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SOLUTIONS LIMITED

PHASE II AND UPDATED RISK ASSESSMENT REPORT FOR WOODHEAD ROAD, HONLEY.

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List Of Acronyms

Acronym	Meaning
BGS	British Geological Survey
BH	Borehole
CDM	Construction Design and Management
CL:AIRE	Contaminated Land: Applications In Real Environments
CLR	Contaminated Land Report
COSHH	Control Of Substances Hazardous to Health
CSM	Conceptual Site Model
DCP	Dynamic Cone Penetrometer
DEFRA	Department for Environment Foods and Rural Affairs
DP	Dynamic Probe
DoE	Department of Environment
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	Generic Acceptance Criteria
HP	Hand Pit
HA	Hand Auger
LPA	Local Planning Authority
LQM	Land Quality Management
mbgl	Metres Below Ground Level
MP	Mackintosh Probe
NPPF	National Planning Policy Framework
NGR	National Grid Reference
OS	Ordnance Survey
SGV	Soil Guideline Value
SSV	Soil Screening Value
WSV	Water Screening Value
SPOSH	Significant Possibility of Significant Harm
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TP	Trial Pit
TT	Trial Trench
WS	Windowless Sample / Window Sample

1. Introduction

GeoEnviro Solutions Ltd (GES) was instructed by Paul Matthews Architectural Ltd (the Client) to conduct a Phase II geoenvironmental site investigation (SI) for the site located at Woodhead Road, Honley, HD9 9PP.

We are content that as a result of the actual site investigation works and subsequent soil testing undertaken, as outlined within this report, we have characterised the ground conditions and consequently the potential for contamination to exist on site. These works and ensuing assessment have been detailed in this report.

This report is written in accordance with the guidance set out in Land Contamination Risk Management (LCRM), Guiding Principles for Land Contamination (GPLC) 1 – 3, and the National Planning Policy Framework (NPPF).

1.1 Objectives

The objectives of this Phase II report are to:

- To gain an understanding of any concerns of the regulatory authorities (Local Authority Planning, Building Control and Environmental Health departments and the Environment Agency) regarding local land filling, flooding, mining, quarrying and other concerns.
- Establish the environmental setting, including sensitivity in relation to human health, surface water, groundwater, and ecological receptors based on the findings of the preliminary CSM.
- Assess by quantitative means the potential nature and extent of contamination from those uses and the environmental risk and liabilities which may affect the site redevelopment.
- Refine the prevalent source-pathway-receptor linkages present on site by means of a Tier 2 contamination risk assessment which incorporates the formulation of an Updated Conceptual Site Model.
- To identify the ground conditions and provide details of their engineering properties in order to facilitate foundation design for the proposed development.

1.2 Background and Instruction

The site investigation undertaken was specified by ourselves as a result of recommendations made in our previously issued Phase I: Desktop Study & Risk Assessment Report for the site (Report Reference: GES 1623-21 PI, issued in September 2021), to which this report should be read in conjunction with. As such this report seeks to address the potential pollutant linkages identified within the Preliminary Conceptual Site Model contained within our Phase I: Desktop Study report.

The site investigation was undertaken off Woodhead Road, Honley, encompassing the proposed area of the two new two storey properties. This report provided the information collected as a whole but references that data specifically relating to the proposed construction.

1.3 Previous Investigations

GES have produced a Phase I: Preliminary Risk Assessment report, dated September 2021.

1.4 Scope

Prior to commencing the site works the proposed scope of investigation was as follows:

- Four window sample boreholes to a nominal depth of up to 5.00 mbgl or refusal.
- Environmental and geotechnical sampling, and in situ geotechnical testing (SPTs).
- Subsequent environmental laboratory testing of samples.
- Subsequent geotechnical laboratory testing of samples.
- The installation of four combined gas and groundwater monitoring standpipes to a nominal depth of 5.00mbgl.
- Subsequent gas and groundwater monitoring on six occasions over a three-month period, commencing approximately one week after the completion of the ground investigation.
- Interpretation and risk assessment of the data in respect of potential contamination and subsequent updating of the preliminary CSM.
- Interpretation of the geotechnical data to provide details of their engineering properties to facilitate foundation design for the proposed development

However, the proposed scope may be subject to change dependent upon site conditions, access, restrictions, and obstructions.

2. Physical Setting

2.1 Site Information

Location

The site is located at land off Woodhead Road, Honley, at approximate National Grid Reference NGR: 414265:411700 (centre of the site).

A site location plan is presented as Drawing No. GES 1623-01 in **Appendix 1**.

Topography

The site is an irregular shaped piece of land with an approximate area of 0.1 Ha. The topography of the site is generally flat, albeit on two distinct levels, approximately 4.0m apart.

Access

The site is accessed from the west, off Woodhead Road, at road level. The lower level is accessed from an entrance via the property adjacent to the north of the site.

Site Description

A site reconnaissance was carried out on the 16th September 2021. All details from the site reconnaissance are included in the site description below.

The site is an irregular shaped piece of land with an approximate area of 0.1 Ha.

The site is currently occupied by a partially cleared site in the early stages of being prepared for construction. Approximately 4 to 5 m into the site from this entrance way is the top of a retaining wall, with a height of approximately 4m. The top of the retaining wall is protected by a Heras type fence. The upper area is occupied by partially installed services (which protrude from the retaining wall) has several planters surround existing trees, the start of a landscaping provision.

The southern area is currently occupied by rough grassland, the northern area contains numerous pallets of building stone. There is a further stockpile of similar stone along with small stockpiles of general rubble in various locations across the site. A footpath runs from the lower section eastwards, round the rear of the site, down a slight slope towards an area of undeveloped land, level with the River Holme, which runs along the east of the site, northwards, bending around the north eastern corner before flowing northwards.

An approximate distribution of the surface covering is given below in Table 2.1: Site Surface Covering.

Table 2.1: Site Surface Covering

Type of Surface Cover	Distribution (%)
Soft Ground (grassed and landscaped areas)	60
Hardstanding	40
Roadways	0
Buildings	0
Water (ponds, streams)	0

2.2 Geology

The British Geological Survey shows the site to be underlain by the geological succession outlined overleaf in Table 2.2: Published Geology.

Table 2.2: Published Geology

Geology	Description /strata
Artificial	None Recorded
Superficial	Alluvium
Bedrock	Rough Rock Sandstone

There are no known artificial deposits recorded underlying the site. However, ground conditions associated with construction and highways are to be anticipated.

The superficial geology recorded underlying the site is shown to be Alluvium which is generally described as *'Clay, Silt, Sand and Gravel. Sedimentary superficial deposit formed between 11.8 thousand years ago and the present day during the Quaternary period.'* (BGS general description).

The bedrock geology beneath the site is shown to be the Rough Rock Sandstone Formation which is generally described as *'Sedimentary bedrock formed between 320 and 319 million years ago during the Carboniferous period.'* (BGS general description).

2.3 Hydrogeology

The Environment Agency designate aquifers in accordance with the Water Framework Directive. These designations reflect not only the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetlands ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

Groundwater Vulnerability

Table 2.3 below presents the Environment Agency groundwater vulnerability definitions:

Table 2.3: Groundwater Vulnerability Definitions

Definition	Description
High Vulnerability	Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
Medium Vulnerability	Intermediate between high and low vulnerability.
Low Vulnerability	Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Superficial Deposits

The Environment Agency aquifer classification scheme indicates that the superficial aquifer designation for the site is classed as Secondary A aquifer which are generally described as *'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'* (EA general description).

Bedrock

The Environment Agency aquifer classification scheme indicates that the bedrock aquifer designation for the site is classed as Secondary A aquifer which are generally described as *'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.'*

The groundwater vulnerability in the vicinity of the site is classified as Low.

2.4 Hydrology

The nearest surface watercourse to the site is the River Holms, located approximately 21m north of the site.

2.5 Contaminant Sources

On-Site Sources

The following possible on-site sources have been identified from the historical study:

- Historical made ground from past demolition activities.
- Uncontrolled infilling from historical landfilling.

The following possible on-site sources have been identified from the Enviro + Geo Insight data:

- Uncontrolled infilling from historical landfilling.

Off Site Sources

The following off site sources have been identified from the historical Enviro + Geo Insight data:

- Historical landfilling.
- Dye Works
- Gas Works
- Candle Works

There are further entries present, but these are considered far enough from the site to pose no risk.

The following contaminants are potentially associated with the on-site sources:

- Heavy Metals and Metalloids
- Inorganics
- PAH
- Asbestos
- Hazardous Ground Gases.

The following contaminants are potentially associated with the off-site sources.

- Heavy Metals and Metalloids
- Inorganics, including Cyanide
- PAH
- Hazardous Ground Gases.

3. Proposed Development

We understand current plans for the development of the site include:

- Two new two storey residential properties including parking and gardens.

An outline development drawing for the site as drawn by the Client, referenced 20/313/03g, and dated February 2020, can be reviewed within **Appendix 1**.

The risk assessment undertaken in this report is therefore based on the proposed development as outlined here. Any variation from this may require a re-assessment and the Conceptual Site model updating accordingly.

4. Fieldworks

4.1 Site Investigation

All site investigation works were completed from 13th October to 15th 2021 under the supervision of a geoenvironmental engineer from GES.

The ground investigation has been carried out in accordance with BS5930: 2015 and the UK Specification for Ground Investigation Second Edition 2012.

All strata descriptions were undertaken in accordance with BS5930: 2015 Amendment 1; EN ISO 14688 -1; EN ISO 14688 -2; and EN ISO 14689.

In summary the investigation included:

- Four windowless sampler boreholes were completed, by means of a competitor dart rig, to a maximum depth of 9.00 mbgl. The location of exploratory position was selected relative to the historic land use and the current proposed redevelopment plans for the site.
- Soil samples were removed from shallow sub surface locations, with further samples taken at observed changes in strata. Samples were subsequently placed in suitable containers including 1kg tubs and 250ml glass jars and placed in cool boxes with cool packs prior to storage within our in-house laboratory fridges and then subsequent forwarding to our designated laboratory for analysis.

The positions of exploratory holes in relation to the existing / intended site layout can be reviewed on drawing number GES1623-21/02 within **Appendix 1**.

5. Geology and Ground Conditions

The following ground conditions were encountered during the site investigation.

5.1 General

A generalised summary of the ground conditions encountered, depths to base, and thickness recorded from the exploratory hole records is presented below in Table 5.1: Summary of Ground Conditions.

Table 5.1: Summary of Ground Conditions

Geology / Strata	Depth (mbgl)				Thickness (m)		Locations encountered
	Top		Base		Min	Max	
	Min	Max	Min	Max			
Made Ground	0.00	8.60	3.00	8.60	3.00	8.60	All Locations
Gravelly clayey **Sand**	3.00	3.00	4.00	4.00	1.00	1.00	WS01
Sandy gravelly **Clay**	8.60	8.60	9.00	9.00	0.40	0.40	WS03

Detailed strata descriptions are presented on the windowless sample borehole logs presented in **Appendix 2**.

5.2 Made Ground

Made ground was encountered in all exploratory hole locations from ground level to depths of between, 3.00 and 8.60 mbgl. The made ground encountered comprised of granular and cohesive made ground materials.

Granular Made Ground

Granular made ground materials were encountered in WS01 from ground level to depths of between 3.00 and 8.60 mbgl, and generally comprised clayey gravelly sand with fragments of brick and concrete.

Cohesive Made Ground

Cohesive made ground materials were encountered WS03 from ground level to depths of between 2.00 and 6.00 mbgl, and generally comprised sandy gravelly clay with fragments of brick and concrete.

5.3 Superficial Deposits (Alluvium)

Soils considered to represent Alluvium were encountered in WS01 and WS03 directly beneath the made ground and were proven to depths of between 4.00 and 9.00 mbgl.

5.4 Bedrock (*Rough Rock Sandstone*)

Bedrock was not encountered during this ground investigation.

5.5 Groundwater

Groundwater was generally not encountered during the site investigation. However, it should be noted that groundwater levels are dependent upon seasonal variations and can change after periods of prolonged rainfall or drought.

5.6 Groundwater Monitoring

A programme of groundwater monitoring is underway and will be reported upon completion.

5.7 Ground Gas Monitoring

A programme of ground gas monitoring is underway and will be reported upon completion.

5.8 Obstructions

No obstructions were encountered during this ground investigation.

5.9 Contamination

No visual or olfactory evidence of contamination was encountered or observed during this ground investigation.

6. Insitu Testing

6.1 Standard Penetration Tests

Standard penetration testing was undertaken in all the boreholes.

Reference to the Standard Penetration Tests results also shows a degree of variability within the ground conditions encountered; N values of between 2 and 50+ were recorded, generally indicating deposits of low to high density.

7. Laboratory Testing - Geotechnical

The following programme of laboratory testing has been undertaken on samples obtained during this investigation:

- Particle Size Distribution BS 1377: 1990: Pt2: 9.2

The test results are summarised in Table 7.1: Summary of Geotechnical Test Results, below:

Table 7.1: Summary of Geotechnical Test Results.

Table: Summary of Geotechnical Test Results			
Test type	**Number of tests**	**Results**	**Comments**
Particle Size Distribution	2	Sandy GRAVEL	

The test results are presented in **Appendix 3**.

The appropriate geotechnical properties are summarised in Table 7.2: Summary of Geotechnical Properties, below:

8. Laboratory Testing - Sulphates

The following programme of chemical laboratory testing has been undertaken on samples obtained during this investigation:

Four samples of the underlying naturally occurring deposits in were submitted for assessment of water-soluble sulphate, total sulphate, pH value and total sulphur concentrations.

Water-soluble sulphate concentrations of 24 mg/l to 215 mg/l were recorded, with pH values ranging from of 8.0 to 9.0 units.

Reference to BRE Special Digest 1 and the test results indicates the results from the fall within Design Sulphate Class DS-1. Consequently, concrete may be designed to AC-1s concrete classification.

9. Geotechnical Recommendations

9.1 Foundations

The weak, near surface soils and made ground are not considered suitable for the construction of shallow foundations due to the risk of unacceptable total and differential settlement occurring under moderately light surface loading.

The site is present on a slope and an existing retaining wall is present. WS01 was undertaken through the retained soils behind the wall and revealed made ground to 3.0 mbgl with dense sand recorded to 4.00 mbgl upon which refusal was recorded and likely represents the weathered deposits of the Rough Rock Sandstone.

WS02 to WS03 were undertaken at the lower level from the base of the retaining wall to the extent of the garden areas. WS02 and WS03 were placed to target the areas of development. The data suggests that land filling has been undertaken on areas of the site with WS04 drilled to further investigate the potential for made ground in the garden areas. The boreholes WS02 to WS04 revealed significant made ground deposits to depth with natural soils recorded in WS03 at depths from 8.60 mbgl. WS02 suggested a transition to natural deposits from 6.00 mbgl with the made ground.

As a consequence, traditional strip and spread deposits are unlikely to be suitable. These would be required from C8.00mbgl and as such would require significant earthworks, shoring and could cause instability in the adjacent properties by the large excavations. Moreover, significant soils may be need to be taken off site.

In view of the above, consideration may be directed to the use of piles to transfer the foundation loads through the fill to more competent soils at depth. For preliminary design purposes it is considered that driven pre-cast concrete piles are likely to represent the most economical foundation solution. In order to formulate a suitable design, it is recommended that the advice of specialist piling contractors be sought. In addition, the pile design should include provision for negative skin friction within the made ground soils as these deposits may be subject to collapse compression if not treated.

9.2 Excavations

Some groundwater was encountered during the investigation at depth. However, it should be appreciated that groundwater levels are subject to seasonal variation or changes on local drainage conditions.

Groundwater is unlikely to represent a particular problem to the construction of the development; however, may become a problem if encountered with excavations in the made ground, sand and gravels during inclement weather. Furthermore, it should be recognized that slight seepages and minor water entries may combine in any long trench excavations to create a significant volume of water which may cause local problems during the construction phase. Any minor groundwater seepages or significant standing water within excavations made upon this site may be removed by using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped. Advice on Groundwater Control is given in CIRIA Report No 515 – Groundwater Control Design and Practice.

The stability of the excavation faces cannot be guaranteed thus temporary support to the excavation faces may become necessary. Under no circumstances should operatives be allowed to enter unsupported excavations.

Subject to space constraints, excavations could be battered back to a suitable angle of repose (typically 1:1 for a 1.00 m deep excavation). Alternatively, if there is a requirement to protect nearby structures or services, appropriate supports may be required. Advice on excavation support is given in CIRIA Report No 97 – Trenching Practice.

Where trench support/shoring is utilised an appropriately qualified and experienced engineer should design the support system. The shoring/support will require regular inspection in accordance with published guidelines to ensure that the support/shoring is adequate for the ground conditions present.

9.3 Groundworks Watching Brief

We would recommend that a watching brief be maintained during the course of the development, particularly during the ground works stage.

During construction works visual and olfactory appraisal of the underlying soils should be made. If during construction works any material is noted to show visual and/or olfactory signs of contamination an environmental consultant should be contacted to supervise/guide further works. This material should be stockpiled separately and tested prior to its appropriate removal off site or re-use as necessary.

If any landscaping materials are to be imported on site, they should be tested to check that they are suitable for the intended use. Clean, uncontaminated rock, subsoil brick rubble, crushed concrete, ceramics and topsoil only should be permitted as infill material.

9.4 Services

Given that new services will be installed as part of the redevelopment of the site, we would recommend the local water board be contacted to determine their specification for the type of pipework, which should be used on this site.

All services and in particular potable water supply pipework should comprise of material that is resistant to attack and degradation to chemical attack.

Further information can be found within the published guidance for the ‘Selection of Water Supply Pipes to be used in Brownfield Sites’, issued in January 2011 by the UK Water Industry Research (UKWIR), this supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note – ‘Laying Pipes in Contaminated Land’ which has been withdrawn.

9.5 Offsite Disposal

If any soils are to be removed off site, it may be prudent to undertake Waste Acceptance Criteria (WAC) analyses on the soils to be removed.

All materials must be transported in compliance with the Duty of Care Regulations by authorising movements with Carrier’s individually numbered Duty of Care conveyance notes, complete with the appropriate EWC Codes. All relevant dockets will need to be kept; to provide evidence of the removal as these may be required as part of a Validation Report.

10. Contamination

10.1 Soil Testing

All samples were sent to a UKAS accredited chemical testing laboratory, and MCERTS were used where available. The analytical strategy focussed on a general suite of potential contaminants and the analytical suites are summarised in Table 4.1 Summary of Chemical Testing Suite below.

Table 4.1: Summary of Chemical Testing Suite

Testing	Comment	No. of soil samples analysed
General metals suite including Arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, phenol, selenium, zinc, pH, and water soluble sulphate	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4
Speciated PAH and TPH CWG	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4
Asbestos Screen	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4

All chemical testing results are presented in **Appendix 4**.

The results of this laboratory testing have been compared to the Soil Guideline Values (SGVs) as well as the CIEH 'LQM' guideline values for inorganic and organic contaminants in soils. The proposed development of the site is intended to comprise of residential and therefore screening has been made against a land use of 'Residential with plant uptake'.

A set of Screening Values are provided in **Appendix 5**.

10.2 Selection of Screening Criteria

The on-site receptors for the study site are considered to be:

- Construction workers (during redevelopment of the site only).
- Future maintenance workers (following redevelopment).
- Future end users and site visitors (following redevelopment); and
- Trespassers (during redevelopment).

Risks to construction workers during the redevelopment process will be mitigated by adhering to appropriate health and safety legislation, and the wearing of appropriate personal protective equipment (PPE). During redevelopment, the site will be securely fenced to prevent trespassers

from accessing the site, and good site management practices will be implemented to mitigate exposure to off-site receptors.

The potential pathways for contaminants within the soil to human health receptors following redevelopment are considered to be:

- Direct ingestion of soil and soil derived dust.
- Dermal contact with soil outside and soil derived dust inside.
- Inhalation of soil derived dust inside and outside; and
- Inhalation of soil derived vapours inside and outside.

The potential pathways for contaminants within the soil to off-site human health receptors following redevelopment are considered to be:

- Direct ingestion of soil and soil derived dust.
- Dermal contact with soil outside and soil derived dust inside.
- Inhalation of soil derived dust inside and outside; and
- Inhalation of soil derived vapours inside and outside if contamination within soil is able to migrate across the site boundary within.

In the first instance, the results of this laboratory testing have been compared to generic assessment criteria (GAC) for the residential with homegrown produce land use scenario. These incorporate the following pathways:

- Direct ingestion of soil and soil derived dust.
- Dermal contact with soil outside and soil derived dust inside.
- Inhalation of soil derived dust inside and outside; and
- Inhalation of soil derived vapours inside and outside.

Contaminants have been screened against revised LQM/CIEH S4UL criteria[i] where available. These GAC have been designed for use under planning, using Health Criteria Values based on minimal risk, and updated exposure parameters. The S4UL are intended to replace the previous LQM/CIEH GAC. The S4UL are based on the assumption of a sandy loam soil the 2.5% soil organic matter (SOM) criteria have been used, where available and appropriate, in the first instance. All soil samples were analysed for %SOM, the range was from 1.41 – 12.2%, and so this conservative approach is considered appropriate for initial screening.

Where no S4UL are available, the EIC/ AGS/ CL:AIRE/ GAC[ii] have been used. The toxicological criteria within these are also based on minimal risk. It is recognised that these criteria have not recently been updated, and in particular, do not incorporate the slightly higher inhalation rates that have been used within the S4UL. However, given that they incorporate additional pathways, they are considered suitable for an initial screen. The EIC/ AGS/ CL:AIRE/ GAC are also based on a sandy loam soil and the 1% SOM criteria have been used in the first instance.

There is neither an S4UL nor a EIC/ AGS/ CL:AIRE/ GAC available for lead. In the absence of a GAC based on minimal risk, the C4SL for lead has been used. It is recognised that this is based on a “low level of toxicological concern” rather than on a minimal risk level. However, it is considered appropriate for use under planning, especially for a site where there will effectively be no pathways for inorganic metals following redevelopment.

All the GAC are based on a sandy loam soil. This is considered appropriate for use for initial screening. Although it is apparent from the laboratory soil descriptions, that the Made Ground, by its very nature is heterogeneous, and often has a significant sand/gravel component, especially at

shallow depths, it is noted that many of the soil descriptions have a significant clay component at increasing depth.

All of the GAC assume unsaturated soils. However, the use of the GAC is considered to be conservative, because they assume a certain air-filled porosity and water-filled porosity.

The GAC also assume that no free phase product is present and are not intended for use in this instance. No free product was observed within soils during the site investigation.

10.3 Soil Testing Results and Screening

All metals, PAHs, and TPH CWG analytes are presented in the following tables with units in mg/kg unless otherwise stated. Other potential contaminants of concern are only shown where there is at least one result exceeding the limit of detection.

The results of the chemical laboratory testing are provided in **Appendix 4**.

Tables 10.1: Metalloids Soil Exceedances, Table 10.2: PAH soil Exceedances and Table 10.3: TPH CWG Aliphatic/Aromatic Soil Exceedances overleaf below summarize the soil testing results.

Metalloids

Table 10.1: Metalloids Soil Exceedances

Determinant	Min	Max	GAC	Number of exceedances	Location of exceedances
Arsenic	8.3	21.4	37*	0	
Cadmium	0.2	0.6	11	0	
Chromium total	26.9	43.8	910*	0	
Chromium (VI)	<0.1	0.2	6*	0	
Copper	36.7	52.7	2400*	0	
Lead	35	301.7	200*	1	WS02 @ 0.30 mbgl
Mercury	<0.5	<0.5	120*[a]	0	
Nickel	16.1	46.9	180*[b]	0	
Selenium	<0.50	<0.5	250*	0	
Zinc	90.2	131.7	3700*	0	
Total Phenols	<0.6	<0.6	1500*	0	
Total Cyanide	<0.6	<0.6	34*	0	

**LQM/CIEH GAC for Public Open Space Near Residential' use scenario based on a sandy loam soil and 2.5% SOM.*
a) Based on the inorganic mercury GAC as the conceptual site model does not suggest that other forms of mercury are likely to be present on site.
b) LQM issued an update to the nickel S4ULs in August 2015, and this has been taken into account.

Organics

Table. 10.2: PAH Soil Exceedances

Determinant	Min	Max	GAC	Number of exceedances	Location of exceedances
Acenaphthylene	<0.09	0.20	1100*	0	

Determinant	Min	Max	GAC	Number of exceedances	Location of exceedances
Acenaphthene	0.16	0.32	920*	0	
Anthracene	0.62	0.88	11000*	0	
Benzo(a)anthracene	1.51	2.97	13*	0	
Benzo(a)pyrene	1.63	4.01	3*	1	WS02 @ 0.30 mbgl
Benzo(b)fluoranthene	1.74	4.24	3.7*	1	WS02 @ 0.30 mbgl
Benzo(k)fluoranthene	0.76	1.62	100*	0	
Benzo(ghi)perylene	0.71	2.22	350*	0	
Chrysene	1.72	3.12	27*	0	
Dibenz(a,h)anthracene	0.19	0.52	0.3*	1	WS02 @ 0.30 mbgl
Fluoranthene	3.69	5.68	890*	0	
Fluorene	0.16	0.22	860*	0	
Indeno(1,2,3-cd)pyrene	0.8	2.34	41*	0	
Naphthalene	0.13	0.22	13*	0	
Phenanthrene	1.57	2.43	440*	0	
Pyrene	3.15	5.35	2000*	0	

**LQM/CIEH GAC for Public Open Space Near Residential' use scenario based on a sandy loam soil and 2.5% SOM.*

Table 10.3: TPH CWG Aliphatic/Aromatic Soil Exceedances

Determinant	Min	Max	GAC	Number of exceedances	Location of exceedances
Aliphatic >C5 - C7	< 0.228	< 0.237	160*	0	
Aliphatic >C6 - C8	< 0.228	< 0.237	530*	0	
Aliphatic >C8 - C10	< 0.228	< 0.237	150*	0	
Aliphatic >C10 - C12	< 4.55	< 4.73	760*	0	
Aliphatic >C12 - C16	< 4.73	11.8	4300*	0	
Aliphatic >C16 – C35	16.53	<152.1	110,000*	0	
Aromatic >C5 - C7	< 0.011	< 0.012	300	0	
Aromatic >C7 - C8	< 0.011	< 0.012	660*	0	
Aromatic >C8 - C10	< 0.046	< 0.048	190*	0	
Aromatic >C10 - C12	< 4.55	< 4.73	380*	0	
Aromatic >C12 - C16	< 4.71	6.27	660*	0	
Aromatic >C16 - C21	13.4	28.9	930*	0	
Aromatic >C21 - C35	43.6	232	1700*	0	

** LQM/CIEH GAC scenario based on a sandy loam soil and 2.50% SOM. It is noted that the LQM/CIEH S4UL guidance recommends an additive approach for the TPH fraction, so that a hazard index approach is used. Based on a preliminary conservative comparison of maximum concentrations to S4ULs, no forward modelling is necessary to prove that this would still result in no exceedances at the site.*

Others

- The asbestos screening returned a positive result from the sample tested at WS02 @0.30 mbgl, as Crocidolite (loose insultation) in excess of 0.001 %.
- BTEX/MTBE screening returned result below the detection limit for any congeners.

10.4 Gas Monitoring Results

Gas monitoring was carried out on six separate occasions to date using a gas monitor (GA5000). Readings were taken from all four installed window sampler boreholes.

The standpipes were tested for the presence of methane, oxygen, carbon dioxide and hydrogen sulphide. The flow rates of the gas and barometric pressure were also recorded.

The rounds of monitoring were generally completed during low but steady pressure conditions. The third visit was the exception, where the ambient conditions were low but rising.

The results of the gas monitoring is provided in **Appendix 6** and summarised below.

Oxygen

Oxygen concentrations ranged from a minimum of 14.8% to a maximum of 21.5%.

Methane

Methane concentrations ranged from a minimum of 0.0% to a maximum of 0.1%.

The maximum peak concentration of Methane obtained was from all the standpipes during the third visit, where a rising ambient pressure was experienced.

Carbon Dioxide

Carbon Dioxide concentrations ranged from a minimum of 0.1% to a maximum of 4.1%.

The maximum peak concentration of Carbon Dioxide obtained was 4.1% from WS03 during the monitoring visit of the 16th November 2021.

Flows Rates

Flow rates were recorded during each round of monitoring from all installations, ranging from a minimum of 0.0 l/hr to a maximum of 0.1 l/hr.

Barometric pressure ranged from a low of 978 mB during the monitoring visit of the 26th November 2021 to a high of 1028 mB attained during the monitoring visit of the 17th December 2021. In the case of any negative flows, it should be assumed that any negative flows can become positive and therefore any negative flows should be taken as positive.

Gas Screening Values

The recorded concentrations of Methane and Carbon Dioxide have been used to calculate a Gas Screening Value (GSV) for the gassing regime at this site.

This value has been subsequently compared against CIRIA values supplied within CIRIA Document C665: Assessing risks posed by hazardous ground gases to buildings (2007), using Situation B for Methane and Carbon Dioxide.

C665 recommends that a maximum worst case theoretical GSV is calculated by multiplying the maximum recorded gas concentration by the maximum recorded flow, irrespective of where the standpipe is, or the date of the visit. However, it is widely accepted that this is not considered representative of the actual site conditions, as too many variables are taken into consideration. As such two alternative approaches have been utilised, both of which are considered equal valid.

- Multiply the highest recorded gas concentration by the highest recorded flow for any given standpipe, irrespective of the timing of the two data points.
- Multiply each gas concentration against the flow rate at each individual monitoring event.

As such GES has adopted the worst-case scenario approach above.

The values used represent the worst-case CO_2 and CH_4 concentrations across all installations. The maximum flow rate was 0.36l/hr and this was taken from all locations and/or monitoring visits.

Table 11.4: Calculated GSV's below summarises the gas monitoring data calculations.

Table 11.4: Calculated GSV's

Peak Flow Rate (l/hr)	Worst Case CO_2	CO_2 GSV	Worst Case CH_4	CH_4 GSV
0.1	4.1%	0.0041l/hr	0.1%	0l/hr

(Worst case CO_2 and CH_4 concentration / 100) x worst case flow rate = GSV

This GSV is a conservative estimate based on the maximum concentrations and flow rate.

Based on the maximum calculated GSV of 0.0041/hr as derived for Carbon Dioxide, along with the maximum concentrations for Methane of 0.1% and Carbon Dioxide of 4.1%, the site can be characterised by Table 8.5 of CIRIA C665 for classification Characteristic Situation 1 (CS1) and as 'very low risk'.

Carbon Monoxide

There was no Carbon Monoxide detected during any of the rounds of monitoring.

Information provided by the World Health Organisation (WHO) provides air quality guidelines for Europe 2000, which provides time weighted average exposures that have been determined in such a way that the carboxyhaemoglobin (COHb) level of 2.5% is not exceeded. These are as follows:

- 87ppm for 15 minutes
- 52ppm for 30 minutes
- 26ppm for one hour
- 9ppm for eight hours

In addition, recommended WHO European guidelines for indoor air quality is as follow:

- 6ppm for twenty four hours so as not to exceed 2% COHb for chronic exposure.

Based on the above, the risks from carbon monoxide are considered to be very low.

Therefore, based on the above results, protection is not considered necessary against Carbon Monoxide.

Hydrogen Sulphide

There was no Hydrogen Sulphide detected during any of the rounds of monitoring.

Information taken directly from the HSE (Health & Safety Executive) Online provides the following:

- 0.0047 ppm is the recognition threshold of human smell, the concentration at which 50% of humans can detect the characteristic odour of hydrogen sulphide.
- 10-20 ppm is the borderline concentration for eye irritation.
- 50-100 ppm leads to eye damage.
- At 150-250 ppm the olfactory nerve is paralyzed after a few inhalations, and the sense of smell disappears, often together with awareness of danger.
- 320-530 ppm leads to pulmonary edema with the possibility of death.
- 530-1000 ppm causes strong stimulation of the central nervous system and rapid breathing, leading to loss of breathing.
- Concentrations over 1000 ppm cause immediate collapse with loss of breathing, even after inhalation of a single breath.

Based on the above, the risks from hydrogen sulphide are considered to be very low.

Therefore, based on the above results, protection is not considered necessary against Hydrogen Sulphide.

10.5 Updated Conceptual Site Model

An updated CSM is provided in Section 11, below. The Level of risk has been assessed in accordance with Annex 4 of the National House Building Council/Environment Agency/Chartered Institute of Environmental Health R&D publication 66, Guidance for the Safe Development of Housing on Land Affected by Contamination (NHBC/EA/CIEH, 2008) which updates and supersedes CIRIA C552: Contaminated Land Risk Assessment, A Guide to Good Practice (Rudland et al., 2001).

A copy of the interpretation is provided in **Appendix 7**.

11. Updated Conceptual Site Model and Risk Assessment

The Conceptual Site Model has been re-formulated based upon the results from the site investigation in accordance with BS10175:2015. It aims to provide information regarding the sources of contamination and the pathways in which contamination can migrate to a vulnerable receptor, all of which need to be present for there to be a risk. This is in relation to the proposed end use being classified as 'residential with homegrown produce'. The following linkages have been identified and are presented in Table 13.1: Updated conceptual Site model, below.

Table 13.1: Updated Conceptual Site Model.

Contaminant Source	Pathways	Receptor	Pollutant Linkage	Probability of Risk	Classification of Consequence	Level of Risk	Justification
On Site: Made Ground soils on site possibly containing elevated metals, other organics such as TPH, PAH, phenols, VOC and SVOCs.	Ingestion, dermal contact, inhalation of dusts/vapours	Future end users and site visitors	Considered Possible	Likely	Mild	Moderate to Low	Contaminants have been identified in the site soils. Further consideration required.
		Construction Workers	Considered Possible	Likely	Medium	Moderate	Contaminants have been identified in the site soils. Further consideration required.
	Leaching through soils and migration via groundwater or soil pore moisture	Controlled Waters	Considered Possible	Low Likelihood	Mild	Low	The proximity of the river and the presence of contaminants in the site soils elevate the risk level. Further consideration required.
	Permeation of water pipes	Construction materials, future end users and site visitors	Considered Possible	Low Likelihood	Minor	Very low	No significantly elevated hydrocarbons encountered.

Contaminant Source	Pathways	Receptor	Pollutant Linkage	Probability of Risk	Classification of Consequence	Level of Risk	Justification
	Uptake	Plant and Wildlife	Considered Unlikely	Unlikely	Minor	Very low	No elevated phytotoxic contaminants identified.
On Site: Asbestos at/near ground surface in Made Ground soils.	Inhalation of fibres in airborne dust	Future end users and site visitors	Considered Possible	Likely	Medium	Moderate	Asbestos encountered in WS02 in excess of 0.001%.
		Construction Workers	Considered Possible	Likely	Medium	Moderate	Asbestos encountered in WS02 in excess of 0.001%.
On Site: Ground Gases (CH_4, CO_2) from on-site Made Ground.	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures.	Considered Unlikely	Unlikely	Minor	Very low	Based on the gas monitoring the site would be classified as CS(1) – very low risk.
Off Site: Ground Gases (CH_4, CO_2, H_2S) from off-site historical landfilling activities.	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures.	Considered Unlikely	Unlikely	Minor	Very low	Based on the gas monitoring the site would be classified as CS(1) – very low risk.

12. Recommendations

The results of the general testing undertake across the site indicates that contamination is not likely across the site but is present in the vicinity of WS02.

However, WS02 is located within the footprint of the proposed building location. As such the pathway will be broken as end users will not be able to come into direct contact with the contamination.

On the basis of the above a site specific Remediation Strategy is not required.

However, it should be noted that the material across the site generally comprised of Made Ground, which is considered to be associated with the historical refuse tip on site, as identified in the PI PRA. On this basis, this material should be considered unsuitable to re-use as a soil within soft landscaping areas and should be replaced.

12.1 Watching Brief and Discovery Strategy

A watching brief should be maintained by the Main Contractor at all times during the groundworks stage. Should any unforeseen contamination, such as oils or soils/groundwater with an unusual colour or odour, be encountered during groundworks then the following procedure should be implemented:

- Work to cease in that area to prevent exposure to ground workers and potential contaminants being spread around.
- Notify a Geo-Environmental Consultant, to attend site and sample material.
- Notify the Environmental Health Department / Contaminated Land Officer(s) of the Local Planning Authority.

If the nature and extent of the contamination is unmanageable under the procedure set out above, then a suitable management, mitigation or remediation procedure will be agreed with the CLO. However, this is considered unlikely at this particular site.

12.2 Gas Protection Measures

No gas protection measures are required.

12.3 Asbestos

Asbestos was encountered in WS02 at a concentration in excess of the guidance as set out in CIRIA 733, as such remediation will be required with respect to Asbestos contamination.

12.4 Services

If new services will be installed as part of the redevelopment of the site, we would recommend the local water board be contacted to determine their specification for the type of pipework which should be used on this site.

All services and in particular potable water supply pipework should comprise of material that is resistant to attack and degradation to chemical attack.

Further information can be found within the published guidance for the '*Selection of Water Supply Pipes to be used in Brownfield Sites'*, issued in January 2011 by the UK Water Industry Research (UKWIR), this supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note – '*Laying Pipes in Contaminated Land'* which has been withdrawn.

12.5 Surface Water

It should be noted that the Environment Agency does not recommend that soakaways be placed within Made Ground, potentially contaminative land or in ground previously identified as contaminated.

12.6 Imported Soil

The proposed areas of soft landscaping are presently situated over historical Made Ground (landfill) material.

Whilst this material is not considered contaminated, it is unlikely to be suitable for re-use as a base for gardens. As such it is recommended that a suitable thickness of material is removed from site and replaced with clean imported Topsoil.

Typically, in situations such as this, adopting BRE: Cover Systems for Land Regeneration as the most appropriate protocol to follow would be considered acceptable. As such, a thickness of 600mm (from the final ground level) of clean imported material would be considered appropriate.

All imported soil should be certified prior to import to be suitable for use as BS2883:2015 compliant for topsoil.

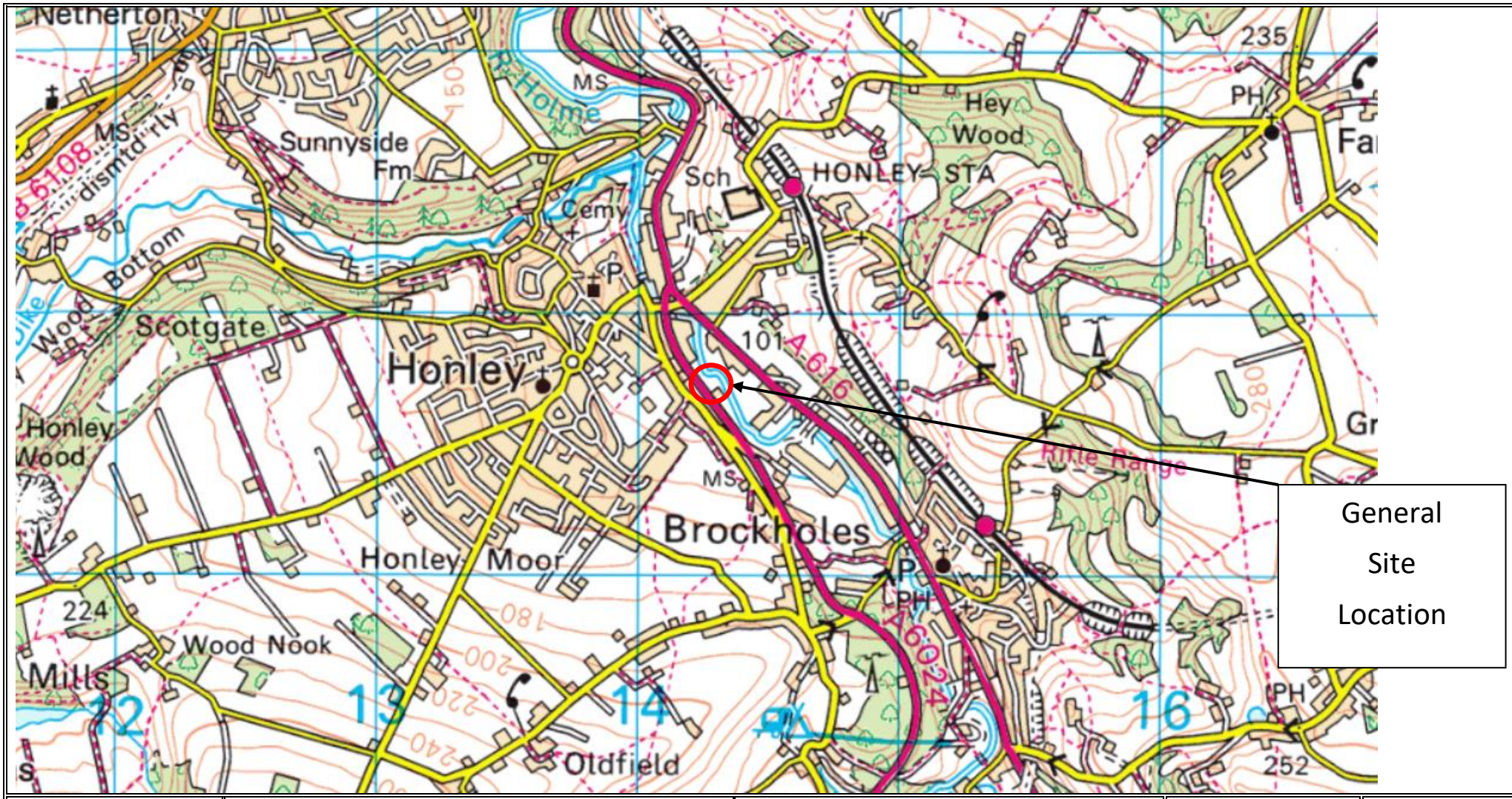
Any imported material should be independently validated as being acceptable for use in a residential setting.

GES recommends that the validation of the imported material is undertaken in accordance with the approach as identified in the YALPAG Verification Requirements for Cover Systems: Technical Guidance for Developers, Landowners and Consultants: Version 4.1 – June 2021.

[i] Nathanial et al. (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, 2015. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3495
[ii] CL:AIRE (2010) The EIC/AGS/CL:AIRE Generic Assessment Criteria for Human Health Risk Assessment

APPENDIX 1

DRAWINGS



GEOENVIRO
SOLUTIONS LIMITED

GeoEnviro Solutions Ltd
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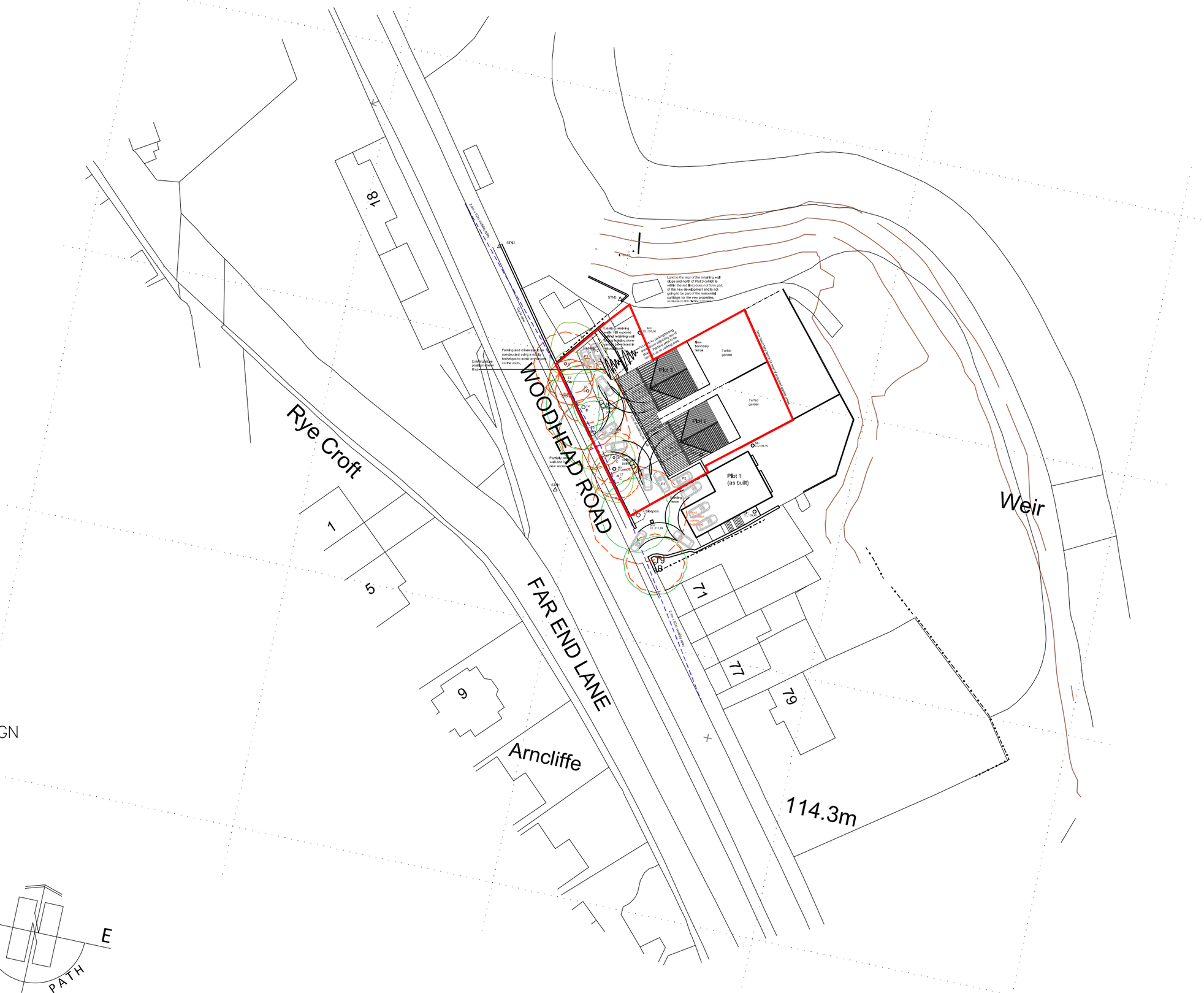
Web: www.geoenvirosoltions.com

N

PROJECT NAME:	DRAWING NO.	SCALE
Woodhead Road, Honley. PROJECT NUMBER: 1623-21	1623-21/01	N.T.S
TITLE	**DATE**	**DRAWN BY**
Site Location Plan	September 2021	ADD



PAUL MATTHEWS ARCHITECTURAL Ltd

ARCHITECTURE | PLANNING | DESIGN

Malkin Farm
Brow Lane
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HD9 2RJ
07946872499
paul@paulmatthewsarchitectural.co.uk
www.paulmatthewsarchitectural.co.uk

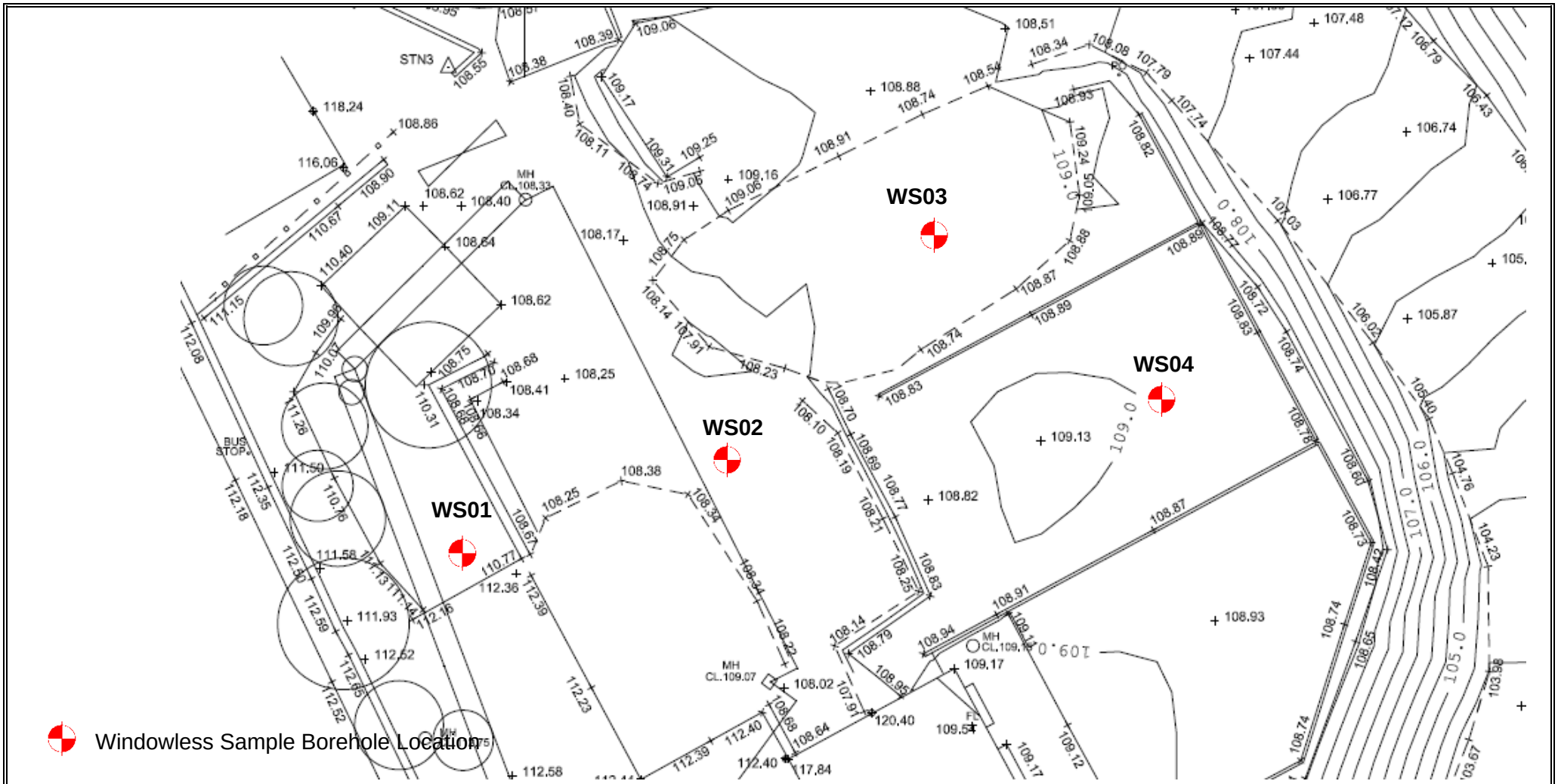
Company Registration Number: 09898149 – Company Registered in England and Wales

Project
Erection of Two Detached Dwellings adj to 71, Woodhead Road, Honley, Holmfirth, HD9 6PP .

Client
Mr P Mitchell

Drawing Title/Issue
Proposed Site Plan

scale	date	sheet size	dwg. no.
1:500	02/20	A2	20/313/03g



GEOENVIRO SOLUTIONS LIMITED	GeoEnviro Solutions Ltd Unit 7 Springvale Works Brighouse West Yorkshire HD6 2RA Tel: 01484 986010 Email: info@geoenvirosolutions.com Web: www.geoenvirosoltions.com	**PROJECT NAME:** Woodhead Road, Honley **PROJECT NUMBER** 1623-21	**DRAWING NO.** 1623/02	**SCALE** N.T.S
		TITLE Borehole Location Plan	**DATE** October 2021	**DRAWN BY** ADD

APPENDIX 2

WINDOWLESS SAMPLE BOREHOLE LOGS

Percussion Drilling Log

Project Name: Woodhead Road, Honley	Client: Paul Matthews Architectural	Date: 13/10/2021
Location:	Contractor:	
Project No. : 1623-21	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS01	WLS		JF	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.20			MADE GROUND: Loose dark brown slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to medium brick, slag and clinker and sandstone.
		1.00	SPT	N=14 (10,3/2,4,4,4)				MADE GROUND: Medium dense brown very sandy clayey sub-angular to sub-rounded fine to coarse GRAVEL of brick, slag and clinker and sandstone. Sand is fine to coarse.
					1.60			MADE GROUND: Medium dense dark brown slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse brick and sandstone.
		2.00	SPT	N=20 (7,5/5,5,5,5)				
		3.00	SPT	N=31 (9,9/6,7,8,10)	3.00			Dense light yellowish brown slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fone to coarse sandstone.
		4.00	SPT	50 (20 for 75mm/50 for 225mm)	4.00			End of Borehole at 4.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Percussion Drilling Log

Project Name: Woodhead Road, Honley	Client: Paul Matthews Architectural	Date: 13/10/2021
Location:	Contractor:	
Project No. : 1623-21	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS02	WLS		JF	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.20			MADE GROUND: Soft dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse brick, slag, clinker, bitumen, concrete and sandstone.
		1.00	SPT	N=3 (1,1/2,0,0,1)				MADE GROUND: Loose sandy slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL of brick, slag, clinker, bitumen, concrete and sandstone.
		2.00	SPT	N=2 (1,0/1,0,1,0)				
					2.40			MADE GROUND: Soft dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse brick and sandstone.
		3.00	SPT	N=3 (1,0/1,1,0,1)				*Sandstone cobble.*
		4.00	SPT	N=3 (1,1/1,1,0,1)				
		5.00	SPT	N=12 (4,4/5,2,2,3)				
	▼				6.00			*Tending to light brown sandy CLAY. Sand is fine to coarse.*
								End of Borehole at 6.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Percussion Drilling Log

Project Name: Woodhead Road, Honley	Client: Paul Matthews Architectural	Date: 15/10/2021
Location:	Contractor:	
Project No. : 1623-21	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS03	WLS		JF	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
								MADE GROUND: Medium dense dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse brick, concrete slag, clinker and sandstone.	
		1.00	SPT	N=13 (6,3/3,3,4,3)					1
		2.00	SPT	N=12 (4,3/3,3,3,3)	2.00			MADE GROUND: Medium dense dark reddish brown slightly gravelly silty fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse brick, concrete, sandstone and coal.	2
		3.00	SPT	N=14 (4,3/4,3,3,4)					3
		4.00	SPT	N=16 (2,3/5,4,3,4)					4
		5.00	SPT	N=13 (3,3/2,4,3,4)					5
		6.00	SPT	N=10 (3,2/2,3,2,3)					6
		7.00	SPT	N=13 (4,3/4,3,3,3)					7
					7.75			MADE GROUND: Soft to firm dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse brick and sandstone	
		8.00	SPT	N=16 (5,5/5,4,3,4)	8.00				8
					8.60			MADE GROUND: Medium dense to dense dark reddish brown slightly gravelly silty fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse brick, concrete, sandstone and coal.	
					9.00			Firm dark brown tending to light creamish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse sandstone.	9
								End of Borehole at 9.000m	10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Percussion Drilling Log

Project Name: Woodhead Road, Honley	Client: Paul Matthews Architectural	Date: 15/10/2021
Location:	Contractor:	
Project No. : 1623-21	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS04	WLS		JF	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		1.00	SPT	N=6 (2,3/2,1,2,1)				GRASS OVER: MADE GROUND: Soft to firm dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse brick, concrete, slag, clinker and sandstone.
		2.00	SPT	N=33 (3,4/5,6,12,10)				
					2.60			MADE GROUND: Soft to firm light yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse brick and sandstone.
		3.00	SPT	N=6 (1,2/1,2,1,2)				
					3.70			MADE GROUND: Soft to firm dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse brick, sandstone and coal.
		4.00	SPT	N=2 (1,0/1,0,1,0)				
					4.40			MADE GROUND: Loose dark reddish brown slightly gravelly silty fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse brick, concrete and coal.
		5.00	SPT	N=5 (1,1/1,2,1,1)				
		6.00	SPT	N=8 (2,1/2,2,2,2)	6.00			End of Borehole at 6.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

APPENDIX 3

GEOTECHNICAL TESTING RESULTS

***GEOENVIROSOLUTIONS* Ltd**

Particle Size Distribution

BS 1377 : Part 2 : 1990 : 9.2 / 9.3

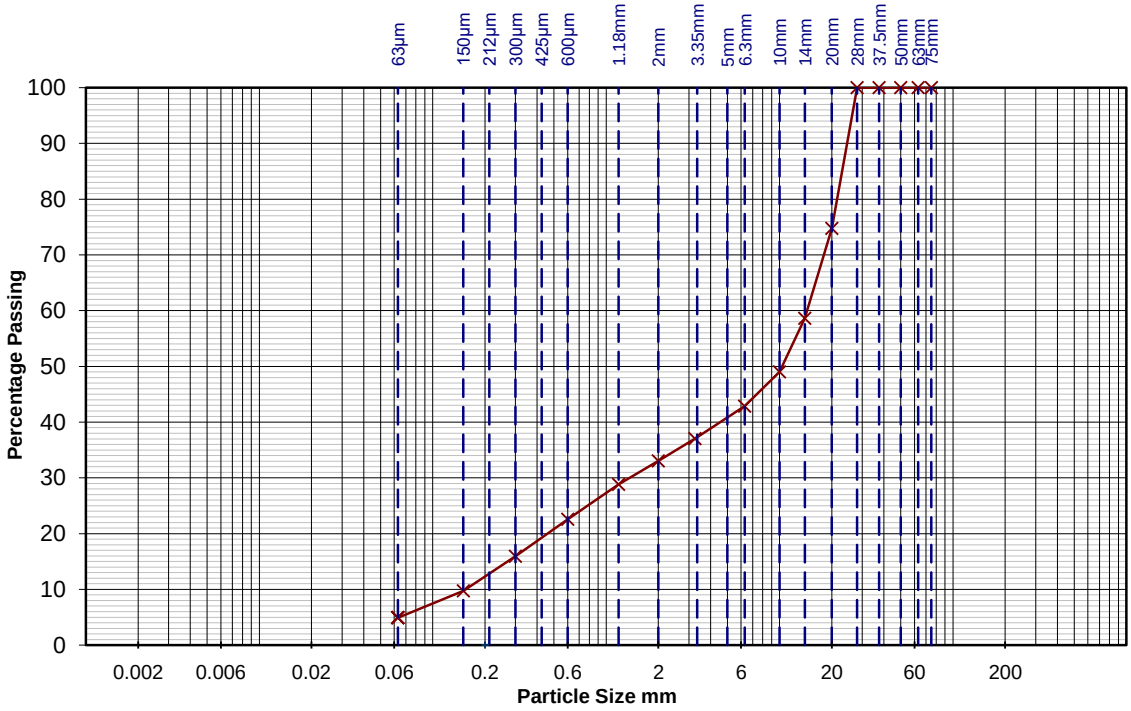
Client: Paul Matthews
Site: Woodhead Road , Honley

BH/TP No. WS03
Sample No. -

Tested by: SE **Chkd by:** RL **Depth:** 3.25m-3.5m

Date: 20/10/2021 **Date:** 20/10/2021

Sieve Size	75	63	50	37.5	28	20	14	10	6.3	
Percentage Passing	100.0	100.0	100.0	100.0	100.0	74.7	58.6	49.0	42.9	
Sieve Size	5	3.35	2	1.18	0.6	0.425	0.3	0.212	0.15	0.063
Percentage Passing	-	37.0	33.0	28.8	22.6	-	15.9	-	9.7	4.9



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
	Silt			Sand			Gravel				

DESCRIPTION:

Remarks:	Contract Number 1623.21
	Figure number 1

***GEOENVIROSOLUTIONS* Ltd**

Particle Size Distribution

BS 1377 : Part 2 : 1990 : 9.2 / 9.3

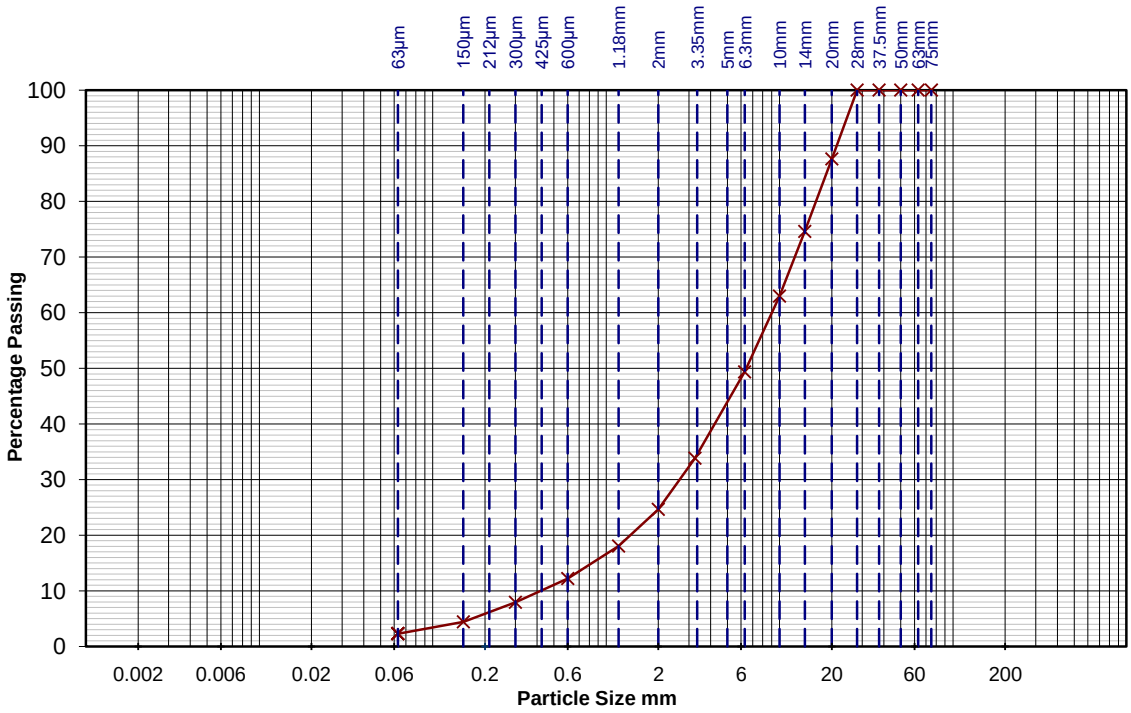
Client: Paul Matthews
Site: Woodhead Road , Honley

BH/TP No. WS03
Sample No. -

Tested by: SE **Chkd by:** RL **Depth:** 8.6m-8.85m

Date: 20/10/2021 **Date:** 20/10/2021

Sieve Size	75	63	50	37.5	28	20	14	10	6.3	
Percentage Passing	100.0	100.0	100.0	100.0	100.0	87.6	74.6	63.0	49.3	
Sieve Size	5	3.35	2	1.18	0.6	0.425	0.3	0.212	0.15	0.063
Percentage Passing	-	33.9	24.6	18.0	12.2	-	7.9	-	4.4	2.3



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
	Silt			Sand			Gravel				

DESCRIPTION:

Remarks:	Contract Number 1623-21
	Figure number 1

APPENDIX 4

CHEMICAL TESTING RESULTS

SOCOTEC

Environmental
Chemistry

Certificate of Analysis

Client: GeoEnviro Solutions Ltd

Project: 21101609

Quote: BEC211023000 V1.1

Project Ref: GeoEnviro Solutions Ltd

Site: Woodhead Road, Honley

Contact: Rob Lewis

Address: Unit 7
Springvale Works
Brookfoot Lane
Brighouse
HD6 2RA

E-Mail: rob@boreholesolutions.com

Phone: 07946 754 894

No. Samples Received: 8

Date Received: 22/10/2021

Analysis Date: 03/11/2021

Date Issued: 03/11/2021

Job Status: Complete

Report Type: Final Version 01

This report supercedes any versions previously issued by the laboratory

Account Manager

Mandy Fitzer

Authorised by the Operations Manager
Becky Batham

SOCOTEC UK, Ashby Road, Bretby, Burton-on-Trent, UK, DE15 0YZ

Client: GeoEnviro Solutions Ltd
Project Name: GeoEnviro Solutions Ltd
Project No: 21101609
Date Issued: 03/11/2021

Samples Analysed

Sample Reference	Text ID	Sample Date	Sample Type		
WS01-0-ES-0.40	21101609-001	19/10/2021 00:00:00	SOLID		
WS02-0-ES-0.30	21101609-002	19/10/2021 00:00:00	SOLID		
WS03-0-ES-0.30	21101609-003	19/10/2021 00:00:00	SOLID		
WS04-0-ES-0.80	21101609-004	19/10/2021 00:00:00	SOLID	WATER	Ground Water

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Analysis Results

Analysis	Method Code	MDL	Units	Accred.	001	002	003	004			
				Customer ID	WS01-0-ES-0.40	WS02-0-ES-0.30	WS03-0-ES-0.30	WS04-0-ES-0.80			
				Sample Type	SOLID	SOLID	SOLID	SOLID			
				Sampling Date	19/10/2021	19/10/2021	19/10/2021	19/10/2021			
>C6-C8 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.2	mg/kg^	UM	<0.228	<0.236	<0.236	<0.237			
>C7-C8 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.01	mg/kg^	UM	<0.011	<0.012	<0.012	<0.012			
>C8-C10 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.2	mg/kg^	UM	<0.228	<0.236	<0.236	<0.237			
>C8-C10 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.04	mg/kg^	UM	<0.046	<0.048	<0.048	<0.048			
C5-C6 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.2	mg/kg^	UM	<0.228	<0.236	<0.236	<0.237			
C5-C7 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.01	mg/kg^	UM	<0.011	<0.012	<0.012	<0.012			
Total GRO C5-C10 HS_1D_Total	GROHSA/BTEXHSA	0.2	mg/kg^	UM	<0.228	<0.236	<0.236	<0.237			
>C6-C8 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.1	mg/l	N							
>C7-C8 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.005	mg/l	U							
>C8-C10 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.1	mg/l	N							
>C8-C10 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.02	mg/l	U							
C5-C6 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.1	mg/l	N							
C5-C7 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.005	mg/l	U							
Total GRO C5-C10 HS_1D_Total	GROHSA/BTEXHSA	0.1	mg/l	U							
Conductivity at 25°C	PHCONDW	100	µS/cm	U							
pH	PHCONDW	1	pH units	U							
pH (2.5:1 extraction)	PHSOIL	1	pH units	UM	9.0	8.7	8.4	8.0			
Chromium (VI) as Cr	KONENS	0.1	mg/kg^	N	0.2	<0.1	<0.1	<0.1			
Phenol Index	SFAPI	0.5	mg/kg^	U	<0.6	<0.6	<0.6	<0.6			

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Analysis Results

Analysis	Method Code	MDL	Units	Accred.	Sample ID	Customer ID	Sample Type	Sampling Date
>C6-C8 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.2	mg/kg^	UM				
>C7-C8 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.01	mg/kg^	UM				
>C8-C10 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.2	mg/kg^	UM				
>C8-C10 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.04	mg/kg^	UM				
C5-C6 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.2	mg/kg^	UM				
C5-C7 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.01	mg/kg^	UM				
Total GRO C5-C10 HS_1D_Total	GROHSA/BTEXHSA	0.2	mg/kg^	UM				
>C6-C8 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.1	mg/l	N				
>C7-C8 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.005	mg/l	U				
>C8-C10 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.1	mg/l	N				
>C8-C10 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.02	mg/l	U				
C5-C6 Aliphatic HS_1D_AL	GROHSA/BTEXHSA	0.1	mg/l	N				
C5-C7 Aromatic HS_1D_AR	GROHSA/BTEXHSA	0.005	mg/l	U				
Total GRO C5-C10 HS_1D_Total	GROHSA/BTEXHSA	0.1	mg/l	U				
Conductivity at 25°C	PHCONDW	100	µS/cm	U				
pH	PHCONDW	1	pH units	U				
pH (2.5:1 extraction)	PHSOIL	1	pH units	UM				
Chromium (VI) as Cr	KONENS	0.1	mg/kg^	N				
Phenol Index	SFAPI	0.5	mg/kg^	U				

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Analysis	Method Code	MDL	Units	Accred.	001	002	003	004			
				Customer ID	WS01-0-ES-0.40	WS02-0-ES-0.30	WS03-0-ES-0.30	WS04-0-ES-0.80			
				Sample Type	SOLID	SOLID	SOLID	SOLID			
				Sampling Date	19/10/2021	19/10/2021	19/10/2021	19/10/2021			
Phenol Index	SFAPI	0.05	mg/l	U							
Total Cyanide	SFAPI	0.5	mg/kg^	UM	<0.6	<0.6	<0.6	<0.6			
Total Cyanide	SFAPI	0.02	mg/l	U							
Soil Organic Matter	WSLM59	0.04	% m/m^	U	1.41	12.2	4.05	3.40			
Total Organic Carbon	WSLM13	0.2	mg/l	U							
Arsenic as As	ICPMSS	0.3	mg/kg^	UM	8.3	21.4	9.3	9.9			
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM	0.4	0.6	0.3	0.2			
Copper as Cu	ICPMSS	1.6	mg/kg^	UM	42.3	52.7	36.7	40.0			
Lead as Pb	ICPMSS	0.7	mg/kg^	UM	35.0	301.7	83.9	55.7			
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM	<0.5	<0.5	<0.5	<0.5			
Nickel as Ni	ICPMSS	2	mg/kg^	UM	16.1	31.5	24.6	46.9			
Selenium as Se	ICPMSS	0.5	mg/kg^	UM	<0.5	<0.5	<0.5	<0.5			
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM	26.9	43.8	38.6	42.2			
Zinc as Zn	ICPMSS	16	mg/kg^	UM	91.8	99.9	131.7	90.2			
Water Soluble Sulphate as SO4 by Mass	ICPWSS	20	mg/kg^	UM	24	92	215	144			
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U							
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U							
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U							
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U							

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Analysis	Method Code	MDL	Units	Accred.	Sample ID	Customer ID	Sample Type	Sampling Date
Phenol Index	SFAPI	0.05	mg/l	U				
Total Cyanide	SFAPI	0.5	mg/kg^	UM				
Total Cyanide	SFAPI	0.02	mg/l	U				
Soil Organic Matter	WSLM59	0.04	% m/m^	U				
Total Organic Carbon	WSLM13	0.2	mg/l	U				
Arsenic as As	ICPMSS	0.3	mg/kg^	UM				
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM				
Copper as Cu	ICPMSS	1.6	mg/kg^	UM				
Lead as Pb	ICPMSS	0.7	mg/kg^	UM				
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM				
Nickel as Ni	ICPMSS	2	mg/kg^	UM				
Selenium as Se	ICPMSS	0.5	mg/kg^	UM				
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM				
Zinc as Zn	ICPMSS	16	mg/kg^	UM				
Water Soluble Sulphate as SO4 by Mass	ICPWSS	20	mg/kg^	UM				
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U				
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U				
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U				
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U				

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Analysis Results

Analysis	Method Code	MDL	Units	Accred.	001	002	003	004			
				Customer ID	WS01-0-ES-0.40	WS02-0-ES-0.30	WS03-0-ES-0.30	WS04-0-ES-0.80			
				Sample Type	SOLID	SOLID	SOLID	SOLID			
				Sampling Date	19/10/2021	19/10/2021	19/10/2021	19/10/2021			
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U							
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U							
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U							
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U							
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U							
Barium as Ba	ICPWATVAR (Dissolved)	0.01	mg/l	U							
Beryllium as Be	ICPWATVAR (Dissolved)	0.01	mg/l	N							
Boron as B	ICPWATVAR (Dissolved)	0.01	mg/l	U							
Total Sulphur as SO4	ICPWATVAR (Dissolved)	3	mg/l	U							
Total Hardness as CaCO3	ICPWATVAR (Dissolved)	6.6	mg/l	U							
MTBE	BTEXHSA	20	µg/kg^	U	<23	<24	<24	<24			
MTBE	BTEXHSA	10	µg/l	U							
Benzene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	<11	<12	<12	<12			
Ethylbenzene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	<11	<12	<12	<12			
m/p-Xylene HS_1D_AR	BTEXHSA	20	µg/kg^	UM	<23	<24	<24	<24			
o-Xylene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	<11	<12	<12	<12			
Toluene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	<11	<12	<12	<12			
Benzene HS_1D_AR	BTEXHSA	5	µg/l	U							
Ethylbenzene HS_1D_AR	BTEXHSA	5	µg/l	U							

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Analysis	Method Code	MDL	Units	Accred.	
				Sample ID	
				Customer ID	
				Sample Type	
				Sampling Date	
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U	
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U	
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U	
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U	
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U	
Barium as Ba	ICPWATVAR (Dissolved)	0.01	mg/l	U	
Beryllium as Be	ICPWATVAR (Dissolved)	0.01	mg/l	N	
Boron as B	ICPWATVAR (Dissolved)	0.01	mg/l	U	
Total Sulphur as SO4	ICPWATVAR (Dissolved)	3	mg/l	U	
Total Hardness as CaCO3	ICPWATVAR (Dissolved)	6.6	mg/l	U	
MTBE	BTEXHSA	20	µg/kg^	U	
MTBE	BTEXHSA	10	µg/l	U	
Benzene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	
Ethylbenzene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	
m/p-Xylene HS_1D_AR	BTEXHSA	20	µg/kg^	UM	
o-Xylene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	
Toluene HS_1D_AR	BTEXHSA	10	µg/kg^	UM	
Benzene HS_1D_AR	BTEXHSA	5	µg/l	U	
Ethylbenzene HS_1D_AR	BTEXHSA	5	µg/l	U	

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Analysis	Method Code	MDL	Units	Accred.	001	002	003	004			
				Customer ID	WS01-0-ES-0.40	WS02-0-ES-0.30	WS03-0-ES-0.30	WS04-0-ES-0.80			
				Sample Type	SOLID	SOLID	SOLID	SOLID			
				Sampling Date	19/10/2021	19/10/2021	19/10/2021	19/10/2021			
m/p-Xylene HS_1D_AR	BTEXHSA	10	µg/l	U							
o-Xylene HS_1D_AR	BTEXHSA	5	µg/l	U							
Toluene HS_1D_AR	BTEXHSA	5	µg/l	U							
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM	0.25	0.32	0.16	0.25			
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U	0.12* B	0.18* B	0.20* B	<0.09* B			
Anthracene	PAHMSUS	0.08	mg/kg^	U	0.75	0.88	0.62	0.63			
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM	1.82	2.97	1.94	1.51			
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM	2.48	4.01	2.47	1.63			
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	2.57	4.24	2.59	1.74			
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM	1.18	2.22	1.32	0.71			
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	1.04	1.62	1.05	0.76			
Chrysene	PAHMSUS	0.08	mg/kg^	UM	1.96	3.12	2.06	1.72			
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM	0.29	0.52	0.31	0.19			
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM	3.99	5.68	3.96	3.69			
Fluorene	PAHMSUS	0.08	mg/kg^	UM	0.16	0.22	0.17	0.20			
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM	1.32	2.34	1.37	0.80			
Naphthalene	PAHMSUS	0.08	mg/kg^	UM	0.21	0.22	0.12	0.13			
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM	1.94	2.43	1.57	2.16			
Pyrene	PAHMSUS	0.08	mg/kg^	UM	3.68	5.35	3.67	3.15			

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Analysis	Method Code	MDL	Units	Accred.	Sample ID	Customer ID	Sample Type	Sampling Date
m/p-Xylene HS_1D_AR	BTEXHSA	10	µg/l	U				
o-Xylene HS_1D_AR	BTEXHSA	5	µg/l	U				
Toluene HS_1D_AR	BTEXHSA	5	µg/l	U				
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM				
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U				
Anthracene	PAHMSUS	0.08	mg/kg^	U				
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM				
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM				
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM				
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM				
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM				
Chrysene	PAHMSUS	0.08	mg/kg^	UM				
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM				
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM				
Fluorene	PAHMSUS	0.08	mg/kg^	UM				
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM				
Naphthalene	PAHMSUS	0.08	mg/kg^	UM				
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM				
Pyrene	PAHMSUS	0.08	mg/kg^	UM				

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Analysis Results

Analysis	Method Code	MDL	Units	Accred.	001	002	003	004			
				Customer ID	WS01-0-ES-0.40	WS02-0-ES-0.30	WS03-0-ES-0.30	WS04-0-ES-0.80			
				Sample Type	SOLID	SOLID	SOLID	SOLID			
				Sampling Date	19/10/2021	19/10/2021	19/10/2021	19/10/2021			
Total PAH 16	PAHMSUS	1.28	mg/kg^	U	23.8	36.3	23.6	19.4			
Acenaphthene	PAHMSW	0.01	µg/l	U							
Acenaphthylene	PAHMSW	0.01	µg/l	U							
Anthracene	PAHMSW	0.01	µg/l	U							
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U							
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U							
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U							
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U							
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U							
Chrysene	PAHMSW	0.01	µg/l	U							
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U							
Fluoranthene	PAHMSW	0.01	µg/l	U							
Fluorene	PAHMSW	0.01	µg/l	U							
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U							
Naphthalene	PAHMSW	0.01	µg/l	U							
Phenanthrene	PAHMSW	0.01	µg/l	U							
Pyrene	PAHMSW	0.01	µg/l	U							
Total PAH 16	PAHMSW	0.16	µg/l	U							
>C10-C12 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	4	mg/kg^	U	<4.55	<4.73	<4.71	<4.73			

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Analysis	Method Code	MDL	Units	Accred.	
				Sample ID	
				Customer ID	
				Sample Type	
				Sampling Date	
Total PAH 16	PAHMSUS	1.28	mg/kg^	U	
Acenaphthene	PAHMSW	0.01	µg/l	U	
Acenaphthylene	PAHMSW	0.01	µg/l	U	
Anthracene	PAHMSW	0.01	µg/l	U	
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U	
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U	
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U	
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U	
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U	
Chrysene	PAHMSW	0.01	µg/l	U	
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U	
Fluoranthene	PAHMSW	0.01	µg/l	U	
Fluorene	PAHMSW	0.01	µg/l	U	
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U	
Naphthalene	PAHMSW	0.01	µg/l	U	
Phenanthrene	PAHMSW	0.01	µg/l	U	
Pyrene	PAHMSW	0.01	µg/l	U	
Total PAH 16	PAHMSW	0.16	µg/l	U	
>C10-C12 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	4	mg/kg^	U	

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Analysis	Method Code	MDL	Units	Accred.	001	002	003	004			
				Customer ID	WS01-0-ES-0.40	WS02-0-ES-0.30	WS03-0-ES-0.30	WS04-0-ES-0.80			
				Sample Type	SOLID	SOLID	SOLID	SOLID			
				Sampling Date	19/10/2021	19/10/2021	19/10/2021	19/10/2021			
>C12-C16 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	4	mg/kg^	U	8.03	11.8	8.40	<4.73			
>C16-C21 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	4	mg/kg^	U	17.4	17.3	14.3	<4.73			
>C21-C35 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	10	mg/kg^	U	70.9	130	131	<11.8			
>C35-C44 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	6	mg/kg^	N	11.5	22.1	12.5	<7.10			
Total TPH >C8-C40 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	20	mg/kg^	U	105	177	164	<23.7			
>C10-C12 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U							
>C12-C16 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U							
>C16-C21 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U							
>C21-C35 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U							
>C35-C44 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	N							
Total TPH >C8-C40 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U							
>C10-C12 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	4	mg/kg^	U	<4.55	<4.73	<4.71	<4.73			
>C12-C16 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	4	mg/kg^	U	4.57	6.27	<4.71	<4.73			
>C16-C21 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	4	mg/kg^	U	19.3	28.9	15.7	13.4			
>C21-C35 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	10	mg/kg^	U	106* B	232* B	122* B	43.6* B			
>C35-C44 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	6	mg/kg^	N	19.0	50.7	20.1	9.22			
Total TPH >C8-C40 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	20	mg/kg^	U	148	312	161	70.2			
>C10-C12 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U							
>C12-C16 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U							

Client: GeoEnviro Solutions Ltd
Project Name: Woodhead Road, Honley
Project No: 21101609
Date Issued: 03/11/2021

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	
				Sample ID	
				Customer ID	
				Sample Type	
				Sampling Date	
>C12-C16 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	4	mg/kg^	U	
>C16-C21 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	4	mg/kg^	U	
>C21-C35 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	10	mg/kg^	U	
>C35-C44 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	6	mg/kg^	N	
Total TPH >C8-C40 (Aliphatic) EH_CU_1D_AL	TPHFIDUS (Aliphatic)	20	mg/kg^	U	
>C10-C12 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U	
>C12-C16 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U	
>C16-C21 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U	
>C21-C35 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U	
>C35-C44 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	N	
Total TPH >C8-C40 (Aliphatic) EH_CU_1D_AL	TPHFID (Aliphatic)	0.01	mg/l	U	
>C10-C12 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	4	mg/kg^	U	
>C12-C16 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	4	mg/kg^	U	
>C16-C21 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	4	mg/kg^	U	
>C21-C35 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	10	mg/kg^	U	
>C35-C44 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	6	mg/kg^	N	
Total TPH >C8-C40 (Aromatic) EH_CU_1D_AR	TPHFIDUS (Aromatic)	20	mg/kg^	U	
>C10-C12 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U	
>C12-C16 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U	

Client: GeoEnviro Solutions Ltd
Project Name: Woodhead Road, Honley
Project No: 21101609
Date Issued: 03/11/2021

Analysis Results

				Sample ID	001	002	003	004			
				Customer ID	WS01-0-ES-0.40	WS02-0-ES-0.30	WS03-0-ES-0.30	WS04-0-ES-0.80			
				Sample Type	SOLID	SOLID	SOLID	SOLID			
				Sampling Date	19/10/2021	19/10/2021	19/10/2021	19/10/2021			
Analysis	Method Code	MDL	Units	Accred.							
>C16-C21 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U							
>C21-C35 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U							
>C35-C44 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	N							
Total TPH >C8-C40 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U							
Total Moisture at 105°C	TMSS	0.1	%	U	12.1	15.4	15.1	15.5			
Total Moisture at 35°C	CLANDPREP	0.1	%	N	6.1	9.7	7.9	13.5			
Colour of Material	CLANDPREP		-	N	Brown/Grey	Brown/Grey	Brown/Grey	Brown/Grey			
Major Constituents	CLANDPREP		-	N	MADE GROUND	MADE GROUND	SILT	CLAY			
Minor Constituents	CLANDPREP		-	N	None	None	Clay	Silt			
Miscellaneous Constituents	CLANDPREP		-	N	na	na	Sandstone	Sandstone			
Asbestos Identification	SUB020		-	N	NAIIS	CR	NAIIS	NAIIS			

Client: GeoEnviro Solutions Ltd
Project Name: Woodhead Road, Honley
Project No: 21101609
Date Issued: 03/11/2021

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	
				Sample ID	
				Customer ID	
				Sample Type	
				Sampling Date	
>C16-C21 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U	
>C21-C35 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U	
>C35-C44 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	N	
Total TPH >C8-C40 (Aromatic) EH_CU_1D_AR	TPHFID (Aromatic)	0.01	mg/l	U	
Total Moisture at 105°C	TMSS	0.1	%	U	
Total Moisture at 35°C	CLANDPREP	0.1	%	N	
Colour of Material	CLANDPREP		-	N	
Major Constituents	CLANDPREP		-	N	
Minor Constituents	CLANDPREP		-	N	
Miscellaneous Constituents	CLANDPREP		-	N	
Asbestos Identification	SUB020		-	N	

IOM

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: SOCOTEC UK Ltd
Environmental Chemistry
PO Box 100
Burton upon Trent
Staffordshire
DE15 0XD

CONTRACT NO: S21638-1

DATE OF ISSUE: 03.11.21

DATE SAMPLES RECEIVED: 27.10.21

DATE ANALYSIS COMPLETED: 03.11.21

DESCRIPTION: Seven soil/loose aggregate samples.

ANALYSIS REQUESTED: Qualitative analysis of samples for determination of presence/type of asbestos.

METHODS:

Our method involves initial examination of the samples followed by detailed analysis of representative sub-samples. The sub-samples are analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

RESULTS:

Initial Screening

Asbestos was detected in one of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.

www.iom-world.org

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Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED registered in Scotland No. SC205670

UKAS TESTING 0374

CONTRACT NO: S21638-1
DATE OF ISSUE: 03.11.21

RESULTS: (cont.)

Table 1: Qualitative Results

SOCOTEC Job I.D: 21101609

IOM sample number	SOCOTEC Sample ID	Client Sample ID	ACM type detected	PLM result
S85757	21101609-001-12	WS01-0-ES-0.40	-	No Asbestos Detected
S85758	21101609-002-12	WS02-0-ES-0.30	Loose Insulation[2]	Crocidolite
S85759	21101609-003-12	WS03-0-ES-0.30	-	No Asbestos Detected
S85760	21101609-004-12	WS04-0-ES-0.80	-	No Asbestos Detected
S85761	21101609-005-12	HP01-0-ES-0.30	-	No Asbestos Detected
S85762	21101609-006-12	HP02-0-ES-0.40	-	No Asbestos Detected
S85763	21101609-007-12	HP03-0-ES-0.30	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

[1] ACM was visible during initial examination of the sample.
[2] ACM was detected during microscopic examination of the sample.

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

K. Parsons-Hewes

AUTHORISED BY: .....
K Parsons-Hewes
Senior Scientific Technician

Client: GeoEnviro Solutions Ltd
Project Name: Woodhead Road, Honley
Project No: 21101609
Date Issued: 03/11/2021

Deviating Sample Report

Sample Reference	Text ID	Reported Name	Incorrect Container	Incorrect Label	Headspace	Incorrect/No Preservative	No Sampling Date	Holding Time

Analysis Method

Analysis	Analysis Type	Analysis Method
BTEXHSA	ORGANIC	Unfiltered
CLANDPREP	PHYS	As Received
GROHSA	ORGANIC	As Received
GROHSA/BTEXHSA	ORGANIC	As Received
ICPMSS	METALS	Air Dried & Ground
ICPMSW (Dissolved)	METALS	Unfiltered
ICPWATVAR (Dissolved)	METALS	Filtered
ICPWSS	METALS	Air Dried & Ground
KONENS	INORGANIC	Air Dried & Ground
PAHMSUS	ORGANIC	As Received
PAHMSW	ORGANIC	Unfiltered
PHCONDW	INORGANIC	Unfiltered
PHSOIL	INORGANIC	As Received
SFAPI	INORGANIC	As Received
SUB020	SUBCON	
TMSS	PHYS	As Received
TPHFID (Aliphatic)	ORGANIC	Unfiltered
TPHFID (Aromatic)	ORGANIC	Unfiltered
TPHFIDUS (Aliphatic)	ORGANIC	As Received
TPHFIDUS (Aromatic)	ORGANIC	As Received
WSLM13	INORGANIC	Unfiltered
WSLM59	INORGANIC	Air Dried & Ground

Client: GeoEnviro Solutions Ltd
Project Name: Woodhead Road, Honley
Project No: 21101609
Date Issued: 03/11/2021

Result Report Notes

Letters alongside results signify that the result has associated report notes.
The report notes are a follows:

Letter	Note
A	Due to the matrix of the sample the laboratory has had to deviate from our standard protocols to be able to process the sample and provide a result. Where applicable the accreditation has been removed and this should be taken into consideration when utilising the data.
B	The QC associated with this result has not wholly met the QMS requirements, the accreditation has therefore been removed. However, the Laboratory has confidence in the performance of the method as a whole and that the integrity of the data has not been significantly compromised.
C	Due to matrix interference the internal standard and/or surrogate has not met the QMS requirements. This should be taken into consideration when utilising the data.
D	A non-standard volume or mass has been used for this test which has resulted in a raised detection limit.
E	Due to recoveries beyond our calibration range and following the maximum size of dilution allowed, the result cannot be quantified and as such the result will appear as a greater than symbol (>) with the accreditation removed. This data should be used for indicative purposes only.
F	Based on the sample history, appearance and smell a dilution was applied prior to testing . Unfortunately, the result is either above (>) or below (<) our calibration range. Results above our calibration range have accreditation removed. The data should be used for indicative purposes only.
G	The day 5 oxygen reading was below the capability of the instrument to detect, and therefore the calculated BOD has been reported unaccredited for guidance purposes only.

HWOL Acronym Key

Acronym	Description
HS	Headspace Analysis
EH	Extractable Hydrocarbons - i.e everything extracted by the solvent(s)
CU	Clean up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
+	Operator to indicate cumulative e.g. EH_CU+HS_1D_Total

Additional Information

This report refers to samples as received, and SOCOTEC UK Ltd takes no responsibility for accuracy or competence of sampling by others.

Results within this report relate only to the samples tested.

In the accreditation column of analysis report the codes are as follows:

U = UKAS accredited analysis
M = MCERT accredited analysis
N = Unaccredited analysis

Any units marked with ^ signify results are reported on a dry weight basis of 105 ºc.

All Air Dried and Ground Samples (ADG) are oven dried at less than 35º c.

This report shall not be reproduced except in full and with approval from the laboratory.

Opinions and interpretations given are outside the scope of our UKAS accreditation.

Any samples marked with * are not covered by our scope of UKAS accreditation. If applicable, further report notes have been added.

Any solid samples where the Major Constituents are not one of the following (Sand, Silt, Clay, Made Ground) are not one of our accredited matrix types.

Any samples marked with ‡ have had MCERTS accreditation removed for this result

Any samples marked with a tick in the deviant table is deviant for the specific reason.

Any samples reported as IS, NA, ND mean the following:

IS = Insufficient Sample to complete analysis
NA = Sample is not amenable for the required analysis
ND = Results cannot be determined

Our deviating sample report does not include deviancy information for Subcontracted analysis. Please see the report from the Subcontracted lab for information regarding any deviancies for this analysis.

End of Certificate of Analysis

APPENDIX 5

CHEMICAL SCREENING CRITERIA

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Metals/metalloids																			
Arsenic	37			40			43			640			79			170			LQM (2014)
Beryllium	1.7			1.7			35			12			2.2			63			LQM (2014)
Boron	290			11000			45			240000			21000			46000			LQM (2014)
Cadmium	11			85			1.9			190			120			532			LQM (2014)
Chromium III	910			910			18000			8600			1500			33000			LQM (2014)
Chromium VI	6			6			1.8			33			7.7			220			LQM (2014)
Copper	2400			7100			520			68000			12000			44000			LQM (2014)
Lead	200			310			80			2330			630			1300			C4SL
Mercury (elemental)	1.2			1.2			21			58 (25.8)			16			30 (25.8)			LQM (2014)
Mercury (Inorganic)	40			56			19			1100			120			240			LQM (2014)
Methylmercury	11			15			6			320			40			68			LQM (2014)
Nickel	180			180			230			980			230			3400			LQM (2014)
Selenium	250			430			88			12000			1100			1800			LQM (2014)
Vanadium	410			1200			91			9000			2000			5000			LQM (2014)
Zinc	3700			40000			620			730000			81000			170000			LQM (2014)
Other																			
Total Sulphate	2,400			2,400			2,400			2,400			2,400			2,400			BRE (2005)
Water Soluble Sulphate (g/l)	0.5			0.5			0.5			0.5			0.5			0.5			BRE (2005)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
PAHs																			
Acenaphthene	210	510	1100	3000 (57)	4700(141)	6000 (336)	34	85	200	84000 (57)	97000 (141)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Acenaphthylene	170	420	920	2900 (86.1)	4600 (212)	6000 (506)	28	69	160	8300 (86.1)	97000 (212)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Anthracene	2400	5400	11000	31000 (1.17)	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	LQM (2014)
Benzo(a)anthracene	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	LQM (2014)
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	LQM (2014)
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	44	44	45	7.1	7.1	7.1	13	15	16	LQM (2014)
Benzo(g,h,i)perylene	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	LQM (2014)
Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	LQM (2014)
Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	LQM (2014)
Dibenz(a,h)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.61	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	LQM (2014)
Fluoranthene	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	63	6300	6400	LQM (2014)
Fluorene	170	400	860	2800 (30.9)	3800 (76.5)	4500 (183)	27	67	160	63000 (30.9)	68000	71000	9900	9900	9900	20000	20000	20000	LQM (2014)
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Naphthalene	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190 (76.4)	460 (183)	1100 (432)	4900	4900	4900	1200 (76.4)	1900 (183)	3000	LQM (2014)
Phenanthrene	95	220	440	1300 (36)	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	LQM (2014)
Pyrene	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	LQM (2014)
Coal Tar (BaP as surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	LQM (2014)
BTEX and TPH																			
Benzene	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	LQM (2014)
Toluene	130	290	660	880 vap (869)	1900	3900	22	51	120	56000 vap (869)	110000 vap (1920)	180000 vap (4360)	56000	56000	56000	87000 vap (869)	95000 vap (1920)	100000 vap (4360)	LQM (2014)
Ethylbenzene	47	110	260	83	190	440	16	39	91	5700 vap (518)	13000 vap (1220)	27000 vap (2840)	24000	24000	25000	17000 vap (518)	22000 vap (1220)	27000 vap (2840)	LQM (2014)
Xylene - o	60	140	330	88	210	480	28	67	160	6600 (478)	15000 (1120)	33000 (2620)	41000	42000	43000	17000 (478)	24000 (1120)	33000 (2620)	LQM (2014)
Xylene - m	59	140	320	82	190	450	31	74	170	6200 (625)	14000 (1470)	31000 (3460)	41000	42000	43000	17000 (625)	24000 (1470)	32000 (3460)	LQM (2014)
Xylene - p	56	130	310	79	180	430	29	69	160	5900 (576)	14000 (1350)	30000 (3170)	41000	42000	43000	17000 (576)	23000 (1350)	31000 (3170)	LQM (2014)
Aliphatic EC 5-6	42	78	160	42	78	160	730	1700	3900	3200 (304)	5900 (558)	12000 (1150)	570000 (304)	590000	600000	95000 (304)	130000 (558)	180000 (1150)	LQM (2014)
Aliphatic EC >6-8	100	230	530	100	230	530	2300	5600	13000	7800 (144)	17000 (322)	40000 (736)	600000	610000	620000	150000 (144)	220000 (322)	320000 (736)	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Aliphatic EC >8-10	27	65	150	27	65	150	320	770	1700	2000 (78)	4800 (190)	11000 (451)	13000	13000	13000	14000 (78)	18000 (190)	21000 (451)	LQM (2014)
Aliphatic EC >10-12	130 (48)	330 (118)	760 (283)	130 (48)	330 (118)	760 (283)	2200	4400	7300	9700 (48)	23000 (118)	47000 (283)	13000	13000	13000	21000 (48)	23000 (118)	24000(283)	LQM (2014)
Aliphatic EC >12-16	1100 (24)	2400 (59)	4300 (142)	1100 (24)	2400 (59)	4300 (142)	11000	13000	13000	59000 (24)	82000 (59)	90000 (142)	13000	13000	13000	25000 (24)	25000 (59)	26000 (142)	LQM (2014)
Aliphatic EC >16-35	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	LQM (2014)
Aliphatic EC >35-44	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	LQM (2014)
Aromatic EC 5-7	70	140	300	370	690	1400	13	27	57	26000 (1220)	46000 (2260)	86000 (4710)	56000	56000	56000	76000 (1220)	84000 (2260)	92000 (4710)	LQM (2014)
Aromatic EC >7-8	130	290	660	860	1800	3900	22	51	120	56000 (869)	110000 (1920)	180000 (4360)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4360)	LQM (2014)
Aromatic EC >8-10	34	83	190	47	110	270	8.6	21	51	3500 (613)	8100 (1500)	17000 (3580)	5000	5000	5000	7200 (613)	8500 (1500)	9300 (3580)	LQM (2014)
Aromatic EC >10-12	74	180	380	250	590	1200	13	31	74	16000 (364)	28000 (899)	34000 (2150)	5000	5000	5000	9200 (364)	9700 (899)	10000	LQM (2014)
Aromatic EC >12-16	140	330	660	1800	2300 (419)	2500	23	27	130	36000 (169)	37000	38000	5100	5100	5000	10000	10000	10000	LQM (2014)
Aromatic EC >16-21	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	LQM (2014)
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Aromatic EC >35-44	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >44-75	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
VOCs																			
1,2-dichloroethane (1,2-DCA)	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	LQM (2014)
1,1,1-trichloroethane	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000 (1425)	76000 (2915)	100000 (6392)	LQM (2014)
1,1,2,2,tetrachloroethane	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	LQM (2014)
tetrachloroethene	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	45	95	1400	1400	1400	810 (424)	1100 (951)	1500	LQM (2014)
tetrachloromethane (Carbon tetrachloride)	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	LQM (2014)
Trichloroethene	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	LQM (2014)
Trichloromethane (chloroform)	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	LQM (2014)
Chloroethene (Vinyl chloride)	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	LQM (2014)
2,4,6 Trinitrotoluene (TNT)	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
RDX	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000 (18.7)	51000	53000	LQM (2014)
HMX	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000 (0.35)	23000 (0.39)	24000 (0.48)	LQM (2014)
Aldrin	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	LQM (2014)
Dieldrin	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	LQM (2014)
Atrazine	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	LQM (2014)
Dichlovos	0.032	0.066	0.014	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	LQM (2014)
Alpha-Endosulfan	7.4	18	41	160 (0.003)	280 (0.007)	410 (0.016)	1.2	2.9	6.8	5600 (0.003)	7400 (0.007)	8400 (0.016)	1200	1200	1200	2400	2400	2500	LQM (2014)
alpha-Hexachlorocyclohexane	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	LQM (2014)
beta-hexachlorocyclohexanes	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	LQM (2014)
gamma-hexachlorocyclohexanes	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	LQM (2014)
Chlorobenzene	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300 (675)	2000 (1520)	2900	LQM (2014)
1,2-Dichlorobenzene	23	55	130	24	57	130	94	230	540	2000 (571)	4800 (1370)	11000 (3240)	90000	95000	98000	24000 (571)	36000 (1370)	51000 (3240)	LQM (2014)
1,3-Dichlorobenzene	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
1,4-Dichlorobenzene	61	150	350	61	150	350	15	37	88	4400 (224)	10000 (540)	25000 (1280)	17000	17000	17000	36000 (224)	36000 (540)	36000 (1280)	LQM (2014)
VOCs Continued																			
1,2,3-Trichlorobenzene	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770 (134)	1100 (330)	1600 (789)	LQM (2014)
1,2,4-Trichlorobenzene	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700 (318)	2600 (786)	4000 (1880)	LQM (2014)
1,3,5-Trichlorobenzene	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380 (36.7)	580 (90.8)	860 (217)	LQM (2014)
1,2,3,4-Tetrachlorobenzene	15	36	78	24	56	120	4.4	11	26	1700 (122)	3080 (304)	4400 (728)	830	830	830	1500 (122)	1600	1600	LQM (2014)
1,2,3,5-Tetrachlorobenzene	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49 (39.4)	120 (98.1)	240 (235)	78	79	79	110 (39)	120	130	LQM (2014)
1,2,4,5-Tetrachlorobenzene	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42 (19.7)	72 (49.1)	96	13	13	13	25	26	26	LQM (2014)
Pentachlorobenzene	5.8	12	22	19	30	38	1.2	3.1	7	640 (43)	770 (107)	830	100	100	100	190	190	190	LQM (2014)
Hexachlorobenzene	1.8 (0.2)	3.3 (0.5)	4.9	4.1 (0.2)	5.7 (0.5)	6.7 (1.2)	0.47	1.1	2.5	110 (0.2)	120	120	16	16	16	30	30	30	LQM (2014)
Phenol	280	550	1100	750	1300	2300	66	140	280	760 dir (31000)	1500 dir (35000)	3200 dir (37000)	760 dir (31000)	1500 dir (35000)	3200 dir (37000)	760 dir (31000)	1500 dir (35000)	3200 dir (37000)	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Chlorophenols (excluding pentachlorophenol)	0.87 (g)	2	4.5	94	150	210	0.13 (g)	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	LQM (2014)
Pentachlorophenol	0.22	0.52	1.2	27 (16.4)	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	LQM (2014)
Carbon Disulphide	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	LQM (2014)
Hexachlorobutadiene	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	LQM (2014)

(g) derived based on 2,3,4,6-tetrachlorophenol; dir - based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only); (vap) calculated for vapour phase only. SOM – Soil Organic Matter; (4.5) solubility.

APPENDIX 6

GAS AND GROUNDWATER MONITORING RESULTS

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client: Fuel Doctor
Site: Woodhead Road Honley
Date: 22/10/2021

Job No: 1623-21
Visit No: 1 **of** 6
Operator:
Project Manager:

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.0	0.0	0.0	0.0	2.2	2.2	0	0	0	0	19.0	19.0	NR	NR	0.0	0.0					0.00	4.50				
WS02	0.0	0.0	0.0	0.0	2.1	2.1	0	0	0	0	18.1	18.1	NR	NR	0.1	0.0					0.00	5.50				
WS03	0.0.	0.0	0.0	0.0	2.0	2.0	0	0	0	0	14.9	15.5	NR	NR	0.0	0.0					0.00	6.50				
WS04	0.0	0.0	0.0	0.0	2.0	2.0	0	0	0	0	14.9	15.5	NR	NR	0.0	0.0			0	0	0.00	5.50				
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.0**	**0.0**	**0.0**	**0.0**	**2.2**	**2.2**	**0**	**0**	**0**	**0**	**19.0**	**19.0**	**ND**	**ND**	**0.1**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**0.00**	**6.50**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**2.0**	**2.0**	**0**	**0**	**0**	**0**	**14.9**	**15.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**0.00**	**4.50**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0.0022

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground:		Dry		Moist	X	Wet		Snow		Frozen
Wind:		Calm		Light	X	Moderate		Strong		
Cloud cover:		None		Slight	X	Cloudy		Overcast		
Precipitation:		None		Slight	X	Moderate		Heavy		
Time monitoring performed:			08:30	Start			10:30	End		
Barometric pressure (mbar):			1003	Start			1003	End		
Pressure trend (Daily):				Falling		Steady	X	Rising		
Source:	Wunderground									
Air Temperature (Deg. C):			8	Before			10	After		

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS: 1623-21
Client: Fuel Doctor
Site: Woodhead Road Honley
Date: 16/11/2021

Job No: 1623-21
Visit No: 2 **of** 6
Operator: BH/RL
Project Manager: 0

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.1	0.1	0.0	0.0	2.4	2.4	0	0	0	0	18.7	18.7	NR	NR	0.0	0.0			0	0	DRY	4.50				
WS02	0.1	0.1	0.0	0.0	3.5	3.5	0	0	0	0	17.3	17.4	NR	NR	0.0	0.0			0	0	DRY	5.00				
WS03	0.1	0.1	0.0	0.0	4.1	4.1	0	0	0	0	14.8	14.8	NR	NR	0.0	0.0			0	0	DRY	5.50				
WS04	0.0	0.0	0.0	0.0	3.8	0.1	0	0	0	0	15.1	21.5	NR	NR	0.0	0.0			0	0	DRY	5.50				
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.1**	**0.1**	**0.0**	**0.0**	**4.1**	**4.1**	**0**	**0**	**0**	**0**	**18.7**	**21.5**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**DRY**	**5.50**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**2.4**	**0.1**	**0**	**0**	**0**	**0**	**14.8**	**14.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**DRY**	**4.50**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground:		Dry	x	Moist		Wet		Snow		Frozen
Wind:	X	Calm		Light		Moderate		Strong		
Cloud cover:		None	X	Slight		Cloudy		Overcast		
Precipitation:		None	X	Slight		Moderate		Heavy		
Time monitoring performed:			10:15				07:12	End		
Barometric pressure (mbar):			1000	Start			1007	End		
Pressure trend (Daily):				Falling	X	Steady		Rising		
Source:	Wunderground									
Air Temperature (Deg. C):			9	Before			9	After		

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS: 0
Client: Fuel Doctor
Site: Woodhead Road Honley
Date: 26/11/2021

Job No: 1623-21
Visit No: 3 **of** 6
Operator: BH
Project Manager: 0

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.1	0.1	0.0	0.0	2.3	2.3	0	0	0	0	19.5	19.5	NR	NR	0.0	0.0			0	0	Dry	4.50				
WS02	0.1	0.1	0.0	0.0	4.0	4.0	0	0	0	0	17.1	17.1	NR	NR	0.0	0.0			0	0	Dry	5.50				
WS03	0.1	0.1	0.0	0.0	3.9	3.9	0	0	0	0	16.8	16.9	NR	NR	0.0	0.0			0	0	Dry	6.50				
WS04	0.1	0.1	0.0	0.0	3.7	1.0	0	0	0	0	16.4	18.0	NR	NR	0.0	0.0			0	0	Dry	5.50				
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.1**	**0.1**	**0.0**	**0.0**	**4.0**	**4.0**	**0**	**0**	**0**	**0**	**19.5**	**19.5**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**DRY**	**6.50**	**NR**	**NR**		
Min	**0.1**	**0.1**	**0.0**	**0.0**	**2.3**	**1.0**	**0**	**0**	**0**	**0**	**16.4**	**16.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**DRY**	**4.50**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0

ND - Not detected
NR - Not recorded
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C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground:		Dry	X	Moist		Wet		Snow		Frozen
Wind:		Calm	X	Light		Moderate		Strong		
Cloud cover:		None		Slight	X	Cloudy		Overcast		
Precipitation:		None		Slight		Moderate		Heavy		
Time monitoring performed:			08:20	Start			09:23	End		
Barometric pressure (mbar):			978	Start			978	End		
Pressure trend (Daily):				Falling		Steady	x	Rising		
Source:	Wunderground									
Air Temperature (Deg. C):			6	Before			6	After		

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client: Fuel Doctor
Site: Woodhead Road Honley
Date:

Job No: 1623-21
Visit No: 4 **of** 6
Operator:
Project Manager: 0

Monitoring Point	GAS CONCENTRATIONS: Methane (%v/v) Peak	Methane (%v/v) Steady	%LEL Peak	%LEL Steady	Carbon dioxide (%v/v) Peak	Carbon dioxide (%v/v) Steady	Carbon monoxide (ppmv) Peak	Carbon monoxide (ppmv) Steady	Hydrogen sulphide (ppmv) Peak	Hydrogen sulphide (ppmv) Steady	Oxygen (%v/v) Min.	Oxygen (%v/v) Steady	VOLATILES: PID Peak (ppm)	Product thickness (mm)	FLOW DATA: Flow rate (l/hr) Peak	Flow rate (l/hr) Steady	Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Worst-credible GSVs: Methane (l/hr)	CO2 (l/hr)	WELL AND WATER DATA: Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	Comments
WS01	0.0	0.0	0.0	0.0	1.9	1.9	0	0	0	0	19.7	19.7	NR	NR	0.0	0.0			0	0	DRY	4.50				
WS02	0.0	0.0	0.0	0.0	2.3	2.3	0	0	0	0	19.5	19.5	NR	NR	0.0	0.0			0	0	DRY	5.50				
WS03	0.0	0.0	0.0	0.0	2.6	2.6	0	0	0	0	18.0	18.1	NR	NR	0.0	0.0			0	0	DRY	6.50				
WS04	0.0	0.0	0.0	0.0	2.4	0.4	0	0	0	0	18.3	21.3	NR	NR	0.0	0.0			0	0	DRY	5.50				
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.0**	**0.0**	**0.0**	**0.0**	**2.6**	**2.6**	**0**	**0**	**0**	**0**	**19.7**	**21.3**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**DRY**	**6.50**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**1.9**	**0.4**	**0**	**0**	**0**	**0**	**18.0**	**18.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**DRY**	**4.50**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground:		Dry	X	Moist		Wet		Snow		Frozen
Wind:	X	Calm		Light		Moderate		Strong		
Cloud cover:		None	X	Slight		Cloudy		Overcast		
Precipitation:	X	None		Slight		Moderate		Heavy		
Time monitoring performed:			15:00	Start			15:55	End		
Barometric pressure (mbar):			988	Start			988	End		
Pressure trend (Daily):				Falling	X	Steady		Rising		
Source:	Wunderground									
Air Temperature (Deg. C):			4	Before			4	After		

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client: Fuel Doctor
Site: Woodhead Road Honley
Date: 17/12/2021

Job No: 1623-21
Visit No: 5 **of** 6
Operator:
Project Manager: 0

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.0	0.0	0.0	0.0	1.7	1.7	0	0	0	0	19.9	19.9	NR	NR	0.0	0.0			0	0	DRY	4.50				
WS02	0.0	0.0	0.0	0.0	2.3	2.3	0	0	0	0	19.4	18.4	NR	NR	0.0	0.0			0	0	DRY	5.50				
WS03	0.0	0.0	0.0	0.0	3.0	3.0	0	0	0	0	16.7	16.8	NR	NR	0.0	0.0			0	0	DRY	6.50				
WS04	0.0	0.0	0.0	0.0	2.8	0.1	0	0	0	0	17.0	21.8	NR	NR	0.0	0.0			0	0	DRY	5.50				
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.0**	**0.0**	**0.0**	**0.0**	**3.0**	**3.0**	**0**	**0**	**0**	**0**	**19.9**	**21.8**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**DRY**	**6.50**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**1.7**	**0.1**	**0**	**0**	**0**	**0**	**16.7**	**16.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**DRY**	**4.50**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground:		Dry	x	Moist		Wet		Snow		Frozen
Wind:	x	Calm		Light		Moderate		Strong		
Cloud cover:		None	x	Slight		Cloudy		Overcast		
Precipitation:		None	x	Slight		Moderate		Heavy		
Time monitoring performed:			15:00	Start			15:50	End		
Barometric pressure (mbar):			1028	Start			1028	End		
Pressure trend (Daily):				Falling	X	Steady		Rising		
Source:	Wunderground									
Air Temperature (Deg. C):			6	Before			6	After		

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client: Fuel Doctor
Site: Woodhead Road Honley
Date: 10/01/2022

Job No: 1623-21
Visit No: 6 **of** 6
Operator:
Project Manager: 0

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA					Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.0	0.0	0.0.	0.0	1.9	1.9	0	0	0	0	18.9	18.9	NR	NR	0.0				0	0	DRY	4.50				
WS02	0.0	0.0	0.0	0.0	2.9	2.9	0	0	0	0	18.3	18.4	NR	NR	0.0				0	0	DRY	5.50				
WS03	0.0	0.0	0.0	0.0	3.1	3.1	0	0	0	0	17.0	17.0	NR	NR	0.0				0	0	DRY	6.50				
WS04	0.0	0.0	0.0	0.0	0.6	0.3	0	0	0	0	20.6	20.9	NR	NR	0.0				0	0	DRY	5.50				
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.0**	**0.0**	**0.0**	**0.0**	**3.1**	**3.1**	**0**	**0**	**0**	**0**	**20.6**	**20.9**	**ND**	**ND**	**0.0**	**ND**	**ND**	**NA**	**0.0000**	**0.0000**	**DRY**	**6.50**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**0.3**	**0**	**0**	**0**	**0**	**17.0**	**17.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**DRY**	**4.50**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0.00093

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground:		Dry	x	Moist		Wet		Snow		Frozen
Wind:	x	Calm		Light		Moderate		Strong		
Cloud cover:		None	x	Slight		Cloudy		Overcast		
Precipitation:		None	x	Slight		Moderate		Heavy		
Time monitoring performed:			08:35	Start			09:45	End		
Barometric pressure (mbar):			1001	Start			1001	End		
Pressure trend (Daily):				Falling	X	Steady		Rising		
Source:	Wunderground									
Air Temperature (Deg. C):			6	Before			6	After		

APPENDIX 7

RISK ASSESSMENT MATRIX

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008) sets out a methodology for the estimation of risk.

At Phase I the risk estimation will take the form of a qualitative risk assessment, which will be entirely based on the conceptual model for each potential end-use of the site. Comments on level of uncertainty will also need to be included for each source-pathway-target linkage to allow the confidence in the assessed risks to be understood. The results of the qualitative risk assessment will allow the risk evaluation to be concisely described in the following chapters.

The methodology for risk evaluation is a qualitative method for interpreting the output for the risk estimation stage of the assessment. It involves the classification of the:

The magnitude of probability (i.e. likelihood).
[takes into account both the presence of the hazard and receptor and the integrity of the pathway]

The magnitude of the potential consequence (i.e. severity).
[takes into account both the potential severity of the hazard and the sensitivity of the receptor]

Classification of Probability

Classification	Definition	Examples
High likelihood (Hi)	There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable in the long term, or there is evidence at the receptor or harm or pollution.	*Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.* *Ground/groundwater contamination could be present from chemical works, containing a number of USTs, having been in operation on the same site for over 50 years*
Likely (Li)	There is a pollutant 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 over the long term.	*Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space.* *Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.*
Low likelihood (Lw)	There is a pollutant 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 over the long term.	*Elevated concentrations of toxic contaminants are present in soils at depths >1m in a residential garden, or 0.5-1.0m in public open space.* *Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.*
Unlikely (Ul)	There is a pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.	*Elevated concentrations of toxic contaminants are present below hardstanding.* *Light industrial unit <10 yrs old containing a double skinned UST with annual integrity testing results available.*

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

Classification of Consequence

	Definition	Examples
Severe (Sv)	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. A Category 1: Human Health risk is present. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long - term maintenance of the population. Catastrophic damage to crops, buildings or property.	*Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.* *Major fish kill in surface water from large spillage of contaminants from site.* *Highly elevated concentrations of List I and substances present in groundwater close to small potable abstraction (high sensitivity).* *Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).*
Medium (Md)	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. A Category 2: Human Health risk is present. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.	*Significant harm to humans is defined in circular 01/2006 as death, disease* serious injury, genetic mutation, birth defects or the impairment of reproductive functions.* *Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability.* *Ingress of contaminants through plastic potable water pipes.*
Mild (Ml)	Exposure to human health unlikely to lead to "significant harm". A Category 3 Human Health risk is present. Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population Minor damage to crops, buildings or property.	*Exposure could lead to slight short - term effects (e.g. mild skin rash).* *Surface spalling of concrete.*
Minor (Mr)	No measurable effect on humans.A Category 4: Human Health risk is present. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	*The presence of contaminants at such concentrations that protective equipment is required during site works.* *The loss of plants in a landscaping scheme.* *Discolouration of concrete.*

* For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.

The classification of consequence does not take into account the probability of the consequence being realized. Therefore, there may be more than one consequence for a particular pollutant linkage. Both a severe and medium classification can result in death. Severe relates to short term (acute) risk while medium relates to long

term (chronic) risk. Mild relates to significant harm but to less sensitive receptors. Minor classification relates to harm which is not significant but could have a financial cost.

The classification gives a guide as to the severity and consequence of identified risk when compared with other risk presented on the site. It should be noted that if a risk is identified it cannot be classified as "no risk" but as "very low risk". Differing stakeholders may have a different view on the acceptability of a risk.

Risk Evaluation Matrix

		Consequence			
		Severe (Sv)	Medium (Md)	Mild (Mi)	Minor (Mr)
Probability	High likelihood (Hi)	Very high risk (VH)	High Risk (H)	Moderate Risk (M)	Mod/low risk (M/L)
	Likely (Li)	High risk (H)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)
	Low likelihood (Lw)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)
	Unlikely (Ul)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)	Very low risk (VL)

Risk Categorizations

Very high risk (VH)	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realized, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High risk (H)	Harm is likely to arise to a designated receptor from an identified hazard. Realization of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
Moderate risk (M)	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk (L)	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realized, would at worst normally be mild.
Very low risk (VL)	There is a low possibility that harm could arise to a receptor. In the event of such harm being realized it is not likely to be severe.

Reference

Rudland, D J, Lancefield, R M, Mayell, P N; 2001; Contaminated land Risk Assessment. A guide to Good Practice; CIRIA Report C552.

The NHBC (National House-Building Council) the Environment Agency and the Chartered Institute of Environmental Health, 2008, Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66.