Our Ref: 1935 R03 231103 GVLR Plot 6 Issue1

3rd 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 Piggeries, Yarmouth Road, Blofield – Plot 6.

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 6, 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/ 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.

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**: ≥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 9th October 2023 to inspect cover system soils used at Plot 6, and obtain samples of the topsoil for laboratory analysis.

The approximate location of inspections and sampling 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 validation samples obtained were submitted to an MCERTS accredited laboratory for testing as soon as possible following recovery.

Two (2no.) soil samples were analysed for asbestos and hydrocarbon contamination, and one (1no.) 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).

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 6 were inspected by GEMCO in September 2023. Samples of topsoil were obtained for validation testing purposes at Plot 6 during the visit.

Based on the inspection observations and chemical analysis of the samples obtained, the topsoil and subsoil are 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 6 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

C. Unsworth

Charles Unsworth
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;

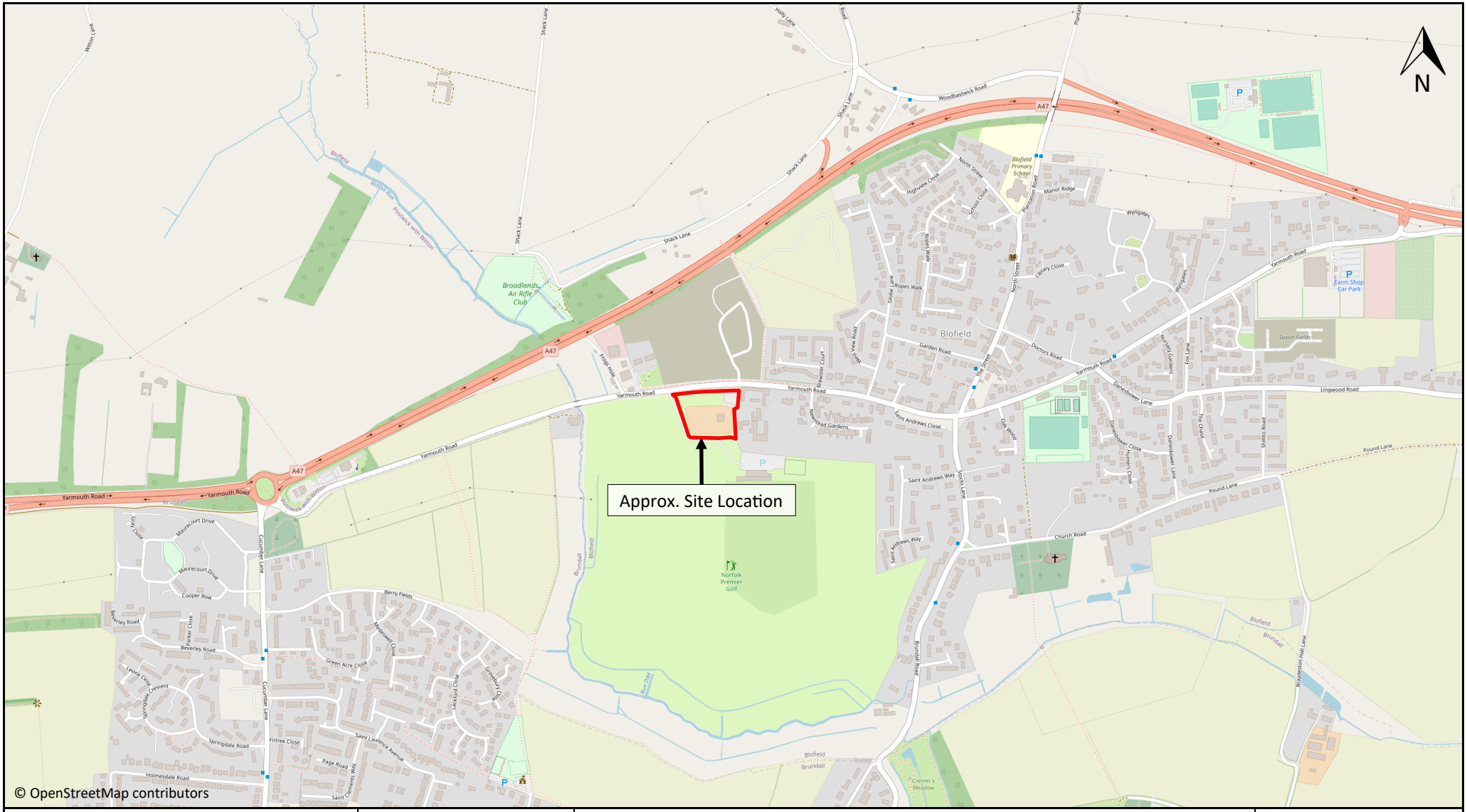
R.5. Green Earth Management Company (GEMCO) Limited, Interim Validation Report, The Former Piggeries, Yarmouth Road, Blofield, Norfolk NR13 4JS, Ref 1935 R02: Issue 1, January 2023;

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



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 R03 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

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

Site:	The Former Piggeries	**Date:**	Nov 2023
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 R03 Issue 1

Legend:

Approx. Site Boundary

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Figure 3

Validation Inspection Plan

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

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 R03 Issue 1

Legend:

- Approx. Site Boundary
- Plot(s) validated during visit
- Validation inspection/sample location

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Appendix 1

Site Photographs

Picture 01

Picture 02

Picture 03

Picture 04

Picture 05

Picture 06

Legend

Pic 01:	Plot 6 E1 validation inspection pit	**Site:**	**Date:**	Nov 2023	GEMCO
Pic 02:	Plot 6 E1 validation inspection arisings.	The Piggeries, Blofield	**Project No:**	1935 R03	
Pic 03:	Plot 6 E2 validation inspection pit	**Title:**	**Issue:**	Issue 1	Green Earth Management Company Ltd Suite 3, Broomfield Park, Coggeshall Road, Earls Colne, Essex CO6 2JX Tel: 01245 206 129 www.gemcoltd.co.uk
Pic 04:	Plot 6 E2 validation inspection arisings.	Appendix 1 - Site Photographs	**Page No:**	1 of 1	
Pic 05:	Plot 6 E3 validation inspection pit	**Client:**	**Drawn by:**	CU	
Pic 06:	Plot 6 E3 validation inspection arisings.	Hatch Homes (Blofield) Ltd	**Checked by:**	DR	

Appendix 2

Chemical Laboratory Results

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

DETS Report No: 23-12817

Site Reference:	Blofield
Project / Job Ref:	1935
Order No:	1935 231011
Sample Receipt Date:	16/10/2023
Sample Scheduled Date:	16/10/2023
Report Issue Number:	1
Reporting Date:	20/10/2023

Authorised by:

Dave Ashworth
Technical 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.

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Rose Lane
Lenham Heath
Maidstone
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Soil Analysis Certificate						
DETS Report No: 23-12817	**Date Sampled**	09/10/23	09/10/23	09/10/23		
Green Earth Management Co Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: Blofield	**TP / BH No**	Plot 6 TS	Plot 6 TS	Plot 6 TS		
Project / Job Ref: 1935	**Additional Refs**	E1	E2	E3		
Order No: 1935 231011	**Depth (m)**	0.00 - 0.20	0.00 - 0.20	0.00 - 0.20		
Reporting Date: 20/10/2023	**DETS Sample No**	680489	680490	680491		

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	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			547		
Total Sulphate as SO_4	%	< 0.02	MCERTS			0.05		
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS			70		
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS			0.07		
Sulphide	mg/kg	< 5	NONE			32		
Organic Matter (SOM)	%	< 0.1	MCERTS			2.4		
TOC (Total Organic Carbon)	%	< 0.1	MCERTS			1.4		
Arsenic (As)	mg/kg	< 2	MCERTS			10		
Barium (Ba)	mg/kg	< 2.5	MCERTS			54		
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			12		
Chromium (hexavalent)	mg/kg	< 2	NONE			< 2		
Copper (Cu)	mg/kg	< 4	MCERTS			22		
Lead (Pb)	mg/kg	< 3	MCERTS			63		
Mercury (Hg)	mg/kg	< 1	MCERTS			< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS			10		
Selenium (Se)	mg/kg	< 2	MCERTS			< 2		
Vanadium (V)	mg/kg	< 1	MCERTS			19		
Zinc (Zn)	mg/kg	< 3	MCERTS			110		
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: 23-12817	**Date Sampled**	09/10/23	09/10/23	09/10/23		
Green Earth Management Co Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: Blofield	**TP / BH No**	Plot 6 TS	Plot 6 TS	Plot 6 TS		
Project / Job Ref: 1935	**Additional Refs**	E1	E2	E3		
Order No: 1935 231011	**Depth (m)**	0.00 - 0.20	0.00 - 0.20	0.00 - 0.20		
Reporting Date: 20/10/2023	**DETS Sample No**	680489	680490	680491		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	0.34	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	0.25	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	4.10	0.32	0.20		
Anthracene	mg/kg	< 0.1	MCERTS	0.88	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	3.26	0.74	0.64		
Pyrene	mg/kg	< 0.1	MCERTS	2.52	0.68	0.62		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	1.05	0.42	0.36		
Chrysene	mg/kg	< 0.1	MCERTS	1.07	0.40	0.40		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	1.23	0.53	0.56		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.43	0.25	0.18		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	1.16	0.47	0.49		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.52	0.30	0.29		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.12	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.49	0.31	0.28		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	17.4	4.4	4		

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Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 23-12817	**Date Sampled**	09/10/23				
Green Earth Management Co Ltd	**Time Sampled**	None Supplied				
Site Reference: Blofield	**TP / BH No**	Plot 6 TS				
Project / Job Ref: 1935	**Additional Refs**	E3				
Order No: 1935 231011	**Depth (m)**	0.00 - 0.20				
Reporting Date: 20/10/2023	**DETS Sample No**	680491				

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	20				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21				
Total >C5 - C35	mg/kg	< 42	NONE	< 42				

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 23-12817	**Date Sampled**	09/10/23				
Green Earth Management Co Ltd	**Time Sampled**	None Supplied				
Site Reference: Blofield	**TP / BH No**	Plot 6 TS				
Project / Job Ref: 1935	**Additional Refs**	E3				
Order No: 1935 231011	**Depth (m)**	0.00 - 0.20				
Reporting Date: 20/10/2023	**DETS Sample No**	680491				

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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Maidstone
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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 23-12817	
Green Earth Management Co Ltd	
Site Reference: Blofield	
Project / Job Ref: 1935	
Order No: 1935 231011	
Reporting Date: 20/10/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
680489	Plot 6 TS	E1	0.00 - 0.20	11.1	Brown sandy clay
680490	Plot 6 TS	E2	0.00 - 0.20	9.3	Brown sandy clay
680491	Plot 6 TS	E3	0.00 - 0.20	10.7	Brown sandy clay with stones

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 23-12817
Green Earth Management Co Ltd
Site Reference: Blofield
Project / Job Ref: 1935
Order No: 1935 231011
Reporting Date: 20/10/2023

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

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]

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]

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]

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) Nathanial, C.P. *et al.* (2015), The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Note that the LQM / CIEM 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) Nathanial, C.P. et al. (2015), The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Nickel update (August 2015).

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			