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CLAYFIELD FARM, VALEWOOD LANE, BARNS GREEN,
HORSHAM, WEST SUSSEX, RH13 0QJ

Contamination Risk Assessment

March 2023

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Environmental Assessment Services Ltd

REPORT DATA SHEET

Requirement	Data
Report Ref:	499a/NJA/ClayfieldFarm/CRA
Date	March 2023
Client	NJA Town Planning
Report type	Contamination Risk Assessment
Purpose	Planning
Revisions	
Prepared by	Lucy Collins BSc (Hons) MSc, QCIEEM  Signed
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Contamination Risk Assessment

March 2023

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Contamination Risk Assessment

March 2023

1. BACKGROUND

1.1 This report follows the Preliminary Contamination Risk Assessment completed for the site in March 2023. The site was found to have some potential contamination risk relating to its former agricultural use.

1.2 The site is intended for residential redevelopment. It was recommended that a Contamination Risk Assessment, including intrusive site investigation, be undertaken in order to assess the extent of any potential contamination at the site and the potential risk to future site users and the wider environment.

1.3 This assessment includes a superficial examination of the site, the excavation of six trial pits at locations reasonably representative of potential contamination, the analysis of soil samples plus a review of data compiled as part of the Preliminary Contamination Risk Assessment. This report does not attempt to comment on the commercial value or viability of the site.

2. THE SITE & PROPOSED DEVELOPMENT

2.1 The site comprises an agricultural barn and adjacent fields within Clayfield Farm off Valewood Lane in Barns Green. The site area is approximately 5.57 ha. The Ordnance Survey (OS) map reference for the site is TQ 1178 2657. The site elevation is approximately +53 m OD. See Figure 1 for site location plan and Figure 2 for the existing site layout.

2.2 The site comprises a large cattle barn built in 2009 with a coated profiled steel cladding and steel portal frame construction. There is a chalk flooring to a depth of approximately two feet (0.6 m), and a central stack of straw. There are straw filled cattle pens (occupied by several cattle) and various equipment associated with keeping cattle.

2.3 There is a workshop area in the northern section of the barn with various small farm or household equipment. There are few small containers of potentially contaminating fluids including paint and engine oil, and car screen wash. There were empty containers labelled formaldehyde.

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2.4 The ground level in the area immediately surrounding the barn is lower than the surrounding level and there was an area of pooled water on the west side of the barn (it had rained recently). The ground level has been raised and the entrances to the barn on the southern and northern facades have been reinforced with hardcore.

2.5 The area to the rear of the barn is covered by overgrown brambles which extend along the eastern boundary of the site. A car is parked within the brambles behind the north section of the barn and bales of bags and netting are parked next to the barn. This area had been cleared immediately prior to the site investigation and excavation of trial holes.

2.6 The field to the south of the barn contains a horse and a pony and has longer grass. There is a dung heap in the northeast corner.

2.7 The area to the west of the barn is laid to grass and contains various piles of debris, two trailers and equipment associated with keeping cattle, sheep and pigs including fencing and shelters. There are two piles of straw and a hay bale. There is a storage container filled with various equipment and clothing. This is surrounded by brambles and there are multiple containers of linseed oil on the southern side of the unit.

2.8 The field to the northwest of the barn has longer grass and was unoccupied at the time of the visit.

2.9 To the north of the barn are two mobile homes, a caravan and a shed. There are kennels containing four dogs and an enclosure containing chickens and geese.

2.10 The wider area surrounding the farm is comprised of agricultural fields, residential areas, and woodland.

3. POTENTIAL SOURCES OF CONTAMINATION

3.1 Land use at the site appears to have comprised:

- Farmland from pre 1876 to date.

3.2 Potential contamination risks associated with the historic and recent agricultural and workshop use of the site, include storage and maintenance of vehicles, storage and use of various potentially contaminating fluids, possible historic burning of waste, and keeping of animals.

3.3 Potential contaminants include petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and heavy metals.

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4. SITE SENSITIVITY

4.1 Environmental site sensitivity

4.1.1 The site is not considered to hydrogeologically sensitive, lying within an area of largely impermeable Weald Clay (Unproductive Strata). The closest record of a watercourse to the site is for a tertiary river approximately 130 m north of the site.

4.1.2 The site does not lie within a source protection zone. There are no records of ground water, surface water or potable water abstraction licences within 2000 m of the site.

4.1.3 The site does not lie within 500 m of any controlled waters (inland fresh waters, groundwater and coastal waters).

4.1.4 According to the Environment Agency flood mapping, the site lies within Flood Zone 1 (low risk of flooding).

4.2 Future site users

4.2.1 It is proposed to redevelop the site for residential use comprising two dwellings with rear soft landscape gardens and hardstand (parking area) to the front of the residences.

4.2.2 Future site users in this case are likely to include construction workers (considered to be adults) engaged in the development of the site, and future residents (which may include both adults and children). Both construction workers and residents are considered likely to come into direct contact with soil on the site. Future residents are likely to come into contact with the soil in the garden areas and may also grow produce for consumption.

4.2.3 New underground service lines will need to be installed as part of the site's development. Depending on the materials used, some water supply pipework may be vulnerable to contaminants within the soil (where present). See UKWIR guidelines.

5. INTRUSIVE SITE INVESTIGATION

5.1 The objectives of the site investigation were to confirm the nature of the underlying soil to establish or confirm whether the former land uses had resulted in contamination of the soil or groundwater at the site.

5.2 The site investigation was carried out on 9th March 2023 and comprised the excavation of six trial pits. The trial pits allowed visual inspection of the underlying soil as well as the selection of samples for analysis.

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5.3 The existing site layout and the trial pit locations are shown on Figure 3. The trial pit logs are given in Appendix B and summarised in Table 5.1 below:

TABLE 5.1
SUMMARY OF TRIAL PIT LOGS

TP 1	**TP 2**	**TP 3**
0.1 m depth of topsoil Brown/light grey clay. (Weald Clay).	0.1 m depth of topsoil Brown/light grey clay. (Weald Clay).	0.2 m of hardcore with chalk (made ground) Brown/light grey clay. (Weald Clay).
TP4	**TP5**	**TP6**
0.1 m topsoil 0.15 m buff weathered clay, Brown/light grey clay. (Weald Clay).	0.1 m topsoil 0.15 m buff weathered clay, Brown/light grey clay. (Weald Clay)	0.2 m of hardcore with chalk (made ground) Brown/light grey clay. (Weald Clay).

5.4 The determinands selected for analysis were those contaminants typically associated with past land uses as identified in the PCRA, including those for which guideline thresholds have been published, as listed below.

Toxic metals:	Arsenic
	Boron (water-soluble)
	Cadmium
	Chromium
	Lead
	Mercury
	Selenium
Phytotoxic metals:	Copper
	Nickel
	Zinc
Other parameters:	pH
Organics:	Cyanide
	Sulphate,
	Total Petroleum Hydrocarbons
	Polycyclic Aromatic Hydrocarbons

6. RESULTS OF THE SITE INVESTIGATION

6.1 A total of 12 soil samples, comprising 6 upper soil samples and 6 lower soil samples, were taken during the site investigation and sent for analysis at i2 Analytical Ltd. Copies of the sample analysis certificates, together with the laboratory's methods and accreditations, are given in Appendix C.

6.2 The pH of the soil samples ranged from 5.5 (moderately acidic) to 9.1 (slightly alkaline).

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6.3 The toxic metals; arsenic, boron, chromium, and lead and the phytotoxic metals; copper, nickel and zinc, were recorded at low concentrations or below the limit of detection within all soil samples.

6.4 Polycyclic Aromatic Hydrocarbons (PAHs) were recorded at generally low concentrations or below the limit of detection within the soil samples. Concentrations above the limit of detection were predominately limited to the upper soil samples. These levels all fall well below the current threshold values for residential use with plant uptake for all samples, with the exception of the upper sample from TP3 which exceeds the residential with plant uptake threshold for three PAHs. The concentrations for these PAHs are below the limit of detection within the lower soil sample from TP3, which indicates that the contamination is limited to the hardcore surfacing.

6.5 Total Petroleum Hydrocarbons (TPHs) were recorded as below the limit of detection for all soil samples except the upper samples from TP2 and TP3. The TPH level at TP2 fell below the threshold for residential with plant uptake. However, the TPH level at TP3 exceeded this value.

6.6 Total sulphate levels are slightly elevated across all upper and lower soil samples. However, the slightly elevated sulphate levels are typical of clay soils.

6.7 No groundwater was encountered in any of the trial pits during the site investigation.

7. INTERPRETATION OF RESULTS

7.1 Physical appearance and topography of the soils

Oil staining, unusual colouring, odour and other superficial indications of significant contamination were not noted in any of the trial pits.

Photographs taken at the site during the current investigation are provided in Appendix A.

7.2 Analysis of the soil samples

The results of the soil sample analysis have been compared with the published DEFRA Category 4 Screening Levels (C4SL) for Assessment of Land Affected by Contamination (as updated 2014) and the LQM/CIEH Suitable for Use Levels (S4UL) for Human Health Risk Assessment (2015). *Copyright Land Quality Management Limited reproduced with permission; Publication Number: S4UL3601. All rights reserved.*

The pH values in the soil samples ranged from 5.5 to 9.1. The samples are generally slightly acidic due to the underlying clay, and the slightly alkaline samples were from within the hardcore/chalk reinforced areas.

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The proposed land use is classified as residential with plant uptake.

Based on the analysis of soil samples taken from the six trial pits, it is concluded that there is some contamination of the superficial made ground layer at the location of TP3 only. It will be necessary to remove some of the made ground at the location of TP3 and replace it with clean soil from an uncontaminated source in order to render it suitable for the proposed residential land use.

The significant soil samples and the nature of their contamination is summarised in Table 7.1 below:

TABLE 7.1

Sample identity		Nature of contamination	Significance
Trial pit	**Depth**		
TP3	0.1 m	PAHs, TPH	Minor - Moderate

8. RISK ASSESSMENT

8.1 The Contamination Risk Assessment has been prepared in accordance with the recommendations given in the Defra/EA publication "Model Procedures for the Management of Land Contaminated – Contaminated Land Report 11" 2004.

8.2 For contamination to be significant, there must be three elements present: *Contamination* (a substance that has the potential to cause harm or cause pollution of controlled waters), a *receptor* (something that could be adversely affected by a contaminant) and a feasible *pathway* (route or means) between substance and receptor. See Diagram 1 below.

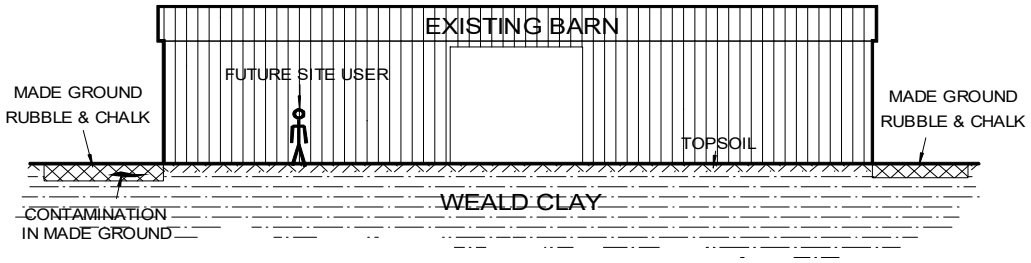


DIAGRAM 1
CONCEPTUAL MODEL

8.3 In this case, the model may be applied to three cases:

i. Construction workers engaged in the redevelopment of the site and exposed to contamination. The receptor assumed to be an adult.

ii. Future residents on the site after the redevelopment is complete and exposed to contact with soil in any garden areas plus, possibly, eating produce grown in a garden. The receptor assumed to be a child.

iii. Post-redevelopment impacts on the wider environment. Includes off-site contamination migration, contamination of watercourses, etc.

In this case, evidence of contamination appears to be limited to a single upper soil sample from made ground and the contamination is minor – moderate. It does not appear to have affected the underlying clay.

8.4 Exposure during construction

In the absence of remediation, those appointed to undertake site clearance and groundworks may be exposed to PAH and TPH contamination at the TP3 location.

This is most effectively addressed by general industrial hygiene when the surface soil and made ground is handled during site clearance and groundworks. Measures should include the wearing of boots, gloves and coveralls, and dust masks on dry days if dust is generated. Eating and smoking in excavations should be avoided.

8.5 Exposure of residents on the site after redevelopment

The site is to be redeveloped for residential use, including areas of soft landscaping and garden.

In the absence of remediation, future site users may be exposed to contaminants within the soil via inhalation, dermal contact and consumption of home grown produce.

This will only be a significant risk if the contaminated upper soil/made ground is allowed to remain within the garden and soft landscaping areas, where residents' contact with the soil is likely.

This is to be addressed by removing any upper soil/made ground identified as contaminated in the proposed garden and soft landscaping areas and replacing with clean topsoil from an uncontaminated source.

8.6 Post-redevelopment risks to buildings, services and the wider environment

There are no particular concerns regarding sulphate concentrations within the soil in relation to concrete building foundations, etc.

Migration of contamination off site is considered very unlikely, and is considered to be limited to only the upper soil/made ground at the location of

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TP3, as evidenced by significant contamination being identified only within the upper soil samples from TP3.

The site does not lie within a groundwater Source Protection Zone and is within an area which is not considered to be hydrogeologically sensitive. In this case, the proposed residential redevelopment of the site is not considered likely to pose a risk of contamination to the wider environment.

9. CONCLUSIONS

9.1 Soils at the site comprise a thin layer of topsoil over undisturbed Weald Clay, with a thicker layer of made ground at each end of the barn. The site lies upon Unproductive Strata (the Weald Clay) and does not lie within a groundwater Source Protection Zone. It is not considered to be hydrogeologically sensitive.

9.2 The site lies within Flood Zone 1, and does not lie within 500 m of any controlled waters. The closest recorded watercourse to the site is a tertiary river 132 m to the north.

9.3 The site does not lie within 250 m of any landfill likely to pose landfill migration risk. The site does not lie within a radon affected area.

9.4 Former land use at the site has comprised farmland, including the keeping and grazing of cattle and horses. Recent land use also includes residential (two mobile homes located north of the barn), workshop use within the northern section of the barn, and use and storage of vehicles/farm machinery.

9.5 An intrusive site investigation was conducted on 9th March 2023, and comprised the excavation of six trial pits. This identified minor – moderate contamination of PAHs and petroleum hydrocarbons in the made ground within the upper sample of TP3. All other upper soil samples and all lower samples within the underlying clay were found to fall within the threshold values for residential use with plant uptake.

9.6 The overall environmental risk for the site is rated according to the risk assessment matrix in Table 9.1 below:

TABLE 9.1
RISK ASSESSMENT MATRIX

PROBABILITY OF IMPACT	CONTAMINATION POTENTIAL		
	SEVERE	MODERATE OR UNCERTAIN	MINIMAL
High	4	3	2
Medium	3	2	1
Low	2	1	1

1 = low risk, 2 = low to medium risk, 3 = medium to high risk, 4 = high risk

9.7 In this case, the probability of impact is medium for a residential land use, but with minimal hydrogeological sensitivity. Minor – moderate contamination has been identified in the upper soil across the site, which would give a rating of 2. However, subject to the remediation measures recommended below, the contamination potential would be reduced to minimal, and the overall environmental risk rating would be reduced to 1 (low).

10. RECOMMENDATIONS

10.1 The existing made ground of hardcore/chalk reinforced track should be removed down to the clean underlying clay from any proposed areas of soft landscaping and garden,. Any soils removed should be disposed of appropriately and replaced with clean topsoil imported from an uncontaminated source.

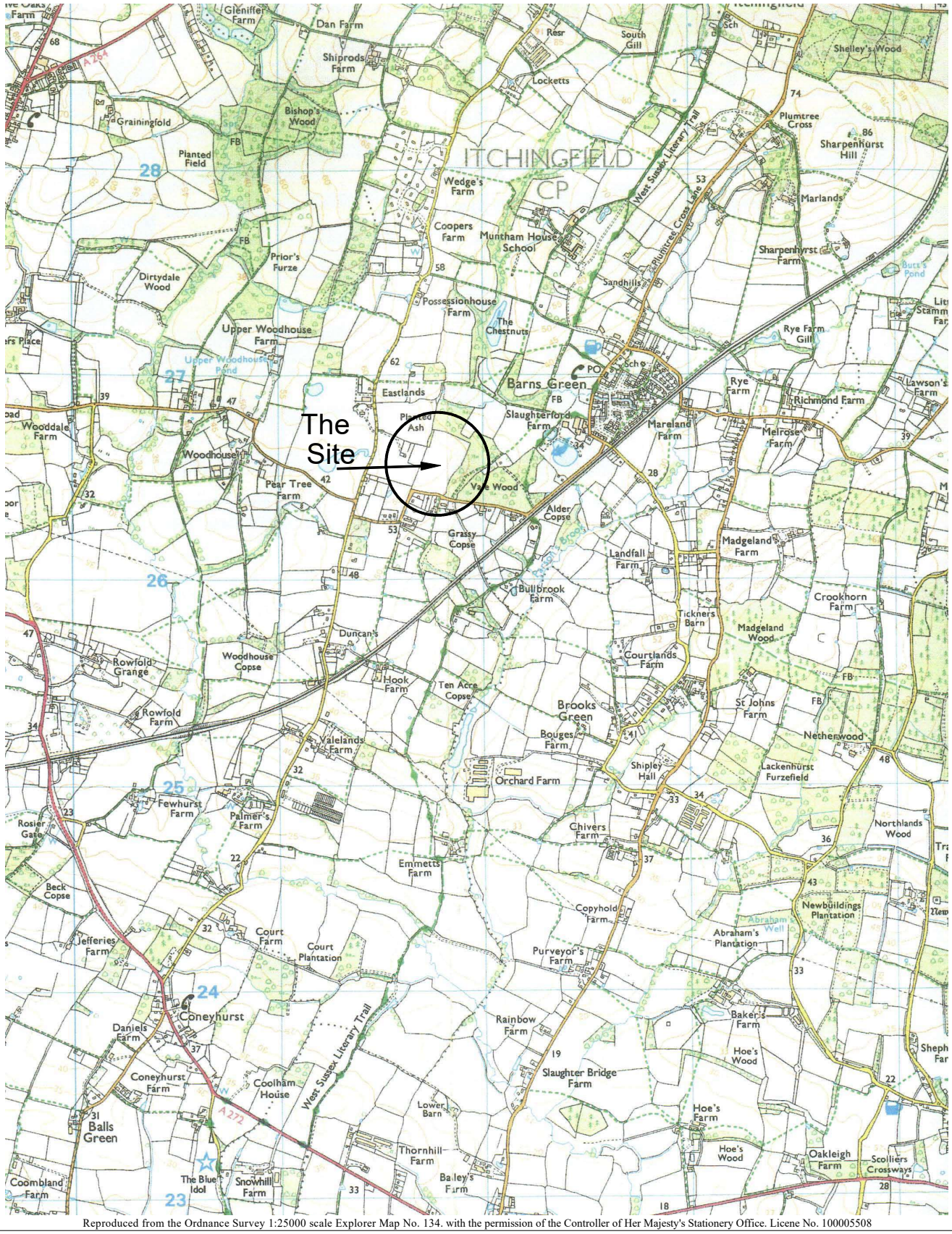
10.2 Groundworkers engaged in the removal of, or working within, the existing made ground should practice appropriate industrial hygiene. Measures should include the wearing of boots, gloves and coveralls, and dust masks on dry days if dust is generated. Eating and smoking in excavations should be avoided.

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FIGURES

FIGURE 1: **Site Location Plan**
FIGURE 2: **Existing Site Layout**
FIGURE 3: **Proposed Development Plan (showing trial pit locations)**



Reproduced from the Ordnance Survey 1:25000 scale Explorer Map No. 134. with the permission of the Controller of Her Majesty's Stationery Office. Licene No. 100005508

Scale 1:25000

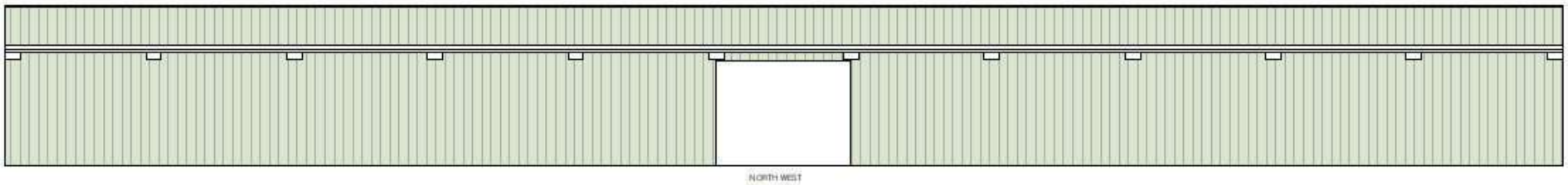
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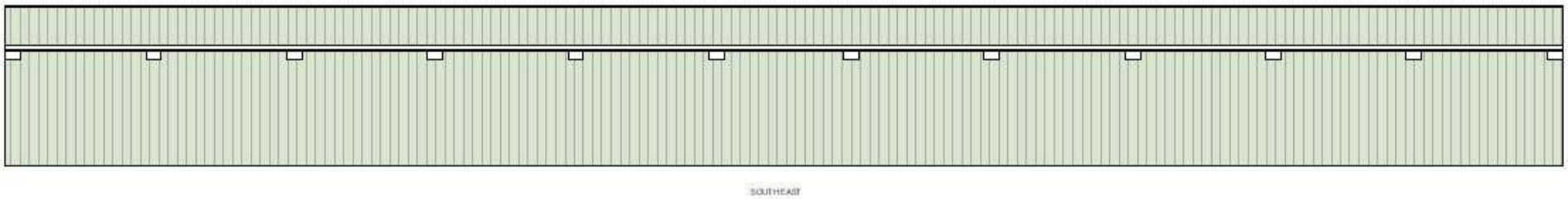
CLAYFIELD FARM, VALEWOOD LANE, BARNS GREEN,

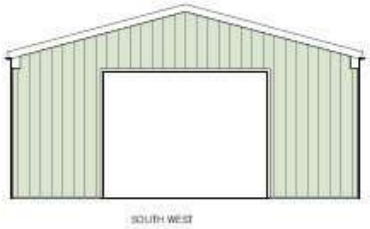
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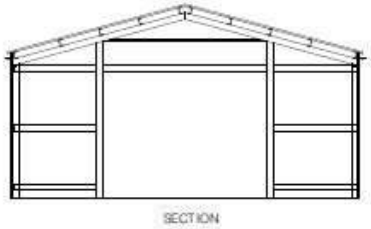
Figure 1: Site Location

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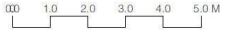












Scale as shown

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Figure 2: Site as Existing

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Figure 3: Proposed Development and Trial Pit Locations

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APPENDIX A

Photographs



Photo 1. TP1



Photo 2. TP2.

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Photo 3. TP3.



Photo 4. TP4.

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Photo 5. TP5.



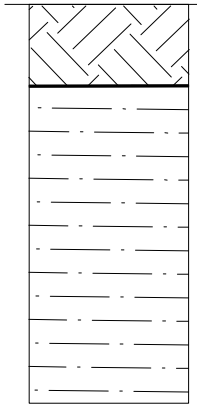
Photo 6. TP6.

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APPENDIX B

Trial Pit Logs

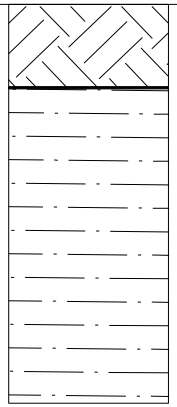
Trial Pit 1



0.1 m Topsoil

Brown/ light grey clay
(Weald Clay)

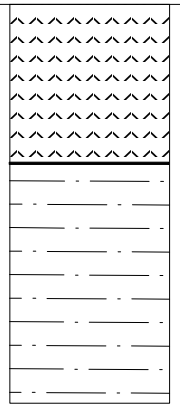
Trial Pit 2



0.1 m Topsoil

Brown/ light grey clay
(Weald Clay)

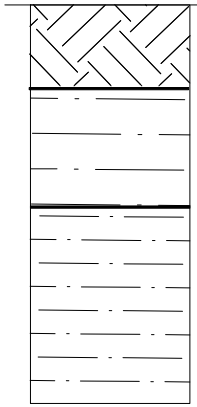
Trial Pit 3



0.2 m Hardcore with Chalk
(Made Ground)

Brown/ light grey clay
(Weald Clay)

Trial Pit 4

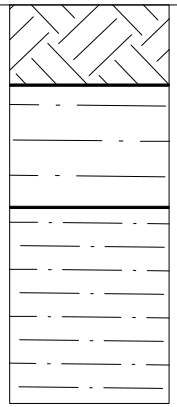


0.1 m Topsoil

0.15 m Weathered Clay
(Weald Clay)

Brown/ light grey clay
(Weald Clay)

Trial Pit 5

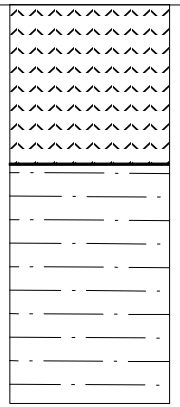


0.1 m Topsoil

0.15 m Weathered Clay
(Weald Clay)

Brown/ light grey clay
(Weald Clay)

Trial Pit 6



0.2 m Hardcore with Chalk
(Made Ground)

Brown/ light grey clay
(Weald Clay)

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Appendix B: Trial Pit Logs

March 2023

APPENDIX C

Analysis Certificates

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

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

Analytical Report Number : 23-22429

Project / Site name:	Clayfield Farm	**Samples received on:**	13/03/2023
Your job number:	499A	**Samples instructed on/ Analysis started on:**	13/03/2023
Your order number:	499A	**Analysis completed by:**	21/03/2023
Report Issue Number:	1	**Report issued on:**	22/03/2023
Samples Analysed:	12 soil samples		

Signed:

Dominika Warjan
Junior Reporting Specialist
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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-22429
Project / Site name: Clayfield Farm
Your Order No: 499A

Lab Sample Number				2613231	2613232	2613233	2613234	2613235
Sample Reference				TP1	TP1	TP2	TP2	TP3
Sample Number				Upper	Lower	Upper	Lower	Upper
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				09/03/2023	09/03/2023	09/03/2023	09/03/2023	09/03/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	5.5	6.7	6.3	6.6	9.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	490	180	480	350	630
Organic Matter (automated)	%	0.1	MCERTS	9.5	1.2	9.4	2.3	1.3
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.16
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.32
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.33
Phenanthrene	mg/kg	0.05	MCERTS	0.09	< 0.05	0.07	0.08	4.5
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1
Fluoranthene	mg/kg	0.05	MCERTS	0.18	< 0.05	0.17	0.11	8.3
Pyrene	mg/kg	0.05	MCERTS	0.18	< 0.05	0.18	0.11	7.5
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.08	< 0.05	0.07	< 0.05	3.8
Chrysene	mg/kg	0.05	MCERTS	0.09	< 0.05	0.09	0.05	3.7
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.09	< 0.05	0.13	< 0.05	4.1
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.05	< 0.05	0.06	< 0.05	2.1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.08	< 0.05	0.1	< 0.05	3.9
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	2.3
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.43
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	2.5
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	0.84	< 0.80	0.87	< 0.80	44.8
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8	14	9	14	14
Boron (water soluble)	mg/kg	0.2	MCERTS	1.2	0.4	1.8	0.2	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	27	24	30	21
Copper (aqua regia extractable)	mg/kg	1	MCERTS	13	15	13	15	14
Lead (aqua regia extractable)	mg/kg	1	MCERTS	24	22	29	32	20
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	10	14	11	14	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	54	52	60	56	50
Petroleum Hydrocarbons								
TPH C10 - C40 $_{EH_CU_1D_TOTAL}$	mg/kg	10	MCERTS	< 10	< 10	25	< 10	83

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Analytical Report Number: 23-22429
Project / Site name: Clayfield Farm
Your Order No: 499A

Lab Sample Number				2613236	2613237	2613238	2613239	2613240
Sample Reference				TP3	TP4	TP4	TP5	TP5
Sample Number				Lower	Upper	Lower	Upper	Lower
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				09/03/2023	09/03/2023	09/03/2023	09/03/2023	09/03/2023
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	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	20	31	20	38	20
Total mass of sample received	kg	0.001	NONE	0.9	0.9	0.9	0.9	0.9
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.2	6.3	6.8	6.2	6.9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	140	520	99	710	260
Organic Matter (automated)	%	0.1	MCERTS	0.8	7.4	0.6	11	0.9
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.13	< 0.05	0.2	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.05	0.2	< 0.05	0.38	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.07	0.2	< 0.05	0.36	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.09	< 0.05	0.15	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.1	< 0.05	0.18	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.12	< 0.05	0.18	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.08	< 0.05	0.12	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.11	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	1.03	< 0.80	1.57	< 0.80
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	9.1	15	9.4	10
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	0.9	< 0.2	1.3	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	36	25	33	27	29
Copper (aqua regia extractable)	mg/kg	1	MCERTS	22	13	28	18	20
Lead (aqua regia extractable)	mg/kg	1	MCERTS	18	26	15	23	13
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	11	12	12	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	62	57	42	80	44
Petroleum Hydrocarbons								
TPH C10 - C40 $_{EH_CU_1D_TOTAL}$	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

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Analytical Report Number: 23-22429
Project / Site name: Clayfield Farm
Your Order No: 499A

Lab Sample Number				2613241	2613242
Sample Reference				TP6	TP6
Sample Number				Upper	Lower
Depth (m)				None Supplied	None Supplied
Date Sampled				09/03/2023	09/03/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	33	21
Total mass of sample received	kg	0.001	NONE	0.9	0.9
General Inorganics					
pH - Automated	pH Units	N/A	MCERTS	7.3	5.8
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	580	310
Organic Matter (automated)	%	0.1	MCERTS	9.2	0.5
Speciated PAHs					
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.13	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.36	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.38	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.16	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.19	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.22	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.13	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.2	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Total PAH					
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1.77	< 0.80
Heavy Metals / Metalloids					
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	11
Boron (water soluble)	mg/kg	0.2	MCERTS	1	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	28
Copper (aqua regia extractable)	mg/kg	1	MCERTS	30	28
Lead (aqua regia extractable)	mg/kg	1	MCERTS	21	16
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	12	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	87	43
Petroleum Hydrocarbons					
TPH C10 - C40 $_{EH_CU_1D_TOTAL}$	mg/kg	10	MCERTS	< 10	< 10

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Analytical Report Number : 23-22429
Project / Site name: Clayfield Farm

* 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 *
2613231	TP1	Upper	None Supplied	Brown clay and loam with gravel and vegetation.
2613232	TP1	Lower	None Supplied	Brown clay with vegetation.
2613233	TP2	Upper	None Supplied	Brown clay and loam with gravel and vegetation.
2613234	TP2	Lower	None Supplied	Brown clay with vegetation.
2613235	TP3	Upper	None Supplied	Brown clay and sand with gravel and stones.
2613236	TP3	Lower	None Supplied	Brown clay.
2613237	TP4	Upper	None Supplied	Brown clay and loam with vegetation.
2613238	TP4	Lower	None Supplied	Brown clay.
2613239	TP5	Upper	None Supplied	Brown clay and loam with vegetation.
2613240	TP5	Lower	None Supplied	Brown clay with vegetation.
2613241	TP6	Upper	None Supplied	Brown clay and loam with gravel and vegetation.
2613242	TP6	Lower	None Supplied	Brown clay and sand with vegetation.

Analytical Report Number : 23-22429
Project / Site name: Clayfield Farm

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
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
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS

Analytical Report Number : 23-22429
Project / Site name: Clayfield Farm

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

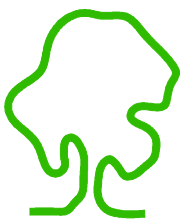
Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house 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



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