

3.6 Previous Reports

3.6.1 WSP Parsons Brinckerhoff

WSP PB prepared a Phase 1 preliminary risk assessment report in December 2016 (reference 70027704-10670-1) based on desktop data and a site walkover.

Their report confirmed the site had been in use as a mill prior to 1881 and up until recent times.

It identified several sources of potential contamination, mainly from the recent operation of a flour mill, including the storage and use of heating oil, diesel and degreasers, vehicle and mechanical maintenance and electrical sub-stations.

3.6.2 Groundtech Consulting

Groundtech Consulting carried out an extensive ground investigation across the mill site, mainly north of the river, in December 2019 and January 2020.

The site work comprised 30nr shallow boreholes and 3nr trial pits. Several boreholes were positioned across the two historic spill zones featured in this investigation.

Chemical laboratory testing was performed on soil and groundwater samples. The testing included analysis for petroleum hydrocarbons and polychlorinated biphenyls (PCBs), which are the contaminants of concern in this investigation. The testing, therefore, provides a baseline of conditions that were present prior to the spills.

Groundtech drilled 3nr boreholes close to the mobile compressor unit (WS09, WS10 and WS11) and 3nr boreholes (WS16, WS18 and WS19) in the yard close to the transformers.

WS09, WS10 and WS11 all encountered olfactory evidence of hydrocarbons in soil prior to the mobile compressor unit being placed at the location. The presence of hydrocarbons was confirmed by the test results. PCBs were below limits of detection (LOD) in groundwater, however soil samples were not tested for PCBs.

Olfactory or visual evidence of hydrocarbons were not present in WS16, WS18 and WS19 in the yard adjacent to the transformer compound. Hydrocarbons and PCBs were below limits of detection (LODs) in soil and groundwater samples.

4 Ground Investigation

4.1 Site Work

Site work was carried out on 20 and 21 March 2024 and was as described in table 4.1.

Table 4.1 Summary of Exploratory Holes

Type	Reference	Depth
Dynamic sampling boreholes	WS101 to WS105	3.0m

The exploratory holes were set out by an Xplor engineer in locations to maximise the available data, whilst operating within the constraints of the site and the investigation rationale.

The engineer's logs of the exploratory holes are presented in Appendix A.

The locations of exploratory holes are presented on Figures 2 and 3.

4.2 Investigation Rationale

The investigation targeted the sources of potential contamination as described in table 4.2.

Table 4.2 Investigation Rationale

Hole	Target	Contaminants of concern
WS101	Downgradient of mobile compressor unit.	Hydrocarbons and PCBs
WS102 to WS105	Downgradient of transformer compound.	Hydrocarbons and PCBs

4.3 Sampling

Soil samples were recovered from the exploratory holes and stored/transported in containers appropriate for the laboratory testing undertaken.

Sample types and depths are recorded on the relevant exploratory hole logs.

Following well development and purging, groundwater samples were obtained on 25 March 2024 from the wells installed in all boreholes using dedicated disposable bailers.

4.4 Installations

Permanent monitoring wells were installed in all the boreholes capable of sampling groundwater. Installations typically comprised a 50mm diameter sealed plain casing (0.5-1.0m depth) and, beneath this, a slotted casing and gravel pack to the base of the hole.

4.5 Chemical Laboratory Analysis

Table 4.3 lists the chemical laboratory that tests were scheduled on samples recovered from the exploratory holes.

Table 4.3 Chemical Analysis

<i>Test</i>	<i>Soil</i>	<i>Water</i>
TPHCWG aromatic/aliphatic petroleum hydrocarbons, benzene, toluene, ethylbenzene and xylenes (BTEX) and methyl tert-butyl ether (MTBE)	10	5
Polychlorinated biphenyls (PCBs, 7 congeners)	10	5

Chemical analysis was undertaken by a UKAS-accredited laboratory and the certificates of analysis are provided in Appendix B.

5 Ground and Groundwater Conditions

5.1 General

During the ground investigation, the following strata sequence was encountered in the exploratory holes. The strata generally matched the expected geology.

Table 5.1 Strata Sequence

Stratum	Depth, mbgl		Thickness, m
	Top	Base	
Made ground and surfacing	GL	0.6 – 1.4	0.6 – 1.4
Alluvium	1.0 – 1.4	1.9 – 2.84	0.5 – 1.84
Glaciofluvial Deposit	0.6 – 0.8	1.3 – 1.5	0.7 – 1.0
Lowestoft Formation	1.3 – 2.84	Base not proved	

Features, structures or certain ground conditions may be present between exploratory hole locations, which are different to those encountered during the investigation.

5.2 Made Ground and Surfacing

Made ground was present in all boreholes, beneath a surfacing of reinforced concrete (WS101-WS103) or macadam (WS104-WS105).

Beneath surfacing were mixed layers of clay, silt, sand and gravel with cobble-size brick pieces in WS101 and WS103. Fragments of cast iron pipe and wood were in WS103 and WS105, respectively. The broken faces of the pipe were not fresh and, therefore, does not indicate an underground services strike.

5.3 Alluvium

Very soft to firm layers of light grey and brown, silty, sandy clay and silty sand were beneath the made ground in WS101 and WS105.

5.4 Glaciofluvial Deposit

Underlying the made ground in WS102 to WS104 were layers of sandy gravelly clay, and sand and gravel in varying proportions.

5.5 Lowestoft Formation

Underlying the alluvium (in WS101 and WS105) and Glaciofluvial Deposit (in WS102-WS104) was a firm to stiff, light to dark grey and brown, silty, slightly gravelly clay (diamicton). The gravel component was of flint, mudstone and chalk. The base of this stratum was not proved.

5.6 Groundwater Conditions

Groundwater was struck in WS101 and WS105 during drilling and achieved levels between 0.8m and 2.46m depth on completion.

During the sampling visit, groundwater was encountered in all monitoring wells at depths between 0.72m and 2.36m.

5.7 Evidence of Contamination

Table 5.2 lists the indicators of potential contamination observed during drilling and monitoring.

Table 5.1 Evidence of Contamination

Observation	Description
Made ground	Beneath surfacing in all boreholes.
Odours	Faint hydrocarbon odour in WS101 between 1.0m and 1.5m (in Alluvium)
	Hydrocarbon odour in WS104 at 0.5m (in made ground)

6 Assessment of Soil Chemical Data

This section presents a human health generic risk assessment to identify potential sources of soil contamination requiring further evaluation. The assessment involves a comparison of chemical laboratory test results to screening levels that are considered to be appropriate to the site and its future use.

6.1 Selection of Assessment Criteria

The soil screening levels for petroleum hydrocarbons used in this assessment were drawn from the Suitable for Use Levels (S4ULs) published in 2015 by Land Quality Management Ltd and the Chartered Institute of Environmental Health. Soil Guideline Values published for dioxin-like PCBs published by the Environment Agency in 2009 were used for assessing PCBs. A full list of soil screening levels used is presented in Appendix C.

The future development will be residential with private gardens and for the purpose of this assessment the land use scenario is residential with homegrown produce (RwHP).

Screening levels were selected based on a soil organic matter (SOM) content of 1%.

6.2 Generic Screening for Human Health

All measured concentrations of petroleum hydrocarbons and PCBs were below the screening levels and, therefore, further assessment in relation to human health risks from these contaminants is not required.

7 Assessment of Groundwater Chemical Data

This section presents a generic assessment to identify potential sources of contamination that could impact on controlled waters (groundwater and surface water).

7.1 Selection of Assessment Criteria

Potential water-based receptors have been identified as follows:

- Groundwater: the most sensitive aquifers beneath the site are the superficial Alluvium and Glaciofluvial Deposit, a Secondary A aquifer. The aquifers are unconfined at this location.
- Surface water: the River Oughton runs through the site.

Potential impacts to surface water quality were assessed through a comparison of analysis results with the Environmental Quality Standard (EQS) published in the Water Framework Directive (WFD) (Standards and Classification) Directions (England and Wales) 2015.

For petroleum hydrocarbons, the World Health Organisation, Guidelines for drinking-water quality (WHO, 2017) have been used for assessing impacts on both groundwater and surface water.

A full list of controlled water screening levels used is included in Appendix D.

7.2 Potential Risk to Groundwater

Contaminant concentrations in groundwater samples were below WHO drinking water criteria.

7.3 Potential Risk to Surface Water

Contaminant concentrations in groundwater samples were below WHO drinking water criteria.

7.4 Controlled Waters Assessment Summary

Following screening of the groundwater test results, no contaminant concentrations exceeded WHO drinking water criteria appropriate for the assessment of both groundwater and surface water quality at the site. Therefore, contamination likely to affect groundwater or surface water quality was not identified.

8 Assessment of Ground Gas and Organic Vapour

This section presents a generic quantitative risk assessment to identify potential sources of organic vapour in the ground that could impact on development.

8.1 Vapour Intrusion Assessment – Soil

A generic quantitative risk assessment has been undertaken of the potential for indoor vapour intrusion from volatile organic compounds (VOCs) in soil. A potential VOC is one with 12 or less carbon atoms. In the absence of published criteria, a set of vapour protection standards has been calculated using CLEA software version 1.071 and these are listed in Appendix E.

No volatile contaminant concentrations were above the vapour protection standards for residential land use and therefore further assessment of vapour intrusion from VOCs in soil is not considered to be necessary.

8.2 Vapour Intrusion Assessment – Groundwater

A generic quantitative risk assessment has been undertaken of the potential for indoor vapour intrusion from VOCs in groundwater using guidance published by the Society of Brownfield Risk Assessment guidance, Development of generic assessment criteria for assessing vapour risks to human health from volatile contaminants in groundwater (SoBRA, 2017). The SoBRA GAC_{gwwap} are listed in Appendix E.

None of the measured contaminant concentrations are above GAC_{gwwap} and therefore further assessment of vapour intrusion from VOCs in groundwater is not considered to be necessary.

8.3 Organic Vapour Assessment Summary

The site is not likely to be impacted by organic vapour from either soils or groundwater sources.

9 Contaminated Land Risk Assessment and Conceptual Site Model

9.1 Introduction

Risk assessment is a process by which the risks posed by identified hazards to specific receptors are estimated. In the context of this study, hazards relate to sources, or potential sources of contamination capable of causing harm (e.g. a contaminant concentration exceeding a screening level). Receptors are the entity which may be at risk of adverse effects from the hazard and include human health, surface waters, groundwater, ecological systems, buildings and services. In order for a hazard to present a risk to a receptor they must be linked by an exposure pathway.

This source-pathway-receptor conceptual site model is considered best practice methodology to evaluate risks arising from potential contamination, according to the LCRM guidance.

9.2 Conceptual Site Model

A conceptual site model (CSM) is not presented as no soil or groundwater sources of hydrocarbons and PCB contamination were identified in the preceding screening assessment sections of the report.

9.3 Risk Assessment Summary

The risk assessment process is concluded at this point as there are no plausible risks to human health or controlled waters from hydrocarbons or PCBs in soil or groundwater at the two spill zones.

10 Remediation and Risk Management

No sources of hydrocarbon and PCB contamination have been identified based on the screening assessments undertaken. Therefore, no remediation or mitigation of hydrocarbons or PCBs are required in the future development.

It should be noted, however, that this report relates only to a study of hydrocarbons and PCBs in soil and groundwater at two historic oil spill zones on the site. The report cannot, therefore, provide guidance on any measures needed across other parts of the site or for other potential contaminants.

11 Conclusions and Recommendations

Xplor Environmental has carried out a ground investigation at the former Bowman Mill in Ickleford. The investigation targeted two historic oil spill zones on the site.

The investigation found no evidence of soil or groundwater contamination that could have come from either of two historic oil spills adjacent to a mobile compressor unit in the west and downgradient of a transformer compound in the east.

Low concentrations of petroleum hydrocarbons were detected in made ground soils at a depth of 0.5m in WS101 (beside the mobile compressor unit). However, they did not exceed residential human health screening values and had not penetrated the deeper alluvial clay. Testing indicated the hydrocarbons were mainly middle distillate fractions that would not be present in oil from a compressor unit. PCBs were not detected in any of the soil or groundwater samples tested from this borehole.

Downgradient of the transformer compound, low concentrations of petroleum hydrocarbons were detected in groundwater at a depth of 2.36m in WS103. However, they did not exceed groundwater or surface water screening values. Testing indicated the hydrocarbons were mainly middle distillate fractions that would not be present in transformer oil. PCBs were not detected in any other soil or groundwater samples tested in the boreholes downgradient of the transformer compound.

No remediation is required for a future residential development, or for the protection of controlled waters, from either hydrocarbons or PCBs in soil or groundwater at the historic oil spill zones.

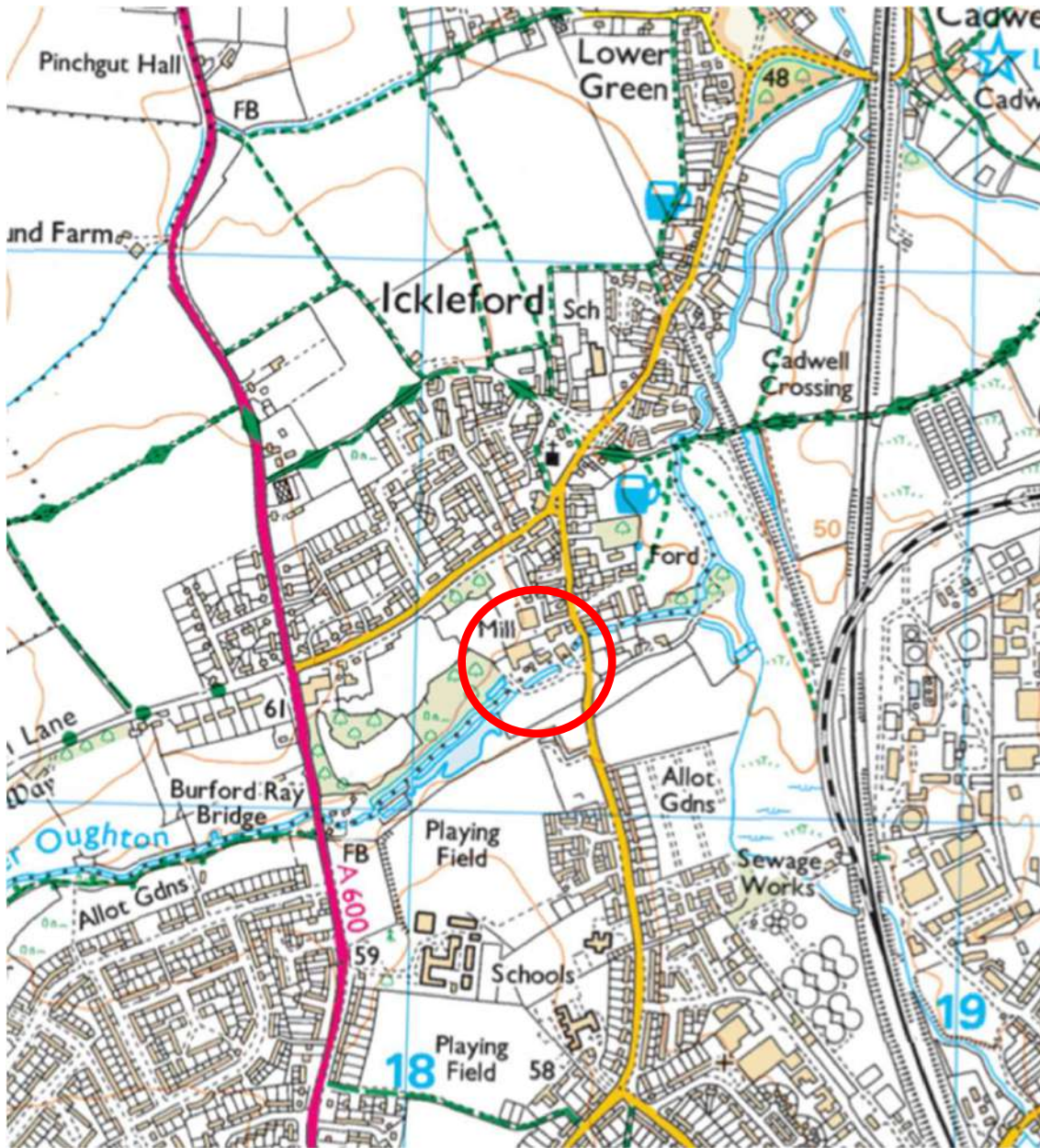
The investigation was targeted and contractors should remain vigilant during the demolition process for evidence of free phase oils, especially when removing foundations or lifting slabs.

Figures

Figure 1 – Site Location Plan

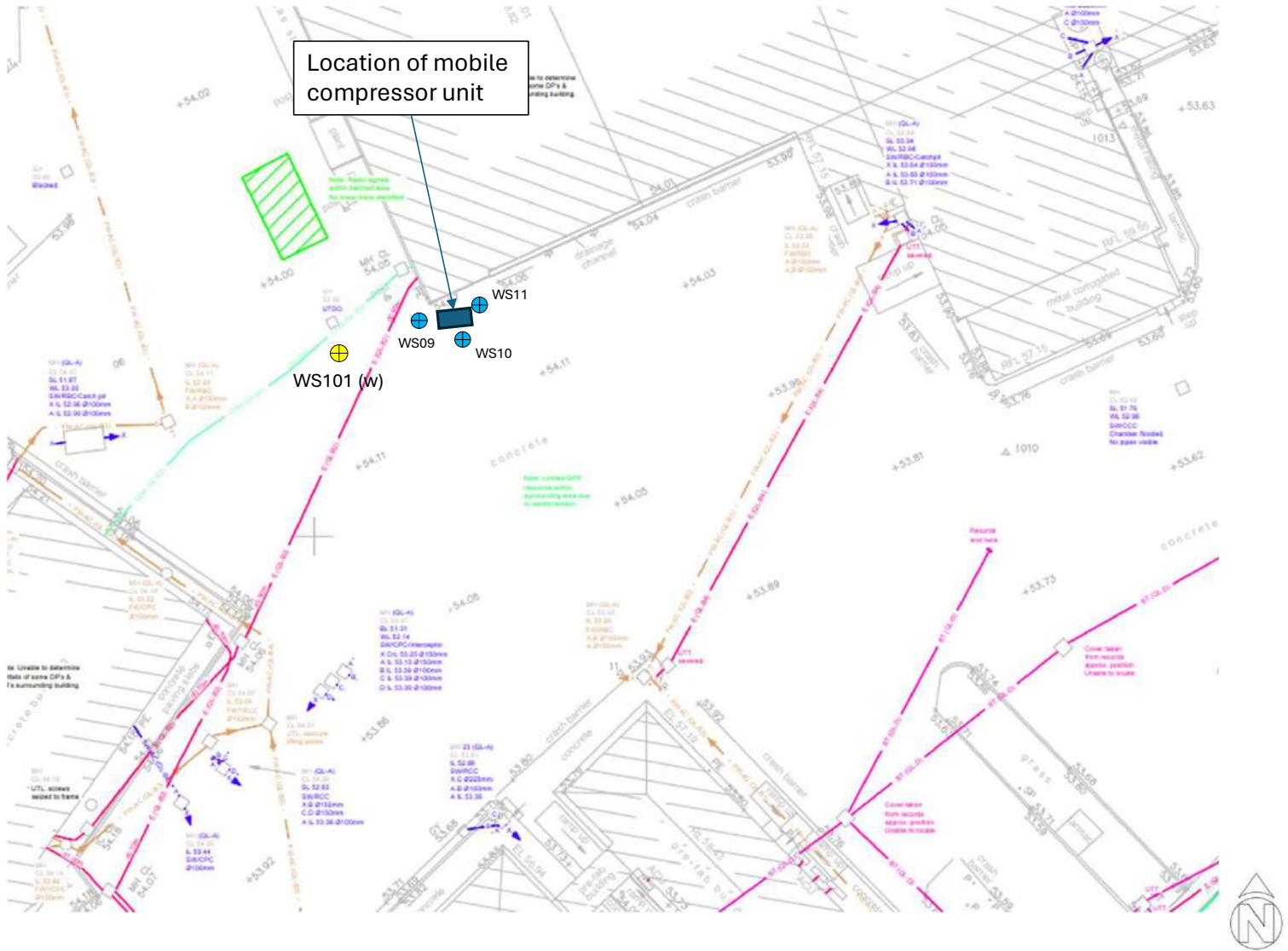
Figure 2 – Exploratory Hole Location Plan (Area 1)

Figure 3 – Exploratory Hole Location Plan (Area 2)



LEGEND

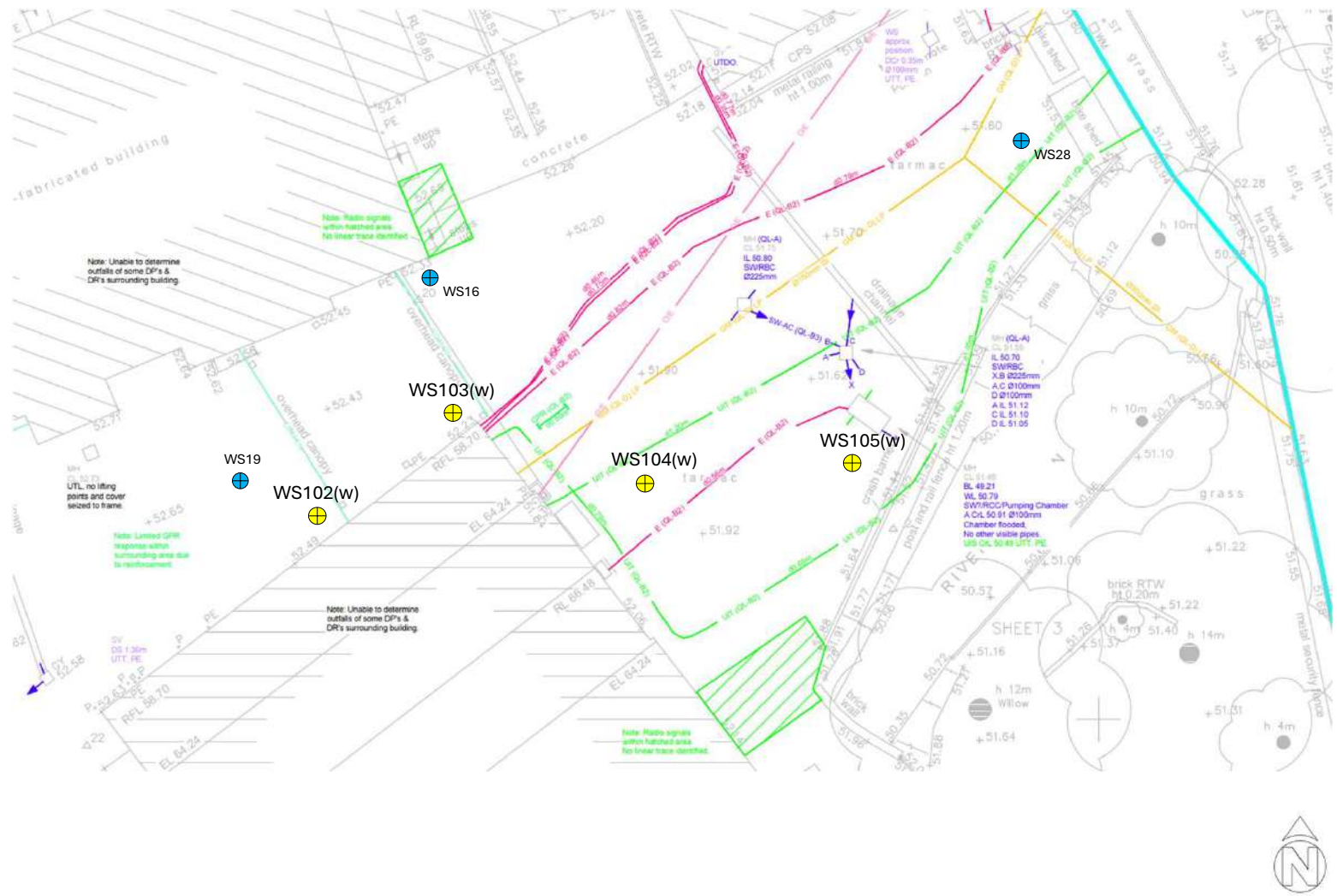
- GROUNDTECH CONSULTING BOREHOLE (2020)
- XPLOR ENVIRONMENTAL BOREHOLE (2024)
- (w) MONITORING WELL



	CLIENT	PROJECT	TITLE	SCALE: NTS	JOB NR.: 23030	DATE: 08.04.24
	LOGIE PROPERTY CO. LTD	BOWMAN'S FLOUR MILL, ICKLEFORD	EXPLORATORY HOLE LOCATION PLAN (AREA 1)	PREPARED BY: MH	REVISION: C03	DRAWING NR. FIGURE 2

LEGEND

- GROUNDTECH CONSULTING BOREHOLE (2020)
- XPLOR ENVIRONMENTAL BOREHOLE (2024)
- (w) MONITORING WELL



	CLIENT	PROJECT	TITLE	SCALE: NTS	JOB NR.: 23030	DATE: 08.04.24
	LOGIE PROPERTY CO. LTD	BOWMAN'S FLOUR MILL, ICKLEFORD	EXPLORATORY HOLE LOCATION PLAN (AREA 2)	PREPARED BY: MH	REVISION: C03	DRAWING NR. FIGURE 3



Appendix A – Exploratory Hole Logs

PROJECT NUMBER 23030	DRILLING DATE 20.03.24-21.03.24	COORDINATES 518150, 231258
PROJECT NAME Bowman's Mill, Ickleford	TOTAL DEPTH 3.0m	COORD SYS OS
CLIENT Logie Property Co. Ltd	DIAMETER 87-77mm	SURFACE ELEVATION 54.015
	CASING 0-1.0m	
	SCREEN 1.0-3.0m	

COMMENTS Adjacent to mobile compressor unit. Hand pit to 1.2m.	LOGGED BY MH/BW CHECKED BY MH
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Samples	% Recovery	Depth (m)	Graphic Log	SPT(N)	Description	Installation	Observations
					Concrete (reinforced)		
		0.5			Orange-brown, clayey SAND with some fine to coarse flint gravel and brick cobbles (MADE GROUND)		
					Grey, sandy gravelly CLAY (MADE GROUND)	Concrete/ bentonite	
		1			Soft to firm, brown and light grey, silty, slightly sandy CLAY with some fine to coarse flint gravel. Occasional black carbonised veins at 1.0-1.5m (ALLUVIUM)		Faint hydrocarbon odour (1.0-1.5m)
		1.5					
					Very soft, light grey and cream, silty, slightly sandy CLAY (ALLUVIUM)		
		2			Light grey, very silty, fine SAND (ALLUVIUM)	Pea shingle	
		2.5		1			Groundwater at 2.46m
					Dark brown SILT (ALLUVIUM)		
		3			Dark grey, firm, silty CLAY with fine to medium subrounded flint gravel (LOWESTOFT FORMATION)		
					End of borehole at 3.0m		
		4					

PROJECT NUMBER 23030			DRILLING DATE 20.03.24-21.03.24			COORDINATES 518262, 231308		
PROJECT NAME Bowman's Mill, Ickleford			TOTAL DEPTH 3.0m			COORD SYS OS		
CLIENT Logie Property Co. Ltd			DIAMETER 87-77mm			SURFACE ELEVATION 52.545		
			CASING 0-1.0m					
			SCREEN 1.0-3.0m					
COMMENTS Adjacent to Building 10 transformer bay. Hand pit to 1.2m						LOGGED BY MH/BW		
						CHECKED BY MH		
Samples	% Recovery	Depth (m)	Graphic Log	SPT(N)	Description	Installation	Observations	
					Concrete (reinforced)			
					Dark brown and black, clayey, SAND and GRAVEL (MADE GROUND)			
0.5					Brown and light grey, clayey SILT with some fine gravel. Occasional black veining (MADE GROUND)	Bentonite /concrete		
					Brown clayey, silty SAND and GRAVEL. Gravel is of flint, chalk, brick and mudstone (MADE GROUND)			
		1			Brown, sandy, gravelly CLAY. Gravel is of flint (GLACIOFLUVIAL DEPOSIT)			
					Brown, silty SAND with fine to coarse gravel of flint, mudstone and sandstone (GLACIOFLUVIAL DEPOSIT)			
1.5					Stiff, grey and light grey mottled, silty CLAY with fine to coarse flint gravel. Occasional medium gravel of mudstone. Very stiff below 2.3m (LOWESTOFT FORMATION)			
		2				Pea shingle		
2.5								
		3			End of borehole at 3.0m. Groundwater not encountered.			
		4						

PROJECT NUMBER 23030	DRILLING DATE 20.03.24-21.03.24	COORDINATES 518268, 231314
PROJECT NAME Bowman's Mill, Ickleford	TOTAL DEPTH 3.0m	COORD SYS OS
CLIENT Logie Property Co. Ltd	DIAMETER 87-77mm	SURFACE ELEVATION 52.303
	CASING 0-1.0m	
	SCREEN 1.0-3.0m	

COMMENTS Hand pit to 1.2m	LOGGED BY MH/BW CHECKED BY MH
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Samples	% Recovery	Depth (m)	Graphic Log	SPT(N)	Description	Installation	Observations
					Concrete (reinforced)		
		0.6			Sandy CLAY with fine to coarse gravel and cobbles of brick. Fragment of cast iron pipe (MADE GROUND)		
		1			Orange brown, silty SAND and GRAVEL. Gravel is of fine to coarse flint (GLACIOFLUVIAL DEPOSIT)	Bentonite/ concrete	
		1.5			Stiff, brown and light grey mottled, silty CLAY with fine to medium flint, mudstone and chalk (LOWESTOFT FORMATION)		
		2				Pea shingle	
		2.5			Firm, grey, slightly silty CLAY with fine to coarse chalk. Occasional gravel size pockets of weak, light grey mudstone (LOWESTOFT FORMATION)		
		3			End of borehole at 3.0m. Groundwater not encountered.		
		4					

PROJECT NUMBER 23030	DRILLING DATE 21.03.24	COORDINATES 518279, 231310
PROJECT NAME Bowman's Mill, Ickleford	TOTAL DEPTH 3.00	COORD SYS OS
CLIENT Logie Property Co. Ltd	DIAMETER 87-77mm	SURFACE ELEVATION 51.905
	CASING 0-1.0m	
	SCREEN 1.0-2.0m	

COMMENTS Hand pit to 1.2m	LOGGED BY BW CHECKED BY MH
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Samples	% Recovery	Depth (m)	Graphic Log	SPT(N)	Description	Installation	Observations
					Macadam		
					Dark grey, sandy GRAVEL of limestone aggregate (MADE GROUND)		
0.5					Brown, silty, fine to coarse SAND with fine to coarse gravel of flint and siltstone (MADE GROUND)		Hydrocarbon odour at 0.5m
0.7					Light grey, silty CLAY with fine to coarse gravel of mudstone (MADE GROUND)	Bentonite/concrete	
		1			Brown, clayey, fine to coarse SAND with fine to coarse gravel of flint (GLACIOFLUVIAL DEPOSIT)		
1.5					Firm, dark, grey, silty CLAY with fine to coarse flint gravel (LOWESTOFT FORMATION)		
		2			Stiff, brown, silty CLAY with fine to medium chalk gravel. Occasional light grey, medium gravel of mudstone below 2.8m (LOWESTOFT FORMATION)	Pea shingle	
2.5							
		3			End of borehole at 3.0m. Groundwater not encountered.		
		4					

PROJECT NUMBER 23030	DRILLING DATE 21.03.24	COORDINATES 518289, 231311
PROJECT NAME Bowman's Mill, Ickleford	TOTAL DEPTH 3.0m	COORD SYS OS
CLIENT Logie Property Co. Ltd	DIAMETER 87-77mm	SURFACE ELEVATION 51.541
	CASING 0-0.4m	
	SCREEN 0.4-2.0m	

COMMENTS Hand pit to 1.2m	LOGGED BY BW CHECKED BY MH
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Samples	% Recovery	Depth (m)	Graphic Log	SPT(N)	Description	Installation	Observations
					Macadam		
					Concrete		
0.3					Dark grey, fine to coarse SAND with gravel of concrete (MADE GROUND)	Bentonite/ concete	
0.5					Orange brown, clayey, silty fine to coarse SAND with gravel of fine to medium flint		
0.75					Grey, clayey, fine to coarse SAND with fine to medium gravel of flint and limestone		Groundwater at 0.8m
		1			Soft, dark grey, silty CLAY with fragment of wood and grey, fine to medium sand	Pea shingle	
1.5					Grey, silty, fine to coarse SAND with fine to coarse gravel of flint and chalk (ALLUVIUM)		
		2			Stiff, brown silty CLAY with medium to coarse flint gravel (LOWESTOFT FORMATION)		
2.5					Stiff, grey silty CLAY with flint and chalk gravel. Rare rootlets and occasional fine gravel size pockets of brown silt (LOWESTOFT FORMATION)		
		3			End of borehole at 3.0m		
		4					

Appendix B – Chemical Laboratory Test Results

Xplor Environmental
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Watford,
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WD18 8YS

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e: reception@i2analytical.com

e: markh@xplorenvironmental.co.uk

Analytical Report Number : 24-010559

Project / Site name:	Bowmans Mill	Samples received on:	22/03/2024
Your job number:	23030	Samples instructed on/ Analysis started on:	22/03/2024
Your order number:	23030	Analysis completed by:	03/04/2024
Report Issue Number:	1	Report issued on:	05/04/2024
Samples Analysed:	10 soil samples		

Signed:



Dominika Liana
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.

Analytical Report Number: 24-010559
Project / Site name: Bowmans Mill
Your Order No: 23030

Lab Sample Number	152457	152458	152459	152460	152461
Sample Reference	WS101	WS101	WS102	WS102	WS103
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	1.50	0.50	1.50	0.60
Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
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	12	34	15	14	11
Total mass of sample received	kg	0.1	NONE	0.3	0.3	0.2	0.3	0.2

Petroleum Hydrocarbons

TPHCWG - Aliphatic >C5 - C6 HS_ID_AL	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >C6 - C8 HS_ID_AL	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >C8 - C10 HS_ID_AL	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
TPHCWG - Aliphatic >C10 - C12 EH_CU_ID_AL	mg/kg	1	MCERTS	8.7	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >C12 - C16 EH_CU_ID_AL	mg/kg	2	MCERTS	220	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >C16 - C21 EH_CU_ID_AL	mg/kg	8	MCERTS	320	< 8.0	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >C21 - C35 EH_CU_ID_AL	mg/kg	8	MCERTS	76	< 8.0	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >C5 - C35 EH_CU+HS_ID_AL	mg/kg	10	NONE	630	< 10	< 10	< 10	< 10

TPHCWG - Aromatic >EC5 - EC7 HS_ID_AR	mg/kg	0.01	NONE	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 HS_ID_AR	mg/kg	0.01	NONE	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 HS_ID_AR	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
TPHCWG - Aromatic >EC10 - EC12 EH_CU_ID_AR	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 EH_CU_ID_AR	mg/kg	2	MCERTS	65	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 EH_CU_ID_AR	mg/kg	10	MCERTS	120	< 10	< 10	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 EH_CU_ID_AR	mg/kg	10	MCERTS	29	< 10	< 10	< 10	< 10
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_ID_AR	mg/kg	10	NONE	220	< 10	< 10	< 10	< 10

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 52	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 101	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 118	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 138	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 153	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Total PCBs	mg/kg	0.007	MCERTS	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-010559
Project / Site name: Bowmans Mill
Your Order No: 23030

Lab Sample Number	152462	152463	152464	152465	152466
Sample Reference	WS103	WS104	WS104	WS105	WS105
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.50	0.70	1.50	0.50	1.50
Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
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	27.4	< 0.1	40.2	40
Moisture Content	%	0.01	NONE	13	8.8	16	8.7	13
Total mass of sample received	kg	0.1	NONE	0.3	0.2	0.3	0.2	0.3

Petroleum Hydrocarbons

TPHCWG - Aliphatic >C5 - C6 HS_ID_AL	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >C6 - C8 HS_ID_AL	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >C8 - C10 HS_ID_AL	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
TPHCWG - Aliphatic >C10 - C12 EH_CU_ID_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >C12 - C16 EH_CU_ID_AL	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >C16 - C21 EH_CU_ID_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >C21 - C35 EH_CU_ID_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >C5 - C35 EH_CU+HS_ID_AL	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10

TPHCWG - Aromatic >EC5 - EC7 HS_ID_AR	mg/kg	0.01	NONE	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 HS_ID_AR	mg/kg	0.01	NONE	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 HS_ID_AR	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
TPHCWG - Aromatic >EC10 - EC12 EH_CU_ID_AR	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 EH_CU_ID_AR	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 EH_CU_ID_AR	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 EH_CU_ID_AR	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_ID_AR	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 52	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 101	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 118	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 138	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 153	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Total PCBs	mg/kg	0.007	MCERTS	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-010559

Project / Site name: Bowmans Mill

* 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 *
152457	WS101	None Supplied	0.5	Brown clay and sand with gravel
152458	WS101	None Supplied	1.5	Brown clay and sand
152459	WS102	None Supplied	0.5	Brown clay and sand with gravel
152460	WS102	None Supplied	1.5	Brown clay and sand with gravel
152461	WS103	None Supplied	0.6	Brown clay and sand with gravel
152462	WS103	None Supplied	1.5	Brown clay and sand with gravel
152463	WS104	None Supplied	0.7	Brown sandy clay with gravel and stones
152464	WS104	None Supplied	1.5	Brown clay and sand with gravel
152465	WS105	None Supplied	0.5	Brown sandy clay with gravel and stones
152466	WS105	None Supplied	1.5	Brown sand with gravel and stones

Analytical Report Number : 24-010559

Project / Site name: Bowmans Mill

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
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
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.	L019B	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L027B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088	D/W	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 30°C.

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

Sample Deviation Report



Analytical Report Number : 24-010559

Project / Site name: Bowmans Mill

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS101	N/A	S	152457	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS101	N/A	S	152457	a	PCB's By GC-MS in soil	L027B	a
WS101	N/A	S	152457	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS101	N/A	S	152458	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS101	N/A	S	152458	a	PCB's By GC-MS in soil	L027B	a
WS101	N/A	S	152458	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS102	N/A	S	152459	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS102	N/A	S	152459	a	PCB's By GC-MS in soil	L027B	a
WS102	N/A	S	152459	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS102	N/A	S	152460	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS102	N/A	S	152460	a	PCB's By GC-MS in soil	L027B	a
WS102	N/A	S	152460	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS103	N/A	S	152461	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS103	N/A	S	152461	a	PCB's By GC-MS in soil	L027B	a
WS103	N/A	S	152461	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS103	N/A	S	152462	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS103	N/A	S	152462	a	PCB's By GC-MS in soil	L027B	a
WS103	N/A	S	152462	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS104	N/A	S	152463	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS104	N/A	S	152463	a	PCB's By GC-MS in soil	L027B	a
WS104	N/A	S	152463	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS104	N/A	S	152464	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS104	N/A	S	152464	a	PCB's By GC-MS in soil	L027B	a
WS104	N/A	S	152464	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS105	N/A	S	152465	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS105	N/A	S	152465	a	PCB's By GC-MS in soil	L027B	a
WS105	N/A	S	152465	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a
WS105	N/A	S	152466	a	BTEX and/or Volatile organic compounds in soil	L073B	a
WS105	N/A	S	152466	a	PCB's By GC-MS in soil	L027B	a
WS105	N/A	S	152466	a	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	a



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Analytical Report Number : 24-011173

Project / Site name:	Bowmans Mill	Samples received on:	26/03/2024
Your job number:	23030	Samples instructed on/ Analysis started on:	26/03/2024
Your order number:	23030	Analysis completed by:	04/04/2024
Report Issue Number:	1	Report issued on:	04/04/2024
Samples Analysed:	5 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-011173
Project / Site name: Bowmans Mill

Your Order No: 23030

Lab Sample Number	156026	156027	156028	156029	156030
Sample Reference	WS101	WS102	WS103	WS104	WS105
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.05	1.20	2.36	1.28	0.72
Date Sampled	25/03/2024	25/03/2024	25/03/2024	25/03/2024	25/03/2024
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

Petroleum Hydrocarbons

TPH - Aliphatic >C5 - C6 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >C6 - C8 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >C8 - C10 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >C10 - C12 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	15	< 10	< 10
TPH - Aliphatic >C12 - C16 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	50	< 10	< 10
TPH - Aliphatic >C16 - C21 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	60	< 10	< 10
TPH - Aliphatic >C21 - C35 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	290	< 10	< 10
TPH - Aliphatic >C5 - C35 _{HS+EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	420	< 10	< 10

TPH - Aromatic >EC5 - EC7 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aromatic >EC12 - EC16 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	25	< 10	< 10
TPH - Aromatic >EC16 - EC21 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	20	< 10	< 10
TPH - Aromatic >EC21 - EC35 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH - Aromatic >EC5 - EC35 _{HS+EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	45	< 10	< 10

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0

PCBs by GC-MS

PCB Congener 28	µg/l	0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PCB Congener 52	µg/l	0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PCB Congener 101	µg/l	0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PCB Congener 118	µg/l	0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PCB Congener 138	µg/l	0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PCB Congener 153	µg/l	0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
PCB Congener 180	µg/l	0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

Total ICES-7 PCBs	µg/l	0.14	NONE	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-011173

Project / Site name: Bowmans Mill

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
PCB's By GC-MS in water	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L028B	W	NONE
Total petroleum hydrocarbons with carbon banding by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
BTEX and/or Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Total petroleum hydrocarbons by GC-MS HS in water	Determination of total petroleum hydrocarbons in water by GC-MS HS	In-house method	L088	W	ISO 17025

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 30°C.

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.



Appendix C – Soil Screening Levels

Soil Screening Levels

The following generic screening levels are used in the report for assessing risks to human health from contaminants in soil. All screening levels are for 1% SOM.

Contaminant	Units	Source	Residential with home produce	Residential without home produce	Commercial	Public open space (residential)	Public open space (park)
Cyanide (free)	mg/kg	RIVM	20	20	30	-	-
Cyanide (total)	mg/kg	RIVM	50	50	500	-	-
Boron	mg/kg	S4UL	290	11,000	240,000	21,000	46,000
Arsenic	mg/kg	S4UL	37	40	640	79	170
Cadmium	mg/kg	S4UL	11	85	190	120	532
Chromium (total)	mg/kg	S4UL	910	910	8,600	1,500	33,000
Copper	mg/kg	S4UL	2,400	7,100	68,000	12,000	44,000
Mercury	mg/kg	S4UL	40	56	1,100	120	240
Nickel	mg/kg	S4UL	180	180	980	230	3,400
Lead	mg/kg	C4SL	200	310	2,330	630	1,300
Selenium	mg/kg	S4UL	250	430	12,000	1,100	1,800
Zinc	mg/kg	S4UL	3,700	40,000	730,000	81,000	170,000
Chromium (hex.)	mg/kg	S4UL	6	6	33	7.7	220
TPH Aliphatic >C5-C6	mg/kg	S4UL	42	42	3,200	570,000	95,000
TPH Aliphatic >C6-C8	mg/kg	S4UL	100	100	7,800	600,000	150,000
TPH Aliphatic >C8-C10	mg/kg	S4UL	27	27	2,000	13,000	14,000
TPH Aliphatic >C10-C12	mg/kg	S4UL	130	130	9,700	13,000	21,000
TPH Aliphatic >C12-C16	mg/kg	S4UL	1,100	1,100	59,000	13,000	25,000
TPH Aliphatic >C16-C21	mg/kg	S4UL	65,000	65,000	1,600,000	250,000	450,000
TPH Aliphatic >C21-C35	mg/kg	S4UL	65,000	65,000	1,600,000	250,000	450,000
TPH Aromatic >C5-C7	mg/kg	S4UL	70	370	26,000	56,000	76,000
TPH Aromatic >C7-C8	mg/kg	S4UL	130	860	56,000	56,000	87,000
TPH Aromatic >C8-C10	mg/kg	S4UL	34	47	3,500	5,000	7,200
TPH Aromatic >C10-C12	mg/kg	S4UL	74	250	16,000	5,000	9,200
TPH Aromatic >C12-C16	mg/kg	S4UL	140	1,800	36,000	5,100	10,000
TPH Aromatic >C16-C21	mg/kg	S4UL	260	1,900	28,000	3,800	7,600
TPH Aromatic >C21-C35	mg/kg	S4UL	1,100	1,900	28,000	3,800	7,800
Naphthalene	mg/kg	S4UL	2.3	2.3	190	4,900	1,200
Acenaphthylene	mg/kg	S4UL	170	2,900	83,000	15,000	29,000
Acenaphthene	mg/kg	S4UL	210	3,000	84,000	15,000	29,000
Fluorene	mg/kg	S4UL	170	2,800	63,000	9,900	20,000
Phenanthrene	mg/kg	S4UL	95	1,300	22,000	3,100	6,200
Anthracene	mg/kg	S4UL	2,400	31,000	520,000	74,000	150,000

Contaminant	Units	Source	Residential with home produce	Residential without home produce	Commercial	Public open space (residential)	Public open space (park)
Fluoranthene	mg/kg	S4UL	280	1,500	23,000	3,100	6,300
Pyrene	mg/kg	S4UL	620	3,700	54,000	7,400	15,000
Benzo[a]anthracene	mg/kg	S4UL	7.2	11	170	29	49
Chrysene	mg/kg	S4UL	15	30	350	57	93
Benzo[b]fluoranthene	mg/kg	S4UL	2.6	3.9	44	7.1	13
Benzo[k]fluoranthene	mg/kg	S4UL	77	11	1,200	190	370
Benzo[a]pyrene	mg/kg	S4UL	2.2	3.2	35	5.7	11
Indeno[1,2,3-c,d]pyrene	mg/kg	S4UL	27	45	500	82	150
Dibenz[a,h]anthracene	mg/kg	S4UL	0.24	0.31	3.5	0.57	1.1
Benzo[g,h,i]perylene	mg/kg	S4UL	320	360	3,900	640	1,400
Phenols (total)	mg/kg	S4UL	120	440	440	440	440
Benzene	µg/kg	S4UL	87	380	27,000	72,000	90,000
Toluene	µg/kg	S4UL	130,000	880,000	56,000,000	56,000,000	87,000,000
Ethylbenzene	µg/kg	S4UL	47,000	83,000	5,700,000	24,000,000	17,000,000
m & p-xylene	µg/kg	S4UL	56,000	79,000	5,900,000	41,000,000	17,000,000
o-xylene	µg/kg	S4UL	60,000	88,000	660,000	41,000,000	17,000,000
Sum of PCDDs, PCDFs and dioxin-like PCBs	µg/kg	EA SC050021	8	8	240	-	-



Appendix D – Controlled Waters Screening Levels

Controlled Waters Screening Levels

Generic screening levels used in the report for assessing risks to controlled waters (surface water and groundwater) from contaminants in water and soil leachate samples.

Contaminant	Units	UK Drinking Water Standard (DWS) ^[1] for groundwater impact	WHO Drinking Water Guideline ^[2]	Environmental Quality Standard (EQS) for surface water impact
Cyanide	µg/l	50	-	1 ^[6]
Boron	µg/l	1000	-	750 ^[4]
Arsenic	µg/l	10	-	50 ^[10]
Cadmium	µg/l	5	-	0.25 ^[6,7]
Chromium (total)	µg/l	50	-	4.7 ^[9]
Copper	µg/l	2000	-	4 ^[8]
Mercury	µg/l	1	-	0.07 ^[11]
Nickel	µg/l	20	-	3.6 ^[6,8]
Lead	µg/l	10	-	1.2 ^[6]
Selenium	µg/l	10	-	7.5 ^[4]
Zinc	µg/l	5000	-	10.9 ^[10]
Chromium (hex.)	µg/l	-	-	3.4 ^[9]
TPH Aliphatic >C5-C6	µg/l	10	15,000	-
TPH Aliphatic >C6-C8	µg/l	10	15,000	-
TPH Aliphatic >C8-C10	µg/l	10	300	-
TPH Aliphatic >C10-C12	µg/l	10	300	-
TPH Aliphatic >C12-C16	µg/l	10	300	-
TPH Aliphatic >C16-C21	µg/l	10	300	-
TPH Aliphatic >C21-C35	µg/l	10	300	-
TPH Aromatic >C5-C7	µg/l	10	10	-
TPH Aromatic >C7-C8	µg/l	10	700	-
TPH Aromatic >C8-C10	µg/l	10	300	-
TPH Aromatic >C10-C12	µg/l	10	90	-
TPH Aromatic >C12-C16	µg/l	10	90	-
TPH Aromatic >C16-C21	µg/l	10	90	-
TPH Aromatic >C21-C35	µg/l	10	90	-
Naphthalene	µg/l	2	-	2 ^[6]
Anthracene	µg/l	-	1	0.1 ^[6]
Fluoranthene	µg/l	-	4	0.0063 ^[6]
Benzo[b]fluoranthene	µg/l	0.1	-	0.00017 ^[6,9]
Benzo[k]fluoranthene	µg/l	0.1	-	0.00017 ^[6,9]
Benzo[a]pyrene	µg/l	0.01	0.7	0.00017 ^[6]
Indeno[1,2,3-c,d]pyrene	µg/l	0.1	-	0.00017 ^[6,9]
Benzo[g,h,i]perylene	µg/l	0.1	-	0.00017 ^[6,9]
Phenols (total)	µg/l	0.5	-	7.7 ^[10]
Benzene	µg/l	1	10	6 ^[6]
Toluene	µg/l	-	700	74 ^[10]
Ethylbenzene	µg/l	-	300	-
m & p-xylene	µg/l	-	500	15.5 ^[3,5]
o-xylene	µg/l	-	500	

Notes

1. Prescribed concentration listed in the Water Supply (Water Quality) Regulations 2016.

2. Drinking water guideline values listed in the World Health Organisation document, Guidelines for drinking-water quality: fourth edition (WHO, 2017). Used to assess impacts to surface water and groundwater from hydrocarbons (use DWS for SPZ1 or Principal aquifer).
3. EQS is the minimum Threshold Value for Groundwater (impacts on surface water) listed in Table 1 of Schedule 5 of the Water Framework Directive (WFD) (Standards and Classification) Directions (England and Wales) 2015.
4. EQS is the General Quality of GW Body listed in Table 1 of Schedule 5 of the Water Framework Directive (WFD) (Standards and Classification) Directions (England and Wales) 2015.
5. EQS is the sum of m, p & o-xylene.
6. EQS is the AA-EQS (inland surface waters) listed in Table 1 of Part 3 of the Water Framework Directive (WFD) (Standards and Classification) Directions (England and Wales) 2015.
7. EQS is for the water hardness band ≥ 200 mg CaCO_3/l .
8. EQS is the sum of PNEC+C_b (Predicted No Effect Concentration + background concentration) calculated in accordance with Table 2 of the Water Framework Directive (WFD) (Standards and Classification) Directions (England and Wales) 2015. PNEC and C_b for copper are 2.6 and 1.0 $\mu\text{g/l}$, respectively.
9. Benzo[a]pyrene is used as a marker compound for the substance.
10. EQS is the standard for fresh water listed in Table 1 of Part 2 (specific pollutants) of the Water Framework Directive (WFD) (Standards and Classification) Directions (England and Wales) 2015.
11. EQS is the MAC-EQS (inland surface waters) listed in Table 1 of Part 3 of the Water Framework Directive (WFD) (Standards and Classification) Directions (England and Wales) 2015.

Appendix E – Vapour Protection Standards

Vapour Protection Standards

The following Protection Standards are used in the report for the assessment of human health risks from organic vapour intrusion into buildings (indoor inhalation).

Volatile Organic Compound	Protection Standard in soil (mg/kg) ^[2]		Protection Standard in groundwater (µg/l) ^[3]	
	Residential	Commercial	Residential	Commercial
TPH Aliphatic >C5-C6	161	19,600 ^[4]	1,900	190,000 ^[5]
TPH Aliphatic >C6-C8	529	64,400 ^[4]	1,500	150,000 ^[5]
TPH Aliphatic >C8-C10	156	19,000 ^[4]	57	5,700 ^[5]
TPH Aliphatic >C10-C12	793 ^[4]	96,600 ^[4]	37	3,600 ^[5]
TPH Aromatic >C5-C7	1.48	173	210,000	20,000,000 ^[5]
TPH Aromatic >C7-C8	4,570 ^[4]	517,000 ^[4]	220,000	21,000,000 ^[5]
TPH Aromatic >C8-C10	553	67,400 ^[4]	1,900	190,000 ^[5]
TPH Aromatic >C10-C12	3,050 ^[4]	373,000 ^[4]	6,800	660,000 ^[5]
Naphthalene	13.2	1,720 ^[4]	220	23,000 ^[5]

1. The selected VOCs have the potential to create a vapour intrusion risk and are defined as a volatile substance with 12 carbon atoms or less.
2. ss.
3. Protection standards for soil were derived using CLEA software version 1.071 (2015) and calculated for the indoor inhalation pathway.
4. Vapour protection standards for groundwater are the GACgwvap published by the Society of Brownfield Risk Assessment publication, Development of generic assessment criteria for assessing vapour risks to human health from volatile contaminants in groundwater (SoBRA, 2017).
5. Soil protection standard exceeds soil saturation limit; vapour risks from NAPL should be considered in addition.
6. GACgwvap exceeds aqueous solubility; vapour risks from NAPL should be considered in addition.

Appendix F – Defining Risk

Risk Evaluation

Risk evaluation is qualitative and is developed from the model provided in CIRIA C552 *Contaminated Land Risk Assessment – a guide to good practice* (DETR 2001). It involves classifying risk in terms of the probability of occurrence x magnitude of the potential consequence of occurrence. The risk rating is used to determine what action, if any, is needed to further investigate that risk and/or remediate to reduce risk to an acceptable level.

Classification of Probability

Classification	Definition
High Likelihood	There is a pollution linkage and an event appears very likely in the short term and almost inevitable in the long term or there is actual evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely in the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is not certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur in the very long term.

Classification of Consequence

Classification	Definition	Examples
Severe	- Short-term (acute) risk to human health likely to result in significant harm. - Short-term (acute) risk of pollution of sensitive water resource. - Short-term (acute) risk to an ecosystem, or organism forming part of an ecosystem.	Unusually high concentration of toxic substance on the surface of a garden. Major release into controlled waters. EA Category 1 pollution incident. Closure of an abstraction point. Explosion, causing building collapse (and death if occupied).
Medium	- Chronic damage to human health likely to result in significant harm. - Pollution of sensitive water resource. - Significant change in a particular ecosystem, or organism forming part of such ecosystem.	Concentration of contaminant from site exceeds generic or site-specific assessment criteria for human health or water supply pipes. Presence of asbestos. Leaching of contaminants from a site to a principal or secondary (A) aquifer. Concentration exceeds DWS or EQS in Inner Source Protection Zone (SPZ1). EA Category 2+ pollution incident. Death of a species or loss of habitat within an area of national importance.
Mild	Exposure is unlikely to result in significant harm to human health.	Concentration of contaminant from site below generic or site-specific assessment criteria.

Classification	Definition	Examples
	- Pollution of non-sensitive water resource. - Damage to sensitive buildings, structures and services or the environment.	Pollution of secondary (B or undifferentiated) aquifer. EA Category 3 pollution incident. Damage to a building rendering it unsafe to occupy. Death of a species or loss of habitat within an area of local importance.
Minor	- Harm (but not significant harm) resulting in a financial loss or expenditure to resolve. - Non-permanent human health effects. - Easily repairable damage to buildings, structures and services	Pollution of unproductive strata. Loss of plants in garden or landscape areas.

Risk Estimation

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Low risk	Low risk
	Low Likelihood	Moderate risk	Low risk	Low risk	Very low risk
	Unlikely	Low risk	Low risk	Very low risk	Very low risk
	No linkage	No risk			

Description of the Estimated Risks and Likely Action Required

Risk	Action
Very high	There is a high probability that severe harm could arise or there is evidence that severe harm is currently happening. This risk, if realised, is likely to result in substantial liability. - Urgent investigation required. - Remediation required for the site in its existing state and for development.
High	Harm is likely to arise. Realisation of the risk is likely to present a significant liability. - Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term. - Remediation required for development.
Moderate	A potential linkage is identifiable. However, it is either relatively unlikely that harm would be severe or, if any harm were to occur, it is more likely that the harm would be relatively mild.

	- Investigation required to quantify the risk and determine potential liability. - Remediation required for development.
Low	It is possible that harm could arise but it is likely that this harm, if realised, would at worst normally be mild. - Investigation is not normally required but could be useful to confirm findings. - Remediation unlikely to be required or will be limited.
Very low	There is a low possibility that harm could arise. In the event of such harm being realised it is not likely to be severe. Site is not capable of being determined under Part 2a. No further action recommended.



GROUNDTECH
CONSULTING

Job title: Bowman's Mill, Ickleford

Report type: Geo-Environmental Appraisal

Prepared for: Bowman's Ingredients Ltd

Date: January 2020

Document Control Form

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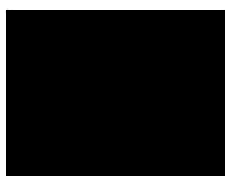
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SUMMARY

SITE DETAILS

Site Location	The site is located circa 2.16 kilometres north of Hitchin Town Centre, approximately centred on National Grid Reference 518218, 231295.
Site Area	The site is irregular in shape covers an area of approximately 3.7Ha. Topography across the site is relatively flat lying. The majority of the site is covered with both active and disused works and office buildings associated with the historic mill activities on site. The south of the site forms a soft landscaped area.

GROUND MODEL

Made Ground Soils	Made Ground is present across the entire site from ground level to between 0.2m and 1.75m bgl. Made Ground generally comprises granular material with brick as a minor constituent, ash is also rarely noted within the Made Ground. Made Ground topsoil with brick and ash is noted within seven locations across the site from ground level to a maximum depth of 0.9m bgl. The majority of the site is surfaced with concrete.
Natural Soils	Natural soils encountered across the site generally confirm the published records, comprising: ○ Alluvium of soft clay, silt and loose to medium dense sand from 0.2m to a maximum depth of 4.45m bgl ○ Glaciofluvial Deposits comprising dense Sand and Gravel from 0.15m to a maximum depth of 1.2m bgl ○ Lowestoft Formation comprising firm to stiff Clay with chalk gravel from 0.35m to a maximum depth of 5.45m bgl.
Bedrock	Bedrock was not encountered during this investigation.
Groundwater	Groundwater was encountered across the site from 1.0m to a maximum depth of 3.45m bgl, predominantly within the Alluvium Deposits.

GROUND ENGINEERING ASSESSMENT

Foundations	The type of foundations most suitable for the development varies across the site as detailed on the Foundation Zone Plan 19271 04. Traditional Strip footings are most suitable in Zone 1 areas, controlled modulus columns or driven piles are most suitable in Zone 2 areas.
Highways	Made Ground is present at proposed formation level across the majority of the site. Untreated Made Ground should be assumed to have a CBR value of <2.5%, unless proven otherwise.
SuDS	Due to the presence of Clay beneath the majority of the site and a relatively shallow groundwater table the use of SuDS drainage is not considered to be feasible.
Constraints	The main constraint associated with the site is the poor and variable ground conditions associated with the Alluvium deposits across the site. A further constraint is the existing buildings and infrastructure restricting access to large areas of the site.

TIER 1 (GQRA) ASSESSMENT AND REVISED (PL) ASSESSMENT

Human Health

Due to the presence of localised gross hydrocarbon contamination in the vicinity of a former diesel UST and asbestos in the vicinity of the former mill the risk from contaminated soils to human health is considered to be moderate.

Controlled Waters

Due to the presence of hydrocarbon contamination within groundwater tested from WS09 and WS17 the risk to groundwater is considered to be moderate to low and the risk to surface waters is considered to be moderate.

Permanent Ground Gas

No putrescible material was noted during the investigation and the initial ground gas monitoring indicates that the site falls within the NHBC Green Traffic Light Zone, therefore the risk from ground gases is currently considered to be moderate to low. This will be confirmed within the ground gas risk assessment upon completion of the gas monitoring program.

FINAL APPRAISAL

The following recommendations are made in order to progress the development through planning to construction phase:

- Completion of gas monitoring programme.
 - Issue gas assessment.
 - Investigation in areas previously inaccessible.
 - Intrusive site investigations comprising Cable Percussive Boreholes.
 - Demolition Asbestos survey.
 - Design of Remedial Specification.
 - Confirmation of Remedial Specification with the Local Authority.
 - Tree survey by qualified arboriculturist.
 - Detailed foundation design and foundation schedule.
 - Confirmation of recommendations made within this report with the Local Authority.
-

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	PROJECT OBJECTIVES	1
1.2	PROPOSED DEVELOPMENT	1
1.3	LIMITATIONS	1
2.0	SITE SETTING	3
2.1	LOCATION.....	3
2.2	SITE DESCRIPTION	3
3.0	SUMMARY OF PREVIOUS INVESTIGATION	5
3.1	GEOLOGY	5
3.2	ENVIRONMENTAL SETTING	5
3.3	CONTAMINATIVE SOURCES.....	5
3.4	CONCEPTUAL SITE MODEL AND RISK ASSESSMENT	6
4.0	SCOPE OF INVESTIGATION AND RATIONALE	7
4.1	PROJECT OBJECTIVES	7
4.2	SCOPE OF WORKS	7
4.3	SOIL SAMPLING	7
4.4	GEO-ENVIRONMENTAL ANALYSIS	8
4.5	GAS AND GROUNDWATER MONITORING/SAMPLING	9
4.6	GROUNDWATER SAMPLING.....	9
5.0	GROUND MODEL.....	10
5.1	MADE GROUND.....	10
5.2	NATURAL GROUND.....	10
5.3	BEDROCK.....	11
5.4	GROUNDWATER.....	11
5.5	WATCHING BRIEF.....	11
5.6	EXCAVATION STABILITY.....	12
5.7	EXCAVATION PROGRESS.....	12
6.0	GROUND ENGINEERING.....	13
6.1	GEOTECHNICAL TESTING RESULTS.....	13
6.2	ASSESSMENT BACKGROUND	13
6.3	GEOTECHNICAL PARAMETERS	14
6.4	PRELIMINARY FOUNDATION DESIGN.....	16
6.5	BUILDING NEAR TREES	18
6.6	FLOOR SLABS	19
6.7	CONSTRUCTION	19
6.8	CONCRETE CLASSIFICATION	19
6.9	HIGHWAY DESIGN	20
6.10	SUSTAINABLE URBAN DRAINAGE SYSTEM (SuDS)	20
7.0	LAND QUALITY.....	22
7.1	GEO-ENVIRONMENTAL TESTING RESULTS - SOILS	22
7.2	TIER I GENERIC QUANTITATIVE RISK ASSESSMENT - SOILS	24
7.3	GEO-ENVIRONMENTAL TESTING RESULTS - GROUNDWATER	26
7.4	TIER I QUANTITATIVE RISK ASSESSMENT - GROUNDWATER	29
7.5	PERMANENT GROUND GASES	30
7.6	REVISED POLLUTION LINKAGE ASSESSMENT	33
7.7	OUTLINE REMEDIAL STRATEGY	39

7.8	ASBESTOS IN SOILS	40
7.9	HEALTH AND SAFETY - CONSTRUCTION AND GROUND WORKERS	40
7.10	WASTE CLASSIFICATION BY ASSESSMENT.....	41
7.11	WASTE ACCEPTANCE CRITERIA (WAC) RESULTS.....	43
8.0	FINAL APPRAISAL.....	44
8.1	LAND QUALITY	44
8.2	GROUND ENGINEERING	44
8.3	REQUIRED SUPPLEMENTARY INVESTIGATION	45
9.0	RELEVANT INDUSTRY REFERENCES.....	46

APPENDIX 1 - PLANS	
APPENDIX 2 – SITE PHOTOGRAPHS	
APPENDIX 3 – EXPLORATORY HOLE LOGS	
APPENDIX 4 – GEO-ENVIRONMENTAL TESTING	
APPENDIX 5 – GEOTECHNICAL TESTING	
APPENDIX 6 – PERMANENT GAS MONITORING RESULTS	
APPENDIX 7 – TIER 1 GENERIC SCREENING VALUES.....	
APPENDIX 8 – ESI STATISTICAL ANALYSIS	
APPENDIX 9 - CIRIA RISK ASSESSMENT METHODOLOGY	
APPENDIX 10 – JIWG ASSESSMENT SHEETS	
APPENDIX 11 – HAZWASTEONLINE REPORT.....	
APPENDIX 12 – LEGISLATIVE BACKGROUND	
APPENDIX 13 - LIMITATIONS	

Plans		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
19271 01	-	Project Location Plan
19271 02	-	Preliminary Development Constraints Plan
19271 03	-	Exploratory Hole Location Plan
19271 04	-	Foundation Zone Plan
19271 05	-	Contamination Plan
19271 06	-	Illustrative Revised CSM

1.0 INTRODUCTION

1.1 Project Objectives

Groundtech Consulting Limited have been instructed by Bowman's Ingredients Limited and their planning consultant Spawforths to undertake a Geo-Environmental Appraisal for a site at Bowman's Mill in Ickleford.

A Preliminary Risk Assessment (Report Ref: 70027704-10670(1)) was previously undertaken by WSP Parsons Brinckerhoff in December 2018.

A main investigation was undertaken in accordance with BS 5930:2015, BS 10175:2013, BS 8576 and BS 22475 to revise the CSM and quantify the level of risk identified in the PRA. The Appraisal has been prepared in accordance with current UK Legislation and to discharge Land Quality pre-commencement planning conditions.

The report has been undertaken to fulfil the requirements of a preliminary risk assessment in accordance with CLR11 "Model Procedures for the Management of Land Contamination".

1.2 Proposed Development

The proposed development is residential end use comprising low rise housing with soft landscaped gardens and associated roads and infrastructure.



1.3 Limitations

This Geo-Environmental Appraisal is based on information obtained from a number of sources, and the information is assumed to be correct.