GROUND INVESTIGATION REPORT

for the site at

LAND ADJACENT TO 1B ST JOHN'S WOOD PARK, LONDON NW8 6QS

on behalf of

LIV-INTERNATIONAL

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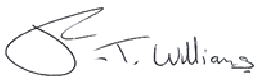
V1.01 July 2015		
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File Reference: Ground and Water/Project Files/ GWPR1319 Land adjacent to 1b St Johns Wood Park, London		

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1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by Liv-International on the 23rd June 2015 to undertake a Ground Investigation on the land adjacent to 1b St John's Wood Park, London NW8 6QS. The scope of the investigation was detailed within the Ground and Water Limited fee proposal ref.: GWQ2504, dated 22nd June 2015.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes.

The requirements of the London Borough of Camden, Camden Geological, Hydrogeological and Hydrological Study, Guidance for Subterranean Development (November 2010) was reviewed with respect to this report.

Included within the fee proposal was an allowance to undertake chemical laboratory testing on soil samples recovered from the site to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any potential contamination identified.

A Desk Study and full scale contamination assessment were not part of the remit of this report.

The techniques adopted for the investigation were chosen considering the anticipated ground conditions and development proposals on-site, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

2.0 SITE SETTING

2.1 Site Location

The site comprised an approximately 350m^2 rectangular shaped plot of land located adjacent to No. 1 St Johns Wood Park, on the western side of the road, opposite Marion Court. The site was located in the South Hampstead/Primrose Hill area of north-west London, within the London Borough of Camden.

The national grid reference for the centre of the site was approximately TQ 26729 83980. A site location plan is given within Figure 1. A plan showing the boundary of the site is provided in Figure 2.

2.2 Site Description

The site comprised a terrace of ~6No. single storey lock up residential garages, located on the northern boundary of the site. The remainder of the site comprised tarmac hard landscaping, accessed via double gates off St John's Wood Park. Mature trees were noted in the north-east corner of the site and two storey residential houses with off-road parking and private rear gardens were noted to the south. An aerial view of the site is provided within Figure 3.

2.3 Proposed Development

At the time of reporting, July 2015, it was understood that the proposed development will comprise the demolition of the existing structures and construction of a three storey detached residential property with a basement. It was understood the development will include the construction of a swimming pool within the basement. A plan showing the proposed development can be seen in Figure 4 with a section of the proposed development shown in Figure 5.

2.4 Geology

The BGS Geological Map (Solid and Drift) for the North London area (Sheet No. 256), and Figures 3 and 4 of the Camden Geological, Hydrogeological and Hydrological Study, revealed that the site was underlain by the London Clay Formation.

London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of Gypsum (Selenite) are often found within the weathered part of the London Clay Formation, and precautions against sulphate attack to concrete are sometimes required. The lowest part of the formation is a sandy bed with black rounded gravel and occasional layers of sandstone and is known as the Basement Bed.

A BGS borehole ~60m north of the site, drilled to 11.12m bgl, revealed ~0.50m of Made Ground to overlie firm to stiff brown, becoming grey with depth, silty clays. Claystone bands and selenite crystals were noted at depth.

No areas of Made Ground or Worked Ground were noted within a 250m radius of the site.

2.5 Slope Stability and Subterranean Developments

The site was not situated within an area where a natural or man-made slope of greater than 7^o was present (Figure 16 Camden Geological, Hydrogeological and Hydrological Study).

Figure 17 of the Camden Geological, Hydrogeological and Hydrological Study indicated that the site was not situated within an area prone to landslides.

Figure 18 of the Camden Geological, Hydrogeological and Hydrological Study indicated that an underground section/tunnel of the London Overground was situated running east to west ~50m north of the site. The Jubilee Underground Line was situated ~45m west of the site, running north to south. No other major subterranean infrastructure (including existing and proposed tunnels) were noted within close proximity to the site.

2.6 Hydrogeology and Hydrology

A study of the aquifer maps on the Environment Agency website, and Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study, revealed the site to be located on **Unproductive Strata** relating to the bedrock deposits of the London Clay Formation. No designation was given for any superficial deposits due to their likely absence.

Superficial (Drift) deposits are permeable unconsolidated (loose) deposits, for example, sands and gravels.The bedrock is described as solid permeable formations e.g. sandstone, chalk and limestone.

Unproductive strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

Examination of the Environment Agency records, and Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study, showed that the site fell within a Groundwater Source Protection Zone 2 (Outer Zone) as classified in the Policy and Practice for the Protection of Groundwater.

A Groundwater Source Protection Zone 2 (Outer Zone) is defined by a 400 day travel time from a point below the water table. The previous methodology gave an option to define Zone 2 as the minimum recharge area required to support 25 per cent of the protected yield. This option is no longer available in defining new Source Protection Zones and instead this zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction;

No surface water features were noted within a 250m radius of the site.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered at depth (>10m below existing ground level (bgl)) and it was considered that the groundwater was flowing in a south-easterly direction in alignment with the groundwater source protection zones, towards the inner zone.

Examination of the Environment Agency records showed that the site was **not** situated within flood zone or flood warning area.

2.7 Radon

BRE 211 (2007) Map 5 of the London, Sussex and west Kent area revealed the site was located within an area where mandatory protection measures against the ingress of Radon were **unlikely to be** required. The site **was not** located within an area where a risk assessment was required.

3.0 FIELDWORK

3.1 Scope of Works

Fieldwork was undertaken on the 1st July 2015 and comprised the drilling of one Premier Windowless Sampler Borehole (BH1) to a depth of 12.50m bgl and the hand excavation of two trial pit foundation exposures (TP/FE1 and TP/FE2). Standard Penetration Testing was undertaken in the borehole at 1.00m intervals.

A small diameter combined bio-gas and groundwater monitoring well was installed within BH1 to 5.00m bgl. The construction of the well installed can be seen tabulated below.

Combined Bio-gas and Groundwater Monitoring Well Construction				
Trial Hole	**Depth of Installation (m bgl)**	**Thickness of slotted piping with gravel filter pack (m)**	**Depth of plain piping with bentonite seal (m bgl)**	**Piping external diameter (mm)**
BH1	5.00	4.00	1.00	63

The approximate locations of the trial holes can be seen within Figure 6.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, exploratory positions were relocated away from these areas.

Upon completion of the site works, the trial holes were backfilled and made good/reinstated in relation to the surrounding area.

3.2 Sampling Procedures

Small disturbed samples were recovered from the trial hole at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A selection of samples were despatched for geotechnical testing purposes. A selection of samples were despatched for geotechnical testing purposes. A programme of chemical laboratory testing, scheduled by Ground and Water Limited and carried out by QTS Environmental Limited, was undertaken on samples recovered from the trial holes.

4.0 ENCOUNTERED GROUND CONDITIONS

4.1 Soil Conditions

All exploratory holes were logged by Francis Williams of Ground and Water Limited generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the trial holes constructed on the site generally conformed to that anticipated from examination of the geology map. Made Ground was noted to overlie Head Deposits within TP/FE1 and the London Clay Formation within BH1.

The ground conditions encountered during the investigation are described in this section. For more complete information about the Made Ground, Head Deposits and the London Clay Formation at particular points, reference must be made to the individual trial hole logs within Appendix B.

The trial hole location plan can be viewed in Figure 6.

For the purposes of discussion the succession of conditions encountered in BH1 in descending order can be summarised as follows:

Made Ground
Head Deposits (TP/FE1 only)
London Clay Formation (BH1 only)

Made Ground

Made Ground was encountered from ground level to 0.50m bgl within BH1 and comprised a layer of tarmac overlying a mid to dark grey, with reddy brown mottling, sandy gravel. The sand was noted to be fine to coarse grained and the gravel was abundant, fine to coarse, sub-angular to sub-rounded concrete and occasional brick.

Within TP/FE1 and TP/FE2 a reinforced concrete slab was noted from ground level to 0.15m and 0.13m bgl respectively. The concrete slab was noted to overlie crushed brick within TP/FE2, and a dark brown to black gravelly sand within TP/FE1, proved to 1.10m bgl. The sand was medium to coarse grained and the gravel was is abundant, fine to coarse, sub-angular to sub-rounded brick and concrete with abundant, fine, sub-angular to sub-rounded clinker and ash.

Head Deposits

Soils described as representative of Head Deposits were encountered underlying the Made Ground within TP/FE1. The deposits comprised a mid to dark brown, orange brown and grey mottled gravelly silty clay. The gravel was occasional, fine to medium, sub-angular to rounded flints. The base of the Head Deposits was not proven within TP/FE1, which was excavated to a depth of 1.50m bgl.

London Clay Formation

Soils described as representative of the London Clay Formation were encountered underlying the Made Ground within BH1 and were proved for the remaining depth of the borehole, a maximum of 12.50m bgl. From 0.50m to 3.60m bgl the deposits were described as mid to dark brown, dark orange brown and light grey mottled silty clay with fine to medium rounded flints noted at 1.50m bgl. From 3.60m to 9.00m bgl the soils comprised a dark brown, with rare orange brown mottling, silty clay. Rare to occasional fine selenite crystals were noted. From 9.00m bgl, and for the remaining

depth of the borehole, the formation was noted to comprise a dark brown grey to dark grey silty clay with claystones and rare to occasional, fine, selenite crystals.

For details of the composition of the soils encountered at particular points, reference must be made to the individual trial hole logs within Appendix B.

4.2 Foundation Exposures

A description of the foundation layout and ground conditions encountered within the hand dug trial pit foundation exposures are given within this section of the report.

TP/FE1

Trial pit foundation exposure TP/FE1 was hand excavated from ground level to the rear of an existing garage. The exact location of the trial hole can be seen in Figure 6 with a section drawing of the foundation encountered in Figure 7.

The foundation layout encountered consisted of a brick wall to ground level. The brick wall continued from ground level to a depth of 0.80m bgl and was noted to rest upon a concrete footing which stepped out by 0.30m and was 0.35m in thickness. The foundation was noted to rest on Head Deposits, described as mid to dark brown, orange brown and grey mottled gravelly silty clay. The ground conditions encountered directly surrounding the foundation are shown in Figure 7. The ground conditions encountered directly surrounding the foundation are described in Section 4.1.

TP/FE2

Trial pit foundation exposure TP/FE2 was hand excavated from ground level at the front of an existing garage. The exact location of the trial hole can be seen in Figure 6 with a section drawing of the foundation encountered in Figure 8.

The foundation layout encountered consisted of concrete blockwork to ground level. The concrete blockwork was noted to rest upon a 0.13m thick reinforced concrete slab. The concrete slab was noted to rest on crushed brick. The ground conditions encountered directly surrounding the foundation are shown in Figure 8. The ground conditions encountered directly surrounding the foundation are described in Section 4.1.

4.3 Roots Encountered

Roots were noted to 0.80m bgl in BH1 by the supervising engineer. Geotechnical testing identified fine rootlets to 1.50m bgl in BH1.

It must be noted that the chance of determining actual depth of root penetration through a narrow diameter borehole is low. Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.4 Groundwater Conditions

No groundwater was encountered. The result of a return visit to monitor the water level within the well installed was not available at the time of reporting and will be issued as an addendum to this report.

Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site. It should be noted that changes in groundwater level do occur for a number of reasons including seasonal effects and variations in drainage.

The site investigation was conducted in July 2015, when groundwater levels should be close to their annual minimum (i.e. lowest). The long-term groundwater elevation might increase at some time in the future due to seasonal fluctuation in weather conditions. Isolated pockets of groundwater may be perched within any Made Ground found at other locations around the site.

4.5 Obstructions

No artificial or natural sub-surface obstructions were noted during construction of the trial holes.

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

5.1 In-Situ Geotechnical Testing

Standard Penetration Testing (SPT) was undertaken within BH1 at 1.00m intervals to a depth of 12.45m bgl. The results of the SPT's have not been amended to take into account hammer efficiency, rod lengths and overburden pressure in accordance with Eurocode 7.

Windowless Sampler Boreholes provide samples of the ground for assessment but they do not give any engineering data.

The Standard Penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50 mm and an inside diameter of 35 mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5 kg falling through a distance of 760 mm. The sample tube is driven 150 mm into the ground and then the number of blows needed for the tube to penetrate each 150 mm up to a depth of 450 mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

The cohesive soils of the London Clay Formation were classified based on the table below.

Undrained Shear Strength from Field Inspection/ SPT blow counts $(N_1)_{60}$ Cohesive Soils (EN ISO 14688-2:2004 & Stroud (1974))		
Classification	**Undrained Shear Strength (kPa)**	**Field Indications**
Extremely High	>300	-
Very High	150 – 300	Brittle or very tough
High	75 – 150	Cannot be moulded in the fingers
Medium	40 – 75	Can be moulded in the fingers by strong pressure
Low	20 – 40	Easily moulded in the fingers
Very Low	10 – 20	Exudes between fingers when squeezed in the fist
Extremely Low	<10	-

An interpretation of the in-situ geotechnical testing results is given in the table below.

Interpretation of In-situ Geotechnical Testing Results (SPT)					
Strata	**SPT "N" Blow Counts**	**Equivalent Undrained Shear Strength (kPa) Cohesive Soils**	**Soil Type**		**Trial Hole/s**
			Cohesive	**Granular**	
London Clay Formation	4 – 38	20 - 190	Very Low – Very High	-	BH1 (0.50 – 12.50m bgl)

It must be noted that field measurements of undrained shear strength are dependent on a number of variables including disturbance of sample, method of investigation and also the size of specimen or test zone etc.

The test results are presented on the trial hole log within Appendix B.

5.2 Laboratory Geotechnical Testing

A programme of geotechnical laboratory testing scheduled by Ground and Water Limited and carried out by K4 Soils Laboratory and QTS Environmental Limited was undertaken on samples recovered from the London Clay Formation. The results of the tests are presented in Appendix C.

The test procedures used were generally in accordance with the methods described in BS1377:1990.

Details of the specific tests used in each case are given below.

Standard Methodology for Laboratory Geotechnical Testing		
Test	**Standard**	**Number of Tests**
Atterberg Limit Tests	BS1377:1990:Part 2:Clauses 3.2, 4.3 & 5	4
Moisture Content	BS1377:1990:Part 2:Clause 3.2	3
Undrained Triaxial Compression Test	BS1377:1990:Part 7:Clause 8	1
Swelling Test	BS1377:1990:Part 5:Clause 3 & 4	1
BRE Special Digest 1 (incl. Ph, Electrical Conductivity, Total Sulphate, W/S Sulphate, Total Chlorine, W/S Chlorine, Total Sulphur, Ammonium as NH4, W/S Nitrate, W/S Magnesium)	BRE Special Digest 1 "Concrete in Aggressive Ground (BRE, 2005).	2

5.2.1 Atterberg Limit Tests

A précis of Atterberg Limit Tests undertaken on four samples of the London Clay Formation can be seen tabulated below.

Atterberg Limit Tests Results Summary							
Stratum/Trial Hole/Depth (m bgl)	**Moisture Content (%)**	**Passing 425 µm sieve (%)**	**Modified PI (%)**	**Soil Class**	**Consistency Index (Ic)**	**Volume Change Potential**	
						BRE	**NHBC**
London Clay Formation BH1/1.00	33	99	60.39	CV	0.88 (Stiff)	Very High	High
London Clay Formation BH1/3.00	29	100	53.00	CV	0.45 (Soft)	High	High
London Clay Formation BH1/5.50	25	100	42.00	CH	0.79 (Stiff)	High	High
London Clay Formation BH1/10.00	25	100	50.00	CV	0.46 (Soft)	High	High

NB: NP – Non-plastic
BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
Soil Classification based on British Soil Classification System.
Consistency Index (Ic) based on BS EN IS0 14688-2:2004.

5.2.2 Comparison of Soil's Moisture Content with Index Properties

5.2.2.1 Liquidity Index Analyses

The results of the Atterberg Limit tests undertaken on four samples of the London Clay Formation were analysed to determine the Liquidity Index of the samples. This gives an indication as to whether the samples recovered showed a moisture deficit and their degree of consolidation. The results are tabulated below.

The test results are presented within Appendix C.

Liquidity Index Calculations Summary					
Stratum/Trial Hole/Depth	**Moisture Content (%)**	**Plastic Limit (%)**	**Modified Plasticity Index (%)**	**Liquidity Index**	**Result**
London Clay Formation **BH1/1.00m bgl** (Brown and grey silty CLAY with rare fine gravel and traces of fine rootlets)	33	25	60.39	0.13	Heavily Overconsolidated
London Clay Formation **BH1/3.00m bgl** (Brown, grey and occasional orange brown silty CLAY with traces of selenite crystals)	29	23	53.00	0.11	Heavily Overconsolidated
London Clay Formation **BH1/5.50m bgl** (Brown silty CLAY with traces of selenite crystals)	25	25	42.00	0.00	Heavily Overconsolidated
London Clay Formation **BH1/10.00m bgl** (Brown silty CLAY with traces of selenite crystals)	25	27	50.00	-0.04	**Potential Moisture Deficit**

Liquidity Index testing revealed evidence for potential moisture deficit within one sample of the London Clay Formation (BH1/10.00m bgl).

The sample was described as a brown silty clay with traces of selenite crystals. Roots were noted to 0.80m bgl and therefore the apparent moisture deficit was likely to be associated with the heavily overconsolidated nature of the soils rather than the moisture demand from roots/trees.

The remaining samples of the London Clay Formation were shown to be heavily overconsolidated.

5.2.2.2 Liquid Limit

A comparison of the soil moisture content and the liquid limit can be seen tabulated overpage.

Moisture Content vs. Liquid Limit				
Strata/Trial Hole/Depth/Soil Description	**Moisture Content (MC) (%)**	**Liquid Limit (LL) (%)**	**40% Liquid Limit (LL)**	**Result**
London Clay Formation **BH1/1.00m bgl** (Brown and grey silty CLAY with rare fine gravel and traces of fine rootlets)	33	86	34.4	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**
London Clay Formation **BH1/3.00m bgl** (Brown, grey and occasional orange brown silty CLAY with traces of selenite crystals)	29	76	30.4	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**
London Clay Formation **BH1/5.50m bgl** (Brown silty CLAY with traces of selenite crystals)	25	67	26.8	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**
London Clay Formation **BH1/10.00m bgl** (Brown silty CLAY with traces of selenite crystals)	25	77	30.8	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**

The results in the table above indicated that a potential significant moisture deficit was present within all four samples of the London Clay Formation tested within BH1 (1.00m, 3.00m, 5.50m and 10.00m bgl). The moisture content values were below 40% of the liquid limits.

The samples were described as a brown and locally grey silty clay with traces of selenite crystals noted within the samples from 3.00m bgl onwards. Rare fine gravel and traces of rootlets were noted within the sample at 1.00m and occasional orange brown silty patches were observed within the 3.00m bg sample. The roots noted at 1.00m could suggest the moisture deficit within the sample was due to the moisture demand from surrounding roots/trees. The potential significant moisture deficits recorded within the samples at 3.00m, 5.50m and 10.00m bgl are likely to be associated with presence of silt patches and heavily overconsolidated nature of the soils rather than the moisture demand from roots/trees.

5.2.3 Moisture Content Profiling

Moisture content versus depth plots for BH1 can be seen within Figure 9. The moisture content profile within Figure 9 does not indicate any potential moisture deficits within the soils encountered. The profile shows an expected decrease in moisture content with depth with subtle variations in moisture content likely caused by minor variations in geology.

5.2.4 Undrained Triaxial Compression Test

A précis of the result of an Undrained Triaxial Compression Test undertaken on a single U38 sample recovered from the London Clay Formation can be seen tabulated overpage.

Summary of Undrained Triaxial Compression Testing Results						
Borehole/ Depth (m bgl)	**Moisture Content (%)**	**Bulk Density (Mg/m^3)**	**Dry Density (Mg/m^3)**	**Mode of Failure**	**Shear Strength (kPa)**	**Classification**
London Clay Formation BH1 at 4.00-4.45m (Brown and blue grey mottled CLAY)	30	2.01	1.55	Brittle	110	High

NB: Soil Classification based on British Soil Classification System.

The tri-axial test was not undertaken on a Class A samples in accordance with Eurocode 7 and therefore possible disturbance of the samples will need to be taken into account in final design.

5.2.5 Swelling Test

A one dimensional Swelling Test was undertaken on a disturbed sample obtained from BH1 at a depth of 3.50m bgl.

The result of this test were not available at the time of reporting and will be issued as an addendum to this report.

5.2.6 BRE Special Digest 1

In accordance with BRE Special Digest 1 'Concrete in Aggressive Ground' (BRE, 2005) two samples of the London Clay Formation (BH1/5.00m and BH1/11.00m bgl) were scheduled for laboratory analysis to determine parameters for concrete specification.

The results are given within Appendix D and a summary is tabulated below.

Summary of Results of BRE Special Digest Testing			
Determinand	**Unit**	**Minimum**	**Maximum**
pH	-	7.7	8.2
Ammonium as NH_4	mg/kg	6	18.9
Sulphur	%	0.19	0.74
Chloride (water soluble)	mg/kg	110	137
Magnesium (water soluble)	mg/l	140	160
Nitrate (water soluble)	mg/kg	<3	4
Sulphate (water soluble)	mg/l	2620	2780
Sulphate (total)	%	0.56	2.20

5.3 Chemical Laboratory Testing – Human Health Risk Assessment

A programme of chemical laboratory testing, scheduled by Ground and Water Limited, and carried out by QTS Environmental Limited, was undertaken on two samples of Made Ground (BH1/0.30m and TP1/0.30m bgl).

A Desk Study and full scale contamination assessment were not part of the remit of this report.

However, two soil samples were sent off for analysis for a broad range of contaminants in accordance with DEFRA/CLEA methodologies. The samples tested and the reasons for testing can be seen tabulated below.

Methodology for Sampling Locations and Chemical Laboratory Testing		
Trial Hole	**Depth (m bgl)**	**Sampling Strategy**
BH1	0.30m	Representative sample of Made Ground
TP/FE1	0.30m	Representative sample of Made Ground

The site comprised an rectangular shaped plot of land, ~350m^2 (0.035 ha) in area with two sampling locations, given an unknown hotspot shape, the sampling density means that a hotspot with an area of approximately 262.5m^2 and a radius of approximately 10.6m would be encountered (CLR 4).

Soil sampling depths were chosen to reflect the receptors of concern, human health, and typically comprised a surface or near surface sample and then at approximately 0.50m depth increments thereafter, extending into the underlying natural soils. The receptors relevant to the sampling depths can be seen below:

Near surface samples	Direct ingestion, dermal contact and dust inhalation. Protection of end-users and maintenance workers e.g. Landscape Gardeners. Protection of shallow rooted plants.
>0.5m below ground level	Protection of deep rooted plants.

The depth of soil sampling can be seen within the trial hole logs presented in Appendix B.

The analysis suite is presented below and comprised:

- Semi Metals and Heavy Metals incl. Arsenic, Cadmium, Chromium (incl. Hexavalent Chromium), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc (BH1/0.30m and TP/FE1/0.30m bgl);
- Asbestos Screen (BH1/0.30m and TP/FE1/0.30m bgl);
- Polycyclic Aromatic Hydrocarbons (PAHs) incl. Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene ((BH1/0.30m and TP/FE1/0.30m bgl);
- Fuel Oils – Speciated TPH including full aliphatic/aromatic split (TP/FE1/0.30m);
- BTEX compounds (Benzene, Toluene, Ethylbenzene, Xylene) and MTBE – used as marker compounds for Volatile Organic Compounds (VOCs) (TP/FE1/0.30m).

The chemical laboratory results are presented in Appendix D.

5.3.1 Soil Assessment Criteria

The derivation of Soil Assessment Criteria used within this report can be seen within Appendix E.

5.3.2 Determination of Representative Contamination Concentration

At the time of reporting, July 2015, it was understood that the proposed development will comprise the demolition of the existing structures and construction of a three storey detached residential property with a basement. It was understood the development will include the construction of a swimming pool within the basement. A plan of the proposed development is provided within Figure 4 with a section of the proposed development shown in Figure 5.

Therefore, the results of the chemical laboratory testing were compared to the LQM/CIEH Suitable 4 Use Levels (S4UL), and C4SL LLTC for Lead, for a ***'Residential with homegrown produce'*** land-use scenario, as this was considered the most appropriate land-use scenario. The C4SL LLTC for Lead was compared to a ***'Residential with plant uptake'*** land-use scenario.

Where no LQM/CIEH S4UL/C4SL LLTC was available for a particular determinant then preliminary reference was made to the laboratory detection limit of the determinant. If a positive concentration was noted then further risk assessment was undertaken.

For Cyanide, where no SGC/GAC or C4SL LLTC was available a Site Specific Assessment Criteria of 10mg/kg was adopted. This is based on ICRCL 59/83, TCL, ATRISK (SOIL) Screening Value and Dutch Intervention Value (ranging from 20 – 34mg/kg). Therefore, a SSAC of ~10mg/kg is considered conservative.

Where a contaminant of concern's LQM/CIEH S4UL/C4SL LLTC varies according to the Soil's Organic Matter (SOM), the SOM recorded for each soil sample was used to derive the appropriate SGV/GAC. The average SOM of the samples analysed was 1.2% (SOM ranged between 0.8 - 1.7%).

The results of the comparison of the representative contaminant concentrations are presented in the table overpage:

Soil Guideline Values and General Acceptance Criteria Results	
Substance	**Sample Location Where available LQM/CIEH S4UL/, CSL4 LLTC or GAC were exceeded for relevant land-use scenario**
	"Residential with home-grown produce" and "Residential with plant uptake" Land-Use Scenarios
Arsenic	None
Boron	None
Cadmium	None
Chromium (III)	None
Hexavalent Chromium (VI)	None
Copper	None
Lead	**BH1 at 0.30m bgl (470mg/kg)**
Mercury (Elemental)	None
Nickel	None
Selenium	None
Vanadium	None
Zinc	None
Cyanide (Total)	None
Total Phenol	None
Naphthalene	None
Acenapthylene	None
Acenapthene	None
Fluorene	None
Phenanthrene	None
Anthracene	None
Fluoranthene	None
Pyrene	None
Benzo(a)anthracene	None
Chrysene	None
Benzo(b)fluoranthene	None
Benzo(k)fluoranthene	None
Benzo(a)pyrene	None
Indeno(1,2,3-cd)pyrene	None
Dibenz(a,h)anthracene	None
Benzo(ghi)perylene	None
TPH C5 – C6 (aliphatic)	None
TPH C6 – C8 (aliphatic)	None
TPH C8 - C10 (aliphatic)	None
TPH C10 - C12 (aliphatic)	None
TPH C12 - C16 (aliphatic)	None
TPH C16 - C21 (aliphatic)	None
TPH C21 - C34 (aliphatic)	None
TPH C5 – C7 (aromatic)	None
TPH C7 – C8 (aromatic)	None
TPH C8 – C10 (aromatic)	None
TPH C10 – C12 (aromatic)	None
TPH C12 – C16 (aromatic)	None
TPH C16 - C21 (aromatic)	None
TPH C21 - C35 (aromatic)	None
Benzene	None
Toluene	None
Ethylbenzene	None
Xylene (o, m & p)	None
MTBE	None
Asbestos Screen	None

Chemical laboratory testing revealed an elevated level of lead in one sample of Made Ground. A level of 470mg/kg was noted within BH1/0.30m bgl in excess of the LQM/CIEH S4ULs of 210mg/kg for a ***"Residential with homegrown produce"*** scenario.

Chemical laboratory testing of the Made Ground revealed no other elevated levels of determinants above the guideline levels for a '***Residential with homegrown produce'*** land-use scenarios.

In addition, the intrusive investigation did not reveal any visual or olfactory evidence to suggest any hydrocarbon-type contamination in the trial holes excavated on the site. The chemical laboratory results have verified that no elevated concentrations of aliphatic/aromatic hydrocarbons (C_5-C_{35}) or BTEX compounds are present in the soils underlying the site.

6.0 ENGINEERING CONSIDERATIONS

6.1 Soil Characteristics and Geotechnical Parameters

Based on the results of the intrusive investigation and geotechnical laboratory testing the following interpretations have been made with respect to engineering considerations.

- Made Ground was proved from ground level to 0.50 – 1.10m bgl. The base of the Made Ground was not proved within TP/FE2.

  As a result of the inherent variability Made Ground, it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

  Made Ground may be found to deeper depth at other locations on the site, especially close to former structures/foundations and service runs.

- Soils described as representative of Head Deposits were encountered underlying the Made Ground within TP/FE1. The deposits comprised a mid to dark brown, orange brown and grey mottled gravelly silty clay. The gravel was occasional, fine to medium, sub-angular to rounded flints. The base of the Head Deposits was not proven within TP/FE1, which was excavated to a depth of 1.50m bgl.

  The Head Deposits were considered likely to have **high volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2.

  Given their limited thickness and extent (TP/FE1 to 1.50m bgl plus) and the proposed construction of a basement, the Head Deposits are likely to be bypassed by foundations. Therefore these deposits are no longer considered as a foundation strata in this report.

- Soils described as the London Clay Formation were encountered underlying the Made Ground within BH1 for the remaining depth of borehole, a maximum of 12.50m bgl.

  The deposits encountered were described as a mid to dark brown, orange brown and locally light grey mottled silty clay becoming a dark brown to dark grey silty clay, with fine selenite crystals and claystones, at depth.

  The London Clay Formation was shown to have very low to very high undrained shear strength (20 – 190kPa).

  Geotechnical testing revealed the soils of the London Clay Formation to have a **high to very high volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2. Consistency Index calculations indicated these soils to be soft to stiff. The deposits of the London Clay Formation were shown to be heavily overconsolidated cohesive soils.

  Potential significant moisture deficits were present within four samples of the London Clay Formation tested (BH1/1.00m, BH1/3.00m, BH1/5.50m and BH1/10.00m bgl). The moisture content values were below 40% of the liquid limit. The samples were described as brown and locally grey silty clay with traces of selenite crystals noted within the samples from 3.00m bgl.

Rare fine gravel and traces of rootlets were noted within the sample at 1.00m and occasional orange brown silty patches were observed within the 3.00m bgl sample. The roots noted at 1.00m could suggest the moisture deficit within the sample is due to the moisture demand from surrounding roots/trees. The potential significant moisture deficits recorded within the samples at 3.00m, 5.50m and 10.00m bgl are likely to be associated with presence of silt patches and the heavily overconsolidated nature of the soils rather than the moisture demand from roots/trees.

The heavily overconsolidated cohesive soils of the London Clay Formation were considered a suitable bearing stratum for moderately loaded footings/foundations. Settlements on loading are likely to be moderate.

The final design of foundations will need to take into account the volume change potential of the soil, the depth of root penetration and/or desiccation and the likely serviceability and settlement requirements of the proposed structure. These parameters for design are discussed in the next section of this report.

- No groundwater was encountered.

- Roots were noted to 0.80m bgl by the supervising engineer. Geotechnical testing identified fine rootlets to 1.50m bgl.

6.2 Basement Foundations

At the time of reporting, July 2015, it was understood that the proposed development will comprise the demolition of the existing structures and construction of a three storey detached residential property with a basement. It was understood the development will include the construction of a swimming pool within the basement. A plan showing the proposed development can be seen in Figure 4 with a section of the proposed development shown in Figure 5.

The proposed development is likely to fall within Geotechnical Design Category 2 in accordance with Eurocode 7. The proposed foundation loads were not known to Ground and Water Limited at the time of reporting but are likely to range from 100 – 180kN/m^2.

Foundations constructed within the soils of London Clay Formation should be designed in accordance with soils of **high volume change potential** in accordance with BRE Digest 240 and NHBC Chapter 4.2.

Given the cohesive nature of the shallow deposits, foundations must therefore not be placed within cohesive root penetrated and/or desiccated soils and the influence of the trees surrounding the site must be taken into account (NHBC Standards Chapter 4.2). It is recommended that foundations are taken at least 300mm into non-root penetrated strata.

Roots were noted to 1.50m bgl within BH1. The proposed foundation level for the basement is over 300mm below this depth.

It is considered likely the proposed basements will be constructed with load bearing concrete retaining walls with semi-ground bearing concrete floors.

The following bearing capacities could be adopted for 5.0m long by 0.75m and 1.0m wide footings, or 1.50m by 1.50m pads at depths of 5.00m and 6.00m bgl. The bearing capacities are tabulated

below.

Limit State: Bearing Capacities Calculated (Based on BH1)		
Depth (m BGL)	**Foundation System**	**Limit Bearing Capacity (kN/m^2) (EC2)**
5.0m	5.00m by 0.75m Strip	319.37
	5.00m by 1.00m Strip	322.13
	1.50m by 1.50m Pad	356.66
5.5m	5.00m by 0.75m Strip	366.21
	5.00m by 1.00m Strip	369.39
	1.50m by 1.50m Pad	406.85
6.0m	5.00m by 0.75m Strip	413.24
	5.00m by 1.00m Strip	416.84
	1.50m by 1.50m Pad	457.14

Serviceability State: Settlement Parameters Calculated (Based on BH1)			
Depth (m BGL)	**Foundation System**	**Limit Bearing Capacity (kN/m^2)**	**Settlement (mm)**
5.0m	5.00m by 0.75m Strip	180	<19
	5.00m by 1.00m Strip	180	<22
	1.50m by 1.50m Pad	180	<19
5.5m	5.00m by 0.75m Strip	200	<21
	5.00m by 1.00m Strip	200	<23
	1.50m by 1.50m Pad	200	<20
6.0m	5.00m by 0.75m Strip	200	<18
	5.00m by 1.00m Strip	200	<19
	1.50m by 1.50m Pad	200	<16

It must be noted that a bearing capacity of less than 84kN/m^2, 92kN/m^2 and 101kN/m^2 at 5.0m, 5.5m and 6.0m bgl respectively could result in heave due to a reduction in effective stress at depth. This will need to be taken into account in final design.

Excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate on the formation level for even a short time not only would an increase in heave occur resulting from the soil increasing in volume by taking up water, but also the shear strength and hence the bearing capacity would also be reduced.

Groundwater was not encountered during the construction of the trial holes. Therefore, groundwater is unlikely to be encountered during excavation of the basement and dewatering will not be required.

If the construction works take place during the winter months, when the groundwater level is expected to be at its higher elevation, perched water could accumulate thus dewatering could be required to facilitate the construction and prevent the base of the excavation blowing before the slab was cast. The advice of a reputable dewatering contractor, familiar with the type of ground and groundwater conditions encountered on this site, should be sought prior to finalising the design of the excavation for the basement.

General Recommendations for Spread Foundations:

- Foundation excavations must be carefully bottomed out and any loose soil or soft spots removed prior to the foundation concrete or blinding being placed. Failure to ensure that foundation excavations are suitably bottomed out could result in additional settlements.

- Inspection of foundation excavations, prior to concreting, must be made by a competent and suitably qualified person to check for any soft spots and to check for the presence of roots.

- The excavation must be kept dry as accumulation of water could result in increased settlements.

- Foundations must not be cast over foundations of former structures and/or other hard spots.

- Any groundwater or surface water ingress must be prevented from entering foundation trenches.

- Isolated Pad Foundations must be at least 1.5 times the width of the widest pad apart to keep to the anticipated settlements.

- Special foundation precautions will be required to prevent possible future shrinkage/swelling within clay strata affecting the integrity of the ground beams. A void, void former or compressible layer must be provided to accommodate potential movement below all ground beams. Compressible material or a void former should also be provided against the inside faces of ground beams.

- Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the structure and the developments proximity to former, present and proposed trees.

6.3 Piled Foundations

Based on the results of the investigation it was considered unlikely that a piled foundations scheme would be required at this site.

6.4 Basement Excavations and Stability

Shallow excavations in the Made Ground and the London Clay Formation are likely to be marginally stable at best. Long, deep excavations, through these strata are likely to become unstable.

The excavation of the basement must not affect the integrity of the adjacent structures beyond the boundaries. The excavation must be supported by suitably designed retaining walls. It is considered unlikely that battering the sides of the excavation, casting the retaining walls and then backfilling to the rear of the walls would be suitable given the close proximity of the party walls.

The retaining walls for the basement will need to be constructed based on cohesive soils with an appropriate angle of shear resistance (Φ') for the ground conditions encountered.

Based on the ground conditions encountered within BH1 the following parameters could be used in the design of retaining walls. These have been designed based the results of geotechnical

classification tests and reference to literature.

Retaining Wall/Basement Design Parameters					
Strata	**Unit Volume Weight (kN/m^3)**	**Cohesion Intercept (c') (kPa)**	**Angle of Shearing Resistance (Ø)**	**Ka**	**Kp**
Made Ground	~15	0	12	0.66	1.52
London Clay Formation	~20 - 22	0	24	0.42	2.37

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

6.5 Hydrogeological Effects

A study of the aquifer maps on the Environment Agency website revealed the site to be located on **Unproductive Strata** relating to the bedrock deposits of the London Clay Formation. No designation was given for any superficial deposits due to their likely absence.

The ground conditions encountered within the trial holes constructed on the site generally conformed to that anticipated from examination of the geology map. Made Ground was noted to overlie the London Clay Formation.

Based on a visual appraisal of the soils encountered, the permeability of the London Clay Formation was considered to be low to very low.

Groundwater was not encountered during the construction of the trial holes.

Based on the above it is considered unlikely that groundwater will be encountered during basement construction. However, perched water could accumulate during basement construction, especially after a period of prolongued rainfall.

Higher groundwater levels during winter months or during inclement weather may affect basement construction.

Once constructed, the Made Ground and the London Clay Formation are unlikely to act as a porous medium for water to migrate through; therefore, additional drainage around the basement should be considered.

6.6 Sub-Surface Concrete

Sulphate concentrations were measured in 2:1 water/soil extracts taken from the London Clay Formation fell into class DS-2 to DS–4 of the BRE Special Digest 1, 2005, *'Concrete in Aggressive Ground'.*

Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-3s. For the classification given, the "static" and "natural" case was adopted given the cohesive nature of the soils encountered (no groundwater strikes or silt/sand lenses) and the residential use of the site. The sulphate concentration in the samples ranged from 93 - 2780mg/l

with a pH range of 7.7 – 9.7. The total potential sulphate concentrations ranged from 0.56 – 2.20%.

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, *'Concrete in Aggressive Ground'* taking into account the pH of the soils.

It is prudent to note that pyrite nodules may be present within the London Clay Formation. Pyrite can oxidise to gypsum and this normally only occurs in the upper weathered layer, but excavation allows faster oxidation and water soluble sulphate values can rapidly increase during construction. Therefore rising sulphate values should be taken into account should ferruginous staining/pyrite nodules be encountered within the London Clay Formation.

6.7 Surface Water Disposal

Infiltration tests were beyond the scope of the investigation.

Soakaways constructed within the cohesive soils of the London Clay Formation are unlikely to prove satisfactory due to low anticipated infiltration rates. Therefore an alternative method of surface water disposal is required.

Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources.

The principles of sustainable urban drainage system (SUDS) should be applied to reduce the risk of flooding from surface water ponding and collection associated with the construction of the basement.

6.8 Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation. For example, there may have been underground storage tanks (UST's) not identified during the Ground Investigation for which there is no historical or contemporary evidence.

Such occurrences may be discovered during the demolition and construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.

6.9 Waste Disposal

Foundation excavations on-site are likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all waste must be classified as;

- Inert;
- Non-hazardous, or;
- Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM2) document outlines the methodology for classifying wastes.

Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

Based on a risk phrase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, the Made Ground encountered on-site was **NON-HAZARDOUS.** The results of the assessment are given within Appendix F.

INERT waste classification should be undertaken to determine if the proposed waste confirms to INERT or NON-HAZARDOUS Waste Acceptable Criteria (WAC).

It is important to note that whilst we consider our in-house assessment tool to be an accurate interpretation of the requirements of WM2, therefore producing an initial classification in accordance with the guidance, landfill operators have their own assessment tools and can often come to different conclusions. As a result, some landfill operators could refuse to take apparently suitable waste. It is recommended that the receiving landfill views the results of this assessment and the chemical laboratory results to determine their own classification.

6.10 Imported Material

Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

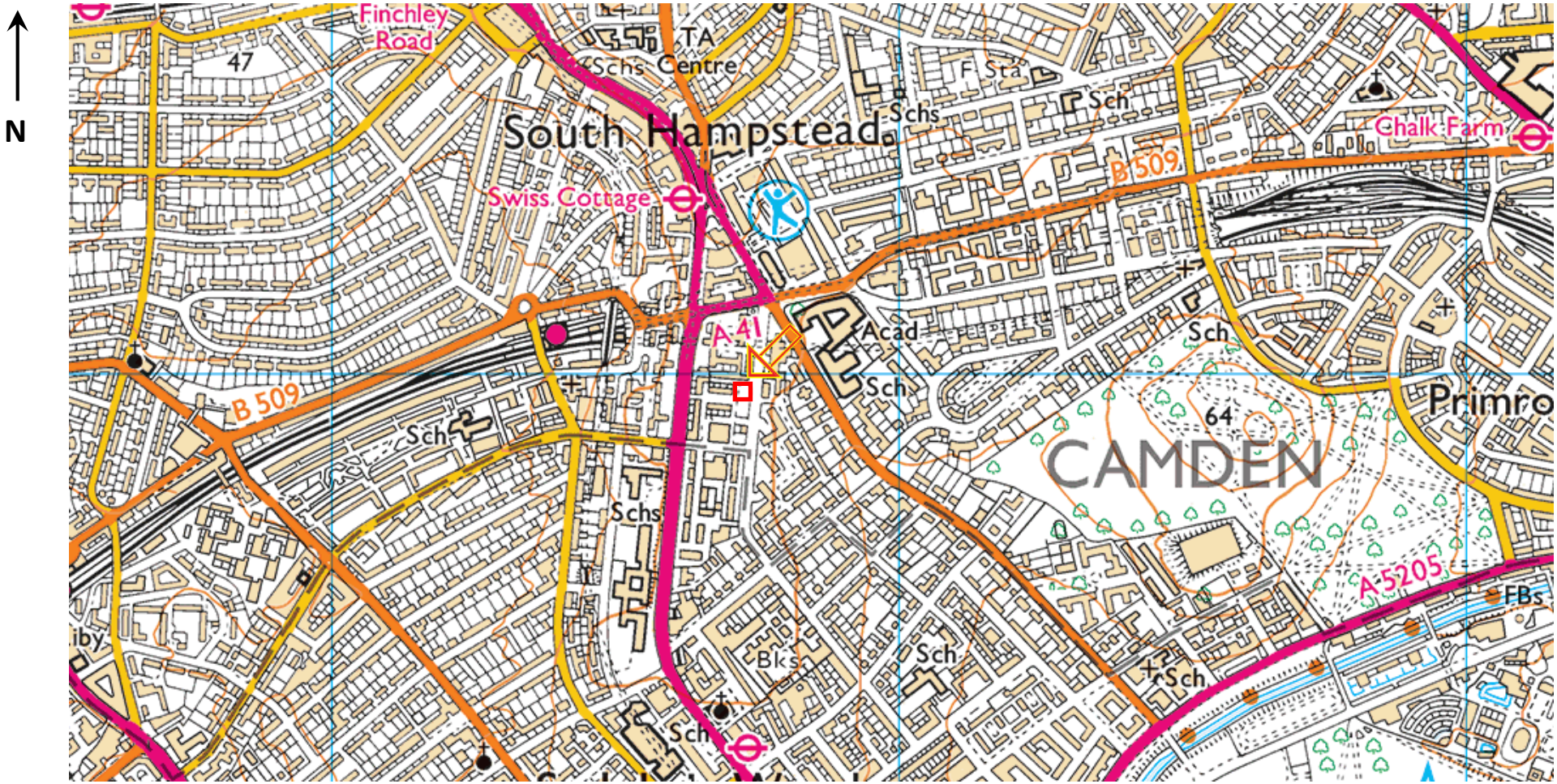
The Topsoil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, either prior to placing (ideally) or after placing, to ensure that the human receptor cannot come into contact with compounds that could be detrimental to human health. The compounds that are to be tested for are those given in the LQM S4UL's, which can be viewed in Appendix E of this report.

6.11 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust were generated as a result of construction activities.

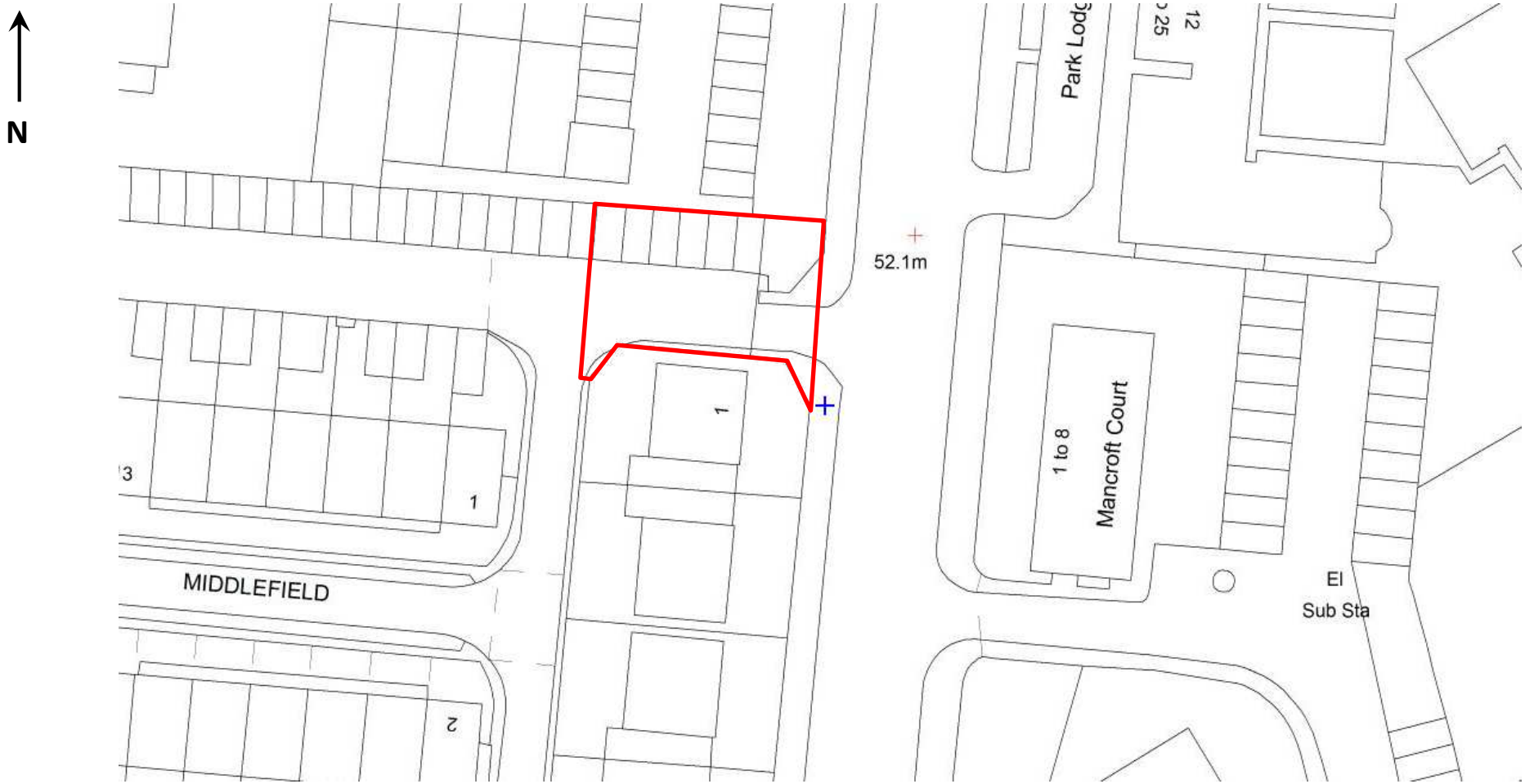
The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Land adjacent to 1b St John's Wood Park, London NW8 6QS		**Figure 1**
Client: Liv-International	**Date:** July 2015	ground&water
Site Location Plan	**Ref:** GWPR1319	



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Land adjacent to 1b St John's Wood Park, London NW8 6QS	**Figure 2**
Client: Liv-International	**Date:** July 2015
Site Development Area	**Ref:** GWPR1319

ground&water

N

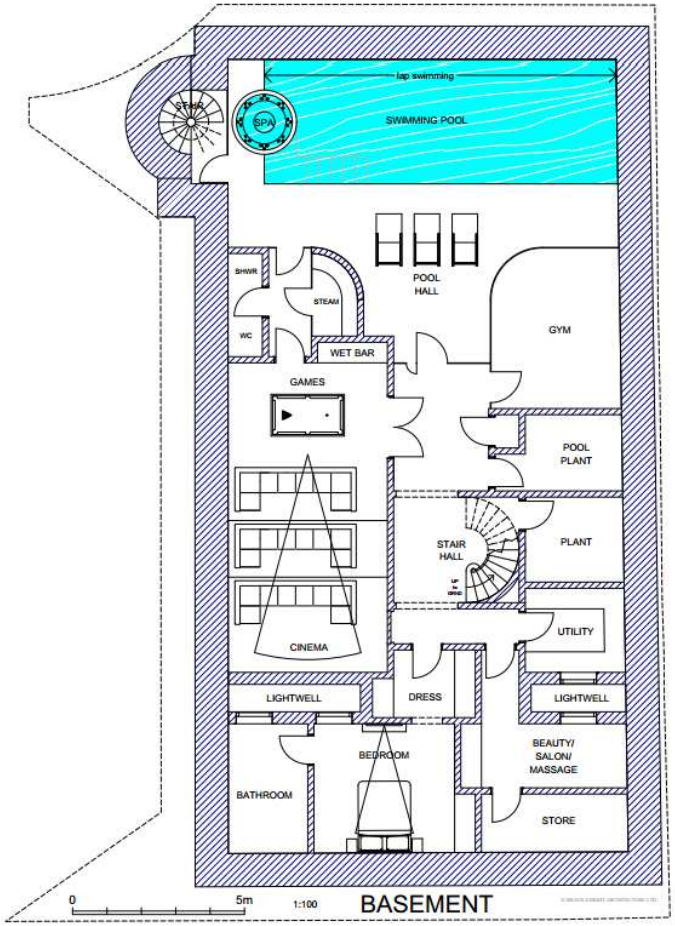
APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Land adjacent to 1b St John's Wood Park, London NW8 6QS	Figure 3
Client: Liv-International	Date: July 2015
Aerial View of Site	Ref: GWPR1319

ground&water

N



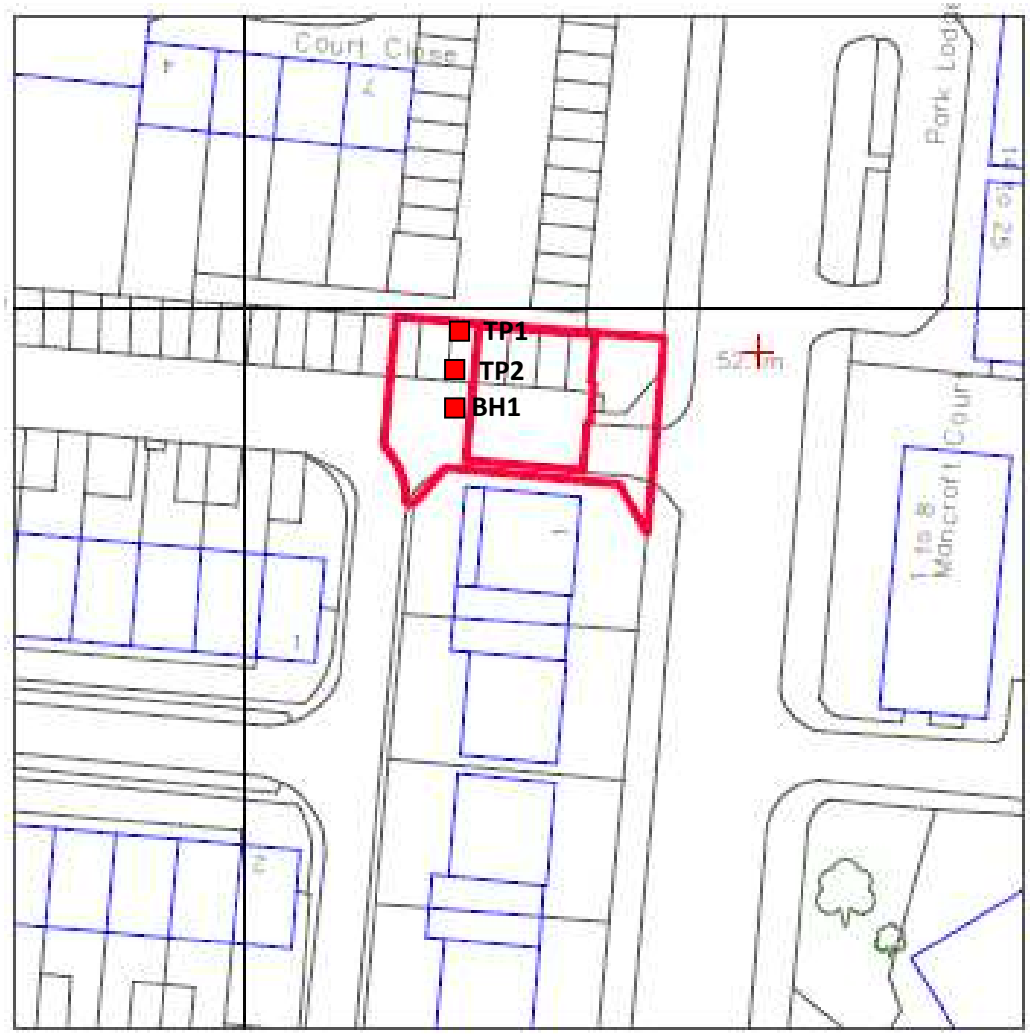
NOTE: NOT TO SCALE

Project: Land adjacent to 1b St John's Wood Park, London NW8 6QS		**Figure 4**
Client: Liv-International	**Date:** July 2015	ground&water
Proposed Development – Plan View	**Ref:** GWPR1319	

NOTE: NOT TO SCALE

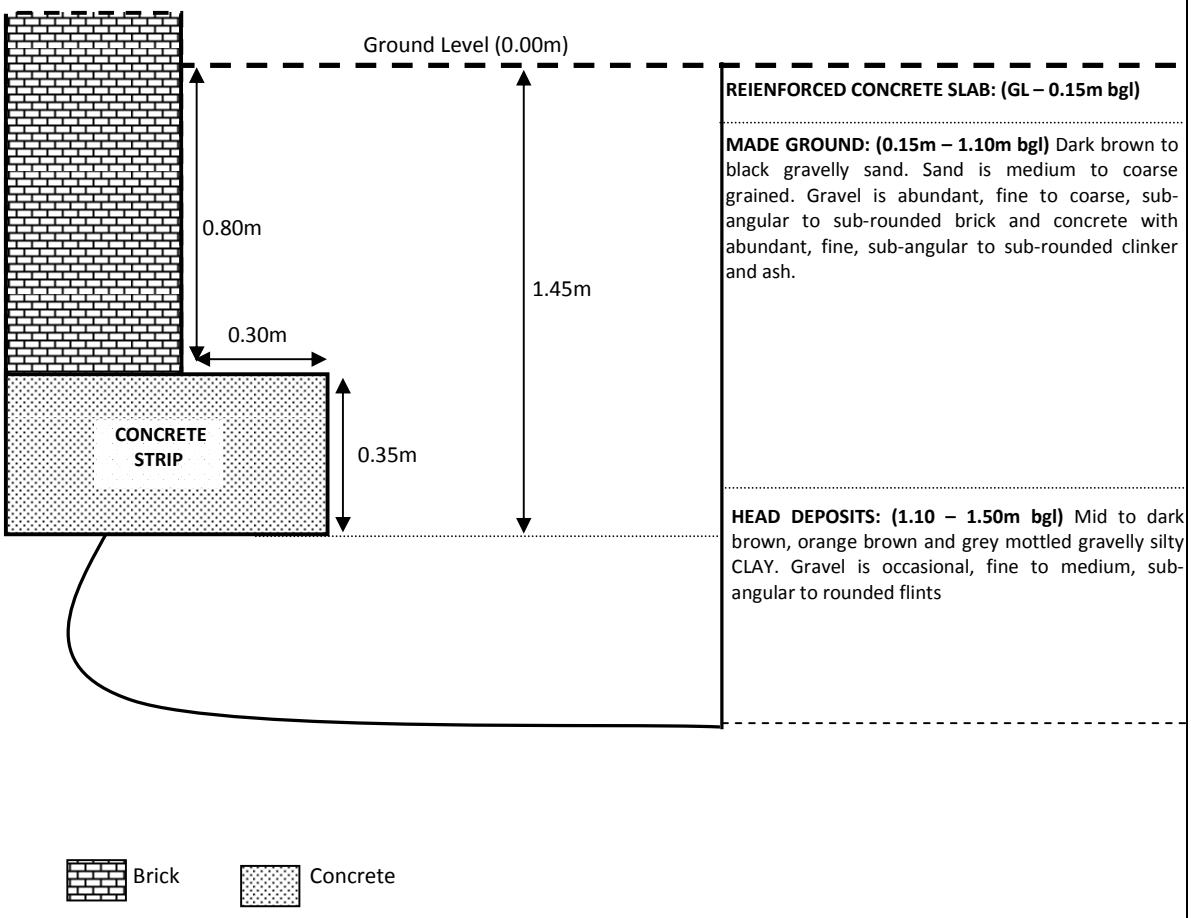
Project: Land adjacent to 1b St John's Wood Park, London NW8 6QS		**Figure 5**
Client: Liv-International	**Date:** July 2015	ground&water
Proposed Development – Section View	**Ref:** GWPR1319	

N



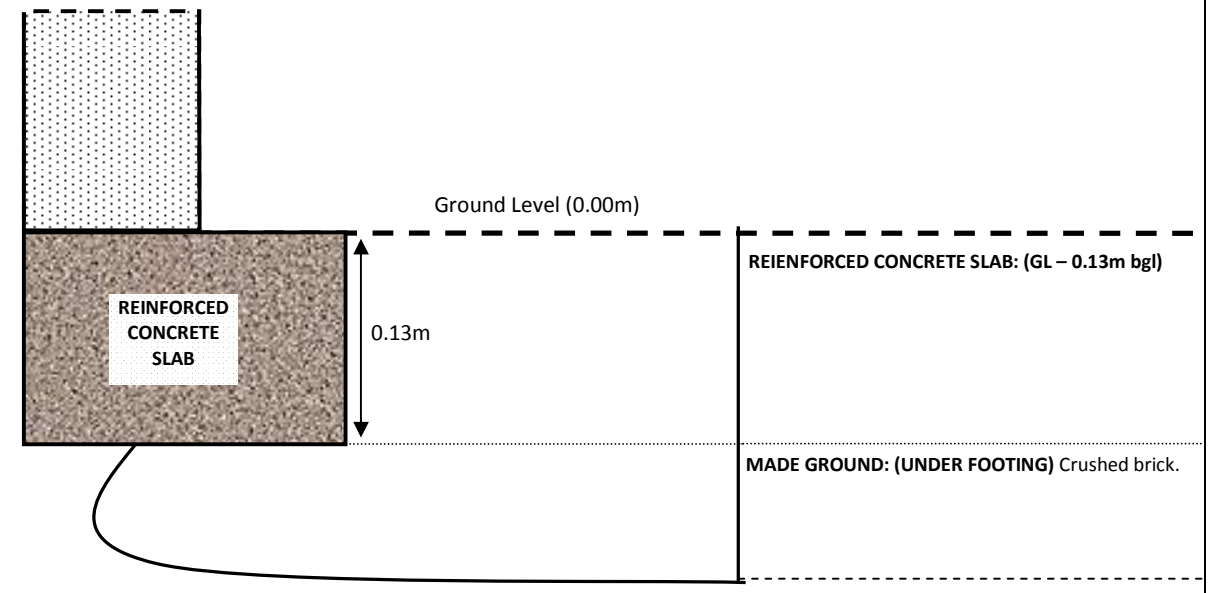
NOTE: NOT TO SCALE

Project: Land Adjacent to 1b St John's Wood Park, London NW8 6QS		**Figure 6**
Client: Liv-International	**Date:** July 2015	ground&water
Trial Hole Location Plan	**Ref:** GWPR1319	



NOTE: NOT TO SCALE

Project: **Land adjacent to 1b St John's Wood Park, London NW8 6QS**		**Figure 7**
Client: **Liv-International**	**Date:** **July 2015**	ground&water
Section Drawing: Foundation Exposure TP/FE1	**Ref:** **GWPR1319**	

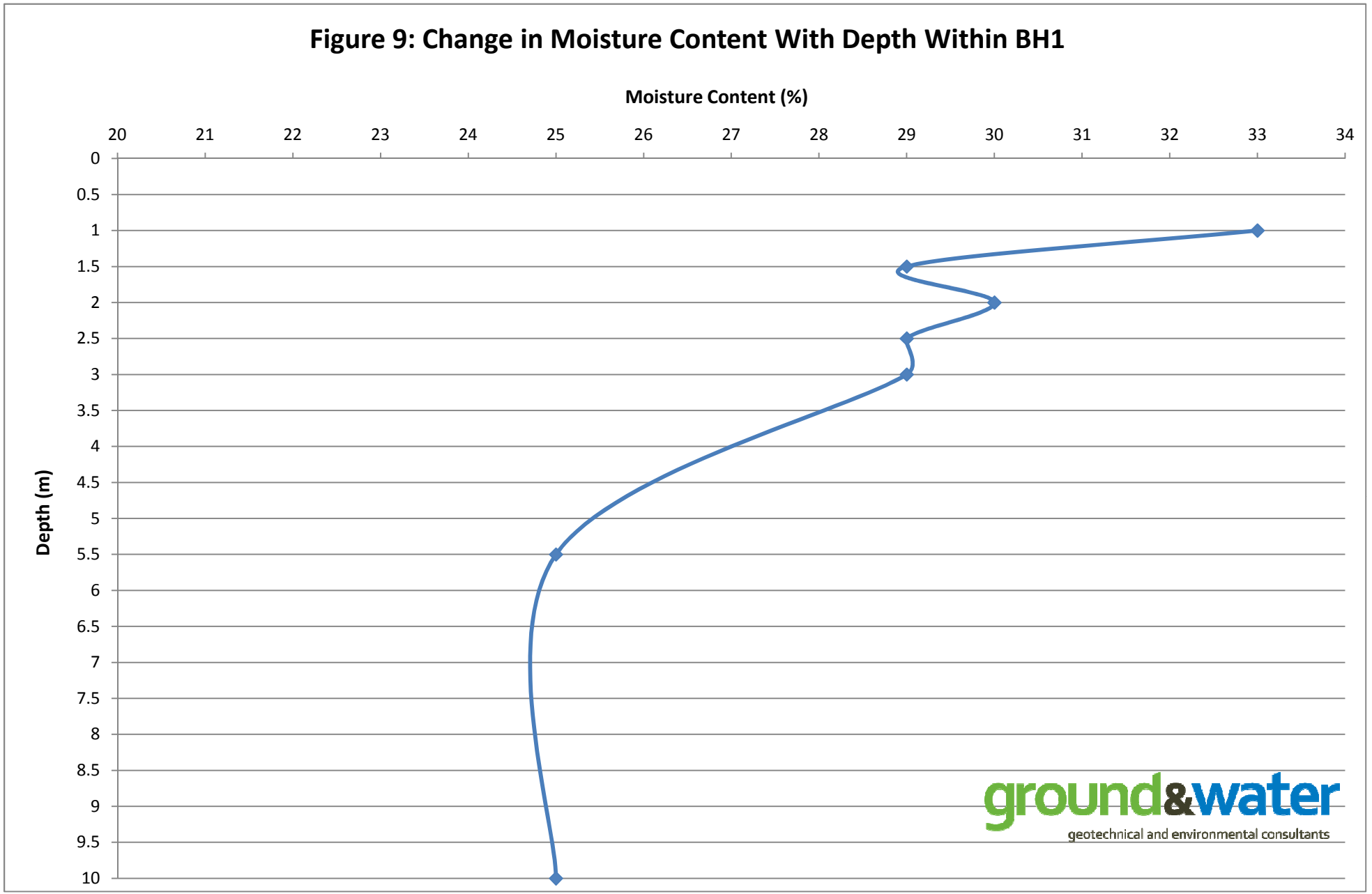


Concrete Concrete Blockwork

NOTE: NOT TO SCALE

Project: **Land adjacent to 1b St John's Wood Park, London NW8 6QS**		**Figure 8**
Client: **Liv-International**	**Date:** **July 2015**	ground&water
Section Drawing: Foundation Exposure TP/FE2	**Ref:** **GWPR1319**	

Figure 9: Change in Moisture Content With Depth Within BH1



APPENDIX A
Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been samples or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to the land adjacent to 1b St John's Wood Park, London NW8 6QS.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

APPENDIX B
Fieldwork Logs

Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Borehole No **BH1**
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Land adjacent to 1b St John's Wood Park	GWPR1319		WLS
Location: London NW8 6QS		Level: -	Scale 1:50
Client: Liv International		Dates: 01/07/2015	Logged By SJM

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.30	D					MADE GROUND: TARMAC over a mid to dark grey, with reddy brown mottling, sandy gravel. Sand is fine to coarse grained. Gravel is abundant, fine to coarse, sub-angular to sub-rounded concrete and occasional brick.
		0.50	D		0.50			
		0.80	D					LONDON CLAY FORMATION: Mid to dark brown, dark orange brown and light grey mottled silty CLAY with fine to medium rounded flints at 1.50m bgl.
		1.00	SPT	N=4 (1,1/ 1,1,1,1)				
		1.00	D					
		1.50	D					
		2.00	SPT	N=10 (1,1/ 2,2,3,3)				
		2.00	D					
		2.50	D					
		3.00	SPT	N=11 (2,2/ 2,3,3,3)				
		3.00	D					
		3.50	D		3.60			
		4.00	SPT	N=17 (2,3/ 4,4,4,5)				LONDON CLAY FORMATION: Dark brown, with rare orange brown mottling, silty CLAY. Rare to occasional fine selenite crystals noted.
		4.00	D					
		4.50	D					
		5.00	SPT	N=15 (3,3/ 3,4,4,4)				
		5.00	D					
		5.50	D					
		6.00	SPT	N=20 (3,4/ 5,5,5,5)				
		6.00	D					
		6.50	D					
		7.00	SPT	N=25 (4,4/ 6,5,7,7)				
		7.00	D					
		7.50	D					
		8.00	SPT	N=27 (4,6/ 6,7,7,7)				
		8.00	D					
		8.50	D					
		9.00	SPT	N=29 (5,5/ 7,7,7,8)	9.00			LONDON CLAY FORMATION: Dark brown grey to dark grey silty CLAY with claystones and rare to occasional, fine, selenite crystals.
		9.00	D					
		9.50	D					
			Type	Results				

Continued next sheet

Remarks: Fine roots noted to 0.80m bgl.
No groundwater encountered.

AGS

ground &water
geotechnical and environmental consultants

Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Borehole No
BH1
Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Land adjacent to 1b St John's Wood Park	GWPR1319		WLS
Location: London NW8 6QS		Level: -	Scale 1:50
Client: Liv International		Dates: 01/07/2015	Logged By SJM

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		10.00	SPT	N=30				LONDON CLAY FORMATION: Dark brown grey to dark grey silty CLAY with claystones and rare to occasional, fine, selenite crystals.
		10.00	D	(6,7/ 7,7,8,8)				
		10.50	D					
		11.00	SPT	N=32				
		11.00	D	(7,7/ 8,7,8,9)				
		11.50	D					
		12.00	SPT	N=38				
		12.00	D	(8,9/ 9,10,9,10)				
		12.50	D		12.50			End of Borehole at 12.50 m
			Type	Results				

11 12 13 14 15 16 17 18 19

Remarks: Fine roots noted to 0.80m bgl.
No groundwater encountered.

AGS

APPENDIX C
Geotechnical Laboratory Test Results

Summary of Classification Test Results

Job No.	Project Name	Programme	
19253	1B St Johns Wood Park, NW8	Samples received	14/07/2015
		Schedule received	10/07/2015
Project No.	Client	Project started	15/07/2015
GWPR1319	Ground and Water Ltd	Testing Started	28/07/2015

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BH1		1.00		D	Bbown and grey silty CLAY with rare fine gravel and traces of fine rootlets	33	99	86	25	61	
BH1		1.50		D	Brown and blue grey silty CLAY with traces of fine rootlets	29					
BH1		2.00		D	Brown and blue grey silty CLAY	30					
BH1		2.50		D	Brown and blue grey silty CLAY	29					
BH1		3.00		D	Brown, grey and occasional orange brown silty CLAY with traces of selenite crystals	29	100	76	23	53	
BH1		5.50		D	Brown silty CLAY with traces of selenite crystals	25	100	67	25	42	
BH1		10.00		D	Brown silty CLAY with traces of selenite crystals	25	100	77	27	50	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials **J.P**

Date: 30/07/2015

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen

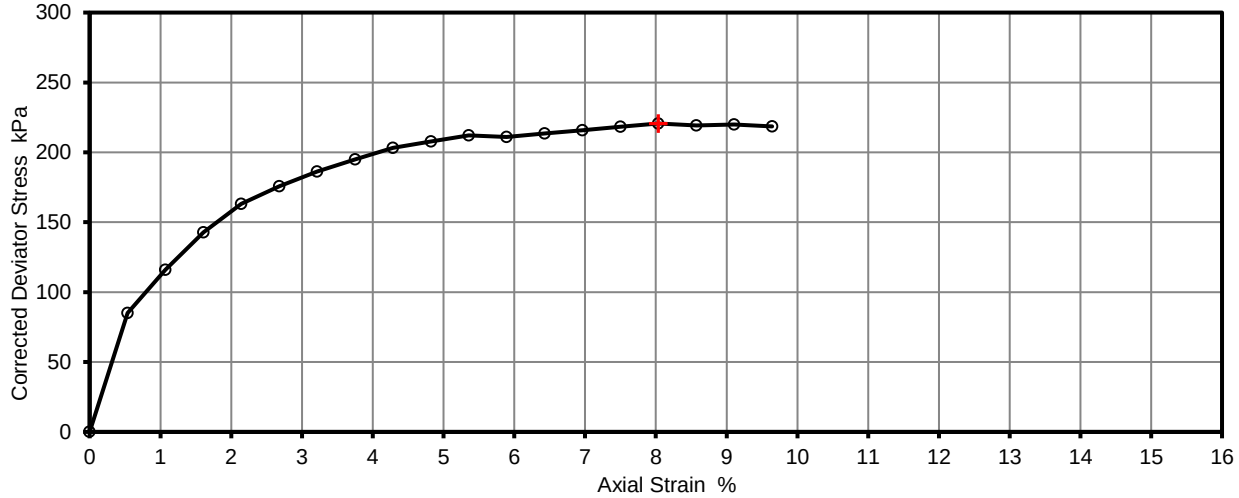
				Job Ref	19253
				Borehole/Pit No.	BH1
Site Name	1B St Johns Wood Park, NW8			Sample No.	
Project No.	GWPR1319	Client	Ground and Water Ltd	Depth	4.00 m
Soil Description	High strength brown and blue grey mottled CLAY			Sample Type	D
				Samples received	14/07/2015
				Schedules received	14/07/2015
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	28/07/2015

Remarks

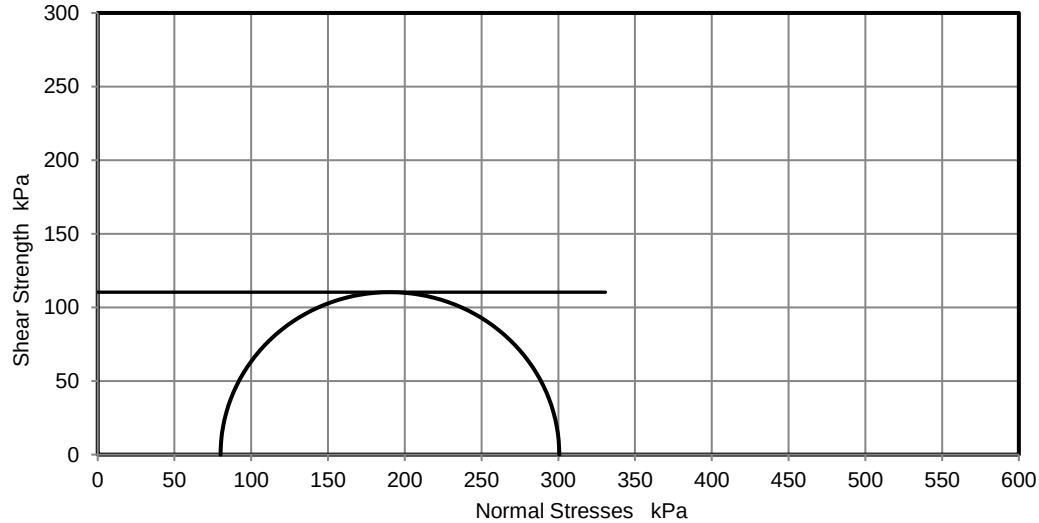
Position within sample

Test Number	1	
Length	140.0	mm
Diameter	70.0	mm
Bulk Density	2.01	Mg/m3
Moisture Content	30	%
Dry Density	1.55	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	80	kPa
Axial Strain	8.0	%
Deviator Stress, (σ1 - σ3)f	221	kPa
Undrained Shear Strength, cu	110	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

Test Report by K4 SOILS LABORATORY
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Date 30/07/2015

UKAS TESTING 2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure
Summary of Results

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test

Job No.	Project Name	Programme	
19253	1B St Johns Wood Park, NW8	Samples received	14/07/2015
		Schedule received	10/07/2015
Project No.	Client	Project started	15/07/2015
GWPR1319	Ground and Water Ltd	Testing Started	27/07/2015

Hole No.	Sample				Soil Description	Test Type	Density		*w*	Length	Diameter	σ3	At failure				Remarks
	Ref	Top	Base	Type			bulk	dry					Axial strain	σ1 - σ3	cu	Mode	
							Mg/m3		%	mm	mm	kPa	%	kPa	kPa		
BH1		4.00		D	High strength brown and blue grey mottled CLAY	UU	2.01	1.55	30	140	70	80	8.0	221	110	B	

Legend
UU - single stage test (single and multiple specimens)
UUM - Multistage test on a single specimen
suffix R - remoulded or recompacted
σ3 Cell pressure
σ1 - σ3 Maximum corrected deviator stress
cu Undrained shear strength, ½ (σ1 - σ3)
Mode of failure ; B - Brittle; P - Plastic; C - Compound

Test Report by K4 SOILS LABORATORY
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Checked and Approved
Initials: J.P
Date: 30/07/2015

APPENDIX D
Chemical Laboratory Test Results

Francis Williams
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2 The Long Barn
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Alton
Hampshire
GU34 3NB

QTS Environmental Ltd
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Rose Lane
Lenham Heath
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t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 15-33422

Site Reference:	1b St Johns Wood Park, NW8
Project / Job Ref:	GWPR1319
Order No:	None Supplied
Sample Receipt Date:	14/07/2015
Sample Scheduled Date:	14/07/2015
Report Issue Number:	1
Reporting Date:	20/07/2015

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
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Soil Analysis Certificate							
QTS Environmental Report No: 15-33422	**Date Sampled**	01/07/15	01/07/15	01/07/15	01/07/15	
Ground & Water Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 1b St Johns Wood Park, NW8	**TP / BH No**	BH1	TP1	BH1	BH1	
Project / Job Ref: GWPR1319	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	**Depth (m)**	0.30	0.30	5.00	11.00	
Reporting Date: 20/07/2015	**QTSE Sample No**	157329	157330	157331	157332	

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	9.5	9.7	8.2	7.7	
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2			
Total Sulphate as SO_4	%	< 0.02	NONE			2.20	0.56	
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	93	1380	2780	2620	
Total Sulphur	%	< 0.02	NONE			0.74	0.19	
Organic Matter	%	< 0.1	MCERTS	1.6	2.2			
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.9	1.3			
Ammonium as NH_4	mg/kg	< 0.5	NONE			6	18.9	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS			110	137	
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS			4	< 3	
Arsenic (As)	mg/kg	< 2	MCERTS	12	7			
W/S Boron	mg/kg	< 1	NONE	< 1	1.2			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3	0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	23	27			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	35	34			
Lead (Pb)	mg/kg	< 3	MCERTS	470	51			
W/S Magnesium	mg/l	< 0.1	NONE			140	160	
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	15	29			
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			
Vanadium (V)	mg/kg	< 2	NONE	61	34			
Zinc (Zn)	mg/kg	< 3	MCERTS	178	84			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2			

Analytical results are expressed on a dry weight basis where samples are dried at less than $30^{O}C$
Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

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

Asbestos Analyst: Marcus Jones

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis $^{(S)}$

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Soil Analysis Certificate - Speciated PAHs							
QTS Environmental Report No: 15-33422	Date Sampled	01/07/15	01/07/15			
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: 1b St Johns Wood Park, NW8	TP / BH No	BH1	TP1			
Project / Job Ref: GWPR1319	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.30	0.30			
Reporting Date: 20/07/2015	QTSE Sample No	157329	157330			

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	0.14	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	0.98	0.32			
Pyrene	mg/kg	< 0.1	MCERTS	0.73	0.30			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.30	0.31			
Chrysene	mg/kg	< 0.1	MCERTS	0.33	0.45			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.48	0.94			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.15	0.28			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.19	0.72			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.31	0.52			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.33	0.42			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	3.9	4.3			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

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Soil Analysis Certificate - TPH CWG Banded							
QTS Environmental Report No: 15-33422	Date Sampled	01/07/15					
Ground & Water Ltd	Time Sampled	None Supplied					
Site Reference: 1b St Johns Wood Park, NW8	TP / BH No	TP1					
Project / Job Ref: GWPR1319	Additional Refs	None Supplied					
Order No: None Supplied	Depth (m)	0.30					
Reporting Date: 20/07/2015	QTSE Sample No	157330					

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	65				
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	65				
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2				
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	39				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	39				
Total >C5 - C35	mg/kg	< 42	NONE	103				

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

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Soil Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 15-33422	**Date Sampled**	01/07/15					
Ground & Water Ltd	**Time Sampled**	None Supplied					
Site Reference: 1b St Johns Wood Park, NW8	**TP / BH No**	TP1					
Project / Job Ref: GWPR1319	**Additional Refs**	None Supplied					
Order No: None Supplied	**Depth (m)**	0.30					
Reporting Date: 20/07/2015	**QTSE Sample No**	157330					

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2				
Toluene	ug/kg	< 5	MCERTS	< 5				
Ethylbenzene	ug/kg	< 2	MCERTS	< 2				
p & m-xylene	ug/kg	< 2	MCERTS	< 2				
o-xylene	ug/kg	< 2	MCERTS	< 2				
MTBE	ug/kg	< 5	MCERTS	< 5				

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 15-33422	
Ground & Water Ltd	
Site Reference: 1b St Johns Wood Park, NW8	
Project / Job Ref: GWPR1319	
Order No: None Supplied	
Reporting Date: 20/07/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 157329	BH1	None Supplied	0.30	13.9	Brown sandy gravel with rubble and concrete
$ 157330	TP1	None Supplied	0.30	10.8	Grey sandy gravel with rubble
$ 157331	BH1	None Supplied	5.00	17	Light brown clay
$ 157332	BH1	None Supplied	11.00	16.8	Grey clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

$ samples exceeded recommended holding times

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Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-33422
Ground & Water Ltd
Site Reference: 1b St Johns Wood Park, NW8
Project / Job Ref: GWPR1319
Order No: None Supplied
Reporting Date: 20/07/2015

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

APPENDIX E
Soil Assessment Criteria

Appendix E
Soil Guideline Values and Genera Assessment Criteria

E1 Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'.

E1.1 Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

1) EA Science Report SC050021/SR2: *Human health toxicological assessment of contaminants in soil.*
2) EA Science Report SC050021/SR3: *Updated technical background to the CLEA model.*
3) EA CLEA Bulletin (2009).
4) CLEA software version 1.06 (2009)
5) Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

- *do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.*
- *do not cover risks to the environment, such as groundwater, ecosystems or buildings.*
- *do not provide a definitive test for telling when human health risks are significant.*
- *are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.*

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

E1.2 Land-use Scenarios

The CLEA model uses a range of standard land-use scenarios to develop conceptual exposure models as follows:

1 Residential (with home grown produce) (RwHP)

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur. (**Residential without homegrown produce (RwoHP**)).

2) Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

3) Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

E1.4 LQM/CIEH SUITABLE 4 USE LEVELS (S4UL)

For derivation of these S4UL reference must be made to:

Nathanial, P., McCaffrey, C., Gillet, A., Ogden, R., Nathanial, J.,. *The LQM/CIEH S4UL's for Human Health Risk Assessment*. **Land Quality Press**. 2015

The LQM/CIEH S4UL for a given land use is the concentration of the contaminant in soil at which the predicted daily exposure, as calculated by the CLEA software, equals the Health Criteria Value.

The final output for each contaminant represents a synthesis of new toxicological (and fate and transport) reviews published since the preparation of the 2nd edition LQM/CIEH GAC's (Nathanial et al., 2009).

In the derivation of LQM/CIEH S4UL's the principles of 'minimal' or 'tolerable' risk enshrined in SR2, which has not been withdrawn, has been maintained.

S4UL's have been derived for the basic CLEA land-uses, as described above, and for two new land uses:

- Public Open Spaces near Residential Housing (POSresi)
- Public Park (POSpark).

Public Open Spaces near Residential Housing (POSresi)
Includes the predominantly grassed areas adjacent to high density housing, the central green area on many 1930's – 1970's housing estates, and smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soils with planting. It is assumed that the close proximity to the place of residence will allow tracking back of soil to occur.

Public Park (POSpark)
An area of open space, usually owned and maintained by the local authority, provided for recreational uses including family visists and picnics, children's play area, informal sporting activities (not a dedicated sports pitch), and dog walking. It is assumed that tracking back of soils into places of residence will be negligible.

E1.5 Category 4 **Screening Levels (C4SLs)**
In the case of Lead, no SGV or GAC has been published to date. This is likely to be due to the toxicity review that is currently being undertaken by the Environment Agency. In the absence of updated toxicity information the SGV derived using CLEA 1.06 methodology and related toxicity will be used.

The overall objective of the C4SLs research project was to assist the provision of technical guidance in support of Defra's revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A) (Defra, 2012a). Specifically, the project aimed to deliver:

• A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
• A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised SG presented a new four category system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a

significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high. More specific guidance on what type of land should be considered as Category 4 (Human Health) is provided in Paragraphs 4.21 and 4.22 of the revised SG, as follows:

"4.21 The local authority should consider that the following types of land should be placed into Category 4: Human Health:
(a) Land where no relevant contaminant linkage has been established.
(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.
(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.
(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).

4.22 The local authority may consider that land other than the types described in paragraph 4.21 should be placed into Category 4: Human Health if following a detailed quantitative risk assessment it is satisfied that the level of risk posed is sufficiently low."

The C4SLs are intended as "relevant technical tools" (in relation to Paragraph 4.21(c)) to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

"The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land."

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):
"SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health."

The implication of Paragraph 47(h) of the IA is that minimal risk is well within Category 4 and that the C4SLs should describe a higher level of risk which, whilst not minimal, can still be considered low enough to allow a judgement to be made

that land containing substances at, or below, the C4SLs would typically fall within Category 4. This reflects Paragraph 4.20 of the revised SG, which states:

"4.20 The local authority should not assume that land poses a significant possibility of significant harm if it considers that there is no risk or that the level of risk posed is low. For the purposes of this Guidance, such land is referred to as a "Category 4: Human Health" case. The authority may decide that the land is a Category 4: Human Health case as soon as it considers it has evidence to this effect, and this may happen at any stage during risk assessment including the early stages."

C4SLs, therefore, should not be viewed as "SPOSH levels" and they should not be used as a legal trigger for the determination of land under Part 2A.

The generic screening values referred to before usually take the form of risk-based Soil Guideline Values (SGVs) or other Generic Assessment Criteria (GACs) that are most typically derived using the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model, as described in the Environment Agency's SR2, SR3 and SR7 reports (EA, 2009b & c; EA, 2008). It is anticipated that C4SLs will be used in a similar manner; as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the SGVs.

The suggested approach to the development of C4SLs consists of the retention and use of the CLEA framework, modified according to considerations of the underlying science within the context of Defra's policy objectives relating to the revised SG. Within this context, it is suggested that the development of C4SLs may be achieved in one of three ways, namely:

- By modifying the toxicological parameters used within CLEA (while maintaining current exposure parameters);
- By modifying the exposure parameters embedded within CLEA (while maintaining current toxicological "minimal risk" interpretations); and
- By modifying both toxicological and exposure parameters.

There is also a suggested check on "other considerations" (e.g., background levels, epidemiological data, sources of uncertainty) within the approach, applicable to all three options.

It is suggested that a new term is defined for the toxicological guidance values associated with the derivation of C4SLs – a Low Level of Toxicological Concern (LLTC). A LLTC should represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as SPOSH.

E1.6 CL:AIRE Generic Assessment Criteria (GAC)

For derivation of the CL:AIRE Generic Assessment Criteria (GAC) reference should be made to the following report:

CL:AIRE, *The Soil Generic Assessment Criteria for Human Health Risk Assessment.* **Contaminated Land: Applications in the Real Environment**. 2009.

Within this report CL:AIRE provided Generic Assessment Criteria (GAC's) in accordance with the CLEA software and the principles outlined above for a further 35 contaminants sometime encountered on land affected by contamination.

E1.7 Detailed Quantitative Risk Assessments (DQRA)
Where the adoption of an S4UL/GAC/C4SL is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses then a DQRA may be undertaking to develop site specific values for relevant soil contaminants.

⇒ Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation.

⇒ Developing more accurate parameters using site data.

E1.8 Phytotoxicity
CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

• ICRCL 70/90: *Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing*.

E1.8 Statistical Tests
DEFRA R&D Publication CLR 7 (DOE 1994) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

The DEFRA discussion paper Assessing risks from land contamination – a proportionate approach ('the way forward') (CLAN06/2006) aimed to increase understanding of the role that statistics can play in quantifying the uncertainty attached to the estimates of the mean concentration of contaminants in soil. In direct response CLAIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CLAIRE/CIEH 2008). A software implementation of the statistical techniques given in the report was published by ESI International (2008).

Treatment of Hot-Spots
⇒ A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.

⇒ Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

E2 Ground and Water Limited Soil Assessment Criteria

The Soil Assessment Criteria used in the preparation of this report are tabulated in the following pages:

C4SL Low Level of Toxicological Concern

C4SL Low Level of Toxicological Concern						
Contaminant	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Lead	<210	<330	<84	<6000	<760	<1400

Phytotoxicity Recommendations

ICRCL 70/90 ***Restoration of metalliferous mining areas***

Phytotoxicity (Harmful to Plants) Threshold Trigger Values	
Copper	250mg/kg
Zinc	1000mg/kg
Notes: Many cultivars and specifically grasses have a high tolerance and there will be no ill-effect at the threshold trigger values given for neutral or near neutral pH. Site observation of plant vitality may give additional guidance.	

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LQM CIEH Suitable 4 Use Levels (S4UL's)

LQM/CIEH Suitable 4 Use Levels – Metals and Semi-metals						
Contaminant	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Metals:						
Arsenic	37	40	43	640	79	170
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11000	45	240000	21000	46000
Cadmium	11	85	1.9	190	120	532
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6	6	1.8	33	7.7	20
Copper	2400	7100	520	68000	12000	44000
Elemental Mercury	1.2	1.2	21	58	16	30
Inorganic Mercury	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	180	180	230	980	230	3400
Selenium	250	430	88	12000	1100	1800
Vanadium	410	1200	91	9000	2000	5000
Zinc	3700	40000	620	730000	81000	170000

LQM/CIEH Suitable 4 Use Levels – BTEX Compounds							
Contaminant	**Soil Organic Matter**	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Benzene	**1.0% SOM**	0.087	0.38	0.017	27	72	90
	2.5% SOM	0.170	0.70	0.034	47	72	100
	6.0% SOM	0.370	1.40	0.075	90	73	110
Toluene	**1.0% SOM**	130	880	22	56000	56000	87000
	2.5% SOM	290	1900	51	110000	56000	95000
	6.0% SOM	660	3900	120	180000	56000	100000
Ethylbenzene	**1.0% SOM**	47	83	16	5700	24000	17000
	2.5% SOM	110	190	39	13000	24000	22000
	6.0% SOM	260	440	91	27000	25000	27000
o-Xylene	**1.0% SOM**	60	88	**28**	6600	**41000**	**17000**
	2.5% SOM	140	210	**67**	15000	**42000**	24000
	6.0% SOM	330	480	**160**	33000	**43000**	33000
m-Xylene	**1.0% SOM**	59	82	31	6200	**41000**	17000
	2.5% SOM	140	190	74	**14000**	**42000**	24000
	6.0% SOM	320	450	170	31000	**43000**	33000
p-Xylene	**1.0% SOM**	**56**	**79**	29	**5900**	**41000**	**17000**
	2.5% SOM	**130**	**180**	69	**14000**	**42000**	**23000**
	6.0% SOM	**310**	**430**	**160**	**30000**	**43000**	**31000**
The most health protective value in each scenario for Xylene is highlighted in bold.							

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LQM/CIEH Suitable 4 Use Levels For TPH

Aliphatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-6	1.0% SOM	42	42	730	3,200 (304) sol	570,000 (304) sol	95,000 (304) sol
	2.5% SOM	78	78	1,700	5,900 (558) sol	590,000	130,000 (558) sol
	6.0% SOM	160	160	3,900	12,000 (1150) sol	600,000[l]	180,000 (1150) sol
EC >6-8	1.0% SOM	100	100	2,300	7,800 (144) sol	600,000	150,000 (144) sol
	2.5% SOM	230	230	5,600	17,000 (322) sol	610,000	220,000 (322) sol
	6.0% SOM	530	530	13,000	40,000 (736) sol	620,000	320,000 (736) sol
EC >8-10	1.0% SOM	27	27	320	2,000 (78) sol	13,000	14,000 (78) sol
	2.5% SOM	65	65	770	4,800 (118) vap	13,000	18,000 (118) vap
	6.0% SOM	150	150	1,700	11,000 (451) vap	13,000	21,000 (451) vap
EC >10-12	1.0% SOM	130 (48) vap	130 (48) vap	2,200	9,700 (48) sol	13,000	21,000 (48) sol
	2.5% SOM	330 (118) vap	330 (118) vap	4,400	23,000 (118) vap	13,000	23,000 (118) vap
	6.0% SOM	760 (283) vap	770 (283) vap	7,300	47,000 (283) vap	13,000	24,000 (283) vap
EC >12-16	1.0% SOM	1,100 (24) sol	1,100 (24) sol	11,000	59,000 (24) sol	13,000	25,000 (24) sol
	2.5% SOM	2,400 (59) sol	2,400 (59) sol	13,000	82,000 (59) sol	13,000	25,000 (59) sol
	6.0% SOM	4,300 (142) sol	4,400 (142) sol	13,000	90,000 (142) sol	13,000	26,000 (142) sol
EC >16-35	1.0% SOM	65,000 (8.48) sol	65,000 (8.48) sol	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) sol	92,000 (21) sol	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000
EC >35-44	1.0% SOM	65,000 (8.48) sol	65,000 (8.48) sol	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) sol	92,000 (21) sol	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000

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LQM/CIEH Suitable 4 Use Levels For TPH

Aromatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-7 (Benzene)	1.0% SOM	70	370	13	26,000 (1220) sol	56,000	76,000 (1220 sol
	2.5% SOM	140	690	27	46,000 (2260) sol	56,000	84,000 (2260) sol
	6.0% SOM	300	1,400	57	86,000 (4710) sol	56,000	92,000 (4710) sol
EC >7-8 (Toluene)	1.0% SOM	130	860	22	56,000 (869) vap	56,000	87,000 (869) sol
	2.5% SOM	290	1,800	51	110,000 (1920) sol	56,000	95,000 (1920) sol
	6.0% SOM	660	3,900	120	180,000 (4360) vap	56,000	100,000 (4360) vap
EC >8-10	1.0% SOM	34	47	8.6	3,500 (613) vap	5,000	7,200 (613) vap
	2.5% SOM	83	110	21	8,100 (1500) vap	5,000	8,500 (1500) vap
	6.0% SOM	190	270	51	17,000 (3850) vap	5,000	9,300 (3580) vap
EC >10-12	1.0% SOM	74	250	13	16,000 (364) sol	5,000	9,200 (364) sol
	2.5% SOM	180	590	31	28,000 (899) sol	5,000	9,700 (889) sol
	6.0% SOM	380	1,200	74	34,000 (2150) sol	5,000	10,000
EC >12-16	1.0% SOM	140	1,800	23	36,000 (169) sol	5,100	10,000
	2.5% SOM	330	2,300 (419) sol	57	37,000	5,100	10,000
	6.0% SOM	660	2,500	130	38,000	5,000	10,000
EC >16-21	1.0% SOM	260	1,900	46	28,000	3,800	7,600
	2.5% SOM	540	1,900	110	28,000	3,800	7,700
	6.0% SOM	930	1,900	260	28,000	3,800	7,800
EC >21-35	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >35-44	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >44-70	1.0% SOM	1,600	1,900	1,200	28,000	3,800	7,800
	2.5% SOM	1,800	1,900	2,100	28,000	3,800	7,800
	6.0% SOM	1,900	1,900	3,000	28,000	3,800	7,900

SOM = Soil Organic Matter Content (%)

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)

Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Acenapthene	1.0% SOM	210	3,000 (57.0) sol	34	84,000(57.0) sol	15,000	29,000
	2.5% SOM	510	4,700(141) sol	85	97,000(141) sol	15,000	30,000
	6.0% SOM	1100	6,000(336) sol	200	100,000	15,000	30,000
Acenapthylene	1.0% SOM	170	2,900(86.1) sol	28	83,000(86.1) sol	15,000	29,000
	2.5% SOM	420	4,600(212) sol	69	97,000(212) sol	15,000	30,000
	6.0% SOM	920	6,000(506) sol	160	100,000	15,000	30,000
Anthracene	1.0% SOM	2,400	31,000(1.17) vap	380	520,000	74,000	150,000
	2.5% SOM	5,400	35,000	950	540,000	74,000	150,000
	6.0% SOM	11,000	37,000	2,200	540,000	74,000	150,000
Benzo(a)anthracene	1.0% SOM	7.20	11	2.90	170	29	49
	2.5% SOM	11	14	6.50	170	29	56
	6.0% SOM	13	15	13	180	29	62
Benzo(a)pyrene	1.0% SOM	2.20	3.20	0.97	35	5.70	11
	2.5% SOM	2.70	3.20	2.00	35	5.70	12
	6.0% SOM	3.00	3.20	3.50	36	5.70	13
Benzo(b)flouranthene	1.0% SOM	2.60	3.90	0.99	44	7.10	13
	2.5% SOM	3.30	4.00	2.10	44	7.20	15
	6.0% SOM	3.70	4.00	3.90	45	7.20	16
Benzo(ghi)perylene	1.0% SOM	320	360	290	3,900	640	1,400
	2.5% SOM	340	360	470	4,000	640	1,500
	6.0% SOM	350	360	640	4,000	640	1,600
Benzo(k)flouranthene	1.0% SOM	77	110	37	1,200	190	370
	2.5% SOM	93	110	75	1,200	190	410
	6.0% SOM	100	110	130	1,200	190	440
Chrysene	1.0% SOM	15	30	4.10	350	57	93
	2.5% SOM	22	31	9.40	350	57	110
	6.0% SOM	27	32	19	350	57	120
Dibenzo(ah)anthracene	1.0% SOM	0.24	0.31	0.14	3.50	0.57	1.10
	2.5% SOM	0.28	0.32	0.27	3.60	0.57	1.30
	6.0% SOM	0.30	0.32	0.43	3.60	0.58	1.40

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)

Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Flouranthene	1.0% SOM	280	1,500	52	2,3000	3,100	6,300
	2.5% SOM	560	1,600	130	2,3000	3,100	6,300
	6.0% SOM	890	1,600	290	2,3000	3,100	6,300
Flourene	1.0% SOM	170	2,800 (30.9) [sol]	27	63,000(30.9) [sol]	9,900	20,000
	2.5% SOM	400	3,800(76.5) [sol]	67	68,000	9,900	20,000
	6.0% SOM	860	4,500(183) [sol]	160	71,000	9,900	20,000
Indeno(123-cd)pyrene	1.0% SOM	27	45	9.50	500	82	150
	2.5% SOM	36	46	21	510	82	170
	6.0% SOM	41	46	39	510	82	180
Napthalene	1.0% SOM	2.30	2.6	4.10	190 [f] (76.4) [sol]	4,900[f]	1,200[f](76.4) [sol]
	2.5% SOM	5.60	5.6	10	460 [f](183) [sol]	4,900[f]	1,900[f](183) [sol]
	6.0% SOM	13	13	24	1,100[f](432) [sol]	4,900[f]	3,000
Phenanthrene	1.0% SOM	95	1,300(183) [sol]	18	22,000	3,100	6,200
	2.5% SOM	220	1,500	38	22,000	3,100	6,200
	6.0% SOM	440	1,500	90	23,000	3,100	6,300
Pyrene	1.0% SOM	620	3,700	110	54,000	7,400	15,000
	2.5% SOM	1200	3,800	270	54,000	7,400	15,000
	6.0% SOM	2000	3,800	620	54,000	7,400	15,000
Coal Tar (Benzo(a)pyrene used as marker compound	1.0% SOM	0.79	1.2	0.32	15	2.20	4.40
	2.5% SOM	0.98	1.2	0.67	15	2.20	4.70
	6.0% SOM	1.10	1.2	1.20	15	2.20	4.80

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.
[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Chloroalkanes & alkenes						
1,2 Dichloroethane						
1.0% SOM	0.0071	0.0092	0.0046	0.67	29	21
2.5% SOM	0.011	0.013	0.0083	0.97	29	24
6.0% SOM	0.019	0.023	0.016	1.70	29	28
1,1,2,2 Tetrachloroethane						
1.0% SOM	1.60	3.90	0.41	270	1,400	1,800
2.5% SOM	3.40	8.00	0.89	550	1,400	2,100
6.0% SOM	7.50	17	2.00	1,100	1,400	2,300
1,1,1,2 Tetrachloroethane						
1.0% SOM	1.20	1.50	0.79	110	1,400	1,500
2.5% SOM	2.80	3.50	1.90	250	1,400	1,800
6.0% SOM	6.40	8.20	4.40	560	1,400	2,100
Tetrachloroethene						
1.0% SOM	0.18	0.18	0.65	19	1,400	810 ^{sol}(424)
2.5% SOM	0.39	0.40	1.50	42	1,400	1,100 ^{sol}(951)
6.0% SOM	0.90	0.92	3.60	95	1,400	1,500
1,1,1 Trichloroethane						
1.0% SOM	8.80	9.00	48	660	140,000	57,000 ^{vap}(1425)
2.5% SOM	18	18	110	1,300	140,000	76,000 ^{vap}(2915)
6.0% SOM	39	40	240	3,000	140,000	100,000 ^{vap}(6392)
Tetrachloromethene						
1.0% SOM	0.026	0.026	0.45	2.90	890	190
2.5% SOM	0.056	0.056	1.00	6.30	920	270
6.0% SOM	0.130	0.130	2.40	14	950	400
Trichloroethene						
1.0% SOM	0.016	0.017	0.041	1.20	120	70
2.5% SOM	0.034	0.036	0.091	2.60	120	91
6.0% SOM	0.075	0.080	0.210	5.70	120	120
Trichloromethane						
1.0% SOM	0.91	1.20	0.42	99	2,500	2,600
2.5% SOM	1.70	2.10	0.83	170	2,500	2,800
6.0% SOM	3.40	4.20	1.70	350	2,500	3,100
Vinyl Chloride						
1.0% SOM	0.00064	0.00077	0.00055	0.059	3.50	4.80
2.5% SOM	0.00087	0.00100	0.00100	0.077	3.50	5.00
6.0% SOM	0.00014	0.00150	0.00180	0.120	3.50	5.40

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Explosives						
2,4,6 Trinitrotoluene						
1.0% SOM	1.60	65	0.24	1,000	130	260
2.5% SOM	3.70	66	0.58	1,000	130	270
6.0% SOM	8.10	66	1.40	1,000	130	270
RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)						
1.0% SOM	120	13,000	17	210,000	26,000	49,000(18.7)^{sol}
2.5% SOM	250	13,000	38	210,000	26,000	51,000
6.0% SOM	540	13,000	85	210,000	27,000	53,000
HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)						
1.0% SOM	5.70	67,00	0.86	110,000	13,000	23,000(0.35)^{vap}
2.5% SOM	13	67,00	1.90	110,000	13,000	23,000(0.39)^{vap}
6.0% SOM	26	67,00	3.90	110,000	13,000	24,000(0.48)^{vap}
Atrazine						
1.0% SOM	3.30	610	0.50	9,300	1,200	2,300
2.5% SOM	7.60	620	1.20	9,400	1,200	2,400
6.0% SOM	17.40	620	2.70	9,400	1,200	2,400
Pesticides						
Aldrin						
1.0% SOM	5.70	7.30	3.20	170	18	30
2.5% SOM	6.60	7.40	6.10	170	18	31
6.0% SOM	7.10	7.50	9.60	170	18	31
Dieldrin						
1.0% SOM	0.97	7.00	0.17	170	18	30
2.5% SOM	2.00	7.30	0.41	170	18	30
6.0% SOM	3.50	7.40	0.96	170	18	31
Dichlorvos						
1.0% SOM	0.032	6.40	0.0049	140	16	26
2.5% SOM	0.066	6.50	0.0100	140	16	26
6.0% SOM	0.140	6.60	0.0220	140	16	27
Alpha - Endosulfan						
1.0% SOM	7.40	160(0.003)^{vap}	1.20	5,600(0.003)^{vap}	1,200	2,400
2.5% SOM	18	280(0.007)^{vap}	2.90	7,400(0.007)^{vap}	1,200	2,400
6.0% SOM	41	410(0.016)^{vap}	6.80	8,400(0.016)^{vap}	1,200	2,400

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Pesticides						
Beta - Endosulfan						
1.0% SOM	7.00	190(0.00007)[vap]	1.10	6,300(0.00007)[vap]	1,200	2,400
2.5% SOM	17	320(0.0002)[vap]	2.70	7,800(0.0002)[vap]	1,200	2,400
6.0% SOM	39	440(0.0004)[vap]	6.40	8700	1,200	2,500
Alpha - Hexachlorocyclohexanes						
1.0% SOM	0.23	6.90	0.035	170	24	47
2.5% SOM	0.55	9.20	0.087	180	24	48
6.0% SOM	1.20	11	0.210	180	24	48
Beta - Hexachlorocyclohexanes						
1.0% SOM	0.085	3.70	0.013	65	8.10	15
2.5% SOM	0.200	3.80	0.032	65	8.10	15
6.0% SOM	0.460	3.80	0.077	65	8.10	16
Gamma - Hexachlorocyclohexanes						
1.0% SOM	0.06	2.90	0.0092	67	8.2	14
2.5% SOM	0.14	3.30	0.0230	69	8.2	15
6.0% SOM	0.33	3.50	0.0540	70	8.2	15
Chlorobenzenes						
Chlorobenzene						
1.0% SOM	0.46	0.46	5.90	56	11,000	1,300(675)[sol]
2.5% SOM	1.00	1.00	14	130	13,000	2,000(1520)[sol]
6.0% SOM	2.40	2.40	32	290	14,000	2,900
1,2-Dichlorobenzene						
1.0% SOM	23	24	94	2,000 (571) [sol]	90,000	24,000(571)[sol]
2.5% SOM	55	57	230	4,800 (1370) [sol]	95,000	36,000(1370)[sol]
6.0% SOM	130	130	540	11,000 (3240) [sol]	98,000	51,000(3240)[sol]
1,3-Dichlorobenzene						
1.0% SOM	0.40	0.44	0.25	30	300	390
2.5% SOM	1.00	1.10	0.60	73	300	440
6.0% SOM	2.30	2.50	1.50	170	300	470
1,4-Dichlorobenzene						
1.0% SOM	61	61	15	4,400 (224)[vap]	17,000[g]	36,000 (224)[vap]
2.5% SOM	150	150	37	10,000 (540)[vap]	17,000[g]	36,000 (540)[vap]
6.0% SOM	350	350	88[g]	25,000 (1280)[vap]	17,000[g]	36,000 (1280)[vap]
1,2,3,-Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134)[vap]
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330)[vap]
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789)[vap]

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Chlorobenzenes						
1,2,3,- Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134)^{vap}
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330)^{vap}
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789)^{vap}
1,2,4,- Trichlorobenzene						
1.0% SOM	2.60	2.60	55	220	15,000	1,700(318)^{vap}
2.5% SOM	6.40	6.40	140	530	17,000	2,600(786)^{vap}
6.0% SOM	15	15	320	1,300	19,000	4,000(1880)^{vap}
1,3,5,- Trichlorobenzene						
1.0% SOM	0.33	0.33	4.70	23	1,700	380(36.7)^{vap}
2.5% SOM	0.81	0.81	12	55	1,700	590(90.8)^{vap}
6.0% SOM	1.90	1.90	140	130	1,800	860(217)^{vap}
1,2,3,4,- Tetrachlorobenzene						
1.0% SOM	15	24	4.40	1,700(122)^{vap}	830	1,500(122)^{vap}
2.5% SOM	36	56	11	3,080(304)^{vap}	830	1,600
6.0% SOM	78	120	26	4,400(728)^{vap}	830	1,600
1,2,3,5,- Tetrachlobenzene						
1.0% SOM	0.66	0.75	0.38	49(39.4)^{vap}	78	110(39)^{vap}
2.5% SOM	1.60	1.90	0.90	120(98.1)^{vap}	79	120
6.0% SOM	3.70	4.30	2.20	240(235)^{vap}	79	130
1,2,4, 5,- Tetrachlobenzene						
1.0% SOM	0.33	0.73	0.06	42(19.7)^{sol}	13	25
2.5% SOM	0.77	1.70	0.16	72(49.1)^{sol}	13	26
6.0% SOM	1.60	3.50	0.37	96	13	26
Pentachlrobenzene						
1.0% SOM	5.80	19	1.20	640(43.0)^{sol}	100	190
2.5% SOM	12	30	3.10	770(107)^{sol}	100	190
6.0% SOM	22	38	7.00	830	100	190
Hexachlorobenzene						
1.0% SOM	1.80(0.20)^{vap}	4.10 (0.20)^{vap}	0.47	110(0.20)^{vap}	16	30
2.5% SOM	3.30(0.50)^{vap}	5.70 (0.50)^{vap}	1.10	120	16	30
6.0% SOM	4.90	6.70 (1.2)^{vap}	2.50	120	16	30

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Phenols & Chlorophenols						
Phenols						
1.0% SOM	280	750	66	760^{dir}(31,000)	760^{dir}(11,000)	760^{dir}(8,600)
2.5% SOM	550	1,300	140	1,500^{dir}(35,000)	1,500^{dir}(11,000)	1,500^{dir}(9,700)
6.0% SOM	1100	2,300	280	3,200^{dir}(37,000)	3,200^{dir}(11,000)	3,200^{dir}(11,000)
Chlorophenols (4 Congeners)						
1.0% SOM	0.87	94	0.13	3,500	620	1,100
2.5% SOM	2.00	150	0.30	4,000	620	1,100
6.0% SOM	4.50	210	0.70	4,300	620	1,100
Pentachlorophenols						
1.0% SOM	0.22	27(16.4)^{vap}	0.03	400	60	110
2.5% SOM	0.52	29	0.08	400	60	120
6.0% SOM	1.20	31	0.19	400	60	120
Others						
Carbon Disulphide						
1.0% SOM	0.14	0.14	4.80	11	11,000	1,300
2.5% SOM	0.29	0.29	10	22	11,000	1,900
6.0% SOM	0.62	0.62	23	47	12,000	2,700
Hexachloro-1,3-Butadiene						
1.0% SOM	0.29	0.32	0.25	31	25	48
2.5% SOM	0.70	0.78	0.61	68	25	50
6.0% SOM	1.60	1.80	1.40	120	25	51

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CL:AIRE Soil Generic Assessment Criteria				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Metals:				
Antimony	ND	550	ND	7500
Barium	ND	1300	ND	22000
Molybdenum	ND	670	ND	17000

ND – Not Derived.
NA – Not Applicable

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
1,1,2 Trichloroethane				
1.0% SOM	0.60	0.88	0.28	94
2.5% SOM	1.20	1.8	0.61	190
6.0% SOM	2.70	3.9	1.40	400
1,1-Dichloroethane				
1.0% SOM	2.40	2.50	9.20	280
2.5% SOM	3.90	4.10	17	450
6.0% SOM	7.40	7.70	35	850
1,1-Dichloroethene				
1.0% SOM	0.23	0.23	2.80	26
2.5% SOM	0.40	0.41	5.60	46
6.0% SOM	0.82	0.82	12	92
1,2,4-Trimethylbenzene				
1.0% SOM	0.35	0.41	0.38	42
2.5% SOM	0.85	0.99	0.93	99
6.0% SOM	2.00	2.30	2.20	220
1,2-Dichloropropane				
1.0% SOM	0.024	0.024	0.62	3.3
2.5% SOM	0.042	0.042	1.20	5.9
6.0% SOM	0.084	0.085	2.60	12
2,4-Dimethylphenol				
1.0% SOM	19	210	3.10	16000*
2.5% SOM	43	410	7.20	24000*
6.0% SOM	97	730	17	30000*
2,4-Dinitrotoluene				
1.0% SOM	1.50	170*	0.22	3700*
2.5% SOM	3.20	170	0.49	3700*
6.0% SOM	7.20	170	1.10	3800*
2,6-Dinitrotoluene				
1.0% SOM	0.78	78	0.12	1900*
2.5% SOM	1.70	84	0.27	1900*
6.0% SOM	3.90	87	0.61	1900*
2-Chloronapthalene				
1.0% SOM	3.70	3.80	40	390*
2.5% SOM	9.20	9.30	98	960*
6.0% SOM	22	22	230	2200*

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Biphenyl				
1.0% SOM	66*	220*	14	18000*
2.5% SOM	160	500*	35	33000*
6.0% SOM	360	980*	83	48000*
Bis (2-ethylhexyl) phthalate				
1.0% SOM	280*	2700*	47*	85000*
2.5% SOM	610*	2800*	120*	86000*
6.0% SOM	1100*	2800*	280*	86000*
Bromobenzene				
1.0% SOM	0.87	0.91	3.2	97
2.5% SOM	2.0	2.1	7.6	220
6.0% SOM	4.7	4.9	18	520
Bromodichloromethane				
1.0% SOM	0.016	0.019	0.016	2.1
2.5% SOM	0.030	0.034	0.032	3.7
6.0% SOM	0.061	0.070	0.068	7.6
Bromoform				
1.0% SOM	2.8	5.2	0.95	760
2.5% SOM	5.9	11	2.1	1500
6.0% SOM	13	23	4.6	3100
Butyl benzyl phthalate				
1.0% SOM	1400*	42000*	220*	940000*
2.5% SOM	3300*	44000*	550*	940000*
6.0% SOM	7200*	44000*	1300*	950000*
Chloroethane				
1.0% SOM	8.3	8.4	110	960
2.5% SOM	11	11	200	1300
6.0% SOM	18	18	380	2100
Chloromethane				
1.0% SOM	0.0083	0.0085	0.066	1.0
2.5% SOM	0.0098	0.0099	0.13	1.2
6.0% SOM	0.013	0.013	0.23	1.6
***Cis* 1,2 Dichloroethene**				
1.0% SOM	0.11	0.12	0.26	14
2.5% SOM	0.19	0.20	0.50	24
6.0% SOM	0.37	0.39	1.0	47

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Dichloromethane				
1.0% SOM	0.58	2.10	0.10	270
2.5% SOM	0.98	2.80	0.19	360
6.0% SOM	1.70	4.50	0.34	560
Diethyl Phthalate				
1.0% SOM	120*	1800*	19*	150000*
2.5% SOM	260*	3500*	41*	220000*
6.0% SOM	570*	6300*	94*	290000*
Di-*n*-butyl phthalate				
1.0% SOM	13*	450*	2.00	15000*
2.5% SOM	31*	450*	5.00	15000*
6.0% SOM	67*	450*	12	15000*
Di-*n*-octyl phthalate				
1.0% SOM	2300*	3400*	940*	89000*
2.5% SOM	2800*	3400*	2100*	89000*
6.0% SOM	3100*	3400*	3900*	89000*
Hexachloroethane				
1.0% SOM	0.20	0.22	0.27	22*
2.5% SOM	0.48	0.54	0.67	53*
6.0% SOM	1.10	1.30	1.60	120*
Isopropylbenzene				
1.0% SOM	11	12	32	1400*
2.5% SOM	27	28	79	3300*
6.0% SOM	64	67	190	7700*
Methyl *tert*-butyl ether				
1.0% SOM	49	73	23	7900
2.5% SOM	84	120	44	13000
6.0% SOM	160	220	90	24000
Propylbenzene				
1.0% SOM	34	40	34	4100*
2.5% SOM	82	97	83	9700*
6.0% SOM	190	230	200	21000*
Styrene				
1.0% SOM	8.10	35	1.60	3300*
2.5% SOM	19	78	3.70	6500*
6.0% SOM	43	170	8.70	11000*

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Total Cresols (2-, 3-, and 4-methylphenol)				
1.0% SOM	80	3700	12	160000
2.5% SOM	180	5400	27	180000*
6.0% SOM	400	6900	63	180000*
***Trans* 1,2 Dichloroethene**				
1.0% SOM	0.19	0.19	0.93	22
2.5% SOM	0.34	0.35	1.90	40
6.0% SOM	0.70	0.71	0.24	81
Tributyl tin oxide				
1.0% SOM	0.25	1.40	0.042	130*
2.5% SOM	0.59	3.10	0.100	180*
6.0% SOM	1.30	5.70	0.240	200*

Notes: *Soil concentration above soil saturation limit

APPENDIX F
Waste Hazard Assessment

Waste Classification Report

KMXCM-ENB2U-7BQKY

Job name

GWPR1319

Waste Stream

GWPR PA

Comments

Project

GWPR1319

Site

1b St Johns Wood Park NW8

Classified by

Name:
Allvey , Phillip
Date:
31/07/2015 15:12 UTC
Telephone:
07740110219

Company:
Ground and Water
15 Bow Street
Alton
GU34 1NY

Report

Created by: Allvey , Phillip
Created date: 31/07/2015 15:12 UTC

Job summary

Classification of sample: BH1/0.30m

Non Hazardous Waste
Classified as **17 05 04**
in the European Waste Catalogue

Sample details

Sample Name:
BH1/0.30m
Sample Depth:
0 m
Moisture content: **0%**
(dry weight correction)

EWC Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Additional: Additional Risk Phrases "This is an additional risk phrase and such a risk phrases alone will not cause a waste to be hazardous."

Risk phrases hit:

R33 "Danger of cumulative effects"

Because of determinand:

lead chromate: (compound conc.: 0.0733%)

Determinands (Moisture content: 0%, dry weight correction)

pH: (Whole conc. entered as: 9.5 pH, converted to conc.:9.5 pH or 9.5 pH)
cyanides (with the exception of complex cyanides): (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
arsenic trioxide: (Cation conc. entered: 12 mg/kg, converted to compound conc.:15.844 mg/kg or 0.00158%)
boron tribromide/trichloride/trifluoride (combined): (Cation conc. entered: <1 mg/kg, converted to compound conc.:<13.43 mg/kg or <0.00134%) IGNORED Because: "<LOD"
cadmium sulfide: (Cation conc. entered: 0.3 mg/kg, converted to compound conc.:0.386 mg/kg or 0.0000386%, Note 1 conc.: 0.00003%)
Chromium (III) Sulphate: (Whole conc. entered as: 23 mg/kg or 0.0023%)
chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<3.846 mg/kg or <0.000385%) IGNORED Because: "<LOD"
copper (I) oxide: (Cation conc. entered: 35 mg/kg, converted to compound conc.:39.406 mg/kg or 0.00394%)
lead chromate: (Cation conc. entered: 470 mg/kg, converted to compound conc.:733.113 mg/kg or 0.0733%, Note 1 conc.: 0.047%)
mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.:<1.353 mg/kg or <0.000135%) IGNORED Because: "<LOD"
nickel dihydroxide: (Cation conc. entered: 15 mg/kg, converted to compound conc.:23.692 mg/kg or 0.00237%)
selenium compounds (with the exception of cadmium sulfoselenide and sodium selenite): (Cation conc. entered: <3 mg/kg, converted to compound conc.:<4.5 mg/kg or <0.00045%) IGNORED Because: "<LOD"
divanadium pentaoxide; vanadium pentoxide: (Cation conc. entered: 61 mg/kg, converted to compound conc.:108.896 mg/kg or 0.0109%)
zinc chromate: (Cation conc. entered: 178 mg/kg, converted to compound conc.:493.798 mg/kg or 0.0494%)
phenol: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
naphthalene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
fluorene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
phenanthrene: (Whole conc. entered as: 0.14 mg/kg or 0.000014%)

anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
fluoranthene: (Whole conc. entered as: 0.98 mg/kg or 0.000098%)
pyrene: (Whole conc. entered as: 0.73 mg/kg or 0.000073%)
benzo[a]anthracene: (Whole conc. entered as: 0.3 mg/kg or 0.00003%)
chrysene: (Whole conc. entered as: 0.33 mg/kg or 0.000033%)
benzo[b]fluoranthene: (Whole conc. entered as: 0.48 mg/kg or 0.000048%)
benzo[k]fluoranthene: (Whole conc. entered as: 0.15 mg/kg or 0.000015%)
benzo[a]pyrene; benzo[def]chrysene: (Whole conc. entered as: 0.19 mg/kg or 0.000019%)
indeno[123-cd]pyrene: (Whole conc. entered as: 0.31 mg/kg or 0.000031%)
dibenz[a,h]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
benzo[ghi]perylene: (Whole conc. entered as: 0.33 mg/kg or 0.000033%)

Legend

- This determinand has its risk phrases defined and maintained by the user

Notes utilised in assessment

Additional Risk Phrase Comments , used on:

Test: "Additional on R33" for determinand: "lead chromate"

C14.3: Step 4 , used on:

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "cadmium sulfide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "arsenic trioxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "copper (I) oxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "lead chromate"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "nickel dihydroxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "zinc chromate"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "phenanthrene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "fluoranthene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "pyrene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]anthracene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "chrysene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[b]fluoranthene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[k]fluoranthene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]pyrene; benzo[def]chrysene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[ghi]perylene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "divanadium pentaoxide; vanadium pentoxide"

Note 1 , used on:

Test: "H5 on R20, R21, R22, R65" for determinand: "cadmium sulfide"
Test: "H6 on R23, R24, R25" for determinand: "cadmium sulfide"
Test: "H7 on R45" for determinand: "cadmium sulfide"
Test: "H10 on R60, R61" for determinand: "lead chromate"
Test: "H10 on R62, R63" for determinand: "cadmium sulfide"
Test: "H11 on R68" for determinand: "cadmium sulfide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "cadmium sulfide"

Determinand notes

Note 1 , used on:

determinand: "cadmium sulfide"
determinand: "lead chromate"

Note A , used on:

determinand: "zinc chromate"

Note E , used on:

determinand: "arsenic trioxide"
determinand: "cadmium sulfide"
determinand: "nickel dihydroxide"
determinand: "zinc chromate"

Classification of sample: TP1/0.30m

Non Hazardous Waste
Classified as **17 05 04**
in the European Waste Catalogue

Sample details

Sample Name:
TP1/0.30m
Sample Depth:
0 m
Moisture content: **0%**
(dry weight correction)

EWC Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Additional: Additional Risk Phrases "This is an additional risk phrase and such a risk phrases alone will not cause a waste to be hazardous."

Risk phrases hit:

R14 "Reacts violently with water"

Because of determinand:

boron tribromide/trichloride/trifluoride (combined): (compound conc.: 0.00161%)

R33 "Danger of cumulative effects"

Because of determinand:

lead chromate: (compound conc.: 0.00796%)

R66 "Repeated exposure may cause skin dryness or cracking"

Because of determinand:

diesel petroleum group: (conc.: 0.0065%)

Determinands (Moisture content: 0%, dry weight correction)

pH: (Whole conc. entered as: 9.7 pH, converted to conc.:9.7 pH or 9.7 pH)
cyanides (with the exception of complex cyanides): (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
arsenic trioxide: (Cation conc. entered: 7 mg/kg, converted to compound conc.:9.242 mg/kg or 0.000924%)
boron tribromide/trichloride/trifluoride (combined): (Cation conc. entered: 1.2 mg/kg, converted to compound conc.:16.116 mg/kg or 0.00161%)
cadmium sulfide: (Cation conc. entered: 0.2 mg/kg, converted to compound conc.:0.257 mg/kg or 0.0000257%, Note 1 conc.: 0.00002%)
Chromium (III) Sulphate: (Whole conc. entered as: 27 mg/kg or 0.0027%)
chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<3.846 mg/kg or <0.000385%) IGNORED Because: "<LOD"
copper (I) oxide: (Cation conc. entered: 34 mg/kg, converted to compound conc.:38.28 mg/kg or 0.00383%)
lead chromate: (Cation conc. entered: 51 mg/kg, converted to compound conc.:79.551 mg/kg or 0.00796%, Note 1 conc.: 0.0051%)
mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.:<1.353 mg/kg or <0.000135%) IGNORED Because: "<LOD"
nickel dihydroxide: (Cation conc. entered: 29 mg/kg, converted to compound conc.:45.805 mg/kg or 0.00458%)
selenium compounds (with the exception of cadmium sulfoselenide and sodium selenite): (Cation conc. entered: <3 mg/kg, converted to compound conc.:<4.5 mg/kg or <0.00045%) IGNORED Because: "<LOD"

divanadium pentaoxide; vanadium pentoxide: (Cation conc. entered: 34 mg/kg, converted to compound conc.:60.696 mg/kg or 0.00607%)
zinc chromate: (Cation conc. entered: 84 mg/kg, converted to compound conc.:233.028 mg/kg or 0.0233%)
phenol: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
naphthalene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
fluorene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
phenanthrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
fluoranthene: (Whole conc. entered as: 0.32 mg/kg or 0.000032%)
pyrene: (Whole conc. entered as: 0.3 mg/kg or 0.00003%)
benzo[a]anthracene: (Whole conc. entered as: 0.31 mg/kg or 0.000031%)
chrysene: (Whole conc. entered as: 0.45 mg/kg or 0.000045%)
benzo[b]fluoranthene: (Whole conc. entered as: 0.94 mg/kg or 0.000094%)
benzo[k]fluoranthene: (Whole conc. entered as: 0.28 mg/kg or 0.000028%)
benzo[a]pyrene; benzo[def]chrysene: (Whole conc. entered as: 0.72 mg/kg or 0.000072%)
indeno[123-cd]pyrene: (Whole conc. entered as: 0.52 mg/kg or 0.000052%)
dibenz[a,h]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
benzo[ghi]perylene: (Whole conc. entered as: 0.42 mg/kg or 0.000042%)
benzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
toluene: (Whole conc. entered as: <5 mg/kg or <0.0005%) IGNORED Because: "<LOD"
ethylbenzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
xylene: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
diesel petroleum group: (Whole conc. entered as: 65 mg/kg or 0.0065%)
TPH (C6 to C40) petroleum group: (Whole conc. entered as: 103 mg/kg or 0.0103%)

Legend
- This determinand has its risk phrases defined and maintained by the user

Test Settings

H3-B on R10: Force this test to non hazardous because: "Not high enough concentration to be flammable"

Notes utilised in assessment

Additional Risk Phrase Comments , used on:

Test: "Additional on R14" for determinand: "boron tribromide/trichloride/trifluoride (combined)"
Test: "Additional on R33" for determinand: "lead chromate"
Test: "Additional on R66" for determinand: "diesel petroleum group"

C14.3: Step 4 , used on:

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "cadmium sulfide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "arsenic trioxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "copper (I) oxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "lead chromate"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "nickel dihydroxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "zinc chromate"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "fluoranthene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "pyrene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]anthracene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "chrysene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[b]fluoranthene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[k]fluoranthene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]pyrene; benzo[def]chrysene"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[ghi]perylene"

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "divanadium pentaoxide; vanadium pentoxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "diesel petroleum group"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "TPH (C6 to C40) petroleum group"

Note 1 , used on:

Test: "H5 on R20, R21, R22, R65" for determinand: "cadmium sulfide"
Test: "H6 on R23, R24, R25" for determinand: "cadmium sulfide"
Test: "H7 on R45" for determinand: "cadmium sulfide"
Test: "H10 on R60, R61" for determinand: "lead chromate"
Test: "H10 on R62, R63" for determinand: "cadmium sulfide"
Test: "H11 on R68" for determinand: "cadmium sulfide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "cadmium sulfide"

Determinand notes

3.4.2 , used on:

determinand: "TPH (C6 to C40) petroleum group"

Note 1 , used on:

determinand: "cadmium sulfide"
determinand: "lead chromate"

Note A , used on:

determinand: "zinc chromate"

Note E , used on:

determinand: "arsenic trioxide"
determinand: "cadmium sulfide"
determinand: "nickel dihydroxide"
determinand: "zinc chromate"

Appendix A: Classifier defined and non CLP determinands

pH

Comments: Appendix C, C4.5
Data source: WM2 - Interpretation of the definition and classification of hazardous waste (Second Edition, version2.2), Environment Agency
Data source date: 30/05/2008
Risk Phrases: None.

boron tribromide/trichloride/trifluoride (combined)

Comments: Combines the risk phrases and the average of the conversion factors for Boron tribromide, Boron trichloride and Boron trifluoride
Data source: N/A
Data source date: 10/01/2011
Risk Phrases: R14, T+; R26/28, C; R34, C; R35

Chromium (III) Sulphate (CAS Number: 10101-53-8)

Comments:
Data source: 10101-53-8
Data source date: 23/06/2015
Risk Phrases: None.

acenaphthylene (CAS Number: 208-96-8)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=59285&HarmOnly=no
Data source date: 16/07/2012
Risk Phrases: R22, R26, R27, R36, R37, R38

acenaphthene (CAS Number: 83-32-9)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=133563&HarmOnly=no
Data source date: 16/07/2012
Risk Phrases: R36, R37, R38, N; R50/53, N; R51/53

fluorene (CAS Number: 86-73-7)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=81845&HarmOnly=no
Data source date: 16/07/2012
Risk Phrases: N; R50/53, R53

phenanthrene (CAS Number: 85-01-8)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=109754&HarmOnly=no
Data source date: 16/07/2012
Risk Phrases: R22, R36, R37, R38, R40, R43, N; R50/53

anthracene (CAS Number: 120-12-7)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=101102&HarmOnly=no
Data source date: 08/03/2013
Risk Phrases: R36, R37, R38, R43, N; R50/53

fluoranthene (CAS Number: 206-44-0)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=56375&HarmOnly=no
Data source date: 16/07/2012
Risk Phrases: R20, R22, R36, N; R50/53

pyrene (CAS Number: 129-00-0)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=87484&HarmOnly=no
Data source date: 16/07/2012
Risk Phrases: R23, N; R50/53

indeno[123-cd]pyrene (CAS Number: 193-39-5)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=128806&HarmOnly=no
Data source date: 08/03/2013
Risk Phrases: R40

benzo[ghi]perylene (CAS Number: 191-24-2)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=15793&HarmOnly=no
Data source date: 16/07/2012
Risk Phrases: N; R50/53

diesel petroleum group

Comments: Risk phrase data given in table A3, page A41
Data source: WM2 3rd edition, 2013
Data source date: 01/08/2013
Risk Phrases: R40, R51/53, R65, R66

TPH (C6 to C40) petroleum group

Comments: Risk phrase data given on page A41
Data source: WM2 3rd edition, 2013
Data source date: 01/08/2013
Risk Phrases: R10, R45, R46, R51/53, R63, R65

Appendix B: Notes

3.4.2

from section: 3.4.2 in the document: "WM2 - Hazardous Waste Technical Guidance"

"If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic due to the presence of oil if all three of the following criteria are met:

- the waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.2 of the CLP for BaP)
- this has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D, and
- the analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel

"

Additional Risk Phrase Comments

from section: Table 2.2 in the document: "WM2 - Hazardous Waste Technical Guidance"

"This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous."

C14.3: Step 4

from section: C14.3 in the document: "WM2 - Hazardous Waste Technical Guidance"

"identify whether any individual ecotoxic substance is present below a cut-off value shown in Table C14.1"

Note 1

from section: 1.1.3.2, Annex VI in the document: "CLP Regulations"

"The concentration stated or, in the absence of such concentrations, the generic concentrations of this Regulation (Table 3.1) or the generic concentrations of Directive 1999/45/EC (Table 3.2), are the percentages by weight of the metallic element calculated with reference to the total weight of the mixture."

Note A

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"

"Without prejudice to Article 17(2), the name of the substance must appear on the label in the form of one of the designations given in Part 3. In Part 3, use is sometimes made of a general description such as '... compounds' or '... salts'. In this case, the supplier is required to state on the label the correct name, due account being taken of section 1.1.1.4."

Note E

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"

"Substances with specific effects on human health (see Chapter 4 of Annex VI to Directive 67/548/EEC) that are classified as carcinogenic, mutagenic and/or toxic for reproduction in categories 1 or 2 are ascribed Note E if they are also classified as very toxic (T+), toxic (T) or harmful (Xn). For these substances, the risk phrases R20, R21, R22, R23, R24, R25, R26, R27, R28, R39, R68 (harmful), R48 and R65 and all combinations of these risk phrases shall be preceded by the word 'Also'."

Appendix C: Version

Classification utilises the following:

- WM2 - Hazardous Waste Technical Guidance - 3rd Edition (Aug 2013)
  Hazardous Waste: Interpretation of the definition and classification of hazardous waste (3rd Edition 2013)
- CLP Regulations - Regulation 1272/2008/EC of 16 December 2008
  REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006
- 1st ATP - Regulation 790/2009/EC of 10 August 2009
  COMMISSION REGULATION (EC) No 790/2009 of 10 August 2009 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures
- 2nd ATP - Regulation 286/2011/EC of 10 March 2011
  COMMISSION REGULATION (EU) No 286/2011 of 10 March 2011 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures
- 3rd ATP - Regulation 618/2012/EU of 10 July 2012
  COMMISSION REGULATION (EU) No 618/2012 of 10 July 2012 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures
- 4th ATP - Regulation 487/2013/EU of 8 May 2013
  COMMISSION REGULATION (EU) No 487/2013 of 8 May 2013 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures
- Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
  COMMISSION REGULATION (EU) No 758/2013 of 7 August 2013 correcting Annex VI to Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures
- 5th ATP - Regulation 944/2013/EU of 2 October 2013
  COMMISSION REGULATION (EU) No 944/2013 of 2 October 2013 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures
- 6th ATP - Regulation 605/2014/EU of 5 June 2014
  COMMISSION REGULATION (EU) No 605/2014 of 5 June 2014 amending, for the purposes of introducing hazard and precautionary statements in the Croatian language and its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures

HazWasteOnline Engine: WM2 version 3 (Aug 2013)
HazWasteOnline Engine Version: 2015.169.2852.5804 (18 Jun 2015)
HazWasteOnline Database: 2015.169.2852.5804 (18 Jun 2015)