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31 Lampits Hill
Corringham
SS17 9AA

Geo-Environmental Investigation

On behalf of Soil Investigation Eastern Ltd

Document Reference: 21-073

April 2021

Site: 31 Lampits Hill, Corringham, SS17 9AA

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Quality Management

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1 INTRODUCTION

Ground and Environmental Investigation Ltd (GEI) was commissioned by Soil Investigation Eastern Ltd to undertake a Geo-Environmental Investigation at a proposed development site at 31 Lampits Hill, Corringham, SS17 9AA.

It was understood that the proposed development of the site will comprise the construction of a three-storey building comprising 16 apartments with associated private gardens, car parking and soft landscaping. Figures 1 and 2 show the current and proposed site layout.

The objectives of the Geo-Environmental Investigation were to provide outline recommendations for foundation and ground floor slab design. Identification of environmental liabilities associated with the site and delineation of any potential areas of contamination resulting from the sites previous and current usage was also undertaken.

This report should be read in conjunction with a Phase 1 Desktop Study undertaken at the site by Ground and Environmental Investigation Ltd (Ref: 20-007, June 2020).

2 SITE LOCATION AND LAYOUT

The site is situated off Lampits Hill, Corringham in a predominantly residential setting. The site is located at approximate Grid Reference TQ 707 837, with the following features immediately bounding the site:

- Northwest, the site is bound by residential properties along Lampits Hill and car parking;
- Southwest, the site is bound by residential properties of Laburnum Drive;
- Northeast, the site is bound by Lampits Hill beyond which are residential properties;
- Southeast, the site is bound by a terraces of small commercial units below residential flats.

At the time of the site investigation, the site comprised a disused petrol garage, car repair workshop and MOT centre with surfacing consisting of a mix of concrete and tarmac.

2.1 UNDERGROUND FUEL STORAGE TANK INFORMATION

During the Phase 1 Desktop Study, Thurrock Council were contacted in order to ascertain whether any records exist of fuel storage on site, as either above ground fuel storage or underground storage tanks (USTs).

Their records indicated that the site had 7 underground fuel tanks of single skinned steel construction and associated pipework installed circa 1970 with capacities as detailed in the table below.

Tank Number	Capacity (litres)	Product	Construction Type
1	7000	Unknown	Single Skin Steel
2	11500	Unknown	Single Skin Steel
3	7000	Unknown	Single Skin Steel
4	11500	Unknown	Single Skin Steel
5	9000	Unknown	Single Skin Steel
6	4500	Unknown	Single Skin Steel
7	4500	Unknown	Single Skin Steel

There were no recorded incidents or spillages for the site, however it was noted by the Petroleum Officer that tank/line testing appeared to have taken place rarely and wet stock monitoring was noted as inadequate.

The officer also noted:

"The site apparently stopped selling fuel Jan/Feb 2014. An officer contacted the owner Mr Monk in Feb 2016 requesting documentation confirming the tanks had been made safe. The owner advised they had been made safe 18/12/2015 and that the work was carried out by Ancorra Environmental Services. The officer contacted Ancorra to request copies of documents but there is no further information on file therefore I would assume no documentation was received. At the time of the last Petroleum Storage Certificate being issued (2015) petroleum was being stored in tanks 2, 4 and 5 only. The other tanks had a liquid seal."

Photographs of foam decommissioning were received although it was unclear what tanks these related to.

3 ENVIRONMENTAL SETTING

3.1 GEOLOGY

Reference to the British Geological Survey online geological map of the area indicates that the geology underlying the site comprises superficial deposits of Head over bedrock geology of the London Clay Formation.

The geological memoir for the area described these strata as follows:

Head

Head is poorly sorted and poorly stratified, angular rock debris and/or clayey hillwash and soil creep, mantling a hillslope and deposited by solifluction and gelifluction processes. Solifluction is the slow viscous downslope flow of waterlogged soil and other unsorted and unsaturated superficial deposits. The term gelifluction is restricted to the slow flow of fluidized superficial deposits during the thawing of seasonally frozen ground. The flow is initiated by meltwater from thawing ice lenses. Polymict deposit: comprises gravel, sand and clay depending on upslope source and distance from source. Locally with lenses of silt, clay or peat and organic material.

London Clay Formation

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 occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels.

3.2 GROUNDWATER

Reference to the British Geological Survey 1:50,000 scale Aquifer Designation Dataset, shows the site to be set upon a Secondary Undifferentiated Aquifer with the superficial deposits with the London Clay Formation being classified as Unproductive strata.

The site is situated within an Environment Agency-designated Groundwater Source Protection Zone 3 (Total Catchment).

4 PRELIMINARY CONCEPTUAL MODEL

The site was noted as a petrol station from 1967 and it was considered likely that there are a minimum of seven underground storage tanks present at the site. Whilst it was understood that the tanks were decommissioned in 2015, there was no documentation available. The petroleum officer stated that leak testing was carried out rarely and wet stock monitoring was noted as inadequate.

Potential ground contamination arising from underground fuel storage tanks includes hydrocarbon contaminants in the underlying soils. It was also considered possible that localised spills occurred during the filling of the underground fuel tanks however the concrete and tarmac hardstanding would act to sever any potential pathway from any potential organic contamination migrating into the underlying natural geology and unproductive strata in the northern part of the site.

Additional potential contamination arising from the site's use as a garage are heavy metals, asbestos and organic compounds as well as paints, thinners, fuel additives and waste materials such as metal, tyres, asbestos and plastics. It was considered unlikely that any such potential contamination will have migrated to the underlying soils due to the hardstanding.

5 INTRUSIVE INVESTIGATION

5.1 FIELDWORK

The intrusive site works were carried out by Soil Investigation Eastern Ltd on the 25th and 26th February 2021 and comprised Continuous Flight Auger (CFA) Boreholes.

- Continuous Flight Auger (CFA) Boreholes;

Subsequent to the fieldwork GEI carried out the following work between the 5th and 26th March 2021:

- Groundwater Level and Soil Gas Monitoring.

The positions of the above works on the site are indicated on Figure 1, Site Location Plan. The investigation locations were chosen to give general coverage across the site.

All intrusive fieldwork was undertaken by Soil Investigation Eastern Limited and generally executed in accordance with the recommendations given in British Standard BS 5930:1999, "Code of Practice for Site Investigations".

Contamination sampling was undertaken in accordance with BS 10175, "Code of Practice for the Investigation of Potentially Contaminated Sites".

Continuous Flight Auger (CFA) Boreholes

Six 100mm diameter CFA boreholes (BH1 to BH6) were excavated to depths of between 5.0m and 15.0m below existing ground level.

The soils and materials encountered in the holes were logged by SIE and representative samples were recovered for laboratory analysis. Mackintosh Probe and Hand Vane testing was carried out at regular intervals.

Upon completion, boreholes BH1, BH2 and BH3 were installed with combined gas and groundwater monitoring standpipes to depths of between 5.0m and 7.0m.

CFA borehole Logs are presented at Appendix 1.

Groundwater Level and Soil Gas Monitoring

A soil vapour survey was undertaken across the site and comprised the monitoring of the atmosphere within the installed window sample holes. Portable gas monitoring equipment (GA 5000) was used to monitor the standpipes for concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2).

A photoionization device (PID) was also used to monitor any vapours present.

The monitoring results are presented in Appendix 2.

5.2 GROUNDWATER

Groundwater was encountered in BH1 during the intrusive works at a depth of 6.8m. No groundwater was encountered in other intrusive locations. During the post fieldwork monitoring, the water level in BH1 was measured at 6.36m.

It should be noted that groundwater levels may vary due to seasonal fluctuations in rainfall, but in the shorter term, can be affected by antecedent weather conditions or other causes.

6 LABORATORY TESTING

6.1 GEOTECHNICAL TESTING

The following range of laboratory tests were scheduled and the results are presented in Appendix 3.

i. Determination of Natural Moisture Content (12 No.).
ii. Determination of Atterberg Limits (6 No.).
iii. Determination of pH (9 No.). See Appendix 4.
iv. Determination of water-soluble sulphate (1 No.). See Appendix 4.

6.2 ANALYTICAL TESTING

Eight soil samples were selected and scheduled for chemical analysis which was undertaken by The Environmental Laboratory Ltd. All soil samples were analysed for a general screening suite of contaminants considered appropriate to the current usage and past history of the site and surrounding area.

Toxic Metals	Phytotoxic Metals	Inorganic Compounds	Organic Compounds
Arsenic Cadmium Chromium Lead Mercury Nickel Selenium	Water Soluble Boron Copper Nickel Zinc	Water Soluble Sulphate pH Asbestos	Total Polyaromatic Hydrocarbons (PAH) Mineral oils Total Petroleum Hydrocarbons (TPH) BTEX

Environmental samples were stored in appropriate containers as specified within BS10175. The containers comprised of 1 kg capacity plastic containers with fitted lids.

Where organic compounds were to be determined, inert containers, which prevent loss by absorption, or volatilization, i.e. wide-mouthed amber glass containers, were used.

Samples were stored in appropriately cooled cool boxes and were transported to the laboratory as quickly as possible in order to minimize any potential for chemical and biological changes to take place.

The results of the analytical testing are presented in Appendix 4.

7 EVALUATION OF GROUND CONDITIONS

The soils encountered during this investigation are described in the CFA Borehole logs presented in Appendix 1. The ground profile encountered at the site comprised Made Ground over the London Clay Formation.

Made Ground

Made Ground was found across the site to depths of between 0.2m and 1.7m.

Surface coverings comprised tarmac over sandy gravel with brick rubble in locations BH1, BH5 and BH6. At locations BH2, BH3 and BH4 the surface covering comprised reinforced concrete over hardcore.

Beneath the surface coverings, the made ground generally comprised orange brown and stained dark grey sandy silty clay and sandy gravelly silty clay with gravel, limestone, mortar and brick fragments. At locations BH1 and BH5, possible fuel odours were noted.

London Clay Formation

Soils typical of the London Clay Formation were encountered in all locations and comprised orange brown, orange brown mottled grey, mid brown, mid grey sandy silty clay, gravelly silty clay, sandy gravelly silty clay, gravelly fine to coarse sand, and silty clay.

The London Clay Formation was proven to a maximum depth of 15.0m. The base of the formation was not proven.

In-situ testing using a Hand Shear Vane recorded the following results:

Depth	Result (kPa)					
	BH1	BH2	BH3	BH4	BH5	BH6
1.0	84 88	-	84 88	90 98	92 96	128 136
2.0	98 102	124 126	112 122	128 132	126 132	140+
3.0	118 128	132 138	130 136	134 138	136 140	136 140+
4.0	140+	140+	140+	140+	140+	140+
5.0	140+	-	-	140+	140+	140+
6.0	140+					
15.0	140+					

In-situ testing with a Mackintosh probe resulted in the following results:

Depth	Result (blows count per 75mm penetration)					
	BH1	BH2	BH3	BH4	BH5	BH6
1.0	-	17,18,22,24	-	-	-	-
5.0	-	29,30,32,34	27,29,31,33	-	-	-
8.0	28,30,31,32					
10.0	27,29,32,34					
12.0	28,30,31,33					

Classification testing indicated clay soils of high plasticity with plasticity indices in the range 40% to 44% recorded. These soils are classified as having a high shrink/swell potential.

For preliminary foundation design purposes the following parameters may be used for consideration of shallow foundations within the London Clay Formation:

Undrained Shear Strength	Su =	75 kN/m² (Stiff) – lower bound
Coefficient of compressibility	m_v =	0.2 m²/MN (typical value)
Shrinkage Potential	=	High

8 ENGINEERING DESIGN

8.1 FOUNDATION DESIGN OPTIONS

At the time of reporting, applied structural loads were unknown. However, it is known that the proposed development will comprise the construction of a three-storey residential dwelling. For preliminary foundation design purposes a maximum line load of 100kN/m run has therefore been adopted.

In deliberation of suitable foundation options consideration was given to the geotechnical hazards and risks as presented below:

Geotechnical Hazard	Qualitative Risk & Consequences	Possible Risk Reduction Measures
Existing underground structures such as service runs, underground fuel tanks and old footings.	**High** Implication for foundation depth and economic feasibility of shallow foundations.	New foundations to be constructed in undisturbed ground or alternatively disturbed ground to be removed and replaced with suitable engineering fill.
Shrinkage/swelling of foundation soils due to action of tree roots.	**Low** Foundation movement and cracking of brickwork.	Follow NHBC guidance on building near trees for high shrink/swell potential soils
Variations in stiffness of ground below foundation depth that could give rise to unacceptable total and differential settlement.	**Low to moderate** Buildings particularly sensitive to differential settlement. Would result in cracking of superstructure if conventional brickwork or brick cladding.	Calculate likely magnitude of settlement and determine if within acceptable tolerances. Make foundations act as reinforced beams. Include movement joints if and where necessary.

Based upon the ground conditions found consideration has been given to founding the proposed new structures on conventional shallow foundations.

Shallow Strip Foundations

Foundation Depths

Strip footings founded within the London Clay Formation will provide a suitable foundation solution for the proposed new structures. A minimum foundation depth of 1.5m is recommended. Any foundations should be placed a minimum of 0.3m into natural soils.

Other forms of disturbance that may affect founding depths are:

- the removal of trees;
- the removal of disused services;
- the relocation of existing services; and
- the removal of other underground obstructions.

Allowable Bearing Pressure and Foundation Sizing

Based on field observations, in situ testing and laboratory test results, a maximum allowable bearing of 150kN/m^2 is recommended for foundations placed at a minimum depth of 1.5m.

Adopting a line load of 100kN/m run a minimum practicable foundation width of 0.65m is recommended.

Settlement

A preliminary settlement analysis was conducted for a 0.65m wide strip foundation with a net increase in foundation loading of 150kN/m^2.

The results of the calculations indicated total settlements would be in the region of 30mm with approximately half of this settlement immediate and therefore 'built out' during construction. The remainder would be long term consolidation settlement.

Piled Foundation

Should the removal of the underground fuel tanks result in it being uneconomical to construct shallow foundations into natural soils, a piled foundation could be employed. The London Clay Formation is considered to provide a suitable founding stratum.

Given the location of the site, which is in a residential area, it is recommended that cast in situ reinforced concrete piles should be used to support the proposed development.

Conventional bored cast in situ piles would not normally require casing through the soils as found on this site. CFA piles would also not normally require casing through soils of the type found on this site. However, the piling contractor should be made aware of possible water ingress and the likely presence of nodular claystone layers within the London Clay. The suitability of these methods of piling for use on this site should be checked with a piling contractor to ensure all factors have been taken into consideration. It should be noted all pile types would require reinforcement.

The piling contractor should be made aware of the presence of near surface underground obstructions such as existing services and remnants of old footings, which if left in situ, may restrict piling progress.

8.2 GROUND FLOORS

NHBC guidance advises that suspended ground floors should be adopted when the plasticity index (PI) of the founding soils is greater than 10%. In addition, where the depth of fill would be greater than 600 m within a self contained area, the floor construction over the whole of that area is required to be self supporting and independent of the fill.

Based upon the results of this ground investigation it is recommended that suspended ground floor slabs should be adopted.

8.3 TEMPORARY WORKS

Excavations in excess of 1.2 m depth will be required in connection with the proposed development on this site. If there is a requirement for personnel to enter into excavations, then the need for trench side support should be considered for any depth of excavation and, therefore, appropriate equipment should be available on site prior to excavation proceeding. A site specific risk assessment should be carried out where man entry into excavations is required.

The base of foundation excavations should be inspected and any soft loose, organic or otherwise deleterious material at foundation level removed and replaced with lean mix concrete. The soils encountered will be liable to softening/loosening when exposed to surface water infiltration. In order to avoid deterioration of the prepared formation the base of foundations should be blinded with concrete as soon as practical after excavation and particularly if there is delay before placing foundation concrete.

8.4 CHEMICAL ATTACK ON BURIED CONCRETE

The results of the chemical testing indicated a concentration of water-soluble sulphate in soils at typical formation depth of 460mg/l as SO_4. pH values were neutral to alkaline with results in the range 7.8 to 10.0 pH units recorded.

In accordance with BRE Special Digest 1 entitled 'Concrete in Aggressive Ground' a design sulphate class for the site of DS-1 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-1 is recommended.

9 GROUND CONTAMINATION ASSESSMENT

The current guidelines used for this contamination assessment are presented within Appendix 5.

The contaminant concentrations encountered as part of this investigation have been compared against either Land Quality Management Generic Assessment Criteria (LQM GAC) for a residential development, the Chartered Institute of Environmental Health's (CIEH) Suitable for Use Levels (S4USL), or where available against newly published Category 4 Screening Levels (C4SLs) for a residential (with home grown produce) end use. Where neither guidelines have limit values, Contaminated Land Exposure Assessment (CLEA) framework guideline limit values have been assessed.

Category 4 Screening Levels (C4SLs) have currently been published for six substances as per the table below.

Substance	Residential (with home-grown produce)	Residential (without home-grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37	40	49	640	79	170
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)Pyrene	5.0	5.3	5.7	77	10	21
Cadmium	22	150	3.9	410	220	880
Chromium VI	21	21	170	49	21	250
Lead	200	310	80	2300	630	1300

All concentrations expressed in mg/kg

This table should be read in conjunction with the Final C4SL R&D Report

9.1 SOIL QUALITY

In terms of any proposed redevelopment of the site, the results of the analysis of the selected soil samples recovered during the site investigation indicated that the concentrations of *metals and metalloids* considered to be potentially toxic to humans were generally below the respective guideline values in all samples tested with the exception of minor elevated lead and arsenic concentrations.

Organic contamination across the site was generally low and concentrations which may be considered to pose an unacceptable risk to human health should any viable pathway exist were generally not encountered with the exception of an elevated TPH concentration and BTEX impacted soils in a single location.

No Asbestos Containing Materials (ACM) were encountered across the site.

A comprehensive description of the soil quality as measured as part of the intrusive site investigation is given below.

9.1.1 Toxic Metals

Concentrations of toxic metals cadmium, chromium, mercury, nickel, selenium, and zinc were all below their respective soil guidance values for either a residential development under the CLEA/LQM GAC guidelines and the C4SL/S4USL guideline values for residential end use (with home grown produce) in all samples tested.

A single minor elevated lead concentration above the 200 mg/kg Category 4 Screening Level was identified at location BH5 (0.4m) at a concentration of 213 mg/kg.

A single minor elevated arsenic concentration above the 37 mg/kg Category 4 Screening Level was identified at location BH4 (4.5m) at a concentration of 43.8 mg/kg.

9.1.2 Phytotoxic Metals

Concentrations of phytotoxic metals copper, zinc and nickel were compared against the maximum permissible concentrations in the Sewage Sludge (Use in Agriculture) Regulations 1989.

The concentrations for copper, nickel and zinc were all found to be below the maximum permissible concentration for the relevant pH level in all locations.

9.1.3 Organic Compounds

Polycyclic Aromatic Hydrocarbons (PAH)

Concentrations of PAH were found to be below the inert waste acceptance criteria of 100 mg/kg as detailed in the Landfill (England and Wales) (Amended) Regulations 2004 in all of the samples tested.

Speciated PAH

All specific PAH compound concentrations were below their relevant guideline values.

BTEX

The following exceedances of the relevant guideline values for BTEX for 1% soil organic matter were noted at location BH3 (4.5m).

	Guideline Value (mg/kg)	Measured concentration (mg/kg)
Ethylbenzene	47	1370
Xylene	175	3200

Total Petroleum Hydrocarbons

Concentrations of TPH were below the inert waste acceptance criteria of 500 mg/kg as detailed within the Landfill (England and Wales) Regulations 2004 and also within the UK Water Industry Research (UKWIR) in all soil samples tested.

Generic Assessment Criteria (GAC) for total petroleum hydrocarbons according to both their molecular weight and chemical structure and also for a range of soil organic matter (SOM) content values have been derived using CLEA software. The LQM CIEH GACs are presented according to their soil organic matter content and proposed end use of the land.

The maximum TPH concentration recorded on site during the site investigation was at location BH3 (4.5m) comprising of 91.4mg/kg within the C8-C10 range which is above the relevant GAC limit of 34mg/kg for this range and soil organic matter concentration and would therefore pose a significant risk of significant harm to human health.

9.1.4 Asbestos

Asbestos screening of the soil samples did not identify any Asbestos Containing Material (ACM).

9.2 SOIL GAS

Three gas monitoring visits were undertaken between the 5th and 26th March 2021 September where a soil vapour survey was undertaken across the site and comprised the monitoring of the atmosphere within the purposely installed monitoring standpipes. Portable gas monitoring equipment (GA 5000) was used to monitor the standpipes for concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2). A Photoionization detector (PID) was used in order to undertake a soil vapour survey with respect to volatile organic compounds.

For determining the gas protection measures which may be required in low rise buildings with a beam and block floor there is published guidance from the NHBC for use on residential developments which utilises a traffic light system of classification. For larger buildings the guidance in CIRIA 665 and BS8485 is used.

Reference has also been made to the British Standard Code of Practice BS8485:2015, *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* and regard has been given to the recommendations presented therein. The processes set out in BS8485 represent good practice and is based on the CIRIA C665 document.

In addition CIRIA document C735, *Good practice on the testing and verification of protection systems for buildings against hazardous ground gases* has also been referenced.

The results obtained from the short-term soil gas monitoring undertaken indicated that elevated concentrations of soil gas are present in the soils underlying the site. The soil gas results are attached at Appendix 2.

The results obtained from the soil gas survey undertaken indicated that significantly elevated methane and carbon dioxide concentrations were recorded at the site above the respective action levels of 1% and 5% for methane and carbon dioxide.

Measurement of both borehole pressure and gas emission rates indicates that no significant gas flows are present. The maximum gas flow rate measured on site was <0.1 l/hr.

Photoionisable compounds were measured in monitoring wells at location BH2 and BH3 up to 160 ppm. No photoionisable compounds were measured in location BH1.

10 CONTAMINATION RISK ASSESSMENT

This risk assessment has been undertaken with due regard to the advice relating to groundwater as provided in the Environment Agency's "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources", the advice provided in the Contaminated Land (England) Regulations 2000, and the associated statutory guidance. The guidance defines contaminated land as any land that is in such a condition that by reason of substances in, on or under the land:

- significant harm is being caused or there is a significant possibility of such harm being caused; or

- pollution of controlled water is being, or is likely to be, caused.

This definition is based on the principles of risk assessment defined as a combination of the probability (or frequency) of occurrence of a defined hazard and the magnitude (including the seriousness) of the consequences. Central to the risk assessment process is the concept of pollutant linkage, that is a linkage between a contaminant and a receptor by means of a pathway.

Statutory definitions relating to pollution linkage.	
Contaminant	"a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters."
Receptor	"a living organism, a group of living organisms, and ecological system or a piece of property" which meets given criteria. "controlled waters which are, or could be, polluted by a contaminant".
Pathway	"one or more routes or means by, or through, which a receptor: • is being exposed to, or affected by, a contaminant, or • could be so exposed or affected".

The relationship between these components is discussed below in order to identify the existence of any source-pathway-receptor linkage on the site, and hence the potential risks associated with any contamination.

This risk assessment is based on the proposed redevelopment of the site to residential end use with plant uptake.

The significance of the risks to the receptors/targets identified is based on an evaluation of the potential pathways between the contaminant source and receptors based on the most sensitive end use, i.e. a residential with home grown produce end use.

Potential receptors/targets at the site and in the area in which the site is located include:

- future occupants and the general public;
- construction/maintenance workers;
- groundwater resources;
- underground services in and around the site;
- plants in proposed soft landscaped areas.

10.1 CONTAMINANT SOURCES

The following general potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Current and Historic Site Use	Near surface in-fill/ reworked material of unknown origin.	PAH, Metals, ACM
	Use of site as a fuel station	TPH, PAH, Metals, ACM, BTEX
	Hazardous materials used within previous on-site buildings	ACM
Current and Historic Surrounding Land Use	Near surface made ground of unknown origin.	Ground Gases (Methane and Carbon Dioxide)

In general, the analytical testing of soils retrieved as part of the intrusive investigation did not reveal significantly elevated contaminant concentrations although as mentioned in Section 9.1 of this report, elevated heavy metal, TPH and BTEX concentrations were encountered on site. The risks associated with these contaminants are discussed below.

10.2 RISK TO HUMAN HEALTH

Toxic Metals

Concentrations of toxic metals cadmium, chromium, mercury, nickel, selenium, and zinc were all below their respective soil guidance values for a residential with plant uptake end use in all samples tested in this site investigation, therefore the risks to human health from these contaminants is considered to be low.

One out of the eight soil samples tested contained lead concentrations above the C4SL guidance level of 200 mg/kg.

One out of the eight soil samples tested contained arsenic concentrations above the C4SL guidance level of 37 mg/kg.

Organic Compounds

Concentrations of PAH were generally low across the site and would therefore not be considered to pose a significant risk of significant harm to human health.

Elevated TPH (C8-C10) and BTEX concentrations were encountered at location BH3 (4.5m) at levels considered to pose a significant risk of significant harm to human health.

Inorganic Compounds

No asbestos containing material (ACM) was encountered at the site.

On the balance of the toxicological risks posed by the ground contamination encountered as part of the intrusive investigation undertaken by GEI, it is considered that the potential risks to site workers and future occupants could be adequately controlled as follows:

Site Workers

- Provision of appropriate personal protective equipment and hygiene facilities.
- Good working practice in line with current legislation when safely handling and disposing of asbestos material.
- Provision of appropriate dust suppression, to minimise the generation of potentially contaminated suspended particulates during site works.

Future Occupants

- Elevated levels of contaminants have been found at the site which could pose a risk to future occupants if exposed to the material for instance in an area of soft landscaping. Current development proposals include such areas.
- With regard to the areas which may be set to soft landscaping in the proposed development it is noted that given the absence of such on site, suitable growth media would need to be imported into these areas of the site. Any such imported growth media would require analytical testing to confirm its suitability as growth media and its compliance with their relevant SGVs.
- It is considered that a simple cover system of approximately 600mm soils would be required to sever the linkage of pollutants in the soil below in the proposed soft landscaped areas based on the worst-case contamination recorded on site. It should be noted that this would be considered a conservative approach since most of the contaminated Made Ground indicated in this area will be removed as part of the site enabling works. Typically, 150 mm topsoil over approximately 450 mm clean free draining subsoils would generally be considered sufficient. Where deep

rooting shrubs / trees are proposed in any landscaping it may be necessary to locally deepen the clean cover to accommodate a healthy root bowl.

- The high TPH and BTEX concentrations are likely related to the presence of the underground fuel storage tanks in the vicinity of location BH3 which will be required to be removed prior to development of the site. The removal of the tanks will be subject to supervision and verification of remaining soils will be undertaken to ensure there is no remaining contamination.
- In areas which are to be covered by either buildings or hard standing, no such clean cover layer is required to sever the source to receptor pathway.
- Given that fuel tanks are present below the site, it is recommended that allowance be made for removal of the fuel tanks and associated pipework and infrastructure by a licensed Contractor prior to or during site demolition. The potential for further contamination around the vicinity of the fuel tank and pipework should be noted and it appears from the results obtained in this investigation that some leakage of the tanks may have occurred. It is recommended that an Environmental Engineer be present on site during removal of the tanks, with samples taken to determine residual contaminant concentrations in the excavation and any associated remedial requirements.
- Following implementation of the aforementioned remedial measures the site would not be considered to pose a potential risk of significant harm to human health in the context of Part 2A.

10.3 RISKS TO WATER RESOURCES

The site is underlain by Unproductive strata with respect to the London Clay Formation.

Significant levels of potentially soluble and therefore mobile organic contaminant sources were not measured on site within the samples tested with the exception of elevated TPH (C8-C10) and BTEX concentrations at location BH3.

Following the remediation works described above and with consideration to the site's setting, risks to groundwater resources are considered to be classed as low across the majority of the site.

10.4 RISKS TO PLANTS

Whilst significantly elevated concentrations of phytotoxic metals which could be considered harmful to plants were not encountered on site, it is necessary to implement the remedial works detailed above i.e. the importation of clean topsoil in proposed soft landscaped areas.

This action would ensure any contamination is isolated below the rooting zone of plants, and therefore unavailable for uptake, thus ensuring any source receptor pathways are severed. The risk to plant health posed by the contaminants identified would be considered to be low following implementation of the remedial strategy.

10.5 RISKS TO BUILDINGS & SERVICES

The risks to buried services from organic contamination such as TPH, which can degrade/permeate plastics and other polymer materials used to supply potable water is considered to be low to moderate.

Based on current guidance, the need to protect incoming water supplies, e.g. by the use of barrier pipes, is likely given the contaminant levels encountered as part of this investigation, however it is always advisable that confirmation from utility suppliers should be sought.

10.6 GAS RISK ASSESSMENT

The levels of soil gas underlying the site have been monitored as part of a short-term soil gas monitoring programme carried out across the site during March 2021. The results obtained from the soil gas survey indicate that elevated levels of soil gas, which may require gas protection measures to be incorporated into the development are present on site. No elevated gas flow rates were recorded during the monitoring.

The highest carbon dioxide concentration encountered on site during this current investigation was measured in BH1 at 5.0% which is equal to the relevant guideline limit of 5%. The highest methane concentration encountered on site during this current investigation was measured in BH2 at 21.0% which does exceeds the relevant guideline limit of 1%. A survey of volatile organic compounds undertaken across the site using a PID indicated the levels of photoionisable compounds measured in the monitoring wells were present at a maximum of 160 ppm.

Measurement of both borehole pressure and gas emission rates indicates that no significant gas flows are present. In order to allow for a worst-case scenario, GEI have used a gas flow rate across the site of 1.0l/h in the following calculations. It should be noted that the maximum gas flow rate detected on site during the short-term gas monitoring was less than 0.1l/h which was measured directly with an internal flow meter.

Based on BS 8485:2015 and C716, we have assessed the site based on the gas monitoring undertaken as part of the site investigation in order to calculate a Characteristic Gas Situation (CS).

Based on the worst-case gas characteristic situation, the worst case implied CS derived by combining the maximum observed concentrations from different borehole standpipes during any monitoring event and a worst-case flow rate of 1.0 l/h are as follows.

Flow Rate (l/h)	CH4 (%)	CO2 (%)	GSV – CH4 (l/h)	GSV – CO2 (l/h)	Implied CH4 CS	Implied CO2 CS
1.0	21	5.0	0.210	0.050	2	2

On the basis of the measurements in the table above, the GSV is taken to be 0.210 l/h, which is the worst case for methane and carbon dioxide. A GSV of 0.210 l/h lies within the GSV values for **CS2** (<0.7 l/h) which has a low hazard potential.

BS 8485:2015 enables the minimum level gas protection (score) for the site or zones to be determined based on the determined CS and the type of proposed building. Given the proposed end use of the site, a Type A building has been used for calculating the appropriate gas protection score.

Given that the site has an implied CS2, the minimum gas protection score required for a Type A building is 2, which means that gas protection measures would be required as part of the proposed development based on current gas concentrations.

The typical scope of gas protection measures would comprise:

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

All joints and penetrations should be sealed.

The source of the gases is considered to be due to historic leaks from the underground fuel tanks present on the site. As the fuel tanks and hydrocarbon impacted soil will be removed from site as part of the site enabling/demolition works the source will be removed and as such the above remedial measures should be considered a conservative approach.

11 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a system diagram identifying contaminant sources, routes of exposure (pathways), and which receptors are affected by contaminants moving along those pathways.

The model is produced to identify the zones of the site with different potential contaminations characteristics (e.g. whether contaminants in the soil are likely to be on the surface or at depth, distributed over an entire area or in localised 'hot spots').

The conceptual site model presented in the table below is based on the findings of the site investigation undertaken.

Source	Pollutant		Pathway	Hazard		Receptor	Observations/ Recommendations	Assessed Risk
Contaminated ground	Metals, organic (hydrocarbons) could be present	➔	Direct contact, ingestion, inhalation.	Health risks including skin irritation.	➔	Humans: site workers and future occupants	Normal health and safety precautions. Elevated contaminant concentrations present in soils likely to be removed from site during site preparatory works. Placement of clean topsoil required in any proposed private garden areas.	Low following proposed remedial works
			Surface run off.	Lateral movement to surface watercourses.	➔	Aquatic resources, ecology and subsequent users including humans.	No surface water courses in immediate vicinity of the site.	Low
			Leaching/ Dispersion.	Downward migration to groundwater.	➔	Aquatic resources – Groundwater, abstraction wells) / surface waters.	Limited significantly elevated contaminant concentrations encountered. Removal of tanks and hydrocarbon impacted soils will be required prior to development of the site.	Low following proposed remedial works
			Uptake by plants.	Phytotoxic effects.	➔	Soft landscaped areas / plants.	No significantly elevated contaminant concentrations encountered. Placement of clean topsoil required in any proposed soft landscaped areas.	Low
			Direct contact	Aggressive chemical attack	➔	Building structures and services	It is considered that protection of services is likely to be required on this site however advice should be sought from Statutory Providers especially as to whether potable water pipes should be protected.	Low

Source	Pollutant		Pathway	Hazard		Receptor	Observations/ Recommendations	Assessed Risk
Liquid contaminant sources	Diesel, Petrol and Oils.	➔	Direct contact; ingestion, inhalation.	Health risks including skin irritation. Lateral and vertical migration of contaminants.	➔	Humans: site workers. Groundwater and surface water.	Limited significantly elevated contaminant concentrations encountered. Removal of tanks and hydrocarbon impacted soils will be required prior to development of the site.	Low following proposed remedial works
Asbestos	Asbestos fibres within made ground and waste on site	➔	Inhalation.	Health risks including asbestosis, mesothelioma, and lung cancer.	➔	Humans: site workers and future occupants.	Appropriate PPE should be worn during site works. No ACM encountered within the samples.	Low
Redundant Waste, Demolition Waste		➔	Dermal Contact/ingestion. Potential for migration via surface water run-off	Health Risks	➔	Humans: Site workers	All waste on site is to be removed from site during site preparatory works and disposed of in accordance with current legislation.	Low
Ground gases	CO2, CH4, VOCs	➔	Inhalation and ingress into buildings	Asphyxiation and explosions	➔	Buildings/humans/future site users	Significantly elevated CO2 and CH4 vapours encountered throughout monitoring period. Minimum gas protection score of 2 required.	Low following proposed remedial works

12 CONCLUSIONS AND RECOMMENDATIONS

Based on the desk study, site investigation, intrusive works and subsequent data assessment, the following conclusions and recommendations have been drawn in respect of the proposed redevelopment of 31 Lampits Hill, Corringham, SS17 9AA comprising the demolition of the existing petrol filling station and the construction of a three-storey building comprising 16 apartments with associated private gardens, car parking and soft landscaping.

Geotechnical

- The ground investigation found the anticipated geology with soils typical of the London Clay Formation encountered beneath a variable thickness of Made Ground.
- At the time of reporting, applied structural loads from the proposed development of the site were unknown. However for preliminary foundation design purposes a line load of 100kN/m run was adopted.
- The London Clay Formation was identified as a suitable founding stratum.
- Based on field observations, in situ testing and laboratory test results, a maximum allowable bearing of 150kN/m^2 was recommended for foundations placed at a minimum depth of 1.5m. Foundation depths would need extending locally to ensure placement in natural soils.
- For a typical line load of 100kN/m a minimum foundation width of 0.65m was recommended.
- For foundations placed at a minimum depth of 1.5m below existing ground level preliminary settlement calculations indicated total settlement would be in the region of 30mm. Approximately half of the predicted settlement would be immediate.
- Should site enabling works comprising the excavation of fuel tanks result in shallow foundations being uneconomical, a piled foundation solution may be required. The London Clay Formation is considered to provide a suitable founding stratum for piles.
- Suspended ground floor slabs are recommended.
- A design sulphate class of DS-1 and an ACEC class of AC-1 was recommended for buried concrete.

Environmental

- The ground investigation found Made Ground over soils comprising London Clay Formation.

- The site is located above unproductive strata with respect to the London Clay Formation.
- Concentrations of toxic metals were found to be below their respective soil guideline values with the exception of minor concentrations of arsenic in one locations and lead in one location.
- Concentrations of PAH were generally low within soil across the site and would therefore not be considered to pose a significant risk of significant harm to human health.
- Elevated TPH and BTEX concentrations were encountered at location BH3 (4.5m) at levels considered to pose a significant risk of significant harm to human health.
- A simple cover system of approximately 600mm soils is recommended to sever the linkage of pollutants in the soil below any proposed soft landscaped areas based on the worst-case contamination recorded on site.
- The underground fuel tanks present at the site will require removal as part of the site enabling works. This process should be undertaken by a suitably qualified contractor and verification samples of surrounding soils should be obtained to ensure all contamination relating to the tanks has been removed. These results will be reported in a remediation verification report.
- Any areas of the site set to be covered by buildings and hardstanding would not pose a significant risk of significant harm to human health as they would sever any potential pollutant pathway and therefore no further action will be required.
- The risks posed to workers involved in any future redevelopment of the site are not considered significant providing standard health and hygiene practices are adopted.
- Asbestos containing material has not been encountered on site.
- It is considered likely that any new services, in particular potable water, will require protection, however it is advisable to seek service provider confirmation of this.
- Due to the site's setting above unproductive strata and following the removal of the underground fuel tanks, the risks to groundwater are considered to be low due to the lack of any significant mobile organic contamination.
- Based on gas monitoring results, the site has been given a classification of CS2 which has a ow hazard potential. Gas protection measures suitable to achieve a minimum gas protection score of 2 will need to be incorporated into any new buildings constructed on the site.

Based on the principles and definitions outlined under section 57 of the Environment Act 1995, the site would not be considered to be "Contaminated Land" based on its proposed residential redevelopment end use following implementation of the above remedial measures.

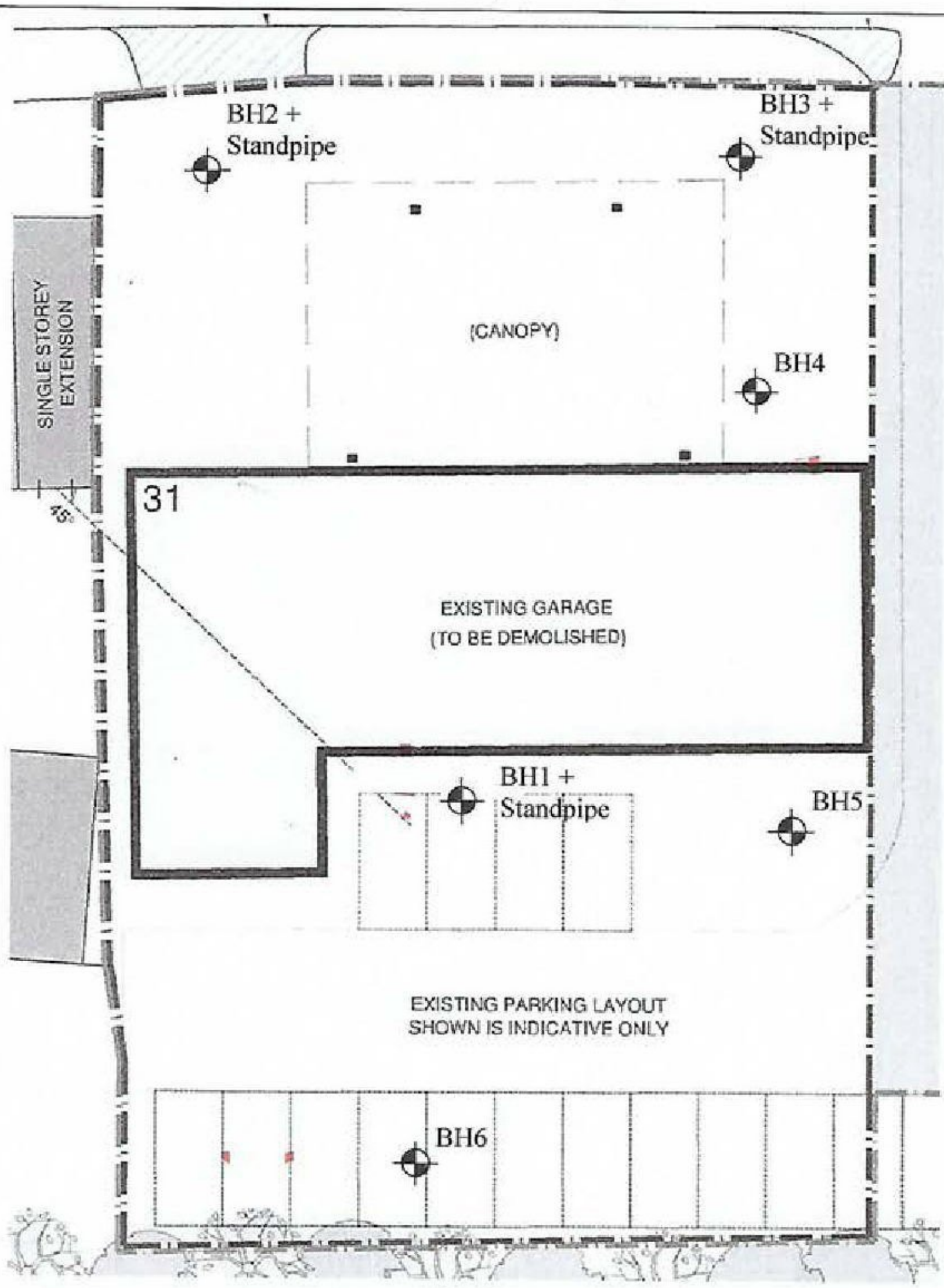
FIGURES

1. Exploratory Hole Location Plan (existing site layout)
2. Proposed Site Layout

Site Location Plan	Sheet: 1 of 1
	Job No: AM3533.1
Scale: Not to scale	Date: 25&26/02/2021
Client: AMD Property Ltd	

SOIL INVESTIGATION
EASTERN LIMITED
Tel/Fax 01245 237555 Mobile 07810 820620

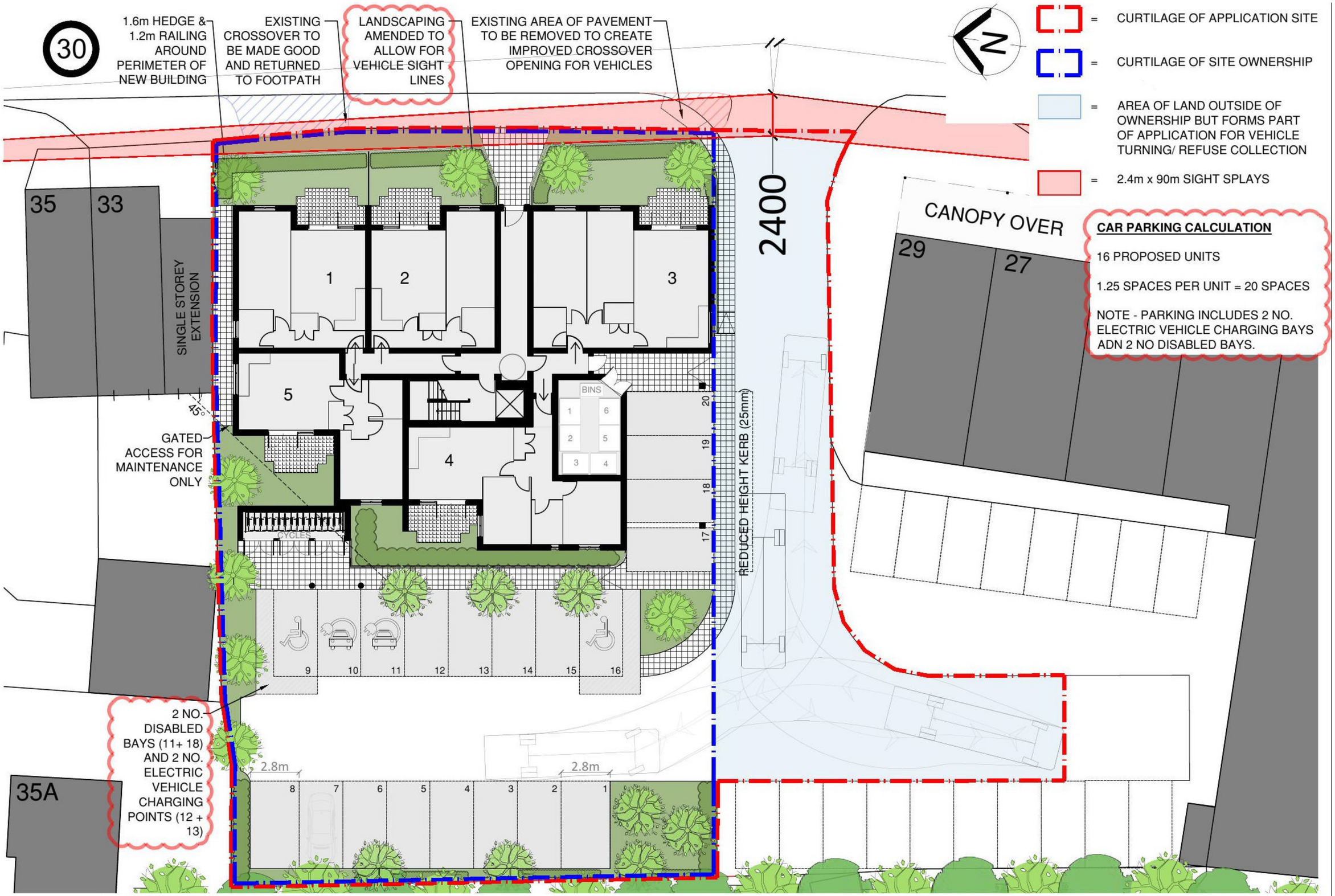
Site: : 31 Lampits Hill, Corringham, Stanford-Le-Hope, Essex, SS17 9AA



Remarks: ON SITE TREE IDENTIFICATION FOR GUIDANCE ONLY. NOT AUTHENTICATED.

Key:

	Trial Pit		Borehole
MH	Man Hole	G	Gulley
SVP	Soil Vent Pipe		Tree / Bush
RWP	Rain Water Pipe		(approx. ht. in m)



PROPOSED SITE PLAN

31 LAMPITS HILL, CORRINGHAM, STANFORD-LE-HOPE, ESSEX, SS17 9AA

4019_PL04A 1:200 @ A3 AH

1:200 @ A3 1 1 2 3 4 5

DATE REVISIONS INITIAL

DOVETAIL ARCHITECTS
SUITE 4. CLOCKTOWER HOUSE. HORNDON INDUSTRIAL PARK. WEST HORNDON. CM13 3XL (01708) 225547

APPENDIX 1

CFA BOREHOLE LOGS

Borehole No: 1	Sheet: 1 of 1	SOIL INVESTIGATION EASTERN LIMITED Tel/Fax 01245 237555 Mobile 07810 820620
	Job No: AM3533	
Boring Method: 100mmø CFA	Date: 25/02/2021	
Client: AMD Property Ltd		Site: 31 Lampits Hill, Corringham

Depth (mm/m)	Description of Strata	Thick-Ness (mm/m)	Legend	Sample	Test Type	Test Result	Depth (mm/m)	Field Records/ Comments	Depth to water (mm/m)
G.L.	TARMAC, over sandy, GRAVEL, with brick rubble.	250		•	Tub & Jar		300		
250	MADE GROUND: Stained dark grey, slightly pungent (suspected fuel), sandy, silty, CLAY, with gravel & brick fragments.	250		•	Tub & Jar		800	100 Occasional roots of live appearance to 2mmø to	
				•	V	84 88	1.0		
500	MADE GROUND: Orange brown, sandy, very silty, CLAY, with occasional small brick fragments.	400		•	Tub & Jar		1.2	600 Occasional roots of live appearance to 1mmø to 900mm.	
900	Stiff, orange brown, sandy, silty, CLAY, with occasional gravel. Thinly laminated with orange & brown silt & fine sand.	2.9		•			1.5		
				•	V	98 102	2.0	No roots observed below 900mm.	
3.8	Very stiff, mid brown, gravelly, silty, CLAY. Thinly laminated with orange & brown silt & fine sand.	600		•			2.5		
				•	V	118 128	3.0		
4.4	Very stiff, sandy, gravelly, silty, CLAY.	2.4		•	V	140+ 140+	4.0		
				•	V	140+	5.0	Water strike at	6.8
6.8	Medium dense, orange brown, slightly pungent (suspected fuel), gravelly, fine, medium & coarse SAND.	6.0		•	V	140+	6.0		
				•	Tub & Jar		7.0		
				•	I	28 30 31 32	8.0		
				•	I	27 29 32 34	10.0		
12.8	Very stiff, orange brown, mottled grey, silty, CLAY. Thinly laminated with orange & brown silt & fine sand.	1.6		•	I	28 30 31 33	12.0		
14.4	Very stiff, mid grey, silty, CLAY, with partings of brown & grey silt & fine sand.	600		•	V	140+ 140+	15.0		
15.0	Borehole ends at 15.0m.								

Remarks: Borehole collapsing from 6.8m. Borehole moist at base. Backfilled to 7.0m. Gas Monitoring Standpipe installed from Ground Level to 7.0m, using 6.0m of slotted standpipe, and 1.0m of plain standpipe b.g.l. Backfilled with 6.0m of gravel, 600mm of bentonite pellets, and a 400mm concrete collar installed. A standpipe cap with gas taps installed.

Key:

- • Small disturbed sample
- B Bulk disturbed sample
- U Undisturbed sample(U100)
- W Water sample
- J Jar sample
- V Pilcon Vane (kPa)
- I Mackintosh Probe
- S Standard penetration test
- N SPT blow count

Borehole No: 2	Sheet: 1 of 1	SOIL INVESTIGATION EASTERN LIMITED Tel/Fax 01245 237555 Mobile 07810 820620
	Job No: AM3533	
Boring Method: 100mmø CFA	Date: 25/02/2021	
Client: AMD Property Ltd c/o Dovetail Architects Ltd.		Site: 31 Lampits Hill, Corringham

Depth (mm/m)	Description of Strata	Thick-Ness (mm/m)	Legend	Sample	Test Type	Test Result	Depth (mm/m)	Field Records/ Comments	Depth to water (mm/m)
G.L.	CONCRETE, reinforced with 6mmø steel mesh.	150							
150	MADE GROUND: HARDCORE & BRICK RUBBLE.	250						100 Occasional hair & fibrous roots to 700mm.	
400	MADE GROUND: Orange brown, sandy, silty, CLAY, with occasional gravel & brick fragments.	1.3		•	Tub & Jar		400	No roots observed below 700mm.	
				•	I	17 18 22 24	1.0		
				•			1.5		
1.7	Stiff, stained grey, pungent (suspected fuel), silty, CLAY, with partings of stained grey silt & fine sand.	2.7		•	Tub & Jar		1.8		
				•	V	124 126	2.0		
				•	Tub & Jar		2.2		
				•			2.5		
				•	V	132 138	3.0		
				•	V	140+ 140+	4.0		
4.4	Medium dense, olive brown, pungent (suspected fuel), silty, fine to medium SAND. Thickly interbedded with grey brown, sandy, very silty, CLAY.	600		•	I	29 30 32 34	5.0		
5.0	Borehole ends at 5.0m.								

Remarks: Borehole dry & open on completion. Gas Monitoring Standpipe installed from Ground Level to 5.0m, using 4.0m of slotted standpipe, and 1.0m of plain standpipe b.g.l. Backfilled with 4.0m of gravel, 600mm of bentonite pellets, and a 400mm concrete collar installed. A standpipe cap with gas taps installed.

Key:

- • Small disturbed sample
- B Bulk disturbed sample
- U Undisturbed sample(U100)
- W Water sample
- J Jar sample
- V Pilcon Vane (kPa)
- I Mackintosh Probe
- S Standard penetration test
- N SPT blow count

Borehole No: 3	Sheet: 1 of 1	SOIL INVESTIGATION EASTERN LIMITED Tel/Fax 01245 237555 Mobile 07810 820620
	Job No: AM3533	
Boring Method: 100mmø CFA	Date: 25/02/2021	
Client: AMD Property Ltd c/o Dovetail Architects Ltd.		Site: 31 Lampits Hill, Corringham

Depth (mm/m)	Description of Strata	Thick-Ness (mm/m)	Legend	Sample	Test Type	Test Result	Depth (mm/m)	Field Records/ Comments	Depth to water (mm/m)
G.L.	CONCRETE, reinforced with 6mmø steel mesh.	150						No roots observed.	
150	MADE GROUND: HARDCORE & BRICK RUBBLE.	250							
400	MADE GROUND: Orange brown, sandy, silty, CLAY, with occasional gravel & brick fragments.	400		•	Tub & Jar		400		
800	Stiff, mid brown, silty, CLAY, with partings of orange & brown silt & fine sand.			•	V	84 88	1.0		
				•			1.5		
				•	V	112 122	2.0		
		3.6		•			2.5		
				•	V	130 136	3.0		
				•	V	140+ 140+	4.0		
4.4	Medium dense, olive brown, pungent (suspected fuel), silty, fine to medium SAND. Thickly interbedded with grey brown, sandy, very silty, CLAY.	600		•	Tub & Jar		4.5		
				•	I	27 29 31 33	5.0		
5.0	Borehole ends at 5.0m.								

Remarks: Borehole dry & open on completion. Gas Monitoring Standpipe installed from Ground Level to 5.0m, using 4.0m of slotted standpipe, and 1.0m of plain standpipe b.g.l. Backfilled with 4.0m of gravel, 600mm of bentonite pellets, and a 400mm concrete collar installed. A standpipe cap with gas taps installed.

Key:

- • Small disturbed sample
- B Bulk disturbed sample
- U Undisturbed sample(U100)
- W Water sample
- J Jar sample
- V Pilcon Vane (kPa)
- I Mackintosh Probe
- S Standard penetration test
- N SPT blow count

Borehole No: 4	Sheet: 1 of 1	SOIL INVESTIGATION EASTERN LIMITED Tel/Fax 01245 237555 Mobile 07810 820620
	Job No: AM3533	
Boring Method: 100mmø CFA	Date: 26/02/2021	
Client: AMD Property Ltd c/o Dovetail Architects Ltd.		Site: 31 Lampits Hill, Corringham

Depth (mm/m)	Description of Strata	Thick-Ness (mm/m)	Legend	Sample	Test Type	Test Result	Depth (mm/m)	Field Records/ Comments	Depth to water (mm/m)
G.L.	CONCRETE, reinforced with 6mmø steel mesh.	120							
120	MADE GROUND: Orange brown, sandy, gravelly, silty, CLAY, with numerous limestone gravel, brick & mortar rubble.	680		•	Tub & Jar		500	100 Occasional roots of live appearance to 2mmø to 800mm.	
800	Stiff, mid brown, silty, CLAY. Thinly laminated with orange & brown silt & fine sand.	2.5		•	V	90 98	1.0	No roots observed below 800mm.	
				•			1.5		
				•	V	128 132	2.0		
				•			2.5		
				•	V	134 138	3.0		
3.3	Very stiff, as above.	1.2		•	V	140+ 140+	4.0		
4.5	Very stiff, pungent (suspected fuel), mid brown, sandy, very silty, CLAY. Thickly laminated with orange brown & olive silt & fine sand.	500		•	Tub & Jar		4.5		
5.0	Borehole ends at 5.0m.			•	V	140+ 140+	5.0		

Remarks: Borehole dry & open on completion.

Key:

- • Small disturbed sample
- B Bulk disturbed sample
- U Undisturbed sample(U100)
- W Water sample
- J Jar sample
- V Pilcon Vane (kPa)
- I Mackintosh Probe
- S Standard penetration test
- N SPT blow count

Borehole No: 5	Sheet: 1 of 1	SOIL INVESTIGATION EASTERN LIMITED Tel/Fax 01245 237555 Mobile 07810 820620
	Job No: AM3533	
Boring Method: 100mmø CFA	Date: 26/02/2021	
Client: AMD Property Ltd c/o Dovetail Architects Ltd.		Site: 31 Lampits Hill, Corringham

Depth (mm/m)	Description of Strata	Thick-Ness (mm/m)	Legend	Sample	Test Type	Test Result	Depth (mm/m)	Field Records/ Comments	Depth to water (mm/m)
G.L.	TARMAC, over MADE GROUND: Dark grey, sandy, GRAVEL, with numerous brick rubble.	300						100 Occasional roots of live appearance to 3mmø to	
300	MADE GROUND: Stained grey, slightly pungent (suspected fuel), sandy, gravelly, CLAY, with brick & limestone gravel fragments.	500		•	Tub & Jar		400	600 Occasional hair & fibrous roots to 1.0m.	
800	Stiff, stained grey, pungent (suspected fuel), sandy, silty, CLAY. Thinly laminated with orange & stained grey silt & fine sand.	300		•	Tub & Jar		800	No roots observed below 1.0m.	
				•	V	92 96	1.0		
1.1	Stiff, orange brown, slightly pungent (suspected fuel), sandy, silty, CLAY. Thinly laminated with orange, brown & olive silt & fine sand.	2.1		•			1.5		
				•	V	126 132	2.0		
				•			2.5		
3.2	Very stiff, with grey staining (pungent), as above.	1.3		•	V	136 140	3.0		
				•	V	140+ 140+	4.0		
4.5	Very stiff, mid brown, pungent (suspected fuel), sandy, very silty, CLAY. Thickly laminated with olive, brown & orange silt & fine sand.	500							
5.0	Borehole ends at 5.0m.			•	V	140+ 140+	5.0		

Remarks: Borehole dry & open on completion.

Key:

•	Small disturbed sample	V	Pilcon Vane (kPa)
B	Bulk disturbed sample	I	Mackintosh Probe
U	Undisturbed sample(U100)	S	Standard penetration test
W	Water sample		
J	Jar sample	N	SPT blow count

Borehole No: 6	Sheet: 1 of 1	SOIL INVESTIGATION EASTERN LIMITED Tel/Fax 01245 237555 Mobile 07810 820620
	Job No: AM3533	
Boring Method: 100mmø CFA	Date: 26/02/2021	
Client: AMD Property Ltd c/o Dovetail Architects Ltd.		Site: 31 Lampits Hill, Corringham

Depth (mm/m)	Description of Strata	Thick-Ness (mm/m)	Legend	Sample	Test Type	Test Result	Depth (mm/m)	Field Records/ Comments	Depth to water (mm/m)
G.L.	TARMAC, over MADE GROUND: Dark grey, sandy, GRAVEL, with numerous brick rubble.	200						100 Numerous roots of live appearance to 6mmø to	
200	Stiff, orange brown, slightly sandy, silty, CLAY. Thinly laminated with orange & brown silt & fine sand.	1.6		•	Tub & Jar		300	900 Numerous roots of live appearance to 2mmø to	
				•	V	128 136	1.0		
				•			1.5	1.4 Numerous roots of live appearance to 1mmø to	
1.8	Very stiff, as above.	1.0		•	V	140+ 140+	2.0	2.2 Occasional hair & fibrous roots to 2.4m.	
				•			2.5	No roots observed below 2.4m.	
2.8	Stiff, orange brown, sandy, very silty, CLAY. Thinly laminated with orange & brown silt & fine sand.	400		•	V	136 140+	3.0		
3.2	Very stiff, as above.	1.8		•	V	140+ 140+	4.0		
5.0	Borehole ends at 5.0m.			•	V	140+ 140+	5.0		

Remarks: Borehole dry & open on completion.

Key:

- • Small disturbed sample
- B Bulk disturbed sample
- U Undisturbed sample(U100)
- W Water sample
- J Jar sample
- V Pilcon Vane (kPa)
- I Mackintosh Probe
- S Standard penetration test
- N SPT blow count

APPENDIX 2

GAS MONITORING RESULTS

SOIL GAS SURVEY

Project:	31 Lampits Hill			Date:	05/03/2021				Equipment Used:	GA 5000		
Location:	Corringham			Weather:	Overcast							
Job No.	21-073			Temp:	4°C							
Monitoring Point No.	Time	O2 (% v/v)	CO2 (% v/v)	CH4 (% v/v)	H2S (PPM)	CO (PPM)	PID (PPM)	Flow (l/hr)	Differential Pressure (mbar)	Water (mbgl)	Site Observations/ Comments	
											Time	Barometric Pressure
BH1		10.9	1.4	0	0	0	40	<0.01		6.36	12:00	1031mb
BH2		20.8	0	0	0	0	49	<0.01		Dry		
BH3		20.8	0	0	0	0	<10	<0.01		Dry	Datum:	

Tested by: MP

mbgl = metres below ground level

Ground and Environmental Services Limited

Accuracy and range of Gas Analyser 5000 (GA5000)

	Accuracy			Range
Gas	Gas Concentrations			
	0-5%	5-15%	0-FS	
CH_4	+/-0.5%	+/-3%		0-70% to specification, 0-100% reading
CO_2	+/-0.5%	+/-3%		0-40% to specification, 0-100% reading
O_2	+/-1%	+/-1%		0-25%
CO			+/-10%FS	0-500ppm
H_2S			+/-10%FS	0-200ppm
B.P.	+/- 5 mBar			700-1200 mBar
Flow:				

Notes:

CH4: methane in percent volume per volume (% v/v)

CO2: carbon dioxide in %v/v

O2: oxygen in % v/v

H2S: hydrogen sulphide in part per million (ppm)

CO: carbon monoxide in ppm

B.P.: Barometric pressure in mBar

Flow: Gas flow in litre per hour (l/h)

SOIL GAS SURVEY

Project:	31 Lampits Hill			Date:	12/03/2021				Equipment Used:	GA 5000		
Location:	Corringham			Weather:	Overcast							
Job No.	21-073			Temp:	8°C							
Monitoring Point No.	Time	O2 (% v/v)	CO2 (% v/v)	CH4 (% v/v)	H2S (PPM)	CO (PPM)	PID (PPM)	Flow (l/hr)	Differential Pressure (mbar)	Water (mbgl)	Site Observations/ Comments	
											Time	Barometric Pressure
BH1		5.7	3.2	14	0	0	75	<0.01		NT	12:00	1001mb
BH2		14.3	0.4	14.3	0	0	142	<0.01		NT		
BH3		12.9	1.2	0	0	0	<10	<0.01		NT	Datum:	

Tested by: MP

mbgl = metres below ground level

Ground and Environmental Services Limited

Accuracy and range of Gas Analyser 5000 (GA5000)

Accuracy				Range
Gas	Gas Concentrations			
	0-5%	5-15%	0-FS	
CH_4	+/-0.5%	+/-3%		0-70% to specification, 0-100% reading
CO_2	+/-0.5%	+/-3%		0-40% to specification, 0-100% reading
O_2	+/-1%	+/-1%		0-25%
CO			+/-10%FS	0-500ppm
H_2S			+/-10%FS	0-200ppm
B.P.	+/- 5 mBar			700-1200 mBar
Flow:				

Notes:

CH4: methane in percent volume per volume (% v/v)

CO2: carbon dioxide in %v/v

O2: oxygen in % v/v

H2S: hydrogen sulphide in part per million (ppm)

CO: carbon monoxide in ppm

B.P.: Barometric pressure in mBar

Flow: Gas flow in litre per hour (l/h)

SOIL GAS SURVEY

Project:	31 Lampits Hill	Date:	26/03/2021	Equipment Used:	GA 5000
Location:	Corringham	Weather:	3/5 cloud cover		
Job No.	21-073	Temp:	10°C		

Monitoring Point No.	Time	O2 (% v/v)	CO2 (% v/v)	CH4 (% v/v)	H2S (PPM)	CO (PPM)	PID (PPM)	Flow (l/hr)	Differential Pressure (mbar)	Water (mbgl)	Site Observations/ Comments	
											Time	Barometric Pressure
BH1		10.1	3.9	11	0	0	64	<0.01		NT	12:00	1008mb
BH2		7.6	2.8	21	0	0	160	<0.01		NT		
BH3		3.9	5	0	0	0	<10	<0.01		NT	Datum:	

Tested by: MP

mbgl = metres below ground level

Ground and Environmental Services Limited

Accuracy and range of Gas Analyser 5000 (GA5000)

	Accuracy			Range
Gas	Gas Concentrations			
	0-5%	5-15%	0-FS	
CH_4	+/-0.5%	+/-3%		0-70% to specification, 0-100% reading
CO_2	+/-0.5%	+/-3%		0-40% to specification, 0-100% reading
O_2	+/-1%	+/-1%		0-25%
CO			+/-10%FS	0-500ppm
H_2S			+/-10%FS	0-200ppm
B.P.	+/- 5 mBar			700-1200 mBar
Flow:				

Notes:

CH4: methane in percent volume per volume (% v/v)

CO2: carbon dioxide in %v/v

O2: oxygen in % v/v

H2S: hydrogen sulphide in part per million (ppm)

CO: carbon monoxide in ppm

B.P.: Barometric pressure in mBar

Flow: Gas flow in litre per hour (l/h)

APPENDIX

LABORATORY TESTING RESULTS

PROPERTY ASSURANCE
Giving our all

SITE INVESTIGATION
FACTUAL REPORT

Report No:	SI-270805
Client:	Soil Investigation Eastern
Site:	3 Lampits Hill, Corringham Thurrock
Client Ref:	0000
Date of Visit:	3/3/2021

ISO 9001 REGISTERED FIRM
ISO 14001 REGISTERED FIRM
OHSAS 18001 REGISTERED FIRM

Home Emergency Response - Subsidence Investigation - Drainage Services – Crack & Level Monitoring – Property Video Surveys

Unit E2 First Floor Suite, Boundary Court
Willow Farm Business Park, Castle Donington
Leicestershire, DE74 2NN

☎ 0843 2272362
✉ enquiries@cet-uk.com
www.cet-uk.com

Construction Testing Solutions

SITE INVESTIGATION
LABORATORY TEST REPORT

SI REPORT NUMBER: 270805

CLIENT : CET Property Assurance (Soil Investigation (Eastern)Ltd)

SITE:
31 Lampitts Hill
Corringham
Stanford-Le Hope

DATE OF SITE VISIT:
25&26/02/2021

DATE RECEIVED BY LABORATORY:
03/03/2021

Compiled by : .....
J. Garrett - Laboratory Manager (B)

Approved by : .....
J. Garrett - Laboratory Manager (B)

DATE REPORTED: 12-Mar-2021

Laboratory Summary Results

Our Ref : 270805

Date Sampled: 25&26/02/2021

Location : 31, Lampitts Hill, Corringham, Stanford-Le-Hope

Date Received : 02/03/2021

Client: CET Property Assurance (Soil Investigations (Eastern)Ltd)

Date Tested : 02/03/2021

Address: Unit 4, Boundary Court, Willow Farm Business Park, Castle Donington, Leicestershire, DE74 2NN

Date of Report : 12/03/2021

Sample Ref		Type	Moisture Content	Soil Fraction	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity * Index	Modified * Plasticity Index	Soil * Class	Filter Paper Contact Time	Soil Sample Suction	Oedometer Strain	Estimated * Heave Potential (Dd)	In situ * Shear Vane Strength	Organic * Content	pH * Value	Sulphate Content * (g/l)		* Class
TP/BH No	Depth (m)		(%) [1]	>0.425mm (%) [2]	(%) [3]	(%) [4]	(%) [5]	[5]	(%) [6]	[7]	(d)	(kPa) [8]	[9]	(mm)[10]	(kPa) [11]	(%)[12]	[13]	SO_3 [14]	SO_4 [15]	[16]
BH1	1.0	D	26	<5											86		7.8	0.38	0.46	DS-1
	1.5	D	28	<5	63	23	40	0.13	40	CH										
	2.0	D	26	<5											100					
	2.5	D	28	<5	65	21	44	0.16	44	CH										
	3.0	D	28	<5											123					
	4.0	D	17	32											> 140					
	5.0	D	12	55											> 140					

Test Methods / Notes

[1] BS 1377 : Part 2 : 1990, Test No 3.2

[2] Estimated if <5%, otherwise measured

[3] BS 1377 : Part 2 : 1990, Test No 4.4

[4] BS 1377 : Part 2 : 1990, Test No 5.3

[5] BS 1377 : Part 2 : 1990, Test No 5.4

[6] BRE Digest 240 : 1993

[7] BS 5930 : 2018 : Figure 8 - Plasticity Chart for the classification of fine soils

[8] In-house method S9a adapted from BRE IP 4/93

[9] In-house Test Procedure S17a: One Dimensional Swell/Strain Test

[10] Estimated Heave Potential (Dd)

[11] Values of shear strength were determined in situ by CET using a Pilcon hand vane or Geonor vane (GV).

[12] BS 1377 : Part 3 : 1990, Test No 4

[13] BS 1377 : Part 2 : 1990, Test No 9

[14] BS 1377 : Part 3 : 1990, Test No 5.6

[15] $SO_4 = 1.2 \times SO_3$

[16] BRE Special Digest One (Concrete in Aggressive Ground) August 2005 Note that if the SO4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4M or DS-5M class respectively unless water soluble magnesium testing is undertaken to prove otherwise.

* These tests are not UKAS accredited

Full reports can be provided upon request.

* Sulphate/PH tested by K4 Soils Ltd

Key

D	Disturbed sample (small)
B	Disturbed sample (bulk)
U	Undisturbed sample
W	Groundwater sample
ENP	Essentially Non-Plastic by inspection
U/S	Underside of Foundation

UKAS TESTING

Test results reported relate only to the items tested.

Our Ref : 270805

Laboratory Testing Results

Date Sampled : 25&26/02/2021

Location : 31, Lampitts Hill, Corringham, Stanford-Le-Hope

Date Received : 02/03/2021

Client: CET Property Assurance (Soil Investigations (Eastern)Ltd)

Date Tested : 02/03/2021

Address: Unit 4, Boundary Court, Willow Farm Business Park, Castle Donington, Leicestershire, DE74 2NN

Date of Report : 12/03/2021

Sample Ref.		Type	Moisture Content	Soil Fraction	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity * Index	Modified * Plasticity Index	Soil * Class	Filter Paper Contact Time	Soil Sample Suction	Oedometer Strain	Estimated * Heave Potential (Dd)	In situ * Shear Vane Strength	Organic * Content	pH * Value	Sulphate Content * (g / l)		* Class
TP/BH No.	Depth (m)		(%) *[1]*	> 0.425mm (%) *[2]*	(%) *[3]*	(%) *[4]*	(%) *[5]*	*[5]*	(%) [6]	*[7]*	(d)	(kPa) [8]	*[9]*	*(mm)[10]*	(kPa) *[11]*	(%)*[12]*	*[13]*	SO_3 *[14]*	SO_4 *[15]*	*[16]*
BH4	1.0	D	25	<5											94					
	1.5	D	25	<5	66	24	42	0.04	42	CH										
	2.0	D	27	<5											130					
	2.5	D	25	<5	67	23	44	0.04	44	CH										
	3.0	D	26	<5											136					

Test Methods / Notes

[1] BS 1377 : Part 2 : 1990, Test No 3.2

[2] Estimated if <5%, otherwise measured

[3] BS 1377 : Part 2 : 1990, Test No 4.4

[4] BS 1377 : Part 2 : 1990, Test No 5.3

[5] BS 1377 : Part 2 : 1990, Test No 5.4

[6] BRE Digest 240 : 1993

[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils

[8] In-house method S9a adapted from BRE IP 4/93

[9] In-house Test Procedure S17a: One Dimensional Swell/Strain Test

[10] Estimated Heave Potential (Dd)

[11] Values of shear strength were determined in situ by CET using a Pilcon hand vane or Geonor vane (GV).

[12] BS 1377 : Part 3 : 1990, Test No 4

[13] BS 1377 : Part 2 : 1990, Test No 9

[14] BS 1377 : Part 3 : 1990, Test No 5.6

[15] $SO_4 = 1.2 \times SO_3$

[16] BRE Special Digest One (Concrete in Aggressive Ground) August 2005

Note that if the SO4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4M or DS-5M class respectively unless water soluable magnesium testing is undertaken to prove otherwise.

* These tests are not UKAS accredited

Full reports can be provided upon request

Key

D	Disturbed sample (small)
B	Disturbed sample (bulk)
U	Undisturbed sample
W	Groundwater sample
ENP	Essentially Non-Plastic by inspection
U/S	Underside of Foundation

UKAS TESTING

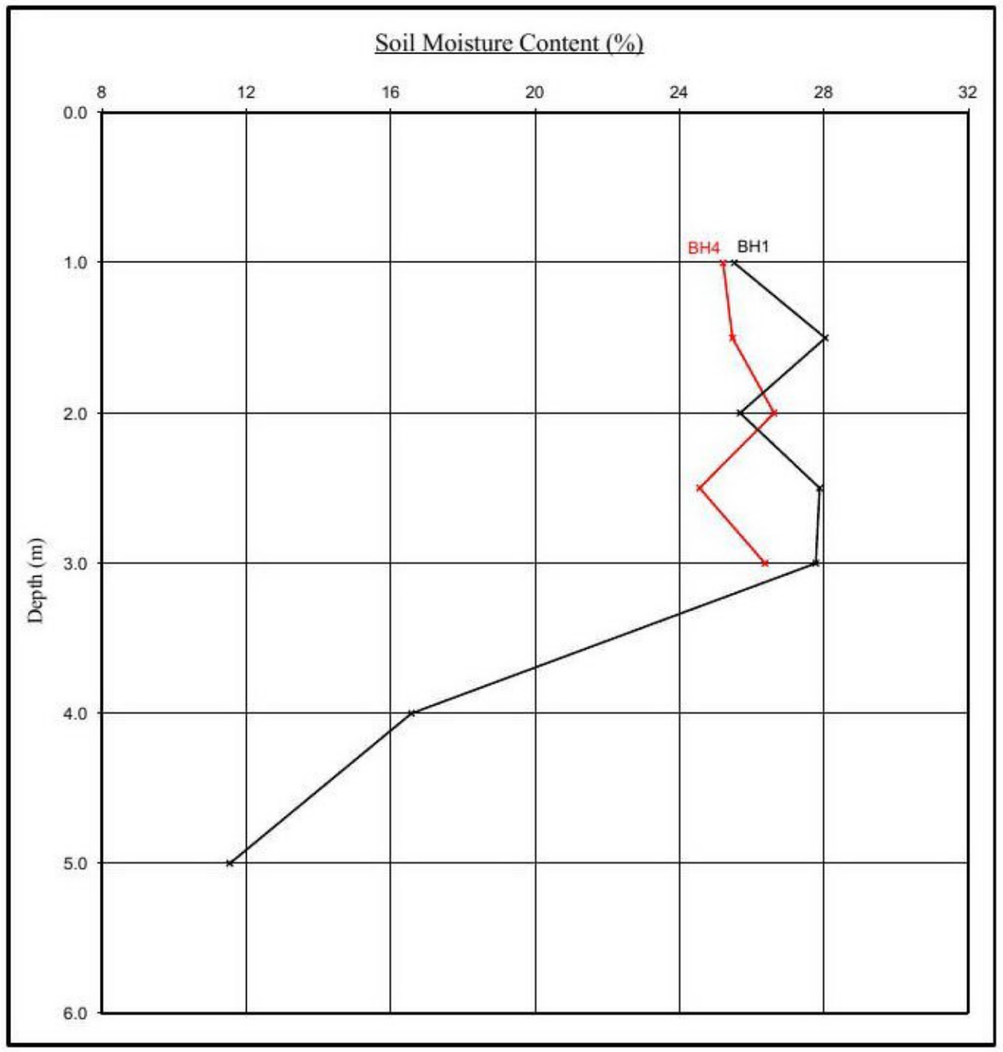
0927

Test results reported relate only to the items tested.

Version: 5BH V1 - 06.01.21

Moisture Content Profiles

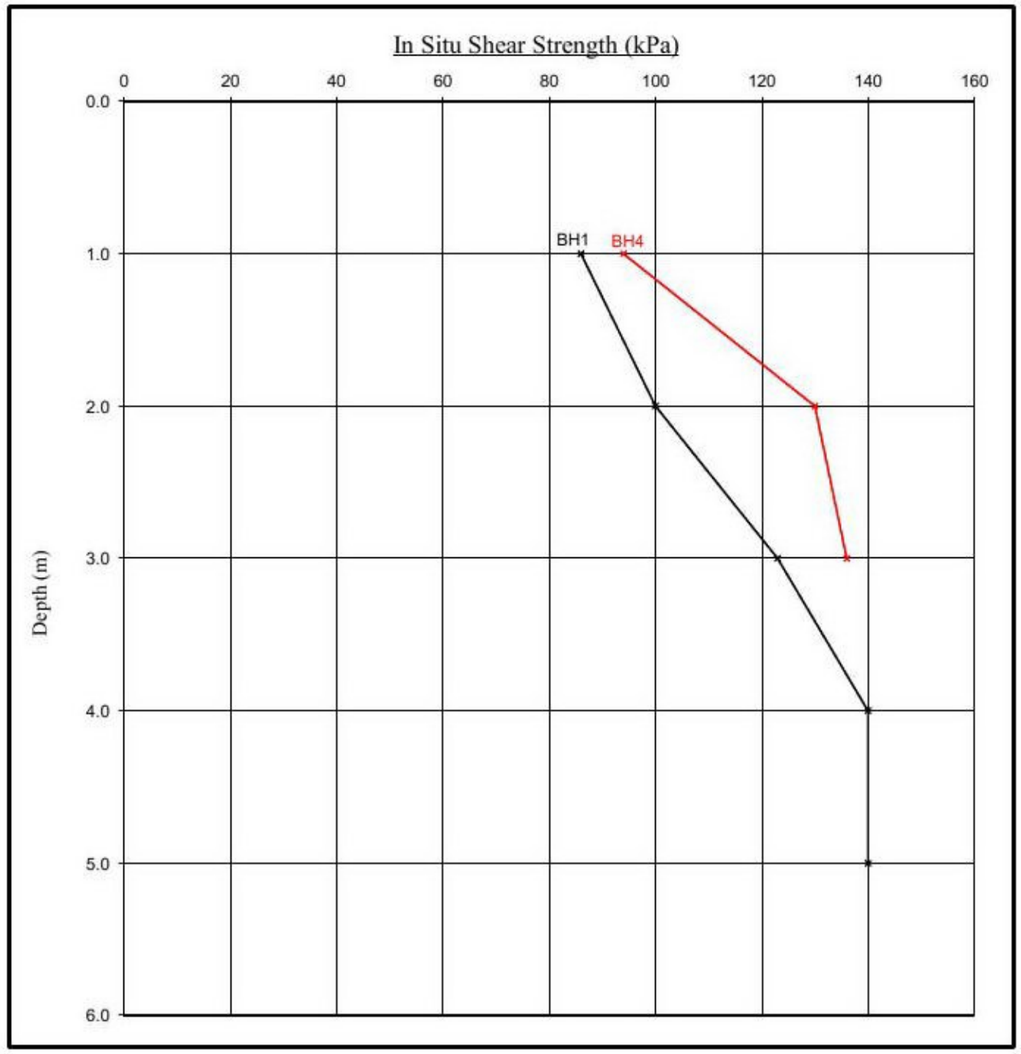
Our Ref : 270805
Location : 31, Lampitts Hill, Corringham, Stanford-Le-Hope
Work carried out for: CET Property Assurance (Soil Investigations (Eastern)Ltd)



Notes
1. If plotted, 0.4 LL and PL+2 (after Driscoll, 1983) should only be applied to London Clay (and similarly overconsolidated clay) at shallow depths.
2. Unless specifically noted the profiles have not been related to a site datum.

Shear Strength Profiles

Date Sampled : 25&26/02/2021
Date Received : 02/03/2021
Date Tested : 02/03/2021
Date of Report : 12/03/2021

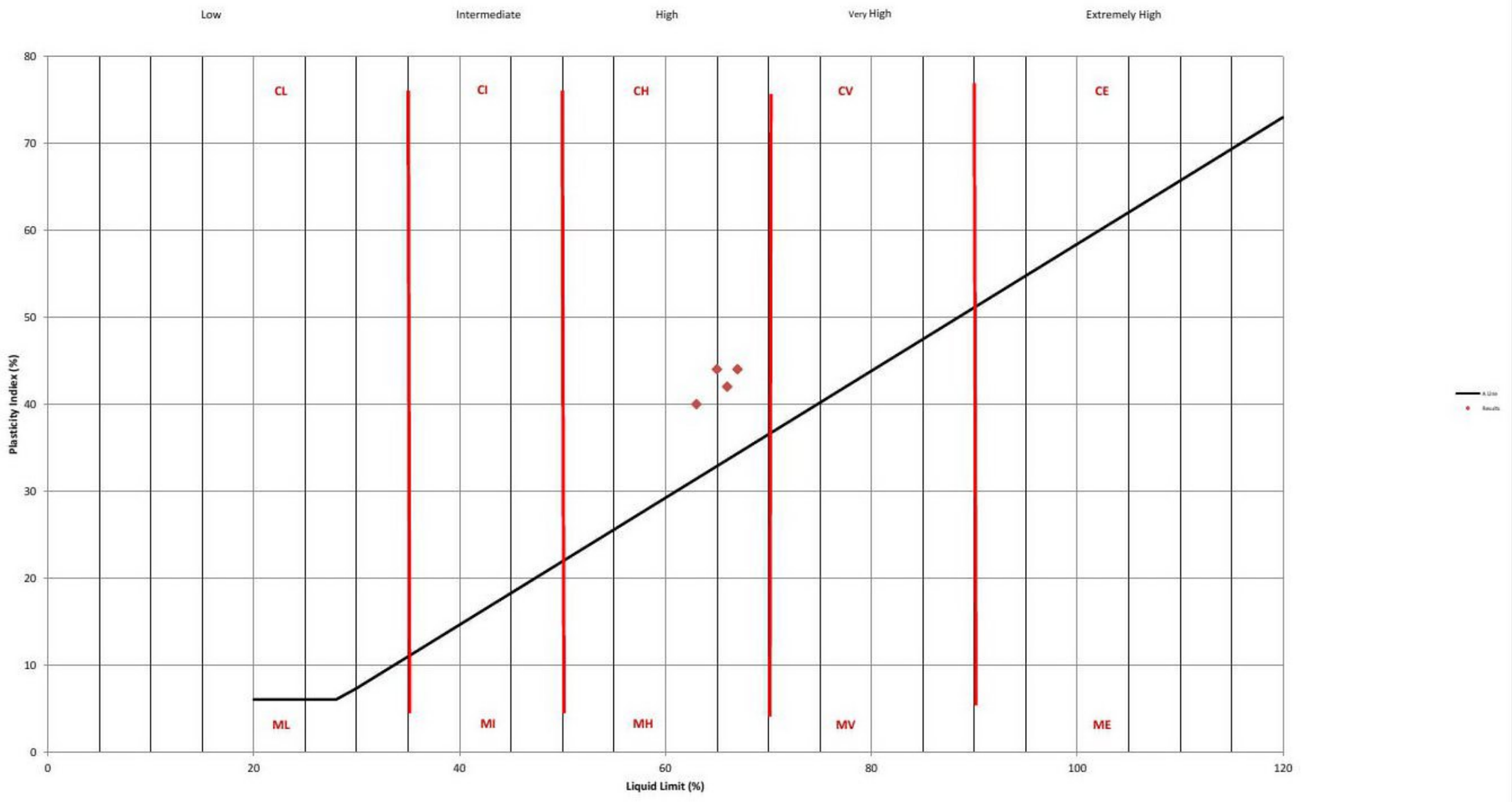


Note
1. Unless otherwise stated, values of Shear Strength were determined in situ by CET using a Pilcon Hand Vane the calibration of which is limited to a maximum reading of 140 kPa.
2. Unless specifically noted the profiles have not been related to a site datum.

Plasticity Chart

Our Ref : 270805
Location : 31, Lampitts Hill, Corringham, Stanford-Le-Hope
Work carried out for: CET Property Assurance (Soil Investigations (Eastern)Ltd)
Unit 4, Boundary Court, Willow Farm Business Park, Castle Donington, Leicestershire, DE74 2NN

Date Sampled : 25&26/02/2021
Date Received : 02/03/2021
Date Tested : 02/03/2021
Date of Report : 12/03/2021



APPENDIX 4

ANALYTICAL TESTING RESULTS

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone: (01424) 718618

cs@elab-uk.co.uk
info@elab-uk.co.uk

UKAS TESTING 2683

mCERTS

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 21-32429

Issue:	1
Date of Issue:	09/03/2021
Contact:	Sandra Brown
Customer Details:	Soil Investigation (Eastern) Ltd Unit 8, Hill Farm Church Lane Chelmsford EssexCM3 1LH
Quotation No:	Q19-01650
Order No:	AM3533.1
Customer Reference:	AM3533.1
Date Received:	03/03/2021
Date Approved:	09/03/2021
Details:	31 Lampitts Hill, Corringham
Approved by:	

Mike Varley, Technical Manager

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

ELAB

Sample Summary

Report No.: 21-32429, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Schedulec	Description	Deviations
229079	BH1 0.30	25/02/2021	03/03/2021	Sandy silty loam	
229080	BH1 0.80	25/02/2021	03/03/2021		
229081	BH1 1.20	25/02/2021	03/03/2021	Silty clayey loam	
229082	BH1 7.00	25/02/2021	03/03/2021	Loamy sand	
229083	BH2 0.40	25/02/2021	03/03/2021		
229084	BH2 1.80	25/02/2021	03/03/2021	Clay	
229085	BH2 2.20	25/02/2021	03/03/2021	Clay	
229086	BH3 0.40	25/02/2021	03/03/2021	Silty clayey loam	
229087	BH3 4.50	25/02/2021	03/03/2021	Silty clayey loam	
229088	BH4 0.50	26/02/2021	03/03/2021		
229089	BH4 4.50	26/02/2021	03/03/2021	Clay	
229090	BH5 0.40	26/02/2021	03/03/2021	Sandy loam	
229091	BH5 0.80	26/02/2021	03/03/2021		
229092	BH6 0.30	26/02/2021	03/03/2021	Silty clayey loam	
229093	BH6 2.00	26/02/2021	03/03/2021		

ELAB

UKAS TESTING 2683

mCERTS

Results Summary

Report No.: 21-32429, issue number 1

ELAB Reference	229079	229081	229082	229084	229085
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	BH1	BH1	BH2	BH2
Sample Depth (m)	0.30	1.20	7.00	1.80	2.20
Sampling Date	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021

Determinand	Codes	Units	LOD					
Soil sample preparation parameters								
Material removed	N	%	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Description of Inert material removed	N		0	None	None	None	None	None
Metals								
Arsenic	M	mg/kg	1	10.9	n/t	23.3	4.6	n/t
Cadmium	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5	n/t
Chromium	M	mg/kg	5	39.8	n/t	40.8	49.7	n/t
Copper	M	mg/kg	5	24.1	n/t	23.3	18.3	n/t
Lead	M	mg/kg	5	78.2	n/t	13.6	14.6	n/t
Mercury	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5	n/t
Nickel	M	mg/kg	5	21.9	n/t	29.7	33.4	n/t
Selenium	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
Zinc	M	mg/kg	5	147	n/t	54.6	60.1	n/t
Inorganics								
Elemental Sulphur	M	mg/kg	20	139	n/t	53	309	n/t
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	n/t	< 0.8	< 0.8	n/t
Thiocyanate	N	mg/kg	4	< 4.0	n/t	< 4.0	< 4.0	n/t
Total Cyanide	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	0.07	n/t	0.03	0.05	n/t
Water Soluble Boron	N	mg/kg	0.5	2.1	n/t	< 0.5	0.6	n/t
Miscellaneous								
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	< 0.1	n/t	n/t	< 0.1
Loss On Ignition (450°C)	M	%	0.01	n/t	4.41	n/t	n/t	4.24
pH	M	pH units	0.1	8.0	8.3	8.8	8.6	8.5
Soil Organic Matter	U	%	0.1	1.6	n/t	0.1	0.5	n/t
Total Organic Carbon	N	%	0.01	n/t	0.19	n/t	n/t	0.11
Phenols								
Phenol	M	mg/kg	1	< 1	n/t	< 1	< 1	n/t
M,P-Cresol	N	mg/kg	1	< 1	n/t	< 1	< 1	n/t
O-Cresol	N	mg/kg	1	< 1	n/t	< 1	< 1	n/t
3,4-Dimethylphenol	N	mg/kg	1	< 1	n/t	< 1	< 1	n/t
2,3-Dimethylphenol	M	mg/kg	1	< 1	n/t	< 1	< 1	n/t
1-Naphthol	N	mg/kg	1	< 1	n/t	< 1	< 1	n/t
2,3,5-trimethylphenol	M	mg/kg	1	< 1	n/t	< 1	< 1	n/t
Total Phenols	N	mg/kg	6	< 6	n/t	< 6	< 6	n/t

Results Summary

2683

Report No.: 21-32429, issue number 1

ELAB Reference	229079	229081	229082	229084	229085
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	BH1	BH1	BH2	BH2
Sample Depth (m)	0.30	1.20	7.00	1.80	2.20
Sampling Date	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021

Determinand	Codes	Units	LOD					
Polyaromatic hydrocarbons								
Naphthalene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Acenaphthylene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Acenaphthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Fluorene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Phenanthrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Fluoranthene	M	mg/kg	0.1	0.1	n/t	< 0.1	< 0.1	n/t
Pyrene	M	mg/kg	0.1	0.1	n/t	< 0.1	< 0.1	n/t
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Chrysene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	n/t
Total PAH(16)	M	mg/kg	0.4	0.4	n/t	< 0.4	< 0.4	n/t
Total PAH (Including Coronene GC-FID)	N	mg/kg	2	n/t	< 2	n/t	n/t	< 2
BTEX								
Benzene	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0	n/t
Toluene	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0	n/t
Ethylbenzene	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0	n/t
Xylenes	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0	n/t
MTBE	N	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0	n/t
Total BTEX	N	mg/kg	0.01	n/t	< 0.01	n/t	n/t	0.03
TPH CWG								
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	< 0.01	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	0.01	< 0.01	n/t
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C10-C12 Aliphatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C12-C16 Aliphatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C16-C21 Aliphatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C21-C35 Aliphatic	M	mg/kg	1	2.0	n/t	< 1.0	< 1.0	n/t
>C35-C40 Aliphatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
Total aliphatic hydrocarbons (>C5 - C40)	N	mg/kg	1	2.4	n/t	< 1.0	< 1.0	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	< 0.01	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	< 0.01	n/t
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C10-C12 Aromatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C12-C16 Aromatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C16-C21 Aromatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
>C21-C35 Aromatic	M	mg/kg	1	2.0	n/t	< 1.0	< 1.0	n/t
>C35-C40 Aromatic	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	n/t
Total aromatic hydrocarbons (>C5 - C40)	N	mg/kg	1	2.8	n/t	< 1.0	< 1.0	n/t
Total petroleum hydrocarbons (>C5 - C40)	N	mg/kg	1	5.2	n/t	< 1.0	< 1.0	n/t
Total Petroleum Hydrocarbons								
Mineral Oil	M	mg/kg	5	n/t	< 5	n/t	n/t	< 5
PCB (ICES 7 congeners)								
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	< 0.03	n/t	n/t	< 0.03

Tests marked N are not UKAS accredited.

Results Summary

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Report No.: 21-32429, issue number 1

ELAB Reference				229086	229087	229089	229090	229092
Customer Reference								
Sample ID								
Sample Type				SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location				BH3	BH3	BH4	BH5	BH6
Sample Depth (m)				0.40	4.50	4.50	0.40	0.30
Sampling Date				25/02/2021	25/02/2021	26/02/2021	26/02/2021	26/02/2021
Determinand	**Codes**	**Units**	**LOD**					
Soil sample preparation parameters								
Material removed	N	%	0.1	< 0.1	< 0.1	< 0.1	37.1	< 0.1
Description of Inert material removed	N		0	None	None	None	Stones	None
Metals								
Arsenic	M	mg/kg	1	9.8	16.9	43.8	16.2	10.5
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	61.8	45.1	54.1	45.2	41.2
Copper	M	mg/kg	5	23.0	13.8	20.7	25.8	23.5
Lead	M	mg/kg	5	31.8	12.8	14.9	213	112
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	31.9	27.9	39.4	26.5	21.8
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	87.1	55.7	70.7	160	183
Inorganics								
Elemental Sulphur	M	mg/kg	20	< 20	< 20	< 20	28	< 20
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Thiocyanate	N	mg/kg	4	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%	0.02	0.11	0.04	0.02	0.18	0.09
Water Soluble Boron	N	mg/kg	0.5	0.8	< 0.5	< 0.5	< 0.5	1.4
Miscellaneous								
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t
pH	M	pH units	0.1	8.0	9.1	8.7	10.0	8.6
Soil Organic Matter	U	%	0.1	0.5	0.4	0.4	2.2	1.1
Total Organic Carbon	N	%	0.01	n/t	n/t	n/t	n/t	n/t
Phenols								
Phenol	M	mg/kg	1	< 1	< 1	< 1	< 1	< 1
M,P-Cresol	N	mg/kg	1	< 1	< 1	< 1	< 1	< 1
O-Cresol	N	mg/kg	1	< 1	< 1	< 1	< 1	< 1
3,4-Dimethylphenol	N	mg/kg	1	< 1	< 1	< 1	< 1	< 1
2,3-Dimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1	< 1
1-Naphthol	N	mg/kg	1	< 1	< 1	< 1	< 1	< 1
2,3,5-trimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1	< 1
Total Phenols	N	mg/kg	6	< 6	< 6	< 6	< 6	< 6

Results Summary

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Report No.: 21-32429, issue number 1

ELAB Reference	229086	229087	229089	229090	229092
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH3	BH3	BH4	BH5	BH6
Sample Depth (m)	0.40	4.50	4.50	0.40	0.30
Sampling Date	25/02/2021	25/02/2021	26/02/2021	26/02/2021	26/02/2021

Determinand	Codes	Units	LOD					
Polyaromatic hydrocarbons								
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.5	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	1.2	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	1.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.5	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.6	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.7	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.8	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.6	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.7	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.5	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	< 0.4	< 0.4	7.9	< 0.4
Total PAH (Including Coronene GC-FID)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t
BTEX								
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	41.9	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	12.2	1370	< 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10	45.3	3200	< 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Total BTEX	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
TPH CWG								
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	0.27	< 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	0.01	34.8	< 0.01	0.04	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	87.5	< 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic	M	mg/kg	1	< 1.0	28.3	< 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic	M	mg/kg	1	< 1.0	3.8	< 1.0	2.8	< 1.0
>C16-C21 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	4.9	< 1.0
>C21-C35 Aliphatic	M	mg/kg	1	2.1	1.8	< 1.0	22.3	< 1.0
>C35-C40 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	28.7	< 1.0
Total aliphatic hydrocarbons (>C5 - C40)	N	mg/kg	1	3.2	123	< 1.0	59.5	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	0.04	< 0.01	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	91.4	< 1.0	< 1.0	< 1.0
>C10-C12 Aromatic	M	mg/kg	1	< 1.0	55.8	< 1.0	< 1.0	< 1.0
>C12-C16 Aromatic	M	mg/kg	1	< 1.0	8.4	< 1.0	4.1	< 1.0
>C16-C21 Aromatic	M	mg/kg	1	1.0	< 1.0	< 1.0	22.0	< 1.0
>C21-C35 Aromatic	M	mg/kg	1	3.3	1.3	< 1.0	88.8	4.8
>C35-C40 Aromatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	80.6	1.7
Total aromatic hydrocarbons (>C5 - C40)	N	mg/kg	1	5.9	158	< 1.0	196	7.9
Total petroleum hydrocarbons (>C5 - C40)	N	mg/kg	1	9.1	281	< 1.0	256	8.3
Total Petroleum Hydrocarbons								
Mineral Oil	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t
PCB (ICES 7 congeners)								
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t

Tests marked N are not UKAS accredited.

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Results Summary

Report No.: 21-32429, issue number 1

WAC Analysis								
Elab Ref:	229085					**Landfill Waste Acceptance Criteria Limits***		
Sample Date:	25/02/2021					**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:	BH2							
Depth (m)	2.2							
Site:	31 Lampitts Hill, Corringham							
Determinand		**Code**	**Units**					
Total Organic Carbon		N	%		0.11	3	5	6
Loss on Ignition		M	%		4.2	--	--	10
Total BTEX		M	mg/kg		0.03	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			8.5	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate
Eluate Analysis			**10:1**		**10:1**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
			mg/l		**mg/kg**			
Arsenic		N	< 0.005		< 0.05	0.5	2	25
Barium		N	0.006		0.06	20	100	300
Cadmium		N	< 0.001		< 0.01	0.04	1	5
Chromium		N	< 0.005		< 0.05	0.5	10	70
Copper		N	< 0.005		< 0.05	2	50	100
Mercury		N	< 0.005		< 0.01	0.01	0.2	2
Molybdenum		N	< 0.005		< 0.05	0.5	10	30
Nickel		N	< 0.001		< 0.05	0.4	10	40
Lead		N	< 0.001		< 0.05	0.5	10	50
Antimony		N	< 0.005		< 0.05	0.06	0.7	5
Selenium		N	< 0.005		< 0.05	0.1	0.5	7
Zinc		N	< 0.005		< 0.05	4	50	200
Chloride		N	< 5		< 50	800	15000	25000
Fluoride		N	< 5		11.00	10	150	500
Sulphate		N	7		70.10	1000	20000	50000
Total Dissolved Solids		N	70		698.00	4000	60000	100000
Phenol Index		N	< 0.01		< 0.10	1	-	-
Dissolved Organic Carbon		N	17.800		178.00	500	800	1000
Leach Test Information								
pH		N	7.4					
Conductivity (uS/cm)		N	104					
Dry mass of test portion (g)			101.000					
Dry Matter (%)			81					
Moisture (%)			24					
Eluent Volume (ml)			963					

Results are expressed on a dry weight basis, after correction for moisture content where applicable

* Stated limits are for guidance only, and not for conformity assessment.

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Results Summary

Report No.: 21-32429, issue number 1

WAC Analysis								
Elab Ref:	229081					**Landfill Waste Acceptance Criteria Limits***		
Sample Date:	25/02/2021					**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:	BH1							
Depth (m)	1.2							
Site:	31 Lampitts Hill, Corringham							
Determinand		**Code**	**Units**					
Total Organic Carbon		N	%		0.19	3	5	6
Loss on Ignition		M	%		4.4	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			8.3	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate
Eluate Analysis			**10:1**		**10:1**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
			mg/l		**mg/kg**			
Arsenic		N	< 0.005		< 0.05	0.5	2	25
Barium		N	< 0.005		< 0.05	20	100	300
Cadmium		N	< 0.001		< 0.01	0.04	1	5
Chromium		N	< 0.005		< 0.05	0.5	10	70
Copper		N	< 0.005		< 0.05	2	50	100
Mercury		N	< 0.005		< 0.01	0.01	0.2	2
Molybdenum		N	< 0.005		< 0.05	0.5	10	30
Nickel		N	0.001		< 0.05	0.4	10	40
Lead		N	< 0.001		< 0.05	0.5	10	50
Antimony		N	< 0.005		< 0.05	0.06	0.7	5
Selenium		N	< 0.005		< 0.05	0.1	0.5	7
Zinc		N	< 0.005		< 0.05	4	50	200
Chloride		N	< 5		< 50	800	15000	25000
Fluoride		N	< 5		< 10	10	150	500
Sulphate		N	6		63.10	1000	20000	50000
Total Dissolved Solids		N	88		877.00	4000	60000	100000
Phenol Index		N	< 0.01		< 0.10	1	-	-
Dissolved Organic Carbon		N	17.000		170.00	500	800	1000
Leach Test Information								
pH		N	7.4					
Conductivity (uS/cm)		N	131					
Dry mass of test portion (g)			101.000					
Dry Matter (%)			80					
Moisture (%)			25					
Eluent Volume (ml)			958					

Results are expressed on a dry weight basis, after correction for moisture content where applicable

* Stated limits are for guidance only, and not for conformity assessment.

ELAB
UKAS TESTING
2683

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Results Summary

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Asbestos Results

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

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
229079	0.30	BH1	Brown sandy soil with stones	No asbestos detected	n/t	n/t	n/t	n/t
229082	7.00	BH1	Brown sandy soil with stones	No asbestos detected	n/t	n/t	n/t	n/t
229084	1.80	BH2	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t
229086	0.40	BH3	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t
229087	4.50	BH3	Brown sandy soil	No asbestos detected	n/t	n/t	n/t	n/t
229089	4.50	BH4	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t
229090	0.40	BH5	Brown sandy soil with stones,brick,clinker	No asbestos detected	n/t	n/t	n/t	n/t
229092	0.30	BH6	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t

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Method Summary

Report No.: 21-32429, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Hexavalent chromium	N	As submitted sample	04/03/2021	110	Colorimetry
Acid Soluble Sulphate	U	Air dried sample	05/03/2021	115	Ion Chromatography
Phenols in solids	M	As submitted sample	03/03/2021	121	HPLC
Elemental Sulphur	M	Air dried sample	04/03/2021	122	HPLC
PAH (GC-FID)	M	As submitted sample	04/03/2021	133	GC-FID
Thiocyanate	N	As submitted sample	05/03/2021	146	Colorimetry
Low range Aliphatic hydrocarbons soil	N	As submitted sample	05/03/2021	181	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	05/03/2021	181	GC-MS
Water soluble boron	N	Air dried sample	04/03/2021	202	Colorimetry
Total cyanide	M	As submitted sample	04/03/2021	204	Colorimetry
TPH CWG soil by gc-gc	M	As submitted sample	04/03/2021	271	
Asbestos identification	U	Air dried sample	04/03/2021	280	Microscopy
Aqua regia extractable metals	M	Air dried sample	04/03/2021	300	ICPMS
Soil organic matter	U	Air dried sample	05/03/2021	BS1377:P3	Titrimetry
Leachate					
Arsenic	N		07/03/2021	301	ICPMS
Cadmium	N		07/03/2021	301	ICPMS
Chromium	N		07/03/2021	301	ICPMS
Lead	N		07/03/2021	301	ICPMS
Nickel	N		07/03/2021	301	ICPMS
Copper	N		07/03/2021	301	ICPMS
Zinc	N		07/03/2021	301	ICPMS
Mercury	N		07/03/2021	301	ICPMS
Selenium	N		07/03/2021	301	ICPMS
Antimony	N		07/03/2021	301	ICPMS
Barium	N		07/03/2021	301	ICPMS
Molybdenum	N		07/03/2021	301	ICPMS
pH Value	N		07/03/2021	113	Electrometric
Electrical Conductivity	N		07/03/2021	136	Probe
Dissolved Organic Carbon	N		07/03/2021	102	TOC analyser
Chloride	N		07/03/2021	131	Ion Chromatography
Fluoride	N		07/03/2021	131	Ion Chromatography
Sulphate	N		07/03/2021	131	Ion Chromatography
Total Dissolved Solids	N		07/03/2021	144	Gravimetric
Phenol index	N		07/03/2021	121	HPLC
WAC Solids analysis	N				
pH Value	M	Air dried sample	04/03/2021	113	Electrometric
Total Organic Carbon	N	Air dried sample	05/03/2021	210	IR
Loss on Ignition	M	Air dried sample	04/03/2021	129	Gravimetric
Acid Neutralization Capacity to pH 7	N	Air dried sample	04/03/2021	NEN 737	Electrometric
Total BTEX	M	As submitted sample	05/03/2021	181	GCMS
Mineral Oil	M	As submitted sample	04/03/2021	117	GCFID
Total PCBs (7 congeners)	M	Air dried sample	04/03/2021	120	GCMS
Total PAH (17)	N	As submitted sample	05/03/2021	133	GCFID

Tests marked N are not UKAS accredited

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Report Information

Report No.: 21-32429, issue number 1

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"
LOD	LOD refers to limit of detection, except in the case of pH soils and pH waters where it means limit of discrimination.

Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.

ELAB are unable to provide an interpretation or opinion on the content of this report.

The results relate only to the sample received.

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

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

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

Sample Retention and Disposal

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage

APPENDIX 5

GUIDELINES ON CONTAMINATION LEVELS

Human Health

CLEA Soil Guideline values (SGV)

The UKs primary contaminated land guidance is contained within the Contaminated Land Exposure Assessment (CLEA) framework. Within this framework a number of Soil Guideline Values (SGVs) were published for key contaminants along with toxicological guideline values relating to intake thresholds. The soil guideline values provided by the CLEA model represent intervention values for end uses based upon potential human exposure and soil concentrations of a contaminant above these values might represent an unacceptable risk to the health of the site users. The Environment Agency had an ongoing programme of SGV publication with associated toxicological information for key contaminants. Where SGVs are available then they should be used as the basis for any human health risk assessment.

All CLEA SGVs were withdrawn for use by the Environment Agency in 2008 whilst they are under review and pending the availability of new toxicological data. To date, new SGV values have been set for benzene, toluene, ethylbenzene and xylene and mercury and selenium. In the absence of the new SGVs and toxicological report data, GEI have used appropriate screening tools or Generic Assessment Criteria Levels as assessment criteria guidelines for those determinands not currently assigned SGVs. It should be noted that the former SGVs for metals were in general agreement with those site specific levels generated by RBCA and other similar computer model based risk assessment tools.

The GEI screening assessment of contaminants within samples has been carried out using these model generated values in the absence of any other values or guidelines. The version of the CLEA model, v1.06, was used. The published SGVs are shown below. Nickel SGV has been withdrawn (2015) pending an assessment of the toxicological data used in the model for nickel. Published SGV values.

	Soil Guideline Value (mg kg^{-1})		
Land use	**Residential**	**Allotment**	**Commercial**
Inorganic arsenic	32	43	640
Nickel	130	230	1,800
Cadmium	10	1.8	230
Phenol	420	280	3200
Elemental Hg	1	26	26
Inorganic Hg	170	80	3600
Methyl Hg	11	8	410
Selenium	350	120	13,000
Benzene	0.33	0.07	95
Toluene	610	120	4400
Ethylbenzene	350	90	2800
o-Xylene	250	160	2600
r-Xylene	240	180	3500
m-Xylene	230	160	3200

Based on a sandy loam soil as defined in Environment Agency (2009b) and 6% SOM.

DEFRA Category four screening level (C4SL)

In addition to the SGVs, guideline screening values proposed in the DEFRA document SP1010-Development of Category 4 Screening Levels for Assessment of Land affected by Contamination Final Project Report (C4SL) are considered along with the suitable for use levels (S4USL) derived by the Chartered Institute of Environmental Health (CIEH) in partnership with the Land Quality Management Organization (LQM). The screening levels are given for residential, commercial, allotment or public open space end uses.

PARAMETER	Residential		Commercial	Allotment	Public open Space near residential POS_{resi}	Public park land POS_{park}	Sources
	With Plant uptake	Without Plant uptake					
Inorganics - mg/kg unless stated							
Arsenic (inorganic)	37	40	640	49	79	170	DEFRA C4SL
Beryllium	1.7	1.7	12	35	2.2	63	LQM/S4USL
Boron	290	11,000	240,000	45	21,000	46,000	LQM/CIEH
Cadmium	22	150	410	3.9	220	880	LQM/S4USL
Chromium III	910	910	8,600	18,000	1,500	33,000	LQM/CIEH
Chromium VI	21	21	49	170	21	250	LQM/S4USL
Copper	2,400	7,100	68,000	520	12,000	44,000	LQM/CIEH
lead	200	310	2,300	80	630	1,300	DEFRA C4SL
Mercury (Inorganic)	40	56	1,100	19	120	240	LQM/CIEH
Nickel	180	180	980	230	230	3,400	LQM/CIEH
Selenium	250	430	12,000	88	1,100	1,800	LQM/CIEH
Vanadium	410	1,200	9,000	91	2,000	5,000	LQM/CIEH
Zinc	3,700	40,000	730,000	620	81,000	170,000	LQM/CIEH
Total sulphate	2400	2400	2400	2400	2400	2400	BRE (2005)
Water-soluble sulphate (g/l)	0.5	0.5	0.5	0.5	0.5	0.5	BRE (2005)
pH	<5	<5	<5	<5	<5	<5	-

CLEA does not currently provide guidance for total Polycyclic Aromatic Hydrocarbons (PAHs). A standalone Defra C4SL for benzo(a)pyrene has been assigned and is shown below. In addition, the Chartered Institute of Environmental Health (CIEH) in partnership with the Land Quality Management Organization (LQM) used CLEA software to derive Generic Assessment Criteria (GAC) and Assessment Sub Criteria (ASC) for the following PAH compounds:

PARAMETER	Residential						Commercial			Allotment			POS	POS	Source
	With Plant uptake			Without Plant uptake											
SOM %	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	resi	park	
Organics - mg/kg unless stated															
Acenaphthene	200	490	1080	2000	3600	5200	75000	92000	100000	34	85	202			CLEA/LQM CIEH
Acenaphthylene	170	400	900	2000	3600	5200	76000	92000	100000	28	68	163			CLEA/LQM CIEH
Anthracene	2300	5400	10700	30000	34000	36000	520000	530000	540000	380	947	2230			CLEA/LQM CIEH
Benzo(a)anthracene	7.5	11	13	12	14	15	170	170	180	2.9	6.5	13			CLEA/LQM CIEH
Benzo(a)pyrene C4SL			5			5.3			77			5.7	10	21	DEFRA C4SL
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	35	35	36	3.6	3.7	3.7			CLEA/LQM CIEH
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	44	45	45	1	2.2	3.9			CLEA/LQM CIEH
Benzo(g,h,i)perylene	315	340	350	360	360	360	3900	4000	4000	290	480	646			CLEA/LQM CIEH
Benzo(k)fluoranthene	77	93	100	110	110	110	1200	1200	1200	37	76	129			CLEA/LQM CIEH
Chrysene	15	22	27	30	31	32	350	350	350	4.1	9.5	19			CLEA/LQM CIEH
Dibenzo(a,h)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	3.5	3.6	3.6	0.14	0.27	0.44			CLEA/LQM CIEH
Fluoranthene	280	560	890	1500	1600	1600	23000	23000	23000	52	127	288			CLEA/LQM CIEH
Fluorene	165	390	850	2200	3400	4200	60000	67000	70000	27	67	158			CLEA/LQM CIEH
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	500	510	510	9.5	21	40			CLEA/LQM CIEH
Naphthalene	1	2.3	5.5	1	2.4	6	100	260	600	4	9.8	23			CLEA/LQM CIEH
Phenanthrene	95	220	440	1300	1400	1500	22000	22000	23000	15	38	90			CLEA/LQM CIEH
Pyrene	620	1200	2000	3700	3800	3800	54000	54000	55000	11	271	620			CLEA/LQM CIEH

Petroleum Hydrocarbons represent a complex situation being a mixture of a range of compounds, the relative concentrations of which may change over time.

As discussed above, Generic Assessment Criteria (GAC) for total petroleum hydrocarbons according to both their molecular weight and chemical structure and also for a range of soil organic matter (SOM) content values have been derived using CLEA software.

The LQM CIEH GACs are again presented according to their soil organic matter content and proposed end use of the land. The generic assessment criteria for a 1%, 2.5% and 6% SOM content are tabulated below and presented according to the proposed end use.

Guidelines on Contamination Levels

	LQM CIEH Generic Assessment Criteria (mg/kg dry weight soil)											
	Residential						Allotment Land Use			Commercial Land Use		
	With Plant Uptake			Without Plant Uptake								
SOM %	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**
Aliphatic												
EC 5 – 6	24	40	80	24	40	80	752	1730	3900	2400	4000	8000
EC > 6 – 8	52	110	250	52	110	250	2304	5580	13000	5200	11000	25000
EC > 8 – 10	13	30	70	13	30	70	321	770	1700	1300	3000	7000
EC > 10 – 12	60	150	360	60	150	360	2153	4300	7150	6000	15000	32000
EC > 12 – 16	500	1200	2600	500	1200	2600	10800	12400	13200	42000	72000	90000
EC > 16 – 35	41000	69000	94000	41000	69000	94000	240000	260000	260000	140000	160000	180000
EC > 35 – 44	41000	69000	94000	41000	69000	94000	240000	260000	260000	140000	160000	180000
Aromatic												
EC 5 – 7 (benzene)	50	110	240	155	300	630	12	25	57	15000	28000	55000
EC > 7 – 8 (toluene)	100	240	550	370	800	1800	21	50	117	33000	68000	130000
EC > 8 – 10	20	50	110	20	53	125	8.6	21	50	2000	5000	120000
EC > 10 – 12	63	150	340	120	280	650	12.5	31	74	11000	22000	31000
EC > 12 – 16	140	320	660	1100	1900	2300	23	57	134	35000	37000	38000
EC > 16 – 21	260	540	930	1800	1900	1900	47	112	260	28000	28000	28000
EC > 21 – 35	1100	1400	1700	1900	1900	1900	370	820	1500	28000	28000	28000
EC > 35 – 44	1100	1400	1700	1900	1900	1900	370	820	1500	28000	28000	28000
Benzene DEFRA C4SL	0.06	0.13	0.3 (0.87)	0.16	0.3	0.64 (3.3)	0.016	0.033	0.073 (0.18)	15	28	57 (98)
Toluene	104	240	550	370	830	1800	22	50	117	33000	68000	130000
Ethylbenzene	30	62	150	34	81	190	16	38	91	3200	7000	16000
o-xylene	30	70	170	40	90	200	28	67	160	3700	8000	19000
m-xylene	30	70	160	34	80	190	30	74	170	3400	8000	18000
p-xylene	30	70	160	33	80	180	28	69	160	3200	8000	17000

POS_{resi}	POS_{park}
140	230

TPH values calculated using CLEA v1.06 with parameter changes in accord with DEFRA (2014) C4SL and LQM/CIEH (2015)

Inert Material

The limit values for inert waste are given in the EC Landfill Directive 1999/31/EC as applied under the Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019 (*SI 2019/39*) and as defined by the council decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC(2003/33/EC).

The regulations and associated guidance provide waste acceptance criteria, which set the limits of contaminants permitted in various waste categories going to landfill. These criteria are of particular use where CLEA guidance or DEFRA Screening values has not yet been provided.

Inert waste is defined as waste which contains insignificant potential for pollution and does not endanger the quality of surface water or groundwater. The Landfill Directive states that inert waste will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health.

For risk assessment purposes we would consider that any materials (soils) containing concentrations of potential contaminants that would result in them being classified as inert would be considered as uncontaminated and therefore representing a low risk to human health.

Similarly, such material would not be considered to represent a significant risk to water resources.

Where CLEA or Defra screening values exist, these would always be used in preference to inert waste values when assessing risks to human health.

Selected inert waste acceptance criteria as given in Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills for the Landfill Directive are given below.

Landfill acceptance criteria for inert waste (mg/kg)	
Total organic carbon (TOC)	30,000
BTEX compounds	6
Mineral oils (C10 – C40)	500
PCBs	1
PAH	100

Risks to Plants

The CLEA framework does not provide a method for the assessment of phytotoxic risks to plants. However maximum permissible concentrations have been published in the Sludge (Use in Agriculture) Regulations 1989 (SI 1989, No. 1263). This legislation enforces the provisions of the EC Directive 86/278/EEC for potentially toxic elements (PTEs) on soils for agricultural use where sewage sludge has been applied (see table below). These limits relate to the potential risk to plants and not human health for which CLEA is the overriding risk assessment model.

Maximum permissible concentration in agricultural soils following sewage sludge application (mg/kg).				
	pH 5.0<5.5	**pH 5.5<6.0**	**pH 6.0-7.0**	**pH >7.0**
Zinc	200	250	300	450
Copper	80	100	135	200
Nickel	50	60	75	110

Risks to buried concrete

The potential risks to buried concrete can be assessed by reference to the BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground'. This document provides a methodology for the specification of concrete based on the ground conditions encountered and is based upon chemical analysis and associated factors (e.g. groundwater). The guidance provides a Design Sulphate Class (DS) based upon the ground conditions and it is considered that a low concentration of sulphate and pH (i.e. DS – 1 and DS – 2) is considered to represent a low risk to buildings.

Risks to buried services

In addition, where water is supplied in plastic pipes which could come into contact with contaminated ground then this can lead to premature failures, resulting in leakage and loss of water quality. Risks to water supply pipes are assessed using guidance published by the UK Water Industry Research (UKWIR) entitled '*Guidance for the Selection of Water Pipes to be used in Brownfield Sites'* (Report Ref. No. 10/WM/03/21). This is known as the UKWIR guidance.

Previous guidance from WRAS has been withdrawn but may still be in use by certain water supply companies. In general water companies have adopted a common set of guidelines as given in the ***Contaminated Land Assessment Guidance from January 2014.***

Additional threshold values for determining pipe material have also been published by certain water supply companies. If these threshold values are exceeded then consideration should be given to the selection of pipe material or to the use of barrier pipes. The UKWIR threshold values, together with those of certain water supply companies are presented in the table below for a range of potential hazards.

Substance[1]	Water UK Guidance	Thames Water
Total VOC	0.5	-
Total BTEX & MTBE	0.1	0.1 or either
Total SVOC	2	-
EC5-EC10 aliphatic and aromatic hydrocarbons	2	-
EC5-EC12 aliphatic hydrocarbons		0.5
EC5-EC12 aromatic hydrocarbons		0.5
EC10-EC16 aliphatic and aromatic hydrocarbons	10	-
EC12-EC21 aliphatic hydrocarbons		10
EC12-EC21 aromatic hydrocarbons		10
EC16-EC40 aliphatic and aromatic hydrocarbons	500	-
EC21-EC35 aliphatic hydrocarbons		500
EC21-EC35 aromatic hydrocarbons		500
Phenols	2	5*
Cresols and chlorinated phenols	2	2
Naphthalene	-	5
Ethers	0.5	-
Nitrobenzene	0.5	-
Ketones	0.5	-
Aldehydes	0.5	-
Amines	0	-
Corrosives pH and EC	# ##	

All units mg kg-1 in soil;
pH <7 for wrapped steel, pH <5 wrapped ductile iron and copper and ##EC >400µS/cm;
*Phenol limit at 2mg/kg in presence of BTEX.