

Vicarage Hill Court
Minera
Phase II Geoenvironmental Report
John Small



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1.0 INTRODUCTION

GroundSolve Ltd was commissioned by John Small to undertake a Preliminary Risk Assessment and Phase II site investigation of the proposed residential development at Vicarage Hill Court, Vicarage Hill, Minera, Wrexham, LL11 3YJ, shown in Appendix A.

The purpose of this investigation was to establish land use history and review the available information to determine the geo-environmental setting of the Site and develop a conceptual site model with due consideration of potential soil and groundwater contamination, hazardous ground gases and mining.

Photographs of the site are presented in Appendix B.

This report presents the findings of the site investigation and laboratory testing along with an updated Conceptual Site Model and risk assessment.

2.0 PROPOSED DEVELOPMENT

Ty Eco plan to redevelop the existing plot of soft landscaping on the western boundary of the Hill Valley Court site in Minera. The proposed development is to comprise of a single-story timber frame structure with a tiled roof.

The development will have an enclosed rear garden adjacent to the southern boundary, with footpath access immediately to the north, east and west of the development. The current parking facilities will be altered to accommodate the new volume of vehicles.

3.0 SITE INVESTIGATIONS

3.1 Fieldwork

An initial phase of ground investigation was undertaken on 29th July 2020 and comprised a single machine excavated trial pit to 2.00m along with soakaway testing.

Further additional investigation was undertaken on 10th February 2022, and comprised Three hand dug pits to a maximum depth of 1.10m.

The exploratory holes were supervised and logged by an engineer from GSL in general accordance with BS 5930: 2015+A1:2020, Reference 1.

The location of the site investigation exploratory holes was determined by GSL, with the locations presented in Figure 2.

The exploratory hole records along with records for insitu testing are presented in the following Appendices:

- Appendix C Trial Pit Logs
- Appendix D Soakaway Test Records

3.2 Laboratory

Physical Testing

No physical testing was undertaken during the site investigation.

Chemical Testing

Samples of the made ground were placed in the appropriate containers and a cool box, and taken immediately to the laboratories of DETS in County Durham for the following chemical testing:

Metals & Non-metals - Arsenic (As), Boron (B), Cadmium (Cd), Chromium (hexavalent), Chromium (Trivalent), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Phenol, Selenium (Se), and Zinc (Zn).

Petroleum Hydrocarbons - Benzene, Toluene, Ethylbenzene, o-xylene, m-xylene, p-xylene, Aliphatics >C5 – C40, Aromatics >EC5 – EC40.

Polyaromatic Hydrocarbons (PAH) – Acenaphthene, Acenaphthylene, Anthracene, Benzo (a) anthracene, Benzo (a) pyrene, Benzo (b) fluoranthene, Benzo (g, h, i) perylene, Benzo (k) fluoranthene, Chrysene, Dibenzo (a, h) anthracene, Fluorene, Fluoranthene, Indeno (1,2,3-cd) pyrene, Naphthalene, Phenanthrene, Pyrene.

Other Contaminants – Sulphide (easily liberated), Water soluble Sulphate (2:1 extract), Cyanide, pH, Soil Organic Matter (SOM), Asbestos screening.

The results are summarised in Section 7, with the results presented in full in Appendix E.

4.0 GROUND CONDITIONS

4.1 General Stratigraphy

The ground conditions encountered across the site are as anticipated. This comprised of topsoil overlying made with the underlying superficial deposits being Glacial Till.

The general stratigraphy encountered in the exploratory holes is summarised below in Table 4.1:

Table 4.1: Stratigraphy

TP No.	Topsoil (mbgl)	Made Ground (mbgl)	Glacial Till (mbgl)
HP01	0.20	0.70	1.00
HP02	0.15	0.55	1.10
HP03	0.12	0.50	1.10
TP01	-	0.60	2.00

4.2 Topsoil

A layer of topsoil was encountered across the site completely, extending to a maximum depth of 0.20m. The topsoil was generally described as grass over brown, slightly gravelly, slightly sandy, silty clay, with the gravel being described as angular, fine to coarse.

4.3 Made Ground

Made ground was encountered within all of the exploratory holes and comprised of soft to firm, brown, slightly gravelly, sandy clay, with the gravel being described as angular fine to coarse of brick and sandstone.

4.4 Glacial Till

Glacial Till was encountered within all of the exploratory holes, and generally described as soft to firm, brown, slightly sandy, gravelly clay, with the gravel being described as angular, fine to coarse of sandstone.

4.5 Groundwater

Ground water was noted in TP02 and TP03 at 0.9m and 0.4m respectively.

4.6 Services

No services were encountered during the site investigation works.

5.0 RESULTS OF CHEMICAL TESTING

The soil samples were taken from the topsoil and subsoil. The sample depths are presented in the table below.

TP No	Depth (m)
HP01	0.30
HP02	0.80
HP03	0.30
TP01	0.10
T01	0.30
TP01	0.60

The results of the soil analyses are presented below, where they have been compared to suitable generic assessment criteria (GACs), in order to allow a generic quantitative risk assessment (GQRA) to be carried out for the site and the proposed development.

The Category 4 Screening Levels (C4SLs) published by DEFRA (2014) have been adopted in the first instance, which have been published for six substances to date. Where a C4SL is unavailable, the “Suitable 4 Use Levels” (S4ULs) published by LQM/CIEH (2015) have been adopted.

These criteria have been derived using the CLEA model for a range of standard end-use scenarios and a range of soil organic matter (SOM) contents. It should be noted that the C4SL values are derived on the basis of a “low level of toxicological concern”, while the S4UL values are based on a “tolerable” or “minimal” level of risk. As such, the S4ULs describe a lower level of risk than the C4SLs, and are equivalent to the former Soil Guideline Values (SGVs, published by the Environment Agency) and the previous editions of the LQM/CIEH GAC values.

A “residential with gardens” end-use has been adopted for this analysis, based on the most-conservative SOM content of 1.0%.

Note: the S4UL values presented below are Copyright Land Quality Management Limited, reproduced with permission; Publication Number S4UL3668. All rights reserved.

Metals & Non-Metals	HP03	HP01	HP02	TP1	TP1	TP1	Adopted Guideline (mg/kg)	Source	Exceedances
	0.3	0.3	0.8	0.1	0.3	0.6			
Arsenic	11	11	11	7.2	11	9.5	37	C4SL	0
Boron, water soluble	< 0.2	0.4	< 0.2	0.3	0.2	< 0.2	290	S4UL	0
Cadmium	1.4	0.3	0.1	0.8	0.4	0.3	22	C4SL	0
Chromium III	15	18	19	10	18	25	910	S4UL	0
Chromium, Hexavalent	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	21	C4SL	0
Copper	27	36	35	28	33	30	2400	S4UL	0
Lead	200	100	91	190	170	130	200	C4SL	0
Mercury	0.09	< 0.05	< 0.05	0.06	0.06	< 0.05	1.2	S4UL	0
Nickel	17	28	18	12	28	21	130	S4UL	0
Phenol - Monohydric	< 0.3	< 0.3	< 0.3	0.4	< 0.3	< 0.3	120	S4UL	0
Selenium	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	250	S4UL	0
Zinc	190	85	39	210	120	90	3700	S4UL	0

None of the above values exceeded SGV values for residential land use with gardens

Petroleum Hydrocarbons	HP03	HP01	HP02	TP1	TP1	TP1	Adopted Guideline (mg/kg)	Source	Exceedances
	0.3	0.3	0.8	0.1	0.3	0.6			
Benzene	-	-	-	-	-	-	0.87	C4SL	0
Toluene	-	-	-	-	-	-	130	S4UL	0
Ethylbenzene	-	-	-	-	-	-	47	S4UL	0
o-xylene	-	-	-	-	-	-	60	S4UL	0
m-xylene	-	-	-	-	-	-	59	S4UL	0
p-xylene	-	-	-	-	-	-	56	S4UL	0
Aliphatic C5-C6	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	42	S4UL	0
Aliphatic C6-C8	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	100	S4UL	0
Aliphatic C8-C10	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	27	S4UL	0
Aliphatic >EC10-EC12	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	130	S4UL	0
Aliphatic >EC12-EC16	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	1100	S4UL	0
Aliphatic >EC16-EC35	23	< 3.4	10	< 3.4	< 3.4	< 3.4	65000	S4UL	0
Aliphatic >EC35-EC40	3.9	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	65000	S4UL	0
Aromatic C5-C7	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	70	S4UL	0
Aromatic C7-C8	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	130	S4UL	0
Aromatic C8-C10	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	34	S4UL	0
Aromatic >EC10-EC12	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	74	S4UL	0
Aromatic >EC12-EC16	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	140	S4UL	0
Aromatic >EC16-EC21	4.9	1.5	< 0.6	< 0.6	< 0.6	< 0.6	260	S4UL	0
Aromatic >EC21-EC35	2	< 1.4	2.7	< 1.4	< 1.4	< 1.4	1100	S4UL	0
Aromatic >EC35-EC40	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	1100	S4UL	0

None of the above values exceeded SGV values for residential land use with gardens

Polyaromatic Hydrocarbons (PAH)	HP03	HP01	HP02	TP1	TP1	TP1	Adopted Guideline (mg/kg)	Source	Exceedances
	0.3	0.3	0.8	0.1	0.3	0.6			
Acenaphthene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	210	S4UL	0
Acenaphthylene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	170	S4UL	0
Anthracene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	2400	S4UL	0
Benzo(a)anthracene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	7.2	S4UL	0
Benzo(a)pyrene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	5	C4SL	0
Benzo(b)fluoranthene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	2.6	S4UL	0
Benzo(g,h,i)perylene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	320	S4UL	0
Benzo(k)fluoranthene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	77	S4UL	0
Chrysene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	15	S4UL	0
Dibenzo(a,h)anthracene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.24	S4UL	0
Fluoranthene	< 0.03	< 0.03	< 0.03	0.03	< 0.03	< 0.03	280	S4UL	0
Fluorene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	170	S4UL	0
Indeno(1,2,3-c,d)pyrene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	27	S4UL	0
Naphthalene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	2.3	S4UL	0
Phenanthrene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	95	S4UL	0
Pyrene	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	620	S4UL	0

None of the above values exceeded SGV values for residential land use with gardens

Other Contaminants / Testing	HP03	HP01	HP02	TP1	TP1	TP1	Adopted Guideline (mg/kg)	Source	Exceedances
	0.3	0.3	0.8	0.1	0.3	0.6			
Organic Matter	1.5	1	0.6	4	0.9	1.1	-	-	-
pH	8.3	8.8	8.4	8	8	8.1	-	-	-
Sulphide	47	39	39	12	20	32	-	-	-
Cyanide, Total	< 0.1	< 0.1	< 0.1	0.6	< 0.1	< 0.1	-	-	-
Sulphur (free)	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	-	-	-
Sulphate Aqueous Extract as SO4	11	50	12	< 10	< 10	< 10	-	-	-
p/m-Xylene	-	-	-	-	-	-	56	S4UL	0

None of the above values exceeded SGV values for residential land use with gardens

In addition, asbestos screening was undertaken on the above samples. The results of the screening resulted negative.

6.0 CONCEPTUAL MODEL AND RISK ASSESSMENT

6.1 General

According to the Contaminated Land Regulations, to determine whether there is a significant possibility of significant harm, the following should be considered:

“The nature and degree of harm, the susceptibility of the receptors and the timescale within which the harm might occur”.

Current good practice therefore requires that the findings from the desk study or site investigation be evaluated for contamination on a site-specific basis using a risk-based approach. Risk assessment involves identification of the hazards and evaluation of the risks associated with these hazards. Risk assessment requires an evaluation of a conceptual “source – pathway – receptor” linkage model and can be qualitative or quantitative.

The basis of an environmental risk assessment involves identifying a ‘source’ of contamination, a ‘pathway’ along which the contamination may migrate and a ‘receptor’ at risk from the contamination.

Current legislation defines the various elements of the pollution linkage as:

- A contaminant ‘source’ is a substance, which is in, or under the ground, and which has the potential to cause harm or to cause pollution of controlled waters.
- A ‘pathway’ is one or more routes through which a receptor is being exposed to, or affected by, a contaminant, or could be so affected.
- A ‘receptor’ is either a living organism, an ecological system, a piece of land or property, or controlled water.

A pollutant linkage indicates that all three elements have been identified. The site can only be defined as ‘Contaminated Land’ if a pollutant linkage exists, and the contamination meets the criteria above.

An revised copy of the CSM is included as Figure 3 in Appendix A

6.2 Source

On Site

The desk study has revealed that the sites historical uses have been as open fields and agricultural land, until the construction of the former Church Hall in the 1960s, and has failed to identify any historic contaminative land uses on site. In addition both phases of ground investigation have failed to identify any contaminants of concern.

Off Site

There is no evidence from the desk study of contamination which will affect the site

6.3 Pathways

In relation to any on site contamination reaching potential site users, the following pathways are generally considered for this type of development:

- Ingestion and skin contact with soils on site,
- Inhalation of ground gas
- Inhalation of contaminated dust,
- Leaching of contaminated materials that may affect controlled waters,
- Direct contact with contaminated material during construction,
- Infiltration and accumulation of ground gas.

6.4 Receptors

The potential impact of a hazard must be assessed with regard to the following target groups:

- Future site users,
- Surface and groundwater, both on and off the site,
- Construction workers,
- Ground gases,
- Building materials and buried services,
- Nearby vegetation.

6.5 Future Site Users Risk Assessment

Current proposals comprise a new residential development which will include gardens and soft landscaping.

The desk study/site investigation did not identify any past contaminated land uses. Therefore, the site at this stage, it is considered to be a low risk for potential contaminants of concern for the proposed land use.

Consequently, in line with current good practice, it would be prudent to undertake a watching brief during excavations. Any potential contaminants of concern encountered should be reviewed by a suitably qualified Engineer (with an assessment in line with the CSM). Appropriate measures should be undertaken to determine the risk to the construction workers, site end users and existing site users.

6.6 Controlled Waters Risk Assessment

When considering the risk to controlled waters, both surface waters and underlying aquifers have to be considered.

The absence of any identifiable contamination at site along with the absence of any identifiable receptors means the risk remains low.

6.7 Construction Workers

The risk to construction workers is considered to be low and can be catered for by appropriate PPE and washing facilities in accordance with current good practice.

Although no sources of contamination have been identified in the desk study and site investigation, in line with current good practice, it is recommended that a watching brief be carried out on all excavations. Should any contamination be encountered, it should be excavated, stored safely on site, tested, and disposed of at a suitably licensed landfill facility.

6.8 Ground Gases

The desk study has revealed no potential sources of landfill gas. In addition, the site lies within a low probability radon area; therefore, no radon protective measures are necessary in the construction of new dwellings or extensions.

6.9 Building Materials

The desk study and site investigation has not revealed any contamination that could adversely affect building materials or services.

6.10 Nearby Vegetation

The desk study has confirmed that there is no risk to vegetation on site and that any topsoil encountered will probably be suitable for re-use in garden and landscaping areas.

REFERENCES

1. BS 5930:2015, Code of Practice for Site Investigation.

APPENDIX A



OS LICENSE No. 100030802

SCALE 1:50,000 @ A4

Figure Title

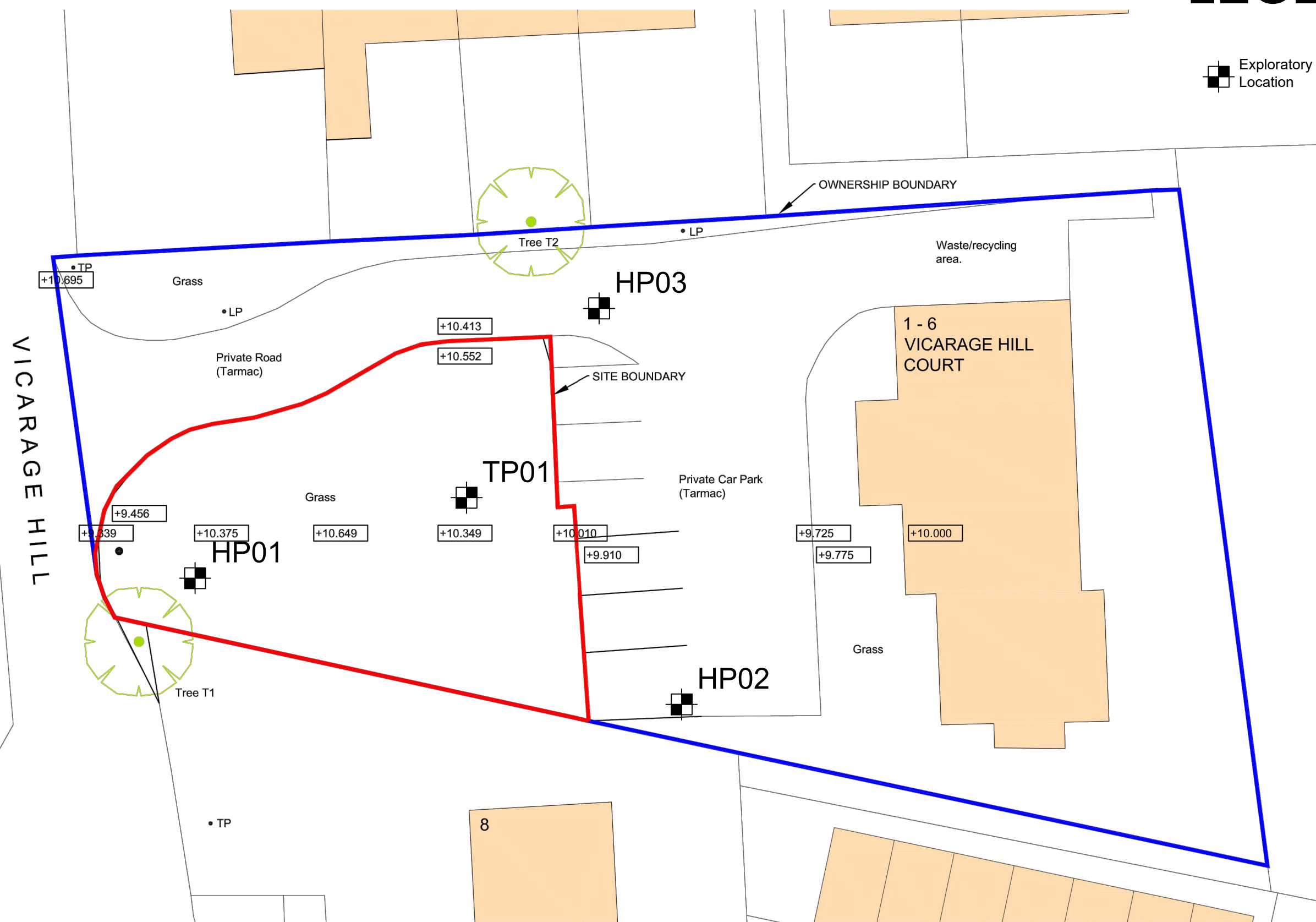
SITE LOCATION

FIGURE 1



LEGEND

Exploratory Hole Location



SCALE 1: 200@ A3

Existing Site Layout &
Exploratory Hole Location Plan

FIGURE 2

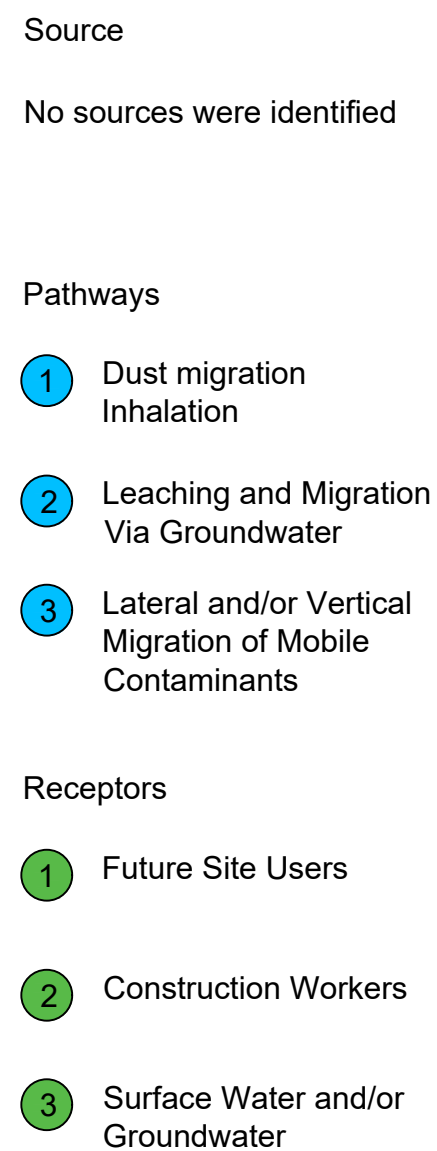


FIGURE 3

APPENDIX B



Photograph 1 – Facing south down Vicarage Hill



Photograph 2 – Facing north up Vicarage Hill at the site entrance

SITE PHOTOGRAPHS



Photograph 3 – Facing north west at the entrance from the proposed development site



Photograph 4 – Facing north east from TP02



Photograph 5 – Facing west from TP03



Photograph 6 – Facing west across the proposed development site from TP01



Photograph 7 – Facing west from TP01 at the site entrance



Photograph 8 – Facing east at the existing building and parking area

APPENDIX C

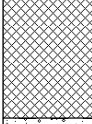
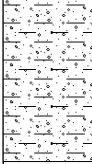
			Hand Dug Trial Pit					HP01	
Project Name: Minera, Vicarage Road				Client: John Small			Date: 10/02/2022		
Location: Vicarage Hill Court				Contractor: Ty Eco			Co-ords: E327188.00 N351899.00		
Project No. : 2683				Crew Name: Ty Eco			Equipment:		
Location Number HP01		Location Type IP		Level		Logged By AB		Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20		Grass over soft slightly gravelly slightly sandy slightly silty CLAY with rootlets. Gravel is angular fine to coarse of mixed lithologies. (TOPSOIL)		
		0.30	ES				Soft to firm light brown gravelly slightly sandy CLAY with strips of tarpaulin. Gravel is angular fine to coarse with some cobble of brick and sandstone, (MADE GROUND)		
		0.90	ES		0.70		Soft to firm brown sandy slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (GLACIAL TILL)		
					1.00		End of Borehole at 1.000m		

Dimensions			Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks	
0.20	0.20	Stable						

Remarks Hole terminated at 1.00m No groundwater encountered							GroundSolve Ltd Unit 1 Well House Barns Chester Road Bretton CH4 0DH
--	--	--	--	--	--	--	--

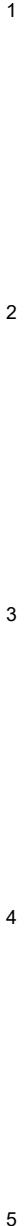
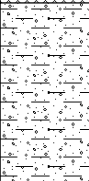
Project Name: Minera, Vicarage Road		Client: John Small		Date: 10/02/2022	
Location: Vicarage Hill Court		Contractor: Ty Eco		Co-ords: E327174.00 N351890.00	
Project No. : 2683		Crew Name: Ty Eco		Equipment:	
Location Number HP02	Location Type IP	Level	Logged By AB	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.15			Grass over soft slightly gravelly slightly sandy slightly silty CLAY with rootlets. Gravel is angular fine to coarse of mixed lithologies.	1
		0.25	ES					Soft dark brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse of brick. (MADE GROUND)	
					0.55			Firm light brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse with some cobbles of sandstone and limestone (GLACIAL TILL)	
		0.80	ES						
					1.10			End of Borehole at 1.100m	5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
0.20	0.20	Stable					

Remarks Hole terminated at 1.10m Groundwater encountered at 0.90m						GroundSolve Ltd Unit 1 Well House Barns Chester Road Bretton CH4 0DH	
--	--	--	--	--	--	--	--

			Hand Dug Trial Pit					HP03	
Project Name: Minera, Vicarage Road			Client: John Small				Date: 10/02/2022		
Location: Vicarage Hill Court			Contractor: Ty Eco				Co-ords: E327190.00 N351887.00		
Project No. : 2683			Crew Name: Ty Eco				Equipment:		
Location Number HP03		Location Type IP		Level		Logged By AB		Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.12		Grass over soft slightly gravelly slightly sandy slightly silty CLAY with rootlets. Gravel is angular fine to coarse of mixed lithologies. (TOPSOIL)		
		0.30	ES		0.50				Soft brown sandy gravelly CLAY. Gravel is angular fine to coarse of brick limestone and sandstone. (MADE GROUND)
									
		1.00	ES		1.10		End of Borehole at 1.100m		

Dimensions			Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks	
0.20	0.20	Stable						

Remarks Hole terminated at 1.10m Groundwater encountered at 0.40m							GroundSolve Ltd Unit 1 Well House Barns Chester Road Bretton CH4 0DH
--	--	--	--	--	--	--	--

Project Name: Minera, Vicarage Road		Client: John Small		Date: 29/07/2020	
Location: Vicarage Hill Court		Contractor: Ty Eco			
Project No. : 2683		Crew Name: Ty Eco		Equipment: JCB 3CX	
Location Number TP1	Location Type TP	Level	Logged By SI	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.10			Loose dark brown gravelly SILT. Gravel is angular to subangular fine to coarse of Limestone. Occasional rootlets noted (MADE GROUND)	
		0.30	ES					Firm brown slightly sandy gravelly CLAY with low cobble content. Gravel is subangular to angular fine to coarse of brick, concrete and Limestone. Cobbles are angular of brick (MADE GROUND)	
		0.60	ES		0.60			Stiff light brown mottled grey slightly gravelly CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subrounded of limestone (GLACIAL TILL)	1
					2.00			End of Borehole at 2.000m	2
									3
									4
									5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
2.50	0.60	Stable					

Remarks Hole terminated at 2.00m No Groundwater encountered							
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APPENDIX D



Certificate of Analysis

Certificate Number 22-03286

Issued: 02-Mar-22

Client GroundSolve Limited
Unit 1
Well House Barns
Bretton
Flintshire
FAO Adam Fenwick
CH4 0DH

Our Reference 22-03286

Client Reference 2683

Order No (not supplied)

Contract Title Minera

Description 3 Soil samples.

Date Received 18-Feb-22

Date Started 18-Feb-22

Date Completed 02-Mar-22

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By



Kirk Bridgewood
General Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 22-03286
 Client Ref 2683
 Contract Title Minera

Lab No	1973068	1973069	1973070
Sample ID	HP03	HP01	HP02
Depth	0.30	0.30	0.80
Other ID			
Sample Type	SOIL	SOIL	SOIL
Sampling Date	10/02/2022	10/02/2022	10/02/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Metals						
Arsenic	DETSC 2301#	0.2	mg/kg	11	11	11
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	0.4	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	1.4	0.3	0.1
Chromium	DETSC 2301#	0.15	mg/kg	15	18	19
Chromium III	DETSC 2301*	0.15	mg/kg	15	18	19
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	27	36	35
Lead	DETSC 2301#	0.3	mg/kg	200	100	91
Mercury	DETSC 2325#	0.05	mg/kg	0.09	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	17	28	18
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	190	85	39
Inorganics						
pH	DETSC 2008#		pH	8.3	8.8	8.4
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%	1.5	1.0	0.6
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	11	50	12
Sulphide	DETSC 2024*	10	mg/kg	47	39	39
Sulphur (free)	DETSC 3049#	0.75	mg/kg	< 0.75	< 0.75	< 0.75
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic >EC10-EC12	DETSC 3521#	1.5	mg/kg	< 1.5	< 1.5	< 1.5
Aliphatic >EC12-EC16	DETSC 3521#	1.2	mg/kg	< 1.2	< 1.2	< 1.2
Aliphatic >EC16-EC21	DETSC 3521#	1.5	mg/kg	3.0	< 1.5	< 1.5
Aliphatic >EC21-EC35	DETSC 3521#	3.4	mg/kg	20	< 3.4	10
Aliphatic >EC35-EC40	DETSC 3521#	3.4	mg/kg	3.9	< 3.4	< 3.4
Aliphatic C5-C40	DETSC 3521*	10	mg/kg	27	< 10	10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic >EC10-EC12	DETSC 3521#	0.9	mg/kg	< 0.9	< 0.9	< 0.9
Aromatic >EC12-EC16	DETSC 3521#	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Aromatic >EC16-EC21	DETSC 3521#	0.6	mg/kg	4.9	1.5	< 0.6
Aromatic >EC21-EC35	DETSC 3521#	1.4	mg/kg	2.0	< 1.4	2.7
Aromatic >EC35-EC40	DETSC 3521*	1.4	mg/kg	< 1.4	< 1.4	< 1.4
Aromatic C5-C40	DETSC 3521*	10	mg/kg	< 10	< 10	< 10
TPH Ali/Aro C5-C40	DETSC 3521*	10	mg/kg	34	< 10	13

Summary of Chemical Analysis

Soil Samples

Our Ref 22-03286
 Client Ref 2683
 Contract Title Minera

Lab No	1973068	1973069	1973070
Sample ID	HP03	HP01	HP02
Depth	0.30	0.30	0.80
Other ID			
Sample Type	SOIL	SOIL	SOIL
Sampling Date	10/02/2022	10/02/2022	10/02/2022
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
PAHs						
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10
Phenols						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3

Summary of Asbestos Analysis

Soil Samples

Our Ref 22-03286

Client Ref 2683

Contract Title Minera

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1973068	HP03 0.30	SOIL	NAD	none	Lee Kerridge
1973069	HP01 0.30	SOIL	NAD	none	Lee Kerridge
1973070	HP02 0.80	SOIL	NAD	none	Lee Kerridge

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 22-03286

Client Ref 2683

Contract Minera

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1973068	HP03 0.30 SOIL	10/02/22	GJ 250ml, GJ 60ml x2, P(other)	Sulphur (free) (7 days), pH + Conductivity (7 days)	
1973069	HP01 0.30 SOIL	10/02/22	GJ 250ml, GJ 60ml x2, P(other)	Sulphur (free) (7 days), pH + Conductivity (7 days)	
1973070	HP02 0.80 SOIL	10/02/22	GJ 250ml, GJ 60ml x4, P(other)	Sulphur (free) (7 days), pH + Conductivity (7 days)	

Key: G-Glass P-Plastic J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 20-18200

29-Sep-20

Client GroundSolve Limited
Unit 1
Well House Barns
Bretton
Flintshire
FAO Adam Fenwick
CH4 0DH

Our Reference 20-18200

Client Reference 2398

Order No 2398

Contract Title Vicarage Court

Description 3 Soil samples.

Date Received 21-Sep-20

Date Started 21-Sep-20

Date Completed 29-Sep-20

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By



Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 20-18200
 Client Ref 2398
 Contract Title Vicarage Court

Lab No	1729701	1729702	1729703
Sample ID	TP1	TP1	TP1
Depth	0.10	0.30	0.60
Other ID	ES	ES	ES
Sample Type	SOIL	SOIL	SOIL
Sampling Date	14/09/2020	14/09/2020	14/09/2020
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Metals						
Arsenic	DETSC 2301#	0.2	mg/kg	7.2	11	9.5
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.3	0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.8	0.4	0.3
Chromium	DETSC 2301#	0.15	mg/kg	10	18	25
Chromium III	DETSC 2301*	0.15	mg/kg	10	18	25
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	28	33	30
Lead	DETSC 2301#	0.3	mg/kg	190	170	130
Mercury	DETSC 2325#	0.05	mg/kg	0.06	0.06	< 0.05
Nickel	DETSC 2301#	1	mg/kg	12	28	21
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	210	120	90
Inorganics						
pH	DETSC 2008#		pH	8.0	8.0	8.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.6	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%	4.0	0.9	1.1
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	< 10	< 10	< 10
Sulphide	DETSC 2024*	10	mg/kg	12	20	32
Sulphur (free)	DETSC 3049#	0.75	mg/kg	< 0.75	< 0.75	< 0.75
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4
Aliphatic C35-C40	DETSC 3072*	3.4	mg/kg	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4
Aromatic C35-C40	DETSC 3072*	1.4	mg/kg	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10
PAHs						
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 20-18200
 Client Ref 2398
 Contract Title Vicarage Court

Lab No	1729701	1729702	1729703
Sample ID	TP1	TP1	TP1
Depth	0.10	0.30	0.60
Other ID	ES	ES	ES
Sample Type	SOIL	SOIL	SOIL
Sampling Date	14/09/2020	14/09/2020	14/09/2020
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10
Phenols						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.4	< 0.3	< 0.3

Summary of Asbestos Analysis

Soil Samples

Our Ref 20-18200

Client Ref 2398

Contract Title Vicarage Court

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1729701	TP1 ES 0.10	SOIL	NAD	none	Joanne Luscombe
1729702	TP1 ES 0.30	SOIL	NAD	none	Joanne Luscombe
1729703	TP1 ES 0.60	SOIL	NAD	none	Joanne Luscombe

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected.

Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 20-18200
 Client Ref 2398
 Contract Vicarage Court

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1729701	TP1 0.10 SOIL	14/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1729702	TP1 0.30 SOIL	14/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1729703	TP1 0.60 SOIL	14/09/20	GJ 250ml, GJ 60ml x2, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report