Mr & Mrs Thurlin
32 Crediton Hill
Camden
London
NW6 1HP

5 December 2022
MES/2212/CA009

FAO: Arto & Lauren Thurlin / Matthew Wardell

Ref: 32 Crediton Hill, Rear Garden – Geo-Environmental Assessment – 2021/5567/P

Dear Sirs

Further to your recent instruction, please find enclosed the requested geo-environmental assessment to discharge Planning Condition (PC) 6 in regard to land contamination risk assessment for the proposed single-storey rear extension at 32 Crediton Hill, London NW6 1HP (the site).

Introduction

It is proposed to develop a ground floor, single storey extension at the site with alterations to the side elevation under Application 2021/5567/P.

The initial phase of ground investigation works was undertaken in September 2021. At the request of the Contaminated Land Officer at London Borough of Camden, in order to discharge Planning Condition PC6, additional ground investigation works were undertaken in the rear garden area on 24th September 2022. Planning Condition 6 stipulated:

Regarding Land Contamination Risk Assessment

Part A: No development shall commence until a site investigation is undertaken and the findings are submitted to and approved in writing by the local planning authority. The site investigation should assess all potential risks identified by the desktop study and should include a generic quantitative risk assessment and a revised conceptual site model. The

assessment must encompass an assessment of risks posed by radon and by ground gas. All works must be carried out in compliance with CLRM (2020) and by a competent person.

Part B: No development shall commence until a remediation method statement (RMS) is submitted to and approved in writing by the local planning authority. This statement shall detail any required remediation works and shall be designed to mitigate any remaining risks identified in the approved quantitative risk assessment. This document should include a strategy for dealing with previously undiscovered contamination. All works must be carried out in compliance with CLRM (2020) and by a competent person.

Part C: Following the completion of any remediation, a verification report demonstrating that the remediation as outlined in the RMS have been completed should be submitted to, and approved in writing, by the local planning authority. This report shall include (but may not be limited to): details of the remediation works carried out, results of any verification sampling, testing or monitoring including the analysis of any imported soil and waste management documentation. All works must be carried out in compliance with CLRM (2020) and by a competent person.

Reason: To ensure the risks from land contamination to the future users of the land and neighbouring land are minimised, together with those to controlled waters, property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other offsite receptors, in accordance with policies G1, D1, A1, and DM1 of the London Borough of Camden Local Plan 2017.

As the investigation works relate to the rear garden area, the most appropriate end use scenario for assessment is considered to be residential (with home grown produce).

Summary of Previous Risk Assessment (September 2021)

Basement Impact Assessment (ref MES/2110/CA002) provides a full description of the ground investigation and assessment works undertaken in September 2021:

Assessment of Potential Risks to Future Site Users (Soil Contamination)

In total seven samples of the shallow soils (0.80m to 3.90m below ground level (bgl)) were collected during the ground investigation for a separate Planning Application for the

development of a basement beneath the footprint of the existing house. These comprised six samples of Made Ground and one sample of the natural soils (London Clay Formation).

The samples were analysed for a range determinands including, asbestos, heavy metals, petroleum hydrocarbons (including using the criteria working group methodology (TPH CWG) and Polycyclic Aromatic Hydrocarbons (PAH)).

Asbestos Containing Materials (ACM)

In addition, three samples of the Made Ground soils (0.80m to 1.90m bgl) were screened for the presence of Asbestos Containing Materials (ACM). No ACM were detected.

Discussion of Results (Soil Contamination)

Recorded concentrations of contaminants (e.g. heavy metals, petroleum hydrocarbons etc) were generally found to be below relevant criteria considering a residential end use. However, elevated concentrations of Lead and PAH species were recorded in one of the Made Ground soil sample analysed from WS2 (1.00m - 1.90m bgl).

No elevated concentrations were recorded in the samples of natural soils analysed.

Reference to the proposed basement development plans indicated that over the majority of the development area there will be hard surfacing or buildings which would sever any direct contact pathways to potentially contaminated soils. In addition, a large proportion of the soils will be removed during the basement excavation i.e. the proposed development will mitigate potential risks to future site users.

A section of the existing rear garden will be retained. It was recommended that it would be prudent to undertake further sampling, testing and assessment of the shallow soils in the rear garden to confirm there would be no risk to future site users.

Maintenance and construction personnel involved in below ground works should be vigilant for potential risks (i.e. latent contamination not encountered during the investigation) and adopt appropriate management procedures.

Rear Garden Risk Assessment (October 2022)

To inform the risk assessment within the rear garden area 5no. soil auger boreholes were completed to maximum depths of 1.00m bgl. The exploratory hole location plan and exploratory hole logs are appended for reference.

In total ten samples of the shallow Made Ground soils (0.30m to 0.80m bgl) were collected during the ground investigation. At each location, one sample was obtained between ground level and <0.60m bgl, and one sample was obtained between 0.60m and <1.00m bgl.

All of the samples were screened for the presence of asbestos and five of the samples were analysed for a range of determinands including heavy metals, petroleum hydrocarbons (including using the criteria working group methodology (TPH CWG) and Polycyclic Aromatic Hydrocarbons (PAH)).

No asbestos containing materials were identified in any of the samples screened.

The majority of the contaminant concentrations were found to be either below the laboratory detection limits or below relevant assessment criteria (residential with homegrown produce). The exceptions are concentrations of Lead which were recorded above relevant assessment criteria in all five samples analysed at depth <0.60m bgl and concentrations of Benzo(k)fluoranthene, Benzo(a)pyrene and Dibenz(a,h)anthracene which were recorded above relevant assessment criteria in locations SA2 (0.30m bgl) and SA3 (0.60m bgl).

The elevated concentrations of Lead are considered to pose a risk to future site users and remedial measures will be required to mitigate risks.

The laboratory test results are appended for reference.

Generic Quantitative Risk Assessment (GQRA)

This section provides a Generic Quantitative Risk Assessment (GQRA) that considers only the shallow soil horizon. No statistical analysis has been completed and recorded concentrations have been compared directly to ‘Suitable 4 Use Levels’ (S4ULs) considering a residential (without home grown produce) end use.

The LQM/CIEH 'Suitable 4 Use Levels' (S4ULs) applied have been developed in accordance with developments in UK human health risk assessment since 2009, in particular the additional land uses and exposure assumptions presented in Defra's C4SL guidance. The S4ULs are all based on Health Criteria that represent minimal or tolerable levels of risks to health as described in the Environment Agency's SR2 guidance, ensuring that the resulting assessment criteria are 'suitable for use' under planning.

In addition to the S4ULs the provisional Category 4 Screening Levels (pC4SL) developed by CL:AIRE for DEFRA in response to the new definitions within the Contaminated Land Statutory Guidance (ref. DEFRA, April 2012) have also been considered within the assessment. C4SL are, 'designed to reflect a more pragmatic approach to contaminated land risk assessment (albeit still strongly precautionary)'.

It should be noted that C4SL have not yet been developed for a comprehensive range of contaminants and as such greater emphasis is placed on the S4ULs in determining potential risks to future site users.

Conclusions

The results of the GQRA have indicated that soil contaminant concentrations are generally below relevant assessment criteria considering residential end use.

However, elevated concentrations of Lead and certain PAH species have been recorded in the Made Ground soils in the rear garden area and remedial measures will be required to mitigate potential risks to future site users.

Recommendations

Based on the proposed development and conclusions presented above, the following recommendations are provided:

- It is recommended that remedial measures are applied in the rear garden area to mitigate potential risks to future site users associated with elevated concentrations of Lead and PAH in the shallow Made Ground soils.
- Should any suspected latent areas of contamination be identified during development then it is recommended that works in this area are postponed enabling consultation with an appropriately qualified environmental consultant.

- It is recommended that maintenance and construction workers involved in below ground works adopt safe management procedures including the use of appropriate PPE.

Updated Conceptual Site Model & Pollutant Linkage Assessment

The desk study (including Preliminary Risk Assessment) information summarised in Section 3.0 the BIA (ref MES/2110/CA002) has been updated based on the results of the ground investigation, laboratory testing and risk assessment herein.

Conceptual Site Model (CSM)

Geological & Hydrogeological Model

The ground investigation data indicates that the ground conditions comprise Made Ground overlying the London Clay Formation.

Groundwater was not recorded during the ground investigation works but was recorded at depths of between 1.39m and 4.13m bgl during return monitoring. The recorded water is considered to be representative of perched and discrete groundwater units. Groundwater is anticipated to be present within the underlying Made Ground.

Following development, the rear garden area will be retained and thus there is anticipated to be no variation in the proportion of rainfall infiltration and direct recharge of groundwater beneath this area of the site.

Direct recharge of groundwater via rainfall infiltration will also be dependent on the Soil Moisture Deficit (SMD) and rates of Evapotranspiration (EP).

Pollutant Linkage Assessment

Based on the results of the Generic Assessment of the analytical results, monitoring and the information presented in the Conceptual Site Model, the plausible pollutant linkages have been summarised in the following:

Pathway Linkage	Present	Yes
	Not Present	No
Future Site Users (Direct exposure pathway)		
Ingestion/Dermal Contact/Inhalation (Site Users).		**Yes**
Ingestion/Dermal Contact/Inhalation (Maintenance and Construction Workers).		**Yes**
Elevated concentrations of Lead and PAH were recorded in the Made Ground soils in the rear garden area and could pose a potential risk to future site users. As per best practice construction/maintenance workers should use of appropriate personal protective equipment.		
Future Site Users (Indirect exposure pathway)		
Enclosed space accumulation of ground gas.		**Yes**
Outdoor volatile vapour exposure		**No**
Elevated concentrations of Methane have been identified during monitoring and are interpreted to pose a low risk to future site users (CIRIA CS2).		
Potable water supply pipes		**No**
The selection of any new potable water supply pipes should be confirmed with the statutory undertaker.		
Risks to Buildings via accumulation of ground gas and volatile vapours in enclosed spaces and sub-floor voids.		**Yes**
Elevated concentrations of Methane have been identified during monitoring and are interpreted to pose a low risk to future site users (CIRIA CS2).		
Water Environment		
Contaminant migration on to neighbouring land		**No**
The contaminant source will be removed to facilitate development during basement excavation.		
Contaminant migration from neighbouring land		**No**
Contamination of groundwater		**No**
Contamination of surface water		**No**
No surface water features have been identified within 250m of the site.		

Source-Pathway-Receptor Model

Bulk Ground Gases

The results of the GQRA and the subsequent updated CSM suggest that there would be a requirement for basic ground gas protection measures at the site (CIRIA CS2).

Direct Exposure Pathway

The results of the GQRA suggest that there is potential for elevated concentrations of Lead and PAH recorded in the Made Ground soils of the rear garden area to pose a risk to future site users via direct contact (Ingestion, Dermal Contact & Inhalation) pathways.

Remedial Actions

As outlined, the additional ground investigation works completed in the rear garden area and subsequent GQRA highlighted potential risks to future site users associated with elevated concentrations of Lead and certain PAH species within Made Ground soils.

As such it was recommended that remedial measures were applied to mitigate the potential risks. The remedial action recommended is the construction of a cover system to sever the pollutant linkage.

Cover System Specification (Areas of Made Ground)

The rear garden area is to be retained, with Made Ground soils currently underlying. As such a cover system design has been completed in accordance with the following design methodology:

- BRE 465 (March 2004). Cover Systems for Land Regeneration: Thickness Design of Cover Systems for Contaminated Land.

BRE 465 suggests that 'if a cover system is required, it is recommended that its minimum thickness is 300mm.' When considering a simple cover system (as defined within BRE 465), the calculation worksheet provided within the above document has been utilised (and is appended for reference) and the recorded concentrations of heavy metals in Made Ground and an assumed concentration (based on conservative residential with plant uptake end use criteria) within clean imported soils applied.

The assessment indicates that a clean **simple** cover system of approximately 510mm thickness would need to be employed in the rear garden area.

Alternatively, an **engineered** cover system of 350mm thickness to the following specification could be employed:

Geotextile Marker	Capillary Break Layer (mm)	Sub-Soil (mm)	Topsoil (mm)	Total Thickness (mm)
Yes	100	150	100	350

Topsoil and subsoil utilised within the cover system should be sourced from a supplier of virgin soil or as surplus from a different development site imported in accordance with the DOWCOP code of practice. Reconstituted or artificial soil or "trommel fines" from waste processing, will not be accepted.

The materials used to make up the capillary break layer (if an engineered system is adopted) should be **virgin** granular materials with a low fines content.

Cover Barrier Chemical Criteria

The specification for the chemical criteria that the cover barrier materials are required to meet is appended for reference.

The criteria are based on a conservative residential (with plant uptake) exposure scenario; however, the criteria for some of the hydrocarbon fractions have been reduced (i.e. lower concentrations proposed) to ensure conservatism and ensure that there is no potential for generation of Light Non-Aqueous Phase Liquids (LNAPL) and/or volatile vapours. Separate criteria are provided for the topsoil / subsoil and capillary break layer.

In the case of topsoil and subsoil, they could conceivably be from different sources, but should both conform to the criteria specified (as appended). In reality, for most small-scale developments (such as the subject site) imported soil will be from one source rather than separate sources of topsoil and subsoil.

No alteration to the cover barrier specification should be made without full written approval of the Environmental Consultant, Client or the Contaminated Land Officer at London Borough of Camden.

Assessment

This assessment has been reviewed and approved by Philip Lewis, a chartered ground engineering professional with over 20 years of contaminated land assessment experience.

It is recommended this assessment is presented to LBC to confirm their agreement of the conclusions and strategy presented prior to the works commencing.

If you have further queries, please do not hesitate to contact the undersigned.

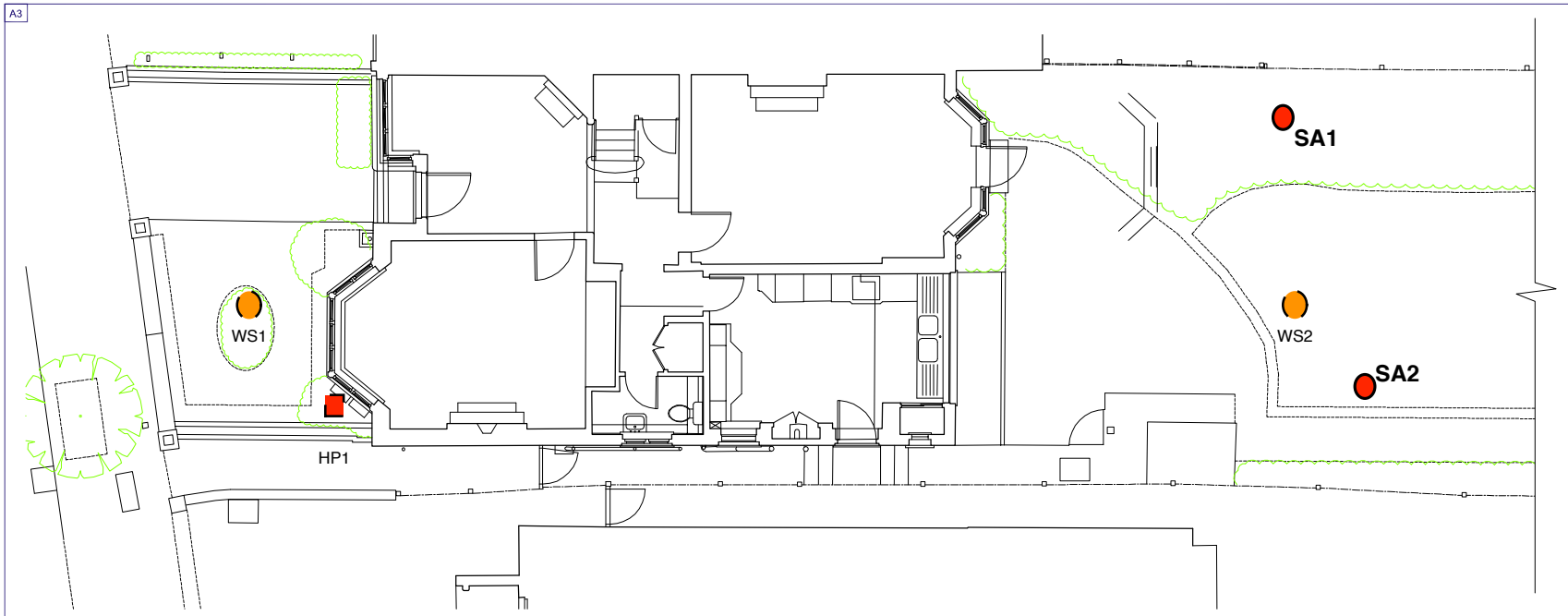
Yours faithfully,

p.p. 

Heather Shaw
Associate

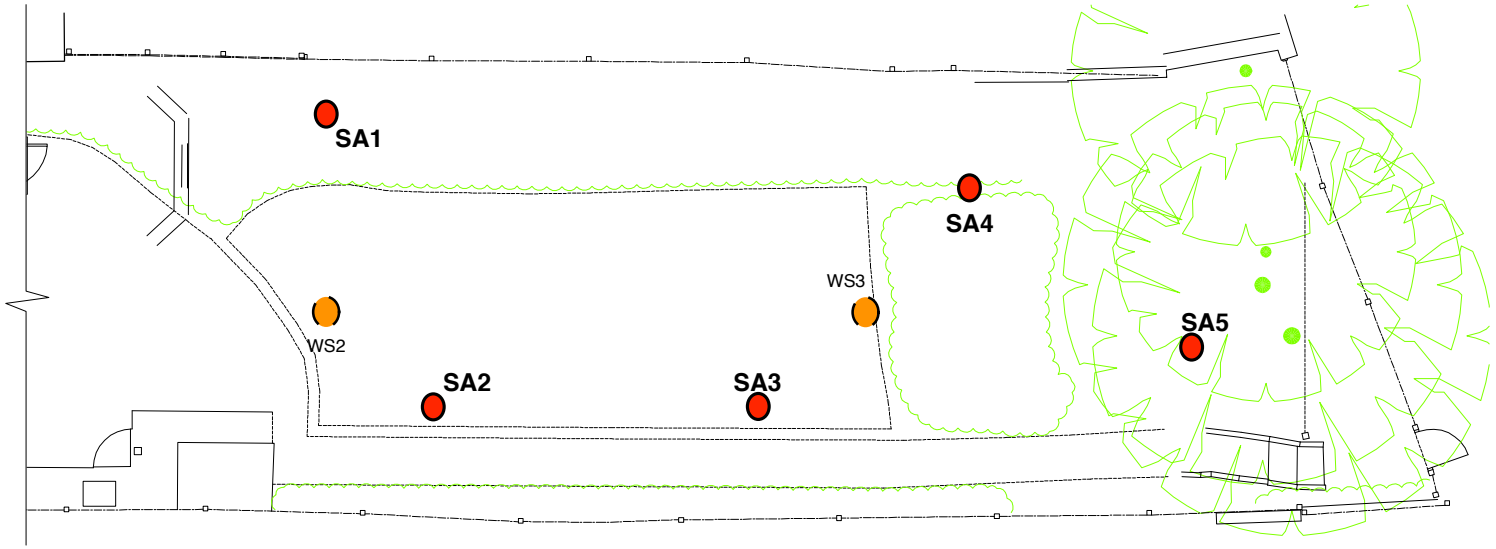
Encs: - Exploratory Hole Location Plan
- Soil Auger Logs
- Laboratory Test Results
- Specification for imported materials
- Soil cover assessment

A3



1 SITE PLAN - AS EXISTING

Scale: 1:100



2 SITE PLAN - AS EXISTING

Scale: 1:100

KEY:
- Existing
- Proposed
- Demolition
- Boundary

0 0.5 1m 3m 5m 10m

Dimensions
No dimensions to be scaled from drawings. All dimensions to be checked on site by the main contractor before commencement of any shop drawings or work whatsoever either on his own behalf or for sub-contractors or suppliers.

Discrepancies
Any discrepancies between drawings and or other documents shall be referred to the architects.

Compliance
All appropriate work to comply with the relevant requirements of the Building Regulations. All materials specified on this drawing are to be used strictly in accordance with the manufacturers recommendations, correct code of practice and where relevant British Board of Agrément Certificate.

Rev	Date	Description

CONNECT ARCHITECTURE

Project:
32 Crediton Hill
London
NW61HP

Client:
Mr. & Mrs. Thurlin

Title:
SITE PLAN:
AS EXISTING

Status:
INFORMATION

Date:	Scale:	
11-04-21	1:100 @A3	
Job No:	Drawing No:	Rev:
330	E-001	000

SCHIFT Geotechnical Monitoring + Risk Management

EXPLORATORY HOLE LOG Borehole SA1

PROJECT NUMBER MES_2211_CA009	**DRILLING DATE** 24/09/2022	**COORDINATES**
PROJECT NAME 32 Crediton Hill	**TOTAL DEPTH** 1.00m	**COORD SYS**
CLIENT Milvum Engineering Services Ltd	**DIAMETER** 100mm	**COMPLETION** No standpipe
ADDRESS 32 Crediton Hill, London NW6 1HP	**CASING** None	**SURFACE ELEVATION** 63.00 mOD
LICENCE NO.	**SCREEN** None	**WELL TOC** N/A

COMMENTS

LOGGED BY HS
CHECKED BY GK

Method	Samples / Tests	Depth (m)	Graphic Log	Material Description	No Standpipe	Elevation (m)
SA		0.05		MADE GROUND: Brown sandy clay with gravel sized fragments of brick. Rootlets.		62.95
		0.1				62.9
		0.15				62.85
		0.2				62.8
		0.25				62.75
		0.3		MADE GROUND: Brown sandy gravelly clay. Gravel of flint and chalk with gravel sized fragments of brick, concrete and tile.		62.7
		0.35				62.65
	D, ES	0.4				62.6
		0.45				62.55
		0.5				62.5
		0.55				62.45
		0.6				62.4
		0.65				62.35
		0.7				62.3
		0.75				62.25
	D, ES	0.8				62.2
		0.85				62.15
		0.9		Firm brown mottled grey gravelly CLAY. Gravel is subrounded flint. (HEAD)		62.1
		0.95				62.05
		1				62

Notes SA = Soil Auger

SCHIFT Geotechnical Monitoring + Risk Management

EXPLORATORY HOLE LOG Borehole SA2

PROJECT NUMBER MES_2211_CA009	**DRILLING DATE** 24/09/2022	**COORDINATES**
PROJECT NAME 32 Crediton Hill	**TOTAL DEPTH** 1.00m	**COORD SYS**
CLIENT Milvum Engineering Services Ltd	**DIAMETER** 100mm	**COMPLETION** No standpipe
ADDRESS 32 Crediton Hill, London NW6 1HP	**CASING** None	**SURFACE ELEVATION** 63.00 mOD
LICENCE NO.	**SCREEN** None	**WELL TOC** N/A

COMMENTS

LOGGED BY HS
CHECKED BY GK

Method	Samples / Tests	Depth (m)	Graphic Log	Material Description	No Standpipe	Elevation (m)
SA		0.05		MADE GROUND: Brown sandy clay with gravel sized fragments of brick. Rootlets.		62.95
		0.1				62.9
		0.15				62.85
		0.2				62.8
		0.25				62.75
	ES	0.3				62.7
		0.35		MADE GROUND: Brown sandy gravelly clay. Gravel of flint and chalk with gravel sized fragments of brick, concrete and tile.		62.65
		0.4				62.6
		0.45				62.55
		0.5				62.5
		0.55				62.45
		0.6				62.4
		0.65				62.35
	D	0.7				62.3
		0.75				62.25
		0.8				62.2
		0.85				62.15
		0.9		Firm brown mottled grey gravelly CLAY. Gravel is subrounded flint. (HEAD)		62.1
		0.95				62.05
		1				62

Notes SA = Soil Auger

SCHIFT Geotechnical Monitoring + Risk Management

EXPLORATORY HOLE LOG Borehole SA3

PROJECT NUMBER MES_2211_CA009	**DRILLING DATE** 24/09/2022	**COORDINATES**
PROJECT NAME 32 Crediton Hill	**TOTAL DEPTH** 1.00m	**COORD SYS**
CLIENT Milvum Engineering Services Ltd	**DIAMETER** 100mm	**COMPLETION** No standpipe
ADDRESS 32 Crediton Hill, London NW6 1HP	**CASING** None	**SURFACE ELEVATION** 63.00 mOD
LICENCE NO.	**SCREEN** None	**WELL TOC** N/A

COMMENTS

LOGGED BY HS
CHECKED BY GK

Method	Samples / Tests	Depth (m)	Graphic Log	Material Description	No Standpipe	Elevation (m)
SA		0.05		MADE GROUND: Brown sandy clay with gravel sized fragments of brick. Rootlets		62.95
		0.1				62.9
		0.15				62.85
		0.2				62.8
		0.25		MADE GROUND: Brown sandy gravelly clay. Gravel of flint and chalk with gravel sized fragments of brick, concrete and tile.		62.75
		0.3				62.7
		0.35				62.65
		0.4				62.6
		0.45				62.55
		0.5				62.5
		0.55				62.45
		0.6				62.4
	ES	0.65				62.35
		0.7				62.3
		0.75				62.25
		0.8				62.2
	D	0.85		Firm brown mottled grey gravelly CLAY. Gravel is subrounded to subangular flint and chalk. (HEAD)		62.15
		0.9				62.1
		0.95				62.05
		1				62

Notes SA = Soil Auger

SCHIFT Geotechnical Monitoring + Risk Management

EXPLORATORY HOLE LOG Borehole SA4

PROJECT NUMBER MES_2211_CA009	**DRILLING DATE** 24/09/2022	**COORDINATES**
PROJECT NAME 32 Crediton Hill	**TOTAL DEPTH** 1.00m	**COORD SYS**
CLIENT Milvum Engineering Services Ltd	**DIAMETER** 100mm	**COMPLETION** No standpipe
ADDRESS 32 Crediton Hill, London NW6 1HP	**CASING** None	**SURFACE ELEVATION** 63.00 mOD
LICENCE NO.	**SCREEN** None	**WELL TOC** N/A

COMMENTS

LOGGED BY HS
CHECKED BY GK

Method	Samples / Tests	Depth (m)	Graphic Log	Material Description	No Standpipe	Elevation (m)
SA		0.05		MADE GROUND: Brown sandy clay with gravel sized fragments of brick and glass. Rootelts.		62.95
		0.1				62.9
		0.15				62.85
		0.2				62.8
		0.25		MADE GROUND: Brown sandy gravelly clay. Gravel of flint and chalk with gravel sized fragments of brick, concrete and tile.		62.75
		0.3				62.7
		0.35				62.65
		0.4				62.6
		0.45				62.55
	ES	0.5				62.5
		0.55				62.45
		0.6				62.4
		0.65				62.35
		0.7				62.3
		0.75				62.25
	D	0.8				62.2
		0.85				62.15
		0.9		Firm brown mottled grey gravelly CLAY. Gravel is subrounded to subangular flint and chalk. (HEAD)		62.1
		0.95				62.05
		1				62

Notes SA = Soil Auger

EXPLORATORY HOLE LOG Borehole SA5

PROJECT NUMBER MES_2211_CA009	**DRILLING DATE** 24/09/2022	**COORDINATES**
PROJECT NAME 32 Crediton Hill	**TOTAL DEPTH** 1.00m	**COORD SYS**
CLIENT Milvum Engineering Services Ltd	**DIAMETER** 100mm	**COMPLETION** No standpipe
ADDRESS 32 Crediton Hill, London NW6 1HP	**CASING** None	**SURFACE ELEVATION** 63.00 mOD
LICENCE NO.	**SCREEN** None	**WELL TOC** N/A

COMMENTS

LOGGED BY HS
CHECKED BY GK

Method	Samples / Tests	Depth (m)	Graphic Log	Material Description	No Standpipe	Elevation (m)
SA		0.05		MADE GROUND: Brown sandy gravelly clay. Gravel of flint and chalk with gravel sized fragments of brick and glass.		62.95
		0.1				62.9
		0.15				62.85
		0.2				62.8
		0.25				62.75
	ES	0.3				62.7
		0.35				62.65
		0.4				62.6
		0.45				62.55
		0.5				62.5
		0.55				62.45
		0.6				62.4
		0.65				62.35
	ES	0.7				62.3
		0.75				62.25
		0.8				62.2
		0.85				62.15
		0.9		Firm brown mottled grey gravelly CLAY. Gravel is subrounded to subangular flint and chalk. (HEAD)		62.1
		0.95				62.05
		1				62

Notes SA = Soil Auger

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London
WC2H 9JQ

e: gkite@milvumgroup.com

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Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 22-86158

Project / Site name:	32 Crediton Hill	**Samples received on:**	26/09/2022
Your job number:	32 CH	**Samples instructed on/ Analysis started on:**	26/09/2022
Your order number:		**Analysis completed by:**	06/10/2022
Report Issue Number:	1	**Report issued on:**	06/10/2022
Samples Analysed:	10 soil samples		

Signed:

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-86158
Project / Site name: 32 Crediton Hill

Lab Sample Number				2436337	2436338	2436339	2436340	2436341
Sample Reference				SA1	SA1	SA2	SA2	SA3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.80	0.30	0.70	0.60
Date Sampled				24/09/2022	24/09/2022	24/09/2022	24/09/2022	24/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	-	< 0.1	-	< 0.1
Moisture Content	%	0.01	NONE	10	-	9.3	-	9.1
Total mass of sample received	kg	0.001	NONE	1.1	-	1.1	-	0.7
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	EC	EC	EC	EC	EC
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.5	-	6.7	-	8.2
Total Cyanide	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	410	-	610	-	440
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0073	-	0.0068	-	0.007
Sulphide	mg/kg	1	MCERTS	4.4	-	29	-	5.1
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.2	-	2.5	-	0.9
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	0.22
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	0.54	-	0.4
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	0.34	-	0.43
Phenanthrene	mg/kg	0.05	MCERTS	1	-	4.4	-	4.9
Anthracene	mg/kg	0.05	MCERTS	0.21	-	0.63	-	1.6
Fluoranthene	mg/kg	0.05	MCERTS	1.8	-	6.7	-	6.2
Pyrene	mg/kg	0.05	MCERTS	1.6	-	5.6	-	5.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.85	-	3.2	-	3
Chrysene	mg/kg	0.05	MCERTS	0.97	-	3.2	-	2.9
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.84	-	3	-	3
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.56	-	2.3	-	1.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.91	-	3.4	-	3.2
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.43	-	1.6	-	1.5
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	0.44	-	0.39
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.56	-	2	-	1.9
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	9.75	-	37.4	-	36.4
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	-	24	-	18
Boron (water soluble)	mg/kg	0.2	MCERTS	0.9	-	0.8	-	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	-	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	43	-	33	-	40
Copper (aqua regia extractable)	mg/kg	1	MCERTS	66	-	150	-	43
Lead (aqua regia extractable)	mg/kg	1	MCERTS	270	-	770	-	290
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	1.1	-	0.7
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	31	-	23	-	31
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	-	190	-	98
Monoaromatics & Oxygenates								

Analytical Report Number: 22-86158
Project / Site name: 32 Crediton Hill

Lab Sample Number				2436337	2436338	2436339	2436340	2436341
Sample Reference				SA1	SA1	SA2	SA2	SA3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.80	0.30	0.70	0.60
Date Sampled				24/09/2022	24/09/2022	24/09/2022	24/09/2022	24/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Benzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Petroleum Hydrocarbons								
TPH C10 - C40 $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	24	-	46	-	42
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	< 2.0	-	< 2.0	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	-	< 8.0	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	-	< 8.0	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	MCERTS	< 10	-	< 10	-	< 10
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	< 2.0	-	< 2.0	-	6.3
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	< 10	-	13	-	12
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	15	-	33	-	24
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	MCERTS	24	-	46	-	42

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-86158
Project / Site name: 32 Crediton Hill

Lab Sample Number				2436342	2436343	2436344	2436345	2436346
Sample Reference				SA3	SA4	SA4	SA5	SA5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	0.50	0.80	0.30	0.70
Date Sampled				24/09/2022	24/09/2022	24/09/2022	24/09/2022	24/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	-	< 0.1	-	< 0.1	-
Moisture Content	%	0.01	NONE	-	11	-	9.3	-
Total mass of sample received	kg	0.001	NONE	-	0.7	-	0.7	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	EC	EC	EC	EC	EC
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	7.1	-	7.7	-
Total Cyanide	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Total Sulphate as SO4	mg/kg	50	MCERTS	-	460	-	1200	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.0072	-	0.024	-
Sulphide	mg/kg	1	MCERTS	-	13	-	8.2	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	-	1.8	-	6.1	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	-
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	-
Phenanthrene	mg/kg	0.05	MCERTS	-	0.4	-	0.31	-
Anthracene	mg/kg	0.05	MCERTS	-	0.37	-	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	-	1	-	0.98	-
Pyrene	mg/kg	0.05	MCERTS	-	0.98	-	1	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.63	-	0.72	-
Chrysene	mg/kg	0.05	MCERTS	-	0.64	-	0.66	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	0.73	-	0.93	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.37	-	0.34	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	0.74	-	0.92	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.35	-	0.54	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.49	-	0.7	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	6.71	-	7.11	-
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	18	-	13	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	0.5	-	3.7	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	-	1.3	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	40	-	25	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	51	-	48	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	270	-	540	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	0.6	-	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	25	-	22	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	180	-	460	-
Monoaromatics & Oxygenates								

Analytical Report Number: 22-86158
Project / Site name: 32 Crediton Hill

Lab Sample Number				2436342	2436343	2436344	2436345	2436346
Sample Reference				SA3	SA4	SA4	SA5	SA5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	0.50	0.80	0.30	0.70
Date Sampled				24/09/2022	24/09/2022	24/09/2022	24/09/2022	24/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Benzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
o-xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Petroleum Hydrocarbons								
TPH C10 - C40 $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	27	-	31	-
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	-	< 2.0	-	< 2.0	-
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	MCERTS	-	< 10	-	< 10	-
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	-	< 2.0	-	< 2.0	-
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-	< 10	-	< 10	-
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-	19	-	21	-
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	MCERTS	-	27	-	26	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-86158
Project / Site name: 32 Crediton Hill

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2436337	SA1	None Supplied	0.4	Brown clay and loam with gravel and vegetation.
2436339	SA2	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
2436341	SA3	None Supplied	0.6	Brown clay and sand with gravel and vegetation.
2436343	SA4	None Supplied	0.5	Brown clay and loam with gravel and vegetation.
2436345	SA5	None Supplied	0.3	Brown loam with gravel and vegetation.

Analytical Report Number : 22-86158
Project / Site name: 32 Crediton Hill

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS

Analytical Report Number : 22-86158
Project / Site name: 32 Crediton Hill

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Chemical Specification: Imported Topsoil & Subsoil

Concentrations of the chemicals in soils should be below the criteria detailed in the Table below:

DETERMINANDS	Soil Concentration (mg/kg)	Source / Justification
Arsenic	37	LQM/CIEH S4ULs
Cadmium	11	LQM/CIEH S4ULs
Chromium (assumes trivalent form)	910	LQM/CIEH S4ULs
Copper	2,400(135)	LQM/CIEH S4ULs. Value in brackets denotes phytotoxic criteria for any plant growing media
Lead	200	C4SLs
Mercury	40	LQM/CIEH S4ULs
Nickel	130(75)	LQM/CIEH S4ULs. Value in brackets denotes phytotoxic criteria for any plant growing media
Selenium	250	LQM/CIEH S4ULs
Zinc(1)	3,700(200)	LQM/CIEH S4ULs. Value in brackets denotes phytotoxic criteria for any plant growing media
Benzo(a)pyrene	2.0	LQM/CIEH S4Uls (rounded down)
Benzo(a)anthracene	7.0	LQM/CIEH S4Uls (rounded down)
Benzo(b)fluoranthene	2.5	LQM/CIEH S4Uls (rounded down)
Benzo(k)fluoranthene	77	LQM/CIEH S4ULs
Benzo(ghi)perylene	300	LQM/CIEH S4Uls (rounded down)
Chrysene	15	LQM/CIEH S4ULs
Dibenzo(ah)anthracene	0.24	LQM/CIEH S4ULs
Fluoranthene	250	LQM/CIEH S4Uls (rounded down)
Indeno(123-cd)pyrene	27	LQM/CIEH S4ULs
Naphthalene	2.0	LQM/CIEH S4Uls (rounded down)
Pyrene	500	LQM/CIEH S4Uls (reduced to ensure conservatism)
Fluorene	3.1 (31*)	Value applied to ensure no NAPL present
Anthracene	500	LQM/CIEH S4Uls (reduced to ensure conservatism)
Phenanthrene	95	LQM/CIEH S4ULs
Acenaphthylene	8.6 (86*)	Value applied to ensure no NAPL present
Acenaphthene	5.7 (57*)	Value applied to ensure no NAPL present
Benzene	0.20	C4SLs (1%)

Toluene		8.7 (870*)	Value applied to ensure no NAPL present
Ethylbenzene		5.2 (520*)	Value applied to ensure no NAPL present
Xylenes (sum m, o & p)		6.3 (630*)	Value applied to ensure no NAPL present
Aliphatic	>C5-C6	20	LQM/CIEH S4Uls (rounded down)
	>C6-C8	50	LQM/CIEH S4Uls (rounded down)
	>C8-10	10	LQM/CIEH S4Uls (rounded down)
	>C10-C12	60	LQM/CIEH S4ULs
	>C12-C16	10	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C16-C35	5.0	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C35-C44	5.0	LQM/CIEH S4Uls (reduced to ensure conservatism)
Aromatic	>C5-C7	10	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C7-C8	10	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C8-C10	20	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C10-C12	20	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C12-C16	20	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C16-C21	20	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C21-C35	10	LQM/CIEH S4Uls (reduced to ensure conservatism)
	>C35-C44	10	LQM/CIEH S4Uls (reduced to ensure conservatism)
Asbestos Containing Materials (ACM)		No ACM identified	

*Denotes the theoretical soil saturation limits. Criteria applied are typically 10% of these concentrations to ensure no LNAPL and potential volatilisation.

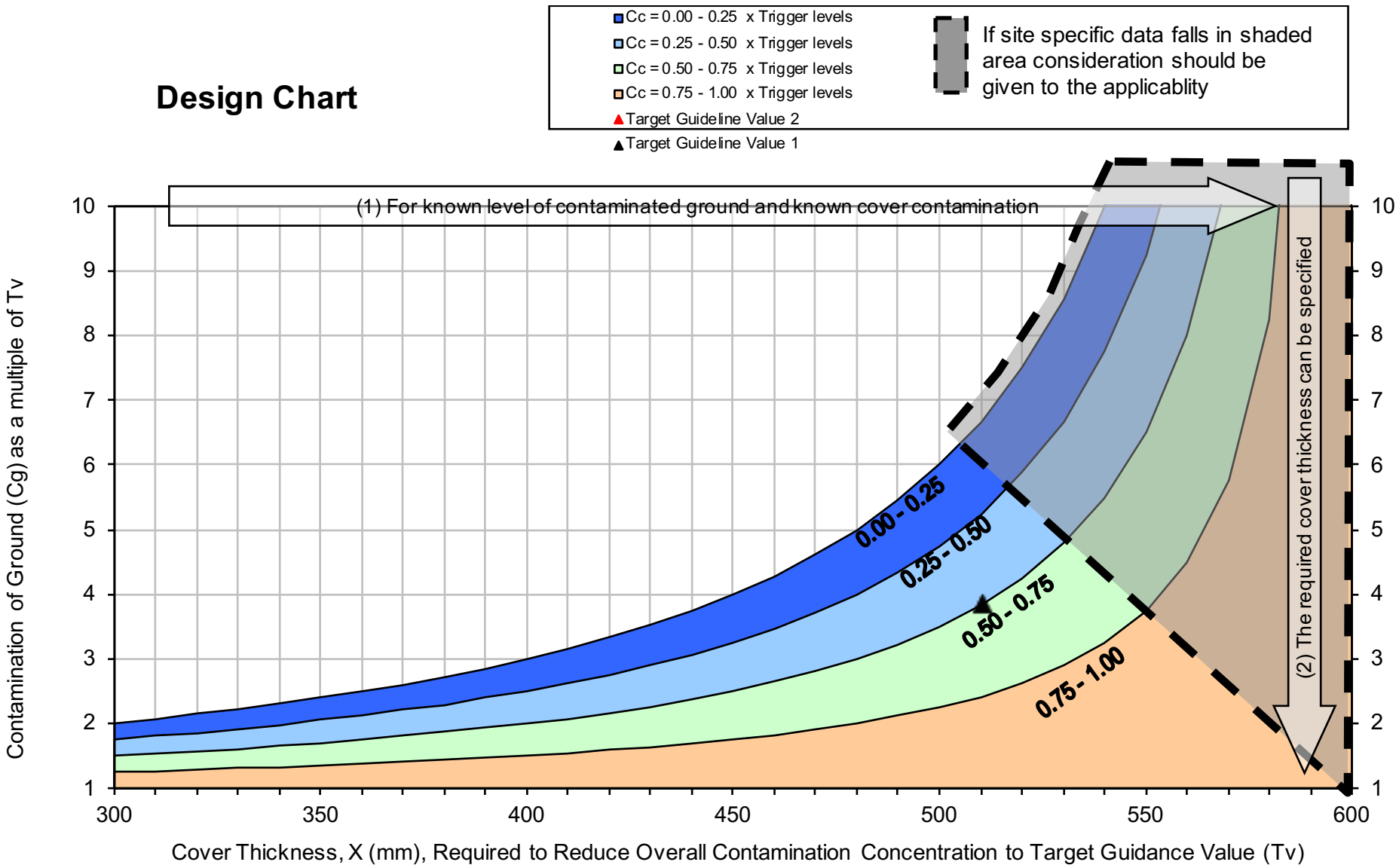
The criteria presented are for a residential end use. However, for organic contaminants these have been reduced to ensure that LNAPL generation and potential volatilisation are negated, and that material that, if waste, would be classified as hazardous, is not imported.

Calculations based on mixed zone (M)	600	mm

Contaminant	Site Data				Expressed as a Factor of Target Guideline Value				Cover Thickness Required for Compliance to Specified Target Guideline Value	
	Contamination of Ground (Cg)	Contamination of Cover (Cc)	Target Guideline Value 1	Target Guideline Value 2	Soil / Target Guideline Value 1	Cover / Target Guideline Value 1	Soil / Target Guideline Value 2	Cover / Target Guideline Value 2	Target Guideline Value 1	Target Guideline Value 2
	Units		Units		Fraction				(mm)	
Arsenic	24	20	37		0.6	0.5	No TV	No TV	None	No TV
Cadmium (Soil pH8)	1.3	5	10		0.1	0.5	No TV	No TV	None	No TV
Chromium	43	500	900		0.0	0.6	No TV	No TV	None	No TV
Chromium (VI)										
Mercury	1.1	10	40		0.0	0.3	No TV	No TV	None	No TV
Selenium	1	50	250		0.0	0.2	No TV	No TV	None	No TV
Copper	150	1000	2400		0.1	0.4	No TV	No TV	None	No TV
Nickel	39	75	130		0.3	0.6	No TV	No TV	None	No TV
Zinc	460	1000	3700		0.1	0.3	No TV	No TV	None	No TV
Lead	770	100	200		3.9	0.5	No TV	No TV	510	No TV
Boron (Water sol)										
Sulphate (total)										
Phenols										
Sulphide										
Cyanide										
Solvent Extractable Matter										

Summary		
	Target Guideline Value 1	Target Guideline Value 2
Number of contaminants	16	16
Number of contaminants **with no** thickness calculation	7	16
Breakdown - Number for which no TV specfied	7	16
Breakdown - Number for which no soil specified	7	7
Breakdown - Number for which no cover specified	7	7
Breakdown - Number for which cover > TV	0	0
Number of contaminants **with** thickness calculation	9	0
Breakdown - Number for which no cover required	8	0
Breakdown - Number for which cover required	1	0

Overall thickness of cover required	**510**	**0**


Design Chart
Cc = 0.00 - 0.25 x Trigger levels
Cc = 0.25 - 0.50 x Trigger levels
Cc = 0.50 - 0.75 x Trigger levels
Cc = 0.75 - 1.00 x Trigger levels
Target Guideline Value 2
Target Guideline Value 1
If site specific data falls in shaded area consideration should be given to the applicablity
(1) For known level of contaminated ground and known cover contamination
(2) The required cover thickness can be specified
0.00 - 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
Contamination of Ground (Cg) as a multiple of Tv
Cover Thickness, X (mm), Required to Reduce Overall Contamination Concentration to Target Guidance Value (Tv)
10
9
8
7
6
5
4
3
2
1
300
350
400
450
500
550
600