GEO-ENVIRONMENTAL PHASE 2 SITE INVESTIGATION

OLD WEYBEARDS FARM

HAREFIELD
UXBRIDGE
UB9 6LH

On behalf of:

PFG Design

Report No.: A230403-R02

Date: July 2023

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Document Control Record

Client:	**PFG Design**
Project:	**Old Weybeards Farm**
Location:	**Harefield, Uxbridge, UB9 6LH**
Report Title:	**Geo-Environmental Phase 2 Site Investigation**
Report No.:	**A230403-R02**
Issue:	**A**
Status:	**For comment**
Comments	**-**
Written by:	**D. Fisher**
Checked by:	**N. Dixon**
Control Date:	**July 2023**

Confidentiality

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1.0 INTRODUCTION

1.1 Background

Adeptus was appointed by PFG Design (the client) to undertake a Phase 2 Geo-Environmental Investigation at the site known as the Old Weybeards Farm. The investigation is required in support of a planning application for redevelopment of the site and to further assess potentially significant contaminant linkages identified in an earlier phase 1 desk study.

Land contamination is a material consideration under the National Planning Policy Framework (2012). This means that local authorities must take the potential or actual presence of contamination into account when considering planning applications.

“Contamination” is defined in BS 10175:2011 as:

presence of a substance or agent, as a result of human activity, in, on or under land, which has the potential to cause harm or to cause pollution.

1.2 Scope and Objectives

The following scope of works has been undertaken:

- Review of desk study and preliminary risk assessment
- Design and implementation of suitable exploratory investigation
- Sample retrieval and laboratory chemical analysis
- Tier 1 quantitative risk assessment
- Update of the initial conceptual site model
- Factual and interpretive reporting

The objectives of the works were as follows:

- Obtain site specific chemical data on potential contaminants
- Provide an assessment of risks to relevant receptors in line with the principles of Environment Agency publication Land Contamination Risk Management (LCRM).

1.3 Supporting Information

Phase 1 Desk Study (Adeptus, April 2023) Ref: A230403-R01

A site plan is included as Appendix A.

Other sources of information utilised in producing this report are listed as Appendix B.

2 SITE LOCATION AND DESCRIPTION

This section provides a review of the land use on and in the vicinity of the Site, with the purpose of identifying potential contaminant sources and environmental constraints.

2.1 Location and Description

Table 2-1: Site Summary

Location	The site is situated west of Hill End Road in a rural location north of Harefield.
Area & Coordinates	0.27 ha. 504600 191776 (centred on, approx.)
Development Proposals	Conversion of existing barns into 5 (2 x 3-bedroom, 2 x 2-bedroom and 1 x 1-bedroom) residential units, with associated external works.

Figure 2-1: Site Location (based on the plan in Appendix A)

2.2 Summary of Preliminary Risk Assessment

The risk assessment identified a number of potentially significant pollutant linkages and a moderate risk, suggesting that further assessment should be undertaken.

Earlier buildings at Weybeards Farm predating the earliest OS map (1865) were demolished between 1934 and 1960, suggesting Made Ground may underlie that part of the site. Rubble 'hardcore' may also underlie the current hardstandings.

A large diesel tank was also noted on the east of the site, although this was fully bunded and no sign of any spills or leaks noted.

Between at least 1896 and 2003, a very large area of groundworkings was formed to the west of the study site by the extraction of lime and gravel. An area within these workings and circa 180m west of the study sit was also registered as a landfill accepting industrial waste between at least 1950 and 1970.

The above are considered to present potentially unacceptable risk to human health due to potential for exposure to contaminants via proposed soft landscaped areas, and potential migration and accumulation of landfill gases.

Moderate risk was identified to future site users as a result of potential soil contamination and ground gas.

3 PHASE 2 EXPLORATORY INVESTIGATION

3.1 Scope of Works

An exploratory investigation was designed based on the findings of the desk study. The scope of works was as follows.

- Formation of exploratory boreholes
- Strata logging and sample retrieval
- PID screening of selected samples
- Construction of environmental monitoring installations in selected boreholes
- Chemical laboratory analysis
- Factual and interpretive reporting of investigation findings

3.2 Fieldworks & Testing

3.2.1 Fieldworks

3No windlowless sampler boreholes were advanced to enable strata logging, sample retrieval and installation of environmental monitoring wells.

Fieldworks were completed on the 10th of July 2023 and are summarised in the table below.

Table 3-1: Fieldworks Summary

Location Reference* and Rationale		Max Depth (mbgl)	Monitoring Wells Response Zone (mbgl)	PID Screening
WS1	West of the existing buildings, targeting current hardstandings in proposed areas of communal garden, and closest to the off-site potential source of ground gases. Down hydraulic gradient from the diesel tank.	5.0	1 - 5	0 ppm
WS2	Northeast of the existing buildings, targeting current hardstandings in proposed private garden.	5.0	-	0 ppm
WS3	Northeast of the existing buildings, targeting current hardstandings in proposed private garden. Immediately adjacent and up gradient from the diesel tank.	5.0	1 - 5	0 ppm

*Notes: * HP = Hand Pit; TP = Mechanically Excavated Trial Pit; WS = Windowless Sampler Borehole; BH = Cable Percussion Borehole | ** + Indicates base of stratum was not reached.*

Monitoring installations consisted of 1m of plain pipe with a bentonite seal at the surface to prevent flooding of the response zone with surface water and to prevent atmospheric leakage/ingress. The standpipes were sealed with a bung and valve with a flush fitting cover.

Exploratory hole locations are shown on the plan in Appendix A, with borehole logs in Appendix C.

Laboratory Analysis

5No. selected samples were submitted for a range of chemical analyses comprising pH, soil organic matter (SOM); total and speciated polycyclic-aromatic hydrocarbons (PAHs); TPH; metals/metalloids, and asbestos ID.

Samples were also screened on site for VOCs using a hand-held photo ionisation detector. No significant PID readings were obtained.

Analytical work was undertaken by UKAS accredited laboratory. Results are summarised and discussed below, and the lab report is attached as Appendix D.

3.3 Ground Conditions

Made Ground

Made Ground was encountered as anticipated underlying hardstandings to depths of around 0.3m and consisting of reworked gravelly silty sand with frequent brick and clay pipe fragments.

Superficial Deposits

Very gravelly silty sand was encountered in all exploratory locations to depths between 2.5-3.5m and considered to represent the Gerrards Cross Gravel.

Solid Geology

Various interbedded clayey sands and silty clays were encountered in all exploratory locations and to the depth of boreholes and considered to represent the Lambeth Group.

3.4 Groundwater Conditions

Groundwater inflow encountered in all boreholes at depths between circa 2.4-4m.

No visual or olfactory evidence of groundwater contamination was noted.

3.5 Environmental Monitoring

Monitoring of permanent ground gases was carried out via WS1 and WS3. The monitoring results are assessed in Section 4.

4 CONTAMINATED LAND RISK ASSESSMENT

4.1 Human Health Risk Assessment

A Tier 1 (generic) quantitative risk assessment has been undertaken by screening measured contaminant concentrations against reference values for chronic (long term) risk to human health known as generic assessment criteria (GAC).

Concentrations exceeding the relevant screening values are described as ‘elevated’ and indicate a requirement to further characterise or otherwise address health and environmental risks.

In line with the initial conceptual site model, GAC for the residential with consumption of homegrown produce (RwHP) scenario have been utilised. The GAC are based on 2.5% SOM, the highest available as the measured values were all above this.

The assessment is summarised in Table 4-1, and the source of GAC is indicated in the final column and footnotes to the table.

Table 4-1: Summary of Soil Analytical Results vs Tier 1 Screening Values

Determinand	GAC	Units	No. of Samples	No. of Exceedances	Exceedance Locations	Summary Statistics*			**
						Minimum	Maxi mum	Average	
Inorganics & Metals / Metalloids									
Asbestos	N/A	-	4	1	-	-	-	-	***
Arsenic	37	mg/kg	4	-	-	10.0	30.0	15.5	1
Barium	1300	mg/kg	4	-	-	42.0	83.0	59.5	2
Beryllium	1.7	mg/kg	4	-	-	0.4	0.8	0.6	1

Boron	290	mg/kg	4	-	-	0.4	1.2	0.6	1
Cadmium	11	mg/kg	4	-	-	< 0.2	< 0.2	< 0.2	1
Chromium	910	mg/kg	4	-	-	12.0	18.0	16.3	1
Copper	2400	mg/kg	4	-	-	12.0	34.0	24.5	1
Lead	200	mg/kg	4	-	-	17.0	55.0	38.8	3
Mercury	1.2	mg/kg	4	-	-	< 0.3	< 0.3	< 0.3	1
Nickel	180	mg/kg	4	-	-	7.2	12.0	10.1	1
Selenium	250	mg/kg	4	-	-	< 1.0	< 1.0	< 1.0	1
Vanadium	1200	mg/kg	4	-	-	22.0	47.0	32.0	1
Zinc	3700	mg/kg	4	-	-	29.0	160.0	85.3	1
Determinand	**GAC**	**Units**	**No. of Samples**	**No. of Exceedances**	**Exceedance Locations**	**Summary Statistics***			****
						Minimum	**Maxi mum**	**Average**	
***PAHs** - at 2.5% SOM*									
Naphthalene	5.6	mg/kg	4	-	-	< 0.05	0.1	0.1	1
Acenaphthylene	420	mg/kg	4	-	-	< 0.05	0.5	0.2	1
Acenaphthene	510	mg/kg	4	-	-	< 0.05	0.5	0.2	1
Fluorene	400	mg/kg	4	-	-	< 0.05	0.4	0.2	1

Phenanthrene	220	mg/kg	4	-	-	< 0.05	5.6	2.6	1
Anthracene	5400	mg/kg	4	-	-	< 0.05	2.2	0.8	1
Fluoranthene	560	mg/kg	4	-	-	0.1	14.0	4.5	1
Pyrene	1200	mg/kg	4	-	-	0.1	12.0	3.9	1
Benzo(a)anthracene	11	mg/kg	4	1	-	< 0.05	6.7	2.8	1
Chrysene	22	mg/kg	4	-	-	< 0.05	7.4	3.1	1
Benzo(b)fluoranthene	3.3	mg/kg	4	1	WS2-0.15m	< 0.05	9.2	3.9	1
Benzo(k)fluoranthene	93	mg/kg	4	-	-	< 0.05	4.3	1.7	1
Benzo(a)pyrene	2.7	mg/kg	4	2	WS2-0.15m	< 0.05	8.4	3.4	1
Indeno(1,2,3-cd) pyrene	36	mg/kg	4	-	-	< 0.05	5.7	2.2	1
Dibenz(a,h)anthracene	0.28	mg/kg	4	2	WS2-0.15m	< 0.05	1.3	0.7	1
Benzo(ghi)perylene	340	mg/kg	4	-	-	< 0.05	7.1	2.8	1
TPH-CWG	Varies	-	2	-	-	< 1.0	< 1.0	< 1.0	1

Notes: ** Summary statistics based on targeted sampling are provided for information only.*

*** Source of GAC: 1 = LQM / CIEH (2014) S4UL3785 | 2 = CL:AIRE (2009) Soil Generic Assessment Criteria for Human Health | 3 = Defra (2014) C4SL*

**** For asbestos, the number of detections is shown and does not relate to any GAC. N.D = Not detected*

Principal findings of the quantitative screening summarised in Table 4-3 are as follows.

- Benzo(a)pyrene was highly elevated in sample WS2 (0.15m) at 3.1 times the guideline value

- Benzo(b)fluoranthene was highly elevated in sample WS2 (0.15m) at 2.8 times the guideline value
- Dibenz(a,h)anthracene was highly elevated in sample WS2 (0.15m) at 4.6 times the guideline value
- Asbestos was detected in sample WS1 (0.1m) – Chrysotile (loose fibres)

4.2 Controlled Waters Risk Assessment

Groundwater was not encountered during the investigation or monitoring visits, and no samples could be obtained during the investigation or monitoring visit undertaken seven weeks later. Further to this, established site history and the nature of material encountered within the exploratory locations are not suggestive of a significant source of mobile or leachable contamination, and risk is considered to be low.

4.3 Ground Gas Quantitative Risk Assessment

Soil gas flow and steady state concentration readings have been taken over two monitoring visits to date. A summary of the monitoring results is provided in the table below based on the highest values measured.

Gas screening values (GSV) are a function of gas concentration and gas flow from a borehole, and therefore provide an indication of gas flux from the ground. The GSVs below are based on the highest steady state flow rate and concentration of each hazardous gas recorded in any of the wells, thereby giving a worst-case scenario for the risk assessment.

Table 3-2: Summary of Gas Screening Values

Monitoring well ID	aP (mb)	Flow (l/h)	CH_4 (%)	CO_2 (%)	VOC (ppm)	O_2	CH_4 GSV (l/hr)	CO_2 GSV (l/hr)	Characteristic Situation	Date
WS1	1003	<0.1	0	0.4	0	19.0	0	<0.05	CS1	14/07/22
WS2	1042	<0.1	0	0.3	0	19.1	0	<0.02	CS1	14/07/22
WS3	1007	<0.1	0	0.2	0	20.0	0	<0.04	CS1	14/07/22

The monitoring has detected no methane and a maximum carbon dioxide concentration of 0.5%, with detected borehole flow rates of zero.

However, in line with the precautionary approach set out in BS8485, assuming a borehole flow rate at the limit of detection (0.1l/h) a GSV of <0.05l/hr is calculated. The calculated GSV is equivalent to Characteristic Situation 1 (very low risk).

As no significant thickness of Made Ground was encountered, no gas flow detected and given the distance to the former landfill off-site, the above is also considered to be a conservative assessment. The relatively high groundwater levels encountered may also mitigate potential gas migration from the lower ground to the west.

Vapours

Total VOC concentrations were also monitored using a ppb RAE handled photoionization detector and no significant concentrations were detected.

4.4 Gas Protection Measures

BS8485 sets out a points system for the selection of appropriate gas protection measures. Essentially, higher characteristic situation sites and more sensitive uses require a greater number of ‘points’ to be scored in terms of gas protective measures and construction methods.

However, according to the above framework, no specific gas protection measures are required for Characteristic Situation 1 sites.

4.5 Updated Conceptual Site Model

The initial conceptual site model has been updated in Table 4-2, below, to reflect the presence of sources proven by the investigation works.

Table 4-2. Updated Conceptual Site Model

Source	Pathway	Receptor	Consequence	Likelihood	Classification*	Rationale
Contaminants exceeding GAC in soil: • PAHs	Dermal contact, ingestion, particulate inhalation	Future site occupants & users	Medium	Likely	Moderate Risk	The PAH exceedances are all from WS2 and correlate with frequent dark coloured gravel of tarmacadam or similar noted in the shallow Made Ground forming the hardstanding east of the main barn buildings. Given that the proposals are for residential development with gardens, the presence of a significant contaminant linkage with sensitive receptors such as children is likely. Adeptus considered that remediation will be necessary in relation to these elevated levels of PAHs and lead.
	Consumption of homegrown produce		Medium	Low Likelihood	Moderate/ Low Risk	
Asbestos fibres in soil (chrysotile)	Inhalation		Medium	Low Likelihood	Moderate/ Low Risk	Four of the five samples were free from asbestos. The single sample that did contain asbestos was taken at shallow depth Made Ground forming the hardstanding west of the main barn building and forming an access road to the field at the rear. Given that the proposals are for residential development with gardens, sensitive receptors such as children may be exposed to asbestos fibres.

**in the absence of any mitigation or remedial measures*

5 CONCLUSIONS

5.1 Summary

Adeptus was appointed by PFG Design to undertake a Phase 2 Geo-Environmental Exploratory Investigation at the site known as Weybeards Farm.

The investigation is required in support of a planning application for redevelopment of the site and to further assess potentially significant contaminant linkages identified in an earlier phase 1 desk study.

The primary objective of the works was to provide a quantitative assessment of risks to relevant receptors in line with the principles of Environment Agency publication ‘Land contamination risk management’ (LCRM).

Proposals are for conversion of the exiting agricultural buildings to dwellings.

The preliminary risk assessment identified a number of potentially significant pollutant linkages and a moderate risk, suggesting that further assessment should be undertaken.

Earlier buildings at Weybeards Farm predating the earliest OS map (1865) were demolished between 1934 and 1960, suggesting Made Ground may underlie that part of the site. Rubble ‘hardcore’ may also underlie the current hardstandings.

A large diesel tank was also noted on the east of the site, although this was fully bunded and no sign of any spills or leaks noted.

Between at least 1896 and 2003, a very large area of groundworkings was formed to the west of the study site by the extraction of lime and gravel. An area within these workings and circa 180m west of the study sit was also registered as a landfill accepting industrial waste between at least 1950 and 1970.

The above were considered to present potentially significant risk to human health due to potential for exposure to contaminants via proposed soft landscaped areas, and potential migration and accumulation of landfill gases. The possibility of an historical diesel release with effects on groundwater also could not be ruled out.

Moderate risk was identified to future site users as a result of potential soil contamination and ground gas.

A phase 2 investigation was undertaken consisting of 3No. window sampler boreholes advanced to circa 5m to allow gas monitoring, as well as targeted sampling of shallow soil and Made Ground.

Samples were tested for the following range of contaminants: organic matter (SOM), metals suite, PAH (USEPA-16), Total Petroleum Hydrocarbons and asbestos ID.

In summary, elevated PAHs and were detected in one sample taken at shallow depth from material forming hardstandings at the east of the main barn. Chrysotile asbestos fibres were also detected in one sample taken at shallow depth from material forming hardstandings at the west of the main barn.

TPHs were not detected in either of the samples tested, and no TVOCs were detected with on-site screening. Together with the absence of visual or olfactory evidence, this is considered to indicate the area close to and down gradient of the tank is unlikely to have been affected by a significant diesel spill.

However, remediation will be required to ensure sensitive receptors are not exposed to elevated contamination or asbestos fibres that may otherwise remain in gardens.

Two rounds of ground gas monitoring were also undertaken after a period of equilibration following the fieldworks. A worst-case GSV for carbon dioxide of <0.05l/hr was calculated, which is equivalent to CS1 (very low risk). No methane was detected.

As no significant thickness of Made Ground was encountered and no gas flow detected, the assumption of gas flow rates at the limit of detection produces a conservative assessment.

N.B.: This summary forms part of the overall risk assessment and should not be viewed or used as an independent report.

5.2 Recommendations

Measures will be required to ensure soil to a depth of 0.6m in the proposed soft landscaped areas does not contain elevated contamination. The most feasible methods of achieving this would initially appear to be by either:

a. Excavating to 0.6m below proposed finished levels and reinstating to levels with certified clean topsoil from an approved source; or

b. Raising finished levels in soft landscaped areas to provide a clean cover system of at least 0.6m thickness.

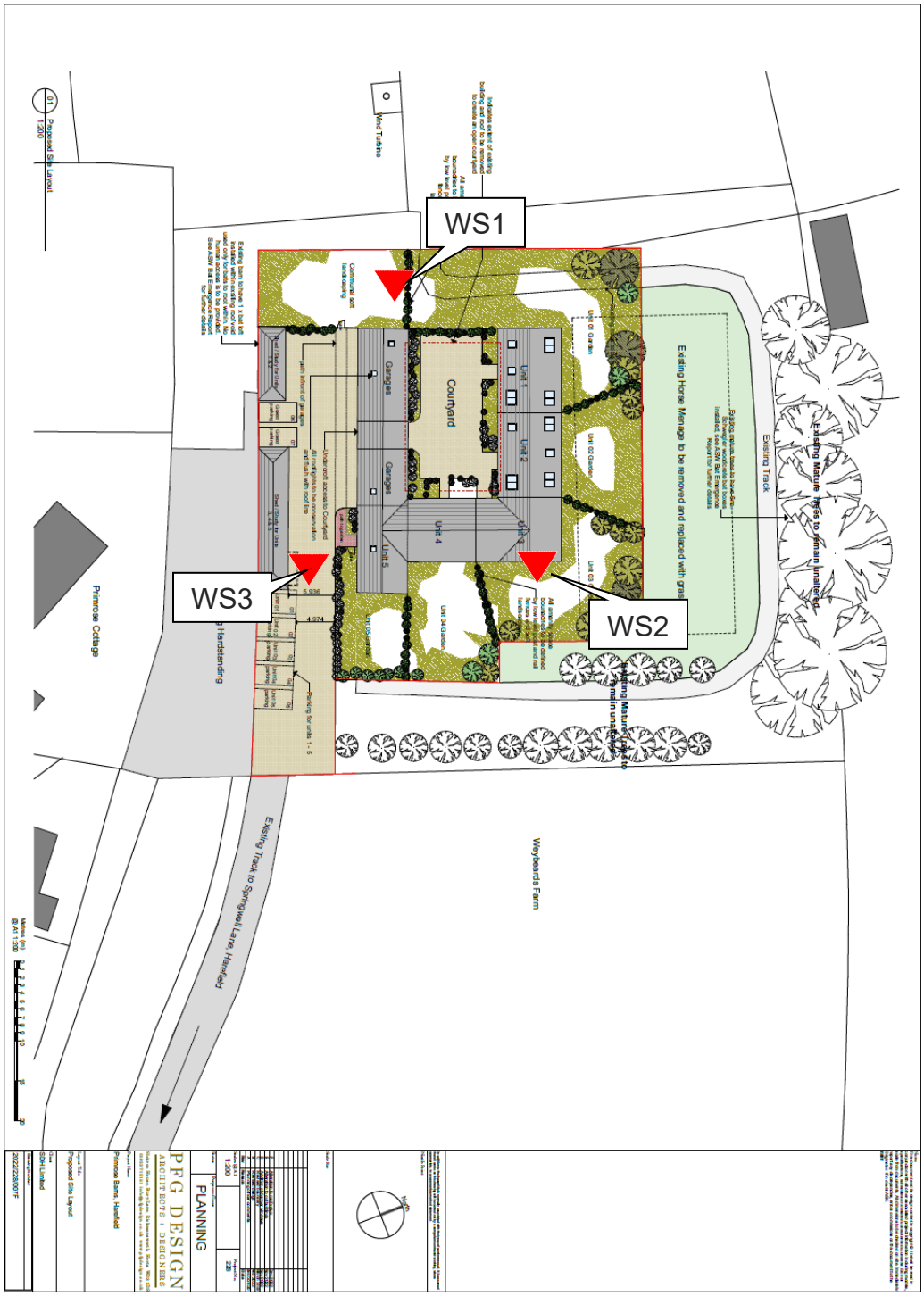
Alternatively, it may also be feasible to substitute some proportion of the proposed soft landscaped areas for hard cover such as paving. Permanent hardstandings are considered to sever contaminant linkages with solid phase contaminants in soil.

Mitigation will also be required to ensure site workers and adjacent land users are not exposed to short term particulate inhalation. Typically, such measures include the use of the correct PPE and wetting down to prevent fugitive dust.

Following waste classification, any excavated material should be disposed of at a suitably licenced facility.

It is emphasized however that LPA approval should be obtained before any works commence on-site.

APPENDIX A – SITE & EXPLORATORY HOLE LOCATION PLAN



APPENDIX B – SUPPORTING INFORMATION

The following information and data sources are utilised in compiling this report:

Phase 1 Desk Study (Adeptus, April 2023) Ref: A230401-R01

This report is based on information available at the time of writing and is subject to the limitations set out in Appendix G.

APPENDIX C – SOIL LOGS

APPENDIX D – LABORATORY CERTIFICATE - SOIL RESULTS

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i2 Analytical Ltd.
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Croxley Green
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f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 23-44736

Project / Site name:	A230403-R02A-LCP2 Old Weybeards Farm	**Samples received on:**	12/07/2023
Your job number:		**Samples instructed on/ Analysis started on:**	13/07/2023
Your order number:		**Analysis completed by:**	20/07/2023
Report Issue Number:	1	**Report issued on:**	21/07/2023
Samples Analysed:	5 soil samples		

Signed:

Anna Goc
PL Head of Reporting Team
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: 23-44736
Project / Site name: A230403-R02A-LCP2 Old Weybeards Farm

Lab Sample Number				2746804	2746805	2746806	2746807	2746808
Sample Reference				WS1	WS1	WS2	WS3	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	4.40	0.15	0.20	0.50
Date Sampled				11/07/2023	11/07/2023	11/07/2023	11/07/2023	11/07/2023
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	43	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	4.7	16	2.4	6.8	7.8
Total mass of sample received	kg	0.001	NONE	0.2	0.4	1.2	1.2	0.4
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile- Loose Fibres	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	-	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	SPU	N/A	SPU	SPU	N/A
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.8	7.5	7.2	8.7	8.2
Organic Matter (automated)	%	0.1	MCERTS	2.7	< 0.1	8.3	1.3	0.3
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	0.1	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.11	-	0.53	0.07	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.07	-	0.49	0.08	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.07	-	0.44	0.09	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1	-	5.6	1.1	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.16	-	2.2	0.14	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.2	-	14	1.7	0.07
Pyrene	mg/kg	0.05	MCERTS	1.9	-	12	1.5	0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.85	-	6.7	0.77	< 0.05
Chrysene	mg/kg	0.05	MCERTS	1.1	-	7.4	0.9	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.4	-	9.2	1.2	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.49	-	4.3	0.44	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.96	-	8.4	0.77	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.55	-	5.7	0.47	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	1.3	0.1	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.65	-	7.1	0.54	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	11.4	-	85.5	9.8	< 0.80
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	-	11	10	30
Barium (aqua regia extractable)	mg/kg	1	MCERTS	83	-	70	42	43
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.65	-	0.76	0.44	0.51
Boron (water soluble)	mg/kg	0.2	MCERTS	1.2	-	0.5	0.4	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	-	18	12	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	-	34	32	12
Lead (aqua regia extractable)	mg/kg	1	MCERTS	40	-	43	55	17
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	12	-	7.2	9.1	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	33	-	47	22	26
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	160	-	86	66	29

Analytical Report Number: 23-44736

Project / Site name: A230403-R02A-LCP2 Old Weybeards Farm

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Date Sampled				11/07/2023	11/07/2023	11/07/2023	11/07/2023	11/07/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0
Toluene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0
p & m-xylene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0
o-xylene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.1	NONE	-	< 0.10	-	-	< 0.10
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.1	NONE	-	< 0.10	-	-	< 0.10
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.1	NONE	-	< 0.10	-	-	< 0.10
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	-	< 1.0	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	-	< 2.0	-	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	-	< 10	-	-	< 10
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.1	NONE	-	< 0.10	-	-	< 0.10
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.1	NONE	-	< 0.10	-	-	< 0.10
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.1	NONE	-	< 0.10	-	-	< 0.10
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	-	< 1.0	-	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	-	< 2.0	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-	< 10	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-	< 10	-	-	< 10
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	-	< 10	-	-	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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* 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 *
2746804	WS1	None Supplied	0.1	Brown loam and sand with brick and stones.
2746805	WS1	None Supplied	4.4	Brown sand.
2746806	WS2	None Supplied	0.15	Brown loam and sand with gravel and vegetation.
2746807	WS3	None Supplied	0.2	Brown sand with gravel and vegetation.
2746808	WS3	None Supplied	0.5	Brown sandy clay with gravel.

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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
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
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
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
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	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

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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
Organic matter (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

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' 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

APPENDIX E - LIMITATIONS

This report was prepared by Adeptus (registered in England: 05908395) for the use of the client, named on page 1. The report has been prepared specifically on the basis of the end use as defined by the client. Any change of end use would necessitate review of this report and its findings. Use of or reliance on this report by any third party is not permitted without our express written agreement, and where this is given, will be subject to our terms and conditions.

We have prepared this report in our professional capacity using reasonable skill, care and diligence. The assessments, conclusions and recommendations within this report pertain to the study site (the extents of which are in Figure 1, below) and the immediate area in continuity with the Site. They are based on the established historical uses, information available at the time of writing and the proposed use of the Site. Where any information supplied by the client or other sources have been utilised, it has been assumed that the information is correct. No responsibility can be accepted by Adeptus for inaccuracies in data supplied by any other party.

Any plans, diagrams, cross sections or images are for illustrative purposes only and should be checked for accuracy on-site. In the event of changes to the proposed end use of the Site, the report may require updating to reflect such changes. Although reference may be made to archaeological, ecological or geotechnical issues, invasive species, flood risk and the presence of asbestos containing materials (ACMs), this report does not constitute an archaeological assessment, ecological assessment, geotechnical assessment, invasive species survey, flood risk assessment or asbestos survey and liability for any claim caused by arising out of or in any way involving asbestos is excluded.

New information relating to environmental matters can come to light after the report has been prepared and changes in conditions and regulatory requirements may occur in future. Either of those factors may change the conclusions presented in our report. If development does not take place within the expected timescales, consideration should be given to reviewing this assessment to confirm that no changes to the site or relevant legislation have taken place. No part of this report is intended to provide legal advice or opinion of any nature.