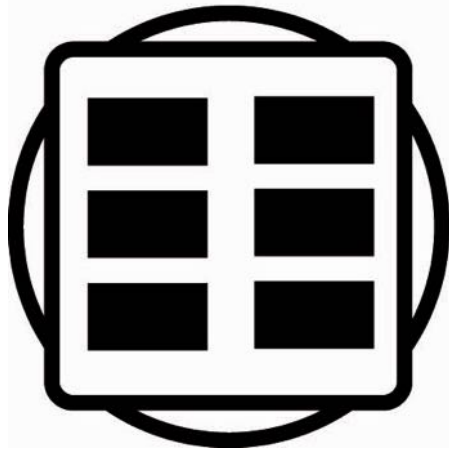




Mugen
Geo Ltd.

**PHASE 2 SITE INVESTIGATION &
GEO-ENVIRONMENTAL APPRAISAL**

**LAND
AT
RIVERSIDE BUSINESS PARK
TODMORDEN ROAD
LITTLEBOROUGH
OL15 9EG**

Document Status: FINAL
Revision: v1

For
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Date: November 2024



Executive Summary and Conceptual Site Model

Site Setting	Client	G.B. Services (Littleborough) LLP
	Site	Land at Riverside Business Park, southeast of Todmorden Road in Littleborough
	Site Location	NGR 394102E 416800N
	Current Land Use & Development Proposal	The site was an irregular shaped parcel of land in a commercial setting in Littleborough. It is planned to add to the existing development at the site for commercial use with an additional portal frame building adjacent to the existing units.
Conceptual Site Model Potential Pollutant Linkages	Surrounding Area	The site was situated within a commercial setting with residential uses noted on the opposite side of the road.
	Geology	The British Geological Survey (BGS) 1:50,000 scale map solid & drift Digital Geological Map of Great Britain indicates the site is underlain by superficial deposits of Alluvium (clay, silt, sand and gravel) below most of the site, with Alluvial Fan Deposits (sand and gravel) in the northwest of the site. Underlying the Superficial Deposits the solid geology of Woodhead Hill Rock sandstone of the Pennine Lower Coal Measures of the Carboniferous Period was recorded. A geological fault is shown to run northwest-southeast about 15m northeast. Natural subsidence hazards are shown as moderate (compressible ground stability).
	Hydrogeology	The aquifers within the bedrock deposits are designated as 'Secondary A'. These are described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and a source of base flow to rivers.
	Possible pollutant linkages on undeveloped site determined from a desk study and site walkover	
	Preliminary Sources	The former garage, underground storage tank and associated pipework on land adjacent to the site was considered the primary potential source of contamination.
	Preliminary Pathways	• Ingestion, inhalation or direct contact • Leaching through unsaturated zone • Direct contact with free phase or dissolved phase • Fugitive dust • Migration through Soils or groundwater to indoor air
	Potential Receptors	• Site Workers • End users of the site • Neighbours • Groundwater and possible abstractors or aquatic ecosystems • Building Products
	Site Investigation Findings	Site Investigation – The site investigation comprised three boreholes with three monitoring wells installed and three trial pits. The ground investigation confirmed the ground conditions comprised made ground recorded between 0.9m and 1.6m thickness. Natural strata were confirmed comprised Alluvial deposits predominantly of silty clays. Geoenvironmental – The findings of the generic risk assessment are that concentrations of all Petroleum Hydrocarbons were below their relevant screening values except Diesel range Aromatic hydrocarbons for a single sample at WS3 where a slight hydrocarbon odour was noted in the vicinity of a former interceptor tank. It is assumed In order to facilitate the proposed development any contaminated soils are

		remediated. Ground Gas Risk – The risks associated with the ground gases methane (CH ₄) and carbon dioxide (CO ₂) have been assessed with reference to BS 8485:2015 and guidelines from CIRIA 665 and the NHBC. Characteristic Situation 1 standard is interpreted to apply at this site and as such no gas protection is necessary under the requirements of BS8485:2015+A1:2019.
	Uncertainties & Limitations	The investigation was limited in scope. Mugen Geo Ltd believes that the current investigation accurately models the site and that the suggested development strategy is adequate for the conditions already encountered and likely to be encountered on clearance of the site.

This is only a summary.

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Note: This report has been formatted to be read as a PDF.

1 INTRODUCTION

Mugen Geo Ltd were commissioned by G.B. Services (Littleborough) LLP to undertake an intrusive investigation of 'Land at Riverside Business Park, southeast of Todmorden Road in Littleborough' (the site).

1.1 Scope and objective of the report

This report has been prepared to provide supporting information relating to geo-environmental aspects for development of the site for a new commercial development.

This report has been developed in accordance with the YALPAG Technical Guidance for Developers Landowners & Consultants Version 10.3 – April 2019 (Ref 12), Land Contamination Risk Management (Ref. 1), and other best practice guidance cited at the end of this report.

The study has not included checks on services on or adjacent to the site, and no structural, ecological or asbestos surveys have been carried out.

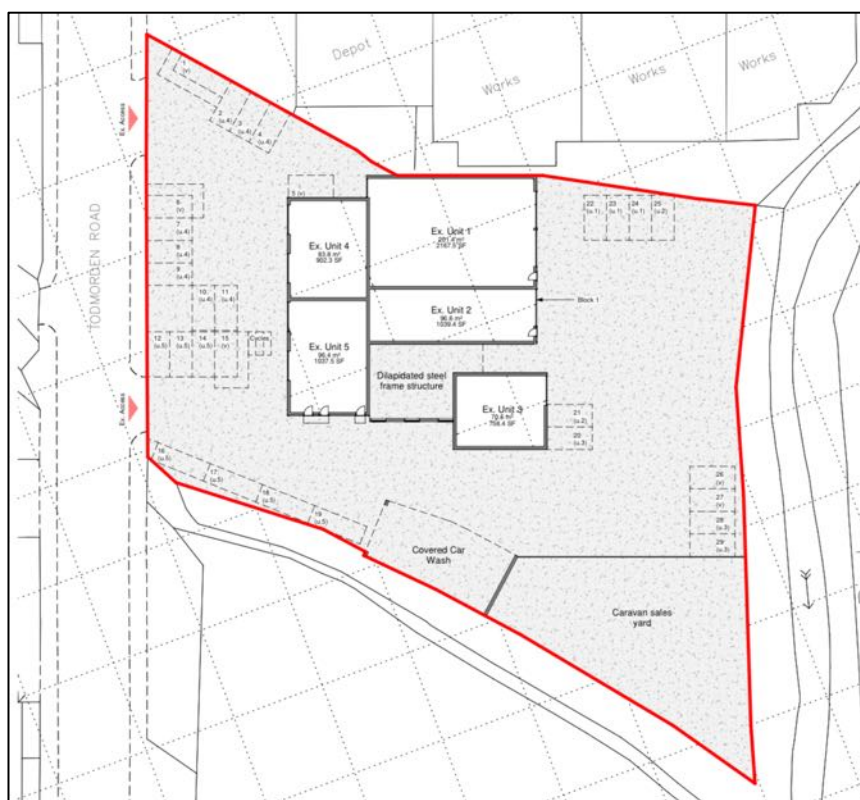


Figure 1 Site Location

1.2 Site Description

The site was an irregular shaped parcel of land in a commercial setting in Littleborough as shown in figures 1 & 2 and the site photos included as appendix B.

The development area comprised a derelict building and the immediately surrounding land. There is a caravan compound at the south of the development area, with portacabin office at its northeast. On the southwest boundary is a portacabin with ground covered with macadam patchwork hardcore and unsurfaced areas.

Town House Brook formed the southwest boundary and flowed south-east and the River Roch formed the southeast boundary and flowed south-west. To the northeast is a small block of industrial units and to the northwest are houses.

Site details are summarised in Table 2.1 below:

Detail	Remarks
Location	Land at Riverside Business Park, southeast of Todmorden Road in Littleborough
NGR	394102E 416800N
Known services	Underground sewers, drainage, gas, electric, water cable/telecoms

Table 2.1 – Site Summary

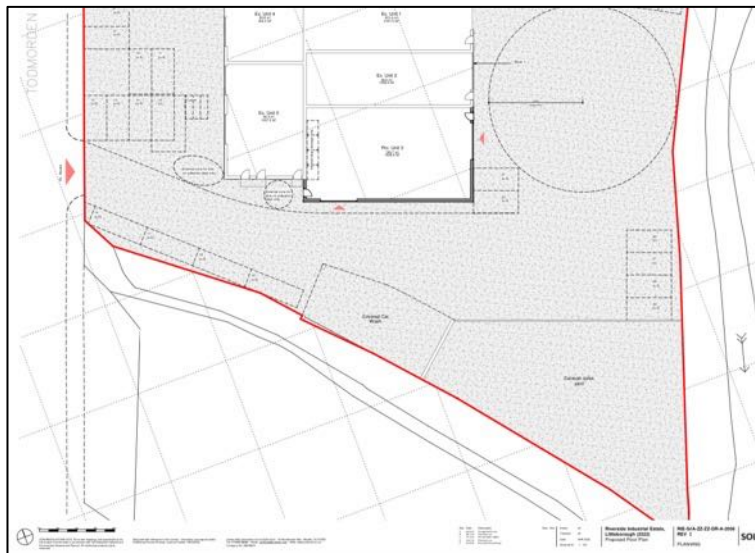


Figure 2 – Indicative development plan

No evidence of Japanese Knotweed or other invasive species was identified during the site walkover, however, a detailed inspection of the fauna was not undertaken.

1.2.1 Underground Fuel Tank

An Underground Fuel Tank was present in the west of the site. It is understood the underground fuel tank was cleaned out and filled with concrete sometime in the 1990's.

It is understood there are no plans to investigate the tank as the development is remote from the tank.

1.3 Previous Reports

A Phase 1 investigation was prepared by Worms Eye Limited to provide supporting information relating to geo-environmental aspects for development of the site for commercial use.

- Preliminary Risk Assessment (Desk Study) - Riverside Business Park Todmorden Road Littleborough OL15 9EG dated October 2023

This report has been used to characterise the site and develop a conceptual site model relating to geo-environmental aspects for development.

1.4 Limitations

This report has been prepared for the sole use and reliance of the Client named above and cannot be relied upon by any other parties without the express written authorisation of Mugen Geo Ltd. Any unauthorized third party relies on this report at their own risk and the authors owe them no duty of care.

Draft versions of this report cannot be relied upon and Mugen Geo Ltd accept no liability for decisions made based upon any draft versions circulated as part of project development. Please refer to the FINAL report only for decision making purposes.

The report should be read in its entirety, including all associated drawings and appendices. Mugen Geo Ltd cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. The report presents observations and factual data obtained during our site investigation, and provides an assessment of geo-environmental issues with respect to information provided by the Client and specific to the proposed development. Further advice should be sought from Mugen Geo Ltd prior to significant revision of the development proposals.

The geo-environmental investigation was undertaken on behalf of The Client (referenced above). The investigation was designed based upon information supplied by the client & on the assumption that the site is to be developed for commercial use.

The findings and opinions based upon the assessment conveyed in this report is based on information obtained from sources which Mugen Geo Ltd believe are reliable. All reasonable endeavours have been made to source the information from reputable organisations, however, Mugen Geo Ltd accepts no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data. No attempt has been made to independently verify any data collected by others or from other sources.

Whilst the prepared report may express an opinion on the possible configuration of strata, contaminants or gases between or beyond exploratory hole positions or on the possible presence of features based on visual, verbal or published evidence, this is for guidance only, and no liability can be accepted for its accuracy.

Comments on groundwater and ground gas conditions are based on observations made at the time of the investigation. It should be noted, however, that groundwater and ground gas levels may vary from those reported due to seasonal or other effects.

Consideration should be given to the possibility that exploratory holes excavated as part of this investigation, and indeed any previous ground work by others, may be encountered beneath or within the influence of the proposed development. Mugen Geo Ltd cannot be held responsible for failure of excavations or structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Existing manhole covers were not lifted and drainage runs were not inspected during the course of this ground investigation.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

Mugen Geo Ltd reserves the right to amend their conclusions and recommendations in the light of further information that may become available.



2 GEO-ENVIRONMENTAL SETTING

Site Setting	Site	Land at Riverside Business Park, southeast of Todmorden Road in Littleborough
	Site Location	NGR 394102E 416800N
	Current Land Use & Development Proposal	The site was an irregular shaped parcel of land in a commercial setting in Littleborough. It is planned to develop the site for commercial use with an additional portal frame building adjacent to the existing units.
Conceptual Site Model Potential Pollutant Linkages	Site History	The site was undeveloped until sometime prior to 1910 when several small structures were noted. By 1961 a Garage was denoted in the northwest of site. The southeast of site shown vacant. There were minor changes in the 1970's and 1980's. By 2023 the Garage was no longer operating and the building extended to northeast and split into individual units, reflecting the existing site usage.
	Surrounding Area	The site was situated within a commercial setting with residential uses noted on the opposite side of the road.
	Geology	The British Geological Survey (BGS) 1:50,000 scale map solid & drift Digital Geological Map of Great Britain indicates the site is underlain by superficial deposits of Alluvium (clay, silt, sand and gravel) below most of the site, with Alluvial Fan Deposits (sand and gravel) in the northwest of the site. Underlying the Superficial Deposits the solid geology of Woodhead Hill Rock sandstone of the Pennine Lower Coal Measures of the Carboniferous Period was recorded. A geological fault is shown to run northwest-southeast about 15m northeast. Natural subsidence hazards are shown as moderate (compressible ground stability).
	Hydrogeology	The aquifers within the bedrock deposits are designated as 'Secondary A'. These are described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and a source of base flow to rivers.
	Possible pollutant linkages on undeveloped site determined from a desk study and site walkover	
	Preliminary Sources	The former use of the site as garage with the potential for localised contamination within the subsurface including asbestos, heavy metals, hydrocarbon compounds, semi-volatile and volatile compounds.
	Preliminary Pathways	• Ingestion, inhalation or direct contact • Leaching through unsaturated zone • Direct contact with free phase or dissolved phase • Fugitive dust • Migration through Soils or groundwater to indoor air
	Potential Receptors	• Site Workers • End users of the site • Neighbours • Groundwater and possible abstractors or aquatic ecosystems • Building Products
	Summary Findings	Contamination - The former garage located off the eastern boundary of the site was considered a potential source of contamination. A site investigation was recommended prior to development of the site.

3 SITE INVESTIGATION

3.1 General

The ground investigation was designed by Mugen Geo Ltd with consideration of the preliminary conceptual site model summarised in the previous section.

The principal objectives of the study were to recover environmental samples to advise regarding potential remedial options for the site.

3.2 Field Works

All intrusive works were undertaken by Mugen Geo Ltd to be in accordance with the standards outlined in BS 10175:2011. Three boreholes were formed on the on the 23rd September 2024 to characterise the shallow soils and install gas monitoring wells for site characterisation. The weather during the ground investigations was generally dry and breezy.

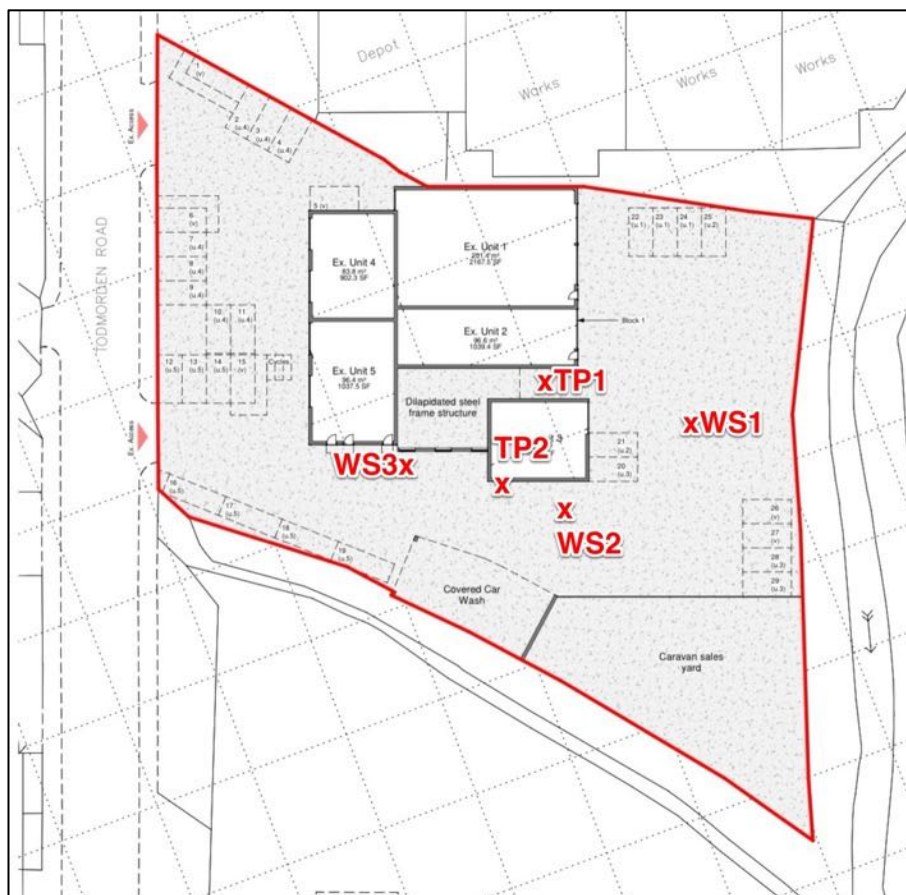


Figure 3 – Borehole Location plan

The boreholes were logged by an Engineering Geologist in accordance with BS 5930 (Ref. 3) and Eurocode 7 (Ref. 4) requirements. Method Statements and a Health &

Safety Plan for the work were prepared prior to mobilisation to site. To ensure that the exploratory holes were not underlain by any services, each location was cross-referenced against supplied utilities plans and then scanned using a cable avoidance tool prior to breaking ground.

A total of No. 6 geo-environmental soil samples were taken from the boreholes during the site works in accordance with BS 10175:2011, Section 8.3 (ref.9). Samples were stored in cool boxes (<4°C).

The borehole and trial pit logs are provided in appendix D, and the results of the chemical analysis results are provided in appendix E.

4 LABORATORY TESTING & MONITORING

4.1 Laboratory Testing

Environmental laboratory testing was scheduled on samples of natural soils taken from the boreholes. I2 Analytical undertook the testing to a schedule drawn up by Mugen Geo Ltd.

Selected samples were scheduled for a basic suite of determinants detailed in the analytical results for soil samples are provided within appendix E.

All testing was undertaken on a standard 10 day turnaround time.

5 GROUND CONDITIONS

5.1 General

Ground conditions encountered during this investigation were generally logged in accordance with the requirements of BS5930:1999. The ground conditions encountered during the investigation were generally in accordance with published records and broadly confirm the findings of the BGS and historic ordnance map records. Detailed borehole logs are included in appendix D.

The boreholes were formed across the site and provided good site coverage and where accessible given the existing structures and active site.

At WS1, made ground was recorded from ground level with grey brown gravelly clay recorded to 0.3m bgl over grey red and brown gravelly clay to 1.0m bgl. From 1.0m to 1.4m bgl made ground of grey brown slightly gravelly clay was recovered. From 1.4m bgl a stiff reddish brown mottled grey slightly gravelly clay was recorded to approximately 4.0m bgl. The borehole terminated within competent strata and a gas and groundwater monitoring well was installed. Groundwater was standing at 1.25m bgl upon completion.

At WS2, made ground was recorded from ground level with grey brown gravelly clay recorded to 0.2m bgl with a brick recovered from 0.2m to 0.3m bgl. From 0.3m bgl made ground of brown slightly gravelly clay to 1.0m bgl. From 1.0m natural soils a stiff reddish brown mottled grey slightly gravelly clay was recorded to approximately 1.9m bgl. From 1.9m to 2.5m the arisings were a soft to firm reddish brown silty saturated clay over stiff reddish brown mottled grey slightly gravelly clay was recorded to approximately 4.0m bgl. The borehole terminated within competent strata and a gas and groundwater monitoring well was installed. Groundwater was standing at 1.85m bgl upon completion.

At WS3, made ground was recorded from ground level with grey brown gravelly clay recorded to 1.2m bgl over a dark grey and brown slightly gravelly clay with a slight diesel/hydrocarbons odour to 1.4m bgl. The borehole was terminated at 1.4m bgl on a solid obstruction and a gas and groundwater monitoring well was installed. The borehole was dry upon completion.

Trial pit TP1 was located to the north of the development site and to the south of the existing portal frame building. Beneath a weak macadam made ground was recorded to approximately 0.5m bgl and comprised a red and grey clayey gravel and cobbles of brick and sandstone. From 0.5m bgl natural strata of a firm grey speckled brown silty clay was recovered to approximately 1.2m bgl. The trial pit was terminated within natural strata and backfilled with the arisings.

Trial pit TP2 was located to the south of the development site. Beneath a weak macadam made ground was recorded to approximately 0.5m bgl and comprised a red and grey clayey gravel and cobbles of brick and sandstone. From 0.5m bgl natural strata of a firm grey speckled brown silty clay was recovered to approximately 1.2m bgl. The trial pit was terminated within natural strata and backfilled with the arisings.

5.2 Soakaway

The ground conditions and shallow groundwater was considered sufficient to confirm that a soakaway system is unlikely to provide the indicated infiltration rate required for the accommodation of surface water drainage for surface run-off from the site. Some form of attenuation scheme is likely to be more suitable given the site setting and development proposal.

6 CONTAMINATION ANALYSIS

6.1 Analytical Strategy

The site investigation comprised random sampling locations. Soil samples were recovered from across the relevant depth range (generally less than 1m) for the conceptual model. The sampling was designed to consider surface soil and root zone for the vegetable cropping end uses to characterise the potentially significant exposure pathways.

The analytical suite comprised generic determinands of heavy metals, inorganics and hydrocarbons for contaminants associated with former historic uses. These were selected with reference to the DoE Industry Profiles.

6.1.1 Results of Chemical Analysis - Soils

Six samples of the recovered soils were analysed by I2 Analytical. The test results are provided in appendix E. The results have been screened in relation to Tier 1 contaminated land risk assessment criteria which are currently in use by the industry. The results of the screening are summarised in the following tables.

Determinand	Units	Screening criteria	Assessment Criteria	No of Samples tested	Min	Max	No. of Exceedences
Arsenic	mg/kg	640	S4UL	6		28	0
Cadmium	mg/kg	410	C4SL	6		1	0
Chromium	mg/kg	8600	C4SL	6		56	0
Lead	mg/kg	1330	S4UL	6		620	0
Mercury	mg/kg	120	S4UL	6		0.5	0
Nickel	mg/kg	980	S4UL	6		35	0
Copper	mg/kg	68000	S4UL	6		66	0
Zinc	mg/kg	730000	S4UL	6		220	0
Selenium	mg/kg	12000	S4UL	6	<1.0	<1.0	0

Table 61.1 Soil laboratory Analysis Results – metals & metalloids

Determinand	Units	Screening criteria	Assessment Criteria	No of Samples tested	Min	Max	No. of Exceedences
Acenaphthene	mg/kg	100000	S4UL	6	<0.05	0.52	0
Acenaphthylene	mg/kg	100000	S4UL	6	<0.05	0.63	0
Anthracene	mg/kg	54000	S4UL	6	<0.05	1.1	0
Benzo(a)anthracene	mg/kg	180	S4UL	6	<0.05	3.8	0
Benzo(a)pyrene	mg/kg	36	S4UL	6	<0.05	3.8	0
Benzo(b)fluoranthene	mg/kg	45	S4UL	6	<0.05	5.2	0
Benzo(ghi)perylene	mg/kg	49	S4UL	6	<0.05	3.8	0
Benzo(k)fluoranthene	mg/kg	1200	S4UL	6	<0.05	1.9	0
Chrysene	mg/kg	350	S4UL	6	<0.05	5	0
Dibenz(ah)anthracene	mg/kg	6.3	S4UL	6	<0.05	0.31	0
Fluoranthene	mg/kg	23000	S4UL	6	<0.05	8.1	0
Fluorene	mg/kg	71000	S4UL	6	<0.05	1.2	0
Indeno (123cd)pyrene	mg/kg	510	S4UL	6	<0.05	2.6	0
Naphthalene	mg/kg	1100	S4UL	6	<0.05	7.4	0
Phenanthrene	mg/kg	23000	S4UL	6	<0.05	4.7	0
Pyrene	mg/kg	54000	S4UL	6	<0.05	8.6	0

Table 61.2 Soil laboratory Analysis Results – Speciated PAHs hydrocarbons

Concentrations of heavy metals were all below their relevant screening values within the shallow soils. Concentrations of all Speciated Poly-aromatic Hydrocarbons were below their relevant screening values. No Asbestos fibres were recorded in selected samples.

Determinand	Units	Screening criteria	Assessment Criteria	No of Samples tested	Min	Max	No. of Exceedences
Aliphatic 1% SOM							
EC 5-6	mg/kg	42	LQM/CIEH S4UL	3	< 0.010	< 0.010	0
EC >6-8	mg/kg	100	LQM/CIEH S4UL	3	< 0.010	0.17	0
EC >8-10	mg/kg	27	LQM/CIEH S4UL	3	< 0.010	0.29	0
EC >10-12	mg/kg	130	LQM/CIEH S4UL	3	< 1.0	<1.0	0
EC >12-16	mg/kg	1100	LQM/CIEH S4UL	3	< 2.0	25	0
EC >16-35	mg/kg	65000	LQM/CIEH S4UL	3	140	11000	0
Aromatic 1% SOM							
EC 5-7	mg/kg	70	LQM/CIEH S4UL	3	< 0.010	< 0.010	0
EC >7-8	mg/kg	130	LQM/CIEH S4UL	3	< 0.010	< 0.010	0

Determinand	Units	Screening criteria	Assessment Criteria	No of Samples tested	Min	Max	No. of Exceedences
EC > 8-10	mg/kg	34	LQM/CIEH S4UL	3	< 0.050	1.1	0
EC > 10-12	mg/kg	74	LQM/CIEH S4UL	3	<1.0	5	0
EC > 12-16	mg/kg	140	LQM/CIEH S4UL	3	< 2.0	14	0
EC > 16-21	mg/kg	260	LQM/CIEH S4UL	3	< 10	300	WS3 0.6m (300)
EC > 21-35	mg/kg	1100	LQM/CIEH S4UL	3	20	6000	WS3 0.6m (6000)

Table 6.1.3 Soil laboratory Analysis Results – hydrocarbons

Concentrations of all Petroleum Hydrocarbons were below their relevant screening values except Diesel range Aromatic hydrocarbons for a single sample at WS3 where a slight hydrocarbon odour was noted in the vicinity of a former interceptor tank.

6.1.2 Results of Ground Gas Monitoring

Geoengineers were commissioned to undertake an extended bulk ground gas sampling and provide an assessment of the site. The report incorporating the gas monitoring data is included in its entirety as appendix F and should be referred to for a detailed assessment.

Guidance on assessing the risk posed by hazardous ground gases is given within CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings'. The risk to the site has been assessed for a commercial end use.

Quantitative Risk Assessment Based on the documentation presented in BS8485:2015+A:2019, which is the 'Code of practice for the characterisation and remediation from soil-gas in affected developments' the hazardous gas flow rate was calculated.

The maximum carbon dioxide and methane concentration was used for the gas concentration and the maximum gas flow across all boreholes and monitoring events was taken for the borehole flow rate, thus simulating a worst-case scenario, and increasing the degree of conservatism adopted.

It was concluded that the site should be regarded as Characteristic Situation 1 (British Standard Class), or Green for the NHBC traffic lights class system if using this company to insure the building control side of the work.

7 GEO-ENVIRONMENTAL RISK ASSESSMENT AND REVISED CONCEPTUAL SITE MODEL

7.1 Introduction

With respect to historic land contamination, Planning Policy Guidance: Planning and Pollution Control (PPS 23) (Ref.7) states that ground contamination is a material planning consideration. Local planning authorities must take account of such issues in determining applications for planning permission. In addition, building work is regulated under the Building Regulations 1991. Schedule 1 (Ref. 8) requires 'precautions shall be taken to avoid danger to health and safety caused by substances found on, or in the ground covered by the building'.

Environmental Risk has been addressed by adopting a site-specific qualitative approach to identify the risk of environmental harm. The guiding principle of this approach is an attempt to establish connecting links between a hazardous source, via an exposure pathway to a potential receptor. This is in accordance with the Department of Environment, Transport and Regions (DETR) guidance on Contaminated Land (Ref.6) and the Construction Industry Research and Information Association (Ref. 7).

By considering where a viable pathway exists, which connects a source with a receptor, this assessment will identify where pollutant linkages may exist. A pollutant linkage is the term used by the DETR in their standard procedure on risk assessment. If there is no pollutant linkage, then there is no risk. The risk assessment conceptual exposure model used is for the standard CLEA UK commercial end-use.

Contaminated land risk assessment is based on development of a conceptual model for the site. This is representation of the relationship between contaminant sources, pathways and receptors developed on the basis of hazard identification.

7.2 Identified Sources

Concentrations of selected heavy metals were all below their relevant screening values within the shallow soils. Concentrations of selected hydrocarbons were all below their relevant screening values within the shallow soils except for Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene and Dibenz(ah)anthracene with the highest values within the malodorous made ground at WS3 at 0.9m bgl. No Asbestos was detected in selected samples. No significant potential risks were identified with respect to controlled waters.

The following pathway links the identified contamination with the potential receptors:

- Ingestion, inhalation or direct contact
- Leaching through unsaturated zone
- Direct contact with free phase or dissolved phase
- Fugitive dust

- Migration through Soils or groundwater to indoor air

The following potential pathways have been identified for controlled waters:

- Leaching/migration of contaminants through soil
- Migration of impacted perched water or groundwater or surface water runoff.

The following pathways have been identified for buildings:

- Migration of ground-borne gases through permeable ground
- Direct contact of buildings with contaminated soil or impacted groundwater
- Migration of ground-borne gases and groundwater along preferential pathways e.g. Service trenches and entries to new structures and services.

The following receptors have been identified:

- Site Workers
- End users of the site
- Neighbours
- Groundwater and possible abstractors or aquatic ecosystems
- Building Products

7.3 Qualitative Risk Assessment and Conceptual Site Model

A qualitative risk assessment has been undertaken for these potential source-pathway-receptor linkages. This is based on consideration of both:

- The likelihood of an event (probability – takes into account both the presence of the hazard and receptor and the integrity of the pathway);
- The severity of the potential consequence (takes into account both the potential severity of the hazard and the sensitivity of the receptor).

The risk assessment has been based on redevelopment of the site with a proposed commercial development.

7.3.1 Findings of the Qualitative Risk Assessment

Long-chain Aromatic hydrocarbon contaminants were recorded at low levels within shallow made ground at WS3, assumed to be a former interceptor, now replaced with a new system. Remedial works will be required to remove the hydrocarbon impacted soils and break the pathways with the planned new receptors.

It is assumed, once site clearance has been completed the localised horizon of hydrocarbon contaminated material around WS3 is removed, banded and a process of aeration of the materials undertaken to reduce contamination levels prior to disposal.

7.3.1.1 Ground Gas Risk

Geoengineer were commissioned to undertake an extended bulk ground gas sampling and provide an assessment of the site. The report incorporating the gas monitoring data is included in its entirety as appendix F and should be referred to for a detailed assessment.

Guidance on assessing the risk posed by hazardous ground gases is given within CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings'. The risk to the site has been assessed for a commercial end use.

Quantitative Risk Assessment Based on the documentation presented in BS8485:2015+A:2019, which is the 'Code of practice for the characterisation and remediation from soil-gas in affected developments' the hazardous gas flow rate was calculated.

The maximum carbon dioxide and methane concentration was used for the gas concentration and the maximum gas flow across all boreholes and monitoring events was taken for the borehole flow rate, thus simulating a worst-case scenario, and increasing the degree of conservatism adopted.

It was concluded that the site should be regarded as Characteristic Situation 1 (British Standard Class), or Green for the NHBC traffic lights class system if using this company to insure the building control side of the work.

7.4 Other Considerations

There is the potential for ground conditions between the exploration holes to be different from those encountered during the ground investigation. Should significantly different ground conditions be encountered, then the relevance of recommendations included in this report should be reviewed in the light of new information.

In addition, a Discovery Strategy should be adopted for use during the redevelopment should unexpected impacted made ground deposits and/or natural soils and/or waste deposits be encountered. The strategy should include a protocol for characterising and dealing with any encountered contamination, including liaison with the Local Authority.

If unexpected ground contamination is identified during ground preparation, then works implemented under the Discovery Strategy should be documented in a verification report that should be submitted to the Local Authority for approval.

8 Geotechnical and Engineering Assessment

8.1 Introduction

It is proposed to redevelop the site with a commercial development. It is considered sufficient to note that the further works should be undertaken in a way that does not create new pathways for future site users.

8.2 Development Proposal

It is understood from the available site development plan that is intended to construct a new commercial development to match the existing construction to the north and west of the site.

8.3 Foundation for Structures

The allowable bearing capacity is a function of the foundation configuration, depth and the ability of the structure to tolerate such movements and should therefore be validated during detailed design.

Based upon the investigation results and consideration of the borehole records on surrounding land the shallow soils can be interpreted as a thin horizon of made ground over Alluvial Deposits to at least 3m bgl.

The Alluvial Deposits are soils with low bearing capacities high compressibility, potentially high groundwater tables and the potential of excessive total and differential settlements. The design and construction quality will have a profound impact on foundation performance. The allowable bearing capacity of the underlying Alluvial Deposits a bearing capacity of ~25kN/m² should be anticipated with potential for greater/excessive settlements with high point loads.

For the assumed development standard strip foundations or pads are considered unlikely to be suitable. Either a raft or piled foundations are potentially suitable, however, bedrock strata of sufficient load carrying capacity have not been adequately confirmed from the current investigation to reliably recommend a piled solution. For an extension to the existing building a raft is therefore considered the more economical solution, providing loads are low and high point loads are not anticipated. This is also in alignment with the existing structure.

Groundwater is anticipated at shallow depths beneath the site and should be considered in the foundation and earthwork design. To control groundwater within shallow excavations (<1.5m bgl), localised pumping from sumps should be adequate.

Movements should be disciplined to ensure that they do not lead to unacceptable levels of distortion and cracking in the existing structure and associated services connections that may cause problems with the everyday use of the building.

Flexible service connections will be necessary on this site. In addition, adequate gradients should be provided for all drains and sewers so as not to create backfalls should any future ground movements take place in the deeper backfill. Compacting the bases of all such trenches will reduce settlement.

Wherever drains and mains services pass from natural to worked/soft ground strata, adequate flexibility should be provided so that breakages do not occur due to adverse settlements between materials of differing strengths.

Buildings located near existing or proposed new trees must have their foundations sited below the root growth zone. The NHBC Standards Chapter 4.2 "Building Near Trees" gives guidance on foundation criteria, depths and construction that should be followed. All services will also have to be similarly protected.

Where service trenches cross the site, foundations should be placed below a line drawn up at 45° from the base of any service excavations.

8.3.1 Raft Foundation

For raft foundations the loose ground is excavated, and the surface proof-rolled in layers up to formation level using clean granular fill. If the formation level is very soft a layer of geotextile fabric should be placed below the granular fill. Any softer spots should have been removed prior to formation.

In construction it is normally recommended that the thickness of the granular fill should be not less than 50% of the foundation depth required by NHBC Chapter 4.2 up to a maximum of 1.25m in order to safeguard against problems with tree roots.

The raft should be laid on at least 1200 gauge Visqueen or equivalent, which in addition to acting as a moisture membrane, will also provide additional protection against any gases.

8.3.2 Piled Foundation

Not recommended for this site, for information purposes only.

At present building loads are not known. A variety of pile types and sizes can be used and consequently detailed recommendations in respect of pile depths and sizes is not appropriate.

Further investigation would be required, however, It appears from the dynamic probe holes that a raft with mini-piles bearing in dense/medium dense strata at depths between 6 to 10m bgl may be suitable for light to moderately-loaded structures. Consolidation of the alluvial clays may cause 'drag-down' of the loaded pile and this should be anticipated.

Any solution must also take into account vibration and the effect on adjacent properties. Vibration during installation may result in additional settlement of the existing structure, particularly if it was founded on traditional strip or spread footings and exerting forces into the alluvial clays. In view of this it is recommended that the advice of specialist piling contractors be sought before finalising the design. Additionally, there may be a requirement for the placement of a suitable engineered piling mat, which should be designed and validated by a suitably qualified experienced engineer.

Cable percussive boreholes are recommended if friction piles are considered subject to discussion with specialist piling contractor experienced in such work. Several light cable percussive boreholes would be required to approximately 15m depth, to fully quantify their design. Dependent on proposed development levels targeted ground investigation, including quick undrained triaxial compression tests for shear strength parameters in order to aid design of proposed foundations.

It should be emphasised that there are a number of approaches to pile design and this section is therefore general.

8.3.3 Roads and Pavements

Where the sub-grade to roads will comprise made ground, it is recommended that a CBR of 2% be adopted for design purposes. Proof rolling of the formation levels should be carried out and any weak or oversized material should be removed and replaced with well compacted granular material.

8.3.4 Buried Concrete

Buried concrete classification is based on guidelines provided in BRE Special Digest 1 (Ref. 14). The site has been assessed as brownfield with shallow groundwater.

8.3.5 Waste Management

Any material excavated on site may be classified as waste and it is the responsibility of the holder of the material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way can cease to be classified as waste for a particular purpose.

One of the ways this can be achieved is set out in the Development Industry Code of Practice (CoP) (CL:AIRE, 2008).

The handling, re-use or disposal of waste is regulated by the Environment Agency. The Agency will take into account the use of the CoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the CoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development. This may be because the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so they have ceased to be waste.

At this stage none of the Made Ground has been tested against Waste Acceptance Criteria (WAC) as it is unclear if any material is to be removed from site for disposal. 'WAC' testing would be required for any material disposed of off-site.

8.4 Uncertainties & Limitations

The investigation was limited in scope and a number of assumptions have been made regarding the nature of the ground conditions based upon professional judgement and experience of working in the area. This report has presented a ground model that Mugen Geo Ltd believes accurately models the likely conditions at the site encountered and likely to be encountered on excavation.

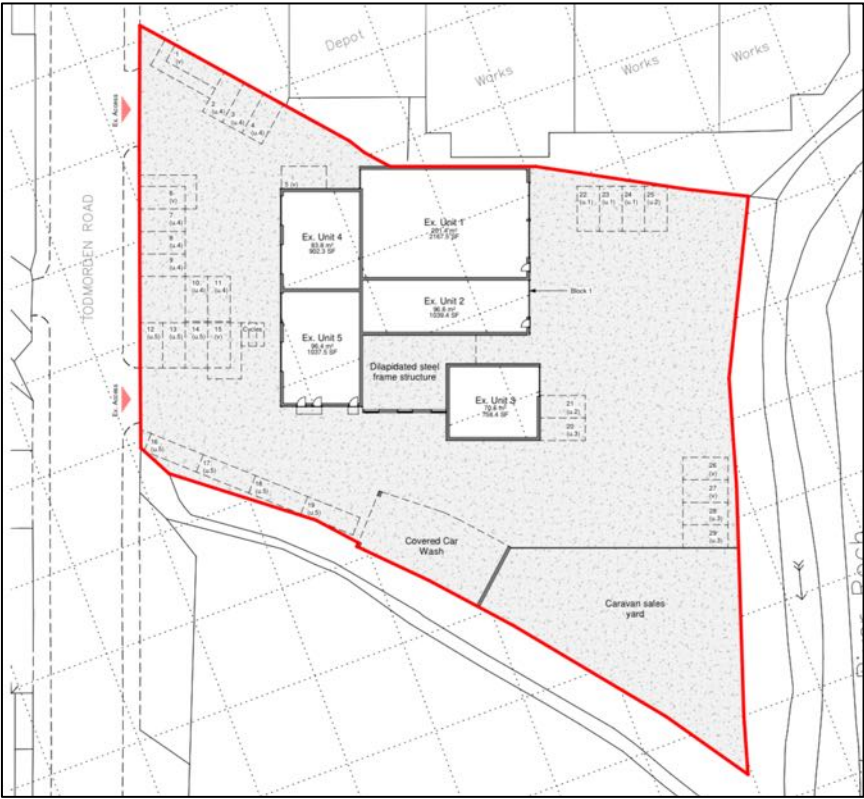
This report has presented options with respect to development that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this

cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (NHBC & Local Authority) for their comment/approval.

9 REFERENCES

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APPENDIX A
SITE LOCATION PLANS



SITE LOCATION PLAN
[Not to scale]

↑
North

APPENDIX B

SITE PHOTOS



General view to the south east towards the Caravan Sale Yard



General view to the north west towards the existing partially demolished structure at the site



View to north east towards WS1 in the north east of the site



View of existing development immediately north of the development site showing interior of unit with concrete slab



View of south east of site looking at the River Roch



TP1 pit



TP1 spoil



TP2 pit



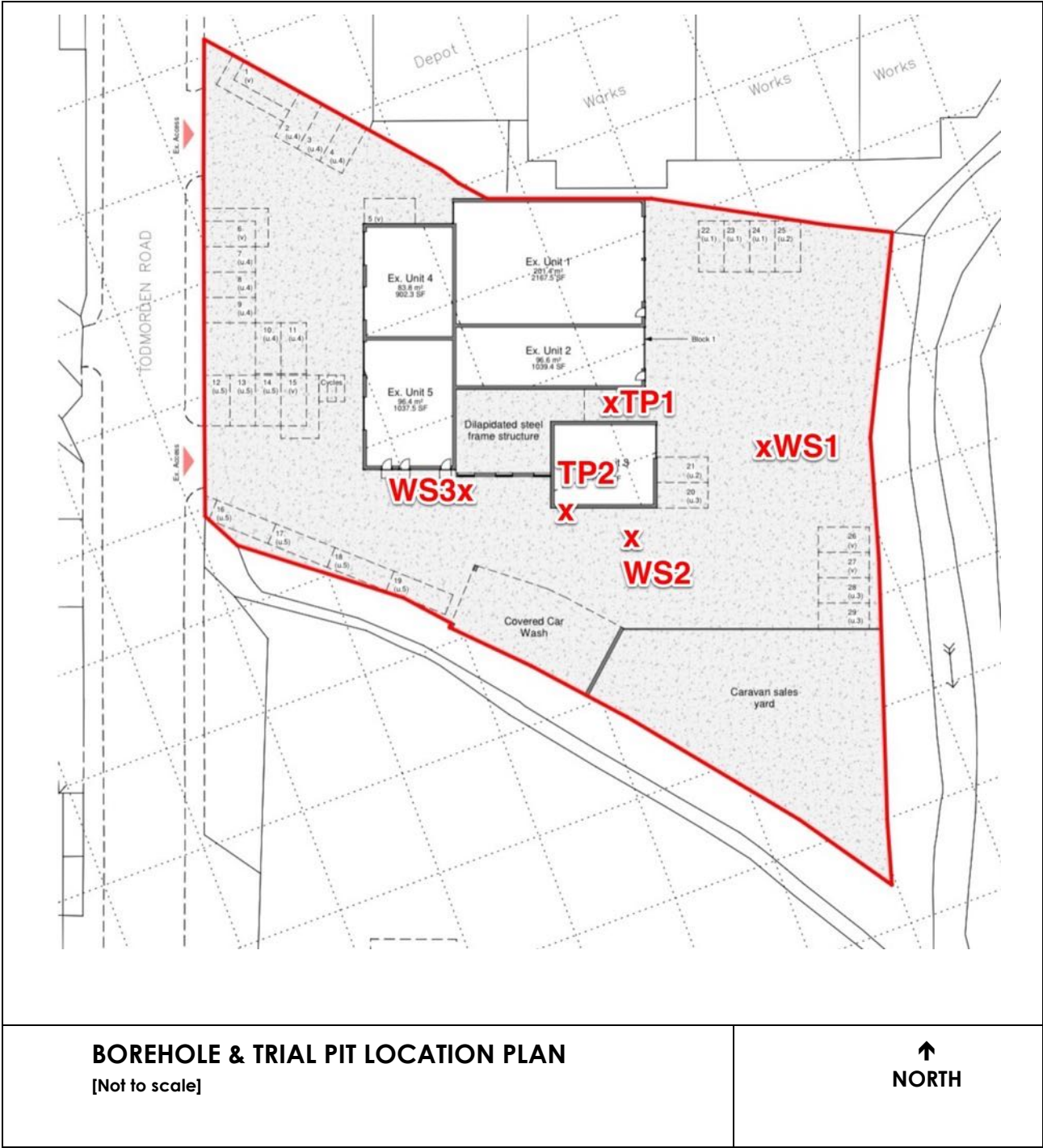
TP1 spoil



TP2 pit

APPENDIX C

SAMPLING LOCATIONS



APPENDIX D

BOREHOLE & TRIAL PIT LOGS



Mugen
Geo Ltd.

Site
Land at Riverside Business Park Todmorden Rd
Littleborough OL15 9EG

Number
WS1

Machine : Archway Competitor
Method : Drive-in Windowless
Sampler

Dimensions

Ground Level (mOD)

Client
GB Services Ltd

Job
Number
2409 OL15 9EG

Location (Handheld GPS)
394127 E 416794 N

Dates
23/09/2024

Engineer

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.30	ES				(0.10) 0.10	MADE GROUND: Dark grey weak macadam over sandy GRAVEL of brick and limestone.			
					(0.40)	MADE GROUND: Red and grey clayey GRAVEL and COBBLES. Gravel was subangular to subrounded fine to coarse of brick and sandstone.			
0.70	ES				0.50	Firm grey speckled brown silty CLAY.			
					(0.70)				
					1.20	Complete at 3.00m			
1.80	D								

Remarks	Scale (approx)	Logged By
	1:25	SJP
	Figure No. 2409 OL15 9EG.WS1	



Mugen
Geo Ltd.

Site
Land at Riverside Business Park Todmorden Rd
Littleborough OL15 9EG

Number
WS2

Machine : Archway Competitor
Method : Drive-in Windowless
Sampler

Dimensions

Ground Level (mOD)

Client
GB Services Ltd

Job
Number
2409 OL15 9EG

Location (Handheld GPS)
394115 E 416786 N

Dates
23/09/2024

Engineer

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20	ES				(0.10) 0.10	MADE GROUND: Dark grey weak macadam over sandy GRAVEL of brick and limestone.			
					(0.40)	MADE GROUND: Red and grey clayey GRAVEL and COBBLES. Gravel was subangular to subrounded fine to coarse of brick and sandstone.			
0.80	ES				0.50	Soft to firm grey silty CLAY with rare horizons of fibrous peat.			
					(2.20)				
					2.70	Medium dense grey black and pale grey slightly clayey sandy GRAVEL. Gravel was subangular to subrounded fine to coarse of sandstone coal and mudstone.			
					(0.30)				
					3.00	Complete at 3.00m			

Remarks

Scale
(approx)
1:25

Logged
By
SJP

Figure No.
2409 OL15 9EG.WS1



Land at Riverside Business Park Todmorden Rd
Littleborough OL15 9EG

Number
WS3

Dimensions

Ground Level (mOD)

GB Services Ltd

**Job
Number**
2409 OL15 9E

Location (Handheld GPS)
394095 E 416794 N

Dates
23/09/2024

Engineer

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.30	ES				(0.10) 0.10	MADE GROUND: Dark grey weak macadam over sandy GRAVEL of brick and limestone.			
0.60	ES				(1.30)	MADE GROUND: Red and grey clayey GRAVEL and COBBLES. Gravel was subangular to subrounded fine to coarse of brick and sandstone.			
					1.40	Complete at 1.40m			

Borehole terminated on solid obstruction. Dry upon completion. Gas monitoring well installed.

Scale (approx)

1:25

Logged
By

SJP

Figure No.

2409 OL15 9EG.WS3



Land at Riverside Business Park Todmorden Rd
Littleborough OL15 9EG

**Trial Pit
Number**
TP2

Machine : 2.8T tracked Kubota
Method : Trial Pit

Dimensions

Ground Level (mOD)

Client

GB Services Ltd

Job Number
2409 OL15 9E

Location (Handheld GPS)
394106 E 416788 N

Dates	23/09/2024
--------------	------------

Engineer

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Dark grey weak macadam over sandy GRAVEL of brick and limestone.		
					0.40	MADE GROUND: Red and grey clayey GRAVEL and COBBLES. Gravel was subangular to subrounded fine to coarse of brick and sandstone.		
					0.50	Firm grey speckled brown silty CLAY.		
					0.70			
					1.20	Complete at 1.20m		
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								
								

Plan

Remarks

Scale (approx)

1:25

Logged By

SJP

Figure No.

2409 OL15 9EG.TP1

APPENDIX E

CHEMICAL ANALYTICAL DATA

Mugen Geo Ltd
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Machpelah
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7 Woodshots Meadow,
Croxley Green
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Watford,
Herts,
WD18 8YS

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

Analytical Report Number : 24-047746

Project / Site name:	Land at Riverside Motors Todmorden Road Littleborough	Samples received on:	26/09/2024
Your job number:	2410 OL15 9EG	Samples instructed on/ Analysis started on:	15/10/2024
Your order number:		Analysis completed by:	22/10/2024
Report Issue Number:	1	Report issued on:	22/10/2024
Samples Analysed:	6 soil samples		


Signed:

Trevor Hill
Customer Service Advisor
For & on behalf of i2 Analytical Ltd.

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

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

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

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

Excel copies of reports are only valid when accompanied by this PDF certificate.

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

Analytical Report Number: 24-047746

Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

Lab Sample Number				348420	348421	348422	348423	348424
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	0.20	0.80	0.30
Date Sampled				23/09/2024	23/09/2024	23/09/2024	23/09/2024	23/09/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	11	30	26	37	21
Total mass of sample received	kg	0.1	NONE	0.1	0.1	0.2	0.2	0.1

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MUA	-	PDO	-	MUA

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.16	0.09	< 0.05	0.18
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.07	< 0.05	0.06
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.41	0.26	< 0.05	0.11
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.26	0.26	< 0.05	0.13
Phenanthrene	mg/kg	0.05	MCERTS	0.18	2.6	2.9	0.05	1.6
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.51	0.78	< 0.05	0.42
Fluoranthene	mg/kg	0.05	MCERTS	0.42	4.3	4.9	0.07	3.5
Pyrene	mg/kg	0.05	MCERTS	0.37	3.7	4.2	0.09	3.4
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.22	1.8	2.1	< 0.05	1.6
Chrysene	mg/kg	0.05	MCERTS	0.25	2.2	2.3	< 0.05	1.8
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.3	2.6	2.5	< 0.05	2.5
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.13	0.88	1.2	< 0.05	0.77
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.24	2	2.2	< 0.05	1.8
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.18	0.89	0.94	< 0.05	1.2
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.22	0.22	< 0.05	0.31
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.17	0.92	0.94	< 0.05	1.3

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	2.46	23.2	25.8	< 0.80	20.8
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5	27	19	8.3	24
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.8	0.6	0.3	2.1
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	32	37	35	31
Copper (aqua regia extractable)	mg/kg	1	MCERTS	13	46	44	18	130
Lead (aqua regia extractable)	mg/kg	1	MCERTS	43	120	77	28	510
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.4	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	26	30	30	69
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	210	130	120	81	500

Analytical Report Number: 24-047746

Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

Lab Sample Number				348420	348421	348422	348423	348424
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	0.20	0.80	0.30
Date Sampled				23/09/2024	23/09/2024	23/09/2024	23/09/2024	23/09/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	-	-	-	3.8
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	-	-	-	27
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	140	-	-	-	330
TPHCWG - Aliphatic >EC5 - EC35 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	140	-	-	-	370

TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	< 0.020	-	-	-	< 0.020
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	-	-	-	< 2.0
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	-	-	-	18
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	20	-	-	-	23
TPHCWG - Aromatic >EC5 - EC35 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	20	-	-	-	41

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	-	-	-	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-047746

Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

Lab Sample Number				348425
Sample Reference				WS3
Sample Number				None Supplied
Depth (m)				0.60
Date Sampled				23/09/2024
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	32
Total mass of sample received	kg	0.1	NONE	0.1

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	-
Asbestos Analyst ID	N/A	N/A	N/A	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	7.4
Acenaphthylene	mg/kg	0.05	MCERTS	0.63
Acenaphthene	mg/kg	0.05	MCERTS	0.52
Fluorene	mg/kg	0.05	MCERTS	1.2
Phenanthrene	mg/kg	0.05	MCERTS	4.7
Anthracene	mg/kg	0.05	MCERTS	1.1
Fluoranthene	mg/kg	0.05	MCERTS	8.1
Pyrene	mg/kg	0.05	MCERTS	8.6
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.8
Chrysene	mg/kg	0.05	MCERTS	5
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	5.2
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.9
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.8
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.6
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.8

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	58.4
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	28
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	56
Copper (aqua regia extractable)	mg/kg	1	MCERTS	66
Lead (aqua regia extractable)	mg/kg	1	MCERTS	620
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	35
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	220

Analytical Report Number: 24-047746

Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

Lab Sample Number				348425
Sample Reference				WS3
Sample Number				None Supplied
Depth (m)				0.60
Date Sampled				23/09/2024
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	0.17
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	0.29
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	25
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	630
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	11000
TPHCWG - Aliphatic >EC5 - EC35 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	12000

TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	1.1
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	5
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	14
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	300
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	6000
TPHCWG - Aromatic >EC5 - EC35 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	6300

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	78
p & m-Xylene	µg/kg	8	MCERTS	340
o-Xylene	µg/kg	5	MCERTS	330

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-047746
Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
348420	WS1	None Supplied	0.3	Brown loam with gravel
348421	WS1	None Supplied	0.7	Black clay and loam
348422	WS2	None Supplied	0.2	Black clay and loam with gravel
348423	WS2	None Supplied	0.8	Black clay
348424	WS3	None Supplied	0.3	Black loam with gravel
348425	WS3	None Supplied	0.6	Black clay and loam with gravel

Analytical Report Number : 24-047746

Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088-PL	D/W	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Analytical Report Number : 24-047746

Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

Analytical Report Number : 24-047746

Project / Site name: Land at Riverside Motors Todmorden Road Littleborough

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

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

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS1	N/A	S	348420	c	BTEX and/or Volatile organic compounds in soil	L073B	c
WS1	N/A	S	348420	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
WS1	N/A	S	348420	c	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
WS1	N/A	S	348421	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
WS2	N/A	S	348422	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
WS2	N/A	S	348423	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
WS3	N/A	S	348424	c	BTEX and/or Volatile organic compounds in soil	L073B	c
WS3	N/A	S	348424	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
WS3	N/A	S	348424	c	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
WS3	N/A	S	348425	c	BTEX and/or Volatile organic compounds in soil	L073B	c
WS3	N/A	S	348425	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
WS3	N/A	S	348425	c	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088-PL	c

APPENDIX F

GAS RISK ASSESSMENT



GeoEnginSeer

FREELANCE DILETTANTE GEOLOGIST

Littleborough Service Station,
Riverside Works
Todmorden Road
OL15 9EG

Semi Quantative Report for Ground Gas Monitoring

Date	Version 1: 22.7.24
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Project Title	Riverside Industrial Estate Todmorden Road Littleborough
GES Report Number	1997
Date	30.09.24, 06.10.24 and 22.11.24.
Client	Mugen Geo
Weather	11°C mostly, cloudy light wind 11 kmph
Development Type	Commercial Extension Project
Bore Hole Numbers	WS1, WS2, WS3
GES Job Ref:	1725
Visit By	Ben Crowther

Report By**Checked/Approved By**

Signature

Paul

Signature

Ben Crowther

Name: Paul Carter – Jones

Name: Ben Crowther

**Company Contact Details**

**Mugen Geo MacPeilah House Hebden Bridge
W. Yorks.**

PRINCIPALS OF TARGETTED SAMPLING

These gas sampling events were conducted by GeoEnginSeerLtd, a specialist Company dealing with the risk in the field of ground gas: Geologist Ben Crowther conducted 3 visits to this site. On one visit the pressure on site was not significantly low, as had been predicted by monitoring weather patterns and sampling did not reveal any significant results. The targeted borehole sampling was conducted at a time when the barometric pressure drop was either steeply over 4-8 hours (4-8+ millibars) or steadily over 24+ hours (20+ millibars) ideally to reach a level below 1008mb. This is to establish if there is indeed a worst-case scenario for gas emanating from the ground into the installed boreholes. Extract of the Barometric Records at the time of sampling are included for the sampling at this location and are presented in the Appendix, along with location plans and calibration certificates.

The tests were conducted using the following methodology and have been extracted and refined from the CL:AIRE methodologies as described in Technical Documents No. TD16, TD17, and TD18 found [here](#). We are seeking at least a Sharp fall but if possible a Very Sharp fall of over 8 mb in 3 hours. Only Sharp falls of barometric pressure were encountered during this study.

The Ground Gas Solutions White paper on 'Atmospheric Pressure and a Simplified Approach to Determining Worst-Case Conditions for Ground Gas Monitoirng in the UK (Andrew Brunton – Associate Director at GGS – October 2024) indicates that in the North East are of the UK autumn-winter is the best time to take samples and is most likely.

Each sampling event comprised of a sampling of each borehole with a clear and sweep of the perimeter and through the centre of the site as a background reading. The boreholes were maintained well during the sampling events at Riverside Industrial Estate. The boreholes are then sampled over approximately 30 minutes with each borehole receiving three rounds of minimum 2 minute sampling and flow samples taken between gas reading values, while keeping the tap of the borehole bung closed between events.

The aim of this action is to remove the chance of faulse positive high readings of gas in the borehole by evacuating all the gas from the borehole through the sampler and checking for a steady flow. The results presented below are the peak steady flows over the 2-3 minute sampling time. GeoEnginSeerLtd has found these then to be consistend on each round at each borehole during the sampling period.

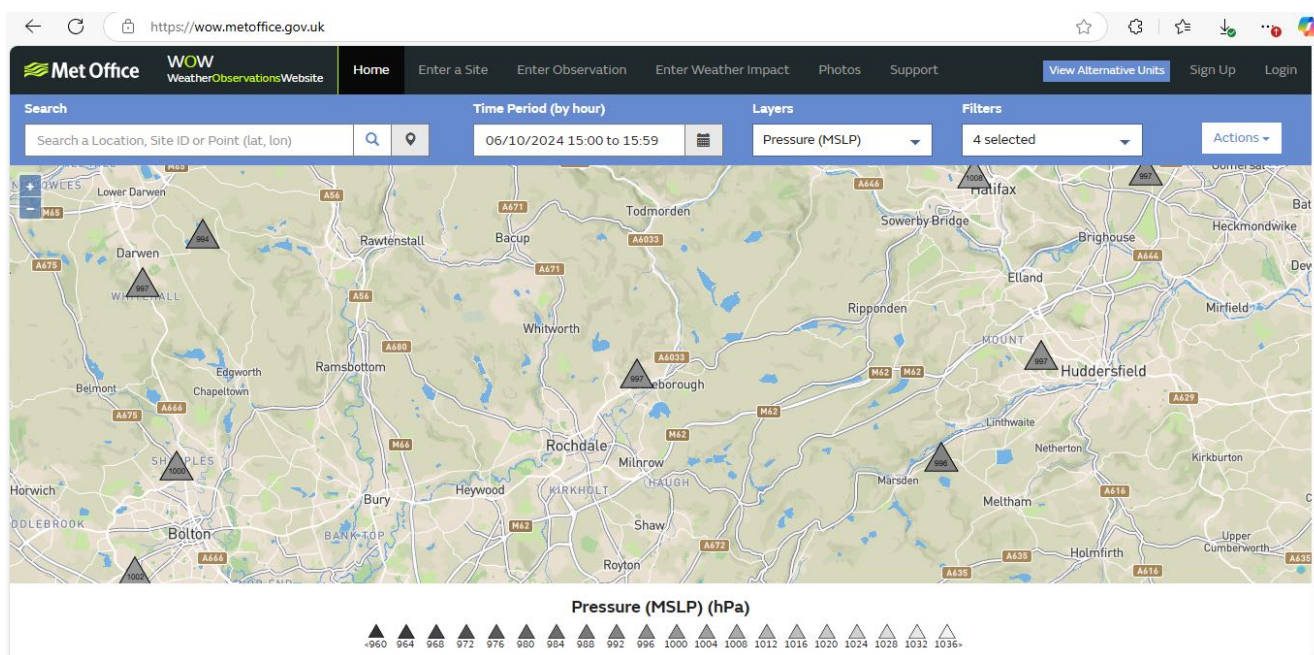
The reasoning for this method is to capture a realistic volume of the bulk ground gasses coming out of the ground from any sources no matter the origin. This area of Leeds is underlain by coal measures plus some local potential sources have been identified, any previous construction site, domestic garages and businesses plus leaking sewerage systems can generate gas.

Water levels and depths are also checked at the end of the gas sampling regimen.

The Barometric data used by GeoEnginSeer Ltd to predict when a low that is great enough to produce the worst-case scenario over a 1-3 month period is the Norwegian MET office data app that is the most calibratable to use to the on the ground corroborative recordings. Below is another system that is interrogatable for historic data. Although GeoEnginSeerLtd does not believe this is the most accurate recording of data on the ground.

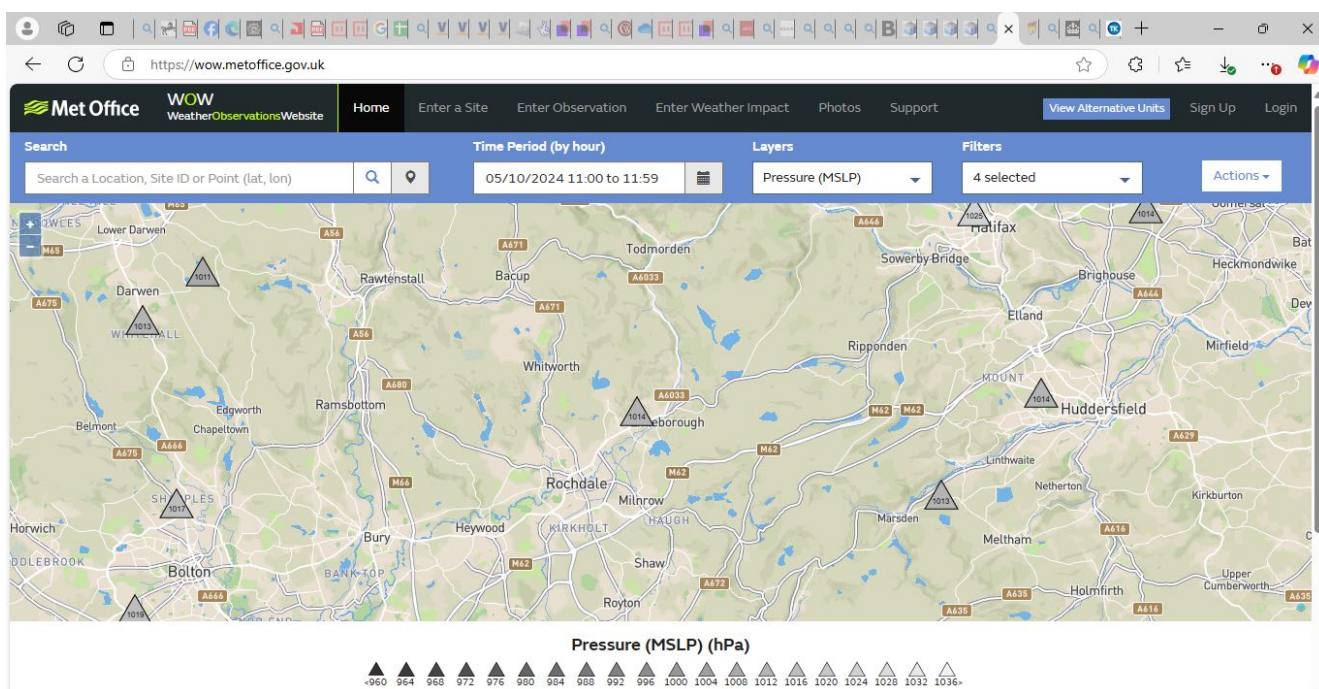
Further lines of evidence regarding targeted data the website MetOffice WOW site for the relevant times are included here: Additional commentary added below conclusions.

Long Steady drop only for this sampling event at 4pm on the 6th of October 2024.

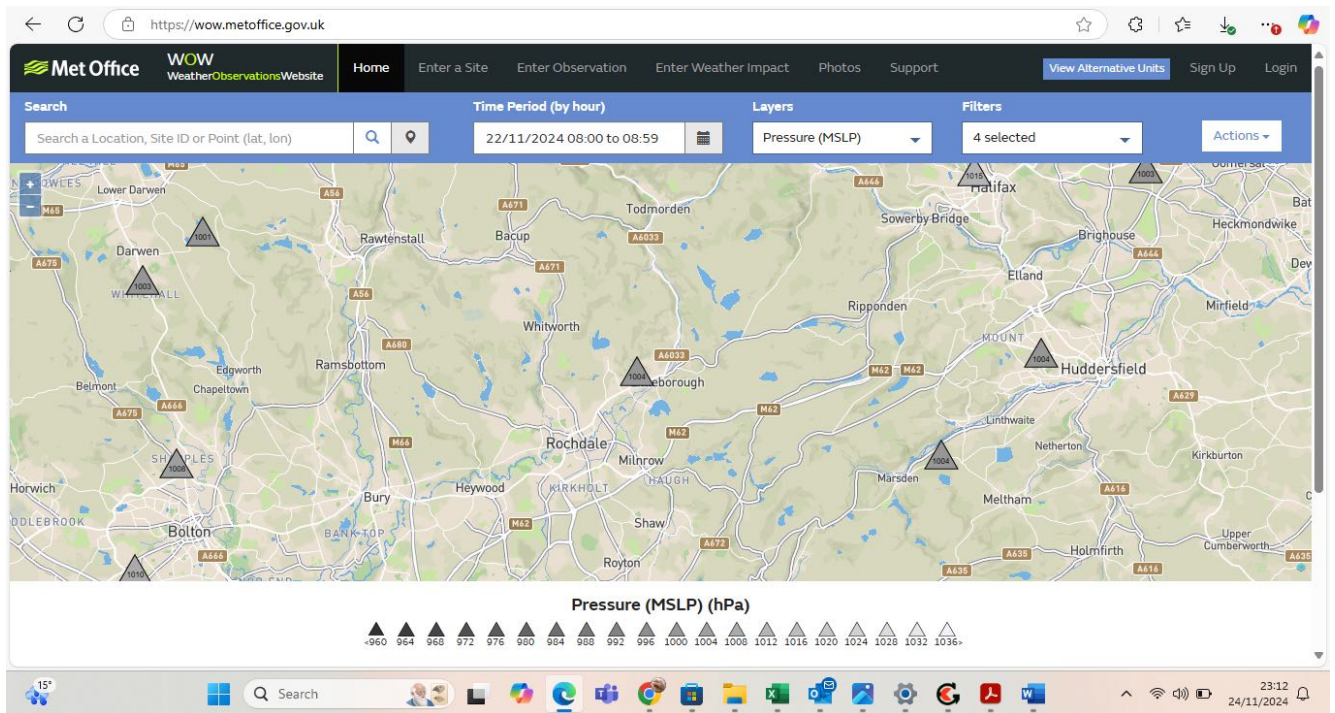


Actual reading on the ground have frequently been found to be significantly lower than the indicative readings found on the App and the Met office WOW website. Note the Halifax monitor and Saltaire monitor, these two read consistently higher or lower when estimating a good time to go sampling.

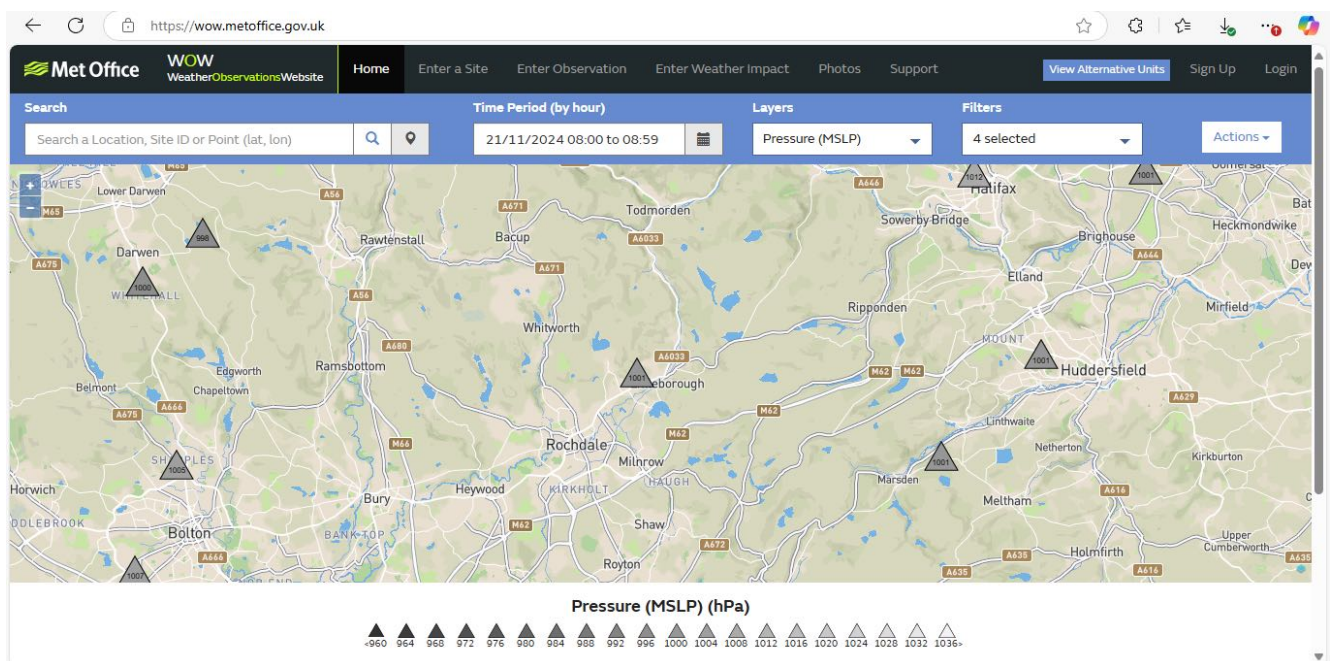
Screen shorts from the first visit: 6th October 2024. On the 5th of October the pressure was well above 1000mb and set to be falling well to get a near new worst case scenario:



Sampling on the third Visit 22th November 2024. 11AM sampling time.



Previous 24 hour higher barometric pressure real time recoded: NB that some amateur stations use uncalibrated devices and site read differently.



Previous 24 hours 990 measures at the same locations. Indicating a 15mb over 24 hours drop getting very close to the Technical Bulletin 17 guidance requirement of 20 in 24 hours below 1000mb range.

REPORT DETAILS

GeoEnginSeer Ltd has been commissioned to complete 3 (three) rounds of gas sampling at the above site. This report summarises the data collected on all three rounds of monitoring. The visits consisted of monitoring x 3 (three) boreholes and a walkover of the grounds with a GMI PS500 gas detector, a Tiger PID and GFM436 with external flow pod.

Average Background Readings:

Walkover (external): CO2 0.0% CH4 0.0% PID/BNZ 0.0% O2 21.7% Flow 0.0 l/h.

Summary Worst Case Boreholes Readings:

Borehole WS1: CO2 2.8% CH4 0.0% PID 1.0 O2 18.5% Flow 0.0 l/h

Borehole WS2: CO2 3.8% CH4 0.0% PID 1.5 O2 19.6% Flow 0.0 l/h

Borehole WS3: CO2 4.7% CH4 0.0% PID 1.3 O2 13.2% Flow 0.0 l/h

These results summarise those findings targeted to barometric pressure lows to emulate the worst-case scenario. To assume a sensible flow rate the Ground Gas Handbook (Wilson et al) suggests 1.2l/hr minimum. GSV calculations with these figures all reveal with a combination of worst case, and no hydrocarbon vapours detected a figure calculated as follows:

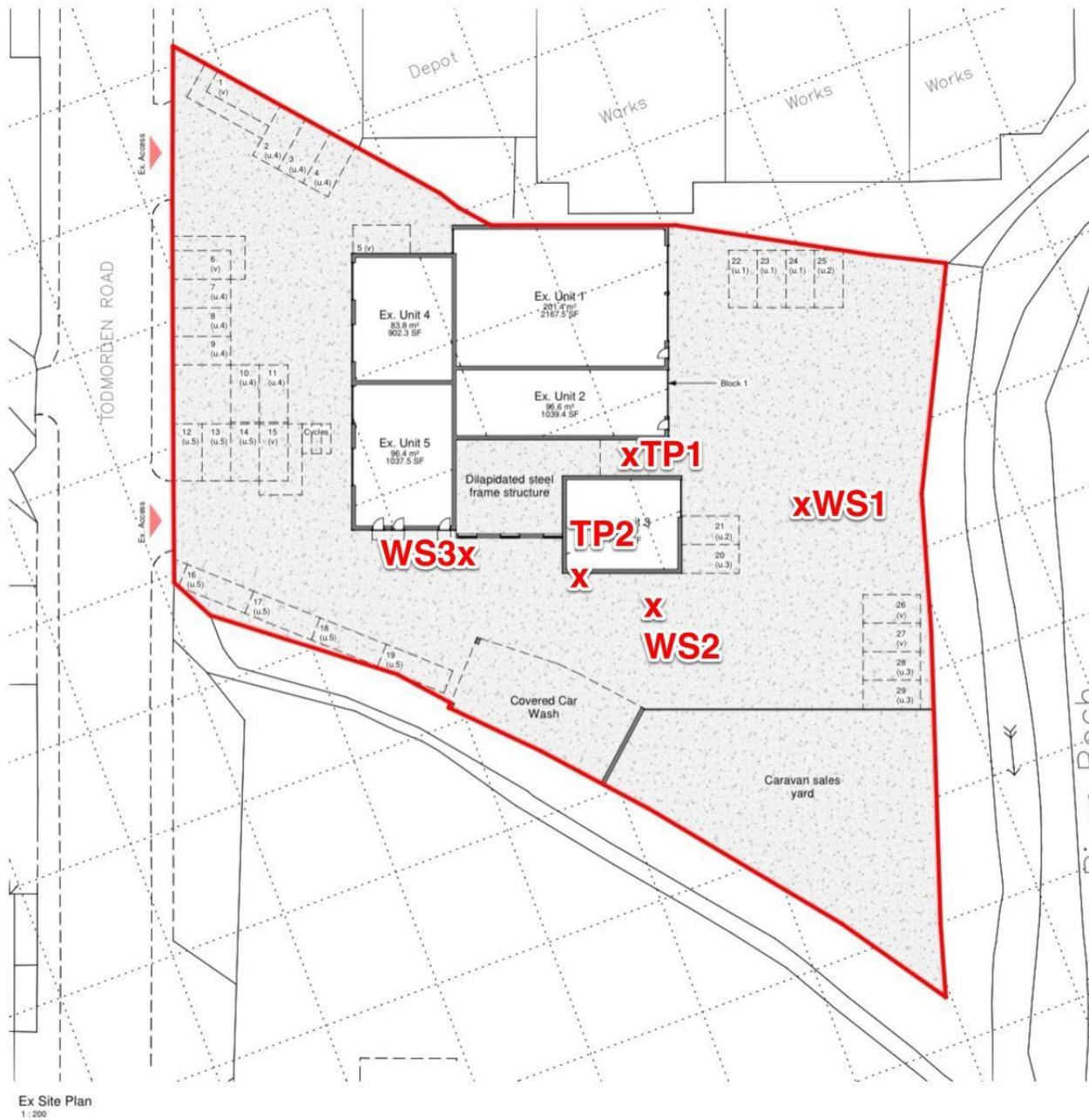
Gas Screening Value (GSV) as follows:

$$4.7 \text{ (Carbon Dioxide Value)} / 100 \times 1.2 \text{ (flow assumption)} = 0.0564$$

This lies below the 0.07 Value for an actionable GSV.

Image courtesy of Google Maps.

Littleborough Borehole Plan:



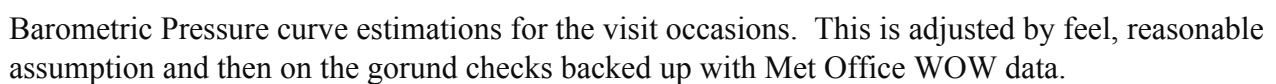
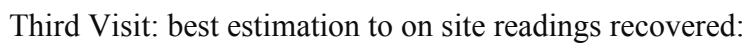
ATKINS 2015. All current drawings and specifications for air be read in conjunction with the Designer's Hazard and Assessment Record. All intellectual property rights.

Designed with reference to the surveys, information and reports listed:
Ordnance Survey Promap, Licence number 100022432

James Kelly Architects Ltd 11a Solid Void - 16 Woolfenden Way, Warrle, OL12 9SS
Tel: 07949448988 - Email: solidvoid@outlook.com - Web: www.solidvoid.co.uk
Company No. 08545334

Rev	Date	Descr
B	10.04.25	Pre-App
C	20.04.25	Plan-1
D	20.11.25	Plan-2
E	10.11.24	Plan-3
F	10.11.24	Review

Visit 1 Worst Case estimation to onsite readings: Low barometric situation:





Indicative readings and trends are observed on a daily basis to attempt to catch a good event demonstrating a near worst case scenario.

Conclusion of Sampling Events Autumn 2024:

Gas Screening Value calculations have been conducted using the highest level of gas detected during the three visits with the highest flow potential event, which happens to be the same borehole and sampling event at the bottom end of a particularly excellent barometric situation for recording on October 6th 2024 at 11AM one of the three barometric pressure drops where recording was conducted.

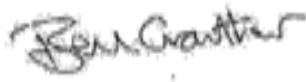
Worst Case for any gasses is $4.7/100 \times 1.2 = 0.0564$ which is firmly in Characteristic Situation 1 (CS1 BS8485:2015+A1:2019) but significantly far enough away from being a CS2 for gas protection purposes and considering this is an extension to an existing building, unlikely to be protected, with largely an addition to the open space industrial unit,

GeoEnginSeerLtd recommends no gas protection requirements are needed.

All Boreholes were wet with at least 0.5m water in each at the base leaving a good response zone not saturated and without presenting any evidence of hydrostatic pressure drivers.

If you have any questions regarding the above, please do not hesitate to contact me.

Yours sincerely



Ben Crowther B.Sc, M.Sc, PGCE, FGS, CIEH, PCA-QT, SGPV

For and on behalf of GeoEnginSeer Ltd.

Commorragh, 738 Burnley Road, Cornholme, Todmorden, OL14 8LF :

07817108921

GeoEnginSeer@gmail.com



Clarification of methods used:

GeoEnginSeer Ltd does not record each and every sample result. A trend is observed each time a sampling event is conducted and the repeated sampling of a borehole three time upon each visit gives an average or a consistent value of gas recorded and flow monitored. With the Technical Guidance noting this has to be at a period of time relatively precisely at the end of a barometric pressure low, it could take a long time to record the volume of results obtained and then stored in excell format and presented.

Bulk gas sampling is indeed a term used which can cover the sampling of gas using canisters or tedlar bags etc. However; it has been the common practice of GeoEnginSeerLtd in the 25 years of Construction Quality Assurance, Site Investigation and specialism in gas sampling and gas protection verification to refer to the gas in the ground as bulk gasses, ie the commonly sampled gasses that are not trace gas, and are indicators of a potentially hazardous naturally or created gas hazard.

Response zone in the approximate 3m deep window sample holes is typically 1-1.5m of slotted pipe bedded in pea gravel. Above this is 1-1.5m plain pipe sealed for the top 1m with bentonite pellets to replicate the soils excavated and create a seal to the underlying gas containing strata, allowing any gas arising to fill the void above water level in the sampling pipe.

Sampling occurs at a borehole or window sample location. To explain; these are three samples for approximately one minute per borehole to get consistent results rotating between boreholes to get three separate results, resulting in nine samples in one visit. This results in a total of about half an hours run time of the gas detection device per sampling event.

The flow results (if any) are steady, an average of three measured flow rates over the three sample events at one borehole over the 30 or so minutes during which sampling occurs upon a site visit. This is to prevent hydrostatic head pressurised borehole tubes that could be reading a higher, or lower, flow due to rising, or falling, water tables. Which could give a faulse flow rate once a borehole is sampled for the first time, which is unlikely to be repeated on the second or third sample taken on each individual borehole.

6.0 Limitations and Challenges of Verification Reporting

This report is based on the information that has been made available to us from the client, contractor and architect regarding the site. The conclusions drawn in the report are considered correct although any subsequent additional information or actions may allow refinement of the conclusions. It should be noted that: The report has been prepared under the express instructions and solely for the use of the Client.

The findings of this report represent the professional opinion of experienced Ground Gas System Surveyors. GeoEnginSeer Ltd does not provide legal advice and the advice of lawyers may also be required.

All work carried out in preparing this report has utilised and is based upon understanding of current relevant UK standards and codes, technology, and legislation. (BS8485:2015+A1:2019 & CIRIA 735).

Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect.

The report is limited to the boundaries identified by the Client on this site and confirmed within this document.

Should additional services be introduced, or service conduits are not sealed or have services provided through them at a later date that are not sealed to the conduit and or gas protection system, a retrospective fit may be required.

If a site is left open for prolonged periods following verification or works are conducted that may damage the integrity of the installation, or the state of the ground maybe altered, by natural events or follow on trades; repairs may be needed.

The standards observed in a positive verification report, or gas sampling report may be compromised or if the ground conditions are changed substantially during development the status of the ground may change. Intellectual rights to this document may be rescinded in addition if payment is not made for the reporting and field work.

GFM 436 Calibration Certification:

TEST DATE AND CONDITIONS		
Date	17/05/2024	
Atmospheric Pressure	990	mB
Ambient Temperature	22.0	°C
EnviroNics Serial No.	5089	

GFM436 Final Inspection & Calibration
Check Certificate

GAS DATA LTD	
Unit D	
Earlplace Business Park	
Flitchamstead Highway	
Coventry	
CV4 9XL	
Tel 02476303311	Fax 02476307711

Customer	GeoEnginSeer Ltd
Certificate Number	125201
Order Number	338262

Serial Number	13915
Software Version	G436-00.0029/0010

Recalibration DUE Date	17/05/25
------------------------	----------

Instrument Checks			
Keyboard	✓	Display Contrast	✓
Pump Flow In	500	Pump Flow @ -200mb	350
Check Set / Running	✓	Labels Fitted	✓

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %
	Readings %		Readings %		Readings %	
	60.2	60	39.6	40	20.9	20.9
	Accept ±0.3		Accept ±0.3		Accept ±0.5	
	5.0	5	5.1	5	6.0	6
	Accept ±0.3		Accept ±0.3		Accept ±0.3	
Zero Reading 160% N ₂	0.0	0	0.0	0	0.0	0
	Accept ±0.0		Accept ±0.0		Accept ±0.1	

Optional Gas Checks					
Applied Gas & Range	Concentration Tested @ (ppm)	Instrument Readings (ppm)			
Gas Type	Range (ppm)	Zero Reading	Instrument Gas Reading		
H ₂ S	5000	2500	0	1500	Accept ±5.0%
CO	2000	2000	0	1003	Accept ±5.0%
Hexane	2.0%	2.0%	0	1.99	Accept ±0.05%

Cross Gas Effects					
Applied Gas (ppm)	Instrument Readings (ppm)				
Gas Type	Concentration	Task 1: H ₂ S	Task 2: CO	Task 3: H ₂	
H ₂ S	1500	1500	0	0	
CO	1000	80	1003	0	
Hexane	2.0%	0	0	1.99	

Pressure Checks			
Atmospheric Pressure (AP) (mB)			
Current Atmospheric Pressure (mB)		Instrument Atmospheric Pressure Reading (mB)	
AP Open Ports		989	Accept ±0.5
AP Port (Internal)		+800 mB +1200mB	799 1200
			Accept ±0.5

Flow Checks			
Borehole Flow		Differential Pressure	
Applied Reading (l/h)	Instrument Reading (l/h)	Applied Pressure (Pa)	Instrument Reading (Pa)
-30	-29.8	-276	-275
-3	-3.1	-13	-13
0	0.0	0	0
3	3.0	16	16
30	30.2	392	391
60	60.1	1244	1245
90	91.1	2490	2508

Temperature Checks		
Calibration Temperature		
Applied Temperature °C	Instrument Temperature Reading °C	
-20	-18.0	Accept ±2.0
0	0.0	Accept ±1.0
30	30.0	Accept ±1.0
60	60.0	Accept ±1.0
100	100.0	Accept ±1.0

Technician:
Jack Rutland

Date Tested:
17/05/2024

The instrument identified by the serial number stated above has been tested by Geo Data personnel for calibration accuracy on the date and under the ambient conditions stated. Geo Data Ltd Internal BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018 compliant workshop procedures were followed to apply known calibration on test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

Geo Data Ltd is certified to BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018.

TEST DATE AND CONDITIONS		
Date	17.5.24	
Atmospheric Pressure	990	mB
Ambient Temperature	22.0	°C
EnviroNics Serial No.	5089	

GAS DATA LTD	
Unit D	
Earlplace Business Park	
Flitchamstead Highway	
Coventry	
CV4 9XL	
UK +44 (0) 24 7630 3311	

GFM436-1 OUTWARD INSPECTION & QUALITY CHECK SHEET

INSTRUMENT DETAILS			
SO Number	Instrument Type	Instrument Serial Number + SW Version	Job Number(s)
338262	GFM436	13915 G436-29/10	125201

Calibration Technician: [Signature] Date: 17.5.24

Inspection Technician: [Signature] Date: 22.5.24

INSTRUMENT CHECKS		Pass (P), Fail (F) or not applicable (NA)	INSTRUMENT PACKING LIST		Tick if included
Function Tests	Dust Caps Fitted	✓	Instrument		✓
	Keyboard Test (All Keys)	✓	Leather Case		✓
	Backlight	✓	Instrument Strap		✓
	Check Set / Running	✓	AC Battery Charger (UK)		✓
	Comms Test	✓	AC Battery Charger (EURO)		✓
	Pump Flow Test (In & Out)	✓	AC Battery Charger (US)		✓
	Overall Leak Test (30mB)	✓	AC Battery Charger (AUS)		✓
	Battery Charge Test	✓	Gas Sample Pigeon (new issue)		✓
	Service Date set to?	17.5.23	Flow Sample Pigeon (new issue)		✓
	Data Logging Enabled?	✓	Hard Carry Case		✓
Channel Tests	Verify CH4/LEL/Hexane/PID	✓	Spares Pot		✓
	Verify CO ₂	✓	Allen Key		✓
	Verify CO	✓	Temperature Probe		✓
	Verify H ₂ S	✓	Vane Anemometer		✓
	Verify CO	✓	USB Cable		✓
	Verify LEL	✓	USB Memory stick		✓
	Verify 1" Option Gas	✓	SM V5 Software	Ver 5.0	✓
	Verify Atmospheric pressure	✓	Internal Filter Pack	Qty	✓
	Verify differential pressure	✓	External Filter Pack	Qty	✓
	Verify flow	✓	Field Guide		✓
DataBase Checks	Verify vane anemometer input	✓	Extra Items:		
	Jobcard(s) completed and signed	✓	Sample Tube		
Label Checks	Jobcard(s) booked off database	✓			
	Calibration certificate completed	✓			
H ₂ S Range	Complete & print QI record	✓			
	No. of Calibration label fitted	GBC 13373			
QA Cylinders Used	MICERTS label displayed	✓			
	Warranty label fitted	✓			
QA Cylinders Used	H ₂ S Range from Sales Order	5000 ppm			
	H ₂ S Range from Cal Cert	5000 ppm			
QA Cylinders Used	Over-range value correct?	✓			
	No. of High Range CH4/CO ₂	955 - 60435			
QA Cylinders Used	No. of Low Range CH4/CO ₂	5000 - 57403			
	No. of H ₂ S	8000 - 652200			
QA Cylinders Used	No. of CO	5000 - 57537			
	No. of Optional Cylinder	n/a			

1 GFM436-1 QA Check

FREELANCE DILETTANTE GEOLOGIST



www.gmiuk.com

Calibration Certificate

Calibrated on 07/11/2023

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For and on behalf of geoengineer.
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Geological Specialist Ben Crowther:



GeoEnginSeer Ltd

Geological Services
Gas Protection Verification
Site Supervision
Ground Gas Sampling

Geological Services: Verification Specialist: Freelance Geologist

Ben Crowther trading as GeoEnginSeer Ltd; Independent Geological Services.

CSCS MAP: 06010225 exp 09/2022

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Qualifications: B.Sc, M.Sc, PGCE, FGS, CIEH, PCA QT (CSSW) SGVP (CL:AIRE)

NVQL3 Assessor of: Verification of Gas Protection Measures (NVQL4)

Confined Spaces L1, IPAF Harness Training, Cradle Safety.

PCA Qualified Technician in structural waterproofing. October 2020

Experience Summary:

15 years local authority regulation

14 years site investigation, site supervision, construction quality assurance and verification

Previous Secretary of, and founder member of the British Verification Council

Attendee of CIRIA Research Group 'Remedial Measures for Proprietary Gas Protection Measures'

Assessor for: NVQL4 Verification of Gas Protection Systems

CL:AIRE GPVS Assessor, SGVP certificate holder No.004

Climber, Fell Runner, Wild Swimmer, Ex Royal Marine Diver.

Recent CPD Summary:

GGG 2 Day A-Z of Ground Gas August 2017

CIRIA Verification Training Event October 2017

PCA Structural Waterproofing Conference 2018, 2019

CIRIA Technical Meeting for Retrospective Fitting of Gas Resistant Membranes 2019

Brownfield Summit Attendance 2018, 2019, 2020, 2021, 2022

DoWCoP CL:AIRE Training March 2021

PCA CSSW Qualified Technician Training 2021, working towards CSSW qualification.

Appeared on: Gassing On! with Neil Salvidge.

HS2 Align Training for Tunnel Shaft H&S Green Tunnels and Shaft Work: C1 and C2,

2022 Cradle safety and IPAF harness use trained: Operator Licence: OP/2157339

Signature:



APPENDIX G
GENERAL TERMS AND CONDITIONS
&
STANDARD PROCEDURES

General Terms & Conditions Mugen Geo Phase II Investigations

This report describes a ground investigation to be undertaken on behalf of The Client and owner of the site) referenced above. The investigation proposed is been designed based upon information supplied by the client & on the assumption that the site is to be developed for commercial use.

The objectives of the investigation are to obtain information relating to the ground conditions at the site in order to comply with a planning condition relating to the site. This report will be produced on behalf of The Client and no responsibility is accepted to any Third Party for all or any part.

The final report should not be relied upon or transferred to any other parties without the express written authorisation of Mugen Geo Ltd. If any unauthorised Third Party comes into possession of this report, they rely on it at their own risk and the authors owe them no duty of care or skill.

Whilst the prepared report may express an opinion on the possible configuration of strata, contaminants or gases between or beyond exploratory hole positions or on the possible presence of features based on either visual, verbal or published evidence, this is for guidance only, and no liability can be accepted for its accuracy.

The comments on groundwater and ground gas conditions will be based on observations made at the time of the investigation. It should be noted, however, that groundwater and ground gas levels may vary from those reported due to seasonal or other effects.

Consideration should be given to the possibility that exploratory holes excavated as part of this investigation, and indeed any previous ground i work by others, may be encountered beneath or within the influence of individual foundations. Mugen Geo Ltd cannot be held responsible for failure of excavations or structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Existing manhole covers will not be lifted and drainage runs will not be inspected during the course of this ground investigation.

Standard Procedure Notes for Phase 2 Reports:

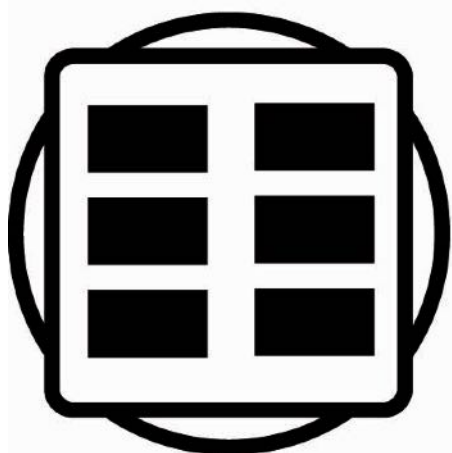
The desk study and ground investigation have been carried out in accordance with the principles of BS EN 1997-1: 2004 "Eurocode 7 - Geotechnical Design - Part 1: General Rules", BS EN 1997-2: 2007 "Eurocode 7 - Geotechnical Design - Part 2: Ground Investigation and Testing", BS5930: 1999 and BS10175: 2001, and the terms of the client's brief.

It must be understood that any ground investigation only samples a small percentage of the ground. As a result changes in ground conditions and soil properties can occur between any two exploratory points, for example local features such as soft ground, pockets of contamination and faults. Unrecorded bell pits and shafts can also exist between exploratory points. The proposed ground investigation is designed to minimize such risks. Conclusions and recommendations are based on the information presented in this report, but unforeseen features may exist. Therefore, the actual ground conditions should be noted during construction and further advice sought if they differ significantly from those predicted.

Further investigation can be carried out to further reduce uncertainty and risk but ultimately these risks cannot be eliminated. In commissioning further research or investigation the costs, and the assumed benefit of doing so, must be considered.

Where buildings are present on a site, structural and asbestos surveys have not been carried out, unless specifically stated. An unexploded ordnance survey has not been carried out. In relevant situations it would be prudent to commission such surveys.

Where information has been obtained from Third Parties, no liability can be accepted for the accuracy or completeness of this information. Where anecdotal evidence or speculations are presented, they must be treated as such and cannot be relied upon.



Mugen Geo Ltd.

REMEDIATION STRATEGY REPORT

**LAND
AT
RIVERSIDE BUSINESS PARK
TODMORDEN ROAD
LITTLEBOROUGH
OL15 9EG**

Document Status: FINAL
Revision: v1

For
G.B. Services (Littleborough)
LLP Higher Swainrod Farm
Halifax Road
Littleborough
OL15 0LF

Prepared for & on behalf of
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Job N° MGEO 2412 OL15 9EG ph3

Date: December 2024

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Appendix A – Site Location Plan

Appendix B – Visual Inspection of Gas Protection Measures Record

Appendix C – Gas Protection Details

Appendix D – Formal Experience of The Person Carrying Out the Verification

Note: This report has been formatted to be read as a PDF.

1 Introduction

Mugen Geo Ltd (Mugen Geo) was commissioned by G.B. Services (Littleborough) LLP to provide a Remedial Strategy report of 'Land at Riverside Business Park, southeast of Todmorden Road in Littleborough' (the site).

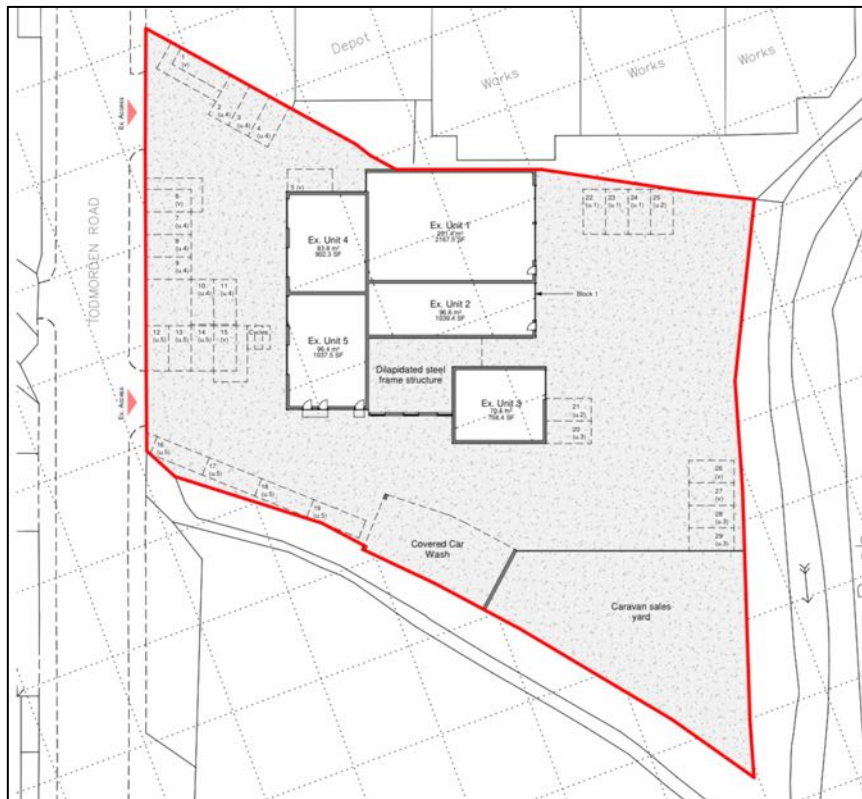


Figure 1 – Site Location Plan

This report has been prepared to provide supporting information relating to geo-environmental aspects for development of the site for a new commercial development.

This report has been developed in accordance with the YALPAG Technical Guidance for Developers Landowners & Consultants Version 10.3 – April 2019 (Ref 12), Land Contamination Risk Management (Ref. 1), and other best practice guidance cited at the end of this report.

The study has not included checks on services on or adjacent to the site, and no structural, ecological or asbestos surveys have been carried out.

1.1 Previous Reports

A Phase 1 investigation was prepared by Worms Eye Limited to provide supporting information relating to geo-environmental aspects for development of the site for commercial use.

- Preliminary Risk Assessment (Desk Study) - Riverside Business Park Todmorden Road Littleborough OL15 9EG dated October 2023

A Phase 2 investigation was prepared by Mugen Geo Ltd to provide supporting information relating to geo-environmental aspects for development of the site for residential use.

- Phase 2 Report of 'Land at Riverside Business Park, southeast of Todmorden Road in Littleborough' dated November 2024

This report has been used to characterise the site and identify remedial options.

1.2 Limitations

This report has been prepared for the sole use and reliance of the Client named above and cannot be relied upon by any other parties without the express written authorisation of Mugen Geo Ltd. Any unauthorized third party relies on this report at their own risk and the authors owe them no duty of care.

Draft versions of this report cannot be relied upon and Mugen Geo Ltd accept no liability for decisions made based upon any draft versions circulated as part of project development. Please refer to the FINAL report only for decision making purposes.

The report should be read in its entirety, including all associated drawings and appendices. Mugen Geo Ltd cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. The report presents observations and factual data obtained during our site investigation, and provides an assessment of geo-environmental issues with respect to information provided by the Client and specific to the proposed development. Further advice should be sought from Mugen Geo Ltd prior to significant revision of the development proposals.

The geo-environmental investigation was undertaken on behalf of The Client (referenced above). The investigation was designed based upon information supplied by the client & on the assumption that the site is to be developed for commercial development.

The findings and opinions based upon the assessment conveyed in this report is based on information obtained from sources which Mugen Geo Ltd believe are reliable. All reasonable endeavours have been made to source the information from reputable organisations, however, Mugen Geo Ltd accepts no responsibility for

inaccuracies in the data supplied or for opinions based on any such inaccurate data. No attempt has been made to independently verify any data collected by others or from other sources.

Whilst the prepared report may express an opinion on the possible configuration of strata, contaminants or gases between or beyond exploratory hole positions or on the possible presence of features based on visual, verbal or published evidence, this is for guidance only, and no liability can be accepted for its accuracy.

The comments on groundwater and ground gas conditions are based on observations made at the time of the investigation. It should be noted, however, that groundwater and ground gas levels may vary from those reported due to seasonal or other effects.

Consideration should be given to the possibility that exploratory holes excavated as part of this investigation, and indeed any previous ground work by others, may be encountered beneath or within the influence of the proposed development. Mugen Geo Ltd cannot be held responsible for failure of excavations or structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Existing manhole covers were not lifted and drainage runs not be inspected during the course of this ground investigation.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

Mugen Geo Ltd reserves the right to amend their conclusions and recommendations in the light of further information that may become available.

2 Site Description

The site was an irregular shaped parcel of land in a commercial setting in Littleborough as shown in figures 1 & 2 and the site photos included as appendix B.

The development area comprised a derelict building and the immediately surrounding land. There is a caravan compound at the south of the development area, with portacabin office at its northeast. On the southwest boundary is a portacabin with ground covered with macadam patchwork hardcore and unsurfaced areas.

Town House Brook formed the southwest boundary and flowed south-east and the River Roch formed the southeast boundary and flowed south-west. To the northeast is a small block of industrial units and to the northwest are houses.

Site details are summarised in Table 2.1 below:

Detail	Remarks
Location	Land at Riverside Business Park, southeast of Todmorden Road in Littleborough
NGR	394102E 416800N
Known services	Underground sewers, drainage, gas, electric, water cable/telecoms

Table 2.1 – Site Summary

No evidence of Japanese Knotweed or other invasive species was identified during the site walkover, however, a detailed inspection of the fauna was not undertaken.

2.1.1 Underground Fuel Tank

An Underground Fuel Tank was present in the west of the site. It is understood the underground fuel tank was cleaned out and filled with concrete sometime in the 1990's.

It is understood there are no plans to investigate the tank as the development is remote from the tank.

2.2 Summary of Environmental Assessment

Window sampling was undertaken to provide good site coverage, recover environmental samples and install gas monitoring wells

The intrusive investigation encountered made ground from ground level to depths of between 1.2 and 1.9m bgl. Below the made ground natural strata generally comprised a stiff reddish brown mottled grey slightly gravelly clay.

Concentrations of selected heavy metals were all below their relevant screening values within the shallow soils. Concentrations of selected hydrocarbons were all below their relevant screening values within the shallow soils except for Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene and Dibenz(ah)anthracene with the highest values within the malodorous made ground at WS3 at 0.9m bgl. No Asbestos was detected in selected samples. No significant potential risks were identified with respect to controlled waters.

2.2.1 Ground Gas

The risks associated with the ground gases methane (CH₄) and carbon dioxide (CO₂) have been assessed with reference to BS 8485:2015 and guidelines from CIRIA 665 and the NHBC. It was concluded that the site should be regarded as Characteristic Situation 1 (British Standard Class), or Green for the NHBC traffic lights class system if using this company to insure the building control side of the work.

3 Remedial Measures

The site is being developed with commercial development constructed in line with similar adjacent commercial units. In order to mitigate the risks posed by the identified contamination present at the site, consideration should be given to the measures outlined in the following sections.

Overall the evaluation takes account of the cost benefit, environmental outcomes, and appropriate timescales for remediation.

The remedial measures identified should be agreed in consultation with the regulatory authorities.

With the information, available from the Phase 2 investigation, the following approach is suggested:

Soil remediation in the vicinity of a former interceptor tank.

3.1 Soil Remediation

Soil remediation in the vicinity of a former interceptor tank.

The localised horizon of hydrocarbon contaminated material around WS3 is removed, banded and a process of aeration of the materials undertaken to reduce contamination levels prior to disposal.

3.2 Summary of Site Preparation

The following works are assumed to be required to be undertaken in order to prepare the site for development:

- Off-site disposal of any contaminated waste prior to any other development works by a qualified contractor to a suitably licenced landfill site.
- Scrape or dig any vegetation, deleterious material from across the development area.
- Import of clean crushed aggregate or suitable granular fill to form proposed formation level.
- Any surplus site won/stockpiled materials will be removed from site in accordance with current duty of care regulations off-site to a suitably licenced landfill site.

With the information, available from the intrusive investigation, the following approach is suggested:

- Removal of the made ground may be considered in areas where it is shallow or an alternative use of the material cannot be made.

Any remaining made ground after formation levels are created and the building demolition waste has been removed will be isolated beneath a cover system or hardstanding or disposed of off-site.

It is assumed that new subsoil and topsoil will be imported for landscaping and that this should be validated as clean and suitable for use. The acceptability of the use of encapsulation to remediate the site, should this be required, would need prior confirmation with the Local Planning Authority before development occurs. Any remaining made ground after formation levels are created and the building demolition waste has been removed will be isolated beneath a cover system or hardstanding or disposed of off-site. This will remove the linkage between the source and the receptor.

This approach is considered the most cost effective. It is assumed that imported topsoil will be utilised for landscaping and gardens and that this will be validated as clean and suitable for use.

Care will be required to protect both construction workers and adjacent residents from the risk of accidental uncontrolled release of contaminants during excavation.

As part of the site development mitigation measures will be required where site workers or site maintenance workers work with the ground. All site operatives should take the necessary measures to ensure that all works in excavations and confined spaces are carried out in accordance with best practice.

Site workers involved in groundworks should use appropriate PPE, i.e. overalls and gloves and where appropriate masks to protect against the inhalation of hazardous gases. Appropriate health and safety measures, e.g. washing hands prior to eating or drinking, should also be enforced. All employers involved in works at the site should produce an appropriate method statement and risk assessment, to which all employees should comply.

During development of the site, all workers should remain vigilant to the possible risk of encountering areas of potentially contaminated material. Should potentially contaminated material be encountered, site management should be informed. Further testing may then be required to assess the risk to health and safety of the site workers and the environment.

All employers involved in works at the site should produce an appropriate method statement and risk assessment, to which all employees should comply.

Reference should also be made to appropriate HSE and other guidance for working on contaminated and potentially contaminated sites.

Any water on site is directed onto the on-site interceptor.

3.3 Buildings and Services

Based on the encountered ground conditions no special protection measures are considered to be necessary for any proposed new water service pipes as these are all likely to be located within clean imported subsoils/granular fill at the site once development commences (as the contaminated soils will be removed from site).

3.4 Amenity Planting

In areas of soft landscaping provision of a suitable thickness of clean growing medium will be required in order to promote plant growth.

3.5 Waste Management

Any material excavated on site may be classified as waste and it is the responsibility of the holder of the material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way can cease to be classified as waste for a particular purpose.

One of the ways this can be achieved is set out in the Development Industry Code of Practice (CoP) (CL:AIRE, 2008).

The handling, re-use or disposal of waste is regulated by the Environment Agency. The Agency will take into account the use of the CoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the CoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development. This may be because the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so they have ceased to be waste.

At this stage none of the Made Ground has been tested against Waste Acceptance Criteria (WAC) as it is unclear if any material were removed from site for disposal. 'WAC' testing would be required for any material disposed of off-site.

3.6 Unexpected Contamination

It is recommended that if, during development any suspicious or unusual odours, colours, liquids or soils are uncovered, these should be brought to the attention of Mugen Geo Ltd and appropriate advice sought.

Should any previously unidentified significant horizons of hydrocarbon contaminated material be present, it is recommended that this material is removed, banded and a process of aeration of the materials undertaken to reduce contamination levels providing timescales allow prior to testing and disposal.

3.7 Site-won Soils

Material can be sourced from site won material i.e. site-won soils from existing open or landscaped areas. In the interest of sustainability, Local Authorities promote the use of such site-won material providing that they are suitable for the intended end use of the site.

A minimum of 3 samples or, dependent on source and receptor, between 1 per 50m³ and 1 per 250m³. Testing to include standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).

It is essential that the 'suitable' material is either placed in its intended area straight away i.e. soft/landscaped areas or stockpiled in a suitable quarantine area to prevent on-site contamination.

In the event that an assessor finds material has been stored in an unsuitable area, samples should be taken to confirm that no cross contamination has occurred (including a visual/olfactory check of the material). The material should then be suitably quarantined or placed at its intended location immediately.

3.8 Imported Materials

Materials proposed to be imported onto site for use as general fill or clean cover in gardens and soft landscaping should be subject to the guidance provided in the following document:

- Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG). Verification requirements for cover systems. Developers, guidance, v4.1, June 2021

The YALPAG guidance provides four broad classifications for materials, these are considered helpful and are summarised below: -

- Greenfield – if it can be demonstrated that it has not been developed and that no past contaminative uses have occurred on the site.
- Manufactured – from a commercial company who manufacture material by mixing or blending mineral soils (subsoil or sand) with an organic amendment (compost).
- Brownfield – material from a donor site that has previously been developed.
- Screened – material from a company who deal with skip/demolition waste which is screened for unsuitable material, i.e. bricks, wood, plastic etc.

Table 3.6 below provides testing requirements for the material types summarised above plus virgin quarried material and crushed hardcore, stone and brick. The testing below applies to each material source.

Type	Number of Samples	Testing Schedule	Assessment Criteria
Virgin Quarried Material	1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.	Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn)	This needs to be agreed with the Local Authority. The Assessment criteria needs to be UK based, e.g. SGV's, LQM or other similarly derived GAC's.
Crushed Hardcore, Stone, Brick	Minimum 1 per 500m ³	Standard metals/metalloids (As above) PAH (16 USEPA speciation) Asbestos	
Greenfield/ Manufactured Soils	Minimum 3, or 1 between 1 per 50m ³ and 1 per 250m ³	Standard metals/metalloids (As above) PAH (16 USEPA speciation) Asbestos	
Brownfield/ Screened Soils	Minimum 6, or between 1 per 50m ³ and 1 per 100m ³	Standard metals/metalloids (As above) PAH (16 USEPA speciation) TPH (CWG banded) Asbestos Any additional analysis dependant on the history of the donor site.	

Table 3.6 Testing Requirements for Material Types

Samples should be tested at source prior to being imported onto the site. This is to avoid the requirement to re-excavate unsuitable material and the possibility of cross-contamination.

Where the material is provided by a commercial company, testing certificates will normally be accepted on the proviso that it:

- (i) relates to the actual material being imported to the site and the type and amount of analysis is in line with Table 3.6 above
- (ii) the certificates are less than two months old.

If the imported materials are sourced from a brownfield site, then any available site investigation data must be provided for review. Test sample results from such sources should be submitted to the engineer for review at least 48 hours prior to being imported onto site. Any materials with concentrations of potential contaminants in excess of their respective threshold concentrations will not be acceptable for use on the site.

Materials for use as clean capping and intended to promote plant growth should be subject to a visual/olfactory inspection in order to ensure that it is a suitable growing medium and free from obvious contamination, Japanese Knotweed and unsuitable materials, i.e. glass, asbestos containing materials, brick, timber. There may also be a requirement for the analysis of imported topsoil (in accordance with BS 3882:2007) to assess whether it is suitable for its intended purpose.

3.8.1 Screening criteria for Imported Soils and verification samples

The intended screening criteria for Imported Soils and verification samples tabled below are currently in use by the industry. Screening values are summarised in the following tables assuming 1% soil organic matter (SOM).

Determinand	Units	Screening criteria	Assessment Criteria
Arsenic	mg/kg	640	LQM/CIEH S4ULs (2015)
Cadmium	mg/kg	410	SGV
Chromium	mg/kg	8600	LQM/CIEH S4ULs (2015)
Lead	mg/kg	1330	SGV
Mercury	mg/kg	120	LQM/CIEH S4ULs (2015)

Determinand	Units	Screening criteria	Assessment Criteria
Nickel	mg/kg	980	LQM/CIEH S4ULs (2015)
Copper	mg/kg	68000	LQM/CIEH S4ULs (2015)
Zinc	mg/kg	730000	LQM/CIEH S4ULs (2015)
Selenium	mg/kg	12000	LQM/CIEH S4ULs (2015)

Table 61.1 Soil laboratory Analysis Results – metals & metalloids

Determinand	Units	Screening criteria	Assessment Criteria
Acenaphthene	mg/kg	100000	LQM/CIEH S4ULs (2015)
Acenaphthylene	mg/kg	100000	LQM/CIEH S4ULs (2015)
Anthracene	mg/kg	54000	LQM/CIEH S4ULs (2015)
Benzo(a) anthracene	mg/kg	180	LQM/CIEH S4ULs (2015)
Benzo(a)pyrene	mg/kg	36	SGV
Benzo(b) fluoranthene	mg/kg	45	LQM/CIEH S4ULs (2015)
Benzo(ghi) perylene	mg/kg	49	LQM/CIEH S4ULs (2015)
Benzo(k) fluoranthene	mg/kg	1200	LQM/CIEH S4ULs (2015)
Chrysene	mg/kg	350	LQM/CIEH S4ULs (2015)
Dibenz(ah) anthracene	mg/kg	6.3	LQM/CIEH S4ULs (2015)
Fluoranthene	mg/kg	23000	LQM/CIEH S4ULs (2015)
Fluorene	mg/kg	71000	LQM/CIEH S4ULs (2015)
Indeno (123cd) pyrene	mg/kg	510	LQM/CIEH S4ULs (2015)
Naphthalene	mg/kg	1100	LQM/CIEH S4ULs (2015)
Phenanthrene	mg/kg	23000	LQM/CIEH S4ULs (2015)
Pyrene	mg/kg	54000	LQM/CIEH S4ULs (2015)

Table 61.2 Soil laboratory Analysis Results – hydrocarbons

4 Verification

On completion of the remedial works, a verification report shall be produced for submission to the Local Authority. This will provide documentary evidence that the works have been undertaken in accordance with the remedial strategy and that the general requirements and objectives have been achieved.

The verification report shall include all relevant site records, test results, including plans and photos showing pertinent information.

The Contractor shall provide copies of all waste transfer notes of materials exported off site and materials imported onto the site, together with the relevant certificates of analysis. Duty of care documentation shall be submitted with the verification report.

Detailed records, plans and photographs showing the depth, dimensions and locations of all excavated materials shall be provided. This shall include the date works commenced and details of any backfill materials.

4.1 Uncertainties & Limitations

This report has presented options with respect to development that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (NHBC & Local Authority) for their comment/approval.

Mugen Geo Ltd believes however, that the current investigation accurately models the site and that the suggested development strategy is adequate for the conditions already encountered and likely to be encountered on clearance of the site.

5 References

1. Department of the Environment, Transport and the Regions and Environment Agency, Model Procedures for the Management of Land Contamination. Contaminated Land Report 11.
2. EA and NHBC 2000. Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66.
3. Department of the Environment, Transport and the Regions, Environment Agency and Institute of Environmental Health. Guidelines for Environmental Risk Assessment and Management. HMSO July 2000.
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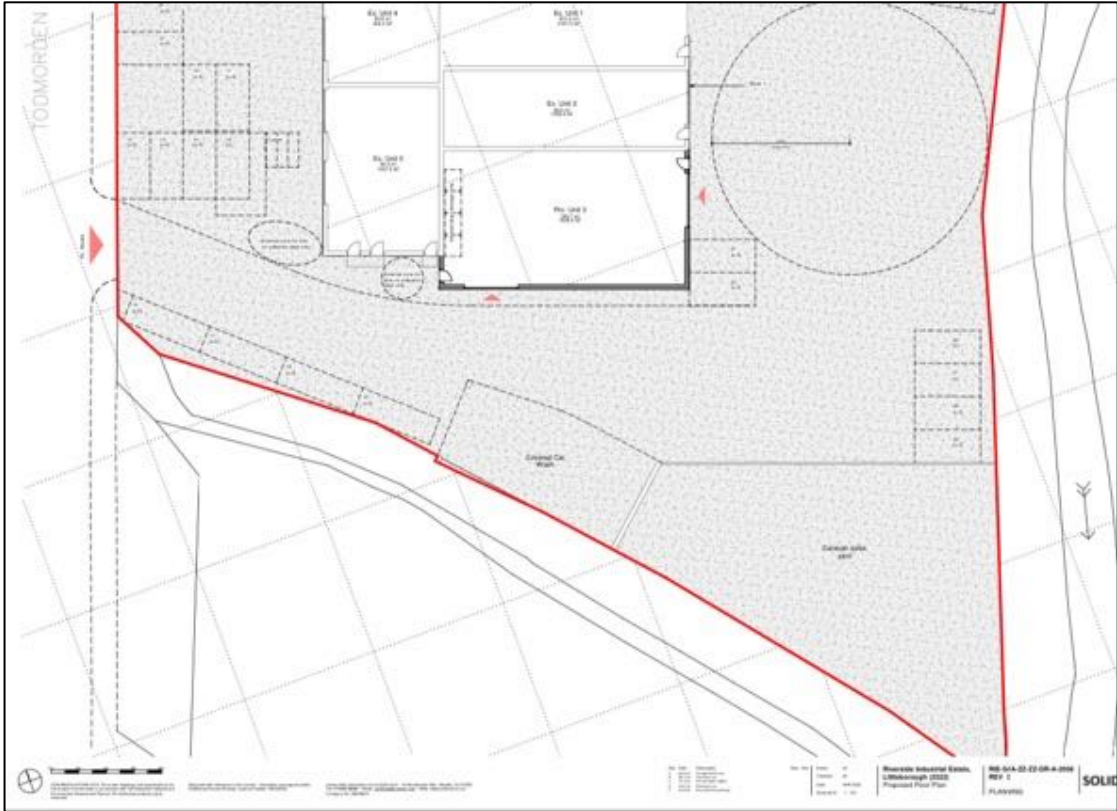
Project Details: Land at Riverside Business Park Todmorden Road Littleborough OL15 9EG

Date: December 2024



APPENDIX A

SITE LOCATION PLANS



SITE DEVELOPMENT PLAN
[Not to scale]

↑
North