



Hilfield Solar Farm and Battery Storage

Ground Investigation Assessment

on behalf of Elstree Green Limited

Prepared by R M Cameron Environmental Services Ltd | December 2020 |
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**GROUND INVESTIGATION ASSESSMENT
LAND AT SLADES FARM BUTTERFLY LANE
ALDENHAM ELSTREE WD6 3AD
FOR
AARDVARK EM LTD**

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1.0 INTRODUCTION

Cameron Environmental was instructed by Aardvark EM Ltd (The Client) to undertake an intrusive investigation across land at Slades Farm, Butterfly Lane Aldenham, Elstree, Herts, WD6 3AD. This ground investigation has been carried out in support of proposals by their Client to utilise the land as part of a proposed solar PV (photo voltaic) farm, which is to include the study site and adjacent fields to the north, north east, and north west.

It was indicated that the area of the study site had previously been subject to pre-licencing landfilling activity, with the land being restored and utilised for grazing purposes. The principal requirements of the investigation were to verify ground conditions at the site, with particular emphasis on determining:

- The potential for landfill gas generation and impacts that landfill gas may have on the proposed utilisation of this area;
- The geotechnical characteristics of the ground particularly the fill materials deposited;
- The extent of any chemical contamination of the fill materials deposited.

2.0 SITE LOCATION AND DESCRIPTION

The study site which formed part of Slades Farm, was located to the south east of Radlett on the northern side of Butterfly Lane at approximate National Grid Reference: TQ167971 and extended over an area of approximately 11.5 Hectares. At the time of the intrusive ground investigation which was carried out between 27th-29th April 2020, the site was laid to rough grass pasture and was being utilised for the grazing of 8 (No.) horses. The site was bisected by a stream which flowed in a generally northerly direction, within a shallow valley/depression. Parts of the field particularly close to the stream had been significantly poached by the livestock present in the site, with some areas also being quite soft and boggy.

The site was bounded to the north by open fields, and to the east by open fields, buildings and farmyard areas associated with Slades Farm. The southern and south eastern boundary was formed by Butterfly Lane, beyond which, were grounds associated with the Haberdashers Askes School. Ground to the south west was occupied by a paddock and an adjoining residential property. To the west and north west were open fields.

A Drawing showing the approximate site location (Figure 1), is presented in Appendix 1.

A Drawing showing the site layout and approximate borehole positions (Figure 2), is also provided in Appendix 1 of the current Report.

Photographs of the site and immediate surrounding areas are provided in Appendix 2 of the current Report.

2.1 Existing Studies

It is known that two (No.) earlier studies have previously been undertaken on this site by others. These have included:

- MJ Carter Associates ground investigation, which was reported in December 1996, Ref: SA/SL/JT/570/01, which is indicated to have comprised some limited gas and groundwater monitoring. It was indicated in this Report that the site had been subject to 'historic uncontrolled filling';



- GroundSpec+ Ltd ground investigation, undertaken on 25th & 26th March 2003, and reported in May 2003, Report Ref: 03-0050. This investigation was undertaken on behalf of the Haberdashers Askes School and their consideration for utilisation of the site for a sports/recreational ground. Site works comprised the installation of two deep boreholes to depths of 9.00m below ground level (with gas monitoring installations), and the excavation of 27 (No.) trial pits, dug by mechanical means to depths of up to 3.00m below ground level. In the eastern half of the site (the east of the bisecting stream), it was indicated that topsoil was encountered overlying London Clay. In the majority of the western area, topsoil overlay fill materials, and at depth, London Clay. It was indicated that the fill materials comprised, bricks, concrete, metal, timber, with occasional coke, fabric, plastic, cables coal dust wire, tile, pipes, pottery, paper and limestone paving slabs. At the maximum depth encountered, waste extended to beyond 4.50m below ground level (mbgl). Seepages of perched water were noted to be present in the fill material, but no distinct groundwater horizon was encountered. It was considered, based upon the limited monitoring information obtained, that there was a potential risk from landfill gas migration towards Slades Farm and the main School building complex of the Haberdashers Askes School.

2.2 Historical Usage

It is indicated in the GroundSpec+ Report, that the landfilling took place during the 1960s, with deposition of material directly on the existing ground surface. It is further indicated that although no records are held by Hertfordshire County Council or the Environment Agency, aerial photographs suggest that this took place after 1965. The filling activities are therefore likely to have been undertaken pre-Licensing; (pre-1974).

3.0 GEOLOGY HYDROGEOLOGY AND HYDROLOGY

3.1 Geology

The geological map for the site area, as published by the British Geological Survey online, 1:50,000 scale, indicates the presence of Bedrock of London Clay overlying at significant depth, the Woolwich Beds and in turn, Cretaceous Upper Chalk. The London Clay typically comprises a firm to stiff grey fissured Clay, weathering to brown near the surface.

No overlying Superficial Deposits are shown to be present across the study site.

3.2 Hydrogeology

The London Clay is indicated to represent a 'Non-Aquifer' and is generally not utilised for the abstraction of groundwater. It was indicated in the GroundSpec+ Report that no groundwater abstractions were present within the local vicinity.

It is considered, given the topographic position of the site, that near-surface groundwater is likely to flow in a generally north north easterly direction towards the Borehamwood Brook.

3.3 Hydrology

As indicated above, a small stream/ditch was present, roughly located centrally, and bisected the site. This stream appeared to flow in a generally south south east to north north west direction. Towards the north west corner of the study site, the stream converged with another ditch or stream which itself flowed along much of the north west boundary of the study site in a north north easterly direction, subsequently discharging into the Borehamwood Brook.

4.0 FIELDWORK

4.1 Intrusive Ground Investigation

In order to provide the necessary information on ground conditions at the site, it was proposed by Cameron Environmental to undertake site works over a period of three (No.) days, given the significant amount of tracking across soft ground that was likely to be needed. It was proposed to install up to 15 (No.) boreholes by percussive windowless sampler technique with combined landfill gas and groundwater monitoring standpipes to be installed in approximately 8 (No.) of the these boreholes for subsequent monitoring purposes. Borehole positions were proposed by Cameron Environmental to provide a broad coverage of the site and were proposed to be installed on both sides of the bisecting stream.

Site works were undertaken between 27th and 29th April 2020. Boreholes were installed using a light percussive 'Territor' windowless sampler rig operated by Geo Soils Ltd. This included a 98mm diameter casing system which is driven into the ground with a series of 1 metre long metal tubes, varying in diameter from 80mm down to 35mm, driven through the casing to obtain disturbed samples at regular depth intervals.

Site works were supervised by an experienced geo-environmental engineer employed by Risk Management Ltd. Boreholes were identified as; BH1 to BH15.

Boreholes BH1 to BH10 were drilled over the western section of the site, which, based upon the findings of the earlier GroundSpec+ ground investigation, was the section of the site which had been subject to historic landfilling activity. These boreholes extended to depths of between 3.00m to 6.00m below existing ground level. All ten (No.) boreholes penetrated through the landfill materials into the underlying Natural Ground.

Boreholes BH11-BH15 were drilled to the east of the stream, and did not encounter any significant thickness of landfill material. These five boreholes were all drilled to a depth of 3.00m below existing ground level, with only boreholes BH12-BH15 encountering a thin band of superficial Made Ground to 0.20m depth, which was not considered to be representative of landfill materials.

Drillers borehole logs are provided in Appendix 3.

Small disturbed samples were taken at regular depth intervals down the boreholes. In addition, the Risk Management Ltd Environmental Engineer recovered samples for subsequent chemical analyses, which were placed in borosilicate amber glass jars, plastic tubs and glass vials. These were immediately placed in a cool box for subsequent transport to the laboratory for chemical analyses.

Both chemical and geotechnical testing was undertaken on recovered samples.

Standard Penetration Test (SPT) 'N' values were also obtained at regular depth intervals within the boreholes. The Dynamic Probe employed for this comprises a weight of 63.6 kg dropping through a free-fall height of 762mm in accordance with British Standard BS 1377 : Part 9. The weight drives a 50mm diameter "split-spoon" sampler into the ground. The resistance to penetration is recorded for 6 consecutive 75mm increments with the SPT 'N' value calculated from an addition of the final four 4 readings.

The SPT 'N' values are plotted against depth on the two appended sheets provided in Appendix 4 of the current Report, one for boreholes BH1-BH10 located on the western section of the site

where landfill material was present and the other for boreholes BH11-BH15 where Natural Ground was encountered close to the ground surface.

Upon completion of boreholes BH1, BH2, BH3, BH4, BH6, BH8, BH10 and BH13, combined groundwater/gas monitoring standpipes were installed to depths of between 3.00m and 4.00m below existing ground level.

The monitoring installations comprised a 1 metre length of plain 50mm diameter HDPE pipe followed by slotted geotextile wrapped HDPE pipe, capped at the base. A cement/bentonite seal was installed from 1.00m to ground level and the installations finished with a gas valve on top of the pipe and a lockable stopcock cover concreted in flush with ground level.

4.2 Ground-borne Gas Monitoring

Following the initial site work, three return gas/groundwater monitoring visits were undertaken by Risk Management Limited on the 6th, 13th and 20th May 2020. On each visit, the barometric pressure was recorded together with concentrations of Carbon Dioxide, Oxygen and Methane. In addition, gas flow measurements were taken and the depth to groundwater recorded.

Full details of the readings are included on the appended Gas/Groundwater Monitoring Record Sheet provided in Appendix 5 of the current Report.

4.2.1 Methane

Methane concentrations determined in most of the standpipes appear to be relatively low, at values below instrument detection limit, although it may be noted that a maximum concentration of 1.3% by volume or 26% LEL (Lower Explosive Limit) was encountered in borehole BH2. For methane, 100% LEL represents 5% by volume. Borehole BH2 was installed in one of the areas where the deepest thickness of fill was encountered (4.50m). In borehole BH1, where a fill depth of 3.50m was encountered, a maximum methane concentration of 0.2% by volume was recorded.

Both boreholes BH1 and BH2 are located on ground to the west of the bisecting stream.

Methane concentrations determined in the other boreholes, were all found to be below the instrument detection limit (<0.1% by volume).

4.2.2 Carbon Dioxide

Carbon dioxide concentrations determined were raised slightly above typically background levels in many of the standpipes, with a maximum concentration of 6.7% by volume in the standpipe installed in borehole BH1. Again, borehole BH1 was installed in an area where the greatest thickness of fill materials appeared to be present. A maximum carbon dioxide concentration of 4.9% by volume was recorded in borehole BH2.

Carbon dioxide concentrations determined in the other boreholes monitored, ranged between 0.1% and 6.0% by volume, the latter being recorded in borehole BH3. Borehole BH3 was located within an area where a thickness of 4.40m of Made Ground was determined.

4.2.3 Oxygen

Oxygen concentrations recorded within boreholes installed on ground to the west of the bisecting stream, where landfill materials were encountered, ranged between; <0.1% by volume and 19.8% by volume. The highest values for oxygen depletion were encountered in boreholes BH1, BH2,



BH3 and BH6. Thicknesses of Made Ground determined in these four boreholes ranged between; 3.50m and 4.40m.

Oxygen concentrations determined in borehole BH13, installed on ground to the east of the bisecting stream, and where a Made Ground thickness of 0.20m was determined, ranged between 18.9% by volume and 19.1% by volume. This represents a very slight depletion on a typical atmospheric oxygen concentration of approximately 21% by volume.

4.2.4 Ground-borne Gas Flow Rates

The ground-borne gas flow rates determined in all of the standpipes were found to be negligible and at values below the instrument detection limit of 0.1/hr.

5.0 SITE FINDINGS

5.1 Strata Encountered

Full details of the light percussion borehole findings are given on the appended borehole record sheets provided in Appendix 4 of the current Report. However, in summary, the following was determined:

Borehole No.	Thickness of Made Ground Encountered	Borehole Termination Depth (bgl)
BH1	3.50m	5.00m
BH2	4.50m	6.00m
BH3	4.40m	5.00m
BH4	3.50m	5.00m
BH5	2.30m	4.00m
BH6	4.40m	5.00m
BH7	3.50m	4.00m
BH8	1.20m	3.00m
BH9	2.40m	3.00m
BH10	2.40m	3.00m
BH11	Not encountered	3.00m
BH12	0.20m	3.00m
BH13	0.20m	3.00m
BH14	0.20m	3.00m
BH15	0.20m	3.00m

The 'landfilled' Made Ground encountered within the western side of the site was described as mainly comprising; brown silty sandy clay with brick fragments, pieces of concrete, clinker and occasional fragments of timber, the latter being the principal biodegradable material described as being present. Within some of the boreholes, the fill material encountered was poorly compacted, with, in some horizons, little to no core recovery. This was particularly noted to be the case in borehole BH2.

Underlying the Made Ground in boreholes BH1-BH10 and Grass over Topsoil or shallow Made Ground in boreholes BH11-BH15 was silty Clay, sandy in parts and with occasional gravel.

5.2 Groundwater

Groundwater was encountered during boring, and during the return monitoring, visits as follows;



Borehole No.	Groundwater depth encountered during boring (mbgl)	Highest groundwater depth during monitoring visits (mbgl)
BH1	3.00m	2.60m
BH2	3.50m	3.18m
BH3	3.20m	3.26m
BH4	3.50m	3.13m
BH5	Not noted.	-
BH6	3.00m	2.91m
BH7	3.00m	-
BH8	Not noted.	0.94m
BH9	Not noted.	-
BH10	Not noted.	2.28m
BH11	2.00m	-
BH12	Not noted.	-
BH13	Not noted.	2.74m
BH14	Not noted.	-
BH15	Not noted.	-

6.0 LABORATORY ANALYSES AND TESTING

6.1 Laboratory Geotechnical Testing

The following geotechnical laboratory tests have been carried out on samples recovered from boreholes BH11-BH15 at this site, outside the landfill area.

Unless otherwise stated, the geotechnical tests have generally been carried out in accordance with the recommendations given in British Standard 1377:1990, "Methods of Test for Soils for Civil Engineering Purposes".

The Geotechnical testing results are provided in Appendix 6 of the current Report.

6.1.1 Natural Moisture Content

The natural moisture content has been determined for five samples of the underlying natural Clay taken from depths of between 1.00m and 2.00m below existing ground level.

The natural moisture contents were found to range between 28% and 39%.

6.1.2 Atterberg Limits Tests

The Atterberg Limits have been determined for two samples of the underlying natural Clay taken from borehole BH12 at a depth of 1.00m and from borehole BH14 at 1.50m depth.

The liquid limits (LL) were 72% and 88%, the plastic limits (PL) 35% and 36% and the plasticity index (PI) 45 and 53.

These results indicate that the samples tested would be classified as Clay of 'Very High' plasticity (CV), in accordance with the Casagrande Geotechnical classification system.

In addition, the samples tested would be classified as having a 'medium' to 'high' potential for swelling/shrinking in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards, after correction for stone content.

6.1.3 Quick Undrained Triaxial Compression Tests

The undrained shear strength has been determined in single stage triaxial compression for three re-moulded, 38mm diameter samples of the natural Clay taken from borehole BH11 at a depth of 1.50m, borehole BH13 at 1.00m depth and borehole BH15 at 2.00m depth.

The resulting mean shear stress (undrained cohesion) C_u values were found to range between 45 kN/m² and 86 kN/m² indicating that the samples tested at this site ranged from 'firm' to 'stiff' in consistency.

6.1.4 pH and Sulphate Tests

The pH has been determined for a total of twelve samples from across the site. The pH values were found to range between 7.0 and 9.2.

The sulphate content has also been determined for four samples on a 2:1 water: soil extract and were found to range between 0.06 g/l and 0.95 g/l.

6.2 Laboratory Chemical Analyses

Chemical laboratory testing has also been undertaken on 10 (No.) selected samples from across the whole of the site (BH1-BH15).

The results of chemical laboratory analyses of the selected samples analysed are presented in Appendix 7 of the current Report.

The chemical testing was carried out in accordance with standard industry methods in a UKAS approved laboratory which is also currently accredited in accordance with MCERTS for the majority of its testing. Further information regarding this accreditation is available on request together with a full list of test methods if required. Analyses also included for the presence of asbestos.

Given the official withdrawal of the DEFRA/EA Soil Guideline Values (SGVs), the current assessment utilised the latest LQM/CIEH S4ULs (Suitable for Use Levels) for comparison against, (Registered User No. S4UL3450). In the absence of a LQM/CIEH S4UL for lead, lead results have been compared against the latest DEFRA/CL:AIRE CAT4SLs.

As the proposed reuse of this area of ground will be continued commercial type activity, the soil chemical analytical results have been compared against LQM/CIEH S4ULs for Commercial & Industrial land-use scenario.

In Appendix 8, these results have also been compared against the latest LQM/CIEH S4UL and DEFRA/CL:AIRE CAT4SLs for soil reuse in a Commercial & Industrial land-use scenario.

Comparison of these results obtained, indicates that:

- None of the soil samples analysed exceeded the latest LQM/CIEH S4UL for metals and metalloids;
- None of the soil samples analysed exceeded the latest DEFRA/CL:AIRE CAT4SLs for lead;



- None of the soil samples analysed exceeded the latest DEFRA/CL:AIRE CAT4SLs for PAHs (polynuclear aromatic hydrocarbons);
- None of the soil samples analysed exceeded the latest DEFRA/CL:AIRE CAT4SLs for petroleum hydrocarbons;
- None of the samples tested were found to contain fibres of asbestos.

7.0 DISCUSSION AND CONCLUSIONS

7.1 Ground Conditions

Boreholes BH1-BH10 indicate that the Made Ground across the previous landfill varied in depth between 1.20m and 4.50m. The Made Ground was penetrated fully in all ten boreholes in this area, and the underlying Natural Ground encountered. The maximum fill depth determined (approximately 4.50m) is generally consistent with that determined in the earlier GroundSpec+ Ltd ground investigation, undertaken in 2003.

Boreholes BH11-BH15 were drilled on ground to the east of the stream and did not encounter any significant thicknesses of material which was considered to be representative of landfill deposits. These five boreholes were all drilled to a depth of 3.00m below existing ground level with boreholes BH12-BH15 encountering a thin band of superficial Made Ground to 0.20m depth. This was not considered to be representative of landfill deposits.

The underlying Natural Ground generally comprised a 'firm' to 'stiff' silty Clay, sandy in parts, and with occasional gravel.

Consistent with the BGS mapping, no overlying Superficial Deposits were encountered above the London Clay Bedrock Deposits, which were encountered across all of the study site.

7.2 Groundwater

As discussed above, groundwater was encountered in boreholes BH1-BH4, BH6 & BH7 at depths of between 3.00m and 3.50m during boring and generally at a similar depth during the return monitoring visits. In addition, groundwater was not noted in borehole BH8 during boring but was found to be as high as 0.94m below existing ground level during the return monitoring visits.

Groundwater in boreholes BH11-BH15 was only noted during boring in borehole BH11 at 2.00m depth. During the return monitoring visits to borehole BH13 groundwater was noted as high as 2.74m below existing ground level.

It appears that where groundwater was encountered, then this was predominantly perched above the lower permeability underlying London Clay, with topographic levels probably being influenced significantly by impacts for any recent precipitation, and seasonal effects.

With respect to impact on any foundation construction, associated with the proposed solar PV farm, should higher seasonal groundwater or surface water accumulate at the base of service or foundation excavations, it will be very important that these are kept dry by, for example, pumping from a sump, the foundation base is kept square and that any soft spots are replaced and compacted prior to pouring of foundation concrete.

Further, it is recommended that where groundwater or surface water flows into foundation excavations, 'blinding' concrete is used at the base of the foundation excavations and that foundation concrete is poured as soon as possible thereafter.

7.3 Landfill Gas

Based upon the results of the recent monitoring carried out to date, there appears to be evidence of some residual degradation of organic matter continuing to take place within landfilled material deposited at this site, although this appears to be predominantly of an aerobic rather than anaerobic nature, with much higher concentrations of carbon dioxide being generated compared to methane. The concentrations of methane and carbon dioxide determined are also considered to be consistent with the description of the fill materials present in the landfill, with what appear to be, relatively low concentrations of biodegradable materials remaining, which appeared to be predominantly comprising fragments of wood.

It also appears that very limited generation of ground-borne gas is taking place on ground within the study site located to the east of the bisecting stream. This is consistent with the very limited to negligible placement of landfill materials which appears to have taken place in this area of the site.

In comparison with the findings of the GroundSpec+ ground investigation, their limited results (obtained in 2003), are considered to be relatively similar, with recorded maximum methane concentrations below instrument detection limit (<0.1% by volume) and maximum carbon dioxide concentration of 5.6% by volume. Again, ground-borne gas flow rates were found to be below instrument detection limit.

As there appears to be a limited thickness of impermeable capping material across this site, it is considered likely that atmospheric oxygen ingress is taking place (hence a predominance of carbon dioxide over methane) and conversely ground surface venting of ground-borne/generated gas is also likely to be currently taking place. Whilst this current situation is allowed to prevail, it is considered that significant off-site migration of ground-borne gas is unlikely to be taking place, although to provide further confirmation of this, it would be necessary to install monitoring boreholes around the site perimeter, particularly around the western and south western and north western sides, where significant thicknesses of landfill materials are known to have been deposited.

However, as there does appear to be a limited thickness of impermeable capping material across the site, it is considered, albeit that relatively low concentrations have been recorded in monitoring boreholes recently installed, that ground-borne gases generated within the landfilled material in ground to the west of the bisecting stream, are likely to be of concern with regards to impact on any development taking place across this area. This would particularly be the case in terms of the potential for accumulation of carbon dioxide within any confined spaces and asphyxiation risks and to a lesser extent intoxication impacts, also associated with this gas. Given that a maximum methane concentration of 1.3% by volume was recorded in the standpipe installed in borehole BH3, then there remain some slight concerns about the potential for methane accumulation in any new buildings constructed on the site.

7.3.1 Ground-borne Gas Screening Value and Characterisation

Based upon Guidance provided in CIRIA 149, (Protecting Development From Methane) it is considered that based upon known previous usage, that the study site would be classified as, Characteristic Situation 'CS3' or 'CS4', i.e. either 'Old Landfill' (Characteristic Situation 3) or 'Completed Landfill' (Characteristic Situation 4).

Based upon Guidance provided in CIRIA Guidance Document C665, (Assessing Risks Posed by Hazardous Ground Gases to Buildings), and using Gas Screening Values to characterise the sites:

The gas screening value (GSV) for the site has been calculated as follows, based upon the following data:

- Maximum gas concentration determined (methane or carbon dioxide): 6.7% by volume – for carbon dioxide in borehole BH1;
- Maximum flow rate taken as 0.1l/hr (for the purpose of calculating a safe GSV this has been increased from <0.1l/hr).

$$\text{GSV} = (0.1 \text{ l/hr}) \times (0.067 \% \text{ vol. CO}_2) = 0.0067 \text{ l/hr}$$

Based on this GSV, the site's gas classification is Characteristic Situation 1 (CS1) as defined in Table 8.5 of CIRIA C665.

For CS1, Table 8.6 of CIRIA C665 indicates that no special precautions are required with respect to construction of office/commercial/industrial development. However, for CS3 and CS4, two to four levels of protection are required, which comprise, where office/commercial/industrial type buildings are constructed on the site:

- a) Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft with at least 1200g DPM² (Damp Proof Membrane);
- b) Beam and block or pre-cast concrete slab and minimum 2000g DPM/reinforced gas membrane;
- c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use.

All joints and penetrations must also be sealed.

In addition to the above for CS3 and CS4, a proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility would be needed. For CS4, there would be the additional requirement of ground venting wells or barriers.

It is considered based upon the findings of the gas monitoring to date that there are unlikely to be significant benefits in utilising ground venting wells or barriers. However, it is considered that the measures indicated in points a) and b) should be introduced together with the requirements of CS3 and CS4, i.e. a proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space (as appropriate) with monitoring facility.

Given the concentrations of methane determined in the monitoring boreholes recently installed (between <0.1 and 1.3% by volume), it is considered that there are unlikely to any significant risks associated with explosivity or combustion of this gas at the ground surface, where suitable atmospheric dilution is taking place, provided however that precautionary measures, as described above are implemented within any buildings constructed on the site.

7.4 Soil and Fill Material Contamination

Soils encountered in the boreholes drilled, exhibited no significant visual or olfactory evidence of significant contamination, and the 10 (No.) samples analysed for a suite of toxic and phytotoxic determinands were found not to exceed the latest LQM/CIEH S4UL and DEFRA/CL:AIRE CAT4SLs Generic Assessment Criteria (GAC) values for soil reusage in a Commercial & Industrial scenario. However, slightly elevated concentrations of lead and zinc were determined in a number of the samples tested.

However, of the 10 (No.) samples tested, no asbestos fibres were determined in the samples analysed

7.5 Geotechnical Considerations

As discussed above, it is understood that a large section of the western side of the site is known to have been an historic landfill, and the current work was therefore commissioned to provide information on the sub-soil conditions, together with laboratory testing, in order to provide information regarding any contamination within the landfill and for possible future foundation design by others.

7.5.1 Foundation Design

From the evidence of the boreholes, shallow foundation or service excavations deeper than about 1 metre will require support in the Made Ground. It is therefore recommended that a contingency is allowed for this at this stage.

Due to the heterogeneous nature of Made Ground, encountered, particularly within ground to the west of the bisecting stream, it is recommended restricting the maximum allowable bearing pressure to some 50 kN/m² at a minimum depth of some 1.00m in the area of the landfill. This could be increased to some 100 kN/m² at a depth of between 1.00m and 2.00m where Natural Ground is encountered.

The results of the Atterberg Limit tests indicate that the natural silty Clay encountered across the site had a 'medium' to 'high' potential for swelling and/or shrinking in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standard. Precautions against shallow foundation sides in the form of compressible material, may therefore be required at this site where they fall within the 'zone of influence' of past, existing or future trees.

In the area of the previous landfill (essentially ground to the west of the bisecting stream), additional reinforcement, top and bottom, should be considered for conventional strip or pad foundations to avoid the effects of differential settlement in the Made Ground. In addition, should ground bearing rafts/slabs be considered then adequate reinforcement should be incorporated into the foundation design and the effects of differential movement across the slab designed for.

It should be noted that should ground conditions differing significantly from those described in our report be encountered during foundation excavation, then Cameron Environmental and Risk Management Limited should be contacted immediately and the above noted allowable bearing pressure or recommended foundation type may need to be altered accordingly.

7.5.2 Buried Concrete Mix Design

The results of the chemical tests at this site indicate that the samples tested, to a depth of 3.00m below existing ground level, would fall into Classes DS-1 and DS-2 of the Building Research Establishments (BRE) classification system.

8.0 RECOMMENDATIONS

8.1 Protection of Groundworkers

Although, as indicated above, no information is currently available which suggests that site soils are significantly contaminated, it is however recommended that, care should be taken by groundworkers and any future construction staff during works, to adopt good standards of personal hygiene and take into consideration recommendations presented in the HSE Guidance Document HS(G)66 'Protection of Workers and the General Public during the Development of



Contaminated Land'. Groundworkers and Construction workers should wear adequate and appropriate PPE whilst working on the site.

It should also be remembered that ground to the west of the bisecting stream represents an historic unlicensed landfill, with likely little control at the time of filling on the nature of materials deposited. On this basis, there could be significant variability in the nature of material encountered during any pre-construction groundworks carried out.

8.2 Control of Impacts from Ground-borne Gas

Although concentrations of methane and carbon dioxide determined in the boreholes recently installed have been found to be relatively low, it is recommended that measures described in Section 7.3.1 (Ground-borne Gas Screening Value and Characterisation), be incorporated into any structures built upon this site. This will be a particular requirement on ground to the west of the bisecting stream.



APPENDIX 1

Figure 1 Plan Showing Site Location

Figure 2 Plan Showing Approximate Positions of Boreholes



Client: Aardvark EM Limited

Site: Land at Slades Farm Butterfly Lane
Aldenham Elstree WD6 3AD

Date: June 2020

Title: Figure 1 Approximate Site
Location

Project Ref: RMC/Feb/20/03/P/Draft1

Scale: Not to scale





Client: Aardvark EM Limited

Site: Land at Slades Farm Butterfly Lane
Aldenham Elstree WD6 3AD

Date: June 2020

Title: Figure 2 Approximate Positions
of Boreholes

Project Ref: RMC/Feb/20/03/P/Draft1

Scale: Not to scale





APPENDIX 2

Site Photographs



**View across eastern side of study site looking north
north west (above) and
looking north west (below) from near Slades Farm on
eastern corner of site**





View across study site parallel with Butterfly Lane looking south west from near Slades Farm (above) and (below) looking north north west along bisecting stream near boundary with Butterfly Lane





View looking north east along north western site boundary (above) and east north east towards Slades Farm from southern boundary of site parallel with Butterfly Lane (below)





View looking north west along north eastern site boundary near Slades Farm (above) and east towards Slades Farm from western site boundary (below)



APPENDIX 3

Drillers' Logs

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>27/04/2020</i>	DIS/BH No.: <i>1</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.10</i>	<i>Made Ground (brown-orange silty sandy clay with brick fragments, pieces of concrete</i>				
<i>2.00</i>	<i>D4</i>		<i>and occasional sub-angular gravel).</i>				
<i>2.50</i>	<i>D5</i>						
<i>3.00</i>	<i>D6</i>	<i>1.40</i>	<i>Made Ground (dark grey silty sandy clay with pieces timber, brick fragments and</i>				
<i>4.00</i>	<i>D7</i>		<i>pieces of concrete).</i>	Groundwater Details			
<i>5.00</i>	<i>D8</i>			Depth Struck		<i>3.0</i>	
		<i>3.50</i>	<i>Firm, brown-orange silty sandy CLAY.</i>	Rise			
				Sample Depth			
		<i>5.00</i>	<i>Hole ended.</i>	Standpipe Depth		<i>4.0</i>	
				Gas Valve (Y/N)		<i>Y</i>	
				Stopcock Cover (Y/N)		<i>Y</i>	
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 3,4,4,4,6,4 2.00m = 2,3,3,3,3,3 3.00m = 15,9,3,3,2,2</i>	Name _____			
			<i>4.00m = 3,2,2,3,4,3</i>	Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.05-0.30m, 1.30-1.60m, 3.50-3.80m</i>				Details of hard driving/hole abandoned:			
Roots noted until: <i>N/A</i>				Hole ended: <i>5.00m</i>			

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>27/04/2020</i>	DIS/BH No.: <i>2</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.15</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>0.50</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.08</i>	<i>Made Ground (brown-orange silty sandy clay with sub-angular gravel and crushed</i>				
<i>2.00</i>	<i>D4</i>		<i>stone).</i>				
<i>2.50</i>	<i>D5</i>						
<i>3.00</i>	<i>D6</i>	<i>1.20</i>	<i>Made Ground (brown silty sandy clay with brick fragments, pieces of concrete and</i>				
<i>5.00</i>	<i>D7</i>		<i>Sub-angular gravel).</i>	Groundwater Details			
<i>6.00</i>	<i>D8</i>			Depth Struck		<i>3.5</i>	
		<i>3.00</i>	<i>No recovery of sample, soft fill material which fell out!!</i>	Rise			
				Sample Depth			
		<i>4.50</i>	<i>Firm brown silty CLAY.</i>	Standpipe Depth		<i>4.0</i>	
				Gas Valve (Y/N)		<i>Y</i>	
		<i>6.00</i>	<i>Hole ended.</i>	Stopcock Cover (Y/N)		<i>Y</i>	
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 1,2,2,3,2,2 2.00m = 1,0,0,1,0,1 3.00m & 4.00m both dropped</i>	Name _____			
			<i>with just weights on! 5.00m = 2,3,2,2,2,2 6.00m = no spt due to BH caving in.</i>	Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.60-0.90m, 3.60-3.90m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>6.00m</i>				

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>27/04/2020</i>	DIS/BH No.: <i>3</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.08</i>	<i>Made Ground (brown-orange silty sandy clay with brick fragment, pieces of concrete</i>				
<i>2.00</i>	<i>D4</i>		<i>and occasional sub-angular gravel).</i>				
<i>3.00</i>	<i>D5</i>						
<i>4.00</i>	<i>D6</i>	<i>2.00</i>	<i>Made Ground (dark grey very silty clay with pieces of timber, brick fragments and</i>				
<i>5.00</i>	<i>D7</i>		<i>Sub-angular gravel).</i>	Groundwater Details			
				Depth Struck		<i>3.2</i>	
		<i>4.40</i>	<i>Firm, brown silty CLAY.</i>	Rise			
				Sample Depth			
		<i>5.00</i>	<i>Hole ended.</i>	Standpipe Depth		<i>4.0</i>	
				Gas Valve (Y/N)		<i>Y</i>	
				Stopcock Cover (Y/N)		<i>Y</i>	
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 1,1,1,2,1,1 2.00m = 2,1,0,0,0,0 3.00m & 4.00m both dropped</i>	Name _____			
			<i>with just weights on! 5.00m = 2,3,3,2,3,3</i>	Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken:</i> <i>0.05-0.30m & 0.90-1.20m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>5.00m</i>				

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>27/04/2020</i>	DIS/BH No.: <i>4</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.08</i>	<i>Made Ground (brown silty sandy clay with brick fragment, pieces of concrete and occasional sub-angular gravel).</i>				
<i>2.00</i>	<i>D4</i>						
<i>2.50</i>	<i>D5</i>						
<i>3.00</i>	<i>D6</i>	<i>3.50</i>	<i>Soft, brown-orange silty CLAY.</i>				
<i>3.50</i>	<i>D7</i>			Groundwater Details			
<i>4.00</i>	<i>D8</i>	<i>4.20</i>	<i>Becoming firm.</i>	Depth Struck		<i>3.5</i>	
<i>4.50</i>	<i>D9</i>			Rise			
<i>5.00</i>	<i>D10</i>			Sample Depth			
		<i>5.00</i>	<i>Hole ended.</i>	Standpipe Depth		<i>4.0</i>	
				Gas Valve (Y/N)		<i>Y</i>	
				Stopcock Cover (Y/N)		<i>Y</i>	
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 1,1,1,1,0,1 2.00m = 1,2,2,2,1,1 3.00m = 1,0,0,1,0,1</i>	Name _____			
			<i>5.00m = 3,2,2,2,2,2</i>	Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.50-0.80m & 3.50-3.80m</i>				Details of hard driving/hole abandoned:			
Roots noted until: <i>N/A</i>				Hole ended: <i>5.00m</i>			

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>27/04/2020</i>	DIS/BH No.: <i>5</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>1.00</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>2.00</i>	<i>D2</i>						
<i>2.50</i>	<i>D3</i>	<i>0.08</i>	<i>Made Ground (brown silty sandy clay with brick fragment, pieces of concrete</i>				
<i>3.00</i>	<i>D4</i>		<i>and sub-angular gravel).</i>				
<i>3.50</i>	<i>D5</i>						
<i>4.00</i>	<i>D6</i>	<i>2.30</i>	<i>Firm, brown-orange silty CLAY.</i>				
				Groundwater Details			
		<i>3.40</i>	<i>With very occasional fragments of siltstone.</i>	Depth Struck			<i>N/A</i>
				Rise			
				Sample Depth			
		<i>4.00</i>	<i>Hole ended.</i>	Standpipe Depth			
				Gas Valve (Y/N)			
				Stopcock Cover (Y/N)			
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 1,1,0,0,0,0 2.00m = 1,1,1,1,1,1 3.00m = 4,4,4,4,4,4</i>	Name _____			
			<i>4.00m = 3,3,4,3,3,3</i>	Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken:</i> <i>0.15-0.45m & 3.50-3.80m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>4.00m</i>				

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>28/04/2020</i>	DIS/BH No.: <i>6</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>1.00</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>2.00</i>	<i>D2</i>						
<i>2.50</i>	<i>D3</i>	<i>0.08</i>	<i>Made Ground (brown silty sandy clay with brick fragments).</i>				
<i>3.00</i>	<i>D4</i>						
<i>3.50</i>	<i>D5</i>	<i>1.70</i>	<i>Made Ground (dark grey/black clinker fill).</i>				
<i>4.00</i>	<i>D6</i>						
		<i>2.20</i>	<i>Made Ground (brown silty sandy clay with a little dark grey staining, brick fragments And pieces of concrete).</i>	Groundwater Details			
				Depth Struck			<i>3.0</i>
				Rise			
		<i>4.40</i>	<i>Firm, brown-orange silty CLAY.</i>	Sample Depth			
				Standpipe Depth			<i>4.0</i>
		<i>5.00</i>	<i>Hole ended.</i>	Gas Valve (Y/N)			<i>Y</i>
				Stopcock Cover (Y/N)			<i>Y</i>
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 1,1,2,2,1,2 2.00m = 1,0,0,1,1,0 3.00m & 4.00 both went down with just the weights! 5.00m = No SPT due to caving in.</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.20-0.50m & 1.20-1.50m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>4.00m</i>				

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>28/04/2020</i>	DIS/BH No.: <i>7</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.50</i>	<i>D2</i>						
<i>2.00</i>	<i>D3</i>	<i>0.08</i>	<i>Made Ground (brown silty clay with occasional brick fragments).</i>				
<i>2.50</i>	<i>D4</i>						
<i>3.00</i>	<i>D5</i>	<i>0.70</i>	<i>Made Ground (brick fill).</i>				
<i>4.00</i>	<i>D6</i>						
		<i>1.10</i>	<i>Made Ground (brown silty clay with occasional brick fragments).</i>	Groundwater Details			
				Depth Struck		<i>3.0</i>	
		<i>2.00</i>	<i>Made Ground (dark grey-green very silty clay with brick fragments and clinker).</i>	Rise			
				Sample Depth			
		<i>3.50</i>	<i>Soft to firm, brown-orange silty CLAY.</i>	Standpipe Depth			
				Gas Valve (Y/N)			
		<i>4.00</i>	<i>Hole ended.</i>	Stopcock Cover (Y/N)			
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 5,4,6,5,4,4 2.00m = 1,1,1,2,1,1 3.00m = 1,0,1,0,1,1,0</i>	Name _____			
			<i>4.00m = 2,3,3,3,3,3</i>	Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.30-0.60m & 0.90-1.20m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>4.00m</i>				

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>28/04/2020</i>	DIS/BH No.: <i>8</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>1.00</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.50</i>	<i>D2</i>						
<i>2.00</i>	<i>D3</i>	<i>0.05</i>	<i>Made Ground (brown silty sandy clay with brick fragments, pieces of concrete and</i>				
<i>2.50</i>	<i>D4</i>		<i>sub-angular gravel).</i>				
<i>3.00</i>	<i>D5</i>						
		<i>1.20</i>	<i>Firm, brown-orange silty CLAY.</i>				
				Groundwater Details			
		<i>3.00</i>	<i>Hole ended.</i>	Depth Struck			<i>N/A</i>
				Rise			
				Sample Depth			
				Standpipe Depth			<i>3.0</i>
				Gas Valve (Y/N)			<i>Y</i>
				Stopcock Cover (Y/N)			<i>Y</i>
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 3,2,3,2,2,2 3.00m = 2,2,3,4,2,3</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.20-0.50m & 1.90-2.20m</i>				Details of hard driving/hole abandoned:			
Roots noted until: <i>N/A</i>				Hole ended: <i>3.00m</i>			

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>28/04/2020</i>	DIS/BH No.: <i>9</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>1.00</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.50</i>	<i>D2</i>						
<i>2.00</i>	<i>D3</i>	<i>0.05</i>	<i>Made Ground (dark brown silty sandy clay with brick fragments, pieces of glass and occasional sub-angular gravel).</i>				
<i>2.50</i>	<i>D4</i>						
<i>3.00</i>	<i>D5</i>						
		<i>0.90</i>	<i>Made Ground (dark brown silty clay with dark grey staining and brick fragments).</i>				
				Groundwater Details			
		<i>2.40</i>	<i>Firm, brown-orange silty CLAY.</i>	Depth Struck		<i>N/A</i>	
				Rise			
		<i>3.00</i>	<i>Hole ended.</i>	Sample Depth			
				Standpipe Depth			
				Gas Valve (Y/N)			
				Stopcock Cover (Y/N)			
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 6,4,3,2,2,2 2.00m = 3,2,2,2,2,2</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 1.20-1.50m & 2.40-2.70m</i>				Details of hard driving/hole abandoned:			
Roots noted until: <i>N/A</i>				Hole ended: <i>3.00m</i>			

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>28/04/2020</i>	DIS/BH No.: <i>10</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>1.00</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.50</i>	<i>D2</i>						
<i>2.00</i>	<i>D3</i>	<i>0.05</i>	<i>Made Ground (brown silty sandy clay with brick fragments, pieces of concrete and</i>				
<i>2.50</i>	<i>D4</i>		<i>clinker).</i>				
<i>3.00</i>	<i>D5</i>						
		<i>0.60</i>	<i>Made Ground (brown-orange silty clay with occasional brick fragments).</i>				
				Groundwater Details			
		<i>2.40</i>	<i>Firm, brown-orange silty CLAY.</i>	Depth Struck			<i>N/A</i>
				Rise			
		<i>3.00</i>	<i>Hole ended.</i>	Sample Depth			
				Standpipe Depth			<i>3.0</i>
				Gas Valve (Y/N)			<i>Y</i>
				Stopcock Cover (Y/N)			<i>Y</i>
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 3,4,3,4,4,3 2.00m = 2,3,2,2,3,4</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.20-0.50m & 2.50-2.80m</i>				Details of hard driving/hole abandoned:			
Roots noted until: <i>N/A</i>				Hole ended: <i>3.00m</i>			

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>28/04/2020</i>	DIS/BH No.: <i>11</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Topsoil with occasional brick fragments.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.20</i>	<i>Firm, brown-orange silty CLAY.</i>				
<i>2.00</i>	<i>D4</i>						
<i>2.50</i>	<i>D5</i>	<i>2.00</i>	<i>With occasional fragments of siltstone.</i>				
<i>3.00</i>	<i>D6</i>						
		<i>3.00</i>	<i>Hole ended.</i>	Groundwater Details			
				Depth Struck			<i>2.0</i>
				Rise			
				Sample Depth			
				Standpipe Depth			
				Gas Valve (Y/N)			
				Stopcock Cover (Y/N)			
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 2,2,2,2,2,2 2.00m = 2,1,3,3,3,3 3.00m = 2,3,3,4,3,3</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.00-0.10m & 0.10-0.40m</i>				Details of hard driving/hole abandoned:			
Roots noted until: <i>N/A</i>				Hole ended: <i>3.00m</i>			

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>29/04/2020</i>	DIS/BH No.: <i>12</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.05</i>	<i>Made Ground (brown silty clay with occasional brick fragments).</i>				
<i>2.00</i>	<i>D4</i>						
<i>2.50</i>	<i>D5</i>	<i>0.20</i>	<i>Firm, brown-orange silty CLAY.</i>				
<i>3.00</i>	<i>D6</i>						
		<i>3.00</i>	<i>Hole ended.</i>	Groundwater Details			
				Depth Struck			<i>N/A</i>
				Rise			
				Sample Depth			
				Standpipe Depth			
				Gas Valve (Y/N)			
				Stopcock Cover (Y/N)			
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 1,2,3,2,2,3 2.00m = 3,3,3,3,3,3 3.00m = 2,2,4,3,3,3</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.05-0.20m & 0.20-0.50m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>3.00m</i>				

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>29/04/2020</i>	DIS/BH No.: <i>13</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.05</i>	<i>Made Ground (brown silty clay with occasional brick fragments).</i>				
<i>2.00</i>	<i>D4</i>						
<i>2.50</i>	<i>D5</i>	<i>0.20</i>	<i>Firm, brown-orange silty CLAY.</i>				
<i>3.00</i>	<i>D6</i>						
		<i>2.00</i>	<i>Becoming brown in colour with pockets of orange-brown & grey silt.</i>	Groundwater Details			
				Depth Struck			<i>N/A</i>
		<i>3.00</i>	<i>Hole ended.</i>	Rise			
				Sample Depth			
				Standpipe Depth			<i>3.0</i>
				Gas Valve (Y/N)			<i>Y</i>
				Stopcock Cover (Y/N)			<i>Y</i>
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 3,2,3,3,2,3 2.00m = 1,1,2,2,3,2 3.00m = 2,3,3,3,3,3</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.05-0.20m & 0.20-0.50m</i>				Details of hard driving/hole abandoned:			
Roots noted until: <i>N/A</i>				Hole ended: <i>3.00m</i>			

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>29/04/2020</i>	DIS/BH No.: <i>14</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.05</i>	<i>Made Ground (brown silty clay with occasional brick fragments).</i>				
<i>2.00</i>	<i>D4</i>						
<i>2.50</i>	<i>D5</i>	<i>0.20</i>	<i>Firm, brown-orange silty CLAY.</i>				
<i>3.00</i>	<i>D6</i>						
		<i>2.00</i>	<i>Becoming brown in colour with pockets of orange-brown & grey silt.</i>	Groundwater Details			
				Depth Struck			<i>N/A</i>
		<i>3.00</i>	<i>Hole ended.</i>	Rise			
				Sample Depth			
				Standpipe Depth			
				Gas Valve (Y/N)			
				Stopcock Cover (Y/N)			
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 2,2,1,3,2,2 2.00m = 3,3,2,3,2,2 3.00m = 4,5,3,3,3,3</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.05-0.20m & 0.20-0.50m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>3.00m</i>				

Drive in Sampler Daily Drillers Records	Contract Name: <i>Elstree</i>	Date: <i>29/04/2020</i>	DIS/BH No.: <i>15</i>
	Operators: <i>Paul & Ian</i>	Job No.: <i>7329</i>	

Sample/Test Details		Strata Details		Drive Details			
Depth (mm)	Sample/Test	Strata Depth	Description	Dia (mm)	Drive Depth	Sample Length	Hole depth
<i>0.50</i>	<i>D1</i>	<i>0.0</i>	<i>Grass over topsoil.</i>	<i>Rig</i>			
<i>1.00</i>	<i>D2</i>						
<i>1.50</i>	<i>D3</i>	<i>0.05</i>	<i>Made Ground (brown silty clay with occasional brick fragments).</i>				
<i>2.00</i>	<i>D4</i>						
<i>2.50</i>	<i>D5</i>	<i>0.20</i>	<i>Soft to firm, brown-orange silty CLAY.</i>				
<i>3.00</i>	<i>D6</i>						
		<i>1.30</i>	<i>Becoming brown in colour with pockets of orange-brown & grey silt.</i>	Groundwater Details			
				Depth Struck			<i>N/A</i>
		<i>3.00</i>	<i>Hole ended.</i>	Rise			
				Sample Depth			
				Standpipe Depth			
				Gas Valve (Y/N)			
				Stopcock Cover (Y/N)			
				Final Site Inspection Completed			
			<i>SPT Results, 1.00m = 2,1,1,1,2,2 2.00m = 3,2,2,2,2,2 3.00m = 2,3,3,2,2,2</i>	Name _____			
				Date _____			
				Time _____			
				Signature _____			
Remarks: <i>Contamination samples taken: 0.05-0.20m & 0.20-0.50m</i>			Details of hard driving/hole abandoned:				
Roots noted until: <i>N/A</i>			Hole ended: <i>3.00m</i>				

APPENDIX 4

Plot of SPT versus Depth Profile

Project Name :

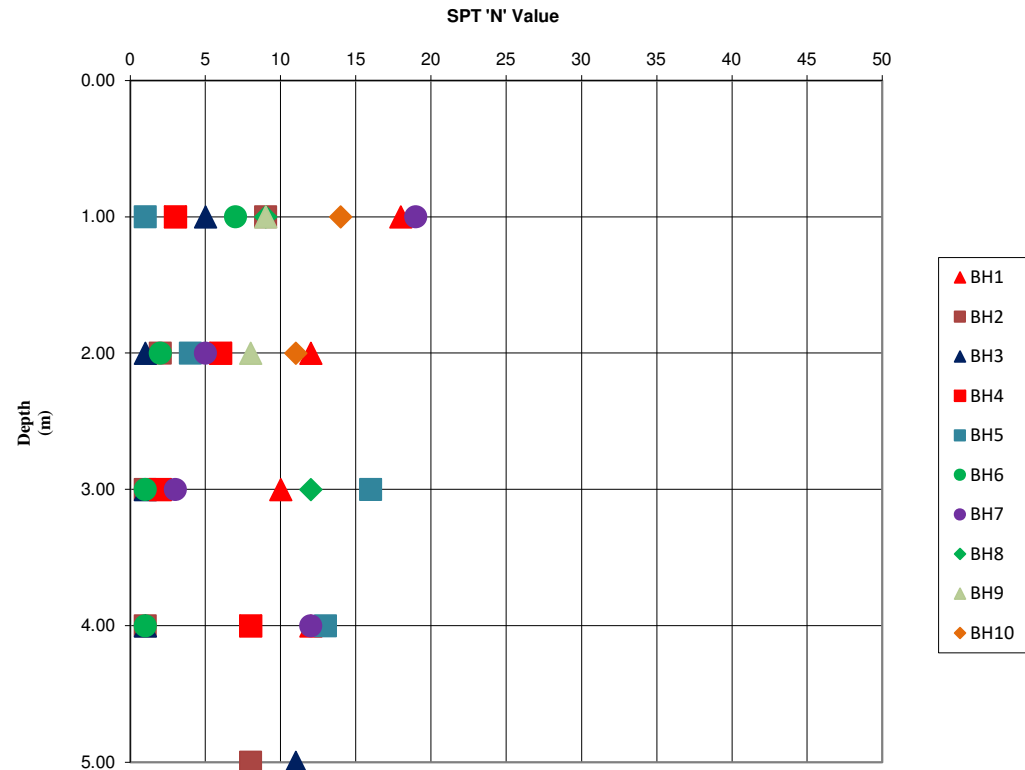
Site off Butterfly Lane, Elstree WD6 3AF

Job No. : RML 7329

Date : May 2020

BH1		BH2		BH3	
Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value
1.00	18	1.00	9	1.00	5
2.00	12	2.00	2	2.00	1
3.00	10	3.00	1	3.00	1
4.00	12	4.00	1	4.00	1
		5.00	8	5.00	11
BH4		BH5		BH6	
Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value
1.00	3	1.00	1	1.00	7
2.00	6	2.00	4	2.00	2
3.00	2	3.00	16	3.00	1
4.00	8	4.00	13	4.00	1
BH7		BH8		BH9	
Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value
1.00	19	1.00	9	1.00	9
2.00	5	3.00	12	2.00	8
3.00	3				
4.00	12				
BH10					
Depth (m)	SPT 'N' value				
1.00	14				
2.00	11				

BH1-BH10 (over Landfill)



Project Name :

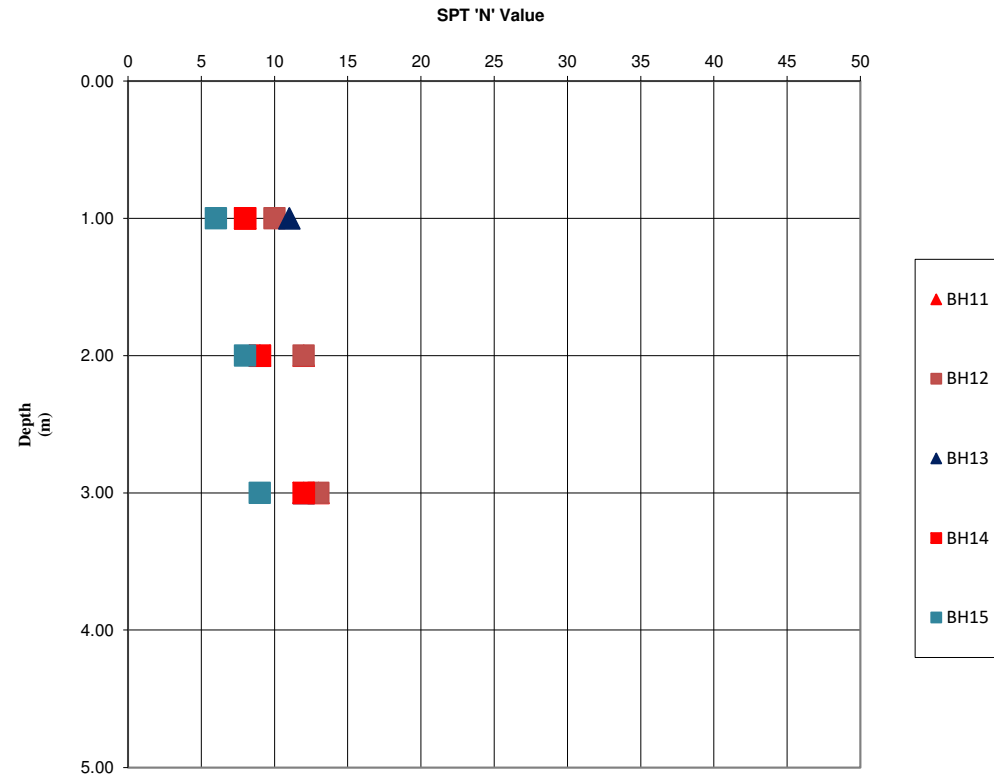
Site off Butterfly Lane, Elstree WD6 3AF

Job No. : RML 7329

Date : May 2020

BH11		BH12		BH13	
Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value
1.00	8	1.00	10	1.00	11
2.00	12	2.00	12	2.00	9
3.00	13	3.00	13	3.00	12
BH14		BH15			
Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value		
1.00	8	1.00	6		
2.00	9	2.00	8		
3.00	12	3.00	9		

BH11-BH15



APPENDIX 5

Ground-borne Gas/Groundwater Level Monitoring Results

GROUNDWATER & GAS MONITORING RESULTS

Project Name: Site off Butterfly Lane, Elstree WD6 3AF

Project No. : RML 7329

Date : May 2020

BH No.	Date	Pressure (mb)	Oxygen (%)	Carbon Dioxide (%)	Methane (%)	Methane LEL (%)	Flow Rate (l/hr)	Groundwater Level (m)
BH1	6th May 2020	1013	0.7	6.0	0.2	4	0	2.60
	13th May 2020	991	0.0	6.7	0.2	4	0	2.61
	20th May 2020	1015	1.0	5.9	0.0	0	0	2.61
BH2	6th May 2020	1012	0.5	4.1	1.3	26	0	3.19
	13th May 2020	991	1.5	4.4	0.6	12	0	3.19
	20th May 2020	1017	2.4	4.9	0.0	0	0	3.18
BH3	6th May 2020	1013	0.2	6.0	0.0	0	0	3.26
	13th May 2020	991	0.0	6.6	0.0	0	0	3.27
	20th May 2020	1018	0.2	6.0	0.0	0	0	3.28
BH4	6th May 2020	1013	6.3	0.7	0.0	0	0	3.13
	13th May 2020	991	16.5	3.3	0.0	0	0	3.18
	20th May 2020	1020	10.8	5.6	0.0	0	0	3.23
BH6	6th May 2020	1010	1.3	3.8	0.0	0	0	2.91
	13th May 2020	991	0.2	4.0	0.0	0	0	2.91
	20th May 2020	1020	0.9	3.7	0.0	0	0	2.91
BH8	6th May 2020	1012	19.8	0.1	0.0	0	0	0.94
	13th May 2020	991	19.2	0.5	0.0	0	0	0.97
	20th May 2020	1012	19.5	0.5	0.0	0	0	1.05
BH10	6th May 2020	1011	16.9	1.9	0.0	0	0	2.72
	13th May 2020	991	17.5	2.0	0.0	0	0	2.49
	20th May 2020	1011	18.4	1.6	0.0	0	0	2.28
BH13	6th May 2020	1009	19.0	0.8	0.0	0	0	2.95
	13th May 2020	991	18.9	0.8	0.0	0	0	2.86
	20th May 2020	1021	19.1	0.7	0.0	0	0	2.74

APPENDIX 6

Laboratory Geotechnical Test Results

Sample Details			Description	Classification Tests					Density Tests		Undrained Triaxial Compression Tests			Chemical Results				Other tests and comments
BH No.	Depth (m)	Sample No.		MC (%)	LL (%)	PL (%)	PI	<425 mic (%)	Bulk (Mg/m ³)	Dry (Mg/m ³)	Cell Pressure kPa	Deviator Stress kPa	Mean Shear Stress kPa	pH	W/S SO ₄ (g/l)	Total SO ₄ (%)	Water SO ₄ (g/l)	
BH2	3.60-3.90	D												8.3	0.15			
BH9	1.20-1.50	D												8.7	0.95			
BH11	1.50	D4	Firm, brown and orange-brown, silty CLAY with occasional fine gravel and lenses of grey silty sand.	31					2.12	1.61	30	133	66					
BH12	1.00	D3	Brown and orange-brown, silty CLAY with occasional fine gravel and fine roots.	39	88	35	53	90									Class CV	
BH13	0.20-0.50	D												7.9	0.06			
	1.00	D3	Firm, brown and orange-brown, silty CLAY with occasional fine gravel and fine roots.	37					1.91	1.39	20	89	45					
BH14	1.50	D4	Brown and orange-brown, silty CLAY with occasional fine gravel and lenses of silty sand.	28	72	36	45	80									Class CV	
BH15	0.20-0.50	D												7.9	0.09			
	2.00	D5	Stiff, brown and orange-brown, silty CLAY with occasional pockets of orange-brown and grey silt.	34					1.92	1.44	40	171	86					

SUMMARY OF GEOTECHNICAL TESTING

APPENDIX 7

Laboratory Chemical Analytical Results



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

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

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 20-28019

Issue: 1

Date of Issue: 12/05/2020

Contact: Malcolm Price

Customer Details: Risk Management Ltd
10 Coopers Place
Combe Lane
Godalming
SurrevGU8 5SZ

Quotation No: Q19-01475

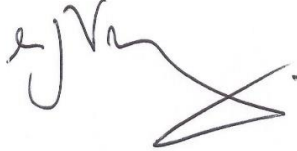
Order No: RML7329

Customer Reference: RML7329

Date Received: 04/05/2020

Date Approved: 12/05/2020

Details: Site off Butterfly Lane, Elstree, WD6 3AF

Approved by: 

Mike Varley, Technical Manager

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

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Sample Summary

Report No.: 20-28019, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
203385	BH1 0.05 - 0.30	27/04/2020	04/05/2020	Silty loam	
203386	BH2 3.60 - 3.90	27/04/2020	04/05/2020	Silty clayey loam	
203387	BH3 0.05 - 0.30	27/04/2020	04/05/2020	Silty loam	
203388	BH3 5.30 - 5.60	27/04/2020	04/05/2020	Clay	
203389	BH4 0.50 - 0.80	27/04/2020	04/05/2020	Silty loam	
203390	BH6 0.20 - 0.50	28/04/2020	04/05/2020	Silty clayey loam	
203391	BH6 1.20 - 1.50	28/04/2020	04/05/2020	Silty clayey loam	
203392	BH8 1.90 - 2.20	28/04/2020	04/05/2020	Clay	
203393	BH9 1.20 - 1.50	28/04/2020	04/05/2020	Silty loam	
203394	BH11 0.00 - 0.10	28/04/2020	04/05/2020	Silty loam	
203395	BH13 0.20 - 0.50	29/04/2020	04/05/2020	Silty clayey loam	
203396	BH15 0.20 - 0.50	29/04/2020	04/05/2020	Silty clayey loam	



Results Summary

Report No.: 20-28019, issue number 1

ELAB Reference	203385	203386	203387	203388
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	BH2	BH3	BH3
Sample Depth (m)	0.05 - 0.30	3.60 - 3.90	0.05 - 0.30	5.30 - 5.60
Sampling Date	27/04/2020	27/04/2020	27/04/2020	27/04/2020

Determinand	Codes	Units	LOD				
Soil sample preparation parameters							
Moisture Content	N	%	0.1	24.0	29.7	16.9	34.3
Stones Content	N	%	0.1	< 0.1	< 0.1	39.0	< 0.1
Material removed	N	%	0.1	< 0.1	< 0.1	39.0	< 0.1
Description of Inert material removed	N		0	None	None	Stones,brick,clinker	None
Metals							
Arsenic	M	mg/kg	1	16.1	19.5	20.5	18.4
Cadmium	M	mg/kg	0.5	1.1	< 0.5	1.4	< 0.5
Chromium	M	mg/kg	5	45.9	39.0	51.3	42.5
Copper	M	mg/kg	5	83.6	54.2	109	36.6
Lead	M	mg/kg	5	231	831	475	42.9
Mercury	M	mg/kg	0.5	0.9	< 0.5	0.5	< 0.5
Nickel	M	mg/kg	5	36.0	37.7	41.9	43.8
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	200	193	410	103
Anions							
Water Soluble Sulphate	M	g/l	0.02	n/t	0.15	n/t	n/t
Inorganics							
Free Cyanide	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8
Total Cyanide	M	mg/kg	1	7.0	< 1.0	3.9	< 1.0
Miscellaneous							
pH	M	pH units	0.1	7.7	8.3	7.2	7.8
Soil Organic Matter	U	%	0.1	4.7	1.2	7.9	0.2
Phenols							
Phenol	M	mg/kg	1	< 1	< 1	< 1	< 1
M,P-Cresol	N	mg/kg	1	< 1	< 1	< 1	< 1
O-Cresol	N	mg/kg	1	< 1	< 1	< 1	< 1
3,4-Dimethylphenol	N	mg/kg	1	< 1	< 1	< 1	< 1
2,3-Dimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1
2,3,5-trimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5
Polyaromatic hydrocarbons							
Naphthalene	M	mg/kg	0.1	0.7	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	4.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	1.4	0.6	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	2.0	0.6	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	36.0	7.8	0.5	< 0.1
Anthracene	M	mg/kg	0.1	9.8	2.1	0.2	< 0.1
Fluoranthene	M	mg/kg	0.1	49.9	8.8	1.1	< 0.1
Pyrene	M	mg/kg	0.1	37.7	6.8	1.0	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	24.6	3.9	0.6	< 0.1
Chrysene	M	mg/kg	0.1	23.8	4.2	0.7	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	16.4	2.7	0.6	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	19.6	3.7	0.8	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	17.9	3.4	0.6	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	12.4	2.3	0.4	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	3.4	0.4	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	10.6	2.1	0.4	< 0.1
Total PAH(16)	M	mg/kg	0.4	270	49.4	7.0	< 0.4
BTEX							

Results Summary

Report No.: 20-28019, issue number 1

ELAB Reference	203385	203386	203387	203388
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	BH2	BH3	BH3
Sample Depth (m)	0.05 - 0.30	3.60 - 3.90	0.05 - 0.30	5.30 - 5.60
Sampling Date	27/04/2020	27/04/2020	27/04/2020	27/04/2020

Determinand	Codes	Units	LOD				
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
TPH CWG							
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aliphatic	M	mg/kg	1	2.1	< 1.0	< 1.0	< 1.0
>C21-C35 Aliphatic	M	mg/kg	1	9.9	< 1.0	< 1.0	< 1.0
>C35-C40 Aliphatic	M	mg/kg	1	1.1	< 1.0	< 1.0	< 1.0
Total aliphatic hydrocarbons (>C5 - C40)	N	mg/kg	1	13.7	1.2	< 1.0	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aromatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aromatic	M	mg/kg	1	10.2	< 1.0	< 1.0	< 1.0
>C16-C21 Aromatic	M	mg/kg	1	68.1	2.4	< 1.0	< 1.0
>C21-C35 Aromatic	M	mg/kg	1	154	6.8	3.0	< 1.0
>C35-C40 Aromatic	M	mg/kg	1	8.9	< 1.0	< 1.0	< 1.0
Total aromatic hydrocarbons (>C5 - C40)	N	mg/kg	1	242	10.5	4.0	< 1.0
Total petroleum hydrocarbons (>C5 - C40)	N	mg/kg	1	255	11.7	4.3	< 1.0



Results Summary

Report No.: 20-28019, issue number 1

ELAB Reference	203389	203390	203391	203392	203393
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH4	BH6	BH6	BH8	BH9
Sample Depth (m)	0.50 - 0.80	0.20 - 0.50	1.20 - 1.50	1.90 - 2.20	1.20 - 1.50
Sampling Date	27/04/2020	28/04/2020	28/04/2020	28/04/2020	28/04/2020

Determinand	Codes	Units	LOD					
Soil sample preparation parameters								
Moisture Content	N	%	0.1	17.4	29.9	22.2	34.6	29.4
Stones Content	N	%	0.1	21.1	7.0	27.6	< 0.1	< 0.1
Material removed	N	%	0.1	21.1	7.0	27.6	< 0.1	< 0.1
Description of Inert material removed	N		0	Stones	Stones	Stones	None	None
Metals								
Arsenic	M	mg/kg	1	15.4	18.1	15.8	16.8	19.1
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5
Chromium	M	mg/kg	5	35.7	38.5	39.2	45.7	38.8
Copper	M	mg/kg	5	75.2	53.8	32.6	19.3	54.8
Lead	M	mg/kg	5	264	209	151	27.4	364
Mercury	M	mg/kg	0.5	0.9	0.7	< 0.5	< 0.5	0.8
Nickel	M	mg/kg	5	29.4	34.8	30.3	20.4	36.9
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	148	166	164	61.5	232
Anions								
Water Soluble Sulphate	M	g/l	0.02	n/t	n/t	n/t	n/t	0.95
Inorganics								
Free Cyanide	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	40.2
Miscellaneous								
pH	M	pH units	0.1	9.2	7.9	8.2	8.1	8.7
Soil Organic Matter	U	%	0.1	1.7	2.5	1.1	1.0	2.1
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
2,3,5-trimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1	< 1
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5	< 5
Polyaromatic hydrocarbons								
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4
Phenanthrene	M	mg/kg	0.1	0.1	0.2	0.2	< 0.1	1.8
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5
Fluoranthene	M	mg/kg	0.1	0.5	0.5	0.6	< 0.1	2.0
Pyrene	M	mg/kg	0.1	0.5	0.5	0.6	< 0.1	1.8
Benzo(a)anthracene	M	mg/kg	0.1	0.4	0.3	0.5	< 0.1	0.7
Chrysene	M	mg/kg	0.1	0.4	0.4	0.6	< 0.1	0.8
Benzo(b)fluoranthene	M	mg/kg	0.1	0.5	0.4	0.7	< 0.1	0.7
Benzo(k)fluoranthene	M	mg/kg	0.1	0.6	0.4	0.8	< 0.1	0.7
Benzo(a)pyrene	M	mg/kg	0.1	0.5	0.3	0.8	< 0.1	0.6
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	0.4	0.2	0.7	< 0.1	0.5
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	0.2	< 0.1	0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	0.4	0.3	0.5	< 0.1	0.5
Total PAH(16)	M	mg/kg	0.4	4.5	3.7	6.2	< 0.4	12.0
BTEX								

Results Summary

Report No.: 20-28019, issue number 1

ELAB Reference	203389	203390	203391	203392	203393
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH4	BH6	BH6	BH8	BH9
Sample Depth (m)	0.50 - 0.80	0.20 - 0.50	1.20 - 1.50	1.90 - 2.20	1.20 - 1.50
Sampling Date	27/04/2020	28/04/2020	28/04/2020	28/04/2020	28/04/2020

Determinand	Codes	Units	LOD					
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
TPH CWG								
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C21-C35 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C35-C40 Aliphatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total aliphatic hydrocarbons (>C5 - C40)	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	2.1
>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	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aromatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aromatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aromatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	1.8
>C21-C35 Aromatic	M	mg/kg	1	1.1	< 1.0	< 1.0	< 1.0	2.5
>C35-C40 Aromatic	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total aromatic hydrocarbons (>C5 - C40)	N	mg/kg	1	1.4	< 1.0	< 1.0	< 1.0	5.6
Total petroleum hydrocarbons (>C5 - C40)	N	mg/kg	1	1.9	1.1	< 1.0	< 1.0	7.7



Results Summary

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ELAB Reference	203394	203395	203396
Customer Reference			
Sample ID			
Sample Type	SOIL	SOIL	SOIL
Sample Location	BH11	BH13	BH15
Sample Depth (m)	0.00 - 0.10	0.20 - 0.50	0.20 - 0.50
Sampling Date	28/04/2020	29/04/2020	29/04/2020

Determinand	Codes	Units	LOD			
Soil sample preparation parameters						
Moisture Content	N	%	0.1	42.8	n/t	n/t
Stones Content	N	%	0.1	< 0.1	n/t	n/t
Material removed	N	%	0.1	< 0.1	< 0.1	< 0.1
Description of Inert material removed	N		0	None	None	None
Metals						
Arsenic	M	mg/kg	1	12.5	n/t	n/t
Cadmium	M	mg/kg	0.5	0.9	n/t	n/t
Chromium	M	mg/kg	5	37.9	n/t	n/t
Copper	M	mg/kg	5	58.9	n/t	n/t
Lead	M	mg/kg	5	96.0	n/t	n/t
Mercury	M	mg/kg	0.5	0.5	n/t	n/t
Nickel	M	mg/kg	5	18.8	n/t	n/t
Selenium	M	mg/kg	1	< 1.0	n/t	n/t
Zinc	M	mg/kg	5	129	n/t	n/t
Anions						
Water Soluble Sulphate	M	g/l	0.02	n/t	0.06	0.09
Inorganics						
Free Cyanide	N	mg/kg	1	< 1.0	n/t	n/t
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	n/t	n/t
Total Cyanide	M	mg/kg	1	< 1.0	n/t	n/t
Miscellaneous						
pH	M	pH units	0.1	7.0	7.9	7.9
Soil Organic Matter	U	%	0.1	9.3	n/t	n/t
Phenols						
Phenol	M	mg/kg	1	< 1	n/t	n/t
M,P-Cresol	N	mg/kg	1	< 1	n/t	n/t
O-Cresol	N	mg/kg	1	< 1	n/t	n/t
3,4-Dimethylphenol	N	mg/kg	1	< 1	n/t	n/t
2,3-Dimethylphenol	M	mg/kg	1	< 1	n/t	n/t
2,3,5-trimethylphenol	M	mg/kg	1	< 1	n/t	n/t
Total Monohydric Phenols	N	mg/kg	5	< 5	n/t	n/t
Polyaromatic hydrocarbons						
Naphthalene	M	mg/kg	0.1	< 0.1	n/t	n/t
Acenaphthylene	M	mg/kg	0.1	< 0.1	n/t	n/t
Acenaphthene	M	mg/kg	0.1	< 0.1	n/t	n/t
Fluorene	M	mg/kg	0.1	< 0.1	n/t	n/t
Phenanthrene	M	mg/kg	0.1	0.1	n/t	n/t
Anthracene	M	mg/kg	0.1	< 0.1	n/t	n/t
Fluoranthene	M	mg/kg	0.1	0.4	n/t	n/t
Pyrene	M	mg/kg	0.1	0.4	n/t	n/t
Benzo(a)anthracene	M	mg/kg	0.1	0.2	n/t	n/t
Chrysene	M	mg/kg	0.1	0.3	n/t	n/t
Benzo(b)fluoranthene	M	mg/kg	0.1	0.4	n/t	n/t
Benzo(k)fluoranthene	M	mg/kg	0.1	0.4	n/t	n/t
Benzo(a)pyrene	M	mg/kg	0.1	0.3	n/t	n/t
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	0.2	n/t	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	n/t	n/t
Benzo[g,h,i]perylene	M	mg/kg	0.1	0.2	n/t	n/t
Total PAH(16)	M	mg/kg	0.4	3.1	n/t	n/t
BTEX						

Results Summary

Report No.: 20-28019, issue number 1

ELAB Reference	203394	203395	203396
Customer Reference			
Sample ID			
Sample Type	SOIL	SOIL	SOIL
Sample Location	BH11	BH13	BH15
Sample Depth (m)	0.00 - 0.10	0.20 - 0.50	0.20 - 0.50
Sampling Date	28/04/2020	29/04/2020	29/04/2020

Determinand	Codes	Units	LOD			
Benzene	M	ug/kg	10	< 10.0	n/t	n/t
Toluene	M	ug/kg	10	< 10.0	n/t	n/t
Ethylbenzene	M	ug/kg	10	< 10.0	n/t	n/t
Xylenes	M	ug/kg	10	< 10.0	n/t	n/t
MTBE	N	ug/kg	10	< 10.0	n/t	n/t
TPH CWG						
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	n/t
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	n/t	n/t
>C10-C12 Aliphatic	M	mg/kg	1	< 1.0	n/t	n/t
>C12-C16 Aliphatic	M	mg/kg	1	< 1.0	n/t	n/t
>C16-C21 Aliphatic	M	mg/kg	1	< 1.0	n/t	n/t
>C21-C35 Aliphatic	M	mg/kg	1	< 1.0	n/t	n/t
>C35-C40 Aliphatic	M	mg/kg	1	< 1.0	n/t	n/t
Total aliphatic hydrocarbons (>C5 - C40)	N	mg/kg	1	< 1.0	n/t	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	n/t	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	n/t	n/t
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	n/t	n/t
>C10-C12 Aromatic	M	mg/kg	1	< 1.0	n/t	n/t
>C12-C16 Aromatic	M	mg/kg	1	< 1.0	n/t	n/t
>C16-C21 Aromatic	M	mg/kg	1	< 1.0	n/t	n/t
>C21-C35 Aromatic	M	mg/kg	1	1.3	n/t	n/t
>C35-C40 Aromatic	M	mg/kg	1	< 1.0	n/t	n/t
Total aromatic hydrocarbons (>C5 - C40)	N	mg/kg	1	1.6	n/t	n/t
Total petroleum hydrocarbons (>C5 - C40)	N	mg/kg	1	1.7	n/t	n/t

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	Gravimetric Analysis Total	Gravimetric Analysis by ACM Type	Free Fibre Analysis	Total Asbestos
203385	0.05 - 0.30	BH1	Brown Soil, (Clay), Stones, Clinker	No asbestos detected	n/t	n/t	n/t	n/t
203386	3.60 - 3.90	BH2	Brown Soil, (Clay), Stones, Clinker	No asbestos detected	n/t	n/t	n/t	n/t
203387	0.05 - 0.30	BH3	Brown Soil, (Clay), Stones, Clinker, Brick	No asbestos detected	n/t	n/t	n/t	n/t
203388	5.30 - 5.60	BH3	Brown Soil, (Clay), Stones	No asbestos detected	n/t	n/t	n/t	n/t
203389	0.50 - 0.80	BH4	Brown Soil, (Clay), Stones	No asbestos detected	n/t	n/t	n/t	n/t
203390	0.20 - 0.50	BH6	Brown Soil, (Clay), Stones, Clinker, Brick	No asbestos detected	n/t	n/t	n/t	n/t
203391	1.20 - 1.50	BH6	Brown Soil, (Clay), Stones, Brick, Clinker,	No asbestos detected	n/t	n/t	n/t	n/t
203392	1.90 - 2.20	BH8	Brown Soil, (Clay), Stones	No asbestos detected	n/t	n/t	n/t	n/t
203393	1.20 - 1.50	BH9	Brown Soil, (Clay), Stones, Brick, Clinker	No asbestos detected	n/t	n/t	n/t	n/t
203394	0.00 - 0.10	BH11	Brown Soil, (Clay), Stones, Brick, Clinker	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

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Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Free cyanide	N	As submitted sample	06/05/2020	107	Colorimetry
Hexavalent chromium	N	As submitted sample	06/05/2020	110	Colorimetry
pH	M	Air dried sample	06/05/2020	113	Electromeric
Aqua regia extractable metals	M	Air dried sample	05/05/2020	118	ICPMS
Phenols in solids	M	As submitted sample	06/05/2020	121	HPLC
PAH (GC-FID)	M	As submitted sample	05/05/2020	133	GC-FID
Water soluble anions	M	Air dried sample	05/05/2020	172	Ion Chromatography
Low range Aliphatic hydrocarbons soil	N	As submitted sample	11/05/2020	181	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	11/05/2020	181	GC-MS
BTEX in solids	M	As submitted sample	11/05/2020	181A	GC-MS
Total cyanide	M	As submitted sample	06/05/2020	204	Colorimetry
TPH CWG soil by gc-gc	M	As submitted sample	04/05/2020	214	
Soil organic matter	U	Air dried sample	06/05/2020	BS1377:P3	Titrimetry
Asbestos identification	U	Air dried sample	12/05/2020	PMAN	Microscopy

Tests marked N are not UKAS accredited



Report Information

Report No.: 20-28019, 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"

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 8

**Laboratory Results Compared Against Generic Assessment Criteria for Commercial
& Industrial Land Use Scenario**

Table 1 Results of Laboratory Chemical Analyses Carried Out On Soil Samples Recovered From Area of Land At Slades Farm Butterfly Lane Aldenham Proposed for Usage as PV Farm Site Compared Against The LQM/CIEH S4ULs For Commercial & Industrial Land-use Scenario At 6% SOM Except Where Indicated Otherwise

Determinand	Generic Assessment Criteria (LQM/CIEH S4ULs) Commercial (mg/kg)	No. of Samples Tested	Minimum (mg/kg)	Maximum (mg/kg)	No. of Exceedances
Metals and Metaloids					
Arsenic (Inorganic)	640	10	12.5	20.5	0
Beryllium	12	10	-	-	?0
Boron (w/s)	240000	10	-	-	?0
Cadmium (Total)	190	10	<0.5	1.4	0
Copper (Total)	68000	10	19.3	109	0
Chromium (Total/III)	8600	10	35.7	51.3	0
Chromium (Hexavalent)	33	10	-	-	?0
Lead (Total)	1100*	10	27.4	831	0
Mercury (Elemental)	25.8	10	-	-	?0
Mercury (Inorganic/Total)	1100	10	<0.5	0.9	0
Mercury (Methyl-mercury)	320	10	-	-	?0
Nickel (Total)	980	10	18.8	43.8	0
Selenium (Total)	12000	10	<1	<1	0
Vanadium (Total)	9000	10	-	-	?0
Zinc (Total)	730000	10	61.5	410	0
PAHs (1% SOM)					
Naphthalene	190	10	<0.1	0.7	0
Acenaphthylene	83000	10	<0.1	4.1	0
Acenaphthene	84000	10	<0.1	1.4	0
Fluorene	63000	10	<0.1	0.4	0
Phenanthrene	22000	10	<0.1	36	0
Anthracene	520000	10	<0.1	9.8	0
Fluoranthene	23000	10	<0.1	49.9	0
Pyrene	54000	10	<0.1	37.7	0
Benz(a)anthracene	170	10	<0.1	24.6	0
Chrysene	350	10	<0.1	23.8	0
Benzo(b)fluoranthene	44	10	<0.1	16.4	0
Benzo(k)fluoranthene	1200	10	<0.1	19.6	0
Benzo(a) pyrene	35	10	<0.1	17.9	0
Indeno(123-cd)pyrene	500	10	<0.1	12.4	0
Dibenzo(ah)anthracene	3.5	10	<0.1	3.4	0
Benzo(ghi)perylene	3900	10	<0.1	10.6	0
TPH (aliphatics) 1% SOM					
>C5-C6	3200	10	<0.01	<0.01	0
>C6-C8	7800	10	<0.01	<0.01	0
>C8-C10	2000	10	<1.0	<1.0	0
>C10-C12	9700	10	<1.0	<1.0	0
>C12-C16	59000	10	<1.0	<1.0	0
>C16-C21	-	10	<1.0	2.1	?0
>C21-C35	-	10	<1.0	9.9	?0
TPH (aromatic) 1% SOM					
>C5-C7	26000	10	<0.01	<0.01	0
>C7-C8	56000	10	<0.01	<0.01	0
>C8-C10	35000	10	<1.0	<1.0	0
>C10-C12	16000	10	<1.0	<1.0	0
>C12-C16	36000	10	<1.0	10.2	0
>C16-C21	28000	10	<1.0	68.1	0
>C21-C35	28000	10	<1.0	154	0
>C35-C44	28000	10	<1.0	8.9	0

*C4SL value provided in absence of S4UL