

OUR REF: A2212/21/LR/V1 16th June 2021

16th June 2021

Mr. Ahmed Yaseen
Crown Advisory c/o
Xenon 303 Ltd
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By Email (ahmed@crownadvisory.co.uk)

Dear Ahmed,

Soil Contamination Delineation Letter Report
Claremont Road, Manchester

Background

A follow up site investigation has been commissioned by Crown Advisory, to undertake soil sampling around two areas of contamination located within the garden areas of the proposed development.

Previous Reporting

This report should be read in conjunction with the following reports previously prepared by Earth Environmental & Geotechnical Ltd:

- Phase I Geo-Environmental Desk Study Report (Reference: A2212/17, August 2017)
- Phase II Geo-Environmental Investigation Report (Reference: A2212/19/B.0, January 2019)
- Asbestos Management Plan (Reference: A2212/19/AMP, January 2019)
- Remediation Strategy (Reference A2212/19/RMS, January 2019)

Reference

Earth Environmental and Geotechnical Ltd were commissioned by the client, to undertake a Geo-Environmental Investigation of the site with the following objectives:

- *Assess the presence and likely extent of any potential environmental hazards (soil contamination) associated with previously identified hotspots within proposed garden areas.*

Proposed Development

It is understood that the Client intends to construct 7no. two-storey residential dwellings with dormers and associated off street parking and garden areas.

A development plan has been provided as Figure 1 overleaf.

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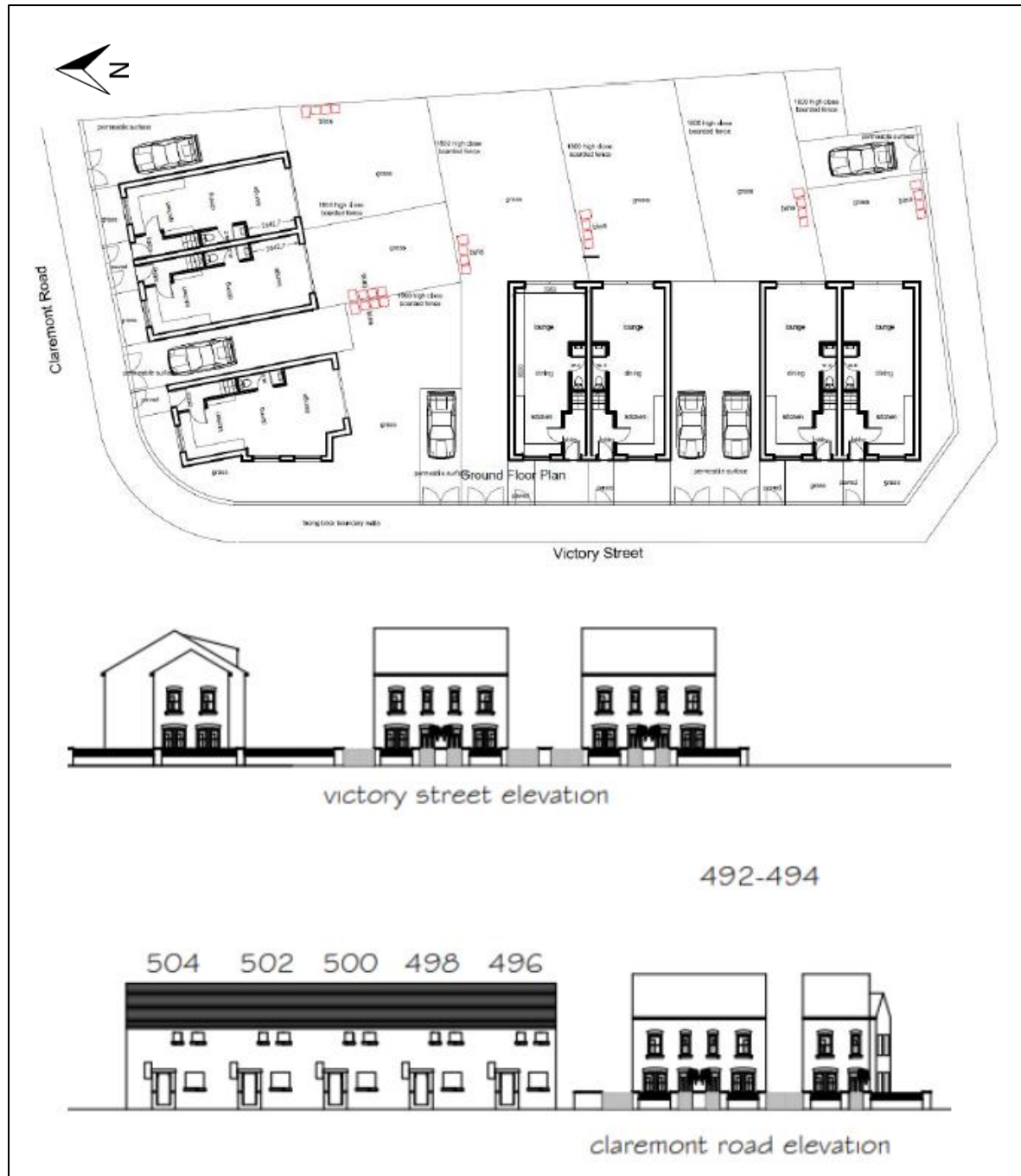
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Figure 1: Site Development Plan



Fieldwork

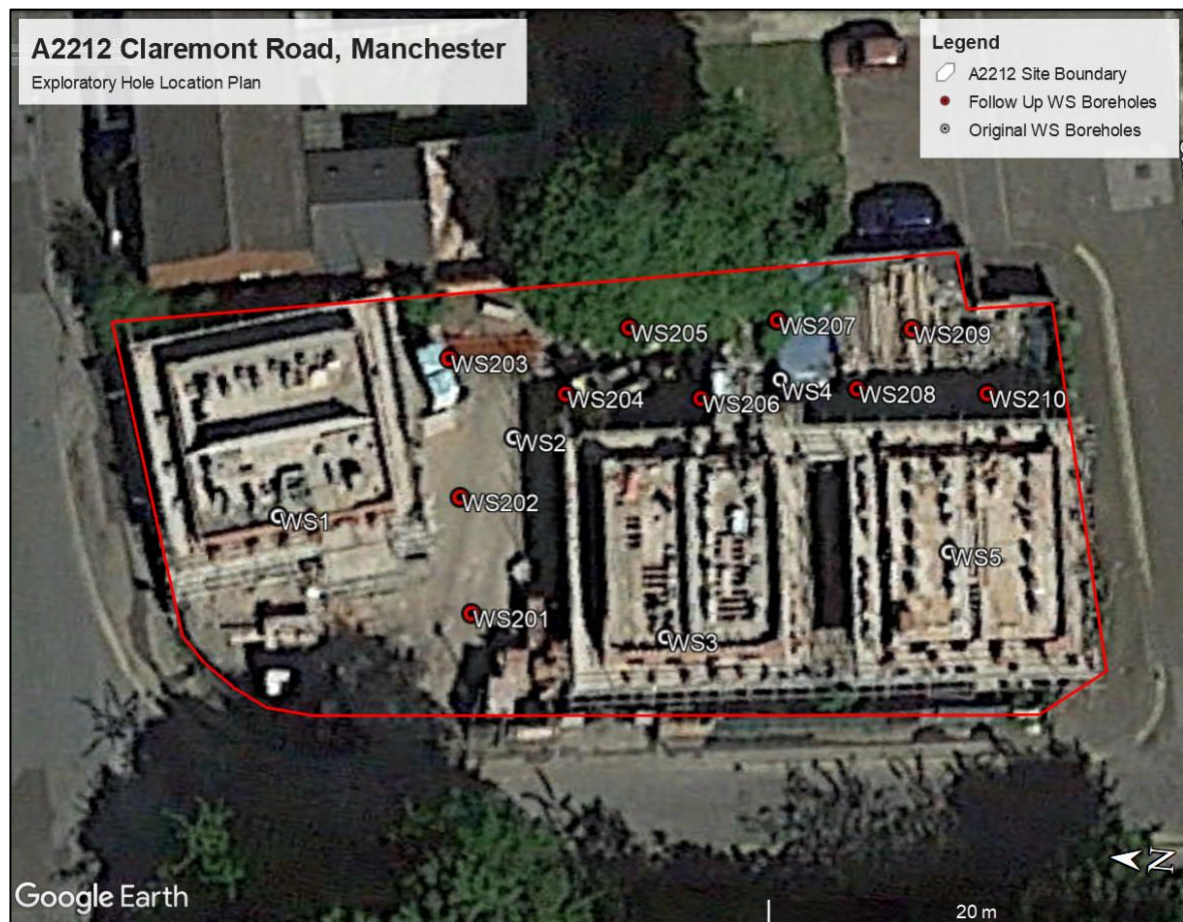
A site visit was conducted on the 26th May 2021, to retrieve samples from around identified contamination hotspots. Ten window sample boreholes (designated WS201 to WS210) were excavated to depths of 1.00m bgl. Each excavation was sampled and backfilled upon completion. Sampling locations are shown in Figure 2 overleaf.

Ground Conditions

In the area of the site investigated the ground conditions consisted primarily of variable made ground gravel with natural clay being encountered in WS209 and WS210.

Exploratory hole logs can be found as Appendix A.

Figure 2: Exploratory Hole Location Plan



Chemical Testing

The environmental chemistry of the ground was investigated by specialist analysis of selected samples, scheduled by EEG and carried out by DETS.

Chemical analyses were carried out on ten soil samples and were submitted for the following suite of determinants:

Arsenic, Beryllium, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Cyanide, Thiocyanate, Phenol, Sulphate (SO₄), Sulphide, pH, Sulphur, Soil Organic Matter and speciated Polyaromatic Hydrocarbons (PAH) and Speciated Petroleum Hydrocarbons (TPH).

At a Tier I stage the long term (chronic) human health toxicity of the soil has been assessed with reference to DEFRA/Environment Agency Contaminated Land Exposure Assessment (CLEA) Soil Guideline Values (SGV) for generic site land uses, soils and exposure. Where Environment Agency generic guidance is absent, reference has been made to the Chartered Institute of Environmental Health (CIEH) S4ULs for human health risk assessment.

In the case of arsenic, cadmium, hexavalent chromium, lead and benzo(a)pyrene DEFRA Category 4 Screening levels have been adopted.

A conservative Soil Organic Matter (SOM) of 1% has been adopted for organic chemicals for the purposes of the initial assessment. A SOM of 6% has been adopted for inorganic chemicals as detailed in 'The LQM / CIEH S4ULs for human health assessment', (2015).

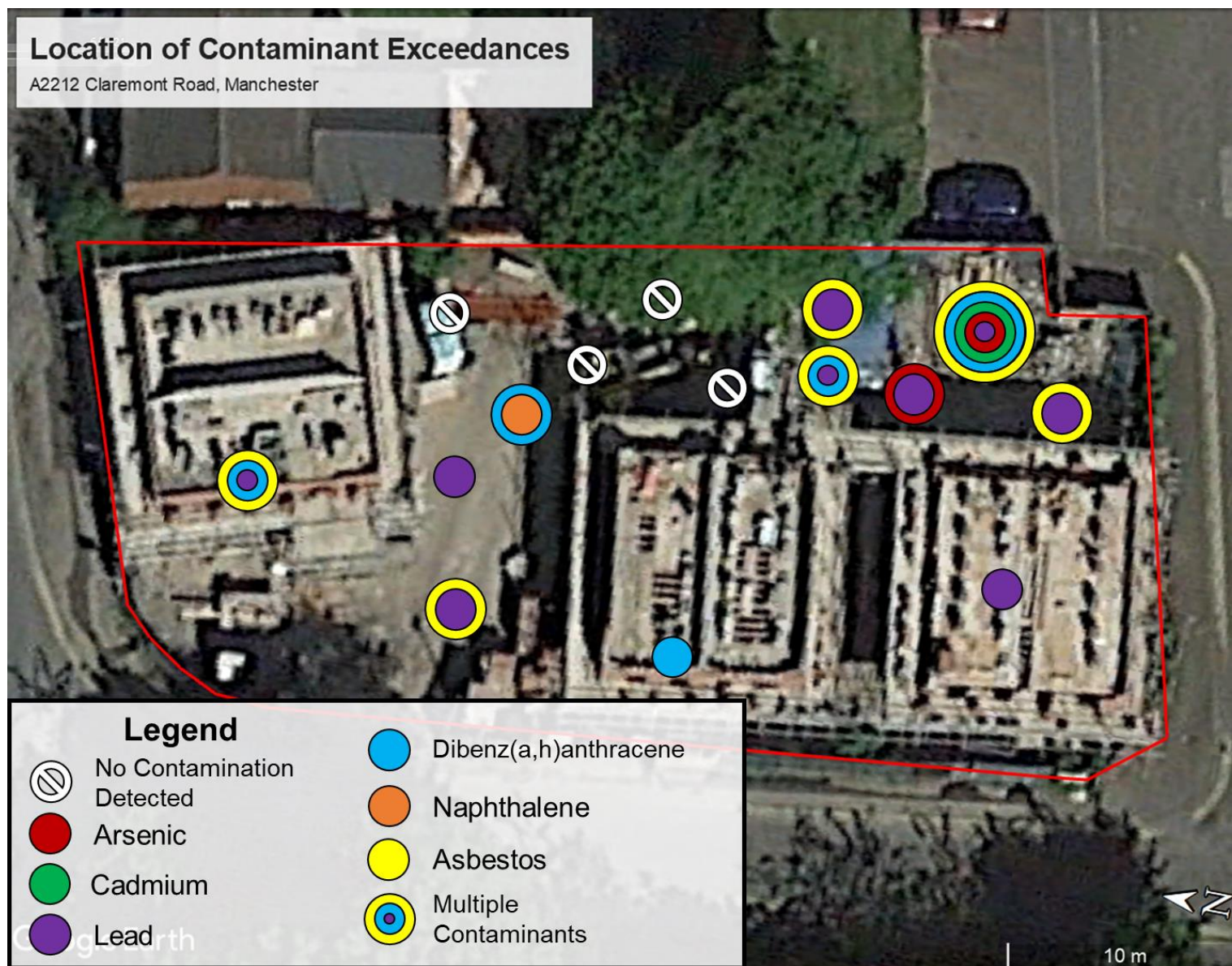
Full results of the chemical analyses are presented in Appendix B and summarised in Table 1 (overleaf).

Table 1: Assessment of Soil Chemical Data

Determinand	C4SL/S4UL Levels Residential (mg/kg)	WS201 0.50m MG	WS202 0.70m MG	WS203 0.40m MG	WS204 0.60m MG	WS205 0.50m MG	WS206 0.80m MG	WS207 0.20m MG	WS208 0.40m MG	WS209 0.30m MG	WS210 0.50m MG	No of Exceedances
Metals												
Arsenic	37	13	24	8	11	10	16	27	38	59	30	2
Beryllium	1.7	< 0.5	1.1	0.5	1.1	1	0.9	1.2	1.6	0.8	1.3	0
Boron	290	< 1	< 1	< 1	1.5	< 1	2.5	< 1	< 1	1.3	1.9	0
Cadmium	22	0.4	0.2	< 0.2	< 0.2	< 0.2	0.3	1.1	2.7	36.6	7.4	1
Chromium	910	17	12	8	18	24	13	13	21	63	25	0
Chromium VI	21	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	0
Copper	2400	49	64	25	25	25	65	89	294	1670	233	0
Lead	200	1040	228	42	34	23	179	468	271	5080	423	6
Mercury	40	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	1.7	1	0
Nickel	180	7	10	7	14	22	17	22	44	118	41	0
Selenium	250	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	0
Vanadium	410	19	24	13	24	27	23	31	42	41	36	0
Zinc	3700	182	72	28	38	52	99	482	642	3020	1550	0
Petroleum Hydrocarbons												
Benzene	0.087	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0
Toluene	130	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0
Ethylbenzene	47	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0
o-xylenes	60	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0
m-xylenes	59	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0
p-xylenes	56	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0
Aliphatic EC >5-6	42	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0
Aliphatic EC >6-8	100	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0
Aliphatic EC >8-10	27	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	0
Aliphatic EC >10-12	130 (v)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	0
Aliphatic EC >12-16	1100 (s)	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	3	0
Aliphatic EC >16-21	65000 (s)	3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	7	5	0
Aliphatic EC >21-35	65000 (s)	165	< 10	< 10	< 10	< 10	< 10	< 10	< 10	192	< 10	0
Aromatic EC >5-7	70	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0
Aromatic EC >7-8	130	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0
Aromatic EC >8-10	34	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	9	0
Aromatic EC >10-12	74	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	12	0
Aromatic EC >12-16	140	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	3	20	0
Aromatic EC >16-21	260	5	< 3	< 3	< 3	< 3	< 3	< 3	< 3	19	10	0
Aromatic EC >21-35	1100	31	< 10	< 10	< 10	< 10	< 10	< 10	< 10	216	< 10	0
Polycyclic Aromatic Hydrocarbons												
Naphthalene	2.3	0.14	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.16	< 0.1	0.19	< 0.1	0

Determinand	C4SL/S4UL Levels Residential (mg/kg)	WS201 0.50m MG	WS202 0.70m MG	WS203 0.40m MG	WS204 0.60m MG	WS205 0.50m MG	WS206 0.80m MG	WS207 0.20m MG	WS208 0.40m MG	WS209 0.30m MG	WS210 0.50m MG	No of Exceedances
Acenaphthylene	210	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0
Acenaphthene	170	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.19	0.13	0
Fluorene	170	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.14	0.17	0
Phenanthrene	95	0.63	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.58	0.19	0.7	0.53	0
Anthracene	2400	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.24	< 0.1	0
Fluoranthene	280	1.23	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.65	0.31	1.58	0.79	0
Pyrene	620	1.29	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.64	0.41	1.88	0.79	0
Benzo(a)anthracene	7.2	0.67	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.27	0.19	0.99	0.3	0
Chrysene	15	0.69	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.31	0.24	1.08	0.37	0
Benzo(a)pyrene	5	0.91	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.43	0.24	2.49	0.69	0
Benzo(b)fluoranthene	2.6	0.29	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.81	0.19	0
Benzo(k)fluoranthene	77	0.67	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.28	0.16	2.25	0.58	0
Indeno(1,2,3-cd)pyrene	27	0.35	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.24	< 0.1	1.26	0.4	0
Dibenz(a,h)anthracene	0.24	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.25	< 0.1	1
Benzo(ghi)perylene	320	0.36	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.27	< 0.1	1.15	0.4	0
Phenols												
Phenol	280	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	0
Concentrations in red are above the assessment criteria based on Residential End Use with Plant Uptake. MG = Made Ground												

Figure 3: Location of Contaminant Exceedances



During the course of this investigation, chemical exceedances in arsenic, cadmium, lead and dibenz(a,h)anthracene (a species of PAH) were detected, with respect to the long-term protection of human health, have been identified across six of the samples tested during this investigation when compared to residential (with plant uptake) end use assessment criteria. The exceedances are summarised below in Table 2 and presented in Figure 3 alongside the previously identified contamination.

Table 2: Summary of Chemical Contamination

Contaminant	Location
Arsenic	WS208 (0.40m) & WS209 (0.30m)
Cadmium	WS209 (0.30m)
Lead	WS1 (0.30m), WS4 (0.40m), WS4 (0.90m), WS5 (0.50m), WS201 (0.50m), WS202 (0.70m), WS207 (0.20m), WS208 (0.40m), WS209 (0.30m), WS210 (0.50m)
PAH	WS1 (0.30m), WS1 (1.00m), WS2 (0.60m), WS3 (0.60m), WS4 (0.40m) & WS209 (0.30m)

Asbestos was identified in four of the samples recovered from this investigation. The details of this can be found in Table 3 alongside the previously identified asbestos contamination with the locations presented in Figure 3.

Asbestos testing results are still awaited from the laboratory and will be reported as an addendum letter report.

Table 3: Summary of Asbestos Encountered

Location	Depth	Sample Matrix	Asbestos Type	Asbestos Quantification
WS1	0.30m	Loose fibres	Chrysotile	0.055%
WS4	0.40m	Fibre bundles	Chrysotile	<0.001%
WS201	0.50m	Fibre bundles	Chrysotile	TBC
WS207	0.20m	Fibre bundles	Chrysotile & anthophyllite	TBC
WS209	0.30m	Microscopic cement & bundles	Chrysotile	TBC
WS210	0.50m	Fibre bundles	Chrysotile	TBC

Soil Waste Assessment

An assessment of the disposal characteristics of the soil in accordance with Environment Agency guidance WM3.1, edition of June 2018, "Guidance on the classification and assessment of waste" has been carried out on soils recovered from the site, using HazWasteOnline.

The results are summarised in Table 4 overleaf and presented in full in Appendix C.

Table 4: Waste Classification of Soils

Location	Depth (m bgl)	WM3.1 Classification	Comments
WS1	0.30	Hazardous	Elevated TPH
WS1	1.00	Non-hazardous	-
WS2	0.60	Non-hazardous	-
WS3	0.60	Non-hazardous	-
WS4	0.40	Non-hazardous	-
WS4	0.90	Non-hazardous	-
WS5	0.50	Non-hazardous	-
WS201	0.50	Non-hazardous	-
WS202	0.70	Non-hazardous	-
WS203	0.40	Non-hazardous	-
WS204	0.60	Non-hazardous	-
WS205	0.50	Non-hazardous	-
WS206	0.80	Non-hazardous	-
WS207	0.20	Non-hazardous	-
WS208	0.40	Non-hazardous	-
WS209	0.30	Hazardous	Elevated copper and lead
WS210	0.50	Non-hazardous	-

The above table shows that two of the soil samples collected during the course of this investigation were classified as **Hazardous** in accordance with WM3.1. These samples were deemed hazardous due to elevated concentrations of TPH in WS1 and elevated concentrations of copper and lead in WS209.

All other soil samples collected from the site were classified as **Non-Hazardous** in accordance with WM3.1.

Further Waste Acceptance Criteria (WAC) testing may prove that this material is acceptable as inert waste.

Conclusions

Based on the results of chemical testing from both the original and follow-up site investigation, exceedances in contaminants were observed in five sampling locations. The contaminants included arsenic, cadmium, lead and two species of polycyclic aromatic hydrocarbons (PAHs) which pose a moderate risk to future residential end users.

In order to break potential pollutant linkages to future residential end users, it is recommended that landscaped areas in close proximity to the contaminated area should be capped with clean cover soils.

A remediation strategy (A2212/19/RMS) and asbestos management plan have already been written for this site. It is advised that the recommendations in these reports be followed during the further development and remediation of this site.

Yours Sincerely,



Luke Glover
Senior GeoEnvironmental Consultant

A Czarnecki

Adam Czarnecki
Director

For and on behalf of Earth Environmental & Geotechnical Ltd

Enclosed: Appendix A – Exploratory Hole Logs
Appendix B – Chemical Testing Results
Appendix C – Soil Waste Assessment

APPENDIX A

EXPLORATORY HOLE LOGS

APPENDIX B

CHEMICAL TESTING RESULTS

APPENDIX C

SOIL WASTE ASSESSMENT