



**EARTH ENVIRONMENTAL
& GEOTECHNICAL**

**PHASE II COMBINED GEO-
ENVIRONMENTAL &
GEOTECHNICAL SITE
INVESTIGATION**

LAND AT DOWER HOUSE

HIGH STREET

HARLINGTON

HAYES

UB3 5DH

REPORT REF: R0653/23

April 2023



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Prepared on Behalf of:

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Land At Dower House, High Street, Harlington, Hayes, UB3 5DH

Report Reference: R0653/23

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Date: 13th April 2023

Prepared for: Komfort Services

Prepared by: Earth Environmental & Geotechnical (Southern) Ltd
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1.0 INTRODUCTION

1.1 Background

A Combined Geo-Environmental and Geotechnical Site Investigation has been commissioned by MorseWebb Architects Ltd on behalf of Komfort Services (the Client) to examine ground conditions, retrieve soil samples for chemical and geotechnical testing and provide information to be used in parameters for foundation design for a proposed new residential development at a site in Harlington, Hayes.

1.2 Terms of Reference

Earth Environmental and Geotechnical (Southern) Ltd (EEGSL) was commissioned by the Client to undertake a Combined Geo-Environmental and Geotechnical Site Investigation of the assessment site in accordance with project proposal R0653/2022 dated 14th September 2022.

The objectives of this site investigation are as follows:

- *Undertake ground investigation works and assessment of ground conditions to provide environmental and geotechnical information on the soils present beneath the assessment site.*
- *Undertake ground investigation works to assess the presence and likely extent of any potential environmental hazards (soil, ground gas and groundwater contamination) associated with the areas of the site investigated.*
- *Undertake three rounds of ground gas and groundwater level monitoring.*
- *Provide a Factual and Interpretive Ground Investigation Report.*

1.3 Report Scope

This report presents full factual records of the site work carried out, the ground conditions encountered in the exploratory holes and the in-situ and laboratory test results. All information collected has been used to provide an interpretation of the ground conditions together with recommendations to inform on parameters used in foundation design.

1.4 Limitations of the Study

The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information, improved practices or changes in legislation may require a reinterpretation of the report in whole or in part. EEGSL reserve the right to amend either conclusions or recommendations in light of any further information that may become available. The report is provided for the sole use by the Client and is confidential to them.

Recommendations within this report are also based on exploratory records and examination of samples and, where applicable, laboratory tests. No liability can be accepted for conditions not revealed by the boreholes and trial pits, particularly at intervening locations. Whilst every effort is made to ensure accuracy of data supplied, all opinions expressed as to the spatial distribution of strata between sampling locations is for guidance only and no responsibility is accepted as to its accuracy.

2.0 SITE LOCATION & DESCRIPTION

2.1 Site Location & Description

The assessment site covers an area of ~0.56ha, is roughly rectangular in shape, and currently comprises Dower House in the west with an area of vegetation and woodland in the middle and east.

The assessment site is bound directly to the north by residential and light industrial buildings with residential buildings beyond and the M4 motorway ~1km north, directly to the east by large open agricultural fields, to the south by residential and light industrial buildings, and directly to the west by High Street Road with residential buildings beyond.

The assessment site itself is located at Dower House, High Street, Harlington, Hayes, UB3 5DH on the eastern side of High Street Road, ~2.2km southwest of Hayes & Harlington train station. The site is centred on National Grid Reference TQ215836 (E:521513, N:183649).

An aerial photograph showing the location of the site is provided in Figure 1.

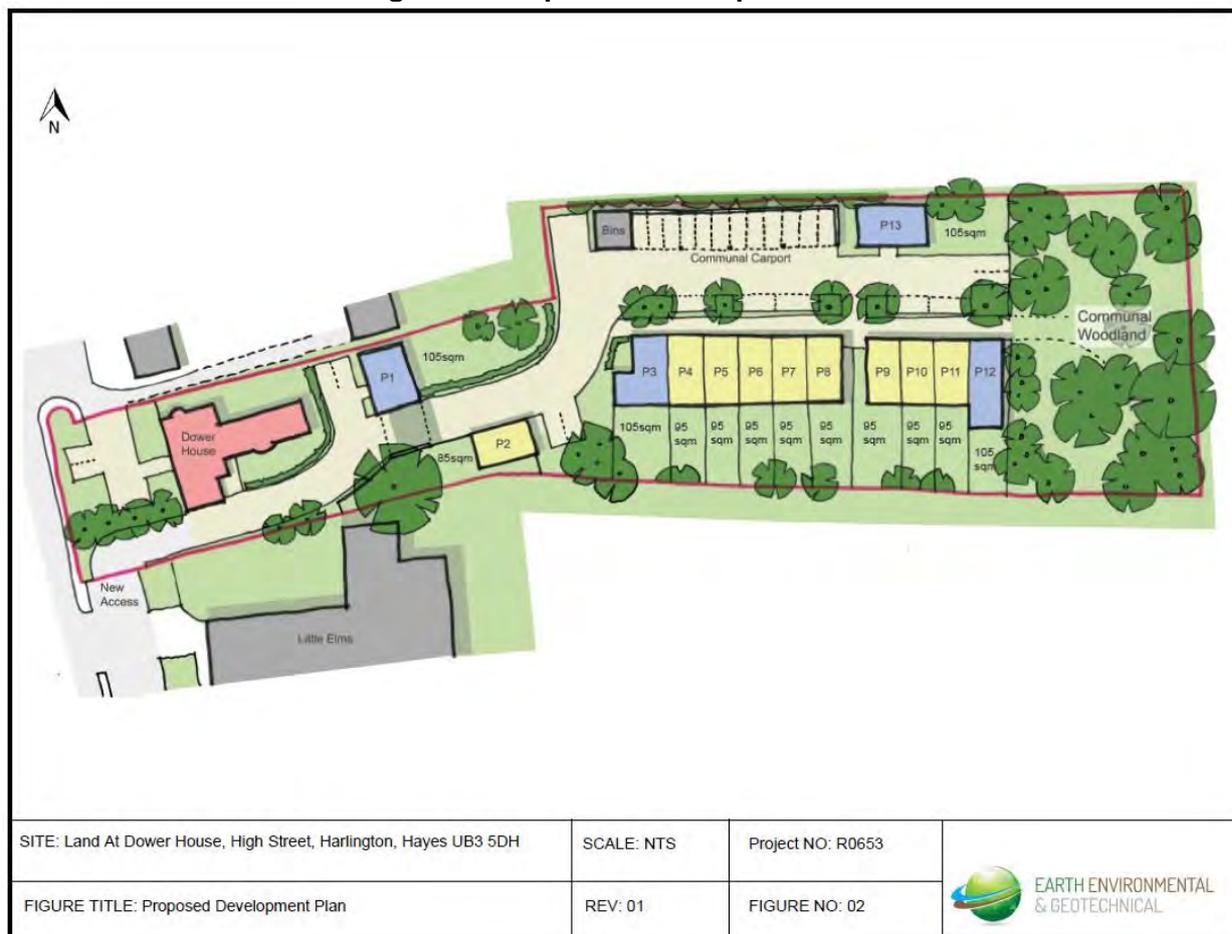
Figure 1: Site Location Plan



2.2 Proposed Development

It is understood that the proposed development involves the clearance of vegetation within the central parts of the assessment site, the renovation of Dower House and construction of up to 5 No. 3 bed dwellings and 12 No. 2 bed dwellings with associated access road, refuse area, parking and communal woodland area (in the eastern end of the assessment site). See figure 2 for the current proposed development plans

Figure 2: Proposed Development Plan



2.3 Published Geology

The BGS states the assessment site is directly underlain by superficial deposits of Langley Silt Member (Clay and Silt). The Langley Silt Member generally comprises varying silt to clay, commonly yellow-brown and massively bedded.

The BGS states that underlying the superficial deposits is bedrock geology comprising the London Clay Formation (Clay, Silt and Sand). The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occur.

2.4 Phase I Desk Study Information

EEGSL have previously completed a Phase I Desk Study for the assessment site (EEGSL: Land at Dower House High Street Harlington Hayes UB3 5DH, Phase I Geo-Environmental Desk Study, Report Ref: R0653/23/DTS, April 2023).

As part of the Phase I Desk Study, it was proposed that a low-moderate risk may be present to current users and adjacent site users, whilst a moderate risk is likely to be present to future site users and construction workers.

Sources of contamination were identified as: Made Ground associated with historical development and a former inert landfill located to east and potentially on site. Contaminants of concern included asbestos, toxic metals, hydrocarbons and landfill gasses.

As part of this ground investigation, the presence or absence of contamination has been assessed, and the actual risks posed on site have been determined by a review against currently accepted human health guideline values.

This report should be read in conjunction with the Phase I Desk Study written by EEGSL.

3.0 SITE INVESTIGATION

3.1 Exploratory Fieldwork

Exploratory fieldwork was carried out by EEGSL on the 14th February 2023 and comprised:

- 6 No. window sample boreholes (designated WS01-WS06) sunk to a maximum depth of 1.60m below existing ground level. Window sample boring is carried out with a small, track-mounted rig, which uses a chain-driven trip hammer to drive sampling tubes or penetrometers into the ground. These tools are coupled to the anvil of the hammer by solid drill rods. Sampling tubes comprise “windowless samplers”, which are plain sampler tubes in which a continuous disturbed sample is recovered within a semi-rigid plastic liner. To reduce friction within the borehole, sampling tubes of progressively smaller diameter are used as the borehole depth increases. Sampler diameters generally range from between approximately 90mm to 50mm. Exploratory Hole logs are included in Appendix 1.
- 1 No. dynamic probe was conducted, at one of the borehole locations (WS02). Dynamic probes were advanced to a maximum depth of 5.0m below existing ground level, the results of which are presented in Appendix 3.
- 50mm diameter standpipes were installed in WS03, WS05 and WS06 to the respective completed depth of the borehole. EEGSL carried out three rounds of groundwater level and ground gas monitoring within the standpipes after the fieldwork period, the results of which are presented in Appendix 2.

The fieldwork was carried out generally in accordance with BS 5930:2015+A1:2020 Code of Practice for Site Investigations unless otherwise stated. The exploratory hole locations were determined on site by EEGSL and considered site restrictions present at the time. The investigation locations completed are shown approximately on the Exploratory Hole Location Plan (Figure 3).

Figure 3: Exploratory Hole Location Plan



Each exploratory location was scanned using a Cable Avoidance Tool (CAT) in order to locate unrecorded underground services, and the exploratory locations were repositioned if necessary. On completion, all samples recovered from the site were taken to a specialist laboratory for testing. All site investigation work was supervised full time by a representative of EEGSL. The logging of soils and rocks has been carried out in accordance with BS5930^(2015+A1:2020) except where superseded by the soil and rock description methodology in BS EN14688-1⁽²⁰⁰²⁾, BS EN 14688-2⁽²⁰⁰⁴⁾ and BS EN 14689-1⁽²⁰⁰³⁾.

A summary of exploratory holes undertaken during the investigation is presented in Table 1.

Table 1: Summary of Exploratory Holes Undertaken

Hole	Type*	Depth (m)	Date Started	Date Finished	Backfill Details**
WS01	WS	1.60	14/02/2023	14/02/2023	A
WS02	WS	1.00	14/02/2023	14/02/2023	A
WS03	WS	1.00	14/02/2023	14/02/2023	SP (Response zone 0.50-1.0mbgl)
WS04	WS	1.60	14/02/2023	14/02/2023	A
WS05	WS	1.00	14/02/2023	14/02/2023	SP (Response zone 0.50-1.0mbgl)
WS06	WS	1.20	14/02/2023	14/02/2023	SP (Response zone 0.50-1.20mbgl)

*WS= Window Sample Borehole, **SP = Standpipe A = Arisings

3.2 Laboratory Testing Programme

3.2.1 Geotechnical Testing

A programme of laboratory testing was carried out on samples taken from the various strata to assist in classification and determine the engineering properties of the materials underlying the site. The testing was scheduled by EEGSL and carried out by Geo Site & Testing Services Ltd. The test procedures used were generally in accordance with the methods described in BS1377:1990 and BS EN ISO 17892-1:2014. Details of the specific tests used in each case are given in Table 2 below:

Table 2: Summary of Geotechnical Testing

TEST	STANDARD	No.
Moisture Content	BS1377:1990 Part 2: 3.2	5
Atterburg Limit (one point method)	BS1377:1990 Part 2, Clause 4.4	5
PSD Sieve	BS1377:1990 Part 2, clause 9.2	2
pH	BS1377:1990 Part 3, Clause 9	7
Water Soluble Sulphate (SO ₄)	BS1377:1990 Part 3, Clause 5	7

The results of the laboratory geotechnical tests are discussed in Section 5 and included in Appendix 4.

3.2.2 Environmental Testing

The environmental chemistry of the ground was investigated by specialist chemical analysis of selected samples, scheduled by EEGSL and carried out by QTSE DETS Ltd.

Chemical analyses were carried out on 9 soil samples and were submitted for the following suite of determinants:

- *Asbestos Screen, Arsenic, Barium, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Cyanide, Thiocyanate, Sulphate (SO₄), Sulphide, pH, Sulphur, Soil Organic Matter, Speciated Petroleum Hydrocarbons (TPH) and Speciated Polyaromatic Hydrocarbons (PAH).*

The results of the laboratory contamination tests are discussed in Section 6 and included in Appendix 5.

4.0 GROUND CONDITIONS ENCOUNTERED

The following sections describe the ground conditions identified during the investigation and discusses the engineering properties of the soils based on insitu testing results and laboratory analysis.

4.1 Soil Profile Encountered

The exploratory holes excavated at the assessment site encountered the following general sequence of strata:

- MADE GROUND: consisting of variable sandy gravelly CLAY and variable clayey gravelly SAND proven to a maximum depth of 0.55mbgl, observed in all exploratory boreholes.
- TAPLOW GRAVEL MEMBER: consisting of variable sandy gravelly CLAY, clayey gravelly SAND and clayey sandy GRAVEL proven to a maximum depth of 1.60mbgl.

The depths at which each stratum was encountered in each exploratory hole is provided within the borehole logs presented within Appendix 1.

From the boreholes undertaken at the assessment site it is noted that Made Ground consisting of variable sandy gravelly Clay and variable clayey gravelly Sand is proven to a maximum depth of 0.55mbgl, overlying the dense sands and gravels of the Taplow Gravel Member. It would appear that the Langley Silt Member is absent from site (or present as a very thin sandy gravelly clay layer present above the Taplow Gravel).

4.2 Obstructions

During the site investigation no manmade obstructions were encountered, however dense natural ground conditions were encountered in all boreholes (WS01 at 1.60mbgl, WS02 at 1.0mbgl, WS03 at 1.0mbgl, WS04 at 1.50mbgl, WS05 at 1.0mbgl and WS06 at 1.20mbgl) which meant continued drilling was not feasible.

4.3 Groundwater

During the site investigation works, groundwater was encountered only in WS01 at a depth of 1.60mbgl.

A total of three rounds of groundwater level monitoring was completed, from boreholes WS03, WS05 and WS06, between the 2nd March 2023 to 15th March 2023. During the monitoring visits no groundwater was encountered within any of the installed boreholes. Detailed results from the monitoring are provided within Appendix 2.

4.4 Ground Gas Monitoring

A total of three rounds of ground gas monitoring were completed from boreholes WS03, WS05 and WS06, between the 2nd March 2023 to 15th March 2023. Detailed results from the monitoring are provided within Appendix 3.

During monitoring the atmospheric pressure was recorded as between 994-1015mb and the following ranges of gas concentrations were identified: Oxygen (O₂) levels ranging from 17.6-

20.8% by volume, Carbon Dioxide (CO₂) levels ranging from 0-3.2% by volume. Concentrations of Methane (CH₄), Carbon Monoxide (CO) and Hydrogen Sulphide (H₂S) were not detected.

Gas flows and borehole pressures were also recorded during the monitoring rounds. A maximum stabilised flow of -2.2 l/hr was recorded alongside a differential borehole pressure of -13 pa.

4.5 Engineering Properties

The following section discusses the engineering properties of the underlying cohesive and granular soils of the Taplow Gravel Member. The assessment is based on results of insitu and laboratory testing obtained during this investigation. The results of laboratory geotechnical testing are summarised in Table 3, whilst full details are included within Appendix 4.

Table 3: Summary of Laboratory Geotechnical Test Results

Location	Depth (m)	Stratum	Classification				Chemical		
			Particle Size Distribution (PSD)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	pH Value	Water Soluble Sulphate (mg/l)
WS01	1.0-1.60	GRAVEL	-	7.3	-	-	-	6.2	31
WS02	0.90-1.0	CLAY	-	17	30	13	17	6.4	17
WS03	0.80-0.90	CLAY	-	14	30	14	16	6.8	12
WS04	0.80-1.50	GRAVEL	80%-Gravel, 20%-Sand	-	-	-	-	7.0	11
WS05	0.80-0.90	CLAY	-	15	31	13	18	7.2	<10
WS05	1.0	GRAVEL	-	4.2	-	-	-	7.2	<10
WS06	0.40-1.20	SAND	48%-Gravel, 51%-Sand, 1%-Silt & Clay					6.2	86

4.5.1 Cohesive Materials (0.30mbgl to 1.0mbgl)

Clay soils were found present at depths between 0.30mbgl to a maximum depth of 1.00mbgl.

Atterberg Limit tests were undertaken on three samples of the underlying clay material. Test results have given values for **liquid limit** ranging from 30-31%, values for **plastic limit** ranging from 13-14%, resulting in values of **plasticity index** ranging from 16-18%. These results suggest the samples tested are clay of low plasticity. For design purposes, a value of plasticity index = 17% is recommended.

Moisture content tests undertaken on samples of the clay materials have given values ranging from 14-17%.

In accordance with NHBC Chapter 4.2 Building Near Trees (2003) soils can be classified in terms of volume change potential, using the relationship:

$$I_p' = I_p \times \frac{\% \text{ less than } 425\mu\text{m}}{100\%}$$

...where I_p' = modified plasticity index, I_p = plasticity index.

Based on the laboratory test results, the above relationship and Table 1 of NHBC Chapter 4.2, the underlying natural Clay deposits are shown to have a **Low Change Potential**.

Effective stress strength parameters for the clay material may be obtained from correlations with plasticity index. For a plasticity index of 17%:

- BS8002 (1994), Table 2 gives $\phi'_{crit} \approx 29.2^\circ$
- Gibson (1953), gives $\phi_d = 29.6^\circ$

Based on the above, design values of $\phi'_{crit} = 29.2^\circ$ and $c' = 0\text{kN/m}^2$ are recommended for the clay material present beneath the assessment site.

Laboratory tests have given values of **water-soluble sulphate** (SO_4) ranging from <10-17mg/l and **pH Values** ranging from 6.4-7.2.

4.5.2 Granular Materials (0.40mbgl to 1.60mbgl)

Sands and Gravels were found present at depths from 0.40mbgl and were proven to a maximum depth of 1.60mbgl. 12 **SPT N** results were obtained between 1.00mbgl and 4.80mbgl with the sand and gravel materials giving a range of values from 21-50, as can be seen from the SPT Vs Depth Plot included as Figure 4. These results would suggest the underlying Sand and Gravel materials are Medium Dense to Very dense.

Laboratory **Particle Size Distribution** (PSD) tests undertaken on samples suggest the samples tested are predominantly Sand and Gravel with a very minor component of silt & clay.

For geotechnical design in granular soils, it is recommended that for assessing ultimate bearing capacities, where the lower values are critical, the lower value of N is used, whereas for assessing settlements average ground conditions will give a more realistic value (therefore the average N value will be used to calculate settlement).

Design values derived from SPT N values for Sand Materials of the Taplow Gravel Formation are summarised in Table 4.

Table 4: Summary of Derived Design Values (Sand & Gravel Materials)

Depth (m)	N Values			Angle of Shearing Resistance (ϕ)*
	Range	Average	Lower Value	
1.00	36-50	45	36	37.6°
1.50	50-50	50	50	41°
2.00	50	50	50	41°

*Based on lower N Value and correlation by Peck, Hanson and Thornburn⁽¹⁹⁷⁴⁾

Laboratory tests have given values of **water-soluble sulphate** (SO_4) ranging from <10-86mg/l and **pH Values** ranging from 6.2-7.2.

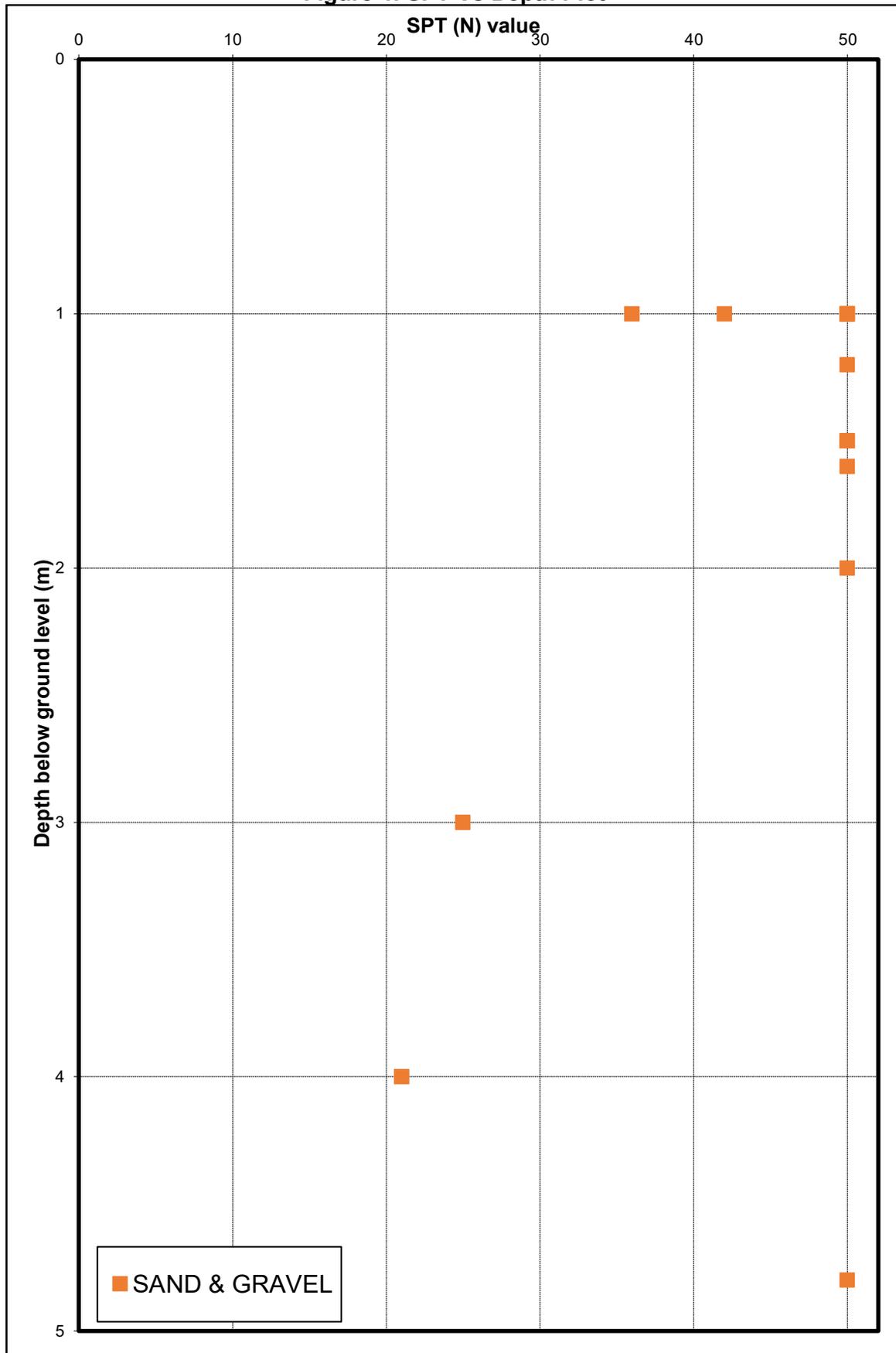
4.6 Dynamic Probe

Dynamic probing was undertaken at borehole location WS02 to a maximum depth of 5.0m below existing ground level. Dynamic probing was undertaken to get a greater understanding of the strength of soils at depth.

The results of the Dynamic probing exercise have been converted to equivalent SPT N-values which indicate that the deeper soils present beneath the assessment site are also Medium Dense to Very Dense.

The results of the dynamic probing can be seen in Appendix 3 and in Figure 4.

Figure 4: SPT Vs Depth Plot



5.0 GEOTECHNICAL ASSESSMENT

This section will discuss possible foundation design for the proposed development and considers the ground conditions identified within Section 4 alongside the design values generated from insitu and laboratory analysis.

Conventional strip and pad foundations should be suitable for the proposed new development, depending on structural loadings, tolerance of the structure to settlement and the potential impacts of trees on the cohesive shallow soils. If structural loadings are too high or settlement too large for conventional foundations, alternative foundations such as piles will need to be used.

5.1 Ground Conditions Encountered

From the investigation undertaken across the assessment site, in general the ground conditions encountered can be summarised as Made Ground proven to a maximum depth of 0.55mbgl, overlying variable sandy gravelly Clay proven to a maximum depth of 1.0mbgl, overlying medium dense to very dense Sands and Gravels of the Taplow Gravel Member.

During the site investigation works, groundwater was encountered only in WS01 at a depth of 1.60mbgl.

5.2 Proposed Development

It is understood that the proposed development involves the clearance of vegetation within the central parts of the assessment site, the renovation of Dower House and construction of up to 5 No. 3 bed dwellings and 12 No. 2 bed dwellings with associated access road, refuse area, parking and communal woodland area (in the eastern end of the assessment site).

5.3 Groundwater

Groundwater has been identified within WS01 at a depth of 1.60mbgl. Due to the dense sands and gravel present, deep groundwater monitoring wells (below this depth) were not able to be installed. Given the current information available, it is recommended that groundwater be expected at or below 1.6mbgl across the site.

For excavations below 1.60mbgl, dewatering activities may be required and should be accounted for in any construction activities.

5.4 Foundations

Where strip and pad foundations are to be used, they should be placed within the medium dense to very dense sand and gravel materials. If any Topsoil, Made Ground, particularly loose or soft materials are encountered at foundation level, this should be either excavated and replaced with suitable granular fill, or the foundation extended to suitable strata.

Anticipated bearing capacities and settlements have been calculated for shallow strip and pad foundations at depths of 1.00mbgl and 1.50mbgl. Table 5 summarises anticipated allowable bearing pressures for strip and pad foundations at these depths. The bearing capacities are calculated assuming a factor of safety against bearing capacity failure of 3. Groundwater is assumed to be at 1.60mbgl.

Table 5: Summary of Allowable Bearing Pressures

Foundation Depth	Foundation Stratum	Design Value	Foundation Type	Foundation Width / Size	Allowable Bearing Pressure
1.00m	SAND & GRAVEL	$\phi = 37.6$	Strip	0.6m	440kN/m ²
				1.0m	475kN/m ²
			Pad	0.75m x 0.75m	>500kN/m ²
				1.5m x 1.5m	>500kN/m ²
1.50m	SAND & GRAVEL	$\phi = 41.0$	Strip	0.6m	>500kN/m ²
				1.0m	>500kN/m ²
			Pad	0.75m x 0.75m	>500kN/m ²
				1.5m x 1.5m	>500kN/m ²

Table 6 gives estimates of anticipated settlements for the above foundations, based on design values discussed in Section 4. Given the high allowable bearing pressures calculated within Table 5.

Table 6: Summary of Anticipated Foundation Settlements

Foundation Depth	Foundation Stratum	Foundation Type	Foundation Size	Foundation Loading	Settlement (mm)		
					Lower Limit	Upper Limit	Best Guess
1.00m	SAND & GRAVEL	Strip	0.6m	440kN/m ²	0-5	5-10	0-5
			1.0m	475kN/m ²	0-5	5-10	5-10
		Pad	0.75m x 0.75m	500kN/m ²	0-5	10-15	5-10
			1.5m x 1.5m	500kN/m ²	0-5	15-20	5-10
1.50m	SAND & GRAVEL	Strip	0.6m	500kN/m ²	0-5	10-15	5-10
			1.0m	500kN/m ²	0-5	15-20	5-10
		Pad	0.75m x 0.75m	500kN/m ²	0-5	5-10	0-5
			1.5m x 1.5m	500kN/m ²	0-5	10-15	5-10

Settlements for other bearing pressures may be estimated on a pro-rata basis but bearing pressures should not exceed the allowable net bearing pressure based on ultimate bearing capacity.

All foundation excavations should be inspected by a suitable qualified engineer to prove that the founding strata is suitable and uniform along the length of the foundation, and capable of taking the anticipated structural loadings.

Should the anticipated structural loadings exceed the allowable bearing pressures above, or anticipated settlements are too large for the proposed structure, alternative foundation options such as piling should be considered.

5.5 Chemical Attack on Buried Concrete

Chemical tests on the soils present beneath the assessment site show low levels of water-soluble sulphates, with values ranging from <10-86mg/l and slightly acidic to near neutral ground conditions with pH values ranging from 6.2-7.2. Based on these conditions, it is recommended that for foundations the Design Sulphate Class, as defined in BRE Special Digest 1 (2005), be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1s. The recommendations of BRE Special Digest 1 should be followed for concrete foundations and ground bearing floor slabs.

5.6 Suitability of Excavated Materials

Acceptability criteria and testing, and methods of compaction/placement will depend on the type of contract and specification used for the construction of the proposed development and it is recommended that earthworks specifications are reviewed by a suitably qualified engineer once these have been prepared by the relevant parties.

It is suggested that the shallow natural cohesive materials be used for landscaping purposes only, whereas the granular deposits may be used for engineering fill. When reusing materials on site, the levels of contamination present also need to be considered (See section 6).

5.7 Temporary Works

Formations will be susceptible to damage both by weather and trafficking, and should be protected immediately on exposure, particularly in areas where construction plant will access the site.

Excavations in the Made Ground and any soft and/or loose material have the potential to be unstable and should be battered back to an angle of 1 in 2, or a system of close sheeting and shoring adopted to ensure stability, and in particular where personnel are required to enter excavations.

All excavations should be adequately supported where personnel are required to enter.

All natural materials on site should be capable of being excavated using conventional excavating machinery.

6.0 SOIL CONTAMINATION RISK ASSESSMENT

6.1 Tier I Human Health Soil Risk Assessment – Future Site Users

As part of the contamination assessment, the chemical results obtained by EEGSL have been screened against accepted compliance criteria, namely:

- Defra C4SL Health Criteria Values (March 2014), where available; and
- Tier 1 assessment values - based on LQM/CIEH Suitable 4 Use Levels⁽²⁰¹⁵⁾ (S4ULs).

As a preliminary screening assessment, all results have been compared to residential end use.

The comparison of results is summarised in Table 7 and 8 below:

Table 7: Soil Results Comparison with Defra C4SL HCV/LLTC Values

Determinant	C4SL (mg/kg)*			Min. (mg/kg)	Max. (mg/kg)	No. of Samples with Exceedances
	Residential with home grown produce (1)	Residential without home grown produce (2)	Commercial (3)			
Arsenic	37	40	640	5	16	0
Benzo(a)pyrene	5.0	5.3	76	<0.1	5.48	1 x (1), 1 x (2)
Cadmium	26	149	410	<0.2	0.5	0
Chromium VI	21	21	9.1	<2	<2	0
Lead	200	310	2300	9	248	3 x (1)

*Minimal risk Health Criteria Values

The comparison within Table 7 has shown four instances of elevated levels of contamination present in excess of the C4SLs for residential end use screening criteria.

The first exceedance relates to elevated levels of Benz(a)pyrene present in a sample taken from WS05 (5.48mg/kg at 0.10-0.30mbgl). This sample is from within the Made Ground, and the levels of contamination present exceed the residential with and without home grown produce criteria.

The second, third and fourth exceedances all relate to elevated levels of Lead present in samples taken from WS02 (201mg/kg at 0.20-0.40mbgl), WS03 (210mg/kg at 0.20-0.40mbgl) and WS06 (248mg/kg at 0-0.40mbgl). All three samples were from the shallow Made Ground, and the levels of contamination present exceed the residential with home grown produce criteria.

Given the residential nature of the proposed development, it is suggested that the above contamination could cause significant risks to the future end users within areas of soft landscaping (if left untreated).

Sulphate and Sulphide were not assessed with respect to risks posed to Human Health as they are not generally considered to represent a significant risk to Human Health (CLR 8);

For contaminants not covered by the Defra C4SLs, reference is made to the Suitable for Use Levels (S4ULs) derived by The Land Quality Management Ltd & Chartered Institute of

Environmental Health⁽²⁰¹⁵⁾ and summarised in Table 8. The S4ULs are based on 1% Soil Organic Matter (SOM).

Table 8: Soil Results Comparison with LQM/CIEH S4UL

Determinant	Suitable 4 Use Levels (mg/kg)*			Min. (mg/kg)	Max. (mg/kg)	No of Exceedances
	Residential		Commercial (3)			
	with homegrown produce (1)	without homegrown produce (2)				
<i>Metals</i>						
Boron	290	11000	240000	<1	<1	0
Chromium	910	910	8600	12	26	0
Copper	2400	7100	68000	5	157	0
Mercury	1.2	1.2	58	<1	<1	0
Nickel	180	180	980	10	23	0
Selenium	250	430	12000	<2	<2	0
Vanadium	410	1200	9000	17	47	0
Zinc	3700	4000	730000	16	374	0
<i>Polycyclic Aromatic Hydrocarbons</i>						
Naphthalene	2.3	2.3	190	<0.1	<0.1	0
Acenaphthylene	170	2900	83000	<0.1	0.12	0
Acenaphthene	210	3000	84000	<0.1	0.16	0
Fluorene	170	2800	63000	<0.1	0.14	0
Phenanthrene	95	1300	22000	<0.1	3.21	0
Anthracene	2400	31000	520000	<0.1	0.66	0
Fluoranthene	280	1500	23000	<0.1	9.57	0
Pyrene	620	3700	54000	<0.1	8.18	0
Benz(a)anthracene	7.2	11	170	<0.1	5.24	0
Chrysene	15	30	350	<0.1	4.27	0
Benzo(b)fluoranthene	2.6	3.9	44	<0.1	6.01	1 x (1), 1 x (2)
Benzo(k)fluoranthene	77	110	1200	<0.1	2.22	0
Indeno(1,2,3-cd)pyrene	27	45	500	<0.1	2.90	0
Dibenz(a,h)anthracene	0.24	0.31	3.5	<0.1	0.66	1 x (1), 1 x (2)
Benzo(ghi)perylene	320	360	3900	<0.1	2.69	0
<i>Phenols</i>						
Phenol	280	750	760	<2	<2	0
Speciated TPH						
Aliphatic >C5 - C6	42	42	3200	<0.01	<0.01	0
Aliphatic >C6 - C8	100	100	7800	<0.05	<0.05	0
Aliphatic >C8 - C10	27	27	2000	<2	<2	0
Aliphatic >C10 - C12	130	130	9700	<2	<2	0
Aliphatic >C12 - C16	1100	1100	59000	<3	<3	0
Aliphatic >C16 - C21	65000	65000	260000	<3	<3	0

Aromatic >C5 - C7	70	370	26000	<0.01	<0.01	0
Aromatic >C7 - C8	130	860	56000	<0.05	<0.05	0
Aromatic >C8 - C10	34	47	3500	<2	<2	0
Aromatic >C10 - C12	74	250	16000	<2	<2	0
Aromatic >C12 - C16	140	1800	36000	<2	2	0
Aromatic >C16 - C21	260	1900	28000	<3	44	0
Aromatic >C21 - C35	1100	1900	28000	<10	99	0
BTEX						
Benzene	0.087	0.38	27	<0.002	<0.002	0
Toluene	130	880	56000	<0.005	<0.005	0
Ethylbenzene	47	83	5700	<0.002	<0.002	0
m & p-xylene	60	88	6600	<0.002	<0.002	0
o-Xylene	59	82	6200	<0.002	<0.002	0
MTBE	56	79	5900	<0.005	<0.005	0

The comparison within Table 8 has shown two instances of elevated levels of contamination present in excess of the S4ULs for residential end use screening criteria.

The first exceedance relates to elevated levels of Benzo(b)fluoranthene present in a sample taken from WS05 (6.01mg/kg at 0.10-0.30mbgl). This sample is from within the Made Ground, and the levels of contamination present exceed the residential with and without home grown produce criteria.

The second exceedance relates to elevated levels of Dibenz(a,h)anthracene present in a sample taken from WS05 (0.66mg/kg at 0.10-0.30mbgl). This sample is from within the Made Ground, and the levels of contamination present exceed the residential with and without home grown produce criteria.

Given the residential nature of the proposed development, it is suggested that the above contamination could cause significant risks to the future end users within areas of soft landscaping (if left untreated).

6.2 Asbestos

Asbestos was not encountered in any of the samples analysed as part of this investigation.

7.0 GROUND GAS CONTAMINATION RISK ASSESSMENT

A preliminary gas risk assessment has been completed for the assessment site based on monitoring data collected from the four installations constructed as part of the recent ground investigation works. The four installations have slotted sections screened across the underlying made ground and superficial geology present beneath the assessment site.

A total of three rounds of ground gas monitoring was completed, from boreholes WS03, WS05 and WS06, between the 2nd March 2023 to 15th March 2023. Detailed results from the monitoring are provided within Appendix 3.

During monitoring the atmospheric pressure was recorded as between 994-1015mb and the following ranges of gas concentrations were identified: Oxygen (O₂) levels ranging from 17.6-20.8% by volume, Carbon Dioxide (CO₂) levels ranging from 0-3.2% by volume. Concentrations of Methane (CH₄), Carbon Monoxide (CO) and Hydrogen Sulphide (H₂S) were not detected.

Gas flows and borehole pressures were also recorded during the monitoring rounds. A maximum stabilised flow of -2.2 l/hr was recorded alongside a differential borehole pressure of -13 pa.

The potential risk associated with ground gases (whether from natural or man-made sources) is dependent on the concentration of gas and its flow rate to the surface. These factors are assessed by the monitoring of borehole installations over varying atmospheric conditions. The variable nature of gas generation and the effect of barometric pressure on gas flow, means that the volume of gas potentially reaching the ground surface can vary over time.

For the assessment of sites, in terms of the potential for ground gas to present a hazard, the risk-based methodology detailed in the CIRIA C665⁽²⁰⁰⁷⁾ is used. This is a risk-based approach that is designed to allow the quick and easy design of gas protection for development by comparing the measured gas emission rates to Characteristic Situations, based on risk-based Gas Screening Values (GSVs). The GSVs equate to the borehole gas volume flow rate as defined by Wilson and Card⁽¹⁹⁹⁹⁾ and are calculated as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.

For the purposes of this evaluation, the calculations will be carried out for Carbon Dioxide only (due to the lack of methane recorded). From the monitoring works a maximum flow of -2.2 l/hr was recorded therefore for assessment purposes a flow rate of 2.2 l/hr will be used as this represents the likely maximum positive flow present at the assessment site.

- Carbon Dioxide: maximum flow rate = 2.2 l/hr, max concentration = 3.2%

Based on the above figures, the GSVs are calculated as:

- Carbon dioxide: GSV = 2.2 x 0.032 = 0.0704 l/hr

The above GSV results would suggest the site can be given a Characteristic Situation of (2), in accordance with Table 9 below, i.e., a 'Low Risk'.

Table 9: Modified Wilson & Card Classification (CIRIA Report 665)

Characteristic Situation (CIRIA Report 149)	Risk Classification	GSV (CH ₄ or CO ₂) (l/hr)	Additional Factors	Typical Source of Generation
1	Very Low Risk	<0.07	Typically, methane ≤1%v/v and/or carbon dioxide ≤5% v/v. Otherwise consider increase to Situation 2.	Natural Soils with low organic content. "Typical" Made Ground.
2	Low Risk	<0.7	Borehole flow rate not to exceed 70l/hr. Otherwise increase to Situation 3.	Natural soil, high peat/organic content. "Typical" Made Ground.
3	Moderate Risk	<3.5		Old landfill, inert waste, mineworking flooded.
4	Moderate to High Risk	<15	Quantitative risk assessment required to evaluate scope of measures required.	Mineworking susceptible to flooding, completed landfill (WMP 26B criteria)
5	High Risk	<70		Mineworking unflooded inactive with shallow workings near surface.
6	Very High Risk	>70		Recent landfill site.

Considering the Characteristic Situation (2), and according to Table 8.6 of CIRIA Report 665, it is recommended that precautions will be required in terms of ground gas mitigation measures. In this instance the protection measures are required due to an elevated risk from carbon dioxide.

It is noted that the GSV for carbon dioxide is only marginally above the Very Low Risk value, however as the site resides adjacent to a historic landfill, the recommendation for basic gas protection measures seems reasonable in this instance.

8.0 CONCLUSIONS AND RECOMMENDATIONS

EEGSL were commissioned by the client to undertake ground investigation works at the assessment site to help inform on parameters used in foundation design as well as undertake a Human Health Risk Assessment for a proposed new residential development in Harlesden, London.

The following section provides a summary of the conclusions and recommendations based on the findings of the investigation works undertaken, laboratory testing results and ground gas and groundwater monitoring results.

8.1 Ground conditions

The ground conditions comprised of Made Ground, proven to a maximum depth of 0.55mbgl, overlying variable sandy gravelly Clay proven to a maximum depth of 1.0mbgl, overlying medium dense to very dense Sands and Gravels of the Taplow Gravel Member proven to a maximum depth of 1.6mbgl. A dynamic probe test was also completed to a depth of 5mbgl. This test proved that the underlying Sand and Gravel was medium dense to very dense.

During the site investigation works, groundwater was encountered at a depth of 1.60mbgl.

Assessment of the ground conditions in terms of the soils bearing capacities and predicted settlements has been undertaken and predicted values provided for a range of foundations at varying depths. From this assessment it is recommended that shallow foundations placed within the Taplow Sand and Gravel should be suitable.

Chemical assessment of the underlying soils has proven that they do not represent particularly aggressive ground conditions and therefore it is recommended that for concrete foundations the Design Sulphate Class, as defined in BRE Special Digest 1(2005), be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1s.

8.2 Soil Contamination

As discussed in Section 6 of this report, chemical testing of soils representative of the materials beneath the assessment site has been undertaken, and the results of which are provided within Appendix 5.

A total of nine soil samples were collected and analysed for a general suite of contaminants. Screening of the results against currently accepted residential end use screening criteria has identified six instances of elevated levels of contamination present beneath the assessment site. All identified exceedances were present within the shallow Made Ground deposits.

In terms of remedial works, it is suggested that some remediation will be required within areas of soft landscaping and gardens. It is suggested that no remediation will be required beneath buildings or permanent hard standing, as the proposed development will act as a physical barrier breaking the source pathway receptor linkage in these areas.

For areas of proposed soft landscaping, the following remediation would be recommended.

Proposed Clean Capping System

Remediation of soft landscaped areas would need to consist of the removal of Made Ground deposits and/or the placement of a clean capping system.

The capping system used for private garden areas should consist of:

- A layer of 600mm clean imported topsoil and subsoil (containing a minimum thickness of 150mm clean topsoil).
- Installation of a no dig barrier (hi vis geotextile) below the 600mm of clean imported materials.

The capping system used for public open spaces should consist of:

- A layer of 350mm clean imported topsoil and subsoil (containing a minimum thickness of 150mm clean topsoil).
- Installation of a no dig barrier (hi vis geotextile) below the 350mm of clean imported materials.

If large trees or shrubs are planned, then these should be planted within over excavated pits with clean imported soils reaching 300mm below the root ball or planted within dedicated raised beds.

Any imported topsoil should conform to BS 3882:2015, and all imported soils must be from a certified clean source (e.g., with appropriate evidence to confirm the absence of contamination).

Excavated materials will require disposal at a suitable landfill site, registered to take the levels of contamination encountered.

Validation of the remedial works will be required. These works can either be completed by EEGSL or another independent consultant.

Agreement from the council regarding the scope of remediation works should sort prior to development.

8.3 Ground Gas

As discussed in Section 7 of this report, three rounds of ground gas monitoring have been undertaken as part of this investigation. The current data shows the presence of elevated levels of carbon dioxide. Based on this information and considering that the site is adjacent to a former landfill, the site has been classed as a Characteristic Situation of (2). It is therefore recommended that ground gas mitigation measures are installed within each of the proposed new dwellings.

The types of proposed ground gas mitigation measures include:

- Incorporation of a gas protection membrane, compliant with BS8485:2015 and suitable for use in NHBC Amber 2 applications, within the construction of the ground floor slab making sure any joints and protruding services are correctly sealed.

And either

- A ventilated sub-floor void with perimeter vents.

Or

- A cast in situ concrete monolithic reinforced ground bearing floor slab with minimal penetrations;

The construction of the ground floor slab is currently unknown however, if it is to consist of a beam and block suspended floor slab, it is recommended that the gas protection membrane is incorporated within the floor slab construction above the beam and block slab and a layer of insulation but beneath the final layer of floor screed.

To prevent damage to the membranes during installation, it should be laid on a blinding layer or layer of insulation board and covered by a protective layer as soon as possible after installation. Care should also be taken to ensure that the membrane is not punctured, stretched or displaced when applying the floor screed /finish.

Installation of the gas membranes across the assessment site should be undertaken by a suitably qualified specialist contractor and validation (including integrity testing) should be provided.

8.4 Site Personnel

As with all construction sites, personnel working on the site during the construction period should be encouraged to maintain a high standard of personal hygiene and on-site washing facilities should be available. The presence of lead and PAH contamination should be made clear to all ground workers and this report should be kept within the sites health and safety file for all to review.

8.5 Other Matters

Due diligence is required during the construction period, and should any further evidence of unknown contamination be found, appropriate investigation and assessment should be taken. The significance of any contamination not discovered by this investigation is outside the scope of this report.

APPENDIX 1
EXPLORATORY BOREHOLE LOGS

Window Sample Log

Project Name: Land At Dower House		Client: MorseWebb Architects Ltd		Date: 14/02/2023	
Location: High Street, Harlington, Hayes, UB3 5DH		Contractor: PM Sampling Ltd		Co-ords: E508874.00 N177330.00	
Project No. : R0653		Crew Name: S		Drilling Equipment: Archway Dart	
Borehole Number WS01	Hole Type WLS	Level	Logged By CA	Scale 1:10	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Hatched Pattern]	▼	0.10 - 0.30	ES		0.40	[Hatched Pattern]	MADE GROUND: Dark Brown slightly sandy slightly gravelly CLAY with fragments of red brick and asphalt. Gravel is angular to subangular fine to medium of flint. Sand is fine to medium.	1	
		0.50 - 0.60	D				Light brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is angular to subangular fine to medium of flint.		
		0.70 - 0.80	ES						
		1.00 - 1.60 1.00 - 1.60 1.00	D ES SPT	N=36 (7,7/7,8,9,12)	1.00	[Hatched Pattern]	Dense to very dense brown slightly clayey sandy angular to subangular fine to medium GRAVEL of flint. Sand is fine to medium.		
		1.60	SPT	N=50 (8,11/50 for 245mm)	1.60		End of Borehole at 1.600m		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.60	87										

Remarks
Groundwater was encountered at 1.60m bgl. Reason for termination - Barrel refusing on solid natural ground conditions, confirmed by SPT with 50+ blows.

Window Sample Log

Project Name: Land At Dower House		Client: MorseWebb Architects Ltd		Date: 14/02/2023	
Location: High Street, Harlington, Hayes, UB3 5DH		Contractor: PM Sampling Ltd		Co-ords: E508903.00 N177340.00	
Project No. : R0653		Crew Name: S		Drilling Equipment: Archway Dart	
Borehole Number WS02	Hole Type WLS	Level	Logged By CA	Scale 1:10	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Pattern]		0.20 - 0.40	ES		0.50	[Pattern]	MADE GROUND: Dark Brown slightly gravelly sandy CLAY with fragments of red brick and asphalt. Sand is fine to medium. Gravel is angular to subangular fine to medium of flint.		
		0.60 - 0.70	D				[Pattern]	Very stiff light brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is angular to subangular fine to medium of flint.	
		0.70 - 0.80	ES						
		0.90 - 1.00	D						
		1.00	SPT	N=50 (6,9/50 for 250mm)	1.00			End of Borehole at 1.000m	1
								2	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	87										

Remarks
 No groundwater was encountered. Reason for termination - 1m SPT refusing on solid natural ground conditions (50+ blows).

Window Sample Log

Project Name: Land At Dower House		Client: MorseWebb Architects Ltd		Date: 14/02/2023	
Location: High Street, Harlington, Hayes, UB3 5DH		Contractor: PM Sampling Ltd		Co-ords: E508930.00 N177326.00	
Project No. : R0653		Crew Name: S		Drilling Equipment: Archway Dart	
Borehole Number WS03	Hole Type WLS	Level	Logged By CA	Scale 1:10	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20 - 0.40	ES		0.40		MADE GROUND: Dark Brown slightly gravelly sandy CLAY with fragments of asphalt. Sand is fine to medium. Gravel is angular to subangular fine to medium of flint.		
		0.40 - 0.50	D					Light brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is angular to subangular fine to medium of flint.	
		0.50 - 0.60	ES		0.90				
		0.80 - 0.90	D						
		0.90 - 1.00	ES						
		1.00	SPT	N=50 (7,11/50 for 260mm)	1.00			Very dense light brown/yellow slightly clayey very gravelly fine to coarse SAND. Gravel is angular to subangular fine to medium of flint.	1
							End of Borehole at 1.000m	2	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	87										

Remarks
No groundwater was encountered. Reason for termination - 1m SPT refusing on solid natural ground conditions (50+ blows).

Window Sample Log

Project Name: Land At Dower House		Client: MorseWebb Architects Ltd		Date: 14/02/2023	
Location: High Street, Harlington, Hayes, UB3 5DH		Contractor: PM Sampling Ltd		Co-ords: E508920.00 N177350.00	
Project No. : R0653		Crew Name: S		Drilling Equipment: Archway Dart	
Borehole Number WS04	Hole Type WLS	Level	Logged By CA	Scale 1:10	Page Number Sheet 1 of 1

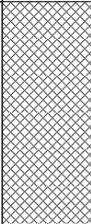
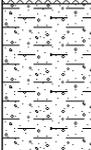
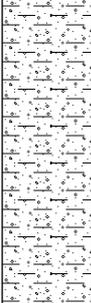
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
Well		0.20 - 0.40	ES		0.55	MADE GROUND	MADE GROUND: Dark Brown slightly sandy slightly gravelly CLAY with fragments of red brick and asphalt. Gravel is angular to subangular fine to medium of flint. Sand is fine to medium.	
		0.55 - 0.65	D				Light brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of flint. Sand is fine to medium.	
		0.65 - 0.75	ES		0.80	GRAVEL	Dense to very dense yellow/brown sandy angular to subangular fine to medium GRAVEL of flint. Sand is fine to coarse.	
		0.80 - 1.50	B ES					
		1.00	SPT	N=42 (6,8/9,10,11,12)				
	1.50	SPT	50 (8,12/50 for 225mm)	1.50			End of Borehole at 1.500m	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.50	87										

Remarks
 No groundwater was encountered. Reason for termination - Barrel refusing on solid natural ground conditions, confirmed by SPT with 50+ blows.

Window Sample Log

Project Name: Land At Dower House		Client: MorseWebb Architects Ltd		Date: 14/02/2023	
Location: High Street, Harlington, Hayes, UB3 5DH		Contractor: PM Sampling Ltd		Co-ords: E508944.00 N177333.00	
Project No. : R0653		Crew Name: S		Drilling Equipment: Archway Dart	
Borehole Number WS05	Hole Type WLS	Level	Logged By CA	Scale 1:10	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.30	ES		0.30		MADE GROUND: Dark Brown slightly gravelly sandy CLAY with fragments of red brick and asphalt. Sand is fine to medium. Gravel is angular to subangular fine of flint.		
		0.40 - 0.50	D				Light brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to medium of flint.		
		0.50 - 0.60	ES		0.90				
		0.80 - 0.90	D				Very dense light brown slightly clayey sandy angular to subangular fine to coarse GRAVEL of flint. Sand is fine to coarse.		
		1.00	SPT	N=50 (7,9/50 for 270mm)	1.00		End of Borehole at 1.000m	1	
								2	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	87										

Remarks
No groundwater was encountered. Reason for termination - 1m SPT refusing on solid natural ground conditions (50+ blows).

Window Sample Log

Project Name: Land At Dower House		Client: MorseWebb Architects Ltd		Date: 14/02/2023	
Location: High Street, Harlington, Hayes, UB3 5DH		Contractor: PM Sampling Ltd		Co-ords: E508948.00 N177341.00	
Project No. : R0653		Crew Name: S		Drilling Equipment: Archway Dart	
Borehole Number WS06	Hole Type WLS	Level	Logged By CA	Scale 1:10	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.00 - 0.40	ES		0.40			MADE GROUND: Dark Brown slightly clayey slightly gravelly fine to coarse SAND with fragments of red brick, china and plastic. Gravel is angular to subangular fine to medium of flint.
		0.40 - 0.80 0.40 - 1.20	ES B					Very dense light brown/yellow slightly clayey very gravelly fine to coarse SAND. Gravel is angular to subangular fine to medium of flint.
		1.20 1.20	ES SPT	N=50 (10,12/50 for 270mm)	1.20		End of Borehole at 1.200m	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.20	87										

Remarks
No groundwater was encountered. Reason for termination - 1.20m SPT refusing on solid natural ground conditions (50+ blows).

APPENDIX 2
GROUND GAS & GROUNDWATER MONITORING RESULTS

Gas Monitoring Record

Project Number:	R0653
Project Name:	Harlington
Date:	02/03/2023
Logger:	IS

Weather:	Sunny Cold
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*mbgl - Meters below Ground Level

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Steady State Flow Readings (taken after gas readings)	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments		
Borehole ID	WS03	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Dry	0.96			
Flow Rate (l/hr)	-1.9	CO2 (%)	0.4	1.3	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	Flow Rate (l/hr)				0	
Atmospheric Pressure (mbar)	1021	O2 (%)	19.1	19.5	19	18.8	18.8	18.8	18.8	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	19		Atmospheric Pressure (mbar)				1021	
Borehole Pressure (Pa)	-11	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Borehole Pressure (Pa)	1
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Time	
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<	<					Peak VOC	0

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Steady State Flow Readings (taken after gas readings)	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments		
Borehole ID	WS05	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Dry	0.955			
Flow Rate (l/hr)	-1.9	CO2 (%)	0.1	1.9	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.1	1.8	Flow Rate (l/hr)				-1.8	
Atmospheric Pressure (mbar)	1021	O2 (%)	20.1	19.9	18.7	18.6	18.5	18.5	18.5	18.5	18.5	18.6	18.6	18.6	18.6	18.6	18.7	18.7	19.1		Atmospheric Pressure (mbar)				1020	
Borehole Pressure (Pa)	-10	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Borehole Pressure (Pa)	-10
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Time	
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Peak VOC	0

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Steady State Flow Readings (taken after gas readings)	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments		
Borehole ID	WS06	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Dry	1.07			
Flow Rate (l/hr)	-1.2	CO2 (%)	1.7	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	Flow Rate (l/hr)				0	
Atmospheric Pressure (mbar)	1020	O2 (%)	19.3	19.4	19.4	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.4		Atmospheric Pressure (mbar)				1019	
Borehole Pressure (Pa)	-7	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Borehole Pressure (Pa)	-1
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Time	
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Peak VOC	0

Gas Monitoring Record

Project Number:	R0653
Project Name:	Harlington
Date:	08/03/2023
Logger:	IS

Weather:	Snowy, Cloudy, Cold
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*mbgl - Meters below Ground Level

		Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Steady State Flow Readings (taken after gas readings)		Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments	
Borehole ID	WS03	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			Dry	0.95	
Flow Rate (l/hr)	-2.2	CO2 (%)	0.4	2.1	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.3	Flow Rate (l/hr)	-0.2					
Atmospheric Pressure (mbar)	986	O2 (%)	19	18.4	17.9	17.8	17.7	17.7	17.7	17.6	17.6	17.6	17.6	17.6	17.6	17.7	17.7	18	Atmospheric Pressure (mbar)	985					
Borehole Pressure (Pa)	-13	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Borehole Pressure (Pa)	-1				
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Time					
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Peak VOC	0				

		Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Steady State Flow Readings (taken after gas readings)		Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	WS05	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			Dry	0.97	
Flow Rate (l/hr)	-2.1	CO2 (%)	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.1	Flow Rate (l/hr)	-2.2				
Atmospheric Pressure (mbar)	986	O2 (%)	18.3	18.3	18.2	18.2	18.1	18.1	18.1	18.1	18.1	18.2	18.2	18.2	18.2	18.3	18.3	18.5	Atmospheric Pressure (mbar)	985				
Borehole Pressure (Pa)	-12	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Borehole Pressure (Pa)	-12			
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Time				
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Peak VOC	0			

		Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Steady State Flow Readings (taken after gas readings)		Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	WS06	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			Dry	1.09	
Flow Rate (l/hr)	-1.9	CO2 (%)	0.1	0	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	Flow Rate (l/hr)	0				
Atmospheric Pressure (mbar)	985	O2 (%)	19.8	19.9	19.4	19.2	19.2	19.1	19.1	19.1	19.1	19.1	19.2	19.2	19.2	19.2	19.2	19.2	Atmospheric Pressure (mbar)	985				
Borehole Pressure (Pa)	-10	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Borehole Pressure (Pa)	1			
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Time				
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Peak VOC	0			

Gas Monitoring Record

Project Number:	R0653
Project Name:	Harlington
Date:	15/03/2023
Logger:	

Weather:	Cloudy, Sunny, Cold
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*mbgl - Meters below Ground Level

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Steady State Flow Readings (taken after gas readings)		Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	WS03	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			Dry	0.95	
Flow Rate (l/hr)	-1.5	CO2 (%)	0	2.2	2.8	2.9	2.9	2.9	3	3	3	3	3	3	3.1	3.1	3.1	3.1	3.2	Flow Rate (l/hr)	-0.8				
Atmospheric Pressure (mbar)	1011	O2 (%)	20.5	19.2	18.3	18.1	18	18	18	18	17.9	17.9	17.9	17.9	17.9	17.8	17.8	17.8	17.7	Atmospheric Pressure (mbar)	1011				
Borehole Pressure (Pa)	-9	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Borehole Pressure (Pa)	-5			
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Time				
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Peak VOC	0			
Borehole ID	WS05	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			Dry	0.96	
Flow Rate (l/hr)	-1.3	CO2 (%)	0.2	1.8	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3	Flow Rate (l/hr)	-1.1			
Atmospheric Pressure (mbar)	1011	O2 (%)	20	19.5	18.7	18.5	18.5	18.5	18.4	18.4	18.4	18.4	18.4	18.4	18.3	18.3	18.3	18.3	18.2	Atmospheric Pressure (mbar)	1011				
Borehole Pressure (Pa)	-7	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Borehole Pressure (Pa)	-6			
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Time				
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Peak VOC	0			
Borehole ID	WS06	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			Dry	1.1	
Flow Rate (l/hr)	-0.8	CO2 (%)	0.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	Flow Rate (l/hr)	-0.1				
Atmospheric Pressure (mbar)	1011	O2 (%)	20.8	20.1	19.8	19.7	19.7	19.7	19.7	19.7	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	Atmospheric Pressure (mbar)	1011				
Borehole Pressure (Pa)	-4	CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Borehole Pressure (Pa)	-1			
Time		H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Time				
Peak VOC	0	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Peak VOC	0			

APPENDIX 3
DYNAMIC PROBE TEST RESULTS

Dynamic Probe Test Results Sheet

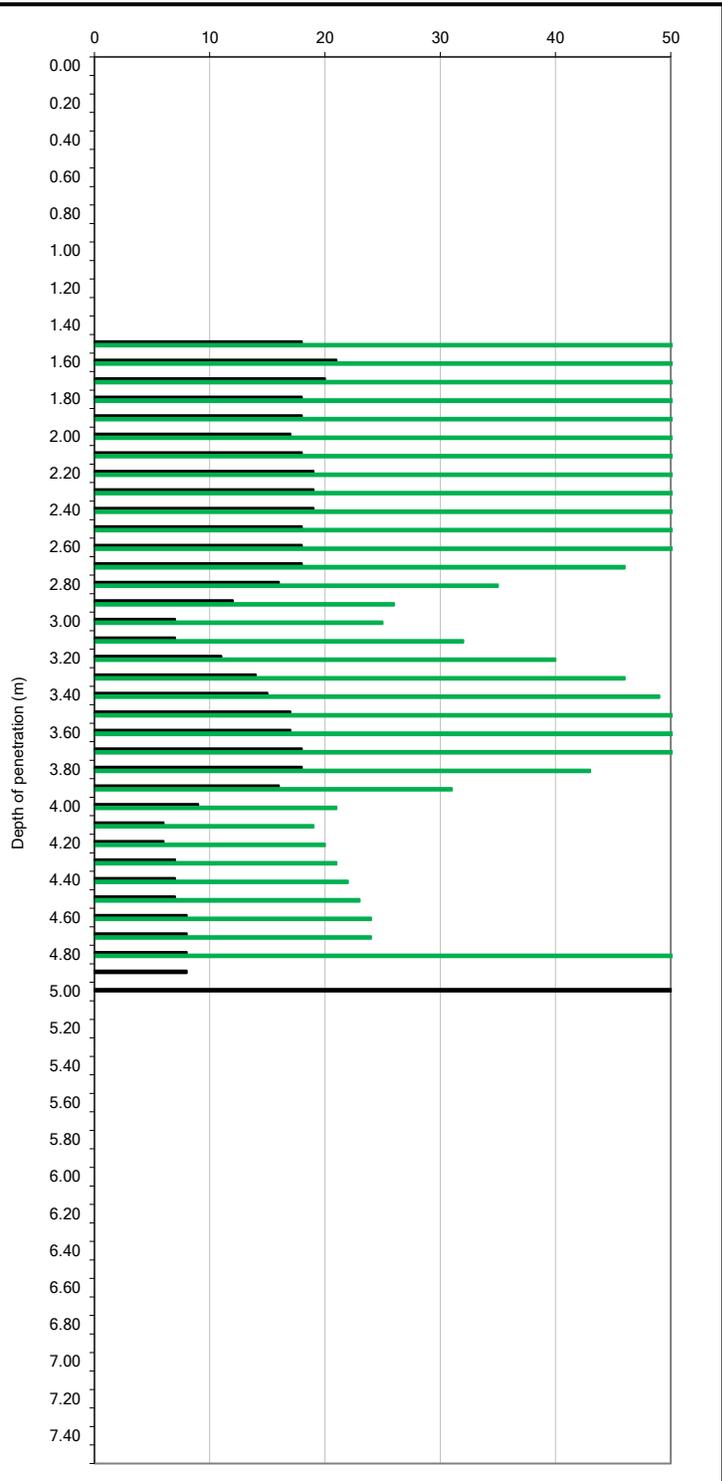
Site: LAND AT DOWER HOUSE
 Job Number: R0653
 Client: MorseWebb Architects Ltd
 Rig Type: Archway Dart

Date: 14-Feb-23
 Test Type: DPSH
 Final Depth: 5.00
 Sheet 1 of 1



DP No: DP02

Penetration Test Results			
Depth (m)	DPN ₁₀₀	DPN ₃₀₀	SPT N *
0.00			
0.10			
0.20			
0.30			
0.40			
0.50			
0.60			
0.70			
0.80			
0.90			
1.00			
1.10			
1.20			
1.30			
1.40			
1.50	18	59	59
1.60	21	59	59
1.70	20	56	56
1.80	18	53	53
1.90	18	53	53
2.00	17	54	54
2.10	18	56	56
2.20	19	57	57
2.30	19	56	56
2.40	19	55	55
2.50	18	54	54
2.60	18	52	52
2.70	18	46	46
2.80	16	35	35
2.90	12	26	26
3.00	7	25	25
3.10	7	32	32
3.20	11	40	40
3.30	14	46	46
3.40	15	49	49
3.50	17	52	52
3.60	17	53	53
3.70	18	52	52
3.80	18	43	43
3.90	16	31	31
4.00	9	21	21
4.10	6	19	19
4.20	6	20	20
4.30	7	21	21
4.40	7	22	22
4.50	7	23	23
4.60	8	24	24
4.70	8	24	24
4.80	8	66	66
4.90	8		
5.00	50		
5.10			
5.20			
5.30			
5.40			
5.50			
5.60			
5.70			
5.80			
5.90			
6.00			
6.10			
6.20			
6.30			
6.40			
6.50			
6.60			
6.70			
6.80			
6.90			
7.00			
7.10			
7.20			
7.30			
7.40			
7.50			



Hammer Mass: 63.5 kg Cone Dia: 50.5mm
 Drop Height: 750 mm Test by: 0

DPN₁₀₀ values (shorter bars) & equivalent SPT values (longer bars)

General Remarks:

DPN₁₀₀ = Dynamic penetration resistance for 100mm penetration.
 DPN₃₀₀ = Dynamic penetration resistance for 300mm penetration (ie: sum of 3 consecutive DPN₁₀₀ values), starting at the depth given.
 * Equivalent SPT N-values (for 300mm penetration) assumed to approximate the DPN₃₀₀ values for dynamic probe "super-heavy" test (DPSH).
 For dynamic probe "heavy" test (DPH), equivalent SPT N-values estimated using the theoretical relationship DPN₃₀₀ = 1.5 SPT-N. [see Card, G.B., Roche, D.P. & Herbert, S.M., in Geol. Soc. Special Publication No 6, *Field Testing in Engineering Geology* (1990)]. SPT values are estimated and are for general guidance only.

APPENDIX 4
LABORATORY TEST RESULTS (GEOTECHNICAL)



Laboratory Report



Contract Number: 64689

Client Ref: **R0653**

Client PO: **R0653/JG/29/02/2023a**

Date Received: **01-03-2023**

Date Completed: **20-03-2023**

Report Date: **20-03-2023**

Client: **Earth Environmental & Geotechnical**

Studio 3

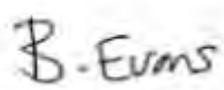
Tollbridge Studios

Toll Bridge Road

Bath

BA1 7DE

This report has been checked and approved by:



Brendan Evans
Office Administrator

Contract Title: **Dower House Harlington**

For the attention of: **John**

Test Description	Qty
Samples Received - @ Non Accredited Test	19
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	5
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	5
Particle Size Distribution (Dry Sieve method) This test is for non-cohesive material only. BS 1377:1990 - Part 2 : 9.3 - * UKAS	2
Water Soluble Sulphate 2:1 extract Sub-contracted Test	7
pH value of soil Sub-contracted Test	7
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (Human Resources/ Health and Safety Manager)

GEO Site & Testing Services Ltd

Units 3-4, Heol Aur, Dafen, Llanelli, Carmarthenshire, Wales SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Dry Sieve, Clause 9.3**

Contract Number 64689

Borehole/Pit No. WS04

Project Name Dower House Harlington

Sample No.

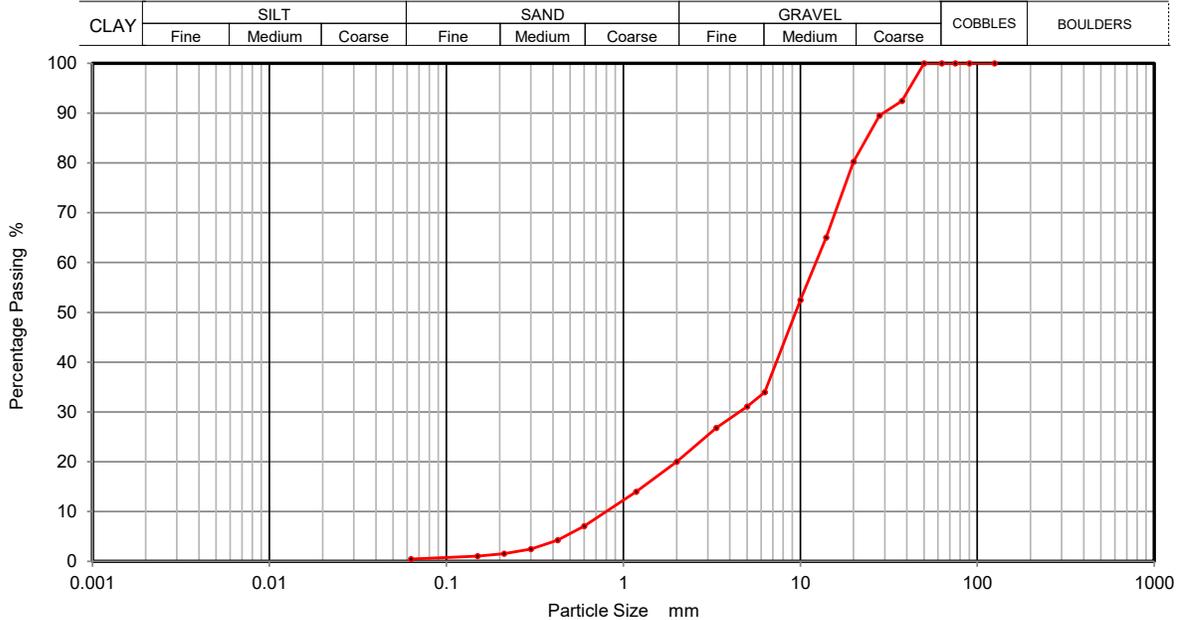
Soil Description Brown fine to coarse sandy fine to coarse GRAVEL

Depth Top 0.80

Depth Base 1.50

Date Tested 15/03/2023

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	92		
28	90		
20	80		
14	65		
10	52		
6.3	34		
5	31		
3.35	27		
2	20		
1.18	14		
0.6	7		
0.425	4		
0.3	2		
0.212	2		
0.15	1		
0.063	0		

Sample Proportions	% dry mass
Cobbles	0
Gravel	80
Sand	20
Silt and Clay	0

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards



2788

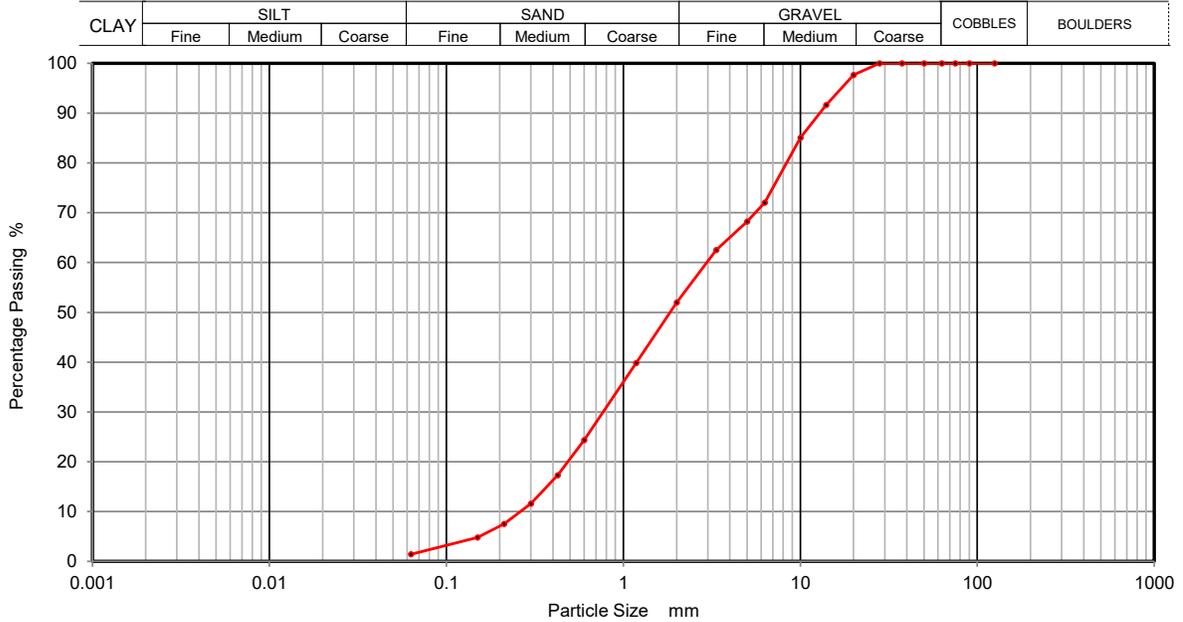


**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Dry Sieve, Clause 9.3**

Contract Number 64689

Borehole/Pit No. WS06

Project Name	Dower House Harlington	Sample No.	
Soil Description	Brown slightly silty/ clayey fine to coarse gravelly fine to coarse SAND	Depth Top	0.40
		Depth Base	1.20
Date Tested	15/03/2023	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	98		
14	92		
10	85		
6.3	72		
5	68		
3.35	63		
2	52		
1.18	40		
0.6	24		
0.425	17		
0.3	12		
0.212	7		
0.15	5		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	51
Silt and Clay	1

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards



2788



ANALYTICAL TEST REPORT

Contract no: 120005

Contract name: Dower House, Harlington

Client reference: R0653

Clients name: Geo Site and Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 07 March 2023

Analysis started: 07 March 2023

Analysis completed: 13 March 2023

Report issued: 13 March 2023

Key

- U UKAS accredited test
- M MCERTS & UKAS accredited test
- \$ Test carried out by an approved subcontractor
- I/S Insufficient sample to carry out test
- N/S Sample not suitable for testing

Approved by:

A handwritten signature in black ink, appearing to read 'S. Rogerson'.

Samantha Rogerson
Reporting Manager

Chemtech Environmental Limited

SOILS

Lab number			120005-1	120005-2	120005-3	120005-4	120005-5	120005-6
Sample id			WS01	WS02	WS03	WS04	WS05	WS05
Depth (m)			1.00-1.60	0.90-1.00	0.80-0.90	0.80-1.50	1.00	0.80-0.90
Sample Type			D	D	D	B	SPT	D
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^u	units	6.2	6.4	6.8	7.0	7.2	7.2
Sulphate (2:1 water soluble)	CE061 ^u	mg/l SO ₄	31	17	12	11	<10	<10

Chemtech Environmental Limited

SOILS

Lab number	120005-7		
Sample id	WS06		
Depth (m)	0.40-1.20		
Sample Type	B		
Date sampled	-		
Test	Method	Units	
pH	CE004 ^u	units	6.2
Sulphate (2:1 water soluble)	CE061 ^u	mg/l SO ₄	86

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
120005-1	WS01	1.00-1.60	Y	All (NSD)
120005-2	WS02	0.90-1.00	Y	All (NSD)
120005-3	WS03	0.80-0.90	Y	All (NSD)
120005-4	WS04	0.80-1.50	Y	All (NSD)
120005-5	WS05	1.00	Y	All (NSD)
120005-6	WS05	0.80-0.90	Y	All (NSD)
120005-7	WS06	0.40-1.20	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

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

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones, where applicable.

APPENDIX 5
LABORATORY TEST RESULTS (CHEMICAL)



John Grace
Earth Environmental & Geotechnical (Southern Ltd)
200 Brook Drive
Green Park
Reading
Berkshire
RG2 6UB

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 23-02782

Site Reference: Dower House Harlington
Project / Job Ref: R0653
Order No: None Supplied
Sample Receipt Date: 15/02/2023
Sample Scheduled Date: 01/03/2023
Report Issue Number: 1
Reporting Date: 07/03/2023

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



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 Maidstone
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Soil Analysis Certificate						
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23	14/02/23
Earth Environmental & Geotechnical (Southern Ltd)	Time Sampled	None Supplied				
Site Reference: Dower House Harlington	TP / BH No	WS01	WS02	WS03	WS03	WS04
Project / Job Ref: R0653	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.20 - 0.40	0.20 - 0.40	0.90 - 1.00	0.20 - 0.40
Reporting Date: 07/03/2023	DETS Sample No	637500	637501	637502	637503	637504

Determinand	Unit	RL	Accreditation	14/02/23	14/02/23	14/02/23	14/02/23	14/02/23
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected				
pH	pH Units	N/a	MCERTS	6.5	6.6	6.2	6.5	5.4
Total Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Complex Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	269	643	497	< 200	480
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.03	0.06	0.05	< 0.02	0.05
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	21	< 10	< 10	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.02	< 0.01	< 0.01	< 0.01
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Organic Matter (SOM)	%	< 0.1	MCERTS	3.5	6.8	5.8	0.5	5.2
Arsenic (As)	mg/kg	< 2	MCERTS	16	13	12	5	12
Barium (Ba)	mg/kg	< 2.5	MCERTS	87	165	157	30	124
Beryllium (Be)	mg/kg	< 0.5	MCERTS	1	1	1	0.5	1
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	0.3	0.4	< 0.2	0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	19	20	19	12	20
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	29	111	60	5	44
Lead (Pb)	mg/kg	< 3	MCERTS	106	201	210	9	195
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	19	19	16	10	16
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Vanadium (V)	mg/kg	< 1	MCERTS	38	36	34	18	36
Zinc (Zn)	mg/kg	< 3	MCERTS	76	243	185	16	205
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	3.4

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate					
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23
Earth Environmental & Geotechnical (Southern Ltd)	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Dower House Harlington	TP / BH No	WS05	WS06	WS06	WS06
Project / Job Ref: R0653	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.50 - 0.60	0.00 - 0.40	1.20
Reporting Date: 07/03/2023	DETS Sample No	637505	637506	637507	637508

Determinand	Unit	RL	Accreditation	14/02/23	14/02/23	14/02/23	14/02/23
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.3	6.9	5.8	6.1
Total Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1
Complex Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	517	< 200	977	< 200
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.05	< 0.02	0.10	< 0.02
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	10	11	197	36
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.01	0.01	0.20	0.04
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5
Organic Matter (SOM)	%	< 0.1	MCERTS	5.6	0.9	5.2	0.8
Arsenic (As)	mg/kg	< 2	MCERTS	13	11	9	6
Barium (Ba)	mg/kg	< 2.5	MCERTS	175	139	147	59
Beryllium (Be)	mg/kg	< 0.5	MCERTS	1.3	1.2	0.8	< 0.5
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3	< 0.2	0.4	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	22	26	18	18
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	157	16	43	10
Lead (Pb)	mg/kg	< 3	MCERTS	193	15	248	28
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	22	23	14	13
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
Vanadium (V)	mg/kg	< 1	MCERTS	41	47	26	17
Zinc (Zn)	mg/kg	< 3	MCERTS	198	42	374	43
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23	14/02/23
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied				
Site Reference: Dower House Harlington	TP / BH No	WS01	WS02	WS03	WS03	WS04
Project / Job Ref: R0653	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.20 - 0.40	0.20 - 0.40	0.90 - 1.00	0.20 - 0.40
Reporting Date: 07/03/2023	DETS Sample No	637500	637501	637502	637503	637504

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	0.24	< 0.1	< 0.1	0.12
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.25	0.50	< 0.1	< 0.1	0.34
Pyrene	mg/kg	< 0.1	MCERTS	0.20	0.41	< 0.1	< 0.1	0.28
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.12	0.21	< 0.1	< 0.1	0.14
Chrysene	mg/kg	< 0.1	MCERTS	0.14	0.22	< 0.1	< 0.1	0.18
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.17	0.26	< 0.1	< 0.1	0.20
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.14	0.19	< 0.1	< 0.1	0.15
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.12	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	2.1	< 1.6	< 1.6	< 1.6



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23	
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Dower House Harlington	TP / BH No	WS05	WS06	WS06	WS06	
Project / Job Ref: R0653	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.50 - 0.60	0.00 - 0.40	1.20	
Reporting Date: 07/03/2023	DETS Sample No	637505	637506	637507	637508	

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	0.12	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	3.21	< 0.1	0.32	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	0.66	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	9.57	< 0.1	0.87	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	8.18	< 0.1	0.76	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	5.24	< 0.1	0.41	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	4.27	< 0.1	0.46	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	6.01	< 0.1	0.56	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	2.22	< 0.1	0.16	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	5.48	< 0.1	0.43	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	2.90	< 0.1	0.25	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.66	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	2.69	< 0.1	0.21	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	51.5	< 1.6	4.4	< 1.6



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Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23	14/02/23
Earth Environmental & Geotechnical (Southern)	Time Sampled	None Supplied				
Site Reference: Dower House Harlington	TP / BH No	WS01	WS02	WS03	WS03	WS04
Project / Job Ref: R0653	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.20 - 0.40	0.20 - 0.40	0.90 - 1.00	0.20 - 0.40
Reporting Date: 07/03/2023	DETS Sample No	637500	637501	637502	637503	637504

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6 : HS_1D_MS_AL	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8 : HS_1D_MS_AL	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34 : EH_CU_1D_AL	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34) : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7 : HS_1D_MS_AR	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8 : HS_1D_MS_AR	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21 : EH_CU_1D_AR	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35 : EH_CU_1D_AR	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35) : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35 : HS_1D_MS+EH_CU_1D_Tot al	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42



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Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23	
Earth Environmental & Geotechnical (Southern)	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Dower House Harlington	TP / BH No	WS05	WS06	WS06	WS06	
Project / Job Ref: R0653	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.50 - 0.60	0.00 - 0.40	1.20	
Reporting Date: 07/03/2023	DETS Sample No	637505	637506	637507	637508	

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6 : HS_1D_MS_AL	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8 : HS_1D_MS_AL	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34 : EH_CU_1D_AL	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34) : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7 : HS_1D_MS_AR	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8 : HS_1D_MS_AR	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21 : EH_CU_1D_AR	mg/kg	< 3	MCERTS	44	< 3	4	< 3	< 3
Aromatic >C21 - C35 : EH_CU_1D_AR	mg/kg	< 10	MCERTS	99	< 10	< 10	< 10	< 10
Aromatic (C5 - C35) : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 21	NONE	145	< 21	< 21	< 21	< 21
Total >C5 - C35 : HS_1D_MS+EH_CU_1D_Tot al	mg/kg	< 42	NONE	145	< 42	< 42	< 42	< 42



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23	14/02/23
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied				
Site Reference: Dower House Harlington	TP / BH No	WS01	WS02	WS03	WS03	WS04
Project / Job Ref: R0653	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.20 - 0.40	0.20 - 0.40	0.90 - 1.00	0.20 - 0.40
Reporting Date: 07/03/2023	DETS Sample No	637500	637501	637502	637503	637504

Determinand	Unit	RL	Accreditation					
Benzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 23-02782	Date Sampled	14/02/23	14/02/23	14/02/23	14/02/23	
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Dower House Harlington	TP / BH No	WS05	WS06	WS06	WS06	
Project / Job Ref: R0653	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.10 - 0.30	0.50 - 0.60	0.00 - 0.40	1.20	
Reporting Date: 07/03/2023	DETS Sample No	637505	637506	637507	637508	

Determinand	Unit	RL	Accreditation				
Benzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
Toluene : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5
Ethylbenzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
p & m-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
o-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
MTBE : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 23-02782	
Earth Environmental & Geotechnical (Southern Ltd)	
Site Reference: Dower House Harlington	
Project / Job Ref: R0653	
Order No: None Supplied	
Reporting Date: 07/03/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
\$ 637500	WS01	None Supplied	0.10 - 0.30	11.3	Brown sandy clay with stones and concrete
\$ 637501	WS02	None Supplied	0.20 - 0.40	17.7	Brown sandy clay with stones and concrete
\$ 637502	WS03	None Supplied	0.20 - 0.40	15.9	Brown sandy clay with stones and vegetation
\$ 637503	WS03	None Supplied	0.90 - 1.00	6.2	Brown sandy clay with stones and concrete
\$ 637504	WS04	None Supplied	0.20 - 0.40	15.3	Brown sandy clay with stones and concrete
\$ 637505	WS05	None Supplied	0.10 - 0.30	14.9	Brown sandy clay with stones and concrete
\$ 637506	WS06	None Supplied	0.50 - 0.60	13	Brown sandy clay with stones and concrete
\$ 637507	WS06	None Supplied	0.00 - 0.40	8.8	Brown sandy clay with stones and concrete
\$ 637508	WS06	None Supplied	1.20	4.1	Black sandy clay with stones and concrete

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

Insufficient Sample ^{1/5}

& samples received in inappropriate containers for hydrocarbon analysis

\$ samples exceeded recommended holding times

Soil Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No:	23-02782
Earth Environmental & Geotechnical (Southern Ltd)	
Site Reference:	Dower House Harlington
Project / Job Ref:	R0653
Order No:	None Supplied
Reporting Date:	07/03/2023

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content: determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCS	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



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List of HWOL Acronyms and Operators
DETS Report No: 23-02782
Earth Environmental & Geotechnical (Southern Ltd)
Site Reference: Dower House Harlington
Project / Job Ref: R0653
Order No: None Supplied
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Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eq. EH+HS_Total or EH_CU+HS_Total

Det - Acronym
Benzene - HS_1D_MS
Ethylbenzene - HS_1D_MS
MTBE - HS_1D_MS
TPH CWG - Aliphatic >C10 - C12 - EH_CU_1D_AL
TPH CWG - Aliphatic >C12 - C16 - EH_CU_1D_AL
TPH CWG - Aliphatic >C16 - C21 - EH_CU_1D_AL
TPH CWG - Aliphatic >C21 - C34 - EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C6 - HS_1D_MS_AL
TPH CWG - Aliphatic >C6 - C8 - HS_1D_MS_AL
TPH CWG - Aliphatic >C8 - C10 - EH_CU_1D_AL
TPH CWG - Aliphatic C5 - C34 - HS_1D_MS+EH_CU_1D_AL
TPH CWG - Aromatic >C10 - C12 - EH_CU_1D_AR
TPH CWG - Aromatic >C12 - C16 - EH_CU_1D_AR
TPH CWG - Aromatic >C16 - C21 - EH_CU_1D_AR
TPH CWG - Aromatic >C21 - C35 - EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C35 - HS_1D_MS+EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C7 - HS_1D_MS_AR
TPH CWG - Aromatic >C7 - C8 - HS_1D_MS_AR
TPH CWG - Aromatic >C8 - C10 - EH_CU_1D_AR
TPH CWG - Total >C5 - C35 - HS_1D_MS+EH_CU_1D_Total
Toluene - HS_1D_MS
m & p-xylene - HS_1D_MS
o-Xylene - HS_1D_MS

APPENDIX 6
REPORT LIMITATIONS

REPORT LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget and staff resources allocated to the project.

Other than that expressly contained in the above paragraph, Earth Environmental & Geotechnical Ltd provides no other representation or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Earth Environmental & Geotechnical Ltd.

If a third party relies on this report, it does so wholly at its own and sole risk and Earth Environmental & Geotechnical Ltd disclaims any liability to such parties.

It is Earth Environmental & Geotechnical Ltd understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was an important 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 will no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without Earth Environmental & Geotechnical Ltd review and advice shall be at the client's sole and own risk.

The report was written in 2023 and should be read in light of any subsequent changes in legislation, statutory requirements and industry best practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. 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 Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

The observations and conclusions described in this report are based solely upon the services that were provided pursuant to the agreement between the client and Earth Environmental & Geotechnical Ltd. Earth Environmental & Geotechnical Ltd has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report.

Earth Environmental & Geotechnical Ltd 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, Earth Environmental & Geotechnical Ltd did not seek to evaluate the presence on or off the site of electromagnetic fields, lead paint, radon gas or other radioactive materials.

The services are based upon Earth Environmental & Geotechnical Ltd observations of existing physical conditions at the site gained from a walkover survey of the site together with Earth Environmental & Geotechnical Ltd interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst Earth Environmental & Geotechnical Ltd have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified.

No responsibility can be accepted for errors within third party items presented in this report. Further Earth Environmental & Geotechnical Ltd was not authorised and 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. Earth Environmental & Geotechnical Ltd is not liable for any inaccurate information, misrepresentation of data 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 Earth Environmental & Geotechnical Ltd and including the doing of any independent investigation of the information provided to Earth Environmental & Geotechnical Ltd save as otherwise provided in the terms of the contract between the client and Earth Environmental & Geotechnical Ltd.

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. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground 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 contract between the client and Earth Environmental & Geotechnical Ltd] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

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.