Pocket Living Ossory Road Limited

2-10 Ossory Road, Peckham, SE1 5AN

Phase 2 Geo-environmental and Geotechnical Site Investigation

29909-R02 (02)

AUGUST 2021

RSK

RSK GENERAL NOTES

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Rev 02	16 August 2021	Minor change to development plans

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by Pocket Living ('the client') to carry out a Geoenvironmental and Geotechnical Site Investigation of the land at 2-10 Ossory Road, Peckham, London, SE1 5AN (hereafter referred to as 'the site'). The project was carried out to an agreed brief as set out in RSK's proposal (Ref. 29909T02, dated 15th April 2020).

This report is subject to the RSK service constraints given in **Appendix A** and limitations that may be described through this document.

1.2 Proposed development

The subject site is being considered for commercial and residential redevelopment. The planned layout of the site is shown in **Appendix B**.

1.3 Objectives

The objectives of the work are:

- to identify any land contamination and/or geotechnical constraints to the proposed development and to support discharge of relevant planning conditions and relevant building control requirements;
- to identify the need for any additional investigation or remediation works to demonstrate that the site is suitable for its proposed use; and
- to determine ground conditions and provide information for piled foundation design and other geotechnical parameters.

1.4 Scope of works

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in CLR 11 Model Procedures for the Management of Land Contamination (Environment Agency, 2004) and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). It is also compliant with relevant planning policy and guidance.

The scope of the intrusive investigation has been designed in line with the recommendations of BS5930: 2015 Code of practice for ground investigations (BSi, 2016), which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. It has also been developed in general accordance with BS 10175: 2011 + A2 2017. Ground gas assessment has been undertaken in general accordance with BS8756: 2013 and BS 8485:2015+A1:2019.

A brief summary of relevant legislation and policy relating to contaminated land is given in **Appendix C**.

The scope of works for the assessment has included the following:

Intrusive Investigation

- design and implementation of an intrusive investigation, in situ testing, soil sampling, laboratory geo-environmental and geotechnical testing, groundwater and ground gas monitoring of installed boreholes;
- interpretation of data to develop a refined conceptual site model (CSM);
- generic quantitative risk assessment (GQRA) to evaluate potentially complete contaminant linkages identified in the refined CSM;
- identification of the need for further action, e.g. supplementary intrusive investigations/ monitoring, remediation works or other mitigation, if any;
- interpretation of ground conditions and geotechnical data to provide preliminary recommendations with respect to foundations and infrastructure design;
- preliminary assessment of the potential waste classification (hazardous / non-hazardous) implications of soil arisings; and
- preparation of this factual and interpretative report with recommendations for further works (i.e. undertake a remedial options appraisal to identify appropriate mitigation measures/produce a remedial implementation and verification plan) and/or remediation as necessary.

1.5 Existing reports

The site was the subject of a Phase 1 investigation by RSK as detailed in the flowing:

- Phase 1 Environmental Study: 2-10 Ossory Road, Peckham, SE1 5AN; ref.29909-R01(01) dated 24th July 2018.

Pertinent information from this report has been summarised in **Section 3**.

1.6 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

Asbestos is often present in soils in discrete areas. Whilst asbestos-containing materials has not been encountered during the fieldworks or supporting laboratory analysis, the history of the site indicates that asbestos may be present in soils and could be encountered during more extensive ground works.

Preliminary geotechnical recommendations are presented and these should be verified in a Geotechnical Design Report once proposed construction and structural design proposals are confirmed.

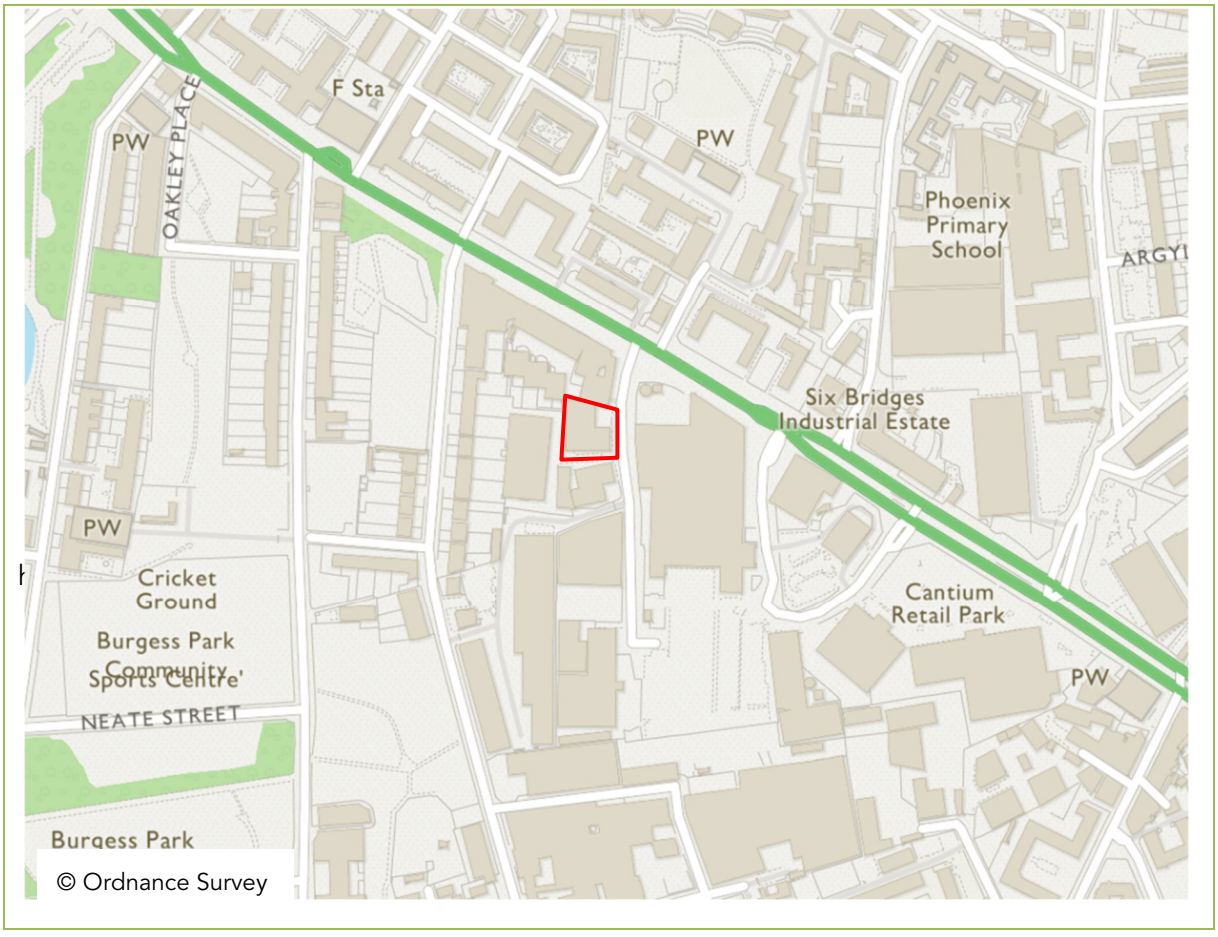
2 SITE DETAILS

2.1 Site location

Site location details are presented in **Table 1**. A site location plan is provided below and on **Figure 1**.

Table 1 Site location details

Site name	Ossory Road, Peckham
Full site address and postcode	2-10 Ossory Road, Peckham, SE1 5AN
National Grid reference (centre of site)	534029, 178000



2.2 Site description

The site covers approximately 0.11 hectares and comprises of a large steel portal framed building, more recently occupied by a car dealership with full exterior hard standing used for parking, as shown on **Figure 2.**

2.3 Surrounding land uses

The site is located within a light predominantly industrial and commercial area. Immediate surrounding land uses are described in **Table 2**.

Table 2 Surrounding land use

	North	East	South	West
Type of boundary	Walls of existing and adjacent buildings	Wall of existing building and open onto Ossory Road	Wall of existing building	Wall of existing building
Adjacent land use	Residential and commercial/retail premises.	An ASDA store and other commercial/retail premises with residential further to the east.	Commercial/retail premises including a religious establishment, a large car park, associated with the ASDA store.	Commercial/retail premises adjacent to the western boundary, and residential properties with associated gardens, a lake and areas of open space beyond.

2.4 Development plans

The proposed layout of the site, at the time of preparing this report, is shown in **Appendix B**.

It is understood that the current occupying structure is to be demolished and the site redeveloped with a 11-storey residential apartment block, with commercial units at ground floor. Soft landscaped areas at ground level are not proposed.

3 SUMMARY OF PREVIOUS PRELIMINARY RISK ASSESSMENT

A summary of pertinent information from the Phase 1 study is included in **Table 3**.

Table 3 Summary of preliminary risk assessment

Report Details	Phase 1 Environmental Study; Ossory Road, Peckham, SE1 5AN (Ref 29909 – R01 (01)) dated 24 July 2018
Site coverage	The report covers the full footprint of the site recognised within this report.
Summary scope of works	The scope of works included a review of all available desk-based information regarding the site and the subsequent development of an initial conceptual site model to identify any potential contaminant linkages.
Proposed development	It is understood that the current occupying structure is to be demolished and the site redeveloped with a block of flats, constructed upon piled foundations.
Site history	A summary of the site history identified potential on-going sources of contamination: • Former car dealership and garage that was on-site; • The Grand Surrey Canal was infilled; • A number of historical industrial trades within a 1km radius including a brewery, a printing works, a gas works, a mineral water works etc.
Geology	A summary of the anticipated geology is: • Made ground to an unknown depth; • Kempton Park Gravels up to a few metres depth; • Thanet Formation up to 18m depth; and • Upper Chalk Formation up to 300m depth.
Hydrogeology and hydrology	The site is an unconfined shallow aquifer relating to the superficial deposits (Kempton Park Gravel Member) overlying the Thanet Sands and White Chalk Group. The units are expected to be in hydraulic continuity. The environmental database report indicates that there are no known licensed groundwater abstractions within a 1.5km radius of the site. The nearest identified surface feature to the site is a lake located adjacent approximately 400 m to the west of the site.
Preliminary Contaminated Land Risk Assessment	A number of potential sources of contamination were identified within the Conceptual Site Model (CSM). However only three complete contaminant linkages with a potential risk of moderate/low or higher was identified, relating to: • on-site made ground- future site users – residential users [oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, ingestion of home-grown produce].

	• on-site storage and underground fuel tanks – future site users and controlled waters [migration and ingress into shallow groundwater and dermal contact with contaminated soil/water]. • on-site storage and underground fuel tanks - future site users and controlled water [inhalation of contaminated vapours, contact with contaminated soils/liquid and surface runoff It should be noted that subsequent to the issue of the PRA, the results of a Petroleum Officer search confirmed that they held no records of any petroleum storage tanks on site.

It is to be noted that the Phase 1 desk study was based on a development proposal which has now been revised. Development proposals have altered the first-floor end use from commercial to residential flats with balconies. This alteration in end use however does not change the CSM outlined in the Phase 1 desk study and can confirm that no new contaminant linkages have been made as an outcome to the change in development.

4 PRELIMINARY GEOTECHNICAL CONSTRAINTS

4.1 Design class

BS EN 1997-1 defines three different Geotechnical Categories that structures may fall into, which are summarised as follows:

- Category 1: Small and relatively simple structures for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations; with negligible risk
- Category 2: Conventional types of structure and foundation with no exceptional risk or difficult ground or loading conditions
- Category 3: Structures or part of structures, which fall outside limits of Geotechnical Categories 1 and 2. Examples include very large or unusual structures; structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions; structures in highly seismic areas; structures in areas of probable site instability or persistent ground movements that require separate investigation or special measures.

Based on the information provided above on the proposed development and in view of the anticipated ground conditions, a Geotechnical Category 2 has been assumed for the purposes of designing the geotechnical investigation. This should be reviewed at all stages of the investigation and revised where necessary.

4.2 Preliminary geotechnical hazards assessment

A summary of commonly occurring geotechnical hazards associated with the anticipated geology outlined in Section 3 above is given in **Table 4** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 4 Summary of preliminary geotechnical risks that may affect site

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions	☒	☐	Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils	☒	☐	Design to NHBC Standards Chapter 4 or similar

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Highly compressible and low bearing capacity soils, (including peat and soft clay)	☐	☒	Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to rapid loss of strength in wet conditions	☒	☐	Likely to affect ground engineering and foundation design and construction
Running sand at and below water table	☒	☐	Likely to affect ground engineering and foundation design and construction
Karstic dissolution features (including 'swallow holes' in Chalk terrain)	☐	☒	May affect ground engineering and foundation design and construction – refer to Section 4.1.2
Evaporite dissolution features and/or subsidence	☐	☒	May affect ground engineering and foundation design and construction
Ground subject to or at risk from landslides	☐	☒	Likely to require special stabilisation measures
Ground subject to peri-glacial valley cambering with gulls possibly present	☐	☒	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion	☐	☒	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)	☐	☒	May affect temporary and permanent works
Rising groundwater table due to diminishing abstraction in urban area	☒	☐	May affect deep foundations, basements and tunnels
Underground mining	☐	☒	Likely to require special stabilisation measures
Effects of extreme temperature (e.g. cold stores or brick kilns/furnaces)	☐	☒	Likely to affect ground engineering and foundation design and construction
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	☒	☐	Likely to affect ground engineering and foundation design and construction

Hazard category	Hazard status based on desk study findings and proposed development		Engineering considerations if hazard affects site
	Could be present and/or affect site	Unlikely to be present and/or affect site	
Filled and made ground (including embankments, infilled ponds and quarries)	☒	☐	Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	☐	☒	May affect ground engineering and foundation design and construction
Site topography	☐	☒	May affect ground engineering and foundation design and construction
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK.			

5 SITE INVESTIGATION STRATEGY & METHODOLOGY

5.1 Introduction

RSK carried out intrusive investigation works and subsequent monitoring of boreholes in July 2020.

5.2 Objectives

The specific objectives of the investigation were as follows:

- to establish the ground conditions underlying the site including the extent and thickness of any made ground;
- to investigate specific potential sources of contamination identified in initial CSM;
- to determine groundwater depth and flow direction;
- to determine the ground gas regime underlying the site; and
- to assess geotechnical properties of soils.

5.3 Selection of investigation methods

The techniques adopted for the investigation were chosen with consideration of the objectives and site constraints, which are described below.

Cable percussion drilling was chosen based on the targeted drill depth, requirement for in-situ geotechnical data, the opportunity to collect both disturbed and undisturbed samples and install monitoring wells. A smaller modular cable percussion rig was implemented for use inside the existing warehouse building. This was supplemented by dynamic sampler boreholes to achieve a greater visibility of the made ground and to access the internal sections of the site. Concrete coring was utilised to penetrate the internal concrete ground slab.

Prior to conducting intrusive works, utility service plans were obtained, and buried service clearance undertaken by a third party contractor in line with RSK's health and safety procedures.

5.4 Scope of works

The scope of works comprised the following:

- A single cable percussion borehole (BH01) to a depth of 35mbgl using a cable percussion rig;
- A single cable percussion borehole (BH02) to a depth of 10mbgl using a modular dismantlable cable percussion rig;
- Three dynamic sampler boreholes (WS01, WS03 and WS04) advanced to a depth of 4.45mbgl;
- Two hand inspection pits (WS02 and WS05) excavated to a maximum depth of 1.45mbgl;
- 1No groundwater monitoring standpipe installed to a depth of 8m; and
- 3No ground gas monitoring standpipes installed to a maximum depth of 3.6m.

5.5 Investigation strategy

The ground investigation was carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930: 2015 Code of practice for ground investigations, which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. Whilst every attempt was made to record full details of the strata encountered in the boreholes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

The investigation strategy involved targeted and/or non-targeted boreholes and trial pits. The investigation comprised locations to provide a general coverage of the site

The constraints to the investigation were as follows:

- WS01 was located in an area of restricted height, which meant that the position was hand excavated to 1.20m instead of investigated using a tracked dynamic sampler rig;
- WS05 encountered a concrete obstruction at 1.20m depth and was therefore terminated prematurely; and
- Due to logistical constraints associated with active site tenants, BH02 was advanced over a weekend, in which time it was only able to progress to 10mbgl due to the density of the soils.

Details of the investigation locations, installations and rationale are presented in **Table 5**.

Table 5 Exploratory hole and monitoring well location rationale

Technique	No	Ref	Depth (mbgl)	Installed?	Response zone depth	Rationale
Cable percussion drilling	2	BH01	35.00	Yes	2.0 to 8.0	To prove the geological succession beneath the site, obtain geotechnical data to inform foundation design and to install a groundwater monitoring well.
		BH02	10.00	No	N/A	
Dynamic Sampling	3	WS01	4.45	Yes	1.5 to 3.5	To determine shallow ground conditions and identify the contamination status beneath the site. Allow for the installation of ground gas monitoring standpipes
		WS03	4.45	Yes	1.2 to 3.2	
		WS04	4.45	Yes	1.6 to 3.6	
Inspection pits	2	WS02	1.20	Yes	1.0 to 1.2	
		WS05	1.45	No	N/A	

The locations of the exploratory positions are shown on **Figure 3**.

5.6 Implementation of investigation works

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS 5930:2015 (which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1).

The monitoring well construction and associated response zones are detailed on the exploratory hole records in **Appendix D**. The response zones were installed to target identified gas generation sources detailed in the initial preliminary CSM.

The soil sampling and analysis strategy was designed to characterise each encountered soil strata, permit an assessment of the potential contaminant linkages identified and investigate the geotechnical characteristics. In addition, samples were taken to allow for geo-environmental and geotechnical testing to be undertaken.

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite required. They were dispatched to the laboratory in cool boxes under chain of custody documentation. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

Selected samples were placed in polythene bags for headspace screening with a photo-ionisation detector (PID) fitted with a 10.6 eV bulb. The PID screening results are presented on the exploratory hole records.

5.7 Monitoring programme

5.7.1 Ground gas and groundwater monitoring

In line with the initial CSM, response zones were installed to target the sources or pathways as detailed in the previous PRA (off-site infilled canal), albeit this was considered a low risk.

Two monitoring rounds have been undertaken to date to provide data to support refinement of the CSM and to provide baseline data to support the anticipated low risk of ground gases beneath the site.

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million.

Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter

The atmospheric pressure before and during monitoring, together with the weather conditions, were recorded. The monitoring included periods of falling atmospheric pressures and after/during rainfall.

Depths to groundwater were recorded using an electronic dip meter.

All ground gas and groundwater monitoring results, together with the temporal conditions, are contained within **Appendix E**. Equipment calibration certificates are available on request.

5.8 Laboratory testing

Laboratory testing was undertaken at a UKAS accredited laboratory with ISO17025 and MCERTS accredited test methods

5.8.1 Chemical analysis of soil samples

The soil sampling strategy was designed to characterise made ground and/or natural strata typically within the shallow soils whilst also characterising deeper strata and the potential for contaminant migration from relevant sources.

The programme of chemical tests undertaken on soil samples obtained from the intrusive investigation is presented in **Table 6** with the laboratory testing results contained in **Appendix F.**

Table 6 Summary of chemical testing of soil samples

Stratum	Tests undertaken	Number of tests
Made Ground	Metals-9 (As, Cd, Cu, Cr, Pb, Ni, Hg, Se, Zn)	5
	Speciated PAH16MS	5
	Speciated TPH-CWG	5
	Total Organic Carbon TOC	4
	Asbestos in soil	5
	Full 1 batch waste suite (WAC-E) 10:1	1
	pH and water soluble sulphate	5
	Volatile Organic Compounds (VOCs)	5
	Semi-Volatile Organic Compounds (SVOCs)	5
Kempton Park Gravel Formation	Metals-9 (As, Cd, Cu, Cr, Pb, Ni, Hg, Se, Zn)	1
	Speciated PAH16MS	1
	Speciated TPH-CWG	1
	Asbestos in soil	1
	pH and water soluble sulphate	1
	Volatile Organic Compounds (VOCs)	1
	Semi-Volatile Organic Compounds (SVOCs)	1

5.8.2 Geotechnical analysis of soils

Where appropriate, disturbed, bulk and undisturbed soil samples were taken for geotechnical classification testing with the depth and nature of samples detailed within the exploratory hole records.

Where appropriate, testing was undertaken in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes or, where superseded, by the relevant part of BS EN ISO 17892:2014 Geotechnical investigation and testing - Laboratory Testing of Soil. Tests carried out

in order to classify the concrete class required on-site have been undertaken following the procedures within BRE SD1:2005.

The programme of geotechnical tests undertaken on samples obtained from the intrusive investigation is presented in **Table 7**. The results are presented in **Appendix G**.

Table 7 Summary of geotechnical testing undertaken

Stratum	Tests undertaken	Number of tests
Kempton Park Gravel (granular and cohesive soils)	Particle Size Distribution	6
	pH and water soluble sulphate	7
Thanet Formation (granular)	Particle Size Distribution (Sieve and Pipette)	2
	pH and water soluble sulphate	2
	Moisture content and Atterberg Limits determination	2
Seaford Chalk Formation	pH and water soluble sulphate	4
	Saturated moisture content	1

5.8.3 Chemical analysis of groundwater samples

Groundwater samples were collected in containers appropriate to the anticipated testing suite required. The containers were filled to capacity and placed in a cool box to minimise volatilisation.

Chemical testing undertaken on water samples obtained during the monitoring programme is presented in **Table 8** with the laboratory testing results contained in **Appendix G**.

Table 8 Summary of chemical testing of groundwater samples

Sample type	Tests undertaken	Number of tests per visit	Number of visits
Groundwater	Metals-9 (As, Cd, Cu, Cr, Pb, Ni, Hg, Se, Zn)	1	1
	Speciated PAH16MS	1	1
	Speciated TPH-CWG	1	1
	Hardness ($CaCO^3$)	1	1
	Volatile Organic Compounds (VOCs) plus TICs	1	1

6 SITE INVESTIGATION FACTUAL FINDINGS

The results of the intrusive investigation and subsequent geo-environmental and geotechnical laboratory analysis undertaken are detailed below.

6.1 Ground conditions encountered

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater, results in-situ testing and details of monitoring well installations are included on the exploratory hole records presented in **Appendix D.**

The exploratory holes revealed that the site is underlain by a variable thickness of made ground over superficial soils of the Kempton Park Gravel Formation, which is in turn underlain by the Thanet Sand Formation and the White Chalk Subgroup.

For the purpose of discussion, the ground conditions encountered during the fieldworks are summarised in Table 9 with the strata discussed in subsequent subsections.

Table 9 General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum (mbgl)	Proven thickness (m)
Concrete Hardstanding	All exploratory holes	Ground level	0.15 to 0.40
Made ground	All exploratory holes	Ground level	1.00 to 2.00
Kempton Park Gravel	All exploratory holes	0.55 to 2.00	4.80 to 5.50
Thanet Sand Formation	BH01, BH02	6.70 to 7.50	6.00
White Chalk Subgroup	BH02	13.50	Proven to 35.00m (terminal depth of investigation)

6.1.1 Made ground

Beneath a variable thickness of concrete hardstanding, made ground was encountered in all of the exploratory holes and extended to depths between 1.00m and 2.00m below ground level (bgl). It generally comprised a dark brown slightly sandy gravelly silt / gravelly fine to coarse sand with frequent concrete, flint, brick and rare fragments of metal and glass.

6.1.2 Kempton Park Gravel Formation

This stratum was encountered beneath the made ground and extended to depths of between 4.80 and 5.50m below ground level. It comprised a mixture of brown and orangish brown slightly gravelly clayey fine to coarse sand, and a multicoloured slightly sandy subangular to subrounded fine to medium flint gravel.

In WS01 and WS04, the stratum was found to contain horizons of brown slightly sandy gravelly clay and clayey silt.

A summary of the in-situ and laboratory test results recorded in the stratum are presented in **Table 10**.

Table 10 Summary of in-situ and laboratory test results for the Kempton Park Gravel

Soil parameters	Min value	Max value	Reference
Moisture content (%)*	12	19	Appendix G
Modified moisture content (%)*	15	21	Appendix G
Liquid limit (%)*	30	47	Appendix G
Plasticity limit (%)*	14	27	Appendix G
Plasticity index (%)*	16	21	Appendix G
Modified plasticity index (%)*	10	20	Appendix G
Plasticity term*	Low	Intermediate	Appendix G
Volume change potential*	Low		Appendix G
Particle size distribution: Gravel Sand Silt/clay	 65 26 1	 71 34 3	Appendix G
SPT 'N' values	6	>50	Figure 3
Density term	typically medium dense to dense	Very dense	

*denotes cohesive portion of stratum

6.1.3 Thanet Formation

Beneath the Kempton Park Gravel, the Thanet Formation was encountered to a depth of 13.5m bgl. It generally comprised a very dense dark brownish grey and grey silty fine sand. At the boundary with the underlying chalk (encountered in BH1 only), the sand contained abundant black flint cobbles (commonly referred to as the 'Bullhead Beds').

A summary of the in-situ test results recorded in the stratum are presented in **Table 11**.

Table 11 Summary of in-situ and laboratory test results for the Thanet Formation

Soil parameters	Min value	Max value	Reference
SPT 'N' values	11	48	Figure 4
Density term	Medium dense	Very Dense	

6.1.4 White Chalk Subgroup

Beneath the Thanet Sand Formation, the White Chalk Subgroup was encountered in BH01 only at a depth of 13.50 mbgl and was proven to extend below the terminal depth of investigation (35.00mbgl).

An accurate description of the chalk is difficult to determine due to the destructive percussive nature of the sampling technique. The stratum was generally recovered as a structureless chalk composed of a soft off-white gravelly silt. The occasional gravel comprised clasts of very weak chalk and flint gravel.

A summary of the in-situ and laboratory test results recorded in the stratum are presented in **Table 12**.

Table 12 Summary of in-situ and laboratory test results for White Chalk Subgroup

Soil parameters	Min value	Max value	Reference
SPT 'N' values	7	43	Figure 3
Inferred CIRIA chalk grade	Dm to Dc		-

6.1.5 Visual/olfactory evidence of soil contamination

Other than extraneous pieces of man-made material within the made ground (such as fragments of metal and glass), no evidence of contamination was observed during the siteworks i.e. no evidence of hydrocarbon staining, odours or asbestos containing materials.

6.2 Groundwater

Groundwater was encountered within the Kempton Park Gravel Formation at depths of between 5.40 and 6.50m, subsequently rising to 5.00m and 6.00m in BH02 and BH01 respectively. Details are presented on the exploratory hole records in **Appendix D**.

6.2.1 Groundwater encountered during monitoring

Groundwater was recorded as standing at a depth of 5.12mbgl within BH01 when monitored on the 14 August 2020.

6.3 Chemical laboratory results

The soil and groundwater testing results are presented in **Appendix F**.

No asbestos was detected in any of the soil samples tested.

6.4 Geotechnical laboratory results

The results of the geotechnical testing are discussed in **Section 10** and presented in **Appendix G**.

6.5 Ground gas monitoring

The results of the ground gas monitoring and testing carried out are given in **Appendix E** and discussed in **Section 7.4**.

7 GEO-ENVIRONMENTAL ASSESSMENT

7.1 Refinement of initial CSM

The findings of the intrusive investigation generally confirmed the conclusions of the initial conceptual site model. Whilst the CSM indicated potential risks associated with on-site storage and underground fuel tanks, a subsequent petroleum officer search confirmed that they held no records of any petroleum storage tanks on the site (this is included as **Appendix H**.)

Groundwater has also been shown to be present below a depth of at least 5mbgl.

7.1.1 Linkages eliminated after refinement of the initial CSM

Based on the discussion above, any linkages associated with the presence of underground petroleum storage tanks have been removed.

The remaining linkages are considered to remain unchanged.

7.2 Linkages for assessment

In line with CLR11 (Environment Agency, 2004), there are two stages of quantitative risk assessment, generic (GQRA) and detailed (DQRA). The GQRA comprises the comparison of soil, groundwater, soil gas and ground gas results with generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted.

Based on the findings of the previous PRA, the potentially complete contaminant linkages that require further assessment and the methodology of assessment are presented in **Table 13.**

Table 13 Linkages for GQRA

Potentially relevant contaminant linkage	Assessment method
Soil	
1. Oral, dermal and inhalation exposure with impacted soil, soil vapour and dust by future residents	Human health GAC in **Appendix I** for a proposed "residential without home grown produce" end use since the proposed end use comprises a new residential apartment block. Although there are no soft landscaped areas nor residential occupancy at ground level, the residential GAC has still been used for conservatism and would accommodate an element of change to development proposals, should this occur. Statistical assessment not carried out due to limited sample size.
2. Inhalation exposure of future residents to asbestos fibres	Qualitative assessment based on the asbestos minerals present, their form, concentration, location and the nature of the proposed development.

Potentially relevant contaminant linkage	Assessment method
3. Uptake of contaminants by vegetation potentially impacting plant growth (phytotoxicity)	Comparison of soil data to GAC in **Appendix J** for phytotoxicity.
4. Contaminants permeating potable water supply pipes	Comparison of soil data to GAC in **Appendix K** for plastic water supply pipes using UKWIR (2010) guidance.
Water	
5. Migration of dissolved phase contaminants to wider secondary aquifer	Comparison of groundwater data to relevant GAC based on UK Drinking Water Standard (DWS) in Table 1 of **Appendix L**. GAC chosen as site is not located within a Source Protection Zone nor within 500m of a surface watercourse.
6. Inhalation exposure of future residents to vapour from groundwater	GrAC in **Appendix M** for groundwater based on indoor inhalation exposure to contaminants in the vapour-phase allowing for a consideration of a capillary fringe.
Ground gas	
7. Concentrations of methane and carbon dioxide in ground gas entering and accumulating in enclosed spaces or small rooms in new buildings, which could affect future site users. For methane this could create a potentially explosive atmosphere, while death by asphyxiation could result from carbon dioxide.	Gas screening values (GSV) have been calculated using maximum methane and carbon dioxide concentrations with maximum flow rates recorded at the site. The GSV have been compared with the revised Wilson and Card classification presented in BS8485.

7.3 Methodology and assessment of soil results

The analysis of laboratory results relating to soil samples submitted for testing, including leachate analysis, is included in the following sections.

7.3.1 Oral, dermal and inhalation exposure with impacted soil by future occupants/site users

In order to assess the soil results against the appropriate GAC, the soil results have been split into appropriate data sets relevant to the oral, dermal and inhalation linkage.

The datasets being considered in the assessment are:

- data set 1 made ground – 5 samples
- data set 2 natural soils (Kempton Park Gravel) – 1 sample

As an initial assessment of each dataset, the soil results in each dataset have been directly compared against the GAC for a 'residential without home grown produce' end use.

7.3.1.1 Dataset 1 – made ground

All made ground results have been compared with the "residential without home grown produce" GAC. A soil organic matter (SOM) of 2.5% has been selected since laboratory results within the made ground range from 1.1% and 5.0%. The soil screening output spreadsheet is presented as **Appendix O**.

Assessment of the results indicates exceedances of the GAC for the contaminants shown in **Table 14**. These are highlighted in red on the screening output spreadsheet.

Table 14 Data summary table – made ground

Determinand	No of samples tested	GAC (mg/kg)	No of exceedances	Maximum concentration (mg/kg)	
				Value	Location/depth (mbgl)
Lead	5	310	4	1060	WS1 @ 0.4m
				649	WS2 @ 0.4m
				401	WS4 @ 0.4m
				334	WS5 @ 0.6m
Dibenzo(ah)anthracene	5	0.32	1	0.32	WS2 @ 0.4m

The findings of the direct comparison exercise of non-targeted samples have revealed exceedances of Lead and dibenzo(ah)anthracene within the shallow made ground beneath the site. Whilst the concentration of dibenzo(ah)anthracene is not considered a cause for concern (as it has been recorded directly at its threshold value and through further assessment using benzo(a)pyrene as a surrogate marker), unacceptable concentrations of lead have been recorded in the soils that will require further consideration.

7.3.1.2 Dataset 2 – natural soils

The results of the single natural sample have been compared with the "residential without home grown produce" GAC. A soil organic matter (SOM) of 1 % has been selected.

The results indicate that all contaminants are below the relevant GAC therefore it is considered that a relevant contaminant linkage does not exist.

7.3.2 Inhalation exposure of future occupants/site users to asbestos fibres

The visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos found no detectable asbestos fibres within the samples of made ground and natural soils.

7.3.3 Uptake of contaminants by vegetation potentially inhibiting plant growth (phytotoxicity)

The results have been compared with the GAC presented in **Appendix J** for this linkage. The average pH used to calculate the UCLs was taken as >7.

The results indicate that a relevant contaminant linkage may exist associated with phytotoxic effects for lead and mercury, both of which have been recorded within the made ground in excess of their respective GACs.

7.3.4 Impact of organic contaminants on potable water supply pipes

For initial assessment purposes, the results of the investigation have been compared with the GAC presented in **Appendix K** for this linkage, which are reproduced from *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

The results indicate that a relevant linkage is likely to exist associated with organic contaminants and therefore it is recommended that contaminant resistant water supply pipes (i.e. ductile iron or PE barrier pipe) are allowed for on the development.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipes are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

7.4 Methodology and assessment of water results

The site is not located within a sensitive area in terms of groundwater resources, as it is located neither inside a Source Protection Zone (SPZ) nor within 500m of a surface watercourse. A surface water feature (a lake) is present 400m to the west.

The groundwater levels recorded to date indicate the presence of a groundwater table within the granular soils of the Kempton Park Gravel at a depth of approximately 5.1mbgl. Due to the limited data points, groundwater direction is not known. It is possible that groundwater may flow towards the lake to the west, otherwise it is most likely to flow towards the River Thames, located approximately 1.8km to the north.

7.4.1 Dissolved phase migration of contaminants to wider aquifer

The analytical results for groundwater samples (presented in **Appendix F**) were compared against UK Drinking Water Standards (DWS), presented in **Appendix L**. The results are all below the DWS,

except for benzo(a)pyrene, indicating contaminant linkages to the wider aquifer associated with contaminants in the dissolved phase are largely incomplete.

The concentrations of benzo(a)pyrene were recorded at 0.06ug/l, above the DWS of 0.01ug/l. However, in the absence of any immediate sensitive receptors, the marginal exceedance of the concentration recorded and the expected generally poor groundwater quality associated with the industrial history of the area, the recorded concentration is not considered a cause for concern.

7.4.2 Inhalation exposure of future residents to vapours from groundwater

Inhalation exposure from VOC within groundwater has initially been assessed through the direct comparison of groundwater data with the RSK GrAC presented in Appendix M.

The GrAC for groundwater is based on indoor inhalation exposure to contaminants in the vapour-phase. Based on the refined conceptual model, a sand soil has been selected and a groundwater depth of 5 m.

The analytical results are below the GrAC indicating that the contaminant linkage is incomplete.

7.5 Ground gas risk assessment

7.5.1 Appropriate guidance

The risks to development from ground gases have been assessed in accordance with BS8485:2015, which provides guidance on ground gas (methane and carbon dioxide) characterisation and hazard assessment, as well as a framework for the prescription of protection measures within new buildings.

The process involves characterising the gas hazard from combining the qualitative assessment of risk (using the conceptual site model) with ground investigation data so that a 'characteristic situation' (CS) can be derived for the site. Characteristic situations range from CS1 to CS6, the higher the CS the higher the hazard potential. Protection measures within new buildings can be prescribed using a point scoring system, taking into consideration the CS and the proposed building type.

BS8485 indicates that the gas hazard can be characterised using the following methods:

- an empirical semi-quantitative approach using gas monitoring data to determine the 'characteristic situation' of the site (or zones of the site) and subsequent protective measures (Wilson and Card approach);
- an empirical semi-quantitative approach using TOC data to determine the 'characteristic situation' of the site (or zones of the site) and subsequent protective measures (CL:AIRE RB17 approach);
- detailed quantitative assessment methodologies

For the purpose of this assessment, the first approach listed above has been used to characterise the gas hazard and provide advice on the protective measures likely to be required within new buildings at the site.

7.5.2 Summary of the refined conceptual site model for ground gas

In the assessment of risks and selection of appropriate mitigation measures, BS8485 highlights the importance of the conceptual model. In summary, potential sources of ground gas within influencing distance of the site identified in the CSM of the previous PRA comprised:

- On-site and off-site made ground (low generation potential); and
- chalk at depth below the site (very low generation potential)

The investigation carried out to date revealed a maximum 2m thickness of made ground, comprising a dark brown slightly sandy gravelly silt/gravelly fine to coarse sand with frequent concrete, flint, brick and rare fragments of metal and glass. Maximum TOC was 5%. On this basis, the on-site made ground is not considered a viable ground gas source.

Monitoring pipes were installed within natural soils to assess background concentrations of ground gases.

This assessment has been undertaken to assess risks to building structures and proposed end users. The assessment has not taken into consideration the health and safety of construction workers. Risks may still be present to construction workers especially where works include the entry into excavations within the ground. Construction workers should undertake appropriate risk assessments and risks should be managed through health and safety procedures and safe systems of work.

The risk assessment has been undertaken based on the current understanding of the previous CSM.

7.5.3 Empirical semi-quantitative approach using borehole monitoring data (Wilson and Card approach)

7.5.3.1 Permanent gases – methane and carbon dioxide

The empirical semi quantitative approach using gas monitoring data is based on calculations of the gas screening value (GSV). BS8485 defines the GSV as the *'flow rate (l/hr) of a specific hazardous gas representative of a site or zone, derived from assessment of borehole concentration and flow rate measurements and taking account of all other influencing factors, in accordance with a conceptual site model'.*

Once derived for both methane and carbon dioxide the GSVs are compared to the thresholds presented in Table 2 of BS8485, so that a CS can be determined for the site, or a zone. It is important to note that the GSV thresholds are guideline values and not absolute. The GSV thresholds may be exceeded in certain circumstances, if the site conceptual model indicates it is safe to do so. Similarly, consideration of additional factors such as very high concentrations of methane, should lead to consideration of the need to adopt a higher risk classification than the GSV threshold indicates.

The results of the ground gas monitoring and testing undertaken at the site are given in Appendix E.

The maximum results recorded are presented in Table 15.

The range of atmospheric pressure over the monitoring completed to date was 1016 mbar.

Table 15 Summary of ground gas monitoring results

Borehole	Response zone / stratum	Probable source(s) of ground gas	Number of monitoring visits	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Flow rate (l/hr)	Water level (mbTOC)	Atmospheric pressure (mbar)
BH01	KPG	Natural	2	0.0 to 0.3	0.3 to 2.1	15.1 to 19.4	0.0 to 0.1	5.12	1014 to 1016
WS01	KPG	Natural	2	0.0 to 0.3	0.3 to 2.6	17.6 to 20.8	0.0	DRY	1014 to 1016
WS02	KPG	Natural	2	0.0 to 0.1	1.8 to 2.4	17.0 to 19.3	0.0 to 0.4	DRY	1014 to 1016
WS03	KPG	Natural	2	0.0 to 0.3	3.8 to 4.1	15.8 to 16.2	0.0	DRY	1013 to 1016
WS04	KPG	Natural	2	0.0 to 0.2	2.9 to 3.1	16.7 to 17.4	0.0 to 0.1	DRY	1015 to 1016

Note: MG – Made Ground, KPG = Kempton Park Gravel

Maximum concentrations and flows are presented in this table (Oxygen minimum concentrations presented)

BS8485 suggests that the GSV should be derived by multiplying the worse credible (worst case) recorded flow value in any standpipe in that strata or zone with the maximum gas concentration in any other standpipe in that strata or zone. Further guidance is given in BS8485 section 6.3.

Considering the assessment of the gas monitoring results the following maximum GSVs have been derived for the site.

- methane GSV (0.0012 l/hr) = methane concentration (0.3% v/v)/100 x flow rate (0.4 l/hr);
- Carbon Dioxide GSV (0.0164 l/hr) = carbon dioxide concentration (4.18 % v/v)/100 x flow rate (0.4 l/hr).

Based on the GSVs derived and the method for determining the CS presented within Table 2 of BS8485, the site has been characterised as 'Characteristic Situation 1' ('CS1') and 'Green'.

The monitoring programme carried out has comprised 2No visits to establish baseline conditions and to support the findings of the initial CSM, which outlined a low risk of ground gas ingress. The investigation and the monitoring have yielded no obvious ground gas sources, together with low concentrations of ground gases and negligible flow rates. On this basis, no further ground gas monitoring visits are considered necessary.

7.5.4 Implications

Based on the current understanding of the conceptual site model and the assessment undertaken, the site has been classified as CS1 and 'Green'. Considering the foregoing and in accordance with BS8485, ground gas protective measures are not considered necessary within proposed buildings.

7.6 Uncertainties and implications in refined CSM and GQRA

In accordance with good practice, data gaps and uncertainties in the refined CSM have been identified at this stage. These are summarised in **Table 16** along with the likely implications.

Table 16 Data gaps and uncertainties

Data gap / uncertainty	Details	Implications
Asbestos not found in made ground samples tested	Although not encountered to date, asbestos containing material (ACM) could still be present in discrete locations	Vigilance should be maintained for any potential ACM or fibrous material during below ground works
Only one round of groundwater monitoring completed to date	There may be seasonal variations in water levels that could affect the direction of groundwater flow or migration pathways	Further groundwater monitoring and/or sampling may be needed over a longer time period to assess such effects
Site access constraints	Due to active nature of site and small areas inaccessible with drilling equipment, there were some areas of the site that could not be directly investigated	There may be small hotspots of as-yet undiscovered contamination that were not encountered during the site investigation

8 PRELIMINARY WASTE ASSESSMENT

In accordance with the definition provided in the Waste Framework Directive (WFD), materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Naturally occurring soils are not considered waste if reused on the site of origin for the purposes of development. Soils such as made ground that are not of clean and natural origin (irrespective of whether they are contaminated or not) and other materials such as recycled aggregate, do not become waste until the criteria above are met. Further background information is provided in **Appendix N**.

Excavation arisings from the development may therefore be classified as waste if surplus to requirements or unsuitable for reuse. The following assessments assume the material tested is classified subsequently as waste.

RSK recommends that a Sampling Plan be prepared to support any waste classifications and hazardous waste assessments, prior to any material being excavated. Given the level of data obtained, scale of the development and heterogeneity of the site soils, the following assessment should be considered indicative and further assessment should be undertaken following the preparation of a waste sampling plan.

8.1 Hazardous waste assessment

Technical Guidance WM3 (EA, 2018) sets out in Appendix D requirements for waste sampling. It is a legal requirement to correctly assess and classify waste. The level of sampling should be proportionate to the volume of waste and its heterogeneity. The preliminary assessment provided below is based only upon the available sample results and may not be sufficient to adequately classify the waste.

8.1.1 Chemical contaminants

Envirolab, an RSK company, has developed a waste soils characterisation assessment tool (HASWASTE), which follows the guidance within Technical Guidance WM3. The analytical results have been assessed using this tool to assess the hazardous properties to support potential off-site disposal of materials in the future. Note that it is ultimately for landfills to confirm what wastes they are able to accept within the constraints of their permit.

The results are summarised in **Table 17** and presented in full in **Appendix P**.

Table 17 Results of waste soils characterisation assessment (HASWASTE)

Sample reference / location	Strata/ Dataset	Hazardous?	Hazardous property	Contaminants
WS1 (0.4m)	MG	Yes	Carcinogenic HP7	Lead
WS2 (0.4m)	MG	No	N/A	N/A
WS3 (0.4m)				
WS4 (0.4m)				
WS5 (0.6m)				
WS2 (0.6m)	Natural			

On the basis of the HASWASTE assessment, the made ground at location WS1 was found to exhibit hazardous properties, associated with elevated concentrations of lead.

The remaining samples were not found to exhibit hazardous properties and are likely to be classed as either a non-hazardous or inert waste.

It should be noted that the typical hazardous threshold value for lead is 1,000mg/kg, in which case concentrations at WS1 (1,060mg/kg) have only marginally exceeded this threshold. The remaining samples of made ground have all returned much lower concentrations such that the mean lead concentration in the dataset is 539mg/kg (and a US95 upper confidence limit of 850mg/kg), based upon 5 samples. The receiving landfill should be contacted to discuss this and ascertain whether they would be happy to accept the soils as a less onerous classification.

8.1.2 Asbestos within waste soils

Technical Guidance WM3 requires that within a mixed waste the separately identifiable wastes be assessed separately.

For instance, where waste soil contains identifiable pieces of asbestos (visible to the naked eye) the asbestos should, where feasible, be separated from the soil and classified separately. This should be disposed of within a hazardous, stable non-reactive hazardous waste landfill or a special cell in a non-hazardous waste landfill.

Samples of made ground and natural soils were collected from site and analysed for the presence of asbestos, the results of which are presented in **Appendix F**. Analysis confirmed that asbestos is not present within the soil samples sent for laboratory analysis.

8.2 WAC assessment

A single sample of made ground (WS3 at 0.4m) was submitted for waste acceptance criteria (WAC) testing (single stage), the results of which are presented in **Appendix Q**.

The results of the WAC testing indicate that the leaching limit values for inert waste (sulphate and total dissolved solids) have been exceeded and therefore the waste is not suitable for disposal within an inert landfill but should be disposed of at a landfill or treatment facility which is permitted to take non-hazardous waste.

Uncontaminated natural soils, anticipated to be won from both foundation and drainage excavations, are exempt from WAC testing and will be automatically classed as an inert waste under European Waste Catalogue (EWC) code 17 05 04.

9 CONTAMINATION APPRAISAL

9.1 Identified pollutant linkages

Based upon the findings of the generic quantitative risk assessment (GQRA), the following pollutant linkages have been identified, which will warrant further consideration

- Direct contact (dermal, ingestion and dust inhalation) of lead within shallow made ground by end users of the site in areas of proposed soft landscaping at ground level;
- Root uptake of lead and mercury by vegetation in areas of proposed soft landscaping at ground level; and
- Degradation of plastic utilities by organic contaminants within the shallow made ground

At the time of writing, development proposals for the site do not include any areas of soft communal landscaping at ground level, these areas instead being located on a number of roof terraces. As a result, the pollutant linkages relating to direct contact and root uptake of contaminants are considered to be severed and do not warrant further action.

NOTE: Should development proposals change such that soft areas of landscaping are created at ground level, the pollutant linkages would be viable and mitigation measures would need to be implemented to protect end users and ensure healthy plant growth.

For the remaining linkages, remedial works and/or further assessment will be required to ensure the site is suitable for its intended residential end-use.

9.2 Potential mitigation measures

9.2.1 Contaminant resistant pipes

Elevated concentrations of organic contaminants with respect to water supply pipes were encountered on site. As a result, it is considered that contaminant-resistant pipes will be required for the proposed development.

Underground water supply pipes placed on the site will be laid within trenches. Clean granular fill shall be used as a bedding material for all services and as backfill material for all service trenches.

The specification of upgraded materials or multi-layer barrier pipes for potable water supply on site will be subject to confirmation by the water supply provider.

9.3 Areas of uncertainty and requirement for further works

The investigation was constrained by the active nature of the site and the inability to investigate beneath certain parts of the existing building. There remains the potential for as-yet undiscovered contamination to be present in these areas of the site and it may be beneficial to carry out further investigation once the building has been demolished to confirm the presence or absence of any as-yet undiscovered sources of contamination.

A watching brief should in any case be maintained throughout the demolition and enabling works and should suspicious soils be encountered, works should cease pending advice from a suitably qualified geo-environmental specialist.

9.4 Summary

Based on the current proposed residential end use (with commercial units at ground level), a summary of potential mitigation measures and/or further works are presented in Table 18 below.

Table 18 Summary of mitigation measures/further works

Viable pollutant linkage	Mitigation measures	Comments
Degradation of plastic utilities by organic contaminants within the shallow made ground	Contaminant-resistant pipe laid within clean granular trenches	May need to consult water authority to gain approvals
Areas of uncertainty	**Further Works**	**Comments**
Asbestos not found in made ground samples tested	Maintain watching brief during siteworks. Discovery strategy should be adhered to if asbestos encountered	Although not encountered to date, asbestos containing material (ACM) could still be present in discrete locations
Due to active nature of site and small areas inaccessible with drilling equipment, there were some areas of the site that could not be directly investigated	The site would benefit from additional shallow investigation post-demolition to confirm presence/absence of additional contaminant sources	There may be small hotspots of as-yet undiscovered contamination that were not encountered during the site investigation

10 GEOTECHNICAL ASSESSMENT

10.1 Proposed development

The proposed development is to comprise demolition of the existing structure and redevelopment of the site with a 11-storey block of flats.

Given the anticipated high structural loads, piled foundations are recommended. Details of the proposed development are provided in **Appendix B**.

10.2 Key geotechnical hazards/development constraints

The key risks identified from the available ground investigation data are discussed below:

- Made ground extending to depths ranging between 1m and 2m bgl;
- ground disturbance relating to demolition of existing structure and removal of redundant foundations, drainage etc;
- variable superficial deposits initially comprising both cohesive and granular soils (sand and gravel) and silt; and
- the potential for a' running sand' instability hazard associated with any groundwater seepages (granular superficial deposits and Thanet Formation).

10.3 Ground model and characteristic values

The preliminary ground model summarised in **Table 19** has been adopted for the purpose of the preliminary foundation design recommendations. A conservative ground model has been adopted based upon the ground conditions encountered during the site investigation.

Table 19 Ground model derived from ground investigation

Stratum	Depth (m bgl)	Thickness (m)
Concrete oversite	Ground Level	0.16 – 0.4
Made Ground (including oversite concrete thickness)	0.16 – 0.4	1 - 2
Kempton Park Gravel (River Terrace Deposits)	1 - 2	BH01 (2) and BH02 (4.8)
Thanet Formation	BH01 (4) and BH02 (6.7)	BH01 (9.5) and BH02 (>3.3)
Chalk	BH01 (13.5)	BH01 (>21.5)
Groundwater	BH01 (6.0) and BH02 (5.0)	

The geotechnical design parameters presented in **Table 20** are based on the results of the fieldwork, in-situ and laboratory testing, and reflect RSK's understanding of the proposed

construction at the time this report was written. The designer should assess the applicability of the characteristic values provided below for the design situation under consideration and to ensure that it is a cautious estimate of the value affecting the occurrence of the relevant limit state(s).

Table 20 Summary of characteristic geotechnical design parameters

Design parameter	Stratum			
	Made Ground (granular)	River Terrace Deposits (Sand and Gravel)	Thanet Formation (Fine sand)	Chalk
Unit weight - $\gamma_{,k}$ (kN/m^3)	18.0[1]	20.0[1 Dry] 21.0[1saturated]	21.0[1saturated]	19.0[4]
Peak Effective Angle of Friction - $\phi'_{pk,k}$ (°)	27[2]	36[3]	34[3]	31[4]
Critical State Angle of Friction - $\phi'_{cv,k}$ (°)	25[2]	34[3]	32[3]	-
Effective cohesion - c'$_{,k}$ (kN/m^2)	0[2]	0[2]	0	0[4]

Notes:
[1]Estimated from soil descriptions using Figure 1 & 2 of BS 8002:2015
[2]Assumed empirical values in the absence of testing
[3] Estimated from equations 3 & 4 for coarse soils from BS 8002:2015
[4] Values documented within CIRIA 574 Engineering in chalk

10.4 Foundations

10.4.1 Foundation options

Due to the relatively high structural loads, piled foundations are recommended comprising either a pile and beam foundation or a piled raft type foundation.

10.4.2 Piled foundations

Recommendations for the design and construction of piled foundations in relation to the ground conditions are set out in **Table 21**.

Table 21 Design and construction of piled foundations

Design/construction considerations	Design/construction recommendations	
Pile type	The construction of both bored and driven piles is considered technically feasible at this site.	
Possible constraints on choice of pile type	Given the close proximity of the site to commercial properties and highways infrastructure it is considered possible that the vibration/noise associated with pile driving may not be acceptable.	
Temporary casing	Given the presence of groundwater strikes below about 4m bgl, bored piles will require temporary casing. Alternatively, the use of continuous-flight-auger (CFA) injected bored piles or driven piles usually overcomes this issue.	
Soft superficial deposits	For the purpose of assessing preliminary pile capacities, the thicknesses of Made Ground recorded during the site investigation should be presumed not to contribute to the load-carrying capacity for the piles and have therefore been ignored within the design. Allowance for negative skin friction within the made ground has not been included for preliminary design purposes.	
Man-made obstructions	The presence of buried sub-structures or other obstructions within made ground may lead to some difficulty during piling. A possible buried obstruction was encountered in WS05 at 1.45m bgl. Pre-pile probing could be carried out at each of the pile positions should this be considered of concern. Where buried obstructions are encountered, it will be necessary to either relocate the pile(s) or make allowance for removing the obstruction.	
Hard strata	An allowance should be made for chiselling through bands of flint within the chalk.	
Pile design parameters for granular deposits	Pile design parameter	Continuous Flight Auger (CFA)
	Shaft friction factor (k_s.tan ⍰)	0.58 Kempton Park Gravel 0.54 Thanet Sand
Pile design parameters for White Chalk	Shaft Resistance (τ_{sf})	0.85σ_v' for N>10
	Base Resistance	Qu = 200N Qall = 1800kN/m^2 for N>25
	Limiting shaft friction (kN/m^2)	140
	Factor of safety	(P_{su} + P_{bu})/2.5

Design/construction considerations	Design/construction recommendations
Special precautions relating to bored pile shafts and bases	Bored pile concrete should be cast as soon after completion of boring as possible and in any event the same day as boring. Prior to pile construction, the base of the pile bore should be clean, otherwise a reduced safe working load will be required. Similarly, if the pile bore is left open the shaft walls may relax/soften, leading to a reduced safe working load.

Table 22 Typical pile design resistances for bored/CFA cast-in-situ piles

Typical pile working loads (kN)			
Depth of pile below existing ground level (m)	Pile diameter		
	300mm	450 mm	600 mm
10	235	429	651
15	474	806	1202
20	618	1202	1730
25	-*	1391	2258
10	235	429	651

*Pile material limiting stress

It should be stressed that the above capacities do not take into consideration pile group effects which is more pronounced for a large number of closely spaced piles.

Notwithstanding the above, it is recommended that the detailed advice of a specialist-piling contractor be sought as to the most suitable type of pile for the prevailing ground conditions and as to their lengths and diameters to support the required design loads.

10.4.3 Foundation works risk assessment

It is considered that a piling works risk assessment will not be required since the site is not located within a groundwater source protection zone.

10.4.4 Ground floor slabs and pavement design

In the 1m to 1.5m below the existing ground level, the exploratory holes have revealed a soil profile comprising made ground between 1m and 2m thick. The made ground generally comprises sand and silt.

In pavement design terms, the groundwater conditions are anticipated to comprise a low water table at least 1 m below the pavement formation level.

In view of the variable Made Ground and assuming the upper silt layer is removed, the recommended sub-grade soil CBR value for preliminary road pavement design is 5%. This value assumes that during construction the formation level will be carefully compacted and any

soft/loose spots, silt-rich soil including any hard spots are removed and replaced with well-compacted granular fill.

In-situ CBR testing should be undertaken at the proposed formation level to confirm the CBR value for final pavement design.

Due to the presence of silt locally, the sub-grade soils should be regarded as frost susceptible, based upon the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450mm.

10.5 Excavations for foundations and services

Do to the predominantly granular nature of the made ground, it is considered that open excavations will be relatively unstable, especially if associated with any ground water seepages. It is therefore recommended that excavation support systems are made available during the groundwork stage of the development.

Manned entry into any excavations should not be undertaken without provision of suitable shoring and support and dewatering or suitable regrading and battering of side slopes to safe angles. Confined spaces protocols for the Health and Safety of personnel must be adopted where manned entry into excavations is to be undertaken as low oxygen conditions may be present.

Shallow groundwater was not noted at the time of the investigation and during subsequent groundwater monitoring visits. Surface water seepages however may result in instability of foundations.

Excavation should be possible using conventional site plant. Breakers may be necessary to remove any concrete obstructions within the made ground.

10.6 Chemical attack on buried concrete

This assessment of the potential for chemical attack on buried concrete at the site is based on BRE Special Digest 1: Concrete in aggressive ground, which represents the most up-to-date guidance on this topic currently available in the UK.

Based on testing results, **Table 23** gives the characteristic pH, water-soluble values for soils from each of the geological units and groundwater encountered on-site.

Table 23 Characteristic pH, water soluble sulphate and total sulphate values

Stratum	pH	Water Soluble Sulphate (mg/l)
Made ground	7.72 to 9.51	30 to 1270
River Terrace Deposits	8.95 to 9.28	<10 to 43
Thanet Formation	8.55	39
Chalk	8.30 to 8.69	43 to 87

Based on the results above and following the steps outlined in the BRE guidance, the Design Sulphate Classes and Aggressive Chemical Environment for Concrete classifications are summarised in **Table 24**, on the basis of water soluble sulphate.

Table 24 Concrete design class

Stratum	Groundwater	Water Soluble Sulphate	
		DS Class	AC Class
Made Ground	Mobile	DS2	AC2
River Terrace Deposits	Mobile	DS1	AC1
Chalk	Mobile	DS1	AC1

On the basis of the above assessment and assuming mobile groundwater conditions beneath the site, it is recommended that buried concrete is designed in accordance with Design Sulphate Class DS-2 and Aggressive Chemical Environment for Concrete Class AC-2 (ACEC-AC). This assumes nominally mobile groundwater conditions.

10.7 Infiltration drainage

The ground conditions appear locally suitable from a geotechnical viewpoint for the use of pit soakaways to discharge surface run-off water into upper unsaturated horizon of the River Terrace Deposits. However, it is stressed that soakaways will need to extend to significant depth to ensure that water is discharged beneath the made ground. In addition, it is noted that to-date no infiltration tests have been performed to confirm this preliminary assessment and the actual infiltration characteristics of the sub-soils. For environmental reasons, careful consideration will have to be given to selecting their locations and design details.

The EA should be contacted at the design stage in order to obtain a 'consent to discharge'. This may not be forthcoming where soakage will be into or just above the water table (i.e. where deeper made ground is present), particularly given the site's location within the Agency's sensitive aquifer protection zones. In addition, planning and building control approval will have to be sought for their use.

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

11.1.1 Geo-environmental assessment

Based upon the findings of the generic quantitative risk assessment (GQRA), the following pollutant linkages have been identified, which will warrant further consideration

- Degradation of plastic utilities by organic contaminants within the shallow made ground

At the time of writing, development proposals for the site do not include any areas of soft communal landscaping at ground level, these areas instead being located on a number of roof terraces. As a result, pollutant linkages relating to direct contact and root uptake of contaminants are considered to be severed and do not warrant further action.

For the remaining linkages, remedial works and/or further assessment will be required to ensure the site is suitable for its intended residential end-use.

A gas classification of 'Characteristic Situation 1' and 'Green' has been calculated on the basis of the low risk of ground gases and the two supporting two monitoring visits carried out to date. Therefore gas protection measures are not considered to be required for the development.

Should unforeseen contamination be encountered during the development then specialist advice should be sought to determine the appropriate course of action.

The made ground is considered to be suitable for disposal as a non-hazardous waste, although it is possible that soils at WS01 may need to be removed as a hazardous waste if the receiving landfill site deems it necessary. All natural arisings would be automatically classed as an inert waste.

11.1.2 Geotechnical assessment

The key risks identified from the available ground investigation data are discussed below:

- Made ground between 1m and 2m below ground level;
- The made ground is generally granular in nature and locally silt-rich;
- There is the potential for buried obstructions (i.e. WS05 at 1.45m bgl)

Whilst the ground conditions are considered technically feasible for the adoption of spread foundations, due to relatively high structural loads, piled foundations are recommended.

It is considered that a foundation works risk assessment report may be required for the development due to piling into the White Chalk.

Subject to inspections and proof rolling, the sub-grade soils (granular made ground) are considered suitable for the adoption of ground bearing floors and pavement construction. For preliminary design purposes, a CBR of 5% can be assumed. Due to the variability within the stratum, the sub-grade soils should be regarded as being frost susceptible. Following preparation of the proposed sub-grade formation soils, plate loading tests should be carried out to confirm design parameters.

On the basis of the above assessment and assuming mobile groundwater conditions beneath the site, it is recommended that buried concrete is designed in accordance with Design Sulphate Class DS-2 and Aggressive Chemical Environment for Concrete Class AC-2.

The ground conditions appear locally suitable from a geotechnical viewpoint for the use of pit soakaways to discharge surface run-off water into upper unsaturated horizon of the River Terrace Deposits. However, it is stressed that soakaways will need to extend to significant depth to ensure that water is discharged beneath the made ground. In addition, it is noted that to-date no infiltration tests have been performed to confirm this preliminary assessment and the actual infiltration characteristics of the sub-soils. For environmental reasons, careful consideration will have to be given to selecting their locations and design details, particularly given the site's location within the Agency's sensitive aquifer protection zone.

11.2 Recommendations

At this stage, remedial measures are likely to include the adoption of contaminant resistant pipes laid in clean granular trenches.

Should development proposals change such that soft areas of landscaping are created at ground level, then mitigation measures (the implementation of a clean cover capping system) would need to be implemented to protect end users and ensure healthy plant growth.

Further sampling beneath the remainder of the building may be beneficial once it has been fully demolished to confirm the absence of additional as-yet undiscovered contaminant sources.

A Remediation Method Statement is likely to be required to discharge future planning conditions.

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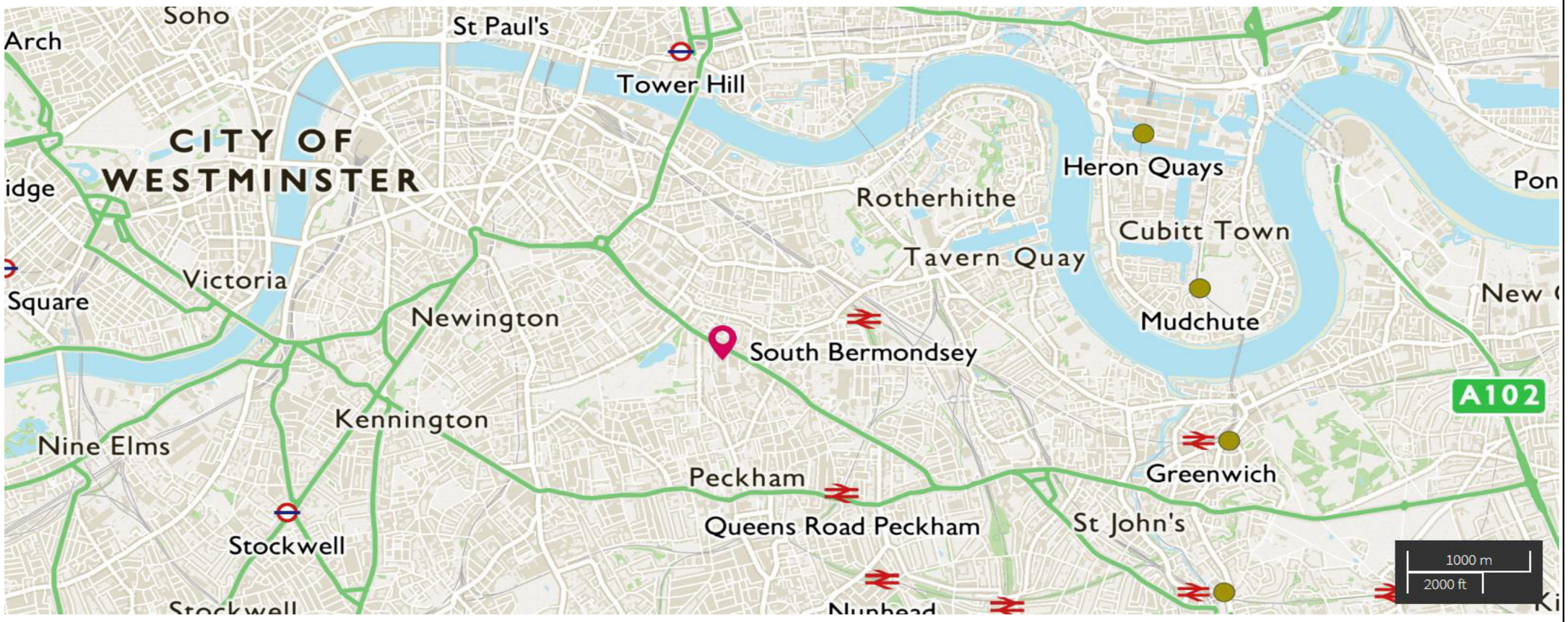
FIGURES



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Drawing Title

Figure 1 - Site Location Plan

Project Title

2-10 Ossory Road, Peckham, SE1 5AN

Client

Pocket Living

Project Number

29909 R02

Legend

- Cable percussion boreholes
- Shallow window sampler boreholes

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Drawing Title
Figure 2 - Exploratory Hole Location Plan

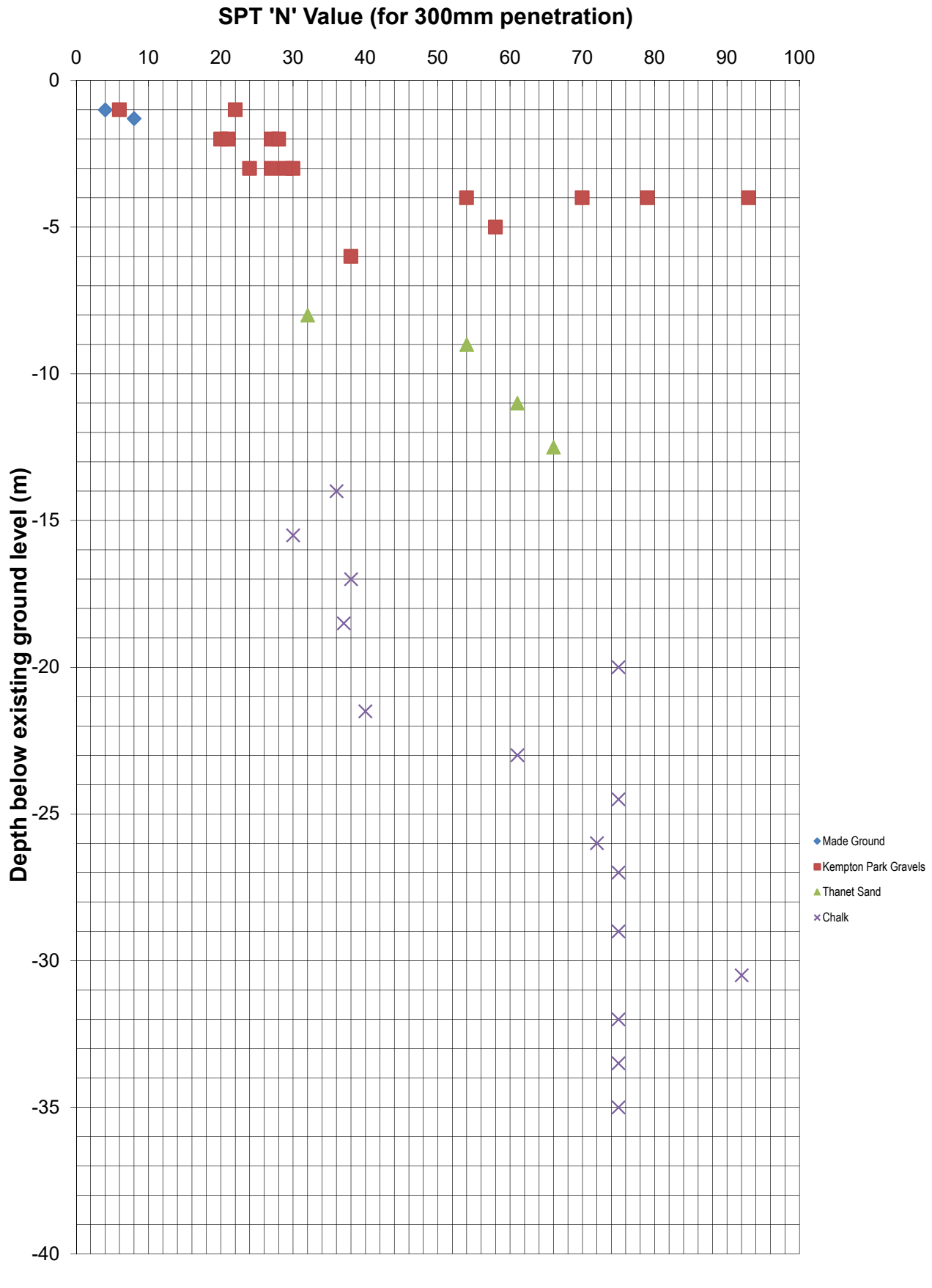
Project Title
2-10 Ossory Road, Peckham, SE1 5AN

Client
Pocket Living

Project Number
29909 R02

SPT 'N' Values vs Depth

Site:	Client:	Job Number:	29909
Ossory Road, Peckham	Pocket Living	Figure:	4



APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Pocket Living (the "client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the "client", dated April 2020.. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):
    a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.
    b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

8. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

9. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

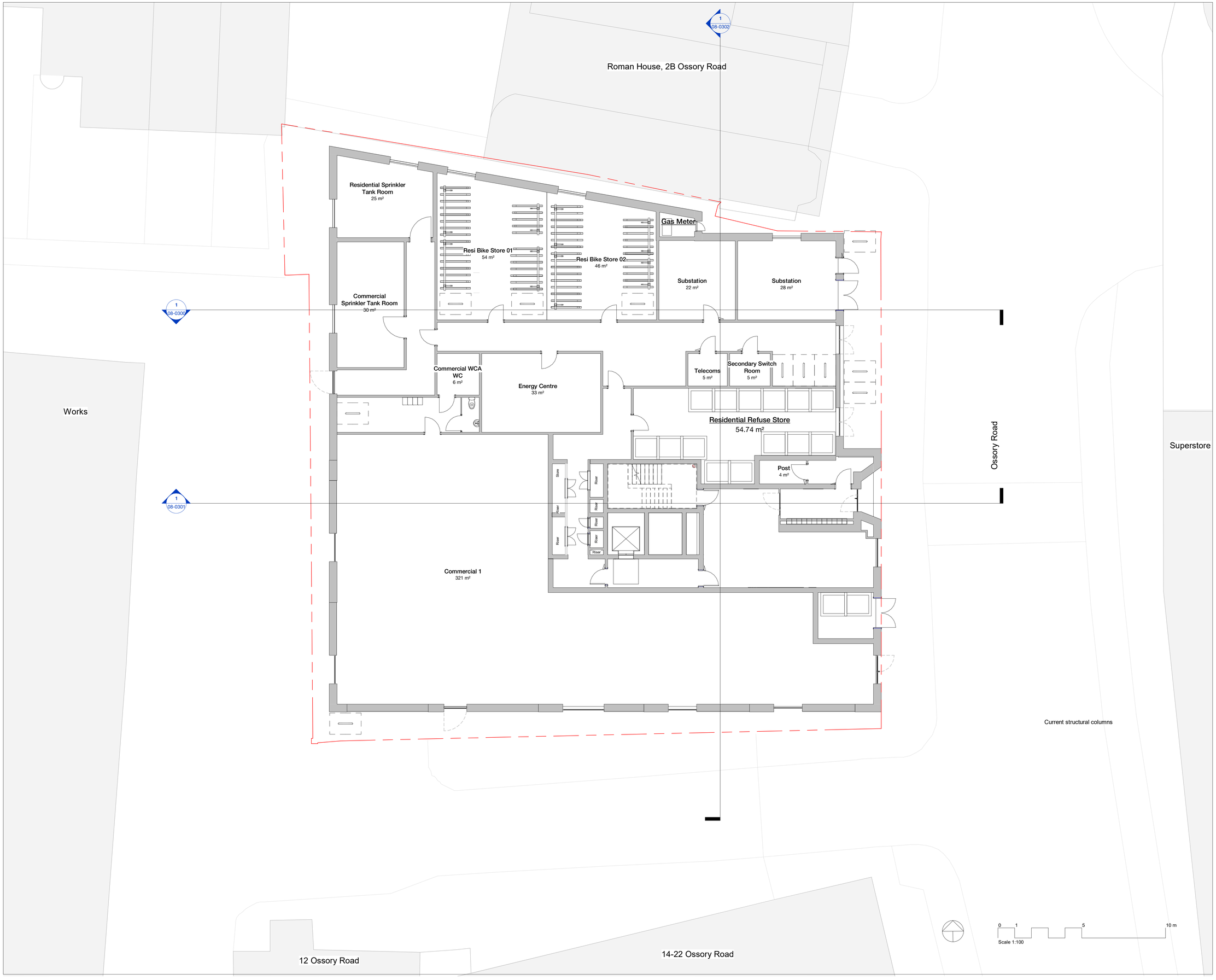
10. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

11. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

12. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

13. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B
DEVELOPMENT DRAWINGS



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conjunction with Architect's specification and other consultant information.

Rev	Description	Date

DRAFT
issued
09/08/21

- Site Boundary
- Cyclist Access Route
- For detailed furniture layouts refer to 20-0600

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Project
Pocket Living, Ossory Road
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London SE1

Drawing
Ground Floor Plan

Scale @ A1	Date
1 : 100	03/06/21
Drawn By: AB	Checked By: GW
Job Number: 18075	Status: S0
Purpose of Issue: Coordination	
Drawing No.: PLOR-HBA-01-00-SK-A-08-0100	Rev

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09/08/21

Site Boundary

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Project
Pocket Living, Ossory Road
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Peckham
London SE1

Drawing
Level 01 Floor Plan

Scale @ A1	Date
1 : 100	09/12/19
Drawn By	**Checked By**
AB	GW

Job Number	Status	Purpose of Issue
18075	S0	Coordination

Drawing No. Rev
PLOR-HBA-01-01-SK-A-08-0101

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Site Boundary

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1 3 4 5 6 7 8 9 10

A B C D E F G H J

2.02 1B1P 37.92 m²
2.03 1B1P 37.92 m²
2.01 1B1P 37.92 m²
2.04 1B1P 37.50 m²
2.05 1B1P (WA) 53.76 m²
2.10 1B1P 37.82 m²
2.09 1B1P 37.92 m²
2.08 1B1P 37.92 m²
2.07 1B1P 37.92 m²
2.06 1B1P 39.82 m²

(Levels 02-09)

0 1 5 10 m
Scale 1:100

Project	Pocket Living, Ossory Road 2 - 10 Ossory Road Peckham London SE1
Drawing	Level 02 Floor Plan

Scale @ A1 1 : 100		Date 02/08/21
Drawn By AB		Checked By TN
Job Number 18075	Status S0	Purpose of Issue Coordination
Drawing No. PLOR-HBA-01-02-SK-A-08-0102		Rev

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Site Boundary

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Project
Pocket Living, Ossory Road
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Peckham
London SE1

Drawing
Level 10 Floor Plan

Scale @ A1	Date
1 : 100	02/08/21
Drawn By	Checked By
AB	TN

Job Number	Status	Purpose of Issue
18075	S0	Coordination

Drawing No. Rev
PLOR-HBA-01-10-SK-A-08-0110

APPENDIX C
SUMMARY OF LEGISLATION AND POLICY RELATING TO CONTAMINATED LAND

Part IIA of the Environmental Protection Act 1990

Part IIA of the Environmental Protection Act 1990 (Part IIA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Planning Policy

Contaminated land is often dealt with through planning because of land redevelopment. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF), reference ISBN: 978-1-5286-1033-9, February 2019.

The new framework has only limited guidance on contaminated land, as follows:

Chapter 11. Making effective use of land

117 Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.

118. Planning policies and decisions should:

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.

Chapter 15. Conserving and enhancing the natural environment

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Ground conditions and pollution

178. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water

- reduce pollution of water, especially by 'priority' and 'priority hazardous' substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2016 (as amended) provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2016 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Notes:

1. *The above information is provided for background but does not constitute site-specific advice*
2. *The above summary applies to England only. Variations exist within other countries of the United Kingdom*

APPENDIX D
EXPLORATORY HOLE RECORDS

BOREHOLE LOG

Contract:	Client:	Borehole:
Ossory Road	**Pocket Living**	**BH01**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	End: **01.07.20**	**---**	**---**	**1** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Concrete	0.30	
0.50	1	B				MADE GROUND: Dark brown slightly sandy gravelly SILT with frequent cobbles of concrete. Gravel is subangular to subrounded fine to coarse flint, brick and concrete. Sand is fine to coarse.	(1.40)	
1.20-1.65	44	U						
1.70	1	D				MADE GROUND: Brown slightly gravelly CLAY with occasional brick fragments. Gravel is subangular to subrounded fine to medium flint.	1.70 2.00	
2.00-2.45	1	SPT(c)	N=21			Medium dense multicoloured very sandy slightly clayey subangular to subrounded fine to coarse GRAVEL of flint. Sand is fine to coarse. (KEMPTON PARK GRAVEL FORMATION)		
2.00-2.50	2	B						
2.70	2	D					(2.00)	
3.00-3.45	2	SPT(c)	N=27					
3.00-3.50	3	B						
3.75	3	D					4.00	
4.00-4.45	3	SPT(c)	N=54			Very dense multicoloured very sandy slightly clayey subangular to subrounded fine to medium GRAVEL of flint. Sand is fine to coarse. (KEMPTON PARK GRAVEL FORMATION)		
4.00-4.50	4	B				. . . Decrease in gravel content with depth below 4.00m depth.		
4.75	4	D						
5.00-5.45	4	SPT(c)	N=58					
5.00-5.50	5	B		4			(3.50)	
6.00-6.45	5	SPT(c)	N=38					
6.00	5	D		4				
							7.50	
7.50	6	D				Dense becoming very dense dark brownish grey silty fine SAND. (THANET FORMATION)		
8.00-8.45	6	SPT(c)	N=32					
8.00-8.50	6	B						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
29/06/20	08:00	0.00	-		0.00
29/06/20	17:00	12.50	-		6.50
30/06/20	08:00	12.50	-		6.50
30/06/20	17:00	29.00	-		6.50
01/07/20	08:00	29.00	-		6.70
01/07/20	12:00	35.50	-		6.70

Chiselling / Slow Progress		
From	To	Duration (hh:mm)
0.00	0.20	00:30

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. Borehole progressed with 8inch casing to 13.00m followed by 6inch casing to 32.00mm.
4. Water added to aid drilling between 1.80 and 12.00m depth.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 4000**	**Trevor Cannon**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log CABLE PERCUSSION LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 24/07/20 - 12:30 | HA2 |

BOREHOLE LOG

Contract:	Client:	Borehole:
Ossory Road	**Pocket Living**	**BH01**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**29.06.20** End: **01.07.20**	**---**	**---**	**2** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results					
9.00-9.45	7	SPT	N=54			Dense becoming very dense dark brownish grey silty fine SAND. (THANET FORMATION) *(stratum copied from 7.50m from previous sheet)*		
9.00	7	D						
9.50-9.95	8	D						
10.00	9	D					(6.00)	
11.00-11.45	8	SPT	N=61					
11.00	10	D						
12.00	11	D						
12.50-12.95	9	SPT	N=66					
12.50-12.95	12	D						
13.00	13	D				. . . Band of subangular to subrounded fine to coarse black flint at 13.00m depth.	13.50	
13.50	14	D				Structureless CHALK recovered as an off-white slightly gravelly SILT with occasional gravel of flint. (WHITE CHALK SUBGROUP)		
14.00-14.50	7	B						
14.00-14.45	10	SPT	N=36					
14.50	15	D						
15.50-15.95	11	SPT	N=30					
15.50-15.95	16	D						
16.50	17	D						
17.00-17.45	12	SPT	N=38					
17.00-17.50	18	D						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

5. Groundwater struck at 6.00m depth, rising to 6.50m depth after 20.00 minutes.
6. 42mm diameter standpipe piezometer (complete with flush protective cover) installed to 8.00m depth on completion. Response zone 2.00m to 8.00m depth.
7. On completion, borehole back filled with

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 4000**	**Trevor Cannon**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log CABLE PERCUSSION LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 24/07/20 - 12:30 | HA2 |

BOREHOLE LOG

Contract:	Client:	Borehole:
Ossory Road	**Pocket Living**	**BH01**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**29.06.20** End: **01.07.20**	**---**	**---**	**3** of **4**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results					
18.00	19	D				Structureless CHALK recovered as an off-white slightly gravelly SILT with occasional gravel of flint. (WHITE CHALK SUBGROUP) *(stratum copied from 13.50m from previous sheet)*		
18.00-18.50	20	D						
18.50-18.95	13	SPT	N=37					
19.00	21	D						
20.00-20.30	14	SPT	10,15/25,25 for 75mm					
20.00-20.50	22	D						
21.00	23	D						
21.50-21.95	15	SPT	N=40					
21.50-21.95	24	D						
22.50	25	D						
23.00-23.45	16	SPT	N=61					
23.00-23.50	26	D						
24.00	27	D					(22.00)	
24.50-24.80	17	SPT	10,15/20,30 for 75mm					
24.50-24.95	28	D						
25.50	30	D						
26.00-26.45	18	SPT	N=72					
26.00-26.50	29	D						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

arisings, bentonite, gravel and concrete cover.
8. Borehole terminated at 35.50m depth.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 4000**	**Trevor Cannon**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log CABLE PERCUSSION LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
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BOREHOLE LOG

Contract:	Client:	Borehole:
Ossory Road	**Pocket Living**	**BH01**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**29.06.20** End: **01.07.20**	**---**	**---**	**4** of **4**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
27.00-27.30	19	SPT	8,12/20,35 for 75mm			Structureless CHALK recovered as an off-white slightly gravelly SILT with occasional gravel of flint. (WHITE CHALK SUBGROUP) *(stratum copied from 13.50m from previous sheet)*		
27.00	31	D						
27.50-27.95	32	D						
28.50	34	D						
29.00-29.23	20	SPT	15,20/40 for 75mm					
29.00-29.45	35	D						
30.00	36	D						
30.50-30.95	21	SPT	N=92					
30.50-30.95	37	D						
31.50	38	D						
32.00-32.23	22	SPT	15,22/38 for 75mm					
32.00-32.45	39	D						
33.00	40	D				. . . Cobble of flint at 33.00m depth.		
33.50-33.73	23	SPT	25,50/50 for 75mm					
33.50-33.95	41	D						
34.50	42	D						
35.00-35.23	24	SPT	25,50/50 for 75mm			. . . Cobble of flint at 35.00m depth.		
35.00-35.45	43	D					35.50	
						Borehole terminated at 35.50m depth.		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 4000**	**Trevor Cannon**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log CABLE PERCUSSION LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
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BOREHOLE LOG

Contract:	Client:	Borehole:
Ossory Road	**Pocket Living**	**BH02**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**11.07.20** End: **12.07.20**	**---**	**---**	**1** of **2**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Concrete	0.15	
0.40-0.70	1	B				MADE GROUND: Dark brown and black slightly silty gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse brick, concrete and flint.	(1.75)	
0.90-1.20	2	B						
1.30-1.75	1	SPT(c)	N=8					
1.30-1.80	3	B					1.90	
1.90	1	D				Medium dense brown and orangish brown slightly gravelly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to medium flint. (KEMPTON PARK GRAVEL FORMATION)		
2.10-2.55	2	SPT(c)	N=12			. . . Increase in clay content below 1.90m depth.		
2.10-2.60	4	B						
2.80	2	D					(2.10)	
3.00-3.45	3	SPT(c)	N=12					
3.00-3.50	5	B					4.00	
4.00-4.40	4	SPT(c)	2,5/11,13,20,6 for 20mm			Very dense multicoloured slightly sandy subangular to subrounded fine to medium GRAVEL of flint. Sand is fine to medium. (KEMPTON PARK GRAVEL FORMATION)		
4.00-4.80	6	B		4		. . . Increase in sand content below 4.00m depth.		
5.00-5.38	5	SPT(c)	4,7/13,18,20 for 75mm	4			(2.70)	
5.00-5.50	7	B						
6.30	3	D					6.70	
6.70	4	D				Very dense brown silty fine to coarse SAND. (THANET FORMATION)		
6.70-7.03	6	SPT	7,10/17,23,10 for 25mm				(1.30)	
6.70-7.00	8	B						
8.00	5	D					8.00	
8.00-8.27	7	SPT	8,15/27,23 for 40mm			Very dense brownish grey and grey slightly clayey fine SAND (THANET FORMATION)		
8.00-8.50	9	B					(2.00)	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
11/07/20	08:00	0.00	0.00		
11/07/20	17:00	8.00	7.50		5.00
12/07/20	08:00	8.00	7.50		5.00
12/07/20	17:00	10.00	9.50		5.40

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. Groundwater struck at 5.00m depth, rising to 5.40m depth after 20 minutes.
4. Borehole terminated at 10.00m depth due to refusal in Thanet Formation.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**David Rosenwold**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log CABLE PERCUSSION LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 24/07/20 - 12:30 | HA2 |

BOREHOLE LOG

Contract:	Client:	Borehole:
Ossory Road	**Pocket Living**	**BH02**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**11.07.20** End: **12.07.20**	**---**	**---**	**2** of **2**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.50	6	D				Very dense brownish grey and grey slightly clayey fine SAND (THANET FORMATION) *(stratum copied from 8.00m from previous sheet)*		
9.70-9.83	8	SPT	12,13/25,25 for 30mm				10.00	
						Borehole terminated due to refusal in Thanet Formation.		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

5. On completion, borehole backfilled with arisings.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Bespoke Rig**	**David Rosenwold**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log CABLE PERCUSSION LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 24/07/20 - 12:30 | HA2 |

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ossory Road	**Pocket Living**	**WS01**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**11.07.20** End: **11.07.20**	**---**	**---**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Concrete	0.21	
	0.40	1	ES				MADE GROUND: Brown slightly gravelly fine to coarse SAND with high brick cobble content. Gravel is subangular to subrounded fine to coarse flint, concrete and brick.	0.50	
							MADE GROUND: Concrete	0.60	
							MADE GROUND: Brick cobbles	(0.40)	
	1.00-1.45 1.00-1.50	1 1	SPT B	N=22			Firm brown slightly sandy CLAY. Sand is fine to coarse. (KEMPTON PARK GRAVEL FORMATION)	1.00 (0.60)	
	1.60-1.90	2	B				Firm off-white mottled light yellowish brown slightly gravelly sandy CLAY (KEMPTON PARK GRAVEL FORMATION)	1.60 (0.30)	
	2.00-2.45 2.00-2.60	2 3	SPT B	N=20			Medium dense brown slightly clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium flint. (KEMPTON PARK GRAVEL FORMATION) . . . Band of clay between 2.00 - 2.20m depth. . . . Band of clay between 2.60 - 2.80m depth.	1.90 (0.90)	
	3.00-3.45 3.00-4.00	3 4	SPT B	N=24			Medium dense becoming very dense brown slightly clayey fine to medium SAND with rare subangular to subrounded fine flint. (KEMPTON PARK GRAVEL FORMATION)	2.80 (1.65)	
	4.00-4.45	4	SPT	N=79				4.45	
							Borehole terminated at 4.45m depth.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. Borehole collapsed to 3.50m upon completion.
5. 42mm diameter standpipe piezometer (complete with flush protective cover) installed to 3.50m depth on completion. Response zone 1.50m to 3.00m depth.
6. Borehole terminated at 4.00m depth.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier rig**	**John Knapp**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log WINDOW SAMPLE LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 24/07/20 - 12:32 | HA2 |

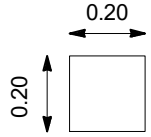
INSPECTION PIT LOG

Contract:	Client:	Trial Pit:
Ossory Road	**Pocket Living**	**WS02**

Contract Ref:	Date:	Ground Level:	Co-ordinates:	Sheet:
29909	**11.07.20**	**---**	**---**	**1** of **1**

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Concrete	0.28	
0.40	1	ES				MADE GROUND: Dark brown and black slightly gravelly sandy SILT with occasional brick fragments. Gravel is subangular to subrounded fine flint and concrete. Sand is fine to medium.	0.55	
0.60	2	ES				Firm dark brown slightly gravelly sandy SILT. Gravel is subangular to subrounded fine flint. Sand is fine to medium. (KEMPTON PARK GRAVEL FORMATION)	(0.35) 0.90	
1.00	1	B				Firm brown slightly clayey SILT with rare subangular to subrounded fine flint. (KEMPTON PARK GRAVEL FORMATION)	(2.30) 3.20	

Plan (Not to Scale)



General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. Borehole terminated at 1.20m depth.
5. 42mm diameter standpipe piezometer (complete with flush protective cover) installed to 1.20m depth on completion. Response zone 0.90m to 1.20m depth.
6. Window sample could not be carried out due to lack of headroom.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Logged By:	Checked By:
Inspection pit + Inspection pit	**Hand tools**	**HAbayatilaka**	BKW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log INSPECTION PIT LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437550, Fax: 01442 437500, Web: www.rsk.co.uk. | 24/07/20 - 12:33 | HA2 |

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ossory Road	**Pocket Living**	**WS03**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**11.07.20** End: **11.07.20**	**---**	**---**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Concrete	0.16	
	0.40	1	ES				MADE GROUND: Dark brown slightly gravelly fine to coarse SAND with medium brick cobble content and rare fragments of metal and glass. Gravel is subangular to subrounded fine to coarse flint, brick, concrete.	(1.04)	
	1.00-1.45	1	SPT	N=4				1.20	
	1.00	1	B						
	1.50	2	B				Loose becoming medium dense brown slightly clayey silty fine to medium SAND with rare subangular to subrounded fine flint. (KEMPTON PARK GRAVEL FORMATION)	(1.15)	
	2.00-2.45	2	SPT	N=27				2.35	
	2.50	3	B				Dense becoming very dense orangish brown slightly silty gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse flint. (KEMPTON PARK GRAVEL FORMATION)	(2.10)	
	3.00-3.45	3	SPT	N=30					
	3.50	4	B						
	4.00-4.45	4	SPT	N=93				4.45	
							Borehole terminated at 4.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. Borehole collapsed to 3.20m upon completion.
5. 42mm diameter standpipe piezometer (complete with flush protective cover) installed to 3.20m depth on completion. Response zone 1.20m to 3.00m depth.
6. Borehole terminated at 4.00m depth.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier rig**	**John Knapp**	**HAbayatilaka**	BW

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log WINDOW SAMPLE LOG - A4P | 29909-OSSORY ROAD.GPJ - v10_01.
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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Ossory Road	**Pocket Living**	**WS04**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
29909	**11.07.20** End: **11.07.20**	**---**	**---**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.40	1	ES				MADE GROUND: Concrete	0.16	
							MADE GROUND: Dark brown slightly gravelly fine to coarse SAND with low brick cobble content. Gravel is subangular to subrounded fine to coarse flint, brick, yellow brick and concrete.	(0.39) 0.55	
	0.80	1	B				MADE GROUND: Dark brown and black slightly gravelly SILT. Gravel is subangular to subrounded fine to medium brick and concrete.	(0.45) 1.00	
	1.00-1.45	1	SPT	N=6			Firm brown slightly sandy CLAY with rare fine subangular to subrounded flint. Sand is fine. (KEMPTON PARK GRAVEL FORMATION)		
	1.00-1.50	2	B					(1.20) 2.20	
	2.00-2.45	2	SPT	N=28					
	2.50-3.00	3	B				Medium dense brown slightly silty SAND and GRAVEL. Gravel is subangular to subrounded fine to medium flint. Sand is fine to coarse. (KEMPTON PARK GRAVEL FORMATION)	(0.80) 3.00	
	3.00-3.45	3	SPT	N=29			Stiff becoming very stiff brown mottled dark grey and off-white slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium flint. (KEMPTON PARK GRAVEL FORMATION)		
	3.00-4.00	4	B					(1.45) 4.45	
	4.00-4.45	4	SPT	N=70					
							Borehole terminated at 4.45m depth.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. Borehole collapsed to 3.60m upon completion.
5. 42mm diameter standpipe piezometer (complete with flush protective cover) installed to 3.60m depth on completion. Response zone 1.60m to 3.00m depth.
6. Borehole terminated at 4.00m depth.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier rig**	**John Knapp**	**HAbayatilaka**	BW

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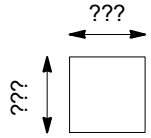
INSPECTION PIT LOG

Contract:	Client:	Trial Pit:
Ossory Road	**Pocket Living**	**WS05**

Contract Ref:	Date:	Ground Level:	Co-ordinates:	Sheet:
29909	**11.07.20**	**---**	**---**	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Concrete	0.10	
						MADE GROUND: Insulation	0.21	
						MADE GROUND: Concrete	0.40	
0.60	1	ES				MADE GROUND: Dark brown slightly gravelly silty fine to coarse SAND with low concrete cobble content. Gravel is subangular to subrounded fine to coarse brick, concrete and flint.	(1.05)	
1.00-1.45 1.00-1.20	1 1	SPT B	N=20				1.45	
						Borehole terminated at 1.45m due to SPT bouncing on possible concrete surface.		

Plan (Not to Scale)



General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. Borehole terminated at 1.20m depth due to refusal.
5. Potential concrete obstruction at 1.20m depth.

All dimensions in metres | Scale: **1:28**

Method Used:	Plant Used:	Logged By:	Checked By:
Inspection pit + Inspection pit	**Hand tools**	**HAbayatilaka**	BKW

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APPENDIX E
GROUND GAS MONITORING DATA

IN-SITU GAS MONITORING RESULTS

	Start Date	End Date	[Pressures]	Previous	During	Start	End	Equipment Used & Remarks
Round R1	23/07/2020	23/07/2020		Constant	Constant	1016	1016	GA2000 + Weather: Cloudy + Ground: Dry + Wind: Medium + Air Temp: 16DegC
Round R2	14/08/2020	14/08/2020		-	Fluctuating	1013	1014	GA5000 + Weather: Overcast + Ground: Dry + Air Temp: 18DegC

Exploratory Position ID	Monitoring Round	Measured Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
BH01	R1	5.50	23/07/2020 11:10:00	1016	1016	$0.0_{(SS)}$	5.50	0.1	0.0	20.9	0.0	3.1	0	0	
BH01	R1	---	15 secs	-	-	-	-	0.1	0.0	17.1	0.0	-	0	0	
BH01	R1	---	30 secs	-	-	-	-	0.1	0.0	16.1	0.0	-	0	0	
BH01	R1	---	60 secs	-	-	-	-	0.3	0.3	15.3	0.0	-	0	0	
BH01	R1	---	90 secs	-	-	-	-	0.4	0.1	15.1	0.0	-	0	0	
BH01	R1	---	120 secs	-	-	-	-	0.5	0.1	15.1	0.0	-	0	0	
BH01	R1	---	180 secs	-	-	-	-	0.7	0.1	15.2	0.0	-	0	0	
BH01	R1	---	240 secs	-	-	-	-	0.8	0.0	15.5	0.0	-	0	0	
BH01	R1	---	300 secs	-	-	-	-	1.0	0.1	15.3	0.0	-	0	0	
BH01	R1	---	360 secs	-	-	-	-	1.1	0.1	15.6	0.0	-	0	0	
BH01	R1	---	420 secs	-	-	-	-	1.3	0.1	15.5	0.0	-	0	0	
BH01	R1	---	480 secs	-	-	-	-	1.5	0.1	15.8	0.0	-	0	0	
BH01	R1	---	540 secs	-	-	-	-	1.9	0.1	16.1	0.0	-	0	0	
BH01	R1	---	600 secs	-	-	-	-	2.1	0.1	16.0	0.0	-	0	0	
BH01	R2	5.48	14/08/2020 09:24:00	1015	1014	$0.1_{(I)}$	5.26	0.1	0.0	20.9	0.0	-	0	0	
BH01	R2	---	30 secs	-	-	-	-	0.1	0.0	20.6	0.0	-	2	0	
BH01	R2	---	60 secs	-	-	-	-	0.1	0.0	20.3	0.0	-	0	0	
BH01	R2	---	90 secs	-	-	-	-	0.1	0.0	20.1	0.0	-	0	0	

Key: I = Initial, Min = Minimum, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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Contract: **Ossory Road**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
BH01	R2	---	120 secs	-	-	-	-	0.2	0.0	19.9	0.0	-	0	0	
BH01	R2	---	180 secs	-	-	-	-	0.2	0.0	19.7	0.0	-	0	0	
BH01	R2	---	240 secs	-	-	-	-	0.2	0.0	19.5	0.0	-	0	0	
BH01	R2	---	300 secs	-	-	$0.4_{(SS)}$	-	0.3	0.0	19.4	0.0	-	0	0	
WS01	R1	---	23/07/2020 10:46:00	1016	1016	$0.0_{(SS)}$	DRY	0.1	0.0	20.9	0.0	0.5	0	0	
WS01	R1	---	15 secs	-	-	-	-	1.0	0.1	20.0	0.0	-	0	0	
WS01	R1	---	30 secs	-	-	-	-	1.2	0.2	19.3	0.0	-	0	0	
WS01	R1	---	60 secs	-	-	-	-	1.3	0.3	19.2	0.0	-	0	0	
WS01	R1	---	90 secs	-	-	-	-	1.7	0.1	18.8	0.0	-	0	0	
WS01	R1	---	120 secs	-	-	-	-	2.2	0.1	18.2	0.0	-	0	0	
WS01	R1	---	180 secs	-	-	-	-	2.6	0.1	17.6	0.0	-	0	0	
WS01	R1	---	240 secs	-	-	-	-	2.6	0.2	17.6	0.0	-	0	0	
WS01	R1	---	300 secs	-	-	-	-	2.6	0.1	17.6	0.0	-	0	0	
WS01	R1	---	360 secs	-	-	-	-	2.6	0.1	17.6	0.0	-	0	0	
WS01	R2	---	14/08/2020 09:14:17	-	-	$0.0_{(I)}$	-	0.2	0.0	21.0	0.0	-	0	0	
WS01	R2	---	15 secs	-	-	-	-	0.1	0.0	21.0	0.0	-	2	0	
WS01	R2	---	30 secs	-	-	-	-	0.0	0.0	21.1	0.0	-	0	0	
WS01	R2	---	60 secs	-	-	-	-	0.0	0.0	21.0	0.0	-	0	0	
WS01	R2	---	90 secs	-	-	-	-	0.0	0.0	21.1	0.0	-	0	0	
WS01	R2	---	120 secs	-	-	-	-	0.0	0.0	21.1	0.0	-	0	0	
WS01	R2	---	180 secs	-	-	-	-	0.0	0.0	21.1	0.0	-	0	0	
WS01	R2	---	240 secs	-	-	-	-	0.2	0.0	20.9	0.0	-	0	0	
WS01	R2	---	300 secs	-	-	-	-	0.3	0.0	20.8	0.0	-	0	0	
WS01	R2	3.36	346 secs	1014	-	$0.0_{(SS)}$	DRY	-	-	-	-	-	-	-	

Key: I = Initial, Min = Minimum, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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GINT_LIBRARY_V10_01.GLB : E - GAS MON - REDUCED - 9A - A4L : 29909-OSSORY ROAD.GPJ : 18/09/20 11:53 : SM4 :

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS02	R1	---	23/07/2020 10:21:00	1016	1016	$0.0_{(SS)}$	DRY	0.1	0.0	20.9	0.0	0.2	0	0	
WS02	R1	---	15 secs	-	-	-	-	2.2	0.1	18.5	0.0	-	0	0	
WS02	R1	---	30 secs	-	-	-	-	2.2	0.0	17.3	0.0	-	0	0	
WS02	R1	---	60 secs	-	-	-	-	2.4	0.1	17.1	0.0	-	0	0	
WS02	R1	---	90 secs	-	-	-	-	2.4	0.0	17.0	0.0	-	0	0	
WS02	R1	---	120 secs	-	-	-	-	2.4	0.1	17.0	0.0	-	0	0	
WS02	R1	---	180 secs	-	-	-	-	2.3	0.0	17.1	0.0	-	0	0	
WS02	R1	---	240 secs	-	-	-	-	2.1	0.1	17.3	0.0	-	0	0	
WS02	R1	---	300 secs	-	-	-	-	2.1	0.1	17.3	0.0	-	0	0	
WS02	R1	---	360 secs	-	-	-	-	2.1	0.1	17.3	0.0	-	0	0	
WS02	R2	---	14/08/2020 09:03:18	-	-	$0.1_{(I)}$	-	0.1	0.0	20.8	0.0	-	0	0	
WS02	R2	---	15 secs	-	-	-	-	1.8	0.0	20.0	0.0	-	1	0	
WS02	R2	---	30 secs	-	-	-	-	1.8	0.0	19.3	0.0	-	0	0	
WS02	R2	---	60 secs	-	-	-	-	1.8	0.0	19.3	0.0	-	0	0	
WS02	R2	---	90 secs	-	-	-	-	1.8	0.0	19.3	0.0	-	0	0	
WS02	R2	---	120 secs	-	-	-	-	1.8	0.0	19.3	0.0	-	0	0	
WS02	R2	---	180 secs	-	-	-	-	1.7	0.0	19.4	0.0	-	0	0	
WS02	R2	---	240 secs	-	-	-	-	1.7	0.0	19.5	0.0	-	0	0	
WS02	R2	---	300 secs	-	-	-	-	1.6	0.0	19.6	0.0	-	0	0	
WS02	R2	1.20	396 secs	1014	-	$0.4_{(SS)}$	DRY	-	-	-	-	-	-	-	
WS03	R1	---	23/07/2020 09:36:00	1016	1016	$0.0_{(SS)}$	DRY	0.1	0.0	20.9	0.0	0.3	0	0	
WS03	R1	---	15 secs	-	-	-	-	3.0	0.1	19.2	0.0	-	0	0	
WS03	R1	---	30 secs	-	-	-	-	3.2	0.1	17.0	0.0	-	0	0	

Key: I = Initial, Min = Minimum, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS03	R1	---	60 secs	-	-	-	-	3.4	0.2	16.6	0.0	-	0	0	
WS03	R1	---	90 secs	-	-	-	-	3.5	0.1	16.5	0.0	-	0	0	
WS03	R1	---	120 secs	-	-	-	-	3.7	0.1	16.3	0.0	-	0	0	
WS03	R1	---	180 secs	-	-	-	-	3.8	0.1	16.3	0.0	-	0	0	
WS03	R1	---	240 secs	-	-	-	-	3.8	0.3	16.2	0.0	-	0	0	
WS03	R1	---	300 secs	-	-	-	-	3.8	0.1	16.2	0.0	-	0	0	
WS03	R1	---	360 secs	-	-	-	-	3.8	0.1	16.2	0.0	-	0	0	
WS03	R2	---	14/08/2020 08:43:14	-	-	$0.0_{(I)}$	-	0.1	0.0	20.9	0.0	-	0	0	
WS03	R2	---	15 secs	-	-	-	-	3.6	0.0	18.9	0.0	-	3	0	
WS03	R2	---	30 secs	-	-	-	-	3.6	0.0	16.7	0.0	-	0	0	
WS03	R2	---	60 secs	-	-	-	-	3.7	0.0	16.3	0.0	-	0	0	
WS03	R2	---	90 secs	-	-	-	-	3.8	0.0	16.2	0.0	-	0	0	
WS03	R2	---	120 secs	-	-	-	-	3.9	0.0	16.1	0.0	-	0	0	
WS03	R2	---	181 secs	-	-	-	-	4.0	0.0	15.9	0.0	-	0	0	
WS03	R2	---	241 secs	-	-	-	-	4.0	0.0	15.9	0.0	-	0	0	
WS03	R2	---	301 secs	-	-	-	-	4.1	0.0	15.8	0.0	-	0	0	
WS03	R2	3.26	362 secs	1013	-	$0.0_{(SS)}$	DRY	-	-	-	-	-	-	-	
WS04	R1	---	23/07/2020 10:00:00	1016	1016	$0.0_{(SS)}$	DRY	0.1	0.0	20.9	0.0	0.5	0	0	
WS04	R1	---	15 secs	-	-	-	-	2.9	0.1	18.5	0.0	-	0	0	
WS04	R1	---	30 secs	-	-	-	-	2.9	0.1	17.5	0.0	-	0	0	
WS04	R1	---	60 secs	-	-	-	-	2.9	0.0	17.4	0.0	-	0	0	
WS04	R1	---	90 secs	-	-	-	-	2.9	0.2	17.4	0.0	-	0	0	
WS04	R1	---	120 secs	-	-	-	-	2.9	0.0	17.4	0.0	-	0	0	
WS04	R1	---	180 secs	-	-	-	-	2.9	0.1	17.4	0.0	-	0	0	

Key: I = Initial, Min = Minimum, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS04	R1	---	240 secs	-	-	-	-	2.9	0.2	17.4	0.0	-	0	0	
WS04	R1	---	300 secs	-	-	-	-	2.9	0.1	17.4	0.0	-	0	0	
WS04	R1	---	360 secs	-	-	-	-	2.9	0.1	17.4	0.0	-	0	0	
WS04	R2	---	14/08/2020 08:51:41	-	-	$0.0_{(I)}$	-	0.1	0.0	20.9	0.0	-	0	0	
WS04	R2	---	16 secs	-	-	-	-	3.0	0.0	18.6	0.0	-	1	0	
WS04	R2	---	31 secs	-	-	-	-	3.0	0.0	17.1	0.0	-	0	0	
WS04	R2	---	61 secs	-	-	-	-	3.0	0.0	16.9	0.0	-	0	0	
WS04	R2	---	91 secs	-	-	-	-	3.0	0.0	16.8	0.0	-	0	0	
WS04	R2	---	121 secs	-	-	-	-	3.0	0.0	16.8	0.0	-	0	0	
WS04	R2	---	181 secs	-	-	-	-	3.1	0.0	16.7	0.0	-	0	0	
WS04	R2	---	241 secs	-	-	-	-	3.0	0.0	16.7	0.0	-	0	0	
WS04	R2	---	301 secs	-	-	-	-	3.0	0.0	16.7	0.0	-	0	0	
WS04	R2	3.14	351 secs	1005	-	$0.1_{(SS)}$	DRY	-	-	-	-	-	-	-	

Key: I = Initial, Min = Minimum, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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Contract: **Ossory Road**

Page: **5** of **5**

APPENDIX F
LABORATORY CERTIFICATES FOR SOIL AND GROUNDWATER ANALYSIS

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/06863
Issue Number: 1 **Date:** 25 August, 2020

Client:
RSK Environment Ltd Hemel
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager: Ben Winch
Project Name: Ossery Road, Peckham
Project Ref: 29909
Order No: N/A
Date Samples Received: 17/08/20
Date Instructions Received: 19/08/20
Date Analysis Completed: 25/08/20

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

UKAS TESTING
1247

Envirolab Job Number: 20/06863

Client Project Name: Ossery Road, Peckham

Client Project Ref: 29909

Lab Sample ID	20/06863/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH1									
Depth to Top	6.00									
Depth To Bottom										
Date Sampled	17-Aug-20									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
pH (w)$_A^\#$	7.45							pH	0.01	A-T-031w
Hardness Total$_A^\#$	348							mg/l Ca CO3	2	A-T-049w
Sulphate (w)$_A^\#$	181							mg/l	1	A-T-026w
Arsenic (dissolved)$_A^\#$	<1							µg/l	1	A-T-025w
Cadmium (dissolved)$_A^\#$	<0.2							µg/l	0.2	A-T-025w
Copper (dissolved)$_A^\#$	<1							µg/l	1	A-T-025w
Chromium (dissolved)$_A^\#$	<1							µg/l	1	A-T-025w
Lead (dissolved)$_A^\#$	<1							µg/l	1	A-T-025w
Mercury (dissolved)$_A^\#$	<0.1							µg/l	0.1	A-T-025w
Nickel (dissolved)$_A^\#$	4							µg/l	1	A-T-025w
Selenium (dissolved)$_A^\#$	5							µg/l	1	A-T-025w
Zinc (dissolved)$_A^\#$	3							µg/l	1	A-T-025w

Envirolab Job Number: 20/06863

Client Project Name: Ossery Road, Peckham

Client Project Ref: 29909

Lab Sample ID	20/06863/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH1									
Depth to Top	6.00									
Depth To Bottom										
Date Sampled	17-Aug-20									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
PAH 16MS (w)										
Acenaphthene (w)$_A^\#$	<0.01							µg/l	0.01	A-T-019w
Acenaphthylene (w)$_A^\#$	<0.01							µg/l	0.01	A-T-019w
Anthracene (w)$_A^\#$	0.02							µg/l	0.01	A-T-019w
Benzo(a)anthracene (w)$_A^\#$	0.07							µg/l	0.01	A-T-019w
Benzo(a)pyrene (w)$_A^\#$	0.06							µg/l	0.01	A-T-019w
Benzo(b)fluoranthene (w)$_A^\#$	0.08							µg/l	0.01	A-T-019w
Benzo(ghi)perylene (w)$_A^\#$	0.04							µg/l	0.01	A-T-019w
Benzo(k)fluoranthene (w)$_A^\#$	0.03							µg/l	0.01	A-T-019w
Chrysene (w)$_A^\#$	0.06							µg/l	0.01	A-T-019w
Dibenzo(ah)anthracene (w)$_A^\#$	<0.01							µg/l	0.01	A-T-019w
Fluoranthene (w)$_A^\#$	0.13							µg/l	0.01	A-T-019w
Fluorene (w)$_A^\#$	<0.01							µg/l	0.01	A-T-019w
Indeno(123-cd)pyrene (w)$_A^\#$	0.05							µg/l	0.01	A-T-019w
Naphthalene (w)$_A^\#$	0.03							µg/l	0.01	A-T-019w
Phenanthrene (w)$_A^\#$	0.07							µg/l	0.01	A-T-019w
Pyrene (w)$_A^\#$	0.11							µg/l	0.01	A-T-019w
Total PAH 16MS (w)$_A^\#$	0.75							µg/l	0.01	A-T-019w

Envirolab Job Number: 20/06863

Client Project Name: Ossery Road, Peckham

Client Project Ref: 29909

Lab Sample ID	20/06863/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH1									
Depth to Top	6.00									
Depth To Bottom										
Date Sampled	17-Aug-20									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
VOC (w)										
Dichlorodifluoromethane$_A$	<1							µg/l	1	A-T-006w
Chloromethane$_A$	<10							µg/l	10	A-T-006w
Vinyl Chloride$_A^\#$	<1							µg/l	1	A-T-006w
Bromomethane$_A^\#$	<1							µg/l	1	A-T-006w
Chloroethane$_A^\#$	<1							µg/l	1	A-T-006w
Trichlorofluoromethane$_A^\#$	<1							µg/l	1	A-T-006w
trans 1,2-Dichloroethene$_A^\#$	<1							µg/l	1	A-T-006w
Dichloromethane$_A$	<5							µg/l	5	A-T-006w
Carbon Disulphide$_A^\#$	<1							µg/l	1	A-T-006w
1,1-Dichloroethene$_A^\#$	<1							µg/l	1	A-T-006w
1,1-Dichloroethane$_A^\#$	<1							µg/l	1	A-T-006w
cis 1,2-Dichloroethene$_A^\#$	<1							µg/l	1	A-T-006w
Bromochloromethane$_A^\#$	<5							µg/l	5	A-T-006w
Chloroform$_A^\#$	<1							µg/l	1	A-T-006w
2,2-Dichloropropane$_A^\#$	<1							µg/l	1	A-T-006w
1,2-Dichloroethane$_A^\#$	<2							µg/l	2	A-T-006w
1,1,1-Trichloroethane$_A^\#$	<1							µg/l	1	A-T-006w
1,1-Dichloropropene$_A^\#$	<1							µg/l	1	A-T-006w
Benzene$_A^\#$	<1							µg/l	1	A-T-006w
Carbon Tetrachloride$_A^\#$	<1							µg/l	1	A-T-006w
Dibromomethane$_A^\#$	<1							µg/l	1	A-T-006w
1,2-Dichloropropane$_A^\#$	<1							µg/l	1	A-T-006w
Bromodichloromethane$_A^\#$	<10							µg/l	10	A-T-006w
Trichloroethene$_A^\#$	<1							µg/l	1	A-T-006w
cis 1,3-Dichloropropene$_A^\#$	<1							µg/l	1	A-T-006w
trans 1,3-Dichloropropene$_A^\#$	<1							µg/l	1	A-T-006w
1,1,2-Trichloroethane$_A^\#$	<1							µg/l	1	A-T-006w
Toluene$_A^\#$	<1							µg/l	1	A-T-006w
1,3-Dichloropropane$_A^\#$	<1							µg/l	1	A-T-006w
Dibromochloromethane$_A^\#$	<3							µg/l	3	A-T-006w
1,2-Dibromoethane$_A^\#$	<1							µg/l	1	A-T-006w
Tetrachloroethene$_A$	2							µg/l	1	A-T-006w

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Client Project Name: Ossery Road, Peckham

Client Project Ref: 29909

Lab Sample ID	20/06863/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH1									
Depth to Top	6.00									
Depth To Bottom										
Date Sampled	17-Aug-20									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
1,1,1,2-Tetrachloroethane$_A$	<1							µg/l	1	A-T-006w
Chlorobenzene$_A^\#$	<1							µg/l	1	A-T-006w
Ethylbenzene$_A^\#$	<1							µg/l	1	A-T-006w
m & p Xylene$_A^\#$	<1							µg/l	1	A-T-006w
Bromoform$_A^\#$	<1							µg/l	1	A-T-006w
Styrene$_A^\#$	<1							µg/l	1	A-T-006w
1,1,2,2-Tetrachloroethane$_A$	<1							µg/l	1	A-T-006w
o-Xylene$_A^\#$	<1							µg/l	1	A-T-006w
1,2,3-Trichloropropane$_A^\#$	<1							µg/l	1	A-T-006w
Isopropylbenzene$_A^\#$	<1							µg/l	1	A-T-006w
Bromobenzene$_A^\#$	<1							µg/l	1	A-T-006w
2-Chlorotoluene$_A^\#$	<1							µg/l	1	A-T-006w
n-propylbenzene$_A^\#$	<1							µg/l	1	A-T-006w
4-Chlorotoluene$_A^\#$	<1							µg/l	1	A-T-006w
1,2,4-Trimethylbenzene$_A^\#$	<1							µg/l	1	A-T-006w
4-Isopropyltoluene$_A^\#$	<1							µg/l	1	A-T-006w
1,3,5-Trimethylbenzene$_A^\#$	<1							µg/l	1	A-T-006w
1,2-Dichlorobenzene$_A^\#$	<1							µg/l	1	A-T-006w
1,4-Dichlorobenzene$_A^\#$	<1							µg/l	1	A-T-006w
sec-Butylbenzene$_A^\#$	<1							µg/l	1	A-T-006w
tert-Butylbenzene$_A^\#$	<2							µg/l	2	A-T-006w
1,3-Dichlorobenzene$_A^\#$	<1							µg/l	1	A-T-006w
n-butylbenzene$_A^\#$	<1							µg/l	1	A-T-006w
1,2-Dibromo-3-chloropropane$_A^\#$	<2							µg/l	2	A-T-006w
1,2,4-Trichlorobenzene$_A^\#$	<3							µg/l	3	A-T-006w
1,2,3-Trichlorobenzene$_A^\#$	<3							µg/l	3	A-T-006w
Hexachlorobutadiene$_A^\#$	<1							µg/l	1	A-T-006w

Envirolab Job Number: 20/06863

Client Project Name: Ossery Road, Peckham

Client Project Ref: 29909

Lab Sample ID	20/06863/1							Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH1									
Depth to Top	6.00									
Depth To Bottom										
Date Sampled	17-Aug-20									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
TPH CWG (w)										
Ali >C5-C6 $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
Ali >C6-C8 $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
Ali >C8-C10 $(w)_A^{\#}$	37							µg/l	5	A-T-055w
Ali >C10-C12 $(w)_A^{\#}$	15							µg/l	5	A-T-055w
Ali >C12-C16 $(w)_A^{\#}$	<5							µg/l	5	A-T-055w
Ali >C16-C21 $(w)_A^{\#}$	<5							µg/l	5	A-T-055w
Ali >C21-C35 $(w)_A^{\#}$	15							µg/l	5	A-T-055w
Total Aliphatics $(w)_A^{\#}$	67							µg/l	5	A-T-055w
Aro >C5-C7 $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
Aro >C7-C8 $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
Aro >C8-C10 $(w)_A$	56							µg/l	5	A-T-055w
Aro >C10-C12 $(w)_A^{\#}$	45							µg/l	5	A-T-055w
Aro >C12-C16 $(w)_A^{\#}$	28							µg/l	5	A-T-055w
Aro >C16-C21 $(w)_A^{\#}$	22							µg/l	5	A-T-055w
Aro >C21-C35 $(w)_A^{\#}$	20							µg/l	10	A-T-055w
Total Aromatics $(w)_A$	171							µg/l	10	A-T-055w
TPH (Ali & Aro >C5-C35) $(w)_A$	238							µg/l	10	A-T-055w
BTEX - Benzene $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
BTEX - Toluene $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
BTEX - Ethyl Benzene $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
BTEX - m & p Xylene $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
BTEX - o Xylene $(w)_A^{\#}$	<1							µg/l	1	A-T-022w
MTBE $(w)_A^{\#}$	<1							µg/l	1	A-T-022w

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: RSK Environment Ltd Hemel, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, UK, HP3 9RT

Project: Ossery Road, Peckham

Clients Project No: 29909

Project No: 20/06863

Date Received: 19/08/2020 (am)

Cool Box Temperatures (°C): 17.7

Lab Sample ID	20/06863/1
Client Sample No	
Client Sample ID/Depth	BH1 6.00m
Date Sampled	17/08/20
Deviation Code	
A7 (no HNO3)	✓

Key
A7 (no HNO3) *No HNO3 preserved bottle provided (dissolved metals will be deviating)*

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT
SUPPLEMENT TO TEST REPORT 20/05699/1

Amendments: Request for project/sample information change

Envirolab Job Number: 20/05699
Issue Number: 2 **Date:** 23 July, 2020

Client:
RSK Environment Ltd Hemel
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager: Ben Winch/Heshawa Abayatilaka
Project Name: Ossory Road
Project Ref: 29909
Order No: N/A
Date Samples Received: 14/07/20
Date Instructions Received: 14/07/20
Date Analysis Completed: 21/07/20

Prepared by:

Sophie France
Client Service Manager

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
% Stones >10mm$_A$	18.7	13.3	4.3	18.5	13.3	16.2		% w/w	0.1	A-T-044
pH$_D$ M#	8.69	9.51	7.72	8.33	8.08	8.18		pH	0.01	A-T-031s
Sulphate (water sol 2:1)$_D$ M#	1.16	0.12	0.03	1.18	1.27	1.22		g/l	0.01	A-T-026s
Sulphate (acid soluble)$_D$ M#	4900	920	430	10000	9700	12000		mg/kg	200	A-T-028s
Total Organic Carbon$_D$ M#	-	2.88	-	0.64	2.09	0.71		% w/w	0.03	A-T-032s
Arsenic$_D$ M#	9	16	10	11	16	14		mg/kg	1	A-T-024s
Cadmium$_D$ M#	0.6	0.8	<0.5	<0.5	0.6	0.5		mg/kg	0.5	A-T-024s
Copper$_D$ M#	56	103	52	26	87	43		mg/kg	1	A-T-024s
Chromium$_D$ M#	25	25	18	15	23	19		mg/kg	1	A-T-024s
Lead$_D$ M#	1060	649	280	254	401	334		mg/kg	1	A-T-024s
Mercury$_D$	1.14	2.51	2.32	1.21	1.95	1.59		mg/kg	0.17	A-T-024s
Nickel$_D$ M#	16	20	13	12	19	15		mg/kg	1	A-T-024s
Selenium$_D$ M#	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-024s
Zinc$_D$ M#	128	292	71	115	174	144		mg/kg	5	A-T-024s

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_D^{\#}$	NAD	NAD	NAD	NAD	NAD	NAD				A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_D$	N/A	N/A	N/A	N/A	N/A	N/A				A-T-045

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
PAH-16MS										
Acenaphthene$_A^{M\#}$	0.03	0.06	<0.01	0.04	0.02	0.02		mg/kg	0.01	A-T-019s
Acenaphthylene$_A^{M\#}$	0.04	0.07	<0.01	<0.01	0.02	0.02		mg/kg	0.01	A-T-019s
Anthracene$_A^{M\#}$	0.14	0.26	<0.02	0.11	0.09	0.09		mg/kg	0.02	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	0.51	2.26	0.11	0.47	0.42	0.48		mg/kg	0.04	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	0.57	2.55	0.14	0.67	0.47	0.50		mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	0.65	3.11	0.16	0.69	0.58	0.59		mg/kg	0.05	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	0.41	1.42	0.10	0.45	0.35	0.33		mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	0.27	1.06	<0.07	0.26	0.22	0.23		mg/kg	0.07	A-T-019s
Chrysene$_A^{M\#}$	0.60	2.51	0.16	0.61	0.56	0.57		mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	0.08	0.32	<0.04	0.09	0.07	0.06		mg/kg	0.04	A-T-019s
Fluoranthene$_A^{M\#}$	1.10	4.57	0.20	0.82	0.85	0.82		mg/kg	0.08	A-T-019s
Fluorene$_A^{M\#}$	0.04	0.06	<0.01	0.03	0.02	0.02		mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	0.43	1.71	0.11	0.50	0.39	0.36		mg/kg	0.03	A-T-019s
Naphthalene $_A^{M\#}$	<0.03	0.07	<0.03	0.04	0.03	<0.03		mg/kg	0.03	A-T-019s
Phenanthrene$_A^{M\#}$	0.55	1.23	0.08	0.50	0.43	0.37		mg/kg	0.03	A-T-019s
Pyrene$_A^{M\#}$	0.93	4.22	0.18	0.73	0.74	0.73		mg/kg	0.07	A-T-019s
Total PAH-16MS$_A^{M\#}$	6.35	25.5	1.24	6.01	5.26	5.19		mg/kg	0.01	A-T-019s

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
TPH CWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
Ali >C8-C10$_A$	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-055s
Ali >C10-C12$_A^{M\#}$	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-055s
Ali >C12-C16$_A^{M\#}$	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-055s
Ali >C16-C21$_A^{M\#}$	2	2	<1	3	2	<1		mg/kg	1	A-T-055s
Ali >C21-C35$_A$	10	10	2	107	10	8		mg/kg	1	A-T-055s
Total Aliphatics$_A$	11	13	2	111	11	9		mg/kg	1	A-T-055s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
Aro >C8-C10$_A$	<1	<1	<1	2	1	2		mg/kg	1	A-T-055s
Aro >C10-C12$_A^{M\#}$	<1	<1	<1	2	<1	<1		mg/kg	1	A-T-055s
Aro >C12-C16$_A$	2	9	<1	7	3	3		mg/kg	1	A-T-055s
Aro >C16-C21$_A^{M\#}$	5	62	1	21	10	18		mg/kg	1	A-T-055s
Aro >C21-C35$_A^{M\#}$	26	268	6	132	57	78		mg/kg	1	A-T-055s
Total Aromatics$_A$	33	341	7	163	71	101		mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35)$_A$	45	354	9	274	82	110		mg/kg	1	A-T-055s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	0.01	A-T-022s

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
SVOC										
Hexachlorobenzene$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Diethyl phthalate$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Dimethyl phthalate$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Dibenzofuran$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Carbazole$_A$	<100	166	<100	<100	<100	<100		µg/kg	100	A-T-052s
Butylbenzyl phthalate$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Bis(2-ethylhexyl)phthalate$_A$	<500	<500	<500	<500	<500	<500		µg/kg	500	A-T-052s
Bis(2-chloroethoxy)methane$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Bis(2-chloroethyl)ether$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
4-Nitrophenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
3+4-Methylphenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
4-Chloro-3-methylphenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2-Nitrophenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2-Methylphenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2-Chlorophenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2,6-Dinitrotoluene$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2,4-Dinitrotoluene$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2,4-Dimethylphenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2,4-Dichlorophenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2,4,6-Trichlorophenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2,4,5-Trichlorophenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2-Chloronaphthalene$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
2-Methylnaphthalene$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Bis(2-chloroisopropyl)ether$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Phenol$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Pentachlorophenol (SVOC)$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
n-Nitroso-n-dipropylamine$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
n-Dioctylphthalate$_A$	<500	<500	<500	<500	<500	<500		µg/kg	500	A-T-052s
n-Dibutylphthalate$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Nitrobenzene$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Isophorone$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Hexachloroethane$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
Hexachlorocyclopentadiene$_A$	<100	<100	<100	<100	<100	<100		µg/kg	100	A-T-052s
Perylene$_A$	101	761	<100	170	<100	232		µg/kg	100	A-T-052s

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
VOC										
Dichlorodifluoromethane$_A$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Chloromethane$_A$	<10	<10	<10	<10	<10	<10		µg/kg	10	A-T-006s
Vinyl Chloride (Chloroethene)$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Bromomethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Chloroethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Trichlorofluoromethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,1-Dichloroethene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Carbon Disulphide$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Dichloromethane$_A$	<5	<5	<5	<5	<5	<5		µg/kg	5	A-T-006s
trans 1,2-Dichloroethene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,1-Dichloroethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
cis 1,2-Dichloroethene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
2,2-Dichloropropane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Bromochloromethane$_A$#	<5	<5	<5	<5	<5	<5		µg/kg	5	A-T-006s
Chloroform$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,1,1-Trichloroethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,1-Dichloropropene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Carbon Tetrachloride$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,2-Dichloroethane$_A$#	<2	<2	<2	<2	<2	<2		µg/kg	2	A-T-006s
Benzene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Trichloroethene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,2-Dichloropropane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Dibromomethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Bromodichloromethane$_A$#	<10	<10	<10	<10	<10	<10		µg/kg	10	A-T-006s
cis 1,3-Dichloropropene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Toluene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
trans 1,3-Dichloropropene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,1,2-Trichloroethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,3-Dichloropropane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Tetrachloroethene$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Dibromochloromethane$_A$#	<3	<3	<3	<3	<3	<3		µg/kg	3	A-T-006s
1,2-Dibromoethane$_A$#	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s

Envirolab Job Number: 20/05699

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6		Units	Limit of Detection	Method ref
Client Sample No	1	1	2	1	1	1				
Client Sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
Depth to Top	0.40	0.40	0.60	0.40	0.40	0.60				
Depth To Bottom										
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
Sample Matrix Code	6ABE	6AE	6AE	6ABE	6ABE	6ABE				
Chlorobenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,1,1,2-Tetrachloroethane$_{A}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Ethylbenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
m & p Xylene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
o-Xylene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Styrene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Bromoform$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Isopropylbenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,1,2,2-Tetrachloroethane$_{A}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,2,3-Trichloropropane$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
Bromobenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
n-Propylbenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
2-Chlorotoluene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,3,5-Trimethylbenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
4-Chlorotoluene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
tert-Butylbenzene$_{A}^{\#}$	*<2*	*<2*	*<2*	*<2*	*<2*	<2		µg/kg	2	A-T-006s
1,2,4-Trimethylbenzene$_{A}^{\#}$	*<1*	*<1*	*<1*	*<1*	*<1*	<1		µg/kg	1	A-T-006s
sec-Butylbenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
4-Isopropyltoluene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,3-Dichlorobenzene$_{A}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,4-Dichlorobenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
n-Butylbenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,2-Dichlorobenzene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,2-Dibromo-3-chloropropane (DCBP)$_{A}$	<2	<2	<2	<2	<2	<2		µg/kg	2	A-T-006s
1,2,4-Trichlorobenzene$_{A}$	<3	<3	<3	<3	<3	<3		µg/kg	3	A-T-006s
Hexachlorobutadiene$_{A}^{\#}$	<1	<1	<1	<1	<1	<1		µg/kg	1	A-T-006s
1,2,3-Trichlorobenzene$_{A}$	<3	<3	<3	<3	<3	<3		µg/kg	3	A-T-006s

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: RSK Environment Ltd Hemel, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, UK, HP3 9RT

Project: Ossory Road

Clients Project No: 29909

Project No: 20/05699

Date Received: 14/07/2020 (am)

Cool Box Temperatures (°C): 14.7

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

APPENDIX G
GEOTECHNICAL RESULTS

STRUCTURAL SOILS LTD

TEST REPORT

Report No. 584302-01 (00) 1774

Date	29-July-2020	Contract	Ossory Road

Client RSK
Address 18 Frogmore Rd
Apsley
Hemel Hempstead
Hertfordshire
HP3 9RT
For the Attention of Ben Winch

Samples submitted by client	07-July-2020	Client Reference	29909
Testing Started	07-July-2020	Client Order No.	n/a
Testing Completed	29-July-2020	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

1.01	Moisture Content (oven drying method) BS1377:Part 2:1990:clause 3.2 (superseded)*
1.03	Liquid Limit (one point method) & Plastic Limit BS1377:Part 2:1990,clause 4.4/5.3 (superseded)*
1.10	Particle Size Distribution wet sieve method BS1377:Part 2:1990,clause 9.2 (superseded)*
1.13a	Particle Size Distribution sedimentation pipette method BS1377:Part 2: 1990,clause 9.4 (superseded)*
5.04	Undrained shear strength triaxial compression without pore pressure measurement (definitive method) 100mm diameter specimens BS1377:Part 7:1990,clause 8.4 (superseded)*
10.02	Saturated moisture content of chalk BS1377:Part 2:1990,clause 3.3

Undertaken by a sub-contractor

2.07	pH value in accordance with BRE Special Digest 1:2005
2.04	Sulphate content (water extract) in accordance with BRE Special Digest 1:2005

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of .
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd 18 Frogmore Rd Hemel Hempstead HP3 9RT Tel.01442 416661 e-mail dimitris.xirouchakis@soils.co.uk

TESTING VERIFICATION CERTIFICATE

1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **29/07/2020 17:23:23**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Sharon Cairns (Laboratory Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU

STRUCTURAL SOILS LTD	Contract: **Ossory Road, Peckham**	Job No: **584302**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | GrfcText L - LAB VERIFICATION REPORT - V02 - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 262323, Fax: 01442 262683, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 29/07/20 - 17:25 | SC1 |

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Description of Sample
BH2		D	8.00	42	NP	NP	NP	100	Dark greyish brown slightly clayey SAND
WS1		B	1.60	19	47	27	20	90	Light brown slightly gravelly sandy CLAY
WS2		B	1.00	19	39	18	21	94	Brown slightly sandy CLAY
WS4		B	1.00	14	31	15	16	93	Brown mottled dark grey and red slightly sandy slightly gravelly CLAY. Gravel includes brick
WS4		B	3.00	12	30	14	16	64	Brown mottled dark grey and white slightly sandy slightly gravelly CLAY

STRUCTURAL SOILS LTD

Contract:

Ossory Road, Peckham

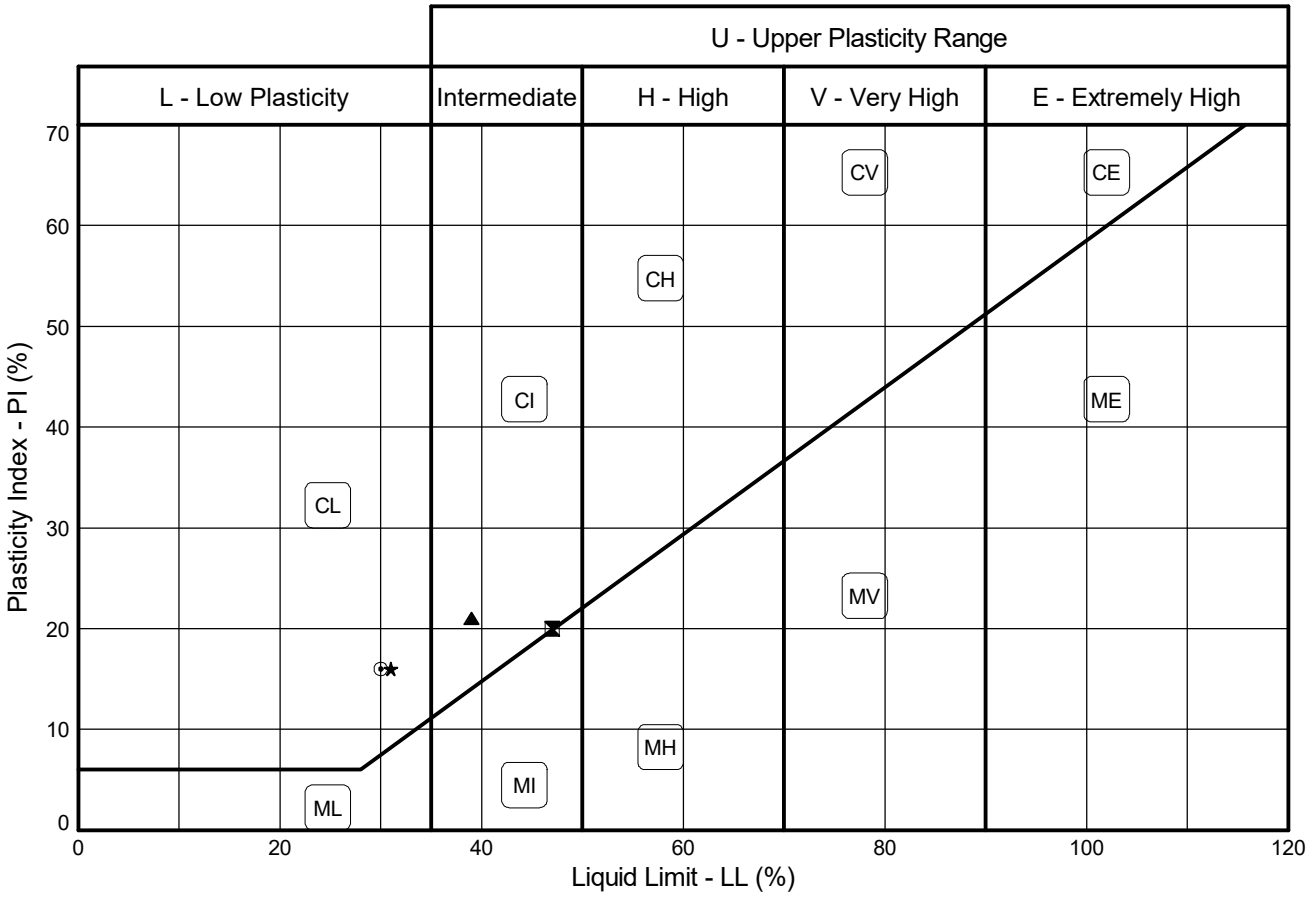
Contract Ref:

584302

AGS

PLASTICITY CHART - PI Vs LL

In accordance with BS5930:2015
Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC %	LL %	PL %	PI %	<425µm %	Lab location	Notes
	Exploratory Position ID	Sample	Depth (m)									
	BH2	D	8.00	3.2/4.3/5.3/5.4	4.2.4	42	NP	NP	NP	100	H	
⊠	WS1	B	1.60	3.2/4.3/5.3/5.4	4.2.4	19	47	27	20	90	H	
▲	WS2	B	1.00	3.2/4.3/5.3/5.4	4.2.4	19	39	18	21	94	H	
★	WS4	B	1.00	3.2/4.3/5.3/5.4	4.2.4	14	31	15	16	93	H	
⊙	WS4	B	3.00	3.2/4.3/5.3/5.4	4.2.4	12	30	14	16	64	H	

Tested in accordance with the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Cone Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	SHARON CAIRNS	23/07/20

Contract	Contract Ref:
Ossory Road, Peckham	584302

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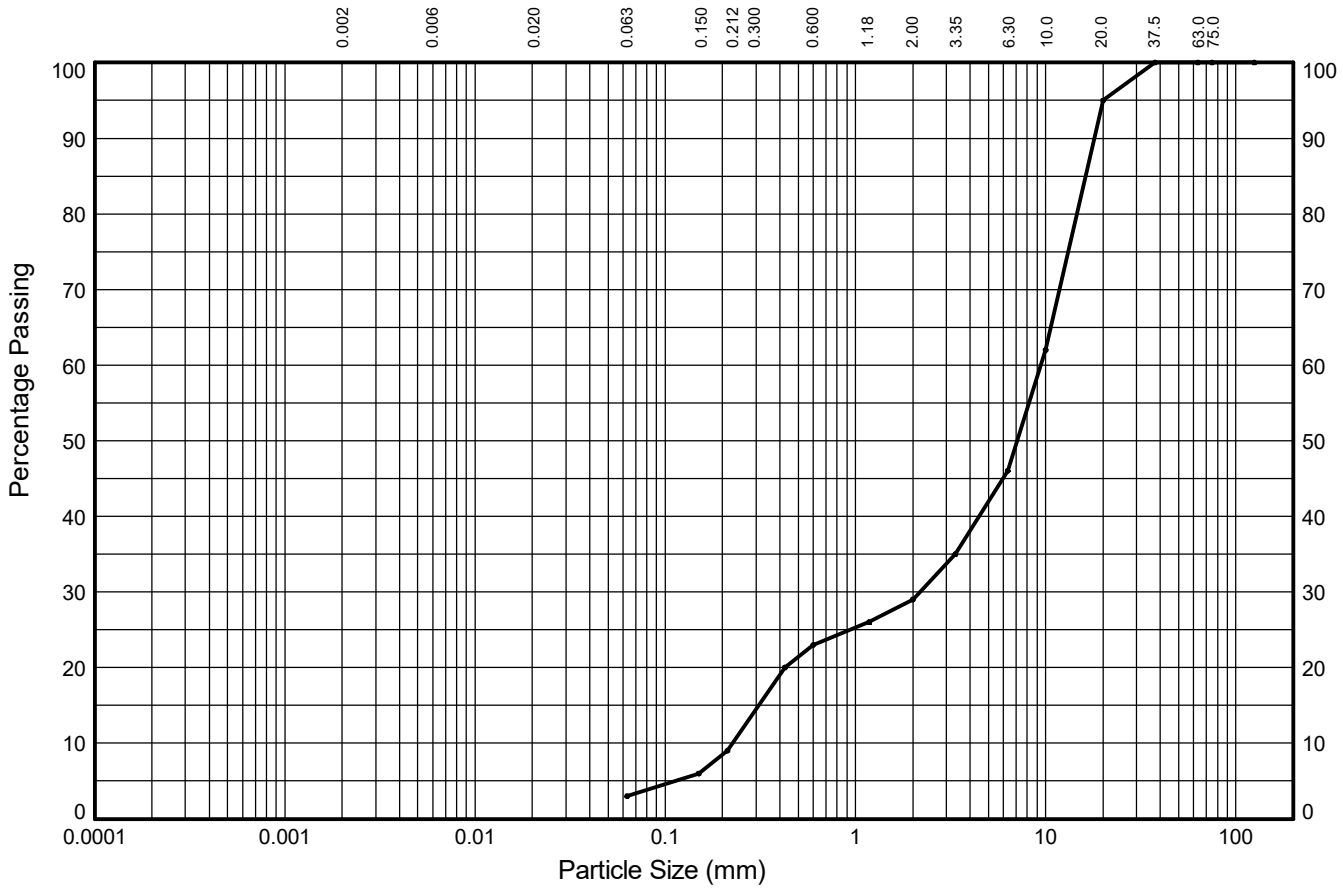
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 262323, Fax: 01442 262683, Web: www.soils.co.uk, Email: ask@soils.co.uk. | 23/07/20 - 14:57 | SC1 |

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Borehole: **BH1** Sample Ref: Sample Type: **B** Depth (m): **2.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	5%	15%	6%	17%	49%	5%	
	SILT			SAND			GRAVEL			
3%				26%			71%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**95**
10.0	**62**
6.30	**46**
3.35	**35**
2.00	**29**
1.18	**26**
0.600	**23**
0.425	**20**
0.212	**9**
0.150	**6**
0.063	**3**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**0.226**
D_{15} (mm)	**0.310**
D_{30} (mm)	**2.180**
D_{50} (mm)	**7.071**
D_{60} (mm)	**9.439**
D_{85} (mm)	**16.211**
D_{90} (mm)	**18.006**
C_U	**42**
C_C	**2**

Soil Description:

Brown very sandy slightly clayey GRAVEL

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date
SHARON CAIRNS	29/07/20

Contract: **Ossory Road, Peckham**

Contract Ref: **584302**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
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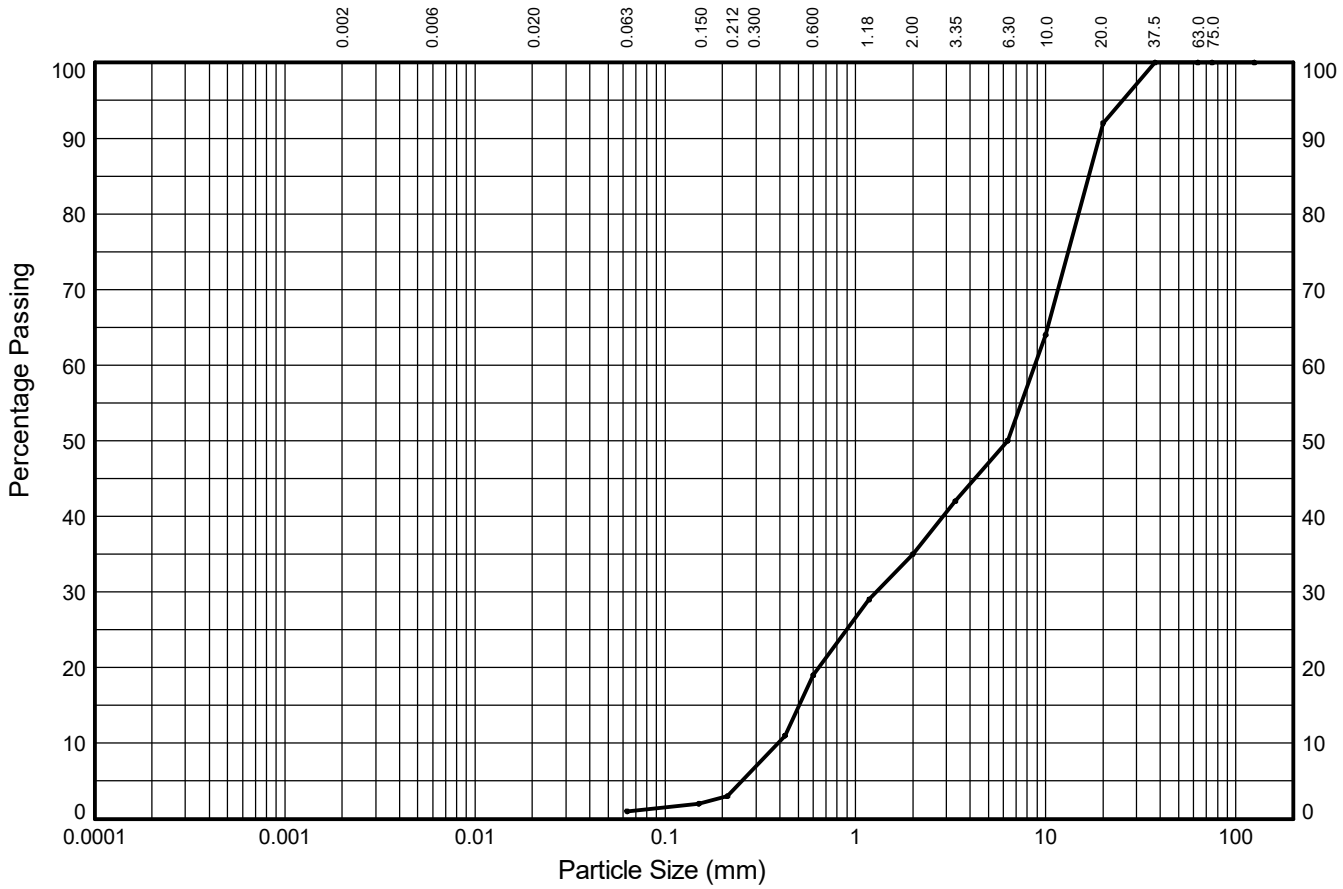
PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Borehole: **BH1** Sample Ref: Sample Type: **B** Depth (m): **5.00**



CLAY				SILT			SAND			GRAVEL			COBBLES
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse				
	-	-	-	2%	17%	15%	15%	42%	8%				
1%				34%			65%						0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**92**
10.0	**64**
6.30	**50**
3.35	**42**
2.00	**35**
1.18	**29**
0.600	**19**
0.425	**11**
0.212	**3**
0.150	**2**
0.063	**1**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**0.390**
D_{15} (mm)	**0.505**
D_{30} (mm)	**1.288**
D_{50} (mm)	**6.300**
D_{60} (mm)	**8.763**
D_{85} (mm)	**16.818**
D_{90} (mm)	**19.034**
C_U	**22**
C_C	**0.49**

Soil Description:

Brown very sandy slightly clayey GRAVEL

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date
SHARON CAIRNS	29/07/20

Contract: **Ossory Road, Peckham**

Contract Ref: **584302**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
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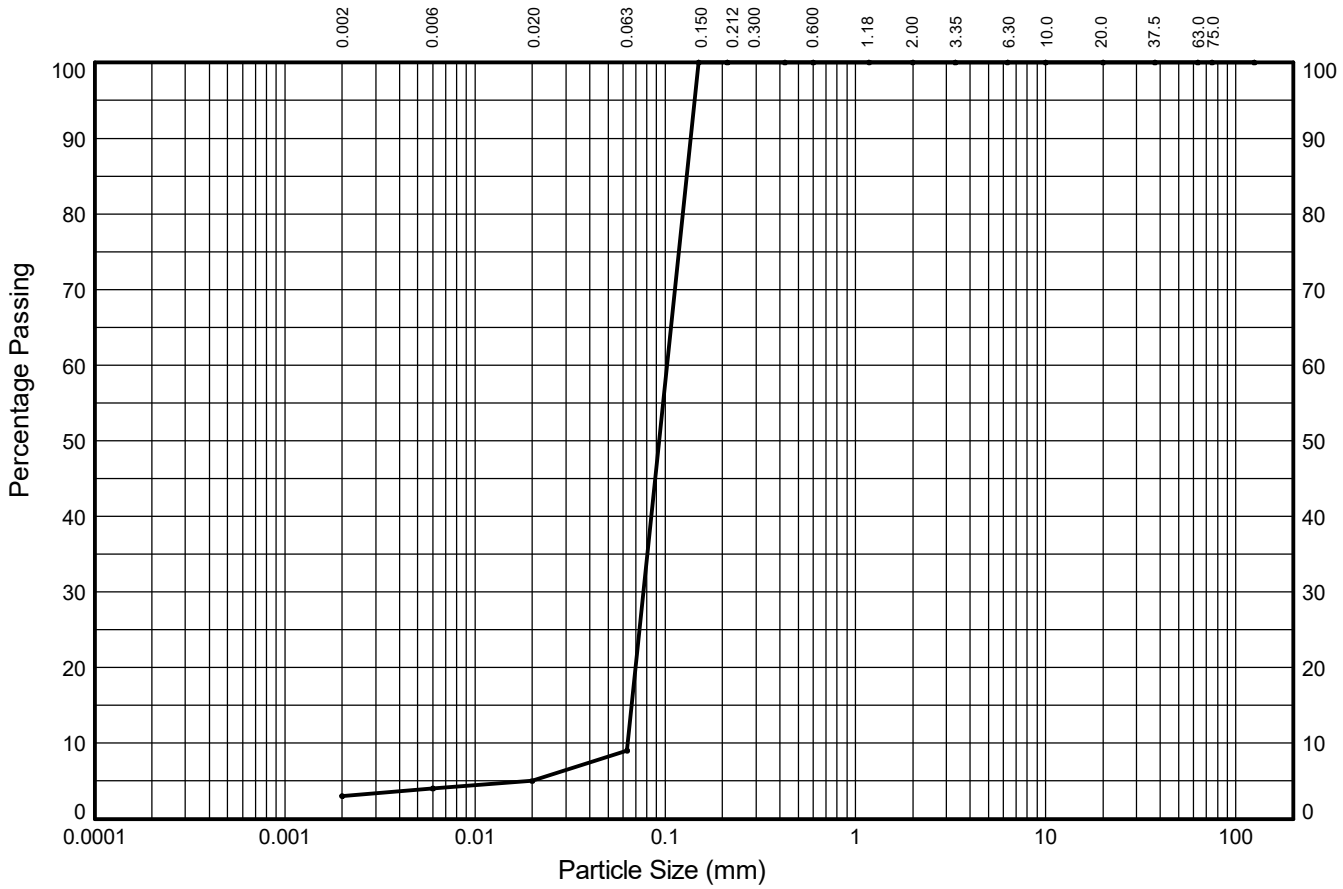
PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Borehole: **BH1** Sample Ref: Sample Type: **B** Depth (m): **8.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	1%	1%	4%	91%	0%	0%	0%	0%	0%	
	SILT			SAND			GRAVEL			
3%	6%			91%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**100**
0.425	**100**
0.212	**100**
0.150	**100**
0.063	**9**

Particle Diameter (mm)	Percent Passing (%)
0.02	**5**
0.006	**4**
0.002	**3**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**0.064**
D_{15} (mm)	**0.067**
D_{30} (mm)	**0.077**
D_{50} (mm)	**0.093**
D_{60} (mm)	**0.102**
D_{85} (mm)	**0.130**
D_{90} (mm)	**0.136**
C_U	**1.6**
C_C	**0.91**

Soil Description:

Brown silty SAND

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date
SHARON CAIRNS	29/07/20

Contract: **Ossory Road, Peckham**

Contract Ref: **584302**

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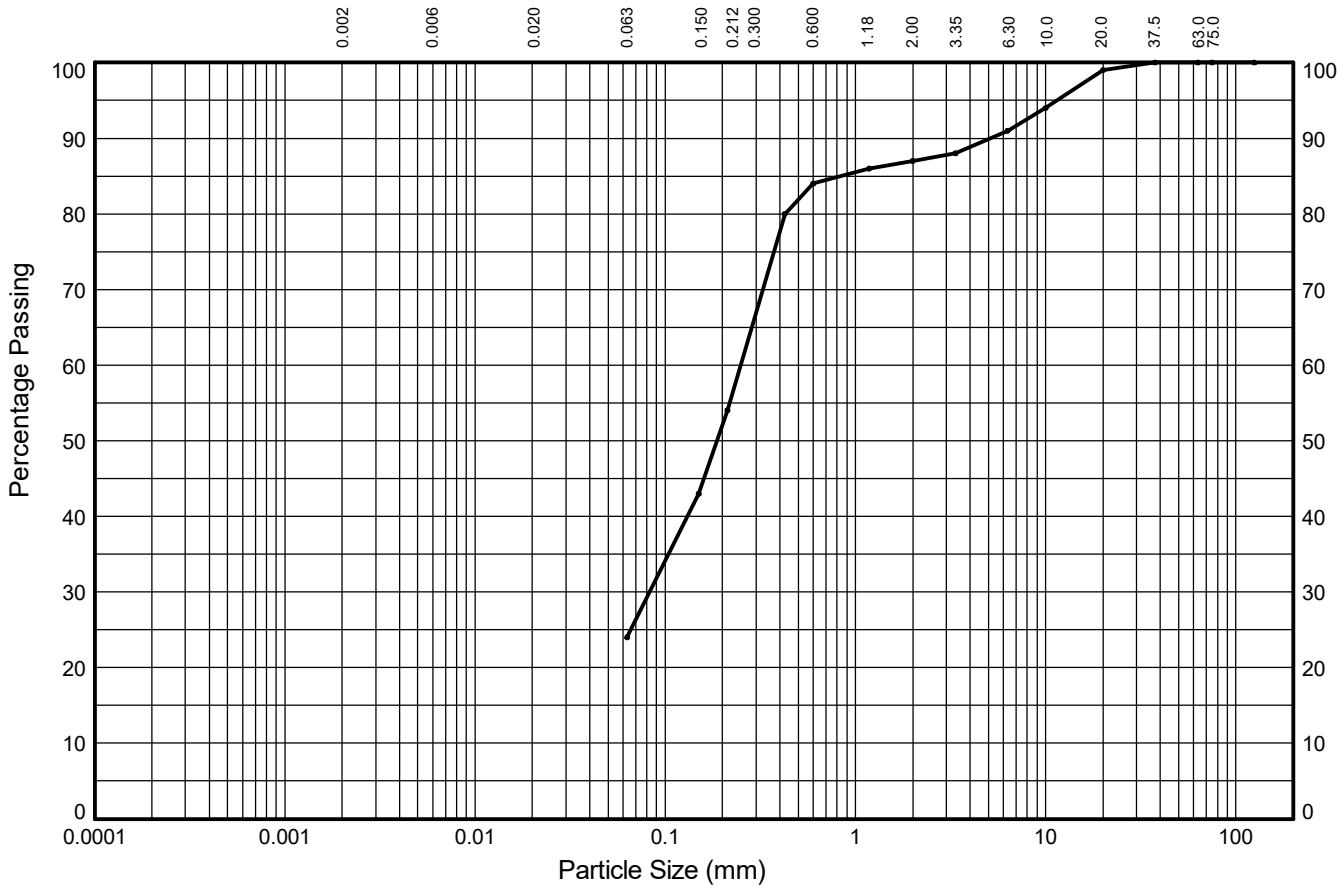
PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Borehole: **BH2** Sample Ref: Sample Type: **B** Depth (m): **2.10**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	28%	32%	3%	4%	8%	1%	
	SILT			SAND			GRAVEL			
24%				63%			13%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**99**
10.0	**94**
6.30	**91**
3.35	**88**
2.00	**87**
1.18	**86**
0.600	**84**
0.425	**80**
0.212	**54**
0.150	**43**
0.063	**24**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**0.083**
D_{50} (mm)	**0.187**
D_{60} (mm)	**0.249**
D_{85} (mm)	**0.841**
D_{90} (mm)	**5.104**
C_U	**NA**
C_C	**NA**

Soil Description:

Dark orangish brown gravelly very clayey SAND

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
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Compiled By	Date
SHARON CAIRNS	29/07/20

Contract	Contract Ref:
Ossory Road, Peckham	**584302**

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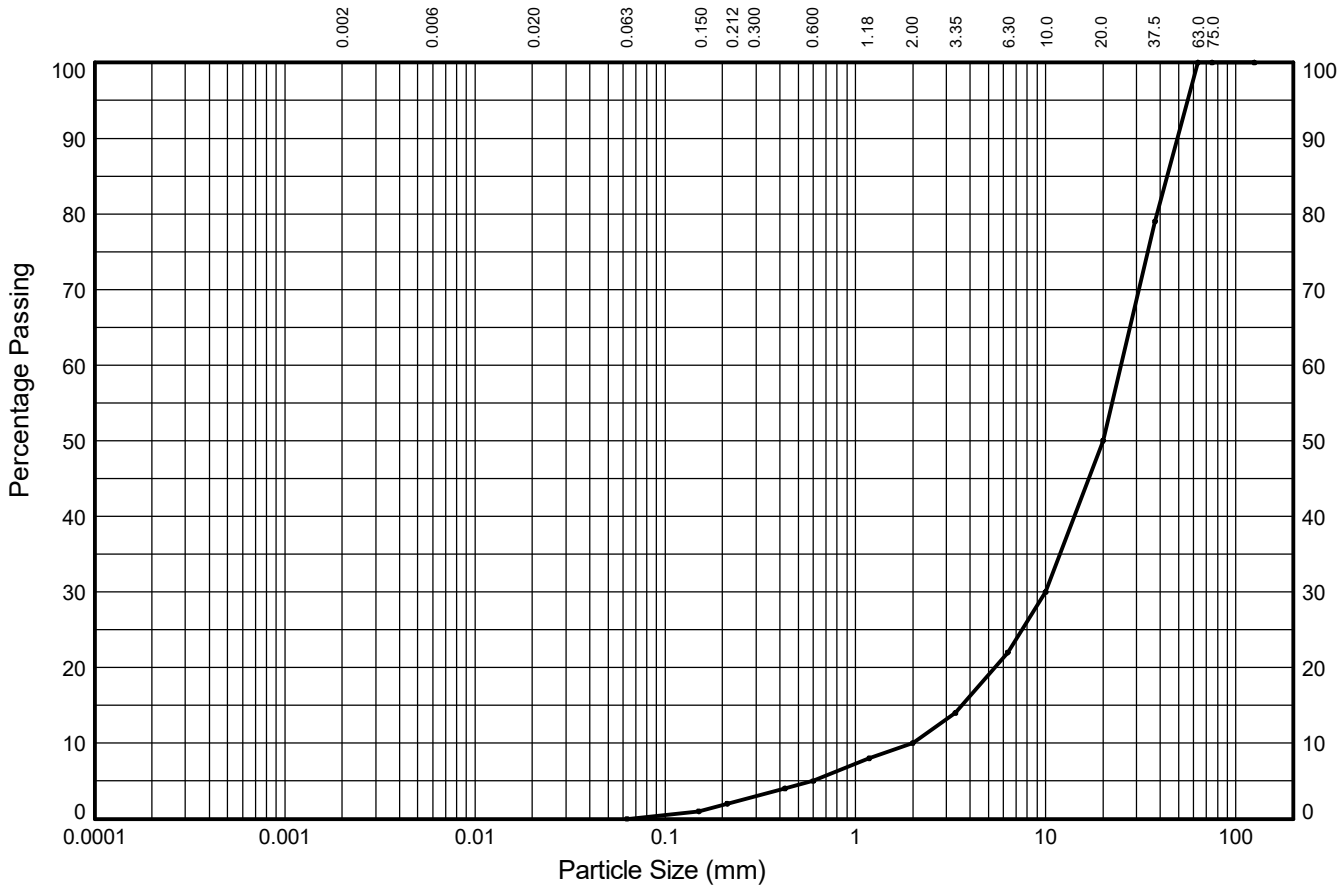
GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442-262683, Fax: 01442-262323, Web: www.soils.co.uk, Email: ask@soils.co.uk | 29/07/20 - 17:24 | SC1 |

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Borehole: **BH2** Sample Ref: Sample Type: **B** Depth (m): **4.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	2%	3%	5%	12%	28%	50%	
	SILT			SAND			GRAVEL			
0%				10%			90%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**79**
20.0	**50**
10.0	**30**
6.30	**22**
3.35	**14**
2.00	**10**
1.18	**8**
0.600	**5**
0.425	**4**
0.212	**2**
0.150	**1**
0.063	**0**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**2.000**
D_{15} (mm)	**3.625**
D_{30} (mm)	**10.000**
D_{50} (mm)	**20.000**
D_{60} (mm)	**24.841**
D_{85} (mm)	**43.492**
D_{90} (mm)	**49.210**
C_U	**12**
C_C	**2**

Soil Description:

Brown mottled light brown, dark grey and white sandy GRAVEL

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
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Hertfordshire
HP3 9RT

Compiled By	Date
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Contract: **Ossory Road, Peckham**

Contract Ref: **584302**

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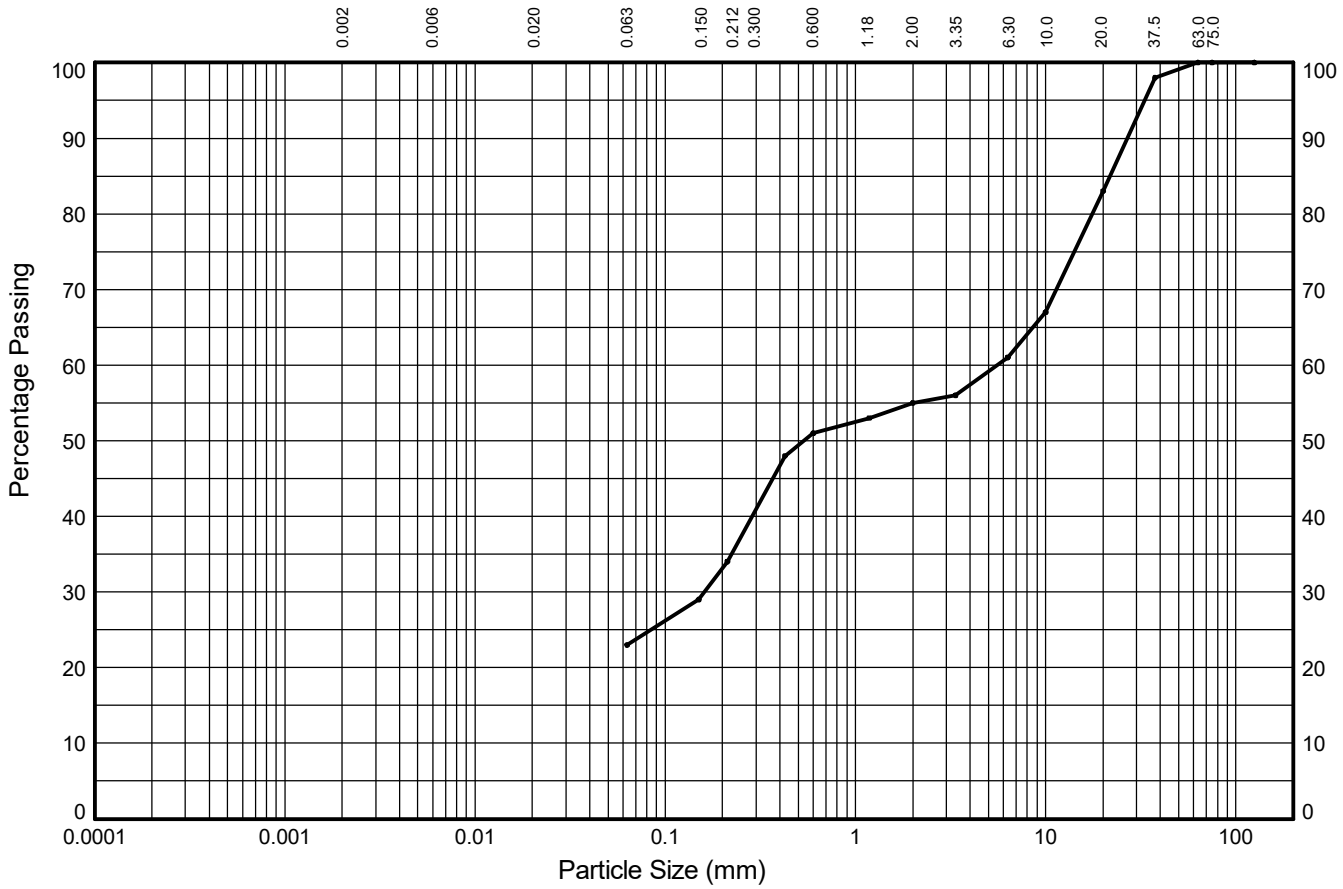
GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442-262683, Fax: 01442-262323, Web: www.soils.co.uk, Email: ask@soils.co.uk | 29/07/20 - 17:24 | SC1 |

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Window Sample: **WS1** Sample Ref: Sample Type: **B** Depth (m): **2.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	10%	18%	4%	6%	22%	17%	
	SILT			SAND			GRAVEL			
23%				32%			45%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**98**
20.0	**83**
10.0	**67**
6.30	**61**
3.35	**56**
2.00	**55**
1.18	**53**
0.600	**51**
0.425	**48**
0.212	**34**
0.150	**29**
0.063	**23**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**0.161**
D_{50} (mm)	**0.535**
D_{60} (mm)	**5.552**
D_{85} (mm)	**21.749**
D_{90} (mm)	**26.818**
C_U	**NA**
C_C	**NA**

Soil Description:

Brown mottled orangish brown and grey very sandy very clayey GRAVEL

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date
SHARON CAIRNS	29/07/20

Contract	Contract Ref:
Ossory Road, Peckham	**584302**

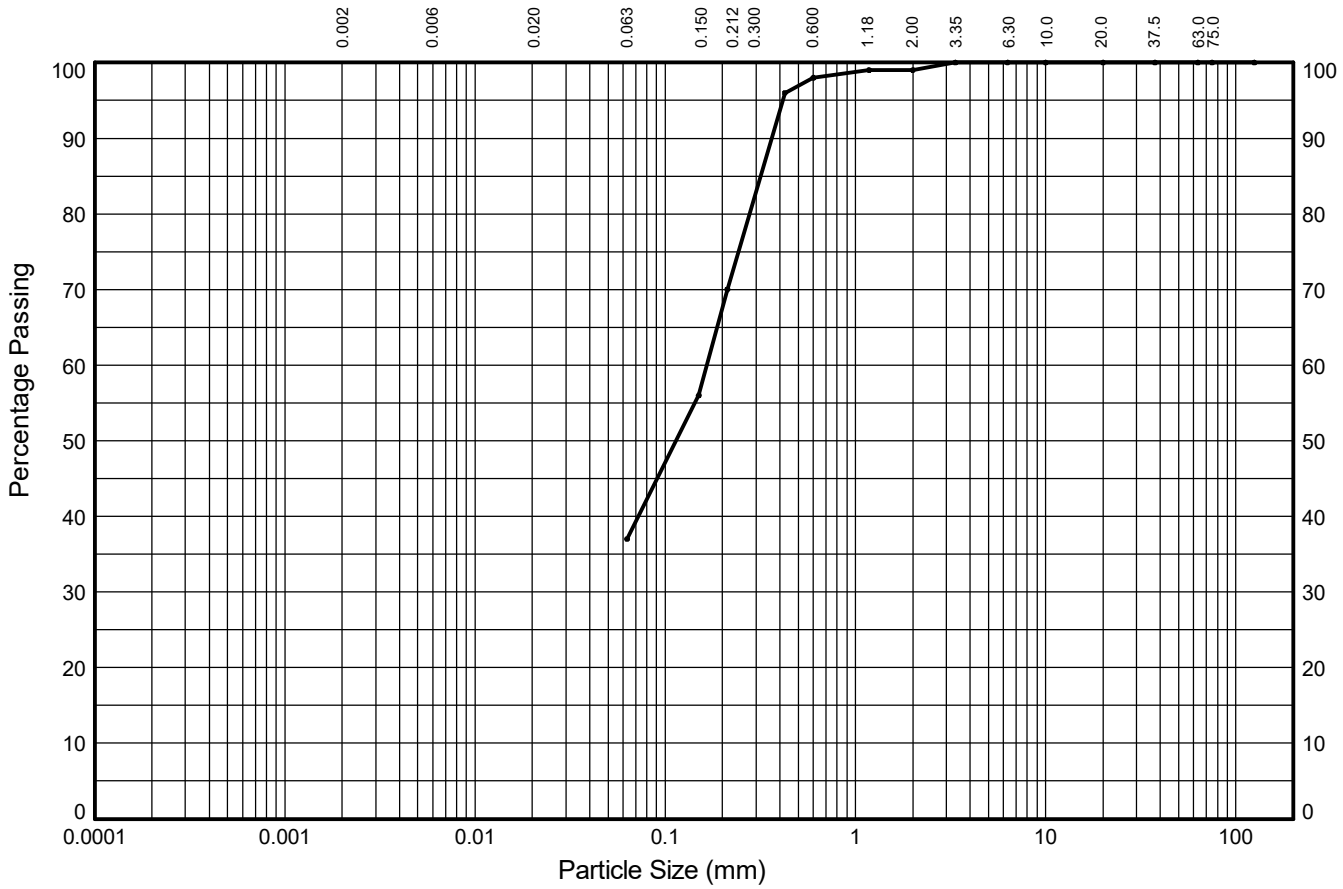
AGS

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442-262683, Fax: 01442-262323, Web: www.soils.co.uk, Email: ask@soils.co.uk | 29/07/20 - 17:24 | SC1 |

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Window Sample: **WS3** Sample Ref: Sample Type: **B** Depth (m): **1.50**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	30%	31%	1%	1%	0%	0%	
	SILT			SAND			GRAVEL			
37%				62%			1%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**99**
1.18	**99**
0.600	**98**
0.425	**96**
0.212	**70**
0.150	**56**
0.063	**37**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.114**
D_{60} (mm)	**0.166**
D_{85} (mm)	**0.317**
D_{90} (mm)	**0.362**
C_U	**NA**
C_C	**NA**

Soil Description:

Brown slightly gravelly very clayey SAND

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date
SHARON CAIRNS	29/07/20

Contract	Contract Ref:
Ossory Road, Peckham	**584302**

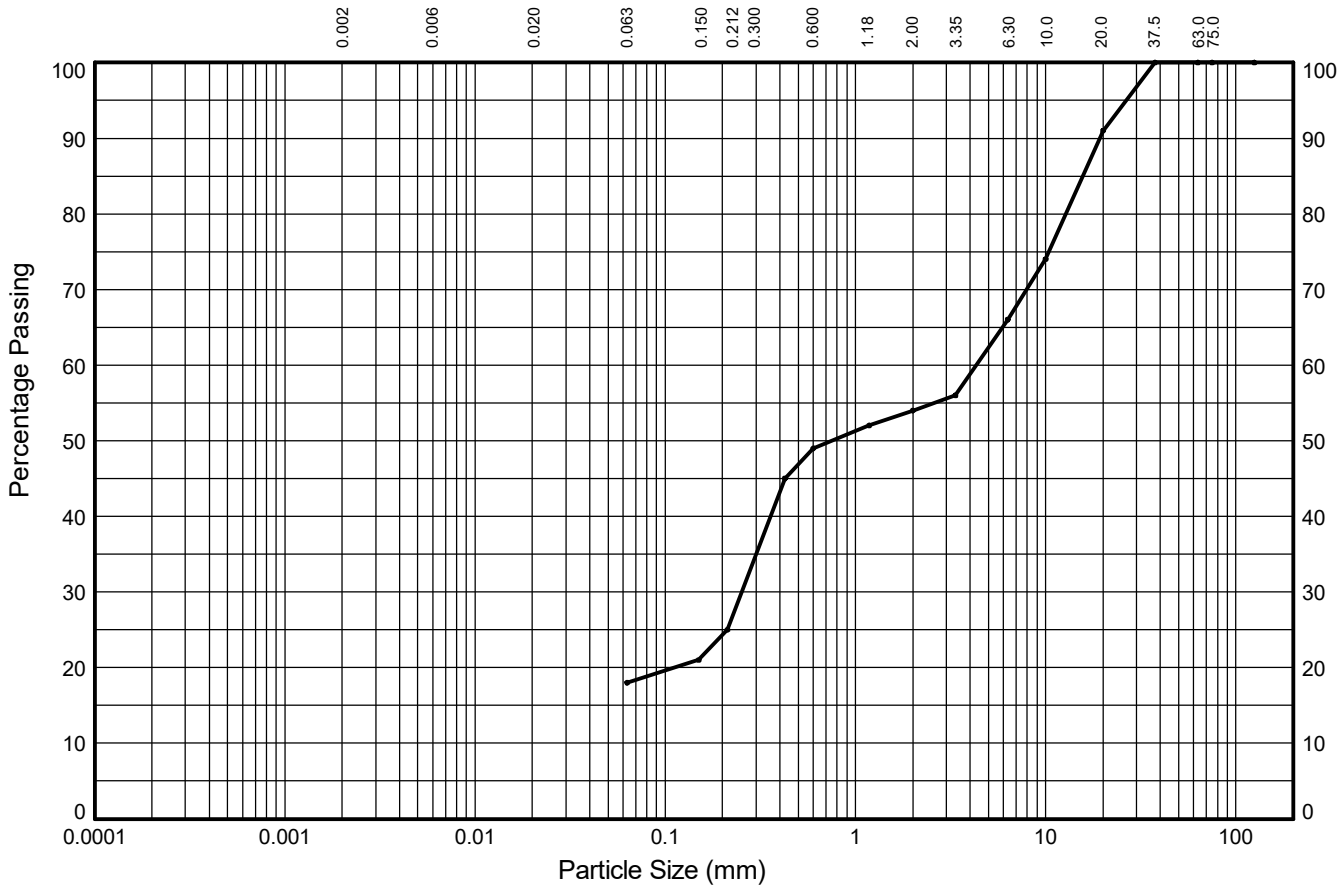
AGS

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442-262323, Fax: 01442-262683, Web: www.soils.co.uk, Email: ask@soils.co.uk | 29/07/20 - 17:24 | SC1 |

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Window Sample: **WS3** Sample Ref: Sample Type: **B** Depth (m): **3.50**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	6%	25%	5%	12%	25%	9%	
	SILT			SAND			GRAVEL			
18%				36%			46%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**91**
10.0	**74**
6.30	**66**
3.35	**56**
2.00	**54**
1.18	**52**
0.600	**49**
0.425	**45**
0.212	**25**
0.150	**21**
0.063	**18**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**0.252**
D_{50} (mm)	**0.752**
D_{60} (mm)	**4.313**
D_{85} (mm)	**15.660**
D_{90} (mm)	**19.201**
C_U	**NA**
C_C	**NA**

Soil Description:

Brown mottled light brown, red and grey very sandy clayey GRAVEL with man-made material

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date
SHARON CAIRNS	29/07/20

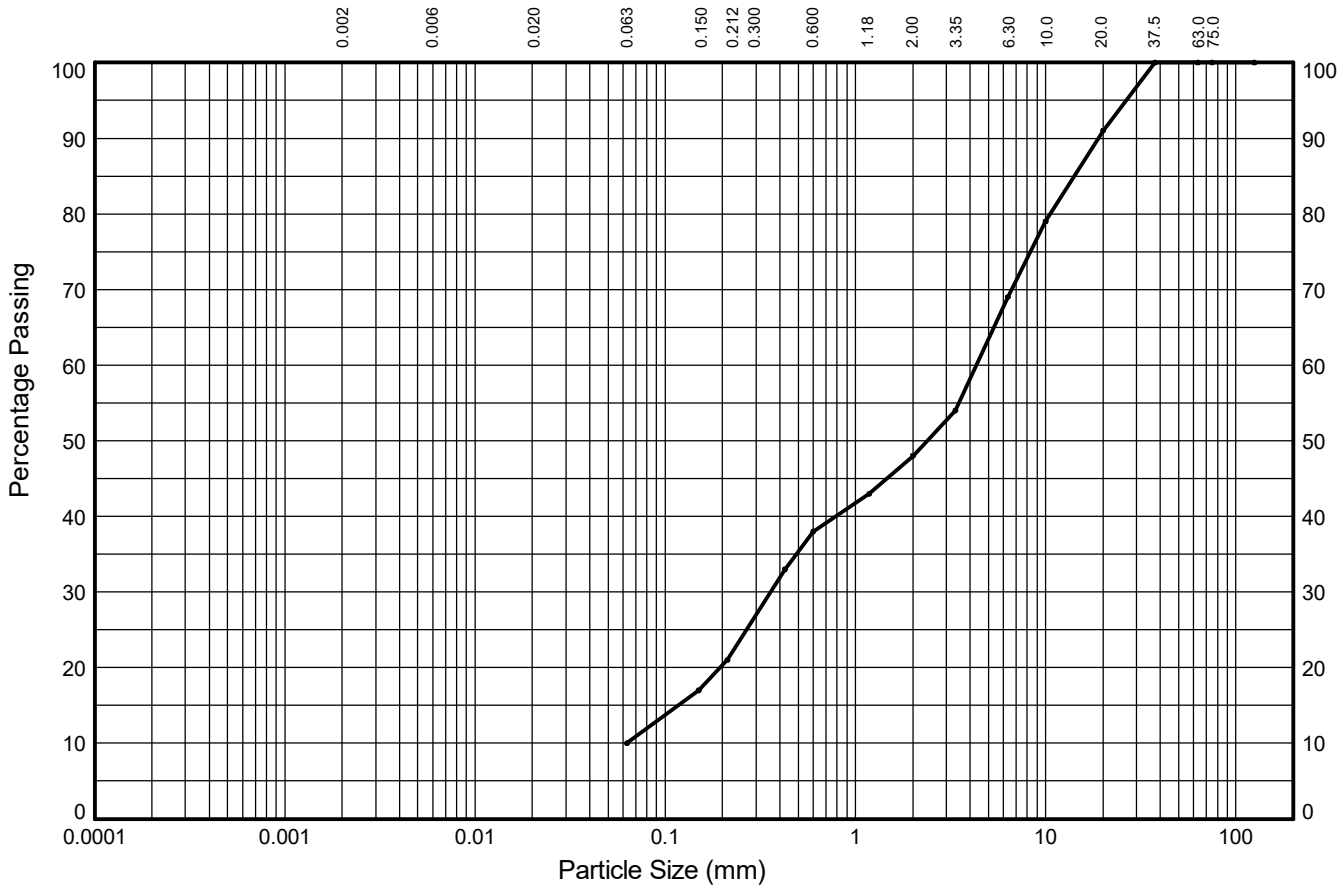
Contract	Contract Ref:
Ossory Road, Peckham	**584302**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442-262683, Fax: 01442-262323, Web: www.soils.co.uk, Email: ask@soils.co.uk | 29/07/20 - 17:24 | SC1 |

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Window Sample: **WS4** Sample Ref: Sample Type: **B** Depth (m): **2.50**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	10%	18%	10%	21%	22%	9%	
	SILT			SAND			GRAVEL			
10%				38%			52%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**91**
10.0	**79**
6.30	**69**
3.35	**54**
2.00	**48**
1.18	**43**
0.600	**38**
0.425	**33**
0.212	**21**
0.150	**17**
0.063	**10**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**0.063**
D_{15} (mm)	**0.117**
D_{30} (mm)	**0.357**
D_{50} (mm)	**2.375**
D_{60} (mm)	**4.313**
D_{85} (mm)	**14.142**
D_{90} (mm)	**18.877**
C_U	**68**
C_C	**0.47**

Soil Description:

Brown mottled grey, pale yellow and white very sandy clayey GRAVEL

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	**SHARON CAIRNS**	**29/07/20**

Contract	Contract Ref:
Ossory Road, Peckham	**584302**

AGS

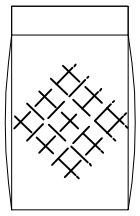
GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - PSD - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442-262683, Fax: 01442-262323, Web: www.soils.co.uk, Email: ask@soils.co.uk | 29/07/20 - 17:24 | SC1 |

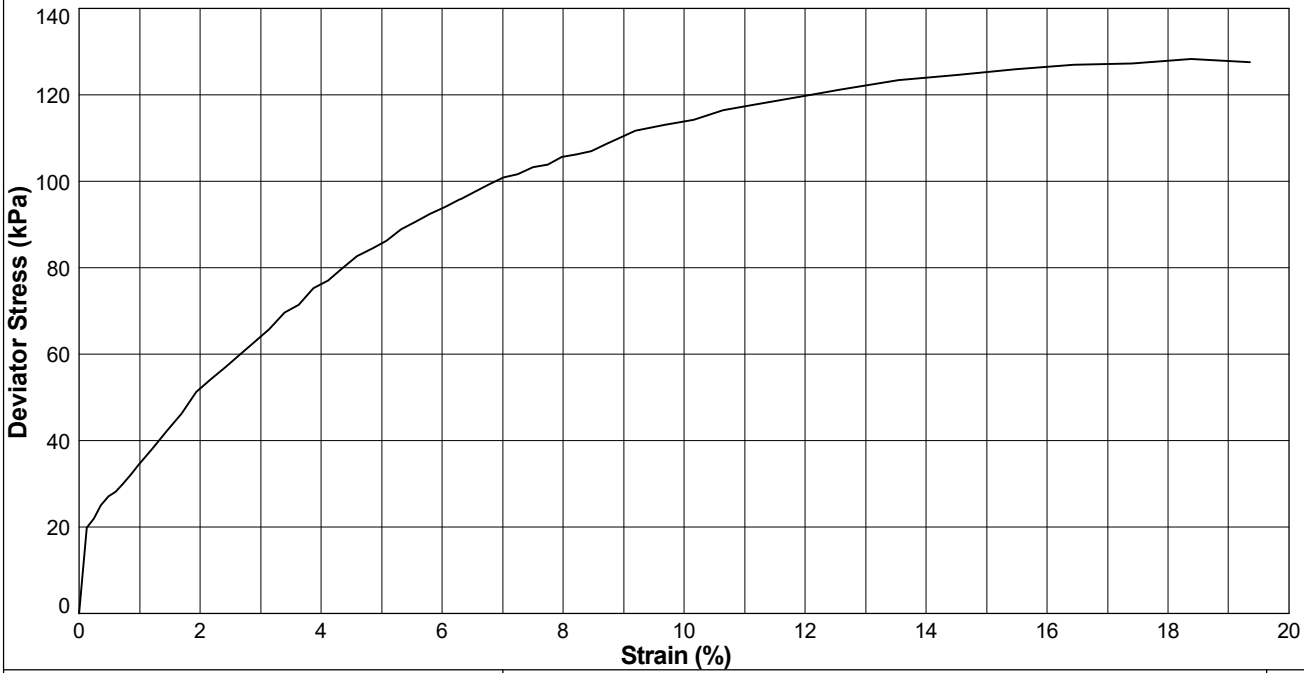
UNCONSOLIDATED QUICK UNDRAINED (SINGLE STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377 Part 7 Clause 8

Borehole: **BH1** Sample Ref: Sample Type: **U** Depth (m): **1.20**

Description : **Brown mottled orange sandy CLAY with some organic material**

STAGE NUMBER			**1**	**2**	**3**
SAMPLE DETAILS	Sample Condition		**Undisturbed**		
	Orientation of sample		**Vertical**		
	Diameter	(mm)	**104.28**		
	Height	(mm)	**206.76**		
	Moisture Content	(%)	**21**		
	Bulk Density	(Mg/m^3)	**2.10**		
	Dry Density	(Mg/m^3)	**1.74**		
TEST DETAILS	Membrane Type		**Rubber**		
	Membrane Thickness	(mm)	**0.23**		
	Rate of Axial Displacement	(%/min)	**1.93**		
	Cell Pressure	(kPa)	**24**		
	Membrane Correction	(kPa)	**0.79**		
	Corrected Deviator Stress	(kPa)	**128**		
	Undrained Shear Strength	(kPa)	**64**		
FAILURE DETAILS	Strain at Failure	(%)	**18.4**		
	Mode of Failure 1 : **Semi-plastic (intermediate)**				



STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	**SHARON CAIRNS**	**23/07/20**

Contract	Contract Ref:
Ossory Road, Peckham	**584302**

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GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph L - TRIAXIAL - BS - A4P | 584302-OSSORY-ROAD-PECKHAM-RSK-29909.GPJ - v10_01.
Structural Soils Ltd, Branch Office - Hemel Hempstead: 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442-262323, Fax: 01442-262683, Web: www.soils.co.uk, Email: ask@soils.co.uk | 23/07/20 - 14:59 | SC1 |

SUMMARY OF SATURATED MOISTURE CONTENT OF CHALK TESTS

In accordance with clause 3.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Number of Lumps	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Saturated Moisture Content %	Description of Sample	Lab location
BH1		B	14.00	3	25*	1.97*	1.57*	27*	White stained grey CHALK	**H**

* denotes the average values from multiple lumps

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	**SHARON CAIRNS**	**23.07.20**

Contract: **Ossory Road, Peckham**

Contract Ref: **584302**

AGS

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/05687
Issue Number: 1 **Date:** 20 July, 2020

Client: Structural Soils Limited (Hemel Hempstead Lab)
18 Frogmore Road
Hemel Hempstead
UK
HP3 9RT

Project Manager: Hemel Lab/Sharon Cairns
Project Name: Ossory Road, Peckham
Project Ref: 29909
Order No: N/A
Date Samples Received: 14/07/20
Date Instructions Received: 14/07/20
Date Analysis Completed: 20/07/20

Prepared by:

Richard Wong
Client Manager

Approved by:

Sophie France
Client Service Manager

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME
UKAS TESTING 1247

Envirolab Job Number: 20/05687

Client Project Name: Ossory Road, Peckham

Client Project Ref: 29909

Lab Sample ID	20/05687/1	20/05687/2	20/05687/3	20/05687/4	20/05687/5	20/05687/6	20/05687/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH01	BH01	BH01	BH01	BH01			
Depth to Top	19.50	25.50	33.00	2.00	5.00	14.00	8.00			
Depth To Bottom				2.50	5.50	14.50	8.50			
Date Sampled										
Sample Type	Solid	Solid	Solid	Solid	Solid	Solid	Soil - B			
Sample Matrix Code	7	7	7	7	7	7	4A			
% Stones >10mm$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
pH BRE$_D^{M\#}$	8.69	8.65	8.77	9.28	8.95	8.30	8.55	pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1)$_D^{M\#}$	66	87	75	29	<10	43	39	mg/l	10	A-T-026s

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40℃).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25℃ / 11550µS/cm @ 20℃ fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: Structural Soils Limited (Hemel Hempstead Lab), 18 Frogmore Road, Hemel Hempstead, UK, HP3 9RT

Project: Ossory Road, Peckham

Clients Project No: 29909

Project No: 20/05687

Date Received: 14/07/2020 (am)

Cool Box Temperatures (°C): 14.6

Lab Sample ID	20/05687/1	20/05687/2	20/05687/3	20/05687/4	20/05687/5	20/05687/6	20/05687/7
Client Sample No							
Client Sample ID/Depth	BH01 19.50m	BH01 25.50m	BH01 33.00m	BH01 2.00-2.50m	BH01 5.00-5.50m	BH01 14.00-14.50m	BH01 8.00-8.50m
Date Sampled							
Deviation Code							
E (no date)	✓	✓	✓	✓	✓	✓	✓

Key
E (no date) *No sampling date provided (all results affected if not provided)*

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/05892
Issue Number: 1 **Date:** 24 July, 2020

Client: Structural Soils Limited (Hemel Hempstead Lab)
18 Frogmore Road
Hemel Hempstead
UK
HP3 9RT

Project Manager: Hemel Lab/Sharon Cairns
Project Name: Ossory Road
Project Ref: 29909
Order No: N/A
Date Samples Received: 20/07/20
Date Instructions Received: 20/07/20
Date Analysis Completed: 24/07/20

Prepared by:

Sophie France
Client Service Manager

Approved by:

Danielle Brierley
Client Manager

Envirolab Job Number: 20/05892

Client Project Name: Ossory Road

Client Project Ref: 29909

Lab Sample ID	20/05892/1	20/05892/2	20/05892/3	20/05892/4	20/05892/5	20/05892/6		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS1	WS2	WS4	WS4	WS4	WS5				
Depth to Top	1.60	1.00	0.80	1.00	3.00	1.00				
Depth To Bottom	1.90			1.50	4.00	1.20				
Date Sampled	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20	11-Jul-20				
Sample Type	Soil - B	Soil - B	Soil - B	Soil - B	Soil - B	Soil - B				
Sample Matrix Code	5A	5A	6A	5AE	5A	6ABE				
% Stones >10mm$_A$	<0.1	6.5	29.4	<0.1	8.8	29.5		% w/w	0.1	A-T-044
pH BRE$_D^{M\#}$	8.26	7.92	7.76	8.15	8.44	7.76		pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1)$_D^{M\#}$	414	28	324	44	<10	776		mg/l	10	A-T-026s

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
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US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: Structural Soils Limited (Hemel Hempstead Lab), 18 Frogmore Road, Hemel Hempstead, UK, HP3 9RT

Project: Ossory Road

Clients Project No: 29909

Project No: 20/05892

Date Received: 20/07/2020 (am)

Cool Box Temperatures (°C): 15.9

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

APPENDIX H
PETROLEUM SEARCH RESPONSE

Petroleum Group LFB Headquarters - 3rd Floor
169 Union Street London SE1 0LL
T 020 8555 1200 x30859
F 020 7960 3624
Minicom 020 7960 3629
london-fire.gov.uk

Ms Sylwia Mianowska
RSK
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

The London Fire Commissioner is the fire and rescue authority for London

Date 24 April 2018
Our Ref 91/007955/IO
Your Ref 29909

Dear Ms Mianowska

THE ENVIRONMENTAL INFORMATION REGULATIONS 2004 - ENVIRONMENTAL ENQUIRY

Premises: 2-10 OSSORY ROAD, PECKHAM LONDON SE1 5AN

The London Fire Commissioner (the Commissioner) is the fire and rescue authority for London. The Commissioner is responsible for enforcing the Petroleum (Consolidation) Regulations 2014 in London.

As requested, a search has been made for information on the above premises. A thorough search of current and historical files and databases has revealed no petroleum tank information for the site.

Please note that this report is restricted to matters currently known by the Commissioner. Although we hold extremely comprehensive records, it is possible that we do not hold any records whatsoever for some solid-filled and very old tanks. This will be for one of the following reasons:-

1. The records held by the Commissioner were passed to it from the Greater London Council in 1986. In 1965 the Greater London Council inherited petroleum related records from the London County Council and the outer London Boroughs / Councils. Some of the outer London records were incomplete.

2. For premises where petroleum tanks have been either removed or permanently made safe, the Commissioner's records have (in a minority of cases) been destroyed; and for these cases the Commissioner does not hold any records that indicate that there was ever a 'petroleum' interest at the premises.

As you are aware, a fee is levied for the provision of this information and payment should be made in accordance with the invoice, which will be sent under separate cover.

Any queries regarding this letter should be addressed to the Petroleum Group Admin Manager. If you are dissatisfied in any way with the response given, please ask to speak to the Team Leader quoting our reference.

Yours faithfully,

Ijay Ogbata
for Assistant Commissioner (Fire Safety)
Directorate of Operations
petroleum@london-fire.gov.uk

Reply to Petroleum
Direct **T** 02085551200 **X** 30859

ENVIRONMENTAL ENQUIRY DETAIL FORM

Premises:
2-10 OSSORY ROAD, PECKHAM LONDON SE1 5AN
Our Reference:
91/007955

Current licence / Petroleum Storage Certificate in force?
YES ☐ NO ☒
Date last licence(s)/storage certificate(s) issued:
N/A

Known leaks or spills at this site:
N/A

Comments:
The Authority holds no record of petroleum storage tanks on this site.

Signed:	Ijay Ogbata
Name:	Ijay Ogbata
Position:	Admin Support
Date:	24th April 2018

APPENDIX I
GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH

Generic assessment criteria for human health: residential scenario without home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs.

C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Where a C4SL has been published, the RSK GAC duplicates the C4SL published values using all input parameters within the SP1010 final project report[3] and associated appendices[6], and adopts them as GAC for these six substances.

For all other substances the C4SL exposure modifications relevant for residential without home-grown produce end use have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) and reducing exposure frequency for dermal contact outdoors.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the Contaminated Land Exposure Assessment (CLEA) tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3]. The SAC are also termed GAC.

Conceptual model

In accordance with SR3[5], the residential without home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In accordance with Box 3.1 of SR3[5], the pathways considered for production of the SAC in the residential without home-grown produce scenario are

- direct soil and dust ingestion in areas of soft landscaping
- dermal contact with soil and indoor dust

- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the

polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated appendices[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a C4SL has been published, the RSK GAC have duplicated the C4SL published values using all input parameters within the SP1010 final project report[3] and associated appendices[6], and has adopted them as GAC for these six substances. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential without home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. SR3[5] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3[3], with a dust loading factor detailed in Section 9.3 of SR3[5]. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3[5] input parameters for residential without home-grown produce

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3[5]. Modifications to the default SR3[5] exposure scenarios based on the C4SL exposure scenarios[3] are presented in Table 2 below.

The final selected GAC are presented by pathway in Table 3 and the combined GAC in Table 4.

Figure 1: Conceptual model for CLEA residential scenario without home-grown produce

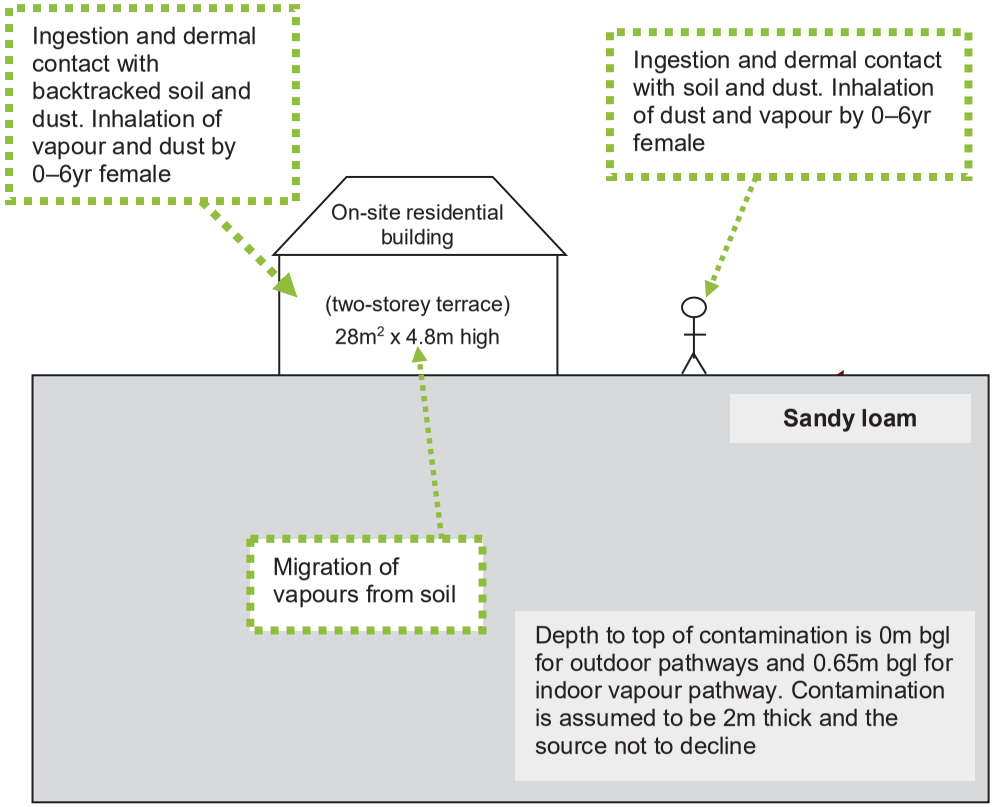

Table 1: Exposure assessment parameters for residential scenario without home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential without home-grown produce	Chosen land use
Receptor	Female child	Key generic assumption given in Box 3.1, SR3[5]
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3[5]. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)[5]
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3)[5]
Start age class (AC)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3[5]
End AC	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential without home-grown produce – modified receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
Soil to skin adherence factor – (outdoor)	mg soil/cm^2 skin	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010[3]					
Inhalation rate	m^3 day^{-1}	5.4	8.0	8.9	10.1	10.1	10.1
Justification		Mean value USEPA, 2011[12]; Table 3.2, SP1010[3]					
Notes: For **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3[1], Science Report SC050021/Cadmium SGV[1] and the project report SP1010[3] for more information.							

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GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR
Barium	(b)	1.35E+03	NR	NR	NR	1.35E+03	NR	NR	NR	1.35E+03	NR	NR	NR
Beryllium		1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR
Boron		1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR
Cadmium	(a)	1.95E+02	4.88E+02	1.49E+02	NR	1.95E+02	4.88E+02	1.49E+02	NR	1.95E+02	4.88E+02	1.49E+02	NR
Chromium (III) - trivalent	(c)	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR
Copper		1.08E+04	1.41E+04	7.13E+03	NR	1.08E+04	1.41E+04	7.13E+03	NR	1.08E+04	1.41E+04	7.13E+03	NR
Lead	(a)	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	2.41E-01	NR	4.31E+00	NR	5.74E-01	NR	1.07E+01	NR	1.25E+00	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		5.71E+01	3.63E+03	5.62E+01	NR	5.71E+01	3.63E+03	5.62E+01	NR	5.71E+01	3.63E+03	5.62E+01	NR
Methyl Mercury (Hg^{4+})		1.80E+01	1.87E+01	9.16E+00	7.33E+01	1.80E+01	3.62E+01	1.20E+01	1.42E+02	1.80E+01	7.68E+01	1.46E+01	3.04E+02
Nickel	(d)	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR
Selenium	(b)	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR
Vanadium		1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR
Zinc	(b)	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR
Cyanide (free)		4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR
Volatile Organic Compounds													
Benzene	(a)	7.36E+01	9.01E-01	8.90E-01	1.22E+03	7.36E+01	1.68E+00	1.64E+00	2.26E+03	7.36E+01	3.48E+00	3.33E+00	4.71E+03
Toluene		2.87E+04	9.08E+02	8.80E+02	8.69E+02	2.87E+04	2.00E+03	1.87E+03	1.92E+03	2.87E+04	4.55E+03	3.93E+03	4.36E+03
Ethylbenzene		1.29E+04	8.34E+01	8.29E+01	5.18E+02	1.29E+04	1.96E+02	1.93E+02	1.22E+03	1.29E+04	4.58E+02	4.42E+02	2.84E+03
Xylene - m		2.32E+04	8.25E+01	8.22E+01	6.25E+02	2.32E+04	1.95E+02	1.93E+02	1.47E+03	2.32E+04	4.56E+02	4.47E+02	3.46E+03
Xylene - o		2.32E+04	8.87E+01	8.83E+01	4.78E+02	2.32E+04	2.08E+02	2.06E+02	1.12E+03	2.32E+04	4.86E+02	4.76E+02	2.62E+03
Xylene - p		2.32E+04	7.93E+01	7.90E+01	5.76E+02	2.32E+04	1.86E+02	1.85E+02	1.35E+03	2.32E+04	4.36E+02	4.28E+02	3.17E+03
Total xylene		2.32E+04	7.93E+01	7.90E+01	6.25E+02	2.32E+04	1.86E+02	1.85E+02	1.47E+03	2.32E+04	4.36E+02	4.28E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		3.87E+04	1.04E+02	1.04E+02	2.04E+04	3.87E+04	1.69E+02	1.69E+02	3.31E+04	3.87E+04	3.21E+02	3.19E+02	6.27E+04
Trichloroethene		6.45E+01	1.72E-02	1.72E-02	1.54E+03	6.45E+01	3.59E-02	3.59E-02	3.22E+03	6.45E+01	7.98E-02	7.97E-02	7.14E+03
Tetrachloroethene		7.13E+02	1.79E-01	1.79E-01	4.24E+02	7.13E+02	4.02E-01	4.02E-01	9.51E+02	7.13E+02	9.21E-01	9.20E-01	2.18E+03
1,1,1-Trichloroethane		7.74E+04	9.01E+00	9.01E+00	1.43E+03	7.74E+04	1.84E+01	1.84E+01	2.92E+03	7.74E+04	4.04E+01	4.04E+01	6.39E+03
1,1,1,2 Tetrachloroethane		7.34E+02	1.54E+00	1.53E+00	2.60E+03	7.34E+02	3.56E+00	3.55E+00	6.02E+03	7.34E+02	8.29E+00	8.20E+00	1.40E+04
1,1,2,2-Tetrachloroethane		7.34E+02	3.92E+00	3.90E+00	2.67E+03	7.34E+02	8.04E+00	7.95E+00	5.46E+03	7.34E+02	1.76E+01	1.72E+01	1.20E+04
Carbon Tetrachloride		5.15E+02	2.58E-02	2.58E-02	1.52E+03	5.15E+02	5.65E-02	5.64E-02	3.32E+03	5.15E+02	1.28E-01	1.28E-01	7.54E+03
1,2-Dichloroethane		1.55E+01	9.20E-03	9.20E-03	3.41E+03	1.55E+01	1.33E-02	1.33E-02	4.91E+03	1.55E+01	2.28E-02	2.27E-02	8.43E+03
Vinyl Chloride		1.81E+00	7.73E-04	7.73E-04	1.36E+03	1.81E+00	1.00E-03	9.99E-04	1.76E+03	1.81E+00	1.53E-03	1.53E-03	2.69E+03
1,2,4-Trimethylbenzene		NR	5.58E+00	NR	4.74E+02	NR	1.29E+01	NR	1.16E+03	NR	2.69E+01	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		7.64E+03	4.86E+04	6.60E+03	5.70E+01	7.64E+03	1.18E+05	7.17E+03	1.41E+02	7.64E+03	2.68E+05	7.43E+03	3.36E+02
Acenaphthylene		7.65E+03	4.59E+04	6.55E+03	8.61E+01	7.65E+03	1.11E+05	7.15E+03	2.12E+02	7.65E+03	2.53E+05	7.42E+03	5.06E+02
Anthracene		3.82E+04	1.53E+05	3.06E+04	1.17E+00	3.82E+04	3.77E+05	3.47E+04	2.91E+00	3.82E+04	8.76E+05	3.66E+04	6.96E+00
Benzo(a)anthracene		1.98E+01	2.47E+01	1.10E+01	1.71E+00	1.98E+01	4.37E+01	1.36E+01	4.28E+00	1.98E+01	6.26E+01	1.50E+01	1.03E+01
Benzo(a)pyrene	(a)	5.34E+00	3.51E+01	NR	9.11E-01	5.34E+00	3.77E+01	NR	2.28E+00	5.34E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		4.97E+00	1.93E+01	3.95E+00	1.22E+00	4.97E+00	2.13E+01	4.03E+00	3.04E+00	4.97E+00	2.22E+01	4.06E+00	7.29E+00
Benzo(g,h,i)perylene		4.38E+02	1.87E+03	3.55E+02	1.54E-02	4.38E+02	1.94E+03	3.58E+02	3.85E-02	4.38E+02	1.97E+03	3.59E+02	9.23E-02
Benzo(k)fluoranthene		1.31E+02	5.41E+02	1.06E+02	6.87E-01	1.31E+02	5.76E+02	1.07E+02	1.72E+00	1.31E+02	5.91E+02	1.07E+02	4.12E+00
Chrysene		3.95E+01	1.19E+02	2.97E+01	4.40E-01	3.95E+01	1.49E+02	3.12E+01	1.10E+00	3.95E+01	1.66E+02	3.19E+01	2.64E+00
Dibenzo(a,h)anthracene		3.95E-01	1.45E+00	3.10E-01	3.93E-03	3.95E-01	1.64E+00	3.18E-01	9.82E-03	3.95E-01	1.74E+00	3.22E-01	2.36E-02
Fluoranthene		1.59E+03	3.83E+04	1.53E+03	1.89E+01	1.59E+03	8.87E+04	1.56E+03	4.73E+01	1.59E+03	1.83E+05	1.58E+03	1.13E+02

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Fluorene		5.09E+03	6.20E+03	2.80E+03	3.09E+01	5.09E+03	1.53E+04	3.82E+03	7.65E+01	5.09E+03	3.62E+04	4.47E+03	1.83E+02
Indeno(1,2,3-cd)pyrene		5.65E+01	2.12E+02	4.46E+01	6.13E-02	5.65E+01	2.38E+02	4.56E+01	1.53E-01	5.65E+01	2.50E+02	4.60E+01	3.68E-01
Naphthalene		2.50E+03	2.33E+01	2.31E+01	7.64E+01	2.50E+03	5.58E+01	5.46E+01	1.83E+02	2.50E+03	1.31E+02	1.25E+02	4.32E+02
Phenanthrene		1.58E+03	7.17E+03	1.30E+03	3.60E+01	1.58E+03	1.76E+04	1.45E+03	8.96E+01	1.58E+03	4.07E+04	1.52E+03	2.14E+02
Pyrene		3.82E+03	8.79E+04	3.66E+03	2.20E+00	3.82E+03	2.04E+05	3.75E+03	5.49E+00	3.82E+03	4.23E+05	3.79E+03	1.32E+01
Phenol		6.48E+04	4.58E+02	4.55E+02	2.42E+04	6.48E+04	6.95E+02	6.88E+02	3.81E+04	6.48E+04	1.19E+03	1.17E+03	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		3.23E+05	4.24E+01	4.24E+01	3.04E+02	3.23E+05	7.79E+01	7.79E+01	5.58E+02	3.23E+05	1.61E+02	1.61E+02	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		3.23E+05	1.04E+02	1.04E+02	1.44E+02	3.23E+05	2.31E+02	2.31E+02	3.22E+02	3.23E+05	5.29E+02	5.29E+02	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		6.45E+03	2.68E+01	2.68E+01	7.77E+01	6.45E+03	6.55E+01	6.53E+01	1.90E+02	6.45E+03	1.56E+02	1.55E+02	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		6.45E+03	1.33E+02	1.32E+02	4.75E+01	6.45E+03	3.31E+02	3.27E+02	1.18E+02	6.45E+03	7.93E+02	7.67E+02	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		6.45E+03	1.11E+03	1.06E+03	2.37E+01	6.45E+03	2.78E+03	2.42E+03	5.91E+01	6.45E+03	6.67E+03	4.37E+03	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC_8-EC_{10}		2.58E+03	4.74E+01	4.72E+01	6.13E+02	2.58E+03	1.16E+02	1.15E+02	1.50E+03	2.58E+03	2.77E+02	2.69E+02	3.58E+03
Aromatic hydrocarbons >EC_{10}-EC_{12}		2.58E+03	2.58E+02	2.52E+02	3.64E+02	2.58E+03	6.39E+02	5.94E+02	8.99E+02	2.58E+03	1.52E+03	1.24E+03	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		2.58E+03	2.85E+03	1.80E+03	1.69E+02	2.58E+03	7.07E+03	2.30E+03	4.19E+02	2.58E+03	1.68E+04	2.48E+03	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	1.86E+03	NR	NR	5.37E+01	1.90E+03	NR	NR	1.34E+02	1.92E+03	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for boron and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

Table 4
Human health generic assessment criteria for residential without home-grown produce

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	40	40	40
Barium	1,300	1,300	1,300
Beryllium	1.7	1.7	1.7
Boron	11,000	11,000	11,000
Cadmium	149	149	149
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	7,100	7,100	7,100
Lead	310	310	310
Elemental Mercury (Hg^0)	0.2	0.6	1.2
Inorganic Mercury (Hg^{2+})	56	56	56
Methyl Mercury (Hg^{4+})	9	12	15
Nickel	180	180	180
Selenium	430	430	430
Vanadium	1,200	1,200	1,200
Zinc	40,000	40,000	40,000
Cyanide (free)	40	40	40
Volatile Organic Compounds			
Benzene	0.9	1.6	3.3
Toluene	900 (869)	1,900	3,900
Ethylbenzene	80	190	440
Xylene - m	80	190	450
Xylene - o	90	210	480
Xylene - p	80	180	430
Total xylene	80	180	430
Methyl tertiary-Butyl ether (MTBE)	100	170	320
Trichloroethene	0.02	0.04	0.08
Tetrachloroethene	0.2	0.4	0.9
1,1,1-Trichloroethane	9.0	18.4	40.4
1,1,1,2 Tetrachloroethane	1.5	3.5	8.2
1,1,2,2-Tetrachloroethane	3.9	8.0	17.2
Carbon Tetrachloride	0.026	0.056	0.128
1,2-Dichloroethane	0.009	0.013	0.023
Vinyl Chloride	0.0008	0.0010	0.0015
1,2,4-Trimethylbenzene	5.6	12.9	26.9
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	6,600 (57)	7,200	7,400
Acenaphthylene	6,600 (86)	7,200	7,400
Anthracene	31,000 (1.17)	35,000	37,000
Benzo(a)anthracene	11.0	13.6	15.0
Benzo(a)pyrene	5.3	5.3	5.3
Benzo(b)fluoranthene	4.0	4.0	4.1
Benzo(g,h,i)perylene	355	358	359
Benzo(k)fluoranthene	106	107	107
Chrysene	30	31	32
Dibenzo(a,h)anthracene	0.31	0.32	0.32
Fluoranthene	1,500	1,600	1,600
Fluorene	2,800 (31)	3,800 (77)	4,500 (183)
Indeno(1,2,3-cd)pyrene	45	46	46
Naphthalene	23	55	125
Phenanthrene	1,300 (36)	1,450	1,520
Pyrene	3,700	3,800	3,800
Phenol	440*	688	1,170
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	42	78	161
Aliphatic hydrocarbons >EC_6-EC_8	100	230	530
Aliphatic hydrocarbons >EC_8-EC_{10}	27	65	155
Aliphatic hydrocarbons >EC_{10}-EC_{12}	130 (48)	330 (118)	770 (283)
Aliphatic hydrocarbons >EC_{12}-EC_{16}	1,100 (24)	2,400 (59)	4,400 (142)
Aliphatic hydrocarbons >EC_{16}-EC_{35}	65,000 (8)	92,000 (21)	111,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	65,000 (8)	92,000 (21)	111,000
Aromatic hydrocarbons >EC_8-EC_{10}	47	115	269
Aromatic hydrocarbons >EC_{10}-EC_{12}	300	600	1,200
Aromatic hydrocarbons >EC_{12}-EC_{16}	1,800 (169)	2,300 (419)	2,500
Aromatic hydrocarbons >EC_{16}-EC_{21}	1,900	1,900	1,900
Aromatic hydrocarbons >EC_{21}-EC_{35}	1,900	1,900	1,900
Aromatic hydrocarbons >EC_{35}-EC_{44}	1,900	1,900	1,900
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC)[1]		

Notes:

'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used

EC - equivalent carbon. SAC - soil assessment criteria.

[1] LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58.
1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS)

RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.

APPENDIX J
GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS

Several compounds can inhibit plant growth; hence it is important to have generic assessment criteria (GAC) to promote healthy plant growth. In the absence of other published GAC, the GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields.

The Council of European Communities Sewage Sludge Directive (86/278/EEC) dated 1986, has been transposed into UK law by Statutory Instrument No. 1263, The Sludge (use in Agriculture) Regulations 1989 (Public Health England, Wales and Scotland), as amended in 1990 and The Sludge (use in Agriculture) Regulations (Northern Ireland) SR No, 245, 1990. In addition the Department of Environment (DoE) produced a Code of Practice (CoP) (Updated 2nd Edition) in 2006 which provided guidance on the application of sewage sludge on agricultural land (however the status of this document is unclear as it is on the archive section of the Defra website).

The directive seeks to encourage the use of sewage sludge in agriculture and to regulate its use in such a way as to "***prevent harmful effects on soil, vegetation, animals and man".*** To this end, it prohibits the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil. Treated sludge is defined as having undergone "biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use". To provide protection against potential health risks from residual pathogens, sludge must not be applied to soil in which fruit and vegetable crops are growing, or less than ten months before fruit and vegetable crops are to be harvested. Grazing animals must not be allowed access to grassland or forage land less than three weeks after the application of sludge.

The specified limits of concentrations of selected elements in soil are presented in Table 4 of the updated 2nd Edition of the DoE Code of Practice and are designed to protect plant growth. It is noted that these values are more stringent than the values set in current UK regulations. However since they were amended following recommendations from the Independent Scientific Committee in 1993. (MAFF/DOE 1993). The GAC are presented in Table 1.

Table 1: Generic assessment criteria

Determinant	Generic assessment criteria (mg/kg)			
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110
Lead	300	300	300	300
Cadmium	3	3	3	3
Mercury	1	1	1	1

Note: Only compounds with assessment criteria documented within the Directive 86/278/EEC have been included, although criteria for 5 additional compounds have been presented within the 2006 CoP.

APPENDIX K
GENERIC ASSESSMENT CRITERIA FOR POTABLE WATER SUPPLY PIPES

A range of pipe materials is available and careful selection, design and installation is required to ensure that water supply pipes are satisfactorily installed and meet the requirements of the Water Supply (Water Fittings) Regulations 1999 in England and Wales, the Byelaws 2000 in Scotland and the Northern Ireland Water Regulations. The regulations include a requirement to use only suitable materials when laying water pipes and laying water pipes without protection is not permitted at contaminated sites. The water supply company has a statutory duty to enforce the regulations.

Contaminants in the ground can pose a risk to human health by permeating potable water supply pipes. To fulfil their statutory obligation, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from specific contaminants, or that the proposed remedial strategy will mitigate any existing risk. If these requirements cannot be demonstrated to the satisfaction of the relevant water company, it becomes necessary to specify an alternative pipe material on the whole development or in specific zones.

In 2010, UK Water Industry Research (UKWIR) published *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (Report Ref. No. 10/WM/03/21). This report reviewed previously published industry guidelines and threshold concentrations adopted by individual water supply companies.

The focus of the UKWIR research project was to develop clear and concise procedures, which provide consistency in the pipe selection decision process. It was intended to provide guidance that can be used to ensure compliance with current regulations and to prevent water supply pipe failing prematurely due to the presence of contamination.

The report concluded that in most circumstances only organic contaminants pose a potential risk to plastic pipe materials and Table 3.1 of the report provides threshold concentrations for polyethylene (PE) and polyvinyl chloride (PVC) pipes for the organic contaminants of concern. The report also makes recommendations for the procedures to be adopted in the design of site investigations and sampling strategies, and the assessment of data, to ensure that the ground through which water supply pipes will be laid is adequately characterised.

Risks to water supply pipes have therefore been assessed against the threshold concentrations for PE and PVC pipe specified in Table 3.1 of Report 10/WM/03/21, which have been adopted as the GAC for this linkage and are reproduced in Table A3 below.

Since water supply pipes are typically laid at a minimum depth of 0.75 m below finished ground levels, sample results from depths between 0.5 m and 1.5 m below finished level are generally considered suitable for assessing risks to water supply. Samples outside these depths can be used, providing the stratum is the same as that in which water supply pipes are likely to be located. The report specifies that sampling should characterise the ground conditions to a minimum of 0.5 m below the proposed depth of the pipe.

It should be noted that the assessment provided in this report is a guide and the method of assessment and recommendations should be checked with the relevant water supply company.

Table Q1: Generic assessment criteria for water supply pipes

	Parameter group	Pipe material	
		GAC (mg/kg)	
		PE	PVC
1	Extended VOC suite by purge and trap or head space and GC-MS with TIC (Not including compounds within group 1a)	0.5	0.125
1a	• BTEX + MTBE	0.1	0.03
2	SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C_5–C_{10}) (Not including compounds within group 2e and 2f)	2	1.4
2e	• Phenols	2	0.4
2f	• Cresols and chlorinated phenols	2	0.04
3	Mineral oil C_{11}–C_{20}	10	Suitable
4	Mineral oil C_{21}–C_{40}	500	Suitable
5	Corrosive (conductivity, redox and pH)	Suitable	Suitable
Specific suite identified as relevant following site investigation			
2a	Ethers	0.5	1
2b	Nitrobenzene	0.5	0.4
2c	Ketones	0.5	0.02
2d	Aldehydes	0.5	0.02
6	Amines	Not suitable	Suitable

Notes: where indicated as 'suitable', the material is considered resistant to permeation or degradation and no threshold concentration has been specified by UKWIR.

APPENDIX L
GENERIC ASSESSMENT CRITERIA FOR CONTROLLED WATERS

GENERIC ASSESSMENT CRITERIA FOR CONTROLLED WATERS

Protection of the water environment

The water environment in the United Kingdom is protected under a number of regulatory regimes. The relevant environmental regulator is consulted where there may be a risk that pollution of 'controlled waters' may occur or may have occurred in the past.

The term 'controlled waters' refers to coastal waters, inland freshwaters and groundwater. The EU Water Framework Directive (WFD) (2000/60/EC) is implemented via domestic regulations and guidance, covering aspects of groundwater and surface water protection as well as drinking water supply policy. Domestic legislation and guidance will vary across the United Kingdom. Therefore, the relevant legislation for England, Wales, Northern Ireland and Scotland should be reviewed, alongside guidance provided by the Environment Agency (EA), Natural Resource Wales (NRW), the Scottish Environmental Protection Agency (SEPA) or the Northern Ireland Environment Agency (NIEA), as appropriate.

The main objectives of the protection and remediation of groundwater under threat from land contamination are set out within "The Environment Agency's approach to groundwater protection", version 1.0 (March 2017)(1) and the associated guidance "Land contamination groundwater compliance points: quantitative risk assessments (March 2017)(1a) that have replaced the previous guidance document "Groundwater Principles and Practice (GP3)". When assessing risks to groundwater, the following need to be considered:

- Where pollutants have not yet entered groundwater, all necessary and reasonable measures must be taken to:
    - ***prevent*** *the input of* ***hazardous*** *substances into groundwater (see description of hazardous substances below)*
    - ***limit*** *the entry of other (non-hazardous) pollutants into groundwater to avoid pollution, deterioration in the status of groundwater bodies and to prevent sustained, upward trends in pollutant concentrations in groundwater.*
- Where pollutants have already entered groundwater, the priority is to take all necessary and reasonable measures to:
    - ***minimise*** *further entry of "contaminants" where there is a defined source*
    - ***limit the pollution*** *of groundwater or any effect on the status of the groundwater body from the future expansion of the 'plume', if necessary, by actively reducing its extent.*

Within the context of groundwater risk assessments on sites affected by land contamination, "reasonable" means feasible without involving disproportionate costs. What costs are "disproportionate" depends on site-specific circumstances, which may include:

- Considerations of technical feasibility such as identified by the remedial options appraisal, this may be due to the distribution or nature of the contamination and the available remedial methods to treat the identified contamination;
- Sustainability considerations.

DEFINITIONS AND SUBSTANCE CLASSIFICATIONS

Risks to surface waters:

When assessing risks to surface waters, the following list of definitions should be understood:

Priority substances (PS) are harmful substances originally identified under the Water Framework Directive (WFD) 2000/60/EC as substances 'presenting a significant risk to or via the aquatic environment' at a European level. Member States are required to incorporate the identified **PS** into their country-wide monitoring programmes. There are currently 33 **PS** defined within the Priority Substances Directive (2013/39/EU; Annex 1), with a further 12 additional substances due to come into force from 22 December 2018. Directive 2013/39/EU has been transposed into domestic legislation for England and Wales by The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

Under the umbrella of **PS**, there is a sub-set of substances identified as being "hazardous", and these are referred to as **Priority hazardous substances (PHS).** The list of **PHS** is defined at EU level within the Priority Substances Directive (2013/39/EU). The WFD defines hazardous substances as 'substances (or groups of substances) that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances that give rise to an equivalent level of concern.' There are currently 15 **PHS**, with a further 6 additional substances due to come into force from 22 December 2018.

There is also another group of substances defined at EU level and which are referred to as **other pollutants (OP)** in Directive 2013/39/EU**.** These are additional substances which although not **priority substances**, have EQS which are identical to those laid down in the legislation which applied prior to 13 January 2009 (Directive 2008/105/EU). The **OP** are listed along with the **priority substance (PS)** within the Priority Substances Directive (2013/39/EU),and their associated EQS are also listed therein. There are 6 **OP** defined within the Priority Substances Directive (2013/39/EU).

In addition to the EU level substances, there are also a group of pollutants defined at a Member State level, referred to as **Specific pollutants (SP)**. These substances are pollutants which are released in significant quantities into water bodies in each of the individual European Member States. Under the WFD, Member States are required to set their own EQS for these substances. An indicative list of **SP** is given in Annex VIII of the WFD. Many of the substances categorised as **SP** in the UK were formerly List 2 substances under the old Groundwater Directive (80/68/EEC). The **SP** are defined within Part 2 (Table 1) of The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

Risks to groundwater:

When assessing risks to groundwater, the following definitions should be understood:

Under the requirements of the Groundwater Daughter Directive (2006/118/EU), the UK has published a list of substances it considers to be **hazardous substances** with respect to groundwater. In their advisory capacity to the government, this list has been derived by the UK Joint Agencies Groundwater Directive Advisory Group (JAGDAG), of which the Environment Agency is a member. The JAGDAG list of **hazardous substances** was published in January 2017 and the Environment Agency will use the updated list of hazardous substances from this date for all new activities that may lead to the discharge of hazardous substances to groundwater. The list is extensive and can be found in full at:

https://www.wfduk.org/stakeholders/jagdag

Selecting the appropriate assessment criteria

When assessing the risks to controlled waters, various assessment criteria apply, depending on the nature of the assessment and the conceptual site model.

Where a surface water body is involved, then Environmental Quality Standards (EQS) are the relevant assessment criteria as they are designed to be protective of surface water ecology.

Where a public water supply or a Principal aquifer is involved, then the standards defined in The Water Supply (Water Quality) Regulations[2] are the primary source of assessment criteria. The Private Water Supplies Regulations[3] may also be applicable in some cases. For instances where there are no UK assessment criteria, then the World Health Organisation (WHO) drinking water guidelines[4] may be used.

This appendix presents the generic assessment criteria (GAC) that RSK considers suitable for assessing risks to controlled waters for our most commonly encountered determinants. A full list of EQS for England and Wales are included in The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

The RSK GAC for controlled waters are presented in **Table 1** and **Table 2**. In line with the Environment Agency's Remedial Targets Methodology, the GAC for controlled waters are termed 'target concentrations'.

The appropriate target concentrations should be selected with consideration to:

- the site conceptual model (i.e. the receptor at potential risk);
- whether the substance is already present in groundwater at the site;
- whether or not the substance is classified as a priority hazardous substance under the Priority Substances Directive (2013/39/EC) (see above), or as a hazardous substance according to the current list of JAGDAG determinations[5]; and
- background concentrations in the aquifer (if applicable).

It is important to remember that the WFD and Environment Agency guidance[1 & 1a] support a sustainable, risk-based approach be applied to groundwater contamination. Exceedance of any target concentration does not necessarily imply that an unacceptable risk exists or that remediation is inevitably required.

Target concentrations shaded in green are statutory values	Target concentrations shaded in orange are non-statutory values

Note: Units µg/l throughout (unless otherwise stated)

Table 1: Target concentrations for controlled waters (excluding TPH CWG fractions)

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Metals & other inorganics						
Hazardous substance	Specific pollutant	Arsenic	-	10[2]	50[6a]	25[6a]
Non-hazardous pollutant	Priority substance	Cadmium	0.1[7]	5[2]	≤0.08, 0.08, 0.09, 0.15, 0.25 [6b]	0.2[6a]
(Not determined)	-	Chromium (total)	-	50[2]	8.1 Sum values for chromium III and VI	-
(None	Specific pollutant	Chromium (III)	-	Use value for total chromium	4.7[6a]	-
Hazardous substance	Specific pollutant	Chromium (VI)			3.4[6a]	0.6[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
(Not determined)	Specific pollutant	Copper	-	2,000[2]	1 bioavailable[6a]	3.76 dissolved, where DOC ≤1mg/l[6a]
						3.76µg/l + (2.677µg/l x ((DOC/2) – 0.5µg/l)) dissolved, where DOC >1mg/l[6a]
Hazardous substance	Priority substance	Lead	-	10[2]	1.2 bioavailable[6a]	1.3[6a]
Hazardous substance	**Priority hazardous substance**	Mercury	0.01[7]	1[2]	0.07[6c]	0.07[6c]
Non-hazardous pollutant	Priority substance	Nickel	-	20[2]	4.0 bioavailable[6a]	8.6[6a]
Non-hazardous pollutant	-	Selenium	-	10[2]	-	-
Non-hazardous pollutant	Specific pollutant	Zinc	-	3,000[8]	10.9 bioavailable[6a]	6.8 dissolved [6a]
None	Specific pollutant	Iron	-	200[2]	1000[6a]*1	1000[6a])*1
None	Specific pollutant	Manganese	-	50[2] (0.05mg/l)	123 bioavailable[6a] (0.123mg/l)	-
(Not determined)	-	Aluminium	-	200[2]	-	-

Substance classification		Determinant	Target concentrations (µg/l)			
			Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
Groundwater receptors[5]	Surface water receptors[6]				Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	**Priority hazardous substance**	Tributyltin compounds (Tributyltin-cation)	0.001[7]	-	0.0002[6a]	0.0002[6a]
(Not determined)	-	Sodium	-	200,000[2] (200 mg/l)	-	-
Non-hazardous pollutant	Specific pollutant	Cyanide (Hydrogen cyanide)	-	50[2] (0.05 mg/l)	1[6a] (0.001 mg/l)	1[6a] (0.001 mg/l)
Non-hazardous pollutant	-	Total ammoniacal nitrogen[$]	-	500[2] (0.5 mg/l) as NH_4 (472 expressed as NH_3; 389 expressed as N)	300[6f] (0.3 mg/l) as N (364 expressed as NH_3; 386 expressed as NH_4)	-
Non-hazardous pollutant	Specific pollutant	Ammonia un-ionised (equilibrium ratio calculated) (NH_3)	-	-	-	21[6a] (0.021 mg/l)
Non-hazardous pollutant	Specific pollutant	Chlorine	-	-	2[6a] (0.002 mg/l)	10[6d] (0.01 mg/l)
(Not determined)	-	Chloride	-	250,000[2] (250 mg/l)	-	-
(Not determined)	-	Sulphate	-	250,000[2] (250 mg/l)	-	-
(Not determined)	-	Nitrate (as NO_3)	-	50,000[2] (50 mg/l)	-	-

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
(Not determined)	-	Nitrite (as NO_2)	-	500[2] (0.5 mg/l)	10[9] (0.01 mg/l)	-
Volatile organic compounds (VOC)						
Non-hazardous pollutant	Other pollutant	Tetrachloroethene (tetrachloroethylene; PCE)	0.1[7]	10[2] sum of TCE and PCE	10[6a]	10[6a]
Hazardous substance	Other pollutant	Trichloroethene (trichloroethylene; TCE)	0.1[7]		10[6a]	10[6a]
None	Specific pollutant	Tetrachloroethane	-	-	140[6a]	-
Hazardous substance	Other pollutant	Carbon tetrachloride (tetrachloromethane)	0.1[7]	3.0[2]	12[6a]	12[6a]
Non-hazardous pollutant	Priority substance	1,2-Dichloroethane	1.0[7]	3.0[2]	10[6a]	10[6a]
Non-hazardous pollutant	-	1.2-Dichloroethene (DCE) sum of cis and trans	-	50.0[4]	-	-
Hazardous substance	-	Vinyl chloride (chloroethene)	-	0.5[2]	-	-
Non-hazardous pollutant	Priority substance	Dichloromethane	-	20[4]	20[6a]	20[6a]
Non-hazardous pollutant	Priority substance	Trichlorobenzenes	0.01[7]	-	0.4[6a]	0.4[(6a)]

Substance classification		Determinant	Target concentrations (µg/l)			
			Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
Groundwater receptors[5]	Surface water receptors[6]				Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	Priority substance	Trichloromethane (Chloroform)	0.1[7]	100[2a] (sum of **trihalomethanes** – chloroform, bromform, dibromochloromethane, bromodichloromethane)	2.5[6a]	2.5[6a]
(Not determined)	-	Bromoform	-		-	-
(Not determined)	-	Dibromochloromethane	-		-	-
(Not determined)	-	Bromodichloromethane	-		-	-
Non-hazardous pollutant	**Priority hazardous substance**	Di(2-ethylhexyl) phthalate (bis(2-ethylhexyl) phthalate, DEHP)	-	8[4]	1.3[6a]	1.3[6a]
None	Specific pollutant	Benzyl butyl phthalate	-	-	7.5[6a]	0.75[6e]
Hazardous substance	**Priority hazardous substance**	Hexachlorobutadiene (as a pesticide, but reported in a VOC suite)	0.005[7]	0.1[2]	0.6[6c]	0.6[6c]
Semi-volatile organic compounds (SVOC)						
(Not determined)	-	Acenaphthylene (Aro EC12-EC16)	-	-	5.8[10]	
Hazardous substance	**Priority hazardous substance**	Anthracene (Aro EC16-EC21)	-	-	0.1[6a]	0.1[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Non-hazardous pollutant	Priority substance	Naphthalene (Aro EC10-EC12)	-	-	2[6a]	2[6a]
Hazardous substance	Priority substance	Fluoranthene (Aro EC21-EC35) not used as an indicator for this EC band	-	-	0.0063[6a]	0.0063[6a]
Hazardous substance(s)	**Priority hazardous substance(s)**	Benzo(a)pyrene (Aro EC21-EC35)	-	0.01[2]	0.00017[6a]	0.00017[6a]
		Benzo(b)fluoranthene (Aro EC21-EC35)	-	0.1[2] sum of the concentration of the four specified compounds	No EQS for these substances. B(a)P should be used as the indicator compound instead.	
		Benzo(k)fluoranthene (Aro EC21-EC35)	-			
		Benzo(g,h,i)perylene (Aro EC21-EC35)	-			
		Indeno(1,2,3-cd) pyrene (Aro EC21-EC35)	-			
Non-hazardous pollutant	Specific pollutant	Phenol	-	-	7.7[6a]	7.7[6a]
Hazardous substance	Specific pollutant	2,4-Dichlorophenol	0.1[7]	-	4.2[6a]	0.42[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
			Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
Groundwater receptors[5]	Surface water receptors[6]				Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	Priority substance	Pentachloro-phenol (PCP) (as a pesticide, but reported in an SVOC suite)	0.1[7]	0.1[2]	0.4[6a]	0.4[6a]
Petroleum hydrocarbons						
Hazardous substance	-	Total petroleum hydrocarbons	-	See Table 2 for individual (non-statutory) TPH CWG fractions with respect to drinking water receptors	See individual risk driving compounds (i.e. BTEX and PAH) for specific EQS	
Hazardous substance	Priority substance	Benzene (Aro EC5-EC7)	1[7]	1[2]	10[6a]	8[6a]
Hazardous substance	Specific pollutant	Toluene (Aro EC7-EC8)	4[7]	700[4]	74[6a]	74[6a]
Hazardous substance	-	Ethylbenzene (Aro EC8-EC10)	-	300[4]	300[11]	-
(Not determined)	-	Xylenes (Aro EC8-EC10)	3[7]	500[4]	30[11]	-
Non-hazardous pollutant	-	Methyl tertiary butyl ether (MTBE)	-	15[12]	-	

Substance classification		Determinant	Target concentrations (µg/l)			
			Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
Groundwater receptors[5]	Surface water receptors[6]				Freshwater	Transitional (estuaries) and coastal waters
Pesticides, fungicides, insecticides and herbicides						
(Not determined) – assume to be Hazardous Substance	-	Total pesticides	-	0.5[2]	-	-
(Not determined) - assume to be Hazardous Substance	-	Other individual pesticides (unless otherwise detailed below)	-	0.1[2]	-	-
Hazardous substance(s)	Other pollutant (Cyclodiene pesticides)	Aldrin	0.003[7]	0.03[2]	0.01[6a] (sum of all four)	0.005[6a] (sum of all four)
		Dieldrin	0.003[7]	0.03[2]		
		Endrin	0.003[7]	0.1[2b] ('other individual pesticide')		
		Isodrin*[2]	0.003[7]	0.1[2b] ('other individual pesticide')		
Hazardous substance	Other pollutant	DDT (total)	0.002[7]	0.1[2] ('other individual pesticide')	0.025[6a]	0.025[6a]
Hazardous substance	Specific pollutant	Carbendazim	-	0.1[2] ('other individual pesticide')	0.15[6a]	-

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	Specific pollutant	Chlorothalonil	-	0.1[2] ('other individual pesticide')	0.035[6a]	-
Hazardous substance	Specific pollutant (until 22/12/18, after which it becomes a Priority substance)	Cypermethrin	-	0.1[2] ('other individual pesticide')	0.0001[6a] From 22/12/18: 8.0E^{-5}[6a]	0.0001[6a] From 22/12/18: 8.0E^{-6}[6a]
Hazardous substance	Specific pollutant	Dimethoate	0.01[7]	0.1[2] ('other individual pesticide')	0.48[6a]	0.48[6a]
(Not determined)	Specific pollutant	Glyphosate	-	0.1[2] ('other individual pesticide')	196[6a]	196[6a]
Hazardous substance	Specific pollutant	Linuron	-	0.1[2] ('other individual pesticide')	0.5[6a]	0.5[6a]
Non-hazardous pollutant	Specific pollutant	Mecoprop	0.04[7]	0.1[2] ('other individual pesticide')	18[6a]	18[6a]
Non-hazardous pollutant	Specific pollutant	Methiocarb	-	0.1[2] ('other individual pesticide')	0.01[6a]	-
Non-hazardous pollutant	Specific pollutant	Pendimethalin	-	0.1[2] ('other individual pesticide')	0.3[6a]	-

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	Specific pollutant	Permethrin	0.001[7]	0.1[2] ('other individual pesticide')	0.001[6a]	0.0002[6a]
Hazardous substance	Priority substance	Alachlor	-	0.1[2] ('other individual pesticide')	0.3[6a]	0.3[6a]
Hazardous substance	Priority substance	Atrazine	0.03[7]	100[4] ('other individual pesticide')	0.6[6a]	0.6[6a]
Hazardous substance	Priority substance	Diuron	-	0.1[2] ('other individual pesticide')	0.2[6a]	0.2[6a]
Hazardous substance	**Priority hazardous substance**	Endosulphan	0.005[7]	0.1[2] ('other individual pesticide')	0.005[6a]	0.0005[6a]
Non-hazardous pollutant	Priority substance	Isoproturon	-	0.1[2] ('other individual pesticide')	0.3[6a]	0.3[6a]
Hazardous substance	Priority substance	Simazine	0.03[7]	0.1[2] ('other individual pesticide')	1[6a]	1 [6a]
Hazardous substance	**Priority hazardous substance**	Trifluralin	0.01[7]	0.1[2] ('other individual pesticide')	0.03[6a]	0.03[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
(Not determined)	From 22/12/18: Priority substance	Dichlorvos	-	0.1[2] ('other individual pesticide')	From 22/12/18: $6.0E^{-4}$[6a]	From 22/12/18: $6.0E^{-5}$[6a]
Hazardous substance	From 22/12/18: Priority substance	Heptachlor and heptachlor epoxide	-	0.03[2]	From 22/12/18: $2.0E^{-7}$[6a]	From 22/12/18: $1.0E^{-08}$[6a]
Miscellaneous						
None	Specific pollutant	Triclosan (antibacterial agent)	-	-	0.1[6a]	0.1[6a]
Hazardous substance	**From 22/12/18: Priority hazardous substance**	Perfluoro-octane sulfonic acid (and its derivatives) (PFOS)	-	-	From 22/12/18: $6.5E^{-4}$[6a]	From 22/12/18: $1.3E^{-4}$[6a]
Hazardous substance	**From 22/12/18: Priority hazardous substance**	Hexabromo cyclododecane (HBCDD)	-	-	From 22/12/18: 0.0016[6a]	From 22/12/18: 0.0008[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
			Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
Groundwater receptors[5]	Surface water receptors[6]				Freshwater	Transitional (estuaries) and coastal waters

Notes:

'-' A target concentration is not available.

$Please note that total ammonia (NH_4^+ and NH_3) is equivalent to ammoniacal nitrogen in laboratory reports

*1 Please note that although iron is listed in the 2015 Direction as 1.000 µg/l, the EQS remains at 1mg/l in Scotland and it is assumed this is an error and should read either 1,000 or 1000µg/l.

*2 Please note that although Isodrin is not listed in name within the group of "Cyclodiene pesticides" in Table 1 of Schedule 3 Part 3 of the 2015 Direction[6], the CAS number for Isodrin (465-73-6) **is** listed and therefore it is assumed that it has been missed off the named list of substances.

*3 Total petroleum hydrocarbons is used for consistency, but is an analytical method-defined measurement for a mixture of hydrocarbons subject to environmental analysis[11].

"Bioavailable" in relation to copper, zinc, nickel and manganese (but not lead) is the generic EQSbioavailable[6a] derived from the Metal Bioavailability Assessment Tool (M-BAT) developed by the Water Framework Directive UK Technical Advisory Group (WFDTAG). Exceedance of this value should prompt a site-specific assessment using the M-BAT with pH, DOC and Ca to derive a site-specific EQS termed the $PNEC_{dissolved}$. http://www.wfduk.org/resources/rivers-lakes-metal-bioavailability-assessment-tool-m-bat.

For zinc, if there is an exceedance of the EQSbioavailable in an initial GQRA, Tier 2 required that the EQS for zinc should also have the ambient background concentration of zinc added as well

Table 2: World Health Organization (WHO) guide values for TPH CWG fractions in drinking water[13] (as referenced in CL:AIRE, 2017[11])

TPH CWG fraction	WHO guide value for drinking water[13] (µg/l)
Aliphatic fractions:	
Aliphatic EC5-EC6	15,000
Aliphatic >EC6-EC8	15,000
Aliphatic >EC8-EC10	300
Aliphatic >EC10-EC12	300
Aliphatic >EC12-EC16	300
Aliphatic >EC16-EC21	-
Aliphatic >EC21-EC35	-
Aromatic fractions:	
Aromatic EC5-EC6	10 (benzene)
Aromatic >EC6-EC8	700 (toluene)
Aromatic >EC8-EC10	300 (ethyl benzene) 500 (xylenes)
Aromatic >EC10-EC12	90
Aromatic >EC12-EC16	90
Aromatic >EC16-EC21	90
Aromatic >EC21-EC35	90
Reference: World Health Organisation (WHO), 2008. Petroleum products in drinking-water. Background document for development of WHO guidelines for drinking water quality. WHO/SDE/WSH/05.08/123. World Health Organisation, Geneva[13].	

References

1. Environment Agency (2017), 'The Environment Agency's approach to groundwater protection', version 1.0, March 2017 (formerly contained within GP3) [accessed 29 March 2017]. https://www.gov.uk/government/collections/groundwater-protection

1a. Environment Agency (2017), 'Land contamination groundwater compliance points: quantitative risk assessments', March 2017 (formerly contained within GP3) [accessed 29 March 2017]. https://www.gov.uk/government/collections/groundwater-protection

2. The Water Supply (Water Quality) Regulations 2016 (SI 2016/619)
    - 2a. Sum of chloroform, bromoform, dibromochloromethane and bromodichloromethane
    - 2b. Standard applies to individual pesticides except aldrin, dieldrin, heptachlor and heptachlor epoxide, for which a separate standard is defined.
3. The Private Water Supplies (England) Regulations 2016. SI 2016 / 618
4. WHO (2011), *Guidelines for drinking-water quality*, 4th edn
5. JAGDAG hazard substance determinations: This list contains substances that are determined to be hazardous substances or non-hazardous pollutants for the purposes of the groundwater directive 2006/118/EC. The absence of an assessment or substance from the list means an assessment has not been done yet and is presented as 'Not yet determined'; if a substance has been assessed but does not fall into either category it is presented as 'None'. For further details on how substances are assessed, see the Joint Agencies Groundwater Directive Advisory Group (JAGDAG) 'Methodology for the determination of hazardous substances in groundwater for the purposes of the groundwater directive 2006/118/EC' which is available from the JAGDAG website. The methodology is a UK –wide framework that sets criteria for how to assess whether a substance is a hazardous substances in groundwater. The list of substances can be found at:

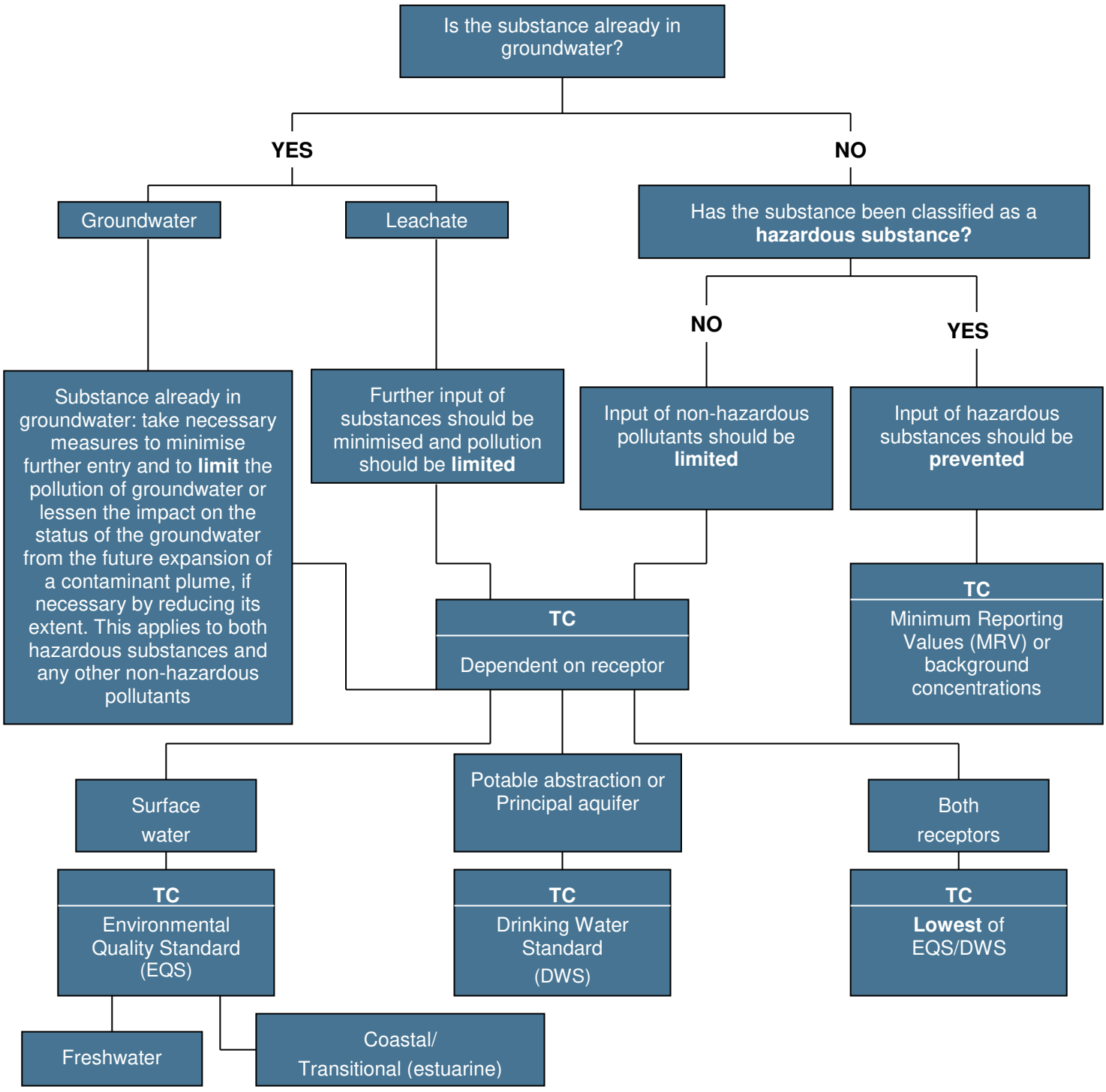
   https://www.wfduk.org/stakeholders/jagdag

6. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.
    - 6a. The EQS for these substances are based on a "long term mean" or an "annual average (AA)" EQS.
    - 6b. For cadmium and its compounds the EQS values vary depending on the hardness of the water as specified in five class categories (Class 1: < 40 mg CaCO3/l, Class 2: 40 to < 50 mg CaCO3/l, Class 3: 50 to < 100 mg CaCO3/l, Class 4: 100 to < 200 mg CaCO3/l and Class 5: ≥ 200 mg CaCO3/l).
    - 6c. The EQS for Mercury and hexachlorobutadiene are based on a "maximum acceptable concentration (MAC)" EQS in absence of an "annual average (AA)" EQS.
    - 6d. The EQS for chlorine in saltwater is based on the 95th percentile concentration of total residual oxidant, which refers to the sum of all oxidising agents existing in water, expressed as available chlorine.
    - 6e. The recommended saltwater standard is derived using a safety factor of 100. Where the standard is failed, it is recommended that supporting evidence of ecological damage should be obtained before committing to expensive action.
    - 6f. EQS for total ammonia is as per Schedule 3, Part 1, Table 7 of of the above directions. EQS applies to river types 1, 2 and 4 and 6 (namely upland and low alkalinity). The EQS for a lowland and high alkalinity rivers (types 3, 5 and 7) is 600µg/l (0.6mg/l).

Additional information on the Metal Bioavailability Assessment Tool (M-BAT) is available at http://www.wfduk.org/resources/rivers-lakes-metal-bioavailability-assessment-tool-m-bat

7. Minimum reporting values listed at https://www.gov.uk/government/publications/values-for-groundwater-risk-assessments/hazardous-substances-to-groundwater-minimum-reporting-values (updated 13 January 2017; accessed 29 March 2017). Note target concentration for xylenes is 3 μg/l each for o-xylene and m/p xylene as it may not be possible to separate m- and p-xylene; 135 tcb, 124 tcb, 123 tcb each to 0.01 μg/l)
8. The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 (as amended). SI 1996 / 3001
9. Council Directive on the Quality of Fresh Waters Needing Protection or Improvement in Order to Support Fish Life (Freshwater Fish Directive) (78/659/EEC)
10. WRc plc (2002), R&D Technical Report P45.
11. CL:AIRE, 2017. Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies. V1.1.
12. Drinking Water Inspectorate (London, UK). Environmental Information Request on MTBE in drinking water. Ref. DWI 1/10/18; dated 28 November 2006. Value is based on the odour threshold for MTBE, which is lower than a health-based guideline value
13. World Health Organisation (WHO), 2008. Petroleum products in drinking-water. Background document for development of WHO guidelines for drinking water quality. WHO/SDE/WSH/05.08/123. World Health Organisation, Geneva. [accessed 29 March 2017] http://www.who.int/water_sanitation_health/dwq/chemicals/petroleumproducts_2add_june2008.pdf

FLOW CHART TO ASSIST WITH SELECTION OF TARGET CONCENTRATIONS



TC = Target concentration

When leachate is being assessed the 'compliance point' is the groundwater body. Therefore dilution within the groundwater body may be applied with caution before comparing with the TC.

When directly assessing a receptor, e.g., a river, the appropriate TC should be selected.

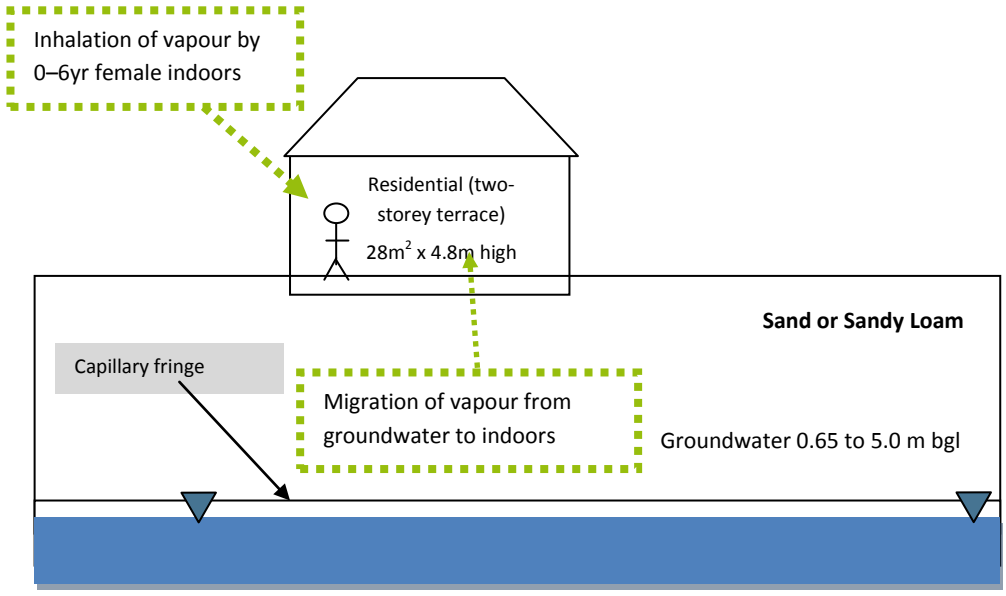
APPENDIX M
GROUNDWATER ASSESSMENT CRITERIA

Generic groundwater assessment criteria (GrAC) for human health: residential scenario (child receptor)

Background

Volatile organic compounds (VOC) in groundwater have the potential to pose risks to residential site end users via indoor and outdoor inhalation exposure. Due to significant dilution effects in outdoor air, inhalation risk is dominated by indoor exposure. The GrAC conceptual site model (CSM) is shown in Figure 1 (not to scale).

Figure 1: GrAC conceptual model for a generic residential scenario



RSK GrAC derivation

Model selection

The Society for Brownfield Risk Assessment (SoBRA) published a set of generic assessment criteria for assessing vapour risk to human health from volatile contaminants in groundwater in February 2017[(1)]. The criteria were developed for a list of common VOC using the Environment Agency Contaminated Land Exposure Assessment (CLEA) tool[(2)] based on a sand soil type and a groundwater depth of 0.65 m below foundation base level. The CLEA tool is not designed to directly model VOC in groundwater and the SoBRA generic criteria are recognised as being conservative since calculations in CLEA are based on three-phase partitioning in the unsaturated zone between soil, soil vapour and soil moisture, with the latter taken by SoBRA as a groundwater equivalent. This method does not take account of the presence of a semi-saturated capillary fringe above the water table, which will serve to provide some mitigation to vertical soil vapour migration.

RSK GrAC are calculated using the RBCA Toolkit for Chemical Releases (version 2.6) with the Johnson and Ettinger model, based on the CSM in Figure 1 for a small terrace house (as defined in SR3[(3)], Table 4.21) and which allows consideration of a capillary fringe. The capillary fringe is

the subsurface layer in which groundwater seeps up from a water table by capillary action to partially fill soil pores.

The RBCA model was used in preference to the Environment Agency Contaminated Land Exposure Assessment (CLEA) tool[2], as the CLEA tool is not designed to directly model VOC in groundwater and does not take account of the presence of a capillary zone.

Conceptual model

In accordance with SR3[3], the residential scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario.

The pollutant linkage considered in production of the GrAC is the volatilisation of compounds from groundwater and subsequent vapour inhalation by residents while indoors. Figure 1 illustrates this linkage. Although the outdoor air inhalation pathway is also valid, this contributes little to the overall risks owing to the dilution of VOC in outdoor air. RBCA does not take direct account of the presence of VOC from non-aqueous phase chemicals but highlights when the assessment criterion exceeds the solubility limit of the pure compound.

Input selection – chemical and toxicological parameters

Key parameters used in the RBCA model are listed and justified in Table 1. The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[2], the EA TOX[5] reports, and published by Nathanial et al.,[6], as appropriate. Toxicological and specific chemical parameters for aromatic hydrocarbon C8–C9 (styrene), 1,2,4-trimethylbenzene and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[7].

The toxicological input parameters are associated with minimal risk, rather than low risk.

For petroleum hydrocarbon fractions, aromatic hydrocarbons C5–C8 were not modelled, as this range comprises benzene and toluene, which are modelled separately. The aromatic C8–C9 hydrocarbon fraction comprises ethylbenzene, xylenes and styrene. As ethylbenzene and xylenes are being modelled separately, the physical, chemical and toxicological data for aromatic C8–C9 have been taken from styrene.

For the GrAC, the Health Criteria Values (HCV) used in the modelling were derived using the toxicological data for the Soil Assessment Criteria, amended as follows:

- A child weighing 13.3kg (average of 0-6 year old female in accordance with Table 4.6 of SR3[3]) and breathing 8.77m^3 (average daily inhalation rate for a 0-6yr old female in accordance with SP1010 final project report for the C4SL (Table 3.2[8]) and USEPA data[9]
- Background inhalation (mean daily intake (MDI)) for a child (Age Classes 1-6)
- Residential amendments to the MDI for younger age groups following Table 3.4 and Section 3.4.1 of SR2[10],; amended to reflect average daily inhalation rates in accordance with SP1010 final project report for the C4SL (Table 3.2[8]) and USEPA data[9]. Correction factors are presented in Table 1.

Table 1: Correction factors used to adjust adult MDI to younger age groups

Age Class	Body weight (kg)[1]	Inhalation rate (m^3/day)[2]	Correction factor for inhalation MDI[3]
1	5.6	5.4	0.34
2	9.8	8	0.51
3	12.7	8.9	0.57
4	15.1	10.1	0.64
5	16.9	10.1	0.64
6	19.7	10.1	0.64
17	70	15.7	-
Mean (AC1-6)	**13.3**	**8.8**	**0.56**

Notes
[1] Body weight from CLEA v1.071
[2] Inhalation rate from Table 3.2 of the SP1010 final project report for the C4SL[(8)]
[3] Inhalation correction factors are the ratio of the average male and female inhalation rates for each age class to the adult rate at age class 17 (age 16–59 years) and are based on the rates used by the Category 4 Screening Levels to derive the C4SLs[(8)],following the methodology in SR2[(10)].

The amended HCV used in the derivation of the RSK GrAC are presented in Table 2.

Note on Trimethylbenzenes

For trimethylbenzenes the CL:AIRE report[(7)] based background inhalation from non-soil sources (MDI) on a Dutch study from 1985, which is reported to have identified an average daily dose of 1,2,4-trimethylbenzene of 86 ug d^{-1} (1,3,5-trimethylbenzene was 20.5 ug d^{-1}). This dose value was based on the upper end of the identified concentration range of 1,2,4-trimethylbenzene (2.46 – 5.66 ug m^{-3}) and was used to calculate an a MDI of 1.23 ug kg^{-1} bw d^{-1} for a 70 kg adult breathing 20 m^3 of air daily.

The approach recommended in SR2[(10)], and also adopted for the C4SLs[(8)], for non-carcinogenic (threshold) compounds such as trimethylbenzenes is to subtract the MDI from the tolerable daily intake (TDI) to obtain a tolerable daily intake from soil (TDSI) in units of ug kg^{-1} bw d^{-1}. For 1,2,4-trimethylbenzene, the adult MDI from the Dutch study used in the CL:AIRE report[(7)] (1.23 ug kg^{-1} bw d^{-1}) is a significant proportion of the TDI (2.0 ug kg^{-1} bw d^{-1}), resulting in a low TDSI (1.0 ug kg^{-1} bw d^{-1}) when the 50% rule is applied (i.e. TDSI = TDI * 0.5 when MDI is high relative to TDI). This TDSI equates to an Inhalation Reference Concentration (or modified Health Criteria Value) for adults of 3.4 ug m^{-3} (70 kg adult breathing 15.7 m^3 d^{-1}).

By comparison the adult inhalation modified HCV for benzene is 6.2 ug m^{-3}, which is proven human carcinogen (non-threshold compound).

Table 2: Amended Health Criteria Values

	Modified HCV (mg/m^3)
VOC / SVOC	Child (Residential)
MTBE	1.0803
Benzene	0.0021
Toluene	2.1164
Ethylbenzene	0.1113
Xylenes	0.0834
Trimethybenzenes	0.0026
TPH_Aliph EC5-EC6	3.7913
TPH_Aliph >EC6-EC8	3.7913
TPH_Aliph >EC8-EC10	0.2199
TPH_Aliph >EC10-EC12	0.2199
TPH_Aliph >EC12-EC16	0.2199
TPH_Arom >EC8-EC9 (styrene)	0.1820
TPH_Arom >EC9-EC10	0.0455
TPH_Arom >EC10-EC12	0.0455
TPH_Arom >EC12-EC16	0.0455
Acenaphthene	0.0910
Acenaphthylene	0.0910
Naphthalene	0.0011
Vinyl chloride	0.0005
Dichloroethane-1,2	0.0002
Tetrachloroethene	0.0083
Carbon tetrachloride	0.0025
Trichloroethane-1,1,1	0.9099
Trichloroethene	0.0009
Tetrachloroethane 1,1,2,2 & 1,1,1,2	0.0086
1,1,2-Trichloroethane	0.0073
1,1-dichloroethene	0.0864
Chloroethane	4.3318
Chloromethane	0.0039
Dichloromethane	0.1781

The MDI for 1,2,4-trimethylbenzene is considered by RSK to be overly conservative for the following reasons:

- The Dutch 1985 study is dated and air quality has improved since this time
- The maximum value in the range (5.66 ug m^{-3}) was used in calculating the MDI
- Experience has shown that trimethylbenzenes often appear to drive inhalation risks to a greater extent than benzene, even though the latter is carcinogenic and more volatile.

As an alternative to the 1985 Dutch study, RSK have obtained automated roadside air quality monitoring data for the UK from www.uk-air.defra.gov.uk/. The average concentration of 1,2,4-

trimethylbenzene measured during 2015 at Eltham, south-east London (urban) was 0.309 ug m^{-3}, significantly lower than that identified in the Dutch study and used by CL:AIRE[7] for calculation of a MDI. Whilst an average concentration of 1,2,4-trimethylbenzene in UK urban and rural areas is likely to be significantly below 0.0.309 ug m^{-3}, this value is considered to be suitably conservative for the calculation of a modified HCV for trimethylbenzenes in the UK.

On this basis, the HCV for 1,2,4-trimethylbenzene for adults and children was calculated as 8.5 ug m^{-3} (0.0085 mg m^{-3}) and 2.6 ug m^{-3} (0.0026 mg m^{-3}), respectively (see Table 3). Due to the paucity of toxicological data for 1,2,3-trimethylbenzene and 1,3,5-trimethylbenzene the modified HCV for 1,2,4-trimethylbenzene is considered suitable for assessing total trimethylbenzenes.

Note on aqueous solubility and the RSK GrAC

Where the modelled assessment criteria, or the modelled assessment criteria with the correction factor applied to those contaminants specified below, exceeds the aqueous solubility limit the assessment criteria defaults to this concentration and consequently the GrAC is set at the limit of solubility. These assessment criteria are shaded in red in Table 4.

The theoretical aqueous solubility is the maximum amount of a single chemical that will dissolve in pure water at a specified temperature. Above this concentration, the chemical will exist in the non-aqueous phase (i.e. in its natural physical form as a solid, liquid (NAPL) or gas). If the contaminant, based on its toxicity, is not considered to pose a risk to human health at the aqueous solubility concentration then the contaminant can be considered not to pose a risk to human health. Where the GrAC is set at the aqueous solubility limit (shaded in red on Table 4), this is not a risk based assessment criteria but is indicative of the maximum amount of chemical that would be found dissolved in the water. Therefore an exceedance of the RSK GrAC set at the aqueous solubility limit is not indicative that there may be potential risks to human health. It should be noted that for certain contaminants (e.g. the lighter petroleum hydrocarbon fractions) the aqueous solubility is very low and may be at, or below, the laboratory method detection limit. It should also be noted that non-aqueous phase may exist where concentrations of individual compounds are well below their solubility limits where they are part of a mixture, in accordance with Raoult's Law.

Input selection - physical parameters

For the residential scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab as detailed in Table 3. Environment Agency document SR3[3] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GrACs are the default CLEA v1.071 inputs presented in Table 3.3 of SR3[3].

The RSK GrAC have been calculated for both Sand and Sandy Loam soils. The soil parameters used in the derivation of the RSK GrAC are those presented in Table 3.1 of SR3[3].

The RSK GrAC have been derived for groundwater depths of 0.65 m, 1.5 m, 2.5 m and 5.0 m below ground level, incorporating a capillary fringe (see Table 4).

Input selection - attenuation factors

In line with recommendations provided in Environment Agency SR3[3] a sub-surface to indoor attenuation factor of 10 has been applied to certain RBCA derived 'site-specific target levels'. SR3[3] states that, as a general rule of thumb, it is recognised that estimating vapour phase

concentrations from dissolved and sorbed phase petroleum hydrocarbons by using partition coefficients are at least a factor of ten higher than those likely to be measured on-site. This difference is likely to be due to a number of factors, however aerobic biodegradation in the unsaturated zone is believed to be largely responsible. RSK has therefore applied this attenuation factor to all volatile petroleum hydrocarbon fractions (including BTEX, tri-methylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene). No such attenuation factors have been applied to other non-hydrocarbon chemical species, including chlorinated hydrocarbons or fuel oxygenates such as MtBE.

Convective (volumetric) air flow through foundation cracks (Q_{soil}) is a sensitive parameter in the calculation of GrAC and has been calculated within RBCA on a soil-specific basis for Sand and Sandy Loam in a residential exposure scenario (see Table 3). This approach is less conservative than using the default Q_{soil} value recommended in SR3[3] for a Sandy Loam (25 cm^3 s^{-1}) and used in the CLEA model (version 1.071) for Sandy Loam (and Sand) soils (25 cm^3 s^{-1}) in a residential scenario.

Table 3: Residential scenario – RBCA inputs

Parameter	Unit	Value	Justification
Receptor – female child			
Averaging time	Years	6	From Box 3.1, SR3[3]
Receptor weight	kg	13.3	Average of CLEA 0-6 year old female data, Table 4.6, SR3[3]
Exposure duration	Years	6	From Box 3.1, report , SR3[3]
Exposure frequency	Days yr^{-1}	350	Weighted using occupancy period of 23 hours per day for 365 days of the year
Soil type – sand			
Total porosity	-	0.54	CLEA value for sand. Parameters for sand from Table 4.4, SR3[3]. Volumetric water content in the vadose zone is a highly sensitive parameter within the model and potentially highly variable in the field.
Volumetric water content – unsaturated (vadose) zone	-	0.24	
Volumetric air content - unsaturated (vadose) zone	-	0.30	
Dry bulk density	g cm^{-3} or kg L^{-1}	1.18	
Volumetric water content – capillary zone	-	0.35	Calculated using SR3 Equation 4.1. Value taken as the average moisture content calculated for suction heads (cm H_2O); 0 (i.e. saturated), 10, 20, 30, 40, 50 (i.e. unsaturated soil at field capacity). This is a highly sensitive parameter within the model.
Volumetric air content - capillary zone	-	0.19	Calculated from total porosity and volumetric water content of capillary zone. This is a highly sensitive parameter within the model.
Vertical hydraulic conductivity	cm d^{-1}	636	CLEA value for saturated conductivity of sandy loam, Table 4.4, SR3[3] equivalent to 7.36 E-03 cm s^{-1}
Vapour permeability	m^2	7.54 E-12	Calculated for sand using equations in Appendix 1, SR3[3]
Capillary zone thickness	m	0.25	Taken from C W Fetter, Applied Hydrogeology 4th Ed, 1994[11] and R Heath, Basic groundwater hydrology 1992[12] for a medium sand
Fraction organic carbon	%	0.0058	Equivalent to SOM = 1%. Note that GrAC are independent on FOC/SOM content since partitioning is assumed to be between aqueous and vapour phases only
Soil type – sandy loam			
Total porosity	-	0.53	CLEA value for sandy loam. Parameters for sandy loam from Table 4.4, SR3[3]. Volumetric water content in the vadose zone is a highly sensitive parameter within the model and potentially highly variable in the field.
Volumetric water content – unsaturated (vadose) zone	-	0.33	
Volumetric air content - unsaturated (vadose) zone	-	0.20	
Dry bulk density	g cm^{-3} or kg/L	1.21	
Volumetric water content – capillary zone	-	0.42	Calculated using SR3 Equation 4.1[3]. Value taken as the average moisture content calculated for suction heads (cm H_2O); 0 (i.e. saturated), 10, 20, 30, 40, 50 (i.e. unsaturated soil at field capacity). This is a highly sensitive parameter within the model.
Volumetric air content - capillary zone	-	0.11	Calculated from total porosity and volumetric water content of capillary zone. This is a highly sensitive parameter within the model.

Parameter	Unit	Value	Justification
Vertical hydraulic conductivity	cm d^{-1}	308	CLEA value for saturated conductivity of sandy loam, Table 4.4, SR3[3] equivalent to 3.56E-3 cm s^{-1}
Vapour permeability	m^2	3.05 E-12	Calculated for sandy loam using equations in Appendix 1, SR3[3]
Capillary zone thickness	m	0.4	Taken from R Heath, Basic Groundwater Hydrology 1992[12] for a fine sand. Note: C W Fetter, Applied Hydrogeology 4th Ed, 1994[11] value for fine sand is 0.5 m
Fraction organic carbon	%	0.0058	Equivalent to SOM = 1%. Note that GrAC are independent on FOC/SOM content since partitioning is assumed to be between aqueous and vapour phases only
Building – small terrace house			
Building volume/area ratio	m	4.8	Table 3.3, SR3[3]
Foundation area	m^2	28	
Foundation perimeter	m	21.16	Calculated using Equation A2 in SR3[3], which assumes the building to be of square proportions.
Building air exchange rate	d^{-1}	12	Table 3.3, SR3[3] Building air exchange rate equivalent to 1.4 E-04 s^{-1}
Depth to bottom of foundation slab	m	0.15	
Foundation thickness	m	0.15	
Foundation crack fraction	-	0.00151	Calculated from floor crack area of 423cm^2 and building footprint of 28m^2 in Table 4.21, SR3[3]
Volumetric water content of cracks	-	0.24 / 0.33	For sand / sandy loam, assumed equal to underlying soil type in assumption that cracks become filled with unsaturated zone soil over time. Parameters for sand and sandy loam from Table 4.4, SR3[3]
Volumetric air content of cracks	-	0.30 / 0.20	
Indoor/outdoor differential pressure	Pa	3.1	From Table 3.3, SR3[3] Equivalent to 31 g/cm/s^2
Convective air flow through cracks (Q_{soil}) - Sand	m^3 s^{-1}	3.4 E-05	Soil-specific calculated parameter in RBCA equivalent (and cross checked) with equations A1, A2, A3, A8, A9 in SR3[3]. Equivalent to **34 cm^3 s^{-1}**
Convective air flow through cracks (Q_{soil}) – Sandy Loam	m^3 s^{-1}	1.4 E-05	Soil-specific calculated parameter in RBCA equivalent (and cross checked) with equations A1, A2, A3, A8, A9 in SR3[3]. Equivalent to **14 cm^3 s^{-1}**

RSK GrAC derivation outputs

The RSK GrACs are presented in Table 4.

Within the RSK GrAC the following should be noted:

- GrAC do not take account of outdoor inhalation exposure to VOC, which is considered to contribute minimally to overall inhalation exposure
- GrAC do not take account of other exposure routes potentially relevant to VOC in shallow groundwater such as direct contact or root uptake
- No biodegradation is assumed to occur in the unsaturated zone. Where aerobic conditions on site are known to exist the GrAC for hydrocarbons may therefore be conservative
- GrAC do not take account of preferential flow into buildings such as through unsealed service entries. In such circumstances GrAC may not be appropriate for use
- GrAC are based on a soil vapour intrusion CSM and are not appropriate for use when the foundation is in direct contact with contaminated groundwater

- GrAC assume that the capillary fringe is un-contaminated with VOC, which is unlikely, particularly where groundwater levels are variable
- GrAC set at the theoretical aqueous solubility limit are not considered to pose a risk to human health
- GrAC do not take into account the interaction between contaminants and the influence this may have on the theoretical aqueous solubility
- GrACs are only applicable to dissolved phase contaminants where the modelled assessment criteria is below the aqueous solubility limits

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	Table 4: RSK GrAC (ug/l)							
	RESIDENTIAL							
	SAND				SANDY LOAM			
GW Depth (m)	0.65	1.5	2.5	5	0.65	1.5	2.5	5
Metals								
Elemental mercury	2.5	3.6	5.0	8.4	14.3	18.5	23.4	35.8
Methyl mercury	21550	27220	33880	50540	46300	48510	51110	57610
Volatile Organic Compounds								
Benzene	470	670	900	1490	2900	3640	4510	6680
Toluene	515140	59000	59000	59000	59000	59000	59000	59000
Ethylbenzene	24300	35190	48000	80020	156380	180000	180000	180000
Xylene - m	22610	32750	44670	74480	144250	181800	200000	200000
Xylene - o	27570	39950	54500	90900	174260	173000	173000	173000
Xylene - p	23640	34230	46700	77860	150470	189710	200000	200000
Total xylene	22610	32750	44670	74480	144250	173000	173000	173000
Methyl tertiary-Butyl ether (MTBE)	185010	267500	364520	607070	945700	1245710	1598660	2481040
Trichloroethene	13	18	25	41	82	100	130	190
Tetrachloroethene	80	120	160	260	520	650	810	1200
1,1,1-Trichloroethane	7110	10230	13910	23090	46230	57820	71450	105540
1,1,1,2 Tetrachloroethane	550	800	1100	1830	3330	4250	5330	8040
1,1,2,2-Tetrachloroethane	3620	5320	7320	12320	14600	20600	27650	45290
Carbon Tetrachloride	12	17	24	39	79	98	120	180
1,2-Dichloroethane	20	28	38	63	100	140	170	260
Vinyl Chloride	1.3	1.8	2.4	4.0	8	10	12	18
1,2,4-Trimethylbenzene	980	1430	1960	3270	6240	7900	9850	14720
Semi-Volatile Organic Compounds								
Acenaphthene	4100	4100	4100	4100	4100	4100	4100	4100
Acenapththylene	7950	7950	7950	7950	7950	7950	7950	7950
Naphthalene	5100	7530	10380	17510	19000	19000	19000	19000
Petroleum Hydrocarbons								
Aliphatic hydrocarbons EC5-EC6	4170	5900	7930	13020	26560	32990	35900	35900
Aliphatic hydrocarbons >EC6-EC8	3210	4540	5370	5370	5370	5370	5370	5370
Aliphatic hydrocarbons >EC8-EC10	120	170	230	380	427	427	427	427
Aliphatic hydrocarbons >EC10-EC12	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9
Aliphatic hydrocarbons >EC12-EC16	0.759	0.759	0.759	0.759	0.759	0.759	0.759	0.759
Aromatic hydrocarbons >EC8-EC9 (styrene)	101450	146880	200320	290000	290000	290000	290000	290000
Aromatic hydrocarbons >EC9-EC10	4150	5870	7900	12960	25730	32120	39630	58400
Aromatic hydrocarbons >EC10-EC12	14480	20510	24500	24500	245000	245000	245000	245000
Aromatic hydrocarbons >EC12-EC16	5750	5750	5750	5750	5750	5750	5750	5750

Notes:

Values less than 100 have not been rounded up or down; values greater than 100 have been rounded to the nearest 10.

Highlighted values exceed solubility limit for the pure compound in water (aqueous solubility); GrAC defaults to the limit of solubility.

No vadose zone biodegradation considered

Sub-surface to indoor air correction factor of 10 applied to all petroleum (non-chlorinated) hydrocarbons

All GrAC are for 1% SOM (0.0058 FOC)

APPENDIX N
TECHNICAL BACKGROUND

N1 Desk Study

Aquifer designation and Source protection zones

Principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale.

Secondary A aquifer: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Secondary B aquifer: predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated aquifer: it has not been possible to attribute either a category A or B to a rock type. In most cases this means that it was previously designated as both a minor and non-aquifer in different locations owing to the variable characteristics.

Unproductive' strata: low permeability with negligible significance for water supply or river base flow.

The EA generally adopts a three-fold classification of source protection zones (SPZ) surround abstractions for public water supply. The Site is situated in an area defined as follows:

- Zone 1 or the 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- Zone 2 or the 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants
- Zone 3 or the 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Preliminary risk assessment methodology

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. Under CLR11, three stages of risk assessment exist: preliminary, generic quantitative and detailed quantitative. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) contaminant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation.

The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
- likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- severe: short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly Likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low Likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required
- high: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term
- moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term
- low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild
- very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

N2 Site Investigation Methodology

Ground gas monitoring

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

Low flow groundwater sampling

Groundwater samples were retrieved using a United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology.

The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the

volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging, in most cases, is the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.

N3 Site Investigation Methodology

Statistical assessment

Statistical analysis of the results has been conducted in accordance with *Guidance on Comparing Soil Contamination Data with a Critical Concentration* (CIEH and CL:AIRE, 2008) as detailed in Appendix D.

Statistical analysis is utilised to establish whether the land is suitable for the proposed use under the land use planning system by attempting to answer a key question. For a site being developed the key question is: '*can we confidently say that the level of contamination on this land is low relative to some appropriate measure of risk?* More specifically, this is expressed as '*Is there sufficient evidence that the true mean concentration of the contaminant (μ) is less than the critical concentration (C_c)?*', where the critical concentration could be the GAC or a site-specific assessment criterion (SSAC). The true mean (μ) is unknown and therefore a conservative estimate, termed the upper confidence limit (UCL), of this value is derived from the data. The UCL is then compared against the GAC.

In statistical terms the question above is handled through the use of a formal hypothesis – the null hypothesis and the alternate hypothesis. The statistical tests are structured to show (with a defined level of confidence, in this case 95%) which of the two hypotheses is most likely to be true, by determining whether the null hypothesis can be rejected.

For consideration under the planning regime, the null (H_0) and alternative (H_1) hypotheses are presented below.

Null and alternative hypotheses

Hypothesis	Equation	Description
Null (H_0)	$\mu \geq C_c$	The true mean concentration is equal to, or greater than, the critical concentration
Alternative (H_1)	$\mu < C_c$	The true mean concentration is less than the critical concentration

Therefore, if the null hypothesis is accepted for a certain contaminant it can be concluded that its concentration is high relative to the critical concentration, which in the case of this assessment is taken to be the GAC/SSAC and as such the whole site may be classed as being contaminated by a particular substance.

In addition, the statistical guidance provides an outlier test (Grubbs' test) that has been used within this assessment for the identification of 'outliers' or 'hotspots'. The 'outlier' test is conducted

before undertaking statistical analysis (and 'outliers' may be removed from the dataset) but only where the conceptual model supports this.

The statistical tests applied to the dataset are selected based on whether the data is normally or non-normally distributed. The distribution of the dataset has been assessed using the Shapiro-Wilks normality test. Where the dataset has been found to be normally distributed the one sample t-test is undertaken. Where data has been found to be non-normally distributed Chebyshev's theorem is utilised.

Reuse of suitable materials

The Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011) (CoP) was developed in consultation with the Environment Agency and development industry to enable the re-use of materials under certain scenarios and subject to demonstrating that specific criteria are met. The current reuse scenarios covered by the CoP comprise

- reuse on the site of origin (with or without treatment)
- direct transfer of clean and natural soils between sites
- use in the development of land other than the site of origin following treatment at an authorised Hub site (including a fixed soil treatment facility).

The importation of made ground soils (irrespective of contamination status) or crushed demolition materials is not permitted currently under the CoP and requires either a standard rules environmental permit or a U1 waste exemption (see below).

In the context of excavated materials used on-sites undergoing development, four factors are considered to be of particular relevance in determining if the material is a waste or when it ceases to be waste:

- the aim of the Waste Framework Directive is not undermined, i.e. if the use of the material will create an unacceptable risk of pollution of the environment or harm to human health it is likely to be waste
- the material is certain to be used
- the material is suitable for use both chemically and geotechnically
- only the required quantity of material will be used.

The CoP requires the preparation of a materials management plan (MMP) that confirms the above factors will be met. This plan needs to be reviewed by a 'Qualified Person' (QP) who will then issue a declaration form to the EA. As the project progresses, data must be collated and on completion a verification report produced that shows the MMP was followed and describes any changes.

The MMP establishes whether specific materials are classified as waste and how excavated materials will be treated and/or reused in line with the CoP. The MMP is likely to form part of the site waste management plan.

APPENDIX O
GQRA DATA SCREENING TABLES – SOILS

Project name	Ossory Road
Project code	29909
Client name	Pocket
Address	
NGR	
Land use	Residential without home-grown produce
SOM	2.5%
GAC version	2019_00

Notes

Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects	Lab sample ID									
									Client sample ID									
									Depth to top									
									Depth to bottom									
									Date sampled									
									20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6				
									WS1	WS2	WS2	WS3	WS4	WS5				
									0.4	0.4	0.4	0.4	0.4	0.6				
Metals and Inorganics																		
Arsenic	mg/kg	40		16	9	6	6	0	9	16	10	11	16	14				
Cadmium	mg/kg	149		0.8	<0.5	6	4	2	0.6	0.8	<0.5	<0.5	0.6	0.5				
Chromium	mg/kg	910	21	25	15	6	6	0	25	25	18	15	23	19				
Copper	mg/kg	7100		103	26	6	6	0	56	103	52	26	87	43				
Lead	mg/kg	310		1060	254	6	6	0	1060	649	280	254	401	334				
Mercury	mg/kg	56	0.6	2.51	1.14	6	6	0	1.14	2.51	2.32	1.21	1.95	1.59				
Nickel	mg/kg	180		20	12	6	6	0	16	20	13	12	19	15				
Selenium	mg/kg	430			<1	6	0	6	<1	<1	<1	<1	<1	<1				
Zinc	mg/kg	40000		292	71	6	6	0	128	292	71	115	174	144				
Asbestos																		
Asbestos in soil						6	0	6	NAD	NAD	NAD	NAD	NAD	NAD				
Petroleum Hydrocarbons																		
Ali >C5-C6	mg/kg	78			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Ali >C6-C8	mg/kg	230			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Ali >C8-C10	mg/kg	65			<1	6	0	6	<1	<1	<1	<1	<1	<1				
Ali >C10-C12	mg/kg	330	118		<1	6	0	6	<1	<1	<1	<1	<1	<1				
Ali >C12-C16	mg/kg	2400	59		<1	6	0	6	<1	<1	<1	<1	<1	<1				
Ali >C16-C21	mg/kg			3	<1	6	4	2	2	2	<1	3	2	<1				
Ali >C21-C35	mg/kg			107	2	6	6	0	10	10	2	107	10	8				
Ali >C16-C35 calculated	mg/kg	92000	21	110	2	6	6	0	12	12	2	110	12	8				
Total Aliphatics	mg/kg			111	2	6	6	0	11	13	2	111	11	9				
Aro >C5-C7	mg/kg				<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Aro >C7-C8	mg/kg				<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Aro >C8-C10	mg/kg	115		2	<1	6	3	3	<1	<1	<1	2	1	2				
Aro >C10-C12	mg/kg	600		2	<1	6	1	5	<1	<1	<1	2	<1	<1				
Aro >C12-C16	mg/kg	2300	419	9	<1	6	5	1	2	9	<1	7	3	3				
Aro >C16-C21	mg/kg	1900		62	1	6	6	0	5	62	1	21	10	18				
Aro >C21-C35	mg/kg	1900		268	6	6	6	0	26	268	6	132	57	78				
Total Aromatics	mg/kg			341	7	6	6	0	33	341	7	163	71	101				
TPH (Ali & Aro)	mg/kg			354	9	6	6	0	45	354	9	274	82	110				
BTEX - Benzene	mg/kg	1.6			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
BTEX - Toluene	mg/kg	1900			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
BTEX - Ethyl Benzene	mg/kg	190			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
BTEX - o Xylene	mg/kg	210			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
BTEX - m & p Xylene	mg/kg	180			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
MTBE	mg/kg	170			<0.01	6	0	6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Polycyclic aromatic hydrocarbons																		
Acenaphthene	mg/kg	7200		0.06	<0.01	6	5	1	0.03	0.06	<0.01	0.04	0.02	0.02				
Acenaphthylene	mg/kg	7200		0.07	<0.01	6	4	2	0.04	0.07	<0.01	<0.01	0.02	0.02				
Anthracene	mg/kg	35000		0.26	<0.02	6	5	1	0.14	0.26	<0.02	0.11	0.09	0.09				
Benzo(a)anthracene	mg/kg	13.6		2.26	0.11	6	6	0	0.51	2.26	0.11	0.47	0.42	0.48				
Benzo(a)pyrene	mg/kg	5.3		2.55	0.14	6	6	0	0.57	2.55	0.14	0.67	0.47	0.5				
Benzo(b)fluoranthene	mg/kg	4		3.11	0.16	6	6	0	0.65	3.11	0.16	0.69	0.58	0.59				

									Lab sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6				
									Client sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
									Depth to top	0.4	0.4	0.4	0.4	0.4	0.6				
									Depth to bottom										
									Date sampled	11/07/20	11/07/20	11/07/20	11/07/20	11/07/20	11/07/20				
Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects													
Benzo(ghi)perylene	mg/kg	358		1.42	0.1	6	6	0		0.41	1.42	0.1	0.45	0.35	0.33						
Benzo(k)fluoranthene	mg/kg	107		1.06	<0.07	6	5	1		0.27	1.06	<0.07	0.26	0.22	0.23						
Chrysene	mg/kg	31		2.51	0.16	6	6	0		0.6	2.51	0.16	0.61	0.56	0.57						
Dibenzo(ah)anthracene	mg/kg	0.32		0.32	<0.04	6	5	1		0.08	0.32	<0.04	0.09	0.07	0.06						
Fluoranthene	mg/kg	1600		4.57	0.2	6	6	0		1.1	4.57	0.2	0.82	0.85	0.82						
Fluorene	mg/kg	3800	77	0.06	<0.01	6	5	1		0.04	0.06	<0.01	0.03	0.02	0.02						
Indeno(123-cd)pyrene	mg/kg	46		1.71	0.11	6	6	0		0.43	1.71	0.11	0.5	0.39	0.36						
Naphthalene	mg/kg	55		0.07	<0.03	6	3	3		<0.03	0.07	<0.03	0.04	0.03	<0.03						
Phenanthrene	mg/kg	1450		1.23	0.08	6	6	0		0.55	1.23	0.08	0.5	0.43	0.37						
Pyrene	mg/kg	3800		4.22	0.18	6	6	0		0.93	4.22	0.18	0.73	0.74	0.73						
Total PAH-16MS	mg/kg			25.5	1.24	6	6	0		6.35	25.5	1.24	6.01	5.26	5.19						
Volatile Organic Compounds (VOC)																					
1,1,1,2-Tetrachloroethane	mg/kg	3.5			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,1,1-Trichloroethane	mg/kg	18.4			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,1,2,2-Tetrachloroethane	mg/kg	8			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,1,2-Trichloroethane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,1-Dichloroethane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,1-Dichloroethene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,1-Dichloropropene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,2,3-Trichlorobenzene	mg/kg				<0.003	6	0	6		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003						
1,2,3-Trichloropropane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,2,4-Trichlorobenzene	mg/kg				<0.003	6	0	6		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003						
1,2,4-Trimethylbenzene	mg/kg	12.9			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,2-Dibromo-3-chloropropane	mg/kg				<0.002	6	0	6		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002						
1,2-Dibromoethane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,2-Dichlorobenzene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,2-Dichloroethane	mg/kg	0.013			<0.002	6	0	6		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002						
1,2-Dichloropropane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,3,5-Trimethylbenzene	mg/kg	12.9			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,3-Dichlorobenzene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,3-Dichloropropane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
1,4-Dichlorobenzene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
2,2-Dichloropropane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
2-Chlorotoluene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
4-Chlorotoluene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
4-Isopropyltoluene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Benzene	mg/kg	1.6			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Bromobenzene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Bromochloromethane	mg/kg				<0.005	6	0	6		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005						
Bromodichloromethane	mg/kg				<0.01	6	0	6		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Bromoform	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Bromomethane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Carbon Disulphide	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Carbon Tetrachloride	mg/kg	0.056			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Chlorobenzene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Chloroethane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Chloroform	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Chloromethane	mg/kg				<0.01	6	0	6		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
cis 1,2-Dichloroethene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
cis 1,3-Dichloropropene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Dibromochloromethane	mg/kg				<0.003	6	0	6		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003						
Dibromomethane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Dichlorodifluoromethane	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Dichloromethane	mg/kg				<0.005	6	0	6		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005						
Ethylbenzene	mg/kg	190			<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Hexachlorobutadiene	mg/kg				<0.001	6	0	6		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						

									Lab sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6				
									Client sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
									Depth to top	0.4	0.4	0.4	0.4	0.4	0.6				
									Depth to bottom										
									Date sampled	11/07/20	11/07/20	11/07/20	11/07/20	11/07/20	11/07/20				
Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects											
Isopropylbenzene	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
m & p Xylene	mg/kg	180			<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
n-Butylbenzene	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
n-Propylbenzene	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
o-Xylene	mg/kg	210			<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
sec-Butylbenzene	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Styrene	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
tert-Butylbenzene	mg/kg				<0.002	6	0	6	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002					
Tetrachloroethene	mg/kg	0.4			<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Toluene	mg/kg	1900			<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
trans 1,2-Dichloroethene	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
trans 1,3-Dichloropropene	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Trichloroethene	mg/kg	0.04			<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Trichlorofluoromethane	mg/kg				<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Vinyl Chloride	mg/kg	0.001			<0.001	6	0	6	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Semi-Volatile Organic Compounds (SVOC)																			
2,4,5-Trichlorophenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2,4,6-Trichlorophenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2,4-Dichlorophenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2,4-Dimethylphenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2,4-Dinitrotoluene	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2,6-Dinitrotoluene	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2-Chloronaphthalene	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2-Chlorophenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2-Methylnaphthalene	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2-Methylphenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
2-Nitrophenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
4-Chloro-3-methylphenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
4-Methylphenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
4-Nitrophenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Bis(2-chloroethoxy)methane	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Bis(2-chloroethyl)ether	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Bis(2-chloroisopropyl)ether	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Bis(2-ethylhexyl)phthalate	mg/kg				<0.5	6	0	6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
Butylbenzyl phthalate	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Carbazole	mg/kg			0.166	<0.1	6	1	5	<0.1	0.166	<0.1	<0.1	<0.1	<0.1					
Dibenzofuran	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Diethyl phthalate	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Dimethyl phthalate	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Hexachlorobenzene	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Hexachlorocyclopentadiene	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Hexachloroethane	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Isophorone	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
n-Dibutylphthalate	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
n-Dioctylphthalate	mg/kg				<0.5	6	0	6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
Nitrobenzene	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
n-Nitroso-n-dipropylamine	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Pentachlorophenol	mg/kg				<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Perylene	mg/kg			0.761	<0.1	6	4	2	0.101	0.761	<0.1	0.17	<0.1	0.232					
Phenols																			
Phenol	mg/kg	688			<0.1	6	0	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Other analytes																			
% Stones >10mm	% w/w			18.7	4.3	6	6	0	18.7	13.3	4.3	18.5	13.3	16.2					
pH	pH			9.51	7.72	6	6	0	8.69	9.51	7.72	8.33	8.08	8.18					
Sulphate (acid soluble)	mg/kg			12000	430	6	6	0	4900	920	430	10000	9700	12000					
Sulphate (water sol 2:1)	g/l			1.27	0.03	6	6	0	1.16	0.12	0.03	1.18	1.27	1.22					

								Lab sample ID	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6				
								Client sample ID	WS1	WS2	WS2	WS3	WS4	WS5				
								Depth to top	0.4	0.4	0.4	0.4	0.4	0.6				
								Depth to bottom										
								Date sampled	11/07/20	11/07/20	11/07/20	11/07/20	11/07/20	11/07/20				
Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects										
Total Organic Carbon	% w/w			2.88	0.64	4	4	0		2.88		0.64	2.09	0.71				
Converted to SOM (x / 0.58)	% w/w			4.965517	1.103448	4	4	0		4.96551724		1.10344828	3.60344828	1.22413793				

APPENDIX P
WM3 ASSESSMENT

Please enter available data in the rows associated with the test (grey) cells. Calculation cells initially display either "0.0000" or "#DIV/0!".
If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Haswaste, developed by Dr. Iain Haslock.

29909 Ossory Road

TP/WS/BH		WS1	WS2	WS2	WS3	WS4	WS5			
Depth (m)		0.40	0.40	0.60	0.40	0.40	0.60			
Envirolab reference		20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6			
% Moisture	%									
pH (soil)		8.69	9.51	7.72	8.33	8.08	8.18			
pH (leachate)										
Arsenic	mg/kg	9	16	10	11	16	14			
Cadmium	mg/kg	0.6	0.8	0.5	0.5	0.6	0.5			
Copper	mg/kg	56	103	52	26	87	43			
CrVI or Chromium	mg/kg	25	25	18	15	23	19			
Lead	mg/kg	1,060	649	280	254	401	334			
Mercury	mg/kg	1.14	2.51	2.32	1.21	1.95	1.59			
Nickel	mg/kg	16	20	13	12	19	15			
Selenium	mg/kg	1	1	1	1	1	1			
Zinc	mg/kg	128	292	71	115	174	144			
Barium	mg/kg									
Beryllium	mg/kg									
Vanadium	mg/kg									
Cobalt	mg/kg									
Manganese	mg/kg									
Molybdenum	mg/kg									
Antimony	mg/kg									
Aluminium	mg/kg									
Bismuth	mg/kg									
CrIII	mg/kg									
Iron	mg/kg									
Strontium	mg/kg									
Tellurium	mg/kg									
Thallium	mg/kg									
Titanium	mg/kg									
Tungsten	mg/kg									
Ammoniacal N	mg/kg									
ws Boron	mg/kg									
PAH (Input Total PAH **OR** individual PAH results)										
Acenaphthene	mg/kg	0.03	0.06	0.01	0.04	0.02	0.02			
Acenaphthylene	mg/kg	0.04	0.07	0.01	0.01	0.02	0.02			
Anthracene	mg/kg	0.14	0.26	0.02	0.11	0.09	0.09			
Benzo(a)anthracene	mg/kg	0.51	2.26	0.11	0.47	0.42	0.48			
Benzo(a)pyrene	mg/kg	0.57	2.55	0.14	0.67	0.47	0.50			
Benzo(b)fluoranthene	mg/kg	0.65	3.11	0.16	0.69	0.58	0.59			
Benzo(ghi)perylene	mg/kg	0.41	1.42	0.10	0.45	0.35	0.33			
Benzo(k)fluoranthene	mg/kg	0.27	1.06	0.07	0.26	0.22	0.23			
Chrysene	mg/kg	0.60	2.51	0.16	0.61	0.56	0.57			
Dibenzo(ah)anthracene	mg/kg	0.08	0.32	0.04	0.09	0.07	0.06			
Fluoranthene	mg/kg	1.10	4.57	0.20	0.82	0.85	0.82			
Fluorene	mg/kg	0.04	0.06	0.01	0.03	0.02	0.02			
Indeno(123cd)pyrene	mg/kg	0.43	1.71	0.11	0.50	0.39	0.36			
Naphthalene	mg/kg	0.03	0.07	0.03	0.04	0.03	0.03			
Phenanthrene	mg/kg	0.55	1.23	0.08	0.50	0.43	0.37			
Pyrene	mg/kg	0.93	4.22	0.18	0.73	0.74	0.73			
Coronene	mg/kg									
Total PAHs (16 or 17)	mg/kg									
TPH										
Petrol	mg/kg									
Diesel	mg/kg									
Lube Oil	mg/kg									
Crude Oil										
White Spirit / Kerosene	mg/kg									
Creosote	mg/kg									
Unknown TPH with ID	mg/kg									
Unknown TPHCWG	mg/kg	45.0	354.0	9.0	274.0	82.0	110.0			
Total Sulphide	mg/kg									
Complex Cyanide	mg/kg									
Free (or Total) Cyanide	mg/kg									
Thiocyanate	mg/kg									
Elemental/Free Sulphur	mg/kg									
Phenols Input Total Phenols HPLC **OR** individual Phenol results.										
Phenol	mg/kg									
Cresols	mg/kg									
Xylenols	mg/kg									
Resourcinol	mg/kg									
Phenols Total by HPLC	mg/kg									
BTEX Input Total BTEX **OR** individual BTEX results.										
Benzene	mg/kg									
Toluene	mg/kg									
Ethylbenzene	mg/kg									
Xylenes	mg/kg									
Total BTEX	mg/kg									
PCBs (POPs)										
PCBs Total (eg EC7/WHO12)	mg/kg									
PBBs (POPs)										
Hexabromobiphenyl (Total or PBB153; 2,2',4,4',5,5'- if only available)	mg/kg									

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Haswaste, developed by Dr. Iain Haslock.

29909 Ossory Road

TP/WS/BH		WS1	WS2	WS2	WS3	WS4	WS5			
Depth (m)		0.40	0.40	0.60	0.40	0.40	0.60			
Envirolab reference		20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6			
POPs Dioxins and Furans Input Total Dioxins and Furans **OR** individual Dioxin and Furan results.										
2,3,7,8-TeCDD	mg/kg									
1,2,3,7,8-PeCDD	mg/kg									
1,2,3,4,7,8-HxCDD	mg/kg									
1,2,3,6,7,8-HxCDD	mg/kg									
1,2,3,7,8,9-HxCDD	mg/kg									
1,2,3,4,6,7,8-HpCDD	mg/kg									
OCDD	mg/kg									
2,3,7,8-TeCDF	mg/kg									
1,2,3,7,8-PeCDF	mg/kg									
2,3,4,7,8-PeCDF	mg/kg									
1,2,3,4,7,8-HxCDF	mg/kg									
1,2,3,6,7,8-HxCDF	mg/kg									
2,3,4,6,7,8-HxCDF	mg/kg									
1,2,3,7,8,9-HxCDF	mg/kg									
1,2,3,4,6,7,8-HpCDF	mg/kg									
1,2,3,4,7,8,9-HpCDF	mg/kg									
OCDF	mg/kg									
Total Dioxins and Furans	mg/kg									
Some Pesticides (POPs unless otherwise stated)										
Aldrin	mg/kg									
α Hexachlorocyclohexane (alpha-HCH) *(leave empty if total HCH results used)*	mg/kg									
β Hexachlorocyclohexane (beta-HCH) *(leave empty if total HCH results used)*	mg/kg									
α Cis-Chlordane (alpha) ***OR*** *Total Chlordane*	mg/kg									
δ Hexachlorocyclohexane (delta-HCH) *(leave empty if total HCH results used)*	mg/kg									
Dieldrin	mg/kg									
Endrin	mg/kg									
χ Hexachlorocyclohexane (gamma-HCH) (lindane) ***OR*** *Total HCH*	mg/kg									
Heptachlor	mg/kg									
Hexachlorobenzene	mg/kg									
o,p'-DDT *(leave empty if total DDT results used)*	mg/kg									
p,p'-DDT ***OR*** *Total DDT*	mg/kg									
χ Trans-Chlordane (gamma) *(leave empty if total Chlordane results used)*	mg/kg									
Chlordecone (kepone)	mg/kg									
Pentachlorobenzene	mg/kg									
Mirex	mg/kg									
Toxaphene (camphechlor)	mg/kg									
Tin										
Tin *(leave empty if Organotin and Tin excl Organotin results used)*	mg/kg									
Organotin										
Dibutyltin; DiBT	mg/kg									
Tributyltin; TriBT	mg/kg									
Triphenyltin; TriPT	mg/kg									
Tetrabutyltin; TeBT	mg/kg									
Tin excluding Organotin										
Tin excl Organotin	mg/kg									

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Haswaste, developed by Dr. Iain Haslock.

29909 Ossory Road

TP/WS/BH	WS1	WS2	WS2	WS3	WS4	WS5			
Depth (m)	0.40	0.40	0.60	0.40	0.40	0.60			
Envirolab reference	20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6			
Asbestos in Soil	Thresholds								
Asbestos detected in Soil (enter Y or N)	Y	n	n	n	n	n	n			

If Asbestos in Soil above is "Y", the soil is Hazardous Waste HP5 and HP7

Asbestos % Composition in Soil (Matrix Loose Fibres or Microscopic Identifiable Pieces only)	see "Carc HP7 % Asbestos in Soil (Fibres)" below	%							
Carcinogenic HP7 % Asbestos in Soil (fibres or micro pieces) *Please be advised, if the calculation cell is "0.00000" DOES NOT MEAN asbestos testing has been undertaken and the result is zero.*	≥0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

If Asbestos in Soil above is "Y", but Asbestos % above is "<0.1%", the soil is Non Hazardous Waste. You can only use Asbestos % results where loose fibres or micro pieces are only present. You cannot use Asbestos % results when visual identifiable pieces are present.

Asbestos Identifiable Pieces visible with the naked eye detected in the Soil (enter Y or N)	Y	n	n	n	n	n	n			

If visual identifiable pieces of asbestos are present, you cannot use Asbestos % results and the whole soil sample is Hazardous Waste HP5 and HP7 Construction material containing Asbestos 17 06 05.
Therefore, if Asbestos in Soil above is "Y", the Asbestos % above is "<0.1%", but the Asbestos Identifiable Pieces visible with the naked eye is "Y", the soil is Hazardous Waste.

Identifiable Pieces are Cement, Fragments, Board, Rope etc. ie anything ACM that is not Loose Fibres.
All visual asbestos pieces need to be removed leaving only fibres (or micro pieces) with an Asbestos % Composition in Soil result of <0.1% for the soil to become non-hazardous waste.

Hazardous Property	Thresholds	Cut Off Value	If cells below turn yellow and the text turns red, the samples should be classified as Hazardous Waste.								
Corrosive HP8	≥5%	<1%	0.00599	0.00691	0.00478	0.00433	0.00653	0.00550	0.00000	0.00000	0.00000
Irritant HP4	≥10%	<1%	0.00752	0.01375	0.00720	0.00439	0.01194	0.00671	0.00000	0.00000	0.00000
Irritant HP4	≥20%	<1%	0.00973	0.01626	0.00853	0.00550	0.01380	0.00801	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥1%		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥20%		0.00006	0.00012	0.00001	0.00005	0.00004	0.00004	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥1%		0.00480	0.00480	0.00346	0.00288	0.00442	0.00365	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥10%		0.10600	0.06490	0.02800	0.02740	0.04010	0.03340	0.00000	0.00000	0.00000
Aspiration Toxicity HP5	≥10%		0.00450	0.03540	0.00090	0.02740	0.00820	0.01100	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Oral)	≥0.1%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Oral)	≥0.25%	<0.1%	0.00130	0.00236	0.00155	0.00157	0.00231	0.00201	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Oral)	≥5%	<0.1%	0.00494	0.00494	0.00360	0.00302	0.00456	0.00379	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Oral)	≥25%	<1%	0.11579	0.08125	0.03658	0.03095	0.05396	0.04146	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Dermal)	≥0.25%	<0.1%	0.00011	0.00025	0.00023	0.00012	0.00020	0.00016	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Dermal)	≥2.5%	<0.1%	0.00480	0.00480	0.00346	0.00288	0.00442	0.00365	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Dermal)	≥15%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Dermal)	≥55%	<1%	0.00006	0.00008	0.00005	0.00005	0.00006	0.00005	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Inhal)	≥0.1%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Inhal)	≥0.5%	<0.1%	0.00497	0.00513	0.00374	0.00305	0.00467	0.00386	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Inhal)	≥3.5%	<0.1%	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00000	0.00000	0.00000
Acute Toxicity HP6 (Inhal)	≥22.5%	<1%	0.11556	0.08058	0.03650	0.03076	0.05377	0.04129	0.00000	0.00000	0.00000
Carcinogenic HP7	≥0.1%		0.10600	0.06490	0.02800	0.02740	0.04010	0.03340	0.00000	0.00000	0.00000
Carcinogenic HP7	≥0.1%		0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
Carcinogenic HP7	≥1%		0.00004	0.00017	0.00001	0.00005	0.00004	0.00004	0.00000	0.00000	0.00000
Carcinogenic HP7 Unknown TPH with ID	≥1,000mg/kg		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carcinogenic HP7 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≥0.01%		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
pH Corrosive HP8 pH (soil or leachate)	H8 ≥11.5		8.69	9.51	7.72	8.33	8.08	8.18	0.00	0.00	0.00
pH Corrosive HP8 pH (soil or leachate)	H8 ≤2		8.69	9.51	7.72	8.33	8.08	8.18	0.00	0.00	0.00
Toxic for Reproduction HP10	≥0.3%		0.10600	0.06490	0.02800	0.02540	0.04010	0.03340	0.00000	0.00000	0.00000
Toxic for Reproduction HP10	≥3%		0.00480	0.03540	0.00346	0.02740	0.00820	0.01100	0.00000	0.00000	0.00000
Mutagenic HP11	≥0.1%		0.00480	0.03540	0.00346	0.02740	0.00820	0.01100	0.00000	0.00000	0.00000
Mutagenic HP11 Unknown TPH with ID	≥1,000mg/kg		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mutagenic HP11 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≥0.01%		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Mutagenic HP11	≥1%		0.00323	0.00404	0.00263	0.00242	0.00384	0.00303	0.00000	0.00000	0.00000
Produces Toxic Gases HP12 Sulphide	≥1,400mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Produces Toxic Gases HP12 Cyanide	≥1,200mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Produces Toxic Gases HP12 Thiocyanate	≥2,600mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HP13 Sensitising	≥10%		0.00480	0.00480	0.00346	0.00288	0.00442	0.00365	0.00000	0.00000	0.00000

Table 3 of the CLP, CL Inventory, ATPs, IARC, Concawe, MSDSs, REACH + Pesticide Properties databases. Worst case REACH + MSDS's used for "*" STOT + Acute Toxicity.

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TP/WS/BH			WS1	WS2	WS2	WS3	WS4	WS5			
Depth (m)			0.40	0.40	0.60	0.40	0.40	0.60			
Envirolab reference			20/05699/1	20/05699/2	20/05699/3	20/05699/4	20/05699/5	20/05699/6			
Ecotoxic HP14 amended v6	≥25%	<0.1%	0.13845	0.12683	0.05071	0.05033	0.08293	0.06562	0.00000	0.00000	0.00000
Ecotoxic HP14 amended v6	≥25%	<0.1% / 1.0%	0.14295	0.16223	0.05161	0.07773	0.09113	0.07662	0.00000	0.00000	0.00000
Ecotoxic HP14 amended v6	≥25%	<0.1% / 1.0%	13.89040	13.03730	5.07970	5.30720	8.37480	6.67190	0.00000	0.00000	0.00000
Persistent Organic Pollutant (PCB, PBB or POP Pesticides)	>0.005%		0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
Persistent Organic Pollutant (Total Dioxins+Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
Persistent Organic Pollutant (Individual Dioxins+Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000

If other contaminants need adding to Haswaste, please contact Envirolab.

APPENDIX Q
WAC RESULTS

envirolab
Units 7 & 8, Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

Final Test Report

SUPPLEMENT TO TEST REPORT 20/05699/1

Envirolab Job Number:	20/05699		
Issue Number:	2	Date:	23-Jul-20

Client: RSK Environment Ltd Hemel
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager:	Ben Winch/Heshawa Abayatilaka
Project Name:	Ossory Road
Project Ref:	29909
Order No:	N/A
Date Samples Received:	14-Jul-20
Date Instructions Received:	14-Jul-20
Date Analysis Completed:	21-Jul-20

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid

Predominant Matrix Codes: 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample

Secondary Matrix Codes: A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Prepared by:

Sophie France
Client Service Manager

Approved by:

Richard Wong
Client Manager

envirolab

Landfill WAC analysis must not be used for hazardous waste classification purposes. This analysis is only applicable for landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Sample Details						Landfill Waste Acceptance Criteria Limits		
Lab Sample ID	Method	ISO17025	MCERTS	20/05699/4				
Client Sample Number				1		Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Client Sample ID				WS3				
Depth to Top				0.4				
Depth to Bottom								
Date Sampled				11/07/2020				
Sample Type				Soil - ES				
Sample Matrix Code				6ABE				
Solid Waste Analysis								
pH (pH Units)$_D$	A-T-031	N	N	**8.33**		-	>6	-
ANC to pH 4 (mol/kg)$_D$	A-T-ANC	N	N	**0.73**		-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg)$_D$	A-T-ANC	N	N	**0.05**		-	to be evaluated	to be evaluated
Loss on Ignition (%)$_D$	A-T-030	N	N	**3.6**		-	-	10
Total Organic Carbon (%)$_D$	A-T-032	N	N	**0.64**		3	5	6
PAH Sum of 17 (mg/kg) $_A$	A-T-019	N	N	**6.11**		100	-	-
Mineral Oil (mg/kg)$_A$	A-T-007	N	N	**17**		500	-	-
Sum of 7 PCBs (mg/kg)$_A$	A-T-004	N	N	**<0.007**		1	-	-
Sum of BTEX (mg/kg)$_A$	A-T-022	N	N	**<0.01**		6	-	-
Eluate Analysis				**10:1**	**10:1**	**Limit values for compliance leaching test using**		
				mg/l	**mg/kg**	**BS EN 12457-2 at L/S 10 l/kg (mg/kg)**		
Arsenic	A-T-025	N	N	0.003	**0.030**	0.5	2	25
Barium	A-T-025	N	N	0.039	**0.390**	20	100	300
Cadmium	A-T-025	N	N	<0.001	**<0.01**	0.04	1	5
Chromium	A-T-025	N	N	0.003	**0.030**	0.5	10	70
Copper	A-T-025	N	N	0.012	**0.120**	2	50	100
Mercury	A-T-025	N	N	<0.0005	**<0.005**	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.009	**0.090**	0.5	10	30
Nickel	A-T-025	N	N	0.002	**0.020**	0.4	10	40
Lead	A-T-025	N	N	0.002	**0.020**	0.5	10	50
Antimony	A-T-025	N	N	0.005	**0.050**	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	**<0.01**	0.1	0.5	7
Zinc	A-T-025	N	N	0.021	**0.210**	4	50	200
Chloride	A-T-026	N	N	22	**223**	800	15000	25000
Fluoride	A-T-026	N	N	0.2	**2.0**	10	150	500
Sulphate as SO_4	A-T-026	N	N	870	**8698**	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	815	**8150**	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	**<0.1**	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<0.2	**<200**	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.7				
Conductivity (µS/cm)	A-T-037	N	N	1630				
Mass Sample (kg)				0.196				
Dry Matter (%)	A-T-044	N	N	89.4				

Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation