GB Card + Partners
CONSULTING ENGINEERS

GB/866- Otterfield Road, Yiewsley

Technical note - Interim Geo-environmental Technical Note (GB866-TN01-JAN-25)

1. Introduction

GB Card & Partners (GBCP) has been commissioned by Bulger Developments Ltd (Bulger) to undertake a supplementary ground investigation works at the site known as Otterfield Road, to support the planning application. The proposed development at the site comprises a public library and residential units with associated parking.

This interim report outlines the geo-environmental testing undertaken on site to date. The aim of these investigations was to assess the environmental and geotechnical conditions of the site to support planning, design, and remediation efforts.

1.1 Background

Bugler Developments intends to develop the site at Otterfield Road, West Drayton, Yiewsley (the Site). GB Card & Partners (GBCP) are appointed as geotechnical and geo-environmental consulting engineers for the project. The site is located on Otterfield Road in the West Drayton area of Yiewsley as shown in Figure 1.

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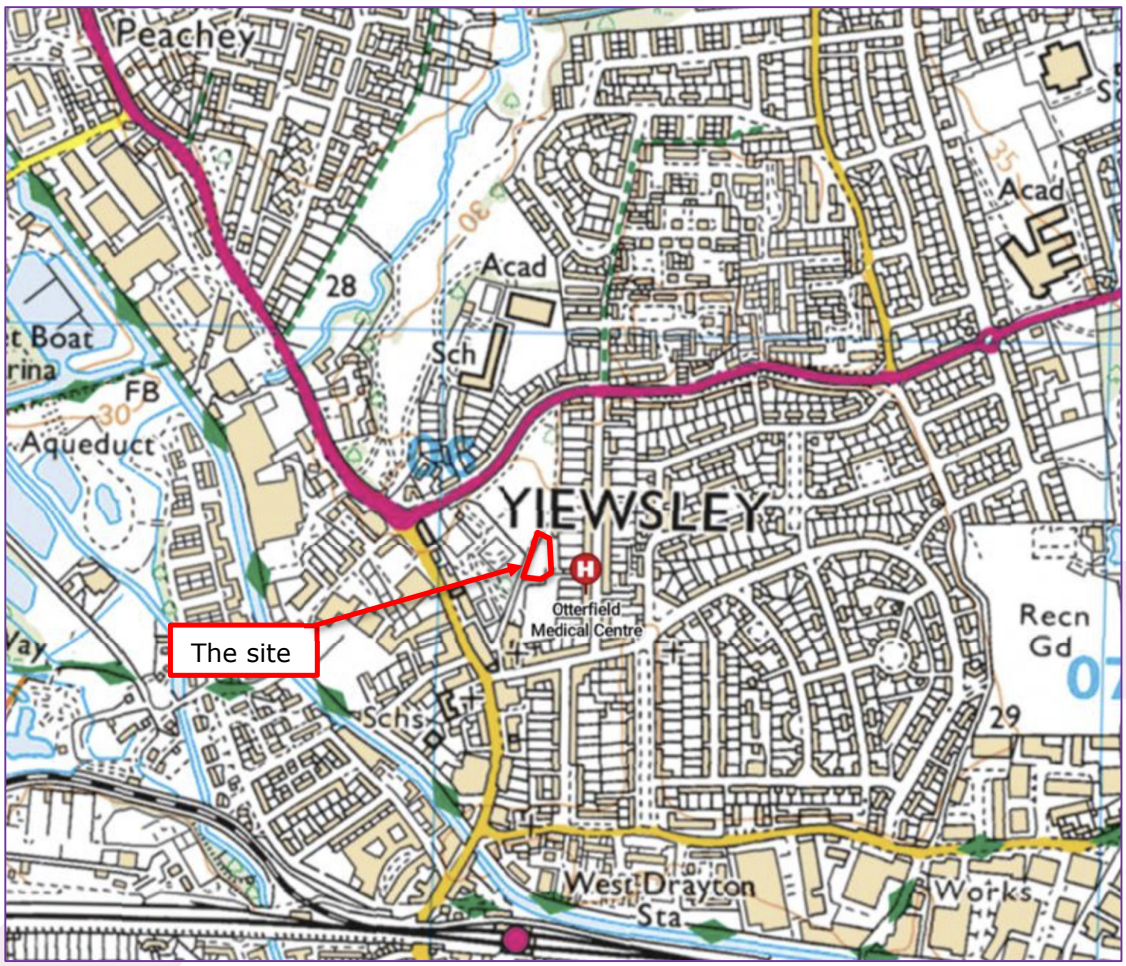

Figure 1: Site Location Plan

Several Phase 2 intrusive ground investigations have been undertaken since 2014 alongside a Phase 1 preliminary risk assessment (PRA) and PRA addendum letters, and finally a Waste Classification Hazard Assessment. These historical reports have been carried out for CET Infrastructure (January 2014), CGL (November & December 2021, July 2023) and most recently for GBCP (December 2024). Locations for all exploratory holes can be found in Figure 2.

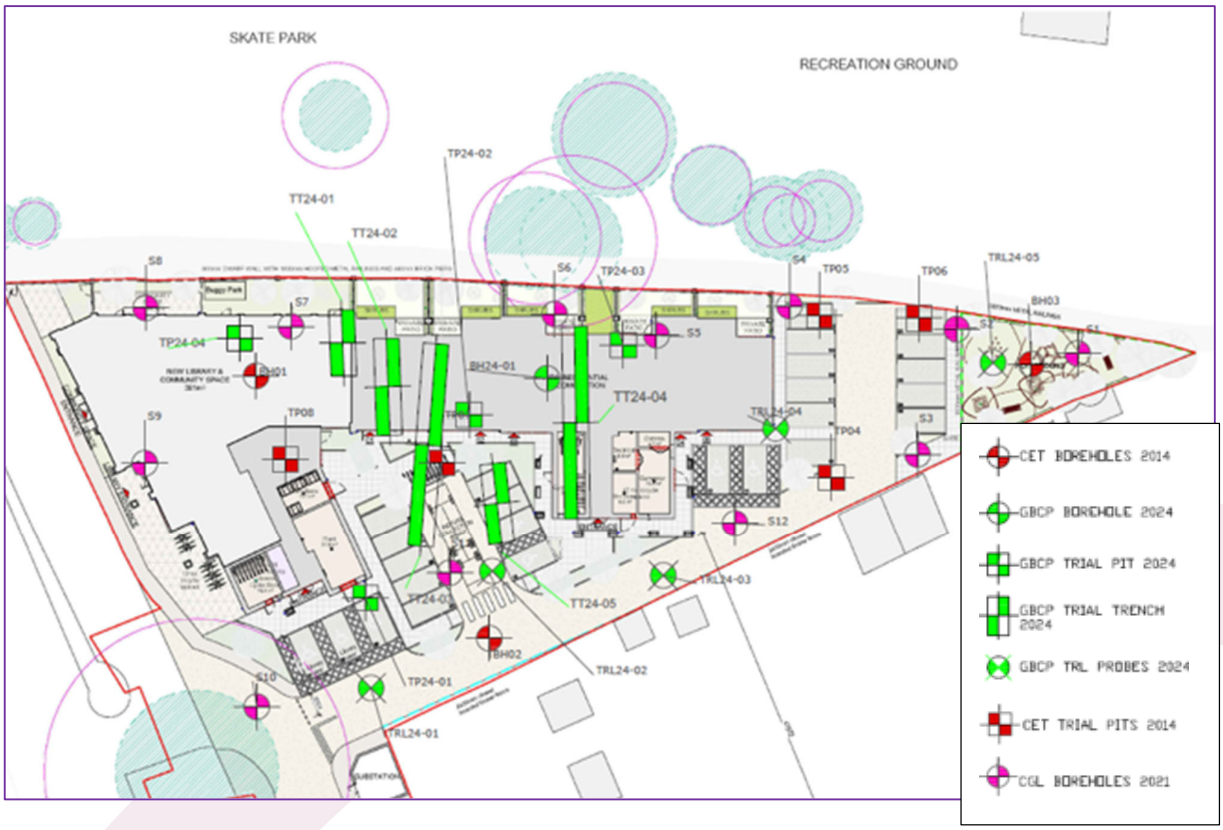

Figure 2: Exploratory hole location plan (do not scale)

2. Site History

Historical Ordnance Survey mapping and the associated detailed information supplied within the Envirocheck report is presented in the Phase 1 Preliminary Risk Assessment report [CET Infrastructure, Jan 2014]. Historically, the site was mapped as open ground until the 1935 series map when an open swimming baths was constructed. A series of buildings were also shown at the site on maps published during the 1960s. This configuration remained until the mid-1980s, at which point these buildings were replaced by an enclosed swimming pool structure that was located at the approximate location of the historical baths. Further detached structures were also mapped on the northern portion of the site during this time. Commercial activities are understood to have historically been carried out on the site too (rubber & plastic manufacturing), with a substation also shown on the 1973 map. The swimming pool structure was last recorded on the 2011 Google Earth Map.

3. Ground Conditions

During the GBCP ground investigation in 2024, Made Ground was recorded in each exploratory hole across the site to a maximum depth of 2.20m bgl and generally contained materials ranging between clay, silt, sand and gravel with fragments of man-made material. The Made Ground was underlain by the Lynch Hill Gravel formation, consisting of silt, sand and medium dense and dense gravel material between depths of 0.40m and 3.90m bgl. The London Clay Formation sits beneath the Lynch Hill Gravel and consists of a firm CLAY that becomes very stiff with depth. This was encountered to a depth of 30.00m bgl during drilling, therefore the end depth of this geological formation was not found.

3.1 Groundwater Observations

Groundwater was encountered (during drilling) within some of the boreholes from the 2014 GI and also (during the excavation) within some of the trial pits, two of the trial trenches and the one borehole from the 2024 GI. The groundwater that was encountered within the 2014 boreholes ranged between drilling groundwater strike depths of 1.60m and 1.70m bgl, with recorded standing groundwater depths of 1.80m and 2.00m bgl. The trial pits, trial trench and borehole from the 2024 investigation encountered groundwater at depths of between 1.90m to 2.20m bgl.

4. Previous Ground Investigation

4.1 Phase 2 Generic Risk Assessment (GRA) (issued in 2014)

An intrusive investigation in 2014 was undertaken by CET Infrastructure and comprised of eight shallow hand excavated trial pits to depths of up to 1.20m below ground level (bgl) and three cable percussion boreholes to 25.00m bgl. Made Ground was proved to a maximum depth of 1.70m bgl, which was underlain by superficial deposits of Lynch Hill Gravel Member then the London Clay Formation. The contaminants tested during this investigation included;

- A suite of metals comprising As, Cu, Cd, Cr, Cr VI, Hg, Pb, Ni, Se and Zn;
- Speciated Poly Aromatic Hydrocarbons (PAHs);
- Polychlorinated biphenyls (PCBs);
- Phenols (total monohydric)

- Asbestos (identification only);
- Volatile and Semi Volatile Organic Compounds (VOCs/SVOCs);
- pH; and
- Total Organic Carbon (TOC).

The GRA report concluded that elevated concentrations of arsenic and three PAH compounds were recorded when the laboratory results of Made Ground samples were compared against the 'residential with plant uptake' generic assessment criteria. The GRA recommended that remedial works should take place before the site would be suitable for residential use.

GBCP has screened the historical results to the most up to date Suitable 4 Use Levels (S4UL) published by Land Quality Management Ltd (LQM) and the Chartered Institute of Environmental Health (CIEH)[1] as well as the Category 4 Screening Levels (C4SL) published by the Department of Environment, Food and Rural Affairs (DEFRA)[2]. The Generic Assessment Criteria (GACs) published by EIC/AGS and CL:AIRE[3] have also been used to supplement the screening assessment. The relevant screening criteria have been selected to comprise the conservative Tier 1 GAC Residential with homegrown produce. A summary table of the results can be seen below.

Table 1: Results Summary Table (CET Infrastructure, 2014)

Contaminant	Number of samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Metals					
Arsenic	9	13	37		0
Cadmium	9	LOD	0.6		0
Chromium	9	20	28		0
Chromium IV	9		1		0
Lead	9	61	280		1 (TP06 0.10mbgl)

[1] LQM/CIEH (2015). *The LQM/CIEH S4ULs for Human Health Risk Assessment.* Land Quality Press.

[2] DEFRA (2014). SP1010 – *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination.* Final Project Report (Revision 2) dated 24 September 2014.

[3] CL:AIRE (2010) in association with AGS and EIC. *Soil Generic Assessment Criteria for Human Health Risk Assessment.* (https://www.clarire.co.uk/component/phocadownload.catagory/8).

Contaminant	Number of samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Mercury	9	LOD	2.1		0
Nickel	9	15	23		0
Copper	9	26	70		0
Zinc	9	56	150		0
Selenium	9	LOD			0
PAHs					
Acenaphthene	9	0.12	0.13	210	0
Acenaphthylene	9	0.12	0.13	170	0
Anthracene	9	0.19	1.11	2400	0
Benzo(a)anthracene	9	0.12	3.35	7.2	1 (TP02 at 0.20)
Benzo(a)pyrene	9	0.13	3.4	2.2	1 (TP02 at 0.20)
Benzo(b)fluoranthene	9	0.11	4.24	2.6	1 (TP02 at 0.20)
Benzo(ghi)perylene	9	0.13	2.31	320	0
Benzo(k)fluoranthene	9	0.12	1.9	77	0
Chrysene	9	0.14	2.71	15	0
Dibenzo(ah)anthracene	9	0.17	0.47	0.24	1 (TP02 0.20)
Fluoranthene	9	0.19	6.93	280	0
Fluorene	9	0.13	0.26	170	0
Indeno(123-cd)pyrene	9	0.14	2.44	27	0
Naphthalene	9	0.24	0.24	2.3	0
Phenanthrene	9	0.12	3.91	95	0
Pyrene	9	0.18	6.09	620	0
Hydrocarbons					
Aliphatic EC5-6	9	0	0	42	0
Aliphatic EC6-8	9	0	0	100	0
Aliphatic EC8-10	9	0	0	27	0
Aliphatic EC10-12	9	0	0	130	0
Aliphatic EC12-16	9	0	0	1100	0
Aliphatic EC16-21	9	3	9	65000	0
Aliphatic EC21-34	9	24	51	65000	0
Aromatic EC5-7	9	0	0	70	0
Aromatic EC7-8	9	0	0	130	0
Aromatic EC8-10	9	0	0	34	0
Aromatic EC10-12	9	0	0	74	0
Aromatic EC12-16	9	0	0	140	0
Aromatic EC16-21	9	13	36	260	0

Contaminant	Number of samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Aromatic EC21-35	9	21	100	1100	0

Notes:
LOD – Laboratory limit of detection

From the GBCP screening assessment, concentrations above the laboratory limit of detection for PAH compounds were encountered in seven of the nine tested samples, with total concentrations ranging from 0.6mg/kg to 6.98mg/kg (TP02 at 0.50m).

Five of the tested samples contained recordable concentrations of the PAH compound benzo(a)pyrene, with concentrations ranging from 0.1mg/kg to 3.7mg/kg (TP02 at 0.50m). Monohydric phenols were not detected in any of the four soil samples tested by the laboratory. Recordable concentrations of PCBs were encountered in the sample recovered from TP04 at 0.20m only, with this specific sample recording a concentration of 0.028mg/kg. Concentrations of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b) fluoranthene and Dibenzo(ah)anthracene all exceeded the generic assessment criteria for 'residential with homegrown produce' within TP02 at 0.50mbgl. This sample was recorded to be taken from the Made Ground.

From the GBCP screening assessment one elevated sample of Lead was identified within TP06 at 0.10mbgl.

Concentrations of VOCs were not detected in any of the four samples scheduled for chemical analysis. With the exception of the recorded PAH compounds discussed above, the large majority of the SVOC compounds tested for were less than the respective analytical detection limits. The only exception was bis(2ethylhexyl)phthalate, which was recorded at a concentration of 0.1mg/kg in TP04 at 0.20m.

4.2 Phase 2 Generic Risk Assessment (issued October 2021)

An intrusive investigation was undertaken by CGL in October 2021 and comprised of twelve shallow hand-augured inspection pits to depths of up to 1.50mbgl. Made Ground was identified to a maximum depth of 1.50m bgl, which was underlain by superficial deposits of Lynch Hill Gravel Member. The London Clay Formation was not identified

during this investigation. Twelve samples were sent to the laboratory for chemical testing. The contaminants tested during this investigation included;

- A suite of metals comprising As, B, Cu, Cd, Cr, Cr VI, Hg, Pb, Ni, Se and Zn;
- Speciated Poly Aromatic Hydrocarbons (PAHs);
- Speciated petroleum hydrocarbons (TPH CWG);
- BTEX;
- Polychlorinated biphenyls (PCBs);
- Asbestos (screen and quantification where positive);
- Total monohydric phenols.

The GRA conducted in 2021 concluded that from the twelve samples tested three exceedances in PAHs were recorded when compared to the S4UL assessment criteria for 'Residential with plant uptake'.

GBCP has screened the historical results to the most up to date Suitable 4 Use Levels (S4UL) published by Land Quality Management Ltd (LQM) and the Chartered Institute of Environmental Health (CIEH) as well as the Category 4 Screening Levels (C4SL) published by the Department of Environment, Food and Rural Affairs (DEFRA) . The Generic Assessment Criteria (GACs) published by EIC/AGS and CL:AIRE have also been used to supplement the screening assessment. The relevant screening criteria have been selected to comprise the conservative Tier 1 GAC Residential with homegrown produce. A summary table of the results can be seen below.

Table 2: Results Summary Table (CGL, 2021)

Contaminant	Number of Samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Metals					
Arsenic	12	10	20	37	0
Cadmium	6	0.2	0.5	11	0
Chromium	12	13	22	910	0
Chromium IV	121	LOD	0.00	21	0
Lead	12	52	168	200	0

Contaminant	Number of Samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Mercury	12	1.3	1.3	40	0
Nickel	12	11	18	130	0
Copper	12	22	48	2400	0
Zinc	12	49	129	3700	0
Selenium	12	LOD			0
PAHs					
Acenaphthene	12	LOD	0.13	210	0
Acenaphthylene	12	LOD	0.13	170	0
Anthracene	12	LOD	1.11	2400	0
Benzo(a)anthracene	12	LOD	3.35	7.2	0
Benzo(a)pyrene	12	LOD	3.40	2.2	1 (Sample 7)
Benzo(b)fluoranthene	12	0.11	4.24	2.6	2 (Sample 7 and 8)
Benzo(ghi)perylene	12	0.13	2.31	320	*0*
Benzo(k)fluoranthene	12	0.12	1.9	77	0
Chrysene	12	0.14	2.71	15	0
Dibenzo(ah)anthracene	12	0.17	0.47	0.24	1 (Sample 7)
Fluoranthene	12	0.19	6.93	280	0
Fluorene	12	0.13	0.26	170	0
Indeno(123-cd)pyrene	12	0.14	2.44	27	0
Naphthalene	12	0.24	0.24	2.3	0
Phenanthrene	12	0.12	3.91	95	0
Pyrene	12	0.18	6.09	620	0
Hydrocarbons					
Aliphatic EC5-6	12	LOD	LOD	42	0
Aliphatic EC6-8	12	LOD	LOD	100	0
Aliphatic EC8-10	12	LOD	LOD	27	0
Aliphatic EC10-12	12	LOD	LOD	130	0
Aliphatic EC12-16	12	LOD	LOD	1100	0
Aliphatic EC16-21	12	3	9	65000	0
Aliphatic EC21-34	12	24	51	65000	0
Aromatic EC5-7	12	LOD	LOD	70	0
Aromatic EC7-8	12	LOD	LOD	130	0
Aromatic EC8-10	12	LOD	LOD	34	0

Contaminant	Number of Samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Aromatic EC10-12	12	LOD	LOD	74	0
Aromatic EC12-16	12	LOD	LOD	140	0
Aromatic EC16-21	12	13	36	260	0
Aromatic EC21-35	12	21	100	1100	0

LOD – Laboratory limit of detection

From the GBCP screening exercise, three PAHs have been identified to have exceeded the adopted assessment criteria. One exceedance of Benzo(a)pyrene was recorded within sample 7. Two exceedances of Benzo(b)fluoranthene were recorded within sample 7 and 8. Two exceedances of Dibenzo(ah)anthracene were recorded within sample 7 and 8.

5. GBCP 2024 Ground Investigation

A ground investigation was undertaken by GBCP in 2024 and comprised of one borehole, five TRL holes for DCP testing, four trial pits and five trial trenches. Three of the trial pits were conducted for soakaway testing and the trial trenches were conducted to enable GBCP to be in attendance to undertake a watching brief and waste classification; also with an aim to try and expose and identify old foundations and/or backfilled materials used to infill the former swimming pool. However, no foundation features were encountered and natural ground was exposed at the base of all but one of the trial trench holes. The investigation revealed Made ground to a maximum depth of >2.20mbgl, followed by the Lynch Hill Gravel Member, underlain by the London Clay Formation. This is inline with the previous investigations undertaken to date. Four samples were scheduled for contamination testing, all the samples chosen for testing were taken from the Made Ground and the chemicals tested included;

- A suite of metals comprising As, Cu, Cd, Cr, Cr VI, Hg, Pb, Ni, Se and Zn;
- Speciated Poly Aromatic Hydrocarbons (PAHs);
- Polychlorinated biphenyls (PCBs);
- Phenols (total monohydric)
- Asbestos (identification only);
- Volatile and Semi Volatile Organic Compounds (VOCs/SVOCs);

- pH; and
- Total Organic Carbon (TOC).

Two additional samples were tested for Waste Acceptance Criteria (WAC) to further assess the material's compliance. As part of the analysis, GBCP screened the results specifically for Polycyclic Aromatic Hydrocarbons (PAH), ensuring that any relevant findings were identified. However, all other parameters outside the scope of PAH were not considered, as they do not fall within the remit of this review.

GBCP has screened the results with the Suitable 4 Use Levels (S4UL) published by Land Quality Management Ltd (LQM) and the Chartered Institute of Environmental Health (CIEH) as well as the Category 4 Screening Levels (C4SL) published by the Department of Environment, Food and Rural Affairs (DEFRA) . The Generic Assessment Criteria (GACs) published by EIC/AGS and CL:AIRE have also been used to supplement the screening assessment. The relevant screening criteria have been selected to comprise the conservative Tier 1 GAC Residential with homegrown produce. A summary table of the results can be seen below.

Table 3: Results Summary Table (GBCP, 2024)

Contaminant	Number of Samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Metals					
Arsenic	4	7.6	13	37	0
Cadmium	4	0.4	0.5	11	0
Chromium	4	29	71	910	0
Chromium IV	4	LOD	LOD	21	0
Lead	4	19	120	200	0
Mercury	4	0.30	0.60	40	0
Nickel	4	14	19	130	0
Copper	4	16	36	2400	0
Zinc	4	22	110	3700	0
Vanadium	4	21	43	410	0
Selenium	4	LOD		250	0
PAHs					
Acenaphthene	6	LOD	0.18	210	0

Contaminant	Number of Samples	Min. value	Max value	GAC	No. of samples exceeding assessment criteria
Acenaphthylene	6	LOD	0.20	170	0
Anthracene	6	LOD	0.51	2400	0
Benzo(a)anthracene	6	LOD	3.10	7.2	0
Benzo(a)pyrene	6	LOD	3.70	2.2	1 (TP24 – 04 at 0.10m bgl – 0.30mbgl)
Benzo(b)fluoranthene	6	LOD	4.10	2.6	1 (TP24 – 04 at 0.10m bgl – 0.30mbgl)
Benzo(ghi)perylene	6	LOD	1.90	320	0
Benzo(k)fluoranthene	6	LOD	1.60	77	0
Chrysene	6	LOD	2.80	15	0
Dibenzo(ah)anthracene	6	LOD	0.38	0.24	1 (TP24 – 04 at 0.10m bgl – 0.30mbgl)
Fluoranthene	6	LOD	5.10	280	0
Fluorene	6	LOD	0.09	170	0
Indeno(123-cd)pyrene	6	LOD	1.80	27	0
Naphthalene	6	LOD	0.08	2.3	0
Phenanthrene	6	LOD	1.50	95	0
Pyrene	6	LOD	5.1	620	0
Hydrocarbons					
Aliphatic EC5-6	4	LOD	LOD	42	0
Aliphatic EC6-8	4	LOD	LOD	100	0
Aliphatic EC8-10	4	LOD	LOD	27	0
Aliphatic EC10-12	4	LOD	LOD	130	0
Aliphatic EC12-16	4	LOD	LOD	1100	0
Aliphatic EC16-21	4	LOD	LOD	65000	0
Aliphatic EC21-34	4	LOD	LOD	65000	0
Aromatic EC5-7	4	LOD	LOD	70	0
Aromatic EC7-8	4	LOD	LOD	130	0
Aromatic EC8-10	4	LOD	LOD	34	0
Aromatic EC10-12	4	LOD	LOD	74	0
Aromatic EC12-16	4	LOD	LOD	140	0
Aromatic EC16-21	4	LOD	LOD	260	0
Aromatic EC21-35	4	LOD	24	1100	0

LOD – Laboratory limit of detection

Concentrations of VOCs/SVOCs were not detected in any of the four samples scheduled for chemical analysis. With the exception of the recorded PAH compounds discussed above, the large majority of the SVOC compounds tested for were less than the respective analytical detection limits.

The GBCP screening assessment revealed that three exceedances of PAH compounds were recorded within TP24-04 at 0.10mbgl – 0.30mbgl. The PAH compounds were Benzo(a) pyrene, Benzo(b)fluoranthene and Dibenzo(ah)anthracene.

6. Conclusions

In conclusion, the findings from all of the previous investigations consistently indicate exceedances in polycyclic aromatic hydrocarbons (PAHs), along with occasional exceedances in metal concentrations. The data collected to date, has identified that remediation measures are likely to be needed. Further information relating to the site, and in particular this interim geo-environmental assessment and a proposed remediation strategy, will be provided within the Geotechnical and Geo-environmental Interpretative report (GGEIR) in due course.

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