



Our Ref: 1935 R14 240321 GVL R Plot 13 Issue1

21st March 2024

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 Piggeries, Yarmouth Road, Blofield – Plot 13.

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 (shown at Figure 1), centred upon the British National Grid (BNG) Reference (TG) 632811, 309473.

The Client is redeveloping the Site to a residential end-use (in accordance with Planning Application Ref: 20150262 issued by the LPA, 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 some 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 were undertaken by Remediate Ltd, 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 at Plot 13 in accordance with the RMS and recommendations of the Interim Validation Report. The plot location 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/mechanical screening 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.

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).

Completion of the Cover System commenced in June 2023. At this stage, the Cover System has been completed and validated in Plots 1, 2, 3, 4, 5, 6, 7, 8, 9, 10/11 and 12.

3 OUTSTANDING REMEDIATION WORKS

The remediation and validation will be completed upon issue of the letter report.

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:** ≥0.25m of suitable validated topsoil; and
- **Landscaping Areas** (POS/softstanding not in gardens): ≥0.25m 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 13th March 2024 to inspect Cover System soils used in the garden and Open Space/Landscaping at Plot 13, and obtain samples of the topsoil for laboratory analysis.

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

The topsoil was present from ground level to $\geq 0.25\text{m}$ bgl, and comprised dark brown sandy clayey topsoil with occasional fine to medium gravel of flint. The topsoil was sampled in-situ.

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

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

5 LABORATORY TESTING

The validation samples obtained were submitted to an MCERTS accredited laboratory for testing as soon as possible following recovery.

One (1no.) soil sample (obtained from the topsoil) was analysed for a standard suite of contaminants of concern in line with the requirements of the Remediation Method Statement (RMS), which is outlined below:

- **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).

The laboratory report is 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.

The sample, shown at Appendix 2, did not identify any chemical determinands exceeding the assessment criteria in the in-situ soils. Additionally, no asbestos was detected.

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



7 CONCLUSIONS

Soils in the garden and landscaping areas at Plot 13 were inspected and sampled for validation testing purposes by GEMCO in March 2024.

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 and landscaped areas of Plot 13 are suitable for a 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

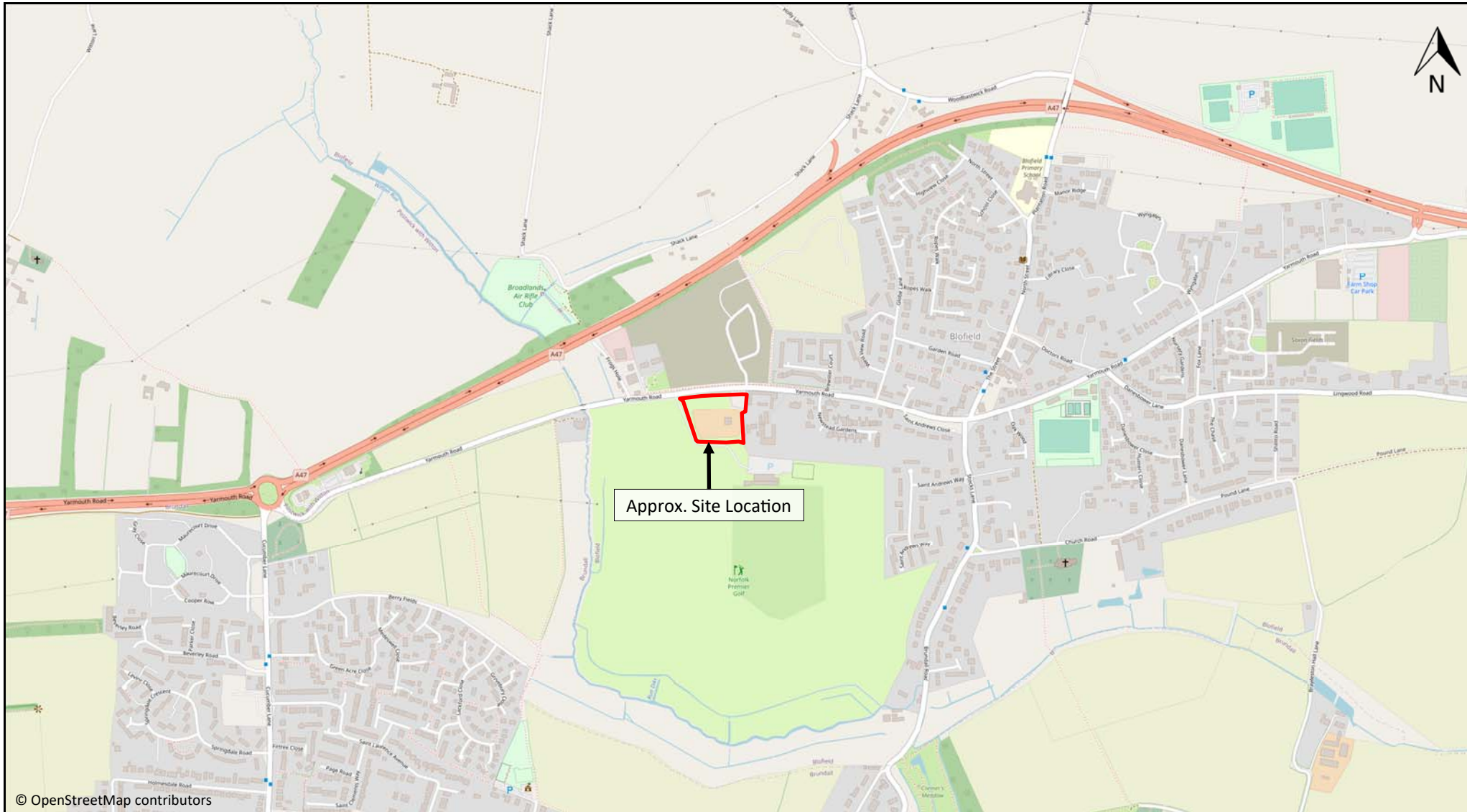
- R.1. Canham Consulting Limited, Contaminated Land Assessment, Manor Farm, Blofield, 204435 Rev 1, Feb 2015;
- R.2. A F Howland Associates Limited, A Phase II Contamination Assessment for Submission in Support of Planning Permission Referenced 20150262 For A Proposed Residential Development at Manor 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:	March 2024
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 R14 Issue 1

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



Figure 2

Proposed Development Layout Plan







Site: The Former Piggeries	Date: March 2024	Legend:  Approx. Site Boundary	 REMEDIATION SPECIALISTS 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 R14 Issue 1		








Figure 3

Validation Inspection Plan





Plan provided by client. drawing ref: 14/379 PL01 Rev J

Site: The Former Piggeries	Date: March 2024	Legend:  Approx. Site Boundary  Garden Plot(s) validated during visit  Landscaping/ Open Space (POS) validated  Validation inspection/sample location	 REMEDIATION SPECIALISTS 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 3		
Grid Ref: 632811, 309473	Drawn by: SCS		
Title: Validation Plan	Checked by: CU		
Client: Hatch Homes Limited	Project No: 1935 R14 Issue 1		



Appendix 1

Site Photographs



Picture 01



Picture 02



Picture 03



Picture 04



Picture 05



Picture 06



Legend

Pic 01: Plot 13 validation inspection pit.

Pic 02: Plot 13 validation inspection pit.

Pic 03: Plot 13 validation inspection pit.

Pic 04: Plot 13 validation inspection pit.

Pic 05: Plot 13 validation inspection pit.

Pic 06: Topsoil stockpile located on Plot 13 ready for spreading.

Site:
The Piggeries, Blofield

Title:
Appendix 1 - Site Photographs

Client:
Hatch Homes (Blofield) Ltd

Date: Mar 2024

Project No: 1935 R14

Issue: Issue 1

Page No: 1 of 1

Drawn by: SCS

Checked by: DR



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Coggeshall Road,
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Essex CO6 2JX
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Appendix 2

Chemical Laboratory Results





Diane Robson
Green Earth Management Co Ltd
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Coggeshall Road
Earls Colne
Essex
CO6 2JX

Normec DETS Limited
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-02734

Site Reference: Blofield
Project / Job Ref: 1935
Order No: 1935 240313
Sample Receipt Date: 15/03/2024
Sample Scheduled Date: 15/03/2024
Report Issue Number: 1
Reporting Date: 20/03/2024

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.



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



Soil Analysis Certificate					
DETS Report No: 24-02734	~Date Sampled	13/03/24			
Green Earth Management Co Ltd	~Time Sampled	None Supplied			
~Site Reference: Blofield	~TP / BH No	Plot 13 TS			
~Project / Job Ref: 1935	~Additional Refs	E1			
~Order No: 1935 240313	~Depth (m)	0.10			
Reporting Date: 20/03/2024	DETS Sample No	704525			

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected			
pH	pH Units	N/a	MCERTS	7.5			
Total Cyanide	mg/kg	< 1	NONE	< 1			
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	270			
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.03			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	20			
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			
TOC (Total Organic Carbon)	%	< 0.1	MCERTS	1.1			
Arsenic (As)	mg/kg	< 2	MCERTS	6			
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	7			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	11			
Lead (Pb)	mg/kg	< 3	MCERTS	41			
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	5			
Selenium (Se)	mg/kg	< 2	MCERTS	< 2			
Vanadium (V)	mg/kg	< 1	MCERTS	14			
Zinc (Zn)	mg/kg	< 3	MCERTS	37			
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)
 ~ Sample details provided by the customer



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 Lenham Heath
 Maidstone
 Kent ME17 2JN
 Tel : 01622 850410



Soil Analysis Certificate - Speciated PAHs

DETS Report No: 24-02734	~Date Sampled	13/03/24				
Green Earth Management Co Ltd	~Time Sampled	None Supplied				
~Site Reference: Blofield	~TP / BH No	Plot 13 TS				
~Project / Job Ref: 1935	~Additional Refs	E1				
~Order No: 1935 240313	~Depth (m)	0.10				
Reporting Date: 20/03/2024	DETS Sample No	704525				

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	0.16			
Pyrene	mg/kg	< 0.1	MCERTS	0.14			
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	0.13			
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			

~ Sample details provided by the customer



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



Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 24-02734	~Date Sampled	13/03/24			
Green Earth Management Co Ltd	~Time Sampled	None Supplied			
~Site Reference: Blofield	~TP / BH No	Plot 13 TS			
~Project / Job Ref: 1935	~Additional Refs	E1			
~Order No: 1935 240313	~Depth (m)	0.10			
Reporting Date: 20/03/2024	DETS Sample No	704525			

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			

~ Sample details provided by the customer



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 Kent ME17 2JN
 Tel : 01622 850410



Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 24-02734	~Date Sampled	13/03/24				
Green Earth Management Co Ltd	~Time Sampled	None Supplied				
~Site Reference: Blofield	~TP / BH No	Plot 13 TS				
~Project / Job Ref: 1935	~Additional Refs	E1				
~Order No: 1935 240313	~Depth (m)	0.10				
Reporting Date: 20/03/2024	DETS Sample No	704525				

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			

~ Sample details provided by the customer



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 Lenham Heath
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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-02734	
Green Earth Management Co Ltd	
~Site Reference: Blofield	
~Project / Job Ref: 1935	
~Order No: 1935 240313	
Reporting Date: 20/03/2024	

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
704525	Plot 13 TS	E1	0.10	12.4	Brown sandy clay with stones

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}

~ Sample details provided by the customer



Normec DETS Limited
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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No: 24-02734	
Green Earth Management Co Ltd	
~Site Reference: Blofield	
~Project / Job Ref: 1935	
~Order No: 1935 240313	
Reporting Date: 20/03/2024	

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
 ~ Sample details provided by the customer



Appendix 3

Soil Assessment Criteria





Generic Soil 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
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

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Generic Soil Assessment Criteria for the Assessment of Risk to Human Health				
Determinand	RwHP¹ (mg/kg)	RwoHP¹ (mg/kg)	POS_{resi}¹ (mg/kg)	Source
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
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

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Generic Soil 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
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 <i>tert</i> -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
Notes:				
^{sol} GAC exceed the solubility saturation limit which is presented in brackets; consideration of the CSM may be required ^{vap} GAC exceed the vapour saturation limit which is presented in brackets; consideration of the CSM may be required ^{sat} GAC exceed a soil saturation limit (not specified) which is presented in brackets; consideration of the CSM may be required ^{dir} GAC is based on tolerable direct contact concentration; long term health protection value presented in brackets (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 (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. (3) CL:AIRE, 'Soil Generic Assessment Criteria for Human Health Risk Assessment', 2010. (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). (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).				

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
British Standard BS 3882:2015, Specification for Topsoil and requirements for use, 2015			