	2	2	2	3	3	3	11				
D	4.2											
U	4.5-4.95	35										
S	5.5-5.95	3	3	3	3	4	4	14				
D	6.5											
U	7-7.45	45										
S	8.5-8.95	4	6	6	6	6	7	25				
D	9.5											
U	10-10.45	45										

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Exploratory Hole No	**BH2**		
Site Address	Kilburn High Road	Project No	P8591J338
Client	Aitch Group	Ground Level	
Site Personnel	SK BD	Commenced	15/10/2014
		Completed	16/10/2014

Type and diameter of equipment: DANDO 175

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata		Strata Description
Type	Depth (m)	Results							Depth (m)	Legend	
		75	75	75	75	75	75	N			
											Continued from previous sheet
S	11.5-11.95	4	6	6	7	7	7	27	11.90		
											Stiff blue grey CLAY
D	12..5										
U	13-13.45	65									
S	14.50-14.5	4	5	8	7	7	8	30			
D	15.5										
U	16-16.45	65									
S	17.5-17.95	7	10	10	10	10	11	41			
D	18.5										
U	19-19.45	80									
S	20.5-20.95	8	10	11	11	12	12	46			

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Exploratory Hole No	**BH2**		
Site Address	Kilburn High Road	Project No	P8591J338
Client	Aitch Group	Ground Level	
Site Personnel	SK BD	Commenced	15/10/2014
		Completed	16/10/2014

Type and diameter of equipment: DANDO 175

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata		Strata Description
Type	Depth (m)	Results							Depth (m)	Legend	
		75	75	75	75	75	75	N			
D	21.5										
U	22-22.45	85									
S	23.5-23.95	11	12	12	13	13	12	50			
						69mm					
D	25.0								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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Site Address	254 Kilburn Road, London	Exploratory Hole No	**WS1**
Client	Aitch Group	Project No	P8592J338
Site Personnel	TC, LP	Ground Level	
		Commenced	13.10.14
		Completed	13.10.14

Type and diameter of equipment: Premier 110

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata			Strata Description
Type	Depth (m)	Results							Depth (m)		Legend	
		75	75	75	75	75	75	N				
									0.15			CONCRETE
P	0.5											Black fine to medium ashy SAND (MADE GROUND)
P	1.0											
SPT	1.0	1	1	1	2	1	1	5	1.00			
												Soft dark brown/black sandy CLAY with frequent fine to medium flints and brick fragments (MADE GROUND)
									1.40			
D	1.5											Firm to stiff orange brown patched blue grey silty CLAY
D	2.0											
SPT	2.0	1	2	2	2	1	2	7				
D	3.0											
SPT	3.0	2	1	2	3	2	2	9				
D	4.0											
SPT	4.0	1	3	3	2	4	4	13	4.00			

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Site Address	254 Kilburn Road, London	Exploratory Hole No	WS2
Client	Aitch Group	Project No	P8592J338
Site Personnel	TC, LP	Ground Level	
		Commenced	13.10.14
		Completed	13.10.14

Type and diameter of equipment: Premier 110

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata			
Type	Depth (m)	Results							Depth (m)		Legend	Strata Description
		75	75	75	75	75	75	N				
									0.20			Reinforced CONCRETE
P	0.4								0.50			Fine to coarse GRAVEL comprising of flint brick and concrete (MADE GROUND)
P SPT	1.0 1.0	1	0	1	0	1	2	4	1.20			Soft dark brown/black sandy CLAY with frequent fine to medium flints and brick fragments (MADE GROUND)
D D SPT	1.5 2.0 2.0	1	2	2	3	2	1	8	2.20			Soft orange brown fine sandy CLAY
D SPT	3.0 3.0	2	2	3	4	3	4	14				Firm to stiff orange brown patched blue grey silty CLAY
D SPT	4.0 4.0	2	4	4	5	3	4	16	4.45			

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Site Address	254 Kilburn Road, London	Exploratory Hole No	WS3
Client	Aitch Group	Project No	P8591J338
Site Personnel	TC, LP	Ground Level	
		Commenced	13.10.14
		Completed	13.10.14

Type and diameter of equipment: Premier 110

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1. Installed 50mm pipe to 2.50m
2.
3.
4

Samples or Tests									Strata		Strata Description
Type	Depth (m)	Results							Depth (m)	Legend	
		75	75	75	75	75	75	N			
									0.15		CONCRETE
P	0.2								0.30		Light brown slightly clayey fine to medium SAND with frequent fine to medium angular flints (MADE GROUND)
P	0.5										Dark brown GRAVEL comprising of lean mix concrete, brick, flint and ash in a fine sand (MADE GROUND)
P	1.0										
SPT	1.0	1	1	1	0	1	0	2	1.20		
P	1.5										Soft dark brown fine sandy CLAY with frequent fine to medium flints and brick fragments (MADE GROUND)
P	2.0										
SPT	2.0	1	2	1	2	2	2	7	2.10		
D	2.5										Firm to stiff orange brown patched blue grey silty CLAY
D	3.0										
SPT	3.0	2	3	4	4	3	5	16			
D	4.0										
SPT	4.0	2	2	4	3	3	4	14	4.45		

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Site Address	254 Kilburn Road, London	Exploratory Hole No	**WS4**
Client	Aitch Group	Project No	P8592J338
Site Personnel	TC, LP	Ground Level	
		Commenced	13.10.14
		Completed	13.10.14

Type and diameter of equipment: Premier 110

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata			Strata Description
Type	Depth (m)	Results							Depth (m)		Legend	
		75	75	75	75	75	75	N				
									0.40			CONCRETE
P	0.5											Soft dark brown/black sandy CLAY with frequent fine to medium flints and brick fragments (MADE GROUND)
P	1.0											
SPT	1.0	1	0	1	1	1	0	3				
D	1.5								1.50			
D	2.0											Firm to stiff orange brown patched blue grey silty CLAY
SPT	2.0	1	2	2	1	2	1	6				
D	3.0											
SPT	3.0	2	3	3	4	2	3	12				
D	4.0											
SPT	4.0	1	3	3	4	4	4	15				
									4.45			

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

JOMAS
Specialists in the investigation & reclamation of brownfield sites

Site Address	254 Kilburn Road, London	Exploratory Hole No	WS5
Client	Aitch Group	Project No	P8592J338
Site Personnel	TC, LP	Ground Level	
		Commenced	13.10.14
		Completed	13.10.14

Type and diameter of equipment: Premier 110

Water levels recorded during boring, m

Date						
Hole Depth						
Casing Depth						
Water Level on strike						
Water Level after 20mins						

Remarks

1.
2.
3.
4

Samples or Tests									Strata			
Type	Depth (m)	Results							Depth (m)		Legend	Strata Description
		75	75	75	75	75	75	N				
									0.05			BLACKTOP
									0.20			CONCRETE
P	0.3											Soft dark brown/black sandy CLAY with frequent fine to medium flints and brick fragments (MADE GROUND)
P	0.5											
P	1.0											
SPT	1.0	1	0	0	1	2	1	4	1.20			
D	1.5											Firm orange brown silty CLAY with fine to medium angular flints
D	2.0											
SPT	2.0	1	1	2	3	1	2	8	2.40			
D	3.0											Firm to stiff orange brown patched blue grey silty CLAY
SPT	3.0	2	2	3	2	4	5	14				
D	4.0											
SPT	4.0	2	3	3	3	3	4	13	4.45			

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
T: 01895 77 2187 E: info@jomasassociates.com W: www.jomasassociates.com

APPENDIX 3 – CHEMICAL LABORATORY TEST RESULTS

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone: (01424) 718618
Facsimile: (01424) 729911
info@elab-uk.co.uk

2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	14-01039
Issue:	1
Date of Issue:	03/11/2014
Contact:	Roni Savage
Customer Details:	Jomas Associates Limited Lakeside House 1 Furzeground Way
Quotation No:	Q14-00127
Order No:	P8592
Customer Reference:	J338-08
Date Received:	23/10/2014
Date Approved:	03/11/2014
Details:	Kilburn High Road
Approved by:	

John Wilson, Operations Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

Sample Summary

Report No.: 14-01039

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
7108	WS1 P 0.50	13/10/2014	24/10/2014	Sandy silty loam	cfg
7109	WS1 P 1.00	13/10/2014	24/10/2014	Silty loam	cfg
7110	WS2 P 1.00	13/10/2014	24/10/2014	Silty clayey loam	cfg
7111	WS2 D 1.50	13/10/2014	24/10/2014	Silty clayey loam	cfg
7112	WS3 P 0.50	13/10/2014	24/10/2014	Stone/ Concrete	cfg
7113	WS3 P 1.00	13/10/2014	24/10/2014	Sandy silty loam	cfg
7114	WS3 P 1.50	13/10/2014	24/10/2014	Silty loam	cfg
7115	WS3 D 3.00	13/10/2014	24/10/2014	Clayey loam	cfg
7116	WS4 P 0.50	13/10/2014	24/10/2014	Silty loam	cfg
7117	WS4 P 1.00	13/10/2014	24/10/2014	Silty loam	cfg
7118	WS5 P 0.30	13/10/2014	24/10/2014	Silty loam	cfg
7119	WS5 P 1.00	13/10/2014	24/10/2014	Silty loam	cfg
7120	BH1 D6 5.20	13/10/2014	24/10/2014	Clay	
7121	BH1 D9 8.00	13/10/2014	24/10/2014	Clayey loam	
7122	BH1 D15 14.00	13/10/2014	24/10/2014	Clayey loam	
7123	BH1 D18 17.00	13/10/2014	24/10/2014	Clay	
7124	BH2 D2 2.20	13/10/2014	24/10/2014	Silty clayey loam	
7125	BH2 D5 4.20	13/10/2014	24/10/2014	Clayey loam	
7126	BH2 D14 12.50	13/10/2014	24/10/2014	Clay	
7127	BH2 D26 25.00	13/10/2014	24/10/2014	Clayey loam	
7128	WS1 1.50	13/10/2014	24/10/2014		
7129	WS1 2.00	13/10/2014	24/10/2014		
7130	WS1 3.00	13/10/2014	24/10/2014		
7131	WS1 4.00	13/10/2014	24/10/2014		
7132	WS2 0.40	13/10/2014	24/10/2014		
7133	WS2 2.00	13/10/2014	24/10/2014		
7134	WS2 3.00	13/10/2014	24/10/2014		
7135	WS2 4.00	13/10/2014	24/10/2014		
7136	WS3 0.20	13/10/2014	24/10/2014		
7137	WS3 2.00	13/10/2014	24/10/2014		
7138	WS3 2.50	13/10/2014	24/10/2014		
7139	WS3 4.00	13/10/2014	24/10/2014		
7140	WS4 1.50	13/10/2014	24/10/2014		
7141	WS4 2.00	13/10/2014	24/10/2014		
7142	WS4 3.00	13/10/2014	24/10/2014		
7143	WS4 4.00	13/10/2014	24/10/2014		
7144	WS5 0.50	13/10/2014	24/10/2014		
7145	WS5 1.50	13/10/2014	24/10/2014		
7146	WS5 2.00	13/10/2014	24/10/2014		
7147	WS5 3.00	13/10/2014	24/10/2014		
7148	WS5 4.00	13/10/2014	24/10/2014		

Results Summary

Report No.: 14-01039

			ELAB Reference	7108	7109	7110	7111	7112	7113
			Customer Reference	P	P	P	D	P	P
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS1	WS1	WS2	WS2	WS3	WS3
			Sample Depth (m)	0.50	1.00	1.00	1.50	0.50	1.00
			Sampling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Arsenic	M	mg/kg	1	13.8	17.5	17.4	14.3	^ 10.6	n/t
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	^ < 0.5	n/t
Chromium	M	mg/kg	5	15.9	27.8	26.9	36.3	^ 18.6	n/t
Copper	M	mg/kg	5	204	52.2	50.1	21.2	^ 57.9	n/t
Lead	M	mg/kg	5	190	351	478	38.4	^ 110	n/t
Mercury	M	mg/kg	0.5	< 0.5	0.7	1.7	< 0.5	^ < 0.5	n/t
Nickel	M	mg/kg	5	33.7	19.7	17.2	15.7	^ 36.0	n/t
Selenium	M	mg/kg	1	1.4	< 1.0	1.3	< 1.0	^ < 1.0	n/t
Zinc	M	mg/kg	45	94.0	88.1	69.8	54.5	^ 67.6	n/t
Anions									
Water Soluble Sulphate	M	g/l	0.01	0.23	0.06	0.04	0.02	^ 0.04	n/t
Inorganics									
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	n/t
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	^ < 1.0	n/t
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	0.22	0.09	0.06	0.04	0.84	n/t
Water Soluble Boron	N	mg/kg	0.5	1.6	2.5	2.1	1.7	1.4	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	< 0.1
Loss Of Ignition (450°C)	N	%	0.01	n/t	n/t	n/t	n/t	n/t	1.4
pH	M	units	0.1	9.6	7.6	7.1	7.4	^ 11.1	8.7
Total Organic Carbon	N	%	0.01	n/t	1.8	n/t	0.39	5.2	3.0

Results Summary

Report No.: 14-01039

			ELAB Reference	7108	7109	7110	7111	7112	7113
			Customer Reference	P	P	P	D	P	P
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS1	WS1	WS2	WS2	WS3	WS3
			Sample Depth (m)	0.50	1.00	1.00	1.50	0.50	1.00
			Sampling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**						
Organics									
>C8-C10 BCB	N	mg/kg	1	< 1.0	8.1	< 1.0	< 1.0	< 1.0	n/t
>C10-C12 BCB	N	mg/kg	1	< 1.0	55.6	< 1.0	< 1.0	< 1.0	n/t
>C12-C16 BCB	N	mg/kg	1	< 1.0	135	< 1.0	< 1.0	< 1.0	n/t
>C16-C21 BCB	N	mg/kg	1	< 1.0	77.8	< 1.0	< 1.0	< 1.0	n/t
>C21-C35 BCB	N	mg/kg	1	4.5	32.8	2.1	2.2	4.7	n/t
>C35-C40 BCB	N	mg/kg	1	< 1.0	4.5	< 1.0	< 1.0	< 1.0	n/t
Total (>C8-C40) BCB	N	mg/kg	1	4.5	314	2.1	2.2	4.7	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	c < 5	c < 5	c < 5	c < 5	c < 5	n/t
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.5	c < 0.5	c 10.7	c < 0.5	c < 0.5	c^ < 0.5	n/t
Acenaphthylene	M	mg/kg	0.5	c < 0.5	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Acenaphthene	M	mg/kg	0.5	c < 0.5	c 1.9	c < 0.5	c < 0.5	c^ < 0.5	n/t
Fluorene	M	mg/kg	0.5	c < 0.5	c 0.6	c < 0.5	c < 0.5	c^ < 0.5	n/t
Phenanthrene	M	mg/kg	0.5	c 0.9	c 2.2	c < 0.5	c < 0.5	c^ < 0.5	n/t
Anthracene	M	mg/kg	0.5	c < 0.5	c 1.6	c < 0.5	c < 0.5	c^ < 0.5	n/t
Fluoranthene	M	mg/kg	0.5	c 1.6	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Pyrene	M	mg/kg	0.5	c 1.3	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (a) anthracene	M	mg/kg	0.5	c 0.9	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Chrysene	M	mg/kg	0.5	c 1.3	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (b) fluoranthene	M	mg/kg	0.5	c 0.9	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (k) fluoranthene	M	mg/kg	0.5	c 0.8	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (a) pyrene	M	mg/kg	0.5	c 0.7	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.5	c 0.6	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.5	c < 0.5	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo(ghi)perylene	M	mg/kg	0.5	c 0.6	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Total PAH(16) Speciated	M	mg/kg	2	c 11	c 18	c < 2	c < 2	c^ < 2	n/t
Total PAH (Including Coronene)	N	mg/kg	2.1	n/t	n/t	n/t	n/t	n/t	c < 2
BTEX									
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	cfg < 0.01
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	n/t	n/t	n/t	n/t	cfg < 5
PCB (ICES 7 congeners)									
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	c < 0.03

Results Summary

Report No.: 14-01039

			ELAB Reference	7114	7115	7116	7117	7118	7119
			Customer Reference	P	D	P	P	P	P
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS3	WS3	WS4	WS4	WS5	WS5
			Sample Depth (m)	1.50	3.00	0.50	1.00	0.30	1.00
			Sampling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Arsenic	M	mg/kg	1	24.4	n/t	23.3	33.7	21.1	22.4
Cadmium	M	mg/kg	0.5	0.7	n/t	< 0.5	0.8	< 0.5	1.3
Chromium	M	mg/kg	5	27.7	n/t	32.0	34.4	48.4	31.1
Copper	M	mg/kg	5	82.0	n/t	91.2	111	63.2	90.9
Lead	M	mg/kg	5	848	n/t	1900	2530	585	555
Mercury	M	mg/kg	0.5	2.3	n/t	1.3	1.4	1.0	1.6
Nickel	M	mg/kg	5	26.7	n/t	28.4	33.6	34.7	28.1
Selenium	M	mg/kg	1	1.8	n/t	1.1	2.2	< 1.0	1.1
Zinc	M	mg/kg	45	837	n/t	413	593	277	119
Anions									
Water Soluble Sulphate	M	g/l	0.01	0.10	n/t	0.22	0.12	0.59	0.20
Inorganics									
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	n/t	< 0.8	< 0.8	< 0.8	< 0.8
Total Cyanide	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	0.16	n/t	0.22	0.16	0.20	0.33
Water Soluble Boron	N	mg/kg	0.5	3.9	n/t	5.1	4.7	3.6	2.9
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	< 0.1	n/t	n/t	n/t	n/t
Loss Of Ignition (450°C)	N	%	0.01	n/t	1.2	n/t	n/t	n/t	n/t
pH	M	units	0.1	7.5	8.1	7.2	7.2	8.0	7.5
Total Organic Carbon	N	%	0.01	n/t	0.26	n/t	n/t	1.9	n/t

Results Summary

Report No.: 14-01039

			ELAB Reference	7114	7115	7116	7117	7118	7119
			Customer Reference	P	D	P	P	P	P
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS3	WS3	WS4	WS4	WS5	WS5
			Sample Depth (m)	1.50	3.00	0.50	1.00	0.30	1.00
			Sampling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**						
Organics									
>C8-C10 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C10-C12 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C12-C16 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C16-C21 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C21-C35 BCB	N	mg/kg	1	cfg 2.4	n/t	cfg 4.1	cfg 4.1	cfg 5.0	cfg 2.5
>C35-C40 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
Total (>C8-C40) BCB	N	mg/kg	1	cfg 2.4	n/t	cfg 4.1	cfg 4.1	cfg 5.0	cfg 2.5
Phenols									
Total Monohydric Phenols	N	mg/kg	5	c < 5	n/t	c < 5	c < 5	c < 5	c < 5
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Acenaphthylene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Acenaphthene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Fluorene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Phenanthrene	M	mg/kg	0.5	c < 0.5	n/t	c 0.5	c 0.5	c < 0.5	c < 0.5
Anthracene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Fluoranthene	M	mg/kg	0.5	c < 0.5	n/t	c 1.5	c 2.5	c < 0.5	c < 0.5
Pyrene	M	mg/kg	0.5	c < 0.5	n/t	c 1.4	c 2.2	c < 0.5	c < 0.5
Benzo (a) anthracene	M	mg/kg	0.5	c < 0.5	n/t	c 1.0	c 1.7	c < 0.5	c < 0.5
Chrysene	M	mg/kg	0.5	c < 0.5	n/t	c 1.2	c 1.9	c < 0.5	c < 0.5
Benzo (b) fluoranthene	M	mg/kg	0.5	c < 0.5	n/t	c 0.7	c 1.1	c < 0.5	c < 0.5
Benzo (k) fluoranthene	M	mg/kg	0.5	c < 0.5	n/t	c 1.1	c 1.8	c < 0.5	c < 0.5
Benzo (a) pyrene	M	mg/kg	0.5	c < 0.5	n/t	c 1.0	c 1.7	c < 0.5	c < 0.5
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.5	c < 0.5	n/t	c 0.5	c 0.9	c < 0.5	c < 0.5
Dibenzo(a,h)anthracene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Benzo(ghi)perylene	M	mg/kg	0.5	c < 0.5	n/t	c 0.5	c 0.8	c < 0.5	c < 0.5
Total PAH(16) Speciated	M	mg/kg	2	c < 2	n/t	c 10	c 16	c < 2	c < 2
Total PAH (Including Coronene)	N	mg/kg	2.1	n/t	c < 2	n/t	n/t	n/t	n/t
BTEX									
Total BTEX	M	mg/kg	0.01	n/t	cfg < 0.01	n/t	n/t	n/t	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	cfg < 5	n/t	n/t	n/t	n/t
PCB (ICES 7 congeners)									
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	c < 0.03	n/t	n/t	n/t	n/t

Results Summary

Report No.: 14-01039

			ELAB Reference	7120	7121	7122	7123	7124	7125
			Customer Reference	D6	D9	D15	D18	D2	D5
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	BH1	BH1	BH1	BH1	BH2	BH2
			Sample Depth (m)	5.20	8.00	14.00	17.00	2.20	4.20
			Sampling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Arsenic	M	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Cadmium	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Chromium	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Copper	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Lead	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Nickel	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Selenium	M	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Zinc	M	mg/kg	45	n/t	n/t	n/t	n/t	n/t	n/t
Anions									
Water Soluble Sulphate	M	g/l	0.01	0.17	0.98	0.33	0.25	0.07	0.03
Inorganics									
Hexavalent Chromium	N	mg/kg	0.8	n/t	n/t	n/t	n/t	n/t	n/t
Total Cyanide	M	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Boron	N	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss Of Ignition (450°C)	N	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
pH	M	units	0.1	8.1	7.8	8.2	8.3	7.8	8.3
Total Organic Carbon	N	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 14-01039

			ELAB Reference	7120	7121	7122	7123	7124	7125
			Customer Reference	D6	D9	D15	D18	D2	D5
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	BH1	BH1	BH1	BH1	BH2	BH2
			Sample Depth (m)	5.20	8.00	14.00	17.00	2.20	4.20
			Sampling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**						
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C21-C35 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C35-C40 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Total (>C8-C40) BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Acenaphthylene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Acenaphthene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Fluorene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Phenanthrene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Anthracene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Fluoranthene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Pyrene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (a) anthracene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Chrysene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (b) fluoranthene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (k) fluoranthene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (a) pyrene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo(ghi)perylene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Total PAH(16) Speciated	M	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
Total PAH (Including Coronene)	N	mg/kg	2.1	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
PCB (ICES 7 congeners)									
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 14-01039

			ELAB Reference	7126	7127
			Customer Reference	D14	D26
			Sample ID		
			Sample Type	SOIL	SOIL
			Sample Location	BH2	BH2
			Sample Depth (m)	12.50	25.00
			Sampling Date	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**		
Metals					
Arsenic	M	mg/kg	1	n/t	n/t
Cadmium	M	mg/kg	0.5	n/t	n/t
Chromium	M	mg/kg	5	n/t	n/t
Copper	M	mg/kg	5	n/t	n/t
Lead	M	mg/kg	5	n/t	n/t
Mercury	M	mg/kg	0.5	n/t	n/t
Nickel	M	mg/kg	5	n/t	n/t
Selenium	M	mg/kg	1	n/t	n/t
Zinc	M	mg/kg	45	n/t	n/t
Anions					
Water Soluble Sulphate	M	g/l	0.01	0.25	0.20
Inorganics					
Hexavalent Chromium	N	mg/kg	0.8	n/t	n/t
Total Cyanide	M	mg/kg	1	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	n/t	n/t
Water Soluble Boron	N	mg/kg	0.5	n/t	n/t
Miscellaneous					
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t
Loss Of Ignition (450°C)	N	%	0.01	n/t	n/t
pH	M	units	0.1	8.3	8.4
Total Organic Carbon	N	%	0.01	n/t	n/t

Results Summary

Report No.: 14-01039

			ELAB Reference	7126	7127
			Customer Reference	D14	D26
			Sample ID		
			Sample Type	SOIL	SOIL
			Sample Location	BH2	BH2
			Sample Depth (m)	12.50	25.00
			Sampling Date	13/10/2014	13/10/2014
Determinand	**Codes**	**Units**	**LOD**		
Organics					
>C8-C10 BCB	N	mg/kg	1	n/t	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	n/t
>C21-C35 BCB	N	mg/kg	1	n/t	n/t
>C35-C40 BCB	N	mg/kg	1	n/t	n/t
Total (>C8-C40) BCB	N	mg/kg	1	n/t	n/t
Phenols					
Total Monohydric Phenols	N	mg/kg	5	n/t	n/t
Polyaromatic hydrocarbons					
Naphthalene	M	mg/kg	0.5	n/t	n/t
Acenaphthylene	M	mg/kg	0.5	n/t	n/t
Acenaphthene	M	mg/kg	0.5	n/t	n/t
Fluorene	M	mg/kg	0.5	n/t	n/t
Phenanthrene	M	mg/kg	0.5	n/t	n/t
Anthracene	M	mg/kg	0.5	n/t	n/t
Fluoranthene	M	mg/kg	0.5	n/t	n/t
Pyrene	M	mg/kg	0.5	n/t	n/t
Benzo (a) anthracene	M	mg/kg	0.5	n/t	n/t
Chrysene	M	mg/kg	0.5	n/t	n/t
Benzo (b) fluoranthene	M	mg/kg	0.5	n/t	n/t
Benzo (k) fluoranthene	M	mg/kg	0.5	n/t	n/t
Benzo (a) pyrene	M	mg/kg	0.5	n/t	n/t
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.5	n/t	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.5	n/t	n/t
Benzo(ghi)perylene	M	mg/kg	0.5	n/t	n/t
Total PAH(16) Speciated	M	mg/kg	2	n/t	n/t
Total PAH (Including Coronene)	N	mg/kg	2.1	n/t	n/t
BTEX					
Total BTEX	M	mg/kg	0.01	n/t	n/t
Total Petroleum Hydrocarbons					
Mineral Oil	U	mg/kg	5	n/t	n/t
PCB (ICES 7 congeners)					
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t

Results Summary

Report No.: 14-01039

WAC Analysis								
Elab Ref:	7115					**Landfill Waste Acceptance Criteria Limits**		
Sample Date:	13/10/2014					**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:	WS3 D							
Depth:	3							
Site:	Kilbum High Road							
Determinand		**Code**	**Units**					
Total Organic Carbon		N	%		0.3	3	5	6
Loss on Ignition		M	%		1.2	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			8.1	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate
Eluate Analysis			**2:1**	**8:1**	**10:1**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
			mg/l	**mg/l**	**mg/kg**			
Arsenic		N	< 0.005	< 0.005	< 0.05	0.5	2	25
Barium		N	< 0.005	< 0.005	< 0.05	20	100	300
Cadmium		N	< 0.001	< 0.001	< 0.01	0.04	1	5
Chromium		N	< 0.005	< 0.005	< 0.05	0.5	10	70
Copper		N	< 0.005	< 0.005	< 0.05	2	50	100
Mercury		N	< 0.005	< 0.005	< 0.01	0.01	0.2	2
Molybdenum		N	< 0.005	< 0.005	< 0.05	0.5	10	30
Nickel		N	< 0.001	< 0.001	< 0.05	0.4	10	40
Lead		N	< 0.001	< 0.001	< 0.05	0.5	10	50
Antimony		N	< 0.005	< 0.005	< 0.05	0.06	0.7	5
Selenium		N	< 0.005	< 0.005	< 0.05	0.1	0.5	7
Zinc		N	< 0.005	< 0.005	< 0.05	4	50	200
Chloride		N	28.000	8.000	104.00	800	15000	25000
Fluoride		N	< 1	< 1	< 10	10	150	500
Sulphate		N	98.000	8.000	183.00	1000	20000	50000
Total Dissolved Solids		N	290.000	140.000	1570.00	4000	60000	100000
Phenol Index		N	< 0.01	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon		N	15.300	9.430	101.00	500	800	1000
Leach Test Information								
Eluent Volume (ml)		N	195	1400				
pH		N	7.9	7.6				
Conductivity (uS/cm)		N	500	149				
Temperature (°C)		N	18	19				
Solid Information								
Dry mass of test portion (g)			175					
Moisture (%)			30					

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ELAB cannot be held responsible for any discrepencies with current legislation

Results Summary

Report No.: 14-01039

WAC Analysis								
Elab Ref:	7113					**Landfill Waste Acceptance Criteria Limits**		
Sample Date:	13/10/2014					**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:	WS3 P							
Depth:	1							
Site:	Kilbum High Road							
Determinand		**Code**	**Units**					
Total Organic Carbon		N	%		3.0	3	5	6
Loss on Ignition		M	%		1.4	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			8.7	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate
Eluate Analysis			**2:1**	**8:1**	**10:1**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
			mg/l	**mg/l**	**mg/kg**			
Arsenic		N	< 0.005	< 0.005	< 0.05	0.5	2	25
Barium		N	0.027	0.008	0.10	20	100	300
Cadmium		N	< 0.001	< 0.001	< 0.01	0.04	1	5
Chromium		N	< 0.005	< 0.005	< 0.05	0.5	10	70
Copper		N	< 0.005	< 0.005	< 0.05	2	50	100
Mercury		N	< 0.005	< 0.005	< 0.01	0.01	0.2	2
Molybdenum		N	0.029	0.007	0.10	0.5	10	30
Nickel		N	0.001	< 0.001	< 0.05	0.4	10	40
Lead		N	< 0.001	< 0.001	< 0.05	0.5	10	50
Antimony		N	< 0.005	< 0.005	< 0.05	0.06	0.7	5
Selenium		N	< 0.005	< 0.005	< 0.05	0.1	0.5	7
Zinc		N	0.006	< 0.005	< 0.05	4	50	200
Chloride		N	16.000	7.000	80.00	800	15000	25000
Fluoride		N	< 1	< 1	< 10	10	150	500
Sulphate		N	637.000	63.000	1450.00	**1000**	20000	50000
Total Dissolved Solids		N	1110.000	170.000	3040.00	4000	60000	100000
Phenol Index		N	< 0.01	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon		N	11.400	6.120	69.00	500	800	1000
Leach Test Information								
Eluent Volume (ml)		N	250	1400				
pH		N	7.5	7.7				
Conductivity (uS/cm)		N	1350	250				
Temperature (°C)		N	18	19				
Solid Information								
Dry mass of test portion (g)			176					
Moisture (%)			22.7					

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ELAB cannot be held responsible for any discrepencies with current legislation

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonards on Sea, East Sussex, TN38 9BY
Tel: +44 (0)1424 718618, Email: info@elab-uk.co.uk, Web: www.elab-uk.co.uk

Results Summary

Report No.: 14-01039

Asbestos Qualitative Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Result
7108	0.50	WS1 P	Sandy silty loam	No asbestos detected
7112	0.50	WS3 P	Stone/ Concrete	No asbestos detected
7114	1.50	WS3 P	Silty loam	No asbestos detected
7116	0.50	WS4 P	Silty loam	No asbestos detected

Method Summary

Report No.: 14-01039

Parameter	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil				
Hexavalent chromium	As submitted sample	28/10/2014	110	Colorimetry
Acid Soluble Sulphate	Air dried sample	03/11/2014	115	Ion Chromatography
Aqua regia extractable metals	Air dried sample	29/10/2014	118	ICPMS
Phenols in solids	As submitted sample	28/10/2014	121	HPLC
Polyaromatic hydrocarbons (GC-FID)	As submitted sample	28/10/2014	133	GC-FID
Water soluble anions	Air dried sample	29/10/2014	172	Ion Chromatography
Water soluble boron	Air dried sample	29/10/2014	202	Colorimetry
Total cyanide	As submitted sample	30/10/2014	204	Colorimetry
Basic carbon banding in soil	As submitted sample	28/10/2014	218	GC-FID
Asbestos identification	As submitted sample	29/10/2014	PMAN	Microscopy
Leachate				
Arsenic*		29/10/2014	101	ICPMS
Cadmium*		29/10/2014	101	ICPMS
Chromium*		29/10/2014	101	ICPMS
Lead*		29/10/2014	101	ICPMS
Nickel*		29/10/2014	101	ICPMS
Copper*		29/10/2014	101	ICPMS
Zinc*		29/10/2014	101	ICPMS
Mercury*		29/10/2014	101	ICPMS
Selenium*		29/10/2014	101	ICPMS
Antimony		29/10/2014	101	ICPMS
Barium*		29/10/2014	101	ICPMS
Molybdenum*		29/10/2014	101	ICPMS
pH Value*		29/10/2014	113	Electrometric
Electrical Conductivity*		29/10/2014	136	Probe
Dissolved Organic Carbon		29/10/2014	102	TOC analyser
Chloride*		29/10/2014	131	Ion Chromatography
Fluoride*		29/10/2014	131	Ion Chromatography
Sulphate*		29/10/2014	131	Ion Chromatography
Total Dissolved Solids		29/10/2014	144	Gravimetric
Phenol index		29/10/2014	121	HPLC
WAC Solids analysis				
pH Value**	Air dried sample	29/10/2014	113	Electrometric
Total Organic Carbon	Air dried sample	29/10/2014	210	IR
Loss on Ignition**	Air dried sample	29/10/2014	129	Gravimetric
Acid Neutralization Capacity to pH 7	Air dried sample	29/10/2014	NEN 737	Electrometric
Total BTEX**	As submitted sample	29/10/2014	181	GCMS
Mineral Oil**	As submitted sample	29/10/2014	117	GCFID
Total PCBs (7 congeners)	Air dried sample	29/10/2014	120	GCMS
Total PAH (17)**	As submitted sample	29/10/2014	133	GCFID

Report Information

Report No.: 14-01039

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

APPENDIX 4 – GEOTECHNICAL LABORATORY TEST RESULTS

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL14/5410

Client's Reference: Report Date: 31 October 2014

Client Name: Jomas Associates Ltd Associates Ltd Associates Ltd
1 Furzeground Way
Lakeside House
Stockley Park
UB11 1BD

For the attention of: Roni Savage

Contract Title: Kilburn High Road

Date Received: 22/10/2014
Date Commenced: 22/10/2014
Date Completed: 31/10/2014

Notes: **Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
M Beastall (Laboratory Manager)

D Lambe (Senior Technician)
S Royle (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH1	1	U	1.50	Firm grey mottled brown slightly gravelly slightly sandy CLAY.
BH1	7	U	5.50	Firm brown mottled grey slightly sandy CLAY.
BH1	10	U	8.50	Stiff brown slightly sandy CLAY.
BH1	13	U	11.50	Very stiff brown slightly sandy CLAY.
BH1	19	U	17.50	Stiff brown slightly sandy CLAY.
BH1	25	U	23.50	Very stiff brown slightly sandy CLAY.
BH2	3	U	2.50	Firm brown slightly sandy CLAY.
BH2	6	U	4.50	Firm brown mottled grey slightly sandy CLAY.
BH2	9	U	7.00	Stiff brown slightly sandy CLAY.
BH2	15	U	13.00	Very stiff brown slightly sandy CLAY.
BH2	21	U	19.00	Very stiff brown slightly sandy CLAY.

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	31/10/14		31/10/14		31/10/14

KILBURN HIGH ROAD.

Contract No: PSL14/5410

Client Ref: P8592J338-07

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH1	1	U	1.50	30				58	26	32	100	High plasticity CH.
BH1	13	U	11.50	30				77	30	47	100	Very high plasticity CV.
BH2	6	U	4.50	31				67	28	39	100	High plasticity CH.
BH2	9	U	7.00	29				71	30	41	100	Very high plasticity CV.
BH2	21	U	19.00	26				54	25	29	100	High plasticity CH.

SYMBOLS : NP : Non Plastic *** : Liquid Limit and Plastic Limit Wet Sieved.**

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	31/10/14		31/10/14		31/10/14

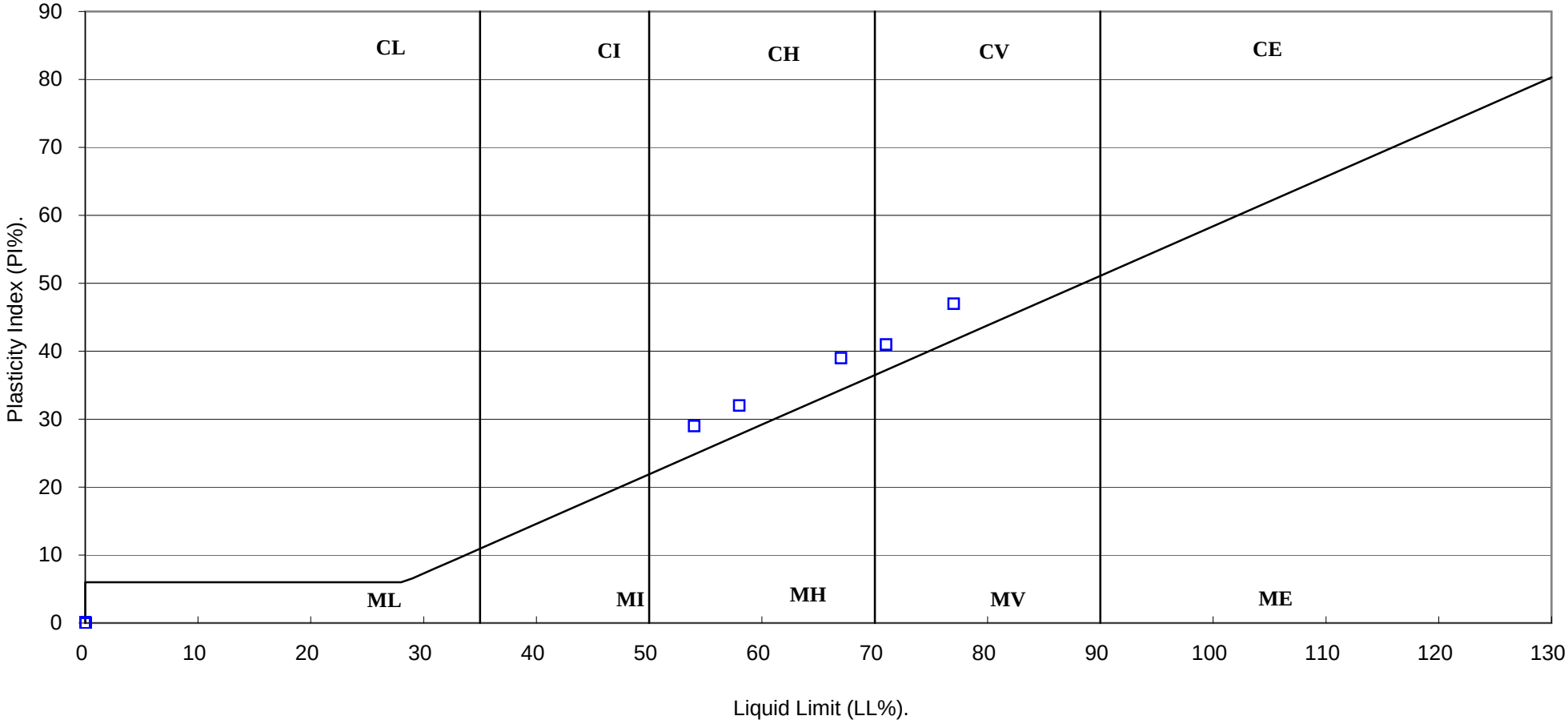
KILBURN HIGH ROAD.

Contract No: **PSL14/5410**

Client Ref: **P8592J338-07**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		31/10/14		31/10/14		31/10/14
	KILBURN HIGH ROAD.				Contract No:	PSL14/5410
					Client Ref:	P8592J338-07

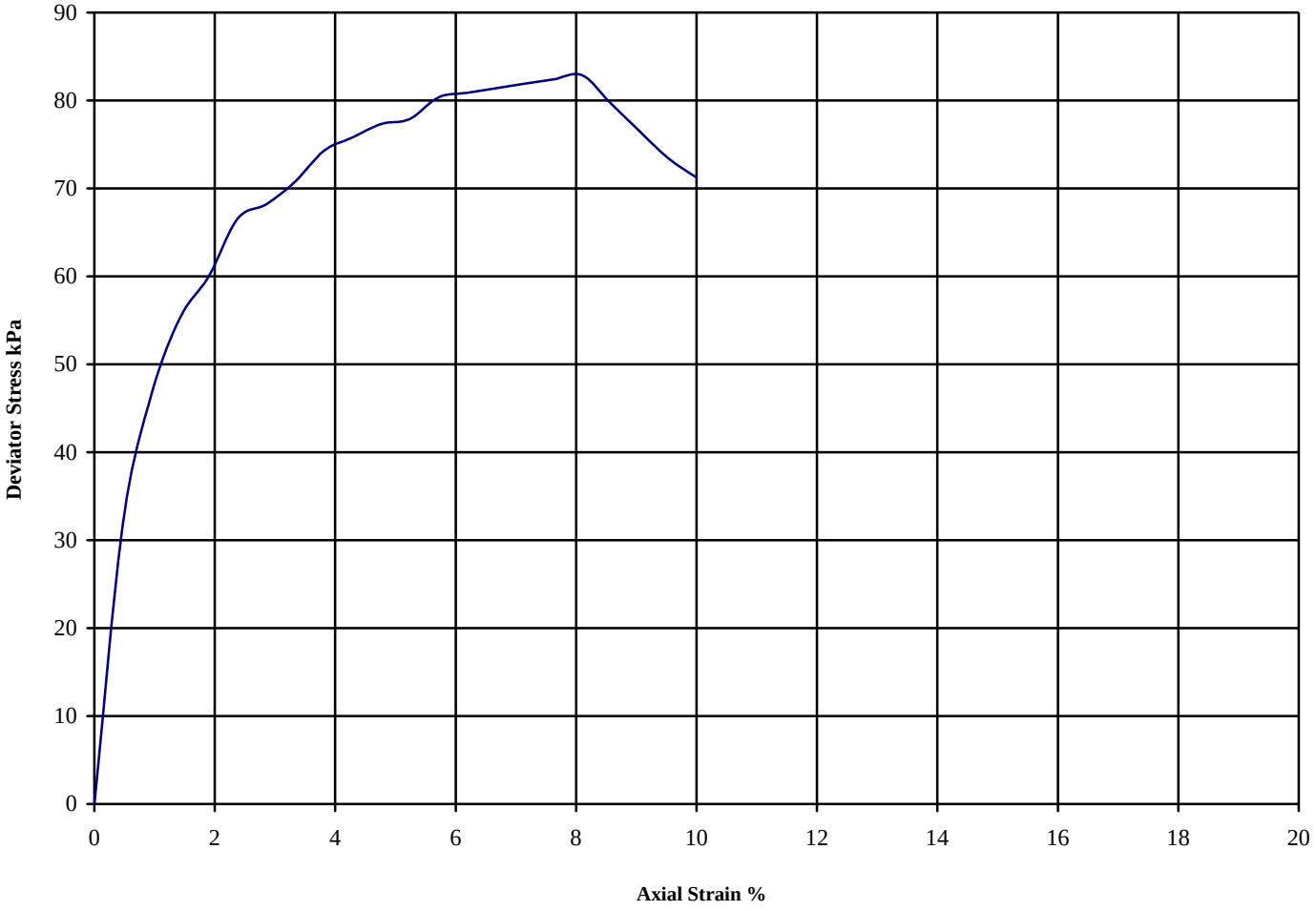
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 1.50

Sample Number: 1 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	30	1.81	1.40	30	83	41	8.1	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

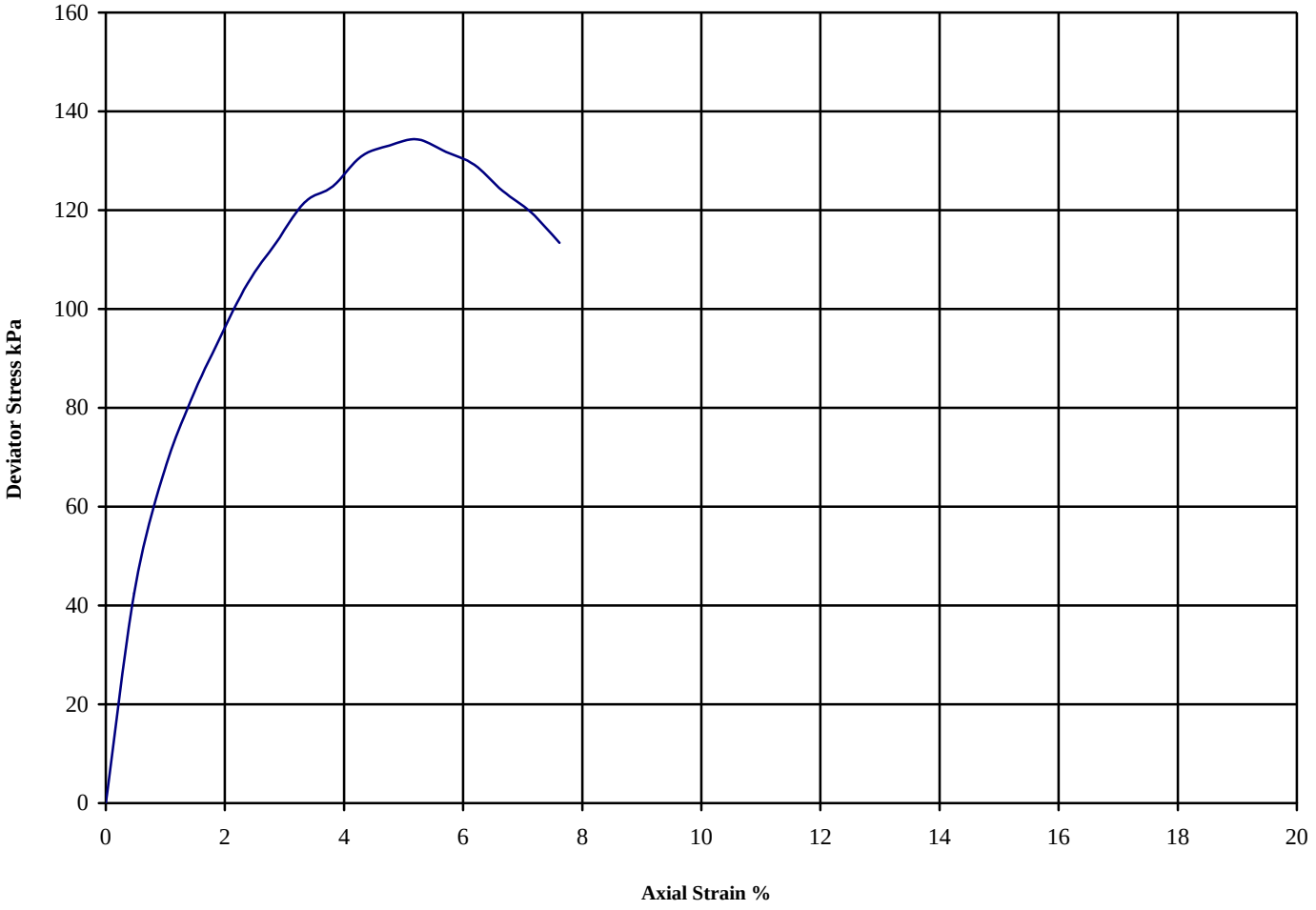
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 5.50

Sample Number: 7 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	32	1.90	1.44	110	134	67	5.2	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL
Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

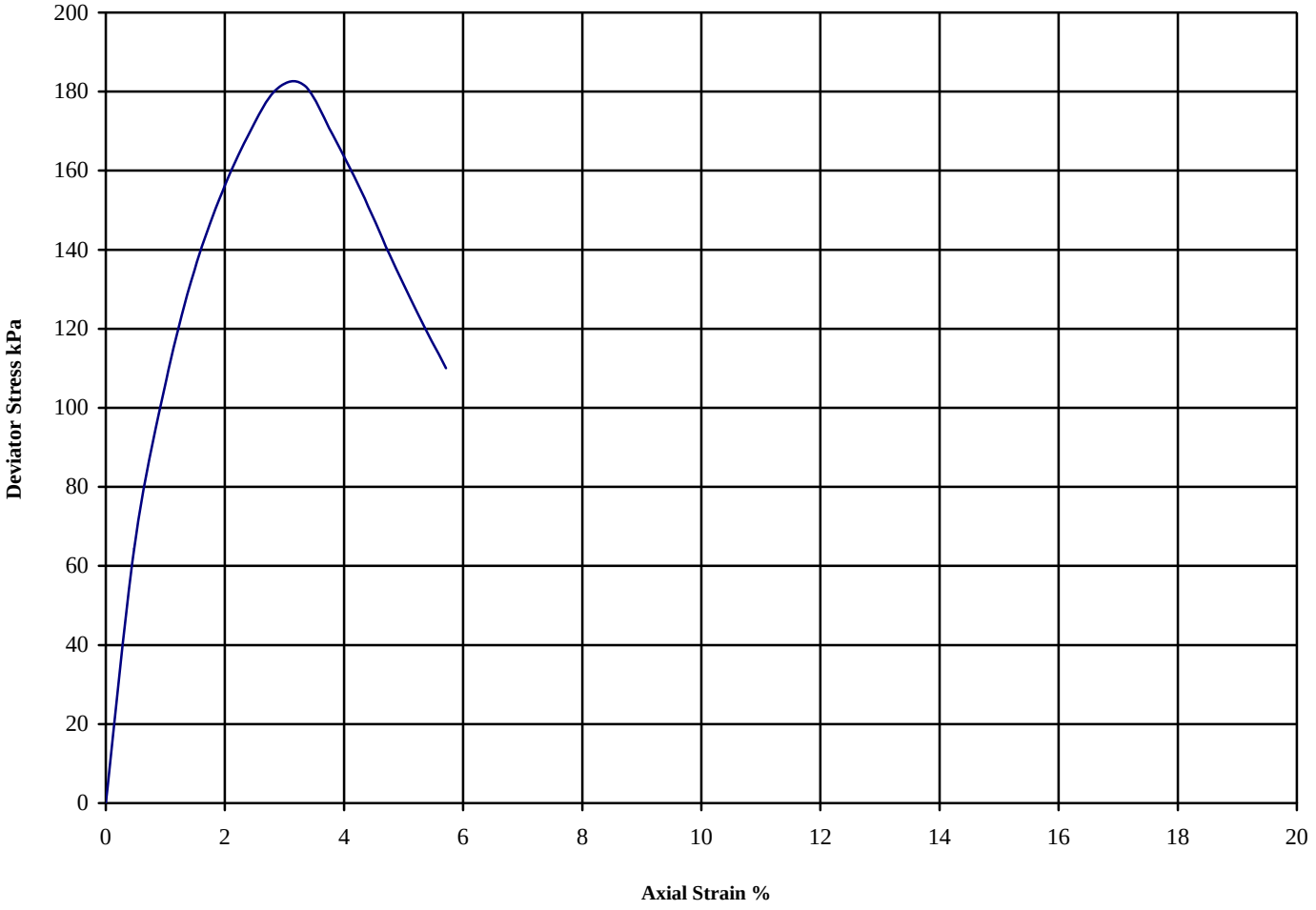
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH1** **Depth (m):** **8.50**

Sample Number: **10** **Sample Type:** **U**



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	31	1.94	1.48	170	182	91	3.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.37 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL
Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

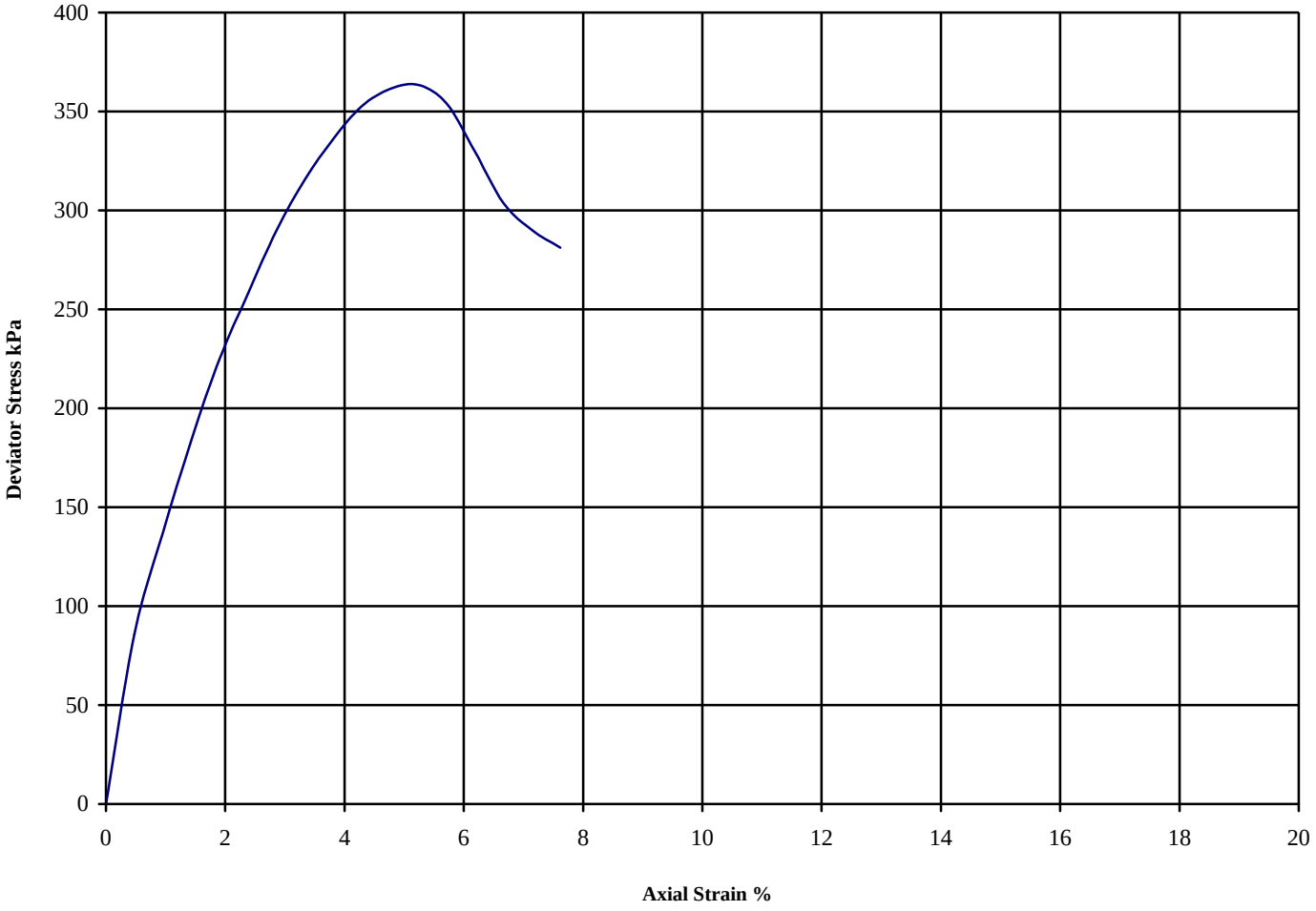
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 11.50

Sample Number: 13 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	30	1.96	1.51	230	363	182	5.2	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

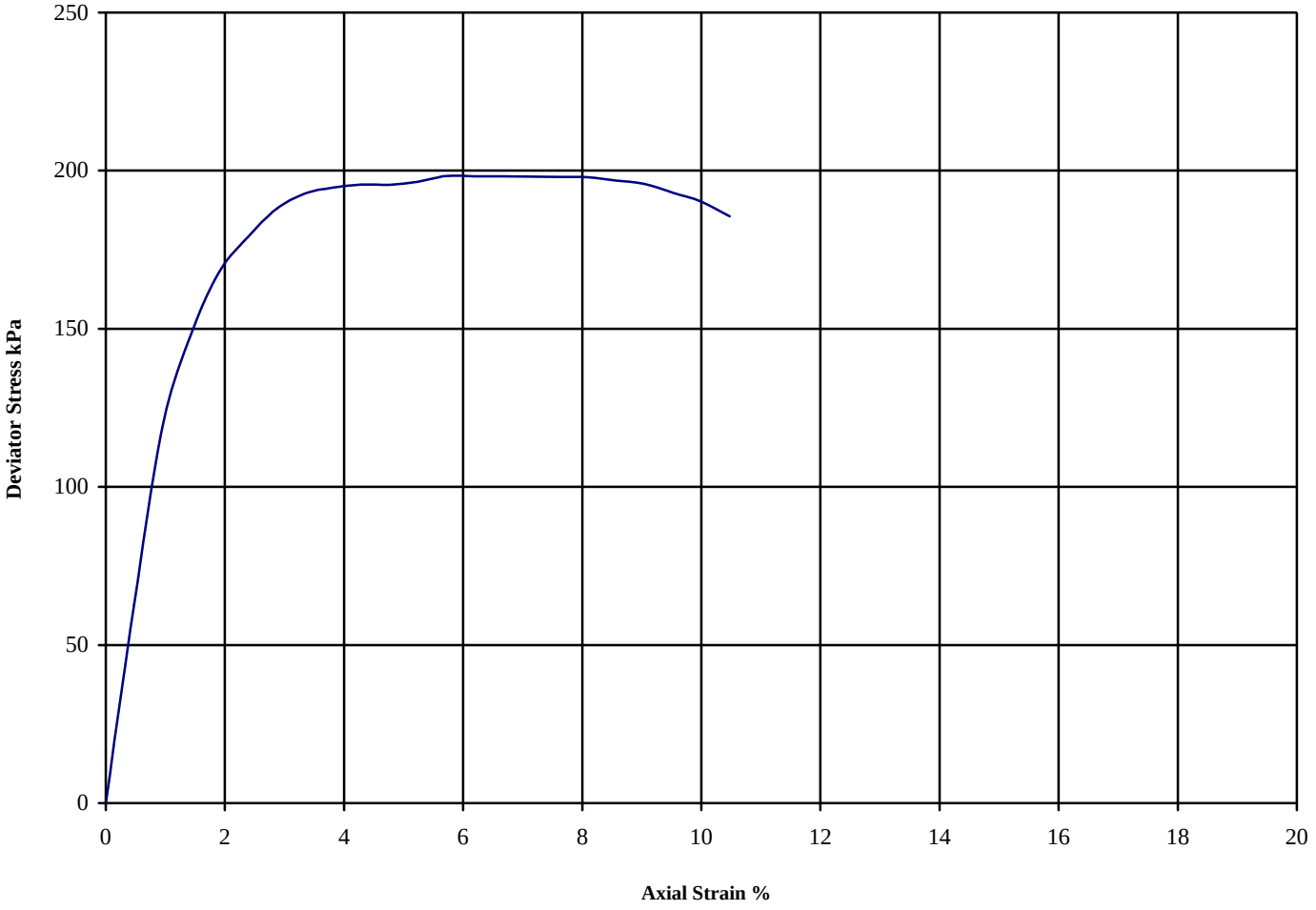
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 17.50

Sample Number: 19 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.96	1.54	350	198	99	5.7	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

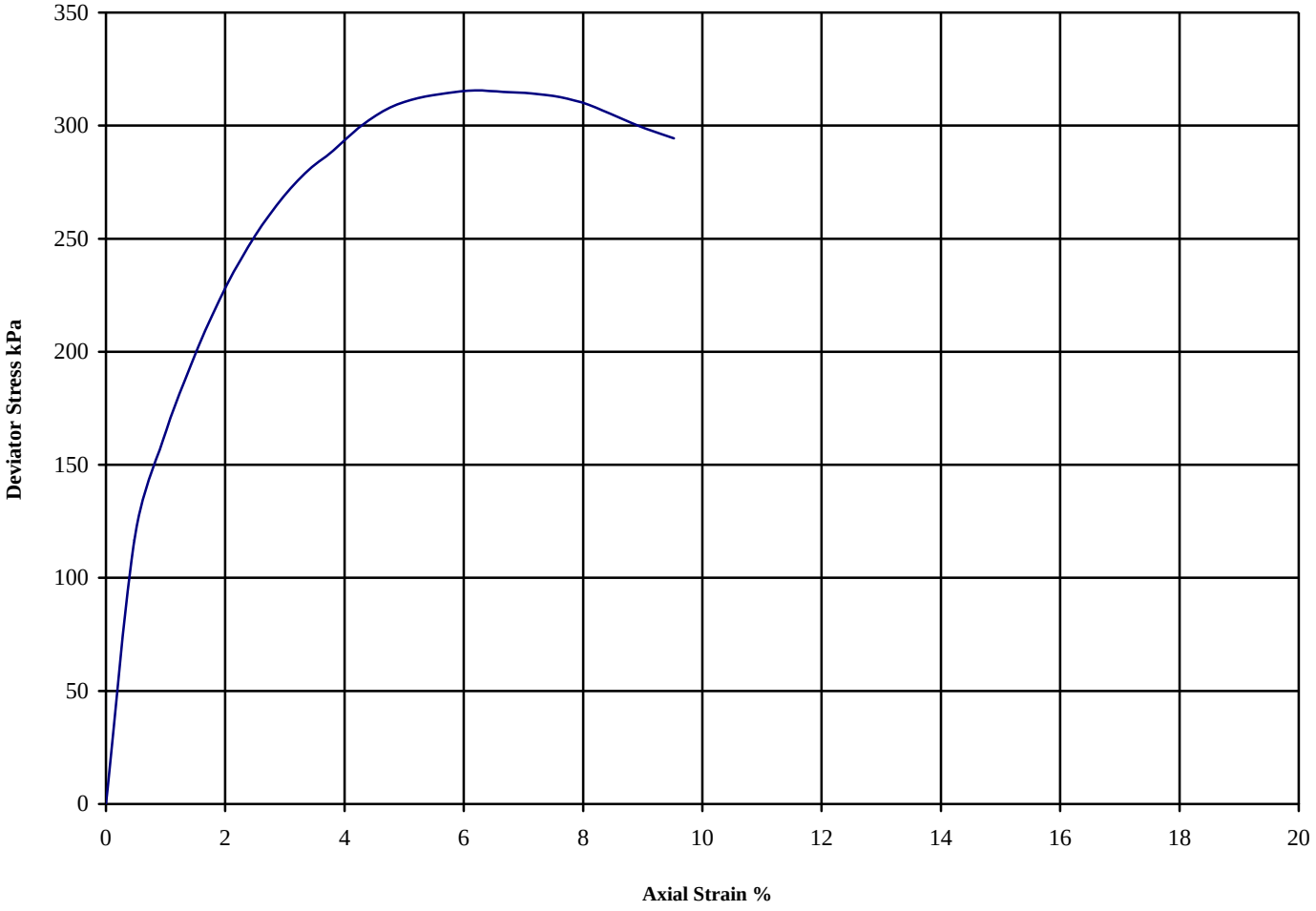
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 23.50

Sample Number: 25 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	30	1.95	1.50	470	316	158	6.2	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL
Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

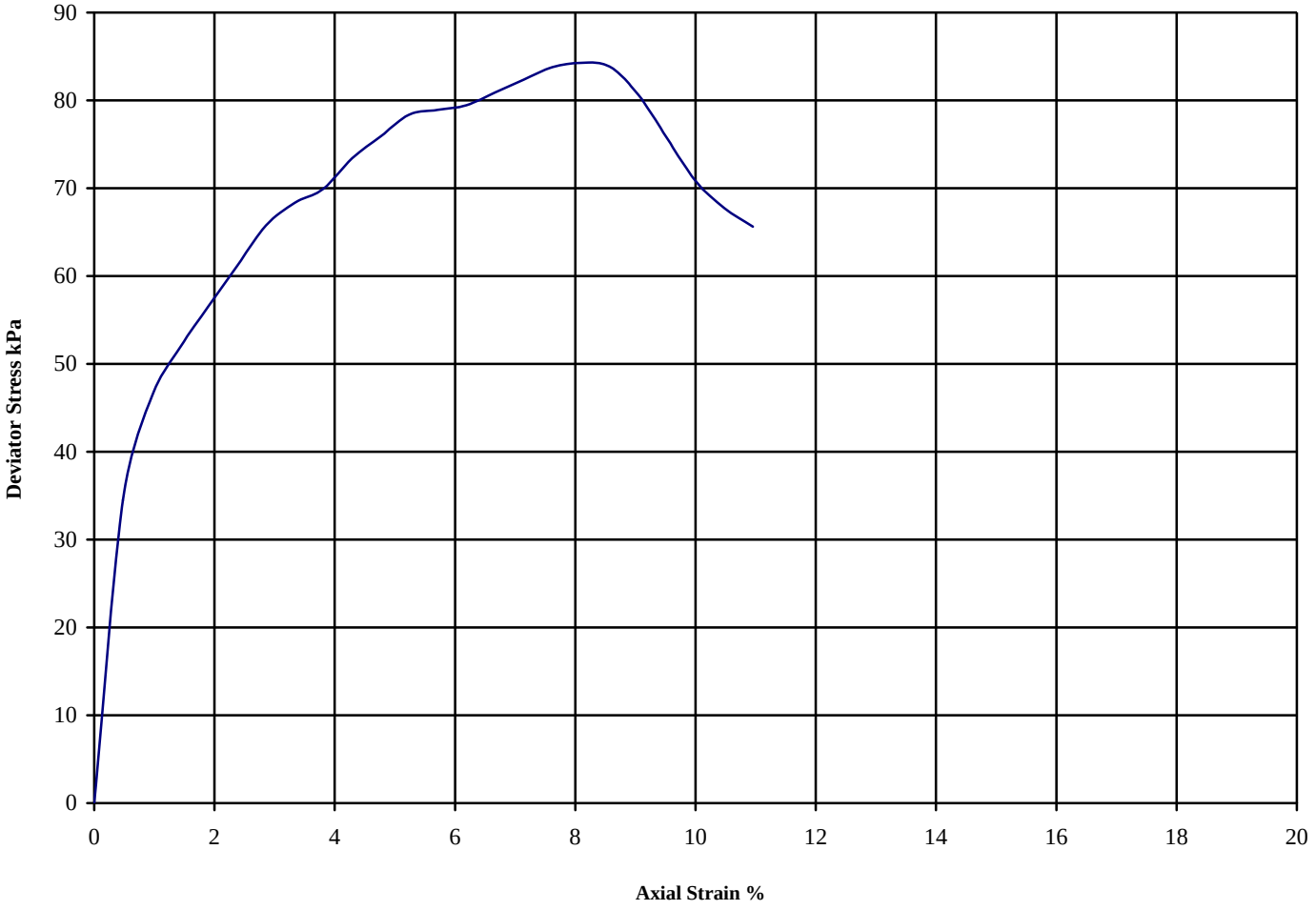
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH2 **Depth (m):** 2.50

Sample Number: 3 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	30	1.96	1.51	50	84	42	8.1	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL
Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

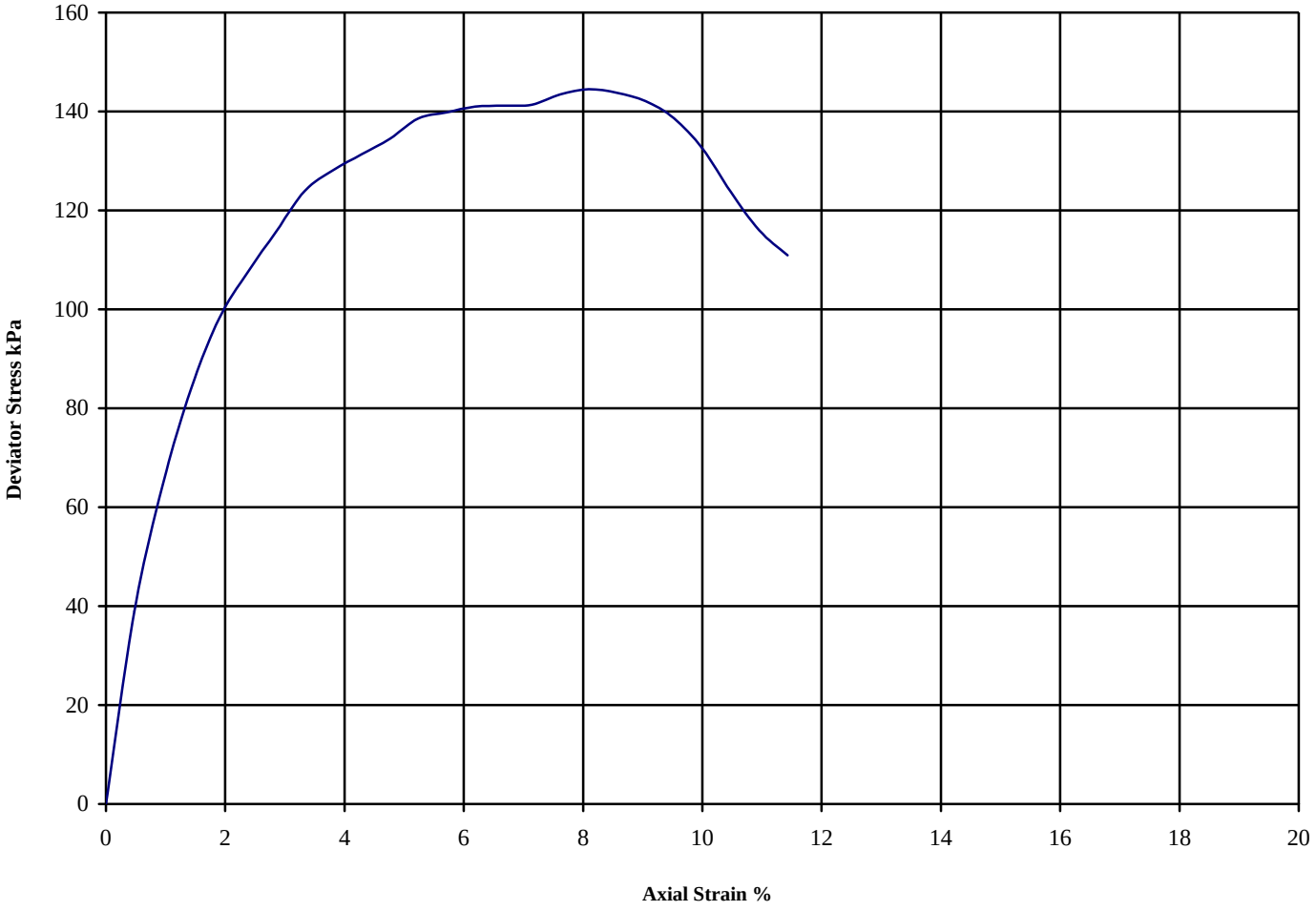
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH2 **Depth (m):** 4.50

Sample Number: 6 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	31	1.93	1.48	90	145	72	8.1	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

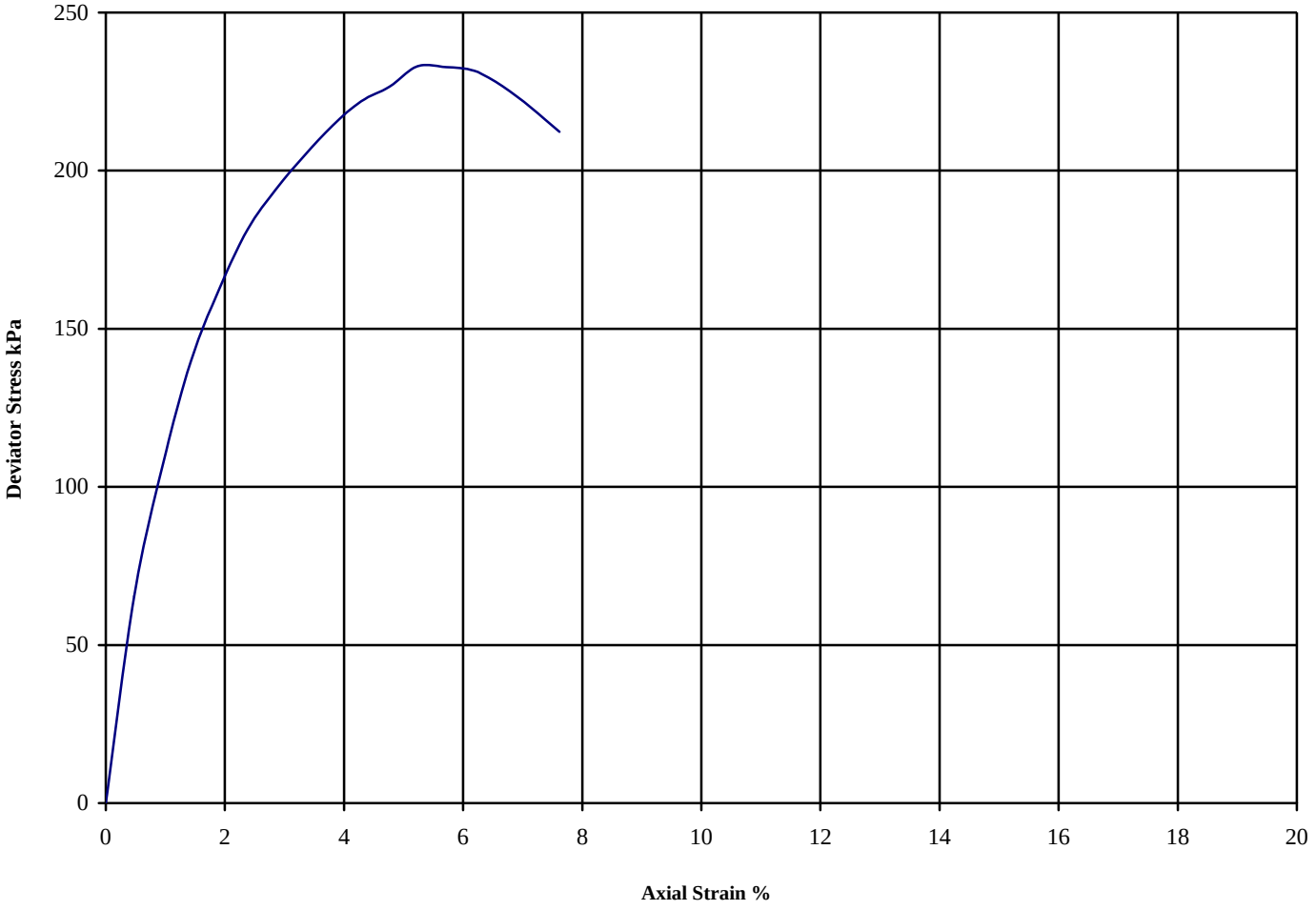
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH2 **Depth (m):** 7.00

Sample Number: 9 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.76	1.36	140	233	116	5.2	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

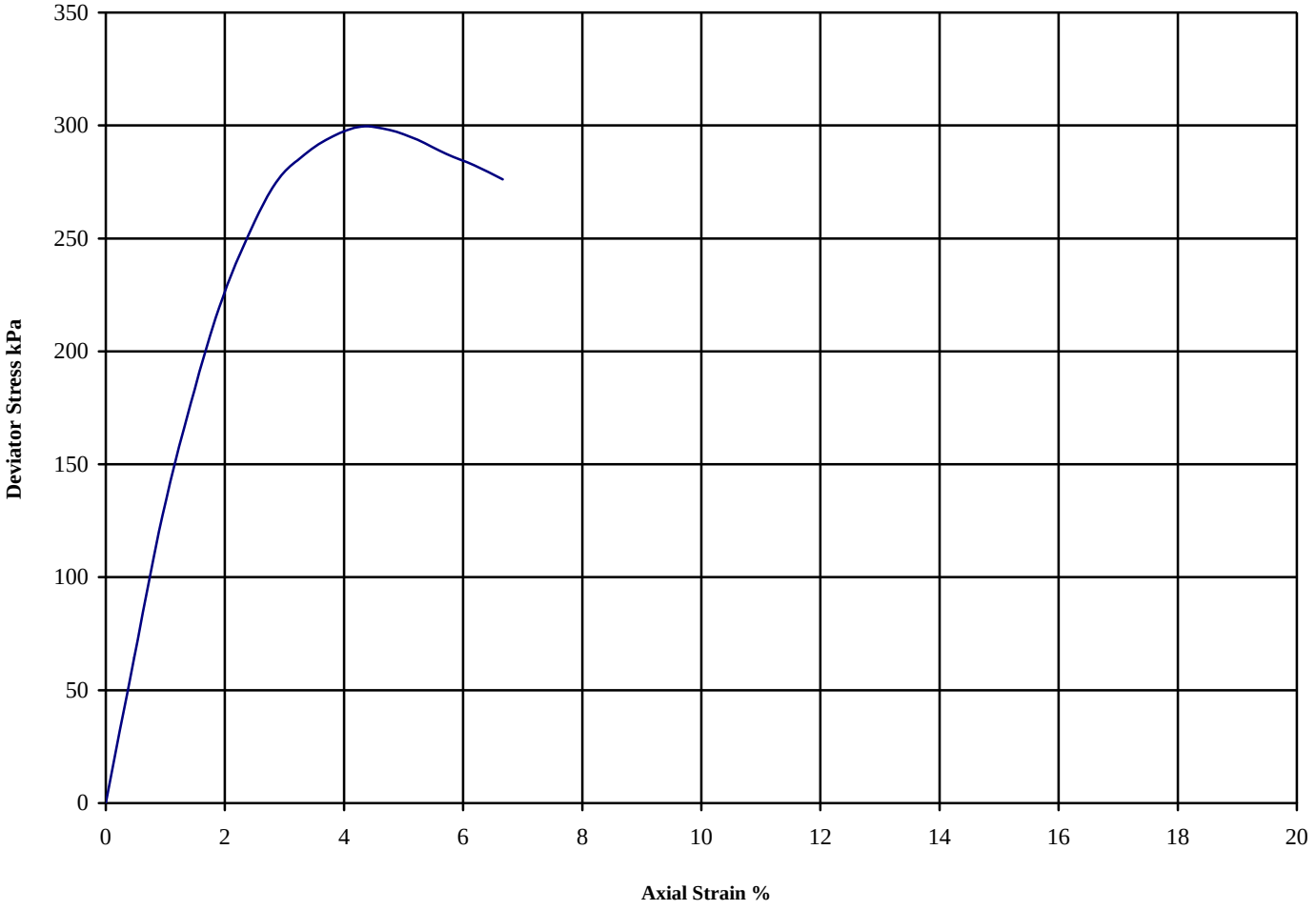
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH2 **Depth (m):** 13.00

Sample Number: 15 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.99	1.56	260	300	150	4.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL
Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

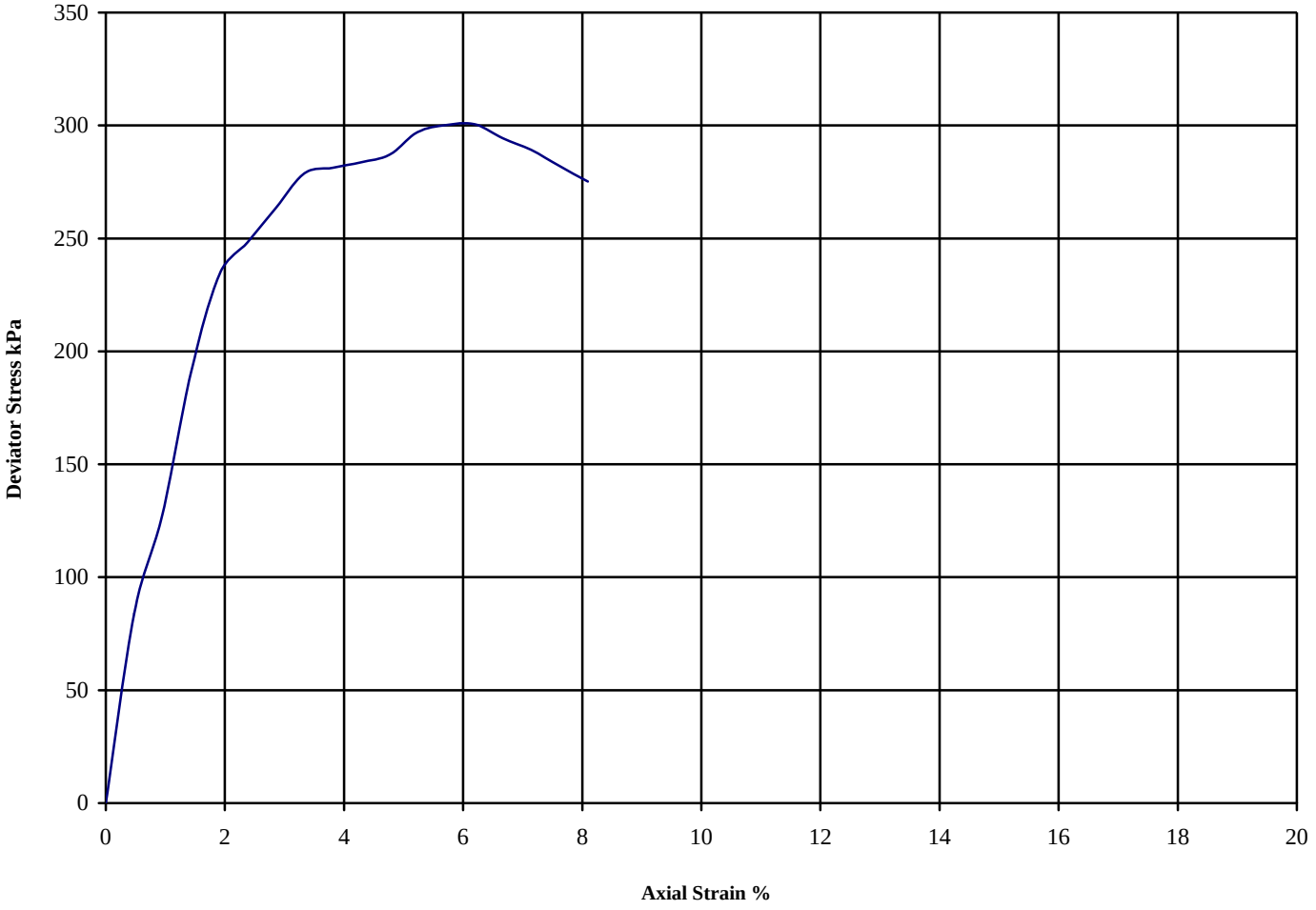
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH2 **Depth (m):** 19.00

Sample Number: 21 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	26	2.02	1.60	380	301	150	6.2	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	31/10/14		31/10/14

PSL Professional Soils Laboratory

KILBURN HIGH ROAD.

Contract No: PSL14/5410

APPENDIX 5 – STATISTICAL ANALYSIS RESULTS

	General UCL Statistics for Full Data Sets	
User Selected Options		
From File	WorkSheet.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations	2000	

Arsenic

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	10.6	Minimum of Log Data	2.361
Maximum	33.7	Maximum of Log Data	3.517
Mean	19.85	Mean of log Data	2.938
Geometric Mean	18.88	SD of log Data	0.335
Median	19.3		
SD	6.641		
Std. Error of Mean	2.1		
Coefficient of Variation	0.335		
Skewness	0.758		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.951	Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.7	95% H-UCL	25.01
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	29.1
95% Adjusted-CLT UCL (Chen-1995)	23.84	97.5% Chebyshev (MVUE) UCL	33.1
95% Modified-t UCL (Johnson-1978)	23.78	99% Chebyshev (MVUE) UCL	40.95

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	7.199	**Data appear Normal at 5% Significance Level**	
Theta Star	2.757		
MLE of Mean	19.85		
MLE of Standard Deviation	7.398		
nu star	144		
Approximate Chi Square Value (.05)	117.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	23.3
Adjusted Chi Square Value	113.1	95% Jackknife UCL	23.7
		95% Standard Bootstrap UCL	23.19
Anderson-Darling Test Statistic	0.198	95% Bootstrap-t UCL	24.57
Anderson-Darling 5% Critical Value	0.725	95% Hall's Bootstrap UCL	24.99
Kolmogorov-Smirnov Test Statistic	0.118	95% Percentile Bootstrap UCL	23.16
Kolmogorov-Smirnov 5% Critical Value	0.267	95% BCA Bootstrap UCL	23.68
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	29
		97.5% Chebyshev(Mean, Sd) UCL	32.97
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	40.75
95% Approximate Gamma UCL (Use when n >= 40)	24.38		
95% Adjusted Gamma UCL (Use when n < 40)	25.28		

	A	B	C	D	E	F	G	H	I	J	K	L
56												
57	**Potential UCL to Use**						Use 95% Student's-t UCL					23.7
58												
59	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
60	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
61	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
62												

	A	B	C	D	E	F	G	H	I	J	K	L
1					**Outlier Tests for Selected Variables**							
2				**User Selected Options**								
3				From File	WorkSheet.wst							
4				Full Precision	OFF							
5				Test for Suspected Outliers with Dixon test	1							
6				Test for Suspected Outliers with Rosner test	1							
7												
8												
9				**Dixon's Outlier Test for Arsenic**								
10												
11	Number of data = 10											
12	10% critical value: 0.409											
13	5% critical value: 0.477											
14	1% critical value: 0.597											
15												
16	**1. Data Value 33.7 is a Potential Outlier (Upper Tail)?**											
17												
18	Test Statistic: 0.467											
19												
20	For 10% significance level, 33.7 is an outlier.											
21	For 5% significance level, 33.7 is not an outlier.											
22	For 1% significance level, 33.7 is not an outlier.											
23												
24	**2. Data Value 10.6 is a Potential Outlier (Lower Tail)?**											
25												
26	Test Statistic: 0.232											
27												
28	For 10% significance level, 10.6 is not an outlier.											
29	For 5% significance level, 10.6 is not an outlier.											
30	For 1% significance level, 10.6 is not an outlier.											
31												

	General UCL Statistics for Full Data Sets	
User Selected Options		
From File	WorkSheet.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations	2000	

Benzo(a)pyrene

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	4

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	1.7	Maximum of Log Data	0.531
Mean	0.69	Mean of log Data	-0.468
Geometric Mean	0.626	SD of log Data	0.419
Median	0.5		
SD	0.39		
Std. Error of Mean	0.123		
Coefficient of Variation	0.565		
Skewness	2.369		

Warning: There are only 4 Distinct Values in this data

There are insufficient Distinct Values to perform some GOF tests and bootstrap methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.586	Shapiro Wilk Test Statistic	0.635
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.916	95% H-UCL	0.919
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.075
95% Adjusted-CLT UCL (Chen-1995)	0.992	97.5% Chebyshev (MVUE) UCL	1.246
95% Modified-t UCL (Johnson-1978)	0.931	99% Chebyshev (MVUE) UCL	1.584
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.797	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	0.182		
MLE of Mean	0.69		
MLE of Standard Deviation	0.354		
nu star	75.94		
Approximate Chi Square Value (.05)	56.87	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	0.893
Adjusted Chi Square Value	54.01	95% Jackknife UCL	0.916
		95% Standard Bootstrap UCL	0.883

56	Anderson-Darling Test Statistic	1.838	95% Bootstrap-t UCL	1.384
57	Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	1.534
58	Kolmogorov-Smirnov Test Statistic	0.411	95% Percentile Bootstrap UCL	0.91
59	Kolmogorov-Smirnov 5% Critical Value	0.267	95% BCA Bootstrap UCL	0.96
60	**Data not Gamma Distributed at 5% Significance Level**		95% Chebyshev(Mean, Sd) UCL	1.228
61			97.5% Chebyshev(Mean, Sd) UCL	1.46
62	**Assuming Gamma Distribution**		99% Chebyshev(Mean, Sd) UCL	1.917
63	95% Approximate Gamma UCL (Use when n >= 40)	0.921		
64	95% Adjusted Gamma UCL (Use when n < 40)	0.97		
65				
66	**Potential UCL to Use**		Use 95% Student's-t UCL	0.916
67			or 95% Modified-t UCL	0.931
68				
69	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**			
70	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**			
71	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**			
72				

	A	B	C	D	E	F	G	H	I	J	K	L
1					**Outlier Tests for Selected Variables**							
2				**User Selected Options**								
3				From File	WorkSheet.wst							
4				Full Precision	OFF							
5				Test for Suspected Outliers with Dixon test	1							
6				Test for Suspected Outliers with Rosner test	1							
7												
8												
9				**Dixon's Outlier Test for Benzo(a)pyrene**								
10												
11	Number of data = 10											
12	10% critical value: 0.409											
13	5% critical value: 0.477											
14	1% critical value: 0.597											
15												
16	**1. Data Value 1.7 is a Potential Outlier (Upper Tail)?**											
17												
18	Test Statistic: 0.583											
19												
20	For 10% significance level, 1.7 is an outlier.											
21	For 5% significance level, 1.7 is an outlier.											
22	For 1% significance level, 1.7 is not an outlier.											
23												
24	**2. Data Value 0.5 is a Potential Outlier (Lower Tail)?**											
25												
26	Test Statistic: 0.000											
27												
28	For 10% significance level, 0.5 is not an outlier.											
29	For 5% significance level, 0.5 is not an outlier.											
30	For 1% significance level, 0.5 is not an outlier.											
31												

	General UCL Statistics for Full Data Sets	
User Selected Options		
From File	WorkSheet.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations	2000	

Lead

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	38.4	Minimum of Log Data	3.648
Maximum	2530	Maximum of Log Data	7.836
Mean	758.5	Mean of log Data	6.045
Geometric Mean	421.8	SD of log Data	1.264
Median	516.5		
SD	818.4		
Std. Error of Mean	258.8		
Coefficient of Variation	1.079		
Skewness	1.549		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.797	Shapiro Wilk Test Statistic	0.967
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1233	95% H-UCL	4401
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2360
95% Adjusted-CLT UCL (Chen-1995)	1320	97.5% Chebyshev (MVUE) UCL	3022
95% Modified-t UCL (Johnson-1978)	1254	99% Chebyshev (MVUE) UCL	4323
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.756	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	1003		
MLE of Mean	758.5		
MLE of Standard Deviation	872.2		
nu star	15.13		
Approximate Chi Square Value (.05)	7.35	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	1184
Adjusted Chi Square Value	6.43	95% Jackknife UCL	1233
		95% Standard Bootstrap UCL	1161
Anderson-Darling Test Statistic	0.221	95% Bootstrap-t UCL	1934
Anderson-Darling 5% Critical Value	0.749	95% Hall's Bootstrap UCL	3853
Kolmogorov-Smirnov Test Statistic	0.161	95% Percentile Bootstrap UCL	1206
Kolmogorov-Smirnov 5% Critical Value	0.274	95% BCA Bootstrap UCL	1292
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1887
		97.5% Chebyshev(Mean, Sd) UCL	2375
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3334
95% Approximate Gamma UCL (Use when n >= 40)	1561		
95% Adjusted Gamma UCL (Use when n < 40)	1784		

	A	B	C	D	E	F	G	H	I	J	K	L
56												
57	**Potential UCL to Use**						Use 95% Approximate Gamma UCL					1561
58												
59	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
60	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
61	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
62												

	A	B	C	D	E	F	G	H	I	J	K	L
1					**Outlier Tests for Selected Variables**							
2				**User Selected Options**								
3				From File	WorkSheet.wst							
4				Full Precision	OFF							
5				Test for Suspected Outliers with Dixon test	1							
6				Test for Suspected Outliers with Rosner test	1							
7												
8												
9				**Dixon's Outlier Test for Lead**								
10												
11	Number of data = 10											
12	10% critical value: 0.409											
13	5% critical value: 0.477											
14	1% critical value: 0.597											
15												
16	**1. Data Value 2530 is a Potential Outlier (Upper Tail)?**											
17												
18	Test Statistic: 0.260											
19												
20	For 10% significance level, 2530 is not an outlier.											
21	For 5% significance level, 2530 is not an outlier.											
22	For 1% significance level, 2530 is not an outlier.											
23												
24	**2. Data Value 38.4 is a Potential Outlier (Lower Tail)?**											
25												
26	Test Statistic: 0.038											
27												
28	For 10% significance level, 38.4 is not an outlier.											
29	For 5% significance level, 38.4 is not an outlier.											
30	For 1% significance level, 38.4 is not an outlier.											
31												

	General UCL Statistics for Full Data Sets	
User Selected Options		
From File	WorkSheet.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations	2000	

Mercury

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	8

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	2.3	Maximum of Log Data	0.833
Mean	1.15	Mean of log Data	-0.000374
Geometric Mean	1	SD of log Data	0.572
Median	1.15		
SD	0.615		
Std. Error of Mean	0.195		
Coefficient of Variation	0.535		
Skewness	0.525		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.911	Shapiro Wilk Test Statistic	0.894
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.507	95% H-UCL	1.835
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.088
95% Adjusted-CLT UCL (Chen-1995)	1.504	97.5% Chebyshev (MVUE) UCL	2.492
95% Modified-t UCL (Johnson-1978)	1.512	99% Chebyshev (MVUE) UCL	3.284
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.675	**Data appear Normal at 5% Significance Level**	
Theta Star	0.43		
MLE of Mean	1.15		
MLE of Standard Deviation	0.703		
nu star	53.5		
Approximate Chi Square Value (.05)	37.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	1.47
Adjusted Chi Square Value	35.4	95% Jackknife UCL	1.507
		95% Standard Bootstrap UCL	1.462
Anderson-Darling Test Statistic	0.441	95% Bootstrap-t UCL	1.564
Anderson-Darling 5% Critical Value	0.73	95% Hall's Bootstrap UCL	1.51
Kolmogorov-Smirnov Test Statistic	0.191	95% Percentile Bootstrap UCL	1.47
Kolmogorov-Smirnov 5% Critical Value	0.268	95% BCA Bootstrap UCL	1.48
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.998
		97.5% Chebyshev(Mean, Sd) UCL	2.365
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3.085
95% Approximate Gamma UCL (Use when n >= 40)	1.632		

	A	B	C	D	E	F	G	H	I	J	K	L
56	95% Adjusted Gamma UCL (Use when n < 40)					1.738						
57												
58	**Potential UCL to Use**						Use 95% Student's-t UCL					1.507
59												
60	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
61	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
62	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
63												

	A	B	C	D	E	F	G	H	I	J	K	L
1					**Outlier Tests for Selected Variables**							
2				**User Selected Options**								
3				From File	WorkSheet.wst							
4				Full Precision	OFF							
5				Test for Suspected Outliers with Dixon test	1							
6				Test for Suspected Outliers with Rosner test	1							
7												
8												
9				**Dixon's Outlier Test for Mercury**								
10												
11	Number of data = 10											
12	10% critical value: 0.409											
13	5% critical value: 0.477											
14	1% critical value: 0.597											
15												
16	**1. Data Value 2.3 is a Potential Outlier (Upper Tail)?**											
17												
18	Test Statistic: 0.333											
19												
20	For 10% significance level, 2.3 is not an outlier.											
21	For 5% significance level, 2.3 is not an outlier.											
22	For 1% significance level, 2.3 is not an outlier.											
23												
24	**2. Data Value 0.5 is a Potential Outlier (Lower Tail)?**											
25												
26	Test Statistic: 0.000											
27												
28	For 10% significance level, 0.5 is not an outlier.											
29	For 5% significance level, 0.5 is not an outlier.											
30	For 1% significance level, 0.5 is not an outlier.											
31												

	General UCL Statistics for Full Data Sets	
User Selected Options		
From File	WorkSheet.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations	2000	

Napthalene

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	2

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	10.7	Maximum of Log Data	2.37
Mean	1.52	Mean of log Data	-0.387
Geometric Mean	0.679	SD of log Data	0.969
Median	0.5		
SD	3.226		
Std. Error of Mean	1.02		
Coefficient of Variation	2.122		
Skewness	3.162		

Warning: There are only 2 Distinct Values in this data

There are insufficient Distinct Values to perform some GOF tests and bootstrap methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.366	Shapiro Wilk Test Statistic	0.366
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3.39	95% H-UCL	2.897
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.448
95% Adjusted-CLT UCL (Chen-1995)	4.288	97.5% Chebyshev (MVUE) UCL	3.065
95% Modified-t UCL (Johnson-1978)	3.56	99% Chebyshev (MVUE) UCL	4.278
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.587	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2.587		
MLE of Mean	1.52		
MLE of Standard Deviation	1.983		
nu star	11.75		
Approximate Chi Square Value (.05)	5.062	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	3.198
Adjusted Chi Square Value	4.325	95% Jackknife UCL	N/A
		95% Standard Bootstrap UCL	N/A

56	Anderson-Darling Test Statistic	3.402								95% Bootstrap-t UCL	N/A	
57	Anderson-Darling 5% Critical Value	0.757								95% Hall's Bootstrap UCL	N/A	
58	Kolmogorov-Smirnov Test Statistic	0.555								95% Percentile Bootstrap UCL	N/A	
59	Kolmogorov-Smirnov 5% Critical Value	0.276								95% BCA Bootstrap UCL	N/A	
60	**Data not Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL	5.966	
61										97.5% Chebyshev(Mean, Sd) UCL	7.89	
62	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL	11.67	
63	95% Approximate Gamma UCL (Use when n >= 40)	3.528										
64	95% Adjusted Gamma UCL (Use when n < 40)	4.13										
65												
66	**Potential UCL to Use**									Use 95% Chebyshev (Mean, Sd) UCL	5.966	
67												
68	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
69	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
70	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
71												

	Outlier Tests for Selected Variables	
User Selected Options		
From File	WorkSheet.wst	
Full Precision	OFF	
Test for Suspected Outliers with Dixon test	1	
Test for Suspected Outliers with Rosner test	1	

Dixon's Outlier Test for Napthalene

Number of data = 10

10% critical value: 0.409

5% critical value: 0.477

1% critical value: 0.597

1. Data Value 10.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 1.000

For 10% significance level, 10.7 is an outlier.

For 5% significance level, 10.7 is an outlier.

For 1% significance level, 10.7 is an outlier.

2. Data Value 0.5 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0.5 is an outlier.

For 5% significance level, 0.5 is an outlier.

For 1% significance level, 0.5 is an outlier.

APPENDIX 6 – SOIL GAS MONITORING RECORDS

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Kilburn high road	**Operative(s):** GG	**Date:** 29/10/14	**Time:** 12:13 pm	**Round: 1**	**Page:** 1 of 3

MONITORING EQUIPMENT

Instrument Type	Instrument Make	Serial No.	Date Last Calibrated
Analox	GA5000		
PID	Phochecker tiger		
Dip Meter	GeoTech		

MONITORING CONDITIONS

Weather Conditions: Cloudy, heavy rain	**Ground Conditions:** wet	**Temperature**: 16c
Barometric Pressure (mbar): 1009	**Barometric Pressure Trend (24hr):** falling	**Ambient Concentration:** 0%CH_4, 0%CO_2, 21.8%O_2

MONITORING RESULTS

Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	Methane %	Methane % LEL	Carbon Dioxide %	Oxygen %	VOC (ppm)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
	Peak	Average						Peak	Average				
WS3	+0.2	/	1009	0.0	0	8.4	11.0	0.0	/	0	0	Dry	2.54
BH2	+0.2	/	1009	0.0	0	0.5	20.5	0.3	/	0	1	Dry	18.54

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Kilburn high road	**Operative(s):** GG	**Date:** 05/11/14	**Time:** 10:32 am	**Round: 2**	**Page:** 2 of 3

MONITORING EQUIPMENT

Instrument Type	Instrument Make	Serial No.	Date Last Calibrated
Analox	GA5000		
PID	Phochecker tiger		
Dip Meter	GeoTech		

MONITORING CONDITIONS

Weather Conditions: Cloudy, heavy rain	**Ground Conditions:** wet	**Temperature**: 12c
Barometric Pressure (mbar): 0983	**Barometric Pressure Trend (24hr):** falling	**Ambient Concentration:** 0%CH_4, 0%CO_2, 21.8%O_2

MONITORING RESULTS

Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	Methane %	Methane % LEL	Carbon Dioxide %	Oxygen %	VOC (ppm)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
	Peak	Average						Peak	Average				
WS3	+0.8	/	0983	0.0	0	9.4	9.9	0.3	/	0	0	Dry	2.54
BH2	+0.2	/	0983	0.0	0	0.6	20.0	0.3	/	0	0	Dry	18.54

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Kilburn high road	**Operative(s):** GG	**Date:** 13/11/14	**Time:** 4.08 pm	**Round: 3**	**Page:** 3 of 3

MONITORING EQUIPMENT

Instrument Type	**Instrument Make**	**Serial No.**	**Date Last Calibrated**
Analox	GA5000		
PID	Phochecker tiger		
Dip Meter	GeoTech		

MONITORING CONDITIONS

Weather Conditions: Cloudy, heavy rain	**Ground Conditions:** wet	**Temperature**: 12c
Barometric Pressure (mbar): 0983	**Barometric Pressure Trend (24hr):** falling	**Ambient Concentration:** 0%CH_4, 0%CO_2, 21.8%O_2

MONITORING RESULTS

Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	Methane %	Methane % LEL	Carbon Dioxide %	Oxygen %	VOC (ppm)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
	Peak	Average						Peak	Average				
WS3	+0.2	/	0983	0.0	0	8.6	10.6	0.0	/	0	0	Dry	2.54
BH2	+0.4	/	0983	0.0	0	0.7	20.0	0.0	/	0	0	Dry	18.54

APPENDIX 7 – IN SITU CBR RESULTS

Dynamic Cone CBR Test

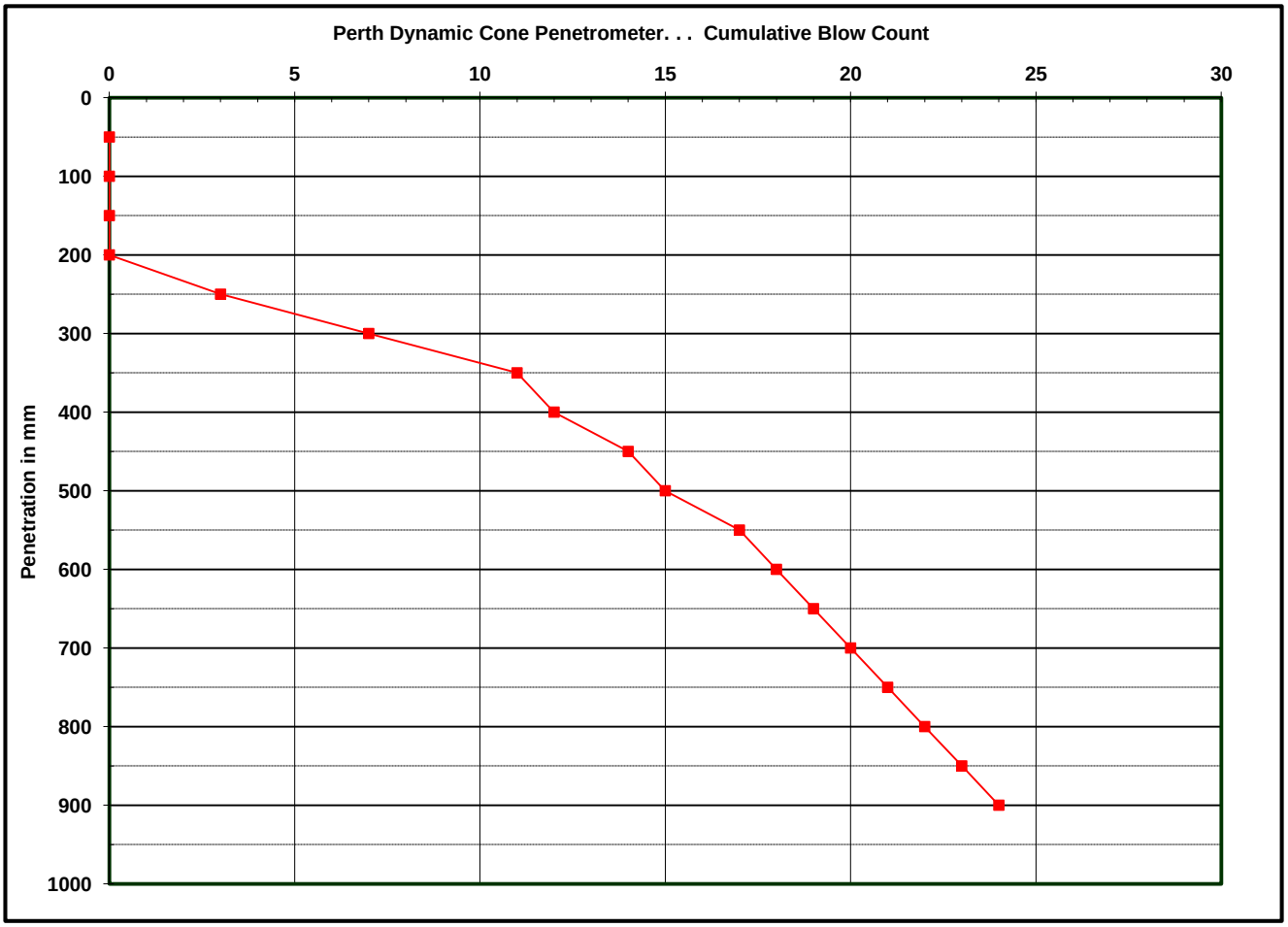
Nr Blows	S Blows	Penetration mm	S Pen. mm
0	0	50	50
0	0	50	100
0	0	50	150
0	0	50	200
3	3	50	250
4	7	50	300
4	11	50	350
1	12	50	400
2	14	50	450
1	15	50	500
2	17	50	550
1	18	50	600
1	19	50	650
1	20	50	700
1	21	50	750
1	22	50	800
1	23	50	850
1	24	50	900

254 Kilburn High Road Test Reference: - CBR 1

Job Nr J338 Date 10-Oct-14

CBR VALUE CALCULATIONS

Initial S Pen mm	Final S Pen mm	Initial S Blows	Final S Blows	Pen/Blow mm	CBR TRRL	CBR KVH	CBR Value (%)
250	350	3	11	12.5	20.9	16.9	**16.9**
350	500	11	15	37.5	6.6	4.1	**4.1**
550	900	17	24	50.0	4.8	2.9	**2.9**



Tested by	DB	Checked		Approved	

Site: 254 Kilburn High Road	**Client:** Aitch	**Date:** 10/10/2014
	Job No: J338	**Test No:** CBR 1

Dynamic Cone CBR Test

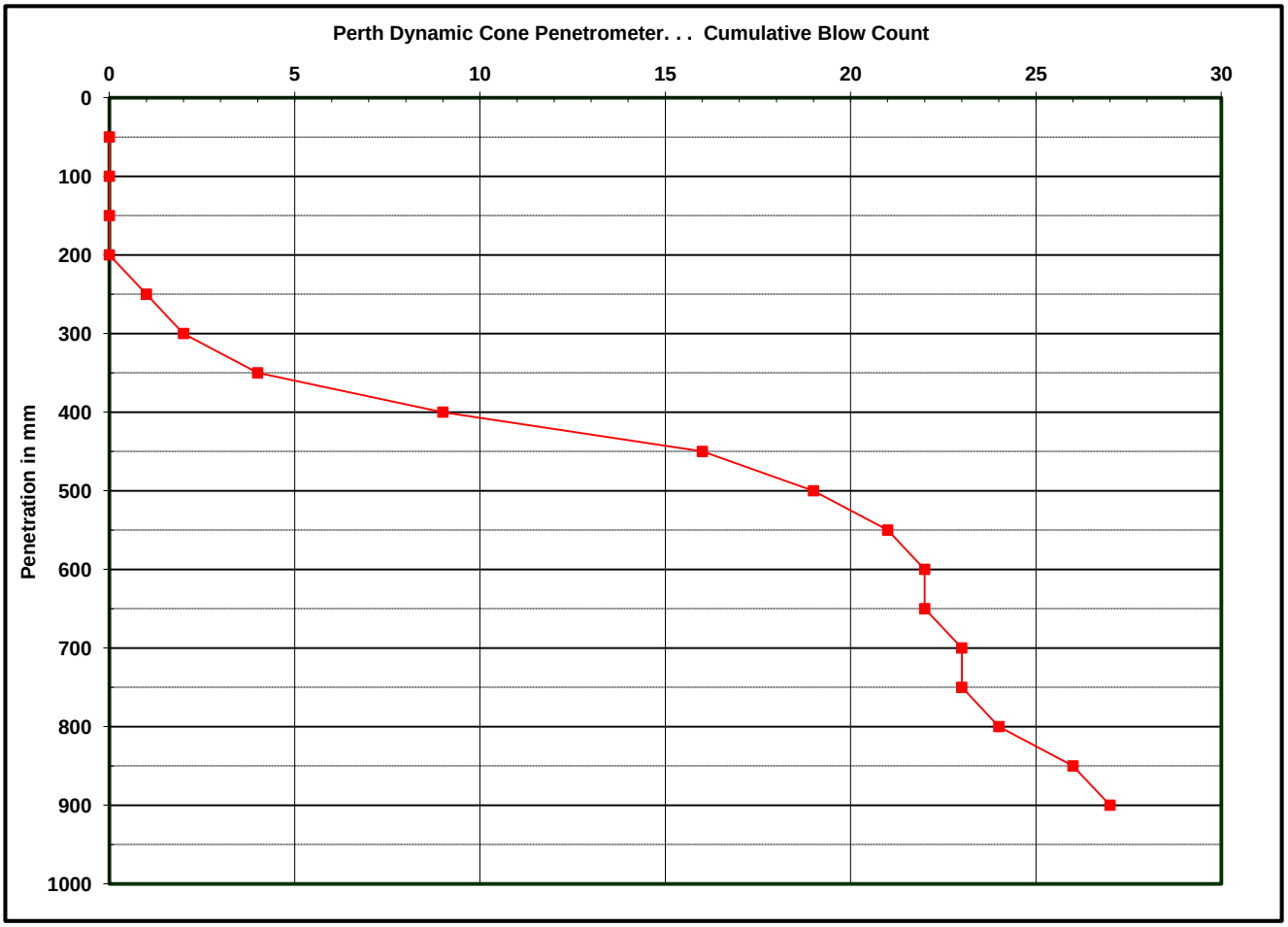
Nr Blows	S Blows	Penetration mm	S Pen. mm
0	0	50	50
0	0	50	100
0	0	50	150
0	0	50	200
1	1	50	250
1	2	50	300
2	4	50	350
5	9	50	400
7	16	50	450
3	19	50	500
2	21	50	550
1	22	50	600
0	22	50	650
1	23	50	700
0	23	50	750
1	24	50	800
2	26	50	850
1	27	50	900
1			
1			

254 Kilburn High Road Test Reference: - CBR 3

Job Nr J338 Date 10-Oct-14

CBR VALUE CALCULATIONS

Initial S Pen mm	Final S Pen mm	Initial S Blows	Final S Blows	Pen/Blow mm	CBR TRRL	CBR KVH	CBR Value (%)
300	400	2	9	14.3	18.2	14.2	**14.2**
400	550	9	21	12.5	20.9	16.9	**16.9**
550	750	21	23	100.0	2.3	1.2	**1.2**
800	900	24	27	33.3	7.4	4.8	**4.8**



Tested by	TC	Checked		Approved	

Site: 254 Kilburn High Road	**Client:** Aitch	**Date:** 10/10/2014
	Job No: J338	**Test No:** CBR2

Dynamic Cone CBR Test

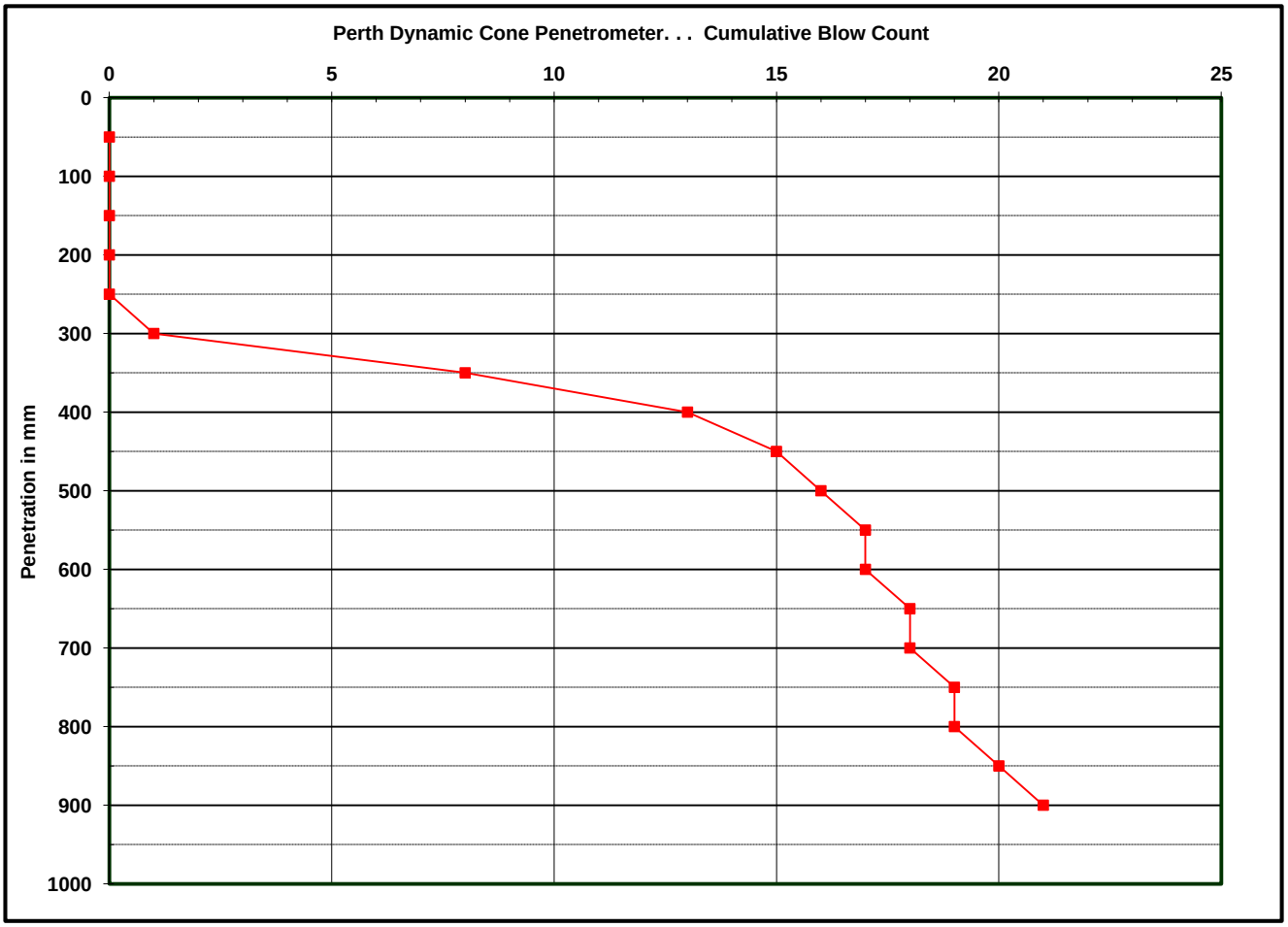
Nr Blows	S Blows	Penetration mm	S Pen. mm
0	0	50	50
0	0	50	100
0	0	50	150
0	0	50	200
0	0	50	250
1	1	50	300
7	8	50	350
5	13	50	400
2	15	50	450
1	16	50	500
1	17	50	550
0	17	50	600
1	18	50	650
0	18	50	700
1	19	50	750
0	19	50	800
1	20	50	850
1	21	50	900

254 Kilburn High Road Test Reference: - CBR 3

Job Nr J338 Date 10-Oct-14

CBR VALUE CALCULATIONS

Initial S Pen mm	Final S Pen mm	Initial S Blows	Final S Blows	Pen/Blow mm	CBR TRRL	CBR KVH	CBR Value (%)
300	400	1	13	8.3	32.1	28.4	**28.4**
400	550	13	17	37.5	6.6	4.1	**4.1**
550	750	17	19	100.0	2.3	1.2	**1.2**
800	900	19	21	50.0	4.8	2.9	**2.9**



Tested by	DB	Checked		Approved	

Site: 254 Kilburn High Road	**Client:** Aitch	**Date:** 10/10/2014
	Job No: J338	**Test No:** CBR 3