



Land at Spring Vale Street, Tottington

Phase 2 Geo-Environmental Ground Investigation Report

For: Pavetec Solutions Ltd.

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1.0 INTRODUCTION

This Geo-Environmental Ground Investigation report has been prepared at the request of Pavetec Solutions Ltd. Instructions to proceed were received in November 2020.

The c. 0.08 Ha rectangular site is located to the north of Spring Vale Street, Tottington, c. 3.6km to the north west of Bury town centre, at the approximate post code BL8 3LR. The National Ordnance Grid Reference for the centre of the site is E377503 N412933.

The site currently comprises offices and a yard, used for storage of plant, vehicles and materials for the Client, a groundwork contracting company. The site is bound by residential properties to the north, industrial sites to the east and west, and Spring Vale Street to the south.

The northern boundary is defined by a retaining wall, c. 4m in height, but only retains c. 2.0-2.5m of material to its off-site (northern) elevation. The wall is of stone construction with brick repair patches and appeared to be in poor condition in places. Plants were noted to be growing on and out of the retaining wall.

A site photo is included below, and a Site Location Plan (SI-01) is contained in Appendix 2.



Figure 1: Looking north: site photo showing the north of site.

This Geo-Environmental Ground Investigation Report is to be used for submission to the Local Authority as part of a planning application as it is the Client's intention to develop the site into 2 No. portal framed industrial units with first floor offices and associated car parking. A proposed development plan is contained in Appendix 3.

1.1 Brief

The brief was to carry out an intrusive geo-environmental ground investigation for the site based upon the proposed development outlined in Section 1.0 and following the findings and recommendations of the *IGE Consulting Phase 1 Geo-Environmental Investigation Report* (April 2020). The investigation was to include the following tasks:

- a) Undertake / install appropriate exploratory holes and collect representative samples from exploratory holes and arrange appropriate chemical testing in accordance with the latest legal framework, record olfactory and / or visual evidence of contamination during intrusive works and undertake on site in-situ and laboratory geotechnical testing;
- b) Formulate conceptual models to accommodate the findings of the site investigation works in terms of the risk to human health, ground gas, controlled waters and the wider environment;
- c) Identify the risks and evaluate whether a Phase 3 numerical risk assessment and / or a Remedial Strategy, is required.
- d) Undertake an assessment of the ground conditions findings to provide outline recommendations for the proposed foundations.

A report was to be provided to summarise the findings and recommendations.

1.2 Third Parties

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2.0 SCOPE OF INVESTIGATION WORK

This Geo-Environmental Ground Investigation has been designed following the findings and recommendations of the *IGE Consulting Phase 1 Geo-Environmental Investigation Report* (April 2020) and Client requirements in relation to the proposed development outlined in Section 1.0.

The ground investigation works were undertaken on 17th November 2020 and comprised 3 No. trial pits. Subsequent chemical laboratory testing was undertaken between 19th and 26th November 2020.

Testing of soil samples for environmental purposes was carried out by i2 Analytical in accordance with the Environment Agency's MCERTS (Monitoring Certification) quality assurance accreditation scheme. These organisations were appointed directly by IGE Consulting to carry out these contracting works.

The locations of the exploratory holes were topographically surveyed (X-Y-Z axis) with an accuracy of 20mm.

The ground investigation was undertaken in general accordance with:

- BS 5930 (2015) Code of Practice for Ground Investigation;
- BS 1377 (1990) Methods of test for Soils for Civil Engineering Purposes;
- BS 10175 (2011) Investigation of Potentially Contaminated Sites – Code of Practice; and
- BS EN 1997-2 (2007) Eurocode 7 – Geotechnical Design – Ground Investigation and Testing.

The sampling strategy for the site has been completed in accordance with CLR4 and the design of the investigation was carried out in accordance with R&D Technical Report P 5-TR066, LCRM (2020) and BS:8485 (2015) + A1 (2019). Further details pertaining to the site investigation works are outlined in the following sections.

The limitations of the investigation work and report are included in Appendix 1.

2.1 Trial Pits

In total, 3 No. trial pits were constructed to depths of between 2.70m and 3.00m bgl (141.40m and 141.00m AOD). The trial pits were placed spatially across the footprint of the proposed development.

The locations of the trial pits are shown on the exploratory hole location plan in Appendix 2 and the trial pit logs are contained in Appendix 4.

2.2 Site Testing and Sampling

The following site tests and sampling were carried out:

- a) Retrieval of bulk disturbed samples from trial pits from ground level to 3.00m bgl, for the purposes of laboratory testing and classification.
- b) Where possible, ex-situ shear strength testing was undertaken within cohesive / fine grained material (clay) from the trial pits using a hand shear vane (HSV) 19mm vane in accordance with BS1377-9. All hand shear vane tests are ex-situ tests.

2.3 Laboratory Testing

2.3.1 Chemical Laboratory Testing

3 No. soil samples were sub-sampled from the samples obtained during exploratory hole construction and sent to i2 Analytical laboratories for chemical testing. These samples were placed into sterile sealed containers to facilitate MCERTS chemical laboratory testing of potential contaminants. Chemical testing suites were based upon a wide range of possible contaminative sources, outlined below:

Asbestos ID, sulphate, pH, nitrate, total and free cyanide, arsenic, barium, beryllium, boron, cadmium, chromium, chromium (hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc, Total Petroleum Hydrocarbon screen and Speciated Polyaromatic Hydrocarbons.

3.0 FINDINGS

3.1 Visual and Olfactory Contamination Findings

During the intrusive exploratory hole investigation works, the soils were examined carefully for both visual and olfactory evidence of contamination. The water from within the suspected land drain in TP03 had a slight hydrocarbon sheen – this was isolated and localised. No other visual and / or olfactory evidence of contamination was encountered during the site investigation. Solid samples in proximity were sampled and tested for an appropriate suite of determinands.

3.2 Ground Conditions

The ground conditions encountered across the site are variable but can be summarised as follows:

- MADE GROUND comprising TARMACADAM / CONCRETE to a depth of 0.10m – 0.35m bgl (144.19m – 143.45m AOD), underlain by;
- MADE GROUND comprising dark greyish brown, sandy GRAVEL to a depth of 0.70m – 1.25m bgl (143.59m – 142.85m AOD), underlain by;
- GLACIAL TILL comprising soft to firm, orangish brown, slightly gravelly CLAY to a depth of 1.40m – 1.60m bgl (142.69m – 142.30m AOD), underlain by;
- GLACIAL TILL comprising firm, grey, slightly gravelly CLAY to a depth of between 1.90m (141.80m AOD) and at least 3.00m bgl (141.29m AOD) at termination.

Notable Exceptions

The notable exceptions to the above ground conditions are noted below:

- In TP01 glacial till deposits were absent and suspected alluvial deposits were present, comprising soft, grey, slightly gravelly CLAY with occasional desiccated rootlets, from 1.25m to 2.40m bgl (142.85m – 141.70m AOD). This was underlain by a second alluvial stratum comprising grey, slightly sandy, clayey SILT with rare, desiccated wood fragments from 2.40m to at least 2.70m bgl (141.70m – 141.40m AOD). These deposits are believed to be associated with the historic stream (pre 1891) that ran through the site.

- In TP03, granular glacial till deposits were present comprising wet, grey, sandy, slightly clayey GRAVEL with frequent cobbles from 1.90m to at least 2.70m bgl (141.80m – 141.00m AOD). These are suspected to be a localised granular band within the glacial till.

Obstructions

The following obstructions were noted on site:

- A concrete slab was present in TP01 from 0.20m to 0.35m bgl (143.90m – 143.75m AOD).
- Frequent cobbles were present within TP03 from 1.40m to 2.70m bgl (142.30 – 141.00m AOD) at termination. Occasional cobbles were also noted in TP02 from 1.20m to 1.60m bgl (143.09m – 142.69m AOD) and frequent whole and half bricks were present in TP01 from 0.35m to 1.10m bgl (143.75m – 143.00m AOD).

It should be noted that a suspected electrical cable, a suspected ceramic land drain and a black plastic water pipe were all encountered within exploratory holes on site between 0.65m and 1.00m bgl (143.10m - 143.05m AOD).

For more detailed descriptions, refer to the trial pit logs contained in Appendix 4.

3.3 Water Strikes

Water strikes were recorded at the following locations and depths:

Strata	Exploratory Hole	Depth (m bgl)	Comments
MADE GROUND	TP01	1.00	Moderate ingress from within black plastic water pipe
	TP03	0.75	Fast ingress (slowing over time) from within suspected land drain

Both of the water strikes, as shown above, were from within pipes; no water strikes were encountered within the site soils. The water strike within TP01 is believed to be the suspected culvert. This was noted to be in poor condition.

For further details pertaining to the water strikes please refer to the trial pit logs in Appendix 4.

3.4 Geotechnical Site Testing

The results of the in-situ site tests undertaken during the site investigation are summarised below.

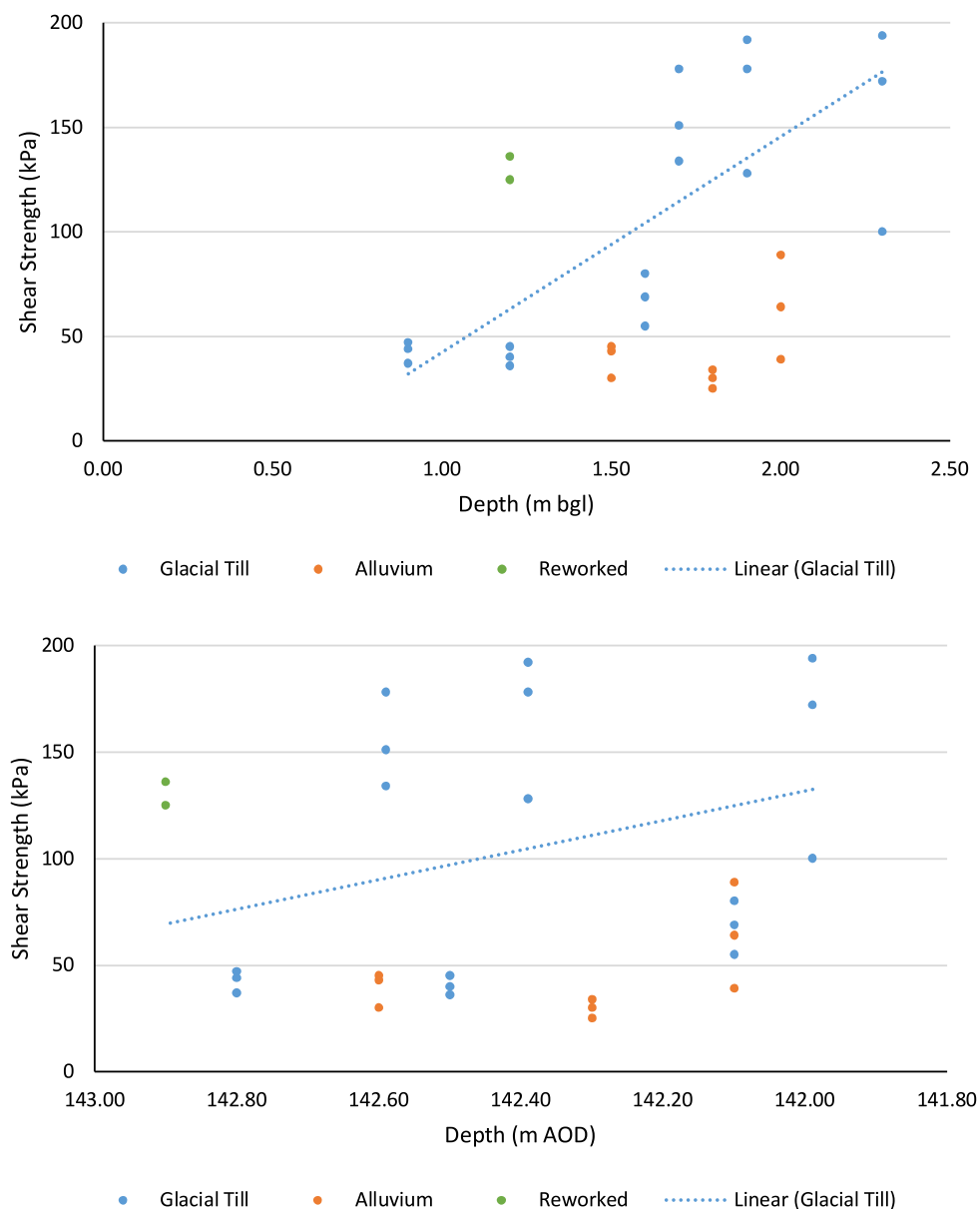
3.4.1 Hand Shear Vane (19mm) Tests

Where possible, ex-situ shear strength testing was undertaken on samples of cohesive material (clay) within trial pits using a hand shear vane (19mm vane) in accordance with BS1377-9.

The following table outlines the undrained shear strength values obtained within cohesive glacial till, alluvium and suspected reworked natural deposits during the site investigation:

Deposit Type	Number of Tests	Depth Range m bgl (m AOD)	Shear Strength Range (kPa)	Shear Strength Average (kPa)
GLACIAL TILL	18	0.90 – 2.30 (142.80 – 141.99)	36 – 194	104
ALLUVIUM	9	1.50 – 2.00 (142.60 – 142.10)	25 – 89	44
SUSPECTED REWORKED	2	1.20 (142.90)	125 – 136	131

The following scatter graphs show shear strength with depth in bgl and AOD. The graphs show that although the results are varied, a general increase in shear strength within the glacial till deposits with depth is evident. The shear strength of the alluvium is generally lower than that of the glacial till and does not show as much of an increase with depth.



For detailed, specific information pertaining to the hand shear vane tests, please refer to the trial pit logs contained within Appendix 4.

3.5 Environmental Laboratory Test Results

The findings of the chemical test results, summarised below, will be assessed against generic assessment criteria (GAC) for the purposes of screening allowable concentrations in comparison to the measured site concentrations. The GAC are

defined based on the critical receptors identified at the site. Receptors are considered in relation to:

- Human health receptors (e.g. end-users, construction workers and the general public) via measured solid concentrations, and;
- Additional receptors may be relevant dependant on the site e.g. flora/fauna, water, buried concrete.

The GAC adopted for assessment of soils in relation to Human Health are based on published LQM/CIEH S4ULs (2015) for those compounds for which published criteria are available for varying scenarios (residential, commercial, allotment, public open space). In the absence of LQM/CIEH S4ULs (2015) the following GAC defining documents are adopted - CL:AIRE Soil GAC for Human Health Assessment (2010) and Category 4 Screening Levels (C4SLs) (2014).

The primary risk to human receptors from free cyanide in soils is an acute risk (i.e. a single dose could have a lethal affect as opposed to adverse effects from cumulative intake (chronic affect)). There is no current UK guidance available for calculating acute risks from free cyanide, therefore an in-house methodology has been used to derive an acute GAC of 60 mg/kg for all exposure scenarios. The value is given for Free or Easily Liberatable Cyanide but should be used to assess Total Cyanide in the absence of cyanide speciation. In cases where the Total Cyanide exceeds the GAC then analysis for Free or Easily Liberatable Cyanide should be completed.

GACs / Tier 1s for waters must be selected to assess potential risks to the identified environmental receptors. There are numerous UK and European guidelines for waters based on the site situation and different receptors. GACs utilised include - The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 (Part 7:Groundwater Threshold Values), UK Drinking Water Standards (2000), Environmental Quality Standards, World Health Organisation concentrations, Environment Agency guidance concentrations and United States Environmental Protection Agency – Region 9 GACs.

3.6.1 Solid Samples

Summary tables indicating the results, assessed against their relevant GACs (commercial end use), are noted below.

MADE GROUND					
Solid Contamination Results					
Determinand	No. of Samples	Range of Results	Mean	GAC	Exceeded Allowable
Inorganics, Carbon and Asbestos					
Asbestos Quantification (%)	2	Non-detected		-	0
Water Soluble Sulphate as SO ₄ 2:1 Extract (mg/l)	2	51 – 554	302	-	-
Soil Organic Matter (%)	2	2.2 – 3.8	3.0	-	-
pH	2	8.2 – 8.4	8.3	-	-
Cyanide, Total	2	<1	<1	60 ²	0
Cyanide, Free	2	<1	<1	60 ²	0
Nitrate as NO ₃ 2:1 water soluble (mg/l)	2	<5.0	<5.0	-	-
Boron (hot water soluble)	2	0.7	0.7	240000	0
Metals and Semi-Metals					
Arsenic	2	27 – 70	49	640	0
Barium	2	310 – 760	535	22000 ³	0
Beryllium	2	1.3 – 2.3	1.9	12	0
Cadmium	2	<0.2 – 6.9	3.6	190	0
Chromium	2	21 – 29	25	8600	0
Copper	2	57 – 270	164	68000	0
Mercury	2	0.3 – 0.4	0.35	58	0
Nickel	2	30 – 86	58	980	0
Lead	2	380 – 890	635	2330 ¹	0
Selenium	2	<1.0	<1.0	12000	0
Vanadium	2	38 – 81	60	9000	0
Zinc	2	390 – 990	690	730000	0
Chromium (Hexavalent)	2	<1.2	<1.2	33	0
Speciated Petroleum Hydrocarbons (TPH-CWG)					
TPH-CWG - Aliphatic >EC5 - EC6	1	<0.001		5900	0
TPH-CWG - Aliphatic >EC6 - EC8	1	<0.001		17000	0
TPH-CWG - Aliphatic >EC8 - EC10	1	<0.001		4800	0
TPH-CWG - Aliphatic >EC10 - EC12	1	9.6		23000	0
TPH-CWG - Aliphatic >EC12 - EC16	1	22		82000	0
TPH-CWG - Aliphatic >EC16 - EC21	1	72		1700000	0
TPH-CWG - Aliphatic >EC21 - EC35	1	470			
TPH-CWG - Aliphatic > EC35 - EC44	1	110		1700000	0
TPH-CWG - Aliphatic (EC5 - EC35)	1	580		-	-
TPH-CWG - Aliphatic (EC5 - EC44)	1	690		-	-
TPH-CWG - Aromatic >EC5 - EC7	1	<0.001		46000	0
TPH-CWG - Aromatic >EC7 - EC8	1	<0.001		110000	0
TPH-CWG - Aromatic >EC8 - EC10	1	<0.001		8100	0
TPH-CWG - Aromatic >EC10 - EC12	1	37		28000	0
TPH-CWG - Aromatic >EC12 - EC16	1	60		37000	0
TPH-CWG - Aromatic >EC16 - EC21	1	220		28000	0
TPH-CWG - Aromatic >EC21 - EC35	1	390		28000	0
TPH-CWG - Aromatic > EC35 - EC44	1	100		28000	0
TPH-CWG - Aromatic (EC5 - EC35)	1	710		-	-
TPH-CWG - Aromatic (EC5 - EC44)	1	810		-	-
Total Petroleum Hydrocarbons Screen					
Petroleum Range Organics (C6-C10)	1	<0.1		-	-
TPH C10-C40	1	610		-	-

TPH C6-C10	1	<0.1	-	-	
TPH C6-C40	1	610	-	-	
TPH (C10-C25)	1	220	-	-	
TPH (C25-C40)	1	330	-	-	
Polynuclear Aromatic Hydrocarbons (PAHs)					
Naphthalene	2	0.66 – 30	15.33	460	0
Acenaphthylene	2	0.35 – 3.5	1.925	97000	0
Acenaphthene	2	0.52 – 4.6	2.56	97000	0
Fluorene	2	0.81 – 8.5	4.655	68000	0
Phenanthrene	2	4.3 – 41	22.65	22000	0
Anthracene	2	1.1 – 9.3	5.2	540000	0
Fluoranthene	2	6.6 – 29	17.8	23000	0
Pyrene	2	6 – 27	16.5	54000	0
Benzo(a)anthracene	2	3.2 – 20	11.6	170	0
Chrysene	2	2.7 – 15	8.85	350	0
Benzo(b)fluoranthene	2	2.9 – 15	8.95	44	0
Benzo(k)fluoranthene	2	1.4 – 10	5.7	1200	0
Benzo(a)pyrene	2	2.3 – 16	9.15	35	0
Indeno(1,2,3-cd)pyrene	2	1.1 – 9.2	5.15	510	0
Dibenz(a,h)anthracene	2	0.38 – 3	1.69	3.6	0
Benzo(ghi)perylene	2	1.2 – 11	6.1	4000	0
Total PAH (Sum of USEPA 16)	2	35.4 - 253	144.2	-	-
Monoaromatics and Oxygenates (BTEX and MTBE)					
All BTEX and MTBE were recorded at concentrations below their respective detection limits					

Generic Assessment Criteria Used: LQM/CIEH S4ULs for Human Health Risk Assessment (3^d edition, 2015), unless stated:

- 1) Category 4 Screening Levels (March 2014)
- 2) In-house screening value has been used as no GAC methodology currently exists
- 3) CL:AIRE Soil GAC for Human Health Assessment (January 2010)

Note 1 – Units are in mg/kg unless stated.

Note 2 – Used 2.5% SOM (average organic matter %) used for GACs as a conservative measure.

Note 3 – Detection limit values used to calculate arithmetic mean

Note 4 – All GAC used relate to the 'commercial' land use scenario.

NATURAL SOILS					
Solid Contamination Results					
Determinand	No. of Samples	Range of Results	Mean	GAC	Exceeded Allowable
Inorganics, Carbon and Asbestos					
Water Soluble Sulphate as SO4 2:1 Extract (mg/l)	1	249	-	-	-
Soil Organic Matter (%)	1	0.5	-	-	-
pH	1	8.2	-	-	-
Cyanide, Total	1	<1	60 ²	0	
Cyanide, Free	1	<1	60 ²	0	
Nitrate as NO ₃ 2:1 water soluble (mg/l)	1	<5.0	-	-	-
Boron (hot water soluble)	1	0.4	240000	0	
Metals and Semi-Metals					
Arsenic	1	7.3	640	0	
Barium	1	61	22000 ³	0	
Beryllium	1	0.56	12	0	
Cadmium	1	<0.2	190	0	
Chromium	1	16	8600	0	
Copper	1	17	68000	0	
Mercury	1	<0.3	58	0	
Nickel	1	17	980	0	
Lead	1	19	2330 ¹	0	

Selenium	1	<1.0	12000	0
Vanadium	1	21	9000	0
Zinc	1	44	730000	0
Chromium (Hexavalent)	1	<1.2	33	0
Total Petroleum Hydrocarbons Screen				
All TPHs were recorded at concentrations below their respective detection limits				
Polynuclear Aromatic Hydrocarbons (PAHs)				
All PAHs were recorded at concentrations below their respective detection limits				

Generic Assessment Criteria Used: LQM/CIEH S4ULs for Human Health Risk Assessment (3rd edition, 2015), unless stated:

- 1) Category 4 Screening Levels (March 2014)
- 2) In-house screening value has been used as no GAC methodology currently exists
- 3) CL:AIRE Soil GAC for Human Health Assessment (January 2010)

Note 1 – Units are in mg/kg unless stated.

Note 2 – Used 1% SOM (average organic matter %) used for GACs as a conservative measure.

Note 3 – Detection limit values used to calculate arithmetic mean

Note 4 – All GAC used relate to the 'commercial' land use scenario.

Full chemical test results are contained in Appendix 5.

3.6 Potable Water Supply

A United Utilities Risk Assessment (UURA) has been undertaken for the site, based on the chemical laboratory testing results contained within Appendix 5. The UURA is contained in Appendix 6 and recommends PE Barrier Pipe Type A water main pipework.

4.0 ENVIRONMENTAL CONCLUSIONS

4.1 Assessment of Environmental Results

Soil sample analyses have assessed the presence of contaminants and the concentrations at which they occur on a spatial basis across the site. No human health GAC exceedances were recorded for the commercial land use scenario. Asbestos was not identified in any of the samples.

4.2 Revised Conceptual Models

The original conceptual models produced in the *IGE Consulting Phase 1 Geo-Environmental Investigation Report* have been revised / updated using the findings from the Geo-Environmental Ground Investigation.

4.2.1 Human Health Risk Assessment

The possible sources of on-site contamination identified within the Phase 1 report include:

- On-site made ground
- Historic on and off-site industrial uses
- On-site building

The human health receptors identified within the Phase 1 report include:

- End users (commercial land use scenario).
- Construction workers.
- The general public and adjacent site users.

The human health pathways identified within the Phase 1 report include:

- Ingestion of soil directly and indoor dust*;
- Inhalation of soil dust (indoor and outdoor);
- Dermal contact with soil (indoor and outdoor);
- Inhalation of soil vapours (indoor and outdoor);
- Oral background;
- Inhalation background.

** Treated as one pathway*

Revised Conceptual Model for Human Health Risk Assessment

No exceedances of human health GACs for a commercial end use were recorded on-site. No areas of soft landscaping are included in the proposed development; due to the 100% hardstanding anticipated, no pathways to human health for the end users exist. Consequently, the risk to human health, including end users and the general public is deemed **low**. Therefore, remedial measures are not deemed necessary.

Construction workers are at a slightly increased risk due to direct contact with the site soils, however, it is envisaged that this can be mitigated with the appropriate use of PPE and health and safety management.

4.2.2 Ground Gas Risk Assessment

Potential ground gas sources identified within the Phase 1 report include:

- On-site made ground
- Off-site infilled reservoirs (1910-1989, 0m N)
- On-site former black brook

Potential ground gas pathways identified within the Phase 1 report include:

- Migration through fractures and fissures in bedrock
- Preferential migration along foundations, service ducts / trenches
- Migration within groundwater
- Ingress through wall cavities and floors and accumulation
- Inhalation of ground gas and vapours

Potential ground gas receptors identified within the Phase 1 report include:

- End users, and to a lesser extent, site workers, if confined spaces are present in which gases are able to accumulate
- Building and structures

Revised Conceptual Model for Ground Gas Risk Assessment

Made ground (maximum 1.25m bgl) was recorded on-site which was considered in the Phase 1 risk assessment to be a potential ground gas source, however, no

significant putrescible or organic rich material was encountered within the made ground, therefore, the ground gas generation potential is anticipated to be low. The made ground is discounted as a ground gas source.

However, organic deposits believed to be associated with the on-site infilled river channel (black brook) were encountered within TP01 from 1.25m to at least 2.70m bgl (base unproven) which remain a potential ground gas source beneath the proposed building. Additionally, the risk posed from the off-site infilled reservoir (0m north) cannot be discounted.

Consequently, the ground gas risk on-site is deemed to be low-moderate and in-line with Characteristic Situation 2 (CS2). Therefore, ground gas protection measures are deemed necessary in the proposed development, in-line with BS8485 + A1 (2019) - see section 4.3.1 below.

Radon

The Indicative Atlas of Radon in England and Wales produced by the Health Protection Agency and British Geological Survey indicates that the site lies within a lower probability area as <1% of homes are above the action level. Consequently, BR211 (2015) indicates that no radon protection measures are necessary in the construction of new dwellings or extensions.

4.2.3 Controlled Waters Risk Assessment

The possible sources of on-site contamination identified within the Phase 1 report include:

- On-site made ground
- Historic on and off-site industrial uses
- On-site building

The controlled water receptors identified within the Phase 1 report include:

- Groundwater contained within the nearby underlying Secondary A Aquifer (23m SE).
- Groundwater contained within the underlying Secondary A Aquifer within the sandstone bedrock.

- Surface water contained within the possible on-site culverted Black Brook.

The controlled waters pathways identified within the Phase 1 report include:

- Vertical migration along current and future foundations and pooling at base / beneath foundations within glacial till.
- Vertical migration through granular made ground, natural granular deposits and granular lenses in natural cohesive deposits.
- Lateral migration along low permeability natural deposits and pooling at relative low points.
- Negligible infiltration through low-permeability natural cohesive deposits.
- Migration through porous sandstone bedrock.
- Migration along groundwater flow.
- Overland flow

Revised Conceptual Model for Controlled Waters Risk Assessment

No significant widespread contaminative sources have been identified on-site, which has been confirmed by the laboratory chemical testing and lack of visual / olfactory evidence in the soil. Also, the current site and proposed site layout comprises 100% hardstanding, meaning infiltration will be significantly reduced and the presence of cohesive deposits beneath the site will also reduce migration. Additionally, although a surface water feature is present in close proximity to the site (19m west), the site slopes away from this and therefore any overland flow would flow in the opposite direction. Consequently, the risk to controlled waters is deemed **very low** as no contaminative linkages are present. No further assessment is deemed necessary.

It is understood that the on-site culvert will be upgraded as part of the development works, which will be more protective of the water within it than the current construction.

4.3 Outline Remedial Strategy

No human health or controlled waters remedial measures will be required on site.

4.3.1 Ground Gas Protection Measures

As stated in Section 4.2.2, ground gas protection measures achieving a minimum of 2.5 points is required for the proposed commercial development (Type C building). Based on no basement and the unknown suspended floor slab design, 2 No. examples of how the required 2.5 points can be achieved are given below:

		BS:8485 (2015) + A1 (2019) Scores	Floor Slab Design Options			
			Pre-cast Beam and Block Suspended Slab		Cast In-situ Suspended Slab	
			Design Choice	Score	Design Choice	Score
Floor Slab	Precast suspended segmental subfloor	0	✓	0		
	Cast in-situ ground bearing floor slab (with only nominal mesh reinforcement)	0.5				
	Cast in-situ monolithic reinforced ground bearing raft or reinforced cast in-situ suspended floor slab with minimal penetrations	1 or 1.5*			✓	1.5
Ventilation	Pressure relief pathway	0.5	✓	0.5		
	Passive sub-floor dispersal layer	1.5 or 2.5**			✓	1.5
	Active dispersal layer	1.5 to 2.5				
	Active positive pressurisation	1.5 to 2.5				
Membrane	Ground gas resistant membrane***	2	✓	2		
Total Points Achieved			2.5		3.0	

* To achieve a score of 1.5 the raft or suspended floor slab should be well reinforced to control cracking and have minimal penetrations cast in.

** 2.5 points = very good performance. 1.5 points = good performance.

*** To achieve the 2 points the gas membrane must meet all criteria set out in BS:8485 (2015) + A1 (2019) Table 7.

5.0 GEOTECHNICAL CONCLUSIONS

5.1 Geotechnical Assessment of Ground Conditions

The site investigation works have revealed that the ground conditions at the site are variable but primarily comprise a surface made ground strata underlain by cohesive glacial till. Granular glacial till deposits were present in one exploratory hole, and the glacial till deposits were absent in another; instead alluvial deposits were present comprising soft, grey clay.

The principal strata identified are outlined in further detail below.

5.1.1 Made Ground

Made ground was encountered to a maximum depth of 1.25m bgl (142.85m AOD). The made ground primarily comprised a surface concrete / tarmacadam layer underlain by dark greyish brown, sandy GRAVEL.

5.1.2 Glacial Till

Glacial till was encountered in two of the exploratory holes and typically comprised soft to firm, orangish brown, slightly gravelly, CLAY; becoming firm and grey from 1.40m – 1.60m bgl (142.69m – 142.30m AOD), to a depth of between 1.90m and 3.00m bgl (141.80m – 141.29m AOD). However, within TP03, grey, sandy, slightly clayey GRAVEL with frequent cobbles was encountered from 1.90m to 2.70m bgl (141.80m – 141.00m AOD). These are suspected to be a localised granular band within the glacial till.

18 No. hand shear vane tests were undertaken within the cohesive glacial till material. These recorded a range of results from 36kPa – 194kPa and an average shear strength of 104kPa.

5.1.3 Alluvium

The glacial till deposits were absent in TP01 and instead alluvium deposits were present comprising soft, grey, slightly gravelly, CLAY with occasional desiccated rootlets; underlain by grey, slightly sandy, clayey SILT with rare desiccated wood

fragments to a depth of 2.70m bgl (141.40m AOD). These deposits are believed to be associated with the historic stream (pre 1891) that ran through the site.

9 No. hand shear vane tests were undertaken within the alluvium material. These recorded a range of results from 25kPa – 89kPa and an average shear strength of 44kPa.

5.2 Groundwater

Water strikes were recorded in 2 exploratory holes. The first was encountered in TP01 and pertained to a moderate ingress from within a black plastic water pipe at a depth of 1.00m bgl (143.10m AOD); the second was encountered in TP03 and pertained to a fast ingress (slowing over time) from within a suspected land drain at a depth of 0.75m bgl (142.95m AOD). The black plastic water pipe may be associated with the culverted former black brook.

Due to the lack of a shallow groundwater table, temporary works including dewatering is not envisaged to be required for excavation works.

5.3 Mining / Geological Assessment

Site investigation works to investigate the solid geology were beyond the scope of these works. The site lies within a Coal Authority 'Coal Mining Reporting Area' but lies just outside or on the boundary of a 'Development High Risk Area'. No mine entries or coal outcrops are recorded on-site, the nearest coal outcrop is the Bassy Coal, located 26m south of the site. However, this is noted to be 'down' dip and so will not underlie the site and the nearest shaft is over 900m from the site. The site does not lie within the Cheshire Brine Subsidence Compensation District. The British Geological survey record that the site is underlain by bedrock comprising the Woodhead Hill Rock (comprising sandstone) of the Pennine Lower Coal Measures.

5.4 Foundations

Following the completion of the site investigation works, based on existing site levels and proposed commercial buildings and the ground conditions encountered, it is not considered feasible to utilise traditional strip / trench foundations due to the highly variable ground conditions encountered. Due to the presence of buildings and a retaining wall in close proximity to the site, the use of vibro stone columns is also considered unsuitable due to the risk of damage due to vibrations.

Consequently, it is recommended that a piled foundation solution is utilised bearing into the underlying glacial till. The use of piled foundations may require pre-boring and / or obstruction removal ('grubbing') earthworks to be undertaken given the identified presence of obstructions (i.e. boulders and a suspected infilled culvert) and given presence of existing boundary walls a non-percussive method may be required.

No arboricultural survey was available at the time of completing the report. We would recommend a tree survey is undertaken and consideration to tree protection measures is made during the final detailed foundation design or given piled solution this is allowed for within the design.

5.5 Floor Slabs

Based on existing levels, the anticipated piled foundation solution and the presence of 0.70m – 1.25m of variable made ground in the vicinity of the proposed development; it is envisaged that a suspended floor slab will be required.

5.6 Concrete Classification

In accordance with BRE Special Digest 1: Concrete in Aggressive Ground (2005), soluble sulphates within the made ground were recorded within design sulphate levels DS-2 and subsequently within the Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1s. Soluble sulphates within the glacial till were recorded within design sulphate levels DS-1 and subsequently within the Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1s.

APPENDIX 1

LIMITATIONS OF INVESTIGATION WORK AND REPORT

LIMITATIONS OF REPORT

This consultancy report was compiled and carried out by IGE Consulting Limited ('IGE') for the client, as defined in the main report (the 'client'), on the basis of a defined programme and scope of works and the terms of a contract between IGE and the client. IGE undertook this with all reasonable skill and care, taking into account the limits of the scope of works required by the client, the prevailing site conditions, the time scale involved and the resources, including financial and manpower resources, agreed between IGE and the client. IGE cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outwith the agreed scope of works.

Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices. This report may not be relied upon, or transferred to, by any other party without the written agreement of its author. If a third party relies on this report, it does so wholly at its own and sole risk and IGE disclaims any liability to such parties.

It is IGE's understanding that this report is to be used for the purpose described in the 'Brief' section of this report. That purpose was a significant factor in determining the scope and the services to be provided. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without IGE's review and advice shall be at the client's sole and own risk.

The information contained in this report is protected by disclosure under Part 3 of the Environmental Information Regulations 2004 pursuant to the provisions of Regulation 12(5) without the consent in writing of a Director of IGE.

This report is a function of the date it was written and should be read in light of any subsequent changes in legislation, statutory requirements and industry practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal

provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of IGE. In the absence of such written advice of IGE, reliance on the report in the future shall be at the client's own and sole risk. Should IGE be requested to review the report in the future, IGE shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between IGE and the client.

The observations and conclusions described in this report are based solely upon the scope of works agreed between the client and IGE. IGE has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report. IGE is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the agreed scope of works. For the avoidance of doubt, this report is strictly limited to the nature of contamination contained within the ground and groundwater at the site. The report does not cover environmental aspects such as air or noise pollution and ground vibrations and the like. In addition, ecological matters relating to wildlife, flora and fauna have not been investigated as part of this report. In particular, the site has not been inspected for the presence or otherwise of invasive species (e.g. Japanese Knotweed). It is recommended that the client appoints a specialist in this subject to carry out a detailed inspection / survey of the site if its presence is suspected. Where mention has been made to the identification of asbestos or asbestos-containing materials this is for indicative purposes only and does not constitute or replace full and proper surveys.

LIMITATIONS OF INVESTIGATION WORK

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations, the potential exists for ground conditions to be encountered which are different to those considered in this report. The explored extent of the site area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site.

In addition, chemical analysis was carried out for a limited number of parameters, based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Exploratory Holes

Where exploratory holes have been carried out as part of this investigation, the spacing has been determined to provide a reasonable indication of the general ground conditions across the site, but the number has ultimately been limited by commercial constraints. The findings of the exploratory holes relate specifically to the exploratory hole locations and are no absolute guarantee of the ground conditions between such locations. Due allowance should be made for the possibility of variation in conditions between exploratory hole locations.

Extent of Contamination Testing

The extent of contaminated land testing carried out on samples obtained from the site has been determined in accordance with the latest legal guidance issued by the government to provide, with reasonable certainty, the probable general levels of contamination present on site that could pose a significant hazard to human health or waters. The extent of site investigation works including chemical testing has also been limited by reasonable commercial constraints. Although extensive testing of samples has been carried out, the volume of samples taken for testing are a minute fraction of the total volume of soils and groundwater present on site. Therefore, there is a residual risk that undetected pockets of contamination may be present on site, situated between testing locations.

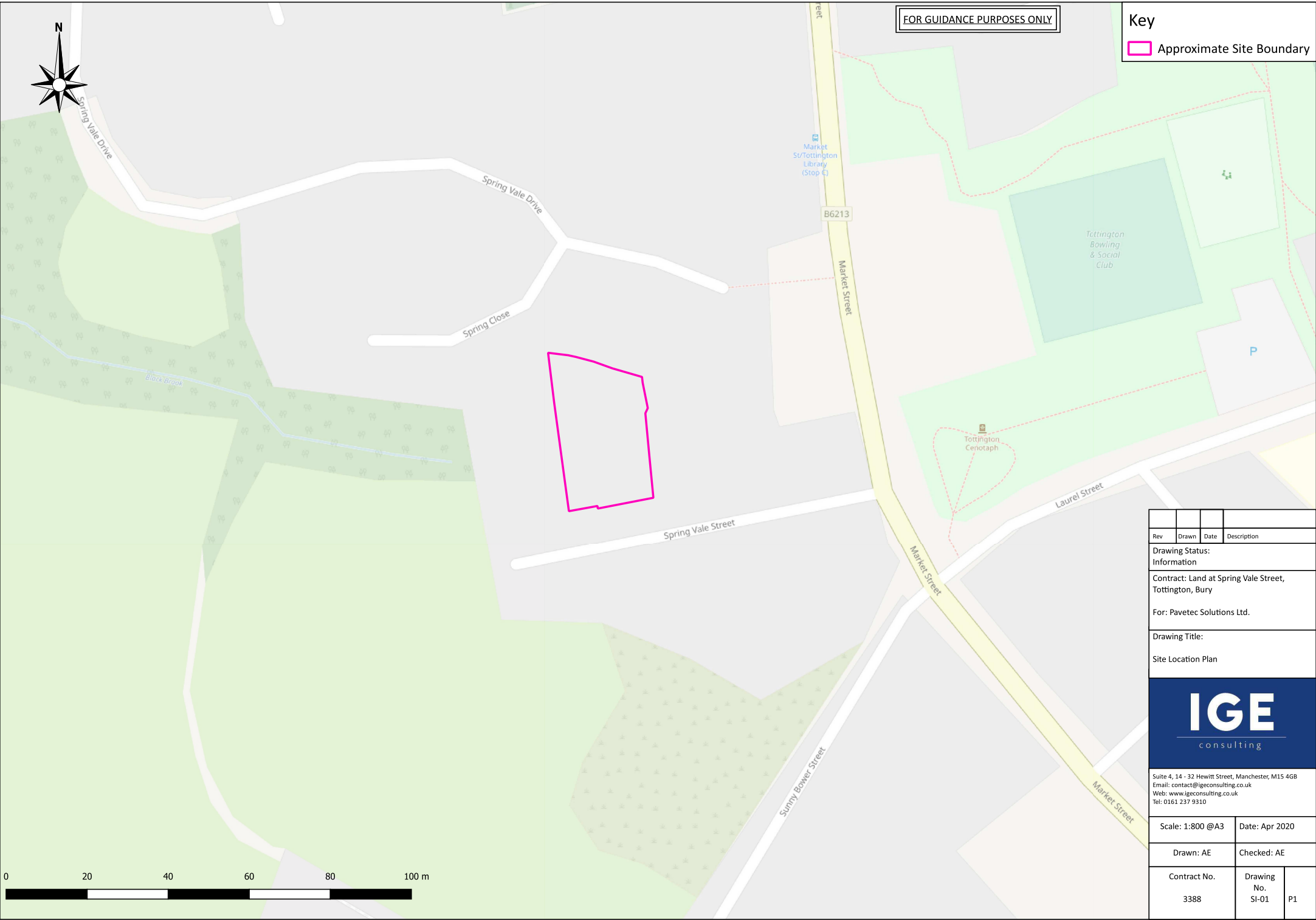
When investigating or developing potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and temporally. The absence of certain ground, ground gas, contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

Extent of Geo-Environmental Studies

This report is strictly limited to the nature of contamination contained within the ground and groundwater at the site. The report does not cover environmental aspects such as air or noise pollution and ground vibrations and the like. In addition, ecological matters relating to wildlife, flora and fauna have not been investigated as part of this report. In particular, the site has not been inspected for the presence or otherwise of invasive species e.g. Japanese Knotweed. It is recommended that the Client appoints a specialist in this subject to carry out a detailed inspection / survey of the site if its presence is suspected. Where mention has been made to the identification asbestos or asbestos-containing materials this is for indicative purposes only and does not constitute or replace a full and proper survey. If an Unexploded Ordnance (UXO) report has been obtained within the report, it has been so on the basis of Health and Safety concerns and no assessment has been made other than transcribing the recommendations of the sub-contractor contained within the report. In terms of a potential contaminative source, unless ordnance has been manufactured / stored on site, UXOs will only be determined as a contaminative source following a positive identification on site.

APPENDIX 2

FIGURES AND DRAWINGS



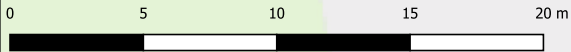
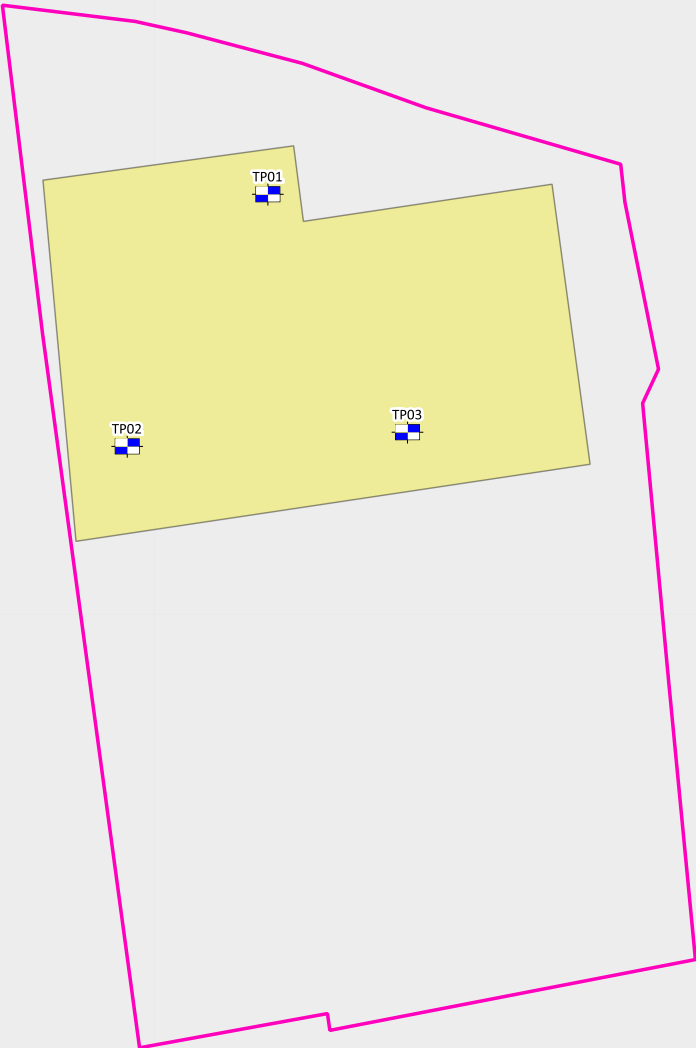
Rev	Drawn	Date	Description
Drawing Status: Information			
Contract: Land at Spring Vale Street, Tottington, Bury			
For: Pavetec Solutions Ltd.			
Drawing Title: Site Location Plan			
IGE consulting Suite 4, 14 - 32 Hewitt Street, Manchester, M15 4GB Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 237 9310			
Scale: 1:800 @A3		Date: Apr 2020	
Drawn: AE		Checked: AE	
Contract No. 3388	Drawing No. SI-01	P1	



Spring Close

FOR GUIDANCE PURPOSES ONLY

-  Approximate Site Boundary
-  Proposed Plots
-  Trial Pits

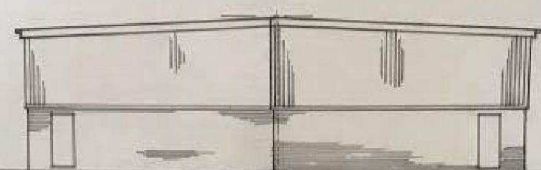


Rev	Drawn	Date	Description
Drawing Status: Information			
Contract: Land at Spring Vale Street, Tottington, Bury			
For: Pavetec Solutions Ltd.			
Drawing Title: Exploratory Hole Location Plan			
IGE consulting			
Suite 4, 14 - 32 Hewitt Street, Manchester, M15 4GB Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 237 9310			
Scale: 1:200 @A3		Date: Nov 2020	
Drawn: JH		Checked: AE	
Contract No. 3388	Drawing No. SI-03	P1	

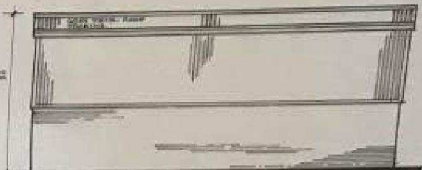
APPENDIX 3
PROPOSED DEVELOPMENT PLAN



R.H. SIDE ELEVATION 1:100



REAR ELEVATION



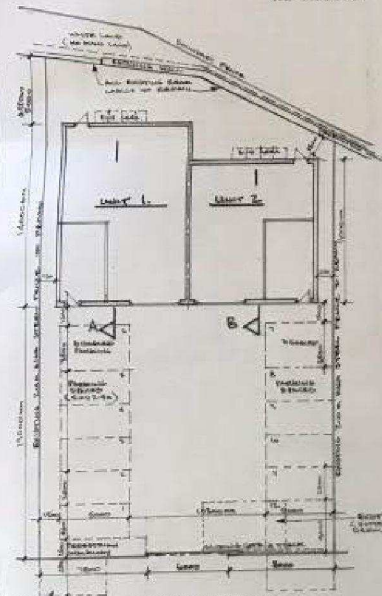
L.H. SIDE ELEVATION

House No. 100
1000 R.H. St. 3 (Spring Vale St. Bury).

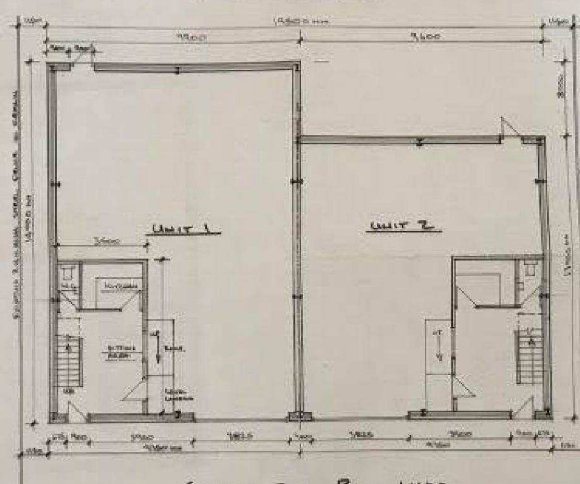
A

B

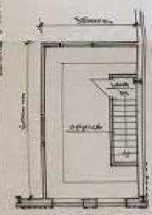
1000 R.H. St. 3
For Information.



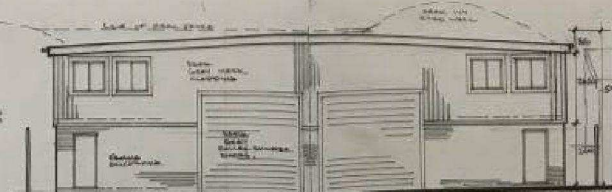
SITE PLAN 1:200



GROUND FLOOR PLAN 1:100



FIRST FLOOR PLAN
(Unit 1 Industrial Unit (Unit 2))



FRONT ELEVATION 1:100

Architectural & Building Services
NEIL BUTTERWORTH

Tel: 01253 8778 2000
50 Higher Ashwood Road, Bury, Lancashire, M33 4LJ

Job Title: PROPOSED NEW INDUSTRIAL UNITS, WITH FIRST FLOOR OFFICES, AT SPRING VALE ST, TOTTINGTON, BURY.

Drawing Title: PROPOSED PLANS & ELEVATIONS

Scale: 1:100	Date: OCT. 19	Drawn by: N.B.	Drawing No.: 2
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Client Copy

APPENDIX 4

TRIAL PIT LOGS AND PHOTOGRAPHS

[illegible]

Trial Pit Photos

TP01

Spring Vale Street



Image 1. TP01
TP01



Image 2. TP01 SPOIL
TP01 SPOIL

Suite 4, 14-32 Hewitt St Manchester, M15 4GB email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk				Trial Pit Log				Trial Pit No. TP02 Sheet 1 of 1			
Project Name: Spring Vale Street						Level (mAOD): 144.29		Date: 17/11/2020		Project No. 3388	
Location: Tottington						Weather: Overcast				Logged By JH	
Client: Pavetec Solutions Ltd.						Co-ords: 377494E - 412937N				Checked By AL	
Water Strike	Samples & In Situ Testing			Depth (mbgl)	Level (mAOD)	Stratum Description					
	Depth (m)	Type	Results								
	0.20	B	5kg	0.10	144.19	TARMACADAM MADE GROUND Dark brown SAND and GRAVEL. Gravel is angular to subangular of fine to coarse red brick (50%), concrete (20%), ceramic (10%) and mixed lithologies (20%). MADE GROUND					
	0.80	B	5kg	0.70	143.59	Firm, friable, orangish brown, slightly gravelly CLAY. Gravel is subangular to well rounded of fine to coarse mixed lithologies. GLACIAL TILL					
						With occasional cobbles from 1.20m bgl. Cobbles are subangular to subrounded of mixed lithologies.					
	1.70 1.70 1.70 1.90 1.90 1.90 2.30 2.30 2.30	B	5kg HVP=134 HVP=151 HVP=178 HVP=128 HVP=178 HVP=192 HVP=100 HVP=172 HVP=194	1.60	142.69	Firm to stiff, light greyish brown, slightly gravelly, silty CLAY with occasional thin light grey sand lenses. Gravel is angular to well rounded of fine to coarse mudstone (30%) and mixed lithologies (70%). GLACIAL TILL					
						Becoming friable, gravelly and stiff from 2.00m bgl.					
				3.00	141.29	Trial Pit terminated at 3.00m.					
Water Strike											
Depth Strike (mbgl)		Remarks									
		No strike									
Stability: Stable											
Remarks: Too friable for hand shear vane tests from 0.70m to 1.60m bgl. Trial pit terminated at 3.00m bgl at target depth.											

Trial Pit Photos

TP02

Spring Vale Street



Image 1. TP02
TP02



Image 2. TP02 SPOIL
TP02 SPOIL

Suite 4, 14-32 Hewitt St Manchester, M15 4GB email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk				Trial Pit Log ver. 1.1				Trial Pit No. TP03 Sheet 1 of 1				
Project Name: Spring Vale Street						Level (mAOD): 143.70		Date: 17/11/2020		Project No. 3388		
Location: Tottington						Weather: Overcast				Logged By JH		
Client: Pavetec Solutions Ltd.						Co-ords: 377505E - 412937N				Checked By AL		
Water Strike	Samples & In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description					
	Depth (m)	Type	Results									
▼	0.40	B	5kg	0.05	143.65		TARMACADAM					
							MADE GROUND					
				0.25	143.45		CONCRETE					
							MADE GROUND					
				Dark greyish brown, gravelly SAND. Gravel is angular to subrounded of fine to coarse sandstone (30%), red brick (30%), concrete (20%) and mixed lithologies (20%).								
				MADE GROUND								
				Pit moved north to avoid suspected electrical service at 0.65m bgl running east to west.								
				Suspected ceramic land drain (c. 0.15m diameter) at 0.75m bgl running north to south.								
	0.80			Soft to firm, orangish brown, silty CLAY with occasional gravel. Gravel is angular to subrounded of fine to coarse sandstone (50%), mudstone (20%) and mixed lithologies (30%).								
				GLACIAL TILL								
0.90	B	5kg HVP=37	0.80	142.90		Firm, damp, grey, gravelly CLAY with frequent cobbles and cobble to boulder sized pockets of sandy gravel. Cobbles are subangular to well rounded of mixed lithologies. Gravel is subangular to well rounded of fine to coarse mixed lithologies.						
0.90											GLACIAL TILL	
0.90												
0.90												
1.20	B	5kg HVP=55 HVP=69 HVP=80	1.40	142.30	Wet, grey, sandy, slightly clayey GRAVEL with frequent cobbles. Cobbles are subangular to well rounded of sandstone (40%) and mixed lithologies (60%). Gravel is subangular to well rounded of fine to coarse sandstone (40%) and mixed lithologies (60%).							
1.20												
1.20												
1.20												
1.60	B	5kg HVP=55 HVP=69 HVP=80	1.40	142.30	GLACIAL TILL							
1.60												
1.60												
1.60												
1.90			1.90	141.80		Trial Pit terminated at 2.70m.						
2.70			2.70	141.00								
Water Strike Depth Strike (mbgl)Remarks 0.75Initial fast ingress from suspected land drain, slowing to a slight ingress. Water has a slight hydrocarbon sheen. Stability: Stable Remarks: Trial pit terminated at 2.70m bgl at target depth.												

Trial Pit Photos

TP03

Spring Vale Street

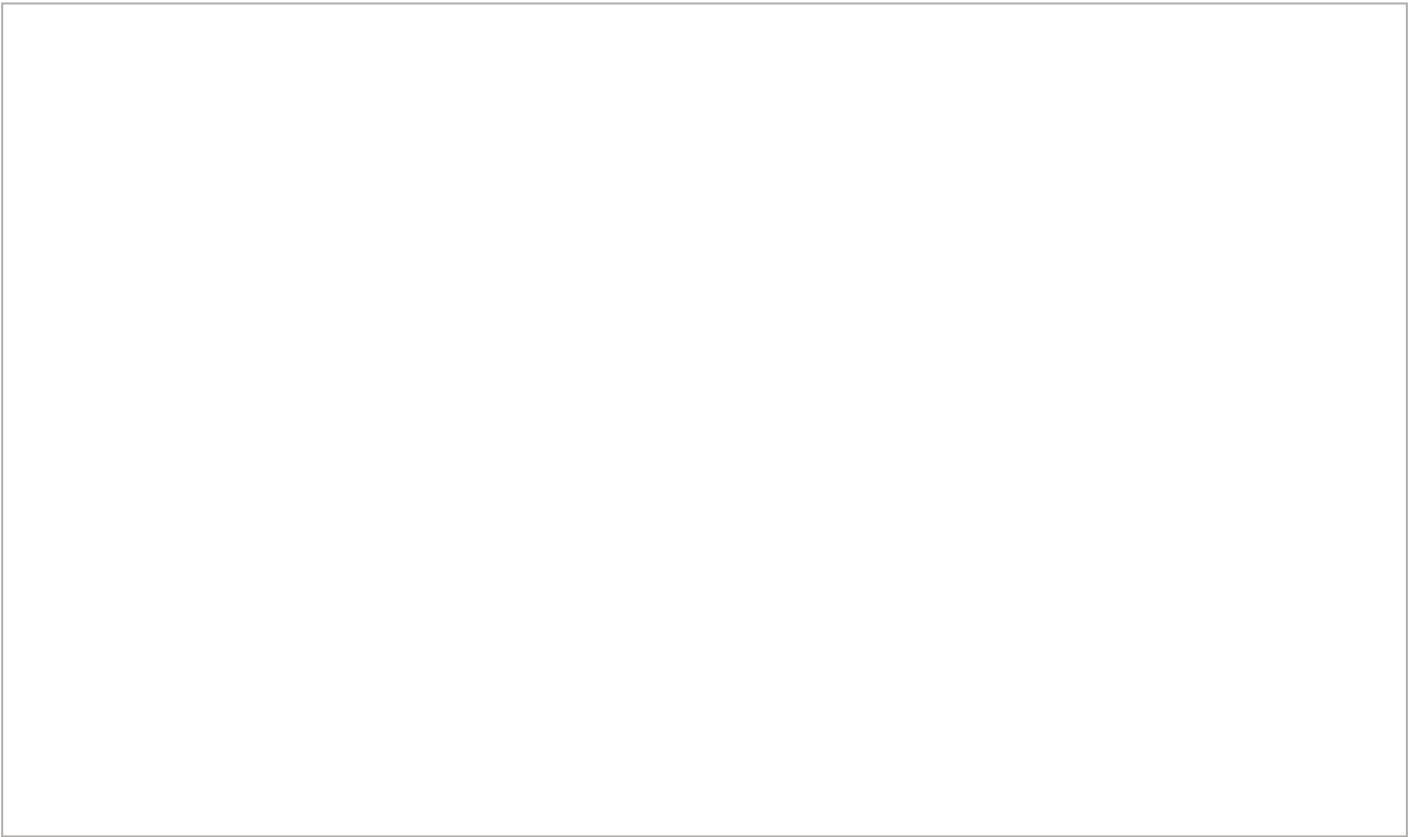


Image 1. TP03
TP03



Image 2. TP03 SPOIL
TP03 SPOIL

APPENDIX 5

CHEMICAL LABORATORY TEST RESULTS



James Harley
IGE Consulting
14-32 Hewitt Street
Manchester
M15 4GB

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

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

e: jamesharley@igeconsulting.co.uk

Analytical Report Number : 20-42486

Project / Site name:	Spring Vale Street, Tottington	Samples received on:	19/11/2020
Your job number:	3388	Samples instructed on/ Analysis started on:	19/11/2020
Your order number:	191120 01	Analysis completed by:	26/11/2020
Report Issue Number:	1	Report issued on:	26/11/2020
Samples Analysed:	3 soil samples		

Signed: _____

Zina Abdul Razzak
Senior Quality 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: 20-42486

Project / Site name: Spring Vale Street, Tottington

Your Order No: 191120 01

Lab Sample Number				1690370	1690371	1690372
Sample Reference				TP01	TP03	TP03
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.40	0.90
Date Sampled				19/11/2020	19/11/2020	19/11/2020
Time Taken				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
Moisture Content	%	0.01	NONE	13	14	16
Total mass of sample received	kg	0.001	NONE	1.2	1.2	1.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	8.2	8.2
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	1100	100	500
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.55	0.051	0.25
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	554	50.5	249
Organic Matter	%	0.1	MCERTS	2.2	3.8	0.5
Water Soluble Nitrate (2:1) as NO3	mg/kg	2	NONE	< 2.0	< 2.0	2.9
Water Soluble Nitrate (2:1) as NO3 (leachate equivalent)	mg/l	5	NONE	< 5.0	< 5.0	< 5.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.66	30	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.35	3.5	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.52	4.6	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.81	8.5	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	4.3	41	< 0.05
Anthracene	mg/kg	0.05	MCERTS	1.1	9.3	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	6.6	29	< 0.05
Pyrene	mg/kg	0.05	MCERTS	6	27	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.2	20	< 0.05
Chrysene	mg/kg	0.05	MCERTS	2.7	15	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	2.9	15	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.4	10	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.3	16	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.1	9.2	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.38	3	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.2	11	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	35.4	253	< 0.80
-----------------------------	-------	-----	--------	------	-----	--------

Analytical Report Number: 20-42486
 Project / Site name: Spring Vale Street, Tottington
 Your Order No: 191120 01

Lab Sample Number				1690370	1690371	1690372
Sample Reference				TP01	TP03	TP03
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.40	0.90
Date Sampled				19/11/2020	19/11/2020	19/11/2020
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	27	70	7.3
Barium (aqua regia extractable)	mg/kg	1	MCERTS	310	760	61
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.4	2.3	0.56
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	0.7	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	6.9	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	29	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	57	270	17
Lead (aqua regia extractable)	mg/kg	1	MCERTS	380	890	19
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.4	0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	30	86	17
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	38	81	21
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	990	390	44

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	-
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	-
o-xylene	µg/kg	1	MCERTS	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	-

Analytical Report Number: 20-42486
 Project / Site name: Spring Vale Street, Tottington
 Your Order No: 191120 01

Lab Sample Number				1690370	1690371	1690372
Sample Reference				TP01	TP03	TP03
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.40	0.90
Date Sampled				19/11/2020	19/11/2020	19/11/2020
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Petroleum Hydrocarbons						
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1
TPH C10 - C40	mg/kg	10	MCERTS	610	-	< 10
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1
TPH C6 - C40	mg/kg	10	NONE	610	-	< 10
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	9.6	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	22	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	72	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	470	-
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	-	110	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	580	-
TPH-CWG - Aliphatic (EC5 - EC44)	mg/kg	10	NONE	-	690	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	37	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	60	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	220	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	390	-
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	-	100	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	710	-
TPH-CWG - Aromatic (EC5 - EC44)	mg/kg	10	NONE	-	810	-
TPH (C10 - C25)	mg/kg	10	MCERTS	220	-	< 10
TPH (C25 - C40)	mg/kg	10	MCERTS	390	-	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample



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* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1690370	TP01	None Supplied	0.5	Brown loam and sand with gravel and brick.
1690371	TP03	None Supplied	0.4	Brown loam and sand with gravel.
1690372	TP03	None Supplied	0.9	Brown loam and clay with gravel.

Analytical Report Number : 20-42486
Project / Site name: Spring Vale Street, Tottington

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Nitrate, water soluble, in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	D	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

Analytical Report Number : 20-42486
Project / Site name: Spring Vale Street, Tottington

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
DRO (Soil)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
TPH C6 - C40 (soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method.	L076-PL	W	NONE
Water Soluble Nitrate (leachate equivalent)	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' 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.

APPENDIX 6

UNITED UTILITIES RISK ASSESSMENT

Risk assessment for water pipes (RA)

The risk assessment for water pipes will help you choose appropriate materials for your development. We are happy to deal with a risk assessment for water pipes in advance of any formal application for a new water supply.

If you need any help completing the form please call us on **0345 072 6067**.

Section 1: Development details	
Development name (<i>if it has one</i>)	Land at Spring Vale Street, Tottington
Development address	Spring Vale Street Tottington BL8 3LR
OS Grid reference (<i>mid point</i>)	377503E, 412933N
Developer's name	Pavetec Solutions Ltd
UUW reference number (<i>for UU use only</i>)	
Please provide details below of the current and historical use of the site and adjacent sites. <i>If your supporting information has details of the current and historical site use, please reference below the relevant sections of your report.</i>	
The site currently comprises offices and a yard, used for storage of plant, vehicles and materials for the Client, a groundwork contracting company. Historically, the site was farmland with a stream crossing the site until 1890 when the site was developed with suspected industrial buildings and the stream was suspected to have been culverted beneath the site. The site layout was reconfigured throughout its history, but the site remains as a light industrial yard with small buildings to the present day.	
Section 2: Preliminary risk assessment	
Has your desk study and site walkover identified any land potentially affected by contamination?	☒ Yes ☐ No
If the site is potentially affected by contamination but you have not completed any intrusive site investigation please provide details below of the rationale behind the intended pipe selection. <i>If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.</i>	

Section 3: Intrusive site investigation																									
Have you completed any intrusive site investigation?	☒ Yes ☐ No																								
Have you completed any none intrusive site investigation?	☐ Yes ☒ No																								
Date(s) when the site investigation(s) undertaken	<table><tr><td>1</td><td>7</td><td>1</td><td>1</td><td>2</td><td>0</td><td>2</td><td>0</td></tr><tr><td>D</td><td>D</td><td>M</td><td>M</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td></tr><tr><td>D</td><td>D</td><td>M</td><td>M</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td></tr></table>	1	7	1	1	2	0	2	0	D	D	M	M	Y	Y	Y	Y	D	D	M	M	Y	Y	Y	Y
1	7	1	1	2	0	2	0																		
D	D	M	M	Y	Y	Y	Y																		
D	D	M	M	Y	Y	Y	Y																		
At what level has groundwater been encountered?	metres below ground level or ☒ Not encountered																								
Table 1 (Pipeline Selection Risk Assessment Summary (PSRAS)) below classifies testing required where the preliminary risk assessment has identified land potentially affected by contamination. Please provide details below of any test groups which have not been tested and the rationale for not testing. <i>If your supporting information has details of the rationale behind not testing any particular test groups, please reference below the relevant sections of your report.</i> VOCs, SVOCs, Phenols and Cresols as no sources identified on-site																									
If the intrusive site investigation has identified concentrations above the PE threshold (see PSRAS) and your intended pipe selection is PE. Please provide details below of the rationale behind the intended pipe selection. <i>If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.</i> N/A																									
Section 4: Site remediation																									
Please provide details below of any site remediation (which may include a change in site levels) already completed. <i>If your supporting information has details of the site remediation already completed, please reference below the relevant sections of your report.</i> None undertaken																									
Has the PSRAS (Table 1) been completed using appropriate data after remediation?	☐ Yes ☐ No ☒ N/A																								
Please provide details below of any proposed site remediation and an analysis of whether this will affect your intended pipe selection. <i>If your supporting information has details of any proposed site remediation and whether this will affect your intended pipe selection, please reference below the relevant sections of your report.</i> N/A																									

Section 5: Final use of site

Please provide details below of any chemicals (including fuel) to be stored on site and any other future contamination risks which may affect your intended pipe selection.

If your supporting information has details of potential contamination risks which may affect your intended pipe selection, please reference below the relevant sections of your report.

None anticipated.

What water pipe materials are intended to be used on site?

☐ PE ☒ PE Barrier Pipe Type A ☐ PE Barrier Pipe Type B
Other (please specify): x

Section 6: Additional information

Please use the section below to provide any additional details to support your intended pipe selection.

Section 7: Risk assessor

Name and relevant qualifications of person directing the risk assessment for water pipes

Neville Shaw MICE CEng (Institute of Civil Engineers)

Name and address of risk assessor's company

IGE Consulting Ltd
Suite 4
14 - 32 Hewitt street
Manchester
M15 4GB

Date risk assessment performed

0 2 1 2 2 0 2 0

Section 8: Declaration

I confirm I have completed this form and provided supporting information in accordance with 'UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and UUW's Supplementary Guidance. I also confirm that if any further site investigation is needed and carried out, I will be required to submit an additional Risk Assessment for Water Pipes with the relevant supporting information. I understand that failure to supply any of the required information may delay my application being processed.

Name

Neville Shaw MICE CEng

Company

IGE Consulting Ltd

Telephone

0161 237 9310

Date

1 6 1 2 2 0 2 0

Please email the completed form and supporting information to DeveloperServicesWater@uuplc.co.uk or post to us at United Utilities Water, Developer Services, Second floor Grasmere House, Lingley Mere, Warrington WA5 3LP.



About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water Limited, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP.
Registered in England and Wales. Registered Number 2366678.

Table 1 - Pipe selection risk assessment summary (PSRAS)

1. Testing must be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. Please use the appropriate testing data to complete Table 1 below.

2. If more than one pipe selection is being made, for example, for pipes in different areas of a large site, a completed PSRAS is required for each selection.

What materials have been tested to populate Table 1 below?

☒ Existing ground materials ☐ Remediated materials ☐ Imported capping materials

All concentrations in mg/kg								
Test Group	Testing Required?	PE threshold	Metal Pipes/ Barrier Pipe	Laboratory Detection Limit	Testing UKAS accredited Y/N	Maximum concentration at proposed pipeline depth See Note [2]	Maximum site concentration See Note [3]	Locations and depths where concentrations exceed proposed pipeline threshold
Total VOCs	Where Preliminary Risk Assessment (PRA) has identified land potentially affected by contamination	0.5	Pass	-	-	-	-	-
Total BTEX & MTBE		0.1	Pass	0.001	Y	Below detection	Below detection	None
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass	-	-	-	-	-
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	0.1	Y	Below detection	Below detection	
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	1.0 / 2.0	Y	129	129	TP03 0.40m bgl
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	10	Y	1362	1362	TP03 0.40m bgl & TP01 0.50m bgl
Phenols* (from SVOC analysis)		2	Pass	-	-	-	-	-
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass	-	-	-	-	-
Ethers*	Only where identified	0.5	Pass					
Nitrobenzene*		0.5	Pass					
Ketones*		0.5	Pass					
Aldehydes*		0.5	Pass					
Amines		Fail	Pass					
Corrosive	Conductivity, Redox and pH	Pass	See Note [1]					

Note [1] Threshold: For wrapped steel, corrosive if pH<7 and conductivity > 400µS/cm. For wrapped ductile iron corrosive if pH<5, Eh not neutral and conductivity > 400µS/cm. For copper, corrosive if pH<5 or >8 and Eh positive.

Note [2] Water pipes are normally laid at 0.75-1.35m below finished ground level.

Note [3] Also state if liquid free product is present in soil or groundwater.

THE INSTITUTION OF CIVIL ENGINEERS

Established 1818

Incorporated by Royal Charter 1828

This is to certify that

**** NEVILLE SHAW ****

was on 1st DECEMBER 1989 admitted a

MEMBER
of
THE INSTITUTION OF CIVIL ENGINEERS

A Society established for the general advancement of Mechanical Science and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a Civil Engineer, being the art of directing the great sources of power in Nature for the use and convenience of Man.



WITNESS our hands and Seal at
Westminster this 2nd day of

DEC

President

Secretary

466 001 58