

Report No	Date
22124/R3	October 2022
Project GROUNDHOG, ABERDULAIS – ADDITIONAL INVESTIGATION REPORT AND RISK ASSESSMENT	
Client	Groundhog

**Spectrum Geo Services
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BRIDGEND
CF32 0EH**

Report No:	Date:
22124/R3	October 2022

Project:
GROUNDHOG, ABERDULAI – ADDITIONAL INVESTIGATION REPORT AND RISK ASSESSMENT

Issue Number	Status	Description of Amendments
1	Draft	
2	Final	Pipe excavation included.

Report prepared by:	
Signed 	October 2022

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1.0 INTRODUCTION

1.1 Introduction

Spectrum Geo Services (SGS) were requested by Groundhog to undertake an additional Ground Investigation Study, of a site at Groundhog, Aberdulaish. SA10 8HH.

This report includes a revised risk assessment following the Remediation Strategy report.

Reports 22124_R1 and R2 should be read in conjunction with this report.

1.2 Scope of Works

The objectives of this assessment are to assess the data recovered during the previous stages and develop a revised risk assessment for the site. In particular, the only risk left outstanding during previous phases has been a lead spike at 500mm in WS02. Additional investigation and cover system assessments have been undertaken at the location, and a revised risk assessment is developed herein.

1.3 Development Proposals

It is assumed that the intention is to develop the site for the purposes of commercial purposes. The area of WS02 will have concrete cover.

1.4 Limitations

Subsoils are inherently variable and by their very nature are hidden from view such that no investigation can be exhaustive to the extent that all soil conditions are revealed. Conditions may therefore be present beneath the site that were not apparent from the data available for review.

Unless specifically noted to the contrary, it should be assumed that this report has not been submitted to any regulatory authorities for approval. Redevelopment sites may have planning conditions attached in respect of contaminated land assessment. Where we are made aware of such conditions in advance of scoping the works, we can tailor the report to the regulatory authority requirements. Where we are not made aware of any such requirements there can be no certainty that our investigation will meet any or all the regulatory authority requirements.

2.0 EXISTING SITE INFORMATION

2.1 Site Location

The site is situated on the northern side of the B4242 Ynysgerwn Avenue, south east of the A4109, north east of Aberdulais and may be located by Grid Reference SS 781 999. The existing site comprised an area of rough ground.

The area of the proposed extension was generally level and occupied by the northern end of the industrial unit and an access road around the site. The area to the north sloped down to the site road and was occupied by woodland.

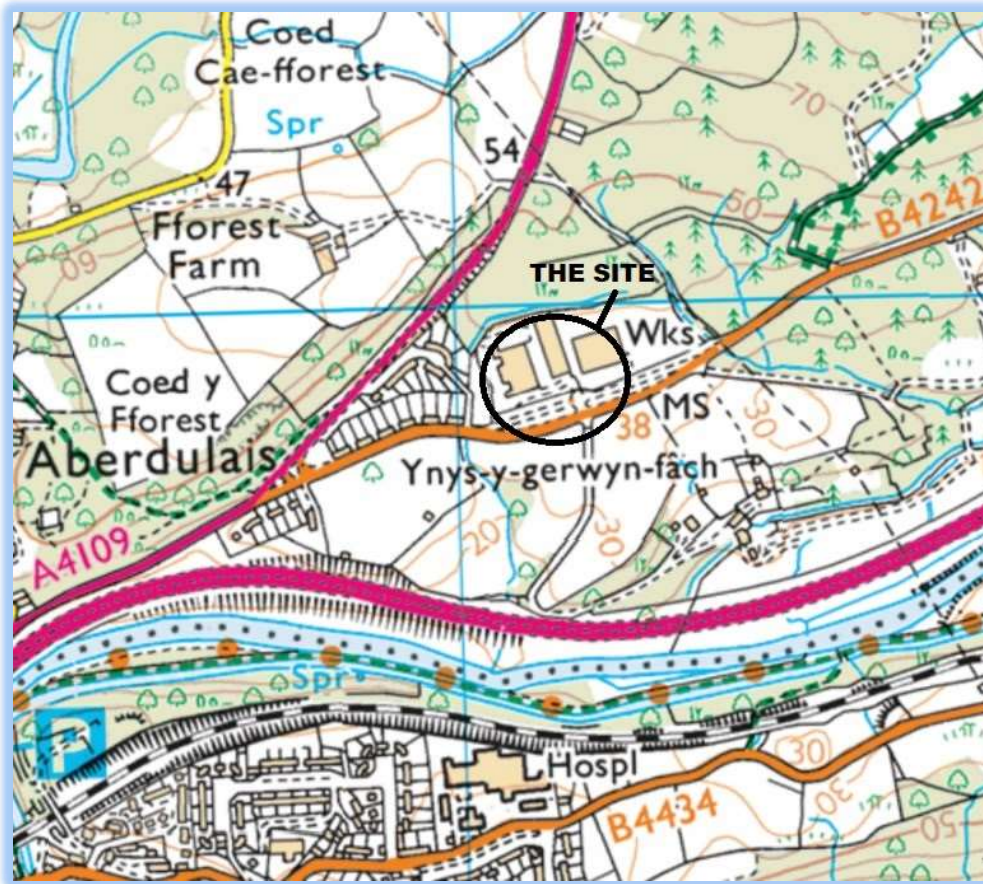


Figure SGS/22124/01: Site Location Plan

2.2 Previous Investigations

A previous investigation had been carried out in close proximity to the site, by Ian Farmer Associates:

- *Report on Ground Investigation, Groundhog Limited, Ynysgerwn Avenue, Aberdulais, SA10 8HH. February 2019.*

Data from that report has been employed within this report.

SGS had previously investigated the site within:

- *Report on Ground Investigation, Groundhog Limited, SA10 8HH. August 2022, Report 22124/R1.*
- *Remediation Strategy, Groundhog Limited, SA10 8HH. October 2022, Report 22124/R2.*

2.3 Published Geology

Based on data available from the BGS webviewer, the following geological setting is anticipated.

The 1:50000 British Geological Map Sheet 247 indicates the site to be underlain by Glacial Sand and Gravel overlying Lower Pennant Coal Measures. Graig and Brithdir Coal Seams are indicated to the west of the site parallel with the Roman Road. The Lower Pennant Coal Measures generally consist of sandstone and mudstone.

The Coal Authority Report included in the Farmers Desk Study, indicated that the site is not within a surface area that could be affected by past underground mining and no mine entries were located within or within 20m of the site.

2.4 Hydrology

The OS Map shows the site to be north of the River Neath.

3.0 SITE OPERATIONS

3.1 Site Works

Additional site works were undertaken on 07 October 2022 and comprised trial pitting around the original location of WS02. Conditions during the fieldwork were predominantly overcast with showers. The positions (and previous positions) are shown on Drawing SGS/22124/Locs.

The work was undertaken in accordance with BS5930.

Samples were recovered of strata encountered, to allow laboratory testing to be undertaken.

4.0 LABORATORY TESTING

4.1 Introduction

On completion of site operations, selected soil samples were scheduled for laboratory testing. The following laboratory testing was undertaken and is Appended.

- pH,
- Sulphate by aqueous extract,
- Metals soil suite,
- PAH,
- Organic Matter,
- Asbestos ID.

The results are presented within Appendix B.

5.0 CONTAMINATION TESTING

During all phases, contamination testing was undertaken on a total of 8 samples, taken from this and previous phases as shown in the Appendices.

The results have been compared with current Environment Agency limits for Commercial Use. Within Table 5 are shown the results of this and previous phases showing the recorded values, related to current Soil Guideline Values (SGVs)/S4UL, or other published values.

It is noted that a single spike of Lead was noted at 500mm at WS02. This area is within what will become the footprint of the new building. Thus, this will be covered by concrete slab.

Report SGS/22124/R2 developed a Cover System Thickness for the location at WS02. This noted a requirement of 360mm “clean” cover. The testing around WS02 noted no exceedances and thus it is considered that an effective Cover System is in place.

All other locations have been shown to have acceptable chemical determinand values.

Sample ID		TP01	WS02	WS03	WS04	1	2	3	4	6% SOM
Depth to Top	Units	0.50	0.50	1.70	0.75	0.00	0.00	0.00	0.00	
		0.80	0.80	2.00	1.00	0.50	0.50	0.50	0.50	Commercial C4SL
% Stones >10mm	% w/w	40.3	36.7	4.6	29.2	<0.1	<0.1	<0.1	<0.1	
pH	pH	8.93	9.49	6.18	7.03	10.01	10.64	11.03	9.94	
Sulphate (water sol 2:1)	g/l	0.09	0.15	<0.01	<0.01	0.62	0.69	0.83	0.02	
Acid Sol Sulphate	mg/kg	1600	2100	<200	<200	7700	8100	13000	470	
Organic Matter	% w/w	1.4	2.1	2.1	1.4	1.9	2	6.1	0.1	
Arsenic	mg/kg	28	810	5	3	51	107	251	16	640
Cadmium	mg/kg	1	10.3	1.8	1.1	1.1	2.6	5.1	<0.5	190
Copper	mg/kg	97	2560	33	21	148	317	681	4	68000
Chromium	mg/kg	26	15	22	16	17	17	14	4	8600
Chromium (hexavalent)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	33
Lead	mg/kg	192	6770	33	17	321	629	1270	19	2700 P
Mercury	mg/kg	1	<0.17	<0.17	<0.17	2.35	1.58	1.41	0.83	1100
Nickel	mg/kg	7	58	38	25	10	18	33	5	980
Asbestos in Soil (inc. matrix)										
Asbestos in soil		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Asbestos ACM - Suitable for Water Absorption Test?		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
PAH-16MS										5% SOM
Acenaphthene	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	100000
Acenaphthylene	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	100000
Anthracene	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	540000
Benzo(a)anthracene	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	98
Benzo(a)pyrene	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	15
Benzo(b)fluoranthene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	100
Benzo(ghi)perylene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	660
Benzo(k)fluoranthene	mg/kg	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	140
Chrysene	mg/kg	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	140
Dibenzo(ah)anthracene	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	13
Fluoranthene	mg/kg	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	23000
Fluorene	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	70000
Indeno(123-cd)pyrene	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	62
Naphthalene	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	540
Phenanthrene	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	23000
Pyrene	mg/kg	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	55000
Total PAH-16MS	mg/kg	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	912768

Table 5: Chemical Testing Assessment

6.0 CONCEPTUAL MODEL AND QUALITATIVE RISK ASSESSMENT POST INITIAL GROUND INVESTIGATIONS

Source Characterisation

All potential **on-site** and **off-site** sources of contamination identified during desk studies are detailed in Table 6.1.1 below. The table also details any potential sources which have been discounted.

The initial works noted only an elevated value of soil lead at WS02, 500mm.

Table 6.1. 1: Identified Potential Sources of Contamination

Source		Distance (m)	Compass Direction	Identified by:	Comments
Elevated Lead at WS02	On Site	0		Initial GI	Test around WS02 and develop BRE Cover System assessment

It is not possible to discount all of the potential sources of contamination. Potential sources of contamination which cannot be discounted are carried forward to a preliminary qualitative risk assessment. The Contaminants of Concern (CoC) for the remaining potential sources of contamination are listed in Table 6.1. 2.

Table 6.1. 2: Contaminants of Concern

Source	Metals	PAH	Soil Organic Matter	SO ₄ , SO ₃	pH	Asbestos
Made Ground	X	X	X	X	X	X

Pathway Characterisation

The potential pathways by which receptors might be exposed to contaminants (sources) at the site can vary depending on the proposed or current land use (e.g. residential properties, public open space, retail).

For humans, the three possible routes of exposure to contaminants are:

- Inhalation of dusts or vapours
- Ingestion of dusts or soil either by hand-to-mouth activity or by eating plants grown in contaminated soils
- Dermal (skin) contact with contaminated soils and waters and transfer of contaminants through the skin into the body

Buildings and service conduits can also be affected by contaminants in the following ways:

- Soil gas or vapour pooling in voids within or beneath structures
- By direct contact of building fabric with contaminated soils
- Service trenches acting as preferential migration pathways
- Ingress of contaminants into conduits, contaminating drinking water supplies

Finally, for the local water environment the following pathways may be present:

- Run-off from the site surface entering surface water courses near the site
- Leaching of contaminants from the soil to on-site groundwater
- Migration of contaminated on-site groundwater to off-site groundwater and/or surface water bodies

Receptor Characterisation

The receptors are the elements in the pollutant linkage that can potentially be harmed by the contaminants. These are as follows:

- Humans: site workers and residential users
- Buildings: building fabric and services; and
- The local water environment (surface water and groundwater)

Pollutant Linkages

The significance of potential pollutant linkages at the site is now qualitatively assessed by considering the magnitude of the hazard and the possibility of the linkages occurring based on the observations made, in Table 6.1.3 below.

Preliminary Qualitative Risk Assessment

The preliminary conceptual model outlined above has been used to undertake a qualitative risk assessment for the site to determine the possibility of significant risks that may exist following development of the site. The qualitative risk assessment will also investigate the risks to the wider environment as a result of contamination from on site sources.

Table 6.1.3: Preliminary Qualitative Environmental Risk Assessment for Identified sources of Contamination

Source	Potential contaminants	Potential Pathway(s)	Potential receptor(s)	Assessment	Potential Severity	Potential Probability	Risk Class	Investigation Required
Made Ground	Lead Spike at SA01	Ingestion, inhalation, dermal contact	Humans (end users)	Dermal contact, inhalation and ingestion pathways will be broken in areas covered by hardstanding. However the risk of humans coming into contact with potential contaminants at the site will remain in areas of soft landscaping. Lead spike at WS02	High	Very Low	Very Low	Yes
			Humans (site workers)	Construction and maintenance workers could come into contact with contaminated made ground. Excessive exposure may occur during some manual activities including working in service trenches. Lead spike at WS02	High	Low	Low	Yes
		Direct contact, aggressive ground conditions,	Building fabric and services	The presence of contamination in shallow soils may pose a risk to buried concrete structures. Direct contact with this contamination in both soil and superficial groundwater (if present) can result in damage to concrete fabric and services in a similar fashion to that described above for water supply pipe. No services planned for the area. Lead spike at WS02	Low	Very Low	Negligible	No
		Leaching, migration.	Surface water environment	There is no surface water at the site. The soil nature is that of a clayey horizon, thus water influx will be considered slow.	High	Very Low	Negligible	No
			Groundwater environment – Superficial Groundwater	Given that superficial deposits are expected to be very limited beneath the site, it is unlikely that a superficial aquifer will be present.				
			Groundwater environment – Bedrock Aquifer	The underlying bedrock is a Secondary (B) Aquifer – Low Permeability Layer	Moderate	Very Low	Negligible	No

7.0 REVISED CONCEPTUAL SITE MODEL

The Conceptual Model developed in Section 6, suggested further testing around WS02, to determine if the source was limited to that location.

Table 7.1 provides the Revised Conceptual Site Model, developed with the knowledge of the findings of the various phases of this investigation, and in particular, the findings of the phase of testing around WS02 are assessed.

Table 7.1. 1: Identified Potential Sources of Contamination

Source		Distance (m)	Compass Direction	Identified by:	Comments
Elevated Lead at WS02	On Site	0		Initial GI	Test around position and develop BRE Cover System assessment

It is not possible to discount all of the potential sources of contamination. Potential sources of contamination which cannot be discounted are carried forward to a preliminary qualitative risk assessment. The Contaminants of Concern (CoC) for the remaining potential sources of contamination are listed in Table 7.1. 2.

Table 7.1. 2: Contaminants of Concern

Source	Metals	PAH	Soil Organic Matter	SO ₄ , SO ₃	pH	Asbestos
Made Ground	X	X	X	X	X	X

Table 7.1: Revised Qualitative Environmental Risk Assessment for Identified sources of Contamination

Source	Potential contaminants	Potential Pathway(s)	Potential receptor(s)	Assessment	Potential Severity	Potential Probability	Risk Class	Investigation Required
Made Ground	Lead spike at SA01	Ingestion, inhalation, dermal contact	Humans (residents & end users)	Lead was noted at WS02. Further testing noted no elevations around that position, and a Cover System Design showed 360mm cover. Thus, cover is sufficient and "inert".	High	Very Low	Negligible	Undertaken
			Humans (site workers)	Lead was noted at WS02. Further testing noted no elevations around that position. Site ground workers should be made aware that when excavating at WS02 suitable care should be taken. Suitable PPE should be employed. Workers should be briefed to note any presence of white furred oxides in the ground and inform site management.	High	Low	Negligible	Undertaken
		Direct contact, aggressive ground conditions,	Building fabric and services	Lead was noted at WS02. Further testing noted no elevations around that position which would affect building fabric.	High	Very Low	Negligible	Undertaken
		Leaching, migration.	Surface water environment	There is no surface water at the site. No groundwater table was noted.	High	Very Low	Negligible	No
			Groundwater environment – Superficial Groundwater					
			Groundwater environment – Bedrock Aquifer	The underlying bedrock is a Secondary (B) Aquifer – Low Permeability Layer	Moderate	Very Low	Negligible	No

8.0 CONCLUSIONS

The recent phase of investigation has noted no similar lead contamination at WS02. Lead contamination was not noted elsewhere at site.

Thus, it is considered that the spike was very localised and within a block of soil less than 2m x 2m x 0.5m. Thus, 2m³.

Further soil testing and a BRE Cover System assessment has shown there to be sufficient "inert" soil cover at the location of WS02 would sufficiently reduce the risk of contact by end users.

It is clear that as part of the development, a drainage pipe will be placed traversing the location of WS02, and thus the materials will need to be removed from this area as part of the engineering process.

Thus, it is recommended that the 2m³ are taken as non-inert soil, with a waste management code 17 05 03, to a Soil Recycling Centre. This can be done by grab wagon and all documentation maintained. It is possible that the chosen facility may require WAC testing prior to movement.

Site groundworkers will need to be briefed on the potential to encounter the white furred oxide at WS02. Suitable PPE should be stipulated, and workers should inform site management should such materials be noted.

APPENDIX A

Exploratory Hole Logs

TP01 to 4

APPENDIX B

Laboratory Testing

APPENDIX C

Drawings

Exploratory Hole Locations

SGS/22124/LocsAdd

APPENDIX D

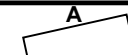
BRE Cover System Assessment

Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	2
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

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[illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water				
ES Environmental Soil Sample				
EW Environmental Water Sample				
	Logger's Signature			
	RHG			

Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	3
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

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[illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water			Logger's Signature	
ES Environmental Soil Sample			RHG	
EW Environmental Water Sample				

Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	4
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

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[illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water			Logger's Signature	
ES Environmental Soil Sample			RHG	
EW Environmental Water Sample				

Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	1
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

[illegible][illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water				
ES Environmental Soil Sample				
EW Environmental Water Sample				
	Logger's Signature			
	RHG			

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/09956
Issue Number: 1

Date: 18 October, 2022

Client: Spectrum Geo Services
Foxglove Cottage
Cwm Risca Lane
Tondu
Wales
CF32 0EH

Project Manager: Rob Griffiths
Project Name: Groundhog Aberdulaios
Project Ref: 22124
Order No: 22124/02
Date Samples Received: 11/10/22
Date Instructions Received: 11/10/22
Date Analysis Completed: 18/10/22

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 22/09956

Client Project Name: Groundhog Aberdulaiois

Client Project Ref: 22124

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	1	2	3	4						
Depth to Top	0.00	0.00	0.00	0.00						
Depth To Bottom	0.50	0.50	0.50	0.50						
Date Sampled	07-Oct-22	07-Oct-22	07-Oct-22	07-Oct-22						
Sample Type	Solid	Solid	Solid	Soil - ES						
Sample Matrix Code	7	7	7	1A						
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1				% w/w	0.1	A-T-044
pH _D ^{M#}	10.01	10.64	11.03	9.94				pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.62	0.69	0.83	0.02				g/l	0.01	A-T-026s
Sulphate (acid soluble) _D ^{M#}	7700	8100	13000	470				mg/kg	200	A-T-028s
Organic Matter _D ^{M#}	1.9	2.0	6.1	0.1				% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	51	107	251	16				mg/kg	1	A-T-024s
Cadmium _D ^{M#}	1.1	2.6	5.1	<0.5				mg/kg	0.5	A-T-024s
Copper _D ^{M#}	148	317	681	4				mg/kg	1	A-T-024s
Chromium _D ^{M#}	17	17	14	4				mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1				mg/kg	1	A-T-040s
Lead _D ^{M#}	321	629	1270	19				mg/kg	1	A-T-024s
Mercury _D	2.35	1.58	1.41	0.83				mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	10	18	33	5				mg/kg	1	A-T-024s

Envirolab Job Number: 22/09956

Client Project Name: Groundhog Aberdulaiois

Client Project Ref: 22124

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	1	2	3	4						
Depth to Top	0.00	0.00	0.00	0.00						
Depth To Bottom	0.50	0.50	0.50	0.50						
Date Sampled	07-Oct-22	07-Oct-22	07-Oct-22	07-Oct-22						
Sample Type	Solid	Solid	Solid	Soil - ES						
Sample Matrix Code	7	7	7	1A						
Asbestos in Soil (inc. matrix)										
Asbestos in soil _D [#]	NAD	NAD	NAD	NAD						A-T-045
Asbestos Matrix (visual) _D	-	-	-	-						A-T-045
Asbestos Matrix (microscope) _D	-	-	-	-						A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A						A-T-045

Envirolab Job Number: 22/09956

Client Project Name: Groundhog Aberdulaiois

Client Project Ref: 22124

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	1	2	3	4						
Depth to Top	0.00	0.00	0.00	0.00						
Depth To Bottom	0.50	0.50	0.50	0.50						
Date Sampled	07-Oct-22	07-Oct-22	07-Oct-22	07-Oct-22						
Sample Type	Solid	Solid	Solid	Soil - ES						
Sample Matrix Code	7	7	7	1A						
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02				mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05				mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05				mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07				mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06				mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08				mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07				mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	<0.08	<0.08	<0.08				mg/kg	0.01	A-T-019s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: Spectrum Geo Services, Foxglove Cottage, Cwm Risca Lane, Tondy, Wales,
CF32 0EH

Project: Groundhog Aberdulaio

Clients Project No: 22124

Project No: 22/09956

Date Received: 11/10/2022 (am)

Cool Box Temperatures (°C): 12.4

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4
Client Sample No				
Client Sample ID/Depth	1 0.00-0.50m	2 0.00-0.50m	3 0.00-0.50m	4 0.00-0.50m
Date Sampled	07/10/22	07/10/22	07/10/22	07/10/22
A-T-019s	13/10/2022	13/10/2022	13/10/2022	13/10/2022
A-T-024s	18/10/2022	18/10/2022	18/10/2022	18/10/2022
A-T-026s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-028s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-031s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-032 OM	17/10/2022	17/10/2022	17/10/2022	17/10/2022
A-T-040s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-044	13/10/2022	13/10/2022	13/10/2022	13/10/2022
A-T-045	12/10/2022	12/10/2022	12/10/2022	12/10/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

600	mm
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Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	1
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

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[illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water				
ES Environmental Soil Sample				
EW Environmental Water Sample				
	Logger's Signature			
	RHG			

Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	2
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

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[illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water				
ES Environmental Soil Sample				
EW Environmental Water Sample				
	Logger's Signature			
	RHG			

Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	3
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

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[illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water				
ES Environmental Soil Sample				
EW Environmental Water Sample				
	Logger's Signature			
	RHG			

Project	Groundhog, Aberdulais Additional Pitting	Project No	22124
Described by	RHG	Trial Pit No	4
Date	07/10/2022	Sheet No	1 of 1

Face Sketch (Indicate stratum boundaries, codes and Face(s) sketched, use additional sheets as required)

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[illegible]

Groundwater Observations None	Strike of Face A		deg	
	Length of Face A	1.5	m	
	Width of Face B	0.3	m	
	Remarks			
Method/plant	2.50 ton tracked excavator			
Stability	Stable			
Shoring	None			
Weather	Raining			
Sample Type:				
U Undisturbed, P Piston, D Disturbed, B Bulk, W Water				
ES Environmental Soil Sample				
EW Environmental Water Sample				
	Logger's Signature			
	RHG			

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/09956
Issue Number: 1

Date: 18 October, 2022

Client: Spectrum Geo Services
Foxglove Cottage
Cwm Risca Lane
Tondu
Wales
CF32 0EH

Project Manager: Rob Griffiths
Project Name: Groundhog Aberdulaio
Project Ref: 22124
Order No: 22124/02
Date Samples Received: 11/10/22
Date Instructions Received: 11/10/22
Date Analysis Completed: 18/10/22

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 22/09956

Client Project Name: Groundhog Aberdulaiois

Client Project Ref: 22124

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	1	2	3	4						
Depth to Top	0.00	0.00	0.00	0.00						
Depth To Bottom	0.50	0.50	0.50	0.50						
Date Sampled	07-Oct-22	07-Oct-22	07-Oct-22	07-Oct-22						
Sample Type	Solid	Solid	Solid	Soil - ES						
Sample Matrix Code	7	7	7	1A						
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1				% w/w	0.1	A-T-044
pH _D ^{M#}	10.01	10.64	11.03	9.94				pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.62	0.69	0.83	0.02				g/l	0.01	A-T-026s
Sulphate (acid soluble) _D ^{M#}	7700	8100	13000	470				mg/kg	200	A-T-028s
Organic Matter _D ^{M#}	1.9	2.0	6.1	0.1				% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	51	107	251	16				mg/kg	1	A-T-024s
Cadmium _D ^{M#}	1.1	2.6	5.1	<0.5				mg/kg	0.5	A-T-024s
Copper _D ^{M#}	148	317	681	4				mg/kg	1	A-T-024s
Chromium _D ^{M#}	17	17	14	4				mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1				mg/kg	1	A-T-040s
Lead _D ^{M#}	321	629	1270	19				mg/kg	1	A-T-024s
Mercury _D	2.35	1.58	1.41	0.83				mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	10	18	33	5				mg/kg	1	A-T-024s

Envirolab Job Number: 22/09956

Client Project Name: Groundhog Aberdulaiois

Client Project Ref: 22124

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	1	2	3	4						
Depth to Top	0.00	0.00	0.00	0.00						
Depth To Bottom	0.50	0.50	0.50	0.50						
Date Sampled	07-Oct-22	07-Oct-22	07-Oct-22	07-Oct-22						
Sample Type	Solid	Solid	Solid	Soil - ES						
Sample Matrix Code	7	7	7	1A						
Asbestos in Soil (inc. matrix)										
Asbestos in soil _D [#]	NAD	NAD	NAD	NAD						A-T-045
Asbestos Matrix (visual) _D	-	-	-	-						A-T-045
Asbestos Matrix (microscope) _D	-	-	-	-						A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A						A-T-045

Envirolab Job Number: 22/09956

Client Project Name: Groundhog Aberdulaiois

Client Project Ref: 22124

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	1	2	3	4						
Depth to Top	0.00	0.00	0.00	0.00						
Depth To Bottom	0.50	0.50	0.50	0.50						
Date Sampled	07-Oct-22	07-Oct-22	07-Oct-22	07-Oct-22						
Sample Type	Solid	Solid	Solid	Soil - ES						
Sample Matrix Code	7	7	7	1A						
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02				mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05				mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05				mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07				mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06				mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04				mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08				mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01				mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03				mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07				mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	<0.08	<0.08	<0.08				mg/kg	0.01	A-T-019s

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For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

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Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

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Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

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1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

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NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

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Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

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Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: Spectrum Geo Services, Foxglove Cottage, Cwm Risca Lane, Tondy, Wales,
CF32 0EH

Project: Groundhog Aberdulaio

Clients Project No: 22124

Project No: 22/09956

Date Received: 11/10/2022 (am)

Cool Box Temperatures (°C): 12.4

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/09956/1	22/09956/2	22/09956/3	22/09956/4
Client Sample No				
Client Sample ID/Depth	1 0.00-0.50m	2 0.00-0.50m	3 0.00-0.50m	4 0.00-0.50m
Date Sampled	07/10/22	07/10/22	07/10/22	07/10/22
A-T-019s	13/10/2022	13/10/2022	13/10/2022	13/10/2022
A-T-024s	18/10/2022	18/10/2022	18/10/2022	18/10/2022
A-T-026s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-028s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-031s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-032 OM	17/10/2022	17/10/2022	17/10/2022	17/10/2022
A-T-040s	14/10/2022	14/10/2022	14/10/2022	14/10/2022
A-T-044	13/10/2022	13/10/2022	13/10/2022	13/10/2022
A-T-045	12/10/2022	12/10/2022	12/10/2022	12/10/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

600	mm
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[illegible]

Summary		
	Target Guideline Value 1	Target Guideline Value 2
Number of contaminants	16	16
Number of contaminants with no thickness calculation	15	16
Breakdown - Number for which no TV specified	15	16
Breakdown - Number for which no soil specified	15	15
Breakdown - Number for which no cover specified	15	15
Breakdown - Number for which cover > TV	0	0
Number of contaminants with thickness calculation	1	0
Breakdown - Number for which no cover required	0	0
Breakdown - Number for which cover required	1	0
Overall thickness of cover required	361	0

