

KNOWSLEY HOUSE, AINSWORTH NURSING HOME, RADCLIFFE

PHASE 2 GEO- ENVIRONMENTAL INVESTIGATION, RISK ASSESSMENT AND REMEDIATION STRATEGY

Job Number: LKC 20 1567-B3

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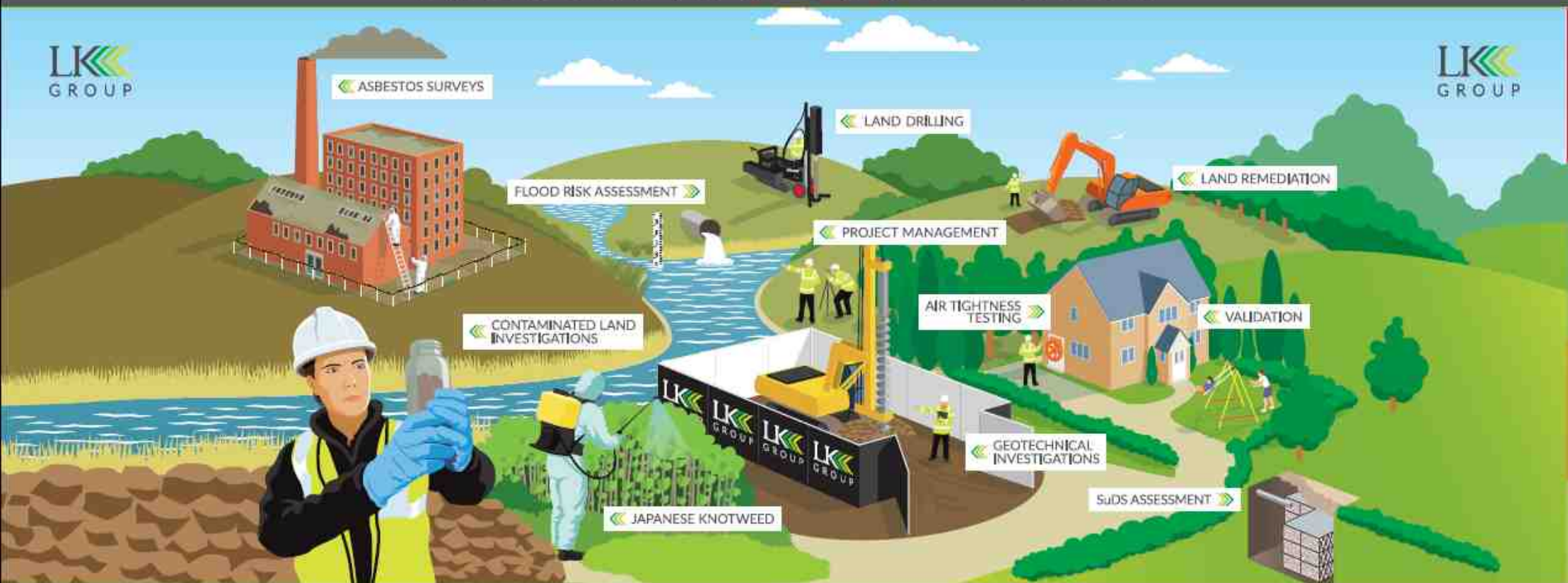
Client: Michael Moore



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1 Introduction

1.1 Background

LK Consult Ltd (LKC) has been commissioned by Michael Moore to carry out a Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy for Knowsley House in Ainsworth Nursing Home, Radcliffe. The proposed works include: an extension in the rear of the building and the change of public open space to private gardens for a future planning application.

The site location is shown on Figure 1 and Figure 2 shows the proposed site use.

The investigation was undertaken in order to provide information to enable either: the discharge of the contaminated land condition relating to the development (CLA1), or propose a Remediation Strategy and validation of any remediation required for submission to the Local Authority (CLA2), which would allow the discharge of the aforementioned contaminated land condition.

The following work has previously been undertaken:

- Preliminary Risk Assessment (PRA) report, undertaken by LKC (Ref: CL-LKC 20 1567-01, dated July 2020).

A summary of available information is provided below in Table 1-1.

Site Location	Site is Knowsley House, Plot No. 3, Ainsworth Nursing Home and surrounding grounds. Centred at approximate National Grid Reference 376430E 410940N.
Site Area	720m ² .
Proposed Development	Redevelopment and extension to existing building.
Historical Land Uses	Existing building first noted on site early 1890s, current layout 1910. The site was historically used as an infectious disease and small pox hospital until the late 1960s. The site was renamed 'Ainsworth Nursing Home' by the 1990s.
Landfill Sites	No recorded landfills within 250m. Several infilled features offsite within 250m (excavations, ponds, wells, filter beds, marshes).
Geology and Hydrogeology	Superficial: None recorded. Glacial till recorded to the south. Bedrock: Pennine Lower Coal Measures (Secondary A Aquifer). Not within a Source Protection Zone. No groundwater abstractions within 250m.
Hydrology	Collects and drain 60m SE, pond 111m W.
Flooding	No risk from rivers or seas.
Coal Mining	Within coal reporting area. Not within a development high risk area.
Preliminary UXO	Low Risk.
Preliminary Conceptual Model PL = Pollutant Linkage	PL1 (dermal contact, ingestion, inhalation): Moderate Risk (ACM, heavy metals, PAHs), Moderate / Low Risk (heavy-end hydrocarbons). PL2 (vapour inhalation): Moderate / Low Risk. PL3: Moderate Risk (hazardous / ground gas), Moderate / Low Risk (Radon). PL4 (controlled waters): Moderate / Low Risk. PL5 (sulphate attack on concrete): Moderate / Low Risk. PL6 (potable water): Moderate / Low Risk. PL7 (phytotoxicity): Low risk.

Table 1-1: Summary of Available Information.

1.2 Regulatory Context

Email correspondence from Rebecca Jones, the EPO (Environmental Protection Officer) for Bury Council, dated 20th August 2020 contained the following response to a request to discharge the contaminated land condition:

The site has formerly been in use as an Infectious Disease Hospital followed by a Nursing Home... There are no registered landfills within 250m of the site. The site is situated above the Lower Coal Measures Secondary A Aquifer which is overlain by no drift to the south and glacial till in the south.

In line with the National Planning Policy Framework, the site is proposed for a sensitive end use we recommend that the following contaminated land conditions are placed on any grant of permission:

CLA1 - Contaminated Land Preliminary Risk Assessment, Site Investigation, Detailed Risk Assessment and Remediation Strategy.

CLA2 - Contaminated Land implementation of Remediation Strategy and Site Verification Report.

1.3 Local Authority Liaison and Scope of Works

LKC advised the client that regulatory contact should be sought in order to agree a scope of works to satisfy the aforementioned contaminated land planning conditions.

The following Scope of Works was agreed with the EPO on the date 11th September 2020:

Knowsley House

- » 5no. Hand dug pits within proposed garden area
- » Shallow soil samples tested for metals, PAH and asbestos

However, as discussed:

- » If visual or olfactory evidence of hydrocarbons is identified testing for TPH CWG should be included.
- » If contamination is found, soil leachability testing should be carried out to assess the risk to controlled waters.
- » If a significant depth of made ground is encountered gas monitoring or RB17¹ assessment should be considered.

¹ CL:AIRE Research Bulletin 17. "A Pragmatic Approach to Ground Gas Risk Assessment". November 2012.

2 Ground Investigation

2.1 Site Investigation Design and Methodology

The investigation was carried out on 22nd September 2020 in line with the scope of works outlined in Section 1.3. A second investigation was undertaken on 30th September 2020 to bottom out the made ground using a soil auger with extension rods and to obtain made ground soil samples to undertake forensic logging to enable a ground gas risk assessment using the RB17² methodology. All site investigation locations are shown in Figure 3.

2.2 Sampling Protocol

2.2.1 Soil Sampling (Contamination)

Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation³.

Soil was collected for onsite testing. A plastic zip bag was half filled with soil allowing a suitably sized headspace. The bag was sealed and stored for at least 20 minutes before being tested for total volatile organic compounds (TVOCs) using a PhoCheck Tiger photoionisation detector (PID). The on-site monitoring was carried out in line CIRIA C665⁴ to aid in screening samples for volatile analysis.

Soil samples of approximately 500g were recovered in amber jars, amber vials for volatile analysis and plastic tubs. All the samples were labelled and stored in cool boxes prior to being collected by courier at the end of the day for delivery to the Chemtest laboratory in Newmarket for chemical testing. If collection was not possible the same day then samples were stored in the sample storage fridge at the LK Group offices below 4°C. Samples were tracked using appropriate Chain of Custody forms provided by Chemtest.

Many of the contamination tests are UKAS or MCERTS accredited and further details are given in the Certificate of Analysis presented in Appendix B. Table 2-1 shows the soil testing undertaken.

² CL:AIRE Research Bulletin 17. "A Pragmatic Approach to Ground Gas Risk Assessment". November 2012.

³ EA (2000). "Technical Aspects of Site Investigation. Volumes 1 & 2 Text Supplements Research and Development Technical Report." P5-065/Tr.

⁴ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

Suites and Contaminants	No. Samples	Location & Depth (m)	Justification
Metals / metalloids, pH, water soluble sulphate, speciated PAHs, SOM and asbestos screen.	8	HD101 0.0-0.5 HD102 0.0-0.4 HD103 0.2-0.6 HD103 0.6-1.0 HD104 0.4-0.9 HD104 0.9-1.2 HD105 0.4-1.0 HD205 1.6-1.8	In line with the scope of works - samples collected of the made ground where no visual, olfactory or PID evidence of hydrocarbon contamination was detected.
SOM of fine fraction <10mm	6	HD204 0.0-0.4 HD205 0.4-1.2 HD205 1.6-1.8	Following forensic logging to enable ground gas risk assessment using RB17.

Table 2-1. Summary of soil sample testing undertaken.

Notes:

Metal/metalloids=arsenic, cadmium, chromium, (total and hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc and boron;; PAH=polycyclic aromatic hydrocarbons, , SOM=Soil Organic Matter.

3 Ground Conditions

Plate 3-1 below provides a photographic record of the works carried out in the first visit on the 22nd September 2020. Logs of the ground encountered are contained in Appendix A.

	
Photograph 1 – General picture of the back of Knowsley house, including possible well on site.	Photograph 2 – General picture of the front of the house
	
Photograph 3 – HD101 - made ground of slightly gravelly slightly sandy silt to 0.50m with brick fragments and coal, natural yellowish brown slightly gravelly slightly sandy silt to 1.20m.	Photograph 4 – Contents of HD101.
	
Photograph 5 – HD102 - made ground of slightly gravelly slightly sandy silt to 0.60m with brick fragments, pottery fragments and coal, overlying natural yellowish brown slightly gravelly slightly sandy silt to 1.20m.	Photograph 6 – Contents of HD102.

Plate 3-1 Photographic record of soils encountered.

	
Photograph 7 – HD103 - made ground of slightly gravelly slightly sandy silt to 0.20m with brick fragments and coal, overlying natural yellowish brown slightly gravelly slightly sandy silt to 0.60m, underlain by a possibly reworked natural yellowish brown slightly sandy silt.	Photograph 8 – Contents of HD103.
	
Photograph 8 - HD104 - made ground of slightly gravelly slightly sandy silt to 0.40m with brick fragments and coal, overlying a second made ground yellowish brown slightly gravelly slightly sandy silt to 0.90m, overlying an ash layer to 1.20m.	Photograph 9 – Contents of HD104.
	
Photograph 10 - HD105 - made ground of slightly gravelly slightly sandy silt to 0.50m with brick fragments and glass fragments, overlying a second made ground yellowish brown slightly gravelly slightly sandy silt to 1.20m.	Photograph 11- Contents of HD105.

Plate 3-1 (continued): Photographic record of soils encountered.

Plate 3-2 below provides a photographic record of the works carried out in the second visit to bottom out the made ground undertaken on the 30th September 2020. Logs of the ground encountered are contained in Appendix A.

	
Photograph 12 – HD201 - made ground of slightly gravelly slightly sandy silt to 0.50m with brick fragments and coal, overlying natural yellowish brown slightly gravelly slightly sandy silt to 1.20m.	Photograph 13 – Location of HD201.
	
Photograph 14 – HD202 - made ground of slightly gravelly slightly sandy silt to 0.60m with brick fragments, pottery fragments and coal, overlying a natural yellowish brown slightly gravelly slightly sandy silt to 1.20m.	Photograph 15 – Location of HD102.
	
Photograph 16 – HD203 - made ground of slightly gravelly slightly sandy silt with brick fragments and coal to 0.60m, natural yellowish brown slightly sandy silt to 0.90m.	Photograph 17 – Location of HD203.

Plate 3-2: Photographic record of soils encountered.

	
Photograph 18 – HD204 - made ground of slightly gravelly slightly sandy silt to 0.40m with brick fragments and coal, overlying a second made ground light brown slightly gravelly slightly sandy silt to 1.20m with concrete fragments, overlying another made ground of predominately brick, that is probably reworked natural to 2.20m where the hand auger refused.	Photograph 19 – Location of HD204 in relation to the nearby well.
	
Photograph 20 – HD205 - made ground of slightly gravelly slightly sandy silt to 0.40m with brick fragments and coal, overlying a second made ground orangish brown slightly gravelly slightly sandy silt to 1.20m, finally a third made ground of grey and reddish brown slightly gravelly silty sand with brick, concrete and coal to 1.85m where the hand auger refused on possible sandstone.	Photograph 21- Location of HD205.

Plate 3-2(continued): Photographic record of soils encountered.

Summary of Ground Conditions

Made ground comprising slightly sandy slightly gravelly SILT (to a maximum depth of 0.60m) overlying a second made ground strata of a reddish brown slightly gravelly sandy SILT was encountered in HD104 and HD105 (north of the site), possibly reworked natural soils. HD101-103 in the south of the site encountered natural yellowish-brown clay below the first made ground. A third layer of made ground was encountered at HD204 and HD205 below 1.2mbgl, which is likely reworked natural strata.

Made ground was bottomed out at all locations except HD204 / HD104, where the hand auger refused on whole brick at 2.20mbgl. As bedrock was encountered at 1.85mbgl in HD205 / HD105 and reworked natural ground was encountered in HD204 from 1.2mbgl, the depth of the made ground at HD204 location is likely related to the installation of the nearby well (see Plate 3-2, photograph 19).

No visual / olfactory or PID evidence of hydrocarbons was identified in the site won topsoil in any of the investigation locations.

4 Generic Risk Assessment

4.1 Introduction

Current good practice requires that the findings from a site investigation should be evaluated on a site-specific basis, using a risk-based approach. Risk assessment involves identification and evaluation of the hazards presented by the concentrations of contaminants measured followed by an evaluation of the risks which are associated with these hazards (CLR11⁵).

4.2 Soil Risk Assessment

4.2.1 Methodology

With regards to the soil risk assessment LKC will use the following hierarchy:

- Category 4 Screening Levels (C4SLs).
- LQM Suitable 4 Use Levels (S4ULs).

C4SLs were published in 2013^{6,7}. The recent change to the contaminated land guidance has changed the evaluation of risk from 'minimal' (referred to as Health Criteria values (HCVs))⁸ used to generate Soil Guideline Values (SGVs) to 'low' (referred to as Lowest Level of Toxicological Concern (LLTCs)). The policy companion document and supporting letter by Defra, dated 3rd September 2014, states that C4SLs *'could be used under the planning regime, as well as within Part 2A'*. Based on these comments LKC considers the justifications and assumptions used to generate 'low' risk are suitable for the planning regime.

Where no C4SLs have been generated LKC will use the LQM S4ULs⁹. Similar assumptions and land uses to C4SLs have been used. However, toxicological information has been based on 'minimal risk' as per previous guidelines and assumptions^{10,11,12,13}.

If contaminants are not present as C4SLs and S4ULs then LKC will use ATRISK SSVs or CL:AIRE GACs¹⁴. These follow the 'minimal' risk principle and more stringent exposure parameters and will be conservative.

LKC consider the main risk drivers for PAHs are benzo(a)pyrene (B(a)P) and naphthalene. This is due to B(a)P possibly being a carcinogen and most toxic of the PAHs^{15,16} and naphthalene the most volatile and soluble¹⁷. The new C4SLs indicate

⁵ EA (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11.

⁶ Defra (2014). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Policy Companion Document."

⁷ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

⁸ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

⁹ LQM (2014). "The LQM/CIEH S4ULs for Human Health Risk Assessment."

¹⁰ EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

¹¹ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

¹² EA (2008). "A Review of Body Weight and Height Data used within the Contaminated Land Exposure Assessment Model (CLEA)." Project SC050021/Technical Review 1.

¹³ EA (2009). "Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values." Science report SC050021/SR7.

¹⁴ CL:AIRE (2009). "The Soil Generic Assessment Criteria for Human Health Risk Assessment."

¹⁵ EA (2002). "Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans. Benzo[a]pyrene." R&D Publication TOX2.

¹⁶ USEPA (1984). "Health Effects Assessment of Polycyclic Aromatic Hydrocarbons (PAHs). EPA 540/1-86-013."

¹⁷ EA (2003). "Review of the Fate and Transport of Selected Contaminants in the Soil Environment." Draft technical report P5- 079/TR1.

B(a)P as a surrogate marker for carcinogenic PAHs, if it falls within appropriate limits, since the risk from other non-carcinogenic PAHs are considered negligible¹⁸. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)¹⁹ and CL:AIRE (2013). Naphthalene will be treated separately using the LQM S4ULs.

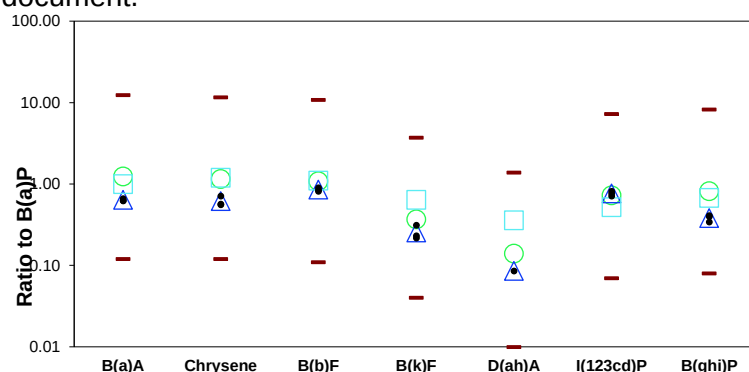
The development comprises a residential house with garden, therefore the assessment criteria for residential with plant uptake has been used. All criteria have been generated using the CLEA V1.06 model²⁰ based either on 1%, 2.5% and 6% Soil Organic matter (SOM). Results will be compared to the nearest appropriate SOM.

A summary of the generic assessment criteria is provided in Appendix C. ATRISK SSVs and CL:AIRE GACs were not required for this dataset and have not been included.

B(a)P as Surrogate Marker

Based on the above assumption for PAHs, LKC undertook an assessment of the data for the site with regards to using B(a)P as a surrogate marker for carcinogenic PAHs as per HPA and CL:AIRE guidelines. The primary toxicological study related to Culp *et al.*²¹, which was based on coal tar mixtures (>80,000mg/kg of total PAHs) fed in food to mice over a two-year carcinogenicity study.

Graph 4-1 summarises the study site data with respect to how the ratios of carcinogenic PAHs relate to B(a)P, within the confidence limits provided in the HPA document.



Graph 4-1: The ratio of PAH to B(a)P in soil for all available data at the site based on 3 samples (where values were >LOD to allow the calculation of a ratio).

Notes:

B(a)P = Benzo(a)pyrene; D(ah)A = Dibenzo(ah)anthracene; B(a)A = Benzo(a)anthracene; B(b)F = Benzo(b)fluoranthene;

B(k)F = benzo(k)fluoranthene; I(123cd)P = Indeno(123cd)pyrene; B(ghi)P = Benzo(ghi)perylene

● = Ratio to B(a)P for all data ○ = Mean ratio to B(a)P for Culp data ▲ = Mean ratio to B(a)P from all data at the site.

□ = Mean ratio to B(a)P for UK data presented by HPA ■ = Upper and Lower limits (order of magnitude from Culp data).

All the data points that could be used to calculate ratios fall inside the upper or lower limits.

¹⁸ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

¹⁹ HPA (2010). "HPA Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)." Version 3.

²⁰ EA (2008). "CLEA Software (Version 1.05) Handbook." Science Report – SC050021/SR4.

²¹ Culp, S; Gaylor, D; Sheldon, W; Goldstein, L and Beland, F (1998). "A Comparison of Tumours Induced by Coal Tar and Benzo-a-pyrene in a 2-Year Bioassay." Carcinogenesis. Vol 19, no. 1, pp. 117-124.

Based on this distribution of data LKC considers B(a)P can be used as a surrogate marker for carcinogenic PAHs and the C4SL criteria is suitable for this dataset.

4.2.2 Soil Results Comparison against Assessment Criteria

Made Ground

Made ground soil results have been compared to the relevant assessment criteria and slightly elevated lead concentration was identified in one sample.

All analysis sheets are presented in Appendix B. All the data has been compared to relevant assessment criteria. Elevated and pertinent results are presented in Table 4-1 and shown on Figure 4.

Contaminant	Units	No. of samples	Elevated Results	Sample Location	Criteria (1%/2.5%/6%)	Source of Criteria
Metals						
Arsenic	mg/kg	7	83	HD101 0.00-0.50	37	C4SL
			55	HD102 0.00-0.40		
Lead	mg/kg	7	410	HD101 0.00-0.50	200	C4SL
			310	HD102 0.00-0.40		
			360	HD104 0.40-0.90		
			250	HD104 0.90-1.20		
PAHs						
Benzo(a)pyrene	mg/kg	7	21	HD101 0.00-0.50	5	C4SL
			5.6	HD102 0.00-0.40		
			7.3	HD104 0.40-0.90		
GENERAL						
pH	pH	3	Range 5.6 to 5.8			
SOM	%	3	Range 2.8 to 6.6			
Asbestos	N/A	3	No asbestos detected.			

Table 4-1: Summary of elevated and pertinent analytical results.

Notes:

Only results that exceeded assessment criteria have been shown and results from **all depths** are noted. Results have been compared to the nearest appropriate SOM.

No asbestos was identified in any soil samples analysed.

The following determinands were elevated above assessment criteria:

- Heavy metals (arsenic and lead).
- PAHs.

4.2.3 Direct Contact Risk

Elevated PAHs and metals (arsenic and lead) have been identified on site, given the number and location of elevated samples, the contamination is considered to be site wide.

The principal pathways for heavy metals and PAHs are the ingestion pathways (soil, dust and vegetables) and dermal contact.

The probability of PAH and metal contamination affecting site users is likely. With a medium consequence, the risk is considered to be moderate and remediation is recommended.

4.2.4 Ground Gas

Made ground >1m is a potential source of ground gas on site. Made ground was encountered at all of the exploratory locations; at two locations (HD104 and HD105), made ground was encountered at depths in excess of 1mbgl (maximum thickness of >2.2m at HD204 / HD104 and 1.85m at HD205 / HD105). Additionally, a well capped with a metal bung was encountered in the vicinity of HD104 / HD204; this may account for the depth of made ground in this part of the site in comparison to the south of the site.

Based upon the findings of the site investigation there may be a small risk for the generation of hazardous gas from made ground onsite.

Guidance given in CIRIA C665²², BS8485:2007²³ and CL:AIRE RB17²⁴ has been used to assess the risk.

Following forensic logging of made ground samples, SOM results were analysed for organic and inorganic fine components, as recorded in Table 4-2.

Location	Soil Component	% of original sample	SOM (%)	TOC (%)	Adjusted TOC (%)
HD204 0.0-0.4	Fines <10mm	79	8.1	4.7	3.0
HD205 0.4-0.9	Fines <10mm	84	3.3	1.9	1.2
HD205 1.6-1.8	Fines <10mm	74	2.8	1.6	1.0
Average of fines			7.1	2.8	1.7

Table 4-2: Summary of SOM results.

Notes:

Forensic logging undertaken according to Appendix C of CL:AIRE RB17²⁴.

TOC = SOM ÷ 1.72

The SOM varied across the made ground (average of 7.1%) which was an equivalent TOC of 2.8%. However, it should be noted that ash and clinker may skew the TOC results generating a false positive for degradable material and not necessarily generating gas. While forensic logging, it was noted that fine sized (<10mm) clinker degraded into ash sized particles when handling the soil. The TOC may be adjusted for non-degradability by approximately 60% for ash and 13% for soil²⁵. By adjusting the average TOC by 63%, assuming 37% is non-degradable (for a mixed ash soil matrix) a revised average TOC of 2.2% (degradable fraction; TOC range of 3.0% in upper 0.4m of made ground to 1.0 in deeper layer of made ground) can be derived and is assumed for this soil. Considering the difficulty in undertaking detailed forensic work on the sample (e.g. due to fragile nature of clinker and degraded nature of leaf litter observed in the upper layer of made ground), this assumption is still considered reasonable.

A qualitative assessment using CL:AIRE RB17 (Table 2 and Table A1) may indicate precautionary Characteristic Situation (CS) 2 gas protection measures in lieu of no gas

²² CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

²³ BSI (2007). "Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments." BS8485:2007.

²⁴ CL:AIRE Research Bulletin 17. "A Pragmatic Approach to Ground Gas Risk Assessment". November 2012.

²⁵ Kumpiene, J; Robinson, R; Brannvall, E, Nordmark D, Bjurstrom, H, Andreas, L; Lagerkvist, A, Ecke, H (2010). "Carbon Speciation in Ash, Residual Waste and Contaminated Soil by Thermal Chemical Analysis." *Waste Manag.* 2011 Jan; **31**(1): 18-25.

monitoring is required at the site. Taking into account the age of the made ground (assuming that the made ground dates back to the earliest mapping showing the current building c. 1893-1910) at >110 years, and the low adjusted TOC of the deeper layers of made ground (1-1.2%), the Characteristic Situation can be reduced to CS1.

Based on the above the risk from ground gas is considered low and no gas protection measures are required.

The probability of ground gas affecting the building and future residents is of low likelihood and remediation is not required.

4.2.5 *Controlled Waters*

The site is underlain by a Secondary A Aquifer located within the bedrock. A 'collects' drainage feature and drain is located 53m E. The nearby pond (111m W) is unlikely to be influenced by the site, given the distance and the presence of clay / silt across the site.

No groundwater was encountered during the site investigation.

Made ground is likely lying directly above the bedrock at HD204 / HD104 and HD205 / HD105, related to the installation of the nearby well, and noted to be reworked natural ground below 1.2mbgl at HD204. Although elevated PAHs and heavy metals were identified on site, this is likely associated with the coal and pottery within the upper layers of made ground. The made ground / reworked natural from HD205 below 1.2mbgl was tested and no elevated contaminants were identified, and should offer the Secondary A Aquifer some protection. As no groundwater was encountered during the site investigation, and the made ground constituents are predominately crystalline, these are unlikely to leach and affect the underling aquifer onsite or the nearby drainage feature.

The probability of contamination affecting underlying and offsite controlled waters receptors is considered to be low and no remediation is required.

5 Conclusions – Contamination Assessment

5.1 Direct Contact Risk

The investigation carried out by LKC has shown that made ground contaminated with heavy metals and PAHs are present within the proposed garden areas and soft landscaped areas of the site. The probability of heavy metal and PAH contamination affecting site users is likely and remediation is required.

5.2 Ground Gas

Made Ground c. 2m thickness was identified in the north of the site. Adjusted TOC for the made ground ranged from 3.0% in the upper 0.4m to 1.0% in the deeper made ground. A qualitative assessment using CL:AIRE RB17 (Table 2 and Table A1) may indicate precautionary Characteristic Situation (CS) 2 gas protection measures in lieu of no gas monitoring is required at the site. Taking into account the age of the made ground at >110 years, and the low adjusted TOC of the deeper layers of made ground (1-1.2%), the Characteristic Situation can be reduced to CS1 (low risk, no gas protection measures required). The probability of ground gas affecting the building and future residents is of low likelihood and remediation is not required.

5.3 Controlled Waters

Although elevated heavy metal and PAH contamination was identified in the soil samples collected from the upper layers of made ground, the elevated results are likely associated with crystalline made ground constituents (clinker, pottery and brick). The reworked silt below 1.2mbgl should offer some protection to the underlying Secondary A Aquifer. The probability of heavy metal and PAH contamination affecting underlying and offsite controlled waters receptors is a low likelihood and no remediation is required.

6 Remedial Options

The recommendations provided below are considered appropriate for the site based on the site investigation work undertaken. LKC should stress that no remediation works should take place until Regulatory approval has been obtained.

6.1 Remediation and Validation Recommendations

Table 6-1 details the remedial recommendations.

Remediation Requirements	Validation Requirements
Clean Cover System: Garden and Soft Landscaped Areas	
<u>Option 1: South of Site</u> <u>Option1a:</u> Removal of all made ground from garden and soft landscaping and raise levels (as required) with suitably chemically validated subsoil and topsoil. <u>Option 1b:</u> Private Front Garden / Shared Landscaping areas: 300mm thick environmental cover system. Either 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 200mm comprising clean inert fill and sufficient topsoil for a growing medium. Or geotextile membrane and at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium.	Consignment notes confirming the removal of made ground. Photographic evidence of natural strata. Chemical validation of imported soils: See Table 6-2.
<u>Option 2: North of Site</u> If all or some of the made ground remains in place in gardens and soft landscaping areas, an environmental cover system will be required. The environmental cover system should be as follows: Private Back Garden: 600mm thick environmental cover system comprising: Either 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 500mm comprising clean inert fill and sufficient topsoil for a growing medium. Or geotextile membrane and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium.	Measuring depth of environmental cover system using a staff and providing photographic evidence. Photographic evidence of the granular physical break or geotextile layer will also be collected. Chemical validation of imported soils: See Table 6-2.
<u>Option 3: Proposed Garage</u> 'Concreted in' hard landscaping such as a patio or parking area will also break the pollutant linkage. Generally, 100-150mm of compacted granular material (such as MOT) and 50mm of concrete is required below the paved area.	Consignment notes confirming the removal of made ground (if required as part of the works) Photographic evidence of the construction of the Hard landscaping areas.
The above options or a combination of the above options implemented correctly will sever the direct contact pollutant linkage.	

Table 6-1: Remediation and validation requirements

Unexpected Contamination (including Asbestos)
The relevant contractors should be briefed that during development works at the site should any unusual ground conditions and / or visual or olfactory evidence of contamination (including asbestos containing material) be encountered at the site, LKC and the Local Authority should be informed, and further assessment of the material may be required.
Should asbestos be identified during groundworks, precautions should be taken to ensure the safety of the construction workers and nearby land users. It would be advisable to introduce an asbestos management strategy in line with CIRIA C733 ²⁶ .

Table 6-1 (continued): Remediation and validation requirements

6.2 Validation of Subsoil / Topsoil

Chemical validation of all imported soils to be used on site in gardens and soft landscaping areas should be undertaken. Imported soils should be accompanied by a certificate of analysis and source details.

A summary of the required imported material sampling requirements is presented in Table 6-2. Ideally, the material should be sampled at source to prevent double handling if soil fails. However, where this is not possible then material imported should be segregated based on source and soil type. Validation samples should be taken prior to placement in gardens to ensure suitability for use.

Material Type	Source	Suite of Analysis	Sampling Rate*
Topsoil	Greenfield	Suite A	1 sample per 50m³
	Brownfield / Unknown	Suite B	
Subsoil	Brownfield / Unknown	Suite B	1 sample per 150m³
	Site won natural material / greenfield	Suite A	
Physical Stone Break Layer	First Generation i.e. quarried sand (subsoil) or stone (break layer)	No testing is required. Certification of material provenance is required.	
	Recycled Stone (6F2 / screened)	Suite B	1 sample per 500m³

Table 6-2: Sampling requirements for imported soils.

Notes:

Suite A - Heavy metals, pH, water soluble sulphate, speciated PAH, soil organic matter and asbestos screen.

Suite B - Heavy metals, pH, water soluble sulphate, speciated PAH, phenol, total and free cyanide, soil organic matter, asbestos screen, banded petroleum hydrocarbons (TPH CWG), BTEX, MTBE.

*Minimum sampling rate of 3 samples per source.

Any soil with visual or olfactory evidence of hydrocarbons should be rejected.

In addition, it should be ensured that the matrix of the topsoil is suitable as a growing medium and no undesirable material is present (in line with BS3882²⁷). LKC advise this information is provided by the supplier before material is imported onto site.

Imported material to be used in gardens will be compared against residential with plant uptake criteria (as used in the contamination risk assessment. Appropriate remedial target criteria are presented in Appendix C.

²⁶ CIRIA (2014). "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks". C733.

²⁷ BS (2015). "Specifications for Topsoil and Requirements for use." BS3882:2015.

6.3 Site Completion Report

It is recommended that any remediation carried out on the site is validated by a third party and suitable documentary evidence provided in a Site Completion Report, such as photographs, consignment documents and analytical results. This should include as a minimum:

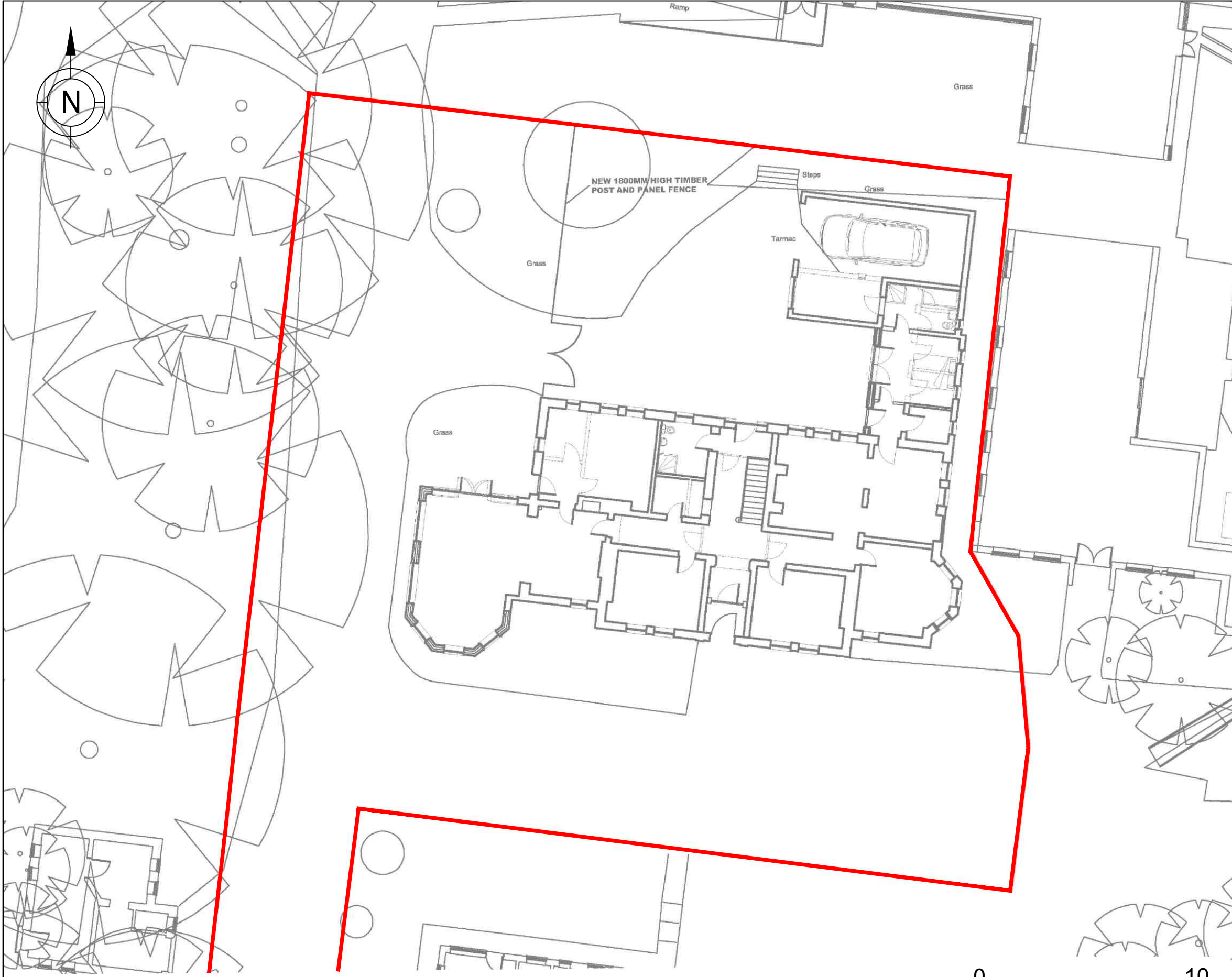
- » **If Option 1 (source removal):** Validation of any made ground removal (photographic evidence that natural strata was reached).
- » **If Option 2 (environmental capping layer):** Validation of environmental cover system depth (physical depth validation including photographic evidence, chemical testing of imported materials).
- » **If Option 3 (hardstanding):** Validation of the construction of the hardstood areas (photographic evidence of construction).
- » Provision of waste transfer documents.
- » Verification testing of all imported soil for garden and soft landscaping areas.
- » Details of any unexpected contamination identified onsite, suitably risk assessed and / or validated.

If a combination of Options 1-3 is employed suitable evidence of each will be required. All the remediation and validation work should be documented in a Site Completion Report. The Completion Report will be provided to satisfy the outstanding contaminated land planning condition.

Figures



Client: Michael Moore				Title: Site Location & Boundary Plan			
Site: Knowsley House, Ainsworth Nursing Home				Scale (see scale bar): 1:25,000 & 1:1,500 @ A4			
Job No.: LKC 20 1567	Drawn By: NJ	Checked By: EK	Drawn: September	Figure: 1	Revision:		



KEY

 Site Boundary

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



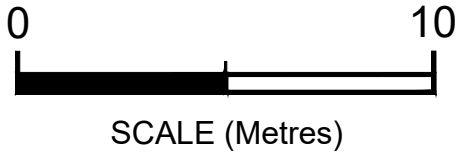
Client: **Michael Moore**

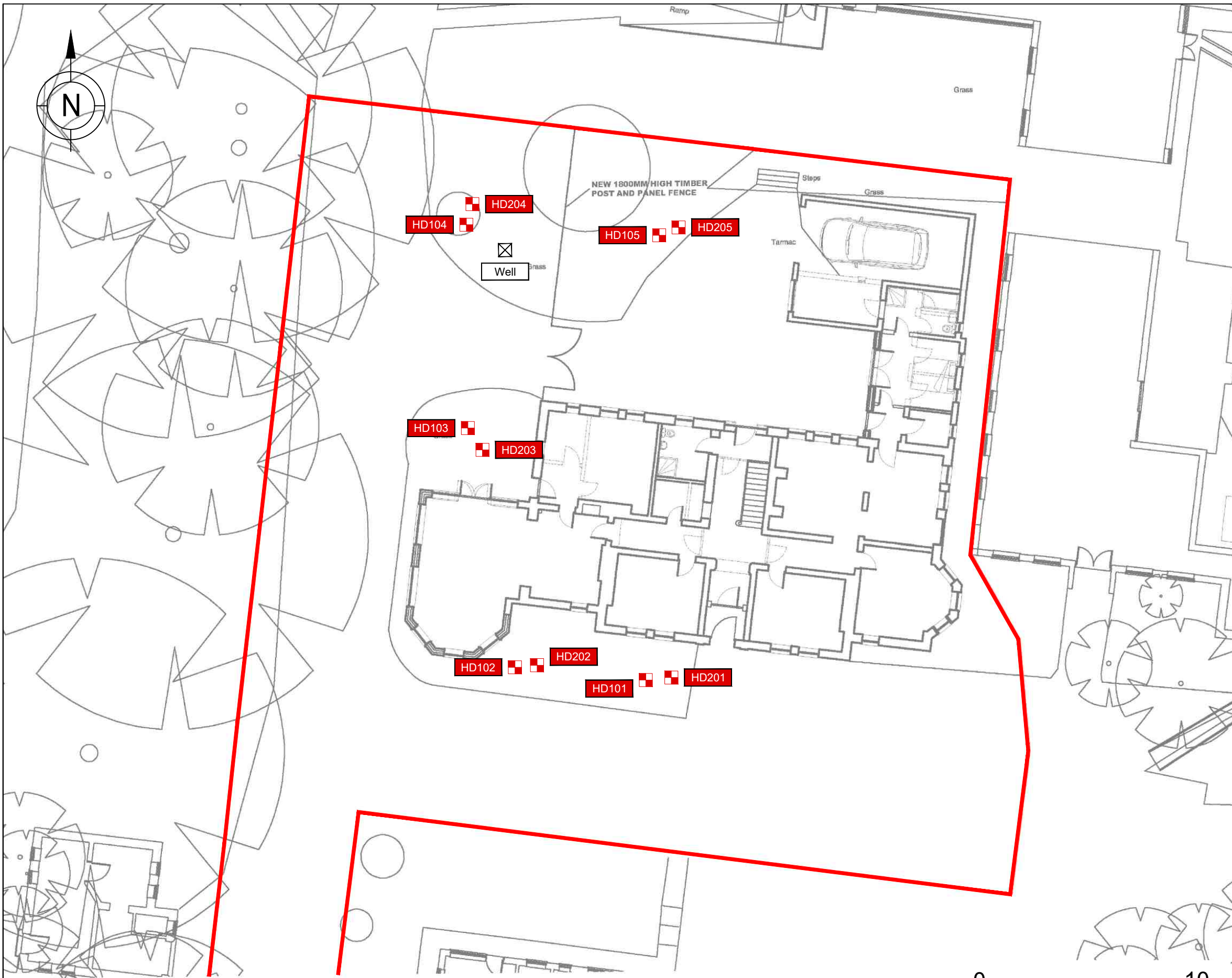
Site: **Knowsley House
Ainsworth Nursing Home**

Title: **Proposed Site Use Plan**

Job No.: LKC 20 1567	Scale (See Scale Bar): See Scale Bar	Figure: 2	Revision:
Drawn By: AC	Checked By: NJ	Drawn: Sep 2020	

Extract from: Plan Supplied by Client
Drawing Ref: Site Plan (Proposed)





KEY

- Site Boundary
- Hand Dug Trial Pit (HD)
- Well Location

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



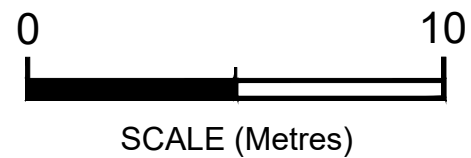
Client: Michael Moore

Site: Knowsley House
Ainsworth Nursing Home

Title: Site Investigation Location Plan

Job No.: LKC 20 1567	Scale (See Scale Bar): See Scale Bar	Figure: 3	Revision:
Drawn By: AC	Checked By: NJ	Drawn: Sep 2020	

Extract from: Plan Supplied by Client
Drawing Ref: Site Plan (Proposed)





KEY

- Site Boundary
- Hand Dug Trial Pit (HD)
- Well Location

Contaminants

- As: Arsenic (As)
- Pb: Lead (Pb)
- PAHs: Polycyclic Aromatic Hydrocarbons

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

Client: Michael Moore			
Site: Knowsley House Ainsworth Nursing Home			
Title: Contamination Location Plan			
Job No.: LKC 20 1567	Scale (See Scale Bar): See Scale Bar	Figure: 4	Revision:
Drawn By: AC	Checked By: EK	Drawn: Oct 2020	

Extract from: Plan Supplied by Client
Drawing Ref: Site Plan (Proposed)

Appendix A

Profile Logs

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Knowsley House, Ainsworth Nursing Home

**Trial Pit
Number
HD101****Excavation Method**

Hand dug trial pit to 1.20mbgl.

Dimensions

0.20m x 0.20m x 1.20m

Ground Level (mOD)

163.00

Client

Michael Moore

**Job
Number**
LKC 20 1567C**Location**

376463 E 410896 N

Dates

22/09/2020

Engineer

LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50 0.00-0.50	B1 ES2 PID=0.70ppm.					MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with rare brick fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
0.50 0.50-1.00 0.50-1.20	PP =24.5KPa. B3 ES4 PID=0.40ppm.			162.50	0.50 (0.70)	Soft consistency yellowish brown slightly sandy silty CLAY. Sand is fine.		
				161.80	1.20	Grey slightly sandy silt present between 1.0-1.10mbgl. Complete at 1.20m		

RemarksElevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.
Hand dug pit dry and stable.**Scale (approx)**

1:25

Logged By

NJ

Figure No.

LKC 20 1567C.HD101

Excavation Method

Hand dug trial pit to 1.20mbgl.

Dimensions

0.20m x 0.20m x 1.20m

Ground Level (mOD)

163.00

Client

Michael Moore

**Job
Number**
LKC 20 1567C

Location

376457 E 410897 N

Dates

22/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	ES2 PID=0.50ppm. B1					MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with occasional brick fragments, pottery fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
0.00-0.60					(0.60)			
0.60	PP =24.53KPa. B3			162.40	0.60	Soft consistency yellowish brown slightly sandy silty CLAY. Sand is fine.		
0.70-1.00	ES4 PID=0.50ppm.				(0.60)			
1.00-1.10	B5			161.80	1.20	Complete at 1.20m		


Remarks

Hand dug pit dry and stable.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.

Scale (approx)

1:25

Logged By

NJ

Figure No.

LKC 20 1567C.HD102

Excavation Method

Hand dug trial pit to 1.00mbgl.

Dimensions

0.20m x 0.20m x 1.00m

Ground Level (mOD)

163.00

Client

Michael Moore

**Job
Number**

LKC 20 1567C

Location

376454 E 410906 N

Dates

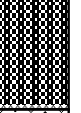
22/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20 0.00-0.20	B1 ES2 PID=0.50ppm.			162.80	(0.20) 0.20	MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with occasional brick fragments, pottery fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
0.20-0.60 0.20-0.60	B3 ES4 PID=0.50ppm. PP =36.79KPa.			162.40	(0.40) 0.60	MADE GROUND: Soft consistency yellowish brown slightly gravelly slightly sandy clayey SILT with occasional brick fragments and coal. Sand is fine. Gravel is fine to medium and angular of slate and sandstone.		
0.60-1.00 0.60-1.00	B5 PID=0.50ppm. ES6			162.00	(0.40) 1.00	Possible reworked natural: Soft consistency yellowish brown slightly sandy SILT. Sand is fine.		
						Complete at 1.00m		


Remarks

Hand dug pit dry and stable.
Hand auger refusal at 1.00mbgl on unknown strata.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Minimal recovery from hand auger due to soft natural of silt between 0.6 and 1.0mbgl.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.

Scale (approx)

1:25

Logged By

NJ

Figure No.

LKC 20 1567C.HD103

Excavation Method

Hand dug trial pit to 1.20mbgl.

Dimensions

0.20m x 0.20m x 1.20m

Ground Level (mOD)

168.00

Client

Michael Moore

**Job
Number**
LKC 20 1567C

Location

376457 E 410917 N

Dates

22/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40 0.00-0.40	B1 ES2 PID=0.30ppm.				(0.40)	MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with occasional brick fragments, pottery fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
0.40-0.90 0.40-0.90	B3 ES4 PID=0.20ppm.			167.60	0.40	MADE GROUND: Soft consistency yellowish brown slightly gravelly slightly sandy clayey SILT with occasional brick fragments, slate fragments and coal. Sand is fine. Gravel is fine to medium and angular of slate and sandstone.		
0.60	PP =36.49KPa.				(0.80)			
0.90-1.20 0.90-1.20	B5 ES6 PID=0.40ppm.			166.80	1.20	Complete at 1.20m		


Remarks

Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.
Hand dug pit dry and stable.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.

Scale (approx)

1:25

Logged By

NJ

Figure No.

LKC 20 1567C.HD104

Excavation Method

Hand dug trial pit to 1.20mbgl.

Dimensions

0.20m x 0.20m x 1.20m

Ground Level (mOD)

168.00

Client

Michael Moore

**Job
Number**

LKC 20 1567C

Location

376465 E 410918 N

Dates

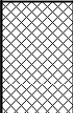
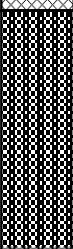
22/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40 0.00-0.40	B1 ES2 PID=0.60ppm.				(0.40)	MADE GROUND: Dark brown gravelly slightly sandy SILT with frequent rootlets, brick fragments and occasional glass fragments. Sand is fine to coarse. Gravel is fine to medium and subangular to subrounded of sandstone.		
0.40 0.40-1.00 0.40-1.00	PP. =36.79KPa. B3 ES4 PID=0.60ppm.			167.60	0.40 (0.80)	MADE GROUND: Soft consistency orangish brown slightly gravelly slightly sandy SILT with occasional brick fragments. Sand is fine to coarse. Gravel is fine and subangular to subrounded of sandstone.		
				166.80	1.20	Complete at 1.20m		


Remarks

Hand dug pit dry and stable.
Hand auger refusal at 1.20mbgl.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.

Scale (approx)

1:25

Logged By

NJ

Figure No.

LKC 20 1567C.HD105

Excavation Method
Hand dug trial pit to 1.20mbgl.

Dimensions
0.20m x 0.20m x 1.20m

Ground Level (mOD)
163.00

Client
Michael Moore

Job Number
LKC 20 1567C

Location (Handheld GPS)
376464 E 410896 N

Dates
30/09/2020

Engineer
LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES1 PID=0.10ppm.				(0.50)	MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with frequent rootlets, rare brick fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
0.50-1.20	B2			162.50	0.50	Soft consistency yellowish brown slightly gravelly slightly sandy silty CLAY. Sand is fine to coarse. Gravel is fine and angular of sandstone.		
				161.80	1.20	Complete at 1.20m		


Remarks

Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.
Hand dug pit dry and unstable.

Scale (approx)

1:40

Logged By

NJ

Figure No.

LKC 20 1567C.HD201

Excavation Method

Hand dug trial pit to 1.20mbgl.

Dimensions

0.20m x 0.20m x 1.20m

Ground Level (mOD)

163.00

Client

Michael Moore

**Job
Number**

LKC 20 1567C

Location (Handheld GPS)

376458 E 410897 N

Dates

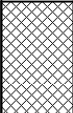
30/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	ES1 PID=0.20ppm.					MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with frequent rootlets, rare brick fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
0.60-1.20	B2			162.40	0.60 (0.60)	Whole brick encountered at 0.60mbgl.		
				161.80	1.20 (0.60)	Soft consistency yellowish brown slightly gravelly slightly sandy silty CLAY. Sand is fine to coarse. Gravel is fine and angular of sandstone.		
						Complete at 1.20m		


Remarks

Hand dug pit dry and stable.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.

Scale (approx)

1:40

Logged By

NJ

Figure No.

LKC 20 1567C.HD202

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Knowsley House, Ainsworth Nursing Home

**Trial Pit
Number
HD203****Excavation Method**

Hand dug trial pit to 0.90mbgl.

Dimensions

0.20m x 0.20m x 0.90m

Ground Level (mOD)

163.00

Client

Michael Moore

**Job
Number**
LKC 20 1567C**Location** (Handheld GPS)

376545 E 410905 N

Dates

30/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70	ES1 PID=0.20ppm.				(0.70)	MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with frequent rootlets, occasional brick fragments, pottery fragments, and coal. Sand is coarse. Gravel is fine to medium and subangular to angular of sandstone and slate.		
0.70-0.90	B2			162.30 162.10	0.70 (0.20) 0.90	Soft consistency yellowish brown slightly gravelly slightly sandy silty CLAY. Sand is fine. Gravel is fine and angular of sandstone. Complete at 0.90m		

**Remarks**

Hand dug pit dry and stable.
Hand auger refusal at 0.90mbgl on possible sandstone strata.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.

Scale (approx)

1:40

Logged By

NJ

Figure No.

LKC 20 1567C.HD203

Excavation Method

Hand dug trial pit to 2.15mbgl.

Dimensions

0.20m x 0.20m x 2.15m

Ground Level (mOD)

163.00

Client

Michael Moore

**Job
Number**

LKC 20 1567C

Location (Handheld GPS)

376457 E 410917 N

Dates

30/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	ES1 PID=0.20ppm.				(0.40)	MADE GROUND: Soft consistency dark brown slightly gravelly slightly sandy SILT with occasional brick fragments, pottery fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
0.40-1.20	ES2 PID=0.20ppm.			162.60	0.40	MADE GROUND: Soft consistency light brown slightly gravelly slightly sandy SILT with frequent brick fragments, pottery fragments, concrete fragments and coal. Sand is coarse. Gravel is fine to medium and subrounded of sandstone.		
					(0.80)			
1.20-1.90	ES3 PID=0.20ppm.			161.80	1.20	Whole brick encountered at 1.20mbgl.		
					(0.95)	MADE GROUND: Reddish brown gravelly sandy SILT with frequent brick fragments. Sand is fine to coarse. Gravel is fine to medium and angular comprising brick and sandstone. Possible reworked natural.		
				160.85	2.15	Whole brick encountered at 2.20mbgl.		
						Complete at 2.15m		


Remarks

Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.
Hand auger refusal at 2.15mbgl on possible whole brick.
Hand dug pit dry and unstable.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
HD204 is approximately 1.00meter from a possible well.

Scale (approx)

1:40

Logged By

NJ

Figure No.

LKC 20 1567C.HD204

Excavation Method

Hand dug trial pit to 1.85mbgl.

Dimensions

0.20m x 0.20m x 1.85m

Ground Level (mOD)

163.00

Client

Michael Moore

**Job
Number**
LKC 20 1567C

Location (Handheld GPS)

Dates

30/09/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	ES1 PID=0.20ppm.				(0.40)	MADE GROUND: Dark brown gravelly slightly sandy SILT with frequent rootlets, brick fragments and occasional coal. Sand is fine to coarse. Gravel is fine to medium and subangular to subrounded of sandstone		
0.40-1.20	ES2 PID=0.20ppm.			162.60	0.40			
					(0.80)	MADE GROUND: Soft consistency orangish brown slightly gravelly slightly sandy SILT with occasional brick fragments. Sand is fine to coarse. Gravel is fine and subangular to subrounded of sandstone.		
				161.80	1.20			
1.60-1.80	ES3 PID=0.80ppm.				(0.65)	MADE GROUND: Grey and reddish brown slightly gravelly silty SAND with brick fragments, concrete fragments, and rare coal. Sand is fine to coarse. Gravel is fine to medium subangular of sandstone.		
				161.15	1.85			
						Complete at 1.85m		


Remarks

Hand dug pit dry and unstable.
Hand auger refusal at 1.85mbgl on possible sandstone bedrock.
Elevation estimated from <https://www.freemaptools.com/elevation-finder.htm>.
Location estimated from <https://gridreferencefinder.com/> accurate to 3.0-5.0m.

Scale (approx)

1:40

Logged By

NJ

Figure No.

LKC 20 1567C.HD205

Appendix B

Certificates of Analysis – Soil



Final Report

Report No.: 20-25460-1

Initial Date of Issue: 28-Sep-2020

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Emma Khadun

Project LKC 20 1567-B3 Knowsley House,
Ainsworth Nursing Home

Quotation No.:

Order No.: 738005

No. of Samples: 7

Turnaround (Wkdays): 5

Date Approved: 28-Sep-2020

Approved By:


Details: Glynn Harvey, Technical Manager

Date Received: 23-Sep-2020

Date Instructed: 23-Sep-2020

Results Due: 29-Sep-2020

Results - Soil

Project: LKC 20 1567-B3 Knowsley House, AinsworthNursing Home

Client: LK Consult	Chemtest Job No.:				20-25460	20-25460	20-25460	20-25460	20-25460	20-25460	20-25460
Quotation No.:	Chemtest Sample ID.:				1068663	1068665	1068668	1068669	1068671	1068672	1068674
	Client Sample ID.:				HD101	HD102	HD103	HD103	HD104	HD104	HD105
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.20	0.60	0.40	0.90	0.40
	Bottom Depth (m):				0.50	0.40	0.60	1.00	0.90	1.20	1.00
	Date Sampled:				22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD							
ACM Type	U	2192		N/A	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	17	18	16	20	15	16	16
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Stones	Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Clay	Sand	Sand	Sand
pH	M	2010		4.0	7.4	7.5	8.2	8.2	8.3	8.3	7.7
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.016	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.012
Arsenic	M	2450	mg/kg	1.0	83	55	9.8	< 1.0	17	19	19
Cadmium	M	2450	mg/kg	0.10	0.54	0.40	< 0.10	< 0.10	0.30	0.31	0.25
Chromium	M	2450	mg/kg	1.0	40	28	24	4.6	26	28	25
Copper	M	2450	mg/kg	0.50	100	74	14	2.1	43	48	56
Mercury	M	2450	mg/kg	0.10	0.26	0.22	< 0.10	< 0.10	0.34	0.53	0.24
Nickel	M	2450	mg/kg	0.50	37	28	11	2.2	18	24	24
Lead	M	2450	mg/kg	0.50	410	310	67	10	360	250	200
Selenium	M	2450	mg/kg	0.20	1.0	1.0	0.57	0.20	0.64	0.49	0.70
Vanadium	U	2450	mg/kg	5.0	62	45	29	5.2	26	26	30
Zinc	M	2450	mg/kg	0.50	110	98	28	5.4	71	81	72
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	14	7.8	3.5	1.9	8.1	5.3	5.9
Naphthalene	M	2800	mg/kg	0.10	0.52	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	0.33	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.41	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	0.28	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	4.8	2.4	< 0.10	< 0.10	3.3	< 0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10	1.5	0.64	< 0.10	< 0.10	1.1	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	24	7.0	< 0.10	< 0.10	8.4	< 0.10	< 0.10
Pyrene	M	2800	mg/kg	0.10	21	6.7	< 0.10	< 0.10	7.5	< 0.10	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	14	3.5	< 0.10	< 0.10	4.6	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	12	4.0	< 0.10	< 0.10	4.1	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	19	4.6	< 0.10	< 0.10	6.2	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	6.6	1.3	< 0.10	< 0.10	1.6	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	21	5.6	< 0.10	< 0.10	7.3	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	15	4.6	< 0.10	< 0.10	5.6	< 0.10	< 0.10

Results - Soil

Project: LKC 20 1567-B3 Knowsley House, AinsworthNursing Home

Client: LK Consult	Chemtest Job No.:				20-25460	20-25460	20-25460	20-25460	20-25460	20-25460	20-25460
Quotation No.:	Chemtest Sample ID.:				1068663	1068665	1068668	1068669	1068671	1068672	1068674
	Client Sample ID.:				HD101	HD102	HD103	HD103	HD104	HD104	HD105
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.20	0.60	0.40	0.90	0.40
	Bottom Depth (m):				0.50	0.40	0.60	1.00	0.90	1.20	1.00
	Date Sampled:				22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020	22-Sep-2020
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD							
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	1.8	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	8.4	2.3	< 0.10	< 0.10	2.5	< 0.10	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	150	43	< 2.0	< 2.0	52	< 2.0	< 2.0

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

Report Information

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T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



Final Report

Report No.: 20-27554-1
Initial Date of Issue: 20-Oct-2020
Client LK Consult
Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Contaminated Land
Emma Khadun

Project LKC 20 1567-B3

Quotation No.: **Date Received:** 13-Oct-2020

Order No.: **Date Instructed:** 13-Oct-2020

No. of Samples: 5

Turnaround (Wkdays): 5 **Results Due:** 19-Oct-2020

Date Approved: 20-Oct-2020

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Soil

Project: LKC 20 1567-B3

Client: LK Consult	Chemtest Job No.:				20-27554	20-27554	20-27554	20-27554	20-27554
Quotation No.:	Chemtest Sample ID.:				1079457	1079458	1079459	1079460	1079461
	Client Sample ID.:				HD205-organic	HD205-inorganic	HD205-organic	HD205-inorganic	HD205
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Date Sampled:				10-Oct-2020	10-Oct-2020	11-Oct-2020	11-Oct-2020	30-Sep-2020
	Asbestos Lab:								DURHAM
Determinand	Accred.	SOP	Units	LOD					
ACM Type	U	2192		N/A					-
Asbestos Identification	U	2192		N/A					No Asbestos Detected
ACM Detection Stage	U	2192		N/A					-
Moisture	N	2030	%	0.020	< 0.020	15	< 0.020	17	17
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	None	Stones	None	None	Stones
Soil Texture	N	2040		N/A	wood	Sand	wood	Sand	Clay
pH	M	2010		4.0					8.1
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010					0.011
Arsenic	M	2450	mg/kg	1.0					11
Cadmium	M	2450	mg/kg	0.10					0.22
Chromium	M	2450	mg/kg	1.0					27
Copper	M	2450	mg/kg	0.50					23
Mercury	M	2450	mg/kg	0.10					0.11
Nickel	M	2450	mg/kg	0.50					21
Lead	M	2450	mg/kg	0.50					110
Selenium	M	2450	mg/kg	0.20					0.28
Vanadium	U	2450	mg/kg	5.0					24
Zinc	M	2450	mg/kg	0.50					66
Chromium (Hexavalent)	N	2490	mg/kg	0.50					< 0.50
Organic Matter	M	2625	%	0.40	6.6	3.3	8.1	2.8	1.9
Naphthalene	M	2800	mg/kg	0.10					< 0.10
Acenaphthylene	N	2800	mg/kg	0.10					< 0.10
Acenaphthene	M	2800	mg/kg	0.10					< 0.10
Fluorene	M	2800	mg/kg	0.10					< 0.10
Phenanthrene	M	2800	mg/kg	0.10					< 0.10
Anthracene	M	2800	mg/kg	0.10					< 0.10
Fluoranthene	M	2800	mg/kg	0.10					0.16
Pyrene	M	2800	mg/kg	0.10					0.14
Benzo[a]anthracene	M	2800	mg/kg	0.10					< 0.10
Chrysene	M	2800	mg/kg	0.10					< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10					< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10					< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10					< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10					< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10					< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10					< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0					< 2.0

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

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None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

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Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



Final Report

Report No.: 20-27422-1
Initial Date of Issue: 14-Oct-2020
Client LK Consult
Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS
Contact(s): Contaminated Land
Emma Khadun
Project LKC 20 1567-B3 Knowsley House,
Ainsworth Nursing Home

Quotation No.:	Date Received:	12-Oct-2020
Order No.:	Date Instructed:	12-Oct-2020
No. of Samples: 2		
Turnaround (Wkdays): 5	Results Due:	16-Oct-2020
Date Approved: 14-Oct-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Soil

**Project: LKC 20 1567-B3 Knowsley House,
Ainsworth Nursing Home**

Client: LK Consult	Chemtest Job No.:				20-27422	20-27422
Quotation No.:	Chemtest Sample ID.:				1078619	1078620
	Client Sample ID.:				HD205 - inorganic	HD205 - organic
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.00	0.00
	Bottom Depth (m):				0.40	0.40
	Date Sampled:				09-Oct-2020	09-Oct-2020
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	20	48
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	None	Roots
Soil Texture	N	2040		N/A	Sand	Sand
Organic Matter	M	2625	%	0.40	8.1	33

Test Methods

SOP	Title	Parameters included	Method summary
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key

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For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
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Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

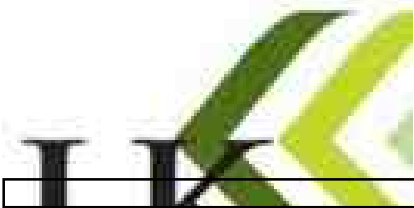
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix C

Generic Assessment Criteria Values

[illegible]



		Client Sample ID.:	HD101	HD102	HD103	HD103	HD104	HD104	HD105	HD205
Residential with plant uptake (1% SOM)		Strata:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):	0.00	0.00	0.20	0.60	0.40	0.90	0.40	1.60
		Bottom Depth (m):	0.50	0.40	0.60	1.00	0.90	1.20	1.00	1.80
Determinand	Units	GAC								
ACM Type	mg/kg		-	-	-	-	-	-	-	-
Asbestos Identification	mg/kg		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	mg/kg		17	18	16	20	15	16	16	17
Soil Colour	mg/kg		Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	mg/kg		Stones and Roots	Stones	Stones	Stones	Stones	Stones	Stones	Stones
Soil Texture	mg/kg		Sand	Sand	Sand	Clay	Sand	Sand	Sand	Clay
Chromatogram (TPH)	mg/kg									
pH	mg/kg		7.4	7.5	8.2	8.2	8.3	8.3	7.7	8.1
Boron (Hot Water Soluble)	mg/kg	290.0								
Sulphate (2:1 Water Soluble) as SO4	g/l		0.016	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.012	0.011
Cyanide (Free)	mg/kg	26.0								
Cyanide (Total)	mg/kg									
Arsenic	mg/kg	37.0	83	55	9.8	< 1.0	17	19	19	11
Cadmium	mg/kg	22.0	0.54	0.40	< 0.10	< 0.10	0.30	0.31	0.25	0.22
Chromium	mg/kg	910.0	40	28	24	4.6	26	28	25	27
Copper	mg/kg	2400.0	100	74	14	2.1	43	48	56	23
Mercury	mg/kg	40.0	0.26	0.22	< 0.10	< 0.10	0.34	0.53	0.24	0.11
Nickel	mg/kg	180.0	37	28	11	2.2	18	24	24	21
Lead	mg/kg	200.0	410	310	67	10	360	250	200	110
Selenium	mg/kg	250.0	1.0	1.0	0.57	0.20	0.64	0.49	0.70	0.28
Vanadium	mg/kg	410.0	62	45	29	5.2	26	26	30	24
Zinc	mg/kg	3700.0	110	98	28	5.4	71	81	72	66
Chromium (Hexavalent)	mg/kg	21.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	mg/l		14	7.8	3.5	1.9	8.1	5.3	5.9	1.9
Naphthalene	mg/kg	2.3	0.52	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	mg/kg	170.0	0.33	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	210.0	0.41	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	170.0	0.28	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	95.0	4.8	2.4	< 0.10	< 0.10	3.3	< 0.10	< 0.10	< 0.10
Anthracene	mg/kg	2400.0	1.5	0.64	< 0.10	< 0.10	1.1	< 0.10	< 0.10	< 0.10
Fluoranthene	mg/kg	280.0	24	7.0	< 0.10	< 0.10	8.4	< 0.10	< 0.10	0.16
Pyrene	mg/kg	620.0	21	6.7	< 0.10	< 0.10	7.5	< 0.10	< 0.10	0.14
Benzo[a]anthracene	mg/kg	7.2	14	3.5	< 0.10	< 0.10	4.6	< 0.10	< 0.10	< 0.10
Chrysene	mg/kg	15.0	12	4.0	< 0.10	< 0.10	4.1	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	mg/kg	2.6	19	4.6	< 0.10	< 0.10	6.2	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	mg/kg	77.0	6.6	1.3	< 0.10	< 0.10	1.6	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	mg/kg	5.0	21	5.6	< 0.10	< 0.10	7.3	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	mg/kg	27.0	15	4.6	< 0.10	< 0.10	5.6	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	mg/kg	0.2	1.8	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	mg/kg	320.0	8.4	2.3	< 0.10	< 0.10	2.5	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	mg/kg		150	43	< 2.0	< 2.0	52	< 2.0	< 2.0	< 2.0

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