TIER 2: GENERIC QUANTITATIVE RISK ASSESSMENT

Project Number: G0125

Project Name: The Builders Yard (rear of Brook Cottage), Lower Layham

Client: 4B Building Ltd.

Date: October 2022

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Report Summary

This investigation has been instructed by Mr Paul Scales of 4B Building Ltd to conduct an assessment for the proposed development project located at Brook Cottage, Lower Layham, Suffolk.

A previous Tier 1 "Phase 1 Desk Study and Preliminary Risk Assessment" report by Stansted Environmental Services recommended "further site investigation works" into contamination at the site. Hazardous ground gasses were identified as presenting a very low risk while a low risk was attributed to historical spillages occurring during filling of the heating oil tank.

Planning has been granted subject to contaminated land conditions requiring risks be assessed and a remediation scheme written, implemented and evidenced. This report seeks to complete the risk assessment.

This "Tier 2 Generic Quantitative Risk Assessment" site investigation consisted of 6 hand dug trial holes, with samples taken for laboratory testing and in order that a detailed description of the soils could be completed. Laboratory testing comprised a general suite of common contaminants, Total Organic Carbon (TOC) and waste assessment criteria (WAC) testing.

Groundwater was not encountered but a stream forming the northern boundary of the site suggests groundwater will be relatively shallow.

The concentration of lead and three polycyclic aromatic hydrocarbons (PAHs) have been reported in excess of the generic assessment screening values in 2 of the 6 hand pits.

The risk to groundwater and surface water was assessed as being negligible.

No significant source of ground gas has been identified. The site was assessed as falling within CS1 with no ground gas protection measures being necessary.

The results of the testing of a sample of made ground from HP03, classified the soil as inert.

It is recommended that a soil cover system be implemented in areas of garden and soft landscaping to form a physical barrier above any contaminated soil.

1 Introduction

1.1 Authorisation

Geotechnical and Contamination Consulting Limited (GAC Consulting) has been instructed by Mr Paul Scales of 4B Building Ltd to conduct a Tier 2: Generic Quantitative Risk Assessment for the proposed development project located at Brook Cottage, Lower Layham, Suffolk.

1.2 Project Background and Development Proposal

It is understood that the proposed project consists of the construction of a single dwelling with a private garden.

The proposed development is summarised in the table below.

Table 1.2; Development Proposals	
Proposed Use	Residential dwelling with private gardens and hardstanding
Landuse Category*	Residential with potential for homegrown produce
BS8485 Building Type**	Type A
Potable water supply	Mains supply
Notes; * Standard land-uses as defined in Environment Agencies' SR3 (Environment Agency, 2009). ** ; BS 8485:2015+A1:2019	

1.3 Previous Reports

This report follows on from a Tier 1 "Phase 1 Desk Study and Preliminary Risk Assessment" (Ref. CON96-LAYH-009) that included a site walkover, written by Stansted Environmental Services, dated May 2022.

The report identified several demolished buildings as possibly giving rise to made ground soils of unknown quality. This material was identified as potentially significantly impacted by "volatile contaminants such as hydrocarbons or other organic materials". The risk of decomposition of such organic materials generating significant concentrations of hazardous ground gasses was identified as being very low. A low risk was attributed to historical spillages occurring during filling of the heating oil tank.

The report concluded that although the risk from potential contamination at the site was low, further site investigation works were warranted in order to quantify these risks.

1.4 Planning Conditions

Planning permission has been applied for under the following reference: DC/22/01930. Planning has been granted subject to the following contaminated land conditions;

1. A strategy for investigating any contamination present on site (including ground gases, where appropriate) has been submitted for approval by the Local Planning Authority.
2. Following approval of the strategy, an investigation shall be carried out in accordance with the strategy.
3. A written report shall be submitted detailing the findings of the investigation referred to in (2) above, and an assessment of the risk posed to receptors by the contamination (including ground gases, where appropriate) for approval by the Local Planning Authority. Subject to the risk assessment, the report shall include a Remediation Scheme as required.
4. Any remediation work shall be carried out in accordance with the approved Remediation Scheme.
5. Following remediation, evidence shall be provided to the Local Planning Authority verifying that remediation has been carried out in accordance with the approved Remediation Scheme.

1.5 Project objectives

Stansted Environmental Services included a ground investigation methodology appended to their desk study report.

This set out the broad scope of proposed ground investigation and consisted of:

- at least 6 hand dug trial holes to the full depth of made ground (maximum 1.5 m deep)
- laboratory testing of a suite of contaminants including heavy metals, PAHs, TPH CWG, BTEX, cyanide, monohydric phenol and asbestos.
- Screening with a PID with any samples returning values of >10ppm tested for VOCs/SVOCs.

In review of Stansted Environmental Services desk study report, GAC Consulting identified that installing ground gas monitoring wells in hand excavated pits is not considered best practice.

A potential risk associated with on-site gassing sources was identified, the depth of made ground was likely to be relatively shallow, and believed to possessed a low degradable organic content. As such, it was deemed appropriate to assess the risk via the empirical approach set out in Annex D of BS 8485; characterizing sites without gas monitoring data.

The purpose of this investigation was to:

- conduct a Tier 2: Generic Quantitative Risk Assessment to confirm the absence/presence of contamination,
- complete an assessment of the ground gas risk using TOC concentration as set out in Annex D of BS 8485,
- complete waste classification via waste assessment criteria (WAC) testing,
- to make appropriate recommendations regarding risk identification and reduction, the need for further assessment and remedial activity (if necessary).

2 Field Investigation

The intrusive investigation was designed to meet the project objectives stated above and to follow the applicable standards and guidance. Where possible, laboratory testing has been undertaken by a UKAS/MCERTS accredited laboratory.

The information gathered and discussed in this report depict subsurface conditions at specific locations at the time of investigation. As no technique is capable of definitively identifying all ground/water conditions, spatially and temporally, ground conditions are necessarily inferred between intrusive locations using professional experience and judgment.

Soils are heterogeneous, semi-elastic materials composed of three phases of matter and which have been subjected to geological and geomorphological processes. Though soil boundaries may be represented as plainer surfaces for ease of depiction, in reality their depth and geometry may vary from those shown herein. Soil boundaries are inferred based on non-continuous sampling techniques and are intended to reflect approximate horizons.

2.1 Intrusive Investigation

2.1.1 Drilling and Excavation

The intrusive investigation was completed in accordance with HSE Construction (Design and Management) Regulations (CDM 2015) and an in-house Construction Phase Plan (CPP), Risk Assessment and Method Statements. In broad terms the procedure consisted of:

- Compilation of the health and safety documentation,
- Site based identification of the intrusive locations with repositioning as necessary,
- Utilities clearance with locations repositioned as necessary,
- Review of GAC Consulting's Risk Assessment,

- Excavation/drilling/sampling/testing as per GAC Consulting's / third party method statements,
- Quality assurance (QA) check of sample type/quality/containment/documentation.

A summary of the intrusive investigation is presented in Table 2.2.1.

Table 2.1.1; Fieldwork Summary

Location	Date	Plant	Depth on completion	Backfill/ Installation
HP01	13/09/2022	Hand tools	1.1 m	Backfilled; Arisings
HP02	13/09/2022	Hand tools	1.2 m	Backfilled; Arisings
HP03	13/09/2022	Hand tools	1.1 m	Backfilled; Arisings
HP04	13/09/2022	Hand tools	1.2 m	Backfilled; Arisings
HP05	13/09/2022	Hand tools	1.2 m	Backfilled; Arisings
HP06	13/09/2022	Hand tools	1.0 m	Backfilled; Arisings

Detailed field records can be found in the appendix.

The fieldwork location plan (G0125-DR02) presented in the appendix, shows the approximate position of the hand pits within the context of the site.

2.1.2 In Field Monitoring – Soil Screening

Soil screening using a photo-ionisation detector (PID) was completed on site using a PID fitted with a 10.6 eV lamp.

The soil samples were screened by removing the lid of the amber jars and attaching the monitoring device in a method devised in house.

All samples returned a concentration of less than 1 ppm with a minimum resolution of 0.1 ppm.

Based on these results, no significant concentration of volatile organics was thought to be present in the samples screened and no laboratory for testing was scheduled.

3 Data Analysis

3.1 Ground Conditions

The soils encountered during this investigation have been logged in accordance with current standards and corrected to ensure consistency with subsequent laboratory test results, as required. A detailed description of all the materials and stratum encountered are included in the logs, presented in the appendix.

The geology across the site was reasonably consistent, with made ground, encountered to a maximum of 1.1 m depth.

The made ground was generally described as light or dark greyish brown slightly gravelly or gravelly sand. The gravel fraction of this material generally consisted of flint and brick with generally rare amounts of metal, coal, clinker plastic and slate noted.

The made ground was underlain by natural orangish brown slightly clayey slight gravelly sand with flint gravel.

HP06 was different from the other locations in that it consisted of a surface covering of Type 1 hardcore to 0.25 m depth, over natural orangish brown slightly gravelly sand.

3.2 Groundwater Data

Groundwater was not encountered during excavation. A stream was located immediately north of the site. Groundwater may be encountered within 2 meters of the ground surface.

3.3 Geo-environmental Laboratory Testing

Upon completion of fieldwork and in house QAQC process, selected samples were promptly transported to a UKAS/MCERTS accredited chemical testing laboratory.

Testing schedules sent to the laboratory are appended to this report. The samples conveyed to the lab and testing requested are summarised in Table 3.3.

Table 3.3; Laboratory Testing Schedule Summary

Location	Sample ID	Sample Depth (m bgl)	Analysis Requested		
			General Suite (Metals, pH, TOC, TPHCWG, BTEX, PAH USEPA16, asbestos screen) (with ID where found) Monohydric Phenols, Total Cyanide,	Total Organic Carbon (TOC)	WAC Full Solid Suite & 10:1 Leachate Suite
Soil Samples					
HP01	ES1	0.3		X	
HP01	ES2	0.5	X		
HP02	ES2	0.35	X		
HP03	ES1	0.1			X
HP03	ES2	0.3	X		
HP04	ES1	0.1	X		
HP05	ES1	0.1 - 0.2	X		

The results of the testing are presented in the appendix and the implications discussed below.

3.4 Data Quality Review

3.4.1 Quality Assurance and Quality Control

All soil samples were handled in accordance with the analytical protocol with respect to holding time, preservation method, storage requirement, and container type.

No duplicate or blank samples were taken during this investigation.

3.4.2 Uncertainty and Sources of Bias

Several sources of uncertainty and potential bias have been identified as being introduced by the investigation methods used:

- With the exception of HP05, non-targeted sampling was used. Sample locations were selected to provide coverage across the site. Non targeted sampling allows the data to be assessed in a statistical analysis however may miss hotspots of contamination arising from specific point sources.
- The location of HP05 was positioned between the heating oil tank and the stream (down gradient). Targeted sampling allows specific sources to be targeted and horizons to be sampled. As such samples from HP05 may be representative of a hotspot but are not suitable for use in statistical analysis.
- A 10.6 eV lamp was used in screening the samples for the presence of VOCs. A 10.6 eV lamp was preferred because it has a considerably longer working life than an 11.7 eV lamp. Different results are possible had a different lamp been used.

Overall, the quality of the field data collected was considered to be sufficient to meet the objectives of this assessment.

4 Discussion

4.1 Generic Quantitative Risk Assessment

4.1.1 Soil Contamination

In order to assist risk-based decision making regarding human health, Land Quality Management Limited (LQM) and the Chartered Institute for Environmental Health (CIEH) published 'Suitable 4 Use Levels' (S4UL) based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) tool, version 1.071. Toxicological data was used along with generic landuse scenarios (with specific assumptions made in each case) to assess the dermal exposure and inhalation of contaminated dust, to provide a combined pathway generic assessment criteria (GAC) screening value. Furthermore, to support decision making regarding a revised Statutory Guidance, designed to address concerns with the real-world application of Part 2A of the Environmental Protection Act 1990 (Part 2A), DEFRA produced Category 4 Screening Levels (C4SL) for six contaminants.

A summary of the laboratory test results is presented in the following table. Where the detected concentration exceeds the GAC, the cell is coloured Red.

Table 4.1.1; GQRA GAC Screening for Residential with Homegrown Produce at 1% SOM						
Analyte	GAC/C4SL	HP01 ES2 0.50 m	HP02 ES2 0.35 m	HP03 ES2 0.30 m	HP04 ES1 0.10 m	HP05 ES1 0.10-0.20 m
Arsenic	37	11	13	13	13	13
Boron	290	1.7	0.8	2	2.8	1.1
Cadmium	11	0.6	0.7	0.6	0.8	0.5
Chromium	910	19	23	18	20	17
Copper	2400	34	45	42	35	30
Lead	200	140	170	250	130	240
Mercury	40	< 0.3	< 0.3	0.4	< 0.3	< 0.3
Nickel	180	19	21	18	18	19
Selenium	250	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	410	160	220	210	190	140
Total Cyanide	34	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Monohydric Phenols	120	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	2.3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	170	< 0.05	< 0.05	< 0.05	< 0.05	0.36
Acenaphthene	210	< 0.05	< 0.05	< 0.05	< 0.05	0.31
Fluorene	170	< 0.05	< 0.05	< 0.05	< 0.05	0.4
Phenanthrene	95	0.72	0.51	0.77	0.58	4.9
Anthracene	2400	< 0.05	< 0.05	< 0.05	< 0.05	1.1
Fluoranthene	280	1.8	1.1	1.8	1.3	9.7
Pyrene	620	1.5	0.97	1.5	1.1	8
Benzo(a)anthracene	7.2	1.1	0.61	1.1	0.74	4.9
Chrysene	15	0.77	0.55	0.89	0.64	3.7
Benzo(b)fluoranthene	2.6	1.1	0.62	1	0.81	4.5
Benzo(k)fluoranthene	77	0.34	0.3	0.48	0.3	2.1
Benzo(a)pyrene	2.2	0.9	0.57	1	0.76	4.6
Indeno(1,2,3-cd)pyrene	27	0.48	0.33	0.51	0.39	2.3
Dibenz(a,h)anthracene	0.24	< 0.05	< 0.05	< 0.05	< 0.05	0.52
Benzo(ghi)perylene	320	0.6	0.4	0.63	0.43	2.4
TPH C10 - C40	-	36	33	28	32	80

Table 4.1.1; GQRA GAC Screening for Residential with Homegrown Produce at 1% SOM						
Analyte	GAC/C4SL	HP01 ES2	HP02 ES2	HP03 ES2	HP04 ES1	HP05 ES1
Aliphatic >EC5 - EC6	42	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aliphatic >EC6 - EC8	100	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aliphatic >EC8 - EC10	27	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aliphatic >EC10 - EC12	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >EC12 - EC16	130	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Aliphatic >EC16 - EC21	65000	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Aliphatic >EC21 - EC35	65000	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Aromatic >EC5 - EC7	70	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aromatic >EC7 - EC8	130	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aromatic >EC8 - EC10	34	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aromatic >EC10 - EC12	74	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic >EC12 - EC16	140	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Aromatic >EC16 - EC21	260	< 10	< 10	< 10	< 10	< 10
Aromatic >EC21 - EC35	1100	21	24	21	26	63
Benzene	0.087	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	47	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	56	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	60	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tertiary Butyl Ether (MTBE)	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

4.1.2 Soil Contamination

Where laboratory test results have returned concentrations below the GAC or limit of detection of the test, there is deemed to be no significant risk to human health. Where concentrations exceed the GAC, or where positive detection is made for an analyte for which no GAC is established, a discussion is provided below.

Asbestos

Asbestos fibres have not been detected in any of the samples tested. As such, asbestos contaminated soils are not considered to present a significant risk to the sensitive receptors identified; specifically Human Health receptors.

Heavy Metals

Several metals have been detected in concentrations that exceed the limit of detection for the test method.

With the exception of lead, in the concentrations detected, heavy metals are not believed to present a significant risk to the sensitive receptors identified; specifically Human Health and Environmental receptors.

Only lead has been detected in concentrations that exceed the generic assessment criteria screening value in two samples; HP03 ES1 at 0.3 m depth and HP05 ES1 at 0.10-0.20 m depth. The testing reported concentrations of 250 mg/kg and 240 mg/kg respectively.

Polycyclic Aromatic Hydrocarbons (PAH)

In all samples tested, several PAHs have been detected in concentrations in excess of the limit of detection for the test method. However, only three (Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenz(a,h)anthracene) have been detected in concentrations that exceed the generic assessment criteria screening value in one sample; HP05 ES1 at 0.10-0.20 m depth.

Total Petroleum Hydrocarbons (TPH)

Positive detection of Petroleum Hydrocarbons (aromatic fraction >EC21 - EC35) has been made in all five samples tested. However, none of the analytes (aliphatic or aromatic TPH) have been detected in concentrations that exceed the generic assessment criteria screening value. As such, in the concentrations detected, Petroleum Hydrocarbons are not believed to present a significant risk to the sensitive receptors identified; specifically Human Health and Environmental receptors.

4.1.3 Groundwater Risk Assessment

Groundwater was not encountered during the intrusive investigation which extended to a maximum depth of 1.2 m bgl.

The groundwater underlying the site was identified as a secondary A aquifer. The site was in the Outer Zone (Zone II) of a groundwater Source Protection Zone. A small stream forms the northern boundary of the site.

Given the shallow made ground encountered together with the very low concentrations of heavy metals, PAHs and TPH fractions reported in the laboratory testing, no ground water sampling or testing was conducted.

The risk to groundwater and surface water is assessed as being negligible.

4.1.4 Gas Risk Assessment

One method of ground gas risk estimation is to use the method set out in Annex D of BS 8485; Characterization without gas monitoring data.

The guidance states that, before applying this empirical method, it is necessary to assess whether any potential actively gassing source of hazardous gasses are present that may produce or transmit such hazardous gasses to the underside of new buildings.

While the mapped geology suggests the potential for alluvium to be present in the area (specifically following the path of the stream forming the northern boundary of the site) no such material was encountered during our investigation and non is suspected.

In any case, should such alluvium or other putrescible soils be encountered during groundworks, it is essential that GAC Consulting be notified so as a full assessment of the potential for ground gas generation can be undertaken.

The guidance states that the empirical approach may be adopted if;

- the preliminary conceptual site model has not identified any high gas generation sources,
- the source (made ground) has less than 3 m average depth and 5 m maximum depth,
- TOC less than 4% for made ground in place for <20 years or 6% for made ground in place for >20 years.

The desk study assessed a very low risk of ground gas generation. Made ground has been found to a maximum depth of 1.1 m. The made ground is believed to have been in place for >20 years being that the mapping indicates that no permanent building has been present on site since the demolition of a single small building prior to the mapping revision of 1999. Maximum TOC concentrations have been reported in laboratory testing at 2.3%.

As such, application of the empirical approach is considered appropriate in this case.

A representative sample was taken from each stratum in each hand pit. Each sample was qualitatively assessed for organic material. One sample from each pit, believed to possess the highest fraction of organic material was submitted for detailed analysis and laboratory quantification of TOC.

Detailed analysis of each selected sample was completed including weighing of the total mass, removal of the fraction greater than >10 mm, each fraction weighed and the material logged.

With the >10 mm soil fraction removed, the remaining sample, consisting of fines <10mm were submitted to the laboratory for TOC quantification.

The following table presents the results of this process.

Table 4.1.4 – Weight of degradable materials found in soil samples (grams)

	HP01 ES1	HP01 ES2	HP02 ES2	HP03 ES1	HP04 ES1	HP05 ES1
Tot wight of sample	1651	1761	1621	1726	1682	1581
Inert particles >10 mm	267	171	268	250	272	299
Woody material	0	0	0	0	0	0
Vegetable matter (green vegetation, grass, etc.)	1	1	1	2	1	7
Cloth, leather	0	0	1	0	0	0
Paper and card	0	0	0	0	0	0
Fine fraction <10 mm	1383	1589	1351	1474	1409	1275

Notable fractions	Coal	Slate Coal	Plastic Coal	Clinker	Clinker Coal	-
TOC	1.7	2.1	2.3	1.8	1.7	1.8

Based on Table D1 of Annex D of BS 8485, in the context of the site, the TOC concentration reported would place the site as falling into Characteristic Situation 2 (CS2).

However, it is noted that coal and clinker have been recorded in several of the samples described above.

Coal, clinker, hydrocarbons and PAHs all have the potential to increase the reported TOC percentage however would not be readily degradable and as such would not give rise to ground gas generation.

In addition, a smithy is labelled on the 1904 mapping presented in Stansted Environmental Services desk study report. A smithy would have generally produced ash as a waste product and it is possible that this ash may have become interred in the soils on site. Ash would also give rise to an increased quantity of TOC while not being degradable in terms of gas generation.

It has not been possible to assess the relative quantity of these different minor fractions and what affect they may have on the TOC content of the samples however it is our belief that the soils encountered, logged and tested do not represent a significant risk of ground gas generation.

Adopting a lines of evidence approach, the following findings are noted:

- Samples assessed as likely to possess the highest TOC were submitted for testing,
- No discreet layers of highly degradable material were noted,
- No natural geological strata that may produce significant volumes of ground gas were encountered,
- The made ground has been in place for >20 years and possibly many decades,
- The made ground was relatively shallow with a maximum depth of 1.1 m being recorded,
- Low TOC content has been recorded, further reduced where the effect of coal, clinker, hydrocarbons, PAH and any ash is taken in to account,
- No putrescible woody material, cloth or leather, paper or card has been recorded in the detailed logging of the samples tested. Very low weights of vegetable matter were recorded,
- No other significant source of ground gas has been identified.

The guidance states that "care is needed where made ground includes organic materials that are not readily degradable". Based on the guidance and in the in the context of the lines of evidence, we recommend revising the characteristic situation from CS2 to CS1.

For a Type A building and for characteristic situation 1, no ground gas protection measures are necessary.

4.2 Waste Assessment

Prior to disposal in a landfill, all waste must be classified as either;

- • Inert,
- • Non-hazardous,
- • Hazardous.

Assessment was completed through waste assessment criteria (WAC) testing. One sample of material likely to be disposed of off-site in a landfill, was submitted for full solid and leachate (10:1) WAC testing

The results of this testing classified the soil as inert. The laboratory certificate is appended to this report.

Waste classification is the responsibility of the contractor and should be undertaken in accordance with relevant guidance such as the Environment Agency's Hazardous Waste Technical Guidance (WM3) document and regulations including the Waste Management and Landfill Regulations.

Where multiple distinct waste materials or disposal/reuse options are available, it can be cost effective to complete assessment using the governments HazWasteOnline portal. Such assessment has not been completed as part of this investigation.

5 Conclusions and Recommendations

5.1 Lines of Evidence

Adopting a lines of evidence approach, the following findings are noted:

- The desk study completed by Stansted Environmental Services identified the heating oil tank as presenting a low risk of contamination and made ground on site presenting a very low risk of significant concentrations of ground gas,
- In addition, a historical smithy has been identified immediately east of the site,
- Made ground has been recorded up to 1.1 m depth,
- Coal and clinker were noted in the soils subjected to detailed logging,
- Laboratory testing returned concentrations of lead and PAH in excess of the screening values,
- Low concentrations of petroleum hydrocarbons were recorded across the site, through at levels below the relevant screening value,
- Ground water was not encountered, though a small stream forms the northern boundary of the site,
- Groundwater underlying the site was identified as a secondary A aquifer. The site was in the Outer Zone (Zone II) of a groundwater Source Protection Zone,
- Though not definitive, leachate testing conducted as part of the waste assessment returned very low concentrations of metals leaching to water,
- Total Organic Carbon content of up to 2.3% was reported,
- No or very low amounts of degradable material were encountered in made ground,
- No degradable natural soils were encountered,
- Made Ground has been in place for >20 years and possibly decades.

5.2 Conclusions

Soil

Based on the investigation completed, the neighbouring "smithy" labelled on historical maps was considered the most significant source of contamination on the site.

Made ground, generally consisting of light and dark greyish brown slightly gravelly to gravelly sand was encountered to a maximum depth of 1.1 m bgl. Coal and clinker have been noted in the soils with the potential for ash to have been interred in the soils.

Laboratory testing has reported lead and PAH contamination in excess of the relevant generic assessment screening values.

With the exception off HP05, a non-targeted sampling strategy was adopted, meaning sample locations were selected to provide coverage across the site.

Based on the concentrations reported, some further assessment or mitigation will need to be completed before the site can be considered "suitable for use".

Groundwater

Given the shallow made ground encountered together with the very low concentrations of heavy metals, PAHs and TPH fractions reported in the laboratory testing, no ground water sampling or testing was conducted.

The risk to groundwater and surface water was assessed as being negligible.

Ground Gas

No significant source of ground gas has been identified. Based on the methodology set out in Annex D of BS 8485, the site was assessed as falling within CS1 with no ground gas protection measures necessary.

Waste Soil

The results of WAC testing classified the soil as inert. The laboratory certificate is appended to this report.

Where multiple distinct waste materials or disposal/reuse options are available, it can be cost effective to complete assessment using the governments HazWasteOnline portal.

5.3 Recommendations

Should any previously unexpected contamination be encountered, this should be reported to the local authority and/or assessed by an environmental engineer to determine the risk as well as what, if anything, should be done to manage that risk.

Should alluvium or other putrescible soils be encountered during groundworks, it is essential that GAC Consulting be notified so as a full assessment of the potential for ground gas generation can be undertaken.

Based on the assessment above, some further action is warranted with regard to soils with small exceedances of PAH and lead contamination. The following options appraisal considers, in general terms, the relative merits of some viable options;

Table 5.3 Options Appraisal – Matrix

Further Action	Cost 1 = less expensive 3 = more expensive	Sustainability 1 = more sustainable 3 = less sustainable	Complexity 1 = less complex 3 = more complex	Likelihood of positive outcome 1 = less likely 3 = more likely
Excavate and dispose of soil	£££ (3)	X (3)	X (3)	XXX (1)
Detailed Quantitative Risk Assessment	££ (2)	X (1)	X (1)	X (3)
Soil cover system	££ (2)	XX (2)	XX (2)	XXX (1)

Excavation and off-site disposal of contaminated soils is likely more expensive and less sustainable than the other options. This can also be beneficial if site levels are planned to be lowered.

A detailed quantitative risk assessment may involve collecting more samples from across the site, completing further laboratory testing and may include some statistical analysis of the results. The outcome of such an assessment may be a demonstration that no significant risk is posed however may demonstrate that remediation in the form of excavation and/or capping may be necessary.

A soil cover system acts to break the contaminant pathway by introducing a barrier between the contaminated soil and the receptor; in this case residents using the site post development. A soil cover system may be implemented in areas of garden and soft landscaping as buildings and hardstanding act as a barrier elsewhere on the site. In any case, it is expected that some landscaping will be completed as part of the development, and this could be incorporated into a soil cover system.

Looking at the qualitative matrix above, both a Detailed Quantitative Risk Assessment and a Soil Cover System are considered similarly beneficial but for the fact the soil cover system is more likely to generate a favourable outcome.

It is recommended that a soil cover system is implemented to reduce the risk to sensitive receptors.

The client and other stakeholders may ascribe different values/weightings or have alternative/competing objectives to those set out above. As such the preferred option may change.

6 Limitations and Closing Statement

This report is prepared for the sole use of the client, as stated above, in accordance with the scope agreed under separate cover. No responsibility or liability is accepted for the use of this report of in whole or in part by third parties. Written authorisation of reliance can be provided under separate cover upon request.

The conclusions presented herein are based on information gathered from multiple sources including but not limited to the client and their representatives, in-house and existing knowledge, third parties (including historical mapping, databased information and public and private online sources) and site visits. Though an effort has been made to use reputable sources and checks made on the validity of information, the information used in this assessment is assumed to be accurate. In the event that the information used is inaccurate or misrepresented, we accept no responsibility for erroneous assessment. Should new information come to light that contradicts or enhances this assessment, we welcome the opportunity to complete a reassessment, to the satisfaction of all parties.

This report assumes the competency of the readership and is intended to facilitate sufficiently experienced and competent individuals and organisations to apply best practice within their professional field of expertise. It is not intended to act as a replacement for experience and competence. We are happy to revise any aspect of this report following discussion with appropriately experienced and competent specialists.

GACC assumes the readership understands and accepts the limitations of the scope of this investigation, including those imposed by time and budgetary considerations that may materially affect the methodology, conclusions and recommendations.

We trust the findings of this investigation meet the requirements of the project objectives, set out above, to be used in isolation or combination with other such reports to address any outstanding requirements of the project described herein.

For Geotechnical and Contamination Consulting

Philip Price, B.Sc., FGS, RSoBRA

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Abbreviations

ACM	Asbestos Containing Material
aOD	above Ordnance Datum
API	American Petroleum Institute
As	Arsenic
AST	Above Ground Storage Tank
B	Boron
Be	Beryllium
bgl	below ground level
BGS	British Geological Survey
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes
Cd	Cadmium
CH4	Methane
CO	Carbon Monoxide
CO2	Carbon Dioxide
Cr	Chromium
CSM	Conceptual Site Model
Cu	Copper
CWG	Criteria Working Group
DCE	Dichloroethane
DNAPL	Dense non-aqueous phase liquid
DWS	Drinking Water Standards
E	east
EA	Environment Agency
ESA	Environmental Site Assessment
EQS	Environmental Quality Standards
GI	Ground Investigation
H	Hydrogen
H2S	Hydrogen sulphide
Hg	Mercury
LNAPL	Light non-aqueous phase liquid
m	metres
m/sec	metres per second
mb	millibar
MTBE	Methyl tert-butyl ether
N	north
N2	Nitrogen
NE	northeast
Ni	Nickle
NW	northwest
O2	Oxygen
OS	ordnance survey
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyls
PCE	Perchloroethylene
PFHxS	Perfluorohexane Sulfonate
PFOA	Perfluorooctanesulfonic acid
PFOS	Perfluorooctanesulfonate
PID	Photo Ionisation Detector
PSC	Potential Sources of Contamination
PRA	Preliminary Risk Assessment
Rn	Radon

S	south
SE	southeast
Se	Selenium
SOM	Soil organic matter
TIC	Tentatively Identified Compounds
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
TPOs	Tree Protection Order
US EPA	United States Environmental Protection Agency
UST	Underground Storage Tank
V	Vanadium
VOA	Volatile organic analysis
VOC	Volatile organic compounds
W	west
Zn	Zinc

Appendices

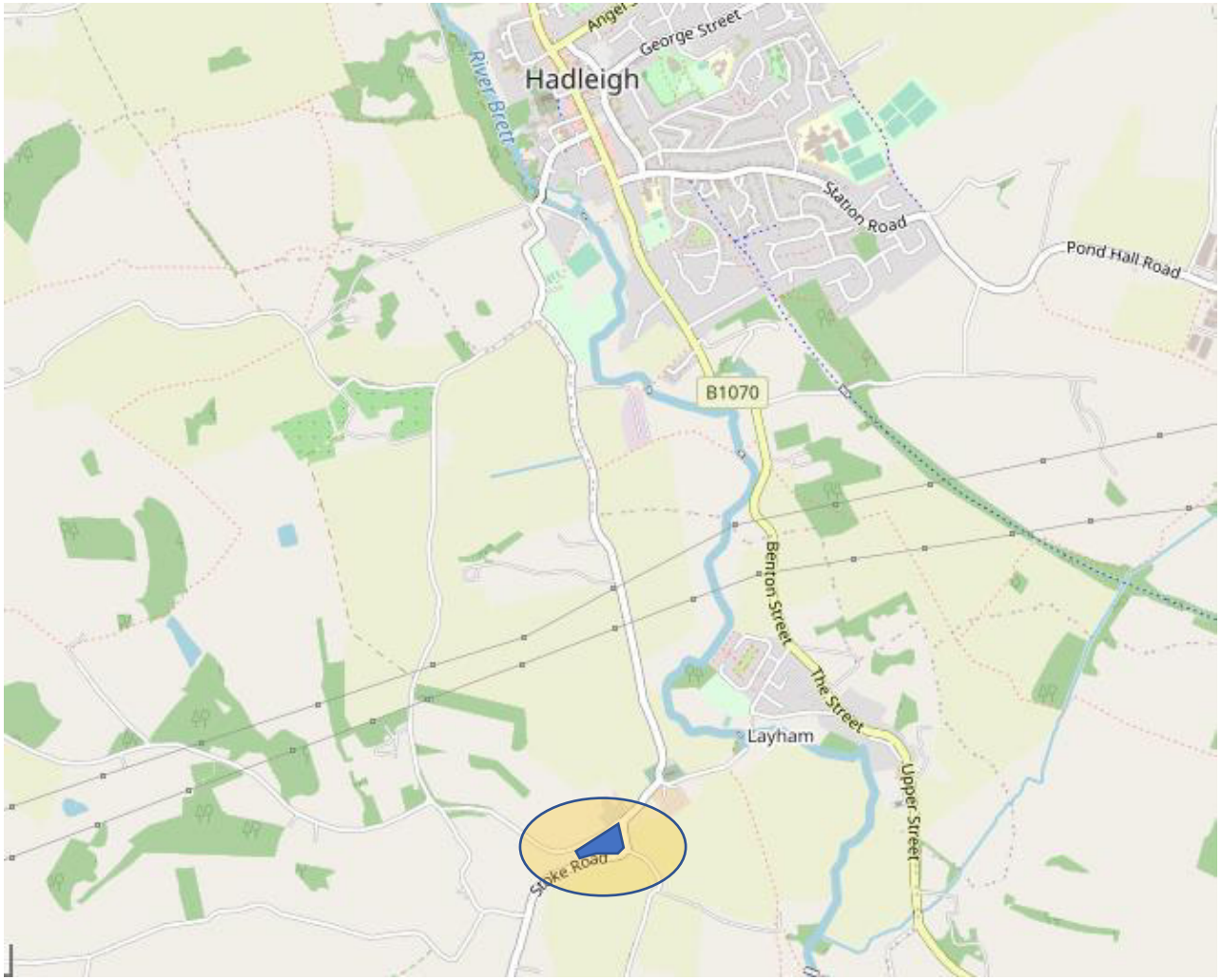
Drawings
- Site Location Plan — G0125-DR01
- Fieldwork Location Plan — G0125-DR02

Fieldwork Records
- Hand Pit Logs

Laboratory Testing
- Testing Schedules
- Laboratory Report — Report 22-84839
  Report 22-84840

Drawings

Drawing Tile: Site Location Plan	Drawing Number: G0125-DR01



Drawing Tile: Fieldwork Location Plan Site Location Plan	Drawing Number: G0125-DR02

Fieldwork Records

GAC CONSULTING - TRIAL PIT LOG

PROJECT NUMBER G0125 **PROJECT NAME** Brook Cottage, Lower Layham **HOLE ID** HP01
DATE 13/09/2022
CLIENT 4B Building Ltd **EASTINGS (X)**
NORTHINGS (Y) **PLANT** Hand Tools
ELEVATION (Z) **LOGGED BY** Philip Price

COMMENTS 1) Groundwater was not encountered. 2) Hole backfilled with arisings.

Elevation	Depth (m)	Material Description	Legend	Stratum Depth (m)	Sample Type/Depth	Notes
-0.1		Made Ground (Dark grey slightly silty gravelly SAND with a low cobble content. Gravel sized fragments of fine to coarse rounded to angular concrete and rare coal and brick. Gravel of fine to coarse rounded to angular flint).		0.0 - 0.37	ES1 @ 0.1 -0.3m	
-0.2						
-0.3						
-0.4		Made Ground (Dark greyish brown slightly clayey slightly gravelly SAND. Rare gravel sized fragments of fine subangular coal and slate. Gravel of fine to medium rounded to subangular flint).		0.37 - 0.84		
-0.5	0.5				ES2 @ 0.5 m	
-0.6						
-0.7						
-0.8						
-0.9		Dark orangish brown slightly clayey slightly gravelly SAND. Gravel of fine to medium subrounded to subangular flint.		0.84 -1.1		
-1	1				D1 @ 1.0 m	
-1.1						
-1.2						
-1.3						
-1.4						

GAC CONSULTING - TRIAL PIT LOG

PROJECT NUMBER G0125 **PROJECT NAME** Brook Cottage, Lower Layham **HOLE ID** HP02
DATE 13/09/2022
CLIENT 4B Building Ltd **EASTINGS (X)**
NORTHINGS (Y) **PLANT** Hand Tools
ELEVATION (Z) **LOGGED BY** Philip Price

COMMENTS 1) Groundwater was not encountered. 2) Hole backfilled with arisings.

Elevation	Depth (m)	Material Description	Legend	Stratum Depth (m)	Sample Type/Depth	Notes
-0.1		Made Ground (Dark greyish brown gravelly SAND. Gravel of fine to coarse subrounded to angular brick and flint).		0.0 - 0.25		
-0.2					ES1 @ 0.2 m	
-0.3		Made Ground (Light greyish brown gravelly SAND with a low cobble content. Gravel of fine to coarse subrounded to subangular brick flint and rare metal plastic coal and chalk).		0.25 - 0.4		
-0.4					ES2 @ 0.35 m	
-0.5	0.5	Made Ground (Dark greyish brown slightly gravelly SAND. Gravel of fine to coarse rounded to angular flint and rare fine brick and coal).		0.4 - 1.1		
-0.6					ES3 @ 0.5 - 0.6 m	
-0.7						
-0.8						
-0.9						
-1	1					
-1.1		Orangish brown slightly clayey slightly gravelly SAND. Gravel of fine to coarse subrounded to subangular flint.		1.1 - 1.2	D1 @ 1.2 m	
-1.2						
-1.3						
-1.4						

GAC CONSULTING - TRIAL PIT LOG

PROJECT NUMBER G0125 **PROJECT NAME** Brook Cottage, Lower Layham **HOLE ID** HP03
DATE 13/09/2022
CLIENT 4B Building Ltd **EASTINGS (X)**
NORTHINGS (Y) **PLANT** Hand Tools
ELEVATION (Z) **LOGGED BY** Philip Price

COMMENTS 1) Groundwater was not encountered. 2) Hole backfilled with arisings.

Elevation	Depth (m)	Material Description	Legend	Stratum Depth (m)	Sample Type/Depth	Notes
-0.1		Made Ground (Dark greyish brown gravelly SAND with a low cobble content. Gravel of fine to medium rounded to angular concrete brick flint clinker and rare metal).		0.0 - 0.4	ES1 @ 0.1 m	
-0.2						
-0.3					ES2 @ 0.3 m	
-0.4		Made Ground (Dark brown slightly clayey slightly gravelly SAND. Gravel of fine to coarse subrounded to angular flint and rare coal).		0.4 - 0.9		
-0.5	0.5					
-0.6						
-0.7						
-0.8					ES3 @ 0.8 m	
-0.9		Dark brown mottled orangish brown slightly clayey slightly gravelly SAND. Gravel of fine to medium subrounded to subangular flint.		0.9 - 1.1		
-1	1				D1 @ 1.0 m	
-1.1						
-1.2						
-1.3						
-1.4						

GAC CONSULTING - TRIAL PIT LOG

PROJECT NUMBER G0125 **PROJECT NAME** Brook Cottage, Lower Layham **HOLE ID** HP04
DATE 13/09/2022
CLIENT 4B Building Ltd **EASTINGS (X)**
NORTHINGS (Y) **PLANT** Hand Tools
ELEVATION (Z) **LOGGED BY** Philip Price

COMMENTS 1) Groundwater was not encountered. 2) Hole backfilled with arisings.

Elevation	Depth (m)	Material Description	Legend	Stratum Depth (m)	Sample Type/Depth	Notes
-0.1		Made Ground (Dark greyish brown gravelly SAND. Gravel of fine to coarse rounded to angular concrete flint and rare plastic chalk clinker and coal).		0.0 - 0.5	ES1 @ 0.1 m	
-0.2						
-0.3					ES2 @ 0.3 m	
-0.4						
-0.5	0.5	Made Ground (Dark brown gravelly SAND. Gravel of fine to coarse subrounded to angular brick chalk and flint).		0.5 - 0.7		
-0.6					ES3 @ 0.6 m	
-0.7		Dark greyish brown slightly clayey slightly gravelly SAND. Gravel of fine to medium subrounded to angular brick clinker coal and flint).		0.7 - 1.0		
-0.8						
-0.9					ES4 @ 0.9 m	
-1	1	Orangish brown slightly clayey slightly gravelly SAND. Gravel of fine to coarse subrounded to subangular flint.		1.0 - 1.2		
-1.1					D1 @ 1.1 m	
-1.2						
-1.3						
-1.4						

GAC CONSULTING - TRIAL PIT LOG

PROJECT NUMBER G0125 **PROJECT NAME** Brook Cottage, Lower Layham **HOLE ID** HP05
DATE 13/09/2022
CLIENT 4B Building Ltd **EASTINGS (X)**
NORTHINGS (Y) **PLANT** Hand Tools
ELEVATION (Z) **LOGGED BY** Philip Price

COMMENTS 1) Groundwater was not encountered. 2) Hole backfilled with arisings.

Elevation	Depth (m)	Material Description	Legend	Stratum Depth (m)	Sample Type/Depth	Notes
		Made Ground (Dark brown slightly gravelly SAND. Gravel of fine to coarse subrounded to subangular flint and rare brick).		0.0 - 0.3		
-0.1					ES1 @ 0.1 - 0.2	
-0.2						
-0.3		Made Ground (Light greyish brown slightly gravelly SAND. Gravel of fine to medium subrounded to subangular brick and flint).		0.3 - 0.6		
-0.4						
-0.5	0.5				ES2 @ 0.45 -0.5 m	
-0.6		Made Ground (Dark brown gravelly SAND. Gravel of fine to medium subrounded to subangular flint and rare fine brick).		0.6 - 1.1		
-0.7					ES3 @ 0.7 m	
-0.8						
-0.9						
-1	1				ES4 @ 1.0 m	
-1.1		Dark brown slightly gravelly SAND. Gravel of fine to medium subrounded to subangular flint.		1.1 - 1.2		
-1.2						
-1.3						
-1.4						

GAC CONSULTING - TRIAL PIT LOG

PROJECT NUMBER G0125 **PROJECT NAME** Brook Cottage, Lower Layham **HOLE ID** HP06
DATE 13/09/2022
CLIENT 4B Building Ltd **EASTINGS (X)**
NORTHINGS (Y) **PLANT** Hand Tools
ELEVATION (Z) **LOGGED BY** Philip Price

COMMENTS 1) Groundwater was not encountered. 2) Hole backfilled with arisings.

Elevation	Depth (m)	Material Description	Legend	Stratum Depth (m)	Sample Type/Depth	Notes
-0.1		Made Ground (Dark orangish brown slightly clayey gravelly SAND. Gravel of fine to coarse rounded to angular granite).		0.0 - 0.25	D1 @ 0.1 m	
-0.2						
-0.3		Orangish yellow gravelly SAND. Gravel of fine to medium subrounded to subangular flint.		0.25 - 1.0		
-0.4						
-0.5	0.5				D2 @ 0.5 m	
-0.6						
-0.7						
-0.8						
-0.9					D3 @ 1.0 m	
-1	1					
-1.1						
-1.2						
-1.3						
-1.4						

Laboratory Testing

i2 SAMPLE CHAIN OF CUSTODY RECORD

No

7 Woodshots Meadow
Croxley Green Business Park
Watford
WD18 8YS

t: 01923 225404
f: 01923 237404

Client:	Geotechnical and Contamination Consulting	Date samples dispatched:	15/09/2022
Address:	The Enterprise Centre, University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ	Samples delivered/collected by:	Courier
client e-mail:	philip.price@gacconsulting.co.uk	Sampler I.d.	PP
Project/Site Name:		Turnaround time/date results due:	10 Days
Project/Site Code:			
Contact Name:	Philip Price		
Tel: 07958 470855	Fax:		

sheet 1 of 1

One project/ site per sheet please

Client PO

PO_G0125_002

reception@i2analytical.com

Please indicate the analysis required for each sample by marking the boxes

Lab Use	BH or TP or Sample ID	Depth (m)	Date sample taken	Time sample taken	S- soil, W - water, L - leachate, O - other	no. of containers	Standard Spectrum Suite: Asbestos Screen & ID , W/S Boron, As, Cr, Cu, Pb, Se, Zn, Cd, Hg, Ni, Speciated PAH, TPH1 & TPH CWG, pH, TOC, Total Sulphate, Sulphide, Monohydric Phenols, Total Cyanide,	TPHCWG (inc. BTEX)	TPH : EPH (C10 – C40)	TOC	WAC Full Solid Suite & WAC BS EN12457-2 : Single Stage 10:1 Leachate Suite								Sample Specific Notes/ **Container types (Lab use Only)**
	HP01 ES1	**0.3**	13/09/2022		S	**1**				X										
	HP04 ES1	**0.1**	13/09/2022		S	**3**	X														
	HP03 ES1	**0.1**	13/09/2022		S	**3**					X										
	HP01 ES2	**0.5**	13/09/2022		S	**3**	X														
	HP02 ES2	0.35	13/09/2022		S	3	X														
	HP03 ES2	0.3	13/09/2022		S	3	X														
	HP05 ES1	0.1 - 0.2	13/09/2022		S	3	X														

Total no. of samples:

Possible Hazard Identification

Non-Hazard ☐ Hazardous ☐ Unknown ☐

Special instructions / QC; requirements & comments:

avg. transport temp.

hours in transport

Sample disposal (a fee maybe assessed if samples are retained longer than 1 month) return to client ☐ disposal by lab ☐ archive for ☐

i2 QUOTE NO

LAB USE ONLY

Data received: time: by:

Data instructed: time: by:

Laboratory notes

Philip price
Geotechnical and Contimination Consulting
The Enterprise Centre
University of East Anglia
Norwich Research Park
Norwich
NR4 7TJ

e: philip.price@gacconsulting.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 22-84839

Project / Site name:		**Samples received on:**	20/09/2022
Your job number:		**Samples instructed on/ Analysis started on:**	20/09/2022
Your order number:	PO_G0125_002	**Analysis completed by:**	03/10/2022
Report Issue Number:	1	**Report issued on:**	03/10/2022
Samples Analysed:	6 soil samples		

Signed:

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-84839

Your Order No: PO_G0125_002

Lab Sample Number				2428629	2428630	2428631	2428632	2428633
Sample Reference				HP01	HP04	HP01	HP02	HP03
Sample Number				1	1	2	2	2
Depth (m)				0.30	0.10	0.50	0.35	0.30
Date Sampled				13/09/2022	13/09/2022	13/09/2022	13/09/2022	13/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	7.1	9.5	8.8	6.3	9.3
Total mass of sample received	kg	0.001	NONE	1	1.4	1.4	1.4	1.4
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	N/A	NTK	NTK	NTK	ASE
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	8.2	7.9	8.0	7.9
Total Cyanide	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	-	1200	510	690	750
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.23	0.0051	0.019	0.018
Sulphide	mg/kg	1	MCERTS	-	7.2	1.6	1.9	3.3
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.7	1.7	2.1	2.3	1.8
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	0.58	0.72	0.51	0.77
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	1.3	1.8	1.1	1.8
Pyrene	mg/kg	0.05	MCERTS	-	1.1	1.5	0.97	1.5
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.74	1.1	0.61	1.1
Chrysene	mg/kg	0.05	MCERTS	-	0.64	0.77	0.55	0.89
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	0.81	1.1	0.62	1
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.3	0.34	0.3	0.48
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	0.76	0.9	0.57	1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.39	0.48	0.33	0.51
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.43	0.6	0.4	0.63
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	7.02	9.23	5.96	9.72
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	13	11	13	13
Boron (water soluble)	mg/kg	0.2	MCERTS	-	2.8	1.7	0.8	2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	0.8	0.6	0.7	0.6
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	20	19	23	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	35	34	45	42
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	130	140	170	250
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	< 0.3	0.4
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	18	19	21	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	190	160	220	210
Monoaromatics & Oxygenates								

Analytical Report Number: 22-84839

Your Order No: PO_G0125_002

Lab Sample Number				2428629	2428630	2428631	2428632	2428633
Sample Reference				HP01	HP04	HP01	HP02	HP03
Sample Number				1	1	2	2	2
Depth (m)				0.30	0.10	0.50	0.35	0.30
Date Sampled				13/09/2022	13/09/2022	13/09/2022	13/09/2022	13/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Benzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH C10 - C40 $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	32	36	33	28
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	-	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	MCERTS	-	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	-	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-	26	21	24	21
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	MCERTS	-	32	28	33	28

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-84839

Your Order No: PO_G0125_002

Lab Sample Number				2428634
Sample Reference				HP05
Sample Number				1
Depth (m)				0.10-0.20
Date Sampled				13/09/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	5.5
Total mass of sample received	kg	0.001	NONE	1.4

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	ASE

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.0
Total Cyanide	mg/kg	1	MCERTS	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	400
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.004
Sulphide	mg/kg	1	MCERTS	2.8
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.8

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.36
Acenaphthene	mg/kg	0.05	MCERTS	0.31
Fluorene	mg/kg	0.05	MCERTS	0.4
Phenanthrene	mg/kg	0.05	MCERTS	4.9
Anthracene	mg/kg	0.05	MCERTS	1.1
Fluoranthene	mg/kg	0.05	MCERTS	9.7
Pyrene	mg/kg	0.05	MCERTS	8
Benzo(a)anthracene	mg/kg	0.05	MCERTS	4.9
Chrysene	mg/kg	0.05	MCERTS	3.7
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	4.5
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4.6
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.3
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.52
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.4

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	49.7

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	30
Lead (aqua regia extractable)	mg/kg	1	MCERTS	240
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	140

Monoaromatics & Oxygenates

Analytical Report Number: 22-84839

Your Order No: PO_G0125_002

Lab Sample Number				2428634
Sample Reference				HP05
Sample Number				1
Depth (m)				0.10-0.20
Date Sampled				13/09/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Benzene	µg/kg	1	MCERTS	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0
Petroleum Hydrocarbons				
TPH C10 - C40 EH_CU_1D_TOTAL	mg/kg	10	MCERTS	80
TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	MCERTS	< 10
TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	63
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	MCERTS	68

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-84839
Project / Site name:

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2428629	HP01	1	0.3	Brown loam with vegetation and brick.
2428630	HP04	1	0.1	Brown loam with rubble and glass
2428631	HP01	2	0.5	Brown loam with gravel and vegetation.
2428632	HP02	2	0.35	Brown loam with gravel and brick.
2428633	HP03	2	0.3	Brown loam with gravel and plastic.
2428634	HP05	1	0.10-0.20	Brown loam with gravel and vegetation.

Analytical Report Number : 22-84839
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS

Analytical Report Number : 22-84839
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 22-84840

Project / Site name:		**Samples received on:**	20/09/2022
Your job number:		**Samples instructed on/ Analysis started on:**	20/09/2022
Your order number:	PO_G0125_002	**Analysis completed by:**	03/10/2022
Report Issue Number:	1	**Report issued on:**	03/10/2022
Samples Analysed:	1 10:1 WAC Sample		

Signed:

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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Waste Acceptance Criteria Analytical Results

Report No:	**22-84840**						
					Client:	**GEOCONTAM**	
Location							
Lab Reference (Sample Number)	2428635 / 2428636				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	13/09/2022				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	HP03 1						
Depth (m)	0.10						
Solid Waste Analysis							
TOC (%)**	1.9				3%	5%	6%
Loss on Ignition (%) **	4.4				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	23.9				100	--	--
pH (units)**	7.4				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	4.0				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0061			0.0540	0.5	2	25
Barium *	0.0205			0.181	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0021			0.019	0.5	10	70
Copper *	0.015			0.13	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0029			0.0254	0.5	10	30
Nickel *	0.0058			0.051	0.4	10	40
Lead *	0.0090			0.079	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.029			0.26	4	50	200
Chloride *	1.4			12	800	15000	25000
Fluoride	0.30			2.6	10	150	500
Sulphate *	32			280	1000	20000	50000
TDS*	95			840	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	13.2			117	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.30						
Dry Matter (%)	92						
Moisture (%)	8.2						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
*= UKAS accredited (liquid eluate analysis only)
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation
** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Analytical Report Number : 22-84840
Project / Site name:

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2428635	HP03	1	0.1	Brown loam with gravel and brick.

Analytical Report Number : 22-84840
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031	W	ISO 17025

Analytical Report Number : 22-84840
Project / Site name:

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total