



Our Ref: 1935 R04 231109 GVL R Plot 7 Issue1

9th November 2023

Hatch Homes (Blofield) Limited,
Sixty-Six North Quay,
Great Yarmouth,
Norfolk NR30 1HE

Attn: Mr Jack Pointer

Dear Jack,

Re: Garden Validation Letter Report for The Former Piggeries, Yarmouth Road, Blofield – Plot 7.

1 BACKGROUND

Green Earth Management Company Limited (GEMCO) were commissioned by Hatch Homes (Blofield) Limited (the Client) to undertake garden validations at Blofield (the Site, shown at Figure 1) and to provide a Verification (Validation) Report.

The Site was a roughly rectangular parcel (area c.0.8 Ha) located to the south of Yarmouth Road, Blofield, Norfolk NR13 4JS (Figure 1), centred upon the British National Grid (BNG) Reference (TG) 632811, 309473.

The Client is redeveloping the Site to residential end-use (Planning Ref: 20150262, issued by Broadland District Council) comprising thirteen (13no.) residential dwellings with associated parking, landscaping, and infrastructure. The development layout is shown in Figure 2.

The Site was previously a poultry farm between the 1950s and 2000. The associated buildings, known to have contained asbestos, were partially destroyed by fire in the 1990s, following which they were restored and converted into a piggery. Demolition waste from the restoration from the fire was used to infill various pits. All structures were removed and the site restored to grassland between 2017 and 2021.

Various Phase I and Phase II Site Investigation works have been undertaken at the Site, reported in February 2015 (R.1, Canham Consulting), January 2018 (R.2, A F Howland), and December 2021 (R.3, GEMCO, Second Issue April 2022) which identified asbestos and Petroleum Hydrocarbon (TPH) contamination within shallow made ground soils (some 1.2-2m thick), as well as pits roughly 3m deep filled with soil and demolition wastes.

A F Howland prepared a Remediation Method Statement (RMS) in May 2018 (RMS, R.4).

Remediation works have been undertaken by Remediate Ltd, which were overseen and verified by GEMCO and reported in the GEMCO Interim Validation Report in January 2023 (R.5). The remediation/validation works were undertaken to address contamination at the Site in order to make it suitable for a residential end-use.

This letter reports the remaining remediation works carried out in accordance with the RMS and recommendations of the Interim Validation Report.

This report pertains to Plot 7, the location of which is shown on Figure 3.

2 SUMMARY OF SITE INVESTIGATION AND REMEDIATION WORKS PREVIOUSLY COMPLETED

In brief, the Site Investigations and Risk Assessments (R.2, R.3) identified:

- Widespread made ground generally 1.2-2.0mbgl thick, but as deep as 3.0m on one occasion, with variable amounts of anthropogenic materials (brick, concrete, asphalt) as well as occasional fragments of Asbestos Containing Material (ACM); and
- Localised Total Petroleum Hydrocarbon and Asbestos Contaminated Soil (ACS).

The key elements of the Remediation Strategy (R.4) were:

- The removal of Petroleum Hydrocarbon Contaminated Soil from the location of TP113;
- The removal of ACS from the location of TP154;
- The excavation of all soils unsuitable for a residential setting to natural soil and hand-picking of ACMs from the arisings;
- Backfilling of excavations with clean as-dug or imported material (if required) to 250mm below the Finished Floor Level (FFL, a.k.a. the Formation Level);
- Implementation of a Cover System (250mm thick) in Garden and Soft Landscaping areas; and
- Verification and validation testing of the works undertaken including validation in private gardens and open landscaped areas.

3 OUTSTANDING REMEDIATION WORKS

Bulk remediation works (i.e., site clearance, excavation and screening of contaminated soils, removal of unsuitable soils from the Site) were undertaken in June/July 2022, as reported in the Interim Validation Report (R.5). The following remediation and validation work remain outstanding:

- Reinstatement and validation of private gardens and softstanding areas (Cover System); and
- Validation Reporting of private garden plots and public/private communal softstanding areas.

The remediation validation criteria for the soils used for reinstatement within the Cover System (also referred to as “capping layer”) are presented in the RMS (R.4). In brief, the reinstated soils should broadly comprise the following:

- **Private gardens:** $\geq 0.25\text{m}$ of suitable validated topsoil; and
- **Landscaping Areas** (POS/softstanding not in gardens): $\geq 0.25\text{m}$ of suitable validated topsoil.

Inspections would be required in three (3no.) locations per garden plot and one (1no.) location per landscaped (non-garden) area. Validation testing would be required at a minimum frequency of one (1no.) sample per garden plot.

The Soil Assessment Criteria (SAC) for validations are reproduced in Appendix 3.



4 SITE WORKS

GEMCO visited the Site on 9th October 2023 to inspect cover system soils used at Plot 7. The garden was reinstated with imported topsoil from a greenfield site at Cringleford new Primary School. The Imported topsoil had already been subject to laboratory testing with the results provided by the supplier, a copy of the analysis is presented at Appendix 2. A further sample of the imported topsoil was obtained on the 6th November and scheduled for further testing.

The approximate location of inspections is shown at Figure 3 and the laboratory test results are presented in Appendix 2.

A selection of photographs taken during the site works are presented in Appendix 1.

The topsoil was present from ground level to 0.25mbgl, and comprised dark brown sandy clayey topsoil with occasional fine to medium gravel of flint.

The subsoil beneath comprised light brown slightly clayey slightly gravelly sand. Gravel was fine to medium rarely coarse flint.

5 LABORATORY TESTING

The imported topsoil was previously tested by the supplier with a sample submitted to an MCERTS accredited laboratory for testing. The sample was analysed for a standard suite of contaminants of concern in line with the requirements of the Remediation Method Statement (RMS) including the following:

- **Metals Screen** – Arsenic, Beryllium, Boron (Water Soluble), Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium and Zinc;
- **Organics Screen** – Total Petroleum Hydrocarbons (TPH) with Criteria Working Group (CWG) banding, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polyaromatic Hydrocarbons (PAH) – USEPA 16 Suite and Total Monohydric Phenols;
- **Inorganics Screen** – Cyanide (Total) and Water-Soluble Sulphate; and
- **Others** – Asbestos, pH and Total Organic Carbon (TOC).

A further one (1no.) sample was taken from plot 7 and was submitted for the same standard suite of contaminants.

The laboratory reports are included in Appendix 2.

6 ASSESSMENT OF THE RESULTS

The soil quality has been assessed against the remediation criteria (Soil Assessment Criteria, SAC) for a residential garden with homegrown produce (RwHP) presented at Appendix 3.

No chemical determinands exceeded the assessment criteria in the samples obtained, and no asbestos fibres were detected.

Additionally, no exceedance of the screening criteria for plants was identified.



7 CONCLUSIONS

Soils at Plot 7 were inspected by GEMCO in October and November 2023. A sample of the imported topsoil was provided by the supplier. A further sample was obtained for validation testing purposes for Plot 7.

Based on the inspection observations and chemical analysis of the samples obtained, the topsoil is not considered to present a significant risk to human health or plants, and the soil depths were in accordance with the RMS (R.4).

Therefore, on the basis of the site inspections and chemical analysis results received, it is considered that the soils in the garden of Plots 7 are suitable for the residential end-use.

We advise that a copy of this letter and the results are provided to the Local Authority and Building Warranty provider in support of discharge of relevant land quality conditions.

If you have any queries, please do not hesitate to contact us.

Yours sincerely,
On behalf of Green Earth Management Company Limited

S. C. Stanley

Stuart Stanley
Environmental Consultant

- Enc. Figure 1: Site Location Plan
 Figure 2: Proposed Development Layout Plan
 Figure 3: Validation Inspection Plan
 Appendix 1: Site Photographs
 Appendix 2: Chemical Laboratory Results
 Appendix 3: Generic Assessment Criteria

8 REFERENCES

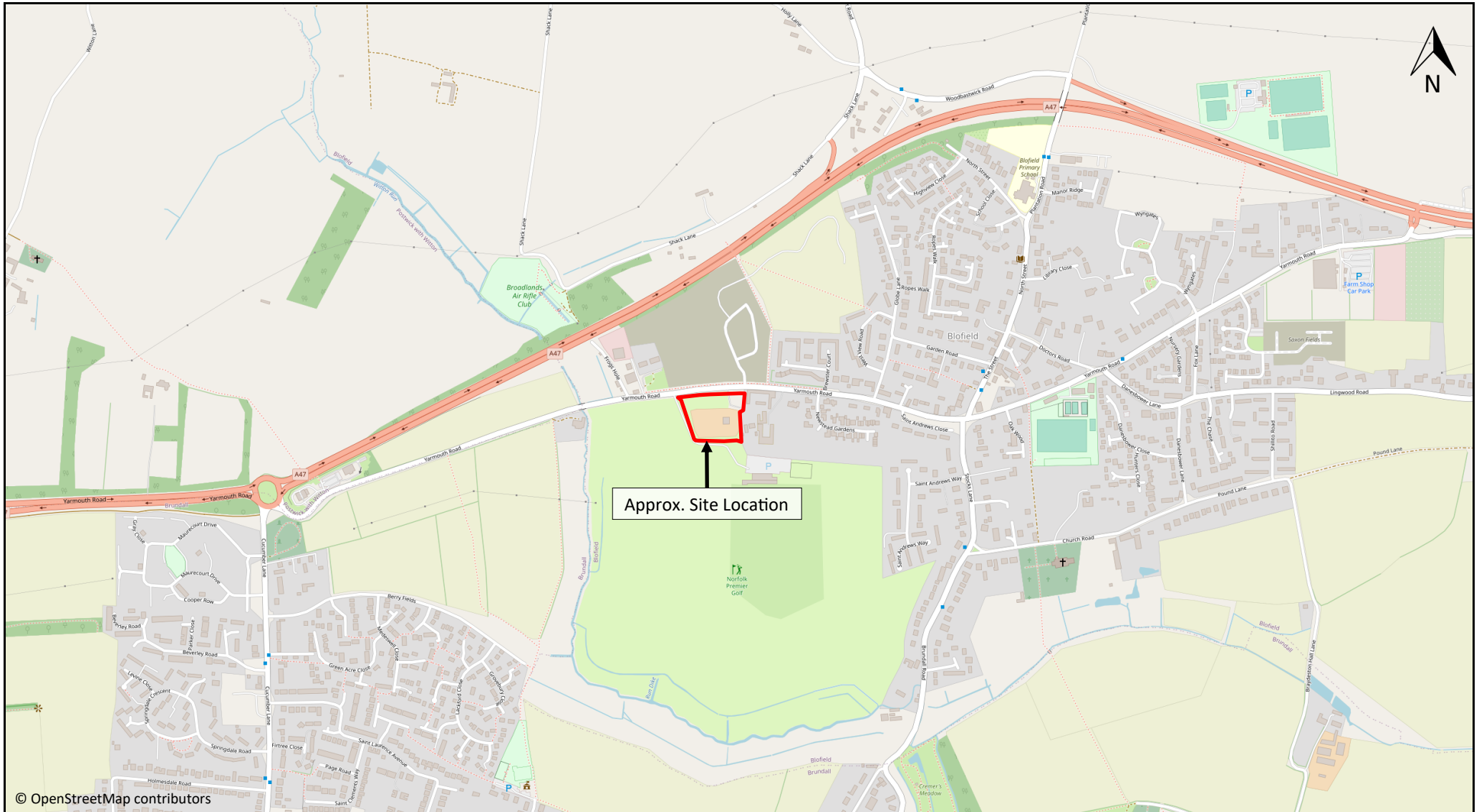
- R.1. Canham Consulting Limited, Contaminated Land Assessment, Manor Farm, Blofield, 204435 Rev 1, Feb 2015;
- R.2. A F Howland Associates Limited, A Phase II Contamination Assessment for Submission in Support of Planning Permission Referenced 20150262 For A Proposed Residential Development at Manor Farm, Yarmouth Road, Blofield, NR13 4JS, Ref. BJH/17.480/Phase2, January 2018;
- R.3. Green Earth Management Company (GEMCO) Limited, Phase II Geotechnical Assessment, The Former Piggeries, Yarmouth Road, Blofield, Norfolk NR13 4JS, Ref 1935 R01: Issue 2, April 2022;
- R.4. A F Howland Associates Limited, A Remediation Method Statement and Verification Plan Prepared in Support of a Proposed Residential Development at Manor Farm, Yarmouth Road, Blofield, NR13 4JS, Ref. BJH/17.480/RMS, May 2018;
- R.5. Green Earth Management Company (GEMCO) Limited, Interim Validation Report, The Former Piggeries, Yarmouth Road, Blofield, Norfolk NR13 4JS, Ref 1935 R02: Issue 1, January 2023;
- R.6. Environmental Protection Act 1990: Part IIA, Contaminated Land Statutory Guidance, April 2012;
- R.7. British Standard BS3882: 2015, Specification for Topsoil.



Figure 1


Site Location Plan





© OpenStreetMap contributors

Site:	The Former Piggeries	Date:	Nov 2023
Address:	Yarmouth Road, Blofield, Norfolk	Scale:	Not to Scale
Post Code:	NR13 4DT	Drawing:	Figure 1
Grid Ref:	632811, 309473	Drawn by:	CU
Title:	Site Location Plan	Checked by:	DR
Client:	Hatch Homes Limited	Project No:	1935 R04 Issue 1

Legend:
 Approx. Site Boundary



Green Earth Management Co Ltd
 Broomfield Park
 Coggeshall Road
 Essex CO6 2JX
 Tel: 01245 206129
 www.gemcoltd.co.uk



Figure 2

Proposed Development Layout Plan







Site: The Former Piggeries	Date: Nov 2023	Legend:  Approx. Site Boundary	 REMEDIATION SPECIALISTS GEMCO Green Earth Management Co Ltd Broomfield Park Coggeshall Road Essex CO6 2JX Tel: 01245 206129 www.gemcoltd.co.uk
Address: Yarmouth Road, Blofield, Norfolk	Scale: Not to Scale		
Post Code: NR13 4DT	Drawing: Figure 2		
Grid Ref: 632811, 309473	Drawn by: CU		
Title: Proposed Development Plan	Checked by: DR		
Client: Hatch Homes Limited	Project No: 1935 R04 Issue 1		



Figure 3

Validation Inspection Plan





Site:	The Former Piggeries	Date:	Nov 2023
Address:	Yarmouth Road, Blofield, Norfolk	Scale:	Not to Scale
Post Code:	NR13 4DT	Drawing:	Figure 3
Grid Ref:	632811, 309473	Drawn by:	CU
Title:	Validation Plan	Checked by:	DR
Client:	Hatch Homes Limited	Project No:	1935 R04 Issue 1

Legend:
Approx. Site Boundary
Plot(s) validated during visit
Validation inspection

 REMEDIATION SPECIALISTS
 Green Earth Management Co Ltd
 Broomfield Park
 Coggeshall Road
 Essex CO6 2JX
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Appendix 1

Site Photographs



Picture 01



Picture 02



Picture 03



Picture 04



Picture 05



Picture 06



Legend

Pic 01: Plot 7 validation Pit (1).

Pic 02: Plot 7 validation pit (1) and arisings.

Pic 03: Plot 7 validation pit (2).

Pic 04: Plot 7 validation pit (3) and arisings.

Pic 05: Plot 7.

Pic 06: Plot 7.

Site:
The Former Piggeries, Blofield

Title:
Appendix 1 - Site Photographs

Client:
Hatch Homes (Blofield) Ltd

Date: Nov 2023

Project No: 1935 R04

Issue: Issue 1

Page No: 1 of 1

Drawn by: SCS

Checked by: DR



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Coggeshall Road,
Earls Colne,
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Appendix 2

Chemical Laboratory Results





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Green Earth Management Co Ltd
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Earls Colne
Essex
CO6 2JX

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 23-13788

Site Reference: Blofield
Project / Job Ref: 1935
Order No: 1935 231106
Sample Receipt Date: 07/11/2023
Sample Scheduled Date: 07/11/2023
Report Issue Number: 1
Reporting Date: 09/11/2023

Authorised by:

Steve Knight
Customer Support Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 23-13788	Date Sampled	06/11/23				
Green Earth Management Co Ltd	Time Sampled	None Supplied				
Site Reference: Blofield	TP / BH No	IMP TS 001				
Project / Job Ref: 1935	Additional Refs	E1				
Order No: 1935 231106	Depth (m)	None Supplied				
Reporting Date: 09/11/2023	DETS Sample No	684280				

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected			
pH	pH Units	N/a	MCERTS	7.9			
Total Cyanide	mg/kg	< 1	NONE	< 1			
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	288			
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.03			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	15			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02			
Sulphide	mg/kg	< 5	NONE	< 5			
Organic Matter (SOM)	%	< 0.1	MCERTS	2.4			
TOC (Total Organic Carbon)	%	< 0.1	MCERTS	1.4			
Arsenic (As)	mg/kg	< 2	MCERTS	7			
Barium (Ba)	mg/kg	< 2.5	MCERTS	25			
Beryllium (Be)	mg/kg	< 0.5	MCERTS	< 0.5			
W/S Boron	mg/kg	< 1	NONE	< 1			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	6			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	12			
Lead (Pb)	mg/kg	< 3	MCERTS	53			
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	6			
Selenium (Se)	mg/kg	< 2	MCERTS	< 2			
Vanadium (V)	mg/kg	< 1	MCERTS	14			
Zinc (Zn)	mg/kg	< 3	MCERTS	32			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 23-13788	Date Sampled	06/11/23				
Green Earth Management Co Ltd	Time Sampled	None Supplied				
Site Reference: Blofield	TP / BH No	IMP TS 001				
Project / Job Ref: 1935	Additional Refs	E1				
Order No: 1935 231106	Depth (m)	None Supplied				
Reporting Date: 09/11/2023	DETS Sample No	684280				

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	0.20			
Pyrene	mg/kg	< 0.1	MCERTS	0.19			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.12			
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.12			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6			



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Tel : 01622 850410



Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 23-13788	Date Sampled	06/11/23				
Green Earth Management Co Ltd	Time Sampled	None Supplied				
Site Reference: Blofield	TP / BH No	IMP TS 001				
Project / Job Ref: 1935	Additional Refs	E1				
Order No: 1935 231106	Depth (m)	None Supplied				
Reporting Date: 09/11/2023	DETS Sample No	684280				

Determinand	Unit	RL	Accreditation				
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01			
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10			
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21			
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01			
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2			
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3			
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10			
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21			
Total >C5 - C35	mg/kg	< 42	NONE	< 42			



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 Lenham Heath
 Maidstone
 Kent ME17 2JN
 Tel : 01622 850410



Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 23-13788	Date Sampled	06/11/23				
Green Earth Management Co Ltd	Time Sampled	None Supplied				
Site Reference: Blofield	TP / BH No	IMP TS 001				
Project / Job Ref: 1935	Additional Refs	E1				
Order No: 1935 231106	Depth (m)	None Supplied				
Reporting Date: 09/11/2023	DETS Sample No	684280				

Determinand	Unit	RL	Accreditation				
Benzene	ug/kg	< 2	MCERTS	< 2			
Toluene	ug/kg	< 5	MCERTS	< 5			
Ethylbenzene	ug/kg	< 2	MCERTS	< 2			
p & m-xylene	ug/kg	< 2	MCERTS	< 2			
o-xylene	ug/kg	< 2	MCERTS	< 2			
MTBE	ug/kg	< 5	MCERTS	< 5			



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Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 23-13788	
Green Earth Management Co Ltd	
Site Reference: Blofield	
Project / Job Ref: 1935	
Order No: 1935 231106	
Reporting Date: 09/11/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
684280	IMP TS 001	E1	None Supplied	11.2	Brown clayey sand

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

& samples received in inappropriate containers for hydrocarbon analysis



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Soil Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No: 23-13788	
Green Earth Management Co Ltd	
Site Reference: Blofield	
Project / Job Ref: 1935	
Order No: 1935 231106	
Reporting Date: 09/11/2023	

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



Chantal Cousins
Ground Technology Services
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NR17 1ZA

Derwentside Environmental Testing Services Ltd
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t: 01622 850410

DETS Report No: 23-03392

Site Reference: Cringleford New Primary
Project / Job Ref: AS0056
Order No: M-AS0056/000006
Sample Receipt Date: 13/03/2023
Sample Scheduled Date: 13/03/2023
Report Issue Number: 1
Reporting Date: 21/03/2023

Authorised by:

Kevin Old
Operations Director

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

For Topsoil and WAC analysis the expanded uncertainty measurement should be considered while evaluating results against compliance values.



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Soil Analysis Certificate			
DETS Report No: 23-03392	Date Sampled	09/03/23	
Ground Technology Services	Time Sampled	None Supplied	
Site Reference: Cringleford New Primary	TP / BH No	GT0407	
Project / Job Ref: AS0056	Additional Refs	1	
Order No: M-AS0056/000006	Depth (m)	0.00	
Reporting Date: 21/03/2023	DETS Sample No	640143	

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	8.0			
Total Cyanide	mg/kg	< 1	NONE	< 1			
Organic Matter (SOM)	%	< 0.1	MCERTS	1.7			
Antimony (Sb)	mg/kg	< 1	NONE	< 1			
Arsenic (As)	mg/kg	< 2	MCERTS	5			
W/S Boron	mg/kg	< 1	NONE	< 1			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	5			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	7			
Lead (Pb)	mg/kg	< 3	MCERTS	34			
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1			
Molybdenum (Mo)	mg/kg	< 1	MCERTS	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	5			
Selenium (Se)	mg/kg	< 2	MCERTS	< 2			
Zinc (Zn)	mg/kg	< 3	MCERTS	22			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2			
Tentative Petroleum Type : EH 1D	N/a	N/a	NONE	N/a			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs					
DETS Report No: 23-03392	Date Sampled	09/03/23			
Ground Technology Services	Time Sampled	None Supplied			
Site Reference: Cringleford New Primary	TP / BH No	GT0407			
Project / Job Ref: AS0056	Additional Refs	1			
Order No: M-AS0056/000006	Depth (m)	0.00			
Reporting Date: 21/03/2023	DETS Sample No	640143			

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6			



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 23-03392	Date Sampled	09/03/23			
Ground Technology Services	Time Sampled	None Supplied			
Site Reference: Cringleford New Primary	TP / BH No	GT0407			
Project / Job Ref: AS0056	Additional Refs	1			
Order No: M-AS0056/000006	Depth (m)	0.00			
Reporting Date: 21/03/2023	DETS Sample No	640143			

Determinand	Unit	RL	Accreditation				
Aliphatic >C5 - C6 : HS_1D_MS_AL	mg/kg	< 0.01	NONE	< 0.01			
Aliphatic >C6 - C8 : HS_1D_MS_AL	mg/kg	< 0.05	NONE	< 0.05			
Aliphatic >C8 - C10 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C10 - C12 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C12 - C16 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C16 - C21 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C21 - C34 : EH_CU_1D_AL	mg/kg	< 10	MCERTS	< 10			
Aliphatic (C5 - C34) : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 21	NONE	< 21			
Aromatic >C5 - C7 : HS_1D_MS_AR	mg/kg	< 0.01	NONE	< 0.01			
Aromatic >C7 - C8 : HS_1D_MS_AR	mg/kg	< 0.05	NONE	< 0.05			
Aromatic >C8 - C10 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2			
Aromatic >C10 - C12 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2			
Aromatic >C12 - C16 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2			
Aromatic >C16 - C21 : EH_CU_1D_AR	mg/kg	< 3	MCERTS	< 3			
Aromatic >C21 - C35 : EH_CU_1D_AR	mg/kg	< 10	MCERTS	< 10			
Aromatic (C5 - C35) : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 21	NONE	< 21			
Total >C5 - C35 : HS_1D_MS+EH_CU_1D_Tot al	mg/kg	< 42	NONE	< 42			



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 23-03392		Date Sampled	09/03/23			
Ground Technology Services		Time Sampled	None Supplied			
Site Reference: Cringleford New Primary		TP / BH No	GT0407			
Project / Job Ref: AS0056		Additional Refs	1			
Order No: M-AS0056/000006		Depth (m)	0.00			
Reporting Date: 21/03/2023		DETS Sample No	640143			

Determinand	Unit	RL	Accreditation				
Benzene : HS 1D MS	ug/kg	< 2	MCERTS	< 2			
Toluene : HS 1D MS	ug/kg	< 5	MCERTS	< 5			
Ethylbenzene : HS 1D MS	ug/kg	< 2	MCERTS	< 2			
p & m-xylene : HS 1D MS	ug/kg	< 2	MCERTS	< 2			
o-xylene : HS 1D MS	ug/kg	< 2	MCERTS	< 2			
MTBE : HS 1D MS	ug/kg	< 5	MCERTS	< 5			



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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3																																							
DETS Report No: 23-03392		Date Sampled	09/03/23		<table border="1"> <thead> <tr> <th colspan="3">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th>Inert Waste Landfill</th> <th>Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th>Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td>3%</td> <td>5%</td> <td>6%</td> </tr> <tr> <td>--</td> <td>--</td> <td>10%</td> </tr> <tr> <td>6</td> <td>--</td> <td>--</td> </tr> <tr> <td>1</td> <td>--</td> <td>--</td> </tr> <tr> <td>500</td> <td>--</td> <td>--</td> </tr> <tr> <td>100</td> <td>--</td> <td>--</td> </tr> <tr> <td>--</td> <td>>6</td> <td>--</td> </tr> <tr> <td>--</td> <td>To be evaluated</td> <td>To be evaluated</td> </tr> </tbody> </table>					Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																					
3%	5%	6%																																					
--	--	10%																																					
6	--	--																																					
1	--	--																																					
500	--	--																																					
100	--	--																																					
--	>6	--																																					
--	To be evaluated	To be evaluated																																					
Ground Technology Services		Time Sampled	None Supplied																																				
Site Reference: Cringleford New Primary		TP / BH No	GT0407																																				
Project / Job Ref: AS0056		Additional Refs	1																																				
Order No: M-AS0056/000006		Depth (m)	0.00																																				
Reporting Date: 21/03/2023		DETS Sample No	640143																																				
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	1																																				
Loss on Ignition ^{MU}	%	< 0.01	1.79																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	< 10																																				
Total PAH ^{MU}	mg/kg	< 1.7	< 1.7																																				
pH ^{MU}	pH Units	N/a	8.0																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																				
Eluate Analysis			2:1 mg/l	8:1 mg/l	Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																	
Arsenic ^U		< 0.01	< 0.01		< 0.2	0.5	2	25																															
Barium ^U		< 0.02	< 0.02		< 0.1	20	100	300																															
Cadmium ^U		< 0.0005	< 0.0005		< 0.02	0.04	1	5																															
Chromium ^U		< 0.005	< 0.005		< 0.20	0.5	10	70																															
Copper ^U		< 0.01	< 0.01		< 0.5	2	50	100																															
Mercury ^U		< 0.0005	< 0.0005		< 0.005	0.01	0.2	2																															
Molybdenum ^U		0.001	< 0.001		< 0.1	0.5	10	30																															
Nickel ^U		< 0.007	< 0.007		< 0.2	0.4	10	40																															
Lead ^U		< 0.005	< 0.005		< 0.2	0.5	10	50																															
Antimony ^U		< 0.005	< 0.005		< 0.05	0.06	0.7	5																															
Selenium ^U		< 0.005	< 0.005		< 0.05	0.1	0.5	7																															
Zinc ^U		0.008	< 0.005		< 0.2	4	50	200																															
Chloride ^U		1	1		14	800	15000	25000																															
Fluoride ^U		< 0.5	< 0.5		< 1	10	150	500																															
Sulphate ^U		2	2		< 20	1000	20000	50000																															
TDS		71	57		588	4000	60000	100000																															
Phenol Index		< 0.01	0.01		< 0.5	1	-	-																															
DOC		11.4	13.2			500	800	1000																															
Leach Test Information																																							
Sample Mass (kg)		0.19																																					
Dry Matter (%)		93.9																																					
Moisture (%)		6.6																																					
Stage 1																																							
Volume Eluate L2 (litres)		0.34																																					
Filtered Eluate VE1 (litres)		0.22																																					
Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion																																							
Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation																																							
M Denotes MCERTS accredited test																																							
U Denotes ISO17025 accredited test																																							



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 23-03392	
Ground Technology Services	
Site Reference: Cringleford New Primary	
Project / Job Ref: AS0056	
Order No: M-AS0056/000006	
Reporting Date: 21/03/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
640143	GT0407	1	0.00	6.1	Brown sandy clay with stones

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{4/5}

Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 23-03392

Ground Technology Services

Site Reference: Cringleford New Primary

Project / Job Ref: AS0056

Order No: M-AS0056/000006

Reporting Date: 21/03/2023

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphénylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCS	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Water Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 23-03392
Ground Technology Services
Site Reference: Cringleford New Primary
Project / Job Ref: AS0056
Order No: M-AS0056/000006
Reporting Date: 21/03/2023

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR dete	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered



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List of HWOL Acronyms and Operators
DETS Report No: 23-03392
Ground Technology Services
Site Reference: Cringleford New Primary
Project / Job Ref: AS0056
Order No: M-AS0056/000006
Reporting Date: 21/03/2023

Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det - Acronym
Benzene - HS_1D_MS
Ethylbenzene - HS_1D_MS
MTBE - HS_1D_MS
Mineral Oil (C10 - C40) (BS EN 12457-3) - EH_CU_1D_AL
TPH CWG - Aliphatic >C10 - C12 - EH_CU_1D_AL
TPH CWG - Aliphatic >C12 - C16 - EH_CU_1D_AL
TPH CWG - Aliphatic >C16 - C21 - EH_CU_1D_AL
TPH CWG - Aliphatic >C21 - C34 - EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C6 - HS_1D_MS_AL
TPH CWG - Aliphatic >C6 - C8 - HS_1D_MS_AL
TPH CWG - Aliphatic >C8 - C10 - EH_CU_1D_AL
TPH CWG - Aliphatic C5 - C34 - HS_1D_MS+EH_CU_1D_AL
TPH CWG - Aromatic >C10 - C12 - EH_CU_1D_AR
TPH CWG - Aromatic >C12 - C16 - EH_CU_1D_AR
TPH CWG - Aromatic >C16 - C21 - EH_CU_1D_AR
TPH CWG - Aromatic >C21 - C35 - EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C35 - HS_1D_MS+EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C7 - HS_1D_MS_AR
TPH CWG - Aromatic >C7 - C8 - HS_1D_MS_AR
TPH CWG - Aromatic >C8 - C10 - EH_CU_1D_AR
TPH CWG - Total >C5 - C35 - HS_1D_MS+EH_CU_1D_Total
Tentative Petroleum Type - EH_1D
Toluene - HS_1D_MS
Total BTEX (BS EN 12457-3) - HS_1D_MS_Total
m & p-xylene - HS_1D_MS
o-Xylene - HS_1D_MS

Parameter	Matrix Type	Suite Reference	Expanded Uncertainty Measurement	Unit
TOC	Soil	BS EN 12457	10.4	%
Loss on Ignition	Soil	BS EN 12457	16.9	%
BTEX	Soil	BS EN 12457	14.0	%
Sum of PCBs	Soil	BS EN 12457	21.1	%
Mineral Oil	Soil	BS EN 12457	9.0	%
Total PAH	Soil	BS EN 12457	17.9	%
pH	Soil	BS EN 12457	0.282	Units
Acid Neutralisation Capacity	Soil	BS EN 12457	18.0	%
Arsenic	Leachate	BS EN 12457	19.5	%
Barium	Leachate	BS EN 12457	12.2	%
Cadmium	Leachate	BS EN 12457	17.2	%
Chromium	Leachate	BS EN 12457	20.7	%
Copper	Leachate	BS EN 12457	14.1	%
Mercury	Leachate	BS EN 12457	16.7	%
Molybdenum	Leachate	BS EN 12457	13.3	%
Nickel	Leachate	BS EN 12457	14.0	%
Lead	Leachate	BS EN 12457	12.1	%
Antimony	Leachate	BS EN 12457	16.1	%
Selenium	Leachate	BS EN 12457	15.5	%
Zinc	Leachate	BS EN 12457	14.0	%
Chloride	Leachate	BS EN 12457	15.7	%
Fluoride	Leachate	BS EN 12457	19.1	%
Sulphate	Leachate	BS EN 12457	27.6	%
TDS	Leachate	BS EN 12457	10.0	%
Phenol Index	Leachate	BS EN 12457	12.9	%
DOC	Leachate	BS EN 12457	20.4	%
Clay Content	Soil	BS 3882: 2015	15.0	%
Silt Content	Soil	BS 3882: 2015	14.0	%
Sand Content	Soil	BS 3882: 2015	13.0	%
Loss on Ignition	Soil	BS 3882: 2015	16.9	%
pH	Soil	BS 3882: 2015	0.282	Units
Carbonate	Soil	BS 3882: 2015	12.0	%
Total Nitrogen	Soil	BS 3882: 2015	12.0	%
Phosphorus (Extractable)	Soil	BS 3882: 2015	24.0	%
Potassium (Extractable)	Soil	BS 3882: 2015	20.0	%
Magnesium (Extractable)	Soil	BS 3882: 2015	26.0	%
Zinc	Soil	BS 3882: 2015	19.8	%
Copper	Soil	BS 3882: 2015	23.2	%
Nickel	Soil	BS 3882: 2015	32.6	%
Available Sodium	Soil	BS 3882: 2015	23.0	%
Available Calcium	Soil	BS 3882: 2015	23.0	%
Electrical Conductivity	Soil	BS 3882: 2015	10.0	%



Appendix 3

Soil Assessment Criteria





Generic Assessment Criteria for the Assessment of Risk to Human Health				
Determinand	RwHP ¹ (mg/kg)	RwoHP ¹ (mg/kg)	POS _{resi} ¹ (mg/kg)	Source
Asbestos	ND	ND	ND	
Metals and Metalloids				
Arsenic	37	40	79	LQM / CIEH (2015) S4UL ²
Barium	-	1300	-	CL:AIRE (2010) ³
Beryllium	1.7	1.7	2.2	LQM / CIEH (2015) S4UL ²
Boron	290	11000	21000	LQM / CIEH (2015) S4UL ²
Cadmium	11	85	120	LQM / CIEH (2015) S4UL ²
Chromium (III)	910	910	1500	LQM / CIEH (2015) S4UL ²
Chromium (VI)	6	6	7.7	LQM / CIEH (2015) S4UL ²
Copper	2400	7100	12000	LQM / CIEH (2015) S4UL ²
Lead	200	310	630	Defra (2014) C4SL ⁴
Mercury - Elemental	1.2	1.2	16	LQM / CIEH (2015) S4UL ²
Mercury - Inorganic	40	56	120	LQM / CIEH (2015) S4UL ²
Mercury - Methyl	11	15	40	LQM / CIEH (2015) S4UL ²
Nickel	130	180	230	LQM / CIEH (2015) S4UL ⁵
Selenium	250	430	1100	LQM / CIEH (2015) S4UL ²
Vanadium	410	1200	2000	LQM / CIEH (2015) S4UL ²
Zinc	3700	40000	81000	LQM / CIEH (2015) S4UL ²
Polyaromatic Hydrocarbons (USEPA 16) – At 1% Soil Organic Matter				
Naphthalene	2.3	2.3	4900	LQM / CIEH (2015) S4UL ²
Acenaphthylene	170	2900 (86.1) ^{sol}	15000	LQM / CIEH (2015) S4UL ²
Acenaphthene	210	3000 (57.0) ^{sol}	15000	LQM / CIEH (2015) S4UL ²
Fluorene	170	2800 (30.9) ^{sol}	9900	LQM / CIEH (2015) S4UL ²
Phenanthrene	95	1300 (36.0) ^{sol}	3100	LQM / CIEH (2015) S4UL ²

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Generic Assessment Criteria for the Assessment of Risk to Human Health				
Determinand	RwHP ¹ (mg/kg)	RwoHP ¹ (mg/kg)	POS _{resi} ¹ (mg/kg)	Source
Anthracene	2400		74000	LQM / CIEH (2015) S4UL ²
Fluoranthene	280	1500	3100	LQM / CIEH (2015) S4UL ²
Pyrene	620	3700	7400	LQM / CIEH (2015) S4UL ²
Benzo(a)anthracene	7.2	11	29	LQM / CIEH (2015) S4UL ²
Chrysene	15	30	57	LQM / CIEH (2015) S4UL ²
Benzo(b)fluoranthene	2.6	3.9	7.1	LQM / CIEH (2015) S4UL ²
Benzo(k)fluoranthene	77	110	190	LQM / CIEH (2015) S4UL ²
Benzo(a)pyrene	2.2	3.2	5.7	LQM / CIEH (2015) S4UL ²
Indeno(1,2,3-cd)pyrene	27	45	82	LQM / CIEH (2015) S4UL ²
Di-benzo(a,h)anthracene	0.24	0.31	0.57	LQM / CIEH (2015) S4UL ²
Benzo(ghi)perylene	320	360	640	LQM / CIEH (2015) S4UL ²
Coal Tar (BaP surrogate marker)	0.79	1.2	2.2	LQM / CIEH (2015) S4UL ²
Total Petroleum Hydrocarbons (LQM Banding) – At 1% Soil Organic Matter				
Aliphatic EC5 - EC6	42	42	570000 (304) ^{sol}	LQM / CIEH (2015) S4UL ²
Aliphatic >EC6 - EC8	100	100	600000	LQM / CIEH (2015) S4UL ²
Aliphatic >EC8 - EC10	27	27	13000	LQM / CIEH (2015) S4UL ²
Aliphatic >EC10 - EC12	130 (48) ^{vap}	130 (48) ^{vap}	13000	LQM / CIEH (2015) S4UL ²
Aliphatic >EC12 - EC16	1100 (24) ^{sol}	1100 (24) ^{sol}	13000	LQM / CIEH (2015) S4UL ²
Aliphatic >EC16 - EC35	65000 (8.48) ^{sol}	65000 (8.48) ^{sol}	250000	LQM / CIEH (2015) S4UL ²
Aliphatic >EC35 - EC44	65000 (8.48) ^{sol}	65000 (8.48) ^{sol}	250000	LQM / CIEH (2015) S4UL ²
Aromatic >EC5 - EC7	70	370	56000	LQM / CIEH (2015) S4UL ²
Aromatic >EC7 - EC8	130	860	56000	LQM / CIEH (2015) S4UL ²
Aromatic >EC8 - EC10	34	47	5000	LQM / CIEH (2015) S4UL ²
Aromatic >EC10 - EC12	74	250	5000	LQM / CIEH (2015) S4UL ²

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Generic Assessment Criteria for the Assessment of Risk to Human Health				
Determinand	RwHP ¹ (mg/kg)	RwoHP ¹ (mg/kg)	POS _{resi} ¹ (mg/kg)	Source
Aromatic >EC12 - EC16	140	1800	5100	LQM / CIEH (2015) S4UL ²
Aromatic >EC16 - EC21	260	1900	3800	LQM / CIEH (2015) S4UL ²
Aromatic >EC21 - EC35	1100	1900	3800	LQM / CIEH (2015) S4UL ²
Aromatic >EC35 - EC44	1100	1900	3800	LQM / CIEH (2015) S4UL ²
Ali + Aro >EC44 - EC70	1600	1900	3800	LQM / CIEH (2015) S4UL ²
BTEX + MTBE – At 1% Soil Organic Matter				
Benzene	0.087	0.38	72	LQM / CIEH (2015) S4UL ²
Toluene	130	880 (869) ^{vap}	56000	LQM / CIEH (2015) S4UL ²
Ethylbenzene	47	83	24000	LQM / CIEH (2015) S4UL ²
o-Xylene	60	88	41000	LQM / CIEH (2015) S4UL ²
m-xylene	59	82	41000	LQM / CIEH (2015) S4UL ²
p-xylene	56	79	41000	LQM / CIEH (2015) S4UL ²
MTBE (Methyl tert-butyl ether)	49	73		CL:AIRE (2010) ³
Phenol – At 1% Soil Organic Matter				
Phenol	120	440 ^{dir} (460)	440 ^{dir} (10000)	LQM / CIEH (2015) S4UL ²
<p>Notes:</p> <p>^{sol} GAC exceed the solubility saturation limit which is presented in brackets; consideration of the CSM may be required</p> <p>^{vap} GAC exceed the vapour saturation limit which is presented in brackets; consideration of the CSM may be required</p> <p>^{sat} GAC exceed a soil saturation limit (not specified) which is presented in brackets; consideration of the CSM may be required</p> <p>^{dir} GAC is based on tolerable direct contact concentration; long term health protection value presented in brackets</p> <p>(1) RwHP = Residential land use including significant production and consumption of home-grown produce; RwoHP = Residential land use without significant production and consumption of home-grown produce; POS_{resi} = Public open space in close proximity to residential properties</p> <p>(2) Nathaniel, C.P. <i>et al.</i> (2015), The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Note that the LQM / CIEH S4ULs update and replace the former LQM / CIEH GAC on the basis of new toxicological and refined modelling data. The S4ULs also cover the Environment Agency SGV substances with the inclusion of updated toxicological and modelling data.</p> <p>(3) CL:AIRE, 'Soil Generic Assessment Criteria for Human Health Risk Assessment', 2010.</p> <p>(4) Defra (2014), 'SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Policy Document Companion Document', Defra, December 2014; CL:AIRE Report 'SP1010 - Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, Rev 2, September 2014; Defra erratum note, Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - SP1010, Erratum (December 2014).</p> <p>(5) Nathaniel, C.P. <i>et al.</i> (2015), The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Nickel update (August 2015).</p>				



Initial Screening Criteria for Risk to Planting

Certain chemicals may have a detrimental effect on plant growth (they are phytotoxic) and should be considered within the context of the end use and location of any areas of landscaping. For the purposes of determining the risk to future planting reference has been made to British Standard BS 3882:2007, Specification for topsoil and requirements for use. The initial screening criteria adopted are presented in the Table below.

Phytotoxic Contaminants (by Soil pH) ¹			
Contaminant (mg/kg dry soil)	Soil pH		
	5.5 – 6.0	6.0 – 7.0	> 7.0
Zinc (nitric acid extractable)	< 200	< 200	< 300
Copper (nitric acid extractable)	< 100	< 135	< 200
Nickel (nitric acid extractable)	< 60	< 75	< 110

Notes: (1) British Standard BS 3882:2015, Specification for Topsoil and requirements for use, 2015