SLJ (Wakefield) Limited

Land of Heathfield Lane, Birkenshaw

Site investigation

350520-R01 (00)

November 2022

RSK GEOSCIENCES

RSK GENERAL NOTES

Project No.: 350520

Title: Birkenshaw Site Investigation, Land off Heathfield Lane, Birkenshaw, Bradford, BD11 2LS

Client: SLJ (Wakefield) Limited

Date: November 2022

Office: RSK Environment Limited, The Potteries, Pottery Street, Castleford, WF10 1NJ. Tel 01977 552255

Status: Rev 00

Author	Will Hopkins	**Technical reviewer**	John Harrison
Signature		Signature	
Project manager	Will Hopkins		
Signature			

Revision control sheet

Revision reference	Date	Reason for revision	Amended by:	Approved by:
Rev 00		First issue	n/a	see above

CONTENTS

1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by SLJ (Wakefield) Limited to undertake a site investigation at Heathfield Lane, Birkenshaw, Bradford, BD11 2LS.

It is understood that the currently vacant parcel of land is to be developed for a residential end use. This site investigation has been completed to provide details of ground conditions, contamination risk assessment, ground gas monitoring and risk assessment.

RSK's service constraints are shown in Appendix A.

1.2 Objectives

The objective of the work is:

- to identify any land contamination and/or geotechnical constraints to the proposed development and to support discharge of relevant planning conditions and relevant building control requirements
- to identify the need for any additional investigation or remediation works to demonstrate that the site is suitable for its proposed use

1.3 Scope of works

The scope of the intrusive investigation has been designed in line with the recommendations of BS5930:2015+A1:2020 Code of practice for ground investigations (BSI, 2020), which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. It has also been developed in general accordance with BS 10175: 2011 + A2 2017.

The scope of works for the assessment has included the following:

- drilling of eight dynamic sampling boreholes to carry out in situ testing (SPTs), obtain soil samples and install monitoring wells
- geotechnical and environmental laboratory testing of soil samples;
- generic quantitative risk assessment (GQRA) of relevant contaminant linkages, reflecting residential end-use
- ground gas and groundwater monitoring and ground gas risk assessment
- interpretation of ground conditions and geotechnical data to provide preliminary recommendations with respect to foundations and infrastructure design
- preparation of this factual and interpretative report

1.4 Existing reports

The following phase 1 desk based report was completed for the site, which has been summarised in Section 3:

- RGS Environmental Geotechnical Specialists, Phase 1 Desk Study Report – Land off Whitehall Road West, Orange design Studios, April 2019, Reference: J4608/19/E/EDS

1.5 Limitations

This report is subject to the RSK service constraints given in Appendix A and limitations that may be described through this document.

2 SITE DETAILS

2.1 Site location

Site location details are presented in Table 1 and a site location plan is provided on Figure 1.

Table 1 Site location details

Site name	Land off Heathfield Lane, Birkenshaw
Full site address and S60 5BL	Heathfield Lane, Birkenshaw, Bradford, BD11 2LS
National Grid reference (centre of site)	SE202276

2.2 Site description

Site is a square parcel of land covering an area of approximately 0.3 hectares, situated amongst residential properties and some commercial units to the west. Site surfaces are uneven and covered with thick vegetation and some mature trees along the south and north boundaries.

2.3 Surrounding land uses

The site is located off Heathfield Lane, Birkenshaw, within a predominantly residential setting. The area around the site is detailed below:

- north: Whitehall Road and West Yorks Fire and Rescue Service
- east: residential
- south: residential
- west: residential and commercial

2.4 Development plans

It is understood that the site is being considered for residential development. A proposed layout is not currently available.

3 SUMMARY OF DESK-BASED INFORMATION

Pertinent information from previous assessments is summarised below.

3.1 Site history

The phase 1 desk study by RGS (2019) outlines the previous land uses using historical maps. The site appeared to be used for agricultural purposes until 1933 when it appears to be used for landscaped gardens. By 1993 the gardens are no longer shown on the maps and the site has not been developed on since.

3.2 Site geology

Published records (British Geological Survey, 2011) and records on the British Geological Survey website (August 2022) for the area indicate the geology of the site to be characterised by the succession recorded in Table 2.

Table 2 Site Geology

Strata	Description	Estimated thickness (m)
Lepton Edge Rock	Sandstone- Fine grained thinly bedded flaggy sandstone.	2 to 11

3.3 Hydrogeology

The underlying Lepton Edge Formation is classified as a Secondary A aquifer.

3.4 Hydrology

There are no ponds, streams or other permanent water courses on site.

3.5 Landfilling and land reclamation

There is no evidence of landfill material on site or any other landfill within 250m from site.

3.6 Conceptual Site Model and Preliminary Risk Assessment

A CSM and PRA was completed as part of the desk study report (Table 8 of report reference J4608/19/E/EDS), which identified risks to human health and controlled waters from potential contamination in site soils and a potential risk from ground gas.

4 SITE INVESTIGATION STRATEGY & METHODOLOGY

4.1 Introduction

RSK carried out intrusive investigation work at the site on the 28th July 2022 and subsequent ground gas and groundwater monitoring between August and September 2022.

The following work was completed during the investigation:

- 8no. dynamic sampling boreholes with installation of ground gas and ground water monitoring wells in each
- Associated sampling and in situ testing
- Chemical laboratory testing
- Ground gas and groundwater level monitoring

4.2 Selection of investigation methods

The techniques adopted for the investigation were chosen with consideration of the objectives and site constraints, which are described below.

The dynamic sampling borehole investigation enabled in situ geotechnical testing to be carried out (standard penetration tests (SPT)), chemical and geotechnical samples to be obtained and the installation of ground gas and groundwater monitoring wells.

Prior to conducting intrusive works, utility service plans were obtained and buried service clearance undertaken in line with RSK's health and safety procedures.

4.3 Investigation strategy

The ground investigation was carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930:2015+A1:2020, which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. Whilst every attempt was made to record full details of the strata encountered in the boreholes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

Eight dynamic sampling boreholes were drilled to a maximum depth of 2.4m bgl, three boreholes were installed with gas monitoring wells. An exploratory hole location plan is presented as Figure 2.

4.3.1 Implementation of investigation works

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS5930:2015+A1:2020 (which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1).

Standard penetration tests (SPTs) were carried out during the dynamic sampling drilling at approximately 1m depth intervals. The SPT results are shown on the exploratory hole records presented in Appendix D.

Hand vane tests were unable to be taken due to the lack of cohesive material.

The soil sampling and analysis strategy was designed to characterise each encountered soil strata, permit an assessment of the potential contaminant linkages identified and investigate the geotechnical characteristics. Samples were taken to allow for geo-environmental and geotechnical testing to be undertaken.

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite required. They were dispatched to the laboratory in cool boxes under chain of custody documentation. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

4.4 Monitoring programme

4.4.1 Ground gas monitoring

Six monitoring rounds have been undertaken to provide data to support refining of the CSM. The number of monitoring rounds undertaken is in general accordance with the decision matrix presented as Figure 6 of BS8576.

A calibrated infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million.

Initial and steady state concentrations were recorded.

The atmospheric pressure before and during monitoring, together with the weather conditions, were recorded.

All ground gas monitoring results to date together with the temporal conditions are contained within Appendix E.

4.4.2 Groundwater level monitoring

Depths to groundwater were recorded using an electronic dip meter during the monitoring visits. The groundwater monitoring data are included in Appendix E.

Groundwater samples were not taken as part of the investigation.

4.5 Laboratory testing

Laboratory testing was undertaken at a UKAS accredited laboratory with ISO17025 and MCERTS accredited test methods were specified where applicable for contamination testing and as shown in the laboratory test certificates appended.

4.5.1 Chemical analysis of soil samples

The soil sampling strategy was designed to characterise soils present on site.

The programme of chemical tests undertaken on soil samples obtained from the intrusive investigation is presented in Table 7 with the laboratory testing results contained in Appendix F.

Table 3 Summary of chemical testing of soil samples

Stratum	Tests undertaken	No. of tests
Topsoil and natural strata	Heavy metals, pH	6
	PAH, TPH, BTEX	6
	Asbestos screening	6

4.5.2 Geotechnical analysis of soils

Due to the presence of granular soils, no Atterberg limits testing was undertaken. Six soil samples were tested for BRE Sulphate Design class testing.

5 SITE INVESTIGATION FACTUAL FINDINGS

The results of the intrusive investigation and subsequent geo-environmental and geotechnical laboratory analysis undertaken are detailed below.

5.1 Ground conditions encountered

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater and in-situ testing are included on the exploratory hole records presented in Appendix D.

The exploratory holes revealed that the site is covered with topsoil directly underlain by the Lepton Edge Sandstone Formation.

The ground conditions encountered during the fieldworks are discussed below.

5.1.1 Topsoil

A veneer of topsoil was present across the site, this comprised light brown clayey gravelly sand or sandy gravelly clay at depths of between 0.1m and 0.4m, typically 0.3m.

5.1.2 Lepton Edge Sandstone Formation

The underlying rock encountered in the boreholes was typically recovered as sandy gravel.

The weathered Lepton Edge Sandstone Formation was typically described as light brown sandy angular fine to coarse gravel. Although, varied in colour slightly across site and was light orangish brown in areas. The weathering of the sandstone also varied across site; the depth of the boreholes correlates to the strength of the rock.

Undrained shear strengths were not obtained as the material was unsuitable for hand shear vane tests.

5.1.2.1 Ease of excavation/ drilling

Bedrock was encountered at very shallow depths and therefore the completion of 1.2m hand dug pits was not possible in any of the boreholes. The pits were typically excavated to a depth of around 0.5m. The boreholes were also terminated at a depth of between 0.7m and 2.0m upon refusal of the SPT.

5.1.3 Visual/olfactory evidence of soil contamination

No visual/olfactory evidence of contamination was encountered during the investigation.

No visual evidence of asbestos was encountered.

5.2 Groundwater

Groundwater was not encountered during the site investigation.

5.2.1 Visual/olfactory evidence of groundwater contamination

No visual/olfactory evidence of groundwater contamination was encountered during the investigation.

5.3 Chemical laboratory results

The soil testing results are presented in Appendix F.

5.4 Ground gas monitoring

The results of the ground gas monitoring carried out to date are given in Appendix E and discussed in section 6.4.

6 GEO-ENVIRONMENTAL ASSESSMENT

6.1 Refinement of initial CSM

Significant contamination was not encountered during the intrusive works and no new source areas were identified.

Groundwater was not encountered during the investigation or subsequent monitoring.

6.2 Methodology and assessment of soil results

The analysis of laboratory results relating to soil samples submitted for testing is included in the following sections.

6.2.1 Oral, dermal and inhalation exposure with impacted soil by future site users

The datasets being considered in the assessment is:

- data set 1 Topsoil
- data set 2 Weathered Bedrock

As an initial assessment of each dataset, all soil results in each dataset have been directly compared against the GAC for a residential with home-grown produce scenario.

The ratio of soil contaminant concentrations of genotoxic PAHs (benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(ah)anthracene, indeno(123-cd)pyrene and benzo(ghi)perylene) against benzo(a)pyrene have been compared against lower and upper limits set out in C4SL project methodology (CL:AIRE, 2014). All genotoxic PAH ratios were within the upper and lower bounds of the underlying toxicological study. Therefore, and in accordance with HPA guidance (HPA, 2010), the assessment of genotoxic PAHs has been based on the use of benzo(a)pyrene as a surrogate marker. Therefore, a risk from genotoxic PAHs is only considered likely if the respective benzo(a)pyrene concentrations exceed the relevant GAC.

6.2.1.1 Data set 1 – Topsoil

All topsoil results have been compared with the residential with home-grown produce GAC. A soil organic matter (SOM) of 6% has been selected. The soil screening output spreadsheets are presented as Appendix H.

Assessment of the results indicates three slight exceedances of the GAC for Arsenic shown in Table 4. This is highlighted in red on the screening output spreadsheet in Appendix H.

Table 4 Data summary table – Data set 1

Determinand	No. of samples tested	GAC (mg/kg)	No of exceedances	Maximum concentration (mg/kg)	
				Value	Location / depth (m bgl)
arsenic	4	37	3	47	WS05 0.2m, WS07 0.3m, WS08 0.2m

6.2.1.2 *Data set 2 – Weathered Bedrock*

All bedrock results have been compared with the residential with home-grown produce GAC. A soil organic matter (SOM) of 1% has been selected. The soil screening output spreadsheets are presented as Appendix H.

Assessment of the results indicates no exceedances of the GAC.

6.2.1.3 *Summary*

All contaminant concentrations are below the GAC, except for three slight exceedances of the GAC for arsenic within the topsoil. The presence of slightly elevated arsenic is not uncommon within coal measures deposits and is not considered significant.

It is recommended that additional topsoil samples are obtained and tested for bioaccessibility to further assess the potential risk to human health. This additional laboratory testing can be used to confirm the suitability of topsoil for reuse within the site.

Overall, based on the assessment and subject to the additional testing noted above, no potentially significant risks associated with the soil contamination have been identified and it is considered that the site may be regarded as suitable for the proposed end use.

6.2.2 Inhalation exposure of future site occupants/ users to asbestos fibres

The visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos found no detectable asbestos fibres within the samples of topsoil or weathered bedrock.

6.3 Ground gas risk assessment – bulk gases

Ground gas monitoring results are presented as Appendix E, with the calculation of borehole hazardous gas flow rates (Q_{hg}) presented as Appendix I. Results indicate negligible/low concentrations of methane, low concentrations of carbon dioxide and low flow rates. The site has been classified as **CS1** and **Green** (NHBC Traffic Light Classification.

7 GEOTECHNICAL ASSESSMENT

7.1 Proposed development

It is understood that the proposed development is to involve the construction of residential properties and associated infrastructure.

At this stage no specific information relating to building loads has been provided.

7.2 Foundations

7.2.1 Foundation options

It is considered that given the presence of shallow bedrock across the site, that reinforced traditional spread foundations (strip foundations) will be suitable for lightly loaded structures. Reinforcement is recommended due to the variability of weathered bedrock.

7.2.2 Foundation works risk assessment

It is anticipated that a foundation works risk assessment report will not be required for the development because no free-phase product or significant contamination has been identified at the site.

7.2.3 Floor slabs

It is anticipated that suspended floor slabs will be utilised across the site.

7.3 Excavations for foundations and services

Man entry into any excavations should not be undertaken without provision of suitable shoring and support and dewatering or suitable regrading and battering of side slopes to safe angles. Confined spaces protocols for the Health and Safety of personnel should always be used where man entry into excavations is to be undertaken as low oxygen conditions may be present.

7.4 Roads, hardstanding and drainage

In pavement design terms, the groundwater conditions are anticipated to comprise a low water table, i.e. at least 1m below the pavement formation level.

The estimated minimum, equilibrium soil-suction, California bearing ratio (CBR) value for the soils and groundwater conditions described above under a completed pavement is 5%, based upon Table C1 in TRRL (1984) Report LR1132.

The recommended sub-grade soil CBR value for road pavement design is therefore 5%. This value assumes that during construction the formation level will be carefully inspected and any soft or loose spots removed and replaced with well-compacted granular fill.

The sub-grade soils can be regarded as frost-susceptible, based upon the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-

susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450 mm.

7.5 Chemical attack on buried concrete

This assessment of the potential for chemical attack on buried concrete at the site is based on BRE Special Digest 1: Concrete in aggressive ground, which represents the most up-to-date guidance on this topic currently available in the UK.

The desk study indicates that, for the purposes of assessing the aggressive chemical environment of the site, the site should be considered as a greenfield development site.

The results of the laboratory analysis undertaken on samples indicate 2:1 water/soil extract water soluble sulphate contents ranging between as <10mg/l and 12mg/l, giving a characteristic value for water soluble sulphate of 11mg/l; and pH value ranging from 4.64 to 7.38 giving a characteristic pH value of 4.64.

These results indicate that, in accordance with *BRE Special Digest 1: 2005 Concrete in aggressive ground* (BRE, 2005), the Design Sulphate Class for the site of DS-1m. This assumes nominally mobile groundwater conditions and that no significantly disturbed clay comes into contact with concrete foundations or structures.

The corresponding ACEC classification for the site is AC-2m, based on an assumption of nominally mobile groundwater conditions, and a characteristic pH value of 4.64.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Geo-environmental assessment

The GQRA indicated that all contaminant concentrations are below the GAC, except for three slight exceedances of the GAC for arsenic within the topsoil. The assessment was based on a small number of samples. It is recommended that additional topsoil samples are obtained and scheduled for PBET (Physiologically Based Extraction Test) to determine the actual bioaccessibility of the arsenic within topsoil, to further assess the potential risk to human health.

Ground gas risk assessment has indicated a **CS1** and **Green** (NHBC Traffic Light Classification, indicating that ground gas protection measures are not required.

Overall, based on the GQRA and subject to the additional testing, no potentially significant risks associated with the soil contamination have been identified and it is considered that the site may be regarded as suitable for the proposed end use.

8.2 Geotechnical assessment

It is considered that reinforced traditional spread foundations (strip or trench fill foundations) will be suitable for lightly loaded structures.

The preliminary recommended sub-grade soil CBR value for road pavement design is 5% based on the ground conditions encountered. The sub-grade soils are regarded as frost susceptible and therefore sub-base of no less than 450mm is required.

A Design Sulphate Class of DS-1m and Aggressive Chemical Environment of AC-2m for concrete classification may be assumed for design purposes.

REFERENCES

Standards and guidance

AGS Interim Guidance (2013), 'Site investigation and asbestos risk assessment for the protection of site investigation and geotechnical laboratory personnel', February.

British Geological Survey, 1:50,000 scale map, Sheet 100 Sheffield, 2011.

British Standards Institution (BSI) (1990), 'BS 1377:1990. Methods of test for soils for civil engineering purposes'.

British Standards Institution (BSI) (2020), 'BS 5930:2015+A1:2020. Code of practice for ground investigations'.

British Standards Institution (BSI) (2011), 'BS 10175:2011 + A2:2017. Investigation of potentially contaminated sites: Code of practice'.

Building Research Establishment (2005), BRE Special Digest 1: Concrete in aggressive ground.

Environment Agency (2020), Land contamination risk management, https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm, 8 October 2020

National House Building Council (NHBC) (2016), Technical Extra, April 2016.

Norbury, D. (2010), Soil and Rock Description in Engineering Practice.

Part IIA of the Environmental Protection Act (Contaminated Land Regulations (England)) 2002.

Rudland, D. J., Lancefield, R. M. and Mayell, P. N. (2001), CIRIA C552. Contaminated Land Risk Assessment: A Guide to Good Practice.

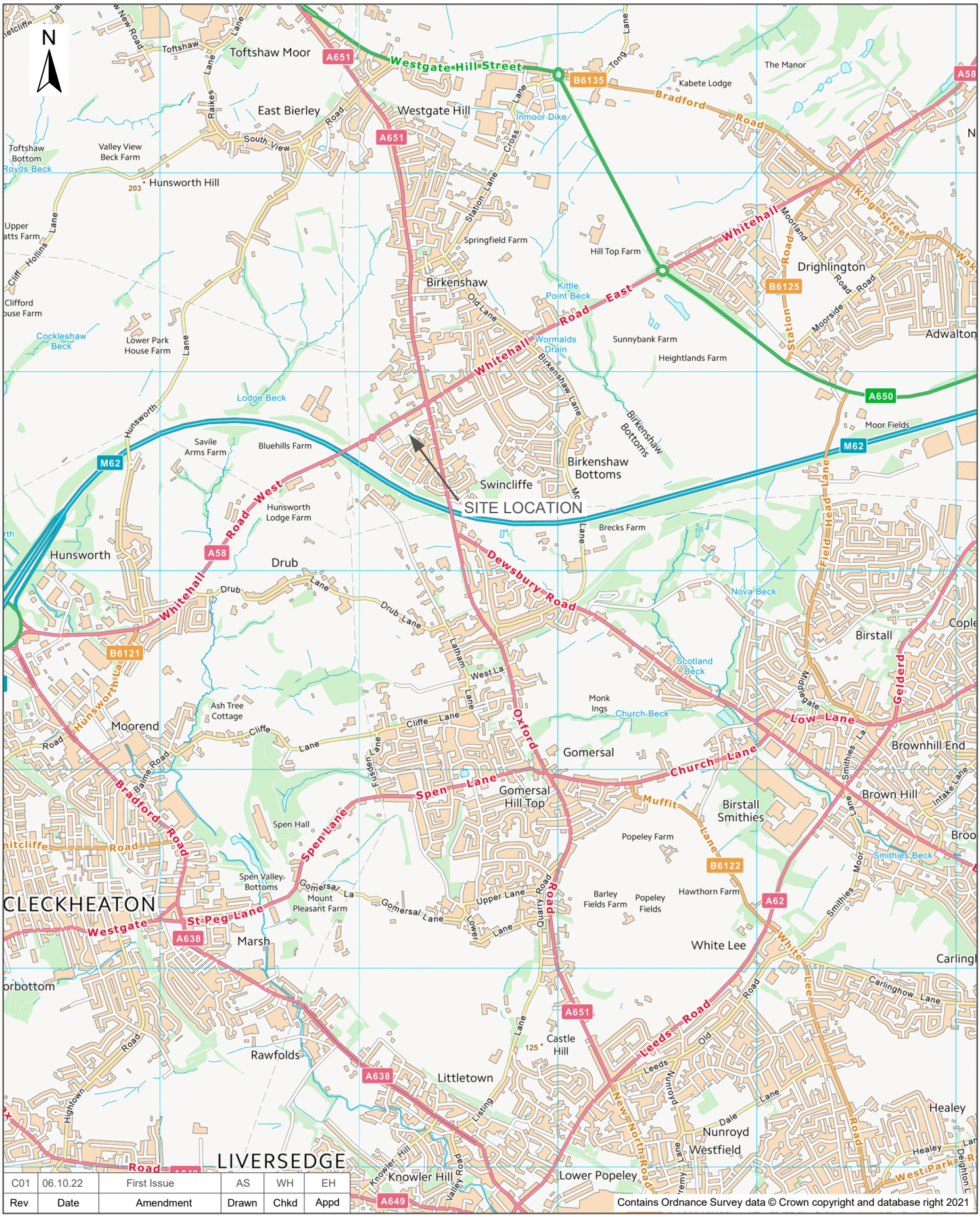
Transport and Road Research Laboratory, (1970), 'TRRL Road Note 29 (Appendix 1). Road pavement design'.

Transport and Road Research Laboratory (1984), 'TRRL Report LR1132 (Table C1)'.

UK Water Industry Research, (2010), UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites.

FIGURES

FIGURE 1 SITE LOCATION PLAN



Rev	Date	Amendment	Drawn	Chkd	Appd
C01	06.10.22	First Issue	AS	WH	EH

RSK GEOSCIENCES
The Potteries
Pottery Street
Castleford
WF10 1NJ
Tel: +44(0)1977 878007
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client: SJL (Wakefield) Ltd

Project Name: Birkenshaw Sit Investigation

Description: Site Location plan

Dimension	Size	Scale	Geolocation	Project ID	Drawing no.	Rev	File name
m	A4	1:25,000	420253, 427684	350520	11101	C01	350520-CS-111-SS-D-C-11101-C01

FIGURE 2 EXPLORATORY HOLE LOCATION PLAN

Rev	Date	Amendment	Drawn	Chkd	Appd
C01	06.10.22	First Issue	AS	WH	WH

LEGEND

- Site boundary
- Window sample location

RSK GEOSCIENCES
The Potteries
Pottery Street
Castleford
WF10 1NJ
Tel: +44(0)1977 878007
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client: SJL (Wakefield) Ltd

Project Name: Birkenshaw Sit Investigation

Description: Borehole Location Plan

Dimension	Scale	Size	Project ID	Drawing no.	Revision	File name
m	NTS	A4	350520	22201	C01	350520-CS-222-SS-D-C-22201-C01

APPENDICES

APPENDIX A SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for JGC (1980) Limited (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, persistent, bioaccumulative or toxic chemicals (including PFAS/ PFOS) or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site,

unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B SUMMARY OF LEGISLATION AND POLICY RELATING TO LAND CONTAMINATION

Part IIA of the Environmental Protection Act 1990

Part IIA of the Environmental Protection Act 1990 (Part IIA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Planning Policy

Contaminated land is often dealt with through planning because of land redevelopment. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF), reference ISBN: 978-1-5286-1033-9, February 2019.

The new framework has only limited guidance on contaminated land, as follows:

Chapter 11. Making effective use of land

117 Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.

118. Planning policies and decisions should:

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.

Chapter 15. Conserving and enhancing the natural environment

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Ground conditions and pollution

178. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water
- reduce pollution of water, especially by ‘priority’ and ‘priority hazardous’ substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2016 (as amended) provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2016 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Notes:

1. *The above information is provided for background but does not constitute site-specific advice*
2. *The above summary applies to England only. Variations exist within other countries of the United Kingdom*

APPENDIX C TECHNICAL BACKGROUND

C1 Desk Study

Aquifer designation and Source protection zones

Principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale.

Secondary A aquifer: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Secondary B aquifer: predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated aquifer: it has not been possible to attribute either a category A or B to a rock type. In most cases this means that it was previously designated as both a minor and non-aquifer in different locations owing to the variable characteristics.

Unproductive' strata: low permeability with negligible significance for water supply or river base flow.

The EA generally adopts a three-fold classification of source protection zones (SPZ) surround abstractions for public water supply. The Site is situated in an area defined as follows:

- Zone 1 or the 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- Zone 2 or the 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants
- Zone 3 or the 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Preliminary risk assessment methodology

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) contaminant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the

likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event 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: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- 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 of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the table below.

		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**Highly likely**	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low

	Unlikely	Moderate/low	Low	Very low	Very low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required
- high: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term
- moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term
- low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild
- very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

C2 Site Investigation Methodology

Ground gas monitoring

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

Low flow groundwater sampling

Groundwater samples were retrieved using a United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology.

The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging, in most cases, is the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.

Reuse of suitable materials

The Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011) (CoP) was developed in consultation with the Environment Agency and development industry to enable the re-use of materials under certain scenarios and subject to demonstrating that specific criteria are met. The current reuse scenarios covered by the CoP comprise

- reuse on the site of origin (with or without treatment)
- direct transfer of clean and natural soils between sites
- use in the development of land other than the site of origin following treatment at an authorised Hub site (including a fixed soil treatment facility).

The importation of made ground soils (irrespective of contamination status) or crushed demolition materials is not permitted currently under the CoP and requires either a standard rules environmental permit or a U1 waste exemption (see below).

In the context of excavated materials used on-sites undergoing development, four factors are considered to be of particular relevance in determining if the material is a waste or when it ceases to be waste:

- the aim of the Waste Framework Directive is not undermined, i.e. if the use of the material will create an unacceptable risk of pollution of the environment or harm to human health it is likely to be waste
- the material is certain to be used
- the material is suitable for use both chemically and geotechnically
- only the required quantity of material will be used.

The CoP requires the preparation of a materials management plan (MMP) that confirms the above factors will be met. This plan needs to be reviewed by a 'Qualified Person' (QP) who will then issue a declaration form to the EA. As the project progresses, data must be collated and on completion a verification report produced that shows the MMP was followed and describes any changes.

The MMP establishes whether specific materials are classified as waste and how excavated materials will be treated and/or reused in line with the CoP. The MMP is likely to form part of the site waste management plan.

APPENDIX D EXPLORATORY HOLE RECORDS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22** End: **28.07.22**	**---**	**---**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.10	1	ES				Light brown gravelly slightly clayey fine to coarse SAND with abundant roots. Gravel is sub-angular fine to coarse of sandstone. (TOPSOIL)	0.10	
0.40 - 0.70 (59mm dia)	0.40-0.70	1	SPT	11,13/21,29 for 75mm			Light brown gravelly fine to coarse SAND. Gravel is angular to sub-angular fine to coarse of sandstone. (WEATHERED SANDSTONE)	(0.65)	
							Inspection pit refused at 0.75m depth with smallest barrell.	0.75	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 0.40m depth.
3. No groundwater encountered.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

RSK GEOSCIENCES

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22**	**---**	**---**	**1** of **1**
	End: **28.07.22**			

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.30	1	ES				Light brown slightly clayey slightly gravelly fine to coarse SAND with rootlets. Gravel is sub-angular of sandstone. (TOPSOIL)	(0.40) 0.40	
0.50 - 1.00 (79mm dia)	0.80	2	ES				Orangish brown and light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	(0.95)	
	1.00-1.30	1	SPT	5,7/22,28 for 75mm				1.35	
	1.00	3	SPTLS						
	1.25	3	SPTLS						
							Inspection pit refused at 1.35m depth.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.00m depth.
3. No groundwater encountered.
4. Backfilled with bentonite.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22**	**---**	**---**	**1** of **1**
	End: **28.07.22**			

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.20	1	ES				Light brown slightly gravelly fine to coarse SAND with rootlets. Gravel is sub-angular fine to coarse sandstone. (TOPSOIL)	(0.40)	
								0.40	
0.40 - 1.00 (79mm dia)	0.80	2	ES				Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	(0.78)	
	1.00-1.23	1	SPT	8,12/50 for 75mm					
	1.00	3	D					1.18	
							Inspection pit terminated at 1.18m depth in bedrock.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.00m depth.
3. No groundwater encountered.
4. Backfilled with bentonite.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22** End: **28.07.22**	**---**	**---**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.10	1	ES				Light brown slightly gravelly slightley clayey fine to coarse SAND with rootlets. (TOPSOIL)	(0.35)	
								0.35	
0.35 - 1.00 (89mm dia)							Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)		
	0.90	2	ES					(1.15)	
	1.00-1.45	1	SPT	N=49					
1.00 - 1.50 (69mm dia)	1.20	3	D						
								1.50	
	1.50-1.50	2	SPT	NP			Inspection pit terminated at 1.50m depth in bedrock.		
	1.50	4	D						

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.00m depth.
3. No groundwater encountered.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22**	**---**	**---**	**1** of **1**
	End: **28.07.22**			

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.20	1	ES				Light brown slightly gravelly slightly clayey SAND with rootlets. (TOPSOIL)	(0.30) 0.30	
0.50 - 0.70 (79mm dia)							Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	(0.53)	
	0.70-0.93	1	SPT	9,10/50 for 75mm				0.83	
							Inspection pit terminated at 0.83m depth in rock.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 0.70m depth.
3. No groundwater encountered.
4. Backfilled with bentonite.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22** End: **28.07.22**	**---**	**---**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.10	1	ES				Brown slightly clayey slightly gravelly fine to coarse SAND with rootlets. Gravel is sub-angular fine to medium of sandstone and brick. (TOPSOIL)	(0.30)	
	0.30	2	ES					0.30	
0.40 - 1.00 (89mm dia)							Light orangish brown sandy sub-angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)		
	1.00-1.45	1	SPT	N=36					
	1.00	3	SPTLS					(2.12)	
1.00 - 2.00 (79mm dia)	1.45	3	SPTLS				. . . At depth 1.50m-2.00m: Clayey.		
	1.60	4	D						
	2.00-2.41	2	SPT	5,6/6,10,14,20 for 30mm					
	2.00	4	D						
							Inspection pit terminated at 2.42m depth.	2.42	

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.00m depth.
3. No groundwater encountered.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

RSK GEOSCIENCES

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS07**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22**	**---**	**---**	**1** of **1**
	End: **28.07.22**			

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
0.30 - 0.80 (101mm dia)	0.30	1	ES				Brown slightly clayey gravelly fine to coarse SAND with rootlets. Gravel is sub-angular fine to coarse of sandstone. (TOPSOIL)	(0.30) 0.30	
	0.60	2	ES				Light orangish brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK) . . . At depth 0.30-0.60m: Clayey.	(0.90)	
	0.80-1.18	1	SPT	11,7/7,10,33 for 75mm					
	1.00	3	D					1.20	
							Inspection pit refused at 1.20m depth due to SPT on bedrock.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 0.80m depth.
3. No groundwater encountered.
4. Backfilled with bentonite.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Birkenshaw	**JGC (1980) LTD**	**WS08**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
350520	**28.07.22**	**---**	**---**	**1** of **1**
	End: **28.07.22**			

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.20	1	ES				Soft dark brown sandy slightly gravelly CLAY with roots. Gravel is sub-angular fine to medium of sandstone and brick. (TOPSOIL)	(0.30) 0.30	
0.30 - 1.00 (101mm dia)	0.30-0.75	1	SPT	N=19			Light orangish brown slightly clayey sandy angular to sub-angular fine to coarse GRAVEL of sandstone.	(1.05)	
	0.80	2	ES						
	1.00-1.24	2	SPT	10,12/25,25 for 10mm					
	1.00	3	D						
							Inspection pit refused at 1.35m depth due to bedrock.	1.35	

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 0.30m depth.
3. No groundwater encountered.
4. Backfilled with bentonite.
5. ES2 no tub.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Archway Dart 227**	**Structural Soils**	**WHopkins**	

APPENDIX E GROUND GAS MONITORING DATA AND SITE CONDITIONS

Exploratory position ID	Monitoring round	Monitoring date	Response zone top (mbgl)	Response zone base (mbgl)	Depth to water (m)	Depth to base (m)	Response zone geological unit	Methane - peak (%/vol)	Methane steady-state (%/vol)	Carbon dioxide peak (%/vol)	Carbon dioxide steady-state (%/vol)	Oxygen minimum (%/vol)	Carbon monoxide peak (ppm)	Hydrogen sulphide peak (ppm)	PID peak (ppm)	Peak gas flow max (l/hr)	Steady-state gas flow (l/hr)	Atmospheric pressure (mb)	Response zone entirely flooded?	Response zone partially flooded?
WS01	1	04/08/2022	0.1	0.75	DRY	0.55	Light brown gravelly fine to coarse SAND (WEATHERED SANDSTONE).	0	0	1.1	1.1	20.5	2	0		0.2	0.2	998	FALSE	FALSE
WS01	2	12/08/2022	0.1	0.75	DRY	0.55	Light brown gravelly fine to coarse SAND (WEATHERED SANDSTONE).	0	0	1	1	20.2	5	0		0	0	1005	FALSE	FALSE
WS01	3	24/08/2022	0.1	0.75	DRY	0.55	Light brown gravelly fine to coarse SAND (WEATHERED SANDSTONE).	0	0	1	0.9	19.8	3	0		0	0	998	FALSE	FALSE
WS01	4	06/09/2022	0.1	0.75	DRY	0.55	Light brown gravelly fine to coarse SAND (WEATHERED SANDSTONE).	0	0	0.9	0.9	20.5	3	0		0	0	995	FALSE	FALSE
WS01	5	15/09/2022	0.1	0.75	DRY	0.55	Light brown gravelly fine to coarse SAND (WEATHERED SANDSTONE).	0.1	0.1	1	1	20.9	2	0		-0.3	0	996	FALSE	FALSE
WS01	6	22/09/2022	0.1	0.75	DRY	0.55	Light brown gravelly fine to coarse SAND (WEATHERED SANDSTONE).	0	0	0.8	0.8	20.7	2	0		0	0	1000	FALSE	FALSE
WS04	1	04/08/2022	0.35	1.5	DRY	1.39	Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.6	0.5	20.6	23	0		0.2	0.2	998	FALSE	FALSE
WS04	2	12/08/2022	0.35	1.5	DRY	1.39	Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.5	0.5	19.6	7	1		0.2	0	1005	FALSE	FALSE
WS04	3	24/08/2022	0.35	1.5	DRY	1.39	Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.8	0.7	19.8	3	0		0	0	998	FALSE	FALSE
WS04	4	06/09/2022	0.35	1.5	DRY	1.39	Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.9	0.9	20.5	3	0		0	0	995	FALSE	FALSE
WS04	5	15/09/2022	0.35	1.5	DRY	1.39	Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.4	0.4	21	1	0		-0.3	0	996	FALSE	FALSE
WS04	6	22/09/2022	0.35	1.5	DRY	1.39	Light brown sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.6	0.4	20.8	2	0		0	0	1000	FALSE	FALSE
WS06	1	04/08/2022	0.8	1.8	DRY	1.51	Light orangish brown sandy sub-angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	1.4	1.4	20.1	14	0		0.2	0.2	998	FALSE	FALSE
WS06	2	12/08/2022	0.8	1.8	DRY	1.39	Light orangish brown sandy sub-angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	1.1	1.1	19.6	6	1		0.2	0.2	1005	FALSE	FALSE
WS06	3	24/08/2022	0.8	1.8	DRY	1.39	Light orangish brown sandy sub-angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	1.1	1.1	20.1	4	1		0	0	998	FALSE	FALSE
WS06	4	06/09/2022	0.8	1.8	DRY	1.39	Light orangish brown sandy sub-angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.8	0.8	20.7	2	0		0	0	995	FALSE	FALSE
WS06	5	15/09/2022	0.8	1.8	DRY	1.39	Light orangish brown sandy sub-angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.9	0.1	20.8	0	1		-0.3	0	996	FALSE	FALSE
WS06	6	22/09/2022	0.8	1.8	DRY	1.39	Light orangish brown sandy sub-angular fine to coarse GRAVEL of sandstone. (WEATHERED BEDROCK)	0	0	0.9	0.9	20.8	2	0		0	0	1000	FALSE	FALSE

Exploratory position ID	Date	Device	Serial number	Atmospheric pressure (mb)	Weather	Air Temp (°C)	Ground condtions	Wind	Tidal state
Monitoring round 1									
WS01	04/08/2022			998				LIGHT	
WS04	04/08/2022			998				LIGHT	
WS06	04/08/2022			998				LIGHT	
Monitoring round 2									
WS01	12/08/2022	GA5000		1005	Dry	28	Dry	light	
WS04	12/08/2022	GA5000		1005	Dry	28	Dry	light	
WS06	12/08/2022	GA5000		1005	Dry	28	Dry	light	
Monitoring round 3									
WS01	24/08/2022	GA5000		998	Dry	25	Dry	light	
WS04	24/08/2022	GA5000		998	Dry	25	Dry	light	
WS06	24/08/2022	GA5000		998	Dry	25	Dry	light	
Monitoring round 4									
WS01	06/09/2022	GA5000		995	wet	16	wet	light	
WS04	06/09/2022	GA5000		995	wet	16	wet	light	
WS06	06/09/2022	GA5000		995	wet	16	wet	light	
Monitoring round 5									
WS01	15/09/2022	GA5000		996	dry	11	dry	light	
WS04	15/09/2022	GA5000		996	dry	11	dry	light	
WS06	15/09/2022	GA5000		996	dry	11	dry	light	
Monitoring round 6									
WS01	22/09/2022	GA5000		1000	dry	14	wet	light	
WS04	22/09/2022	GA5000		1000	dry	14	wet	light	
WS06	22/09/2022	GA5000		1000	dry	14	wet	light	

APPENDIX F LABORATORY CERTIFICATES FOR SOIL ANALYSIS

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/07619
Issue Number: 1 **Date:** 18 August, 2022

Client: RSK Environment Ltd Castleford
The Potteries
Pottery Street
Castleford
WF10 1NJ

Project Manager: John Harrison
Project Name: Not specified
Project Ref: 350520
Order No: N/A
Date Samples Received: 04/08/22
Date Instructions Received: 04/08/22
Date Analysis Completed: 18/08/22

Approved by:

Richard Wong
Client Manager

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME
UKAS TESTING 1247

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/1	22/07619/2	22/07619/3	22/07619/4	22/07619/5	22/07619/6	22/07619/7	Units	Limit of Detection	Method ref
Client Sample No	1	2	3	2	2	1	2			
Client Sample ID	WS01	WS02	WS02	WS03	WS04	WS05	WS06			
Depth to Top	0.2	0.80	1.00	0.80	0.90	0.2	0.70			
Depth To Bottom			1.35							
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22			
Sample Type	Soil - ES	Solid	Solid	Soil - ES	Solid	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	7	7	4A	7	4AE	4A			
% Stones >10mm$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
pH$_D$$^{M\#}$	4.94	6.80	-	-	-	6.56	6.56	pH	0.01	A-T-031s
pH BRE$_D$$^{M\#}$	-	-	7.38	4.64	6.95	-	-	pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1)$_D$$^{M\#}$	-	-	<10	12	<10	-	-	mg/l	10	A-T-026s
Organic Matter$_D$$^{M\#}$	6.1	0.2	-	-	-	13.8	0.7	% w/w	0.1	A-T-032 OM
Arsenic$_D$$^{M\#}$	20	7	-	-	-	47	<1	mg/kg	1	A-T-024s
Cadmium$_D$$^{M\#}$	2.7	0.7	-	-	-	3.1	3.3	mg/kg	0.5	A-T-024s
Copper$_D$$^{M\#}$	41	8	-	-	-	52	15	mg/kg	1	A-T-024s
Chromium$_D$$^{M\#}$	35	13	-	-	-	32	24	mg/kg	1	A-T-024s
Lead$_D$$^{M\#}$	82	5	-	-	-	79	13	mg/kg	1	A-T-024s
Mercury$_D$	<0.17	<0.17	-	-	-	<0.17	<0.17	mg/kg	0.17	A-T-024s
Nickel$_D$$^{M\#}$	22	19	-	-	-	28	29	mg/kg	1	A-T-024s
Selenium$_D$$^{M\#}$	2	<1	-	-	-	4	2	mg/kg	1	A-T-024s
Zinc$_D$$^{M\#}$	95	25	-	-	-	138	62	mg/kg	5	A-T-024s

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/1	22/07619/2	22/07619/3	22/07619/4	22/07619/5	22/07619/6	22/07619/7	Units	Limit of Detection	Method ref
Client Sample No	1	2	3	2	2	1	2			
Client Sample ID	WS01	WS02	WS02	WS03	WS04	WS05	WS06			
Depth to Top	0.2	0.80	1.00	0.80	0.90	0.2	0.70			
Depth To Bottom			1.35							
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22			
Sample Type	Soil - ES	Solid	Solid	Soil - ES	Solid	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	7	7	4A	7	4AE	4A			
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_D^{\#}$	NAD	NAD	-	-	-	NAD	NAD			A-T-045
Asbestos Matrix (visual)$_D$	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope)$_D$	-	-	-	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_D$	N/A	N/A	-	-	-	N/A	N/A			A-T-045

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/1	22/07619/2	22/07619/3	22/07619/4	22/07619/5	22/07619/6	22/07619/7	Units	Limit of Detection	Method ref
Client Sample No	1	2	3	2	2	1	2			
Client Sample ID	WS01	WS02	WS02	WS03	WS04	WS05	WS06			
Depth to Top	0.2	0.80	1.00	0.80	0.90	0.2	0.70			
Depth To Bottom			1.35							
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22			
Sample Type	Soil - ES	Solid	Solid	Soil - ES	Solid	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	7	7	4A	7	4AE	4A			
PAH-16MS										
Acenaphthene$_A^{M\#}$	0.26	<0.01	-	-	-	0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene$_A^{M\#}$	0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-019s
Anthracene$_A^{M\#}$	0.25	<0.02	-	-	-	0.03	<0.02	mg/kg	0.02	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	0.81	<0.04	-	-	-	0.17	<0.04	mg/kg	0.04	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	0.59	<0.04	-	-	-	0.16	<0.04	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	0.73	<0.05	-	-	-	0.23	<0.05	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	0.26	<0.05	-	-	-	0.09	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	0.21	<0.07	-	-	-	<0.07	<0.07	mg/kg	0.07	A-T-019s
Chrysene$_A^{M\#}$	0.92	<0.06	-	-	-	0.24	<0.06	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	0.08	<0.04	-	-	-	<0.04	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene$_A^{M\#}$	1.81	<0.08	-	-	-	0.34	<0.08	mg/kg	0.08	A-T-019s
Fluorene$_A^{M\#}$	0.18	<0.01	-	-	-	0.01	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	0.36	<0.03	-	-	-	0.13	<0.03	mg/kg	0.03	A-T-019s
Naphthalene $_A^{M\#}$	0.22	<0.03	-	-	-	<0.03	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene$_A^{M\#}$	1.53	<0.03	-	-	-	0.18	<0.03	mg/kg	0.03	A-T-019s
Pyrene$_A^{M\#}$	1.46	<0.07	-	-	-	0.30	<0.07	mg/kg	0.07	A-T-019s
Total PAH-16MS$_A^{M\#}$	9.68	<0.08	-	-	-	1.89	<0.08	mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/1	22/07619/2	22/07619/3	22/07619/4	22/07619/5	22/07619/6	22/07619/7	Units	Limit of Detection	Method ref
Client Sample No	1	2	3	2	2	1	2			
Client Sample ID	WS01	WS02	WS02	WS03	WS04	WS05	WS06			
Depth to Top	0.2	0.80	1.00	0.80	0.90	0.2	0.70			
Depth To Bottom			1.35							
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22			
Sample Type	Soil - ES	Solid	Solid	Soil - ES	Solid	Soil - ES	Soil - ES			
Sample Matrix Code	4AE	7	7	4A	7	4AE	4A			
TPH CWG with Clean Up										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10$_A$	1	<1	-	-	-	2	<1	mg/kg	1	A-T-055s
Ali >C10-C12$_A^{M\#}$	<1	<1	-	-	-	<1	<1	mg/kg	1	A-T-055s
Ali >C12-C16$_A^{M\#}$	<1	<1	-	-	-	1	<1	mg/kg	1	A-T-055s
Ali >C16-C21$_A^{M\#}$	2	<1	-	-	-	2	<1	mg/kg	1	A-T-055s
Ali >C21-C35$_A^{M\#}$	37	1	-	-	-	14	<1	mg/kg	1	A-T-055s
Total Aliphatics$_A$	36	1	-	-	-	17	<1	mg/kg	1	Calc-As Recd
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10$_A$	1	<1	-	-	-	2	<1	mg/kg	1	A-T-055s
Aro >C10-C12$_A$	2	<1	-	-	-	2	<1	mg/kg	1	A-T-055s
Aro >C12-C16$_A$	8	<1	-	-	-	6	<1	mg/kg	1	A-T-055s
Aro >C16-C21$_A^{M\#}$	23	<1	-	-	-	10	<1	mg/kg	1	A-T-055s
Aro >C21-C35$_A^{M\#}$	65	<1	-	-	-	24	<1	mg/kg	1	A-T-055s
Total Aromatics$_A$	89	<1	-	-	-	39	<1	mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35)$_A$	125	1	-	-	-	56	<1	mg/kg	1	Calc-As Recd
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	-	-	-	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/8	22/07619/9	22/07619/10	22/07619/11	22/07619/12			Units	Limit of Detection	Method ref
Client Sample No	3	1	2	1	3					
Client Sample ID	WS06	WS07	WS07	WS08	WS08					
Depth to Top	1.00	0.3	0.60	0.2	1					
Depth To Bottom	1.45									
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22					
Sample Type	Soil - D	Soil - ES	Soil - ES	Soil - ES	Soil - D					
Sample Matrix Code	4A	4AE	6AE	4AE	4A					
% Stones >10mm$_A$	<0.1	<0.1	<0.1	<0.1	<0.1			% w/w	0.1	A-T-044
pH$_D$$^{M\#}$	-	5.58	-	6.72	-			pH	0.01	A-T-031s
pH BRE$_D$$^{M\#}$	6.78	-	6.70	-	6.94			pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1)$_D$$^{M\#}$	<10	-	<10	-	<10			mg/l	10	A-T-026s
Organic Matter$_D$$^{M\#}$	-	15.5	-	17.6	-			% w/w	0.1	A-T-032 OM
Arsenic$_D$$^{M\#}$	-	41	-	37	-			mg/kg	1	A-T-024s
Cadmium$_D$$^{M\#}$	-	2.7	-	4.8	-			mg/kg	0.5	A-T-024s
Copper$_D$$^{M\#}$	-	56	-	155	-			mg/kg	1	A-T-024s
Chromium$_D$$^{M\#}$	-	34	-	33	-			mg/kg	1	A-T-024s
Lead$_D$$^{M\#}$	-	105	-	194	-			mg/kg	1	A-T-024s
Mercury$_D$	-	<0.17	-	<0.17	-			mg/kg	0.17	A-T-024s
Nickel$_D$$^{M\#}$	-	27	-	26	-			mg/kg	1	A-T-024s
Selenium$_D$$^{M\#}$	-	4	-	2	-			mg/kg	1	A-T-024s
Zinc$_D$$^{M\#}$	-	113	-	248	-			mg/kg	5	A-T-024s

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/8	22/07619/9	22/07619/10	22/07619/11	22/07619/12			Units	Limit of Detection	Method ref
Client Sample No	3	1	2	1	3					
Client Sample ID	WS06	WS07	WS07	WS08	WS08					
Depth to Top	1.00	0.3	0.60	0.2	1					
Depth To Bottom	1.45									
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22					
Sample Type	Soil - D	Soil - ES	Soil - ES	Soil - ES	Soil - D					
Sample Matrix Code	4A	4AE	6AE	4AE	4A					
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_{D}^{\#}$	-	NAD	-	NAD	-					A-T-045
Asbestos Matrix (visual)$_{D}$	-	-	-	-	-					A-T-045
Asbestos Matrix (microscope)$_{D}$	-	-	-	-	-					A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_{D}$	-	N/A	-	N/A	-					A-T-045

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/8	22/07619/9	22/07619/10	22/07619/11	22/07619/12			Units	Limit of Detection	Method ref
Client Sample No	3	1	2	1	3					
Client Sample ID	WS06	WS07	WS07	WS08	WS08					
Depth to Top	1.00	0.3	0.60	0.2	1					
Depth To Bottom	1.45									
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22					
Sample Type	Soil - D	Soil - ES	Soil - ES	Soil - ES	Soil - D					
Sample Matrix Code	4A	4AE	6AE	4AE	4A					
PAH-16MS										
Acenaphthene$_A^{M\#}$	-	0.02	-	0.02	-			mg/kg	0.01	A-T-019s
Acenaphthylene$_A^{M\#}$	-	<0.01	-	0.01	-			mg/kg	0.01	A-T-019s
Anthracene$_A^{M\#}$	-	0.04	-	0.05	-			mg/kg	0.02	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	-	0.23	-	0.36	-			mg/kg	0.04	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	-	0.22	-	0.32	-			mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	-	0.28	-	0.41	-			mg/kg	0.05	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	-	0.11	-	0.16	-			mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	-	<0.07	-	0.11	-			mg/kg	0.07	A-T-019s
Chrysene$_A^{M\#}$	-	0.28	-	0.45	-			mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	-	<0.04	-	<0.04	-			mg/kg	0.04	A-T-019s
Fluoranthene$_A^{M\#}$	-	0.42	-	0.76	-			mg/kg	0.08	A-T-019s
Fluorene$_A^{M\#}$	-	<0.01	-	0.01	-			mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	-	0.16	-	0.22	-			mg/kg	0.03	A-T-019s
Naphthalene $_A^{M\#}$	-	0.04	-	<0.03	-			mg/kg	0.03	A-T-019s
Phenanthrene$_A^{M\#}$	-	0.23	-	0.31	-			mg/kg	0.03	A-T-019s
Pyrene$_A^{M\#}$	-	0.36	-	0.68	-			mg/kg	0.07	A-T-019s
Total PAH-16MS$_A^{M\#}$	-	2.39	-	3.87	-			mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/07619

Client Project Name: Not specified

Client Project Ref: 350520

Lab Sample ID	22/07619/8	22/07619/9	22/07619/10	22/07619/11	22/07619/12			Units	Limit of Detection	Method ref
Client Sample No	3	1	2	1	3					
Client Sample ID	WS06	WS07	WS07	WS08	WS08					
Depth to Top	1.00	0.3	0.60	0.2	1					
Depth To Bottom	1.45									
Date Sampled	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22	28-Jul-22					
Sample Type	Soil - D	Soil - ES	Soil - ES	Soil - ES	Soil - D					
Sample Matrix Code	4A	4AE	6AE	4AE	4A					
TPH CWG with Clean Up										
Ali >C5-C6$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
Ali >C6-C8$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
Ali >C8-C10$_A$	-	2	-	<1	-			mg/kg	1	A-T-055s
Ali >C10-C12$_A^{M\#}$	-	1	-	<1	-			mg/kg	1	A-T-055s
Ali >C12-C16$_A^{M\#}$	-	2	-	<1	-			mg/kg	1	A-T-055s
Ali >C16-C21$_A^{M\#}$	-	2	-	1	-			mg/kg	1	A-T-055s
Ali >C21-C35$_A^{M\#}$	-	13	-	12	-			mg/kg	1	A-T-055s
Total Aliphatics$_A$	-	18	-	11	-			mg/kg	1	Calc-As Recd
Aro >C5-C7$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
Aro >C7-C8$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
Aro >C8-C10$_A$	-	2	-	<1	-			mg/kg	1	A-T-055s
Aro >C10-C12$_A$	-	2	-	1	-			mg/kg	1	A-T-055s
Aro >C12-C16$_A$	-	6	-	4	-			mg/kg	1	A-T-055s
Aro >C16-C21$_A^{M\#}$	-	11	-	11	-			mg/kg	1	A-T-055s
Aro >C21-C35$_A^{M\#}$	-	27	-	27	-			mg/kg	1	A-T-055s
Total Aromatics$_A$	-	40	-	35	-			mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35)$_A$	-	58	-	46	-			mg/kg	1	Calc-As Recd
BTEX - Benzene$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
BTEX - Toluene$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
BTEX - o Xylene$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s
MTBE$_A^{\#}$	-	<0.01	-	<0.01	-			mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
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.
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.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

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.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
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, 9 = INCINERATOR ASH.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,
E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable 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.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve
Subscript "^" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.
EPH CWG results have humics mathematically subtracted through instrument calculation
TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

v2

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: RSK Environment Ltd Castleford, The Potteries, Pottery Street, Castleford, WF10 1NJ

Project No: 22/07619

Date Received: 04/08/2022 (am)

Cool Box Temperatures (°C): 14.8, 15.2

Project:

Clients Project No: 350520

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/07619/1	22/07619/2	22/07619/3	22/07619/4	22/07619/5	22/07619/6	22/07619/7	22/07619/8	22/07619/9	22/07619/10	22/07619/11	22/07619/12
Client Sample No	1	2	3	2	2	1	2	3	1	2	1	3
Client Sample ID/Depth	WS01 0.2m	WS02 0.80m	WS02 1.00-1.35m	WS03 0.80m	WS04 0.90m	WS05 0.2m	WS06 0.70m	WS06 1.00-1.45m	WS07 0.3m	WS07 0.60m	WS08 0.2m	WS08 1m
Date Sampled	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22
A-T-019s	09/08/2022	09/08/2022				09/08/2022	09/08/2022		09/08/2022		09/08/2022	
A-T-022s	15/08/2022	15/08/2022				15/08/2022	15/08/2022		15/08/2022		15/08/2022	
A-T-024s	12/08/2022	12/08/2022				12/08/2022	12/08/2022		12/08/2022		12/08/2022	
A-T-026s			12/08/2022	12/08/2022	12/08/2022			12/08/2022		12/08/2022		12/08/2022
A-T-031s	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022	12/08/2022
A-T-032 OM	11/08/2022	11/08/2022				11/08/2022	11/08/2022		11/08/2022		11/08/2022	
A-T-044	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022	08/08/2022
A-T-045	05/08/2022	05/08/2022				05/08/2022	05/08/2022		05/08/2022		05/08/2022	
A-T-055s	18/08/2022	18/08/2022				18/08/2022	18/08/2022		18/08/2022		18/08/2022	
Calc-As Recd	18/08/2022	18/08/2022				18/08/2022	18/08/2022		18/08/2022		18/08/2022	

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

APPENDIX G GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH

Generic assessment criteria for human health: residential scenario with home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report[3] and associated chemical specific reports[6], and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications, with the exception of the "top two" produce type approach taken in the C4SL, have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) for residential land use, reducing exposure frequency for dermal contact outdoors for residential land use, and updated produce type consumption rates (90th percentile) based on recent data from the National Diet and Nutrition Survey.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3]. The SAC are also termed GAC.

Conceptual model

In accordance with SR3[5], the residential with home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In accordance with Box 3.1 of SR3[5], the pathways considered for production of the SAC in the residential with home-grown produce scenario are

- direct soil and dust ingestion
- consumption of home-grown produce
- consumption of soil attached to home-grown produce
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated appendices[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a LLTC[3,6] has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium, methyl tertiary-butyl ether (MTBE), 1,1,2-trichlorethane, 1,1-dichloroethene, 1,2-dichloropropane, 2-chloronaphthalene, chloroethane, chloromethane, cis 1,2-dichloroethene, dichloromethane, hexachloroethane and trans 1,2-dichloroethene were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential with home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. The house is assumed to have a 100m^2 private garden consisting of lawn and flowerbeds, incorporating a 20m^2 plot for growing fruit and vegetables consumed by the residents. SR3[5] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3[3], with a dust loading factor detailed in Section 9.3 of SR3[5]. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3[5] input parameters for residential with home-grown produce land-use scenario

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3[5]. Modifications to the default SR3[5] exposure scenarios based on the C4SL exposure scenarios[3] are presented in Tables 2 and 3 below.

The final selected GAC are presented by pathway in Table 4 and the combined GAC in Table 5.

Figure 1: Conceptual model for residential scenario with home-grown produce

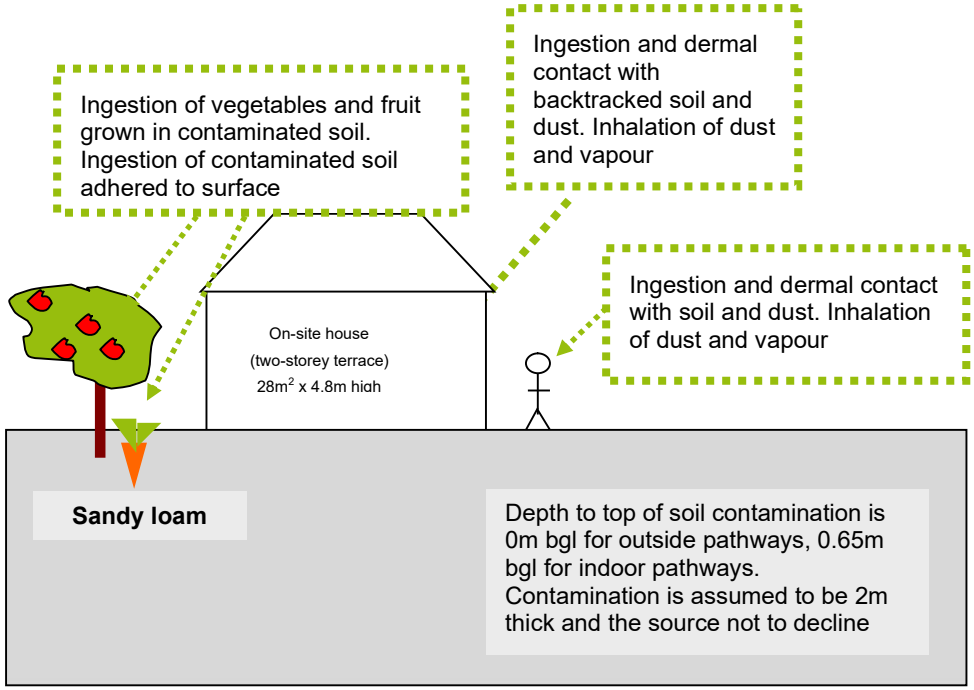


Table 1: Exposure assessment parameters for residential scenario with home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential with homegrown produce	Chosen land use
Receptor	Female child age 1 to 6	Key generic assumption given in Box 3.1, SR3[5]
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)[5]
Soil type	Sandy Loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3)[5]
Start AC (age class)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3[5]
End AC (age class)	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential with home-grown produce – modified home-grown produce data

Name	Consumption rate 90th percentile (g FW kg^{-1} BW day^{-1}) by age class						Dry weight conversion factor (g DW g^{-1} FW)	Home-grown fraction (average)	Home-grown fraction (high end)	Soil loading factor (g g^{-1} DW)	Preparation correction factor
	1	2	3	4	5	6					
Green vegetables	7.12	5.87	5.87	5.87	4.53	4.53	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	10.7	2.83	2.83	2.83	2.14	2.14	0.103	0.06	0.4	1.00E-03	1.00E+00
Tuber vegetables	16	6.6	6.6	6.6	4.95	4.95	0.21	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	1.83	3.39	3.39	3.39	2.24	2.24	0.058	0.06	0.4	1.00E-03	6.00E-01
Shrub fruit	2.23	0.46	0.46	0.46	0.19	0.19	0.166	0.09	0.6	1.00E-03	6.00E-01
Tree fruit	3.82	10.3	10.3	10.3	5.16	5.16	0.157	0.04	0.27	1.00E-03	6.00E-01
Justification	Table 3.4, SP1010 [3]						Table 6.3, SR3[5]	Table 4.19, SR3[5]		Table 6.3, SR3[5]	

Table 3: Residential with home-grown produce – modified and use and receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
EF (soil and dust ingestion)	day yr^{-1}	180	365	365	365	365	365
EF (consumption of home-grown produce)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, indoor)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, outdoor)	day yr^{-1}	170	170	170	170	170	170
EF (inhalation of dust and vapour, indoor)	day yr^{-1}	365	365	365	365	365	365
EF (inhalation of dust and vapour, outdoor)	day yr^{-1}	365	365	365	365	365	365
Justification		Table 3.5, SP1010[3]; Table 3.1, SR3[5]					
Soil to skin adherence factor (outdoor)	mg cm^{-2} day^{-1}	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010[3]					
Inhalation rate	m^3 day^{-1}	5.4	8.0	8.9/f	10.1	10.1	10.1
Justification		Mean value USEPA, 2011[12]; Table 3.2, SP1010[3]					
Notes: For **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3[1], Science Report SC050021/Cadmium SGV[1] and the project report SP1010[3] for more information.							

References

1. Environment Agency (2009), 'Science Reports SC050021 - SGV and TOX reports for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'; 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs', and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'. Available at: https://www.gov.uk/government/publications/contaminants-in-soil-updated-collation-of-toxicological-data-and-intake-values-for-humans and https://www.gov.uk/government/publications/land-contamination-soil-guideline-values-sgvs (accessed 4 February 2015)

2. Nathanial, C. P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A. G., Ogden, R. C. and Scott, D. (2009), *LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment*, second edition (Nottingham: Land Quality Press).

3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.

4. Department for Environment, Food and Rural Affairs (Defra) (2014), 'SP1010: Development of Category 4 Screening Levels for assessment of land affected by contamination – Policy Companion Document', Revision 2.

5. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).

6. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Appendices C to H). DEFRA research project SP1010'. CL:AIRE (2021). Category 4 Screening Levels: Trichloroethene (TCE). CL:AIRE, London. ISBN 978-1-905046-38-6. CL:AIRE (2021). Category 4 Screening Levels: Vinyl Chloride. CL:AIRE, London. ISBN 978-1-905046-36-2. CL:AIRE (2021). Category 4 Screening Levels: Tetrachloroethene (PCE). CL:AIRE, London. ISBN 978-1-905046-37-9.

7. Nathanial, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanial, J. F. (2015), *The LQM/CIEH S4ULs for Human Health Risk Assessment* (Nottingham: Land Quality Press).

8. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2* (Bristol: Environment Agency).

9. Environment Agency (2009), *Science Report – SC050021/SR4 CLEA Software (version 1.05) Handbook* (Bristol: Environment Agency).

10. Environment Agency (2008), *Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* (Bristol: Environment Agency).

11. CL:AIRE (2010), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).

12. USEPA (2011), *Exposure factors handbook*, EPA/600/R-090/052F (Washington, DC: Office of Research and Development).

13. Environment Agency (2009), 'Changes made to the CLEA framework documents after the three-month evaluation period in 2008', released January 2009.

14. USEPA (2010). Hydrogen cyanide and cyanide salts. Integrated Risk Information Systems (IRIS) Chemical Assessment Summary. September 2010. https://www.epa.gov/iris (accessed 9 December 2015)

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE

Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR
Barium	(b)	1.34E+03	NR	NR	NR	1.34E+03	NR	NR	NR	1.34E+03	NR	NR	NR
Beryllium		1.13E+02	1.72E+00	NR	NR	1.13E+02	1.72E+00	NR	NR	1.13E+02	1.72E+00	NR	NR
Boron		3.00E+02	5.20E+06	NR	NR	3.00E+02	5.20E+06	NR	NR	3.00E+02	5.20E+06	NR	NR
Cadmium	(a)	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR
Chromium (III) - trivalent	(c)	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR
Copper		2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR
Lead	(a)	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	2.35E-01	NR	4.31E+00	NR	5.60E-01	NR	1.07E+01	NR	1.22E+00	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR
Methyl Mercury (Hg^{4+})		1.26E+01	1.87E+01	7.52E+00	7.33E+01	1.26E+01	3.62E+01	9.34E+00	1.42E+02	1.26E+01	7.68E+01	1.08E+01	3.04E+02
Nickel	(d)	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR
Selenium	(b)	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR
Vanadium		4.13E+02	1.46E+03	NR	NR	4.13E+02	1.46E+03	NR	NR	4.13E+02	1.46E+03	NR	NR
Zinc	(b)	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR
Cyanide (free)		1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR
Volatile Organic Compounds													
Benzene	(a)	2.62E-01	9.01E-01	2.03E-01	1.22E+03	5.39E-01	1.68E+00	4.08E-01	2.26E+03	1.16E+00	3.48E+00	8.72E-01	4.71E+03
Toluene		1.53E+02	9.08E+02	1.31E+02	8.69E+02	3.49E+02	2.00E+03	2.97E+02	1.92E+03	7.95E+02	4.55E+03	6.77E+02	4.36E+03
Ethylbenzene		1.10E+02	8.34E+01	4.74E+01	5.18E+02	2.61E+02	1.96E+02	1.12E+02	1.22E+03	6.00E+02	4.58E+02	2.60E+02	2.84E+03
Xylene - m		2.10E+02	8.25E+01	5.92E+01	6.25E+02	5.01E+02	1.95E+02	1.40E+02	1.47E+03	1.15E+03	4.56E+02	3.27E+02	3.46E+03
Xylene - o		1.92E+02	8.87E+01	6.07E+01	4.78E+02	4.56E+02	2.08E+02	1.43E+02	1.12E+03	1.05E+03	4.86E+02	3.32E+02	2.62E+03
Xylene - p		1.98E+02	7.93E+01	5.66E+01	5.76E+02	4.70E+02	1.86E+02	1.33E+02	1.35E+03	1.08E+03	4.36E+02	3.10E+02	3.17E+03
Total xylene		1.92E+02	7.93E+01	5.66E+01	6.25E+02	4.56E+02	1.86E+02	1.33E+02	1.47E+03	1.05E+03	4.36E+02	3.10E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		1.54E+02	1.04E+02	6.22E+01	2.04E+04	2.97E+02	1.69E+02	1.08E+02	3.31E+04	6.03E+02	3.21E+02	2.10E+02	6.27E+04
1,1,1,2 Tetrachloroethane		5.39E+00	1.54E+00	1.20E+00	2.60E+03	1.27E+01	3.56E+00	2.78E+00	6.02E+03	2.92E+01	8.29E+00	6.46E+00	1.40E+04
1,1,2,2-Tetrachloroethane		2.81E+00	3.92E+00	1.64E+00	2.67E+03	6.10E+00	8.04E+00	3.47E+00	5.46E+03	1.36E+01	1.76E+01	7.67E+00	1.20E+04
1,1,1-Trichloroethane		3.33E+02	9.01E+00	8.77E+00	1.43E+03	7.26E+02	1.84E+01	1.80E+01	2.92E+03	1.62E+03	4.04E+01	3.94E+01	6.39E+03
1,1,2 Trichloroethane		1.95E+00	1.25E+00	7.62E-01	4.03E+03	4.21E+00	2.55E+00	1.59E+00	8.21E+03	9.35E+00	5.59E+00	3.50E+00	1.80E+04
1,1-Dichloroethene		1.93E+01	3.29E-01	3.23E-01	2.23E+03	3.85E+01	5.82E-01	5.74E-01	3.94E+03	8.15E+01	1.17E+00	1.16E+00	7.94E+03
1,2-Dichloroethane		3.17E-02	9.20E-03	7.13E-03	3.41E+03	5.73E-02	1.33E-02	1.08E-02	4.91E+03	1.09E-01	2.28E-02	1.88E-02	8.43E+03
1,2,4-Trimethylbenzene		NR	1.76E+00	NR	4.74E+02	NR	4.26E+00	NR	1.16E+03	NR	9.72E+00	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
1,2-Dichloropropane		4.28E+00	3.40E-02	3.37E-02	1.19E+03	8.44E+00	6.00E-02	5.96E-02	2.11E+03	1.77E+01	1.21E-01	1.20E-01	4.24E+03
Carbon Tetrachloride (tetrachloromethane)		3.10E+00	2.58E-02	2.57E-02	1.52E+03	7.11E+00	5.65E-02	5.62E-02	3.32E+03	1.62E+01	1.28E-01	1.27E-01	7.54E+03
Chloroethane		NR	1.17E+01	NR	2.61E+03	NR	1.59E+01	NR	3.54E+03	NR	2.57E+01	NR	5.71E+03
Chloromethane		NR	1.17E-02	NR	1.91E+03	NR	1.38E-02	NR	2.24E+03	NR	1.85E-02	NR	2.99E+03
Cis 1,2 Dichloroethene		1.56E-01	NR	NR	3.94E+03	2.66E-01	NR	NR	6.61E+03	5.18E-01	NR	NR	1.29E+04
Dichloromethane		7.04E-01	3.05E+00	6.24E-01	7.27E+03	1.27E+00	4.06E+00	1.08E+00	9.68E+03	2.33E+00	6.42E+00	1.92E+00	1.53E+04
Tetrachloroethene (PCE)		1.33E+01	3.19E-01	3.11E-01	4.24E+02	3.11E+01	7.15E-01	6.99E-01	9.51E+02	7.12E+01	1.64E+00	1.60E+00	2.18E+03
Trans 1,2 Dichloroethene		6.45E+00	2.76E-01	NR	3.42E+03	1.29E+01	4.99E-01	NR	6.17E+03	2.74E+01	1.02E+00		1.26E+04
Trichloroethene (TCE)		9.30E-03	3.61E-02	NR	1.54E+03	1.95E-02	7.57E-02	NR	3.22E+03	4.34E-02	1.68E-01	NR	7.14E+03
Vinyl Chloride (chloroethene)		1.13E-02	1.47E-02	6.38E-03	1.36E+03	2.09E-02	1.90E-02	9.97E-03	1.76E+03	3.88E-02	2.91E-02	1.66E-02	2.69E+03
Semi-Volatile Organic Compounds													
2-Chloronaphthalene		2.76E+02	5.39E+00	5.29E+00	1.14E+02	6.59E+02	1.33E+01	1.30E+01	2.80E+02	1.45E+03	3.17E+01	3.10E+01	6.69E+02

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE

Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Acenaphthene		2.27E+02	4.86E+04	2.26E+02	5.70E+01	5.41E+02	1.18E+05	5.38E+02	1.41E+02	1.18E+03	2.68E+05	1.17E+03	3.36E+02
Acenaphthylene		1.85E+02	4.59E+04	1.84E+02	8.61E+01	4.42E+02	1.11E+05	4.40E+02	2.12E+02	9.78E+02	2.53E+05	9.74E+02	5.06E+02
Anthracene		2.43E+03	1.53E+05	2.39E+03	1.17E+00	5.53E+03	3.77E+05	5.45E+03	2.91E+00	1.10E+04	8.76E+05	1.09E+04	6.96E+00
Benzo(a)anthracene		1.01E+01	2.47E+01	7.18E+00	1.71E+00	1.42E+01	4.37E+01	1.07E+01	4.28E+00	1.69E+01	6.26E+01	1.33E+01	1.03E+01
Benzo(a)pyrene	(a)	4.96E+00	3.51E+01	NR	9.11E-01	4.96E+00	3.77E+01	NR	2.28E+00	4.96E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		2.96E+00	1.93E+01	2.56E+00	1.22E+00	3.89E+00	2.13E+01	3.29E+00	3.04E+00	4.43E+00	2.22E+01	3.69E+00	7.29E+00
Benzo(g,h,i)perylene		3.77E+02	1.87E+03	3.14E+02	1.54E-02	4.09E+02	1.94E+03	3.38E+02	3.85E-02	4.23E+02	1.97E+03	3.48E+02	9.23E-02
Benzo(k)fluoranthene		8.92E+01	5.41E+02	7.66E+01	6.87E-01	1.10E+02	5.76E+02	9.22E+01	1.72E+00	1.21E+02	5.91E+02	1.00E+02	4.12E+00
Chrysene		1.66E+01	1.19E+02	1.46E+01	4.40E-01	2.54E+01	1.49E+02	2.17E+01	1.10E+00	3.19E+01	1.66E+02	2.67E+01	2.64E+00
Dibenzo(a,h)anthracene		2.90E-01	1.45E+00	2.41E-01	3.93E-03	3.43E-01	1.64E+00	2.84E-01	9.82E-03	3.69E-01	1.74E+00	3.04E-01	2.36E-02
Fluoranthene		2.87E+02	3.83E+04	2.85E+02	1.89E+01	5.63E+02	8.87E+04	5.60E+02	4.73E+01	9.00E+02	1.83E+05	8.96E+02	1.13E+02
Fluorene		1.77E+02	6.20E+03	1.72E+02	3.09E+01	4.19E+02	1.53E+04	4.07E+02	7.65E+01	8.98E+02	3.62E+04	8.77E+02	1.83E+02
Hexachloroethane		2.68E-01	NR	NR	8.17E+00	6.57E-01	NR	NR	2.01E+01	1.55E+00	NR	NR	4.81E+01
Indeno(1,2,3-cd)pyrene		3.09E+01	2.12E+02	2.70E+01	6.13E-02	4.22E+01	2.38E+02	3.59E+01	1.53E-01	4.92E+01	2.50E+02	4.11E+01	3.68E-01
Naphthalene		2.78E+01	2.33E+01	1.27E+01	7.64E+01	6.66E+01	5.58E+01	3.04E+01	1.83E+02	1.53E+02	1.31E+02	7.06E+01	4.32E+02
Phenanthrene		9.85E+01	7.17E+03	9.72E+01	3.60E+01	2.24E+02	1.76E+04	2.22E+02	8.96E+01	4.48E+02	4.07E+04	4.43E+02	2.14E+02
Pyrene		6.25E+02	8.79E+04	6.20E+02	2.20E+00	1.25E+03	2.04E+05	1.24E+03	5.49E+00	2.05E+03	4.23E+05	2.04E+03	1.32E+01
Phenol		1.60E+02	4.58E+02	1.20E+02	2.42E+04	2.96E+02	6.95E+02	2.09E+02	3.81E+04	5.86E+02	1.19E+03	3.93E+02	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		4.99E+03	4.24E+01	4.23E+01	3.04E+02	1.13E+04	7.79E+01	7.78E+01	5.58E+02	2.50E+04	1.61E+02	1.60E+02	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		1.49E+04	1.04E+02	1.03E+02	1.44E+02	3.43E+04	2.31E+02	2.31E+02	3.22E+02	7.11E+04	5.29E+02	5.28E+02	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		1.61E+03	2.68E+01	2.67E+01	7.77E+01	2.91E+03	6.55E+01	6.51E+01	1.90E+02	4.26E+03	1.56E+02	1.54E+02	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		4.57E+03	1.33E+02	1.32E+02	4.75E+01	5.51E+03	3.31E+02	3.26E+02	1.18E+02	5.98E+03	7.93E+02	7.65E+02	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		6.27E+03	1.11E+03	1.06E+03	2.37E+01	6.34E+03	2.78E+03	2.41E+03	5.91E+01	6.36E+03	6.67E+03	4.34E+03	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC8-EC_{10}		5.76E+01	4.74E+01	3.45E+01	6.13E+02	1.38E+02	1.16E+02	8.38E+01	1.50E+03	3.07E+02	2.77E+02	1.94E+02	3.58E+02
Aromatic hydrocarbons >EC_{10}-EC_{12}		8.29E+01	2.58E+02	7.52E+01	3.64E+02	1.96E+02	6.39E+02	1.79E+02	8.99E+02	4.25E+02	1.52E+03	3.91E+02	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		1.47E+02	2.85E+03	1.45E+02	1.69E+02	3.36E+02	7.07E+03	3.32E+02	4.19E+02	6.81E+02	1.68E+04	6.74E+02	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	2.63E+02	NR	NR	5.37E+01	5.45E+02	NR	NR	1.34E+02	9.34E+02	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for boron and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

Table 5
Human Health Generic Assessment Criteria for Residential with home-grown produce

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	37	37	37
Barium	1,300	1,300	1,300
Beryllium	1.7	1.7	1.7
Boron	300	300	300
Cadmium	22	22	22
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	2,500	2,500	2,500
Lead	200	200	200
Elemental Mercury (Hg^0)	0.2	0.6	1.2
Inorganic Mercury (Hg^{2+})	39	39	39
Methyl Mercury (Hg^{4+})	10	10	10
Nickel	130	130	130
Selenium	258	258	258
Vanadium	410	410	410
Zinc	3,900	3,900	3,900
Cyanide (free)	1.4	1.4	1.4
Volatile Organic Compounds			
Benzene	0.20	0.41	0.87
Toluene	130	300	680
Ethylbenzene	50	110	260
Xylene - m	59	140	327
Xylene - o	61	143	332
Xylene - p	57	133	310
Total xylene	57	133	310
Methyl tertiary-Butyl ether (MTBE)	60	110	210
1,1,1,2 Tetrachloroethane	1.20	2.78	6.46
1,1,2,2-Tetrachloroethane	1.6	3.5	7.7
1,1,1-Trichloroethane	9	18	39
1,1,2 Trichloroethane	0.8	1.6	3.5
1,1-Dichloroethene	0.32	0.57	1.16
1,2-Dichloroethane	0.007	0.011	0.019
1,2,4-Trimethylbenzene	1.8	4.3	9.7
1,3,5-Trimethylbenzene	NR	NR	NR
1,2-Dichloropropane	0.034	0.060	0.120
Carbon Tetrachloride (tetrachloromethane)	0.026	0.056	0.127
Chloroethane	11.7	15.9	25.7
Chloromethane	0.012	0.014	0.019
Cis 1,2 Dichloroethene	0.16	0.27	0.52
Dichloromethane	0.62	1.08	1.92
Tetrachloroethene (PCE)	0.31	0.70	1.60
Trans 1,2 Dichloroethene	0.28	0.50	1.02
Trichloroethene (TCE)	0.009	0.020	0.043
Vinyl Chloride (chloroethene)	0.006	0.010	0.017
Semi-Volatile Organic Compounds			
2-Chloronaphthalene	5	13	31
Acenaphthene	230	540	1,170
Acenaphthylene	180	440	970
Anthracene	2,400	5,500	10,900
Benzo(a)anthracene	7	11	13
Benzo(a)pyrene	5	5	5
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(g,h,i)perylene	310	340	350
Benzo(k)fluoranthene	77	92	100
Chrysene	15	22	27
Dibenzo(a,h)anthracene	0.24	0.28	0.30
Fluoranthene	290	560	900
Fluorene	170	410	880
Hexachloroethane	0.27	0.66	1.55
Indeno(1,2,3-cd)pyrene	13	30	71
Naphthalene	13	30	71
Phenanthrene	100	220	440
Pyrene	620	1,240	2,040
Phenol	120	210	390
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	42	78	160
Aliphatic hydrocarbons >EC_6-EC_8	100	230	530
Aliphatic hydrocarbons >EC_8-EC_{10}	27	65	154
Aliphatic hydrocarbons >EC_{10}-EC_{12}	130 (48)	330 (118)	760 (283)
Aliphatic hydrocarbons >EC_{12}-EC_{16}	1,100 (24)	2,400 (59)	4,300 (142)
Aliphatic hydrocarbons >EC_{16}-EC_{35}	65,000 (8)	92,000 (21)	110,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	65,000 (8)	92,000 (21)	110,000
Aromatic hydrocarbons >EC_8-EC_{10}	30	80	190
Aromatic hydrocarbons >EC_{10}-EC_{12}	80	180	390
Aromatic hydrocarbons >EC_{12}-EC_{16}	140	330	670
Aromatic hydrocarbons >EC_{16}-EC_{21}	260	540	930
Aromatic hydrocarbons >EC_{21}-EC_{35}	1,100	1,500	1,700
Aromatic hydrocarbons >EC_{35}-EC_{44}	1,100	1,500	1,700
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC)[1]		

Notes:

'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used

EC - equivalent carbon. SAC - soil assessment criteria.

[1] LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS)

RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.

APPENDIX H GQRA DATA SCREENING TABLES – SOILS

Project name	Birkenshaw
Project code	350520
Client name	JCG (1980) LTD
Address	Heathfield Lane Birkenshaw Bradford BD11 2LS
NGR	
Land use	Residential with home-grown produce
SOM	6%
GAC version	2021_00

Notes

Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects	Lab sample ID: 22/07619/1	22/07619/6	22/07619/9	22/07619/11
									Client sample ID: WS01	WS05	WS07	WS08
									Depth to top: 0.2	0.2	0.3	0.2
									Depth to bottom:			
									Date sampled: 28/07/22	28/07/22	28/07/22	28/07/22
Metals and Inorganics												
Arsenic	mg/kg	37		47	20	4	4	0	20	47	41	37
Cadmium	mg/kg	22		4.8	2.7	4	4	0	2.7	3.1	2.7	4.8
Chromium	mg/kg	910	21	35	32	4	4	0	35	32	34	33
Copper	mg/kg	2500		155	41	4	4	0	41	52	56	155
Lead	mg/kg	200		194	79	4	4	0	82	79	105	194
Mercury	mg/kg	39	1.2		<0.17	4	0	4	<0.17	<0.17	<0.17	<0.17
Nickel	mg/kg	130		28	22	4	4	0	22	28	27	26
Selenium	mg/kg	258		4	2	4	4	0	2	4	4	2
Zinc	mg/kg	3900		248	95	4	4	0	95	138	113	248
Asbestos												
Asbestos in soil						4	0	4	NAD	NAD	NAD	NAD
Petroleum Hydrocarbons												
Ali >C5-C6	mg/kg	160			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
Ali >C6-C8	mg/kg	530			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
Ali >C8-C10	mg/kg	154		2	<1	4	3	1	1	2	2	<1
Ali >C10-C12	mg/kg	760	283	1	<1	4	1	3	<1	<1	1	<1
Ali >C12-C16	mg/kg	4300	142	2	<1	4	2	2	<1	1	2	<1
Ali >C16-C21	mg/kg			2	1	4	4	0	2	2	2	1
Ali >C21-C35	mg/kg			37	12	4	4	0	37	14	13	12
Ali >C16-C35 calculated	mg/kg	110000		39	13	4	4	0	39	16	15	13
Total Aliphatics	mg/kg			36	11	4	4	0	36	17	18	11
Aro >C5-C7	mg/kg				<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
Aro >C7-C8	mg/kg				<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
Aro >C8-C10	mg/kg	190		2	<1	4	3	1	1	2	2	<1
Aro >C10-C12	mg/kg	390		2	1	4	4	0	2	2	2	1
Aro >C12-C16	mg/kg	670		8	4	4	4	0	8	6	6	4
Aro >C16-C21	mg/kg	930		23	10	4	4	0	23	10	11	11
Aro >C21-C35	mg/kg	1700		65	24	4	4	0	65	24	27	27
Total Aromatics	mg/kg			89	35	4	4	0	89	39	40	35
TPH (Ali & Aro)	mg/kg			125	46	4	4	0	125	56	58	46
BTEX - Benzene	mg/kg	0.87			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
BTEX - Toluene	mg/kg	680			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
BTEX - Ethyl Benzene	mg/kg	260			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
BTEX - o Xylene	mg/kg	332			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
BTEX - m & p Xylene	mg/kg	310			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
Fuel oxygenates												
MTBE	mg/kg	210			<0.01	4	0	4	<0.01	<0.01	<0.01	<0.01
Polycyclic aromatic hydrocarbons												
Acenaphthene	mg/kg	1170		0.26	0.01	4	4	0	0.26	0.01	0.02	0.02
Acenaphthylene	mg/kg	970		0.01	<0.01	4	2	2	0.01	<0.01	<0.01	0.01
Anthracene	mg/kg	10900		0.25	0.03	4	4	0	0.25	0.03	0.04	0.05

								Lab sample ID	22/07619/1	22/07619/6	22/07619/9	22/07619/11					
								Client sample ID	WS01	WS05	WS07	WS08					
								Depth to top	0.2	0.2	0.3	0.2					
								Depth to bottom									
								Date sampled	28/07/22	28/07/22	28/07/22	28/07/22					
Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects									
Benzo(a)anthracene	mg/kg	13		0.81	0.17	4	4	0	0.81	0.17	0.23	0.36					
Benzo(a)pyrene	mg/kg	5		0.59	0.16	4	4	0	0.59	0.16	0.22	0.32					
Benzo(b)fluoranthene	mg/kg	3.7		0.73	0.23	4	4	0	0.73	0.23	0.28	0.41					
Benzo(ghi)perylene	mg/kg	350		0.26	0.09	4	4	0	0.26	0.09	0.11	0.16					
Benzo(k)fluoranthene	mg/kg	100		0.21	<0.07	4	2	2	0.21	<0.07	<0.07	0.11					
Chrysene	mg/kg	27		0.92	0.24	4	4	0	0.92	0.24	0.28	0.45					
Dibenzo(ah)anthracene	mg/kg	0.3		0.08	<0.04	4	1	3	0.08	<0.04	<0.04	<0.04					
Fluoranthene	mg/kg	900		1.81	0.34	4	4	0	1.81	0.34	0.42	0.76					
Fluorene	mg/kg	880		0.18	<0.01	4	3	1	0.18	0.01	<0.01	0.01					
Indeno(123-cd)pyrene	mg/kg	41		0.36	0.13	4	4	0	0.36	0.13	0.16	0.22					
Naphthalene	mg/kg	71		0.22	<0.03	4	2	2	0.22	<0.03	0.04	<0.03					
Phenanthrene	mg/kg	440		1.53	0.18	4	4	0	1.53	0.18	0.23	0.31					
Pyrene	mg/kg	2040		1.46	0.3	4	4	0	1.46	0.3	0.36	0.68					
Total PAH-16MS	mg/kg			9.68	1.89	4	4	0	9.68	1.89	2.39	3.87					
Other analytes																	
% Stones >10mm	% w/w				<0.1	4	0	4	<0.1	<0.1	<0.1	<0.1					
Organic matter	% w/w			17.6	6.1	4	4	0	6.1	13.8	15.5	17.6					
pH	pH			6.72	4.94	4	4	0	4.94	6.56	5.58	6.72					
pH BRE	pH					0	0	0									

Project name	Birkenshaw
Project code	350520
Client name	JCG (1980) LTD
Address	Heathfield Lane Birkenshaw Bradford BD11 2LS
NGR	
Land use	Residential with home-grown produce
SOM	1%
GAC version	2021_00

Notes

Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects	Lab sample ID							
									22/07619/2	22/07619/3	22/07619/4	22/07619/5	22/07619/7	22/07619/8	22/07619/10	22/07619/12
									WS02	WS02	WS03	WS04	WS06	WS06	WS07	WS08
									0.8	1	0.8	0.9	0.7	1	0.6	1
										1.35				1.45		
									28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22
Metals and Inorganics																
Arsenic	mg/kg	37		7	<1	2	1	1	7				<1			
Cadmium	mg/kg	22		3.3	0.7	2	2	0	0.7				3.3			
Chromium	mg/kg	910	21	24	13	2	2	0	13				24			
Copper	mg/kg	2500		15	8	2	2	0	8				15			
Lead	mg/kg	200		13	5	2	2	0	5				13			
Mercury	mg/kg	39	0.2		<0.17	2	0	2	<0.17				<0.17			
Nickel	mg/kg	130		29	19	2	2	0	19				29			
Selenium	mg/kg	258		2	<1	2	1	1	<1				2			
Zinc	mg/kg	3900		62	25	2	2	0	25				62			
Asbestos																
Asbestos in soil						2	0	2	NAD				NAD			
Petroleum Hydrocarbons																
Ali >C5-C6	mg/kg	42			<0.01	2	0	2	<0.01				<0.01			
Ali >C6-C8	mg/kg	100			<0.01	2	0	2	<0.01				<0.01			
Ali >C8-C10	mg/kg	27			<1	2	0	2	<1				<1			
Ali >C10-C12	mg/kg	130	48		<1	2	0	2	<1				<1			
Ali >C12-C16	mg/kg	1100	24		<1	2	0	2	<1				<1			
Ali >C16-C21	mg/kg				<1	2	0	2	<1				<1			
Ali >C21-C35	mg/kg			1	<1	2	1	1	1				<1			
Ali >C16-C35 calculated	mg/kg	65000	8	1	<1	2	1	1	1				<1			
Total Aliphatics	mg/kg			1	<1	2	1	1	1				<1			
Aro >C5-C7	mg/kg				<0.01	2	0	2	<0.01				<0.01			
Aro >C7-C8	mg/kg				<0.01	2	0	2	<0.01				<0.01			
Aro >C8-C10	mg/kg	30			<1	2	0	2	<1				<1			
Aro >C10-C12	mg/kg	80			<1	2	0	2	<1				<1			
Aro >C12-C16	mg/kg	140			<1	2	0	2	<1				<1			
Aro >C16-C21	mg/kg	260			<1	2	0	2	<1				<1			
Aro >C21-C35	mg/kg	1100			<1	2	0	2	<1				<1			
Total Aromatics	mg/kg				<1	2	0	2	<1				<1			
TPH (Ali & Aro)	mg/kg			1	<1	2	1	1	1				<1			
BTEX - Benzene	mg/kg	0.2			<0.01	2	0	2	<0.01				<0.01			
BTEX - Toluene	mg/kg	130			<0.01	2	0	2	<0.01				<0.01			
BTEX - Ethyl Benzene	mg/kg	50			<0.01	2	0	2	<0.01				<0.01			
BTEX - o Xylene	mg/kg	61			<0.01	2	0	2	<0.01				<0.01			
BTEX - m & p Xylene	mg/kg	57			<0.01	2	0	2	<0.01				<0.01			
Fuel oxygenates																
MTBE	mg/kg	60			<0.01	2	0	2	<0.01				<0.01			
Polycyclic aromatic hydrocarbons																
Acenaphthene	mg/kg	230			<0.01	2	0	2	<0.01				<0.01			
Acenaphthylene	mg/kg	180			<0.01	2	0	2	<0.01				<0.01			
Anthracene	mg/kg	2400			<0.02	2	0	2	<0.02				<0.02			

								Lab sample ID	22/07619/2	22/07619/3	22/07619/4	22/07619/5	22/07619/7	22/07619/8	22/07619/10	22/07619/12		
								Client sample ID	WS02	WS02	WS03	WS04	WS06	WS06	WS07	WS08		
								Depth to top	0.8	1	0.8	0.9	0.7	1	0.6	1		
								Depth to bottom		1.35				1.45				
								Date sampled	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22	28/07/22		
Analyte	Unit	GAC	T1	Max	Min	Count	# Detects	# Non-detects										
Benzo(a)anthracene	mg/kg	7			<0.04	2	0	2	<0.04				<0.04					
Benzo(a)pyrene	mg/kg	5			<0.04	2	0	2	<0.04				<0.04					
Benzo(b)fluoranthene	mg/kg	2.6			<0.05	2	0	2	<0.05				<0.05					
Benzo(ghi)perylene	mg/kg	310			<0.05	2	0	2	<0.05				<0.05					
Benzo(k)fluoranthene	mg/kg	77			<0.07	2	0	2	<0.07				<0.07					
Chrysene	mg/kg	15			<0.06	2	0	2	<0.06				<0.06					
Dibenzo(ah)anthracene	mg/kg	0.24			<0.04	2	0	2	<0.04				<0.04					
Fluoranthene	mg/kg	290			<0.08	2	0	2	<0.08				<0.08					
Fluorene	mg/kg	170			<0.01	2	0	2	<0.01				<0.01					
Indeno(123-cd)pyrene	mg/kg	27			<0.03	2	0	2	<0.03				<0.03					
Naphthalene	mg/kg	13			<0.03	2	0	2	<0.03				<0.03					
Phenanthrene	mg/kg	100			<0.03	2	0	2	<0.03				<0.03					
Pyrene	mg/kg	620			<0.07	2	0	2	<0.07				<0.07					
Total PAH-16MS	mg/kg				<0.08	2	0	2	<0.08				<0.08					
Other analytes																		
% Stones >10mm	% w/w				<0.1	8	0	8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
Organic matter	% w/w			0.7	0.2	2	2	0	0.2				0.7					
pH	pH			6.8	6.56	2	2	0	6.8				6.56					
pH BRE	pH			7.38	4.64	6	6	0		7.38	4.64	6.95		6.78	6.7	6.94		

APPENDIX I GQRA DATA SCREENING TABLES – GAS

Calculations of borehole hazardous gas flow rate in accordance with BS8485

Project No.:	350520
Client:	JGC (1980) Ltd
Site:	Birkenshaw

In accordance with BS8485 Section 6.3.1 the data presented below are calculations of borehole hazardous gas flow rates (Q_{hg}).

The Q_{hg} can then be used, along with a robust conceptual site model and review of the data collected, to designate a site characteristic (or zone) gas screening value (GSV).

GSVs are used to characterise the potential risk and inform mitigation measures where appropriate.

The assessment below presents calculated Q_{hg} values and compares them directly to Characteristic Situations as presented in BS8485 Table 2.

The ultimate site characteristic GSV (for the site or for individual zones) to inform risk assessment and mitigation measures is detailed in the body of the report, and may be different to the individual calculations below.

The calculations below use peak concentrations and steady state flow to calculate the Q_{hg}.

Characteristic Situation	Hazard potential	GSV
1	Very Low	<0.07
2	Low	<0.7
3	Moderate	<3.5
4	Moderate to High	<15
5	High	<70
6	Very High	>=70

British Standard Institution (BSI) (2019), 'BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

KEY	
Qhg	Borehole hazardous gas flow rate (steady state flow * (peak concentration / 100))
GSV	Gas Screening Value
	GSV / Q_{hg} indicates very low hazard potential
	GSV / Q_{hg} indicates low to moderate hazard potential
	GSV / Q_{hg} indicates moderate or greater hazard potential
	Data exceeds either 1% CH_4, 5% CO_2 or 70 L/hr flow (see BS8485 Table 2)

SUMMARY OF Qhg VALUES PER BOREHOLE, PER MONITORING ROUND

BH NO.	DATE	CH_4 peak %v/v	CH_4 SS %v/v	CO_2 peak %v/v	CO_2 SS %v/v	O_2 min %v/v	Flow SS l/hr	Baro mbar	Q_{hg} CH_4	Q_{hg} CO_2	CS No.
WS01	04/08/2022	0	0	1.1	1.1	20.5	0.2	998	0.00	0.00	CS1
	12/08/2022	0	0	1	1	20.2	0	1005	0.00	0.00	CS1
	24/08/2022	0	0	1	0.9	19.8	0	998	0.00	0.00	CS1
	06/09/2022	0	0	0.9	0.9	20.5	0	995	0.00	0.00	CS1
	15/09/2022	0.1	0.1	1	1	20.9	0	996	0.00	0.00	CS1
	22/09/2022	0	0	0.8	0.8	20.7	0	1000	0.00	0.00	CS1
WS04	04/08/2022	0	0	0.6	0.5	20.6	0.2	998	0.00	0.00	CS1
	12/08/2022	0	0	0.5	0.5	19.6	0	1005	0.00	0.00	CS1
	24/08/2022	0	0	0.8	0.7	19.8	0	998	0.00	0.00	CS1
	06/09/2022	0	0	0.9	0.9	20.5	0	995	0.00	0.00	CS1
	15/09/2022	0	0	0.4	0.4	21	0	996	0.00	0.00	CS1
	22/09/2022	0	0	0.6	0.4	20.8	0	1000	0.00	0.00	CS1
WS06	04/08/2022	0	0	1.4	1.4	20.1	0.2	998	0.00	0.00	CS1
	12/08/2022	0	0	1.1	1.1	19.6	0.2	1005	0.00	0.00	CS1
	24/08/2022	0	0	1.1	1.1	20.1	0	998	0.00	0.00	CS1
	06/09/2022	0	0	0.8	0.8	20.7	0	995	0.00	0.00	CS1
	15/09/2022	0	0	0.9	0.1	20.8	0	996	0.00	0.00	CS1
	22/09/2022	0	0	0.9	0.9	20.8	0	1000	0.00	0.00	CS1

WORST-CASE Qhg VALUES PER BOREHOLE

		Maximum CH_4		Maximum CO_2				Baro	Maximum Q_{hg}		
BH NO.	DATE	CH_4 peak %v/v	CH_4 SS %v/v	CO_2 peak %v/v	CO_2 SS %v/v	Min O_2	Max SS Flow	mbar	CH_4	CO_2	CS No.
WS01		0.1	0.1	1.1	1.1	19.8	0.2		0.00	0.00	CS1
WS04		0	0	0.9	0.9	19.6	0.2		0.00	0.00	CS1
WS06		0	0	1.4	1.4	19.6	0.2		0.00	0.00	CS1

WORST-CASE Qhg CHECK FOR SITE (BS8485 Section 6.3.7.4)

		Maximum CH_4		Maximum CO_2				Baro	Maximum Q_{hg}		
BH NO.	DATE	CH_4 peak %v/v	CH_4 SS %v/v	CO_2 peak %v/v	CO_2 SS %v/v	Min O_2	Max SS Flow	mbar	CH_4	CO_2	CS No
ALL		0.1	0.1	1.4	1.4	19.6	0.2		0.00	0.00	CS1