



ML (Wooler) Ltd

Bradford Road, Bailiff Bridge
*Phase 2 Geo-Environmental Investigation
and Assessment Report*

G2240-GR-02-o

6th June 2016

PSA Design Limited
The Old Bank House
6 Berry Lane
Longridge
Preston PR3 3JA

Tel. 01772 786066
Fax. 01772 786265

www.psadesign.co.uk
mail@psadesign.co.uk

ML (Wooler) Ltd

Bradford Road, Bailiff Bridge


Phase 2 Geo-Environmental Investigation and Assessment Report

Document Control Sheet

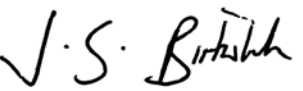
Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

Job	Date	Issue	Copy
G2240	6 th June 2016	G2240-GR-02-o	

Originator...  ... Dr JS Birtwhistle BSc PhD FGS CGeol

Checker....  . DL Wallbank BEng CEng MICE

Approver...  Dr JS Birtwhistle BSc PhD FGS CGeol

Copyright PSA Design Ltd. All rights reserved.

No part of this report may be copied or reproduced by any means without prior written permission from PSA Design. If you have received this report in error, please destroy all copies in your possession or control and notify PSA Design.

This report has been prepared for the exclusive use of the commissioning party and unless otherwise agreed in writing by PSA Design, no other party may use, make use of or rely on contents of the report. No liability is accepted by PSA Design for any use of this report, other than for the purposes for which it was originally prepared and provided.

Opinions and information provided in the report are on the basis of PSA Design using due skill, care and diligence in the preparation of the same and no explicit warranty is provided as to their accuracy. It should be noted that and it is expressly stated that no independent verification of any of the documents or information supplied to PSA Design has been made.

ML (Wooler) Ltd**Bradford Road, Bailiff Bridge****Phase 2 Geo-Environmental Investigation and Assessment Report**

CONTENTS

Chapter	Title
1	Preface
2	Introduction
3	Site Description
4	Historical Site Information
5	Ground Investigation
6	Geotechnical Testing & Earthworks Assessment
7	Soil Contamination Results and Analysis
8	Pavement & Foundation Assessment
9	Gas Risk Assessment
10	Hazard Assessment
11	Conclusions & Recommendations
12	Report Limitations

DRAWINGS

Drawing No.	Title
G2240-01	Regional Location Plan
G2240-02	Current Site Features Plan
G2240-03	Development Layout Plan
G2240-05A	Revised Conceptual Model
G2240-06	Ground Investigation Exploratory Hole Locations
G2240-07	Contamination Plan

APPENDICES

Appendix	Title
A	Borehole & Trial Pit Logs
B	Chemical Testing Certificates
C	Geotechnical Testing Certificates
D	Statistical Analysis of Chemical Testing
E	Gas/Groundwater Monitoring Results
F	Risk Assessment Method

1.0 PREFACE

The site is located off Bradford Road, Bailiff Bridge. HD64DY. (GR 414908E, 425244N). Full site occupies an area of approximately 0.6 hectares.

PSA Design were commissioned by *ML (Wooler) Ltd* to provide a Phase 2 Geo-Environmental Investigation & Assessment of the site. It is understood that consideration is being given to the redevelopment of the site as a *food retail* development. A development layout plan has been provided, which is included in this report as Drawing No. G2240-03.

PSA Design's investigation has incorporated selective information originally included within the following reports:

- Bradford Road, Bailiff Bridge *Phase 1 Land Quality Assessment*, Report No. G2240-GR-01, March 2016, *PSA Design*
- *Geoenvironmental Appraisal* of land at Clifton Mills (Areas C+D), Bailiff Bridge. Report No. 9382/1, May 2007, *Encia Consulting Ltd*;
- *Remediation Strategy* for land at Clifton Mills (Area D), Axminster Drive, Bailiff Bridge. Report No. 1321/1, September 2011, *Lithos Consulting*.

A summary of salient geo-environmental issues is provided in the table below.

Issue	Remarks
Former uses	Former uses of site have included a carpet mill prior to the phased demolition in (post 2002) and basic ground remediation (infilling of basements).
Proposed Development	The proposal for the site is for a large food retail building to be constructed, with associated parking and landscaping.
Hazardous Gas	The previous ground reports appear to suggest that the site is at low risk from gas. A landfill within 250m, deep infill within site and underlying coal measures rocks are present, and therefore represent a low/medium risk of ground gas generation. Therefore, in accordance with CIRIA C665, and in view of the nature of the commercial development (with potential future proofing) a minimum of six gas monitoring visits were undertaken over a three month period. The very low gas concentration and flow rates show that the proposed development is at low risk from gas and as such no protection measures are required for the scheme.
Ground Investigation	Intrusive investigation comprising trial pits and window sampler boreholes across site, including installation of groundwater monitoring wells, with geotechnical and chemical soils analysis.
Ground Conditions	Made Ground (granular & cohesive) overlying a thin GLACIAL DEPOSITS [stiff gravelly CLAY, over MUDSTONE [Coal Measures].
Soil Contamination	Chemical testing on soils materials from the various ground investigations have proved that for the commercial end-use there is a low/moderate risk of contamination affecting human health and receptors from very low % asbestos. The extent and concentration of the asbestos affected fill material is small, within two hot-spots within the central and N areas of the site. Barrier pipe will be required for water supply.
Groundwater	Minor evidence of groundwater strikes throughout the site. The perched groundwater occurs within a small localized area trapped within the gravel fill.
Anticipated Foundation Solutions	For the food retail development, where deeper fill (approximately 3-6m depth) and occasional trapped perched groundwater are present, a piled solution is recommended. Structural assessment will be required of building loadings and foundation proximity compared to the slope. Retaining structures are likely, dependent upon the final ground levels for the development.
Additional Investigation	Mining Investigation will be required to assess the risk from shallow mine workings and the shaft.
<i>Environmental & Engineering Remediation Issues</i>	<ol style="list-style-type: none"> 1. Earthworks suitability assessment of made ground deposits for re-use. 2. Preparation of highways and parking footprints prior to construction (including possible ground improvement). 3. Waste disposal assessment of material arisings, in particular asbestos containing soils within hot-spots. 4. Validation of any imported topsoil and cover system materials for proposed landscaped areas, if required.
<i>Geotechnical Issues</i>	<ol style="list-style-type: none"> 1. Depth, extent and variation in made ground deposits causing potential differential settlement. 2. Obstructions at depth within made ground deposits, such as building foundation brick structures and in-situ slabs 3. Settlement issues regarding improvement of fill deposits. 4. Tree influence upon clay heave within the site. 5. Retaining structures are likely, dependent upon final design proposals. 6. Mine Workings.

2.0 INTRODUCTION

2.1 *Terms of Reference*

2.1.1 PSA Design were commissioned by *ML (Wooler) Ltd* to carry out a Phase 2 Geo-Environmental Investigation and Assessment of the former Clifton Mills site at Bradford Road, Bailiff Bridge. The investigation was designed to assess the gas, ground and groundwater conditions within the site and risk to local receptors, in particular for the proposed food retail development.

2.1.2 This report presents up to date ground data for the site. This report should be read in conjunction with the previous geo-environmental desk study report (ref G2240-GR-01) for the site carried out by PSA Design in 2016.

2.1.3 The agreed scope of works included:

- Borehole and trial pit investigation and gas/groundwater well installation across the site
- Chemical & geotechnical testing of materials
- Assessment of ground, groundwater and surface water conditions, including additional information regarding potential contaminants
- Gas monitoring and risk assessment
- Assessment of anticipated foundation and engineering issues associated with redevelopment for a *commercial* end-use.

2.1.4 This report does not cover the risk to the site related to the shallow mine workings and shaft.

2.2 *Proposed Development*

2.2.1 It is understood that consideration is being given to the re-development of the site to provide a food store. The general end use within these areas will be a large building within the central E area, including a loading bay, with associated car parking and landscaping.

2.2.2 A development layout plan has been provided, which is included in this report as Drawing No. G2240-03.

2.3 *Planning*

2.3.1 The report aims are to satisfy the requirements of Calderdale Council related to contaminated land concerns, likely to be

- Protect environmental receptors and render the site suitable for the proposed end use of a commercial development, with associated infrastructure
- Provide a “clean” development platform for subsequent construction of the proposed development and associated infrastructure
- Satisfy requirements of the planning condition.

- 2.3.2 This present report is therefore designed to satisfy the requirements of Planning Condition related to (ii) ground investigation, following on from the original desk study (G2240-GR-01).

3.0 SITE DESCRIPTION**3.1 General**

- 3.1.1 The site location is shown on Drawing Number G2240-01. Site details are summarised in the Table below. Current site layout plan shown in Drawing Number G2240-02. The site is situated in an *urban* location.

Detail	Remarks
Location	Bailiff Bridge centre (Dwg G2240-01).
Address	Bradford Road, Bailiff Bridge, Bradford. HD6 4DY
NGR	414908E, 425244N
Area	0.6Ha.
Known services	Water and sewers run through N area of site (NE-SW) & sewer runs through S area of site (NE-SW).

3.2 Site Features

- 3.2.1 A PSA Design Engineer completed a recent walkover survey of the site on 12th February 2016 and the salient features are presented below.
- 3.2.2 The site is undulating and all buildings have been demolished and removed from the site. The tarmac surfacing of the NE-SW historic highway is still present within the N area of the site.
- 3.2.3 Wild grass and low-lying weed vegetation is present across the majority of the site. The site has recently been cleared of larger mature shrubs that would appear to have been present over large swathes of the site.
- 3.2.4 There is the potential that the stockpile within the S area of the site, described in previous reports, is still present, but is hidden by the cover of recent vegetation. The ground levels generally drop away from N to S, and E to W, with a terraced upper and lower level within the S area of the site. The SW corner of the site, has had the most recent demolition of the final mill building. A manhole chamber is present within the central E area of the site.
- 3.2.5 Access to the site through locked fencing, off an access road, N of the site, off Wyke Old Lane.
- 3.2.6 Existing salient features are shown in Drawing Number G2240-02.
- 3.2.7 Surrounding land use is mixed, with retail/commercial to the N, W and S of the site, with recent large residential development to the E.
- 3.2.8 Existing salient features are shown in Drawing Number G2240-02.
- 3.3 Site Operations**
- 3.3.1 Current site operations are empty and secured, and not therefore considered to represent a significant source of ground contamination.

4.0 HISTORICAL SITE INFORMATION

- 4.1 The Table below provides a summary of the salient points relating to the history of the site with respect to the proposed end use. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in bold text for ease of reference.

Date(s)	Site	Surrounding Land
1854	Four thin rectangular buildings located across the southern and central areas. Highway crossing site (NE-SW). Terraced housing within N area. Water course running (NE-SW) along SE corner of site.	Land uses throughout the immediate surrounding area are a mixture of greenfield and brownfield generally developing out in a linear pattern out from the Bailiff Bridge cross-roads, SW of the site. Cotton & Woollen Mills located to the N (30m), E and W (50m) of the site. Wike Beck (running N-S), 60m W of site boundary. School adjacent to NW corner of site. Highway along W boundary of site.
1892-93	Clifton (Woollen) Mill built within S half of site. Watercourse culverted/diverted under buildings.	Clifton Mills extend to the E of the site, with tank 40m E of site. Railway constructed (N-S) 160m E of site. Old Coal Pit , 150m N of site.
1905-07	Clifton Mill recorded as manufacturing carpets .	Extension of Clifton Mill building to NE of site. Old shaft , 210m E of site. Gasometer , 60m E of site. Victoria Yarn Mill , 200m NW of site.
1922	No significant changes within site.	Clifton Mill extension within NE area, plus across highway to S, with reservoirs recorded 50m S & 50m E of site and tanks 75m S of site. Residential development to N. Tramway along highway to W of site.
1931-33	Highway amended within site, with reconstruction of buildings along W boundary.	Extension of Victoria Mill to NW.
1938	No significant changes within site.	No significant changes surrounding site.
1948-55	No significant changes within site.	Reservoir to E infilled .
1957-61	Various changes to buildings within E area.	No significant changes surrounding site.
1964-66	No significant changes within site.	Mill to W now Carpet Factory. Railway to E dismantled.
1970-76	Housing in N area removed.	Wyke Old Lane highway constructed along N boundary of site.
1981-85	No significant changes within site.	No significant changes surrounding site.
1986-88	No significant changes within site.	Mill to N demolished and replaced with Braxholme Ind Est.
1992	No significant changes within site.	No significant changes surrounding site.
2002	No significant changes within site.	No significant changes surrounding site.
2010	Majority of factory demolished apart from in SW area.	Following removal of factory to E of site boundary, new housing built and Axminster Drive highway bounds E edge of site. Victoria Mill demolished and replaced with housing to W of site.
2014-current	Removal of SW building. Site cleared and de-vegetated.	No significant changes surrounding site.

5.0 GROUND INVESTIGATION

5.1 *Introduction*

The proposed ground investigation was designed to assess primarily the contamination risks in relation to soil, water & gas for the proposed commercial development at Bradford Road, Bailiff Bridge.

5.2 *Previous Ground Investigations*

5.2.1 The following previous investigations have been undertaken for the re-development site area, to determine the environmental status of the site, which were contained within the seller's pack for the site:

- Trial Pitting (Encia Consulting Ltd [May 2007])

5.3 *Review of Findings of Investigations*

5.3.1 The reports that have been provided are incomplete, with important information missing, including trial pit logs and an exploratory hole location plan for the latest ground investigation. As such, the reader should be fully aware that the information set out below is an interpretation of the text provided in the 2007 ground investigation, and inaccuracies may occur due to the lack of a full amount of data to review. Although the information is incomplete the information provided below is thought useful in providing a broad review of ground conditions across the site, although the accuracy of minor variations to the norm will be lacking.

5.3.2 The appraisal by Encia Consulting Ltd (ECL) in 2007 was for the site to be redeveloped into residential apartments. The central and southern main area of the current site is referred to in the ECL Appraisal as Area D, with the smaller area in the N, referred to as Area C. The ECL report summarised various historic ground investigations, of which they were provided with report copies. These investigations were generally for land to the east of the site, with minor cross-over into the existing site. Of particular note was the Jordan Pritchard Gorman ground investigation, which comprised of ten rotary boreholes and four probeholes. ECL state that the four probe holes were within the site, but do not state how many (if any) of the rotary boreholes were within the proposed site area. The JPG report concluded that no workable coal was present below the site. A summary of a historic pitting (4No.) and drilling (1No.) investigation by Consult in 2003 (albeit without an exploratory hole plan) described depths of fill between 0.05-1.90mbgl. The fill generally overlaid either a thin gravelly clay, or mudstone/sandstone. The maximum depth drilled/excavated was 4.0mbgl.

5.3.3 The ECL ground investigation in 2007 comprised of a pitting exercise across the site, apart from inside the remaining building within the SW area of the site. The investigation objectives were to aid foundation design, collect environmental samples for testing and also investigate to check for mine entries. It was noted that the pits for mine entry investigation were abandoned due to depth and instability of the fill in the S area of the site. The ECL ground investigation comprised of 18No. trial pits (TP201-218), with final depths ranging from 1.3-4.7m. Reviews of the site investigation undertaken within the site area suggests that the basic ground model consists of a varying thickness covering of

Made Ground (cohesive and granular), with a thick fill deposit in the S area, overlying a firm-stiff gravelly clays (Till) overlying mudstone bedrock. A thin coal deposit (0.1-0.2m thick) was encountered in two trial pits (TP205 & 207) at depths 1.8-2.3mbgl within the SE area of the site (Area D, within the original report).

5.3.4 Across the proposed N area (area C in the original report), groundwater was not encountered, however within the S area, localised perched groundwater strikes were recorded in a minority of holes at varying levels (1.1-4.4mbgl). Obstructions were encountered in 8No. of the holes, either surface concrete slabs or relict brick walls, with a potential deep concrete lining within the localised basement areas. Basic chemical testing and geotechnical testing were carried out in the exploratory holes, including the S stockpile of demolition rubble, with 16 samples taken. Again, like with the trial pit logs, full test certificates are not available as part of the seller's pack. No asbestos was found within the site area. In general the test results for both soil and water showed that there appears, from the limited testing a low level of contamination risk at the site. The original end-usage was residential and it was assessed that there were raised inorganic levels of lead and arsenic. No gas monitoring was conducted, although ECL reference previous investigations that recorded low methane levels, low carbon dioxide (<5.0%v/v), with minimal flow rates.

5.3.5 A summary of ground conditions, based on the previous ground investigation text is set out below:

MADE GROUND

Made ground material was recorded throughout the site to a depth of generally 1.0mbgl with a range of 0.05-4.40mbgl thickness. The deeper fill material was located in the southern area of the site (ranging 2.50-4.40mbgl). The fill thickness within the central area of the site averaged 1.20mbgl, with the fill thickness generally shallower in the N area ranging from 0.05-1.60mbgl. Various made ground deposits were described, as follows:

- Granular Made Ground [mixed sandy gravels, comprising of sandstone, mudstone & brick + concrete. No measure of density within fill] ***DEMOLITION FILL***.
- Cohesive Made Ground [sandy clays with much gravels/cobbles] ***COHESIVE FILL***

NATURAL SOILS – GLACIAL TILL - CLAY

The underlying clay was described as firm, becoming stiff brown/grey gravelly CLAY. No thickness or depth range was recorded for the deposit in the report text.

ROCK –MUDSTONE

MUDSTONE was recorded across the site within a depth range of 1.8-2.5mbgl. No mention in the text was made to the presence of mudstone underlying the thicker (4.4m) fill deposit.

5.3.6 Various foundation recommendations (strip, raft, piled) were provided that were due to the observed variation in made ground stratum. They stated that the foundation loadings should be imposed directly upon the glacial till or lower, or treat the upper ground. A suspended floor construction was recommended unless re-engineering of the underlying

soils were conducted. Consideration of the concrete design has led to a recommendation of Design Sulphate Class DS-2 and AEC Class AC-2 for structures coming into contact with the made ground. ECL recommended a full turnover of the made ground to avoid the potential geotechnical issues relating to differential settlement.

5.3.7 ECL referred to previous mining investigations rather than elaborate on the fact that their own mining investigation for the missing shaft was abandoned. They stated that the previous investigations had not found any evidence of shallow mine workings and that there is no workable seam under the site. ECL stated that the second, unlocated shaft may be a circular chimney base rather than a mine shaft.

5.3.8 ECL state that a surface water culvert crosses E-W through the S area of the site.

5.4 *PSA Design Ground Investigation*

5.4.1 PSA Design conducted the following work:

- Intrusive investigation of ground conditions beneath the site, to include boreholes and trial pits, sampling and in-situ testing
- Installation of gas/groundwater wells across the site
- Assessment of groundwater underlying site
- Gas monitoring and analysis
- Chemical and geotechnical analysis of soils groundwater beneath the site, where appropriate.

5.4.2 *Summary*

A ground investigation was undertaken to assess the ground conditions at the site in preparation for the proposed re-development as a commercial development with associated infrastructure. The investigation consisted of a borehole drilling and trial pitting exercise followed by chemical testing of representative samples. General ground conditions consisted of Made Ground (granular & cohesive) overlying a thin, sporadic GLACIAL DEPOSIT (stiff CLAY) over MUDSTONE (Coal Measures).

5.4.3 This report does not include information and assessment of the mining investigation that will be need to be carried out for the site. A separate report will be produced by a specialist mining consultant to deal with this engineering issue.

5.5 *Fieldwork*

5.5.1 *Objectives*

5.5.1.1 To determine the general nature of the soils underlying the site, including the thickness and type of any made ground.

5.5.1.2 To assess the density and strength of natural soils on the site to enable pavement and foundation recommendations to be made.

5.5.1.3 To recover soil samples for both chemical and geotechnical analysis.

ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

5.5.1.4 To install groundwater wells within the boreholes across the site to identify and assess groundwater quality and flow regime.

5.5.1.5 To monitor gas values and flow across the site.

5.5.2 Scope of Works

5.5.2.1 Fieldwork was carried out in two phases, drilling (16-17th February 2016) and trial pitting (22nd March 2016). The fieldwork was supervised by PSA Design. The exploratory holes are listed in the following table.

Technique	Date	Exploratory Holes	Final Depth(s) & Location	Remarks
		<i>Logs in Appendix A</i>	<i>Ground Investigation Plan (Drwg G2240-06)</i>	<i>Lab Testing in Appendix B+C.</i>
Window Sample Vertical Boreholes	16-17/02/16	WS1	4.30mbgl [Central E area-proposed centre of building]	General ground conditions, sampling for lab testing, in-situ testing, well installation.
		WS2 WS2A	0.72mbgl 4.30mbgl [SE area-proposed SE corner of building]	General ground conditions, abandoned due to impenetrable fill material, sampling for lab testing, well installation.
		WS3	4.50mbgl [SE area – car park and landscaping]	General ground conditions, sampling for lab testing, in-situ testing.
		WS4	6.70mbgl [Central area-proposed SW corner of building]	General ground conditions, sampling for lab testing, in-situ testing, well installation.
		WS5	4.10mbgl [SW area – car park and landscaping]	General ground conditions, sampling for lab testing, in-situ testing.
		WS6	1.70mbgl [Central W area – car park and landscaping]	General ground conditions, sampling for lab testing, in-situ testing.
		WS7	1.70mbgl [Central area-proposed NW corner of building]	General ground conditions, sampling for lab testing, in-situ testing.
		WS8	2.0mbgl [N area]	General ground conditions, sampling for lab testing, in-situ testing.
		WS9	4.30mbgl [Central E area-proposed centre of building]	General ground conditions, sampling for lab testing, in-situ testing, well installation.
Trial Pits	22/03/16	TP1-3	1.20-1.70 [N area]	General ground conditions, sampling for lab testing, in-situ testing.
		TP4+5	0.60-1.80mbgl [Central area- proposed N edge of building]	General ground conditions, sampling for lab testing, in-situ testing. Hole abandoned due to obstruction.
		TP6	2.00mbgl [Central W area – car park and landscaping]	General ground conditions, sampling for lab testing, in-situ testing.
		TP7, 8+10	1.00-1.80mbgl [Central area- proposed SW corner of building]	General ground conditions, sampling for lab testing, in-situ testing. Hole abandoned due to obstruction.
		TP9, 11+12	1.70-2.40mbgl [SW area – car park and landscaping]	General ground conditions, sampling for lab testing, in-situ testing.
		TP13	1.90mbgl [SE area – car park and landscaping]	General ground conditions, sampling for lab testing, in-situ testing. Hole abandoned due to obstruction.
		TP14-16	2.00-2.70mbgl [SE area – car park and landscaping]. Potential mine shaft area.	General ground conditions, sampling for lab testing, in-situ testing. Hole abandoned due to obstruction.

The exploratory holes are presented in Appendix A. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode EN ISO 14688, of the materials encountered and details of the samples taken, together with observations made during drilling.

5.5.2.2 A total of 10No. boreholes were sunk across the site to depths of between 0.72-6.70mbgl using a window sampler rig and 16No. trial pits dug to depths 0.60-2.70mbgl. Detailed logs are presented in Appendix A.

5.5.2.3 1No. borehole (WS2) and 9No. trial pits (TP4, 5, 6, 7, 10, 13-16) were abandoned at shallow depths due to impenetrable fill material, due to the excavator/drill hitting a large block of material, which was impenetrable. Trial pit TP8 was abandoned due to instability, caused by water ingress and loose material cavings.

5.5.3 *Soil Descriptions, In-situ Testing and Sampling*

5.5.3.1 The soils encountered during this investigation have been logged by a Chartered Geologist in accordance with BS5930:1999 "Code of Practice for Site Investigation" and EN ISO 14688.

5.5.3.2 Geotechnical in-situ testing of the materials encountered was undertaken using a Geonor H-60 Vane for measuring shear strength values.

5.5.3.3 During drilling representative samples were taken at regular intervals, to assist in the identification of soils and allow chemical testing to be programmed.

5.5.4 *Exploratory Hole Locations*

5.5.4.1 Exploratory hole locations were selected by PSA Design to provide a representative view of strata beneath the site and are shown on Drawing G2240-06.

5.5 Ground Conditions**5.5.1 Geological Summary**

The ground conditions encountered within the exploratory pits at the site have been compiled and reviewed. They can be described in terms of the given lithologies (based on published geological data) and are discussed in the subsequent paragraphs. The lithologies encountered during this investigation are summarised in the following table;

Lithology	Depth (m) to base below current ground levels [present in hole]	Thickness (m)
Made Ground (Gravel Fill)	0.30-2.90 [WS1, 2, 2A, 4, 7, 8, TP1, 4, 5, 7, 8, 10-16]	0.20-1.80
Made Ground (Firm Cohesive Fill)	0.10-3.70 [WS1, 2, 2A, 3, 5, 6, 8, 9, TP2-4, 6-9, 14-16]	0.10-2.50
Made Ground (Soft-Firm Cohesive Fill)	1.40-5.80 [WS4, TP9+11]	0.70-2.90
Made Ground (Clayey Gravel Fill)	2.00-4.10 [WS2A, 3, 4+9]	0.50-2.00
Glacial Till [Boulder Clay] (Stiff slightly, gravelly CLAY)	0.70-1.50 [WS6-8, TP2+3]	0.30-0.80
Glacial Till [Boulder Clay] (Firm-stiff, very gravelly CLAY)	Undetermined, at least to 1.20-4.30 [WS1, 2A, 3, 5, 8-9, TP1-3, 6, 9, 11+12]	At least 0.20-1.10
Mudstone	Undetermined, at least to 1.70-6.70 [WS1, 2A, 3-9, TP9]	At least 0.10-0.90
Groundwater Entries	Dry-0.30-2.80[WS4, TP8+11]	

5.5.2 Made Ground

5.5.2.1 Made ground was encountered in all of the 26No. exploratory boreholes, during the course of the ground investigation.

5.5.2.2 The thickness of made ground within the PSA Design investigation was found to vary from 0.10m (borehole TP2) to a maximum of 5.80m in borehole WS4. It should be noted that obstructions prevented full determination of the made ground in 10No. holes, however the other 16No. holes will give an indication of the composition and extent of the fill deposits across the site. The obstructions were generally within the central and southern areas of the site, likely to be related to the backfilling of the mill building basements, post-demolition. Shallower fill thickness was encountered in the northern area with an average thickness of approximately 0.6m, but varying from 0.10m (TP2) to 1.0m (TP1). Within the central and southern areas, there are deeper fill deposits, with deposits 1.0-2.0m thick in the western area (where ground levels are lower than the eastern terrace by

approximately 2.0m). The deepest fill is within the SE quadrant of the site (within the footprint of the proposed building), with general fill thicknesses of 4.0m, with an isolated deeper patch reaching 5.8mbgl (WS4), in the central area of the site.

5.5.2.3 4No. types of made ground were encountered within the ground investigation, described as:

- Firm Cohesive Fill
- Gravel Fill
- Soft-Firm Cohesive Fill
- Clayey Gravel Fill

5.5.2.4 The firm cohesive fill was found across the majority of the site, in 22No. holes (WS1, 2, 2A, 3, 5, 6, 8, 9, TP2-4, 6-9, 14-16), often at the surface, but sometime inter-bedded with the gravel fill. The material was generally described as: *MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill).* The thickness of the deposit was inconsistent and varied from 0.10-2.50m, at various depths.

5.5.2.5 The gravel fill was found across the majority of the site, in 18No. holes (WS1, 2, 2A, 4, 7, 8, TP1, 4, 5, 7, 8, 10-16), often at the surface, but sometime inter-bedded with the cohesive fill. The material was generally described as: *MADE GROUND: Dense, becoming medium dense (driller's description), grey-brown, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick, concrete, mudstone and sandstone fragments and rare coal and steel (Granular Fill).* The thickness of the deposit was inconsistent and varied from 0.20-1.80m at various depths. The abandoned trial pits, were generally terminated within this deposit.

5.5.2.6 The soft-firm cohesive fill was found within an isolated area of the site, locally in the central W area, in 3No. holes (WS4, TP9+11). The material was generally described as: *MADE GROUND: Soft-firm, grey, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of mudstone and rare coal fragments (Cohesive Fill).* The thickness of the deposit was inconsistent and varied from 0.70-2.90m at various depths.

5.5.2.7 The clayey gravel fill was found within isolated areas of the site, locally in the SE area of the site, in 4No. holes (WS2A, 3, 4+9). The material was generally described as: *MADE GROUND: Dense, becoming medium dense (driller's description), grey-brown, clayey, in part slightly sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick, concrete, mudstone and sandstone fragments and rare coal and steel (Granular Fill).* The thickness of the deposit was inconsistent and varied from 0.50-2.00m at various depths.

5.5.3 *Natural Soils*

5.5.3.1 The natural deposits underlying the surface fill are relatively consistent, with the stiff brown gravelly CLAY (*glacial till*), overlying the MUDSTONE.

Glacial Till – Stiff slightly gravelly Clay

5.5.3.2 The light brown slightly gravelly clay was encountered in 5No. of the holes (WS6-8, TP2+3), underlying the made ground. The material was generally described: *Stiff, light brown-mottled grey, high strength, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare coal fragments.* The borehole investigation recorded the extent of the glacial clay deposit to be 0.30-0.80m thick. The full depth of the clay during the trial pitting exercise was not reached, due to termination within the strata.

Glacial Till – Firm-stiff very gravelly Clay

5.5.3.3 The brown gravelly clay was encountered in 13No. of the holes (WS1, 2A, 3, 5, 8-9, TP1-3, 6, 9, 11+12), underlying the made ground or slightly gravelly clay. The material was generally described: *Stiff, occasionally firm, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone, siltstone and sandstone fragments.* The borehole investigation recorded the extent of the glacial clay deposit to be 0.20-1.00m thick. The full depth of the clay during the trial pitting exercise was not reached, due to termination within the strata.

Mudstone

5.5.3.4 *Mudstone* was encountered in 9No. of the boreholes (WS1, 2A, 3-9), but the trial pitting exercise was terminated at depths above the rock-head, apart from in trial pit TP9. The material was generally described as: *weak light grey brown MUDSTONE. (Lower Coal Measures).* The thickness of the deposit varied from 0.10-0.90m. The full depth of the mudstone was unrecorded, due to refusal of the drilling operation in the rock. The depth to the top of the mudstone across the site varied significantly across the site, influenced in part by the fill thickness and ground level. The depth to bedrock varied from 1.00m to 5.80mbgl, with the depth increasing from N to S.

5.5.4 *Groundwater*

5.5.4.1 Groundwater strikes were encountered in only 3No. holes (WS4, TP8+11) in localised, isolated positions within the central western area of the site, close to the slope. The remaining 23No. holes were dry and did not encounter groundwater. The strikes were at depths of 0.30-2.80mbgl, interpreted as perched water tables in isolated areas of the site, related to surface water drainage infiltrating into the fill and sitting on the relatively impermeable lower clay/mudstone deposit.

5.5.4.2 Groundwater wells were installed as part of the PSA Design investigation works at various depths within 4No. of the boreholes (WS1, 2A, 4+9), across the entire site area. During the ground investigation monitoring period, groundwater was encountered within 3No. of the boreholes with well installations (WS2A, 4+9). The range of groundwater depths during the monitoring period, where recorded, varied from dry (WS1) to 1.58-

2.42mbgl. The water is assumed to be trapped within the granular fill, held above the relatively impermeable underlying clay/mudstone.

5.5.6 *Stability*

Trial pit excavations were stable in the majority of the pits, with only 6No. unstable (TP6, 8, 11, 14-16) during, which was unstable for various reasons, including the loose nature of the gravel backfill, water ingress and the large % of boulders within the fill deposits, causing cavings.

5.5.7 *Coal Shaft Search*

With reference to the previous reports, an investigation within the SE corner of the site was conducted (trial pits TP14-16). Using the Coal Authority plan from the report (ref 51001102751001), the location of the unknown shaft was located within the highway footprint, 5m E of the site boundary. However, due to the potential for error in reporting the exact location, and to try to resolve if the shaft was inside the site boundary, three pits were excavated to try to identify the missing shaft. Longer pits were excavated, but the holes were terminated at depths varying from 2.0-2.70m, due to the excavator being unable to penetrate through large boulders, within the fill matrix. It is recommended that a further investigation is made, using a large excavator that can penetrate the large obstructions within the fill. It is advised that the fill is stripped back in layers, in a grid pattern to check if the shaft is present or not within the development platform.

6.0 GEOTECHNICAL TESTING & EARTHWORKS ASSESSMENT

6.1 *Introduction*

Selective strata was investigated to gain geotechnical parameters of the ground conditions using the in-situ testing techniques of hand shear vanes, in accordance with BS 1377:1990. Furthermore sulphate and chemical testing was carried out to aid concrete design.

6.2 *In-situ Testing*

6.2.1 18No. Hand Vane tests were carried out, in the two glacial till deposits. The tests were carried out on both disturbed and undisturbed samples. Detailed results are tabulated in the logs (Appendix A).

6.2.2 Shear strength results for slightly gravelly clay ranged from 85-130kPa (high strength), described as stiff, whilst the very gravelly clay results were more varied, 75-130kPa (high strength), described as firm to stiff in the field.

6.3 *Earthworks*

6.3.1 The ground levels generally drop away from N to S, and E to W, with a terraced upper and lower level within the S area of the site, with a level difference of approximately 2m from the SE to SW corners of the site.

6.3.2 An assessment of the ground investigation has encountered a range of made ground deposits, both granular and cohesive. These materials are often inter-mixed, with no defined area of one type. The granular deposits within the central and S areas contained boulders, which may have an impact on the earthworks. The density of the compacted fills within these areas, combined with the size of some material and the potential of relict in-situ slabs, still being in place will mean that plant used on the scheme will need to be of significant power to optimise the speed of earthworks.

6.3.3 Detailed proposed development levels for the site have yet to be determined, however it is expected that due to the boundary constraints and the overall terraced nature of the site (with steep slopes from the east to the west within the S area) the likely final levels will need to be modified from the existing levels, to accommodate the proposed building and parking infrastructure. It is likely that approximately 0.5m-1.5m of fill will need to be excavated from the proposed building footprint area in the central E area, with fill required to bring levels up in the western parking zones, in part, by up to 1.5m.

6.3.4 Re-use of excavated materials should be based on approved material acceptability criteria, following detailed pavement design.

6.3.5 Any major earthworks activity within the site needs to take into account the properties of the fill deposits, in particular the major constituents, ie gravel fill and cohesive fill. Localised hot-spot areas of the granular and cohesive fill within the central and NE areas are recorded as containing traces of asbestos. Earthworks design will need to mitigate the

risks of this material by site procedures and programming to reduce the probability of exposure occurring.

6.3.6 The construction method statement should take account of compaction requirements of the appropriate highways specification for the various formation materials. The imported fill being placed and compacted within suitable layers and the correct specification as set out in the latest Specification for Highway Works (Volume 1) [Manual of Contract Documents for Highway Works (MCDHW)], Series 600 (Earthworks).

6.3.7 The current levels of the site have been inferred based on the original topographic survey, provided by the client.

6.4 Excavations & Groundwater

6.4.1 Excavations at the site should be feasible using an appropriate scale of hydraulic plant. However, as previously described, the granular fill materials encountered within the ground investigation in the central and S areas proved very difficult to penetrate and suitable equipment will be required to break up this material. Likewise, in part the rock-head is shallow in the NW parts of the site (<2mbgl in boreholes WS1, 6,7+8 and TP9) with the shallowest mudstone layer encountered at 1.00mbgl, which may affect the method to create any proposed deep excavations.

6.4.2 In addition, underground obstructions could be encountered within the footprint of the historic mill and breaking techniques would be required for their removal to an appropriate depth, particularly in the footprint of the new structure, and beneath new external areas of hard-standing.

6.4.3 The close proximity of the highways on all four site boundaries must be taken into account with any excavation works. Allowance may be required for temporary shoring and reinforcement to protect the neighbouring structures, whilst excavation works occur along the edges of the site.

6.4.4 Minor groundwater strikes were observed within the central area of the site, which are likely to be perched water trapped within the granular materials. These water bodies are localised and no continuous groundwater table was observed.

6.4.5 All excavations will require adequate lateral support to ensure their stability and a suitably designed de-watering system. Reference should be made to best practice techniques as set out in CIRIA Document C532 "Control of Water Pollution from Construction Sites" (2001).

6.5 Sulphate and PH

6.5.1 The concentration of water soluble sulphate (SO₄) was determined on samples of the natural soils. The results have been assessed in accordance with BRE Special Digest SD1; Concrete in Aggressive Ground, 2005.

6.5.2 Results of the 10No. samples are detailed in Appendix B. The sulphate values ranged from 450-2,700 mg/kg. The upper limit for total sulphate in Design Sulphate Class 1 (DS - 1) is 0.24 %, which is equivalent to 2,400 mg/kg. The results would suggest that the materials tested lie within the Class DS-2 limit.

6.5.3 The pH values for tested samples showed neutral to alkaline conditions within the underlying soils, 8.07-11.12. The site would be classified as *brownfield* with *mobile groundwater* conditions.

6.5.4 Therefore, the 'Aggressive Chemical Environment for Concrete' (ASEC) class for the site is considered to be AC-2 and design/mix of buried concrete should be undertaken in accordance with these classifications.

6.6 Laboratory Testing

6.6.1 On completion of the fieldwork samples were selected for testing. The laboratory testing was scheduled by PSA Design and carried out by *Structural Soils Labs*, a UKAS accredited laboratory.

6.6.2 Geotechnical testing was targeted at all the various strata identified within the ground investigation, which was the glacial till, clay observed throughout the site underlying the fill at varying depths. This clay may be affected by trees along the boundaries of the site.

6.6.3 2No. soil samples was obtained from the site and was tested and analysed for the following suite of geotechnical parameters:

- Moisture content
- Plastic limit
- Liquid Limit

6.6.4 A complete record of the strata encountered is given on the exploratory hole records presented in Appendix A.

6.6.5 Geotechnical test results are presented in Appendix C. Geotechnical testing on the glacial till was carried out for the depths 0.70-1.10mbgl (WS6+8). The plasticity index for the samples ranged from 18-19%, with liquid limit 41%. This corresponds with an *intermediate* plasticity clay. The moisture content ranged from 17-24%.

7.0 SOIL CONTAMINATION RESULTS & ANALYSIS

7.1 Introduction

The 2016 ground investigation by PSA Design was conducted to develop an understanding of the extent of the ground conditions. The investigation included the construction of well installations followed by gas monitoring. The PSA Design investigation encountered soil results, in general, below trigger values for the commercial end-use, apart from the presence of trace amounts of asbestos in isolated samples. Chemical testing results are presented within Appendix B.

7.2 Chemical Analysis

7.2.1 In view of the site history, selected soil samples were taken during the ground investigation and were analysed for a screening suite. On the basis of the Conceptual Environmental Risk Model, it has been considered that a range of potential contaminants could exist in soils at the site, as follows:

- Elements which could pose a risk to human health and/or controlled water: arsenic, cadmium, chromium, hexavalent chromium, lead, mercury, nickel, selenium;
- Potentially phyto-toxic elements: boron, copper & zinc;
- Inorganic chemicals which could pose a risk to human health, buildings and/or controlled water: cyanide, nitrate, sulphate & sulphide;
- Other inorganic contaminants: pH conditions;
- Organic contaminants: Polynuclear Aromatic Hydrocarbons (PAH's with split of 16 priority EPA PAH's).
- Hydrocarbons (speciated)
- VOC & SVOC's
- TOC
- Asbestos identification & % content

7.2.2 Samples from the ground investigation were chemically tested at Envirolab Laboratories Ltd, a UKAS accredited laboratory.

7.2.3 Chemical testing was targeted at all the various surface strata identified within the ground investigation that would be deemed a potential threat to human health with natural materials tested also. This could be broken down into the following:

- Made Ground-Granular
- Made Ground-Cohesive

7.2.4 Sample selection criteria for chemical testing included good coverage of the site area at various depths and lithologies. The samples to volume ratio reflected not only the spatial element of the various compositions of the ground but also represented the %composition of the particular lithological fill type in the total volume of the most recent fill, situated in the site. The sampling was in accordance with BS 10175:2011, Investigation of potentially contaminated sites - Code of Practice. The investigation was conducted in tandem with the findings of the previous ground investigations. The previous chemical testing results showed low soils contamination risk from the materials tested.

- 7.2.5 15No. soil samples obtained from the site, were tested in total with 10 No. analysed for the following suite of chemical determinands:
- Arsenic, cadmium, chromium, hexavalent chromium, lead, mercury, nickel, selenium
 - Boron (water soluble), copper, zinc
 - Cyanide (total)
 - Sulphide (acid soluble)
 - Phenol (total)
- 7.2.6 10No. samples of the various sub-surface materials were analysed for the following suite of determinands:
- Sulphate
 - pH conditions
- 7.2.7 10No. samples of the various sub-surface materials were analysed for the following suite of determinands:
- Total PAH's (speciated)
- 7.2.8 10 No. samples of the various sub-surface materials were analysed for the following suite of determinands:
- Aliphatic & Aromatic Hydrocarbons (speciated)
- 7.2.9 2 No. samples of the various sub-surface materials were analysed for the following suite of determinands:
- VOC
 - SVOC
- 7.2.10 15 No. samples of the various sub-surface materials were analysed for the following suite of determinands:
- Asbestos
- 7.2.11 3 No. samples of the various sub-surface materials were analysed for the following suite of determinands:
- Total Organic Carbon
- 7.2.12 The analytical results of the chemical testing undertaken are presented in full in Appendix D.
- 7.3 *Current Guidance on Interpretation of Analytical Data***
- 7.3.1 The UK approach to contaminated land is based upon the principles of risk assessment. This in turn is founded upon the use of so called source→pathway→receptor/target principles in order to establish the presence, or potential presence, of a pollutant linkage.
- 7.3.2 PSA Design adopts a tiered approach to risk assessment that is consistent with UK guidance. The initial step (tier 1) is the comparison of site data with published guidance
-

levels or remedial targets. In March 2002 DEFRA and the Environment Agency published a series of technical research papers (R&D Publications CLR7,8,9 &10) introducing a new approach to the assessment of risk to human health from land contamination. This research includes the development of the new CLEA model and the Soil Guidance Values (SGV's).

7.3.3 Currently, these guidelines only address seven contaminants and the development of both the CLEA model and additional SGV's is ongoing. Where published, SGV's have been utilised as intervention values for the purpose of a Tier 1 assessment.

7.3.4 For chemical determinants that have yet to have an SGV published alternative literature guidance sources have been used to create a generic assessment criteria (GAC). These sources are as follows:

- LQM/CIEH (2015) *Suitable 4 Use Levels for Human Health Risk Assessment*
- EIC/AGS/CL:AIRE (2009) *Soil Generic Assessment Criteria for Human Health Risk Assessment*
- BRE (2005) *Concrete in Aggressive Ground* BRE Special Digest SD1
- ICRCL (1987) *Guidance on the Assessment and Redevelopment of Contaminated Land Note 59/83* (Landscaped/buildings), DoE
- CIRIA C733 (2014) *Asbestos in soil and made ground: a guide to understanding and managing risks.*

7.3.5 The potential risk to building material is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest SD1, 2005: "Concrete in Aggressive Ground".

7.3.6 Tier 1 groundwater risk assessments are undertaken by comparing leachate concentrations with the appropriate water quality standard. Depending upon the specific characteristics of the site, the appropriate standard may be one of the following:

- Water Supply (Water Quality) Regulations, 1989
- Water Framework Directive, 2003
- River Basin Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions, 2010
- Environmental Quality Standards (for freshwater)
- The surface Waters (abstraction for drinking water) Regulations
- World Health Organisation – Guidelines for Drinking Water Quality, 2005
- Environment Agency: Basic Surface Water Discharges, 2011
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (10/WM/03/21) [UK Water industry Research], 2011
- United Utilities Water guidance for the selection of water pipes in land potentially affected by contamination, July 2011

7.3.7 Since the withdrawal of the ICRCL values in December 2002, there has seemingly been no direct reference for the assessment of potential phyto-toxic effects of contaminants.

PSA Design continue to use the former ICRL values for copper, nickel and zinc as the withdrawal was in relation to human health implications.

- 7.3.8 Should any Tier 1 criteria-in terms of human health, environment and groundwater be exceeded, then two courses of action are available. The first is to 'break' the pollutant linkage by recommending an appropriate level of remedial action – removal of contaminated material for example. The alternative approach is to carry out a detailed risk assessment in order to determine whether contamination risks actually exist.

7.4 Contamination Results

- 7.4.1 The analytical results certificates are presented in Appendix B. Statistical analysis has been carried out on each sample as presented in Appendix D.
- 7.4.2 The preliminary screening process has been compared with the relevant SGV's and GAC's for a *commercial* end land use, as the most suitable equivalent for the proposed development.
- 7.4.3 The *commercial* development will be covered in a mixture of associated hard standing and soft landscaping.
- 7.4.4 No elevated US₉₅ concentrations have been calculated for the CLEA determinands by the statistical analysis, however 3No. samples recorded asbestos present within the cohesive and granular fill, deemed to be of concern (to human health).
- 7.4.5 Soil sample testing identified 3No. specimens (TP3, TP8 & WS4) that recorded asbestos within the screening process out of the 15No. samples tested, although no asbestos material was observed during the logging of the materials. The asbestos material was found in what would appear to be random samples, both cohesive and granular fill materials, generally at shallow depth (0.40-0.90mbgl –WS4, 0.10-0.40mbgl TP3+0.10-0.50mbgl TP8). The fill is generally a shallow fill, and likely to have been a product of the demolition activity on the site.
- 7.4.6 Upon identification, these samples were subsequently assessed for % asbestos in the soil composition, with low results (0.001% w/w). The samples contained either chrysotile insulation fibre (TP3+TP8) or loose insulation (WS4). This would be interpreted as a minor trace of asbestos and not a significant risk to human health (re-development workers or end users). In particular, the covering of the site in hard-standing will, by acting as a barrier reduce the risk of ingestion/inhalation further. Site workers should take suitable precautions, PPE to reduce the risk of contact. In particular, site workers should take suitable precautions, PPE to reduce the risk of contact in line with the current HSE regulations set out in the Control of Asbestos Regulations 2012. Within soft landscaping areas further remediation works will be required for this risk. Currently, based on the preliminary ground investigation, the site has delineated the amount of low level asbestos affected material is set out in Drawing G2240-07. There appears to be two hot-spots of soils containing asbestos. The soils within the N area around trial pit TP3 and within the

central area around borehole WS4 and trial pit TP8. The thickness of the fill deposit in the N area is <2.0m, whereas the fill thickness is at it's maximum around borehole WS4.

- 7.4.6 The results of the chemical testing of soils from the ground investigation show values for the underlying materials of the site that are elevated for asbestos, above values deemed appropriate for the commercial end use and further action will be required.
- 7.4.7 To conclude, from a soil risk perspective, the chemical test results for the samples tested by PSA Design showed that statistically, there are elevated levels of contaminants for the proposed commercial development and as such a low risk from soil contamination in this refined environmental model for the site. As such, remediation measures due to soil contamination risk are required for the site. This will need to take the form of a remediation strategy to assess the risks to the proposed landscaping areas and to development workers.
- 7.4.8 Raised levels (compared to United Utilities trigger levels for ground surrounding water supply pipes on new developments) of hydrocarbons within the site prove that barrier pipes are required for the development due to raised hydrocarbons (C10-C16), compared to UU guidance levels. However, within any areas affected by asbestos soils (should they not be removed) this will require that the pipe trench is comprised of clean inert material, to prevent future risk to utilities workers, plus a geo-membrane barrier surround.

8.0 PAVEMENT & FOUNDATION ASSESSMENT

8.1 *Introduction*

The surface ground conditions for the site, comprising of mixed made ground overlying stiff clays, over mudstone will require moderate engineering solutions for both the pavement and foundation construction.

8.2 *Pavement Assessment*

8.2.1 The ground investigation results have indicated that the formation materials at sub-grade level for the proposed highways and parking areas will be made ground deposits of mixed composition, with minor areas of shallow fill where clay/mudstone may be at formation level.

8.2.2 The made ground materials are unsuitable as a formation material unless further treatment is undertaken. In order to avoid long term consolidation settlement, appropriate design measures should be adopted to ensure the long term integrity of the pavement. It is essential that any fill/pavement materials are placed and compacted in accordance with a suitable engineering specification. The cohesive fill deposits are unlikely to be suitable as sub-grade materials, without significant ground improvement.

8.2.3 The granular fill materials, won from any excavation works could be used for filling operations should they be classified as acceptable materials, dependent upon engineering and environmental acceptability. Further works and field trials would be required to assess their suitability for the bulk engineering fill of the tank areas.

8.2.4 Detailed pavement design will be required for all hard-standing areas and allowance should be made for potential ground improvement of the fill deposits. Further works are required including, a field trial/in-situ pavement investigation of the made ground deposits, to ascertain suitability for highways design.

8.3 *Foundation Construction*

8.3.1 The made ground material varied in thickness across the site and is not a suitable foundation stratum. It is evident that the thickness of the made ground across the site is generally relatively shallow in the N, on average, approximately 1.00m thick, but much deeper in the SE area, with fill deposit thickness recorded as up to 5.80m. There are localised deeper fill deposits (>4.0m thick) found in the S area of the site, associated with the infilled basements of the original mill building.

8.3.2 The underlying stiff boulder clay or stiff gravelly clay with much weathered rock fragments is considered to be competent founding strata (subject to loadings), although the fact that the clay is not present throughout the site (borehole WS4), may deem this deposit unsuitable within the localised areas of the proposed development to ensure that differential settlement doesn't occur with part of the foundations sat on clay and part on mudstone. It may be prudent to take all foundations down onto the underlying mudstone. The depth to the mudstone layer varies from 1.00m (borehole WS6) to 5.80m (borehole

WS4). The depth to mudstone in the southern building footprint area ranges from 1.20-5.80mbgl.

- 8.3.3 Shear vane values for the till ranged from 75-130kPa. We estimate the allowable bearing capacity of the *glacial till* to be about **100kN/m²**. We estimate the allowable bearing capacity of the *mudstone* to be about **250kN/m²**.
- 8.3.4 The final proposed floor slab level for the building has yet to be detailed but the current proposed finished floor level is 81.50mAOD, approximately 0.50 to 1.50m below the existing ground levels. Due to the extent of fill materials encountered during the investigation of the site it is recommended that the building foundations for the development be taken down on to the underlying mudstone (rather than the inconsistent overlying clay layer). For the proposed large building in the central E area the variation in potential foundation depth will need to be considered as to the most economic solution, with the approximate maximum depth of fill being 5.80m in a localised southern area (borehole WS4), which is likely to require a piled foundation.
- 8.3.5 Foundation design needs to take into account the occurrence of different materials encountered at the proposed founding level, ie stiff clay and mudstone across the span of an individual building and make allowances accordingly, either by additional reinforcement or instructions to take the formation level down to one consistent material.
- 8.3.6 There is a possibility that there are deeper fill areas within the footprint of the proposed building that have yet to be exposed, in very localised infilled basements (described in the ECL GI Report). As such, for the main site development in the central E area, structural design may require a deeper foundation in a localised area, where the formation level is >6.0mbgl. If this is the case then it is advised that a specialist piling contractor is consulted, to enable the most economic design solution to be constructed, combined with liaison with the structural engineer to assess the impact of the loads of the building on the ground conditions described in this report. The close proximity of the local residential apartments close to the E boundary of the site needs to be taken into account, when choosing the type of piling technique to use on the foundation construction. In addition, the piling contractor should be made aware that within this report and the original ECL GI report, many obstructions were recorded within the trial pits, which may affect the type of piling technique utilised on the scheme.
- 8.3.7 The foundation design will require the input of a structural engineer to assess the impact of the loads of the buildings on the ground conditions described in this report.
- 8.3.8 The presence of dense shrubs within the site, prior to the recent de-vegetation in 2016, relatively close to the proposed development will affect the structural design for the foundations within this area, as their presence is combined with ground conditions of clay (potential volume changes due to influence of trees). The proposed dwellings varied in distance from the vegetation which will result in varying foundation designs for each individual property. Reference should be made to the NHBC 2006 Document on Foundations Part 4.2 for "building near trees".

- 8.3.9 Plasticity data from the geotechnical samples of clay material from the site, would classify the clay as an intermediate plasticity clay. From the site walkover, the decapitated shrub trunks, observed across the site area, needs to be considered for individual buildings in the foundation design. Proposed building locations will vary in distance from the vegetation which will result in varying foundation designs for each individual building.
- 8.3.10 Assessment of tree distances and suitability for re-engineering fill materials will need to be conducted to define whether the floor slabs will need to be suspended or not.
- 8.3.11 Detailed proposed development levels for the site have yet to be determined, however it is expected that due to the boundary constraints and the overall sloping nature of the site (with a terraced area in the S) the likely final levels will be similar to the existing levels in the N, but within the S areas, retaining structures may be required to create a more suitable landform area, to accommodate the building and parking zones.
- 8.3.12 The close proximity of the highways surrounding the site boundary must be taken into account with any deep excavation works (such as the sewer diversion). Allowance may be required for temporary sheet piling to protect these highway structures.
- 8.3.13 Foundation design must take into account the risk of the unknown mine shaft and the shallow mine workings underlying the site, which is not covered within this report. Further investigation is required prior to detailed structural design, to ensure the building and infrastructure are not at risk from instability from mining activity.

9.0 GAS TESTING & ASSESSMENT

9.1 Introduction

9.1.1 In order to characterise the ground gas regime and to obtain information on the groundwater conditions beneath the site, 4no. well installations (Boreholes WS1, 2A, 4+9) were monitored across the site during the ground investigation.

9.2 Scope of Works

9.2.1 For the gas assessment the wells were monitored on 6No. visits, undertaken between February and May 2016, following installation of the standpipes.

9.2.2 A standard procedure was followed in accordance with CIRIA guidance; this procedure involved measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration on site immediately prior to and on completion of, monitoring
- Weather conditions
- Emission rate using a GA5000 internal flowmeter
- Methane, oxygen and carbon dioxide concentrations using a Geotechnical Instruments GA5000 infra-red gas analyser
- Measurements of peak and steady state concentrations of these gases were recorded via the standpipe gas valve over a time period of at least 180 seconds
- Standing water level using a dipmeter.

9.3 Current Guidance

9.3.1 Current guidance for the assessment of risk associated with the presence of methane and carbon dioxide within ground gas is provided by five recent publications; BS8576:2013 *"Guidance on investigations for ground gas – Permanent gases & Volatile Organic Compounds"* BSI (2013), *"A pragmatic Approach to Ground Gas Risk Assessment"* CL:AIRE RB17 (2012), the *"Ground Gas Handbook"* Wilson, Card & Haines (2009), the NHBC *"Guidance on Evaluation of Development Proposals on sites where Methane and Carbon Dioxide are present"* (2007) and CIRIA Report C665 *"Assessing risks posed by hazardous ground gases to building"* (2007). These reports have developed from previous publications such as:

- BS8485:2007 *"Code of Practice for the characterization and remediation from ground gas in affected developments"*
- Waste Management Paper 27
- BRE Report 212 *"Construction of new buildings on gas-contaminated land"*
- CIRIA Report 149 *"Protecting Development from methane"*
- CIRIA Report 152 *"Risk assessment for methane and other gases from the ground"*
- CIRIA Report 150 *"Methane investigation strategies"*
- Wilson & Card, Ground Engineering *"Reliability and risk in gas protection design"*.

9.3.2 As indicated in these documents, the level of potential risk associated with a given ground gas regime not only depends upon ground gas composition, but also upon ground gas

pressure, as this is a significant driving force for gas migration, either horizontally or vertically through the sub-surface environment. Measurement of gas pressure within or gas flow from, a monitoring standpipe provides useful data which can be used, together with ground gas compositional analysis, to provide a more robust estimation of the level of risk posed to the building development, than consideration of gas composition data alone.

9.4 Monitoring Results

9.4.1 The results of the standpipe monitoring are presented in Appendix E and summarised in the table below.

Borehole	Response zone(mbgI)/strata	Evidence of contamination	No. of monitoring occasions & Dates	Methane (%)	Carbon dioxide (%)	Flow (l/hr)	Range of Atmospheric pressures during monitoring	Water Levels (mbgl)
WS1	1.0-2.0 M/C/R	N	6[24/02/16- 24/05/16]	0.0	0.1- 2.1	0.0- 0.1	998- 1014	Dry
WS2A	1.0-3.0 M/C/R	N	6[24/02/16- 24/05/16]	0.0	0.2- 0.5	0.0	998- 1014	1.65-1.75
WS4	1.0-3.0 M	Y	6[24/02/16- 24/05/16]	0.0	0.2- 0.8	0.0- 0.1	998- 1014	2.40-2.42
WS9	1.0-3.0 M	Y	6[24/02/16- 24/05/16]	0.0	0.0	0.0	998- 1014	1.58-1.60
M=Made Ground, C= Clay, R=Mudstone								

9.4.2 The monitoring results show that none of the 4No. borehole monitoring standpipes recorded methane.

9.4.3 The results for carbon dioxide recorded low concentrations (<5% v/v) within the 4No. boreholes, ranging from 0.0-2.10% v/v. Oxygen concentrations were slightly depleted corresponding to the slightly elevated carbon dioxide levels.

9.4.4 Very low flow rates of 0.0-0.1 l/hr were recorded in the boreholes, during the monitoring period.

9.5 Source of Gas

9.5.1 The presence of infilled ground within 250m of the site and potential mine workings represents a low-medium risk of elevated concentrations of ground gas at the site.

- 9.5.2 The type of underlying deposits found within the site is considered a suitable source of the low quantities of gas, but also reflect the lack of gas flow recorded. The lack of flow shows that the material will not degrade significantly (unlike putrescible, household waste). The TOC (Total Organic Carbon) values for the 3No. fill samples tested, were low, ranging from 0.31-4.02%.

9.6 **Frequency of Monitoring**

- 9.6.1 The proposed likely end use for the development is classed as commercial development. The sensitivity of the development has been classed as *low* with the generation potential of the source as *very low*. However, to future proof the N development it is recommended that the sensitivity of the development should be classed as *high*, with the subsequent extension of the monitoring period.

- 9.6.2 The frequency of monitoring has been based on current guidance as set in the following table.

Typical minimum periods and frequency of monitoring (CIRIA 2007)

		Generation potential of source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of development	Low	4/1	6/2	6/3	12/6	12/12
	Moderate	6/2	6/3	9/6	12/12	24/24
	High	6/3	9/6	12/6	24/12 ³	24/24 ³

1. First number is minimum number of readings and second number is minimum period, for example 4/1 – Four sets of readings over 1 month

2. At least two sets of readings must be at low and falling atmospheric pressure (<1000mb)

3. The acceptability of placing high sensitivity end use on a high gas hazard site is not normally acceptable unless source is removed or treated to reduce gassing potential

- 9.6.3 Potential temporal variable were accommodated within the monitoring regime with monitoring undertaken at barometric pressures below 1000mb on 2No. occasions when the pressure was falling.

9.7 **Gas Screening Values (GSVs)**

- 9.7.1 Gas Screening Values (GSV's), which equate to the borehole gas volume flow rate, as defined by Wilson & Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered have been calculated from a risk-

based methodology for deriving threshold concentrations for gas flow rates. The Gas Screening Value (GSV) of a particular ground gas being considered equates to:

- $\text{GSV (l/hr)} = \text{borehole flow rate (l/hr)} \times \text{gas concentration (\%v/v)}.$

9.7.2 Maximum methane concentration on site was 0.0% v/v. The maximum carbon dioxide concentration of 2.1%v/v, with a worst case flow rate of 0.1 l/hr (for arithmetic purposes). The GSV can thus be calculated as:

- Methane $0.000 \times 0.1 = \mathbf{0.000 \text{ l/hr}}$
- Carbon Dioxide $0.021 \times 0.1 = \mathbf{0.0021 \text{ l/hr}}$

9.8 Traffic Light System of Gas Assessment

9.8.1 The NHBC guidance has set out a series of 'Traffic Lights' that can be applied to gas risk assessments specific to low-rise housing developments (but have been assumed to be a worst case situation for this type of development). This is a risk-based approach that is designed to allow quick and easy design of gas protection for a low-rise development by comparing the measured gas emission rates to generic Traffic Lights. The Traffic Lights include 'Typical Maximum Concentrations' are provided for initial screening purposes and risk-based Gas Screening Values (GSVs) for consideration for situations where the Typical Maximum Concentrations are exceeded. The GSV's equate to the borehole gas volume flow rate, as defined by Wilson & Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered. The calculations are carried out for both methane and carbon dioxide and the worst-case adopted in order to establish the appropriate protection measures. The table below sets out the gas risk assessment criteria:

GRA_Traffic Lights with Typical Max Concentrations and GSVs

Traffic Light Classification	Methane ¹		Carbon Dioxide ²	
	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)
Green	1	0.13	5	0.78
Amber 1	5	0.63	10	1.60
Amber 2	20	1.60	30	3.10
Red				
Notes: 1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated; 2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered; 3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so; 4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.				

9.8.2 The GSV for the site area has been calculated as 0.0021 l/hr which puts the site in the Green Classification for NHBC or the Characteristic Situation 1 for the Wilson et

al.,2006/2007 (modified from Wison&Card,1999) Classification/CIRIA, 2006, with the typical carbon dioxide and methane concentrations being <5% and <1% respectively. The lack of flow, will have an affect on the final protection measures, with the GSV values alone, classified as Green, which stays green due to the maximum gas concentration being below typical maximum levels.

9.9 Assessment

9.9.1 The ground conditions throughout the site have proved to be small pockets of inert granular and cohesive fill, surrounded by clay and mudstone deposits. The natural materials will tend to inhibit gas migration, with the clay fill reducing potential migration of gas, buffering flow, due to its' relative impermeability. The source of the low concentrations of gas is likely to be the inert granular/cohesive fill, with minimal gas flow, although the low levels could reflect natural background levels. Elevated levels of methane and carbon dioxide, compared to background levels have not been recorded. The fill is aged and the fill dimensions are of a relatively small volume.

9.9.2 The low potential of gas source combined the low potential of at risk sensitive receptors for the infill would lead to the conclusion that the gas risk for the site is low. The shallow thickness and small volume of material would give a very small gas generation potential for this infill and combined with ground conditions would most likely prevent any migration of gas into the structure.

9.10 Gas Protection Measures

9.10.1 Based upon the Traffic Light classification the ground gas protection measures required can be defined as presented in the Table below:

Ground Gas Protection Measures

Traffic Light	Ground Gas Protection Measures Required
Green	Ground gas protection measures are not required.
Amber 1	Low-level ground gas protection measures are required, using a membrane and ventilated sub-floor void that creates a permeability contrast to limit the ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BRE 414. Ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24 hours.
Amber 2	High-level ground gas protection measures are required, creating a permeability contrast to prevent ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BRE 414. Membranes used should always be fitted by a specialist contractor and should be fully certified (see Appendix E). As with Amber 1, ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24 hours.
Red	Standard residential housing is not normally acceptable without further Ground Gas Risk Assessment and/or possible remedial mitigation measures to reduce/remove the source of the ground gases. In certain circumstances, active protection methods could be applied, but only when there is a legal agreement assuring the management and maintenance of the system for the life of the property.

9.10.2 On the basis of the Traffic Light Classification it is recommended that for the site development gas protection measures are not required.

9.10.3 From the readings, it is concluded that the risks posed by the presence of gas underlying the site is very low. The commercial development is classified as Green (Table 14.2, NHBC, 2007) or Characteristic 1 (Table 8.5, CIRIA 665, 2007). As such, basic gas protection measures will not be required for the scheme.

10.0 HAZARD ASSESSMENT**10.1 Sources**

10.1.1 The industrial processes and activities undertaken on or adjacent to the site that may act as potential historical or current sources of environmental hazard are shown in the Table below.

Type of Issue	SOURCE-Specific Issue	HAZARD-Remarks
Potential on-site contamination sources HISTORICAL	1. Carpet Mill. 2. Made Ground underlying site from demolition. 3. Infilled Basements. 4. Coal Measures Rocks.	1. Potential source of soil and groundwater contamination (metalloids, hydrocarbons, PAH, organics). 2. Asbestos represents human health risk (inhalation) 3. Risk of ground gas production (CO ₂ & CH ₄).
Potential off-site contamination sources HISTORICAL	1. Landfills. 2. Woollen Mills	1. Risk of ground gas production (CO ₂ & CH ₄). 2. Potential source of soil and groundwater migration (metalloids, hydrocarbons, PAH, organics).
Potential on-site contamination sources CURRENT	None.	N/A.
Potential off-site contamination sources CURRENT	None.	N/A.
Potential geotechnical hazards	1. Shallow mine workings & shafts. 2. Relict foundations of old buildings. 3. Vegetation within site (recently removed).	1. Instability, voids and potential foundation/pavement collapse. 2. Obstruction during foundation construction. 3. Deeper foundations due to tree influence (clay heave).

10.2 Pathways and Receptors

10.2.1 Five pollutant receptors have been identified for the site, and are listed in the table below, together with the pathways through which they may be linked to pollutant sources.

Receptor	Pathways
HUMAN HEALTH Re-development Workers End users- staff	Inhalation, ingestion, skin contact
FAUNA & FLORA Landscaping	Root uptake
WATER ENVIRONMENT Groundwater	Groundwater
BUILT ENVIRONMENT Buildings and services	Diffusion of landfill / mine gas through ground and collection in confined spaces Direct contact with contaminated soil and groundwater

10.3 *Conceptual Model and Qualitative Risk Assessment*

10.3.1 A preliminary conceptual model of pollutant linkages is given in the table below, together with a qualitative risk assessment for each linkage. The risk assessment uses the method of risk evaluation set out in CIRIA 552 'Contaminated Land Risk Assessment'. The scale of risk is determined from a matrix that combines the *consequence* of a hazard with the *likelihood* of the event happening. Details of the assessment method are included in Appendix F. A schematic summary of the conceptual model is given in Drawing Number G2240-05A.

ML (Wooler) Ltd**Bradford Road, Bailiff Bridge****Phase 2 Geo-Environmental Investigation and Assessment Report**

Source	Pathway	Receptor	Consequence	Probability	Risk Classification	Remediation
On site historic sources of ground/groundwater contamination from carpet mill activities, including metalloids, PAHs, organics & hydrocarbons.	Inhalation, ingestion, skin contact	Re-development workers	Medium	low	Low/moderate risk	<i>PPC required during ground-works.</i>
		End users	Medium	low	Low/moderate risk	<i>Results from the ground investigation chemical testing have shown that the soils contamination related to the original carpet mill activity do not require remediation measures for the commercial end use.</i>
	Root Uptake	Landscaping Vegetation	Minor	likely	Low risk	<i>Imported topsoil to be validated.</i>
	Groundwater	Controlled Waters	Medium	low	Low/moderate risk	<i>Remediation measures unlikely to be required.</i>
	Direct Contact	Buildings and Services	Medium	low	Low/moderate risk	<i>Higher specification barrier pipe materials to UU guidelines, due to raised hydrocarbons levels in fill. Concrete specification AC-2.</i>

Source	Pathway	Receptor	Consequence	Probability	Risk Classification	Remediation Measures
On & off site sources of ground contamination (gas) arising from historic underlying fill /coal measures deposits (CO ₂ and CH ₄ gas).	Migration, ingress, accumulation and inhalation	Re-development workers	severe	unlikely	Low-moderate risk	<i>A three month gas monitoring period recorded very low results, with no gas protection measures required.</i>
		End users- staff/customers	severe	unlikely	Low-moderate risk	
	Explosion	Buildings & Services	Medium	Unlikely	Low risk	

ML (Wooler) Ltd**Bradford Road, Bailiff Bridge****Phase 2 Geo-Environmental Investigation and Assessment Report**

Source	Pathway	Receptor	Consequence	Probability	Risk Classification	Remediation
On site historic sources of ground/groundwater contamination from <i>demolition materials & basement infill</i> , including metalloids, asbestos & PAH.	Inhalation, ingestion, skin contact	Re-development workers	Medium	low	Low/moderate risk	<i>PPC required during ground-works.</i>
		End users	Medium	low	Low/moderate risk	<i>Results from the ground investigation chemical testing have shown that there is a presence within the shallow fill materials within two hot-spots of low % asbestos contaminated soils for the proposed end use. Likely options are cover system and/or dig out and replace within soft landscaping areas.</i>
	Root Uptake	Landscaping Vegetation	Minor	likely	Low risk	<i>Imported topsoil to be validated.</i>
	Groundwater	Controlled Waters	Medium	low	Low/moderate risk	<i>No remediation measures required related to this pollution source.</i>
	Direct Contact	Buildings and Services	Medium	low	Low/moderate risk	<i>In areas where services run through asbestos contaminated soils strata with raised asbestos levels, sterile trenches, with geo-membrane surround for utility pipes and higher specification barrier pipe materials to UU guidelines.</i>

ML (Wooler) Ltd**Bradford Road, Bailiff Bridge**Phase 2 Geo-Environmental Investigation and Assessment Report

Source	Pathway	Receptor	Consequence	Probability	Risk Classification	Remediation Measures
Off-site historic sources of ground contamination arising from migration of pollution from <i>mills</i> , including metalloids, PAHs & hydrocarbons	Inhalation, ingestion, skin contact	Re-development workers	medium	unlikely	Low risk	<i>Chemical testing has proved that remediation measures unlikely to be required due to this source of pollution.</i>
		End users- staff	medium	unlikely	Low risk	
	Root uptake	Landscaping	minor	unlikely	Very low risk	
	Groundwater	Groundwater	medium	unlikely	Low risk	
	Direct Contact	Buildings and Services	Medium	unlikely	Low risk	

10.3.2 *On-site ground and groundwater contamination from historic carpet mill source*

The risk classification for *five* pollutant linkages relating to potential sources of contamination in the Made Ground and natural materials from possible spillages/leaks and infill varied between *low* risk to *moderate/low* risk. Investigation, if not already undertaken, is normally required in cases where the risk is classified as *moderate* or higher, and some remedial works may be required. The *five* receptors include human health (construction workers and end users-staff/customers), groundwater, landscaping vegetation and gardens, and buildings and services.

Four *low/moderate* risks were identified for the staff/customers, re-development workers, groundwater & services (water supply pipes) receptors via the pathway of direct contact with contaminated soil. The evidence of previous investigations within the site has shown within the limited data collected that the site appears to be a *low* contaminated land risk.

Following investigation and testing the risks to future end users from on-site historical contamination from ground and groundwater migration would appear to be *low/moderate*. Statistical analysis has proved that in general the surface made ground material is within tolerance levels for a commercial development from the pollution source.

The levels of C10-C16 hydrocarbons, are slightly raised for the fill materials across the site area, falling above the limits for PV pipe for UU specification, and as such a barrier pipe will be required for water supply specification. Sterile trenches in contaminated areas will be required due to asbestos in fill deposits affecting maintenance staff. The level of risk to construction staff can be adequately controlled by the implementation of good working practices during the site clearance/earthworks. During the ground works phase of the development, appropriate personal protective equipment, adequate hygiene and accommodation facilities, and the implementation of dust control when required should be implemented. The work force should undergo a site safety briefing to identify the site as 'brownfield' and potentially contaminated. The construction arisings from the zones of asbestos risk should be disposed of off-site.

The risk to groundwater receptors from the various contamination sources appears to be *low risk*. The groundwater observed was found to be perched, trapped either by stiff glacial till or mudstone deposits, within the deeper infill in the southern area. The underlying glacial clay and mudstone layers will act as a buffer for surface water leaching through the fill deposits through to the aquifer. Care should be taken to minimise the risk of potentially contaminative incidents occurring during re-development of the site. Good working practices should be adopted during construction works in order to minimise the risk of contamination occurring as a result of spillage or leakage of fuels, oils or chemicals stored or used at the site during re-development. All such materials should be sited on an impervious base within a bund and should be adequately secured.

Imported topsoil will be required for the commercial development and care should be taken to guarantee that imported topsoil for the landscaped areas is within clean soil guidance levels, with full validation required.

10.3.3 *Gas risk from on and off-site infill and coal seams*

The potential hazards of gas from the historic infilling of the site and surrounding areas, plus underlying coal measures rocks has been linked with several receptors, which include construction workers and end-users and the built environment. For moderate risk receptors (Re-development Construction Workers and End Users) the consequences of gas inhalation are necessarily *severe*, but the probability of such an event is considered to be *unlikely*. Risk to the receptor Buildings and Services is classed *low*. The consequences of damage from gas is necessarily *medium*, but the probability of such an event is estimated to be *unlikely* for similar reasons to those stated above.

A gas risk assessment for the site following completion of the three month monitoring period has concluded that no gas protection measures will be required for the proposed development.

10.3.4 *On-site ground and groundwater contamination from demolition materials & basement infill sources*

The risk classification for *five* pollutant linkages relating to potential sources of contamination in the Made Ground and natural materials from infill related to the demolition process, in particular within the basement footprints varied between *low* risk to *moderate/low* risk. Investigation, if not already undertaken, is normally required in cases where the risk is classified as *moderate* or higher, and some remedial works may be required. The *five* receptors include human health (construction workers and end users-staff/customers), groundwater, landscaping vegetation and gardens, and buildings and services.

Four *low/moderate* risks were identified for the staff/customers, re-development workers, groundwater & services (water supply pipes) receptors via the pathway of direct contact with contaminated soil. The evidence of previous investigations within the site has shown within the limited data collected that the site appears to be a low contaminated land risk.

Following investigation and testing the risks to future end users from on-site historical contamination from ground and groundwater migration would appear to be *moderate*. Statistical analysis has proved that in general the surface made ground material is within tolerance levels for a commercial development, however localised areas of fill materials containing low % asbestos (within 2 hot spot areas) will need mitigation. The concentrations of asbestos were deemed to be very low (0.001%w/w). The majority of the proposed site development will have a hard-standing car park pavement or building slab constructed over the surface area, which will act as a barrier to any potential exposure to the very low concentrations of asbestos material. The contamination issues for the site will require some form of remediation measure to reduce the risk of affecting end user human health within the potential landscaping areas and also development workers during construction, in particular the low/moderate risk to health from asbestos soils. Options of remediation measures should be developed in a remediation strategy.

The levels of C10-C16 hydrocarbons, are slightly raised for the fill materials across the site area, falling above the limits for PV pipe for UU specification, and as such a barrier

pipe will be required for water supply specification. Sterile trenches in contaminated areas will be required due to asbestos in fill deposits affecting maintenance staff. The level of risk to construction staff can be adequately controlled by the implementation of good working practices during the site clearance/earthworks. During the ground works phase of the development, appropriate personal protective equipment, adequate hygiene and accommodation facilities, and the implementation of dust control when required should be implemented. The work force should undergo a site safety briefing to identify the site as 'brownfield' and potentially contaminated. The construction arising from the zones of asbestos risk should be disposed of off-site.

The risk to groundwater receptors from the various contamination sources appears to be *low risk*. The groundwater observed was found to be perched, trapped either by stiff glacial till or mudstone deposits, within the deeper infill in the southern area. The underlying glacial clay and mudstone layers will act as a buffer for surface water leaching through the fill deposits through to the aquifer. Care should be taken to minimise the risk of potentially contaminative incidents occurring during re-development of the site. Good working practices should be adopted during construction works in order to minimise the risk of contamination occurring as a result of spillage or leakage of fuels, oils or chemicals stored or used at the site during re-development. All such materials should be sited on an impervious base within a bund and should be adequately secured.

Imported topsoil will be required for the commercial development and care should be taken to guarantee that imported topsoil for the landscaped areas is within clean soil guidance levels, with full validation required.

10.3.5 *Off-site historic ground and groundwater contamination from various industrial mill activities, through migration.*

The risk classification for *five* pollutant linkages relating to potential sources of contamination in the underlying ground and groundwater from migration of off-site historic industrial contamination sources varied between *low* risk to *very low* risk. Investigation, if not already undertaken, is normally required in cases where the risk is classified as *moderate* or higher, and some remedial works may be required.

Four *low* risks were identified for the staff, re-development workers, groundwater and services receptors via the pathway of direct contact with contaminated soil/groundwater. The risk of pollution from the contamination migration was assumed to be relatively low risk due to various factors. These include distance from the site, ground conditions – any spillages will tend to drain vertically into the underlying glacial deposits, impermeable clay acting as a buffer to migration, working practices reducing pollution linkages, topography and hydrogeology. The *very low* risk was identified for landscaping that were deemed less of a risk due to the *minor* consequences from pollution.

Following investigation and testing the risks to future end users from this particular source contamination from ground and groundwater migration would appear to be *low*.

10.3.6 *Uncertainties*

There remains the possibility that some historical occupation of the site has not been identified, which could lead to unforeseen ground contamination.

11.0 CONCLUSIONS/RECOMMENDATIONS

11.1 *Ground Investigation*

- 11.1.1 The ground investigation by PSA Design in 2016 set out to investigate and assess the current ground, gas and groundwater conditions within the site.
- 11.1.2 The borehole investigation consisted of 10No. boreholes to varying depths across the site (varying from 0.72-6.70mbgl), plus 16No. trial pits. Ground conditions generally comprised of Made Ground (granular & cohesive) overlying a sporadic, thin glacial deposit, stiff gravelly CLAY, over MUDSTONE.
- 11.1.3 The ground investigation provided geotechnical and environmental data to create an accurate ground model for the site to aid both foundation, pavement and remediation design and provide a groundwater and gas risk assessment.
- 11.2 *Contamination***
- 11.2.1 A thorough chemical testing regime was conducted of the various fill deposits and natural materials, plus groundwater. Statistical analysis has proved that in general the surface made ground material is within tolerance levels for a commercial development, however within 2No. localised hot spots, central area (borehole WS4 and trial pit TP8) and northern area (TP3) cohesive and granular fill materials contained very low % asbestos. The concentrations of asbestos were deemed to be very low, but need to be addressed, to a degree, due to the sensitive nature of the development. The soil chemical tests show elevated levels of C10-C16 hydrocarbons (against UU guidelines), within a few areas (boreholes WS4, 5+9), affecting water supply pipe specification. This will require several forms of remediation measures to reduce the risk of affecting end user human health within the potential landscaping areas and development staff health/ local residents, during construction. Options of remediation measures should be developed in a remediation strategy.
- 11.2.2 Soil samples from areas of low % asbestos (<0.001% w/w) within the central and N area of the site will require remediation measures. The concentrations of asbestos were deemed low, and therefore remediation measures will be required to reduce the risk affecting the end-user human health, within the proposed landscaping areas of the site. Where excavated arisings occur within these hot-spot areas, associated with the asbestos traces, the material should not be re-used and disposed of off-site to a suitably licensed facility.
- 11.2.3 The findings of this report indicate that remediation is required in respect of human health risks from contaminated land.
- 11.2.4 The presence of a potential mine workings & infill within 250m of the site represents a low/medium risk of ground gas generation. A three month gas monitoring exercise has been completed. Readings from gas wells across the site show low levels of carbon dioxide (<5% v/v) and no methane, with low flow rates. Gas protection measures will not be required.

- 11.2.5 A remediation strategy will be required to address the contamination issues highlighted within the report.

11.3 Foundations

- 11.3.1 The findings of the PSA Design Ground Investigation give a more accurate model of the ground conditions within the site of the proposed commercial development. The extent of the made ground, glacial deposits and mudstone was mapped throughout this targeted area. The main findings identified the extent and thickness of infilled ground, glacial till overlying the mudstone.

- 11.3.2 The options for foundation solutions for the proposed building is likely to require a piled solution, due to the localised increased depth of fill within the footprint of the proposed building.

11.4 Drainage, Highways & Earthworks

- 11.4.1 The ground investigation identified the extent and type of fill deposit at formation level within the area investigated.
- 11.4.2 Detailed pavement design will be required for all hard-standing areas and allowance should be made for potential ground improvement of the loose/soft surface fill deposits.
- 11.4.3 Further in-situ testing and field trials will be required to establish a suitable highways specification.
- 11.4.4 Detailed proposed development levels for the site have yet to be determined, however it is expected that due to the boundary constraints and the overall sloping nature of the site (with steeper slopes from the E to W in the S area) the likely final levels will be similar to the existing levels, apart from in the S areas, where retaining structures may be required to create more suitable landform. The close proximity of the highways to the site boundary must be taken into account with any excavation works.

11.5 Future Works

- 11.5.1 Further works are required including, a field trial/in-situ pavement investigation of the made ground deposits, to ascertain suitability for the ground slab, highways and drainage design.
- 11.5.2 Pavement and foundation design must take into account the risk of the unknown mine shaft and the shallow mine workings underlying the site, which is not covered within this report. Further investigation is required prior to detailed structural design, to ensure the building and infrastructure are not at risk from instability from mining activity.
- 11.5.3 A remediation strategy should be created and submitted to the local authority for approval, prior to the start of the remediation works. The strategy should take into account waste disposal (in particular of the shallow asbestos affected soils), controls over material import (such as topsoil and cover system for landscaping), and barrier water pipe specification.

12.0 REPORT LIMITATIONS

- 12.1 PSA Design believes that providing information with regard to limitations is essential to assist the *client* identify and therefore manage its risks. The ground is a product of continuing natural and artificial processes and, as a result, may exhibit a variety of characteristics which may vary from place to place, and with time. The risks associated with these variations may be mitigated by appropriate investigations, but cannot be eliminated.
- 12.2 This report contains interpretations of information which has been gathered from published sources and observations. Such information is only relevant to the ground at the published sources and observations. The information from these is interpreted here in good faith and is believed to be accurate. PSA Design cannot guarantee the authenticity of data obtained from external sources.
- 12.3 An interpretation or recommendation based on this information and given in this report is based on our judgment and experience of this information and not on any greater knowledge that might be implied.
- 12.4 The interpretations and recommendations contained herein represent our opinions which are provided for the sole use of our client in accordance with a specific brief. As such these do not necessarily address all aspects of ground behaviour at the site. Should these interpretations be used by any third party to assess ground conditions then verification should be made by reference to the appropriate factual information.
- 12.5 The remit of the scope of works for this particular site was in regard to a shallow borehole investigation of the soils underlying the site. The aspect of shallow mine working risk was not covered in the brief for PSA Design and as such this report does not cover this element. The engineer should be aware that the site is at risk from shallow mine workings and advice should be taken from a mining specialist in relation to this particular site.

ML (Wooler) Ltd


Bradford Road, Bailiff Bridge

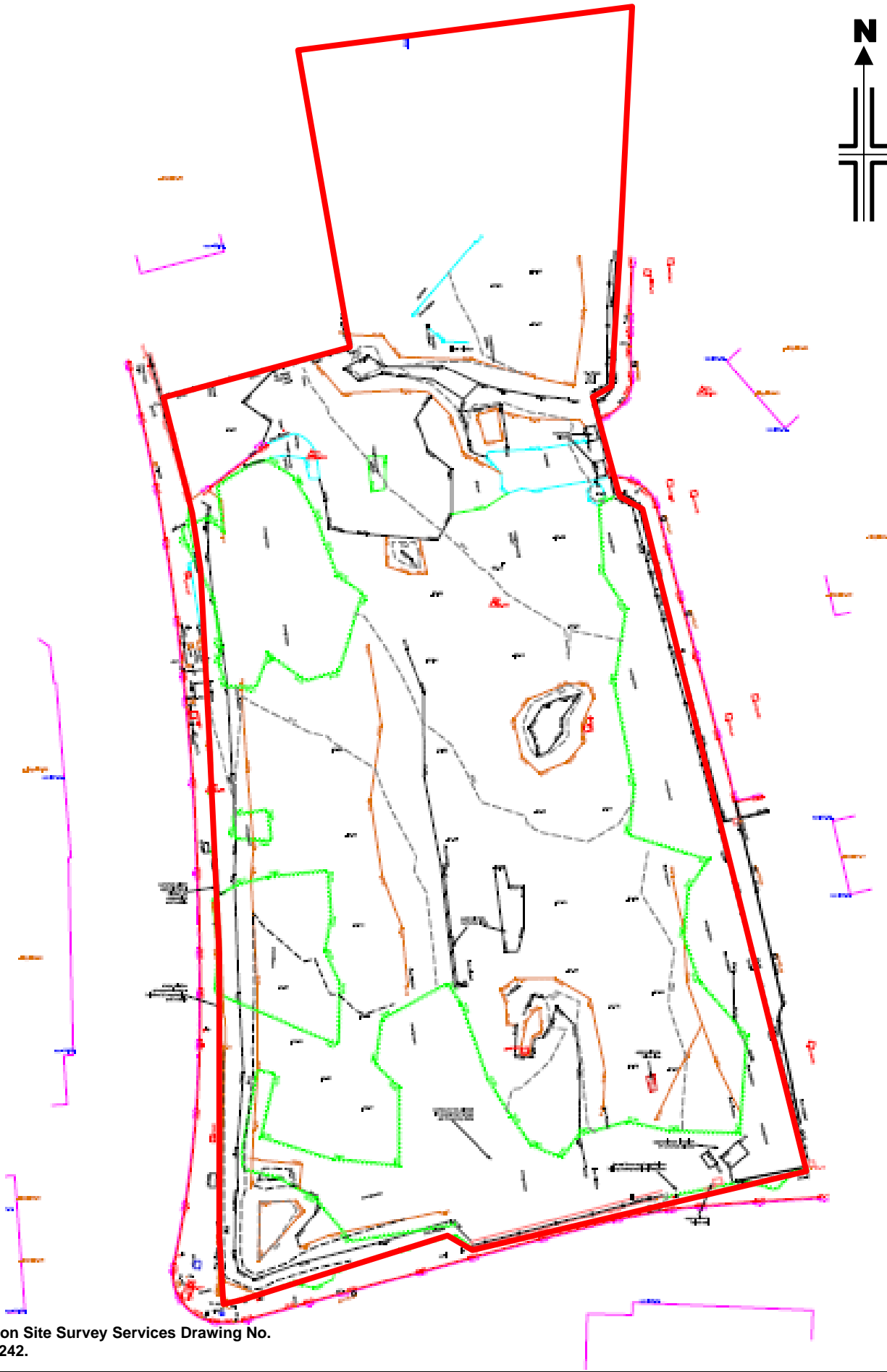
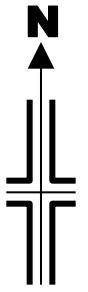
Phase 2 Geo-Environmental Investigation and Assessment Report

DRAWINGS



© Crown Copyright. All rights reserved.
Licence number AL100034996.

 <p>PSA Design The Old Bank House 6 Berry Lane, Longridge Preston, PR3 3JA Tel. 01772 786066</p> <p>engineering your environment</p>	Client	ML (Wooler) Ltd	Drawn	JB	Date	11.02.2016	Drawing No.	G2240-01
	Job	Bradford Road, Bailiff Bridge	Checked		Scale	NTS	Rev	
	Title	Regional Location Plan	Approved					



Base on Site Survey Services Drawing No.
SSS6242.

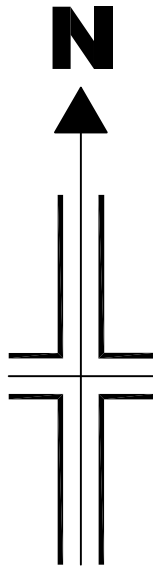


PSA Design
The Old Bank House
6 Berry Lane, Longridge
Preston, PR3 3JA
Tel. 01772 786066

Client	ML (Wooler) Ltd
Job	Bradford Road, Bailiff Bridge
Title	Current Site Features Plan

Scale	NTS
Drawn	JSB
Check	JSB
Appr	JSB

Dwg No.	G2240-02
Date	15-03-2016
Rev	



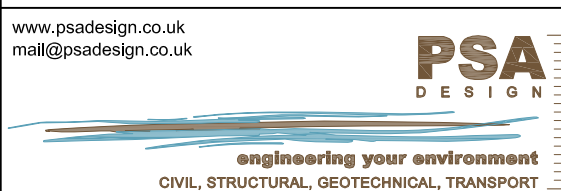
SF - YO 1			
Code	Existing	Nothing	Height
WS1	414895.748	425341.708	63.082
WS2	414575.659	425322.872	60.551
WS3	414877.704	425172.401	79.827
WS4	414823.788	425263.109	84.751
WS5	414880.197	425258.848	82.895

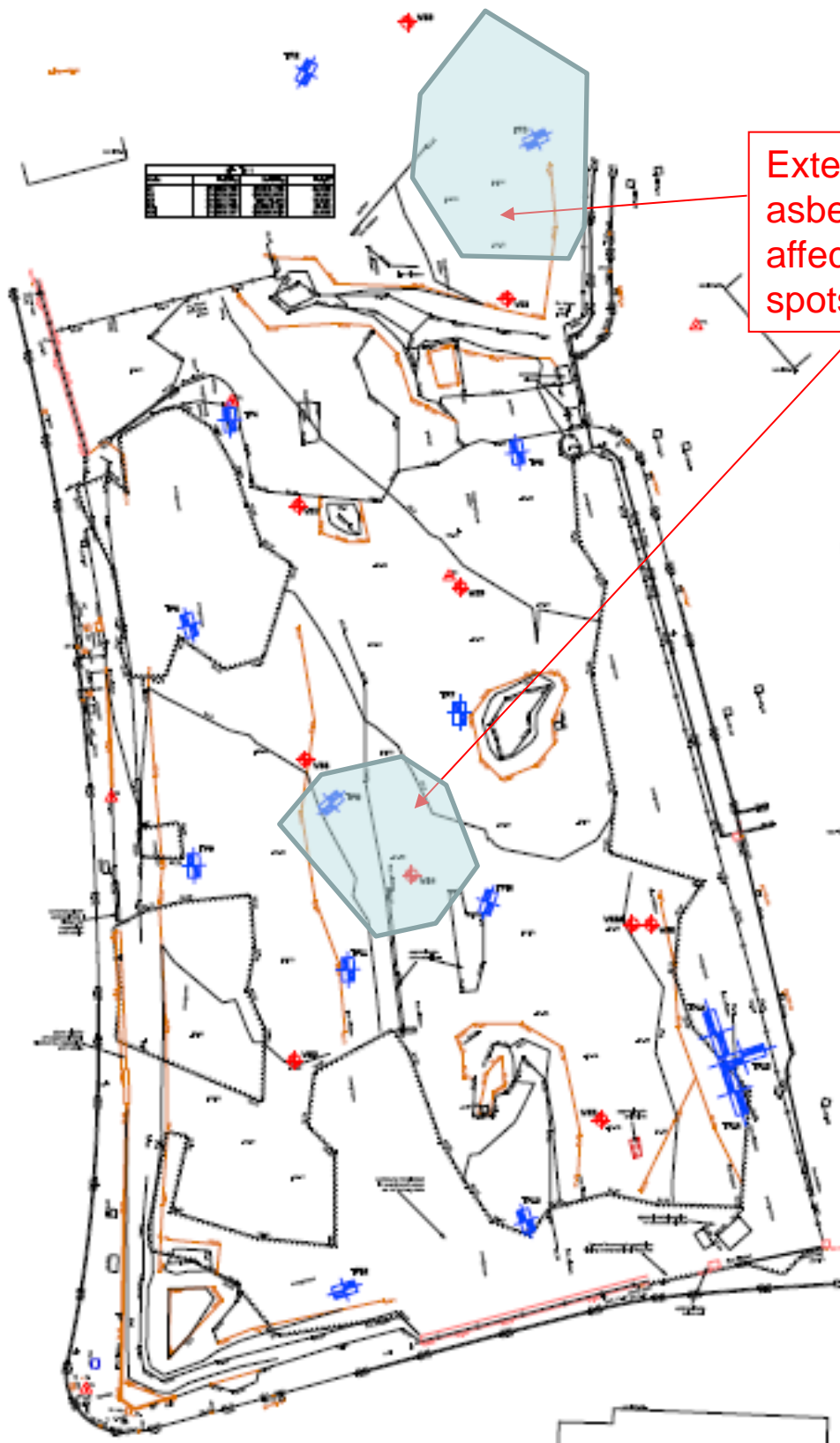
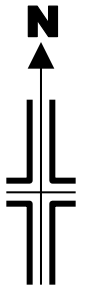
Legend

- WS5 - Window Sampler Boreholes
- TP3 - Trial Pit

Notes

Based on topographic drawing number: SSS-6242-A by site surveying services

ML (WOOLER) LTD			
GROUND INVESTIGATION PLAN BRADFORD ROAD BAILIFF BRIDGE		Scale 1:200@A1	
		Drawn AR	Checked JB
 www.psadesign.co.uk mail@psadesign.co.uk PSA Design The Old Bank House 6 Berry Lane, Longridge Preston, PR3 3JA Tel. 01772 786066 Fax. 01772 786265		Drwg No. G2240/06	
		Date 30.03.16	
		Rev.	



Extent of
asbestos
affected soil hot-
spots

Legend


WSS - whole sample
Residence

WPS - Total Pb

Notes

Based on: Topographic
Survey 1988, 1991-2004
by WTS surveying services

Base PSA Design Dwg No. G2240-06.

 engineering your environment CIVIL STRUCTURAL GEOTECHNICAL TRANSPORT	PSA Design The Old Bank House 6 Berry Lane, Longridge Preston, PR3 3JA Tel. 01772 786066	Client ML (Wooler) Ltd		Scale NTS		Dwg No. G2240-07			
		Job Bradford Road, Bailiff Bridge		Drawn	Check	Date 18-05-2016		Rev	
		Title Contamination Plan		JSB	JSB	Appr	JSB		

ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

APPENDICES

ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

APPENDIX A BOREHOLE & TRIAL PIT LOGS

Project Name
Former Clifton MillProject No.
G2440

Co-ords: -

Hole Type
WS

Location: Bradford Rd, Bailiff Bridge

Level: 84.10 m AOD

Scale
1:50

Client: ML (Wooler) Ltd

Dates: 16/02/2016

Logged By
JSB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50-0.90	ES		0.90	83.20		MADE GROUND: Firm, light brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
		1.40	IVN 1	130	1.20	82.90		MADE GROUND: Medium dense (driller's description), grey-red brown, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick and sandstone fragments (Granular Fill). (MADE GROUND)	1
					1.80	82.30		Stiff, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone and sandstone fragments. (GLACIAL TILL)	2
					2.00	82.10		Weak light brown-grey MUDSTONE. (Lower Coal Measures) Refusal of drilling (possible bedrock).	
								End of Borehole at 2.00 m	
									3
									4
									5
									6
									7
									8
									9
			Type	Results					

Remarks: Premier Plant Hydraulic Compact Rubber Tracked Percussion Drilling Rig. In-situ shear strength (IVN) in kPa, based on avg of 3 tests using Geonor H-60 Vane. 50mm HDPE Gas/Groundwater Standpipe Installation.

Project Name

Former Clifton Mill

Project No.

G2440

Co-ords: -

Hole Type

WS

Location: Bradford Rd, Bailiff Bridge

Level: 81.60 m AOD

Scale

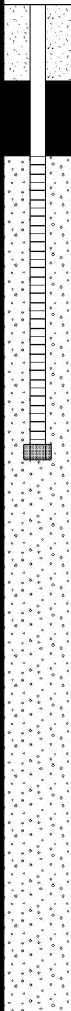

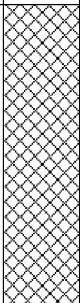
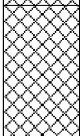
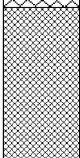
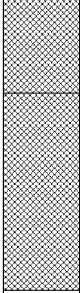


1:50

Client: ML (Wooler) Ltd

Dates: 16/02/2016

Logged By

JSB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40-0.90	ES					MADE GROUND: Dense, becoming medium dense (driller's description), grey-brown, clayey, in part slightly sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick, concrete, mudstone and sandstone fragments and rare coal and steel (Granular Fill). (MADE GROUND)	1
					2.00	79.60		MADE GROUND: Medium dense, becoming loose (driller's description), grey-brown, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone and rare brick fragments (Granular Fill). (MADE GROUND)	2
					2.90	78.70		MADE GROUND: Soft-firm, grey, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of mudstone and rare coal fragments (Cohesive Fill). (MADE GROUND)	3
					4.50	77.10		MADE GROUND: Soft-firm, grey, silty, slightly gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of mudstone and rare coal fragments (Cohesive Fill). (MADE GROUND)	5
					5.80	75.80		Very weak grey MUDSTONE. (Lower Coal Measures)	6
					6.60	75.00		Weak grey MUDSTONE. (Lower Coal Measures)	7
					6.70	74.90		Refusal of drilling (possible bedrock).	
								End of Borehole at 6.70 m	
									8
									9

Remarks: Premier Plant Hydraulic Compact Rubber Tracked Percussion Drilling Rig. In-situ shear strength (IVN) in kPa, based on avg of 3 tests using Geonor H-60 Vane. 50mm HDPE Gas/Groundwater Standpipe Installation.



Project Name

Former Clifton Mill

Project No.

G2440

Co-ords: -

Hole Type

WS

Location: Bradford Rd, Bailiff Bridge

Level: 80.00 m AOD

Scale

1:50

Client: ML (Wooler) Ltd

Dates: 17/02/2016

Logged By

JSB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20-0.50	ES					MADE GROUND: Firm-stiff, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick, sandstone and coal fragments (Cohesive Fill). (MADE GROUND)	1
					1.20	78.80		MADE GROUND: Firm, occasionally soft, light grey-green, slightly silty, slightly gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, coal, mudstone and rare brick fragments (Cohesive Fill). (MADE GROUND)	2
					2.20	77.80		MADE GROUND: Soft-firm, light grey-green, slightly silty, slightly gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, coal, mudstone and rare brick fragments (Cohesive Fill). (MADE GROUND)	
					2.70	77.30		MADE GROUND: Firm, light grey-green, slightly silty, slightly gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, coal, mudstone and rare brick fragments (Cohesive Fill). (MADE GROUND)	3
		3.80	IVN 1	80	3.70	76.30		Stiff, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone and sandstone fragments. (GLACIAL TILL)	4
					3.90	76.10		Weak grey MUDSTONE. (Lower Coal Measures)	
					4.10	75.90		Refusal of drilling (possible bedrock).	
								End of Borehole at 4.10 m	5
									6
									7
									8
									9

Remarks: Premier Plant Hydraulic Compact Rubber Tracked Percussion Drilling Rig. In-situ shear strength (IVN) in kPa, based on avg of 3 tests using Geonor H-60 Vane.

Project Name

Former Clifton Mill

Project No.

G2440

Co-ords: -

Hole Type

WS

Location: Bradford Rd, Bailiff Bridge

Level: 81.10 m AOD

Scale

1:50

Client: ML (Wooler) Ltd

Dates: 16/02/2016

Logged By

JSB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.70 0.70-1.00	IVN 1 D	130	0.30	80.80		MADE GROUND: Firm, light brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
					1.00	80.10		Stiff, light brown-mottled grey, high strength, gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare coal fragments. (GLACIAL TILL)	1
					1.70	79.40		Weak light brown-grey MUDSTONE. (Lower Coal Measures)	
								Refusal of drilling (possible bedrock).	
								End of Borehole at 1.70 m	2
									3
									4
									5
									6
									7
									8
									9

Remarks: Premier Plant Hydraulic Compact Rubber Tracked Percussion Drilling Rig. In-situ shear strength (IVN) in kPa, based on avg of 3 tests using Geonor H-60 Vane.

Project Name

Former Clifton Mill

Project No.

G2440

Co-ords: -

Hole Type

WS

Location: Bradford Rd, Bailiff Bridge

Level: 82.65 m AOD

Scale

1:50

Client: ML (Wooler) Ltd

Dates: 16/02/2016

Logged By

JSB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10-0.50	ES		0.50	82.15		MADE GROUND: Dense, becoming medium dense (driller's description), grey-brown, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick and sandstone fragments and rare coal, tarmac, ash and clinker (Granular Fill). (MADE GROUND)	1
		0.70	IVN 1	130	1.20	81.45		Stiff, light brown-mottled grey, high strength, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare coal fragments. (GLACIAL TILL)	2
					1.70	80.95		Weak light brown-grey/green MUDSTONE. (Lower Coal Measures) Refusal of drilling (possible bedrock).	3
								End of Borehole at 1.70 m	4
									5
									6
									7
									8
									9
			Type	Results					

Remarks: Premier Plant Hydraulic Compact Rubber Tracked Percussion Drilling Rig. In-situ shear strength (IVN) in kPa, based on avg of 3 tests using Geonor H-60 Vane.

Project Name

Former Clifton Mill

Project No.

G2440

Co-ords: -

Hole Type

WS

Location: Bradford Rd, Bailiff Bridge

Level: 85.50 m AOD

Scale

1:50

Client: ML (Wooler) Ltd

Dates: 16/02/2016

Logged By

JSB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10-0.50	ES		0.50	85.00		MADE GROUND: Dense, becoming medium dense (driller's description), light brown, occasionally grey, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick and sandstone fragments and rare coal (Granular Fill). (MADE GROUND)	
		0.80-1.10 1.00	D IVN 1	100	0.70	84.80			1
		1.70	IVN 2	110	1.50	84.00		MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
					1.90	83.60		Stiff, light brown-mottled grey, high strength, gravelly CLAY, with occasional fine rootlets. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare coal fragments. (GLACIAL TILL)	2
					2.00	83.50			
								Stiff, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone fragments. (GLACIAL TILL)	3
								Weak light brown-grey MUDSTONE. (Lower Coal Measures) Refusal of drilling (possible bedrock).	
								End of Borehole at 2.00 m	4
									5
									6
									7
									8
									9

Remarks: Premier Plant Hydraulic Compact Rubber Tracked Percussion Drilling Rig. In-situ shear strength (IVN) in kPa, based on avg of 3 tests using Geonor H-60 Vane.

Project Name

Former Clifton Mill

Project No.

G2440

Co-ords: -

Hole Type

WS

Location: Bradford Rd, Bailiff Bridge

Level: 83.00 m AOD

Scale

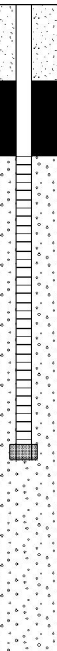





1:50

Client: ML (Wooler) Ltd

Dates: 17/02/2016

Logged By

JSB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50-0.90	ES		1.20	81.80		MADE GROUND: Stiff, grey-light brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, brick and mudstone fragments (Cohesive Fill). (MADE GROUND)	1
					2.00	81.00		MADE GROUND: Medium dense (driller's description), grey-light brown, very clayey GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone and concrete fragments (Granular Fill). (MADE GROUND)	2
								MADE GROUND: Firm-stiff, green-brown, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare brick and coal fragments (Cohesive Fill). (MADE GROUND)	3
		3.85	IVN 1	80	3.70	79.30		Stiff, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone fragments. (GLACIAL TILL)	4
					4.00	79.00		Weak grey, mottled orange MUDSTONE. (Lower Coal Measures)	
					4.30	78.70		Refusal of drilling (possible bedrock).	
								End of Borehole at 4.30 m	5
									6
									7
									8
									9

Remarks: Premier Plant Hydraulic Compact Rubber Tracked Percussion Drilling Rig. In-situ shear strength (IVN) in kPa, based on avg of 3 tests using Geonor H-60 Vane. 50mm HDPE Gas/Groundwater Standpipe Installation.

Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: -

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 2.50m

Depth
1.70m

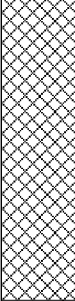
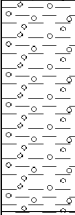
0.90m



Scale
1:25

Logged By
JSB

Client: ML (Wooler) Ltd




Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
1.30	IVN 1	95	1.00			MADE GROUND: Dark grey-brown, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick and sandstone fragments and rare coal (Granular Fill). (MADE GROUND)	1
			1.70			Stiff, light brown-mottled grey, high strength, gravelly CLAY, with occasional fine rootlets. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare coal fragments. (GLACIAL TILL)	
Trialpit Complete at 1.70 m							2
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were stable. On completion, pit was backfilled with materials arising.

Groundwater: None



Project Name Former Clifton Mill	Project No. G2440	Co-ords: - Level: -	Date 22/03/2016
Location: Bradford Rd, Bailiff Bridge	Dimensions: 2.50m Depth 1.20m 0.90m		Scale 1:25
Client: ML (Wooler) Ltd			Logged By JSB



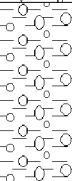
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.60	IVN 1	85	0.10			MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
1.00	IVN 2	90	0.90			Stiff, light brown-mottled grey, high strength, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare coal fragments. (GLACIAL TILL)	1
			1.20			Stiff, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone, siltstone and sandstone fragments. (GLACIAL TILL)	2
Trialpit Complete at 1.20 m							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were stable. On completion, pit was backfilled with materials arising.

Groundwater: None.





Project Name Former Clifton Mill	Project No. G2440	Co-ords: - Level: 84.70 m AOD	Date 22/03/2016
Location: Bradford Rd, Bailiff Bridge	Dimensions: 2.50m Depth 1.30m		Scale 1:25
Client: ML (Wooler) Ltd			Logged By JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10-0.40	ES					MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
0.55	IVN 1	85	0.40	84.30		Stiff, light brown-mottled grey, high strength, gravelly CLAY, with occasional fine rootlets. Gravel is fine to coarse, sub-angular, consisting of sandstone, mudstone and rare coal fragments. (GLACIAL TILL)	
1.00	IVN 2	75	0.70	84.00		Stiff, occasionally firm, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone, siltstone and sandstone fragments. (GLACIAL TILL)	1
			1.30	83.40		Trialpit Complete at 1.30 m	2
							3
							4

Remarks:	All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were stable. On completion, pit was backfilled with materials arising.
Groundwater:	None.

Project Name Former Clifton Mill	Project No. G2440	Co-ords: - Level: 82.60 m AOD	Date 22/03/2016
Location: Bradford Rd, Bailiff Bridge		Dimensions: 2.50m Depth 0.60m	Scale 1:25
Client: ML (Wooler) Ltd			Logged By JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.30	82.30		MADE GROUND: Dark grey-brown, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick and sandstone fragments and rare coal (Granular Fill). (MADE GROUND)	
			0.60	82.00		MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND) Refusal of excavation on historic road surface.	
Trialpit Complete at 0.60 m							1
							2
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were stable. On completion, pit was backfilled with materials arising.

Groundwater: None.





Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: 81.20 m AOD

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 2.50m



Depth
2.00m

0.90m

Scale
1:25

Client: ML (Wooler) Ltd

Logged By
JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
1.90	IVN 1	90				MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally boulder sized flagstones, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	1
			1.80	79.40		Stiff, occasionally firm, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone, siltstone and sandstone fragments. (GLACIAL TILL)	2
			2.00	79.20		Trialpit Complete at 2.00 m	
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.

Groundwater: None.



Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: 82.70 m AOD

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 2.50m

Depth
1.50m

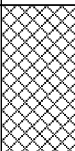
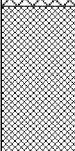
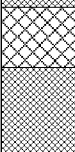

0.90m



Scale
1:25

Client: ML (Wooler) Ltd

Logged By
JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10-0.50	ES		0.50	82.20		MADE GROUND: Light grey-brown, slightly clayey GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick and sandstone fragments and rare coal (Granular Fill). (MADE GROUND)	
			1.00	81.70		MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
			1.20	81.50		MADE GROUND: Red brown, sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick fragments (Granular Fill). (MADE GROUND)	1
			1.50	81.20		MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND) Water Mains Pipe encountered	
						Trialpit Complete at 1.50 m	
							2
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were stable. On completion, pit was backfilled with materials arising.

Groundwater: None.



Project Name Former Clifton Mill	Project No. G2440	Co-ords: - Level: 81.20 m AOD	Date 22/03/2016
Location: Bradford Rd, Bailiff Bridge	Dimensions: 2.50m Depth 1.80m 0.90m		Scale 1:25
Client: ML (Wooler) Ltd			Logged By JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10-0.50	ES					MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to boulder-sized, sub-angular, consisting of sandstone, mudstone, concrete, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	1
			1.30	79.90		MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of sandstone, mudstone, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
			1.80	79.40		Trialpit Complete at 1.80 m	2
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.

Groundwater: Fast Seepage at 1.3mbgl.

Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: 80.20 m AOD

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 2.50m

Depth
1.70m

0.90m

Scale
1:25

Logged By
JSB

Client: ML (Wooler) Ltd

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10-0.50	ES					MADE GROUND: Firm, grey-brown, very gravelly CLAY. Gravel is fine to boulder-sized, sub-angular, consisting of sandstone, mudstone, concrete, brick and rare coal fragments (Cohesive Fill). (MADE GROUND)	
			0.70	79.50		MADE GROUND: Firm, brown, slightly gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of mudstone & siltstone fragments (Cohesive Fill). (MADE GROUND)	1
1.50	IVN 1	80	1.40	78.80		Stiff, occasionally firm, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone, siltstone and sandstone fragments. (GLACIAL TILL)	
			1.60	78.60			
			1.70	78.50		Weak light brown-grey MUDSTONE. (Lower Coal Measures)	
Trialpit Complete at 1.70 m							2
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were stable. On completion, pit was backfilled with materials arising.

Groundwater: None.




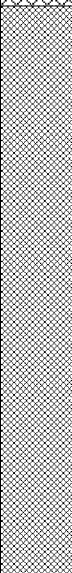


Project Name Former Clifton Mill		Project No. G2440	Co-ords: - Level: 81.70 m AOD	Date 22/03/2016
Location: Bradford Rd, Bailiff Bridge			Dimensions: 2.50m Depth 1.00m	Scale 1:25
Client: ML (Wooler) Ltd				Logged By JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10-0.40	ES					MADE GROUND: Dark grey-brown, sandy GRAVEL. Gravel is fine to coarse, occasionally boulder-sized, sub-angular, consisting of brick and sandstone fragments and rare coal (Granular Fill). (MADE GROUND)	
			1.00	80.70		Refusal of excavation on large obstructions.	1
						Trialpit Complete at 1.00 m	
							2
							3
							4

Remarks:	All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were stable. On completion, pit was backfilled with materials arising.
Groundwater:	None.



Project Name Former Clifton Mill	Project No. G2440	Co-ords: - Level: 80.60 m AOD	Date 22/03/2016
Location: Bradford Rd, Bailiff Bridge		Dimensions: 2.50m Depth 2.40m	Scale 1:25
Client: ML (Wooler) Ltd			Logged By JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.00-0.30	ES		0.30	80.30		MADE GROUND: Grey-brown, very sandy GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick and sandstone fragments and rare coal, ash and clinker (Granular Fill). (MADE GROUND)	
						MADE GROUND: Soft-firm, grey, silty, slightly gravelly CLAY. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of mudstone and rare coal fragments (Cohesive Fill). (MADE GROUND)	1
2.30	IVN 1	80	2.20	78.40		Stiff, occasionally firm, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone, siltstone and sandstone fragments. (GLACIAL TILL)	
			2.40	78.20			2
Trialpit Complete at 2.40 m							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.

Groundwater: Fast seepage at 0.3mbgl.



Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: 80.00 m AOD

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 2.50m

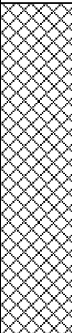
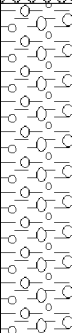
Depth
2.20m

0.90m

Scale
1:25

Client: ML (Wooler) Ltd

Logged By
JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
1.50	IVN 1	75	1.10	78.90		MADE GROUND: Grey-brown, sandy, slightly clayey GRAVEL. Gravel is fine to coarse, occasionally cobble sized, sub-angular, consisting of brick, concrete and sandstone fragments (Granular Fill). (MADE GROUND)	1
						Stiff, occasionally firm, light brown-mottled grey, high strength, very gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of much weathered mudstone, siltstone and sandstone fragments. (GLACIAL TILL)	2
			2.20	77.80	Trialpit Complete at 2.20 m		
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.

Groundwater: None.



Project Name Former Clifton Mill		Project No. G2440	Co-ords: - Level: 82.30 m AOD	Date 22/03/2016
Location: Bradford Rd, Bailiff Bridge			Dimensions: 2.50m Depth 1.90m	Scale 1:25
Client: ML (Wooler) Ltd				Logged By JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.20-0.60	ES					MADE GROUND: Grey-brown, sandy, slightly clayey GRAVEL. Gravel is fine to coarse, occasionally boulder-sized, sub-angular, consisting of brick, concrete and sandstone fragments (Granular Fill). (MADE GROUND)	1
			1.90	80.40		Refusal of excavation on large obstructions. Trialpit Complete at 1.90 m	2
							3
							4

Remarks:	All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.
Groundwater:	None.



Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: 82.30 m AOD

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 5.00m

Depth
2.00m



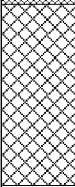
0.90m



Scale
1:25

Client: ML (Wooler) Ltd

Logged By
JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.70	81.60		MADE GROUND: Firm, grey, gravelly CLAY. Gravel is fine to boulder-sized, sub-angular, consisting of shale and brick fragments (Cohesive Fill). (MADE GROUND)	
			1.40	80.90		MADE GROUND: Firm, grey, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of mudstone, sandstone and siltstone fragments (Cohesive Fill). (MADE GROUND)	1
			2.00	80.30		MADE GROUND: Grey-brown, sandy, slightly clayey GRAVEL. Gravel is fine to coarse, occasionally boulder-sized, sub-angular, consisting of brick, concrete and sandstone fragments (Granular Fill). (MADE GROUND)	
						Refusal of excavation on large obstructions. Trialpit Complete at 2.00 m	2
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.

Groundwater: None.



Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: 83.40 m AOD

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 5.00m

Scale
1:25

Client: ML (Wooler) Ltd

Depth
2.70m

0.90m

Logged By
JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.80	82.60		MADE GROUND: Firm, grey, gravelly CLAY. Gravel is fine to boulder-sized, sub-angular, consisting of shale and brick fragments (Cohesive Fill). (MADE GROUND)	
						MADE GROUND: Firm, grey, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of mudstone, sandstone and siltstone fragments (Cohesive Fill). (MADE GROUND)	1
			2.50	80.90			2
			2.70	80.70		MADE GROUND: Light grey-brown, slightly clayey GRAVEL. Gravel is fine to coarse, occasionally boulder-sized, sub-angular, consisting of brick and sandstone fragments and rare coal (Granular Fill). (MADE GROUND) Refusal of excavation on large obstructions.	3
						Trialpit Complete at 2.70 m	
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.

Groundwater: None.



Project Name
Former Clifton Mill

Project No.
G2440

Co-ords: -
Level: 82.50 m AOD

Date
22/03/2016

Location: Bradford Rd, Bailiff Bridge

Dimensions: 5.00m




Scale
1:25

Client: ML (Wooler) Ltd

Depth
2.00m

0.90m

Logged By
JSB

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.70	81.80		MADE GROUND: Firm, grey, very gravelly CLAY. Gravel is fine to boulder-sized, sub-angular, consisting of shale and brick fragments (Cohesive Fill). (MADE GROUND)	
			1.30	81.20		MADE GROUND: Firm, grey, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular, consisting of mudstone, sandstone and siltstone fragments (Cohesive Fill). (MADE GROUND)	1
			2.00	80.50		MADE GROUND: Light grey-brown, slightly clayey GRAVEL. Gravel is fine to coarse, occasionally boulder-sized, sub-angular, consisting of brick and sandstone fragments and rare coal (Granular Fill). (MADE GROUND)	
						Refusal of excavation on large obstructions.	2
						Trialpit Complete at 2.00 m	
							3
							4

Remarks: All Hydraulic Tracked 8.5 tonne 360 Hitachi Excavator. In-situ shear strength results (IVN) in kPa, based on average of 3 tests using Geonor H-60 hand vane. Trial pit sides were unstable at depth with cavings. On completion, pit was backfilled with materials arising.

Groundwater: None.



ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

APPENDIX B CHEMICAL TESTING CERTIFICATES

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 16/00967
Issue Number: 1

Date: 03 March, 2016

Client: PSA Design
The Old Bank House
6 Berry Lane
Longridge
Preston
Lancashire
UK
PR3 3JA

Project Manager: John Birtwhistle
Project Name: Bradford Rd, Bailiff Bridge
Project Ref: G2240
Order No: G2240-01
Date Samples Received: 18/02/16
Date Instructions Received: 18/02/16
Date Analysis Completed: 03/03/16

Prepared by:



Melanie Marshall
Laboratory Coordinator

Approved by:



Iain Haslock
Analytical Consultant

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
% Stones >10mm _A [#]	26.8	27.2	42.1	<0.1	25.8	38.8	15.1	6.9	% w/w	A-T-044
pH _D ^{M#}	9.26	10.34	11.12	8.89	8.57	8.59	8.25	8.49	pH	A-T-031s
Sulphate (acid soluble) _D ^{M#}	940	2700	1100	1400	1200	830	1100	800	mg/kg	A-T-028s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	A-T-050s
Total Organic Carbon _D ^{M#}	-	-	0.31	-	4.02	-	2.59	-	% w/w	A-T-032s
Arsenic _D ^{M#}	13	4	1	5	12	4	10	7	mg/kg	A-T-024s
Boron (water soluble) _D ^{M#}	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	mg/kg	A-T-027s
Cadmium _D ^{M#}	1.5	0.8	0.5	1.3	1.0	<0.5	0.8	1.1	mg/kg	A-T-024s
Copper _D ^{M#}	108	10	5	47	70	13	208	40	mg/kg	A-T-024s
Chromium _D ^{M#}	19	9	10	24	17	11	26	20	mg/kg	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-040s
Lead _D ^{M#}	479	48	14	193	350	105	3350	175	mg/kg	A-T-024s
Mercury _D	0.29	0.83	0.24	2.95	1.31	0.43	0.19	0.81	mg/kg	A-T-024s
Nickel _D ^{M#}	23	7	10	12	19	10	14	28	mg/kg	A-T-024s
Selenium _D	2	<1	<1	<1	1	<1	<1	<1	mg/kg	A-T-024s
Zinc _D ^{M#}	228	46	21	138	148	132	158	128	mg/kg	A-T-024s

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
Asbestos in Soil (inc. matrix)										
Asbestos in soil _A [#]	NAD	NAD	NAD	Chrysotile	NAD	NAD	NAD	NAD		A-T-045
Asbestos Matrix (microscope) _A	-	-	-	Loose Insulation	-	-	-	-		A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		Gravimetry
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	-	-	-	<0.001	-	-	-	-	% w/w	A-T-054

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
PAH 16										
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	0.19	1.81	0.14	0.02	0.71	mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	0.02	0.28	0.01	<0.01	0.02	mg/kg	A-T-019s
Anthracene _A ^{M#}	0.05	0.02	<0.02	0.52	4.43	0.39	0.07	1.13	mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.36	0.18	<0.04	1.21	25.4	0.95	0.38	1.55	mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.31	0.15	<0.04	1.02	27.5	0.87	0.37	1.09	mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.37	0.18	<0.05	1.28	27.8	0.95	0.44	1.26	mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.16	0.10	<0.05	0.66	11.9	0.56	0.26	0.56	mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.19	0.08	<0.07	0.42	13	0.52	0.27	0.62	mg/kg	A-T-019s
Chrysene _A ^{M#}	0.35	0.21	<0.06	1.27	22.8	0.93	0.40	1.55	mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.04	<0.04	<0.04	0.14	2.81	0.14	0.07	0.16	mg/kg	A-T-019s
Fluoranthene _A ^{M#}	0.49	0.35	<0.08	2.59	33.3	1.82	0.64	3.76	mg/kg	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	0.16	1.53	0.11	<0.01	0.59	mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.20	0.11	<0.03	0.76	15.7	0.60	0.30	0.73	mg/kg	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	0.28	2.21	0.11	<0.03	0.61	mg/kg	A-T-019s
Phenanthrene _A ^{M#}	0.19	0.10	<0.03	1.84	13.7	1.15	0.20	4.11	mg/kg	A-T-019s
Pyrene _A ^{M#}	0.45	0.32	<0.07	2.24	36.3	1.60	0.57	3.09	mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	3.19	1.82	<0.08	14.6	240	10.8	3.99	21.5	mg/kg	A-T-019s

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
SVOC (PSA Design)										
Hexachlorobenzene _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Diethyl phthalate _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Dimethyl phthalate _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Dibenzofuran _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Carbazole _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Butylbenzyl phthalate _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Bis(2-ethylhexyl)phthalate _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Bis(2-chloroethoxy)methane _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Bis(2-chloroethyl)ether _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
4-Nitrophenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
4-Methylphenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
4-Chloro-3-methylphenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2-Nitrophenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2-Methylphenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2-Chlorophenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2,6-Dinitrotoluene _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2,4-Dinitrotoluene _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2,4-Dimethylphenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2,4-Dichlorophenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2,4,6-Trichlorophenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2,4,5-Trichlorophenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2-Chloronaphthalene _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
2-Methylnaphthalene _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Bis(2-chloroisopropyl)ether _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Phenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Pentachlorophenol _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
n-Nitroso-n-dipropylamine _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
n-Diethylphthalate _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
n-Dibutylphthalate _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Nitrobenzene _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Isophorone _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Hexachloroethane _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
Hexachlorocyclopentadiene _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
SVOC Total (excl. PAH/Phenols/Cresols) _A	<100	-	-	-	-	-	-	206	µg/kg	A-T-052s
Phenol Total _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Cresol & Chlorinated Phenol Total _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-052s
Perylene _A	<100	-	-	-	-	-	-	206	µg/kg	A-T-052s

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
VOC (PSA Design)										
Dichlorodifluoromethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Chloromethane _A [#]	<10	-	-	-	-	-	-	<10	µg/kg	A-T-006s
Vinyl Chloride _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Bromomethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Chloroethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Trichlorofluoromethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,1-Dichloroethene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Carbon Disulphide _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Dichloromethane _A	<5	-	-	-	-	-	-	<5	µg/kg	A-T-006s
trans 1,2-Dichloroethene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,1-Dichloroethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
cis 1,2-Dichloroethene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
2,2-Dichloropropane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Bromochloromethane _A [#]	<5	-	-	-	-	-	-	<5	µg/kg	A-T-006s
Chloroform _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,1,1-Trichloroethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,1-Dichloropropene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Carbon Tetrachloride _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,2-Dichloroethane _A [#]	<2	-	-	-	-	-	-	<2	µg/kg	A-T-006s
Benzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Trichloroethene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,2-Dichloropropane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Dibromomethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Bromodichloromethane _A [#]	<10	-	-	-	-	-	-	<10	µg/kg	A-T-006s
cis 1,3-Dichloropropene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Toluene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
trans 1,3-Dichloropropene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,1,2-Trichloroethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,3-Dichloropropane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Tetrachloroethene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Dibromochloromethane _A [#]	<3	-	-	-	-	-	-	<3	µg/kg	A-T-006s
1,2-Dibromoethane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
Chlorobenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,1,1,2-Tetrachloroethane _A	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Ethylbenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
m & p Xylene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
o-Xylene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Styrene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Bromoform _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Isopropylbenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,1,2,2-Tetrachloroethane _A	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,2,3-Trichloropropane _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
Bromobenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
n-Propylbenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
2-Chlorotoluene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,3,5-Trimethylbenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
4-Chlorotoluene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
tert-Butylbenzene _A [#]	<2	-	-	-	-	-	-	<2	µg/kg	A-T-006s
1,2,4-Trimethylbenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
sec-Butylbenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
4-Isopropyltoluene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,3-Dichlorobenzene _A	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,4-Dichlorobenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
n-Butylbenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,2-Dichlorobenzene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,2-Dibromo-3-chloropropane _A	<2	-	-	-	-	-	-	<2	µg/kg	A-T-006s
1,2,4-Trichlorobenzene _A	<3	-	-	-	-	-	-	<3	µg/kg	A-T-006s
Hexachlorobutadiene _A [#]	<1	-	-	-	-	-	-	<1	µg/kg	A-T-006s
1,2,3-Trichlorobenzene _A	<3	-	-	-	-	-	-	<3	µg/kg	A-T-006s
VOC Total _A	<100	-	-	-	-	-	-	<100	µg/kg	A-T-006s

Envirolab Job Number: 16/00967

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00967/1	16/00967/2	16/00967/3	16/00967/4	16/00967/5	16/00967/6	16/00967/7	16/00967/8	Units	Method ref
Client Sample No	1	1	1	1	1	1	1	1		
Client Sample ID	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9		
Depth to Top	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50		
Depth To Bottom	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90		
Date Sampled	16-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	17-Feb-16	16-Feb-16	16-Feb-16	17-Feb-16		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6A	4A	4A	4AB	4AB	4AB	4A	5AB		
TPH CWG (PSA Design)										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	<0.1	<0.1	<0.1	1.4	0.2	<0.1	<0.1	mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	0.5	<0.1	<0.1	2.8	2.2	<0.1	<0.1	mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	2.3	<0.1	<0.1	3.0	6.9	<0.1	1.7	mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	0.4	<0.1	<0.1	0.7	33.5	<0.1	<0.1	mg/kg	A-T-023s
Total Aliphatics _A	<0.1	3.3	<0.1	<0.1	7.8	42.7	<0.1	1.7	mg/kg	A-T-022+23s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	<0.1	<0.1	4.4	4.6	0.6	<0.1	4.9	mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	<0.1	<0.1	15.4	12.2	1.3	<0.1	19.3	mg/kg	A-T-023s
Aro >C16-C21 _A [#]	0.5	1.2	<0.1	39.0	54.1	5.0	0.6	51.9	mg/kg	A-T-023s
Aro >C21-C35 _A [#]	<0.1	0.6	<0.1	89.9	132	11.5	0.4	55.3	mg/kg	A-T-023s
Total Aromatics _A	0.5	1.8	<0.1	149	203	18.4	1.0	131	mg/kg	A-T-022+23s
EPH Total Ali & Aro (>C10-C16) _A [#]	<0.1	0.5	<0.1	19.8	20.9	4.2	<0.1	24.1	mg/kg	A-T-023s
EPH Total Ali & Aro (>C16-C35) _A [#]	0.5	4.6	<0.1	129	190	56.9	1.0	109	mg/kg	A-T-023s
TPH (Ali & Aro) _A	0.5	5.1	<0.1	149	210	61.1	1.0	133	mg/kg	A-T-022+23s
BTEX and MTBE Total _A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
VPH total (>C5-C10) _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s

REPORT NOTES

Notes - Soil chemical analysis

All results are reported as dry weight (<40 °C).

For samples with Matrix Codes 1 - 6 natural stones and brick and concrete fragments >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis. For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos and/or if they are from outside the European Union and this supercedes any "D" subscripts.

Superscript "M" indicates method accredited to MCERTS.

If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

TPH analysis of water by method A-T-007

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos in soil

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if present as discrete fibres/fragments. Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample. Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 16/01775
Issue Number: 1

Date: 13 April, 2016

Client: PSA Design
The Old Bank House
6 Berry Lane
Longridge
Preston
Lancashire
UK
PR3 3JA

Project Manager: John Birtwhistle
Project Name: Bradford Road, Bailiff Bridge
Project Ref: G2240
Order No: G2240-03
Date Samples Received: 24/03/16
Date Instructions Received: 29/03/16
Date Analysis Completed: 13/04/16

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Lianne Bromiley
Senior Client Manager

Envirolab Job Number: 16/01775

Client Project Name: Bradford Road, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/01775/1	16/01775/2	16/01775/3	16/01775/4	16/01775/5	16/01775/6	16/01775/7		Units	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	TP3	TP7	TP8	TP9	TP10	TP11	TP13			
Depth to Top	0.10	0.10	0.10	0.10	0.10	0.00	0.20			
Depth To Bottom	0.40	0.50	0.50	0.50	0.40	0.30	0.60			
Date Sampled	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	4A	6A	4A	4ABE	4A			
% Stones >10mm _A [#]	<0.1	-	-	-	-	-	22.5		% w/w	A-T-044
pH _D ^{M#}	8.07	-	-	-	-	-	8.94		pH	A-T-031s
Sulphate (acid soluble) _D ^{M#}	450	-	-	-	-	-	1900		mg/kg	A-T-028s
Cyanide (total) _A ^{M#}	2	-	-	-	-	-	<1		mg/kg	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	-	-	-	-	-	<0.2		mg/kg	A-T-050s
Arsenic _D ^{M#}	8	-	-	-	-	-	5		mg/kg	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	-	-	-	-	-	3.5		mg/kg	A-T-027s
Cadmium _D ^{M#}	0.8	-	-	-	-	-	0.8		mg/kg	A-T-024s
Copper _D ^{M#}	21	-	-	-	-	-	55		mg/kg	A-T-024s
Chromium _D ^{M#}	13	-	-	-	-	-	19		mg/kg	A-T-024s
Chromium (hexavalent) _D	<1	-	-	-	-	-	<1		mg/kg	A-T-040s
Lead _D ^{M#}	45	-	-	-	-	-	161		mg/kg	A-T-024s
Mercury _D	<0.17	-	-	-	-	-	0.87		mg/kg	A-T-024s
Nickel _D ^{M#}	24	-	-	-	-	-	14		mg/kg	A-T-024s
Selenium _D	1	-	-	-	-	-	2		mg/kg	A-T-024s
Zinc _D ^{M#}	65	-	-	-	-	-	113		mg/kg	A-T-024s

Envirolab Job Number: 16/01775

Client Project Name: Bradford Road, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/01775/1	16/01775/2	16/01775/3	16/01775/4	16/01775/5	16/01775/6	16/01775/7		Units	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	TP3	TP7	TP8	TP9	TP10	TP11	TP13			
Depth to Top	0.10	0.10	0.10	0.10	0.10	0.00	0.20			
Depth To Bottom	0.40	0.50	0.50	0.50	0.40	0.30	0.60			
Date Sampled	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	4A	6A	4A	4ABE	4A			
Asbestos in Soil (inc. matrix)										
Asbestos in soil _A [#]	Chrysotile	NAD	Chrysotile	NAD	NAD	NAD	NAD			A-T-045
Asbestos Matrix (microscope) _A	Loose Fibres	-	Loose Fibres	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A			Gravimetry
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	<0.001	-	0.001	-	-	-	-		% w/w	A-T-054

Envirolab Job Number: 16/01775

Client Project Name: Bradford Road, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/01775/1	16/01775/2	16/01775/3	16/01775/4	16/01775/5	16/01775/6	16/01775/7		Units	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	TP3	TP7	TP8	TP9	TP10	TP11	TP13			
Depth to Top	0.10	0.10	0.10	0.10	0.10	0.00	0.20			
Depth To Bottom	0.40	0.50	0.50	0.50	0.40	0.30	0.60			
Date Sampled	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	4A	6A	4A	4ABE	4A			
PAH 16										
Acenaphthene _A ^{M#}	0.11	-	-	-	-	-	0.11		mg/kg	A-T-019s
Acenaphthylene _A ^{M#}	0.49	-	-	-	-	-	0.03		mg/kg	A-T-019s
Anthracene _A ^{M#}	0.95	-	-	-	-	-	0.27		mg/kg	A-T-019s
Benzo(a)anthracene _A ^{M#}	4.52	-	-	-	-	-	0.91		mg/kg	A-T-019s
Benzo(a)pyrene _A ^{M#}	3.41	-	-	-	-	-	0.82		mg/kg	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	4.31	-	-	-	-	-	1.06		mg/kg	A-T-019s
Benzo(ghi)perylene _A ^{M#}	1.35	-	-	-	-	-	0.51		mg/kg	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	1.69	-	-	-	-	-	0.36		mg/kg	A-T-019s
Chrysene _A ^{M#}	4.18	-	-	-	-	-	0.97		mg/kg	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.51	-	-	-	-	-	0.12		mg/kg	A-T-019s
Fluoranthene _A ^{M#}	7.51	-	-	-	-	-	1.60		mg/kg	A-T-019s
Fluorene _A ^{M#}	0.28	-	-	-	-	-	0.08		mg/kg	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	1.84	-	-	-	-	-	0.54		mg/kg	A-T-019s
Naphthalene _A ^{M#}	0.23	-	-	-	-	-	0.09		mg/kg	A-T-019s
Phenanthrene _A ^{M#}	3.06	-	-	-	-	-	0.94		mg/kg	A-T-019s
Pyrene _A ^{M#}	6.53	-	-	-	-	-	1.50		mg/kg	A-T-019s
PAH (total 16) _A ^{M#}	41	-	-	-	-	-	9.87		mg/kg	A-T-019s

Envirolab Job Number: 16/01775

Client Project Name: Bradford Road, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/01775/1	16/01775/2	16/01775/3	16/01775/4	16/01775/5	16/01775/6	16/01775/7		Units	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	TP3	TP7	TP8	TP9	TP10	TP11	TP13			
Depth to Top	0.10	0.10	0.10	0.10	0.10	0.00	0.20			
Depth To Bottom	0.40	0.50	0.50	0.50	0.40	0.30	0.60			
Date Sampled	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	4A	6A	4A	4ABE	4A			
TPH CWG (PSA Design)										
Ali >C5-C6 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Ali >C6-C8 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Ali >C8-C10 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Ali >C10-C12 _A [#]	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-023s
Ali >C12-C16 _A [#]	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-023s
Ali >C16-C21 _A [#]	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-023s
Ali >C21-C35 _A [#]	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-023s
Total Aliphatics _A	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-022+23s
Aro >C5-C7 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Aro >C7-C8 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Aro >C8-C10 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Aro >C8-C9 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Aro >C9-C10 _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
Aro >C10-C12 _A [#]	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-023s
Aro >C12-C16 _A [#]	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-023s
Aro >C16-C21 _A [#]	3.7	-	-	-	-	-	1.6		mg/kg	A-T-023s
Aro >C21-C35 _A [#]	6.2	-	-	-	-	-	2.0		mg/kg	A-T-023s
Total Aromatics _A	9.8	-	-	-	-	-	3.6		mg/kg	A-T-022+23s
EPH Total Ali & Aro (>C10-C16) _A [#]	<0.1	-	-	-	-	-	<0.1		mg/kg	A-T-023s
EPH Total Ali & Aro (>C16-C35) _A [#]	9.8	-	-	-	-	-	3.6		mg/kg	A-T-023s
TPH (Ali & Aro) _A	9.8	-	-	-	-	-	3.6		mg/kg	A-T-022+23s
BTEX and MTBE Total _A	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
BTEX - Benzene _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
BTEX - Toluene _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
BTEX - o Xylene _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
MTBE _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s
VPH total (>C5-C10) _A [#]	<0.01	-	-	-	-	-	<0.01		mg/kg	A-T-022s

REPORT NOTES

Notes - Soil chemical analysis

All results are reported as dry weight (<40 °C).

For samples with Matrix Codes 1 - 6 natural stones and brick and concrete fragments >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis. For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos and/or if they are from outside the European Union and this supercedes any "D" subscripts.

Superscript "M" indicates method accredited to MCERTS.

If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

TPH analysis of water by method A-T-007

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos in soil

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if present as discrete fibres/fragments. Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample. Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

APPENDIX C GEOTECHNICAL TESTING CERTIFICATES

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 16/00966
Issue Number: 1

Date: 02 March, 2016

Client: PSA Design
The Old Bank House
6 Berry Lane
Longridge
Preston
Lancashire
UK
PR3 3JA

Project Manager: John Birtwhistle
Project Name: Bradford Rd, Bailiff Bridge
Project Ref: G2240
Order No: G2240-02
Date Samples Received: 18/02/16
Date Instructions Received: 18/02/16
Date Analysis Completed: 02/03/16

Prepared by:

A blue ink signature of Kate Ellison, consisting of a series of loops and a long horizontal stroke.

Kate Ellison
Administrative Assistant

Approved by:

A blue ink signature of Lianne Bromiley, featuring a stylized 'L' and 'B'.

Lianne Bromiley
Senior Client Manager

Envirolab Job Number: 16/00966

Client Project Name: Bradford Rd, Bailiff Bridge

Client Project Ref: G2240

Lab Sample ID	16/00966/1	16/00966/2							Units	Method ref
Client Sample No	G1	G1								
Client Sample ID	WS8	WS6								
Depth to Top	0.80	0.70								
Depth To Bottom	1.10	1.00								
Date Sampled	16-Feb-16	16-Feb-16								
Sample Type	Soil - D	Soil - D								
Sample Matrix Code										
% Moisture BS1377 1990 pt2 cl3.2 _A [#]	Appended	Appended								Subcon
Atterburg 1Pt BS13777 1990 pt2 cl4.4,5.3+5.4 _A [#]	Appended	Appended								Subcon

REPORT NOTES

Notes - Soil chemical analysis

All results are reported as dry weight (<40 °C).

For samples with Matrix Codes 1 - 6 natural stones and brick and concrete fragments >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis. For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos and/or if they are from outside the European Union and this supercedes any "D" subscripts.

Superscript "M" indicates method accredited to MCERTS.

If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

TPH analysis of water by method A-T-007

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos in soil

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if present as discrete fibres/fragments. Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample. Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.



STRUCTURAL SOILS LTD

TEST REPORT



Report No. 781980 R1

1774

Date 02-March-2016 Contract G2240

Client Envirolab Ltd
Address Units 7 & 8 Sandpits Business Park
Mottram Road
Hyde
SK14 3AR

For the Attention of Iain Haslock

Samples submitted by client 19/02/2016
Testing Started 22/02/2016
Testing Completed 02/03/2016

Client Reference 16/00966
Client Order No. P0733287
Instruction Type Written

UKAS Accredited Tests Undertaken

Moisture Content (oven drying method) BS1377:Part 2:1990,clause 3.2 (superseded)**
Liquid Limit (one point method) BS1377:Part 2:1990,clause 4.4
Plastic Limit BS1377:Part 2:1990,clause 5.3
Plasticity Index Derivation BS1377:Part 2:1990,clause 5.4

* Tests were undertaken on samples 'as received' unless otherwise stated

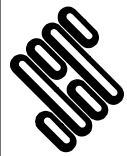
**This clause of BS1377 no longer most up-to-date due to publication of ISO 17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425um	Description of Sample
WS6	16/00966/2	D	0.70	17	41	22	19	90	Orange brown slightly sandy slightly gravelly CLAY
WS8	16/00966/1	D	0.80	24	41	23	18	91	Grey brown slightly sandy slightly gravelly CLAY




STRUCTURAL
SOILS LTD

Contract:

16/00966

Contract Ref:

781980



Testing in accordance with BS1377-2:1990

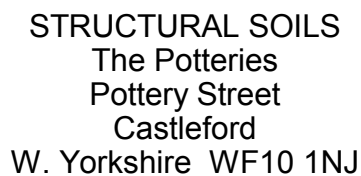
[illegible]

- 3.2 - Moisture Content
- 4.3 - Cone Penetrometer Method
- 4.4 - One Point Cone Penetrometer Method
- 4.6 - One Point Casagrande Method
- 5.3 - Plastic Limit Method
- 5.4 - Plasticity Index

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT)



M. Fisher.

02/03/16

Contract Ref:

781980



TESTING VERIFICATION CERTIFICATE



1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **02/03/2016 11:49:54.**

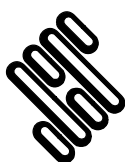
Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Mark Athorne (Laboratory Quality Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT



**STRUCTURAL
SOILS LTD**

Contract:

16/00966

Job No:

781980



ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

APPENDIX D STATISTICAL ANALYSIS OF CHEMICAL TESTING

Maximum Value Test
Bradford Road, Bailiff Bridge
Soil

Trial Pit/BH
1
Sample No
1
Sample Depth Top (mbsgl)
0.50
Sample Depth Base (mbsgl)
0.90
Soil Type
det name

LOD units

	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9	TP3	TP7	TP8	TP9	TP10	TP11	TP13
	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50	0.10	0.10	0.10	0.10	0.10	0.00	0.20
	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90	0.40	0.50	0.50	0.50	0.40	0.30	0.60
	COH FILL	GRAN FILL	COH FILL	GRAN FILL	COH FILL	GRAN FILL	GRAN FILL	COH FILL	COH FILL	GRAN FILL	COH FILL	COH FILL	GRAN FILL	GRAN FILL	GRAN FILL
arsenic	13	4	1	5	12	4	10	7	8						5
boron	1	1	1	1	1	1	1	1	1						1
cadmium	1.5	0.8	0.5	1.3	1	0.5	0.8	1.1	0.8						0.8
copper	108	10	5	47	70	13	208	40	21						55
chromium	19	9	10	24	17	11	26	23	13						19
Chromium Hexavalent	1	1	1	1	1	1	1	1	1						1
lead	479	48	14	193	350	105	3350	175	45						161
mercury	0.29	0.83	0.24	2.95	1.31	0.43	0.19	0.81	0.17						0.87
nickel	23	7	10	12	19	10	14	28	24						14
selenium	2	1	1	1	1	1	1	1	1						2
zinc	228	46	21	138	148	132	158	128	65						113
cyanide (total)	1	1	1	1	1	1	1	2							1
phenols	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2						0.2
sulphate	940	2700	1100	1400	1200	830	1100	800	450						1900
pH	9.26	10.34	11.12	8.89	8.57	8.59	8.25	8.49	8.07						8.94

Asbestos in soil

Asbestos Matrix

(microscope)

Asbestos Amount

Total Organic Carbon

	NAD	NAD	NAD	Chrysotile	NAD	NAD	NAD	NAD	Chrysotile	NAD	Chrysotile	NAD	NAD	NAD	NAD
	-	-		Loose Insulation	-	-	-	-	Loose Fibres	-	Loose Fibres				
				0.001					0.001		0.001				
			0.31		4.02		2.59								
PAH (total)	3.19	1.82	0.08	14.6	240	10.8	3.99	21.5	0.11						0.11
Acenaphthene	0.01	0.01	0.01	0.19	1.81	0.14	0.02	0.71	0.49						0.03
Acenaphthylene	0.01	0.01	0.01	0.02	0.28	0.01	0.01	0.02	0.95						0.27
Anthracene	0.05	0.02	0.02	0.52	4.43	0.39	0.07	1.13	4.52						0.91
Benzo(a)anthracene	0.35	0.18	0.04	1.21	25.4	0.95	0.38	1.55	3.41						0.82
Benzo(a)pyrene	0.31	0.15	0.04	1.02	27.5	0.87	0.37	1.09	4.31						1.06
Benzo(b)fluoranthene	0.37	0.18	0.05	1.28	27.8	0.95	0.44	1.26	1.35						0.51
Benzo(ghi)perylene	0.16	0.1	0.05	0.66	11.9	0.56	0.26	0.56	1.69						0.36
Benzo(k)fluoranthene	0.19	0.08	0.07	0.42	13	0.52	0.27	0.62	4.18						0.97
Chrysene	0.35	0.21	0.06	1.27	22.8	0.93	0.4	1.55	0.51						0.12
Dibenzo(ah)anthracene	0.04	0.04	0.04	0.14	2.81	0.14	0.07	0.16	7.51						1.6
Fluoranthene	0.49	0.35	0.08	2.59	33.3	1.82	0.64	3.76	0.28						0.08
Fluorene	0.01	0.01	0.01	0.16	1.53	0.11	0.01	0.59	1.84						0.54
Indeno(123-cd)pyrene	0.03	0.2	0.11	0.03	0.76	15.7	0.6	0.3	0.73	0.23					0.09
Naphthalene	0.03	0.03	0.03	0.28	2.21	0.11	0.03	0.61	3.06						0.94
Phenanthrene	0.19	0.1	0.03	1.84	13.7	1.15	0.2	4.11	6.53						1.5
Pyrene	0.45	0.32	0.07	2.24	36.3	1.6	0.57	3.09	41						9.87

Petroleum Hydrocarbons

TPH	0.5	5.1	0.1	149	210	61.1	1	133	9.8						3.6
-----	-----	-----	-----	-----	-----	------	---	-----	-----	--	--	--	--	--	-----

Aliphatic Fraction

C5-C6	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C6-C8	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C8-C10	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C10-C12	0.1	0.1	0.1	0.1	1.4	0.2	0.1	0.1	0.1						0.1
>C12-C16	0.1	0.5	0.1	0.1	2.8	2.2	0.1	0.1	0.1						0.1
>C16-C21	0.1	2.3	0.1	0.1	3	6.9	0.1	1.7	0.1						0.1
>C21-C35	0.1	0.4	0.1	0.1	0.7	33.5	0.1	0.1	0.1						0.1
Total Aliphatics	0.1	0.1	0.1	0.1	7.8	42.7	0.1	1.7	0.1						0.1
Aromatic Fraction	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C5-C7 (Benzene)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C7-C8 (Toluene)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C8-C9	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C9-C10	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
>C10-C12	0.1	0.1	0.1	4.4	4.6	0.6	0.1	4.9	0.1						0.1
>C12-C16	0.1	0.1	0.1	15.4	12.2	1.3	0.1	19.3	0.1						0.1
>C16-C21	0.1	0.5	1.2	0.1	39	54.1	5	0.6	51.9	3.7					1.6
>C21-C35	0.1	0.6	0.1	89.9	132	11.5	0.4	55.3	6.2						2
Total Aromatics	0.1	0.5	1.8	0.1	149	203	18.4	1	131	9.8					3.6
BTEX - Benzene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
BTEX - Toluene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
BTEX - Ethyl Benzene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
MTBE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01

VOC & SVOC

Chloroalkenes &

alkenes

1,2 Dichloroethane ^V	2 ug/kg	2						2							0.30
1,1,1 Trichloroethane ^V	1 ug/kg	1						1							0.00
1,1,2,2-tetrachloroethane ^V	1 ug/kg	1						1							0.00
Carbon tetrachloride ^V	1 ug/kg	1						1							0.00
Trichloroethene	1 ug/kg	1						1							0.00
Chloroform ^V	25 ug/kg	25						25							1.40
Vinyl Chloride ^V	1 ug/kg	1						1							0.00
2-methylphenol ^S	100 ug/kg	100						100							2.00
4-methylphenol ^S	100 ug/kg	100						100							2.00
2,4 Dimethylphenol ^S	100 ug/kg	100						100							2.00
Toluene ^V	1 ug/kg	1						1							0.00
Benzene ^V	1 ug/kg	1						1							0.00
Chlorobenzene ^V	1 ug/kg	1						1							0.00
Bromobenzene ^V	1 ug/kg	1						1							0.00
Carbon Disulphide ^V	1 ug/kg	1						1							0.00
m&p Xylene ^V	1 ug/kg	1						1							0.00
Styrene ^V	1 ug/kg	1						1							0.00
Hexachloroethane ^S	100 ug/kg	100						100							2.00
Bromoform ^V	1 ug/kg	1						1							0.00
Chloroethane ^V	1 ug/kg	1						1							0.00
Chloromethane ^V	1 ug/kg	1						1							0.00
Isopropylbenzene ^S	1 ug/kg	1						1							0.00

UU Total C5-C10	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
UU Total C10-C16	0.1	0.1	0.5	0.1	19.8	20.9	4.2	0.1	24.1	0.1					0.1
UU Total C16-C40	0.1	0.5	4.6	0.1	129	190	56.9	1	109	9.8					3.6
UU BTEX & MTBE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01						0.01
UU VOC Total	0.1	0.1						0.1							0.1
UU SVOC Total	0.1	0.1						0.206							-1.00
UU Phenol	0.1	0.1						0.1							-1.00
UU Cresols	0.1	0.1						0.1							-1.00

logarithm of results

T value for 10%, N = 10 is 2.04
statistical analysis

average standard y max no. samples T
dev

1.11	0.60	0.00	0.70	1.08	0.60	1.00	0.85	0.90							0.70
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00							0.54
0.18	-0.10	-0.30	0.11	0.00	-0.30	-0.10	0.04	-0.10							-0.10
2.03	1.00	0.70	1.67	1.85	1.11	2.32	1.60	1.32							1.74
1.28	0.95	1.00	1.38	1.23	1.04	1.41	1.30	1.11							1.28
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00							0.00
2.68	1.68	1.15	2.29	2.54	2.02	3.53	2.24	1.65							2.21
-0.54	-0.08	-0.62	0.47	0.12	-0.37	-0.72	-0.09	-0.77							-0.06
1.36	0.85	1.00	1.08	1.28	1.00	1.15	1.45	1.38							1.37
0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00							0.30
2.36	1.66	1.32	2.14	2.17	2.12	2.20	2.11	1.81							2.05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30							0.00
-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70							-0.70
2.97	3.43	3.04	3.15	3.08	2.92	3.04	2.90	2.65							3.28
0.97	1.01	1.05	0.95	0.93	0.93	0.92	0.93	0.91							0.95

Bradford Road, Bailiff Bridge
Mean Value Test
Soil

number of samples = 10

2

statistical analysis

Trial Pit/BH	WS1	WS2A	WS3	WS4	WS5	WS7	WS8	WS9	TP3	TP7	TP8	TP9	TP10	TP11	TP13
Sample No	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sample Depth Top (mbgl)	0.50	0.30	0.30	0.40	0.20	0.10	0.10	0.50	0.10	0.10	0.10	0.10	0.10	0.00	0.20
Sample Depth Base (mbgl)	0.90	0.60	0.70	0.90	0.50	0.50	0.50	0.90	0.40	0.50	0.50	0.40	0.30	0.60	0.60
Soil (S)/Water(W)	COH FILL	GRAN FILL	COH FILL	GRAN FILL	COH FILL	GRAN FILL	GRAN FILL	COH FILL	COH FILL	GRAN FILL	COH FILL	COH FILL	GRAN FILL	GRAN FILL	GRAN FILL

det name

units

arsenic	mg/kg	13	4	1	5	12	4	10	7	8					5
boron	mg/kg	1	1	1	1	1	1	1	1	1					3.5
cadmium	mg/kg	1.5	0.8	0.5	1.3	1	0.5	0.8	1.1	0.8					0.8
copper	mg/kg	108	10	5	47	70	13	208	40	21					55
chromium	mg/kg	19	9	10	24	17	11	26	20	13					19
Chromium Hexavalent	mg/kg	1	1	1	1	1	1	1	1	1					1
lead	mg/kg	479	48	14	193	350	105	3350	175	45					161
mercury	mg/kg	0.29	0.83	0.24	2.95	1.31	0.43	0.19	0.81	0.17					0.87
nickel	mg/kg	23	7	10	12	19	10	14	28	24					14
selenium	mg/kg	2	1	1	1	1	1	1	1	1					2
zinc	mg/kg	228	46	21	138	148	132	158	128	65					113
cyanide (complex)	mg/kg	1	1	1	1	1	1	1	1	2					1
phenols	mg/kg	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2					0.2
sulphate	mg/kg	940	2700	1100	1400	1200	830	1100	800	450					1900
pH		9.26	10.34	11.12	8.89	8.57	8.59	8.25	8.49	8.07					8.94

PAH (total)	mg/kg	3.19	1.82	0.08	14.6	240	10.8	3.99	21.5	0.11					0.11
Acenaphthene	mg/kg	0.01	0.01	0.01	0.19	1.81	0.14	0.02	0.71	0.49					0.03
Acenaphthylene	mg/kg	0.01	0.01	0.01	0.02	0.28	0.01	0.01	0.02	0.95					0.27
Anthracene	mg/kg	0.05	0.02	0.02	0.52	4.43	0.39	0.07	1.13	4.52					0.91
Benzo(a)anthracene	mg/kg	0.36	0.18	0.04	1.21	25.4	0.95	0.38	1.55	3.41					0.82
Benzo(a)pyrene	mg/kg	0.31	0.15	0.04	1.02	27.5	0.87	0.37	1.09	4.31					1.06
Benzo(b)fluoranthene	mg/kg	0.37	0.18	0.05	1.28	27.8	0.95	0.44	1.26	1.35					0.51
Benzo(ghi)perylene	mg/kg	0.16	0.1	0.05	0.66	11.9	0.56	0.26	0.56	1.69					0.36
Benzo(k)fluoranthene	mg/kg	0.19	0.08	0.07	0.42	13	0.52	0.27	0.62	4.18					0.97
Chrysene	mg/kg	0.35	0.21	0.06	1.27	22.8	0.93	0.4	1.55	0.51					0.12
Dibenzo(ah)anthracene	mg/kg	0.04	0.04	0.04	0.14	2.81	0.14	0.07	0.16	7.51					1.6
Fluoranthene	mg/kg	0.49	0.35	0.08	2.59	33.3	1.82	0.64	3.76	0.28					0.08
Fluorene	mg/kg	0.01	0.01	0.01	0.16	1.53	0.11	0.01	0.59	1.84					0.54
Indeno(123-cd)pyrene	mg/kg	0.2	0.11	0.03	0.76	15.7	0.6	0.3	0.73	0.23					0.09
Napthalene	mg/kg	0.03	0.03	0.03	0.28	2.21	0.11	0.03	0.61	3.06					0.94
Phenanthrene	mg/kg	0.19	0.1	0.03	1.84	13.7	1.15	0.2	4.11	6.53					1.5
Pyrene	mg/kg	0.45	0.32	0.07	2.24	36.3	1.6	0.57	3.09	41					9.87

Petroleum

Hydrocarbons

TPH	mg/kg	0.5	5.1	0.1	149	210	61.1	1	133	9.8					3.6
-----	-------	-----	-----	-----	-----	-----	------	---	-----	-----	--	--	--	--	-----

Aliphatic Fraction

C5-C6	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
>C6-C8	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
>C8-C10	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
>C10-C12	mg/kg	0.1	0.1	0.1	0.1	1.4	0.2	0.1	0.1	0.1					0.1
>C12-C16	mg/kg	0.1	0.5	0.1	0.1	2.8	2.2	0.1	0.1	0.1					0.1
>C16-C21	mg/kg	0.1	2.3	0.1	0.1	3	6.9	0.1	1.7	0.1					0.1
>C21-C35	mg/kg	0.1	0.4	0.1	0.1	0.7	33.5	0.1	0.1	0.1					0.1

Aromatic Fraction

>C5-C7 (Benzene)	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
>C7-C8 (Toluene)	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
>C8-C9	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
>C9-C10	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
>C10-C12	mg/kg	0.1	0.1	0.1	4.4	4.6	0.6	0.1	4.9	0.1					0.1
>C12-C16	mg/kg	0.1	0.1	0.1	15.4	12.2	1.3	0.1	19.3	0.1					0.1
>C16-C21	mg/kg	0.5	1.2	0.1	39	54.1	5	0.6	51.9	3.7					1.6
>C21-C35	mg/kg	0.1	0.6	0.1	89.9	132	11.5	0.4	55.3	6.2					2

BTEX - Benzene

BTEX - Toluene

BTEX - Ethyl Benzene

MTBE

VOC & SVOC

Chloroalkenes & alkenes

1,2 Dichloroethane ^V	ug/kg	2							2						
1,1,1 Trichloroethane ^V	ug/kg	1							1						
1,1,2,2-tetrachloroethane ^V	ug/kg	1							1						
Carbon tetrachloride ^V	ug/kg	1							1						
Trichloroethene	ug/kg	1							1						
Chloroform ^V	ug/kg	25							25						
Vinyl Chloride ^V	ug/kg	1							1						
2-methylphenol ^S	ug/kg	100							100						
4-methylphenol ^S	ug/kg	100							100						
2,4 Dimethylphenol ^S	ug/kg	100							100						
Toluene ^V	ug/kg	1							1						
Benzene ^V	ug/kg	1							1						
Chlorobenzene ^V	ug/kg	1							1						
Bromobenzene ^V	ug/kg	1							1						
Carbon Disulphide ^V	ug/kg	1							1						
m&p Xylene ^V	ug/kg	1							1						
Styrene ^V	ug/kg	1							1						
Hexachloroethane ^S	ug/kg	100							100						
Bromoform ^V	ug/kg	1							1						
Chloroethane ^V	ug/kg	1							1						
Chloromethane ^V	ug/kg	1							1						
Isopropylbenzene ^V	ug/kg	1							1						

UU Total C5-C10	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
UU Total C10-C16	mg/kg	0.1	0.5	0.1	19.8	20.9	4.2	0.1	24.1	0.1					0.1
UU Total C16-C40	mg/kg	0.5	4.6	0.1	129	190	56.9	1	109	9.8					3.6
UU BTEX & MTBE	mg/kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01					0.01
UU VOC Total	mg/kg	0.1							0.1						
UU SVOC Total	mg/kg	0.1							0.206						
UU Phenol	mg/kg	0.1							0.1						
UU Cresols	mg/kg	0.1							0.1						

average std dev t value US 95

6.9	3.8	1.833	9.13	arsenic
1.3	0.8	1.833	1.71	boron
0.9	0.3	1.833	1.10	cadmium
57.7	61.6	1.833	93.38	copper
16.8	5.9	1.833	20.21	chromium
1.0	0.0	1.833	1.00	Chromium Hexavalent
492.0	1014.5	1.833	1080.06	lead
0.8	0.8	1.833	1.30	mercury
16.1	7.0	1.833	20.17	nickel
1.2	0.4	1.833	1.44	selenium
117.7	60.3	1.833	152.65	zinc
1.1	0.3	1.833	1.28	cyanide (complex)
0.2	0.0	1.833	0.20	phenols
1242.0	642.0	1.833	1614.13	sulphate
9.1	1.0	1.833	9.61	pH

29.6	74.3	1.833	72.67	PAH (total)
0.3	0.6	1.833	0.67	Acenaphthene
0.2	0.3	1.833	0.33	Acenaphthylene
1.2	1.8	1.833	2.23	Anthracene
3.4	7.8	1.833	7.94	Benzo(a)anthracene
3.7	8.5	1.833	8.58	Benzo(a)pyrene
3.4	8.6	1.833	8.39	Benzo(b)fluoranthene
1.6	3.6	1.833	3.74	Benzo(ghi)perylene
2.0	4.0	1.833	4.38	Benzo(k)fluoranthene
2.8	7.0	1.833	6.90	Chrysene
1.3	2.4	1.833	2.64	Dibenzo(ah)anthracene
4.3	10.3	1.833	10.28	Fluoranthene
0.5	0.7	1.833	0.87	Fluorene
1.9	4.9	1.833	4.69	Indeno(123-cd)pyrene
0.7	1.1	1.833	1.35	Napthalene
2.9	4.3	1.833	5.44	Phenanthrene
15.6	15.6	1.833	18.62	Pyrene

57.3	78.2	1.833	102.63	TPH
0.0	0.0	1.833	0.01	Aliphatic Fraction
0.0	0.0	1.833	0.01	C5-C6
0.0	0.0	1.833	0.01	>C6-C8
0.0	0.0	1.833	0.01	>C8-C10
0.2	0.4	1.833	0.48	>C10-C12
0.6	1.0	1.833	1.20	>C12-C16
1.5	2.2	1.833	2.73	>C16-C21
3.5	10.5	1.833	9.63	>C21-C35

0.0	0.0	1.833	0.01	Aromatic Fraction
0.0	0.0	1.833	0.01	>C5-C7 (Benzene)
0.0	0.0	1.833	0.01	>C7-C8 (Toluene)
0.0	0.0	1.833	0.01	>C8-C9
0.0	0.0	1.833	0.01	>C9-C10
1.5	2.2	1.833	2.76	>C10-C12
4.9	7.6	1.833	9.29	>C12-C16
15.8	22.8	1.833	29.01	>C16-C21
29.8	47.0	1.833	57.03	>C21-C35

ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

APPENDIX E GAS/GROUNDWATER MONITORING RESULTS

Gas Monitoring Results



JOB DETAILS				Sheet No:	1
Location:	Bradford Rd, Bailiff Bridge			Engineer:	Dr J Birtwhistle
Date:	24/02/2016	Job No:	G2240	Time:	10.30

Meteorological and site information

State of ground.		Dry		Moist	✓	Wet		
Wind.		Calm	✓	Light		Moderate		Strong
Cloud cover.		None		Slight		Cloudy	✓	Overcast
Precipitation.	✓	None		Slight		Moderate		Heavy
Barometric pressure (mb)	1005			Air Temp.	2°C			

Calibration (Start)	O.K.	Calibration (End)	O.K.	
---------------------	------	-------------------	------	--

B.H. Ref:	CH4 (% vol in air)	CO2 (% vol in air)	O2 (% vol in air)	Flow Range (l/hr)	Average Flow (l/hr)	Pressure difference (Mb)	Groundwater Level (mbgl)
WS1	0.0	2.1	18.7	0.0	0.0	-0.02	dry
WS2	0.0	0.2	19.3	0.0	0.0	-0.03	1.65
WS4	0.0	0.3	20.1	0.0-0.1	0.1	0.02	2.42
WS9	0.0	0.0	19.8	0.0	0.0	0.00	1.60

Notes: Mixed pressure across UK
GA5000

	CO2 (% vol in air)	O2 (% vol in air)
Background	0	20.5

Gas Monitoring Results



JOB DETAILS				Sheet No:	1
Location:	Bradford Rd, Bailiff Bridge			Engineer:	Dr J Birtwhistle
Date:	11/03/2016	Job No:	G2240	Time:	10.30

Meteorological and site information

State of ground.		Dry		Moist	✓	Wet		
Wind.		Calm	✓	Light		Moderate		Strong
Cloud cover.		None		Slight		Cloudy	✓	Overcast
Precipitation.	✓	None		Slight		Moderate		Heavy
Barometric pressure (mb)	999			Air Temp.	4°C			

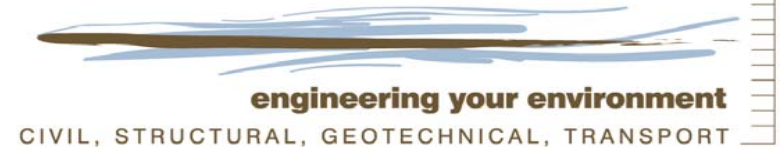
Calibration (Start)	O.K.	Calibration (End)	O.K.	
---------------------	------	-------------------	------	--

B.H. Ref:	CH4 (% vol in air)	CO2 (% vol in air)	O2 (% vol in air)	Flow Range (l/hr)	Average Flow (l/hr)	Pressure difference (Mb)	Groundwater Level (mbgl)
WS1	0.0	1.5	19.5	0.0	0.0	0.01	dry
WS2	0.0	0.3	19.4	0.0	0.0	0.00	1.68
WS4	0.0	0.5	19.8	0.0	0.0	0.00	2.40
WS9	0.0	0.0	20.2	0.0	0.0	0.01	1.59

Notes: Low pressure across UK
GA5000

	CO2 (% vol in air)	O2 (% vol in air)
Background	0	20.8

Gas Monitoring Results



JOB DETAILS				Sheet No:	1
Location:	Bradford Rd, Bailiff Bridge			Engineer:	Dr J Birtwhistle
Date:	29/03/2016	Job No:	G2240	Time:	10.30

Meteorological and site information

State of ground.		Dry		Moist	✓	Wet		
Wind.		Calm	✓	Light		Moderate		Strong
Cloud cover.		None		Slight		Cloudy	✓	Overcast
Precipitation.	✓	None		Slight		Moderate		Heavy
Barometric pressure (mb)	998			Air Temp.	4°C			

Calibration (Start)	O.K.	Calibration (End)	O.K.	
---------------------	------	-------------------	------	--

B.H. Ref:	CH4 (% vol in air)	CO2 (% vol in air)	O2 (% vol in air)	Flow Range (l/hr)	Average Flow (l/hr)	Pressure difference (Mb)	Groundwater Level (mbgl)
WS1	0.0	1.1	19.8	0.0	0.0	0.00	dry
WS2	0.0	0.2	19.9	0.0	0.0	-0.03	1.70
WS4	0.0	0.7	19.6	0.0	0.0	-0.02	2.40
WS9	0.0	0.0	20.6	0.0	0.0	0.00	1.60

Notes: Low pressure across UK
GA5000

	CO2 (% vol in air)	O2 (% vol in air)
Background	0.0	21.0

Gas Monitoring Results



JOB DETAILS				Sheet No:	1
Location:	Bradford Rd, Bailiff Bridge			Engineer:	Dr J Birtwhistle
Date:	22/04/2016	Job No:	G2240	Time:	10.30

Meteorological and site information

State of ground.	<input type="checkbox"/>	Dry	<input type="checkbox"/>	Moist	<input checked="" type="checkbox"/>	Wet	<input type="checkbox"/>	Strong
Wind.	<input type="checkbox"/>	Calm	<input type="checkbox"/>	Light	<input checked="" type="checkbox"/>	Moderate	<input type="checkbox"/>	Overcast
Cloud cover.	<input type="checkbox"/>	None	<input type="checkbox"/>	Slight	<input type="checkbox"/>	Cloudy	<input checked="" type="checkbox"/>	Heavy
Precipitation.	<input checked="" type="checkbox"/>	None	<input type="checkbox"/>	Slight	<input type="checkbox"/>	Moderate	<input type="checkbox"/>	
Barometric pressure (mb)	1014			Air Temp.	9°C			

Calibration (Start)	O.K.	Calibration (End)	O.K.	
---------------------	------	-------------------	------	--

B.H. Ref:	CH4 (% vol in air)	CO2 (% vol in air)	O2 (% vol in air)	Flow Range (l/hr)	Average Flow (l/hr)	Pressure difference (Mb)	Groundwater Level (mbgl)
WS1	0.0	0.9	19.8	0.0	0.0	-0.01	dry
WS2	0.0	0.4	19.9	0.0	0.0	0.00	1.70
WS4	0.0	0.2	19.6	0.0	0.0	0.00	2.40
WS9	0.0	0.0	20.6	0.0	0.0	0.02	1.60

Notes: Mixed pressure across UK
GA5000

	CO2 (% vol in air)	O2 (% vol in air)
Background	0.0	21.0

Gas Monitoring Results



JOB DETAILS				Sheet No:	1
Location:	Bradford Rd, Bailiff Bridge			Engineer:	Dr J Birtwhistle
Date:	06/05/2016	Job No:	G2240	Time:	10.30

Meteorological and site information

State of ground.	<input type="checkbox"/>	Dry	<input type="checkbox"/>	Moist	<input checked="" type="checkbox"/>	Wet	<input type="checkbox"/>	Strong
Wind.	<input type="checkbox"/>	Calm	<input type="checkbox"/>	Light	<input checked="" type="checkbox"/>	Moderate	<input type="checkbox"/>	Overcast
Cloud cover.	<input type="checkbox"/>	None	<input type="checkbox"/>	Slight	<input type="checkbox"/>	Cloudy	<input checked="" type="checkbox"/>	Heavy
Precipitation.	<input checked="" type="checkbox"/>	None	<input type="checkbox"/>	Slight	<input type="checkbox"/>	Moderate	<input type="checkbox"/>	
Barometric pressure (mb)	1014			Air Temp.	11'C			

Calibration (Start)	O.K.	Calibration (End)	O.K.	
---------------------	------	-------------------	------	--

B.H. Ref:	CH4 (% vol in air)	CO2 (% vol in air)	O2 (% vol in air)	Flow Range (l/hr)	Average Flow (l/hr)	Pressure difference (Mb)	Groundwater Level (mbgl)
WS1	0.0	1.8	19.3	0.0	0.0	-0.01	dry
WS2	0.0	0.5	19.9	0.0	0.0	-0.01	1.73
WS4	0.0	0.7	20.0	0.0	0.0	0.00	2.41
WS9	0.0	0.0	20.1	0.0	0.0	0.00	1.60

Notes: Mixed pressure across UK
GA5000

	CO2 (% vol in air)	O2 (% vol in air)
Background	0.0	21.0

Gas Monitoring Results



JOB DETAILS				Sheet No:	1
Location:	Bradford Rd, Bailiff Bridge			Engineer:	Dr J Birtwhistle
Date:	24/05/2016	Job No:	G2240	Time:	11.00

Meteorological and site information

State of ground.	<input type="checkbox"/>	Dry	<input type="checkbox"/>	Moist	<input checked="" type="checkbox"/>	Wet	<input type="checkbox"/>	Strong
Wind.	<input type="checkbox"/>	Calm	<input type="checkbox"/>	Light	<input checked="" type="checkbox"/>	Moderate	<input type="checkbox"/>	Overcast
Cloud cover.	<input type="checkbox"/>	None	<input type="checkbox"/>	Slight	<input type="checkbox"/>	Cloudy	<input checked="" type="checkbox"/>	Heavy
Precipitation.	<input checked="" type="checkbox"/>	None	<input type="checkbox"/>	Slight	<input type="checkbox"/>	Moderate	<input type="checkbox"/>	
Barometric pressure (mb)	1008			Air Temp.	13°C			

Calibration (Start)	O.K.	Calibration (End)	O.K.	
---------------------	------	-------------------	------	--

B.H. Ref:	CH4 (% vol in air)	CO2 (% vol in air)	O2 (% vol in air)	Flow Range (l/hr)	Average Flow (l/hr)	Pressure difference (Mb)	Groundwater Level (mbgl)
WS1	0.0	4.0	16.1	0.0-0.1	0.1	0.07	dry
WS2	0.0	0.5	18.2	0.0	0.0	0.05	1.75
WS4	0.0	0.8	19.4	0.0	0.0	0.40	2.42
WS9	0.0	0.0	20.3	0.0	0.0	0.01	1.58

Notes: Mixed pressure across UK
GA5000

	CO2 (% vol in air)	O2 (% vol in air)
Background	0.0	21.3

ML (Wooler) Ltd

Bradford Road, Bailiff Bridge

Phase 2 Geo-Environmental Investigation and Assessment Report

APPENDIX F RISK ASSESSMENT METHOD

Table 6.3 Classification of Consequence

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied)
Medium	Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (Note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	Concentrations of a contaminant from site exceed the generic, or site -specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the <i>Draft Circular on Contaminated Land</i> , DETR, 2000). Damage to sensitive buildings/structures or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Table 6.4 Classification of Probability

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table 6.5 Comparison of consequence against probability

		consequence			
		severe	medium	mild	minor
probability	high likelihood	very high risk	high risk	moderate risk	moderate/ low risk
	likely	high risk	moderate risk	moderate/ low risk	low risk
	low likelihood	moderate risk	moderate/low risk	low risk	very low risk
	unlikely	moderate/ low risk	low risk	very low risk	very low risk

Table 6.6 Description of the classified risks and likely action required

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