



Ashley House & Cannon Factory, Ashley Road South, Tottenham Hale, London

Supplementary Ground Investigation - Interpretive Report

May 2023

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Comments

Comments

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Executive Summary

Objectives

Waterman were instructed on behalf of Notting Hill Genesis to undertake supplementary ground investigation to fill gaps in information and reduce uncertainties with respect to previously recorded hydrocarbon contamination at two sites, Ashley House and Cannon Factory located at Ashley Road South, Tottenham Hale, London (hereafter referred to separately as “Ashley House” and “Cannon Factory”).

Site Setting

Current Use	The sites comprise two separate plots, Ashley House and Cannon Factory, both located on Ashley Road. Both sites are vacant with empty former works and industrial units on both. Areas not covered by vacant building are covered with concrete hard standing. Land around both plots has been largely recently redeveloped for a residential led use.
History	Historically the Ashley House Site was a farm between 1850 – 1898 prior to becoming occupied by multiple factories in 1913. In 1936 the Ashley House Site was occupied by a printing ink and varnish factory which included various tanks chimneys and a water-cooling tower. From 1972 to present there has been little change to the Site layout. The Cannon Factory Site was undeveloped until the 1940's when warehouses and a rubber factory occupied the site. From 1970 to present partial redevelopment to the large warehouse in the northern Site portion has occurred.
Ground Conditions	Both sites are covered by concrete hardstanding underlain by made ground which is subsequently underlain by the Enfield Silt Member, Kempton Part Gravel and the London Clay formation. Impacted soil as a results of the site's previous use were encountered during the ground investigation.
Controlled Waters	Groundwater levels at Cannon Factory ranged from 2.43m bgl to 2.80m bgl and in Ashley House 2.52m bgl to 2.78m bgl. Groundwater was locally impacted with hydrocarbons however detailed assessment of the contamination confirmed a risk to controlled water receptors was not present.
Ground Gas Regime	The ground gas and vapour regime was confirmed as not pose a risk to the future development.

Conceptual Model

Potential contaminant linkages identified for the Site are as follows:

- Future Site users in areas of proposed soft landscaping, and construction workers may come into direct contact with shallow contaminants;
- Off-site users may be exposed to contaminated dust and fibres during redevelopment of the Site;
- Risk of chemical attack on buried foundations or services;
- Plant uptake of contaminants in shallow soils and groundwater;
- Impacts to groundwater are present on site both Ashley Road and the Cannon Factory however have been confirmed not to pose a risk to off site controlled water receptors. However betterment remedial works will take place at Cannon Factory.
- Buried tanks are known to be present on Ashley Road these will be removed as part of redevelopment. Other potentially contaminative infrastructure may exist on site, this will also be removed as part of the redevelopment of the sites.
- Piling through low permeability Enfield Silt Member and London Clay Formation may present a potential risk to Secondary A Aquifers and Principal Aquifer at depth.

Conclusions

Given the proposed end use the overall risk rating for the Site is **Medium**, however following implementation of remedial measures are set out the Remediation Strategy (WIE16248-100-S-1-2-1.RS the risk will be **Low**.

Recommendations

- A Remediation Strategy has been prepared (Report ref. WIE16248-100-R-1-2-1-RS) detailing remedial measures to be carried out as part of the site redevelopment. The Remediation Strategy should be fully consulted prior to works commencing to ensure the requirements of the Remediation Strategy are understood and can be adequately planned and accounted for.
- Soft landscaping areas will require capping layers of at least 600mm certified clean materials to break potential contaminant pathways between contaminants in soils and future Site users. A colour marker is also required. Soil in soft landscaping areas should be suitable for a residential end-use;
- Clean service corridors, physically separated from residual contaminated soils and groundwater, should be provided for new services to ensure a preferential pathway is not created for contamination to migrate off-site.
- Barrier pipes are recommended for water supply pipes to be placed into Site soils. This approach would need to be agreed with Thames Water;
- Potentially hazardous chemicals should be appropriately stored, banded and sited away from surface waters;
- Import criteria for soils are presented in the Remediation Strategy and should be adhered to for all material imported to site.
- Construction workers should utilise appropriate PPE when undertaking handling soils and groundwater. If required, dampening down of material should take place during excavation works. Construction workers will adhere to good practice hygiene and safety measures, and the Control of Asbestos Regulations 2012.
- Asbestos fragments and fibres in soil have been encountered and construction workers should be asbestos awareness trained and works should be undertaken in accordance with the APoW. Appropriate measure should be in place to prevent fibre release and corresponding monitoring;
- Entry to confined spaces should be carried out in line with the Confined Space Entry Regulations 1997;
- The risk of chemical attack to buried concrete can be mitigated by selecting a concrete class appropriate for the ground conditions in accordance with BRE-Special Digest 1;
- Classification of waste soils in accordance with WM3 (in particular Appendix D on waste sampling) to confirm the findings of the Preliminary Waste Classification Assessment. Most of the soil samples did not return hazardous properties. Natural uncontaminated soils may be acceptable as inert waste without testing at some landfills;
- A Foundation Works Risk Assessment should be carried out to confirm piling carried out will not pose a risk to controlled water receptors.
- Uncontaminated concrete may be recovered for reuse on-site subject to compliance with the WRAP Quality Protocol for Production of Aggregates from Inert Waste or recovered as inert waste subject to acceptance at an appropriately permitted facility;
- Verification Report(s) should be prepared following phases of work as required demonstrating works were carried out in line with the agreed Remediation Strategy

1. Introduction

1.1 Objectives

Notting Hill Genesis instructed Waterman Infrastructure & Environment Limited (“Waterman”) to undertake supplementary ground investigation to fill gaps in information and reduce uncertainties with respect to previously recorded hydrocarbon contamination at two adjacent sites, Ashley House and Cannon Factory, Ashley Road South, Tottenham Hale, London (hereafter referred to separately as “Ashley House” and “Cannon Factory”).

A Site Location Plan is presented in Appendix A.

This assessment follows on from and should be read in conjunction with the following reports:

- Ashley House & Cannon Factory, Ashley Road South, Tottenham Hale, London. Factual and Interpretative Report on Ground Investigation. Ref. D8061-18, August 2019. Socotec UK Limited (hereafter “the Socotec report”);
- Ashley Road Regeneration – Ashley Gardens. Preliminary Risk Assessment – Land Quality. Ref. 70022931-GB1, April 2017. WSP Parsons Brinckerhoff (hereafter “the WSP report”);
 - Land subject to report located off-site, immediately to the north;
- Ashley House, Tottenham Hale. Geo-Environmental Site Assessment. Ref. 27663 R01 (00), February 2015. RSK Environment Ltd (hereafter “the RSK Ashley House report”);
- Cannon Factory, Ashley Road, Tottenham Hale, London N17 9LH. Environmental Site Assessment. Ref. 27782R01 (00), April 2015. RSK Environment Limited (hereafter “the RSK Cannon Factory report”).

A number of third parties (RSK and Socotec) have completed ground investigation at the two Sites and recorded hydrocarbon contamination in both the soils and groundwater. Waterman were provided the above reports together with planning consultation feedback from Haringey Council for review.

This report has been prepared to address comments received from Haringey Council Pollution Officer by email on 22 February 2023 following submission of the Socotec report to discharge Planning Condition 25 Part A (Land Contamination) of Planning Permission HGY/2016/4165 and to provide the findings of the supplementary Ground Investigation (GI) carried at Ashley Road and the Cannon Factory Sites, which will inform preparation of the Remediation Strategy which is reported under a separate cover.

This report should be submitted to facilitate discharge Condition 25 Part A (Land Contamination) of Planning Permission HGY/2016/4165.

1.2 Regulatory Status

It is understood that the above referenced RSK report was first submitted to Haringey Council in pursuit of discharge of planning condition 25 Part A. A second round of ground investigation by Socotec was undertaken and further comments from Haringey Council received. For clarity the comments received are detailed below.

Each comment from Haringey Council Pollution Officer on the Socotec report is reproduced below:

“Groundwater:

*a. Sub-section 8.31 (Controlled Water Risk Assessment Screening) indicates that four groundwater samples were recovered on 24th April 2019. However, it is unclear on the method of groundwater sampling used. Given the potential for chlorinated solvents and petroleum hydrocarbons we would expect the groundwater samples to have been taken using low flow techniques minimising the volatile contaminant loss. This is consistent with best practice. **Clarification is therefore required***

- b. The Socotec UK Limited report mentions the potential impact of offsite sources to be the cause of hydrocarbon contamination at Ashley House. No assessment has been undertaken to determine if this is the case. **The sites impact on the groundwater regime should be determined** by assessing the groundwater flow direction (via groundwater levels) and comparison of contaminant concentrations up hydraulic gradient and down hydraulic gradient of the site.
- c. We agree with the conclusions drawn in Subsection 8.31 of the Socotec UK limited report that Ashley House represents an unacceptable risk to controlled ground waters and that further investigation and risk assessment is required. **As a minimum we would expect that an additional groundwater sampling round utilising all monitoring wells is completed.**
- d. We disagree with the conclusion that the risk of Cannon Factory causing unacceptable pollution of controlled waters is considered to be low. Given the concentrations recorded in BH02 and the oily sheen observed during sampling, we would consider that a potentially unacceptable risk is present. **We would therefore require additional sampling to be undertaken at Cannon Factory in line with points b and c above.**
- e. The bioavailable contaminants (zinc, lead, nickel, copper, manganese) threshold criteria have not been calculated using the EA M-BAT tool and therefore are highly conservative.

Ground Gas:

- f. Section 9 (Ground Gas) does not provide a review of the potential sources of ground gas. **We would expect an assessment of the potentially significant source offsite sources as well as onsite sources, using ground condition information obtained by the RSK investigations.**
- g. Section 9.2 (Gas Monitoring Assessment) indicates that “each monitoring pipe response zone was saturated by groundwater, which can influence gas readings”. As per best practice guidance the ground gas monitoring wells should be installed within the unsaturated zone to avoid interference from small quantities of organic material in the water column. Therefore, the ground gas regime for both Ashley House and Cannon Factory need to be reassessed with unrepresentative ground gas monitoring results identified and removed from consideration.”

Soil:

- h. From a review of the soil sampling results it is noted that samples BH4, PH1A and BH3 are deviant laboratory results due to the holding time being exceeded. **These results would not be accepted as the exceeded holding time can affect the measured concentrations, particularly the volatile compounds. Further soil testing is therefore required.**

The applicant will need to provide us with an updated Ground Investigation Report covering the above issues before we can recommend the discharge of the above condition.”

1.3 Proposed Development

Outline planning permission (ref. HGY/2016/4165) was granted May 2018 for demolition of the existing buildings at Ashley House and Cannon Factory and erection of three buildings to provide up to 3,600sqm of commercial floorspace (GEA) (Class A1/A3/B1/D1), up to 265 residential units (Class C3), new public realm, landscaped amenity space, car and cycle parking and all associated works. (Outline planning application).

The proposed layout is included in Appendix A.

The proposed Development aims to regenerate two existing brownfield sites in Tottenham Hale as three high quality, successful mixed use buildings.

The development will produce a new commercial and residential destination, which will provide more jobs and housing for locals and the wider community. The project looks to improve and increase the efficiency of the site by offering the following:

- 255 units for housing;
- 3,100 square metres of commercial space;
- 1,500 square metres of residential amenity space within the buildings;
- Childrens Play Space;
- 19 Car Parking Spaces.

The development comprises a total Residential NIA of 17,313m².

Both sites have an approximate plan area of 1.03 Hectares.

Building 2, adjacent to Down Lane Park to the west of the Ashley House Site, is four storeys above ground and includes commercial space at Ground Floor with three storeys of residential over.

Building 2A, between Building 2 and Ashley Road is between four and seven storeys above ground. The Ground Floor includes commercial space, plant rooms, bin stores, bike stores and residential areas. Above ground floor the building is residential with a shared roof terrace and green/brown roof areas.

Building 3, located at the Cannon Factory Site is between nine and seventeen storeys above ground. The Ground Floor includes commercial space, plant rooms, bin stores, bike stores, car parking and residential entrances. The First Floor is primarily commercial space, with a shared external residential amenity space, including a children's play park. Above first floor the building is residential with a shared roof terrace and green/brown roof areas.

2. Procedures

This Generic Quantitative Environmental Risk Assessment has been undertaken in general accordance with the Land contamination: risk management guidance (LCRM – Environment Agency, April 2021). The report includes the following:

- review and confirmation of the overall site objectives
- GQRA objectives
- outline Conceptual Model for the Site
- results of Intrusive Ground Investigation
- confirmation of Generic Assessment Criteria used to assess risks
- assessment of results against Generic Assessment Criteria
- formulation of a new Conceptual Model for the Site
- identification of potentially unacceptable risks
- record of findings and recommendations for further action.

This report forms a decision record for the contaminant linkages identified, the generic assessment criteria used to assess risks, the unacceptable risks identified and the proposed next steps in relation to the site. The report also provides an explanation of the refinement of the outline conceptual model following the ground investigation, the selection of criteria and assumptions, an assessment of uncertainties and limitations, the evaluation of potential risks and the basis for the decision on what happens next.

3. Outline Conceptual Model

The following section presents a summary of the site settings established by RSK and Socotec to date.

3.1 Ground Conditions

3.1.1 Geology

The geological sequences encountered at the Ashley House and Cannon Factory Sites by Socotec are summarised in Tables 1 and 2.

Table 1: Geological strata encountered by Socotec – Cannon Factory Site

Soil Type	Depth of Top of Stratum (m bgl)	Thickness (m)	Typical Description
Made Ground	0.00	0.25 – 2.17	Sub-base underlain by a silty gravelly sand
Enfield Silt Member	0.50 – 2.10	0.70 – 1.60	Orangish/yellowish brown slightly sandy gravelly clay
Kempton Park Gravel Member	2.10 – 2.20	3.20 – 4.60	Orangish brown very gravelly sand to very sandy gravel.
London Clay Formation	5.40 – 6.70	15.80 – 16.30	Grey and dark brown clay
Lambeth Group	21.70 – 22.50	>17.45	Clay underlain by silty sand

Table 2: Geological strata encountered by Socotec – Ashley House Site

Soil Type	Depth of Top of Stratum (m bgl)	Thickness (m)	Typical Description
Made Ground	0.00	0.59 – 1.20	Concrete slab 0.15 to 0.30m thick. A second concrete slab 0.08 – 0.15m thick at depths of between 0.22 to 0.90m bgl. Sub-base underlain by a sandy gravelly clay with fragments of brick, concrete
Enfield Silt Member	0.59 – 1.20	1.10 – 1.27	Orangish/yellowish brown slightly sandy gravelly clay.
Kempton Park Gravel Member	1.86 – 2.30	>1.14 – 3.50	Orangish brown very gravelly sand to very sandy gravel.
London Clay Formation	5.30 – 5.70	>2.50	Grey and dark brown clay.

3.1.2 Hydrogeology

Groundwater monitoring at the Cannon Factory Site recorded ground water levels ranging between 2.19 and 2.47m bgl (i.e. within the Kempton Park Gravel Member).

Groundwater monitoring at the Ashley House Site recorded ground water levels ranging between 2.39 and 2.59m bgl (i.e. within the Kempton Park Gravel Member).

3.1.3 Recorded Visual and Olfactory Evidence of Contamination

The Socotec investigation recorded the following visual and olfactory evidence of contamination.

Cannon Factory Site

- Potential asbestos containing materials in Made Ground in PH3 at 0.90 m bgl;
- Potential asbestos containing materials in Made Ground in PH3a at 0.15 m bgl;
- Moderate to strong hydrocarbon odours in Made Ground and Kempton Park Gravel Member in BH02 at 0.80 to 4.50 m bgl, and weak hydrocarbon odour in Kempton Park Gravel Member 4.50 to 6.80m bgl;

The Socotec report also notes the following observations were made in RSK Cannon Factory report:

- Black staining adjacent to electricity substation in SW part of the Cannon Factory site;
- Chrysotile cement-board in the Made Ground in PH1 at 0.80m bgl

Ashley House Site

- Hydrocarbon odour in Made Ground in PH1a at 0.65 to 2.90 m bgl.

The Socotec report also notes the following observations were made in RSK Ashley House report:

- Local black staining and hydrocarbon odour in Made Ground at WS102 and WS111;
- Local black staining and hydrocarbon odour in the Kempton Park Gravel Member at WS101, WS103, WS105, and WS109;
- Strong hydrocarbon odour and black discolouration of groundwater in one borehole (WS107) (although no free product - LNAPL);
- Local fibrous material, possibly asbestos, in the Made Ground in WS102 at 1.00m bgl.

3.2 Potentially Significant Pollution Linkages

The conceptual site model set out in Table 13 of the Socotec report is summarised in Tables 3 and 4 below.

Table 3: Socotec Revised Conceptual Site Model – Ashley House Site

Receptor	Potential sources	Pathways	Risk	Justification
Human Health				
Future site occupants	On-site historical factory and works: Fuel oils, heavy metals, solvents, lubricating oils, PAHs, asbestos, cyanides. On-site historical and current storage tanks and other point sources (1930s–current): Current two diesel tanks and interceptor – petroleum hydrocarbons (fuels oils) Historical tanks – petroleum hydrocarbons, chlorinated solvents, cyanides, metals. Current warehouses and potential chemical storage onsite: Asbestos, hydrocarbons lube oil, kerosene, trichloroethylene (TCE). Made Ground associated with previous phases of development: Unknown fill material (but potentially including heavy metals, ash, clinker, PAHs, asbestos etc.)	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	High	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH, TPH and the local presence of asbestos. Remedial action will be required.
		Vapour inhalation	Moderate	The in situ and laboratory test results indicate a generally low risk from vapours in the ground. However, it should be noted that in the Ashley House part of the site the RSK report records the presence of underground diesel tanks (with associated fuel pump), together with an effluent tank and a waste oil tank. These redundant tanks represent enclosed spaced within which vapours or ground gases may have accumulated
		Exposure to ground gases	High	Gas monitoring has demonstrated CS2 at the Ashley House area. Remedial action will be required in the Ashley House part of the site. Due to the distance of the nearest landfill, it is considered unlikely that it represents the source of the ground gas, or the contaminants encountered in the groundwater.
Adjacent site users (commercial)	Off-site current BP filling station to immediate south of site: Petroleum hydrocarbons.	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH, TPH and the local presence of asbestos on-site. It is considered unlikely, however, that these would affect occupants of nearby sites
Adjacent site users (residential)	Off-site historical and current railways: Fuel oils, lubricating oils, heavy metals, PAHs, ash and asbestos.	Exposure to ground gases and vapours	Moderate	Gas monitoring has demonstrated CS2 at the Ashley House Site. Although the gas source has not been determined, it is possible that gases within the ground beneath the site could migrate laterally to neighbouring sites.
	Historical landfill 601m north-east 1955 to 1962: landfill gases, leachate.	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH, TPH and the local presence of asbestos on-site. It is considered unlikely, however, that these would affect occupants of nearby sites
Property				

Receptor	Potential sources	Pathways	Risk	Justification
Potable water supply pipes and buildings	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Chemical attack on the proposed infrastructure (water supply pipes and buildings)	High	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH and TPH which can affect potable water supplies and pipework. Appropriate remedial action will need to be considered during the design of any new water supply pipes.
Controlled Waters				
Groundwater beneath the site (shallow Secondary A aquifer in the Kempton Park Gravel Member)	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Lateral migration	High	The results of the laboratory testing programmes on groundwater samples indicate numerous exceedances of metals, PAH and TPH in the groundwater within the Kempton Park Gravel Member (i.e. shallow aquifer) beneath the site.
Groundwater beneath the site (deep aquifers underlying the London Clay Formation – Lambeth Group Secondary A Aquifer, Thanet Formation, Chalk Group). Source Protection Zone 2.		Vertical and lateral migration	Low	Due to a substantial thickness (20m) of clay strata between the shallow (contaminated) groundwater and the deeper aquifer, migration of contaminants to the deeper aquifer is considered unlikely.
Surface watercourses and SSSI located to the east of the site			Low to Moderate	The results of the laboratory testing programmes on groundwater samples indicate numerous exceedances of metals, PAH and TPH in the groundwater within the Kempton Park Gravel Member (i.e. shallow aquifer) beneath the site. Nevertheless, due to the distance of the nearest surface water feature (360m east of the site) and SSSI site (560m east of the site), the risk of contamination from this site affecting the surface water feature or the groundwater at the SSSI site is considered low to moderate.

Table 4: Socotec Revised Conceptual Site Model – Cannon Factory Site

Receptor	Potential sources	Pathways	Risk	Justification
Human Health				
Future site occupants	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	High	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH, TPH and the local presence of asbestos. Remedial action will be required.
		Vapour inhalation	Low	The in situ and laboratory test results indicate a generally low risk from vapours in the ground
		Exposure to ground gases	Low	Gas monitoring has demonstrated CS1 at the Cannon Factory Site.
Adjacent site users (commercial)		Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH, TPH and the local presence of asbestos on-site. It is considered unlikely, however, that these would affect occupants of nearby sites
Adjacent site users (residential)		Exposure to ground gases and vapours	Low	Gas monitoring has demonstrated CS1 at the Cannon Factory Site.
		Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH, TPH and the local presence of asbestos on-site. It is considered unlikely, however, that these would affect occupants of nearby sites
Property				
Potable water supply pipes and buildings	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Chemical attack on the proposed infrastructure (water supply pipes and buildings)	High	The results of the laboratory testing programmes indicate numerous exceedances of metals, PAH and TPH which can affect potable water supplies and pipework. Appropriate remedial action will need to be considered during the design of any new water supply pipes.
Controlled Waters				
Groundwater beneath the site (shallow Secondary A aquifer in the Kempton Park Gravel Member)	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development:	Lateral migration	High	The results of the laboratory testing programmes on groundwater samples indicate numerous exceedances of metals, PAH and TPH in the groundwater within the Kempton Park Gravel (i.e. shallow aquifer) beneath the site.

Receptor	Potential sources	Pathways	Risk	Justification
Groundwater beneath the site (deep aquifers underlying the London Clay Formation – Lambeth Group Secondary A Aquifer, Thanet Formation, Chalk Group). Source Protection Zone 2.	PAHs, asbestos	Vertical and lateral migration	Low	Due to a substantial thickness (20m) of clay strata between the shallow (contaminated) groundwater and the deeper aquifer, migration of contaminants to the deeper aquifer is considered unlikely.
Surface watercourses and SSSI located to the east of the site		Migration of chemicals through the shallow unsaturated zone and lateral migration in the groundwater	Low to Moderate	The results of the laboratory testing programmes on groundwater samples indicate numerous exceedances of metals, PAH and TPH in the groundwater within the Kempton Park Gravel Member (i.e. shallow aquifer) beneath the site. Nevertheless, due to the distance of the nearest surface water feature (360m east of the site) and SSSI site (560m east of the site), the risk of contamination from this site affecting the surface water feature or the groundwater at the SSSI site is considered low to moderate.

4. Rationale and Specific Objectives

The objective of this supplementary investigation is to fill gaps in information and reduce uncertainties with respect to contamination at the Ashley House and Cannon Factory Sites.

Specific objectives include:

- Address comments received from Haringey Council Pollution Officer by email on 22 February 2023 pertaining to the Socotec report;
- Refine the conceptual site models, identify potentially unacceptable risks to receptors, and inform a Remediation Strategy.

5. Methodology

The intrusive investigation work was undertaken in general accordance with the Code of Practice for Ground Investigation BS 5930 (2015) and the Code of Practice for the Investigation of Potentially Contaminated Sites BS 10175 (2017).

5.1 Design of Investigation

The ground investigation was designed to fill gaps in information, reduce uncertainties and address comments from Haringey Council Pollution Officer.

Prior to commencement of the ground investigation, Waterman provided the Haringey Council Pollution Officer with a short technical note (Ref. WIE16248-100.R.2.2.1.TN, March 2023) detailing how the works would address each of their comments, proposed ground investigation location plans and a schedule of proposed exploratory hole locations and rationales.

The responses provided to each of the Pollution Officers comments are summarised in Table 5.

Following review of the technical note, email correspondence received from the Pollution Officer on 26 April 2023 stated they were satisfied with the proposed ground investigation and raised two queries on the detailed ground gas assessment presented in Appendix C of the technical note. The queries and Waterman responses are presented in [Table 6](#)

The rationale/target features of the exploratory hole locations are set out in [Table 7](#) and [Table 8](#).

Table 5: Waterman Responses to Pollution Officer Comments

Haringey Council Pollution Officer Comment	Waterman Response
a. Sub-section 8.31 (Controlled Water Risk Assessment Screening) indicates that four groundwater samples were recovered on 24th April 2019. However, it is unclear on the method of groundwater sampling used. Given the potential for chlorinated solvents and petroleum hydrocarbons we would expect the groundwater samples to have been taken using low flow techniques minimising the volatile contaminant loss. This is consistent with best practice. Clarification is therefore required.	Groundwater monitoring using low flow techniques will be undertaken as part of the supplementary ground investigation. Groundwater samples will be recovered from newly installed monitoring wells and serviceable existing monitoring wells installed by RSK and Socotec. Site inspection has established that most of the previously installed monitoring wells are serviceable and contain groundwater.
b. The Socotec UK Limited report mentions the potential impact of offsite sources to be the cause of hydrocarbon contamination at Ashley House. No assessment has been undertaken to determine if this is the case. The sites impact on the groundwater regime should be determined by assessing the groundwater flow direction (via groundwater levels) and comparison of contaminant concentrations up hydraulic gradient and down hydraulic gradient of the site.	Additional monitoring wells will be installed at Ashley House and post investigation groundwater reduced level monitoring and groundwater sampling will be undertaken to establish groundwater flow direction and upgradient and downgradient concentrations of contaminants to ascertain potential sources of contamination and risk to groundwater quality.
c. We agree with the conclusions drawn in Subsection 8.31 of the Socotec UK limited report that Ashley House represents an unacceptable risk to controlled ground waters and that further investigation and risk assessment is required. As a minimum we would expect that an additional groundwater sampling round utilising all monitoring wells is completed.	Groundwater monitoring using low flow techniques will be undertaken as part of the supplementary ground investigation. Groundwater samples will be recovered from newly installed monitoring wells and serviceable existing monitoring wells installed by RSK and Socotec. Site inspection has established that most of the previously installed monitoring wells are serviceable and contain groundwater.
d. We disagree with the conclusion that the risk of Cannon Factory causing unacceptable pollution of controlled waters is considered to be low. Given the concentrations recorded in BH02 and the oily sheen observed during sampling, we would consider that a potentially unacceptable risk is present. We would therefore require additional sampling to be undertaken at Cannon Factory in line with points b and c above.	Additional window sample holes will be advanced around BH02 and installed with groundwater monitoring wells. BH02 is serviceable and groundwater will be sampled from this location as part of post investigation groundwater level monitoring and sampling, along with the newly installed monitoring wells.
e. The bioavailable contaminants (zinc, lead, nickel, copper, manganese) threshold criteria have not been calculated using the EA M-BAT tool and therefore are highly conservative.	The supplementary investigation will comprise a revised controlled waters risk assessment using site-specific zinc, lead, nickel, copper, manganese assessment criteria derived using the EA M-BAT tool.
f. Section 9 (Ground Gas) does not provide a review of the potential sources of ground gas. We would expect an assessment of the potentially significant source offsite sources as well as onsite sources, using ground condition information obtained by the RSK investigations.	A detailed ground gas risk assessment has been undertaken which includes a review of on and off site potential sources of ground gas and information obtained by the RSK investigations. A copy of the assessment is presented as Appendix B (of the technical note provided to the Pollution Officer).

g. Section 9.2 (Gas Monitoring Assessment) indicates that “each monitoring pipe response zone was saturated by groundwater, which can influence gas readings”. As per best practice guidance the ground gas monitoring wells should be installed within the unsaturated zone to avoid interference from small quantities of organic material in the water column. Therefore, the ground gas regime for both Ashley House and Cannon Factory need to be reassessed with unrepresentative ground gas monitoring results identified and removed from consideration.

The detailed ground gas risk assessment includes a review of previous ground gas monitoring data, review of the source – pathway – receptor linkages, and a revised risk assessment. A copy of the assessment is presented as Appendix B (of the technical note provided to the Pollution Officer). Should the findings of the supplementary investigation change the findings the Ground Gas Risk assessment it will be updated.

*h. From a review of the soil sampling results it is noted that samples BH4, PH1A and BH3 are deviant laboratory results due to the holding time being exceeded. **These results would not be accepted as the exceeded holding time can affect the measured concentrations, particularly the volatile compounds. Further soil testing is therefore required.***

The supplementary ground investigation will target locations of deviant soils chemical analysis. Soil samples will be recovered from these new locations and submitted for chemical analysis within the appropriate holding times to confirm the chemical status of soils at these locations.

The applicant will need to provide us with an updated Ground Investigation Report covering the above issues before we can recommend the discharge of the above condition.

A ground investigation interpretive report and revised Conceptual Site Model will be prepared and submitted assessing results of previous ground investigation as well as the findings of the supplementary investigation.

Table 6: Waterman Responses to Pollution Officer Comments – Detailed Ground Gas Assessment

Haringey Council Pollution Officer Comment	Waterman Response
1. The report concludes that Ground gas protection measures would not be required in the completed developments and that no significant gas generating sources are present on-site. The report attributes the high concentrations of methane identified in WS101 to “black oil is identified in the sandy pockets” at 1.2-1.8m bgl but argues that “there is no significant risk in the long term (because the volumes of gas are typically small)”. However, this is an on-site source of ground gas that is likely to remain on-site due to its depth. The report also notes that that CO2 concentrations of 5.2% were identified in BH3. Calculating the GSVs using these gas concentrations would place the site in ‘Characteristic Situation’ 2 (low hazard) in Table 8.5 of CIRIA 665 – requiring some level of ground gas protection.	In accordance with BS8485:2015 (2019), where methane and/or carbon dioxide are reported at concentrations >1% and 5% respectively, consideration has been given to whether an increase to Characteristic situation 2 (CS2) is appropriate. Concentrations of methane and/or carbon dioxide recorded above these values do not automatically require an increase to CS2 and the purpose of the detailed assessment is to ascertain if the increase to CS2 is required. An increase to CS2 is identified as not required for the following reasons: – Petroleum hydrocarbons degrade and produce methane at very slow rates such that hazardous rates of surface emissions are unlikely in the long term. The absence of high flow rates in WS101 and on-site is further evidence the methane is being produced at a very slow rate. The volume of methane produced is also low. This is evidenced by the decrease in methane concentrations over the monitoring periods which identifies a methane source with a small reservoir of readily degradable material rather than a large methane source as would be present at a landfill for example which would have large reservoir of readily degradable material+ – As identified in the CL:AIRE 2012 RB17 guidance document and CIRIA C665, ground gases only pose a risk to developments when the following can be satisfied: • An accumulation of a large volume of gas in the ground in or near the buildings (source). Large volume of gas is absent. Therefore, source is absent. • A pathway that allows gas to migrate through and/or out of the ground into a building or other structure sufficiently quickly to allow it to build up inside the building (pathway). Low gas flow rates. Therefore, rapid gas build up will not occur. Therefore, pathway is absent. • A confined space within the building or structure where gas can build up to unacceptable levels (receptor). Confined spaces potentially present. However, source and pathway are absent. Therefore, linkage is broken. – The methane recorded in WS101 is unrepresentative of the ground gas regime on-site and is not evidence of a long term of high surface emissions risk; Ground gas monitoring data is consistent with the microbial respiration of organic materials in soil (as identified by ground gas ternary plots), in which a low flow and low volume of ground gas is present. Therefore, in accordance with 2018 EPG Ternary Plot Guidance, where the carbon dioxide is likely caused by biological

respiration of small quantities of organic matter as present on-site the increase in characteristic situation (CS1 to CS2) is only required should a high gas risk scenario be present; landfill, coal mining, volcanic activity, or acidic mine water. None of which are present at the site or surrounding area.

2. It is noted that "The proposed Development will incorporate a 250mm thick cast in-situ ground bearing reinforced floor slab with minimal penetrations. The ground floor slab will be tanked with a waterproof membrane with a minimum 200 gauge thickness". I presume this is supposed to be 250mm?

Correct, it should state 250mm cast in-situ ground bearing reinforced floor slab with minimal penetrations. The 250mm thick cast in-situ ground bearing floor slab would restrict the vertical migration of residual ground gas into the building, and a built structure which would inherently restrict the migration of ground gases into the proposed Development.

5.1.1 Strategy for Selection of Exploratory Hole Locations

A summary of the investigation locations and features investigated is presented in Table 7 and Table 8.

Table 7: Ground Investigation Strategy – Cannon Factory

Exploratory Hole	Rationale	Monitoring Well Installation Details
Window Sample Holes		
WWS01	Provide additional site coverage within accessible internal areas. Target Kempton Park Gravel Member. Obtain environmental soil samples.	None
WWS02	Provide additional site coverage within accessible internal areas. Target Kempton Park Gravel Member. Obtain environmental soil samples. Install groundwater monitoring well to assess groundwater flow direction and collect groundwater samples potentially downgradient of hydrocarbon contamination identified in BH02.	Screening Enfield Silt Member and Kempton Park Gravel Member 1.00 – 3.00m bgl
WWS03	Provide additional site coverage in the south of the Site. Target Kempton Park Gravel Member. Obtain environmental soil samples. Note: position moved and drilled through WTP02 to the north due to obstructions at original proposed location. Trial pit (WTP11) advanced at original proposed location of WWS03.	Screening Kempton Park Gravel Member 2.00 – 3.00m bgl
WWS10	Additional window sample hole advanced between WTP03 in the north-east and WWS02 in the south-east following identification of hydrocarbon contamination in the Kempton Park Gravel Member at these locations Target Kempton Park Gravel Member. Obtain environmental soil samples. Install groundwater monitoring well in the Kempton Park Gravel Member.	Screening Kempton Park Gravel Member 2.00 – 4.00m bgl
WWS11	Target Kempton Park Gravel Member. Additional window sample hole advanced through WTP03 to install a monitoring well in the north-east of the Site	Screening Kempton Park Gravel Member 2.00 – 3.00m bgl
Trial Pits		
WTP01	Investigate location of previously identified asbestos containing materials below the concrete slab in PH3 and PH3A. Target Made Ground. Collect environmental soil samples adjacent to PH3 and PH3A where deviating laboratory results were reported.	N/A
WTP02	Provide additional site coverage within accessible internal areas. Target Made Ground. Obtain environmental soil samples.	N/A
WTP03	Provide additional site coverage within accessible internal areas. Target Made Ground. Obtain environmental soil samples.	N/A
WTP11	Replacement for original proposed location of WWS03, which was moved due to shallow obstructions. Target Made Ground. Expose obstructions and obtain environmental soil samples.	N/A

Table 8: Ground Investigation Strategy – Ashley House

Exploratory Hole	Rationale	Monitoring Well Installation Details
Window Sample Holes		
WWS04	Provide site coverage within accessible internal areas. Target Kempton Park Gravel Member Obtain environmental soil samples.	Screening Kempton Park Gravel Member 2.00 – 3.50m bgl
WWS05	Provide site coverage within accessible internal areas. Target Kempton Park Gravel Member Obtain environmental soil samples.	None
WWS06	Target Made Ground / Kempton Park Gravel Member Collect environmental soil samples adjacent to BH03 where deviating laboratory results were reported. Install a groundwater monitoring well adjacent to BH03 due to this well not being serviceable.	Screening Kempton Park Gravel Member 2.00 – 3.50m bgl
WWS07	Target Kempton Park Gravel Member. Obtain environmental soil samples in area of previously identified hydrocarbon contamination. Install groundwater monitoring well to assess groundwater flow direction and groundwater chemical analysis potentially upgradient of previously identified hydrocarbon contamination at BH04 and WS107.	Screening Made Ground and Kempton Park Gravel Member 1.00 – 3.00m bgl
WWS08	Target Kempton Park Gravel Member. Obtain environmental soil samples in area of previously identified hydrocarbon contamination. Install groundwater monitoring well to assess groundwater flow direction and groundwater chemical analysis potentially downgradient of previously identified hydrocarbon contamination in groundwater at BH04 and WS107.	Screening Kempton Park Gravel Member 2.00 – 3.50m bgl
WWS09	Provide additional site coverage in the west of the Site. Target Kempton Park Gravel Member. Obtain environmental soil samples.	None
Trial Pits		
WTP04	Collect environmental soil samples adjacent to PH1A where deviating laboratory results were reported. Target Made Ground	N/A
WTP05	Provide additional Site coverage in the west of the Site. Investigate potential obstructions. Target Made Ground. Obtain environmental soil samples.	N/A
WTP06	Investigate location of WS102 where potential asbestos containing materials encountered. Target Made Ground. Obtain environmental soil samples.	N/A
WTP07	Collect environmental soil samples adjacent to BH04 where deviating laboratory results were reported. Target Made Ground/ Enfield Silt Member	N/A
WTP08 to WTP10	Investigate proposed location of drainage run and establish the presence and location of underground diesel tanks and associated fuel lines.	N/A

Target Made Ground.
Obtain environmental soil samples.

5.1.2 Sampling Strategy

Soils

Discrete environmental soil samples were collected every 0.5m in Made Ground, every 1.0m in natural soils, at the interface between strata and where visual and/or olfactory evidence of contamination was encountered.

Each environmental soil sample for subjected to headspace testing by Photoionisation Detector (PID) to monitor for volatile compounds and inform scheduling of laboratory analysis.

Groundwater

Groundwater samples were obtained from monitoring wells using low flow sampling (peristaltic pump) to minimise disturbance of the groundwater column and potential for volatile contaminant loss.

Groundwater samples were recovered from newly installed monitoring wells. In addition, groundwater samples were also collected from serviceable monitoring wells in and around locations where uncertainties in groundwater analysis were identified previously.

Groundwater samples were recovered from the following existing monitoring wells screening the Kempton Park Gravel Member:

- BH01 (Cannon Factory). Sample recovered using low-flow techniques due to uncertainties pertaining to Socotec groundwater sampling methodology;
- BH02 (Cannon Factory). Previously identified hydrocarbon contamination at this location and uncertainties pertaining to Socotec groundwater sampling methodology;
- BH04 (Ashley House). Previously identified hydrocarbon contamination at this location and nearby at WS107 (which is no longer present), and uncertainties pertaining to Socotec groundwater sampling methodology;
- BH101-shallow (Ashley House). Potentially representative of groundwater quality flowing off-site (based on anticipated groundwater flow direction);
- BH102-shallow (Ashley House). Potentially representative of groundwater quality flowing onto the Site (based on anticipated groundwater flow direction);
- BH103-shallow (Ashley House). Previously identified hydrocarbon contamination at BH04 and WS107. Potentially downgradient of BH04 and WS107 (based on anticipated groundwater flow direction);
- WS109 (Ashley House). Potentially upgradient of BH04 (based on anticipated groundwater flow direction) where hydrocarbon contamination was previously identified.

5.2 Quality Control

The samples were despatched in batches on a daily basis under a chain of custody procedure to i2 Analytical who are a UKAS accredited laboratory, for subsequent chemical analysis. Where appropriate, samples were stored within cool boxes containing ice packs.

All contractors, including laboratories, used during this project have been approved by Waterman as a part of in-house Integrated Management System (BS ISO 9001, BS ISO 14001) procedure. This requires all third parties to demonstrate competence and a high standard of work during a regular audit scheme.

6. Site Activities

Details of the ground investigation activities undertaken are shown in Table 9.

Table 9: Summary of fieldwork activities

Phase of Work.	Activity	Date
Ground Investigation	Service clearance comprising: Review of buried services plans, ground penetrating radar (GPR) survey of proposed exploratory hole locations, lifting inspection covers, and tracing service runs. Hand dug inspection pits to 1.2m bgl at each window sample hole location.	20 April 2023
	11No. Window sample holes (5No. at Cannon Factory to a max. depth of 5.00m bgl and 6No. at Ashley House to a max. depth of 5.00m bgl) Soil logging and sampling for environmental purposes.	20 – 21 April and 24 April 2023
	9No. Trial pits (4No. at Cannon Factory to a max. depth of 2.5m bgl and 5No. at Ashley House to max. depth of 2.6m bgl) Soil logging and sampling for environmental purposes.	20 – 21 April and 24 April 2023
	UXO Engineer Supervision	20 – 21 April and 24 April 2023
	3No. Falling head tests WWS03: 2.00 – 3.00m bgl (Kempton Park Gravel Member) WWS04: 2.50 – 3.50 m bgl (Kempton Park Gravel Member) WWS11: 2.50 – 3.50m bgl (Kempton Park Gravel Member)	21 and 24 April 2023
	Installation of groundwater monitoring wells in 8No. window sample holes (4No. at Cannon Factory and 4no. at Ashley House)	20 – 21 April and 24 April 2023
	Collection of groundwater samples from newly installed and existing monitoring wells. Recording groundwater levels. Collection of a surface water sample from Pymmes Brook to inform M-BAT tool assessment.	2 and 16 May 2023
Scheduling of Laboratory Analysis	Scheduling of soils and groundwater analysis	21 April – 16 May 2023

6.1 Window Sample Holes

6.1.1 Cannon Factory

Five window sample holes were advanced to depths of between 1.20m and 5.00m bgl (7.81m AOD and 4.05m AOD).

Window samples WWS02, WW03, WWS10 and WWS11 were installed with a 50mm internal diameter (ID) High Density Polyethylene (HDPE) monitoring standpipe with gas tap and bung and finished at surface with a lockable flush cover. Monitoring standpipes targeted the Kempton Park Gravel Member.

WWS01 was terminated at 1.2m bgl within the upper horizons of the Enfield Silt Member on the advice of the UXO engineer following detection of a metallic anomaly signal. The soils were logged and environmental soil samples collected from Made Ground and the Enfield Silt Member to fill gaps in information on shallow soils in this part of the Site. An alternative location was not selected due to the close proximity of WTP01, WTP02, and WWS03.

The proposed location of WWS03 was originally in the south of the Site. However, due to the presence of shallow obstructions encountered in the hand dug inspection pit, this location was advanced as a trial pit (WTP11) to expose and log the obstruction. WWS03 was moved north, drilled through WTP02 and

installed with a monitoring well targeting the Kempton Park Gravel Member to provide information for the Controlled Waters risk assessment.

WWS10 and WWS11 are additional boreholes drilled to assist with delineation of hydrocarbon impacted Kempton Park Gravel Member which was encountered in WWS02 in the south-east and WTP03 in the north-east. WWS11 was drilled through WTP03 and installed with a monitoring well following identification of hydrocarbon impacted soils in the groundwater smear zone at this location. WWS10 was also installed with a monitoring well to provide information for the Controlled Waters risk assessment.

Generally, the window samples were terminated due to refusal in dense sand and gravel of the Kempton Park Gravel Member.

6.1.2 Ashley House

Six window sample holes were advanced to depths of between 0.5m and 5.0m bgl (elevations of between 8.80m AOD and 3.92m AOD).

Window samples WWS04, WW06, WWS07 and WWS08 were installed with a 50mm internal diameter (ID) HDPE monitoring standpipe with gas tap and bung and finished at surface with a lockable flush cover. Monitoring standpipes targeted the Kempton Park Gravel Member.

WWS05 was terminated at 0.50m bgl due to the presence of a second concrete slab. The soils were logged and environmental soil samples collected from Made Ground to fill gaps in information on shallow soils in this part of the Site. An alternative location was not selected due to vertical and lateral space constraints. However, WTP04 and previous RSK locations WS103 and WS104 were all advanced in the vicinity of WWS05 and provided a record of ground conditions down to the Kempton Park Gravel Member. Therefore, the potential gap in information with respect to ground conditions at WWS05 is not considered to be significant.

Generally, the window samples were terminated due to refusal in dense sand and gravel of the Kempton Park Gravel Member.

6.1.3 In-situ Tests

Falling Head Tests

Three falling head tests were undertaken in the Kempton Park Gravel Member at depths of between 2.00 and 3.50m bgl to provide a record of its permeability. Two tests were undertaken at Cannon Factory (in WWS03 and WWS11) and one test undertaken at Ashley House (in WWS04).

It is considered that due to the proximity of the Sites, the three values provide a robust assessment of the characteristics of the Kempton Park Member in the local area.

Standard Penetration Tests (SPTs)

SPT tests were undertaken at 1m intervals in window sample holes to provide information on soil geotechnical properties.

6.2 Trial Pits

All trial pits were advanced using a wheeled mechanical excavator with a backactor following breaking out of hardstanding.

6.2.1 Cannon Factory

Four trial pits were advanced to depths of between 0.60m bgl and 2.5m bgl (8.39m AOD and 6.54m AOD). WTP01 was terminated at 0.60m bgl in Made Ground due to the presence of asbestos cement fragments embedded in the base of a second concrete slab which was present 0.18 to 0.40m bgl. Loose

asbestos cement fragments were also encountered on Made Ground directly below this slab. A soil sample was collected from the Made Ground underlying the concrete slab then the trial pit was backfilled with the asbestos cement impacted materials first followed by the other arising as encountered. The surface of the trial pit was reinstated with concrete to avoid potential disturbance of the arisings. The information regarding the presence of asbestos at this location has been passed to the client team including the contractor due to undertake work at the Site in the near future.

As the purpose of WTP01 was to investigate the presence of asbestos and recover environmental soil samples adjacent to PH3 and PH3A where deviating laboratory results were reported the aims of this trial pit were achieved and an alternative location was not required.

WTP11 was advanced in the original proposed location of WWS3 due to the presence of shallow obstructions preventing WWS3 from being drilled. WTP11 exposed the obstructions and shallow soil samples were recovered from Made Ground and the upper horizon of the Enfield Silt Member to fill gaps in information in this part of the Site.

All trial pits achieved their aim of gathering information on Made Ground across the Site. In addition, WTP02 and WTP03 gathered information on the Enfield Silt Member and upper horizons of the Kempton Park Gravel Member.

6.2.2 Ashley House

Five trial pits were advanced to depths of between 0.61m bgl and 2.60m bgl (8.54m AOD and 6.40m AOD).

WTP05 was terminated at 1.20m bgl due to the presence of an unrecorded gas main at 1.1m bgl. Environmental soil samples were collected from the Made Ground then the trial pit was backfilled. Whilst the thickness of Made Ground was not proven, an alternative location was not advanced as samples of the Made Ground had been recovered for analysis and WTP04 close to the north, proved the thickness of Made Ground.

WTP08 to WTP10 were combined into a single trial pit (WTP08-10) due to space limitations in the anticipated location of the underground diesel tanks including drainage runs, a small wooden shed, a trailer, wooden pallets, and parts of a boat. WTP08-10 exposed a second concrete slab at 0.61m bgl. The slab was not broken out as a precaution due to uncertainty of the location of the tanks and fuel lines and potential risk of damage to these. Notwithstanding, a sample of shallow Made Ground was obtained for chemical analysis prior to backfilling the trial pit.

An inspection cover lifted to the west of to the north-west of WTP08-10 (to the west of WWS08) exposed fill points and fuel lines. Therefore, it is expected that the underground diesel tanks remain in-situ.

All trial pits achieved their aims of gathering information on Made Ground across the Site and collecting samples in locations of previously reported deviating samples. In addition, WTP04 gathered information on the Enfield Silt Member and upper horizons of the Kempton Park Gravel Member. WTP06 also gathered information on the Enfield Silt Member.

6.3 Groundwater Monitoring

Groundwater level monitoring and sampling were undertaken on 3 May 2023. Groundwater levels were recorded newly installed monitoring wells and together with the serviceable monitoring wells installed by RSK and Socotec.

Groundwater levels were recorded using a dip meter and the presence of free product inspected using an oil interface probe.

Groundwater sampling was undertaken using low-flow sampling (peristaltic pump) in combination with a multi-parameter monitor. Samples were collected following stabilisation of water parameters including dissolved oxygen, temperature, total dissolved solids, pH, redox potential, and conductivity. A

submersible bailer was also used to recover a surface water sample from Pymmes Brook about 300m west of the Cannon Factory and Ashley House Sites. Pymmes Brook is anticipated to be ultimately downgradient of groundwater flow from the Sites.

A second visit was undertaken on 16 May 2023 following receipt of data from the first monitoring round to augment the existing dataset.

6.3.1 Cannon Factory

Of the newly installed monitoring wells, groundwater samples were recovered from WWS02 and WWS10 only. Groundwater samples were also recovered from BH01 and BH02.

The columns of water present in WWS03 and WWS11 were insignificant (0.16m and 0.03m) and could not be recovered by the peristaltic pump or submersible bailer. However, no evidence of hydrocarbon contamination was encountered during drilling of WWS03 or excavation of WTP02.

6.3.2 Ashley House

Of the newly installed monitoring wells, groundwater samples were recovered from WWS06 and WWS08 only. Groundwater samples were also recovered from BH04, BH101, BH102, BH103, and WS109.

WWS04 was dry. However, no evidence of hydrocarbon contamination was encountered during drilling at this location and a groundwater sample was recovered from WS109, which is anticipated to be downgradient of groundwater flow from WWS04.

WWS07 was dry. However, no evidence of hydrocarbon contamination was encountered during drilling at this location and groundwater samples were recovered from WWS08, WS109, and BH04 nearby.

6.4 Laboratory Scheduling

6.4.1 Soils

Table 10 and Table 11 provide summaries of soils chemical analysis undertaken at Cannon Factory and Ashley Road.

Cannon Factory

A total of twenty soils samples were analysed from Cannon Factory. These included eight samples of Made Ground, four samples of Enfield Silt Member, and eight samples of Kempton Park Gravel Member.

Hydrocarbon contamination analysis was undertaken on soil samples obtained from exploratory holes targeting locations of previously reported deviating samples. Including: WTP01 - 0.50m bgl targeting Socotec locations PH3 and PH3A.

Table 10: Summary of Soil Chemical Analysis – Cannon Factory

Chemical Analysis	No. of Samples Analysed and Stratum
Soil properties (organic matter, total organic carbon, pH, moisture content, fraction of organic carbon)	18No. (8No. Made Ground, 4No. Enfield Silt Member, 6No. Kempton Park Gravel Member)
Soil properties (fraction of organic carbon only)	2No. Kempton Park Gravel Member
Metals Suite (As, W/S B, Cd, Cr, Cr VI, Cu, Hg, Pb, Ni, Se, V, Zn)	7No. (6No. Made Ground, 1No. Kempton Park Gravel Member)
Total Petroleum Hydrocarbons (TPH-CWG C5-C44, plus BTEX and MTBE)	16No. (6No. Made Ground, 4No. Enfield Silt Member, 6No. Kempton Park Gravel Member)

Chemical Analysis	No. of Samples Analysed and Stratum
Hydrocarbons (Speciated PAHs-16)	10No. (4No. Made Ground, 2No. Enfield Silt Member, 4No. Kempton Park Gravel Member)
Volatile Organic Compounds	4No. (1No. Made Ground, 1No. Enfield Silt Member, 2No. Kempton Park Gravel Member)
Semi-volatile Organic Compounds	2No. (1No. Made Ground, 1No. Kempton Park Gravel Member)
Asbestos Screen (quantification if positive ID)	7No. Made Ground

Ashley House

A total of twenty-seven soils samples were analysed from Ashley House. These included sixteen samples of Made Ground, four samples of Endfield Silt Member, and seven samples of Kempton Park Gravel Member.

Organic contamination analysis was undertaken on soil samples obtained from exploratory holes targeting locations of previously reported deviating samples. Including: WWS06 – 0.30, 1.5, and 3.5m bgl targeting Socotec location BH03; WTP04 – 1.00, 2.00, and 2.60m bgl targeting Socotec location PH1A; WTP07 – 1.00 and 2.00m bgl targeting Socotec location BH04.

Table 11: Summary of Soil Chemical Analysis – Ashley House

Chemical Analysis	No. of Samples Analysed and Stratum
Soil properties (organic matter, total organic carbon, pH, moisture content, fraction of organic carbon)	26No. (16No. Made Ground, 4No. Enfield Silt Member, 6No. Kempton Park Gravel Member)
Soil properties (fraction of organic carbon only)	1No. Kempton Park Gravel Member
Metals Suite (As, W/S B, Cd, Cr, Cr VI, Cu, Hg, Pb, Ni, Se, V, Zn)	9No. (8No. Made Ground, 1No. Kempton Park Gravel Member)
Total Petroleum Hydrocarbons (TPH-CWG C5-C44, plus BTEX and MTBE)	22No. (13No. Made Ground, 3No. Enfield Silt Member, 6No. Kempton Park Gravel Member)
Hydrocarbons (Speciated PAHs-16)	13No. (10No. Made Ground, 3No. Kempton Park Gravel Member)
Volatile Organic Compounds	3No. (1No. Made Ground, 2No. Enfield Silt Member)
Semi-volatile Organic Compounds	3No. (1No. Made Ground, 2No. Enfield Silt Member)
Asbestos Screen (quantification if positive ID)	15No. Made Ground

6.4.2 Groundwater

A total of six and groundwater samples were analysed from Cannon Factory and Ashley House respectively.

Sample were analysed for the suite detailed in Table 12.

Table 12: Summary of Groundwater Chemical Analysis

Chemical Analysis	No. of Samples Analysed
Water properties (pH, total hardness, dissolved organic carbon, total organic carbon)	14No. (6No. from Cannon Factory, 8No. from Ashley House)

Metals Suite (dissolved: As, Cd, Ca, Cr (total and dissolved), Cr VI, Cu, Hg, Pb, Ni, Se, Zn, Mn)	4No. (4No from Cannon Factory, 4No. from Ashley House)
Total Petroleum Hydrocarbons (TPH-CWG C5-C44, plus BTEX and MTBE)	12No. (4No. from Cannon Factory, 8No. from Ashley House)
Hydrocarbons (Speciated PAHs-16)	12No. (4No. from Cannon Factory, 8No. from Ashley House)
Volatile Organic Compounds	10No. (3No. from Cannon Factory, 7No. from Ashley House)
Electron Acceptors and Metabolic by-products (NO ₃ and NO ₂ , SO ₄ and S ₂ , Cl, total inorganic carbon, Fe(II) and Fe(III), Mn(II) and Mn(IV))	11No. (4No. from Cannon Factory, 7No. from Ashley House)

In addition to the groundwater samples, the surface water sample recovered from Pymmes Brook was analysed for dissolved organic carbon and the metals suite.

7. Results

Detailed logs of the strata encountered, together with records of the samples taken during both trial pitting and borehole installation and PID readings, are provided in Appendix B. A summary of the geological strata and manmade underground structures encountered is presented below.

7.1 Geological Strata

Geological strata encountered at Ashley House and Cannon Factories are summarised in Table 13 and Table 14. The geological sequence encountered generally mirrors that encountered by previous investigations by Socotec and RSK.

Table 13: Geological strata encountered – Cannon Factory

Soil Type	Depth of Top of Stratum (m bgl)	Thickness (m)	Typical Description
Hardstanding	0	0.13 – 0.30	Grey reinforced concrete with medium gravel inclusions of quartzite
Made Ground	0.13 – 0.30	0.64 – 1.35	Sand and gravel of varying proportions. With quartzite, brick, and concrete. Locally silty and clayey.
Enfield Silt Member	0.80 – 1.55	0.60 – 1.00 (where proven)	Sandy gravelly silt and/or clay.
Kempton Park Gravel Member	1.80 – 2.30	Not proven	Sand and gravel of varying proportions. Locally silty and clayey.

Hardstanding covers about 20% of the Cannon Factory Site, with the rest of the Site occupied by a two-storey office building along the western boundary, adjoining warehouses along the northern and eastern boundaries.

Table 14: Geological strata encountered – Ashley House

Soil Type	Depth of Top of Stratum (m bgl)	Thickness (m)	Typical Description
Hardstanding	0	0.20 – 0.24	Grey reinforced concrete with medium gravel inclusions of quartzite
Made Ground	0.20 – 0.24	0.46 - 2.27 (where proven)	Gravelly sand. With quartzite, brick, and concrete. Locally silty and clayey.
Enfield Silt Member	0.70 – 2.40 (where encountered)	Absent to 0.80 (where proven)	Sandy silt and/or clay. Locally gravelly.
Kempton Park Gravel Member	2.00 – 2.90	Not proven	Sand and gravel of varying proportions. Locally clayey.

Hardstanding covers about 60% of the Ashley House Site with the remaining areas occupied by a two-storey office building along the western boundary and warehouse along the northern boundary. Perimeter planting is present around the east and south of the two-storey office building and numerous raised planter beds are present in the central portion of the Site.

7.2 Underground Structures and Obstructions

Numerous obstructions were encountered during the works as follows:

Cannon Factory

- WWS01
 - Buried reinforced concrete slab 0.18 – 0.41m bgl;
 - 1.20m bgl: metallic anomaly detected by the UXO engineer. Window sample hole terminated as a precaution;
- WWS02
 - Buried reinforced concrete slab: 0.23 – 0.38m bgl.
- WTP01
 - Buried reinforced concrete slab 0.18 – 0.40m bgl.
- WTP11
 - Linear concrete features encountered at 0.80 and 1.50m bgl (potentially historical footings and/or foundations).

Ashley House

- WWS05
 - Buried reinforced concrete slab 0.40 - ≥0.50m bgl.
- WTP05
 - Unrecorded low-pressure gas main at 1.1m bgl.
- WTP08-10
 - Buried concrete structure at 0.60m bgl.

7.3 Chemical Analysis

The laboratory test results are presented in Appendix D.

7.4 Visual and Olfactory Observations of Contamination

Visual and olfactory evidence of contamination encountered during advancement of exploratory holes and subsequent groundwater monitoring is summarised below.

The nature of visual and olfactory contamination observed was consistent with previous investigations by RSK and Socotec.

Cannon Factory

Soils

- WWS02
 - Moderate hydrocarbon odour 2.20 to 3.00m bgl (Kempton Park Gravel Member);
 - Dark grey staining 2.80 to 3.00m bgl (Kempton Park Gravel Member).
- WWS10
 - Moderate hydrocarbon odour with dark grey staining 2.10 to 2.40m bgl (Kempton Park Gravel Member);
 - Moderate hydrocarbon odour with dark grey staining 3.70 to 4.00m bgl (Kempton Park Gravel Member).

- WWS11
 - Moderate hydrocarbon odour 2.30 to 2.60m bgl (Kempton Park Gravel Member).
- WTP01
 - Asbestos cement embedded within the base of the buried concrete slab 0.40m bgl (Made Ground);
 - Asbestos cement fragments in Made Ground 0.40 to 0.60m bgl (Made Ground).
- WTP11
 - Localised areas of multicoloured clay 0.55m bgl (Made Ground).

PID headspace monitoring recorded a maximum VOC concentration of 2.6ppm in WWS10 at 2.20m bgl corresponding with a moderate hydrocarbon odour with dark grey staining in the Kempton Park Gravel Member.

PID headspace readings were generally below the instrument's limit of detection (<0.1ppm).

Groundwater

The following visual/olfactory observations of contamination were made during groundwater monitoring:

- BH01
 - Hydrocarbon-like odour
- BH02
 - Slight Hydrocarbon-like odour
- WWS02
 - Slight hydrocarbon-like odour
- WWS10
 - Slight hydrocarbon-like odour

Non-aqueous phase liquid was not recorded in the monitored wells. No hydrocarbon sheens were observed on the recovered groundwater.

Ashley House

Soils

- WWS09
 - Slight hydrocarbon odour 1.30 to 1.50m bgl (Made Ground).
- WTP04
 - Moderate hydrocarbon odour 0.60 to 1.80 (Made Ground).

PID headspace monitoring recorded a maximum VOC concentration of 1.5ppm in WTP04 at 1.00m bgl corresponding with a moderate hydrocarbon odour in Made Ground.

Most PID headspace readings were below the instrument's limit of detection (<0.1ppm).

Groundwater

The following visual/olfactory observations of contamination were made during groundwater monitoring:

- BH04
 - Slight solvent-like odour
- BH103
 - Slight hydrocarbon odour

Non-aqueous phase liquid was not recorded in the monitored wells. No hydrocarbon sheens were observed on the recovered groundwater.

7.5 Controlled Waters

Groundwater monitoring records (groundwater levels, monitoring observations, and multiparameter readings) are presented in Appendix C. Permeability testing and groundwater strike records are presented in the Ground Investigation Factual Report in Appendix B.

7.5.1 Groundwater Levels and Flow Direction

The following groundwater strikes were recorded at Cannon Factory:

- WWS02 – 2.80m bgl (6.25m AOD);
- WWS03 – 3.00m bgl (6.04m AOD);
- WWS10 – 3.00m bgl (6.04m AOD);
- WWS11 – 3.00m bgl (6.05m AOD);

The following groundwater strikes were recorded at Ashley House:

- WWS04 – 3.40m bgl (5.85m AOD);
- WWS06 – 2.50m bgl (6.40m AOD);
- WWS07 – 2.80m bgl (6.34m AOD);
- WWS08 – 2.50m bgl (6.61m AOD);
- WWS09 – 2.90m bgl (6.04m AOD).

All of the groundwater strikes were recorded in the Kempton Park Gravel Member.

Monitored groundwater levels at Cannon Factory ranged from 2.43m bgl (BH02) to 2.80m bgl (WWS03). Groundwater elevations ranged from 6.19m AOD (BH01) to 6.49m AOD (WWS10).

Monitored groundwater levels at Ashley House ranged from 2.52m bgl (BH103) to 2.78m bgl (WS101). Groundwater elevations ranged from 6.36m AOD (WWS06) to 6.62m AOD (WS109).

Groundwater elevation contour plotting, presented in Appendix A, indicates groundwater at the Cannon Factory and Ashley House Sites is flowing west, contrary to anticipated groundwater flow direction towards Pymmes Brook about 300m east.

Recent development (Berol Yard) to the immediate south of Cannon Factory comprises a basement with a finished floor level of 3.7m AOD. Therefore, this basement will be intercepting groundwater in the Kempton Park Gravel Member. It is also known that recent development (Ashley Gardens) adjacent north of Ashley House comprises a basement with a finished floor level of 4.1m AOD. Basements are also known to be present at the Berol Yard development on the opposite side of Ashley Road to the east with finished floor levels of basements ranging from 6.0m AOD to 3.7m AOD. Therefore, basements in the surrounding area are most likely intercepting groundwater in the Kempton Park Gravel Member and interfering with its natural flow direction at a local level.

Notwithstanding the above, it also cannot be discounted that current and relic foundations at both Cannon Factory and Ashley House are intercepting groundwater in the Kempton Park Gravel Member resulting in localised fluctuations in groundwater elevations. This is particularly apparent on the groundwater contour plot for Ashley House where a steep dip in groundwater elevation at BH04 is shown – likely caused by the buried diesel tanks located between BH103 and BH04.

Groundwater in the wider area is expected to flow towards Pymmes Brook. However, as evidenced by the groundwater contour plotting, its route will be affected by numerous subsurface structures along its flow path increasing its travel time and route.

7.5.2 Permeability Testing

The falling head test results are as follows:

- WWS03: 2.00 – 3.00m bgl (Kempton Park Gravel Member) = $1.80\text{E-}07$ (0.00000018) m/s
- WWS04: 2.50 – 3.50 m bgl (Kempton Park Gravel Member) = $1.32\text{E-}06$ (0.00000132) m/s
- WWS11: 2.50 – 3.50m bgl (Kempton Park Gravel Member) = $5.32\text{E-}08$ (0.0000000532) m/s.

8. Generic Assessment Criteria

The information requirements for generic quantitative risk assessment will depend on:

- The substance being assessed;
- The receptors being considered;
- The pathways being considered; and
- The complexity of the site.

Potential contaminant linkages identified in Table 3 have been investigated and the results assessed against generic assessment criteria. The generic assessment criteria selected for each potential contaminant linkage are summarised in Table 15.

Table 15: Generic assessment criteria

Source	Pathway	Receptor	Generic Assessment Criteria	Justification/ Site Specific Information used to Support the Generic Risk Assessment
Contamination in Site Soils	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Future Site occupants	GAC for residential land use without plant uptake ($RESI_{wopu}$) for soils with 1% SOM. GAC derived from Category 4 Screening Levels (C4SLs), LQM/CIEH S4ULs (Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3060. All rights reserved).	The development comprises commercial and residential uses with residential amenity space. The most sensitive use is residential and amenity space will be present. Therefore, the GAC for residential land use without home-grown produce has been selected. 1% SOM, for organic contaminants has been selected. 1% was selected as a conservative and consistent approach across the Site and was based on the lowest SOM % identified in the soils.
	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Adjacent site users (commercial and residential users)	Semi-quantitative Risk Assessment using soils GAC.	The Site is in an area of residential and commercial uses. Therefore, risks to off-site residents and users will be assessed through analysis of soils on-site.
	Chemical attack on the proposed infrastructure (water supply pipes and buildings)	Potable water supply pipes and buildings	Qualitative Risk Assessment. BRE Special Digest 1: 2005 Concrete in Aggressive Ground. UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites.	The risk to buried structures was assessed in accordance with the guidelines included within BRE Special Digest 1:2005 Concrete in Aggressive Ground. The risk to water supply pipes was assessed in accordance with the UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites.
Contamination in Site soils and shallow groundwater	Vapour Inhalation	Future Site occupants	Quantitative assessment of groundwater against the Society of Brownfield Risk Assessment (SoBRA) derived GAC_{GWVAP} for residential end-use. Semi-quantitative risk Assessment for vapours utilising PID measurements alongside soil and groundwater contamination results in accordance with CIRIA C682 and BS8576: 2013.	The risk from vapours to human health receptors will be determined quantitatively through assessment of the groundwater concentrations against the GAC_{GWVAP} as derived by SoBRA. Based on the ground conditions on-site this quantitative assessment builds in the following precautionary assumptions; - No biodegradation is occurring between the source term, and the receptor; - The groundwater is at 0.65mbgl; - The geology on-site is a sandy stratum; and - The omission of capillary fringe between the saturated and unsaturated zones.

Source	Pathway	Receptor	Generic Assessment Criteria	Justification/ Site Specific Information used to Support the Generic Risk Assessment
Ground gases in Site soils	Exposure to Vapours	Adjacent Site users (commercial and residential)	Semi-quantitative Risk Assessment using ground gas and vapour monitoring data. Quantitative assessment of groundwater against the Society of Brownfield Risk Assessment (SoBRA) derived GAC _{GWVAP} .	The quantitative risk assessment will therefore be inherently conservative in its approach. A semi-quantitative approach will be used to assess risks from vapours in soils accordance with CIRIA C682. Soil headspace testing has been used along with analysis for VOCs and SVOCs in soil samples.
		Future Site occupants	Gas Screening Value determination and assessment in accordance with CIRIA C665 and BS8485:2015+A1:2019. CL:AIRE Research Bulletin RB17 (2012)	Risks to off-site residents and users will be assessed through analysis of soil, groundwater, and vapour concentrations on-site, assessment of the hydrogeological regime at the Site and potential for off-site migration of contamination and vapour.
	Exposure to ground gases	Adjacent Site users	Semi-quantitative risk assessment using findings from the assessment of risks to future Site occupants	The potential risk arising from ground gas to the development will be assessed using the approach recommended in CIRIA C665, BS 8485:2015+A1:2019, BS 8576: 2013, and guidance presented in CL:AIRE Research Bulletin RB17 (2012). Risks to off-site residents and users will be assessed through characterisation of the ground gas regime at the Site and the potential for off-site migration of ground gas
Contamination in Site soils and shallow groundwater	Lateral migration	Groundwater beneath the site (shallow aquifer – Kempton Park Gravel Member)	Environmental Quality Standards (EQS) for freshwater and EQS _{bioavailable} .	The Kempton Park Gravel Member is a Secondary A Aquifer. The closest surface water feature is Pymmes Brook, some 300m east. Given its distance away and inferred groundwater flow directions at both Ashley House and Cannon Factory, Pymmes Brook is unlikely to be a receptor of contamination at the Site. However, there is likely to be hydraulic continuity between the Kempton Park Gravel Member and Pymmes Brook. Therefore, EQS has been selected as conservative assessment criteria. The Kempton Park Gravel Member is unlikely to have hydraulic continuity with the River Lee Navigation as this surface water feature is canalised.
	Vertical and lateral migration	Groundwater beneath the site (deep aquifers underlying the London Clay)	Semi-quantitative Risk Assessment using soils and groundwater analysis and monitoring and, screening of groundwater from shallow groundwater.	Aquifers at depth are overlain by cohesive deposits of the London Clay Formation and a significant portion of the Lambeth Group also comprises cohesive deposits. A such, downward vertical migration of shallow contamination is restricted.

Source	Pathway	Receptor	Generic Assessment Criteria	Justification/ Site Specific Information used to Support the Generic Risk Assessment
		Formation – Lambeth Group Secondary A Aquifer, Thanet Formation, Chalk Group). Source Protection Zone 2.		Notwithstanding, the development is likely to comprise piled foundations. Therefore, a semi-quantitative approach will be used to assess potential risks to the aquifers at depth using soils and groundwater analysis.
Contaminated soils and shallow groundwater	Migration of chemicals through the shallow unsaturated zone and lateral migration in the groundwater	Surface watercourses and SSSI located to the east of the site	Environmental Quality Standards (EQS) for freshwater and EQS _{bioavailable} . Quantitative Risk Assessment using soils analysis	Given its distance away (some 300m east) and inferred groundwater flow directions at both Ashley House and Cannon Factory, Pymmes Brook is unlikely to be a receptor of contamination at the Site. However, there is likely to be hydraulic continuity between the Kempton Park Gravel Member and Pymmes Brook. Therefore, EQS has been selected as conservative assessment criteria. The Kempton Park Gravel Member is unlikely to have hydraulic continuity with the River Lee Navigation as this surface water feature is canalised. The SSSI is some 500m east. Therefore it is highlight unlikely to be a receptor of contaminated groundwater at the Site.

The generic assessment criteria used in this report are included in Appendix I.

9. Quantitative Environmental Risk Assessment – Risk Estimation

The potential contaminant linkages identified in Section 3.2 have been evaluated using the Generic Assessment Criteria described in Section 8 and Appendix I. The results of this evaluation are reported below:

9.1 Risk to Human Health

A summary of GAC exceedances reported at Cannon Factory and Ashley House are presented in Table 16.

Table 16: Summary of generic quantitative risk assessment for human health

Contaminant	Location, depth (m bgl)	Concentration (mg/kg)	Stratum	Generic Assessment Criteria (mg/kg)
Cannon Factory				
Lead	WWS01 – 0.50	1,700	Made Ground	310
	WTP11 – 0.50	1,300	Made Ground	
Mercury	WTP11 – 0.50	2.30	Made Ground	1.20*
TPH Aromatic C21-35	WWS02 – 2.80	2,100	Kempton Park Gravel Member	1,900
	WWS10 – 2.20	2,800	Kempton Park Gravel Member	
	WTP11 – 3.00	2,600	Kempton Park Gravel Member	
	WTP03 – 2.50	3,300	Kempton Park Gravel Member	
Di-benzo(a,h.)anthracene	WTP03 – 0.50	0.37	Made Ground	0.31
Ashley House				
Lead	WWS09 – 0.50	610	Made Ground	310
	WTP10 – 0.50	340	Made Ground	
Mercury	WWS09 – 0.50	1.70	Made Ground	1.20*
Naphthalene	WTP07 – 1.00	4.00	Made Ground	2.30
Benzo(a)anthracene	WTP05 – 1.00	13.00	Made Ground	11
Benzo(b)fluoranthene	WWS08 – 1.00	7.30	Made Ground	3.90
	WTP07 – 1.00	7.30	Made Ground	
	WTP05 – 1.00	11.00	Made Ground	
Benzo(a)pyrene	WWS08 – 1.00	4.80	Made Ground	3.2
	WTP07 – 1.00	5.00	Made Ground	
	WTP05 – 1.00	11.00	Made Ground	
Di-benzo(a,h.)anthracene	WWS08 – 1.00	0.61	Made Ground	0.31
	WTP07 – 1.00	0.68	Made Ground	
	WTP05 – 1.00	0.89	Made Ground	

*The GAC for elemental mercury, which the inhalation of vapours indoor exposure pathway contributes significantly to the overall exposure in the residential and commercial land uses¹, is 1.20mg/kg. The GAC for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methylmercury compounds are likely to be very low. Elemental mercury is unlikely to form in natural near-surface soils. However, consideration should be given to whether elemental mercury could be been introduced to the Site by anthropogenic activity². The GAC for inorganic mercury is 56mg/kg for residential land use without plant uptake. The dominant pathway in this scenario is ingestion of soil and indoor dust. Mercury is considered likely to be in its inorganic form in soils on-site. Historical uses of the Site are considered not to be a source of elemental mercury, which is associated with processes that used amalgams such as millinery or chloralkali production². Comparison of mercury concentrations against the GAC for inorganic mercury (56mg/kg) returns no exceedances.

9.1.1 Asbestos Screening

Cannon Factory

Suspected asbestos cement fragments were encountered embedded in the base of a buried concrete slab present 0.18 and 0.40m bgl at WTP01. Suspected asbestos cement fragments were also encountered in Made Ground underlying the buried concrete slab at this location. None of the Made ground samples screened for asbestos by the laboratory (seven in total) identified the presence of asbestos. However, the presence of asbestos fibres in Made Ground has been confirmed by previous investigations by RSK and Socotec.

ACMs have also been reported in Made Ground below the concrete slab by RSK and Socotec at locations PH1 (RSK), PH3, and PH3A. It is, therefore, apparent that there are pockets of ACMs present underlying the existing units at Cannon Factory. The absence of ACMs at other exploratory hole locations suggests the contamination is localised.

Ashley House

ACMs were not observed in soils during advancement of the exploratory holes at Ashley House. However, the RSK investigation identified a suspected ACM (fibrous material) in WS102 at 1.00m bgl. Subsequent asbestos identification and quantification on this sample confirmed the presence of chrysotile and amosite and reported an asbestos concentration of 6.265%. WTP06 which targeted this area did not record any visual evidence of ACMs but did report asbestos in Made Ground samples from 0.30m bgl and 0.50m bgl at concentrations of <0.001% and 0.005% respectively.

A summary of Made Ground samples identified as containing asbestos fibres at part of this investigation is presented in Table 17.

Table 17: Summary of Made Ground Samples Containing Asbestos Fibres – Waterman Investigation

Location, Depth (m bgl)	Asbestos Type	Concentration (%)
WTP06 – 0.30	Amosite loose fibres	<0.001
WTP06 – 0.50	Chrysotile and Crocidolite loose fibres and loose fibrous debris	0.005
WTP04 – 1.00	Chrysotile and Crocidolite loose fibres and loose fibrous debris	0.063
WWS05 – 0.30	Amosite loose fibres	<0.001
WWS08 – 2.00	Chrysotile and Amosite loose fibres	<0.001
WTP10 – 0.50	Chrysotile and Amosite loose fibres	<0.001

¹ Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. 2015. The LQM/CIEH S4UIs for Human Health Risk Assessment. Land Quality Press, Nottingham.

² Environment Agency (2009). (Withdrawn). Soil Guideline Values for mercury in soil (Science Report No. SC050021 / Mercury SGV). Environment Agency (Bristol, UK)

WTP05 – 1.00

Amosite loose fibres

<0.001

Asbestos fibres have been identified in Made Ground across Ashley House. In light of this, and the presence of an ACM encountered by RSK at WTP06, there is potential for localised pockets of ACMs to be present across Ashley House.

9.1.2 Risk From Soils Contamination at Cannon Factory

Future Site Users

Isolated GAC exceedances of lead were reported in shallow Made Ground at WWS01 and WTP11. A marginal exceedance of di-benzo(a,h.)anthracene was also reported in shallow Made Ground at WTP03. The lead exceedance at WTP11 may be associated with some localised multicoloured clay (potentially lead paint) that was encountered in Made Ground at this location and depth.

Four slight exceedances of TPH Aromatic C21-35 were reported in samples taken from exploratory holes in the east of Cannon Factory. The samples were taken from the Kempton Park Gravel Member at depths of between 2.20 and 3.00m bgl and the exceedances correspond with locations of dark grey staining and hydrocarbon odours. However, given the depth of the exceedances in the Kempton Park Gravel Member, this contamination will present a low risk to future Site users.

The contamination recorded to be elevated at the Site is of low volatility within the subsurface. The proposed development will either comprise buildings or associated hardstandings indicating the potential risk of contact with the underlying soils is low. Areas of soft landscaping will be incorporated into the development which will require an engineered cover system to ensure the end-user remains isolated from the underlying soils.

The nature of contamination reported in shallow soils is similar to that reported by Socotec and RSK (asbestos and speciated PAHs). Furthermore, asbestos containing materials (ACMs) have been identified in Made Ground by this investigation and those undertaken previously by RSK and Socotec. Therefore, it has been confirmed that capping layers will be required in proposed soft landscaping areas to break the direct contact (ingestion, dermal contact, dust and fibre inhalation).

The absence of ACMs in site-won concrete needs to be confirmed prior to any processing for recycled aggregates.

Off-site Users (Residential and Commercial)

Potential risks to off-site users from elevated contaminants in Made Ground and shallow natural soils include inhalation of contaminated dusts and fibres during groundworks. These risks can be mitigated using standard techniques employed during construction works such as dust suppression, dampening down of exposed surfaces and covering of stockpiles. These measures would be typically implemented and managed through a Construction Environmental Management Plan (CEMP).

Construction Workers

Construction and maintenance workers should wear appropriate Personal Protective Equipment (PPE) during any below ground works in order to mitigate potential effects from direct contact, dermal absorption, inhalation, and ingestion of contaminants in soils and groundwater and asbestos in soils. The requirements included within the Confined Space Regulations 1997 should be adhered to also.

All construction workers should be subject to mandatory health and safety requirements under the Construction, Design and Management (CDM) Regulations 2018 and Control of Substances Hazardous to Health (COSHH) Regulations 2002 and Control of Asbestos Regulations 2012 (CAR 2012).

Asbestos has been identified in Made Ground and embedded in the underside of buried concrete slabs. Therefore, construction workers should be asbestos awareness trained. An Asbestos Risk Assessment and Plan of Work should also be prepared in accordance with CAR 2012 prior to work commencing.

9.1.3 Risk from Soils Contamination at Ashley House

Future Site Users

Isolated GAC exceedances of lead were reported in shallow Made Ground at WWS09 and WTP10. Exceedances of several speciated PAHs were also reported in shallow Made Ground at WTP05, WTP07, and WWS08. Exceedances are generally marginal. Asbestos fibres have also been identified in Made Ground at several locations across the Site.

The contamination recorded to be elevated at the Site is of low volatility within the subsurface. The proposed development will either comprise buildings or associated hardstanding indicating the potential risk of contact with the underlying soils is low. Areas of soft landscaping will be incorporated into the development which will require an engineered cover system to ensure the end-user remains isolated from the underlying soils.

The nature of contamination reported in soils is similar to that reported by Socotec and RSK (asbestos, arsenic, lead, nickel, speciated PAHs, and TPHs). Furthermore, ACMs have been identified in Made Ground at WS102 at 1.00m bgl by the RSK investigation. It is further confirmed that capping layers will be required in proposed soft landscaping areas to break the direct contact (ingestion, dermal contact, dust and fibre inhalation).

Off-site Users (Residential and Commercial)

Potential risks to off-site users from elevated contaminants in Made Ground and shallow natural soils include inhalation of contaminated dusts and fibres during groundworks. These risks can be mitigated using standard techniques employed during construction works such as dust suppression, dampening down of exposed surfaces and covering of stockpiles. These measures would be typically implemented and managed through a CEMP.

Construction Workers

Construction and maintenance workers should wear appropriate PPE during any below ground works in order to mitigate potential effects from direct contact, dermal absorption, inhalation, and ingestion of contaminants in soils and groundwater and asbestos in soils. The requirements included within the Confined Space Regulations 1997 should be adhered to also.

All construction workers should be subject to mandatory health and safety requirements under the CDM Regulations 2018, COSHH Regulations 2002, and CAR 2012.

Asbestos has been identified in Made Ground. Therefore, construction workers should be asbestos awareness trained. An Asbestos Risk Assessment and Plan of Work should also be prepared in accordance with CAR 2012 prior to work commencing.

9.1.4 Risk from Vapours

Cannon Factory

Exceedances of soil GAC for contaminants with a significant vapour phase were not identified. Furthermore, soils headspace analysis reported negligible concentrations of VOCs.

Assessment of groundwater chemical analysis against (SoBRA) derived GAC_{GWWAP} for residential end-use also reported no exceedances. Therefore, a significant vapour regime is not inferred at the Cannon Factory Site and the risk to future site users and off-site users is low and the assessed risk is consistent with conclusions made in the Socotec report.

Ashley House

Exceedances of soil GAC for contaminants with a significant vapour phase were limited to a slight exceedance of naphthalene in WTP07 at 1.00m bgl. Given the exceedance is marginal and isolated, this is not indicative of a significant vapour regime in soils at the Ashley House Site. Furthermore, an exceedance is no longer reported if the GAC is adjusted to 5.60mg/kg to account for the 2.5% organic matter content of the sample. Soil headspace analysis also reported negligible concentrations of VOCs.

Assessment of groundwater chemical analysis against (SoBRA) derived GAC_{GWVAP} for residential end-use also reported no exceedances. Therefore, a significant vapour regime is not inferred at the Ashley House Site and the risk to future site users and off-site users is low and the assessed risk is consistent with conclusions made in the Socotec report.

9.2 Risk to Controlled Waters

9.2.1 Shallow Aquifer and Surface Waters

A summary of freshwater EQS exceedances reported at Cannon Factory and Ashley House from this investigation are presented in Table 18.

Table 18: Summary of generic quantitative risk assessment for controlled waters

Contaminant	Location	Concentration (ug/l)	Generic Assessment Criteria (EQS) (ug/l)	Comments
Cannon Factory				
Dissolved chromium	WWS10	8.5	4.70	Low-level isolated exceedance. Chromium reported as below the laboratory limit of detection (<0.2ug/l) in BH02 downgradient of groundwater flow.
Dissolved lead	WWS10	16	11.80*	Low-level isolated exceedance. Lead reported as below the laboratory limit of detection (<0.2ug/l) in BH02 downgradient of groundwater flow.
Dissolved manganese	WWS10	3,600	701.43*	Metabolic by-product indicative of biodegradation of organic compounds in the groundwater. ³
	WWS02	8,300		
	BH02	2,500		
Anthracene	BH02	0.28	0.10	Low-level exceedance typical of former brownfield Sites. Anthracene has low mobility in groundwater. ⁴
Fluoranthene	BH02	0.24	0.0063	Low-level exceedance typical of former brownfield Sites. Fluoranthene has low mobility in groundwater. ⁴
Ashley House				

³ Guidance on the Assessment and Monitoring of Natural Attenuation of Contaminants in Groundwater. R&D Publication 95. Environment Agency. 2000.

⁴ CL:AIRE, 2017. Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies. CL:AIRE, London

Contaminant	Location	Concentration (ug/l)	Generic Assessment Criteria (EQS) (ug/l)	Comments
Anthracene	WWS06	0.23	0.1	Low-level exceedance typical of former brownfield Sites. Anthracene has low mobility in groundwater. ⁴
Fluoranthene	WWS06	1.11	0.0063	Low-level exceedance typical of former brownfield Sites. Fluoranthene has low mobility in groundwater. ⁴
Benzo(a)pyrene	WWS06	0.35	0.00017	Low-level exceedance typical of former brownfield Sites. Benzo(a)pyrene has very low mobility in groundwater. ⁴
Benzo(b)fluoranthene	WWS06	0.51	0.00017	Low-level exceedance typical of former brownfield Sites. Benzo(b)fluoranthene has very low mobility in groundwater. ⁴
Benzo(k)fluoranthene	WWS06	0.2	0.00017	Low-level exceedance typical of former brownfield Sites. Benzo(k)fluoranthene has very low mobility in groundwater. ⁴

*EQS_{bioavailable} calculated for copper, lead, nickel, manganese, and zinc using the Water Framework Directive UK Technical Advisory Group (WFD-UKTAG) Metal Bioavailability Assessment Tool (M-BAT) using the following parameters from Pymmes Brook surface water sampling: DOC: 9.83mg/l, pH: 7.4, calcium: 130mg/l. An Ambient Background Concentration (ABC) for dissolved zinc of 3.3µg/l has been used, corresponding to the Lee area/region⁵.

The exceedances reported in Table 18 are not indicative of significant groundwater contamination at the Cannon Factory and Ashley House Sites. Slightly elevated concentrations of speciated PAHs in groundwater are typical of urban and brownfield Sites. Furthermore, the PAHs reported are of low and very low mobility and, therefore, significant migration will not occur and the risk to the Kempton Park Gravel Member Secondary A Aquifer is low.

Isolated slightly elevated concentrations of chromium and lead have been reported at Cannon Factory. However, these were not detected in BH02 downgradient. Therefore, significant attenuation is occurring and the risk to the Kempton Park Gravel Member Secondary A Aquifer from lead and chromium in groundwater at Cannon Factory is low.

Given the distance to Pymmes Brook and inferred groundwater flow direction, the risk to surface waters from these slightly elevated concentrations of metals and PAHs is low.

The elevated concentrations of manganese are indicative of biodegradation of organic compounds in the groundwater. This is discussed further below.

Whilst there are no freshwater EQS for TPH, the WHO have produced a health-based risk assessment for drinking waters with regard to TPH⁶ aliphatic bands C8-C10, C10-C12, and C12-C16, and aromatic bands C8-C10, C10-C12, C12-C16, C16-C21, and C21-C35. These values have been used as conservative reference criteria to screen groundwater TPH concentrations against. A summary of exceedances is presented in Table 19. Further discussion on TPH concentrations in groundwater is presented in Section 9.2.3.

⁵ Water Framework Directive – United Kingdom Advisory Group (WFD-UKTAG). July 2014. UKTAG Guide to the Metal Bioavailability Assessment Tool (M-BAT).

⁶ World Health Organisation - Petroleum Products in Drinking Waters, Background document for development of WHO Guidelines for Drinking-water Quality. Ref. WHO/SDE/WSH/05.08/123, 2008.

Table 19: Summary of WHO drinking water standards exceedances

TPH-CWG Banding	Location	Concentration (ug/l)	Drinking Water Standard (DWS) (ug/l)
Cannon Factory			
Aliphatic			
>C12-C16	WWS10	1,300	300
Ashley House			
Aromatic			
>C10-C12	BH04	120	90

9.2.2 Evidence of Biodegradation of Organic Compounds

Evidence of biodegradation of organic contamination has been identified in groundwater sampled from Cannon Factory and Ashley House.

Oxygen is the most favoured electron acceptor for microbes in the biodegradation of organics and micro-organisms will generally use electron acceptors in the following order of preference: oxygen, nitrate, Manganese IV, iron III, sulphate, CO₂. Low concentrations of dissolved oxygen are typical in groundwater where biodegradation of organic compound is taken place and metabolic by-products from nitrate, manganese IV, iron III, and sulphate reduction are anticipated, including: nitrite, manganese II, iron II, and sulphide. A potential increase in concentrations of inorganic carbon and chloride could also indicate biodegradation of organic compounds.³

The evidence that biodegradation is occurring at Cannon Factory and Ashley House is summarised in Table 20. The highest concentrations of metabolic by-products were reported in locations where TPH contamination has been reported in groundwater by the Waterman investigation or from groundwater analysis previously undertaken by Socotec.

Table 20: Groundwater parameters indicating biodegradation of organic contamination

Screening Factor	Reported Groundwater Results	Lines of Evidence ^{4,7} / Comments
pH	Cannon Factory: 6.9 – 7.1 Ashley House: 7.0 – 7.5	Optimal pH range for microbial degradation lies between approximately 6 and 8.5.
Dissolved Oxygen (electron acceptor) (Stabilised Readings)	Cannon Factory: <0.01 – 0.16 mg/l Ashley House: 0.18 – 3.38 mg/l	Highest energy-yielding electron acceptor for biodegradation of organic constituents. Dissolved oxygen concentrations <1.0mg/l are indicative of anaerobic conditions. Anaerobic degradation is unlikely to occur at dissolved oxygen concentrations >0.5mg/l, and does not occur at concentrations greater than 1mg/l. A decrease in dissolved oxygen concentration is a trend associated with biodegradation. Most recorded dissolved oxygen concentrations indicate anaerobic conditions at Cannon Factory and Ashley House. Aerobic conditions reported in WWS06 (3.38 mg/l) and BH103 (3.1 mg/l) at Ashley House favours ongoing biodegradation by aerobic respiration.
Nitrate (electron acceptor)	Cannon Factory: 0.10 – 4.99 mg/l Ashley House: 0.09 – 14.8	Decrease in concentration is evidence of biodegradation. Thermodynamically next favourable electron acceptor after oxygen for microbial degradation of organics. Depletion indicates (denitrification) anaerobic degradation of organics. Cannon Factory: Lowest concentration reported in BH02. Ashley House: Lowest concentration reported in BH04.
Nitrite (metabolic by-product from biodegradation)	Cannon Factory: <1.0 – 200 ug/l Ashley House: <1.0 – 220 ug/l	Cannon Factory: Highest concentration reported in BH02. Ashley House: Highest concentration reported in WWS06.
Manganese IV (electron acceptor)	Cannon Factory: <0.02 – 1.34 mg/l Ashley House: <0.02 – 0.77 mg/l	May act as an electron acceptor during anaerobic degradation of contaminants where more thermodynamically favourable electron acceptors are absent. Cannon Factory: Lowest concentration reported in BH01. Ashley House: Lowest concentration (<0.02mg/l) reported in BH102, BH04, BH101, BH103.
Manganese II (metabolic by-product from biodegradation)	Cannon Factory: 0.03 – 6.34 mg/l Ashley House: 0.06 – 1.89 mg/l	Indicator of anaerobic degradation of organics, where manganese (IV) acts as an electron acceptor. Cannon Factory: Highest concentration reported in WWS02. Ashley House: Highest concentration reported in WWS06.

⁷ Lines of evidence as detailed in *Guidance on the Assessment and Monitoring of Natural Attenuation of Contaminants in Groundwater*. R&D Publication 95. Environment Agency. 2000.

Screening Factor	Reported Groundwater Results	Lines of Evidence ^{4,7} / Comments
Iron (III) (electron acceptor)	Cannon Factory: <0.20 mg/l Ashley House: <0.20 mg/l	Biologically available Fe (III) can act as an electron acceptor during anaerobic degradation of organics. Cannon Factory: Reported as below the laboratory limit of detection in BH01, BH02, WWS02, and WWS10. Ashley House: Reported as below the laboratory limit of detection in BH102, BH04, BH101, BH103, WWS06, WS109.
Iron (II) (metabolic by-product from biodegradation)	Cannon Factory: <0.20 – 0.92 mg/l Ashley House: <0.20 – 0.82 mg/l	Indication of iron (III) reduction during microbial degradation of organic compounds in the absence of oxygen, nitrate and manganese (IV). Cannon Factory: Highest concentration reported in WWS10. Ashley House: Highest concentration reported in BH04.
Sulphate (electron acceptor)	Cannon Factory: 40.4 – 174 mg/l Ashley House: 89.2 – 390 mg/l	Used as an electron acceptor in biodegradation of organic constituents. Reduced to form sulphide. Cannon Factory: Lowest concentration reported in BH01. Ashley House: Lowest concentration reported in WWS08
Sulphide (metabolic by-product from biodegradation)	Cannon Factory: <5.0 – 4,200 ug/l Ashley House: <5.0 ug/l	Microbially reduced form of sulphate. Indicates reduced conditions. Cannon Factory: Highest concentration reported in WWS10. Ashley House: Reported as below the laboratory limit of detection in BH102, BH04, BH101, BH103, WWS06, WWS08, WS109.
Inorganic Carbon	Cannon Factory: 38.8 – 97.1 mg/l Ashley House: 46.6 – 121 mg/l	Increases due to biodegradation of organic compounds. Cannon Factory: Highest concentration reported in WWS10. Ashley House: Highest concentration reported in WWS06 and WWS08
Chloride	Cannon Factory: 15 – 67 mg/l Ashley House: 43 – 350 mg/l	Cannon Factory: Highest concentration reported in BH02. Ashley House: Highest concentration reported in WWS06.

9.2.3 TPH in Groundwater

Cannon Factory

Elevated concentrations of TPH were reported in groundwater samples from WWS02 and WWS10 in the east of the Cannon Factory Site. Reported concentrations of total TPH-CWG (C5-44) in these samples were 25mg/l and 160mg/l respectively. All of the TPH in groundwater sampled from WWS02 and WWS10 was reported in aliphatic carbon bands, mostly in carbon bands C21-C35.

A summary of the groundwater TPH-CWG analysis is presented in Table 21.

Table 21: Summary of TPH-CWG analysis at Cannon Factory

	BH01	BH02	WWS02	WWS10
TPH-CWG Banding (ug/l)				
Aliphatic				
>C5-C6	<1.0	<1.0	<1.0	<1.0
>C6-C8	<1.0	<1.0	<1.0	<1.0
>C8-C10	<1.0	<1.0	<1.0	<1.0
>C10-C12	<10	<10	<10	<10
>C12-C16	<10	<10	<10	1,300
>C16-C21	<10	<10	3,800	38,000
>C21-C35	<10	<10	20,000	120,000
>C35-C44	<10	<10	340	370
Total Aliphatics (C5-C44)	<10	<10	25,000	160,000
Aromatic				
>C5-C7	<1.0	<1.0	<1.0	<1.0
>C7-C8	<1.0	<1.0	<1.0	<1.0
>C8-C10	<1.0	<1.0	<1.0	<1.0
>C10-C12	<10	<10	<10	<10
>C12-C16	<10	<10	<10	<10
>C16-C21	<10	<10	<10	<10
>C21-C35	<10	<10	<10	<10
>C35-C44	<10	<10	<10	<10
Total Aromatics (C5-C44)	<10	<10	<10	<10

Made Ground and shallow soils encountered during the ground investigation at the Cannon Factory did not indicate visual or olfactory signs of TPH contamination and correspondingly the Made Ground soils subject to laboratory testing recorded concentrations that were below the GACs. An obvious shallow soil source has therefore not been identified to date.

The recorded geology at the Site indicates a silt / clay layer overlying the Kempton Park Member, which would provide a low permeability layer inhibiting potential vertical migration of contamination.

However, visual and olfactory evidence of hydrocarbon contamination was identified in natural soils at depth (beneath the low permeability clay /silt layer) associated with the Kempton Park Gravel Member at or around the level of groundwater in the east of Cannon Factory (exploratory holes WWS02, WWS10, and WWS11).

Laboratory analysis of the natural soils reported total speciated TPH (C5-C44) concentrations of up to 15,300mg/kg (reported in WWS02 at 2.80m bgl). The Socotec investigation also recorded hydrocarbon odours in the Kempton Park Gravel Member at BH02. However, RSK exploratory holes PH2, PH4, PH5, PH6, and Socotec exploratory holes PH3C and PH3B, also in the east of the Site, did not record visual or olfactory evidence of hydrocarbon contamination in Made Ground, Enfield Silt Member, or the Kempton Park Gravel Member and reported negligible concentrations of PAHs and TPHs in analysed soils (up to 1.5m bgl).

The vast majority of the TPH in samples of Kempton Park Gravel Member from WWS02, WWS10, WWS11, and BH02 has been reported in aliphatic and aromatic carbon bands C21-C35. Furthermore, laboratory interpretation of the groundwater and soils TPH analysis suggested the contamination is lubricating oil.

The apparent absence of current potential sources of the TPH, such as existing tanks or gross contamination in Made Ground soils indicates the contamination is from a historic source, potentially relating to the Site's former use for rubber manufacturing around the mid-1900s. Furthermore, historical maps dated 1961 and 1977, presented in the RSK Cannon Factory report, show potential small tanks in the north-east of the Site.

Assessment of Risk

A shallow soil source has not been identified to date in the Made Ground, however, it is recognised that the Site is a former industrial premises with a former potential tank recorded in the north-east of the Site. Site conditions indicate a low permeability layer overlying the permeable Kempton Park Member, with TPH present beneath this layer associated with the smear zone soils and within the shallow groundwater.

As part of the redevelopment it will be recommended that the impacted smear zone soils will be removed and disposed of off-site. In addition, a Watching Brief will be recommended to address unexpected visual and olfactory evidence of contamination recorded during earthworks, together with inspection of the former tank area.

The direction of groundwater migration has been inferred east to west, with elevated TPH concentrations recorded in the groundwater at boreholes (WWS02, WWS10) and soils in the groundwater smear zone in WWS11) at the east, but not in boreholes BH01 and BH02 west of these locations. The migration of contamination is considered to be limited across the Site for a number of reasons. The majority of the contamination recorded in the groundwater is contained in carbon bands aliphatic C21-C35, indicated as lubricating oil, which typically has a low mobility in the environment and does not readily migrate. In addition, the falling head tests completed at the Site demonstrate a low hydraulic conductivity of the gravel at both sites which indicates further a limited potential for migration. The qualitative lines of evidence indicate the risk from the Site to the surrounding environment is low.

To further confirm the low risk a Controlled Waters Detailed Quantitative Risk Assessment (DQRA) was undertaken for the Cannon Factory site using the EA Remedial Targets Methodology (RTM). The derivation methodology of the physical and chemical input parameters together with the sensitivity analysis and model outputs is presented in the Appendix E sub-section I.

Based on the low mobility of the identified contaminants, limited hydraulic gradient and low hydraulic conductivity recorded within the Kempton Park Gravels the derived Remedial Target Values (RTVs) at a 50m compliance point identifies no exceedances in the groundwater, A summary of the output of the RTM model is provided in Table 22: Summary of RTM model results Cannon Factory .

Table 22: Summary of RTM model results Cannon Factory

Contaminant	Initial Concentration (mg/l)	Target Concentration (mg/l)	RTV at Compliance Point (mg/l)	Groundwater Exceedances
Fluoranthene	2.8×10^{-4}	6.3×10^{-6}	3.18×10^7	None
Benzo(b)fluoranthene	1×10^{-5}	1.7×10^{-7}	5.78×10^3	None
Benzo(k)fluoranthene	1×10^{-5}	1.7×10^{-7}	1.38×10^{-2}	None
Aromatic >C05-C06 (Benzene)	1×10^{-5}	0.01	8.06×10^{11}	None
Aromatic >C08-C10 (Xylenes)	1×10^{-5}	0.03	2.24×10^{19}	None
Aromatic >C10-C12	1×10^{-3}	0.09*	1.99×10^{27}	None
Aromatic >C12-C16	1×10^{-3}	0.09*	2.19×10^{11}	None
Aromatic >EC16-EC21 (anthracene)	1×10^{-5}	1.0×10^{-4}	2.43×10^8	None
Aromatic >EC16-EC21	0.01	0.09*	1.20×10^4	None
Aromatic >EC21-EC35 (benzo[a]pyrene)	1×10^{-5}	1.7×10^{-7}	4.49×10^4	None
Aromatic >EC21-EC35	0.01	0.09*	1.20×10^4	None
Aliphatic >C5-C6	1×10^{-3}	15*	9.19×10^3	None
Aliphatic >C12-C16	1.3	0.3 *	1.84×10^2	None
Aliphatic >C16-C21	38	0.3 *	1.84×10^2	None
Aliphatic >C21-C35	120	0.3 *	1.84×10^2	None
Aliphatic >C35-C44	0.37	0.3 *	1.84×10^2	None

* World Health Organization (WHO) guide values for TPHCWG fractions in drinking water

The RTM model therefore confirms hydrocarbon contaminants are not posing a risk to controlled water receptors. The RTM worksheets are presented in Appendix E sub-section III.

The multiple lines of evidence including geology, hydraulic conditions, contamination mobility together with the quantitative assessment indicate the risk from the groundwater at the Site to the surrounding environment is low.

Ashley House

Reported concentrations of total speciated TPH (C5-C44) in groundwater at Ashley House range from <10 to 4,000ug/l. However, total speciated TPH concentrations in four of the seven monitoring wells (BH101, BH102, BH103, and WWS08) were all below the laboratory limit of detection (10ug/l).

A summary of groundwater TPH-CWG results reported above the laboratory limit of detection is presented in Table 23.

Table 23: Summary of TPH-CWG analysis results above the laboratory limit of detection at Ashley House

	BH04	WWS06	WS109
TPH-CWG Banding	Concentration (ug/l)		
Aliphatic			
>C5-C6	130	<1.0	26
>C6-C8	<1.0	<1.0	<1.0
>C8-C10	<1.0	<1.0	<1.0
>C10-C12	<10	<10	<10
>C12-C16	<10	48	<10
>C16-C21	<10	560	<10
>C21-C35	<10	3,100	<10
>C35-C44	<10	230	<10
Total Aliphatics (C5-C44)	130	4,000	26
Aromatic			
>C5-C7	<1.0	<1.0	<1.0
>C7-C8	<1.0	<1.0	<1.0
>C8-C10	<1.0	<1.0	<1.0
>C10-C12	120	<10	<10
>C12-C16	20	<10	<10
>C16-C21	20	<10	<10
>C21-C35	<10	<10	<10
>C35-C44	<10	<10	<10
Total Aromatics (C5-C44)	160	<10	<10

WS109 reported a total speciated TPH concentration of 26ug/l (all of which was reported in aliphatic band C5-C6), and BH04 reported 290ug/l (reported mostly in aliphatic band C5-C6 and aromatic band C10-C12). WWS06 is about 50m downgradient of groundwater flow from WS109 and BH04. However, concentrations of TPH in aliphatic band C5-C6 and aromatic band C10-C12 at this location were reported as below the laboratory detection limits of <1.0ug/l and <10 respectively. Therefore, significant attenuation, and biodegradation (as evidenced in Table 19) is inferred.

The TPH concentration of 4,000ug/l in WWS06 was reported entirely in aliphatic carbon bands ranging from C12-C44 which have a very low mobility⁴. The absence of aromatics and lighter chain TPH suggests a heavily degraded historical contamination source. Groundwater analysis from BH03 (adjacent north-east of WWS06) undertaken by Socotec reported a total speciated TPH concentration of 55ug/l. This was reported entirely in low to very low mobility carbon bands of C16-C35. Therefore, is apparent the contamination reported WWS06 is localised. The localised nature of the contamination was further demonstrated by a second round of groundwater analysis which reported TPH-CWG (C5-44) as below the laboratory limit of detection (<10ug/l).

Evidence of hydrocarbon contamination was not recorded during drilling of WWS06 or BH03 and TPH concentrations in soils analysed from depths of between 0.30 and 3.50m bgl in WWS06 were below the laboratory limit of detection (<10mg/kg). BH03 reported low levels of speciated TPH (<100mg/kg) in soil samples analysed from depths of between 0.40 and 2.3m bgl. The TPH identified in groundwater at

WWS06 may be associated with historical above ground tanks that were situated around this location when the Site operated as a printing ink and varnish works from around the 1930s to around the 1960s.

Assessment of Risk

Potential sources of contamination exist at the Ashley House Site in the form of underground diesel tanks in the east of the Site that remain in-situ. Furthermore, historical tanks were present on-site during its operation as a printing ink and varnish works from around the 1930s to around the 1960s. The presence of these potential contaminant sources likely resulted in entry of hydrocarbon contamination to soils and groundwater.

As part of the redevelopment it will be recommended that tanks remaining in-situ are decommissioned and removed along with surrounding impacted soils. In addition, a Watching Brief will be recommended to address unexpected visual and olfactory evidence of contamination recorded during earthworks, together with inspection of the former tank areas.

A Controlled Waters Detailed Quantitative Risk Assessment (DQRA) was undertaken for the Ashley House site using the EA Remedial Targets Methodology (RTM) to confirm the identified risks remain low at the site. The derivation methodology of the physical and chemical input parameters together with the sensitivity analysis and model outputs is presented in the Appendix E sub-section IV.

Based on the low mobility of the identified contaminants, limited hydraulic gradient and low hydraulic conductivity recorded within the Kempton Park Gravels the derived Remedial Target Values (RTVs) at a 50m compliance point identifies no exceedances in the groundwater. The RTM model therefore identifies hydrocarbon contaminants as not posing a risk to controlled water receptors. The RTM worksheets are presented in Appendix E sub-section VI., a summary of the out put is provided in Table 24

Table 24: Summary of RTM model results Ashley House

Contaminant	Initial Concentration (mg/l)	EQS (mg/l)	RTV at Compliance Point (mg/l)	Groundwater Exceedances
Aromatic >C5-C6 (Benzene)	0.03	0.01	8.57x10 ³	None
Aromatic >C8-C10 (Xylenes)	1.35	0.03	5.25x10 ⁷	None
Aromatic >C10-C12	0.12	0.09*	6.05x10 ¹¹	None
Aromatic >C12-C16	0.02	0.09*	1.49x10 ⁴	None
Aromatic >EC16-EC21 (anthracene)	2.3x10 ⁻⁴	1.0x10 ⁻⁴	16.6	None
Aromatic >EC16-EC21	0.02	0.09*	7.66	None
Aromatic >EC21-EC35 (benzo[a]pyrene)	3.5x10 ⁻⁴	1.7x10 ⁻⁷	9.99x10 ⁻³	None
Aromatic >EC21-EC35	0.01	0.09*	7.66	None
Aliphatic >C5-C6	0.13	15*	1.44x10 ²	None
Aliphatic >C12-C16	0.048	0.3*	2.89	None
Aliphatic >C16-C21	0.56	0.3*	2.89	None
Aliphatic >C21-C35	3.1	0.3*	2 89	1 (WWS06)

Aliphatic >C35-C44	0.23	0.3*	2.89	None
* World Health Organization (WHO) guide values for TPHCWG fractions in drinking water				

These exceedance for WWS106 is not consider significant for the following reasons. WWS06 is approximately 20m fro the west boundary of the site and the model shows that within 54 m the RTV is greater than the concentration measure at WWS06. The second round of sampling from WWS06 did not detect C21 to C35 above the limit of detection confirming the contamination detected is not representative of wide spread contamination at this location. Also using the WHO DWS as the assessment criteria is conservative as the water in the aquifer being assessed will not and is not abstracted from for drink water.

The multiple lines of evidence including geology, hydraulic conditions, contamination mobility together with the quantitative assessment indicate the risk from the groundwater at the Site to the surrounding environment is low.

Underground diesel tanks in the east of the Ashley Road site remain in-situ and will require removal as part of redevelopment works.

9.2.4 Deep Aquifers

The Sites are underlain by about 20m of cohesive deposits of the London Clay Formation and Lambeth Group. Therefore, downward migration of shallow contamination is prevented. However, developments at Ashley House and Cannon Factory are expected to utilise piled foundation solution. Therefore, there is potential for hydrocarbon contamination to be driven downwards and, if foundations are to founded below cohesive deposits of the Lambeth Group, created a preferential pathway for contamination to impact on the aquifers at depth.

The risks from creating preferential pathways from piling can be mitigated by undertaking a Foundation Work Risk Assessment and use of appropriate piling methods.

9.3 Risk to Structures

9.3.1 Buried Concrete

The risk of chemical attack to buried concrete can be mitigated by selecting a concrete class appropriate for the ground conditions in accordance with BRE-Special Digest 1.

Assessment of the appropriate concrete class is presented in the Socotec report (Ref. D8061-18, August 2019).

9.3.2 Water Supply Pipes

Drinking water supply pipes are to be placed into clean service corridors using barrier pipe. The UKWIR project steering group decided that barrier pipes would provide sufficient protection for the supply of drinking water in all Brownfield site conditions. This approach would need to be agreed with Thames Water.

9.4 Risk from Ground Gas

A detailed ground gas risk assessment has been undertaken which includes a review of on and off-site potential sources of ground gas and information obtained by the RSK investigations. The detailed ground gas risk assessment includes a review of previous ground gas monitoring data, review of the source – pathway – receptor linkages, and a revised risk assessment. The assessment concludes that ground gas protection measures are not required for the developments at Cannon Factory and Ashley House. Additional commentary on how this conclusion was reached is presented in Table 6 in Section 5 above.

A copy of the assessment is presented as Appendix F.

Made Ground encountered as part of this investigation is consistent with the investigations undertaken by RSK and Socotec. Significant quantities of potentially putrescible materials were not encountered. Therefore, the conclusions of the detailed ground gas risk assessment remain relevant and the assessment does not require revisiting.

10. Conclusions and Risk Evaluation

Following the implementation of the ground investigation, the Socotec Conceptual Site Model has been re-evaluated and reclassified in relation to the additional information obtained, using the risk rating matrix presented in Appendix G and Assessment criteria in Appendix I. The results of the reassessment are summarised in Table 25 and Table 26.

The supplementary ground investigation and subsequent risk assessment has filled information gaps and addressed comments from the Haringey Council Pollution Officer through the following actions:

- Targeting Socotec ground investigation locations (PH1A, PH3, PH3A, BH03, and BH04) to recover and analyse soil samples for hydrocarbon analysis where deviating results were previously reported;
- Targeting gaps in area coverage;
- Installation of additional groundwater monitoring wells to establish groundwater flow direction, establish up and downgradient concentrations of contaminants, identify sources of contamination and risk to groundwater quality;
- Additional investigation locations around BH02 at Cannon Factory to identify and delineate the source of previously identified contamination at BH02;
- Additional groundwater level monitoring and groundwater sampling to inform controlled waters risk assessment;
- Use of low flow groundwater sampling techniques to minimise potential loss of volatile contaminant during sampling;
- Controlled water risk assessment using site-specific zinc, lead, nickel, copper, manganese assessment criteria derived using the EA M-BAT tool;
- A revised ground gas risk assessment;
- A revised controlled waters risk assessment;
- A revised Conceptual Site Model.

Table 25: Revise Conceptual Site Model – Ashley House

Receptor	Potential sources	Pathways	Risk	Justification
Human Health				
Future site occupants	On-site historical factory and works: Fuel oils, heavy metals, solvents, lubricating oils, PAHs, asbestos, cyanides. On-site historical and current storage tanks and other point sources (1930s–current): Current two diesel tanks and interceptor – petroleum hydrocarbons (fuels oils) Historical tanks – petroleum hydrocarbons, chlorinated solvents, cyanides, metals. Current warehouses and potential chemical storage onsite: Asbestos, hydrocarbons lube oil, kerosene, trichloroethylene (TCE).	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Medium	Ground investigations have reported elevated concentrations of metals, PAHs, and TPHs in shallow soils. ACM fragments and asbestos fibres have also been recorded in Made Ground. Clean capping layers will be required in soft landscaping areas to break the contaminant pathways and reduce the risk to low.
		Vapour inhalation	Low	A Significant vapour risk has not been identified and vapour protection measures are now required. Underground diesel tanks and associated fill points and fuel links remain in-situ. The underground diesel fuel tanks, fill points and fuel lines will require decommissioning and removal as part of redevelopment works along with any surrounding impacted soils.
		Exposure to ground gases	Low	Detailed ground gas risk assessment shows a significant ground gas regime at the Site is not present and ground gas protection measures are not required for the development.
Adjacent site users (commercial)	Made Ground associated with previous phases of development: Unknown fill material (but potentially including heavy metals, ash, clinker, PAHs, asbestos etc.) Off-site current BP filling station to immediate south of site: Petroleum hydrocarbons. Off-site historical and current railways: Fuel oils, lubricating oils, heavy metals, PAHs, ash and asbestos.	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	Ground investigations have reported elevated concentrations of metals, PAHs, and TPHs in shallow soils. ACM fragments and asbestos fibres have also been recorded in Made Ground. It is considered unlikely, however, that these would affect occupants of nearby sites. Notwithstanding, risks to off-site users can be mitigated using standard techniques employed during construction works such as dust suppression, dampening down of exposed surfaces and covering of stockpiles. These measures would be typically implemented and managed through a Construction Environmental Management Plan (CEMP).
Adjacent site users (residential)	Historical landfill 601m north-east 1955 to 1962: landfill gases, leachate.	Exposure to ground gases and vapours	Low	Detailed ground gas risk assessment shows a significant ground gas regime at the Site. A significant vapour regime has not been identified at the Site. Therefore, the risk to off-site users from ground gas and vapour is low.

Receptor	Potential sources	Pathways	Risk	Justification
		Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	Ground investigations have reported elevated concentrations of metals, PAHs, and TPHs in shallow soils. ACM fragments and asbestos fibres have also been recorded in Made Ground. It is considered unlikely, however, that these would affect occupants of nearby sites. Notwithstanding, risks to off-site users can be mitigated using standard techniques employed during construction works such as dust suppression, dampening down of exposed surfaces and covering of stockpiles. These measures would be typically implemented and managed through a Construction Environmental Management Plan (CEMP). Works will also proceed in line with CAR 2012.
Property				
Potable water supply pipes and buildings	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Chemical attack on the proposed infrastructure (water supply pipes and buildings)	Medium	Potential risks to water supply pipes from contaminants in soils can be mitigated by installation of barrier pipes and clean service corridors. Potential risk to buried concrete can be mitigated by selecting a concrete class appropriate for the ground conditions in accordance with BRE-Special Digest 1. These measures will ensure the risks to potable water supply pipes and buried concrete are low.
Controlled Waters				
Groundwater (shallow Secondary A aquifer in the Kempton Park Gravel Member)	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Lateral migration	Low	The revised controlled waters risk assessment demonstrates a low risk to controlled waters from contamination in the Kempton Park Gravel Member Secondary A Aquifer. However, current potential sources of contamination including underground diesel fuel tanks, fill points, and fuel lines will require decommissioning and removal as part of redevelopment works along with any surrounding impacted soils to reduce the risk to low.
Groundwater (deep aquifers underlying the London Clay Formation – Lambeth Group Secondary A Aquifer, Thanet Formation, Chalk)		Vertical and lateral migration	Low	Due to a substantial thickness (20m) of clay strata between the shallow (contaminated) groundwater and the deeper aquifer, migration of contaminants to the deeper aquifer is considered unlikely. The risks from creating preferential pathways from piling can be mitigated by undertaking a Foundation Work Risk Assessment and use of appropriate piling methods.

Receptor	Potential sources	Pathways	Risk	Justification
Group). Source Protection Zone 2.				
Surface watercourses and SSSI located to the east of the site			Low	The revised controlled waters risk assessment demonstrates a low risk to controlled waters from contamination in the Kempton Park Gravel Member Secondary A Aquifer. Given their distances from the Site, and groundwater flow path, the risk to surface watercourses and the SSSI is low.

Table 26: Revise Conceptual Site Model – Cannon Factory

Receptor	Potential sources	Pathways	Risk	Justification
Human Health				
Future site occupants	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Medium	Ground investigations have reported elevated concentrations of metals, PAHs, and TPHs in shallow soils. ACM fragments and asbestos fibres have also been recorded in Made Ground. Clean capping layers will be required in soft landscaping areas to break the contaminant pathways and reduce the risk to low.
		Vapour inhalation	Low	A Significant vapour risk has not been identified and vapour protection measures are now required.
		Exposure to ground gases	Low	Detailed ground gas risk assessment shows a significant ground gas regime at the Site is not present and ground gas protection measures are not required for the development.
Adjacent site users (commercial)		Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	Ground investigations have reported elevated concentrations of metals, PAHs, and TPHs in shallow soils. ACM fragments and asbestos fibres have also been recorded in Made Ground. It is considered unlikely, however, that these would affect occupants of nearby sites. Notwithstanding, risks to off-site users can be mitigated using standard techniques employed during construction works such as dust suppression, dampening down of exposed surfaces and covering of stockpiles. These measures would be typically implemented and managed through a Construction Environmental Management Plan (CEMP).
Adjacent site users (residential)		Exposure to ground gases and vapours	Low	Detailed ground gas risk assessment shows a significant ground gas regime at the Site. A significant vapour regime has not been identified at the Site.

Receptor	Potential sources	Pathways	Risk	Justification
				Therefore, the risk to off-site users from ground gas and vapour is low.
		Direct contact (ingestion, dermal contact, dust and fibre inhalation)	Low	Ground investigations have reported elevated concentrations of metals, PAHs, and TPHs in shallow soils. ACM fragments and asbestos fibres have also been recorded in Made Ground. It is considered unlikely, however, that these would affect occupants of nearby sites. Notwithstanding, risks to off-site users can be mitigated using standard techniques employed during construction works such as dust suppression, dampening down of exposed surfaces and covering of stockpiles. These measures would be typically implemented and managed through a Construction Environmental Management Plan (CEMP).
Property				
Potable water supply pipes and buildings	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Chemical attack on the proposed infrastructure (water supply pipes and buildings)	Medium	Potential risks to water supply pipes from contaminants in soils can be mitigated by installation of barrier pipes and clean service corridors. Potential risk to buried concrete can be mitigated by selecting a concrete class appropriate for the ground conditions in accordance with BRE-Special Digest 1. These measures will ensure the risks to potable water supply pipes and buried concrete are low.
Controlled Waters				
Groundwater beneath the site (shallow Secondary A aquifer in the Kempton Park Gravel Member)	Various current and historic industrial land uses on and off site, tanks, electrical substation, railway land, landfill and made ground from previous phases of development: PAHs, asbestos	Lateral migration	Low	The revised controlled waters risk assessment demonstrates a low risk to controlled waters from lateral migration of contamination in the Kempton Park Gravel Member Secondary A Aquifer due to its very low mobility. However, contamination in the smear zone will be delineated and removed to achieve a betterment of subsurface conditions.
Groundwater beneath the site (deep aquifers underlying the London Clay Formation – Lambeth Group Secondary A)		Vertical and lateral migration	Low	Potential risks to water supply pipes from contaminants in soils can be mitigated by installation of barrier pipes and clean service corridors. Potential risk to buried concrete can be mitigated by selecting a concrete class appropriate for the ground conditions in accordance with BRE-Special Digest 1.

Receptor	Potential sources	Pathways	Risk	Justification
Aquifer, Thanet Formation, Chalk Group). Source Protection Zone 2.				These measures will ensure the risks to potable water supply pipes and buried concrete are low.
Surface watercourses and SSSI located to the east of the site		Migration of chemicals through the shallow unsaturated zone and lateral migration in the groundwater	Low	The revised controlled waters risk assessment demonstrates a low risk to controlled waters from lateral migration of contamination in the Kempton Park Gravel Member Secondary A Aquifer due to its very low mobility. Given their distances from the Site, and groundwater flow path, the risk to surface watercourses and the SSSI is low.

11. Recommendations

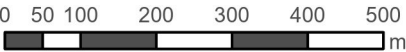
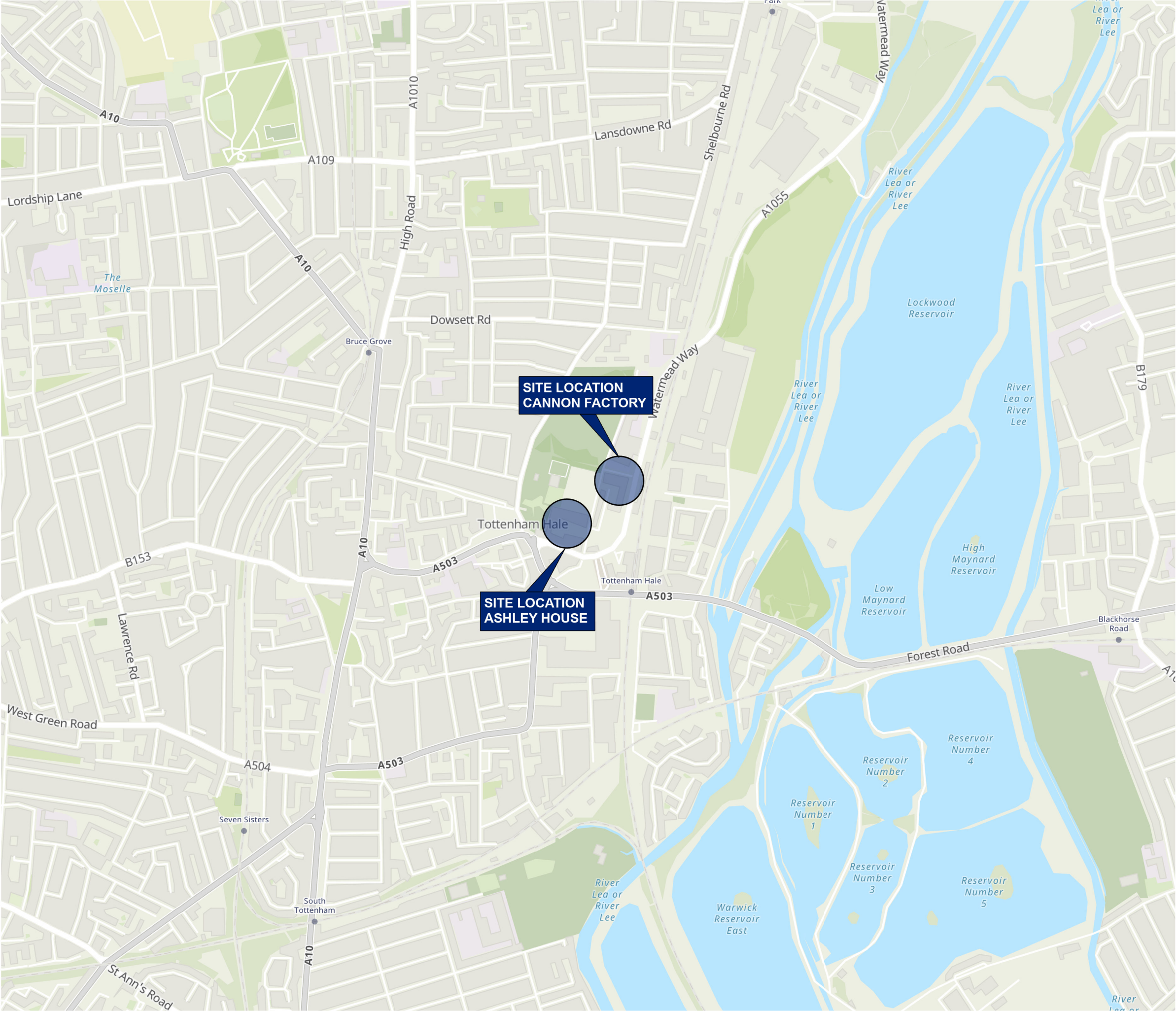
The following actions are recommended to address the potentially unacceptable risks that remain:

- A Remediation Strategy has been prepared (Report ref. WIE16248-100-R-1-2-1-RS) detailing remedial measures to be carried out as part of the site redevelopment. Remedial measures include, amongst others, removal of impacted material from the smear zone at the Cannon Factory following a delineation exercise. This is required to achieve betterment of subsurface contamination conditions. Removal of buried tanks are required at Ashley House. The Remediation Strategy also includes requirements where unforeseen or uncharted contaminants or buried potentially contaminative infrastructure is encountered. The Remediation also includes other requirements beyond these stated above. The Remediation Strategy should be fully consulted prior to works commencing to ensure the requirements of the Remediation Strategy are understood and can be adequately planned and accounted for.
- Soft landscaping areas will require capping layers of at least 600mm certified clean materials to break potential contaminant pathways between contaminants in soils and future Site users. Soils in soft landscaping areas should be suitable for a residential end-use;
- Clean service corridors, should be provided for new services to ensure a preferential pathway is not created for contamination to migrate off-site.
- Barrier pipes are recommended for water supply pipes to be placed into Site soils. This approach would need to be agreed with Thames Water;
- Potentially hazardous chemicals should be appropriately stored, banded and sited away from surface waters;
- Validation, import criteria for soils are presented in the Remediation Strategy and should be adhered to for all material imported to site.
- Construction workers should utilise appropriate PPE when undertaking handling soils and groundwater. If required, dampening down of material should take place during excavation works. Construction workers will adhere to good practice hygiene and safety measures, and the Control of Asbestos Regulations 2012.
- Asbestos fragments and fibres in soil have been encountered and construction workers should be asbestos awareness trained and works should be undertaken in accordance with the APoW. Appropriate measure should be in place to prevent fibre release and corresponding monitoring;
- Entry to confined spaces should be carried out in line with the Confined Space Entry Regulations 1997;
- The risk of chemical attack to buried concrete can be mitigated by selecting a concrete class appropriate for the ground conditions in accordance with BRE-Special Digest 1;
- Classification of waste soils in accordance with WM3 (in particular Appendix D on waste sampling) to confirm the findings of the Preliminary Waste Classification Assessment. Most of the soil samples did not return hazardous properties. Natural uncontaminated soils may be acceptable as inert waste without testing at some landfills;
- A Foundation Works Risk Assessment should be carried out to confirm piling will not pose a risk to controlled water receptors.
- Uncontaminated concrete may be recovered for reuse on-site subject to compliance with the WRAP Quality Protocol for Production of Aggregates from Inert Waste or recovered as inert waste subject to acceptance at an appropriately permitted facility;
- Verification Report(s) should be prepared following phases of work as required demonstrating works were carried out in line with the agreed Remediation Strategy

APPENDICES

Appendix A Site Plans

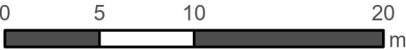
- **Site Location Plan**
- **Ground Investigation Plan – Cannon Factory**
- **Ground Investigation Plan – Ashley House**
- **Ground Investigation Locations – Ashley House (Waterman – 2023, Socotec – 2018, and RSK – 2015)**
- **Ground Investigation Locations – Cannon Factory (Waterman – 2023, Socotec – 2018, and RSK – 2015)**
- **Groundwater Contour Plot – Cannon Factory**
- **Groundwater Contour Plot – Ashley House**



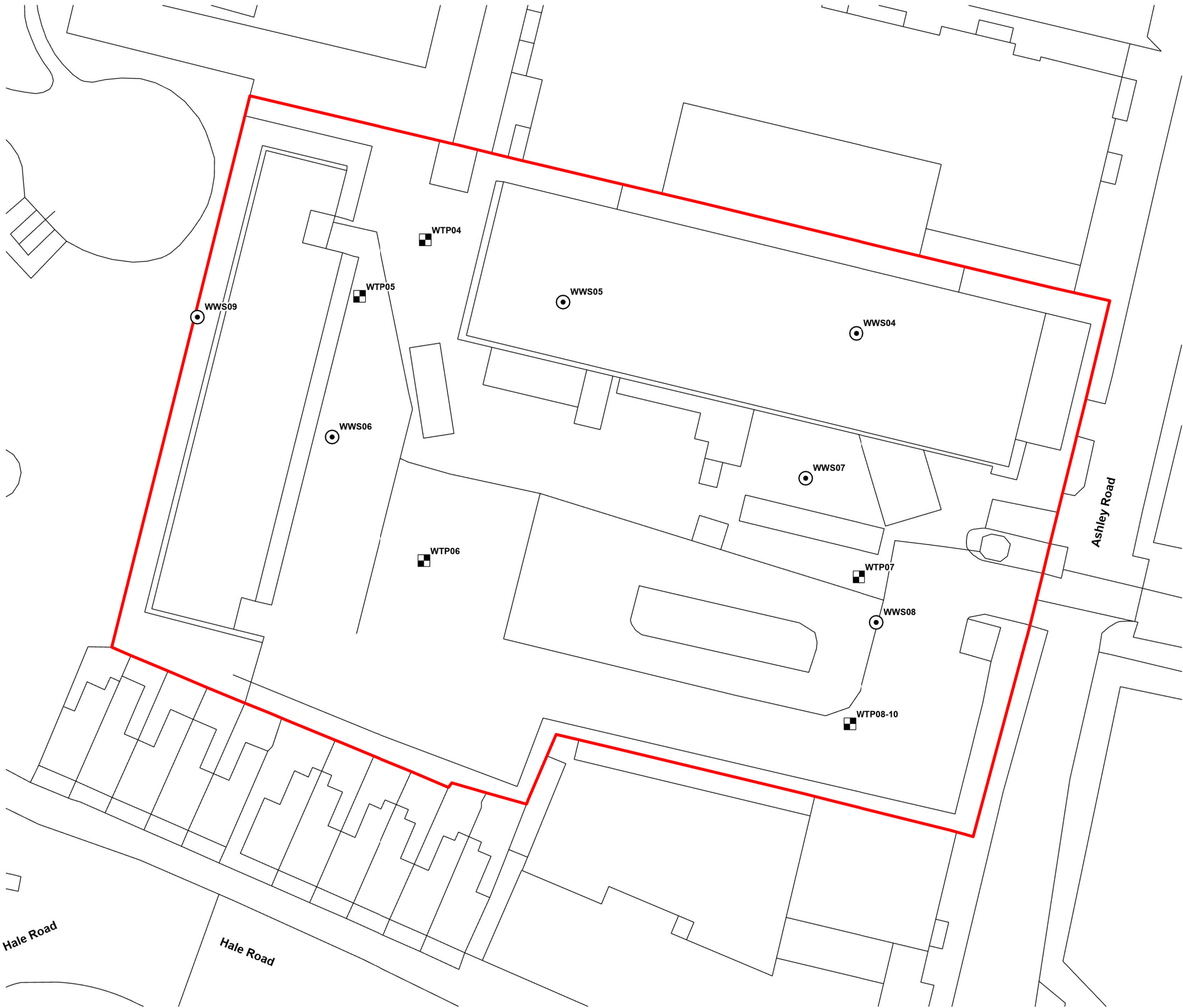
Project Details	Figure: WIE16248-100: Cannon Factory and Ashley House
Figure Title	Figure 1: Site Location Plan
Figure Ref	WIE16248-100_GIS_GQRA_1A
Date	May 2023
File Location	N:\Projects\Figure9_GIS\WIE16248-100_GIS_LQD



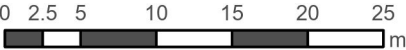
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- Trial Pit
- Window Sample



Project Details	Figure: WIE16248-100: Cannon Factory
Figure Title	Figure 2: Ground Investigation Locations – Cannon Factory
Figure Ref	WIE16248-100_GIS_GQRA_2A
Date	May 2023
File Location	N:\Projects\Figure9_GIS\WIE16248-100_GIS_LQD
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- Site Boundary
- Trial Pit
- Window Sample



Project Details	Figure: WIE16248-100: Ashley House
Figure Title	Figure 3: Ground Investigation Locations – Ashley House
Figure Ref	WIE16248-100_GIS_GQRA_3A
Date	May 2023
File Location	N:\Projects\Figure9_GISWIE16248-100_GIS_LQD
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Site Boundary

Waterman GI Locations

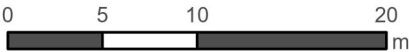
- Trial Pit
- Window Sample

RSK GI Locations

- Probe Hole

Socotec GI Locations

- Borehole
- Window Samples



Project Details	Figure: WIE16248-100: Cannon Factory
Figure Title	Figure 4: Ground Investigation Locations – Cannon Factory (Waterman - 2023, Socotec -2019, and RSK - 2015)
Figure Ref	WIE16248-100_GIS_GQRA_4A
Date	May 2023
File Location	N:\Projects\Figure9_GIS\WIE16248-100_GIS_LQD
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Site Boundary

Waterman GI Locations

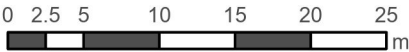
- Trial Pit
- Window Sample

RSK GI Locations

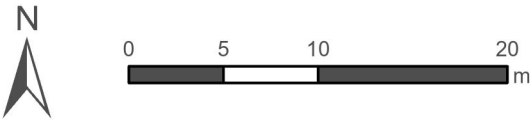
- Deep Borehole Location
- Shallow Window Sample Location

Socotec GI Locations

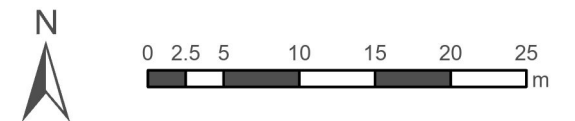
- Borehole
- Window Sample



Project Details	Figure: WIE16248-100: Ashley House
Figure Title	Figure 5: Ground Investigation Locations – Ashley House (Waterman - 2023, Socotec -2019, and RSK - 2015)
Figure Ref	WIE16248-100_GIS_GQRA_5A
Date	May 2023
File Location	N:\Projects\Figure9_GIS\WIE16248-100_GIS_LQD
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Project Details	Figure: WIE16248-100: Cannon Factory
Figure Title	Figure 6: Groundwater Contour Plot – Cannon Factory (02/05/2023)
Figure Ref	WIE16248-100_GIS_GQRA_6A
Date	May 2023
File Location	N:\Projects\Figure9_GIS\WIE16248-100_GIS_LQD
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GROUNDTECH
CONSULTING

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Appraisal

Prepared for: Notting Hill Genesis

Date: May 2023

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Plans

<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
GRO-23113-P01	-	Project Location Plan
GRO-23113-P02A	-	Exploratory Hole Location Plan – Cannon Factory
GRO-23113-P02B	-	Exploratory Hole Location Plan – Ashley House

1.0 INTRODUCTION

1.1 Project Objectives

Groundtech Consulting Limited have been instructed by Waterman I&E on behalf of Notting Hill Genesis to undertake a Ground Investigation for a site at Ashley House and Cannon Factory in Tottenham.

A main investigation was undertaken in accordance with BS 5930:2015, BS 10175:2013, BS 8576 and BS 22475.

1.2 Proposed Development

Details of the proposed development have not been provided at this stage.

1.3 Limitations

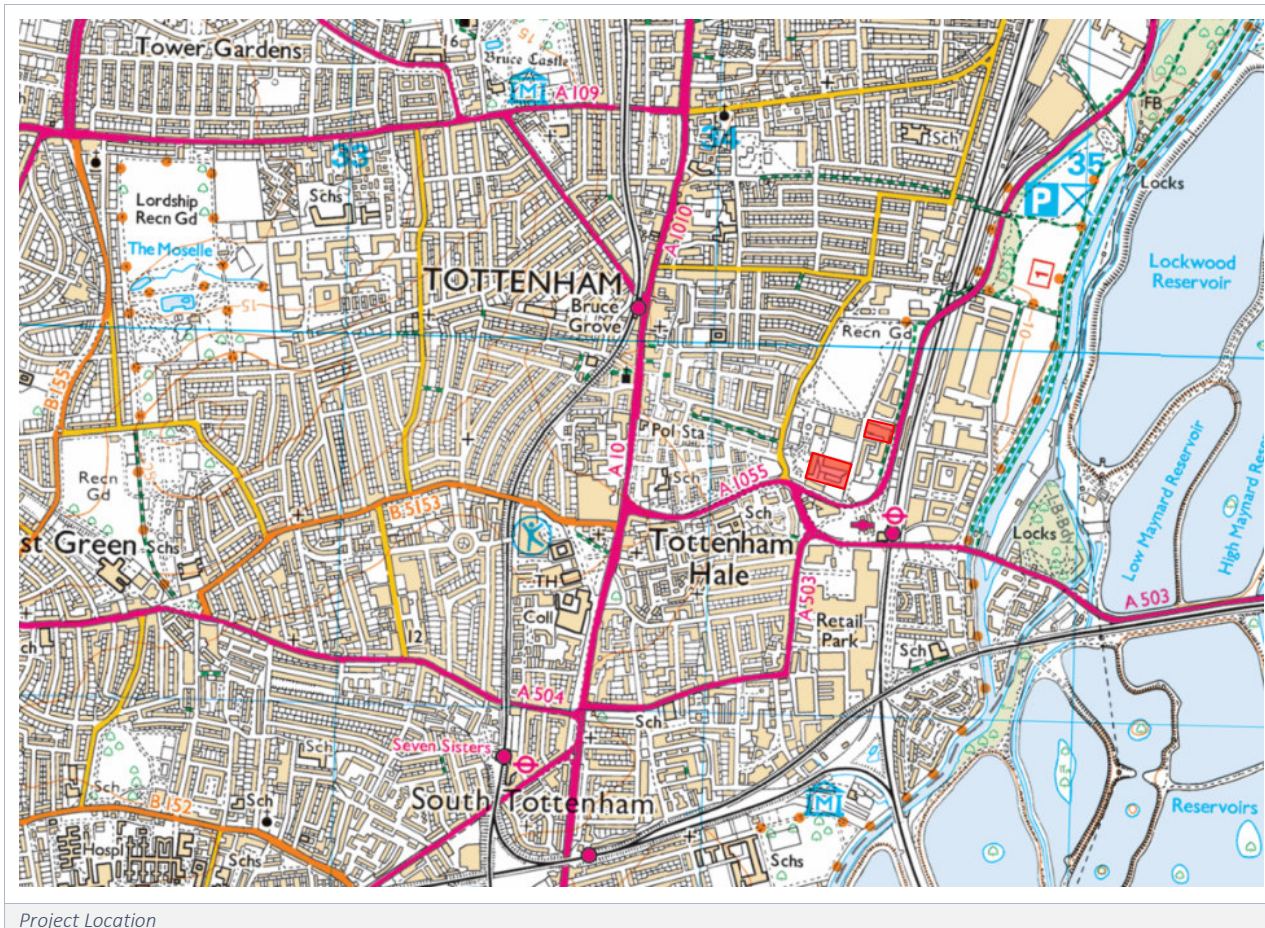
Other conditions may exist on the site that have not been taken into account in this assessment as they are outside the scope of works. Groundtech Consulting are not responsible for these circumstances that are not outlined in the report.

The assessment has been prepared for the exclusive use of the client. No third parties may rely on or reproduce the contents of the report without the written permission of Groundtech Consulting Limited. If any unauthorised third party comes into possession of the report, they rely on it at their own risk and Groundtech Consulting Limited will not be obliged to provide a duty of care.

2.0 SITE SETTING

2.1 Location

The investigation focused on two sites located circa 130m north west and 200 metres north of Tottenham Hale train station, as shown on the Project Location Plan GRO-23113-P01. The northernmost site is approximately centred on National Grid Reference 534454,189771 and the southernmost site is approximately centred on National Grid Reference 534325, 189654.



Access to the site is gained off Ashley Road which bisects the two areas of the site.

2.2 Site Description

The site is formed by two separate parcels of land which are both approximately rectangular in shape and are generally flat lying topographically.

Northern Plot – Cannon Factory

The northern plot is circa 0.25Ha in area and is developed commercially with a disused Cannon factory which occupies the majority of the site. The factory building is predominantly of brick construction with corrugated steel wall cladding. Large sliding doors provide internal access to the warehouse building. The southwestern portion of the site is formed by a concrete surfaced service yard.



A gravel surfaced strip is present along the northern edge of the factory building with several mature trees present and some light vegetation.

The western, northern and eastern site boundaries are formed by Ashley Road, Burdock Road and Watermead Way respectively. The southern boundary is formed by a brick wall and the adjacent commercial/residential premises.

The Cannon Factory is surrounded by the following features/land uses:

- North - Burdock Road and Secondary School
- East - Watermead Way and railway line
- South - Residential apartments
- West - Ashley Road and residential apartments.

Southern Plot – Ashley House

The southernmost plot is circa 0.65Ha in area and is currently developed with disused warehouse buildings and an office block. Associated parking, storage, loading yards and some soft landscaping are present. Disused allotment gardens are present in the centre of the site.

The site boundaries are generally formed by a combination of wooden/metal fencing and brick walls.

Ashley House is surrounded by the following features/land uses:

- North - Residential apartments
- East - Ashley Road and residential properties.
- South - Residential apartments and houses
- West - Public Park.

Site photographs are presented in *Appendix 2*.

3.0 SCOPE OF INVESTIGATION AND RATIONALE

3.1 Project Objectives

The aim of the fieldwork was to:

Determine the stratification beneath the site.
Maintain a watching brief for visual and olfactory evidence of contamination.
Obtain samples using methodology in current guidance for contamination analysis.
Determine the presence of obstructions and buried structures.
Record details of buried services encountered.
Install standpipes for groundwater monitoring.

3.2 Scope of Works

The following scope of works was completed between 20th April and the 24th April 2023:

- *All exploratory hole locations were cleared by a specialist service clearance team prior to breaking ground including GPR and CAT scanning.*
- *Coring of the concrete hardsurfacing was undertaken at all windowless sample locations.*
- *9 No. Machine dug trial pits (WTP01 to WTP11) were undertaken to a maximum depth of 2.5m bgl.*
- *11 No. Windowless sample boreholes (WWS01 to WWS11) were undertaken to a maximum depth of 5.0m bgl.*
- *Photo Ionisation Detector (PID) screening of all environmental samples.*
- *Surveying of all exploratory hole locations to National Grid and meters Above Ordnance Datum (mAOD).*
- *UXO supervision for the duration of the works.*

The exploratory hole locations are presented on Groundtech Plan GRO-23113-P02, and the exploratory hole logs are presented in Appendix 3.

The exploratory hole locations were positioned by Waterman I&E to establish the stratification beneath the site and target areas of concern as set out in the specification. The exploratory holes were logged by a suitably experienced geo-environmental engineer in general accordance with the following current guidance:

- *BS 5930 'Code of Practice for Site Investigations' 2015.*
- *BS EN 14688-1:2002 'Geotechnical Investigation and Testing – Identification and classification of soil'.*
- *BS EN ISO 14689:2002 'Geotechnical investigation and testing – Identification and classification of rock'.*

3.3 Soil Sampling

During the intrusive investigation, representative samples were taken at regular intervals, changes of strata and where evidence of contamination existed. Laboratory analysis was scheduled on the samples obtained.

The samples obtained are summarised in the table below:

Soil Sample	Number
<i>Environmental Sample</i>	<i>93</i>

The samples have been obtained in accordance with current environmental and geotechnical guidance. The sampling plan has been designed to obtain samples from all required strata using the correct methodology.

Disturbed samples of soil for chemical analysis were placed in the correct sampling containers as required by the laboratory in accordance with their MCERTS and UKAS Accreditation. Transportation was arranged in a timely manner and the samples were at the correct temperature.

The sample locations and depths are recorded on the exploratory logs.

3.4 Geo-Environmental Analysis

All testing was scheduled and received by Waterman I&E.

3.6 Groundwater Monitoring

Groundwater monitoring installations were constructed in the boreholes under the instruction of Waterman I&E. The standpipes consisted of high-density polyethylene (HDPE) pipe - a bentonite seal was placed around the plain pipe and a clean gravel pack was placed around the slotted pipe. A summary of the installation construction is presented in the table below:

Location	Depth (m bgl)	Response Zone (m bgl)	Targeted Strata	Reason
WWS02	3.0	1.0 - 3.0	Natural Clay & Sand	Groundwater
WWS03	3.0	2.0 - 3.0	Natural Sand	Groundwater
WWS04	3.5	2.0 - 3.5	Natural Gravel	Groundwater
WWS06	3.5	2.0 - 3.5	Natural Sand	Groundwater
WWS07	3.0	2.0 - 3.0	Made Ground & Natural Sand	Groundwater
WWS08	3.0	2.0 - 3.0	Made Ground & Natural Gravel	Groundwater
WWS10	4.0	2.0 - 4.0	Natural Sand	Groundwater
WWS11	3.5	2.0 - 3.5	Natural Silt & Gravel	Groundwater

Waterman I&E are conducting all the post fieldwork monitoring of the wells for groundwater.

3.7 Vapour Survey - Photo Ionisation Detector

Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation. The onsite monitoring was carried out in line CIRIA C665 to aid targeting samples for VOC laboratory analysis.

Soil was collected for onsite testing. A plastic bag was half filled with soil allowing a suitably sized headspace. The bag was sealed and stored for at least 20 minutes before being tested for Total Volatile Organic



Compounds (TVOCs) using a Photo Ionisation Detector (PID). Results of the PID readings are presented in *Appendix 5*.

4.0 GROUND MODEL

4.1 Made Ground

Made Ground was encountered in all exploratory hole locations to a maximum depth of 2.5m bgl in WWS08 in the central area of Ashley House near the USTs.

Surfacing

Concrete surfacing was present at all locations from ground level to a maximum depth of 0.54m bgl. In the Cannon Factory site, the concrete was divided into two slabs separated by a brown grey sandy gravel.

The site can be divided into Cannon Factory in the north, which contains boreholes WWS01 to WWS03 and WWS10 to WWS11 along with trial pits WTP01 to WTP03 and WTP11, and Ashley House in the south containing boreholes WWS04 to WWS09 and trial pits WTP04 to WTP10. WTP08 to WTP10 were combined into one trial pit looking for the underground tank. The ground conditions for the two separate areas of the site are described below.

Cannon Factory (WWS01-WWS03, WWS10, WWS11 & WTP01-WTP03, WTP11)

Made Ground was encountered to depths between 0.6m and 1.55m bgl and comprised two main strata described below:

- Grey brown gravelly fine to coarse sand with minor constituents of quartzite, brick and concrete was encountered in WWS01 to WWS03, WWS10, WTP01 and WTP11 from a minimum depth of 0.13m bgl to a maximum depth of 1.5m bgl.
- Dark grey sandy angular to subangular fine to coarse gravel with minor constituents of brick and concrete was encountered in WTP02 to WTP03, WWS01, WWS03 and WWS11 from a minimum depth of 0.2m bgl to a maximum depth of 1.3m bgl.

Locally in WTP11, firm gravelly sandy silty clay was encountered from a depth of 0.5m bgl to 1.55m bgl.



Ashley House (WWS04-WWS09 & WTP04-WTP10)

Made Ground was encountered to a maximum of 2.5m bgl.

The following three main Made Ground populations were encountered up to a depth of 2.5m bgl:

- Grey brown gravelly fine to coarse variably clayey gravelly sand with minor constituents of quartzite, brick and concrete was encountered in WWS04, WWS06 to WWS09 and WTP04 to WTP10 from a minimum depth of 0.2m bgl to a maximum depth of 2.4m bgl.
- Brown grey sandy angular to subangular fine to coarse gravel with minor constituents of brick and concrete was encountered in WWS04 and WWS06 from a minimum depth of 0.22m bgl to a maximum depth of 0.8m bgl.
- Soft and soft to firm brown silty sandy gravelly clay was encountered in WWS07 to WWS09 from a minimum depth of 1.3m bgl to a maximum depth of 2.5m bgl.



Exploratory Hole Locations for Ashley House.

4.2 Natural Ground

Natural strata was observed in the majority of exploratory holes and consisted of brown variably sandy, gravelly, clayey silt and soft to firm variably silty, sandy, gravelly clay from depths of 0.7m bgl to a maximum depth of 2.9m bgl. This was generally underlain by gravelly sand and sandy gravel from depths of 1.8m bgl to the base of the exploratory holes. This confirms the records from the geological maps where the Enfield Silt Member is indicated to rest on the River Terrace deposits of the Kempton Park Gravel Member.

4.3 Bedrock

Bedrock was not encountered during the ground investigation.

4.4 Groundwater

Groundwater was encountered in the majority of the window samples during the investigation at depths between 2.5m and 3.0m bgl. Groundwater strikes are summarised in the table below:

Location	Depth (m bgl)	Strata	Type
WWS02	2.8	Natural Sand	Strike
WWS03	3.0	Natural Sand	Strike
WWS04	3.0	Natural Gravel	Strike
WWS06	2.5	Natural Sand	Strike
WWS07	2.8	Natural Sand	Strike
WWS08	2.5	Natural Gravel	Strike
WWS09	2.9	Natural Gravel	Strike
WWS10	3.0	Natural Sand	Strike
WWS11	3.5	Natural Sand	Strike

4.5 Watching Brief

A watching brief was maintained during the Ground Investigation for visual and olfactory evidence of contamination. The contamination identified is detailed in the table below.

Location	Depth (m bgl)	Strata	Visual Evidence	Olfactory Evidence
WWS02	2.2-3.0	Sand	Hydrocarbon staining	Moderate Hydrocarbon Odour
WWS09	1.3-2.0	Made Ground	-	Moderate hydrocarbon odour
WWS10	2.1-2.4	Sand	Hydrocarbon staining	Moderate hydrocarbon odour
WWS10	3.7-4.0	Sand	Hydrocarbon staining	Moderate hydrocarbon odour
WWS11	2.3-2.6	Gravel	-	Moderate hydrocarbon odour
WTP04	0.6-1.8	Made Ground	-	Moderate hydrocarbon odour
WTP11	0.5-1.55	Made Ground	Multicoloured Clay	-
WTP01	0.4-0.6	Made Ground	Asbestos Cement present	-

4.6 Excavation Stability

Boreholes were cased off to avoid collapse. Trial pits were stable.

4.7 Borehole Progress/Obstructions

Several obstructions were encountered during the investigation or the locations were terminated for the reasons detailed in the table below:

Location	Depth (m bgl)	Obstruction/Termination Reason
WWS01	1.2	Potential UXO
WWS05	0.5	Concrete
WTP11	1.6	Concrete footings
WTP05	1.1	Gas pipe
WTP01	0.4	Asbestos cement
WTP08-10	0.6	Concrete

Second slabs were noted in several window samples boreholes. These are recorded on the exploratory hole logs.

A live low pressure gas pipe was struck in WTP05. The emergency gas teams were notified and the damage was repaired on the same day.

Boreholes that penetrated the Made Ground generally terminated due to sampler refusals in the dense sand and gravel.

4.8 Falling Head Tests

Falling head permeability tests were carried out in the at locations WWS04, WWS03 and WWS11 between depths of 2.5m and 3.5m bgl, within the natural granular soils.

On completion of the drilling, the boreholes were filled with water and the depth of water within the borehole was recorded at regular intervals over a 60-minute period.

Location	Strata	Infiltration Rate (m/s)
WWS03	Gravelly Sand	1.8×10^{-7}
WWS04	Sandy gravel	1.32×10^{-6}
WWS11	Gravelly sand	5.32×10^{-8}

Calculated soil infiltration rates range between 1.32×10^{-6} and 5.32×10^{-8} m/s.

The results of the falling head tests are presented in *Appendix 4*.

5.0 RELEVANT INDUSTRY REFERENCES

British Standards Institution '*Investigation of Potentially Contaminated sites - code of practice*' BS 10175:2017.

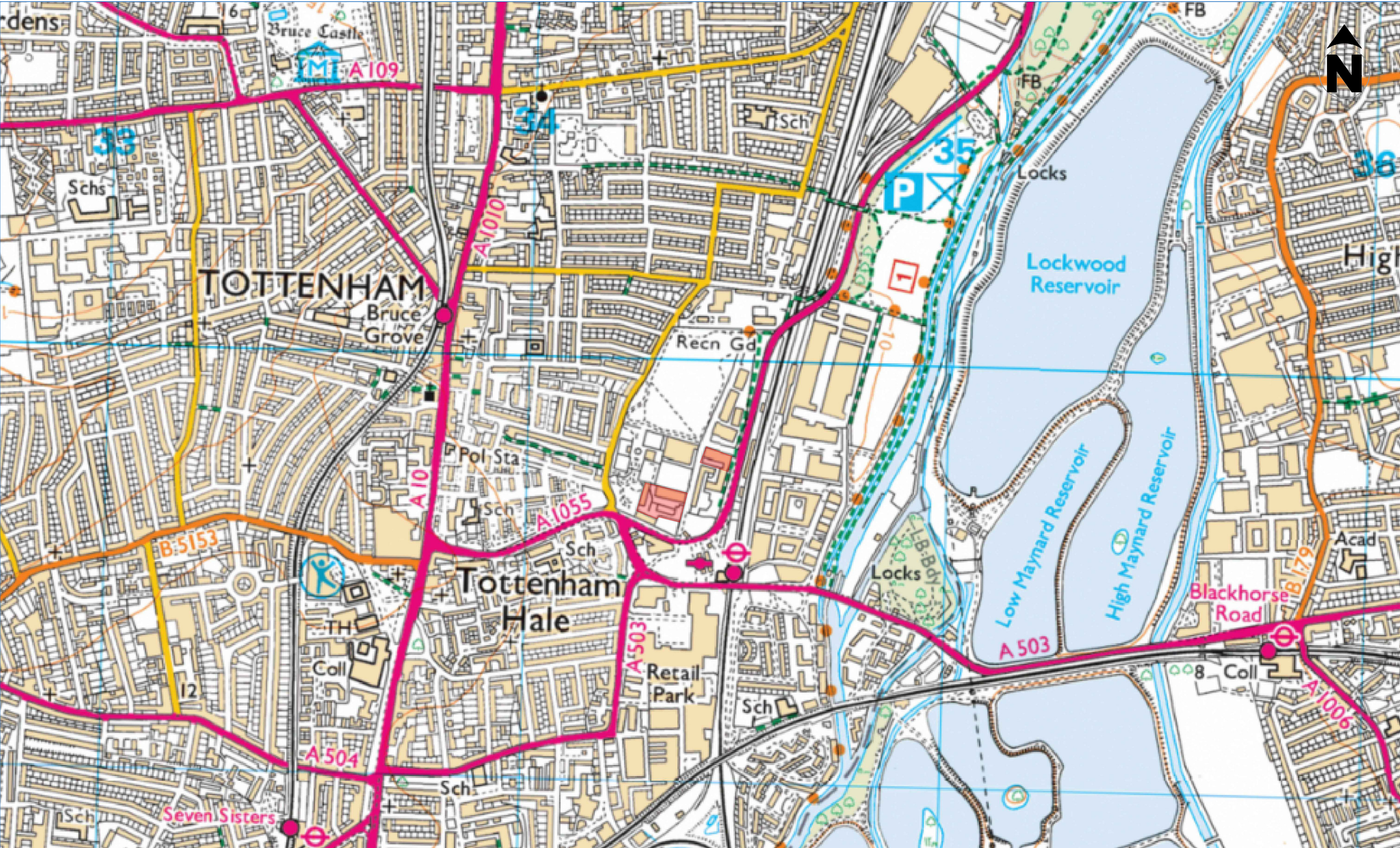
British Standards Institution '*Code of Practice for Site Investigations*' BS 5930:2015

British Standards Institution '*Geotechnical investigation and testing – Identification and classification of soil*' BS EN ISO 14688:2002.

BS EN ISO 14689:2002 '*Geotechnical investigation and testing – Identification and classification of rock*'.



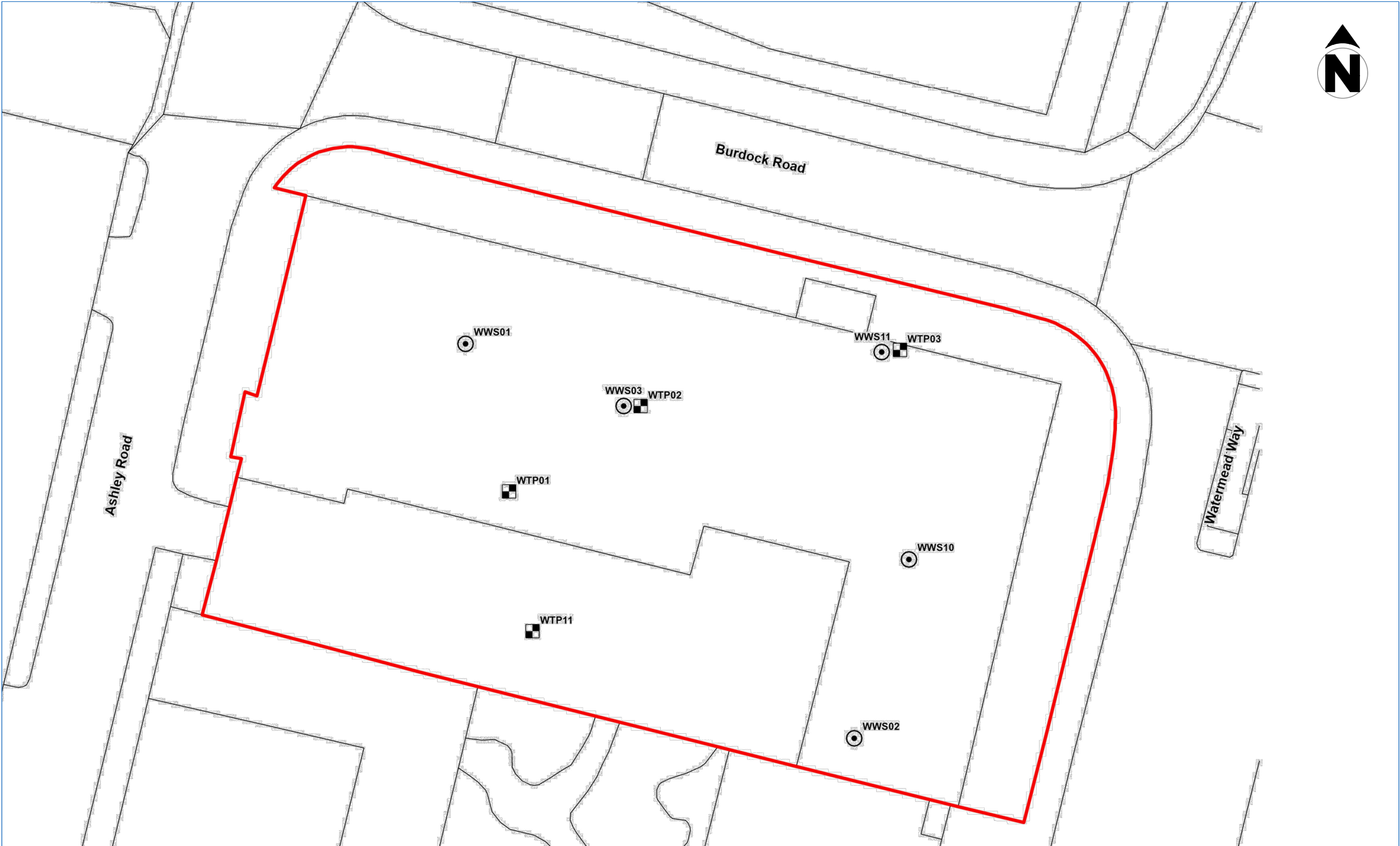
APPENDIX 1 - Plans



GROUNDTECH CONSULTING	CLIENT	DATE			Status	
	NOTTING HILL GENESIS	APRIL 2023			Preliminary	
	PROJECT TITLE	SCALE			Draft	
	ASHLEY HOUSE AND CANNON FACTORY	NTS			Issued	☒
	PLAN TITLE	PLAN NUMBER			For Comment	
	PROJECT LOCATION PLAN	GRO-23113-P01	Rev.	Details	Date	Approved

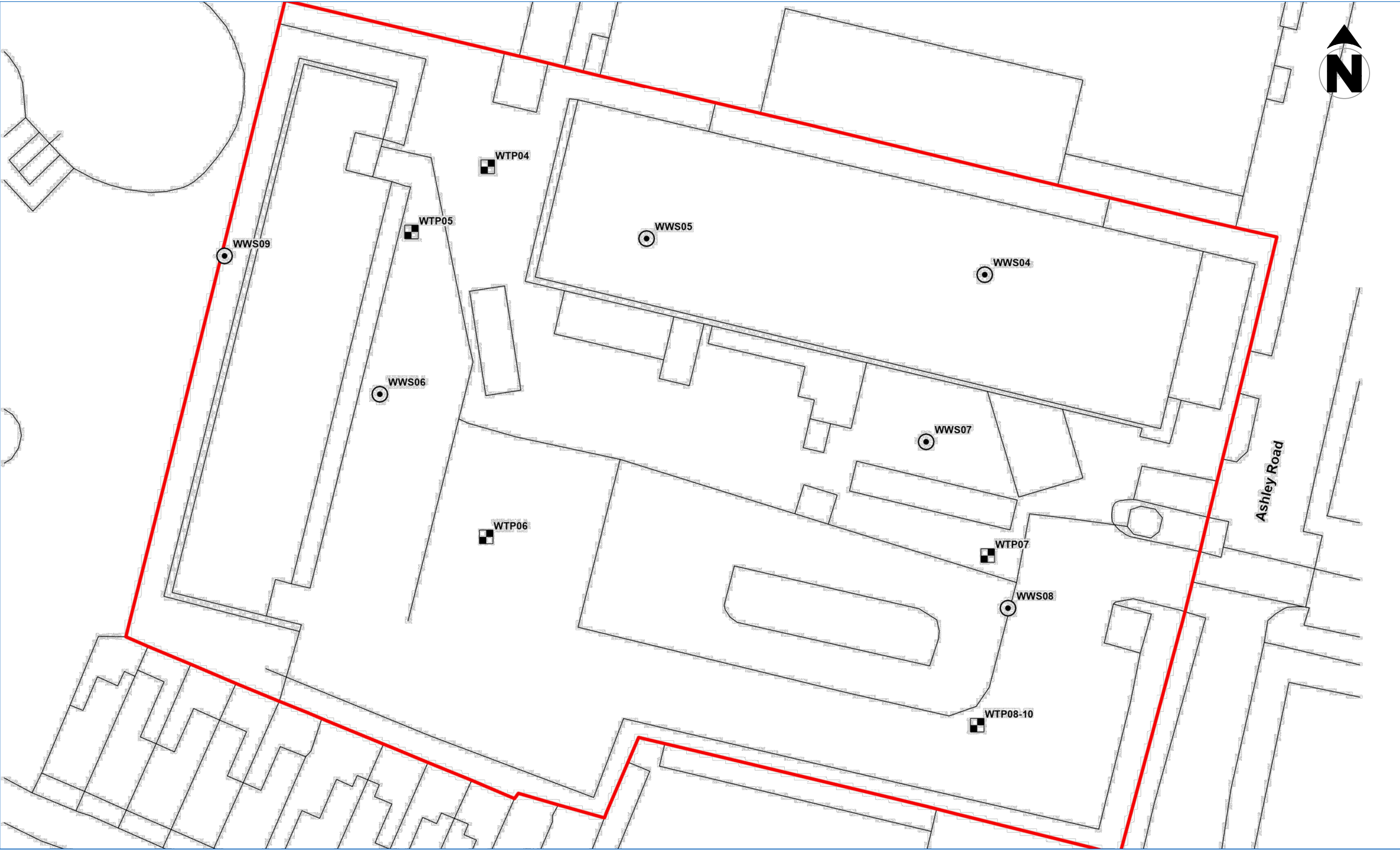
Notes

Site Location



GROUNDTECH CONSULTING	CLIENT	DATE			Status		Notes
	NOTTING HILL GENESIS	MAY 2023				Preliminary	
	PROJECT TITLE	SCALE				Draft	
	ASHLEY HOUSE AND CANNON FACTORY	NTS				Issued	
	PLAN TITLE	PLAN NUMBER				For Comment	
	EXPLORATORY HOLE LOCATION PLAN	GRO-23113-P02A	Rev.	Details	Date	Approved	





GROUNDTECH CONSULTING	CLIENT	DATE				Status		Notes
	NOTTING HILL GENESIS	MAY 2023				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	ASHLEY HOUSE AND CANNON FACTORY	NTS				Issued		
	PLAN TITLE	PLAN NUMBER				For Comment		
	EXPLORATORY HOLE LOCATION PLAN	GRO-23113-P02B	Rev.	Details	Date	Approved		



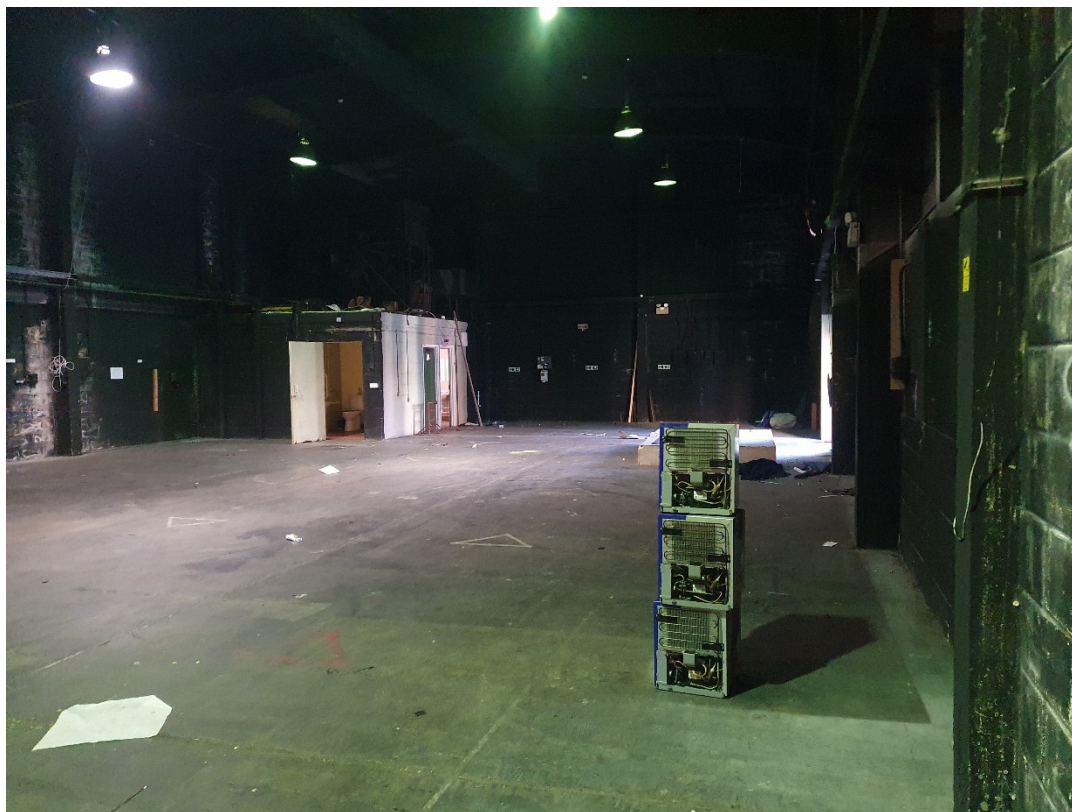
APPENDIX 2 - Site Photographs



Photograph 1 – Internal area of Cannon Factory looking towards WWS01.



Photograph 2 - . Internal area of Cannon Factory looking towards WTP02.



Photograph 3 – Internal area of Cannon Factory looking towards WWS02.



Photograph 4 – Concrete coring and hand pit of WWS01.



Photograph 5 – Hand pit arisings of WWS01.



Photograph 6 – WTP01.



Photograph 7 – Arisings from WWS02.



Photograph 8 – Arisings from WWS07.



Photograph 9 – Arisings from WWS06.



Photograph 10 – Arisings from WWS04.



Photograph 11 – Arisings from WWS09.



Photograph 12 – Arisings from WWS10.



Photograph 13 – Concrete obstruction in WTP10 near underground tank.



Photograph 14 – WTP07.



Photograph 15 – WTP11.



Photograph 16 – WTP04.



APPENDIX 3 - Exploratory Hole Logs



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Borehole Log

Borehole No.

WWS01

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534439.80 - 189779.07

Hole Type
WS

Location: TOTTENHAM

Level: 9.01

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.16			0.16	8.85		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
		0.18			0.18	8.83		MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of quartzite.	
		0.42	ES	PID=0	0.41	8.60		MADE GROUND: Grey rebar reinforced concrete with medium gravel inclusions of quartzite.	
		0.50	ES	PID=0	0.50	8.51		MADE GROUND: Grey sandy angular to subangular fine to coarse gravel of brick and concrete. Sand is fine to coarse.	
					0.80	8.21		MADE GROUND: Red brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick.	
		1.00	ES	PID=0				MADE GROUND: Soft brown sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of quartzite. Sand is fine to medium.	
					1.20	7.81		End of borehole at 1.20 m	5

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole terminated at 1.2m bgl on the advice from UXO supervisor. 4. Groundwater not encountered. 5. Borehole backfilled with arisings.





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Borehole Log

Borehole No.

WWS02

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534472.41 - 189746.01

Hole Type
WS

Location: TOTTENHAM

Level: 9.05

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.13			0.13	8.92		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	
		0.23			0.23	8.82		MADE GROUND: Brown grey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick, concrete and sandstone.	
		0.38			0.38	8.67		MADE GROUND: Grey rebar reinforced concrete with medium gravel inclusions of quartzite.	
		0.40	ES	PID=0				MADE GROUND: Brown grey gravelly fine to coarse sand with low cobble content of brick. Gravel is angular to subangular fine to coarse of brick, concrete and sandstone.	
		0.50	ES	PID=0					
		1.00	ES	PID=0					
		1.20		N=12 (1,1/2,3,3,4)					
		1.30			1.30	7.75			
		1.50	ES	PID=0				Soft brown sandy gravelly silty CLAY. Gravel is subangular to subrounded fine to coarse of quartzite and flint. Sand is fine to medium.	
		2.00		N=15 (4,4/5,4,4,2)					
		2.20			2.20	6.85			
		2.50	ES	PID=0				Brown silty fine to medium SAND with moderate hydrocarbon odour. <i>Moderate Hydrocarbon odour and dark grey staining from 2.8m to 3.0m bgl.</i>	
		2.80	ES	PID=0	2.80	6.25		Dark grey silty fine to medium SAND. Moderate hydrocarbon odour.	
		3.00		N=11 (1,1/3,2,3,3)	3.00	6.05			
		3.50	ES	PID=0				Light brown very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of quartzite. Sand is fine to medium.	
		4.00		N=35 (7,7/8,9,9,9)					
		4.50	ES	PID=0					
		5.00		N=39 (8,7/6,8,12,13)	5.00	4.05		End of borehole at 5.00 m	

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 2.8m bgl. 5. Borehole terminated at 5.0m bgl. 6. Borehole installed to 3.0m bgl using 1.0m plain and 2.0m slotted.





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Borehole Log

Borehole No.

WWS03

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534454.49 - 189773.86

Hole Type
WS

Location: TOTTENHAM

Level: 9.04

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20			0.20	8.84		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
		0.30	ES	PID=0					
		0.50	ES	PID=0					
					1.00	8.04		MADE GROUND: Brown sandy angular to subangular fine to coarse gravel of concrete and brick with low cobble content of brick. Sand is fine to coarse.	
					1.80	7.24		Soft orange brown very sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of flint and quartzite. Sand is fine to medium.	
		2.60	ES					Orange brown clayey gravelly fine to medium SAND. Gravel is angular to subrounded fine to coarse of flint and quartzite.	2
		3.00		N=50 (11,11/50 for 290mm)	3.00	6.04		End of borehole at 3.00 m	3
									4
									5

Remarks

1. Area cleared by specialist utility clearance company. 2. Borehole drilled through backfill of WTP02. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 3.0m bgl. 5. Borehole terminated at 3.0m bgl due to refusal on dense sand. 6. Falling Head Test conducted in borehole at 3.0m bgl. 7. Borehole installed to 3.0m bgl using 2.0m plain and 1.0m slotted.





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Borehole Log

Borehole No.

WWS04

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534354.43 - 189678.19

Hole Type
WS

Location: TOTTENHAM

Level: 9.25

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.23	9.02		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
		0.30	ES	PID=0	0.33	8.92		MADE GROUND: Brown grey sandy angular to subangular fine to coarse gravel of concrete and brick.	
		0.55	ES	PID=0	0.54	8.71		MADE GROUND: Brown concrete with medium to coarse gravel inclusions of quartzite.	
					0.80	8.45		MADE GROUND: Brown grey sandy angular to subangular fine to coarse gravel of concrete and brick. Sand is fine to coarse.	
		1.00	ES	PID=0				MADE GROUND: Dark grey clayey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick.	
		1.20		N=2 (1,0/1,0,1,0)	1.30	7.95			2
		1.40	ES	PID=0				Soft brown clayey sandy SILT. Sand is fine to medium.	
		2.00		N=37 (5,7/7,10,10,10)	2.10	7.15			
		2.20	ES	PID=0				Brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to coarse.	
		3.00		N=50 (10,9/11,15,12,12)					
		3.20	ES	PID=0					3
					3.50	5.75			
								End of borehole at 3.50 m	
									4
									5

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 3.4m bgl. 5. Borehole terminated at 3.5m bgl due to refusal on dense gravel. 6. Falling Head Test conducted in borehole at 3.5m bgl. 7. Borehole installed to 3.5m bgl using 2.0m plain and 1.5m slotted.





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Borehole Log

Borehole No.

WWS05

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534319.28 - 189681.94

Hole Type
WS

Location: TOTTENHAM

Level: 9.30

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES	PID=0	0.20	9.10		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
					0.40	8.90		MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of quartzite.	
					0.50	8.80		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite. End of borehole at 0.50 m	
									2
									3
									4
									5

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole terminated at 0.5m bgl due to second concrete slab. 4. Groudwater not encountered. 5. Borehole backfilled with arisings.





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Borehole Log

Borehole No.

WWS06

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534291.55 - 189665.78

Hole Type
WS

Location: TOTTENHAM

Level: 8.92

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.22	8.70		MADE GROUND: Grey rebar reinforced concrete with medium gravel inclusions of quartzite.	1
		0.30	ES	PID=0				MADE GROUND: Grey brown sandy angular to subangular fine to coarse gravel of brick and concrete. Sand is fine to coarse.	
		0.50	ES	PID=0					
					0.80	8.12		MADE GROUND: Brown silty gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick.	2
		1.00	ES	PID=0					
		1.20		N=0 (0,0/0,0,0,0)					
					1.30	7.62		Brown sandy SILT. Sand is fine to coarse.	3
		1.50	ES	PID=0					
					2.00				
				N=16 (3,4/4,4,5,3)	2.10	6.82		Brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of quartzite and flint.	4
		2.50	ES	PID=0					
		3.00		N=23 (4,4/3,7,7,6)					
									5
		3.50	ES	PID=0					
		4.00		N=40 (25 for 140mm/11,11,10,8)					
		4.30		50 (11,11/50 for 220mm)					5
		4.50	ES	PID=0					
					5.00	3.92		End of borehole at 5.00 m	

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 2.5m bgl. 5. Borehole terminated at 5.0m bgl. 6. Borehole installed to 3.5m bgl using 2.0m plain and 1.5m slotted.





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Borehole Log

Borehole No.

WWS07

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534348.34 - 189660.84

Hole Type
WS

Location: TOTTENHAM

Level: 9.14

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20	8.94		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
		0.30	ES	PID=0				MADE GROUND: Brown grey clayey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and concrete.	
		0.50	ES	PID=0	0.70	8.44		MADE GROUND: Orange gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and quartzite.	
		0.90	ES	PID=0				MADE GROUND: Soft brown silty sandy clay. Sand is fine to coarse.	
		1.20	ES	N=3 (2,3/1,1,0,1)	1.30	7.84		MADE GROUND: Red brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick.	2
		1.20	ES	PID=0				Brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of quartzite and flint.	
		1.40	ES	PID=0	1.80	7.34		Grey gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of quartzite and flint.	
		1.90	ES	PID=0	2.00	7.14		End of borehole at 3.00 m	
		2.00	ES	N=34 (4,7/7,7,8,12)					3
		2.10	ES	PID=0	2.50	6.64			
		2.60	ES	PID=0	3.00	6.14			4
		3.00		N=50 (5,8/50 for 235mm)					5

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 2.8m bgl. 5. Borehole terminated at 3.0m bgl due to refusal on dense sand. 6. Borehole installed to 3.0m bgl using 1.0m plain and 2.0m slotted.





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Borehole Log

Borehole No.

WWS08

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534356.85 - 189643.57

Hole Type
WS

Location: TOTTENHAM

Level: 9.11

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.23	8.88		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
		0.40	ES	PID=0				MADE GROUND: Brown red gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick, concrete, flint and quartzite.	
		0.60	ES	PID=0					
		1.00	ES	PID=0	0.80	8.31		MADE GROUND: Dark brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of flint, quartzite, brick and concrete.	
		1.20		N=5 (1,0/1,1,2,1)					
		1.50	ES	PID=0	1.30	7.81		MADE GROUND: Dark brown clayey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of flint, quartzite, brick and concrete.	2
		2.00	ES	N=12 (1,2/5,3,3,1) PID=0	1.80	7.31		MADE GROUND: Soft to firm brown grey sandy gravelly clay. Gravel is angular to subangular fine to coarse of brick and concrete. Sand is fine to coarse.	
		2.00							
		2.50	ES	PID=0	2.50	6.61		Brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to coarse.	3
		3.00		50 (25 for 10mm/50 for 10mm)					
				3.50	5.61	End of borehole at 3.50 m			4

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 2.5m bgl. 5. Borehole terminated at 3.5m bgl due to refusal in dense gravel. 6. Borehole installed to 3.5m bgl using 2.0m plain and 1.5m slotted.





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Borehole Log

Borehole No.

WWS09

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534275.41 - 18960.14

Hole Type
WS

Location: TOTTENHAM

Level: 8.94

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.21			0.21	8.73		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
		0.30	ES	PID=0				MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick	
		0.50	ES	PID=0					
		1.00	ES	PID=0					2
		1.20		N=6 (1,1/1,2,2,1)	1.30	7.64			
		1.50	ES	PID=0				MADE GROUND: Soft brown grey sandy gravelly clay. Gravel is angular to subangular fine to coarse of brick. Sand is fine to coarse. <i>Slight hydrocarbon odour from 1.3m to 1.5m bgl.</i>	
		1.90	ES	PID=0					
		2.00		N=30 (3,2/2,8,10,10)	2.00	6.94		Firm brown silty sandy CLAY. Sand is fine to medium.	
		2.10	ES	PID=0					
		3.00	ES	N=50 (9,9/50 for 295mm) PID=0	2.90	6.04		Brown sandy clayey angular to subrounded fine to coarse GRAVEL of quartzite and flint. Sand is fine to coarse.	3
		3.00			3.40	5.54		End of borehole at 3.40 m	4
									5

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 2.9m bgl. 5. Borehole terminated at 3.4m bgl due to refusal on dense gravel. 6. Borehole bacfilled with arisings.





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Borehole Log

Borehole No.

WWS10

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534477.00 - 189761.00

Hole Type
WS

Location: TOTTENHAM

Level:

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.25			MADE GROUND: Grey rebar reinforced concrete with medium gravel inclusions of quartzite.	1
		0.30	ES	PID=0	0.40			MADE GROUND: Red brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick.	
		0.50	ES	PID=0				MADE GROUND: Dark grey clayey gravelly fine to coarse sand. Gravel is angular to subangular of brick.	
		1.00	ES	PID=0					
		1.20		N=7 (1,1/1,1,1,4)					2
		1.60	ES	PID=0	1.50			Soft to firm brown silty sandy CLAY. Sand is fine to medium.	
		2.00		N=46 (5,9/10,12,12,12)	2.10				
		2.20	ES	PID=3	2.40			Dark grey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint and quartzite. Moderate hydrocarbon odour with dark grey staining.	
		2.50	ES	PID=0				Brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint and quartzite.	3
		3.00		N=21 (3,3/4,4,6,7)					
		3.50	ES	PID=0	3.70				
		3.80	ES	PID=2				Dark grey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint and quartzite. Moderate hydrocarbon odour with dark grey staining.	
		4.00		N=50 (12,12/50 for 255mm)	4.00			End of borehole at 4.00 m	4
									5

Remarks

1. Area cleared by specialist utility clearance company. 2. Hand dug pit to 1.2m bgl. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 3.0m bgl. 5. Borehole terminated at 4.0m bgl due to refusal on dense sand. 6. Borehole installed to 4.0m bgl using 2.0m plain and 2.0m slotted.





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Borehole Log

Borehole No.

WWS11

Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON
FACTORY

Project No.
GRO-23113

Co-ords: 534476.25 - 189778.56

Hole Type
WS

Location: TOTTENHAM

Level: 9.05

Scale
1:25

Client: NOTTING HILL GENESIS

Dates: 20/04/2023 -

Logged By
MB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30	8.75		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
					1.30	7.75		MADE GROUND: Dark grey sandy angular to subangular fine to coarse gravel of brick and concrete.	
					2.30	6.75		Soft orange brown sandy gravelly fine to medium SILT. Gravel is angular to subrounded fine to coarse of flint and quartzite. Sand is fine to medium.	2
		3.00	ES	PID=0	3.50	5.55		Brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to medium. <i>Between 2.3m and 2.6m bgl moderate hydrocarbon odour.</i>	3
								End of borehole at 3.50 m	4
									5

Remarks

1. Area cleared by specialist utility clearance company. 2. Borehole drilled through backfilled WTP03. 3. Borehole cleared by UXO supervision. 4. Groundwater encountered at 3.0m bgl. 5. Borehole terminated at 3.0m bgl in dense gravel. 6. Borehole installed to 3.0m bgl using 2.0m plain and 1.0m slotted.



Trial Pit Log

Trialpit No
WTP01
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534443.45 - 189766.70
Level: 8.99

Date
20/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
0.60

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	ES	PID=0	0.16 0.18 0.40 0.60	8.83 8.81 8.59 8.39	   	MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite. MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of quartzite. MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite. Asbestos cement embedded within the base of the concrete. MADE GROUND: Grey brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of quartzite, flint and asbestos cement. End of pit at 0.60 m

1
2
3
4
5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Asbestos cement encountered below concrete slab between 0.3m and 0.6m bgl. 4. Trial pit backfilled with arisings. 5. Trial pit reinstated with concrete to avoid unwanted disturbance of the asbestos.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP02
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534454.49 - 189773.86
Level: 9.04

Date
20/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
2.50

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20	8.84		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	
	0.30	ES	PID=0				MADE GROUND: Brown sandy angular to subangular fine to coarse gravel of concrete and brick with low cobble content of brick. Sand is fine to coarse.	
	0.50	ES	PID=0					
	1.00	ES	PID=0	1.00	8.04		Soft orange brown very sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of flint and quartzite. Sand is fine to medium.	1
			PID=0					
	2.00	ES	PID=0	1.80	7.24		Orange brown clayey gravelly fine to medium SAND. Gravel is angular to subrounded fine to coarse of flint and quartzite.	2
			PID=0					
			PID=0	2.50	6.54		End of pit at 2.50 m	
								3
								4
								5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Trial pit backfilled with arisings.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP03
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534476.25 - 189778.56
Level: 9.05

Date
21/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
2.50

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES	PID=0	0.30	8.75		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	1
	1.20	ES	PID=0	1.30	7.75		MADE GROUND: Dark grey sandy angular to subangular fine to coarse gravel of brick and concrete. Sand is fine to coarse.	
	1.50	ES	PID=0				Soft brange brown sandy gravelly fine to medium SILT. Gravel is angular to subrounded fine to coarse of flint and quartzite. Sand is fine to medium.	2
	1.90	ES	PID=0					
	2.50	ES	PID=0	2.30	6.75		Brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to coarse.	
				2.50	6.55		End of pit at 2.50 m	3
								4
								5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Trial pit backfilled with arisings.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP04
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534302.77 - 189689.40
Level: 9.00

Date
21/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
2.60

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20	8.80		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	
	0.30	ES	PID=0				MADE GROUND: Grey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick concrete and quartzite.	
	0.50	ES	PID=0	0.60	8.40			
	0.80	ES	PID=0				MADE GROUND: Dark grey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and concrete. Moderate hydrocarbon odour.	
	1.00	ES	PID=2					1
	1.50	ES	PID=1					
				1.80	7.20		Firm brown sandy silty CLAY. Sand is fine to medium.	
	2.00	ES	PID=0					2
	2.40	ES	PID=0	2.30	6.70		Brown clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to medium of quartzite and flint.	
	2.60	ES	PID=0	2.60	6.40		End of pit at 2.60 m	
								3
								4
								5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Trial pit backfilled with arisings.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP05
Sheet 1 of 1

Project Name:	ASHLEY HOUSE AND CANNON FACTORY	Project No.	GRO-23113	Co-ords:	534279.07 - 189687.26	Date	21/04/2023
Location:	TOTTENHAM	Dimensions (m):	Depth 1.20	Level:	9.05	Scale	1:25
Client:	NOTTING HILL GENESIS					Logged	MB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES	PID=0	0.22	8.83		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	
	0.50	ES	PID=0	0.40	8.65		MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and quartzite.	
	1.00	ES	PID=0	1.20	7.85		MADE GROUND: Red brown clayey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and flint.	1
							End of pit at 1.20 m	2
								3
								4
								5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Low pressure gas pipe encountered at 1.1m bgl. Hole abandoned and pipe repaired by Cadent. 4. Trial pit backfilled with arisings.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP06
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534302.61 - 189650.97
Level: 8.95

Date
21/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
1.50

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES	PID=0	0.24	8.70		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	
	0.50	ES	PID=0				MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and quartzite.	
	1.00	ES	PID=0	0.70	8.24		Firm orange brown sandy gravelly silty CLAY. Gravel is subangular to subrounded fine to medium of quartzite. Sand is fine to coarse.	1
	1.50	ES	PID=0	1.50	7.44		End of pit at 1.50 m	2
								3
								4
								5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Trial pit backfilled with arisings.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP07
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534354.74 - 189649.03
Level: 9.05

Date
24/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
2.50

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20			0.20	8.85		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	
	0.30	ES	PID=0					
	0.50	ES	PID=0				MADE GROUND: Red brown clayey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and flint.	
	1.00	ES	PID=0	1.10	7.95			1
	1.20	ES	PID=0				MADE GROUND: Dark brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick.	
	2.00	ES	PID=0					2
				2.40	6.65			
				2.50	6.55		Firm light brown silty CLAY.	
							End of pit at 2.50 m	
								3
								4
								5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Trial pit backfilled with arisings.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP08-10
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534353.65 - 189631.42
Level: 9.15

Date
24/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
0.60

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	ES	PID=0	0.20	8.95		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.
	0.50	ES	PID=0	0.45	8.70		MADE GROUND: Yellow brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and quartzite.
				0.60	8.55		MADE GROUND: Red brown gravelly fine to coarse sand with moderate cobble content of bricks. Gravel is angular to subangular fine to coarse of brick and quartzite.
				0.61	8.54		MADE GROUND: Grey concrete with medium gravel inclusions of quartzite.
							End of pit at 0.60 m

1

2

3

4

5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Concrete structure encountered at 0.6m bgl. 4. Trial pit backfilled with arisings.

Stability: STABLE



Trial Pit Log

Trialpit No
WTP11
Sheet 1 of 1

Project Name: ASHLEY HOUSE AND CANNON FACTORY

Project No.
GRO-23113

Co-ords: 534445.42 - 189754.99
Level: 8.84

Date
24/04/2023

Location: TOTTENHAM

Dimensions (m):

Depth
1.65

Scale
1:25

Logged
MB

Client: NOTTING HILL GENESIS

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES	PID=0	0.20	8.64		MADE GROUND: Grey reinforced concrete with medium gravel inclusions of quartzite.	
	0.50	ES	PID=0	0.50	8.34		MADE GROUND: Brown gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and concrete.	
	1.00	ES	PID=0				MADE GROUND: Firm dark brown gravelly sandy silty clay. Gravel is angular to subangular fine to coarse of brick. <i>From 0.55m bgl localised areas of multicoloured clay.</i>	1
	1.60	ES	PID=0	1.55 1.65	7.29 7.19		Soft light brown silty CLAY.	
							End of pit at 1.65 m	2
								3
								4
								5

Remarks: 1. Area cleared by specialist utility clearance company. 2. Groundwater not encountered. 3. Linear concrete feature encountered at 0.8m and 1.5m bgl thought to be foundations of previous structures. 4. Trial pit backfilled with arisings.

Stability: STABLE





APPENDIX 4 – Falling Head Test Results

ASHLEY HOUSE & CANNON FACTORY
GRO-23113
NOTTING HILL GENESIS

VARIABLE HEAD PERMEABILITY TEST



Sheet 1 of 2

Date of Test: 21/04/2023 Type of Test: Falling Head Position: WWS04 Engineer: Michael Berry Weather: Sunny, clear

Test Measurements

Depth below top of casing/standpipe to:

(i) bottom of borehole:	3.50	m
(ii) bottom of casing:	2.50	m
(iii) top of filter material:	-	m
(iv) centre of piezometer tip:	-	m
(v) initial groundwater level:		m
Height of casing/standpipe above surface	-	m
Elevation of casing/standpipe (AOD)	-	m
Diameter of casing/standpipe	0.10	m
Length of filter	1.00	m
Diameter of filter	0.10	m

Test Data

Time Elapsed (mins)

Depth to Water Level (m)

0	1.24
0.5	1.30
1	1.40
1.5	1.45
2	1.47
2.5	1.50
3	1.56
3.5	1.60
4	1.65
4.5	1.72
5	1.79
6	1.86
7	7.90
8	2.02
9	2.04
10	2.06
15	2.34
20	2.40
25	2.50
30	2.55
40	2.64
50	2.83
60	3.00

VARIABLE HEAD PERMEABILITY TEST

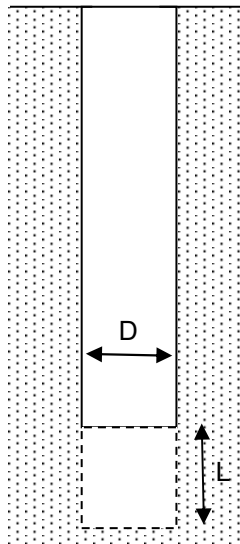
Sheet 2 of 2

Borehole WWS04

By: MB Checked: RW

Variable Head Permeability Test in accordance with BS 5930

Calculation of Intake Factor (F)



$$\text{Area of base (A)} = 0.01 \text{ m}^2$$

$$\text{Diameter (D)} = 0.10 \text{ m}$$

$$\text{Length (L)} = 1.00 \text{ m}$$

$$F = \frac{2 \pi L}{\ln \left\{ \left(\frac{L}{D} \right) + \sqrt{1 + \left(\frac{L}{D} \right)^2} \right\}}$$

$$F = \frac{6.283}{2.998}$$

$$F = 2.096$$

Calculation of Infiltration Rate

$$\text{At time} = 10 \text{ mins (t}_1\text{) Depth to water} = 2.06 \text{ m}$$

$$t_1 = 600 \text{ sec}$$

$$\text{Depth to base of borehole} = 3.50 \text{ m}$$

$$\text{Depth of Water (H}_1\text{)} = 1.44 \text{ m}$$

$$\text{At time} = 60 \text{ mins (t}_2\text{) Depth to water} = 3.00 \text{ m}$$

$$t_2 = 3600 \text{ sec}$$

$$\text{Depth to base of borehole} = 3.50 \text{ m}$$

$$\text{Depth of Water (H}_2\text{)} = 0.50 \text{ m}$$

$$k = \frac{A}{F(t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k = \frac{0.01}{6287} \ln \frac{1.44}{0.5}$$

$$k = 1.32\text{E-}06 \text{ m/s}$$

ASHLEY HOUSE & CANNON FACTORY
GRO-23113
NOTTING HILL GENESIS

VARIABLE HEAD PERMEABILITY TEST



Sheet 1 of 2

Date of Test: 24/04/2023 Type of Test: Falling Head Position: WWS11 Engineer: Michael Berry Weather: Sunny, clear

Test Measurements

Depth below top of casing/standpipe to:

(i) bottom of borehole:	3.50	m
(ii) bottom of casing:	2.50	m
(iii) top of filter material:	-	m
(iv) centre of piezometer tip:	-	m
(v) initial groundwater level:		m
Height of casing/standpipe above surface	-	m
Elevation of casing/standpipe (AOD)	-	m
Diameter of casing/standpipe	0.10	m
Length of filter	1.00	m
Diameter of filter	0.10	m

Test Data

Time Elapsed (mins)

Depth to Water Level (m)

0	1.00
0.5	1.02
1	1.02
1.5	1.02
2	1.03
2.5	1.03
3	1.03
3.5	1.03
4	1.03
4.5	1.03
5	1.03
6	1.05
7	1.06
8	1.07
9	1.09
10	1.10
15	1.12
20	1.15
25	1.16
30	1.18
40	1.18
50	1.19
60	1.20

VARIABLE HEAD PERMEABILITY TEST

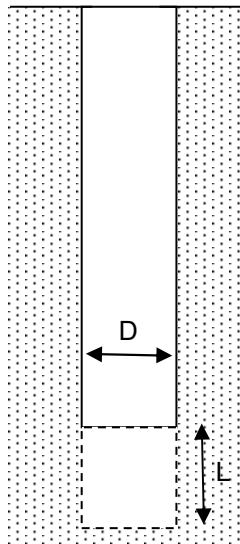
Sheet 2 of 2

Borehole WWS11

By: MB Checked: RW

Variable Head Permeability Test in accordance with BS 5930

Calculation of Intake Factor (F)



Area of base (A) = 0.01 m²

Diameter (D) = 0.10 m

Length (L) = 1.00 m

$$F = \frac{2 \pi L}{\ln \left\{ \left(\frac{L}{D} \right) + \sqrt{1 + \left(\frac{L}{D} \right)^2} \right\}}$$

$$F = \frac{6.283}{2.998}$$

$$F = 2.096$$

Calculation of Infiltration Rate

At time = 10 mins (t₁) Depth to water = 1.10 m

t₁ = 600 sec

Depth to base of borehole = 3.50 m

Depth of Water (H₁) = 2.40 m

At time = 60 mins (t₂) Depth to water = 1.20 m

t₂ = 3600 sec

Depth to base of borehole = 3.50 m

Depth of Water (H₂) = 2.30 m

$$k = \frac{A}{F(t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k = \frac{0.01}{6287} \ln \frac{2.4}{2.3}$$

$$k = 5.32E-08 \text{ m/s}$$

ASHLEY HOUSE & CANNON FACTORY
GRO-23113
NOTTING HILL GENESIS

VARIABLE HEAD PERMEABILITY TEST



Sheet 1 of 2

Date of Test: 24/04/2023 Type of Test: Falling Head Position: WWS03 Engineer: Michael Berry Weather: Sunny, clear

Test Measurements

Depth below top of casing/standpipe to:

(i) bottom of borehole:	3.00	m
(ii) bottom of casing:	2.00	m
(iii) top of filter material:	-	m
(iv) centre of piezometer tip:	-	m
(v) initial groundwater level:		m
Height of casing/standpipe above surface	-	m
Elevation of casing/standpipe (AOD)	-	m
Diameter of casing/standpipe	0.10	m
Length of filter	1.00	m
Diameter of filter	0.10	m

Test Data

Time Elapsed (mins)

Depth to Water Level (m)

0	1.01
0.5	1.01
1	1.02
1.5	1.02
2	1.02
2.5	1.02
3	1.02
3.5	1.02
4	1.02
4.5	1.02
5	1.02
6	1.03
7	1.04
8	1.05
9	1.06
10	1.06
15	1.10
20	1.15
25	1.15
30	1.20
40	1.24
50	1.30
60	1.32

VARIABLE HEAD PERMEABILITY TEST

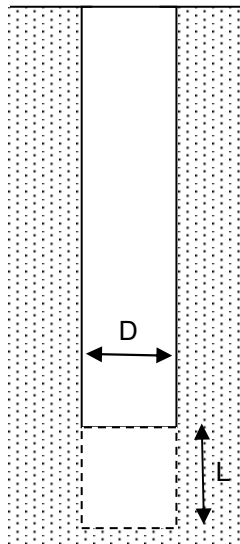
Sheet 2 of 2

Borehole WWS03

By: MB Checked: RW

Variable Head Permeability Test in accordance with BS 5930

Calculation of Intake Factor (F)



Area of base (A) = 0.01 m²

Diameter (D) = 0.10 m

Length (L) = 1.00 m

$$F = \frac{2 \pi L}{\ln \left\{ \left(\frac{L}{D} \right) + \sqrt{1 + \left(\frac{L}{D} \right)^2} \right\}}$$

$$F = \frac{6.283}{2.998}$$

$$F = 2.096$$

Calculation of Infiltration Rate

At time = 10 mins (t₁) Depth to water = 1.06 m

t₁ = 600 sec

Depth to base of borehole = 3.00 m

Depth of Water (H₁) = 1.94 m

At time = 60 mins (t₂) Depth to water = 1.32 m

t₂ = 3600 sec

Depth to base of borehole = 3.00 m

Depth of Water (H₂) = 1.68 m

$$k = \frac{A}{F(t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k = \frac{0.01}{6287} \ln \frac{1.94}{1.68}$$

$$k = 1.80E-07 \text{ m/s}$$



APPENDIX 5 – PID Results

SITE NAME:	ASHLEY HOUSE & CANNON FACTORY
CLIENT:	NOTTING HILL GENESIS
JOB NO:	GRO-23113

BH Ref.	Depth (m)	Result (ppm)
WTP01	0.50	0.0000
WTP02	0.30	0.0000
WTP02	0.50	0.0000
WTP02	1.00	0.0000
WTP02	1.50	0.0000
WTP02	2.00	0.0000
WTP02	2.50	0.0000
WWS01	0.42	0.0000
WWS01	0.50	0.0000
WWS01	1.00	0.0000
WWS02	0.40	0.0000
WWS02	0.50	0.0000
WWS02	1.00	0.0000
WWS02	1.50	0.0000
WWS02	2.50	0.0000
WWS02	2.80	0.0000
WWS02	3.50	0.0000
WWS02	4.50	0.0000
WWS03	0.30	0.0000
WWS03	0.50	0.0000
WWS07	0.30	0.0000
WWS07	0.50	0.0000
WWS07	0.90	0.0000
WWS07	1.20	0.0000
WWS05	0.30	0.0000
WWS06	0.30	0.0000
WWS06	0.50	0.0000
WWS06	1.00	0.0000
WWS06	1.50	0.0000
WWS06	2.50	0.0000
WWS06	3.50	0.0000
WWS06	4.50	0.0000
WWS07	1.40	0.0000
WWS07	1.90	0.0000
WWS07	2.10	0.0000
WWS07	2.60	0.0000
WWS08	0.40	0.0000
WWS08	0.60	0.0000
WWS08	1.00	0.0000

BH Ref.	Depth (m)	Result (ppm)
WWS08	1.50	0.0000
WWS08	2.00	0.0000
WWS08	2.50	0.0000
WWS09	0.30	0.0000
WWS09	0.50	0.0000
WWS09	1.00	0.0000
WWS09	1.50	0.0000
WWS09	1.90	0.0000
WWS09	2.10	0.0000
WWS09	3.00	0.0000
WWS04	0.30	0.0000
WWS04	0.55	0.0000
WWS04	1.00	0.0000
WWS04	1.40	0.0000
WWS04	2.20	0.0000
WWS04	3.20	0.0000
WTP07	0.30	0.0000
WTP07	0.50	0.0000
WTP07	1.00	0.0000
WTP07	1.20	0.0000
WTP07	2.00	0.0000
WTP10	0.30	0.0000
WTP10	0.50	0.0000
WTP11	0.20	0.0000
WTP11	0.50	0.0000
WTP11	1.00	0.0000
WTP11	1.60	0.0000
WWS10	0.30	0.0000
WWS10	0.50	0.0000
WWS10	1.00	0.0000
WWS10	1.60	0.0000
WWS10	2.20	2.6000
WWS10	2.50	0.5000
WWS10	3.50	0.0000
WWS10	3.80	1.8000
WWS11	3.00	0.2000
WTP03	0.50	0.0000
WTP03	1.20	0.0000
WTP03	1.50	0.0000

BH Ref.	Depth (m)	Result (ppm)
WTP03	1.90	0.0000
WTP03	2.50	0.0000
WTP04	0.30	0.0000
WTP04	0.50	0.0000
WTP04	0.80	0.0000
WTP04	1.00	1.5000
WTP04	1.50	0.6000
WTP04	2.00	0.0000
WTP04	2.40	0.0000
WTP04	2.60	0.0000
WTP05	0.30	0.0000
WTP05	0.50	0.0000
WTP05	1.00	0.0000
WTP06	0.30	0.0000
WTP06	0.50	0.0000
WTP06	1.00	0.0000
WTP06	1.50	0.0000

APPENDIX 6 - Limitations

Limitations

This report (Report) forms part of the Services and if applicable Additional Services undertaken by Groundtech Consulting Ltd pursuant to a written contract (Agreement) which contains detailed provisions including express limitations of the liability of Groundtech Consulting Ltd.

This Report was prepared using reasonable skill and care as stated in the Agreement for the purpose including intended end use stated by the Client (Purpose) and the liability of Groundtech Consulting Ltd in respect of the form and content of this Report is no greater than its liability under the Agreement. All records, measurements notes, or any other data (Data) obtained by or for the benefit of the Consultant were obtained at a specific point in time and it may not be assumed by the Client or any person relying on this Report that the Data will remain unaffected by the passage of time, the seasons, weather conditions, changes in the water table or the carrying out and completion of works at the Site.

Unless otherwise agreed this Report has been prepared exclusively for the use and reliance of the Client and may not be relied upon, by any other party except as provided for in the Agreement. A third party who relies on this Report, does so at their own and sole risk and Groundtech Consulting Ltd has no liability to such parties.

Groundtech Consulting Ltd that this Report is to be used for the Purpose. The Purpose was instrumental in determining the scope and of the Services provided. If the Purpose should change, the Client may not be able to rely on the Report without the separate agreement of Groundtech Consulting Ltd.

Since the Report was written, later changes in legislation, statutory requirements and industry best practices have not been considered and this should be allowed for. Ground conditions can also change (see below) and should be investigated if there is any significant delay in acting on the findings of this Report. The period of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the Report inaccurate or unreliable. The information and conclusions in this Report should not be relied upon in the future without written confirmation from Groundtech Consulting Ltd that it is safe to do so.

The observations and conclusions outlined in this Report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting Ltd.

Groundtech Consulting Ltd is not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The Report is based upon Groundtech Consulting Ltd's observations of existing physical conditions at the Site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the Client on the history and usage of the Site. The findings and recommendations contained in this Report are based in part upon information provided by third parties, and Groundtech Consulting Ltd have relied upon such information assuming it to be correct.

Groundtech Consulting Ltd accepts no responsibility for errors or inaccuracies in third party information presented in this Report. Groundtech Consulting Ltd was not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services or Additional Services. Groundtech Consulting Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting Ltd and forms the contract with the client.



Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions may also vary due to the ground's heterogeneous properties and because investigation exploratory locations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this Report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. If so stipulated in the Agreement, geo-environmental testing was carried out for a limited number of parameters based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

Any groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and groundwater levels may occur at other times of the year which are higher than were recorded during this investigation.

Any site drawings provided in this Report are preliminary and used to present the general relative locations of features on, and surrounding, the Site.



Appendix C

Groundwater Monitoring Data

- **Monitored Groundwater Levels and Observations**
- **Groundwater Monitoring Multiparameter Readings**

02/05/2023 Ashley Road Groundwater Monitoring Observations

Borehole	Dip (m bgl)	GW Elevation (m AOD)	Oil Interface Meter	Bailer Observations
Ashley House				
BH102 S	2.53	6.51	No napl recorded	Cloudy, slightly silty. No odour
BH03	N/A		N/A	Not servicable. Damaged Cover
WWS06	2.56	6.36	No napl recorded	Very silty orange water, no smell or sheen.
WS101	2.78	6.38	No napl recorded	Clear water at top of column, dark silt at base
WS104	N/A		N/A	Not servicable. Damaged Cover
WWS07	DRY		N/A	Dry well
BH04	2.59	6.43	No napl recorded	Cloudy and silty towards the base. No oil spotting or sheen. Slight hydrocarbon-like odour
BH101 S	2.53	6.55	No napl recorded	Slightly cloudy water
WWS04	DRY		N/A	Dry well
WS109	2.6	6.62	No napl recorded	Brown murky water, no sheen or smell. Drained clear during low flow
WWS08	N/A		N/A	Well cover sealed with cement. Could not open.
BH103 S	2.52	6.55	No napl recorded	Clear, slightly brown water.
Cannon Factory				
BH01	2.67	6.19	No napl recorded	Clear waters slight floating sediment particles and hydrocarbon odour
BH02	2.43	6.32	No napl recorded	Brown murky water with slight solvent hydrocarbon-like odour
WWS02	2.64	6.41	No napl recorded	Brown murky water with slight hydrocarbon-like odour.
WWS10	2.55	6.49	No napl recorded	Brown murky water with slight hydrocarbon-like odour
WWS03	2.8	6.24	No napl recorded	Negligable water column. (<0.16m) Unable to recover sample
WWS11	DRY		N/A	Dry well

16/05/2023 Ashley Road Groundwater Monitoring Observations - Additional Targeted Visit

Borehole	Dip (m bgl)	GW Elevation (m AOD)	Oil Interface Meter	Bailer Observations
Ashley House				
WWS06	2.53	6.39	No napl recorded	N/A. Low flow sampling only.
WWS08	2.51	6.6	No napl recorded	N/A. Low flow sampling only.
Cannon Factory				
BH01	2.32	6.54	No napl recorded	N/A. Low flow sampling only.
BH02	2.41	6.34	No napl recorded	N/A. GW level dip only
WWS02	2.62	6.43	No napl recorded	N/A. Low flow sampling only.
WWS10	2.58	6.46	No napl recorded	N/A. Low flow sampling only.
WWS03	Dry		N/A	
WWS11	2.87	6.18	No napl recorded	Could not sample. (0.03m water column present)

Low-Flow Test Report:

Test Date / Time: 02/05/2023 09:58:33
Project: WIE16248 Ashley House
Operator Name: RJM

Location Name: Ashley House WS109 Well Diameter: 5 cm Casing Type: Plastic Total Depth: 3.14 m Initial Depth to Water: 2.6 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 400 ml Flow Cell Volume: 130 ml Final Flow Rate: 40 ml/min Final Draw Down: 0.07 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 09:58	00:00	6.98 pH	16.51 °C	1,548.5 µS/cm	0.00 mg/L	90.94 NTU	-196.4 mV	260.00 cm	40.00 ml/min
02/05/2023 09:59	00:30	7.01 pH	15.86 °C	1,272.1 µS/cm	0.00 mg/L	281.97 NTU	-188.1 mV	260.00 cm	40.00 ml/min
02/05/2023 09:59	01:00	7.02 pH	15.87 °C	1,122.9 µS/cm	0.00 mg/L	132.68 NTU	-195.6 mV	260.00 cm	40.00 ml/min
02/05/2023 10:00	01:30	7.02 pH	15.34 °C	1,106.7 µS/cm	0.00 mg/L	518.89 NTU	-206.1 mV	260.00 cm	40.00 ml/min
02/05/2023 10:00	02:00	7.01 pH	15.31 °C	1,015.7 µS/cm	0.00 mg/L	626.54 NTU	-206.3 mV	260.00 cm	40.00 ml/min
02/05/2023 10:01	02:30	7.02 pH	15.29 °C	1,007.1 µS/cm	0.00 mg/L	966.36 NTU	-212.0 mV	260.00 cm	40.00 ml/min
02/05/2023 10:01	03:00	7.05 pH	15.06 °C	980.24 µS/cm	0.00 mg/L	1,762.8 NTU	-215.3 mV	260.00 cm	40.00 ml/min
02/05/2023 10:02	03:30	7.08 pH	14.95 °C	969.44 µS/cm	0.01 mg/L	2,075.8 NTU	-218.0 mV	260.00 cm	40.00 ml/min
02/05/2023 10:02	04:00	7.11 pH	14.88 °C	944.48 µS/cm	0.05 mg/L	1,685.5 NTU	-218.3 mV	260.00 cm	40.00 ml/min
02/05/2023 10:03	04:30	7.10 pH	14.83 °C	946.87 µS/cm	0.10 mg/L	1,288.2 NTU	-215.5 mV	260.00 cm	40.00 ml/min
02/05/2023 10:03	05:00	7.12 pH	14.81 °C	855.88 µS/cm	0.15 mg/L	774.46 NTU	-221.5 mV	260.00 cm	40.00 ml/min
02/05/2023 10:04	05:30	7.10 pH	14.78 °C	855.28 µS/cm	0.19 mg/L	642.14 NTU	-227.2 mV	260.00 cm	40.00 ml/min
02/05/2023 10:04	06:00	7.10 pH	14.75 °C	859.73 µS/cm	0.22 mg/L	609.96 NTU	-230.2 mV	260.00 cm	40.00 ml/min
02/05/2023 10:05	06:30	7.10 pH	14.72 °C	858.65 µS/cm	0.24 mg/L	538.38 NTU	-231.6 mV	260.00 cm	40.00 ml/min
02/05/2023 10:05	07:00	7.09 pH	14.71 °C	852.13 µS/cm	0.25 mg/L	487.16 NTU	-232.7 mV	260.00 cm	40.00 ml/min
02/05/2023 10:06	07:30	7.11 pH	14.69 °C	851.38 µS/cm	0.26 mg/L	347.70 NTU	-231.5 mV	260.00 cm	40.00 ml/min

02/05/2023 10:06	08:00	7.08 pH	14.68 °C	851.37 µS/cm	0.27 mg/L	338.06 NTU	-230.0 mV	260.00 cm	40.00 ml/min
02/05/2023 10:07	08:30	7.08 pH	14.66 °C	859.19 µS/cm	0.28 mg/L	249.86 NTU	-230.4 mV	260.00 cm	40.00 ml/min
02/05/2023 10:07	09:00	7.09 pH	14.64 °C	852.55 µS/cm	0.28 mg/L	209.61 NTU	-223.3 mV	260.00 cm	40.00 ml/min
02/05/2023 10:08	09:30	7.08 pH	14.62 °C	849.01 µS/cm	0.28 mg/L	243.66 NTU	-223.3 mV	260.00 cm	40.00 ml/min
02/05/2023 10:08	10:00	7.10 pH	14.60 °C	847.59 µS/cm	0.28 mg/L	215.40 NTU	-227.3 mV	260.00 cm	40.00 ml/min

Samples

Sample ID:	Description:
Ashley House WS109	

Low-Flow Test Report:

Test Date / Time: 02/05/2023 10:28:34
Project: WIE16248
Operator Name: NU

Location Name: Ashley House BH04 Well Diameter: 5 cm Casing Type: Plastic Total Depth: 4.67 m Initial Depth to Water: 2.59 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 800 ml Flow Cell Volume: 130 ml Final Flow Rate: 80 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 10:28	00:00	7.14 pH	14.61 °C	1,001.1 µS/cm	1.66 mg/L	365.77 NTU	-228.6 mV	259.00 cm	80.00 ml/min
02/05/2023 10:29	00:30	7.15 pH	14.16 °C	987.77 µS/cm	1.13 mg/L	266.56 NTU	-262.8 mV	259.00 cm	80.00 ml/min
02/05/2023 10:29	01:00	7.15 pH	13.99 °C	980.79 µS/cm	0.73 mg/L	241.49 NTU	-272.9 mV	259.00 cm	80.00 ml/min
02/05/2023 10:30	01:30	7.15 pH	13.92 °C	970.29 µS/cm	0.50 mg/L	229.73 NTU	-277.5 mV	259.00 cm	80.00 ml/min
02/05/2023 10:30	02:00	7.15 pH	13.91 °C	966.54 µS/cm	0.40 mg/L	209.38 NTU	-284.9 mV	259.00 cm	80.00 ml/min
02/05/2023 10:31	02:30	7.16 pH	13.89 °C	965.36 µS/cm	0.34 mg/L	210.58 NTU	-289.9 mV	259.00 cm	80.00 ml/min
02/05/2023 10:31	03:00	7.16 pH	13.88 °C	964.09 µS/cm	0.31 mg/L	202.36 NTU	-291.8 mV	259.00 cm	80.00 ml/min
02/05/2023 10:32	03:30	7.15 pH	13.86 °C	961.28 µS/cm	0.28 mg/L	199.74 NTU	-294.4 mV	259.00 cm	80.00 ml/min
02/05/2023 10:32	04:00	7.16 pH	13.85 °C	962.20 µS/cm	0.27 mg/L	217.35 NTU	-299.2 mV	259.00 cm	80.00 ml/min
02/05/2023 10:33	04:30	7.16 pH	13.85 °C	960.83 µS/cm	0.26 mg/L	194.99 NTU	-301.8 mV	259.00 cm	80.00 ml/min
02/05/2023 10:33	05:00	7.17 pH	13.84 °C	960.21 µS/cm	0.24 mg/L	207.73 NTU	-307.5 mV	259.00 cm	80.00 ml/min
02/05/2023 10:34	05:30	7.16 pH	13.84 °C	960.24 µS/cm	0.24 mg/L	179.01 NTU	-312.3 mV	259.00 cm	80.00 ml/min
02/05/2023 10:34	06:00	7.16 pH	13.84 °C	954.02 µS/cm	0.22 mg/L	177.29 NTU	-318.7 mV	259.00 cm	80.00 ml/min
02/05/2023 10:35	06:30	7.16 pH	13.84 °C	954.22 µS/cm	0.22 mg/L	175.67 NTU	-323.3 mV	259.00 cm	80.00 ml/min
02/05/2023 10:35	07:00	7.17 pH	13.84 °C	956.34 µS/cm	0.21 mg/L	166.11 NTU	-325.0 mV	259.00 cm	80.00 ml/min
02/05/2023 10:36	07:30	7.17 pH	13.83 °C	953.19 µS/cm	0.21 mg/L	155.23 NTU	-328.5 mV	259.00 cm	80.00 ml/min

02/05/2023 10:36	08:00	7.19 pH	13.83 °C	953.72 µS/cm	0.20 mg/L	154.49 NTU	-330.2 mV	259.00 cm	80.00 ml/min
02/05/2023 10:37	08:30	7.17 pH	13.83 °C	955.16 µS/cm	0.20 mg/L	143.23 NTU	-332.0 mV	259.00 cm	80.00 ml/min
02/05/2023 10:37	09:00	7.17 pH	13.83 °C	952.11 µS/cm	0.20 mg/L	160.95 NTU	-331.8 mV	259.00 cm	80.00 ml/min
02/05/2023 10:38	09:30	7.19 pH	13.83 °C	952.08 µS/cm	0.19 mg/L	145.17 NTU	-335.1 mV	259.00 cm	80.00 ml/min
02/05/2023 10:38	10:00	7.18 pH	13.83 °C	953.50 µS/cm	0.18 mg/L	190.40 NTU	-334.8 mV	259.00 cm	80.00 ml/min

Samples

Sample ID:	Description:
Ashley House BH04	

Low-Flow Test Report:

Test Date / Time: 02/05/2023 11:03:49
Project: WIE16248 Ashley House (2)
Operator Name: NU

Location Name: Ashley House BH102 s Well Diameter: 0.38 cm Casing Type: Plastic Total Depth: 6.91 m Initial Depth to Water: 2.53 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 440 ml Flow Cell Volume: 130 ml Final Flow Rate: 80 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 11:03	00:00	7.19 pH	14.73 °C	872.10 µS/cm	2.00 mg/L	348.53 NTU	-146.1 mV	253.00 cm	80.00 ml/min
02/05/2023 11:04	00:30	7.22 pH	14.57 °C	862.19 µS/cm	1.66 mg/L	142.51 NTU	-147.9 mV	253.00 cm	80.00 ml/min
02/05/2023 11:04	01:00	7.24 pH	14.30 °C	861.14 µS/cm	1.21 mg/L	104.71 NTU	-148.5 mV	253.00 cm	80.00 ml/min
02/05/2023 11:05	01:30	7.24 pH	14.22 °C	857.77 µS/cm	0.94 mg/L	79.00 NTU	-150.2 mV	253.00 cm	80.00 ml/min
02/05/2023 11:05	02:00	7.24 pH	14.15 °C	863.36 µS/cm	0.73 mg/L	68.86 NTU	-150.9 mV	253.00 cm	80.00 ml/min
02/05/2023 11:06	02:30	7.24 pH	14.14 °C	866.65 µS/cm	0.61 mg/L	51.00 NTU	-151.7 mV	253.00 cm	80.00 ml/min
02/05/2023 11:06	03:00	7.24 pH	14.12 °C	847.25 µS/cm	0.53 mg/L	52.43 NTU	-153.4 mV	253.00 cm	80.00 ml/min
02/05/2023 11:07	03:30	7.24 pH	14.10 °C	854.45 µS/cm	0.49 mg/L	50.91 NTU	-153.9 mV	253.00 cm	80.00 ml/min
02/05/2023 11:07	04:00	7.24 pH	14.08 °C	858.26 µS/cm	0.45 mg/L	44.35 NTU	-154.1 mV	253.00 cm	80.00 ml/min
02/05/2023 11:08	04:30	7.24 pH	14.07 °C	851.47 µS/cm	0.42 mg/L	46.33 NTU	-153.9 mV	253.00 cm	80.00 ml/min
02/05/2023 11:08	05:00	7.25 pH	14.07 °C	859.32 µS/cm	0.41 mg/L	43.70 NTU	-154.7 mV	253.00 cm	80.00 ml/min
02/05/2023 11:09	05:30	7.24 pH	14.06 °C	863.94 µS/cm	0.39 mg/L	47.58 NTU	-155.0 mV	253.00 cm	80.00 ml/min

Samples

Sample ID:	Description:
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Low-Flow Test Report:

Test Date / Time: 02/05/2023 11:26:17
Project: WIE16248 Ashley House (3)
Operator Name: RJM

Location Name: Ashley House WWS06 Well Diameter: 5 cm Casing Type: Plastic Total Depth: 2.79 m Initial Depth to Water: 2.56 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 90 ml Flow Cell Volume: 130 ml Final Flow Rate: 30 ml/min Final Draw Down: 0.23 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 11:26	00:00	7.36 pH	14.89 °C	991.36 µS/cm	3.48 mg/L	953.25 NTU	-137.7 mV	256.00 cm	30.00 ml/min
02/05/2023 11:26	00:30	7.40 pH	14.91 °C	1,997.7 µS/cm	3.29 mg/L	24.41 NTU	-133.3 mV	256.00 cm	30.00 ml/min
02/05/2023 11:27	01:00	7.42 pH	14.92 °C	2,251.0 µS/cm	3.12 mg/L	2.53 NTU	-131.1 mV	256.00 cm	30.00 ml/min
02/05/2023 11:27	01:30	7.42 pH	14.90 °C	2,262.5 µS/cm	3.01 mg/L	3.25 NTU	-130.0 mV	256.00 cm	30.00 ml/min
02/05/2023 11:28	02:00	7.41 pH	14.89 °C	2,284.1 µS/cm	2.92 mg/L	3.05 NTU	-129.0 mV	256.00 cm	30.00 ml/min
02/05/2023 11:28	02:30	7.42 pH	14.94 °C	2,447.0 µS/cm	2.83 mg/L	4.15 NTU	-128.1 mV	256.00 cm	30.00 ml/min
02/05/2023 11:29	03:00	7.42 pH	14.95 °C	2,461.8 µS/cm	3.38 mg/L	6.50 NTU	-125.7 mV	256.00 cm	30.00 ml/min

Samples

Sample ID:	Description:
Ashley House WWS06	Drained dry, sample from purge bucket

Low-Flow Test Report:

Test Date / Time: 02/05/2023 12:34:09
Project: WIE16248 Ashley House (4)
Operator Name: RJM

Location Name: Ashley Road BH101 S Well Diameter: 3.8 cm Casing Type: Plastic Total Depth: 6.62 m Initial Depth to Water: 2.53 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 240 ml Flow Cell Volume: 130 ml Final Flow Rate: 30 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 12:34	00:00	6.97 pH	14.31 °C	1,308.3 µS/cm	2.74 mg/L	193.39 NTU	-67.4 mV	253.00 cm	30.00 ml/min
02/05/2023 12:34	00:30	6.97 pH	14.14 °C	1,348.5 µS/cm	2.14 mg/L	185.75 NTU	-67.3 mV	253.00 cm	30.00 ml/min
02/05/2023 12:35	01:00	6.96 pH	14.09 °C	1,343.9 µS/cm	1.55 mg/L	175.23 NTU	-67.2 mV	253.00 cm	30.00 ml/min
02/05/2023 12:35	01:30	6.96 pH	14.06 °C	1,340.7 µS/cm	1.17 mg/L	163.24 NTU	-66.8 mV	253.00 cm	30.00 ml/min
02/05/2023 12:36	02:00	6.97 pH	14.07 °C	1,338.2 µS/cm	0.99 mg/L	142.05 NTU	-66.9 mV	253.00 cm	30.00 ml/min
02/05/2023 12:36	02:30	6.97 pH	14.07 °C	1,335.5 µS/cm	0.86 mg/L	118.54 NTU	-67.3 mV	253.00 cm	30.00 ml/min
02/05/2023 12:37	03:00	6.97 pH	14.06 °C	1,330.6 µS/cm	0.77 mg/L	101.77 NTU	-66.9 mV	253.00 cm	30.00 ml/min
02/05/2023 12:37	03:30	6.98 pH	14.07 °C	1,329.0 µS/cm	0.71 mg/L	90.58 NTU	-66.9 mV	253.00 cm	30.00 ml/min
02/05/2023 12:38	04:00	6.98 pH	14.07 °C	1,329.2 µS/cm	0.68 mg/L	78.93 NTU	-66.7 mV	253.00 cm	30.00 ml/min
02/05/2023 12:38	04:30	6.98 pH	14.08 °C	1,322.8 µS/cm	0.66 mg/L	72.54 NTU	-65.8 mV	253.00 cm	30.00 ml/min
02/05/2023 12:39	05:00	6.99 pH	14.09 °C	1,319.9 µS/cm	0.64 mg/L	59.07 NTU	-65.6 mV	253.00 cm	30.00 ml/min
02/05/2023 12:39	05:30	6.98 pH	14.11 °C	1,318.8 µS/cm	0.62 mg/L	53.44 NTU	-65.7 mV	253.00 cm	30.00 ml/min
02/05/2023 12:40	06:00	6.98 pH	14.10 °C	1,317.9 µS/cm	0.60 mg/L	49.19 NTU	-65.1 mV	253.00 cm	30.00 ml/min
02/05/2023 12:40	06:30	7.00 pH	14.09 °C	1,316.4 µS/cm	0.59 mg/L	38.64 NTU	-64.7 mV	253.00 cm	30.00 ml/min
02/05/2023 12:41	07:00	6.99 pH	14.10 °C	1,315.0 µS/cm	0.57 mg/L	34.72 NTU	-64.4 mV	253.00 cm	30.00 ml/min
02/05/2023 12:41	07:30	6.99 pH	14.10 °C	1,312.0 µS/cm	0.55 mg/L	31.63 NTU	-64.1 mV	253.00 cm	30.00 ml/min

02/05/2023 12:42	08:00	7.00 pH	14.09 °C	1,308.7 μS/cm	0.53 mg/L	28.50 NTU	-63.8 mV	253.00 cm	30.00 ml/min
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Samples

Sample ID:	Description:
Ashley House BH101 S	

Low-Flow Test Report:

Test Date / Time: 02/05/2023 13:01:07
Project: WIE16248 Ashley House (5)
Operator Name: RJM

Location Name: Ashley House BH103 s Well Diameter: 3.8 cm Casing Type: Plastic Total Depth: 5.58 m Initial Depth to Water: 2.52 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 880 ml Flow Cell Volume: 130 ml Final Flow Rate: 80 ml/min Final Draw Down: 0.01 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 13:01	00:00	7.28 pH	14.47 °C	910.67 µS/cm	8.01 mg/L	1,861.9 NTU	-66.1 mV	252.00 cm	80.00 ml/min
02/05/2023 13:01	00:30	7.24 pH	14.18 °C	905.29 µS/cm	7.22 mg/L	1,412.0 NTU	-63.9 mV	252.00 cm	80.00 ml/min
02/05/2023 13:02	01:00	7.22 pH	14.06 °C	904.12 µS/cm	6.74 mg/L	1,089.9 NTU	-62.3 mV	252.00 cm	80.00 ml/min
02/05/2023 13:02	01:30	7.21 pH	13.96 °C	906.26 µS/cm	6.39 mg/L	784.47 NTU	-61.5 mV	252.00 cm	80.00 ml/min
02/05/2023 13:03	02:00	7.21 pH	13.89 °C	908.61 µS/cm	6.01 mg/L	634.35 NTU	-61.5 mV	252.00 cm	80.00 ml/min
02/05/2023 13:03	02:30	7.21 pH	13.83 °C	907.59 µS/cm	5.65 mg/L	533.36 NTU	-61.8 mV	252.00 cm	80.00 ml/min
02/05/2023 13:04	03:00	7.20 pH	13.81 °C	910.61 µS/cm	5.34 mg/L	470.22 NTU	-62.1 mV	252.00 cm	80.00 ml/min
02/05/2023 13:04	03:30	7.20 pH	13.79 °C	911.81 µS/cm	5.06 mg/L	359.91 NTU	-62.5 mV	252.00 cm	80.00 ml/min
02/05/2023 13:05	04:00	7.20 pH	13.78 °C	913.63 µS/cm	4.79 mg/L	321.36 NTU	-63.0 mV	252.00 cm	80.00 ml/min
02/05/2023 13:05	04:30	7.20 pH	13.77 °C	912.09 µS/cm	4.56 mg/L	281.05 NTU	-63.4 mV	252.00 cm	80.00 ml/min
02/05/2023 13:06	05:00	7.20 pH	13.77 °C	913.75 µS/cm	4.41 mg/L	246.30 NTU	-64.1 mV	252.00 cm	80.00 ml/min
02/05/2023 13:06	05:30	7.20 pH	13.76 °C	915.94 µS/cm	4.25 mg/L	204.58 NTU	-64.9 mV	252.00 cm	80.00 ml/min
02/05/2023 13:07	06:00	7.20 pH	13.75 °C	916.17 µS/cm	4.09 mg/L	179.22 NTU	-65.9 mV	252.00 cm	80.00 ml/min
02/05/2023 13:07	06:30	7.20 pH	13.73 °C	916.80 µS/cm	3.95 mg/L	167.62 NTU	-66.8 mV	252.00 cm	80.00 ml/min
02/05/2023 13:08	07:00	7.19 pH	13.73 °C	917.86 µS/cm	3.81 mg/L	140.43 NTU	-67.7 mV	252.00 cm	80.00 ml/min
02/05/2023 13:08	07:30	7.19 pH	13.71 °C	919.73 µS/cm	3.70 mg/L	133.54 NTU	-68.8 mV	252.00 cm	80.00 ml/min

02/05/2023 13:09	08:00	7.19 pH	13.71 °C	920.96 µS/cm	3.60 mg/L	107.60 NTU	-69.9 mV	252.00 cm	80.00 ml/min
02/05/2023 13:09	08:30	7.20 pH	13.70 °C	921.73 µS/cm	3.50 mg/L	120.25 NTU	-71.0 mV	252.00 cm	80.00 ml/min
02/05/2023 13:10	09:00	7.20 pH	13.70 °C	923.49 µS/cm	3.41 mg/L	105.16 NTU	-72.1 mV	252.00 cm	80.00 ml/min
02/05/2023 13:10	09:30	7.19 pH	13.69 °C	924.71 µS/cm	3.32 mg/L	92.88 NTU	-72.9 mV	252.00 cm	80.00 ml/min
02/05/2023 13:11	10:00	7.19 pH	13.68 °C	924.72 µS/cm	3.25 mg/L	83.54 NTU	-73.8 mV	252.00 cm	80.00 ml/min
02/05/2023 13:11	10:30	7.20 pH	13.69 °C	925.65 µS/cm	3.17 mg/L	78.11 NTU	-74.7 mV	252.00 cm	80.00 ml/min
02/05/2023 13:12	11:00	7.19 pH	13.68 °C	927.52 µS/cm	3.10 mg/L	74.38 NTU	-75.7 mV	252.00 cm	80.00 ml/min

Samples

Sample ID:	Description:
Ashley House BH103 S	

Low-Flow Test Report:

Test Date / Time: 02/05/2023 14:27:25
Project: WIE16248 Ashley House (6)
Operator Name: RJM

Location Name: Ashley House (Cannon) BH02 Well Diameter: 5 cm Casing Type: Plastic Total Depth: 6.33 m Initial Depth to Water: 2.43 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 800 ml Flow Cell Volume: 130 ml Final Flow Rate: 80 ml/min Final Draw Down: 0.01 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 14:27	00:00	6.92 pH	15.92 °C	780.02 µS/cm	4.74 mg/L	1,781.6 NTU	-174.4 mV	243.00 cm	80.00 ml/min
02/05/2023 14:27	00:30	6.90 pH	15.34 °C	680.07 µS/cm	2.35 mg/L	2,765.6 NTU	-183.2 mV	243.00 cm	80.00 ml/min
02/05/2023 14:28	01:00	6.89 pH	15.18 °C	673.14 µS/cm	1.18 mg/L	2,574.5 NTU	-185.5 mV	243.00 cm	80.00 ml/min
02/05/2023 14:28	01:30	6.90 pH	15.04 °C	668.96 µS/cm	0.66 mg/L	2,535.1 NTU	-187.0 mV	243.00 cm	80.00 ml/min
02/05/2023 14:29	02:00	6.90 pH	14.98 °C	663.37 µS/cm	0.40 mg/L	2,107.4 NTU	-187.4 mV	243.00 cm	80.00 ml/min
02/05/2023 14:29	02:30	6.90 pH	14.92 °C	687.13 µS/cm	0.29 mg/L	1,838.8 NTU	-186.9 mV	243.00 cm	80.00 ml/min
02/05/2023 14:30	03:00	6.90 pH	14.87 °C	643.72 µS/cm	0.24 mg/L	1,900.7 NTU	-187.9 mV	243.00 cm	80.00 ml/min
02/05/2023 14:30	03:30	6.89 pH	14.82 °C	874.48 µS/cm	0.22 mg/L	1,818.8 NTU	-188.6 mV	243.00 cm	80.00 ml/min
02/05/2023 14:31	04:00	6.89 pH	14.80 °C	869.95 µS/cm	0.22 mg/L	1,765.3 NTU	-189.0 mV	243.00 cm	80.00 ml/min
02/05/2023 14:31	04:30	6.89 pH	14.76 °C	852.22 µS/cm	0.22 mg/L	1,694.0 NTU	-189.2 mV	243.00 cm	80.00 ml/min
02/05/2023 14:32	05:00	6.89 pH	14.76 °C	843.43 µS/cm	0.21 mg/L	1,676.5 NTU	-189.7 mV	243.00 cm	80.00 ml/min
02/05/2023 14:32	05:30	6.90 pH	14.74 °C	827.10 µS/cm	0.20 mg/L	1,607.8 NTU	-190.2 mV	243.00 cm	80.00 ml/min
02/05/2023 14:33	06:00	6.89 pH	14.74 °C	804.77 µS/cm	0.19 mg/L	1,623.3 NTU	-190.6 mV	243.00 cm	80.00 ml/min
02/05/2023 14:33	06:30	6.90 pH	14.73 °C	832.10 µS/cm	0.19 mg/L	1,483.5 NTU	-190.9 mV	243.00 cm	80.00 ml/min
02/05/2023 14:34	07:00	6.89 pH	14.73 °C	817.62 µS/cm	0.18 mg/L	1,421.5 NTU	-191.4 mV	243.00 cm	80.00 ml/min
02/05/2023 14:34	07:30	6.90 pH	14.72 °C	799.04 µS/cm	0.17 mg/L	1,331.8 NTU	-192.0 mV	243.00 cm	80.00 ml/min

02/05/2023 14:35	08:00	6.91 pH	14.73 °C	776.66 µS/cm	0.17 mg/L	1,232.5 NTU	-192.6 mV	243.00 cm	80.00 ml/min
02/05/2023 14:35	08:30	6.90 pH	14.73 °C	758.00 µS/cm	0.16 mg/L	1,163.1 NTU	-193.3 mV	243.00 cm	80.00 ml/min
02/05/2023 14:36	09:00	6.91 pH	14.74 °C	752.95 µS/cm	0.16 mg/L	1,021.8 NTU	-194.9 mV	243.00 cm	80.00 ml/min
02/05/2023 14:36	09:30	6.91 pH	14.75 °C	744.02 µS/cm	0.17 mg/L	914.27 NTU	-196.9 mV	243.00 cm	80.00 ml/min
02/05/2023 14:37	10:00	6.92 pH	14.77 °C	905.93 µS/cm	0.16 mg/L	785.57 NTU	-199.8 mV	243.00 cm	80.00 ml/min

Samples

Sample ID:	Description:
Ashley House (Cannon) BH02	

Low-Flow Test Report:

Test Date / Time: 02/05/2023 14:53:45
Project: WIE16248 Ashley House (7)
Operator Name: RJM

Location Name: Ashley House (Cannon) WWS02 Well Diameter: 5 cm Casing Type: Plastic Total Depth: 2.98 m Initial Depth to Water: 2.64 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 400 ml Flow Cell Volume: 130 ml Final Flow Rate: 80 ml/min Final Draw Down: 0.34 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 14:53	00:00	7.15 pH	15.69 °C	631.39 µS/cm	1.70 mg/L	0.33 NTU	-194.9 mV	264.00 cm	80.00 ml/min
02/05/2023 14:54	00:30	7.15 pH	15.66 °C	538.27 µS/cm	0.89 mg/L	0.00 NTU	-192.3 mV	264.00 cm	80.00 ml/min
02/05/2023 14:54	01:00	7.15 pH	15.55 °C	529.35 µS/cm	0.37 mg/L	0.00 NTU	-187.8 mV	264.00 cm	80.00 ml/min
02/05/2023 14:55	01:30	7.15 pH	15.28 °C	530.76 µS/cm	0.15 mg/L	0.00 NTU	-192.6 mV	264.00 cm	80.00 ml/min
02/05/2023 14:55	02:00	7.15 pH	15.15 °C	646.04 µS/cm	0.06 mg/L	0.00 NTU	-192.5 mV	264.00 cm	80.00 ml/min
02/05/2023 14:56	02:30	7.14 pH	15.30 °C	646.43 µS/cm	0.04 mg/L	0.77 NTU	-193.8 mV	264.00 cm	80.00 ml/min
02/05/2023 14:56	03:00	7.13 pH	15.39 °C	643.10 µS/cm	0.06 mg/L	0.84 NTU	-196.6 mV	264.00 cm	80.00 ml/min
02/05/2023 14:57	03:30	7.13 pH	15.47 °C	636.30 µS/cm	0.10 mg/L	1.92 NTU	-198.9 mV	264.00 cm	80.00 ml/min
02/05/2023 14:57	04:00	7.13 pH	15.52 °C	629.28 µS/cm	0.13 mg/L	1.77 NTU	-200.5 mV	264.00 cm	80.00 ml/min
02/05/2023 14:58	04:30	7.14 pH	15.57 °C	626.69 µS/cm	0.13 mg/L	3.88 NTU	-201.7 mV	264.00 cm	80.00 ml/min
02/05/2023 14:58	05:00	7.15 pH	15.61 °C	626.58 µS/cm	0.16 mg/L	8.65 NTU	-197.5 mV	264.00 cm	80.00 ml/min

Samples

Sample ID:	Description:
Ashley House (Cannon) WWS02	Drained dry during low flow, sampled from purge bucket

Low-Flow Test Report:

Test Date / Time: 02/05/2023 15:18:10
Project: WIE16248 Ashley House (8)
Operator Name: RJM

Location Name: Ashley House (Cannon) WWS10 Well Diameter: 5 cm Casing Type: Plastic Total Depth: 2.95 m Initial Depth to Water: 2.55 m	Pump Type: Peristaltic Tubing Type: Plastic Estimated Total Volume Pumped: 640 ml Flow Cell Volume: 130 ml Final Flow Rate: 80 ml/min Final Draw Down: 0.26 m	Instrument Used: Aqua TROLL 500 Serial Number: 848860
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
02/05/2023 15:18	00:00	7.15 pH	15.94 °C	669.86 µS/cm	5.81 mg/L	0.00 NTU	-174.3 mV	255.00 cm	80.00 ml/min
02/05/2023 15:18	00:30	7.17 pH	15.81 °C	684.11 µS/cm	2.95 mg/L	0.00 NTU	-175.3 mV	255.00 cm	80.00 ml/min
02/05/2023 15:19	01:00	7.19 pH	15.68 °C	705.40 µS/cm	1.23 mg/L	0.00 NTU	-175.2 mV	255.00 cm	80.00 ml/min
02/05/2023 15:19	01:30	7.22 pH	15.59 °C	702.52 µS/cm	0.42 mg/L	0.00 NTU	-182.5 mV	255.00 cm	80.00 ml/min
02/05/2023 15:20	02:00	7.25 pH	15.50 °C	712.59 µS/cm	0.14 mg/L	0.00 NTU	-202.8 mV	255.00 cm	80.00 ml/min
02/05/2023 15:20	02:30	7.30 pH	15.44 °C	698.61 µS/cm	0.04 mg/L	0.00 NTU	-228.5 mV	255.00 cm	80.00 ml/min
02/05/2023 15:21	03:00	7.35 pH	15.38 °C	706.13 µS/cm	0.00 mg/L	0.00 NTU	-239.4 mV	255.00 cm	80.00 ml/min
02/05/2023 15:21	03:30	7.37 pH	15.33 °C	709.02 µS/cm	0.00 mg/L	0.00 NTU	-247.5 mV	255.00 cm	80.00 ml/min
02/05/2023 15:22	04:00	7.37 pH	15.30 °C	746.78 µS/cm	0.00 mg/L	0.00 NTU	-254.8 mV	255.00 cm	80.00 ml/min
02/05/2023 15:22	04:30	7.36 pH	15.27 °C	730.93 µS/cm	0.00 mg/L	0.00 NTU	-257.4 mV	255.00 cm	80.00 ml/min
02/05/2023 15:23	05:00	7.36 pH	15.24 °C	734.72 µS/cm	0.00 mg/L	0.00 NTU	-258.8 mV	255.00 cm	80.00 ml/min
02/05/2023 15:23	05:30	7.37 pH	15.22 °C	754.44 µS/cm	0.00 mg/L	0.00 NTU	-247.2 mV	255.00 cm	80.00 ml/min
02/05/2023 15:24	06:00	7.38 pH	15.20 °C	740.74 µS/cm	0.00 mg/L	0.00 NTU	-250.0 mV	255.00 cm	80.00 ml/min
02/05/2023 15:24	06:30	7.39 pH	15.18 °C	722.16 µS/cm	0.00 mg/L	0.00 NTU	-257.2 mV	255.00 cm	80.00 ml/min
02/05/2023 15:25	07:00	7.40 pH	15.17 °C	715.33 µS/cm	0.00 mg/L	0.00 NTU	-263.5 mV	255.00 cm	80.00 ml/min
02/05/2023 15:25	07:30	7.42 pH	15.16 °C	702.48 µS/cm	0.00 mg/L	0.24 NTU	-263.0 mV	255.00 cm	80.00 ml/min

02/05/2023 15:26	08:00	7.44 pH	15.16 °C	716.00 µS/cm	0.00 mg/L	0.00 NTU	-267.4 mV	255.00 cm	80.00 ml/min
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Samples

Sample ID:	Description:
Ashley House (Cannon) WWS10	

Appendix D

Laboratory Analysis

- **Soils**
- **Groundwater and Surface Water**

Jon Coates

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Analytical Report Number : 23-29890

Replaces Analytical Report Number: 23-29890, issue no. 1

Additional analysis undertaken.

VOCs and SVOCs added to sample 2656737 as per clients request

The report has been updated to the current Schedule of Accreditation issue No: 113 Issue date: 09 May 2023

Project / Site name:	Ashley House Cannon Factory	Samples received on:	21/04/2023
Your job number:	WIE16248	Samples instructed on/ Analysis started on:	21/04/2023
Your order number:	122387	Analysis completed by:	10/05/2023
Report Issue Number:	2	Report issued on:	11/05/2023
Samples Analysed:	10 soil samples		



Signed:

Elżbieta Suchy
Junior Reporting Specialist
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: 23-29890
 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number				2656728	2656729	2656730	2656731	2656732
Sample Reference				WWS01	WWS01	WWS02	WWS02	WWS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	0.50	1.50	2.80
Date Sampled				20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
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	25	50	< 0.1
Moisture Content	%	0.01	NONE	14	14	11	2.7	7.8
Total mass of sample received	kg	0.001	NONE	0.9	0.9	0.6	0.9	0.9

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	-
Asbestos Analyst ID	N/A	N/A	N/A	WEM	N/A	WEM	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.7	7.6	7.4	8	8.6
Organic Matter (automated)	%	0.1	MCERTS	1.9	1	2.5	0.2	3.9
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.011	0.0055	0.015	0.0012	0.022
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.1	0.6	1.5	0.1	2.2

Speciated PAHs

Naphthalene	mg/kg	0.05	NONE	< 0.05	< 0.05	-	-	< 0.05
Acenaphthylene	mg/kg	0.05	NONE	< 0.05	< 0.05	-	-	< 0.05
Acenaphthene	mg/kg	0.05	NONE	< 0.05	< 0.05	-	-	< 0.05
Fluorene	mg/kg	0.05	NONE	< 0.05	< 0.05	-	-	< 0.05
Phenanthrene	mg/kg	0.05	NONE	0.54	< 0.05	-	-	< 0.05
Anthracene	mg/kg	0.05	NONE	0.08	< 0.05	-	-	< 0.05
Fluoranthene	mg/kg	0.05	NONE	1.3	< 0.05	-	-	< 0.05
Pyrene	mg/kg	0.05	NONE	1.2	< 0.05	-	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	NONE	0.55	< 0.05	-	-	< 0.05
Chrysene	mg/kg	0.05	NONE	0.56	< 0.05	-	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	0.62	< 0.05	-	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	0.37	< 0.05	-	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	0.56	< 0.05	-	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	0.35	< 0.05	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	< 0.05	< 0.05	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	0.41	< 0.05	-	-	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	6.47	< 0.80	-	-	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	24	-	28	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	1.7	-	6.5	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.5	-	< 0.2	-	-
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	-	< 1.2	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	78	-	23	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	190	-	69	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	1700	-	290	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	0.7	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	52	-	24	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	58	-	42	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	2500	-	92	-	-

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Lab Sample Number	2656728	2656729	2656730	2656731	2656732
Sample Reference	WWS01	WWS01	WWS02	WWS02	WWS02
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	1.00	0.50	1.50	2.80
Date Sampled	20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene	µg/kg	5	NONE	< 5.0	< 5.0	-	< 5.0	< 5.0
Toluene	µg/kg	5	NONE	< 5.0	< 5.0	-	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	NONE	< 5.0	< 5.0	-	< 5.0	< 5.0
p & m-xylene	µg/kg	5	NONE	< 5.0	< 5.0	-	< 5.0	< 5.0
o-xylene	µg/kg	5	NONE	< 5.0	< 5.0	-	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	-	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	NONE	< 2.0	< 2.0	-	< 2.0	17
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	NONE	12	< 8.0	-	18	1100
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	NONE	65	< 8.0	-	130	10000
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	20	< 8.4	-	20	1300
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	77	< 10	-	150	11000
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	97	< 10	-	170	12000

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	NONE	< 1.0	< 1.0	-	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	NONE	2	< 2.0	-	< 2.0	4.2
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	NONE	11	< 10	-	< 10	250
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	NONE	50	< 10	-	34	2100
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	9.1	< 8.4	-	< 8.4	920
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	63	< 10	-	38	2400
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	73	< 10	-	40	3300

VOCs

Chloromethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Chloroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Bromomethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Vinyl Chloride	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Trichlorofluoromethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1-Dichloroethene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Cis-1,2-dichloroethene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1-Dichloroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
2,2-Dichloropropane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Trichloromethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1,1-Trichloroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2-Dichloroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1-Dichloropropene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Benzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Tetrachloromethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2-Dichloropropane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Trichloroethene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Dibromomethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Bromodichloromethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Cis-1,3-dichloropropene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0

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Lab Sample Number				2656728	2656729	2656730	2656731	2656732
Sample Reference				WWS01	WWS01	WWS02	WWS02	WWS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	0.50	1.50	2.80
Date Sampled				20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Trans-1,3-dichloropropene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Toluene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1,2-Trichloroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,3-Dichloropropane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Dibromochloromethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Tetrachloroethene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2-Dibromoethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Chlorobenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1,1,2-Tetrachloroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Ethylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
p & m-Xylene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Styrene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Tribromomethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
o-Xylene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,1,2,2-Tetrachloroethane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Isopropylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Bromobenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
n-Propylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
2-Chlorotoluene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
4-Chlorotoluene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,3,5-Trimethylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
tert-Butylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2,4-Trimethylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
sec-Butylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,3-Dichlorobenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
p-Isopropyltoluene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2-Dichlorobenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,4-Dichlorobenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Butylbenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2-Dibromo-3-chloropropane	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2,4-Trichlorobenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Hexachlorobutadiene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0
1,2,3-Trichlorobenzene	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	NONE	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	NONE	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	NONE	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	NONE	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	NONE	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	NONE	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Naphthalene	mg/kg	0.05	NONE	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-

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Lab Sample Number				2656728	2656729	2656730	2656731	2656732
Sample Reference				WWS01	WWS01	WWS02	WWS02	WWS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	0.50	1.50	2.80
Date Sampled				20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	NONE	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	NONE	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	NONE	-	-	-	-	-
Acenaphthene	mg/kg	0.05	NONE	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	NONE	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-	-
Fluorene	mg/kg	0.05	NONE	-	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Phenanthrene	mg/kg	0.05	NONE	-	-	-	-	-
Anthracene	mg/kg	0.05	NONE	-	-	-	-	-
Carbazole	mg/kg	0.3	NONE	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-	-
Fluoranthene	mg/kg	0.05	NONE	-	-	-	-	-
Pyrene	mg/kg	0.05	NONE	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-	-	-	-
Chrysene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-	-	-	-

Miscellaneous Organics

Product ID		N/A	NONE	-	-	-	-	See Appendix
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Project / Site name: Ashley House Cannon Factory
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Lab Sample Number				2656733	2656734	2656735	2656736	2656737
Sample Reference				WWS02	WWS02	WTP01	WTP02	WTP02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.50	4.50	0.50	1.00	2.50
Date Sampled				20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
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	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	5.7	7.4	2	11	8.5
Total mass of sample received	kg	0.001	NONE	1	1	0.9	0.9	0.9

Asbestos in Soil	Type	N/A	ISO 17025	-	-	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A	N/A	WEM	WEM	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-	12.3	7.8	8.6
Organic Matter (automated)	%	0.1	MCERTS	-	-	0.4	0.5	0.2
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.001	< 0.0010	0.002	0.003	< 0.0010
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	-	-	0.2	0.3	< 0.1

Speciated PAHs

Naphthalene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Fluorene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Anthracene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	NONE	-	-	-	0.07	< 0.05
Pyrene	mg/kg	0.05	NONE	-	-	-	0.06	< 0.05
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Chrysene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-	-	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	-	-	-	< 0.80	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	16	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	0.9	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
Chromium (hexavalent)	mg/kg	1.2	NONE	-	-	-	< 1.2	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	26	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	16	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	30	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	23	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	44	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	89	-

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 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number				2656733	2656734	2656735	2656736	2656737
Sample Reference				VWS02	VWS02	WTP01	WTP02	WTP02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.50	4.50	0.50	1.00	2.50
Date Sampled				20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics & Oxygenates								
Benzene	µg/kg	5	NONE	-	-	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	NONE	-	-	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	NONE	-	-	< 5.0	< 5.0	< 5.0
p & m-xylene	µg/kg	5	NONE	-	-	< 5.0	< 5.0	< 5.0
o-xylene	µg/kg	5	NONE	-	-	< 5.0	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	< 5.0	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	NONE	-	-	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	NONE	-	-	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	NONE	-	-	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	NONE	-	-	24	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	-	-	< 8.4	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	-	28	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	-	28	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	-	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	NONE	-	-	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	NONE	-	-	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	NONE	-	-	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	NONE	-	-	< 10	< 10	< 10
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	-	-	< 8.4	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	-	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	-	< 10	< 10	< 10

VOCs

Chloromethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Chloroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Bromomethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Vinyl Chloride	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Trichlorofluoromethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1-Dichloroethene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Cis-1,2-dichloroethene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1-Dichloroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
2,2-Dichloropropane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Trichloromethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1,1-Trichloroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2-Dichloroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1-Dichloropropene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Benzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Tetrachloromethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2-Dichloropropane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Trichloroethene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Dibromomethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Bromodichloromethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Cis-1,3-dichloropropene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0

Analytical Report Number: 23-29890
 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number				2656733	2656734	2656735	2656736	2656737
Sample Reference				VWS02	VWS02	WTP01	WTP02	WTP02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.50	4.50	0.50	1.00	2.50
Date Sampled				20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Trans-1,3-dichloropropene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Toluene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1,2-Trichloroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,3-Dichloropropane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Dibromochloromethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Tetrachloroethene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2-Dibromoethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Chlorobenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1,1,2-Tetrachloroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Ethylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
p & m-Xylene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Styrene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Tribromomethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
o-Xylene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,1,2,2-Tetrachloroethane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Isopropylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Bromobenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
n-Propylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
2-Chlorotoluene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
4-Chlorotoluene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,3,5-Trimethylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
tert-Butylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2,4-Trimethylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
sec-Butylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,3-Dichlorobenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
p-Isopropyltoluene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2-Dichlorobenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,4-Dichlorobenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Butylbenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2-Dibromo-3-chloropropane	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2,4-Trichlorobenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
Hexachlorobutadiene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0
1,2,3-Trichlorobenzene	µg/kg	5	NONE	-	-	< 5.0	-	< 5.0

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
Phenol	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
2-Chlorophenol	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
2-Methylphenol	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Hexachloroethane	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Nitrobenzene	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
Isophorone	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
2-Nitrophenol	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Naphthalene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
2,4-Dichlorophenol	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1

Analytical Report Number: 23-29890
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2656733	2656734	2656735	2656736	2656737
Sample Reference				VWS02	VWS02	WTP01	WTP02	WTP02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.50	4.50	0.50	1.00	2.50
Date Sampled				20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
2-Chloronaphthalene	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
Dimethylphthalate	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	< 0.1	-	< 0.1
Acenaphthylene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
Dibenzofuran	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Diethyl phthalate	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
4-Nitroaniline	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
Fluorene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Azobenzene	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
Hexachlorobenzene	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Phenanthrene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Anthracene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Carbazole	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	< 0.2	-	< 0.2
Anthraquinone	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Fluoranthene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Pyrene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	< 0.3	-	< 0.3
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Chrysene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05

Miscellaneous Organics

Product ID		N/A	NONE	-	-	-	-	-
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-29890

Project / Site name: Ashley House Cannon Factory

* 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 *
2656728	WWS01	None Supplied	0.5	Brown sand with gravel.
2656729	WWS01	None Supplied	1	Brown clay and sand with gravel.
2656730	WWS02	None Supplied	0.5	Brown sand with gravel and stones.
2656731	WWS02	None Supplied	1.5	Brown sand with gravel and stones.
2656732	WWS02	None Supplied	2.8	Brown sand with gravel.
2656733	WWS02	None Supplied	3.5	Brown sand with gravel.
2656734	WWS02	None Supplied	4.5	Brown sand with gravel.
2656735	WTP01	None Supplied	0.5	Brown sand with gravel and rubble.
2656736	WTP02	None Supplied	1	Brown clay and sand with gravel.
2656737	WTP02	None Supplied	2.5	Brown clay and sand with gravel.

Analytical Report Number : 23-29890

Project / Site name: Ashley House Cannon Factory

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
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 °C)	In house method.	L019-UK/PL	W	NONE
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	NONE
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
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
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	NONE
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
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W	NONE
Product ID in soil	Determination of product ID by interpretation against standard chromatograms - Soil.	In-house method	L064-PL/UK	W	NONE
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	NONE
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Organic matter (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
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	NONE

Analytical Report Number : 23-29890
Project / Site name: Ashley House Cannon Factory

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
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

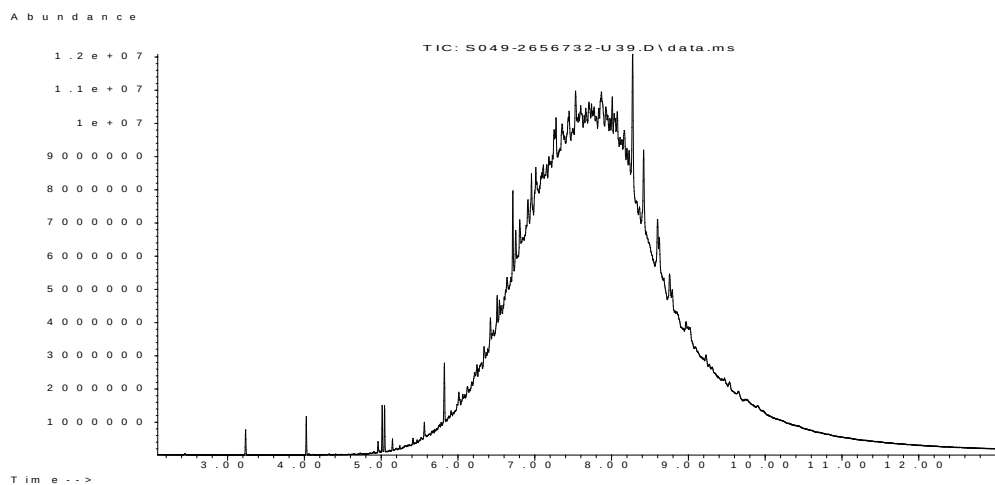
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

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



The total ion count (TIC trace) shows a carbon range from C10 to greater than C40
The sample TIC trace is complex, showing aliphatic product sources.
The trace does not match the standard product profiles but is suggestive of lube oil.

Jon Coates

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Analytical Report Number : 23-30326

Project / Site name:	Ashley House Cannon Factory	Samples received on:	21/04/2023
Your job number:	WIE16248	Samples instructed on/ Analysis started on:	25/04/2023
Your order number:	122387	Analysis completed by:	02/05/2023
Report Issue Number:	1	Report issued on:	03/05/2023
Samples Analysed:	1 soil sample		

**Signed:**

Anna Goc
Junior Reporting Specialist
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

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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: 23-30326

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number				2659080
Sample Reference				WWS02
Sample Number				None Supplied
Depth (m)				1.00
Date Sampled				20/04/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	12
Total mass of sample received	kg	0.001	NONE	1

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.9
Organic Matter (automated)	%	0.1	MCERTS	1.8
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.01
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-30326

Project / Site name: Ashley House Cannon Factory

* 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 *
2659080	WWS02	None Supplied	1	Brown clay and sand with gravel.

Analytical Report Number : 23-30326

Project / Site name: Ashley House Cannon Factory

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
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
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
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 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
Organic matter (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
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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.

Jon Coates

Waterman Infrastructure & Environment Ltd
Pickfords Wharf
Clink Street
London
SE1 9DG

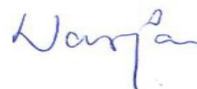
t: 02079287888**e:** jon.coates@watermangroup.com

i2 Analytical Ltd.
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Croxley Green
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Herts,
WD18 8YS

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

Analytical Report Number : 23-30785

Project / Site name:	Ashley House, Cannon Factory	Samples received on:	26/04/2023
Your job number:	WIE16248	Samples instructed on/ Analysis started on:	26/04/2023
Your order number:	122387	Analysis completed by:	08/05/2023
Report Issue Number:	1	Report issued on:	08/05/2023
Samples Analysed:	8 soil samples		

**Signed:**

Dominika Warjan
Junior Reporting Specialist
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: 23-30785
Project / Site name: Ashley House, Cannon Factory
Your Order No: 122387

Lab Sample Number				2661681	2661682	2661683	2661684	2661685
Sample Reference				WTP03	WTP03	WTP06	WTP06	WTP06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	2.50	0.30	0.50	1.00
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
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	47	71	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.5	3.9	7	13	18
Total mass of sample received	kg	0.001	NONE	0.9	0.8	0.8	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Amosite	Chrysotile & Crocidolite	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Detected	Detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	< 0.001	0.005	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	< 0.001	0.005	-
Asbestos Analyst ID	N/A	N/A	N/A	WEM	N/A	WEM	WEM	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	10.9	8.1	11.7	10.7	8.1
Organic Matter (automated)	%	0.1	MCERTS	3.7	2.4	< 0.1	1.3	0.6
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.022	0.014	< 0.0010	0.0077	0.0034
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.1	1.4	< 0.1	0.8	0.3

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.26	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	1.3	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	0.56	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	6.1	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	0.83	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	8.1	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	7.2	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.3	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	2.8	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	3.2	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.4	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.4	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.2	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.37	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.4	-	-	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	40.3	-	-	-	-
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	9.9	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	3.5	0.2	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	9.4	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	33	5.9	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	83	11	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	14	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	36	17	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	19	-	-	-

Analytical Report Number: 23-30785
 Project / Site name: Ashley House, Cannon Factory
 Your Order No: 122387

Lab Sample Number	2661681	2661682	2661683	2661684	2661685
Sample Reference	WTP03	WTP03	WTP06	WTP06	WTP06
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	2.50	0.30	0.50	1.00
Date Sampled	21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	-	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	-	< 5.0
p & m-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	-	-	< 5.0
o-xylene	µg/kg	5	MCERTS	< 5.0	21	-	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	-	-	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	0.55	-	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-	2.1
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	2.7	39	-	-	13
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	51	910	-	-	38
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	300	4700	-	-	34
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	91	1600	-	-	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	350	5700	-	-	87
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	440	7300	-	-	89

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	0.061	-	-	< 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	3.2	23	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	45	670	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	330	3300	-	-	< 10
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	120	830	-	-	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	380	4000	-	-	12
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	500	4800	-	-	12

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Chloroethane	µg/kg	5	NONE	-	-	-	-	< 5.0
Bromomethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Vinyl Chloride	µg/kg	5	NONE	-	-	-	-	< 5.0
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-	-	< 5.0
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-	-	< 5.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-	-	< 5.0
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-	-	< 5.0
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Trichloromethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-	-	< 5.0
Benzene	µg/kg	5	MCERTS	-	-	-	-	< 5.0
Tetrachloromethane	µg/kg	5	NONE	-	-	-	-	< 5.0
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Trichloroethene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Dibromomethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0

Analytical Report Number: 23-30785
 Project / Site name: Ashley House, Cannon Factory
 Your Order No: 122387

Lab Sample Number				2661681	2661682	2661683	2661684	2661685
Sample Reference				WTP03	WTP03	WTP06	WTP06	WTP06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	2.50	0.30	0.50	1.00
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Toluene	µg/kg	5	MCERTS	-	-	-	-	< 5.0
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Tetrachloroethene	µg/kg	5	NONE	-	-	-	-	< 5.0
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	-	-	-	< 5.0
p & m-Xylene	µg/kg	5	MCERTS	-	-	-	-	< 5.0
Styrene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Tribromomethane	µg/kg	5	NONE	-	-	-	-	< 5.0
o-Xylene	µg/kg	5	MCERTS	-	-	-	-	< 5.0
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Bromobenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Butylbenzene	µg/kg	5	NONE	-	-	-	-	< 5.0
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-	-	< 5.0
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	< 5.0

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	< 0.1
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	< 0.2
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-	-	< 0.05
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	< 0.2
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	< 0.1

Analytical Report Number: 23-30785
Project / Site name: Ashley House, Cannon Factory
Your Order No: 122387

Lab Sample Number				2661681	2661682	2661683	2661684	2661685
Sample Reference				WTP03	WTP03	WTP06	WTP06	WTP06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	2.50	0.30	0.50	1.00
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	-	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	-	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	< 0.1
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-	< 0.1
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-	< 0.2
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-	< 0.2
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Azobenzene	mg/kg	0.3	NONE	-	-	-	-	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	0.09
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-	< 0.2
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-	< 0.3
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	0.26
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	0.26
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-	< 0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	0.12
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	0.17
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	0.14
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	0.09
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	0.12
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-30785
Project / Site name: Ashley House, Cannon Factory
Your Order No: 122387

Lab Sample Number				2661686	2661687	2661688
Sample Reference				WTP04	WTP04	WTP04
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	2.60
Date Sampled				21/04/2023	21/04/2023	21/04/2023
Time Taken				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	18	17	13
Total mass of sample received	kg	0.001	NONE	0.8	0.8	0.5

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile & Crocidolite	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	-	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	0.063	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	0.063	-	-
Asbestos Analyst ID	N/A	N/A	N/A	WEM	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.6	8.3	8.3
Organic Matter (automated)	%	0.1	MCERTS	3.8	1.9	0.9
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.022	0.011	0.005
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.2	1.1	0.5

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.14	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	0.09	-	-
Fluorene	mg/kg	0.05	MCERTS	0.25	-	-
Phenanthrene	mg/kg	0.05	MCERTS	0.77	-	-
Anthracene	mg/kg	0.05	MCERTS	0.11	-	-
Fluoranthene	mg/kg	0.05	MCERTS	0.75	-	-
Pyrene	mg/kg	0.05	MCERTS	0.8	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.41	-	-
Chrysene	mg/kg	0.05	MCERTS	0.51	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.69	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.35	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.46	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.36	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.08	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.39	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	6.16	-	-
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-

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Project / Site name: Ashley House, Cannon Factory
Your Order No: 122387

Lab Sample Number				2661686	2661687	2661688
Sample Reference				WTP04	WTP04	WTP04
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	2.60
Date Sampled				21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Monoaromatics & Oxygenates						
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
p & m-xylene	µg/kg	5	MCERTS	42	< 5.0	41
o-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	1.7
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	3.4	4.6	3.2
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	120	75	130
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	190	110	160
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	240	220	160
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	24	31	9.9
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	550	410	460
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	580	440	470

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	0.03	< 0.001	0.032
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	1.7	4.2	3.3
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	49	47	76
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	100	110	120
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	220	320	150
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	34	50	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	380	480	350
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	410	530	360

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	-
Chloroethane	µg/kg	5	NONE	-	-	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-
Trichloromethane	µg/kg	5	ISO 17025	-	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-
Tetrachloromethane	µg/kg	5	NONE	-	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-

Analytical Report Number: 23-30785
Project / Site name: Ashley House, Cannon Factory
Your Order No: 122387

Lab Sample Number				2661686	2661687	2661688
Sample Reference				WTP04	WTP04	WTP04
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	2.60
Date Sampled				21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-
Styrene	µg/kg	5	ISO 17025	-	-	-
Tribromomethane	µg/kg	5	NONE	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-
Bromobenzene	µg/kg	5	ISO 17025	-	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-
Butylbenzene	µg/kg	5	NONE	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-

Analytical Report Number: 23-30785
 Project / Site name: Ashley House, Cannon Factory
 Your Order No: 122387

Lab Sample Number				2661686	2661687	2661688
Sample Reference				WTP04	WTP04	WTP04
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	2.60
Date Sampled				21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-30785
Project / Site name: Ashley House, Cannon Factory
Your Order No: 122387

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2661683	WTP06	0.30	137	Loose Fibres	Amosite	< 0.001	< 0.001
2661684	WTP06	0.50	129	Loose Fibres & Loose Fibrous Debris	Chrysotile & Crocidolite	0.005	0.005
2661686	WTP04	1.00	146	Loose Fibres & Loose Fibrous Debris	Chrysotile & Crocidolite	0.063	0.063

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 23-30785

Project / Site name: Ashley House, Cannon Factory

* 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 *
2661681	WTP03	None Supplied	0.5	Brown sand with gravel and stones.
2661682	WTP03	None Supplied	2.5	Brown sand with gravel and stones.
2661683	WTP06	None Supplied	0.3	Brown sand with gravel.
2661684	WTP06	None Supplied	0.5	Brown sand with gravel.
2661685	WTP06	None Supplied	1	Brown clay and sand with gravel.
2661686	WTP04	None Supplied	1	Brown clay and sand with gravel.
2661687	WTP04	None Supplied	2	Brown clay and sand with gravel.
2661688	WTP04	None Supplied	2.6	Brown clay and sand with gravel.

Analytical Report Number : 23-30785

Project / Site name: Ashley House, Cannon Factory

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
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 °C)	In house method.	L019-UK/PL	W	NONE
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
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
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	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
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	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 in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Organic matter (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
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS

Analytical Report Number : 23-30785
Project / Site name: Ashley House, Cannon Factory

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
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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 30°C.

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

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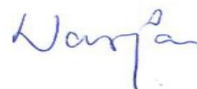
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Analytical Report Number : 23-30796

Project / Site name:	Ashley House Cannon Factory	Samples received on:	26/04/2023
Your job number:	WIE16248	Samples instructed on/ Analysis started on:	26/04/2023
Your order number:	122387	Analysis completed by:	08/05/2023
Report Issue Number:	1	Report issued on:	08/05/2023
Samples Analysed:	17 soil samples		



Signed:

Dominika Warjan
Junior Reporting Specialist
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: 23-30796
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2661711	2661712	2661713	2661714	2661715
Sample Reference				WWS04	WWS04	WWS05	WWS06	WWS06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.55	2.20	0.30	0.30	1.50
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
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	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	16	10	13	5.5	15
Total mass of sample received	kg	0.001	NONE	0.9	0.8	0.8	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Amosite	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Detected	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	< 0.001	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	< 0.001	-	-
Asbestos Analyst ID	N/A	N/A	N/A	PDO	N/A	PDO	PDO	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8	8.2	9.9	12.2	8.7
Organic Matter (automated)	%	0.1	MCERTS	1.1	< 0.1	0.7	< 0.1	0.4
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.0066	< 0.0010	0.0041	< 0.0010	0.0024
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.7	< 0.1	0.4	< 0.1	0.2

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluorene	mg/kg	0.05	MCERTS	0.08	< 0.05	< 0.05	-	-
Phenanthrene	mg/kg	0.05	MCERTS	1.3	< 0.05	0.32	-	-
Anthracene	mg/kg	0.05	MCERTS	0.27	< 0.05	0.05	-	-
Fluoranthene	mg/kg	0.05	MCERTS	3.1	< 0.05	0.4	-	-
Pyrene	mg/kg	0.05	MCERTS	2.8	< 0.05	0.43	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.6	< 0.05	0.28	-	-
Chrysene	mg/kg	0.05	MCERTS	1.5	< 0.05	0.28	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.8	< 0.05	0.26	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.74	< 0.05	0.1	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.7	< 0.05	0.24	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.89	< 0.05	0.15	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.22	< 0.05	< 0.05	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1	< 0.05	0.17	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	16.8	< 0.80	2.68	-	-
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	15	14	11	-
Boron (water soluble)	mg/kg	0.2	MCERTS	2	1.4	1	0.4	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	25	23	16	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	110	15	34	11	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	160	13	140	6.8	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.7	< 0.3	< 0.3	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	25	18	8.1	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	46	46	41	20	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	38	100	19	-

Analytical Report Number: 23-30796
 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number	2661711	2661712	2661713	2661714	2661715
Sample Reference	WWS04	WWS04	WWS05	WWS06	WWS06
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.55	2.20	0.30	0.30	1.50
Date Sampled	21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0#	< 5.0#	< 5.0#	< 5.0#
p & m-xylene	µg/kg	5	MCERTS	-	< 5.0#	< 5.0#	< 5.0#	< 5.0#
o-xylene	µg/kg	5	MCERTS	-	< 5.0#	< 5.0#	< 5.0#	< 5.0#
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	-	< 0.001	< 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	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	-	< 2.0	< 2.0	9.3	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	-	< 8.0	< 8.0	13	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	-	< 8.0	< 8.0	33	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	-	< 8.4	< 8.4	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	< 10	< 10	56	< 10
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	< 10	< 10	61	< 10

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	-	< 0.001	< 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	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	-	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	-	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	-	< 10	17	< 10	< 10
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	-	< 8.4	< 8.4	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	< 10	22	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	< 10	22	< 10	< 10

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chloroethane	µg/kg	5	NONE	-	-	-	-	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-	-	-
Tetrachloromethane	µg/kg	5	NONE	-	-	-	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-

Analytical Report Number: 23-30796
 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number				2661711	2661712	2661713	2661714	2661715
Sample Reference				WWS04	WWS04	WWS05	WWS06	WWS06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.55	2.20	0.30	0.30	1.50
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-	-	-
Styrene	µg/kg	5	ISO 17025	-	-	-	-	-
Tribromomethane	µg/kg	5	NONE	-	-	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Bromobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Butylbenzene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-

Analytical Report Number: 23-30796
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2661711	2661712	2661713	2661714	2661715
Sample Reference				WWS04	WWS04	WWS05	WWS06	WWS06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.55	2.20	0.30	0.30	1.50
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-30796
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2661716	2661717	2661718	2661719	2661720
Sample Reference				WWS06	WWS06	WWS07	WWS07	WWS07
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.50	4.50	1.40	2.10	2.60
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
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	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	8	10	16	5.9	9.1
Total mass of sample received	kg	0.001	NONE	0.8	0.8	0.8	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	-	Not-detected	-	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A	N/A	PDO	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.6	-	7.5	7.1	7.8
Organic Matter (automated)	%	0.1	MCERTS	< 0.1	-	0.3	< 0.1	< 0.1
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	< 0.0010	< 0.0010	0.0016	< 0.0010	< 0.0010
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	< 0.1	-	0.2	< 0.1	< 0.1

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	-	-	< 0.05	< 0.05	-
Anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Chrysene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	< 0.05	< 0.05	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	< 0.05	< 0.05	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	-	-	< 0.80	< 0.80	-
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	13	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	0.7	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	< 0.2	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	-	-	< 1.8	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	30	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	15	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	14	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	< 0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	26	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	< 1.0	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	49	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	54	-	-

Analytical Report Number: 23-30796
 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number	2661716	2661717	2661718	2661719	2661720
Sample Reference	WWS06	WWS06	WWS07	WWS07	WWS07
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	3.50	4.50	1.40	2.10	2.60
Date Sampled	21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Monoaromatics & Oxygenates					
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0#	< 5.0#
p & m-xylene	µg/kg	5	MCERTS	< 5.0#	< 5.0#
o-xylene	µg/kg	5	MCERTS	< 5.0#	< 5.0#
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	-	< 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	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	-	< 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	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	-	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	< 8.4	-	< 8.4	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	-	< 10	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	-	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	-	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	-	< 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	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	< 2.0	-	< 2.0	< 2.0	3.9
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	-	< 10	< 10	12
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	-	< 10	< 10	33
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	< 8.4	-	< 8.4	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	< 10	-	< 10	< 10	49
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	< 10	-	< 10	< 10	51

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chloroethane	µg/kg	5	NONE	-	-	-	-	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-	-	-
Tetrachloromethane	µg/kg	5	NONE	-	-	-	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-

Analytical Report Number: 23-30796
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 Your Order No: 122387

Lab Sample Number				2661716	2661717	2661718	2661719	2661720
Sample Reference				WWS06	WWS06	WWS07	WWS07	WWS07
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.50	4.50	1.40	2.10	2.60
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-	-	-
Styrene	µg/kg	5	ISO 17025	-	-	-	-	-
Tribromomethane	µg/kg	5	NONE	-	-	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Bromobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Butylbenzene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-

Analytical Report Number: 23-30796
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2661716	2661717	2661718	2661719	2661720
Sample Reference				WWS06	WWS06	WWS07	WWS07	WWS07
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.50	4.50	1.40	2.10	2.60
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-30796
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2661721	2661722	2661723	2661724	2661725
Sample Reference				WWS08	WWS08	WWS08	WWS09	WWS09
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	2.40	0.50	1.50
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
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	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	12	14	15	15	11
Total mass of sample received	kg	0.001	NONE	0.8	0.8	0.8	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Chrysotile & Amosite	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Detected	-	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	< 0.001	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	< 0.001	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	PDO	PDO	N/A	PDO	PDO

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.6	8.5	7.9	7.5	7.8
Organic Matter (automated)	%	0.1	MCERTS	0.9	1	1.4	4.3	0.9
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.005	0.006	0.0082	0.025	0.0054
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.5	0.6	0.8	2.5	0.5

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.14	-	-	0.27	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.14	-	-	0.34	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.3	-	-	0.13	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.24	-	-	0.32	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	3.5	-	-	4.3	< 0.05
Anthracene	mg/kg	0.05	MCERTS	2.1	-	-	1.1	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	13	-	-	7.5	< 0.05
Pyrene	mg/kg	0.05	MCERTS	12	-	-	6	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	7.7	-	-	3.4	< 0.05
Chrysene	mg/kg	0.05	MCERTS	7.4	-	-	3.1	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	7.3	-	-	3.3	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.3	-	-	1	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4.8	-	-	2.2	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.1	-	-	0.93	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.61	-	-	0.29	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.9	-	-	0.89	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	64.6	-	-	35	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	-	-	35	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	-	-	1.3	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	-	-	< 1.8	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	-	-	23	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	56	-	-	130	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	160	-	-	610	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	1.7	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	-	-	23	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	37	-	-	47	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	120	-	-	270	-

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Lab Sample Number	2661721	2661722	2661723	2661724	2661725
Sample Reference	WWS08	WWS08	WWS08	WWS09	WWS09
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.00	2.00	2.40	0.50	1.50
Date Sampled	21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Monoaromatics & Oxygenates					
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0
p & m-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0
o-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	< 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	< 1.0	2.2
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	< 2.0	4.5	< 2.0	71
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	13	< 8.0	110
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	350	< 8.0	330
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	< 8.4	< 8.4	110	< 8.4	110
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	< 10	370	< 10	520
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	< 10	490	< 10	620

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	< 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	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	6.1	< 2.0	7.7	< 2.0	39
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	48	< 10	16	19	120
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	100	< 10	180	43	300
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	< 8.4	< 8.4	44	< 8.4	72
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	150	< 10	200	62	460
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	160	< 10	250	65	530

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chloroethane	µg/kg	5	NONE	-	-	-	-	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-	-	-
Tetrachloromethane	µg/kg	5	NONE	-	-	-	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-

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Lab Sample Number				2661721	2661722	2661723	2661724	2661725
Sample Reference				WWS08	WWS08	WWS08	WWS09	WWS09
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	2.40	0.50	1.50
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-	-	-
Styrene	µg/kg	5	ISO 17025	-	-	-	-	-
Tribromomethane	µg/kg	5	NONE	-	-	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Bromobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Butylbenzene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-

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Lab Sample Number				2661721	2661722	2661723	2661724	2661725
Sample Reference				WWS08	WWS08	WWS08	WWS09	WWS09
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	2.40	0.50	1.50
Date Sampled				21/04/2023	21/04/2023	21/04/2023	21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Your Order No: 122387

Lab Sample Number				2661726	2661727
Sample Reference				VWS09	VWS09
Sample Number				None Supplied	None Supplied
Depth (m)				2.10	3.00
Date Sampled				21/04/2023	21/04/2023
Time Taken				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	13	17
Total mass of sample received	kg	0.001	NONE	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7	6.1
Organic Matter (automated)	%	0.1	MCERTS	0.9	0.4
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.0055	0.002
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.5	0.2

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	-	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-

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 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number				2661726	2661727
Sample Reference				VWS09	VWS09
Sample Number				None Supplied	None Supplied
Depth (m)				2.10	3.00
Date Sampled				21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Monoaromatics & Oxygenates					
Benzene	µg/kg	5	MCERTS	-	< 5.0
Toluene	µg/kg	5	MCERTS	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0
p & m-xylene	µg/kg	5	MCERTS	-	< 5.0
o-xylene	µg/kg	5	MCERTS	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS,1D,AL}	mg/kg	0.001	NONE	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS,1D,AL}	mg/kg	0.001	NONE	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS,1D,AL}	mg/kg	0.001	NONE	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 _{EH,CU,1D,AL}	mg/kg	1	MCERTS	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH,CU,1D,AL}	mg/kg	2	MCERTS	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	-	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 _{EH,CU,1D,AL}	mg/kg	8.4	NONE	-	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) _{EH,CU+HS,1D,AL}	mg/kg	10	NONE	-	< 10
TPH-CWG - Aliphatic (EC5 - EC44) _{EH,CU+HS,1D,AL}	mg/kg	10	NONE	-	< 10

TPH-CWG - Aromatic >EC5 - EC7 _{HS,1D,AR}	mg/kg	0.001	NONE	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS,1D,AR}	mg/kg	0.001	NONE	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS,1D,AR}	mg/kg	0.001	NONE	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH,CU,1D,AR}	mg/kg	1	MCERTS	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH,CU,1D,AR}	mg/kg	2	MCERTS	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	-	< 10
TPH-CWG - Aromatic >EC21 - EC35 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	-	< 10
TPH-CWG - Aromatic > EC35 - EC44 _{EH,CU,1D,AR}	mg/kg	8.4	NONE	-	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) _{EH,CU+HS,1D,AR}	mg/kg	10	NONE	-	< 10
TPH-CWG - Aromatic (EC5 - EC44) _{EH,CU+HS,1D,AR}	mg/kg	10	NONE	-	< 10

VOCs

Chloromethane	µg/kg	5	ISO 17025	< 5.0	-
Chloroethane	µg/kg	5	NONE	< 5.0	-
Bromomethane	µg/kg	5	ISO 17025	< 5.0	-
Vinyl Chloride	µg/kg	5	NONE	< 5.0	-
Trichlorofluoromethane	µg/kg	5	NONE	< 5.0	-
1,1-Dichloroethene	µg/kg	5	NONE	< 5.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	< 5.0	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	< 5.0	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	< 5.0	-
Trichloromethane	µg/kg	5	ISO 17025	< 5.0	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	< 5.0	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	< 5.0	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	< 5.0	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	< 5.0	-
Benzene	µg/kg	5	MCERTS	< 5.0	-
Tetrachloromethane	µg/kg	5	NONE	< 5.0	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	< 5.0	-
Trichloroethene	µg/kg	5	ISO 17025	< 5.0	-
Dibromomethane	µg/kg	5	ISO 17025	< 5.0	-
Bromodichloromethane	µg/kg	5	ISO 17025	< 5.0	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	< 5.0	-

Analytical Report Number: 23-30796
 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number				2661726	2661727
Sample Reference				VWS09	VWS09
Sample Number				None Supplied	None Supplied
Depth (m)				2.10	3.00
Date Sampled				21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	< 5.0	-
Toluene	µg/kg	5	MCERTS	< 5.0	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	< 5.0	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	< 5.0	-
Dibromochloromethane	µg/kg	5	ISO 17025	< 5.0	-
Tetrachloroethene	µg/kg	5	NONE	< 5.0	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	< 5.0	-
Chlorobenzene	µg/kg	5	ISO 17025	< 5.0	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-
p & m-Xylene	µg/kg	5	MCERTS	< 5.0	-
Styrene	µg/kg	5	ISO 17025	< 5.0	-
Tribromomethane	µg/kg	5	NONE	< 5.0	-
o-Xylene	µg/kg	5	MCERTS	< 5.0	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	< 5.0	-
Isopropylbenzene	µg/kg	5	ISO 17025	< 5.0	-
Bromobenzene	µg/kg	5	ISO 17025	< 5.0	-
n-Propylbenzene	µg/kg	5	ISO 17025	< 5.0	-
2-Chlorotoluene	µg/kg	5	ISO 17025	< 5.0	-
4-Chlorotoluene	µg/kg	5	ISO 17025	< 5.0	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	< 5.0	-
tert-Butylbenzene	µg/kg	5	ISO 17025	< 5.0	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	< 5.0	-
sec-Butylbenzene	µg/kg	5	ISO 17025	< 5.0	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	< 5.0	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	< 5.0	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	< 5.0	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	< 5.0	-
Butylbenzene	µg/kg	5	NONE	< 5.0	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	< 5.0	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	< 5.0	-
Hexachlorobutadiene	µg/kg	5	NONE	< 5.0	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	< 5.0	-

SVOCs

Aniline	mg/kg	0.1	NONE	< 0.1	-
Phenol	mg/kg	0.2	ISO 17025	< 0.2	-
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	-
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	-
Hexachloroethane	mg/kg	0.05	ISO 17025	< 0.05	-
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	-
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	-
Isophorone	mg/kg	0.2	MCERTS	< 0.2	-
2-Nitrophenol	mg/kg	0.3	NONE	< 0.3	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	-
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-

Analytical Report Number: 23-30796
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2661726	2661727
Sample Reference				WWS09	WWS09
Sample Number				None Supplied	None Supplied
Depth (m)				2.10	3.00
Date Sampled				21/04/2023	21/04/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	< 0.1	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	< 0.2	-
2-Methylnaphthalene	mg/kg	0.1	NONE	< 0.1	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	-
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	< 0.1	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	< 0.2	-
Dibenzofuran	mg/kg	0.2	MCERTS	< 0.2	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	< 0.3	-
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-
4-Nitroaniline	mg/kg	0.2	NONE	< 0.2	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-
Azobenzene	mg/kg	0.3	NONE	< 0.3	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-
Carbazole	mg/kg	0.3	MCERTS	< 0.3	-
Dibutyl phthalate	mg/kg	0.2	NONE	< 0.2	-
Anthraquinone	mg/kg	0.3	NONE	< 0.3	-
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	< 0.3	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-30796
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2661713	WWS05	0.30	129	Loose Fibres	Amosite	< 0.001	< 0.001
2661722	WWS08	2.00	141	Loose Fibres	Chrysotile & Amosite	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 23-30796

Project / Site name: Ashley House Cannon Factory

* 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 *
2661711	WWS04	None Supplied	0.55	Brown clay and sand with gravel.
2661712	WWS04	None Supplied	2.2	Brown clay with gravel.
2661713	WWS05	None Supplied	0.3	Brown sand with gravel.
2661714	WWS06	None Supplied	0.3	Brown sand with gravel.
2661715	WWS06	None Supplied	1.5	Brown clay and sand with gravel.
2661716	WWS06	None Supplied	3.5	Brown sand with gravel.
2661717	WWS06	None Supplied	4.5	Brown sand with gravel.
2661718	WWS07	None Supplied	1.4	Brown clay and sand with gravel.
2661719	WWS07	None Supplied	2.1	Brown sand with gravel.
2661720	WWS07	None Supplied	2.6	Brown sand with gravel.
2661721	WWS08	None Supplied	1	Brown clay and sand with gravel.
2661722	WWS08	None Supplied	2	Brown clay and sand with gravel.
2661723	WWS08	None Supplied	2.4	Brown clay with gravel.
2661724	WWS09	None Supplied	0.5	Brown loam and clay with gravel and vegetation.
2661725	WWS09	None Supplied	1.5	Brown clay and sand with gravel.
2661726	WWS09	None Supplied	2.1	Brown clay and loam with gravel and vegetation.
2661727	WWS09	None Supplied	3	Brown clay and sand with gravel.

Analytical Report Number : 23-30796

Project / Site name: Ashley House Cannon Factory

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
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 °C)	In house method.	L019-UK/PL	W	NONE
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
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
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	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
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	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 in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Organic matter (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
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS

Analytical Report Number : 23-30796
Project / Site name: Ashley House Cannon Factory

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
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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 30°C.

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

#Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and therefore may be compromised.

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Analytical Report Number : 23-30799

Replaces Analytical Report Number: 23-30799, issue no. 1

Additional analysis undertaken.

Product ID added for samples 2661734 and 2661736 as per client's request

The report has been updated to the current Schedule of Accreditation issue No: 113 Issue date: 09 May 2023

Project / Site name:	Ashley House, Cannon Factory	Samples received on:	26/04/2023
Your job number:	WIE16248	Samples instructed on/ Analysis started on:	26/04/2023
Your order number:	122387	Analysis completed by:	12/05/2023
Report Issue Number:	2	Report issued on:	13/05/2023
Samples Analysed:	5 soil samples		



Signed:

Elżbieta Suchy
Junior Reporting Specialist
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: 23-30799

Project / Site name: Ashley House, Cannon Factory

Your Order No: 122387

Lab Sample Number				2661732	2661733	2661734	2661735	2661736
Sample Reference				WWS10	WWS10	WWS10	WWS10	WWS11
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	1.60	2.20	3.80	3.00
Date Sampled				24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
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	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	12	6.3	6.9	6.2
Total mass of sample received	kg	0.001	NONE	0.8	0.8	0.8	0.8	0.8

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	LFT	N/A	N/A	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.2	6.9	8	8.3	7.6
Organic Matter (automated)	%	0.1	MCERTS	1.5	1.6	3.6	2.2	6.1
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.0088	0.009	0.021	0.013	0.036
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.9	0.9	2.1	1.3	3.6

Speciated PAHs

Naphthalene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	NONE	-	-	< 0.05	-	0.12
Fluorene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	NONE	-	-	< 0.05	-	2.6
Anthracene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Fluoranthene	mg/kg	0.05	NONE	-	-	0.43	-	< 0.05
Pyrene	mg/kg	0.05	NONE	-	-	0.75	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Chrysene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-	< 0.05	-	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	-	-	1.18	-	2.76
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	1.3	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	310	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	170	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	42	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	93	-	-	-	-

Analytical Report Number: 23-30799

Project / Site name: Ashley House, Cannon Factory

Your Order No: 122387

Lab Sample Number	2661732	2661733	2661734	2661735	2661736
Sample Reference	WWS10	WWS10	WWS10	WWS10	WWS11
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.30	1.60	2.20	3.80	3.00
Date Sampled	24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	< 5.0
p & m-xylene	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	9.3
o-xylene	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	16
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	0.43
TPH-CWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	NONE	-	< 1.0	3.9	2.9	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	NONE	-	3.3	46	24	29
TPH-CWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	NONE	-	81	720	440	790
TPH-CWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	NONE	-	510	4400	2300	3700
TPH-CWG - Aliphatic > EC35 - EC44 _{EH_CU_1D_AL}	mg/kg	8.4	NONE	-	140	990	580	1200
TPH-CWG - Aliphatic (EC5 - EC35) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	-	590	5100	2700	4500
TPH-CWG - Aliphatic (EC5 - EC44) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	-	730	6100	3300	5700

TPH-CWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.001	NONE	-	< 0.001	< 0.001	< 0.001	0.05
TPH-CWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	NONE	-	< 2.0	19	14	20
TPH-CWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	NONE	-	73	570	370	570
TPH-CWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	NONE	-	460	2800	1600	2600
TPH-CWG - Aromatic > EC35 - EC44 _{EH_CU_1D_AR}	mg/kg	8.4	NONE	-	94	730	470	860
TPH-CWG - Aromatic (EC5 - EC35) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	-	530	3400	2000	3200
TPH-CWG - Aromatic (EC5 - EC44) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	-	620	4100	2500	4100

Miscellaneous Organics

Product ID		N/A	NONE	-	-	See Appendix	-	See Appendix
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-30799

Project / Site name: Ashley House, Cannon Factory

* 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 *
2661732	WWS10	None Supplied	0.3	Brown sand with gravel.
2661733	WWS10	None Supplied	1.6	Brown clay with gravel.
2661734	WWS10	None Supplied	2.2	Brown sand with gravel.
2661735	WWS10	None Supplied	3.8	Brown sand with gravel.
2661736	WWS11	None Supplied	3	Brown sand with gravel.

Analytical Report Number : 23-30799

Project / Site name: Ashley House, Cannon Factory

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
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
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	NONE
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
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 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. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W	NONE
Product ID in soil	Determination of product ID by interpretation against standard chromatograms - Soil.	In-house method	L064-PL/UK	W	NONE
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	NONE
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Organic matter (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
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS

Analytical Report Number : 23-30799

Project / Site name: Ashley House, Cannon Factory

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
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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

Sample Deviation Report



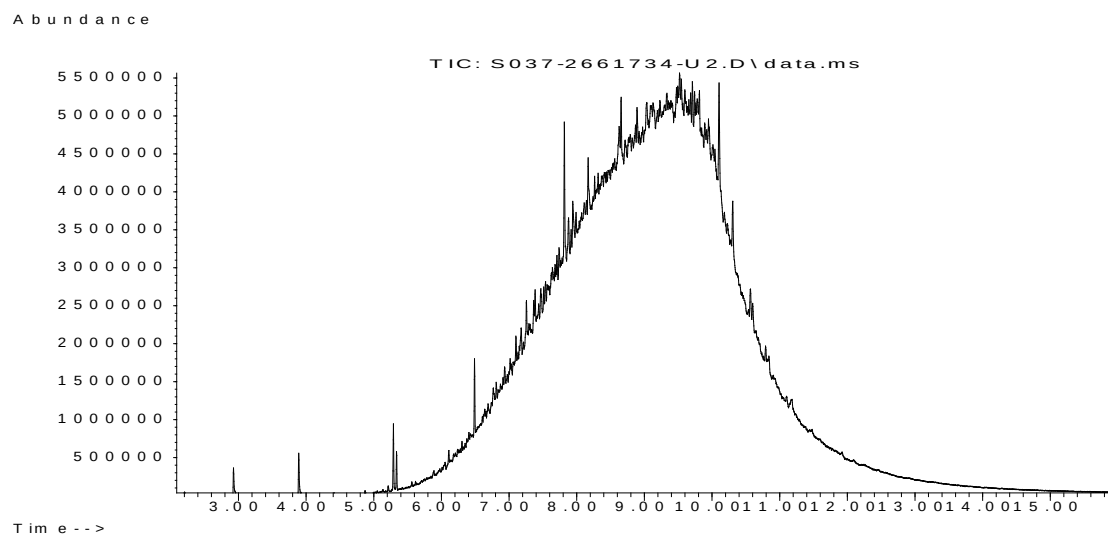
Analytical Report Number : 23-30799

Project / Site name: Ashley House, Cannon Factory

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WWS10	None Supplied	S	2661733	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WWS10	None Supplied	S	2661733	b	TPHCWG (Soil)	L088/76-PL	b



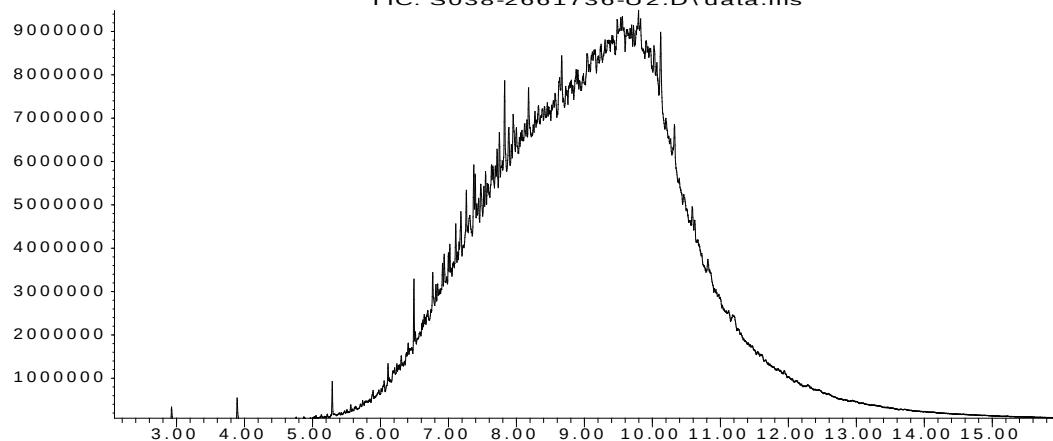
The total ion count (TIC trace) shows a carbon range from C16 to C21.

The sample TIC trace is complex, showing aliphatic product sources.

The trace does not match the standard product profiles but is suggestive of Lube oil

Abundance

TIC: S038-2661736-U2.D\data.ms



Time-->

The total ion count (TIC trace) shows a carbon range from C12 to C21.

The sample TIC trace is complex, showing aliphatic product sources.

The trace does not match the standard product profiles but is suggestive of Lube oil

Jon Coates

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Analytical Report Number : 23-30803

Project / Site name:	Ashley House Cannon Factory	Samples received on:	26/04/2023
Your job number:	WIE16248	Samples instructed on/ Analysis started on:	26/04/2023
Your order number:	122387	Analysis completed by:	05/05/2023
Report Issue Number:	1	Report issued on:	05/05/2023
Samples Analysed:	5 soil samples		

Izabela Wójcik
Signed:

Izabela Wójcik
Reporting Specialist
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

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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: 23-30803

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number				2661746	2661747	2661748	2661749	2661750
Sample Reference				WTP07	WTP07	WTP10	WTP11	WTP11
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.00	0.50	0.50	1.60
Date Sampled				24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
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	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	19	17	12	19	12
Total mass of sample received	kg	0.001	NONE	0.8	0.8	0.8	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile & Amosite Detected	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	< 0.001	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	< 0.001	-	-
Asbestos Analyst ID	N/A	N/A	N/A	SPU	SPU	SPU	SPU	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.7	8	11.6	7.3	7.9
Organic Matter (automated)	%	0.1	MCERTS	2.5	0.5	0.9	1.8	0.5
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.015	0.0027	0.0054	0.01	0.0031
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.5	0.3	0.5	1	0.3

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	4	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.65	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	4.3	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	3.4	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	25	< 0.05	0.6	0.27	< 0.05
Anthracene	mg/kg	0.05	MCERTS	6.3	< 0.05	0.15	0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	24	< 0.05	1.5	0.77	< 0.05
Pyrene	mg/kg	0.05	MCERTS	19	< 0.05	1.4	0.72	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	8.6	< 0.05	0.82	0.33	< 0.05
Chrysene	mg/kg	0.05	MCERTS	8.3	< 0.05	0.88	0.41	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	7.3	< 0.05	0.97	0.43	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.9	< 0.05	0.38	0.15	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	5	< 0.05	0.7	0.24	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.2	< 0.05	0.32	0.12	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.68	< 0.05	0.1	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.1	< 0.05	0.4	0.13	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	124	< 0.80	8.2	3.62	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	18	19	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	0.6	0.5	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	< 0.2	< 0.2	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	-	-	< 1.8	U/S##	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	26	240	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	85	71	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	340	1300	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	< 0.3	2.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	18	8.1	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	35	30	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	270	170	-

Analytical Report Number: 23-30803
 Project / Site name: Ashley House Cannon Factory
 Your Order No: 122387

Lab Sample Number	2661746	2661747	2661748	2661749	2661750
Sample Reference	WTP07	WTP07	WTP10	WTP11	WTP11
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.00	2.00	0.50	0.50	1.60
Date Sampled	24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene#	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene#	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
o-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.001	NONE	< 0.001	< 0.001	< 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	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 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	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 _{EH_CU_1D_AL}	mg/kg	8.4	NONE	< 8.4	< 8.4	< 8.4	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.001	NONE	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	4	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	19	< 2.0	6.1	2.5	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	53	< 10	19	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	64	< 10	66	12	< 10
TPH-CWG - Aromatic > EC35 - EC44 _{EH_CU_1D_AR}	mg/kg	8.4	NONE	< 8.4	< 8.4	< 8.4	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	140	< 10	92	21	< 10
TPH-CWG - Aromatic (EC5 - EC44) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	150	< 10	98	21	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



Analytical Report Number: 23-30803
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2661748	WTP10	0.50	144	Loose Fibres	Chrysotile & Amosite	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 23-30803

Project / Site name: Ashley House Cannon Factory

* 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 *
2661746	WTP07	None Supplied	1	Brown clay and sand with gravel.
2661747	WTP07	None Supplied	2	Brown clay and sand with gravel.
2661748	WTP10	None Supplied	0.5	Brown sand with gravel and brick.
2661749	WTP11	None Supplied	0.5	Brown clay and sand with gravel.
2661750	WTP11	None Supplied	1.6	Brown clay and sand with gravel.

Analytical Report Number : 23-30803

Project / Site name: Ashley House Cannon Factory

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
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
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
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 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. Individual components MCERTS accredited	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 in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Organic matter (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
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS

Analytical Report Number : 23-30803

Project / Site name: Ashley House Cannon Factory

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
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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

- Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

U/S - Unsuitable for analysis due to high colour intensity.

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Analytical Report Number : 23-31932

Project / Site name: Ashley House Cannon Factory

Samples received on: 03/05/2023

Your job number: WIE16248

**Samples instructed on/
Analysis started on:** 03/05/2023

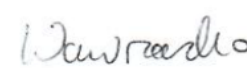
Your order number: 122387

Analysis completed by: 11/05/2023

Report Issue Number: 1

Report issued on: 11/05/2023

Samples Analysed: 1 soil sample



Signed:

Joanna Wawrzeczko
Reporting Specialist
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: 23-31932
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2668681
Sample Reference				WTP05
Sample Number				None Supplied
Depth (m)				1.00
Date Sampled				21/04/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	44
Moisture Content	%	0.01	NONE	13
Total mass of sample received	kg	0.001	NONE	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Amosite
Asbestos in Soil	Type	N/A	ISO 17025	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	< 0.001
Asbestos Quantification Total	%	0.001	ISO 17025	< 0.001
Asbestos Analyst ID	N/A	N/A	N/A	EC

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.5
Organic Matter (automated)	%	0.1	MCERTS	2.5

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	26
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24
Copper (aqua regia extractable)	mg/kg	1	MCERTS	620
Lead (aqua regia extractable)	mg/kg	1	MCERTS	150
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	43
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	46
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	290

Monoaromatics & Oxygenates

Benzene	µg/kg	5	NONE	< 5.0
Toluene	µg/kg	5	NONE	< 5.0
Ethylbenzene	µg/kg	5	NONE	< 5.0
p & m-xylene	µg/kg	5	NONE	< 5.0
o-xylene	µg/kg	5	NONE	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0

Analytical Report Number: 23-31932
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2668681
Sample Reference				WTP05
Sample Number				None Supplied
Depth (m)				1.00
Date Sampled				21/04/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.001	NONE	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.001	NONE	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.001	NONE	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	NONE	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	NONE	3
TPH-CWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	NONE	14
TPH-CWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	NONE	56
TPH-CWG - Aliphatic > EC35 - EC44 _{EH_CU_1D_AL}	mg/kg	8.4	NONE	16
TPH-CWG - Aliphatic (EC5 - EC35) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	72
TPH-CWG - Aliphatic (EC5 - EC44) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	88

TPH-CWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.001	NONE	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.001	NONE	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.001	NONE	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	NONE	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	NONE	17
TPH-CWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	NONE	79
TPH-CWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	NONE	100
TPH-CWG - Aromatic > EC35 - EC44 _{EH_CU_1D_AR}	mg/kg	8.4	NONE	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	200
TPH-CWG - Aromatic (EC5 - EC44) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	210

VOCs

Chloromethane	µg/kg	5	NONE	< 5.0##
Chloroethane	µg/kg	5	NONE	< 5.0
Bromomethane	µg/kg	5	NONE	< 5.0##
Vinyl Chloride	µg/kg	5	NONE	< 5.0
Trichlorofluoromethane	µg/kg	5	NONE	< 5.0
1,1-Dichloroethene	µg/kg	5	NONE	< 5.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	< 5.0
Cis-1,2-dichloroethene	µg/kg	5	NONE	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0
1,1-Dichloroethane	µg/kg	5	NONE	< 5.0
2,2-Dichloropropane	µg/kg	5	NONE	< 5.0
Trichloromethane	µg/kg	5	NONE	< 5.0
1,1,1-Trichloroethane	µg/kg	5	NONE	< 5.0##
1,2-Dichloroethane	µg/kg	5	NONE	< 5.0
1,1-Dichloropropene	µg/kg	5	NONE	< 5.0##
Trans-1,2-dichloroethene	µg/kg	5	NONE	< 5.0
Benzene	µg/kg	5	NONE	< 5.0
Tetrachloromethane	µg/kg	5	NONE	< 5.0
1,2-Dichloropropane	µg/kg	5	NONE	< 5.0
Trichloroethene	µg/kg	5	NONE	< 5.0##
Dibromomethane	µg/kg	5	NONE	< 5.0
Bromodichloromethane	µg/kg	5	NONE	< 5.0
Cis-1,3-dichloropropene	µg/kg	5	NONE	< 5.0##
Trans-1,3-dichloropropene	µg/kg	5	NONE	< 5.0
Toluene	µg/kg	5	NONE	< 5.0
1,1,2-Trichloroethane	µg/kg	5	NONE	< 5.0
1,3-Dichloropropane	µg/kg	5	NONE	< 5.0
Dibromochloromethane	µg/kg	5	NONE	< 5.0
Tetrachloroethene	µg/kg	5	NONE	< 5.0##

Analytical Report Number: 23-31932
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2668681
Sample Reference				WTP05
Sample Number				None Supplied
Depth (m)				1.00
Date Sampled				21/04/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
1,2-Dibromoethane	µg/kg	5	NONE	< 5.0
Chlorobenzene	µg/kg	5	NONE	< 5.0
1,1,1,2-Tetrachloroethane	µg/kg	5	NONE	< 5.0
Ethylbenzene	µg/kg	5	NONE	< 5.0
p & m-Xylene	µg/kg	5	NONE	< 5.0
Styrene	µg/kg	5	NONE	< 5.0
Tribromomethane	µg/kg	5	NONE	< 5.0
o-Xylene	µg/kg	5	NONE	< 5.0
1,1,2,2-Tetrachloroethane	µg/kg	5	NONE	< 5.0
Isopropylbenzene	µg/kg	5	NONE	< 5.0##
Bromobenzene	µg/kg	5	NONE	< 5.0
n-Propylbenzene	µg/kg	5	NONE	< 5.0
2-Chlorotoluene	µg/kg	5	NONE	< 5.0##
4-Chlorotoluene	µg/kg	5	NONE	< 5.0
1,3,5-Trimethylbenzene	µg/kg	5	NONE	< 5.0
tert-Butylbenzene	µg/kg	5	NONE	< 5.0
1,2,4-Trimethylbenzene	µg/kg	5	NONE	< 5.0
sec-Butylbenzene	µg/kg	5	NONE	< 5.0##
1,3-Dichlorobenzene	µg/kg	5	NONE	< 5.0
p-Isopropyltoluene	µg/kg	5	NONE	< 5.0
1,2-Dichlorobenzene	µg/kg	5	NONE	< 5.0
1,4-Dichlorobenzene	µg/kg	5	NONE	< 5.0##
Butylbenzene	µg/kg	5	NONE	< 5.0
1,2-Dibromo-3-chloropropane	µg/kg	5	NONE	< 5.0##
1,2,4-Trichlorobenzene	µg/kg	5	NONE	< 5.0
Hexachlorobutadiene	µg/kg	5	NONE	< 5.0
1,2,3-Trichlorobenzene	µg/kg	5	NONE	< 5.0

SVOCs

Aniline	mg/kg	0.1	NONE	< 0.1
Phenol	mg/kg	0.2	NONE	< 0.2
2-Chlorophenol	mg/kg	0.1	NONE	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	NONE	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	NONE	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	NONE	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	< 0.1
2-Methylphenol	mg/kg	0.3	NONE	< 0.3
Hexachloroethane	mg/kg	0.05	NONE	< 0.05
Nitrobenzene	mg/kg	0.3	NONE	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	< 0.2
Isophorone	mg/kg	0.2	NONE	< 0.2
2-Nitrophenol	mg/kg	0.3	NONE	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	NONE	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	< 0.3
Naphthalene	mg/kg	0.05	NONE	0.51
2,4-Dichlorophenol	mg/kg	0.3	NONE	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1
Hexachlorobutadiene	mg/kg	0.1	NONE	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	< 0.2



Analytical Report Number: 23-31932
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Lab Sample Number				2668681
Sample Reference				WTP05
Sample Number				None Supplied
Depth (m)				1.00
Date Sampled				21/04/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
2-Methylnaphthalene	mg/kg	0.1	NONE	0.5
2-Chloronaphthalene	mg/kg	0.1	NONE	< 0.1
Dimethylphthalate	mg/kg	0.1	NONE	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	NONE	< 0.1
Acenaphthylene	mg/kg	0.05	NONE	< 0.05
Acenaphthene	mg/kg	0.05	NONE	3
2,4-Dinitrotoluene	mg/kg	0.2	NONE	< 0.2
Dibenzofuran	mg/kg	0.2	NONE	1.1
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	< 0.3
Diethyl phthalate	mg/kg	0.2	NONE	< 0.2
4-Nitroaniline	mg/kg	0.2	NONE	< 0.2
Fluorene	mg/kg	0.05	NONE	2.1
Azobenzene	mg/kg	0.3	NONE	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	NONE	< 0.2
Hexachlorobenzene	mg/kg	0.3	NONE	< 0.3
Phenanthrene	mg/kg	0.05	NONE	20
Anthracene	mg/kg	0.05	NONE	6.2
Carbazole	mg/kg	0.3	NONE	1.1
Dibutyl phthalate	mg/kg	0.2	NONE	< 0.2
Anthraquinone	mg/kg	0.3	NONE	< 0.3
Fluoranthene	mg/kg	0.05	NONE	30
Pyrene	mg/kg	0.05	NONE	25
Butyl benzyl phthalate	mg/kg	0.3	NONE	< 0.3
Benzo(a)anthracene	mg/kg	0.05	NONE	13
Chrysene	mg/kg	0.05	NONE	11
Benzo(b)fluoranthene	mg/kg	0.05	NONE	11
Benzo(k)fluoranthene	mg/kg	0.05	NONE	6.2
Benzo(a)pyrene	mg/kg	0.05	NONE	11
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	5.5
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	0.89
Benzo(ghi)perylene	mg/kg	0.05	NONE	5.8

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



Analytical Report Number: 23-31932
Project / Site name: Ashley House Cannon Factory
Your Order No: 122387

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2668681	WTP05	1.00	131	Loose Fibres	Amosite	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.



Analytical Report Number : 23-31932
Project / Site name: Ashley House Cannon Factory

* 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 *
2668681	WTP05	None Supplied	1	Brown clay and sand with gravel and stones.

Analytical Report Number : 23-31932
Project / Site name: Ashley House Cannon Factory

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
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
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
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
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	NONE
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W	NONE
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	NONE
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Organic matter (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
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS

Analytical Report Number : 23-31932
 Project / Site name: Ashley House Cannon Factory

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
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
 For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
 For method numbers ending in 'PL or B' 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

- Quality control parameter has a high recovery (outside of limit); however the associated result is below the reporting limit, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.



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Environmental Science

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Analytical Report Number : 23-31744

Replaces Analytical Report Number: 23-31744, issue no. 1

Additional analysis undertaken.

Product ID added for 2667590, 2667591 samples as per client's request

Project / Site name:	Ashley House - Cannon Factory	Samples received on:	03/05/2023
Your job number:	WIE16246	Samples instructed on/ Analysis started on:	03/05/2023
Your order number:	122387	Analysis completed by:	17/05/2023
Report Issue Number:	2	Report issued on:	19/05/2023
Samples Analysed:	10 water samples		

Signed:

Elżbieta Suchy
 Junior Reporting Specialist
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.



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667583	2667584	2667585	2667586
Sample Reference				BH102S	VWS06	BH04	BH101S
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.53	2.56	2.59	2.53
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1055	1115	1019	1208
Analytical Parameter (Water Analysis)				Units	Limit of detection	Accreditation Status	

General Inorganics

pH (L005B)	pH Units	N/A	ISO 17025	7.3	7.5	7.1	7.1
Sulphate as SO ₄	mg/l	0.045	ISO 17025	161	240	89.2	292
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0
Chloride	mg/l	0.15	ISO 17025	81	350	59	67
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	4.13	7.99	3.21	3.24
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	4.5	10	4.8	3.29
Total Inorganic Carbon (TIC)	mg/l	0.1	NONE	46.6	121	96.7	84.6
Nitrate as N	mg/l	0.01	ISO 17025	14.8	0.26	0.09	5.21
Nitrate as NO ₃	mg/l	0.05	ISO 17025	65.7	1.15	0.4	23.1
Nitrite as N	µg/l	1	ISO 17025	16	220	1.2	9.4
Nitrite as NO ₂	µg/l	5	ISO 17025	54	730	< 5.0	31

Hardness - Total	mg CaCO ₃ /l	1	ISO 17025	447	248	429	566
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	1.83	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	0.2	< 0.01	0.13	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	0.47	< 0.01	0.32	< 0.01
Fluorene	µg/l	0.01	ISO 17025	0.29	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	0.38	0.85	0.15	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	0.23	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	1.11	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	0.25	1.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	0.48	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	0.44	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	0.51	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	0.2	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	0.35	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	1.59	5.18	2.43	< 0.16
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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667583	2667584	2667585	2667586
Sample Reference				BH102S	VWS06	BH04	BH101S
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.53	2.56	2.59	2.53
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1055	1115	1019	1208
Analytical Parameter (Water Analysis)				Units	Limit of detection	Accreditation Status	

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	-	-	-	-
Cadmium (dissolved)	µg/l	0.08	ISO 17025	-	-	-	-
Calcium (dissolved)	mg/l	0.012	ISO 17025	160	89	150	200
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	-	-	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	-	-	-	-
Copper (dissolved)	µg/l	0.7	ISO 17025	-	-	-	-
Iron (dissolved)	mg/l	0.004	ISO 17025	0.013	0.067	0.82	0.015
Fe2+	mg/l	0.2	NONE	< 0.20	< 0.20	0.82	< 0.20
Fe3+	mg/l	0.2	NONE	< 0.20	< 0.20	< 0.20	< 0.20
Lead (dissolved)	µg/l	1	ISO 17025	-	-	-	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	10	6.4	12	16
Manganese (dissolved)	µg/l	0.06	ISO 17025	-	-	-	-
Mn (II)	mg/l	0.02	NONE	0.14	1.89	0.26	0.21
Mn (IV)	mg/l	0.02	NONE	< 0.02	0.77	< 0.02	< 0.02
Mercury (dissolved)	µg/l	0.5	ISO 17025	-	-	-	-
Nickel (dissolved)	µg/l	0.3	ISO 17025	-	-	-	-
Selenium (dissolved)	µg/l	4	ISO 17025	-	-	-	-
Zinc (dissolved)	µg/l	0.4	ISO 17025	-	-	-	-

Chromium (total)	µg/l	0.2	ISO 17025	0.2	-	-	0.6
Chromium (total)	µg/l	0.4	ISO 17025	-	-	-	-
Manganese (total)	µg/l	0.05	ISO 17025	200	-	-	630

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.68	-	-	0.31
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.03	-	-	0.05
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	-	-	0.6
Copper (dissolved)	µg/l	0.5	ISO 17025	4	-	-	5.4
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	-	-	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	120	-	-	210
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	-	-	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	6.8	-	-	7
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.1	-	-	6.3
Zinc (dissolved)	µg/l	0.5	ISO 17025	9.6	-	-	11

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	8.9	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	8.2	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667583	2667584	2667585	2667586
Sample Reference				BH102S	VWS06	BH04	BH101S
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.53	2.56	2.59	2.53
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1055	1115	1019	1208
Analytical Parameter (Water Analysis)				Units	Limit of detection	Accreditation Status	

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	130	< 1.0
TPH-CWG - Aliphatic >C6 - C8 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	48	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	560	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	3100	< 10	< 10
TPH-CWG - Aliphatic >C35 - C44 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	230	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH_ID_AL_MS}	µg/l	10	NONE	< 10	3700	130	< 10
TPH-CWG - Aliphatic (C5 - C44) _{HS+EH_ID_AL_MS}	µg/l	10	NONE	< 10	4000	130	< 10

TPH-CWG - Aromatic >C5 - C7 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	120	< 10
TPH-CWG - Aromatic >C12 - C16 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	20	< 10
TPH-CWG - Aromatic >C16 - C21 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	20	< 10
TPH-CWG - Aromatic >C21 - C35 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C35 - C44 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) _{HS+EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	160	< 10
TPH-CWG - Aromatic (C5 - C44) _{HS+EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	160	< 10

VOCs

Chloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Chloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Bromomethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Vinyl Chloride	µg/l	3	NONE	< 3.0	< 3.0	< 3.0	< 3.0
Trichlorofluoromethane	µg/l	3	NONE	< 3.0	< 3.0	< 3.0	< 3.0
1,1-Dichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0#	< 3.0
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1-Dichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
2,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Trichloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,1-Trichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1-Dichloropropene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Trans-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	8.9	< 3.0
Tetrachloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0#	< 3.0
1,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Trichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Dibromomethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Bromodichloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0#	< 3.0
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,2-Trichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,3-Dichloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Dibromochloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667583	2667584	2667585	2667586
Sample Reference				BH102S	VWS06	BH04	BH101S
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.53	2.56	2.59	2.53
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1055	1115	1019	1208
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				
Tetrachloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dibromoethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Chlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
p & m-Xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	8.2	< 3.0
Styrene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Tribromomethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
o-Xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,2,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Isopropylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Bromobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
n-Propylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
2-Chlorotoluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
4-Chlorotoluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
tert-Butylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	7.8	< 3.0
sec-Butylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,3-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
p-Isopropyltoluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,4-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Butylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Hexachlorobutadiene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0#	< 3.0
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0

Miscellaneous Organics

Product ID		N/A	NONE	-	-	-	-
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667587	2667588	2667589	2667590
Sample Reference				WS109	BH103	BH02	WWS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.60	2.52	2.43	2.64
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1002	1255	1416	1446
Analytical Parameter (Water Analysis)				Units	Limit of detection	Accreditation Status	

General Inorganics

pH (L005B)	pH Units	N/A	ISO 17025	7	7.2	6.9	U/S*
Sulphate as SO ₄	mg/l	0.045	ISO 17025	146	146	54.7	83.2
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	11
Chloride	mg/l	0.15	ISO 17025	52	45	67	34
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	2.89	2	14.3	34.7
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	4.18	2.01	14.5	96.2
Total Inorganic Carbon (TIC)	mg/l	0.1	NONE	95.1	83.8	92	70
Nitrate as N	mg/l	0.01	ISO 17025	0.35	5.05	0.1	0.15
Nitrate as NO ₃	mg/l	0.05	ISO 17025	1.55	22.4	0.45	0.65
Nitrite as N	µg/l	1	ISO 17025	< 1.0	< 1.0	200	1.7
Nitrite as NO ₂	µg/l	5	ISO 17025	< 5.0	< 5.0	650	5.7

Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	486	452	330	249
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.64	U/S*
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.69	U/S*
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.62	U/S*
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	1.14	U/S*
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.28	U/S*
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.24	U/S*
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.25	U/S*
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	U/S*

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	3.86	U/S*
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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667587	2667588	2667589	2667590
Sample Reference				WS109	BH103	BH02	WWS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.60	2.52	2.43	2.64
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1002	1255	1416	1446
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	-	-	-	6
Cadmium (dissolved)	µg/l	0.08	ISO 17025	-	-	-	< 0.08
Calcium (dissolved)	mg/l	0.012	ISO 17025	180	160	110	89
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	-	-	-	< 0.4
Copper (dissolved)	µg/l	0.7	ISO 17025	-	-	-	1.7
Iron (dissolved)	mg/l	0.004	ISO 17025	0.039	0.021	0.16	0.33
Fe2+	mg/l	0.2	NONE	< 0.20	< 0.20	< 0.20	0.33
Fe3+	mg/l	0.2	NONE	< 0.20	< 0.20	< 0.20	< 0.20
Lead (dissolved)	µg/l	1	ISO 17025	-	-	-	< 1.0
Magnesium (dissolved)	mg/l	0.005	ISO 17025	11	11	12	6.8
Manganese (dissolved)	µg/l	0.06	ISO 17025	-	-	-	8300
Mn (II)	mg/l	0.02	NONE	0.8	0.06	2.71	6.34
Mn (IV)	mg/l	0.02	NONE	0.04	< 0.02	0.05	1.12
Mercury (dissolved)	µg/l	0.5	ISO 17025	-	-	-	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	-	-	-	8.3
Selenium (dissolved)	µg/l	4	ISO 17025	-	-	-	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	-	-	-	5.1

Chromium (total)	µg/l	0.2	ISO 17025	5.9	0.6	1.4	-
Chromium (total)	µg/l	0.4	ISO 17025	-	-	-	114
Manganese (total)	µg/l	0.05	ISO 17025	630	400	3400	69000

Arsenic (dissolved)	µg/l	0.15	ISO 17025	11.4	0.38	1.51	-
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02	0.03	0.03	-
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.4	< 0.2	-
Copper (dissolved)	µg/l	0.5	ISO 17025	7.9	4.4	4.5	-
Lead (dissolved)	µg/l	0.2	ISO 17025	0.2	< 0.2	< 0.2	-
Manganese (dissolved)	µg/l	0.05	ISO 17025	530	51	2500	-
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	-
Nickel (dissolved)	µg/l	0.5	ISO 17025	7.9	2.8	6.5	-
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6	7	< 0.6	-
Zinc (dissolved)	µg/l	0.5	ISO 17025	5.2	10	12	-

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	6.5	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667587	2667588	2667589	2667590
Sample Reference				WS109	BH103	BH02	WWS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.60	2.52	2.43	2.64
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1002	1255	1416	1446
Analytical Parameter (Water Analysis)				Units	Limit of detection	Accreditation Status	

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6 _{HS_ID_AL}	µg/l	1	ISO 17025	26	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aliphatic >C12 - C16 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aliphatic >C16 - C21 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aliphatic >C21 - C35 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aliphatic >C35 - C44 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH_ID_AL_MS}	µg/l	10	NONE	26	< 10	< 10	U/S*
TPH-CWG - Aliphatic (C5 - C44) _{HS+EH_ID_AL_MS}	µg/l	10	NONE	26	< 10	< 10	U/S*

TPH-CWG - Aromatic >C5 - C7 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aromatic >C12 - C16 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aromatic >C16 - C21 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aromatic >C21 - C35 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aromatic >C35 - C44 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aromatic (C5 - C35) _{HS+EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*
TPH-CWG - Aromatic (C5 - C44) _{HS+EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10	U/S*

VOCs

Chloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Chloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Bromomethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Vinyl Chloride	µg/l	3	NONE	< 3.0	< 3.0	< 3.0	< 3.0
Trichlorofluoromethane	µg/l	3	NONE	< 3.0	< 3.0	< 3.0	< 3.0
1,1-Dichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	3	ISO 17025	< 3.0#	< 3.0	< 3.0#	< 3.0#
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1-Dichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
2,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Trichloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,1-Trichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1-Dichloropropene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Trans-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Benzene	µg/l	3	ISO 17025	6.5	< 3.0	< 3.0	< 3.0
Tetrachloromethane	µg/l	3	ISO 17025	< 3.0#	< 3.0	< 3.0#	< 3.0#
1,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Trichloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Dibromomethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Bromodichloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0#	< 3.0	< 3.0#	< 3.0#
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,2-Trichloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,3-Dichloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Dibromochloromethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667587	2667588	2667589	2667590
Sample Reference				WS109	BH103	BH02	WWS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.60	2.52	2.43	2.64
Date Sampled				02/05/2023	02/05/2023	02/05/2023	02/05/2023
Time Taken				1002	1255	1416	1446
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				
Tetrachloroethene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dibromoethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Chlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
p & m-Xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Styrene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Tribromomethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
o-Xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,1,2,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Isopropylbenzene	µg/l	3	ISO 17025	3.6	< 3.0	< 3.0	< 3.0
Bromobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
n-Propylbenzene	µg/l	3	ISO 17025	4.2	< 3.0	< 3.0	< 3.0
2-Chlorotoluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
4-Chlorotoluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
tert-Butylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
sec-Butylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,3-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
p-Isopropyltoluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,4-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Butylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Hexachlorobutadiene	µg/l	3	ISO 17025	< 3.0#	< 3.0	< 3.0#	< 3.0#
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0

Miscellaneous Organics

Product ID		N/A	NONE	-	-	-	See Appendix
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667591	2667592
Sample Reference				WWS10	Pymmes Brook
Sample Number				None Supplied	None Supplied
Depth (m)				2.55	None Supplied
Date Sampled				02/05/2023	02/05/2023
Time Taken				1513	1347
Analytical Parameter (Water Analysis)				Units	Limit of detection
				Accreditation Status	

General Inorganics

pH (L005B)	pH Units	N/A	ISO 17025	U/S*	7.4
Sulphate as SO ₄	mg/l	0.045	ISO 17025	174	-
Sulphide	µg/l	5	NONE	4200	-
Chloride	mg/l	0.15	ISO 17025	24	-
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	159	9.83
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	262	-
Total Inorganic Carbon (TIC)	mg/l	0.1	NONE	97.1	-
Nitrate as N	mg/l	0.01	ISO 17025	0.14	-
Nitrate as NO ₃	mg/l	0.05	ISO 17025	0.6	-
Nitrite as N	µg/l	1	ISO 17025	< 1.0	-
Nitrite as NO ₂	µg/l	5	ISO 17025	< 5.0	-

Hardness - Total	mg CaCO ₃ /l	1	ISO 17025	534	363
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	U/S*	-
Acenaphthylene	µg/l	0.01	ISO 17025	U/S*	-
Acenaphthene	µg/l	0.01	ISO 17025	U/S*	-
Fluorene	µg/l	0.01	ISO 17025	U/S*	-
Phenanthrene	µg/l	0.01	ISO 17025	U/S*	-
Anthracene	µg/l	0.01	ISO 17025	U/S*	-
Fluoranthene	µg/l	0.01	ISO 17025	U/S*	-
Pyrene	µg/l	0.01	ISO 17025	U/S*	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	U/S*	-
Chrysene	µg/l	0.01	ISO 17025	U/S*	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	U/S*	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	U/S*	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	U/S*	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	U/S*	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	U/S*	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	U/S*	-

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	U/S*	-
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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667591	2667592
Sample Reference				WWS10	Pymmes Brook
Sample Number				None Supplied	None Supplied
Depth (m)				2.55	None Supplied
Date Sampled				02/05/2023	02/05/2023
Time Taken				1513	1347
Analytical Parameter (Water Analysis)				Units	Limit of detection
				Accreditation Status	

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	8.8	-
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	-
Calcium (dissolved)	mg/l	0.012	ISO 17025	200	130
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	8.5	-
Copper (dissolved)	µg/l	0.7	ISO 17025	16	-
Iron (dissolved)	mg/l	0.004	ISO 17025	0.92	-
Fe2+	mg/l	0.2	NONE	0.92	-
Fe3+	mg/l	0.2	NONE	< 0.20	-
Lead (dissolved)	µg/l	1	ISO 17025	16	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	11	11
Manganese (dissolved)	µg/l	0.06	ISO 17025	3600	-
Mn (II)	mg/l	0.02	NONE	2.17	-
Mn (IV)	mg/l	0.02	NONE	1.34	-
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	-
Nickel (dissolved)	µg/l	0.3	ISO 17025	17	-
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	-
Zinc (dissolved)	µg/l	0.4	ISO 17025	19	-

Chromium (total)	µg/l	0.2	ISO 17025	-	0.3
Chromium (total)	µg/l	0.4	ISO 17025	970	-
Manganese (total)	µg/l	0.05	ISO 17025	240000	30

Arsenic (dissolved)	µg/l	0.15	ISO 17025	-	1.14
Cadmium (dissolved)	µg/l	0.02	ISO 17025	-	0.03
Chromium (dissolved)	µg/l	0.2	ISO 17025	-	0.3
Copper (dissolved)	µg/l	0.5	ISO 17025	-	7.5
Lead (dissolved)	µg/l	0.2	ISO 17025	-	0.3
Manganese (dissolved)	µg/l	0.05	ISO 17025	-	14
Mercury (dissolved)	µg/l	0.05	ISO 17025	-	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	-	5.5
Selenium (dissolved)	µg/l	0.6	ISO 17025	-	1.2
Zinc (dissolved)	µg/l	0.5	ISO 17025	-	22

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0	-
Toluene	µg/l	3	ISO 17025	< 3.0	-
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	-
p & m-xylene	µg/l	3	ISO 17025	< 3.0	-
o-xylene	µg/l	3	ISO 17025	< 3.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	-



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number	2667591	2667592
Sample Reference	WWS10	Pymmes Brook
Sample Number	None Supplied	None Supplied
Depth (m)	2.55	None Supplied
Date Sampled	02/05/2023	02/05/2023
Time Taken	1513	1347
Analytical Parameter (Water Analysis)	Units	Limit of detection
		Accreditation Status

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	-
TPH-CWG - Aliphatic >C6 - C8 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	-
TPH-CWG - Aliphatic >C8 - C10 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	-
TPH-CWG - Aliphatic >C10 - C12 _{EH_ID_AL_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aliphatic >C12 - C16 _{EH_ID_AL_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aliphatic >C16 - C21 _{EH_ID_AL_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aliphatic >C21 - C35 _{EH_ID_AL_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aliphatic >C35 - C44 _{EH_ID_AL_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH_ID_AL_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aliphatic (C5 - C44) _{HS+EH_ID_AL_MS}	µg/l	10	NONE	U/S*	-

TPH-CWG - Aromatic >C5 - C7 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	-
TPH-CWG - Aromatic >C7 - C8 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	-
TPH-CWG - Aromatic >C8 - C10 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	-
TPH-CWG - Aromatic >C10 - C12 _{EH_ID_AR_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aromatic >C12 - C16 _{EH_ID_AR_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aromatic >C16 - C21 _{EH_ID_AR_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aromatic >C21 - C35 _{EH_ID_AR_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aromatic >C35 - C44 _{EH_ID_AR_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aromatic (C5 - C35) _{HS+EH_ID_AR_MS}	µg/l	10	NONE	U/S*	-
TPH-CWG - Aromatic (C5 - C44) _{HS+EH_ID_AR_MS}	µg/l	10	NONE	U/S*	-

VOCs

Chloromethane	µg/l	3	ISO 17025	< 3.0	-
Chloroethane	µg/l	3	ISO 17025	< 3.0	-
Bromomethane	µg/l	3	ISO 17025	< 3.0	-
Vinyl Chloride	µg/l	3	NONE	< 3.0	-
Trichlorofluoromethane	µg/l	3	NONE	< 3.0	-
1,1-Dichloroethene	µg/l	3	ISO 17025	< 3.0	-
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	3	ISO 17025	< 3.0#	-
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	-
1,1-Dichloroethane	µg/l	3	ISO 17025	< 3.0	-
2,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0	-
Trichloromethane	µg/l	3	ISO 17025	< 3.0	-
1,1,1-Trichloroethane	µg/l	3	ISO 17025	< 3.0	-
1,2-Dichloroethane	µg/l	3	ISO 17025	< 3.0	-
1,1-Dichloropropene	µg/l	3	ISO 17025	< 3.0	-
Trans-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0	-
Benzene	µg/l	3	ISO 17025	< 3.0	-
Tetrachloromethane	µg/l	3	ISO 17025	< 3.0#	-
1,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0	-
Trichloroethene	µg/l	3	ISO 17025	< 3.0	-
Dibromomethane	µg/l	3	ISO 17025	< 3.0	-
Bromodichloromethane	µg/l	3	ISO 17025	< 3.0	-
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0#	-
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0	-
Toluene	µg/l	3	ISO 17025	< 3.0	-
1,1,2-Trichloroethane	µg/l	3	ISO 17025	< 3.0	-
1,3-Dichloropropane	µg/l	3	ISO 17025	< 3.0	-
Dibromochloromethane	µg/l	3	ISO 17025	< 3.0	-



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Environmental Science

Analytical Report Number: 23-31744

Project / Site name: Ashley House - Cannon Factory

Your Order No: 122387

Lab Sample Number				2667591	2667592
Sample Reference				WWS10	Pymmes Brook
Sample Number				None Supplied	None Supplied
Depth (m)				2.55	None Supplied
Date Sampled				02/05/2023	02/05/2023
Time Taken				1513	1347
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		
Tetrachloroethene	µg/l	3	ISO 17025	< 3.0	-
1,2-Dibromoethane	µg/l	3	ISO 17025	< 3.0	-
Chlorobenzene	µg/l	3	ISO 17025	< 3.0	-
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0	-
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	-
p & m-Xylene	µg/l	3	ISO 17025	< 3.0	-
Styrene	µg/l	3	ISO 17025	< 3.0	-
Tribromomethane	µg/l	3	ISO 17025	< 3.0	-
o-Xylene	µg/l	3	ISO 17025	< 3.0	-
1,1,2,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0	-
Isopropylbenzene	µg/l	3	ISO 17025	< 3.0	-
Bromobenzene	µg/l	3	ISO 17025	< 3.0	-
n-Propylbenzene	µg/l	3	ISO 17025	< 3.0	-
2-Chlorotoluene	µg/l	3	ISO 17025	< 3.0	-
4-Chlorotoluene	µg/l	3	ISO 17025	< 3.0	-
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0	-
tert-Butylbenzene	µg/l	3	ISO 17025	< 3.0	-
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0	-
sec-Butylbenzene	µg/l	3	ISO 17025	< 3.0	-
1,3-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	-
p-Isopropyltoluene	µg/l	3	ISO 17025	< 3.0	-
1,2-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	-
1,4-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0	-
Butylbenzene	µg/l	3	ISO 17025	< 3.0	-
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	< 3.0	-
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0	-
Hexachlorobutadiene	µg/l	3	ISO 17025	< 3.0#	-
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0	-

Miscellaneous Organics

Product ID		N/A	NONE	See Appendix	-
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U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



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Environmental Science

Analytical Report Number : 23-31744

Project / Site name: Ashley House - Cannon Factory

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
Metals in water by ICP-OES (total)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW (Al, Fe, Cu, Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-MS (total)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Iron (II) and Iron (III) in water	Determination of Iron II and Iron III in water by coloration with phenanthroline and calculation.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L079-PL	W	NONE
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025
Nitrite in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry).Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrate in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode.	In-house method	L029-PL	W	NONE
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	ISO 17025
Total organic carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR analyser. Accredited matrices: SW PW GW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025



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Environmental Science

Analytical Report Number : 23-31744

Project / Site name: Ashley House - Cannon Factory

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
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Nitrite as N in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Product ID	Determination of product ID by interpretation against standard chromatograms - Water.	In-house method	L070-PL/UK	W	NONE
Total inorganic carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025
Manganese II and IV in Water	Analysis of manganese compounds by periodate oxidation method.	In house method and calculation based on standard methods for the examination of water and waste water.	L090-PL	W	NONE
TPH in (Water)	Determination of TPH bands by HS-GC-MS/GC-MS	In-house method, TPH with carbon banding.	L088/70-PL	W	NONE
Chloride in water	Determination of Chloride (diissolved) colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.	L082-PL	W	ISO 17025

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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



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Environmental Science

Analytical Report Number : 23-31744

Project / Site name: Ashley House - Cannon Factory

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
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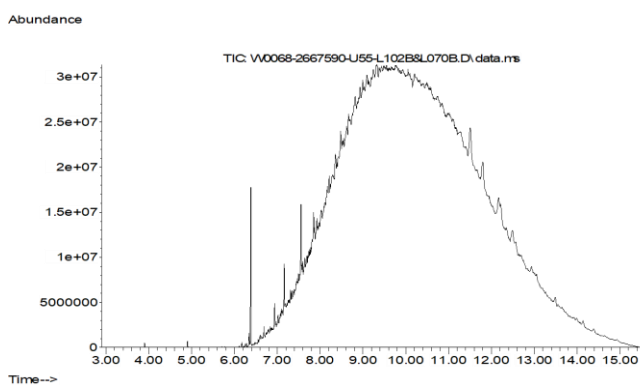
Operator - understore to separate acronyms (exception for +)

+

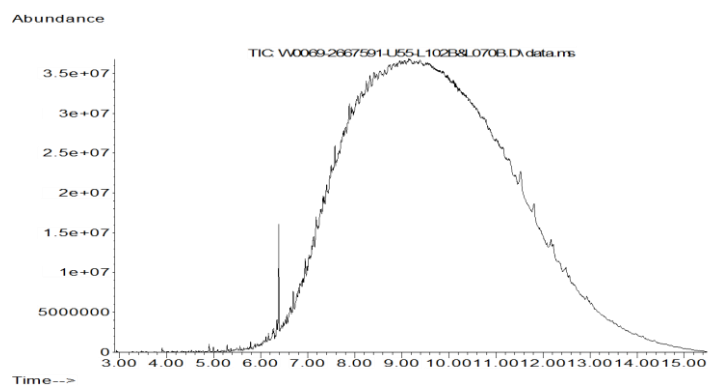
Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

*Analysis could not be completed due to sample matrix.

#Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and therefore may be compromised.



The total ion count (TIC trace) shows a carbon range from C16 to greater than C40
The sample TIC trace is complex, showing aromatic and aliphatic product sources.
The trace does not match the standard product profiles but is suggestive of lube oil.



The total ion count (TIC trace) shows a carbon range from C16 to greater than C40
The sample TIC trace is complex, showing aromatic and aliphatic product sources.
The trace does not match the standard product profiles but is suggestive of lube oil.



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Environmental Science

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WD18 8YS

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e: reception@i2analytical.com

Analytical Report Number : 23-34220

Project / Site name:	Ashley House Cannon Factory	Samples received on:	17/05/2023
Your job number:	WIE16248	Samples instructed on/ Analysis started on:	17/05/2023
Your order number:	122387	Analysis completed by:	24/05/2023
Report Issue Number:	1	Report issued on:	24/05/2023
Samples Analysed:	5 water 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.



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Environmental Science

Analytical Report Number: 23-34220

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number	2681944	2681945	2681946	2681947
Sample Reference	WWS08	BH01	WWS02	WWS10
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	2.51	2.32	2.62	2.58
Date Sampled	16/05/2023	16/05/2023	16/05/2023	16/05/2023
Time Taken	1007	1120	1142	1204
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH (L005B)	pH Units	N/A	ISO 17025	7.5	7	7.1	7.1
Sulphate as SO ₄	µg/l	45	ISO 17025	390000	40400	-	-
Sulphate as SO ₄	mg/l	0.045	ISO 17025	390	40.4	-	-
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	-	-
Chloride	mg/l	0.15	ISO 17025	43	15	-	-
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	7.3	1.76	39.5	U/S
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	7.35	1.86	-	-
Total Inorganic Carbon (TIC)	mg/l	0.1	NONE	121	38.8	-	-
Nitrate as N	mg/l	0.01	ISO 17025	0.58	4.99	-	-
Nitrate as NO ₃	mg/l	0.05	ISO 17025	2.55	22.1	-	-
Nitrite as N	µg/l	1	ISO 17025	11	6.3	-	-
Nitrite as NO ₂	µg/l	5	ISO 17025	35	21	-	-

Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	662	191	274	474
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16
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Heavy Metals / Metalloids

Calcium (dissolved)	mg/l	0.012	ISO 17025	240	71	97	170
Chromium (hexavalent)	µg/l	5	ISO 17025	-	< 5.0	-	-
Iron (dissolved)	mg/l	0.004	ISO 17025	0.036	0.024	-	-
Fe ²⁺	mg/l	0.2	NONE	< 0.20	< 0.20	-	-
Fe ³⁺	mg/l	0.2	NONE	< 0.20	< 0.20	-	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	14	3.4	7.6	10
Mn (II)	mg/l	0.02	NONE	0.66	0.03	-	-
Mn (IV)	mg/l	0.02	NONE	0.54	< 0.02	-	-

Lead (total)	µg/l	0.2	ISO 17025	-	< 0.2	-	-
Manganese (total)	µg/l	0.05	ISO 17025	-	610	-	-
Mercury (total)	µg/l	0.05	ISO 17025	-	< 0.05	-	-
Nickel (total)	µg/l	0.5	ISO 17025	-	14	-	-
Selenium (total)	µg/l	0.6	ISO 17025	-	1.2	-	-



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Environmental Science

Analytical Report Number: 23-34220

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number				2681944	2681945	2681946	2681947
Sample Reference				WWS08	BH01	WWS02	WWS10
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.51	2.32	2.62	2.58
Date Sampled				16/05/2023	16/05/2023	16/05/2023	16/05/2023
Time Taken				1007	1120	1142	1204
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				
Zinc (total)	µg/l	0.5	ISO 17025	-	2.4	-	-

Arsenic (dissolved)	µg/l	0.15	ISO 17025	-	0.43	-	-
Cadmium (dissolved)	µg/l	0.02	ISO 17025	-	< 0.02	-	-
Chromium (dissolved)	µg/l	0.2	ISO 17025	-	0.3	-	-
Copper (dissolved)	µg/l	0.5	ISO 17025	-	1.6	-	-
Lead (dissolved)	µg/l	0.2	ISO 17025	-	< 0.2	-	-
Manganese (dissolved)	µg/l	0.05	ISO 17025	-	3.4	-	-
Mercury (dissolved)	µg/l	0.05	ISO 17025	-	< 0.05	-	-
Nickel (dissolved)	µg/l	0.5	ISO 17025	-	1.6	-	-
Selenium (dissolved)	µg/l	0.6	ISO 17025	-	1.1	-	-
Zinc (dissolved)	µg/l	0.5	ISO 17025	-	2.1	-	-

Copper (total)	µg/l	0.5	ISO 17025	-	7.9	-	-
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Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6## _{HS 1D AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8## _{HS 1D AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10## _{HS 1D AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 _{EH 1D AL MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 _{EH 1D AL MS}	µg/l	10	NONE	< 10	< 10	< 10	1300
TPH-CWG - Aliphatic >C16 - C21 _{EH 1D AL MS}	µg/l	10	NONE	< 10	< 10	3800	38000
TPH-CWG - Aliphatic >C21 - C35 _{EH 1D AL MS}	µg/l	10	NONE	< 10	< 10	20000	120000
TPH-CWG - Aliphatic >C35 - C44 _{EH 1D AL MS}	µg/l	10	NONE	< 10	< 10	340	370
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH 1D AL MS}	µg/l	10	NONE	< 10	< 10	24000	160000
TPH-CWG - Aliphatic (C5 - C44) _{HS+EH 1D AL MS}	µg/l	10	NONE	< 10	< 10	25000	160000

TPH-CWG - Aromatic >C5 - C7 _{HS 1D AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 _{HS 1D AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 _{HS 1D AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 _{EH 1D AR MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 _{EH 1D AR MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 _{EH 1D AR MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 _{EH 1D AR MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C35 - C44 _{EH 1D AR MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) _{HS+EH 1D AR MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C44) _{HS+EH 1D AR MS}	µg/l	10	NONE	< 10	< 10	< 10	< 10

VOCs

Chloromethane##	µg/l	3	ISO 17025	-	< 3.0	-	-
Chloroethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Bromomethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Vinyl Chloride	µg/l	3	NONE	-	< 3.0	-	-
Trichlorofluoromethane	µg/l	3	NONE	-	< 3.0	-	-
1,1-Dichloroethene##	µg/l	3	ISO 17025	-	< 3.0	-	-
1,1,2-Trichloro-1,2,2-trifluoroethane##	µg/l	3	ISO 17025	-	< 3.0	-	-



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Environmental Science

Analytical Report Number: 23-34220

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number				2681944	2681945	2681946	2681947
Sample Reference				WWS08	BH01	WWS02	WWS10
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.51	2.32	2.62	2.58
Date Sampled				16/05/2023	16/05/2023	16/05/2023	16/05/2023
Time Taken				1007	1120	1142	1204
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	-	< 3.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	-	< 3.0	-	-
1,1-Dichloroethane	µg/l	3	ISO 17025	-	< 3.0	-	-
2,2-Dichloropropane	µg/l	3	ISO 17025	-	< 3.0	-	-
Trichloromethane	µg/l	3	ISO 17025	-	< 3.0	-	-
1,1,1-Trichloroethane##	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2-Dichloroethane	µg/l	3	ISO 17025	-	< 3.0	-	-
1,1-Dichloropropene	µg/l	3	ISO 17025	-	< 3.0	-	-
Trans-1,2-dichloroethene	µg/l	3	ISO 17025	-	< 3.0	-	-
Benzene	µg/l	3	ISO 17025	-	< 3.0	-	-
Tetrachloromethane##	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2-Dichloropropane	µg/l	3	ISO 17025	-	< 3.0	-	-
Trichloroethene	µg/l	3	ISO 17025	-	< 3.0	-	-
Dibromomethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Bromodichloromethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	-	< 3.0	-	-
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	-	< 3.0	-	-
Toluene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,1,2-Trichloroethane	µg/l	3	ISO 17025	-	< 3.0	-	-
1,3-Dichloropropane	µg/l	3	ISO 17025	-	< 3.0	-	-
Dibromochloromethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Tetrachloroethene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2-Dibromoethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Chlorobenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Ethylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
p & m-Xylene	µg/l	3	ISO 17025	-	< 3.0	-	-
Styrene	µg/l	3	ISO 17025	-	< 3.0	-	-
Tribromomethane	µg/l	3	ISO 17025	-	< 3.0	-	-
o-Xylene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,1,2,2-Tetrachloroethane	µg/l	3	ISO 17025	-	< 3.0	-	-
Isopropylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
Bromobenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
n-Propylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
2-Chlorotoluene	µg/l	3	ISO 17025	-	< 3.0	-	-
4-Chlorotoluene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
tert-Butylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
sec-Butylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,3-Dichlorobenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
p-Isopropyltoluene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2-Dichlorobenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,4-Dichlorobenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
Butylbenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	-	< 3.0	-	-
Hexachlorobutadiene##	µg/l	3	ISO 17025	-	< 3.0	-	-
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	-	< 3.0	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



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Environmental Science

Analytical Report Number: 23-34220

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number				2681948
Sample Reference				WWS06
Sample Number				None Supplied
Depth (m)				2.53
Date Sampled				16/05/2023
Time Taken				1039
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH (L005B)	pH Units	N/A	ISO 17025	7.1
Sulphate as SO ₄	µg/l	45	ISO 17025	-
Sulphate as SO ₄	mg/l	0.045	ISO 17025	-
Sulphide	µg/l	5	NONE	-
Chloride	mg/l	0.15	ISO 17025	-
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	3.45
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	-
Total Inorganic Carbon (TIC)	mg/l	0.1	NONE	-
Nitrate as N	mg/l	0.01	ISO 17025	-
Nitrate as NO ₃	mg/l	0.05	ISO 17025	-
Nitrite as N	µg/l	1	ISO 17025	-
Nitrite as NO ₂	µg/l	5	ISO 17025	-

Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	314
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16
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Heavy Metals / Metalloids

Calcium (dissolved)	mg/l	0.012	ISO 17025	120
Chromium (hexavalent)	µg/l	5	ISO 17025	-
Iron (dissolved)	mg/l	0.004	ISO 17025	-
Fe ²⁺	mg/l	0.2	NONE	-
Fe ³⁺	mg/l	0.2	NONE	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	5.9
Mn (II)	mg/l	0.02	NONE	-
Mn (IV)	mg/l	0.02	NONE	-

Lead (total)	µg/l	0.2	ISO 17025	-
Manganese (total)	µg/l	0.05	ISO 17025	-
Mercury (total)	µg/l	0.05	ISO 17025	-
Nickel (total)	µg/l	0.5	ISO 17025	-
Selenium (total)	µg/l	0.6	ISO 17025	-



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Environmental Science

Analytical Report Number: 23-34220

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number				2681948
Sample Reference				WWS06
Sample Number				None Supplied
Depth (m)				2.53
Date Sampled				16/05/2023
Time Taken				1039
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
Zinc (total)	µg/l	0.5	ISO 17025	-

Arsenic (dissolved)	µg/l	0.15	ISO 17025	-
Cadmium (dissolved)	µg/l	0.02	ISO 17025	-
Chromium (dissolved)	µg/l	0.2	ISO 17025	-
Copper (dissolved)	µg/l	0.5	ISO 17025	-
Lead (dissolved)	µg/l	0.2	ISO 17025	-
Manganese (dissolved)	µg/l	0.05	ISO 17025	-
Mercury (dissolved)	µg/l	0.05	ISO 17025	-
Nickel (dissolved)	µg/l	0.5	ISO 17025	-
Selenium (dissolved)	µg/l	0.6	ISO 17025	-
Zinc (dissolved)	µg/l	0.5	ISO 17025	-

Copper (total)	µg/l	0.5	ISO 17025	-
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Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6## _{HS,1D,AL}	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C6 - C8## _{HS,1D,AL}	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C8 - C10## _{HS,1D,AL}	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C10 - C12 _{EH,1D,AL,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C12 - C16 _{EH,1D,AL,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C16 - C21 _{EH,1D,AL,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C21 - C35 _{EH,1D,AL,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C35 - C44 _{EH,1D,AL,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH,1D,AL,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic (C5 - C44) _{HS+EH,1D,AL,MS}	µg/l	10	NONE	< 10

TPH-CWG - Aromatic >C5 - C7 _{HS,1D,AR}	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C7 - C8 _{HS,1D,AR}	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C8 - C10 _{HS,1D,AR}	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C10 - C12 _{EH,1D,AR,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C12 - C16 _{EH,1D,AR,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C16 - C21 _{EH,1D,AR,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C21 - C35 _{EH,1D,AR,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C35 - C44 _{EH,1D,AR,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aromatic (C5 - C35) _{HS+EH,1D,AR,MS}	µg/l	10	NONE	< 10
TPH-CWG - Aromatic (C5 - C44) _{HS+EH,1D,AR,MS}	µg/l	10	NONE	< 10

VOCs

Chloromethane##	µg/l	3	ISO 17025	-
Chloroethane	µg/l	3	ISO 17025	-
Bromomethane	µg/l	3	ISO 17025	-
Vinyl Chloride	µg/l	3	NONE	-
Trichlorofluoromethane	µg/l	3	NONE	-
1,1-Dichloroethene##	µg/l	3	ISO 17025	-
1,1,2-Trichloro-1,2,2-trifluoroethane##	µg/l	3	ISO 17025	-



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Environmental Science

Analytical Report Number: 23-34220

Project / Site name: Ashley House Cannon Factory

Your Order No: 122387

Lab Sample Number				2681948
Sample Reference				WWS06
Sample Number				None Supplied
Depth (m)				2.53
Date Sampled				16/05/2023
Time Taken				1039
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	-
1,1-Dichloroethane	µg/l	3	ISO 17025	-
2,2-Dichloropropane	µg/l	3	ISO 17025	-
Trichloromethane	µg/l	3	ISO 17025	-
1,1,1-Trichloroethane##	µg/l	3	ISO 17025	-
1,2-Dichloroethane	µg/l	3	ISO 17025	-
1,1-Dichloropropene	µg/l	3	ISO 17025	-
Trans-1,2-dichloroethene	µg/l	3	ISO 17025	-
Benzene	µg/l	3	ISO 17025	-
Tetrachloromethane##	µg/l	3	ISO 17025	-
1,2-Dichloropropane	µg/l	3	ISO 17025	-
Trichloroethene	µg/l	3	ISO 17025	-
Dibromomethane	µg/l	3	ISO 17025	-
Bromodichloromethane	µg/l	3	ISO 17025	-
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	-
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	-
Toluene	µg/l	3	ISO 17025	-
1,1,2-Trichloroethane	µg/l	3	ISO 17025	-
1,3-Dichloropropane	µg/l	3	ISO 17025	-
Dibromochloromethane	µg/l	3	ISO 17025	-
Tetrachloroethene	µg/l	3	ISO 17025	-
1,2-Dibromoethane	µg/l	3	ISO 17025	-
Chlorobenzene	µg/l	3	ISO 17025	-
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	-
Ethylbenzene	µg/l	3	ISO 17025	-
p & m-Xylene	µg/l	3	ISO 17025	-
Styrene	µg/l	3	ISO 17025	-
Tri bromomethane	µg/l	3	ISO 17025	-
o-Xylene	µg/l	3	ISO 17025	-
1,1,2,2-Tetrachloroethane	µg/l	3	ISO 17025	-
Isopropylbenzene	µg/l	3	ISO 17025	-
Bromobenzene	µg/l	3	ISO 17025	-
n-Propylbenzene	µg/l	3	ISO 17025	-
2-Chlorotoluene	µg/l	3	ISO 17025	-
4-Chlorotoluene	µg/l	3	ISO 17025	-
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	-
tert-Butylbenzene	µg/l	3	ISO 17025	-
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	-
sec-Butylbenzene	µg/l	3	ISO 17025	-
1,3-Dichlorobenzene	µg/l	3	ISO 17025	-
p-Isopropyltoluene	µg/l	3	ISO 17025	-
1,2-Dichlorobenzene	µg/l	3	ISO 17025	-
1,4-Dichlorobenzene	µg/l	3	ISO 17025	-
Butylbenzene	µg/l	3	ISO 17025	-
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	-
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	-
Hexachlorobutadiene##	µg/l	3	ISO 17025	-
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



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Environmental Science

Analytical Report Number : 23-34220

Project / Site name: Ashley House Cannon Factory

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
Metals in water by ICP-MS (total)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Iron (II) and Iron (III) in water	Determination of Iron II and Iron III in water by coloration with phenanthroline and calculation.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L079-PL	W	NONE
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025
Nitrite in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrate in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
pH at 20oC in water	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L005-PL	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode.	In-house method	L029-PL	W	NONE
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	ISO 17025
Total organic carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR analyser. Accredited matrices: SW PW GW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025



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Environmental Science

Analytical Report Number : 23-34220

Project / Site name: Ashley House Cannon Factory

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
Nitrite as N in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Total inorganic carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Manganese II and IV in Water	Analysis of manganese compounds by periodate oxidation method.	In house method and calculation based on standard methods for the examination of water and waste water.	L090-PL	W	NONE
TPH in (Water)	Determination of TPH bands by HS-GC-MS/GC-MS	In-house method, TPH with carbon banding.	L088/70-PL	W	NONE
Chloride in water	Determination of Chloride (dissolved) colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.	L082-PL	W	ISO 17025

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' 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 30°C.

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

- Quality control parameter has a high recovery (outside of limit); however the associated result is below the reporting limit, other checks applied prior to report data have been accepted. The result should be considered as being deviating and may be compromised.



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Appendix E Controlled Waters Detailed Quantitative Risk Assessment Data

- I. Derivation of Site Specific Remediation Target Values – Cannon Factory**
- II. Parameter Calculations – Cannon Factory**
- III. Remedial Target Worksheets – Cannon Factory**
- IV. Derivation of Site Specific Remediation Target Values – Ashley House**
- V. Parameter Calculations – Ashley House**
- VI. Remedial Target Worksheets – Ashley House**

I. Derivation of Site Specific Remediation Target Values - Cannon Factory

1. Derivation of Site Specific Remediation Target Values – Cannon Factory

Elevated concentrations of hydrocarbons were recorded in the groundwater at the Site. Lines of Evidence indicate the source of this contamination is likely to be from off-site. However, to confirm the concentrations recorded at the Site pose a low risk to the surrounding controlled waters environment, the following risk assessment has been completed. The following section outlines the methodology used together with justification of the input parameters.

1.1 Remedial Targets Methodology

Assessment of the potential risk to controlled water receptors from the identified contaminants of concern has been progressed using the EA Remedial Targets Methodology (RTM). The EA RTM model is a one-dimensional fate and transport single porosity model, which assess contaminant and groundwater migration in the intergranular flow pathway. Contaminants are present in the groundwater, the Level 3 groundwater assessment has therefore been used to model contaminant fate and transport on-site.

Conservatism

The RTM model is a deterministic model which attempts to replicate ground conditions from Site specific and literature information in order to conclude the possible risks to receptors, and generate criteria at which an impact at the receptor is absent. Due to the complexities of ground conditions and contaminant fate and transport in the environment any model is inevitably a very simplified assessment which may not consider various factors and is likely to provide an overly conservative assessment even with Site specific values. Examples of conservatism built into the model and the outputs are included below;

- The RTM Model assumes below ground obstructions are absent and a linear groundwater and contaminant flow path comprising a homogeneous material is present between the source and receptor. However, the aquifer is not located within a heterogeneous material and several below ground obstructions are present in the local area including basements, likely to be distorting groundwater flow. Groundwater and contaminant flow are likely to be less than modelled with increased attenuation of contaminants along the flow path expected.
- An assumption has been made on the plume extending through the whole groundwater body, no allowance has been made for vertical contaminant concentration in the groundwater body. Utilisation of a plume through the entire groundwater body retains conservatism within the model.
- The RTM assessment models the soil transport pathway through predicting the proportion of a contaminant that will enter the dissolved phase within the soil. The dissolved component is then assumed as mixing with and becoming diluted by the underlying groundwater. The dilution is calculated from the ratio of infiltrating rainwater and groundwater flux. The RTM model does not however account for any potential attenuation as the leaching contaminant percolates through the vadose zone.
- The initial concentrations used are set at the maximum recorded groundwater concentrations, the maximum groundwater concentrations are assumed to originate from the closest monitoring well to the Site boundary. The use of the maximum concentration also assumes that concentration is present across the entire Site whereas in reality the maximum concentration is limited in its extent.
- No application of vertical transport retardation in the unsaturated zone including volatilisation of contaminants.

1.2 Physical and Chemical Input Parameters

Table 1 presents the physical and chemical input parameters and associated references used within the RTM worksheets.

Table 1: Controlled Waters Risk Assessment Input Parameters

Parameter	Value	Unit	Information Source
Level 1			
Water Filled Porosity	0.24	Fraction	The water bearing strata at the site is generally described as comprising very gravelly sand to very sandy gravel representing the Kempton Park Gravel Member. A Particle Size Distribution (PSD) test undertaken by Socotec indicated the gravel fraction to range from 83% to 92%. The standard default values for a sandy soil as specified in EA Science Report SCO50021/SR3 are used.
Air Filled Porosity	0.30	Fraction	The water bearing strata at the site is generally described as comprising very gravelly sand to very sandy gravel representing the Kempton Park Gravel Member. A Particle Size Distribution (PSD) test undertaken by Socotec indicated the gravel fraction to range from 83% to 92%. The standard default values for a sandy soil as specified in EA Science Report SCO50021/SR3 are used.
Bulk Density of Soil Zone Material	1.18	g/cm ³	The water bearing strata at the site is generally described as comprising very gravelly sand to very sandy gravel representing the Kempton Park Gravel Member. A Particle Size Distribution (PSD) test undertaken by Socotec indicated the gravel fraction to range from 83% to 92%. The standard default values for a sandy soil as specified in EA Science Report SCO50021/SR3 are used.
Fraction of Organic Carbon in the Soil	0.012	Fraction	An average value has been selected based on the TOC values recorded within the Sand and Gravel site soils, refer to Appendix E sub-section II.
Level 2			
Infiltration	4.33x10 ⁻⁶	m/day	Based on a total annual rainfall between 2000 and 2022 of 631.9mm/year (Annual Rainfall for Heathrow). Based on the proposed landscaping parameters drawing (ref: 449-102 Rev 02 included in Appendix A) 95% of the site is proposed to be hardstanding, therefore a 5% of the rainfall is assumed to fall on permeable ground. Of the 5% falling on permeable ground the effective rainfall is calculated as 5% of annual rainfall entering the groundwater.
Length of contaminant source in direction of groundwater flow	50.57	m	Elevated concentrations of heavy chained hydrocarbons were recorded in soil samples from WWS02, WWS10, WWS11 and WTP03 within the sand and gravel band representing Kempton Park Gravels with TPH trace suggestive of Lube oil. However, water samples from WWS02 and WWS10 could not be analysed due to high content of silt. The only water sample obtained from BH02, situated c. 15m

Parameter	Value	Unit	Information Source
			downgradient of WWS10, recorded TPH concentrations below the laboratory limits of detection. The distance between exploratory hole locations is approximately 50.57m therefore this is taken as a dimension of the hotspot. This is considered to be an overestimation of a potential hotspot, however, to provide a conservative assessment, this value has been adopted.
Saturated aquifer thickness	3.1	m	Thickness of the Secondary A aquifer, comprising the Kempton Park Gravels, is taken from the borehole observations as the depth of strike to the low permeability layer.
Hydraulic gradient of water table	0.0069	-	Calculated as an average hydraulic gradient from on-site groundwater levels from the first monitoring round considered to be most representative of groundwater levels across the monitoring period. Refer to Appendix E sub-section II for calculations.
Hydraulic conductivity of aquifer in which dilution occurs	0.0101	m/d	Representative of the Secondary A Aquifer, comprising the Kempton Park Gravels. Based on average of site specific Falling Head Tests. Refer to Appendix E sub-section II for calculations.
Width of contaminant perpendicular to groundwater flow	25	m	No specific hotspots of contamination were recorded at the Site, however, the distance between exploratory hole locations is approximately 25m therefore this is taken as a dimension of the hotspot.
Level 3 – soil			
Distance to compliance point	50m	m	The default 50 metres compliance point is used in the model for Hazardous Substances.
Bulk Density	1.18	g/cm ²	The Kempton Park Gravels at the site are heterogeneous but are generally described as sand and gravel. The standard default values for a sand as specified in EA Science Report SCO50021/SR3 are used.
Fraction of Organic Carbon in the Aquifer	0.012	fraction	An average value has been selected based on the TOC values recorded within the superficial site soils (Kempton Park Gravels), refer to Appendix E sub-section II.
Level 3 – Groundwater			
Effective Porosity	0.2	%	Adjusted value given Domenico et al identify a total porosity for sand/gravel between 24% and 53%.
Bulk Density of Aquifer	1.18	g/m ²	The Kempton Park Gravels at the site are heterogeneous but are generally described as sand and gravel. The standard default values for a sand as specified in EA Science Report SCO50021/SR3 are used.
Plume thickness	3.1	m	Entire width of saturated aquifer.
Dispersivity	1 dimension User defined	-	Dispersivity in one direction has been used simulating a source at the top of the groundwater body. Xu and Eckstein has been used with the vertical dispersion altered to a low number to ensure the plume thickness does not exceed the physical limits of the aquifer. This is as advised in the 2006 EA RTM User Manual.

Parameter	Value	Unit	Information Source
Initial contaminant concentration in groundwater at plume core.	0.00028 (fluoranthene)	mg/l	Taken as the maximum contaminant concentration recorded in groundwater over the course of the groundwater monitoring.
	<0.000001 (benzo(b)fluoranthene)		
	<0.000001 (Benzo(k)fluoranthene)		
	<0.001 (Arom >C05-C06 (Benzene))		
	<0.001 (Arom >C08-C10 (xylenes))		
	<0.001 (Arom >C10-C12)		
	<0.001 (Arom >C12-C16)		
	0.00024 (Arom >C16- C21(anthracene))		
	<0.000001 (Arom >C21-C35 (benzo[a]pyrene))		
	<0.001 (Ali >C5- C6)		
	1.3 (Ali >C12 – C16)		
	38 (Ali >C16-C21)		
	120 (Ali >C21- C35)		
	0.37 (Ali >C35- C44)		

1.2.1 Hydraulic Gradient

Groundwater monitoring on a Site wide basis has been undertaken by Waterman on two occasions on 3rd and 16th of May 2023, within which groundwater levels have generally remained consistent between monitoring rounds. The groundwater levels recorded are presented in Appendix E sub-section II, with the first round of groundwater level readings used to calculate the hydraulic gradient.

The hydraulic gradient of the site was calculated based on groundwater levels recorded in the Kempton Park Gravels. Known distances between boreholes and changes in piezometric surface were calculated to derive hydraulic gradients. Analysis of the range of values indicates a small variation across the site.

The range in values was calculated between 0.0032 and 0.014, which is considered to be indicative of the heterogeneous nature of the Kempton Park Gravels, comprising varying sand and gravel content. To decide on a representative value to be used within this risk assessment, basic statistics were calculated including the mean and median value. The mean was derived as 0.0069, with a standard deviation of 0.005, alternatively the median was calculated, which was 0.0051. To provide a representative value,

0.0069 has been used within this risk assessment. Appendix E sub-section II presents the derived input parameters used in the Controlled Waters Risk Assessment.

The inferred groundwater direction plan (Figure Ref WIE16248-100_GIS_GQRA_6A, Appendix A) indicates the movement of groundwater is generally to the west.

1.2.2 Hydraulic Conductivity

Two falling head tests were undertaken as part of the Waterman Ground Investigation in 2023. The falling head test was completed in the Kempton Park Gravel (shallow groundwater body) and the results summarised in Table 2.

Table 2: Hydraulic conductivity test results

Borehole ID	Depth of falling head test (m bgl)	Strata	Hydraulic Conductivity (k) m/s
WWS03	2.0-3.0	Made Ground to 1.0mbgl (reinforced concrete underlain by granular Mad Ground). Clay to 1.8mbgl (soft orange brown very sandy gravelly Clay. Gravel is angular to subrounded fine to coarse of flint and quartzite.) Kempton Park Gravel to 3.0mbgl (orange, brown clayey gravelly fine to medium SAND. Gravel is angular to subrounded fine to coarse of flint and quartzite.)	1.8×10^{-07}
WWS11	2.5-3.5	Made Ground to 1.3mbgl (reinforced concrete underlain by granular Mad Ground). Silt to 2.3mbgl (Soft orange brown sandy gravelly fine to medium SILT.) Kempton Park Gravel to 3.5mbgl (Brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to medium)	5.32×10^{-08}

One falling head test was also completed on the adjacent Ashley House site. Although this is a different site, it is underlain by the Kempton Park Member, and is located approximately 85m to the southwest of the Cannon Factory Site. The results of the falling head tests for Ashley House are summarised in Table 3 below.

Table 3: Hydraulic conductivity test results (Ashley House)

Borehole ID	Depth of falling head test (m bgl)	Strata	Hydraulic Conductivity (k) m/s
WWS04	2.5-3.5	Made Ground to 1.3mbgl (variable Made Ground consisting of coarse gravel and fine to coarse sand). Silt to 2.1mbgl (soft brown clayey sandy Silt. Sand is fine to medium.) Kempton Park Gravel to 3.5mbgl (brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to coarse.)	1.32×10^{-06}

The variability of the values between 1.32×10^{-06} and 5.32×10^{-08} m/s indicates a variable permeability within the Kempton Park Gravel.

The relevance of this value measured can be compared to literature values.

Domenico and Schwartz 1990 provide literature values for gravel between 3×10^{-4} and 3×10^{-2} m/s and for coarse sand between 9×10^{-7} and 6×10^{-3} m/s.

Freeze and Cherry, 1979, provides literature values for gravel between 1×10^{-3} and 1.0 m/s, with a sandy gravel given as between 1×10^{-3} m/s and 1×10^{-2} m/s. The Kempton Park Gravels are generally described as between gravelly sand and a sandy gravel, which would indicate 1×10^{-2} m/s and 1×10^{-3} m/s, might be relevant literature values.

Falling head tests were not previously undertaken for the Site as part of the 2015 RSK and 2019 Socotec ground investigations.

Measured hydraulic conductivity from the ground investigation works indicates the site derived values are much lower than those expected from the literature values. This could be due the compaction of the strata and variable sand and gravel content. To ensure the assessment remains site specific the site derived hydraulic conductivity will be applied.

It is therefore considered that the hydraulic conductivity recorded on the Site is representative and will be applied.

1.2.3 Saturated Aquifer Thickness

Two rounds of groundwater monitoring have been completed following the completion of ground investigations. The results of the groundwater monitoring of the shallow aquifer have been tabulated and included in Appendix E sub-section II.

The saturated aquifer thickness of 3.1m is utilised in the assessment. The value is extrapolated from the recorded groundwater strikes and depth of low permeability London Clay as an average thickness.

1.2.4 Infiltration

Hard Cover and Soft landscaping

Soft landscaping is proposed as part of the development, bordering western and most of the northern Site boundaries. It is estimated that soft landscaping will cover approximately 5% of the proposed development. As a result the ground cover will remain open and the volume of infiltration through these areas will be much higher than the surrounding Development areas.

Based on this type of land-use and ground conditions across the site (sand and clay matrix in Made Ground, sandy gravelly superficial deposits), the effective infiltration, i.e. the percentage of rainfall that reaches the water table following losses from surface run-off, root zone recharge and plant uptake, should be calculated. This calculation is complex, however it is generally estimated that effective precipitation (i.e. that available to plants etc) is approximately half of total rainfall. Taking into account additional losses to run-off it is estimated that 5.0% of precipitation will end up as deep percolation to the underlying groundwater. It should also be noted that this is likely to be far less in the dry summer months as the ground surface is harder and the soils are drier, leading to a greater loss to surface run off and plant uptake. However, in the winter this is likely to be higher due to saturated soils and softer ground surface.

1.2.5 Contaminant Values

As discussed in the report text, indicative concentrations of key contaminants were tested for as part of the laboratory testing and the ground conditions were considered to be favourable to degradation.

Degradation in the dissolved phase only will be run for the contaminants of concern given the absence of sorption being a primary attenuation factor for them.

Half life values and partition coefficients for the contaminants of concern are included in Table below;

Table 4: Contaminant Values

Contaminant	Half life (days)	Koc (l/kg)	Henry's Law Constant (dimensionless)	Target Concentration mg/l (Source)
Aromatic >C05-C06 (Benzene)	750	68	0.116	0.01 (EQS)
Aromatic >C08-C10 (xylenes)	360	1590	0.112 (m-xylene)	0.03 (EQS)
Aromatic >EC10-EC12	204	2510	7.22×10^{-2}	0.09 (WHO)
Aromatic >EC12-EC16	920	5010	1.26×10^{-2}	0.09 (WHO)
Aromatic >EC16-EC21 (anthracene)	920	5.62×10^3	1.81×10^{-4}	0.0001 mg/l (EQS)
Aromatic >EC16-EC21	4000	1.58×10^4	6.95×10^{-4}	0.09 (WHO DWS)
Aromatic >EC21-EC35 (benzo[a]pyrene)	1060	1.29×10^5	1.76×10^{-6}	0.00000017 (EQS)
Aromatic >EC21-EC35	4000	1.26×10^5	2.48×10^{-5}	0.09 (WHO DWS)
Aliphatic >C5-C6	10000	794	21	15 (WHO)
Aliphatic >C12-C16	10000	5.01×10^6	171	0.3 (WHO)
Aliphatic >C16-C21	10000	6.31×10^8	1.07×10^3	0.3 (WHO)
Aliphatic >C21-C35*	10000	6.31×10^8	1.07×10^3	0.3 (WHO)
Aliphatic >C35-C44 *	10000	6.31×10^8	1.07×10^3	0.3 (WHO)

* There are no contaminant values derived for Aliphatic C21-C35 and C35-C44 bands due to their low mobility, however, for the conservative approach we have applied values for lighter chain Aliphatic band (C16-C21) to derive the RTV.

1.2.6 Distance to Compliance Point

The contaminants of concern are hazardous groundwater contaminants, a default compliance point of 50m will be used in the assessment, consistent with EA guidance.

It is noted the key surface water receptor at the Site is the Pymmes Brook, measured as a direct distance from the nearest point along the site boundary to be 360m east of the Site from the eastern site boundary.

This is unlikely to be the distance the groundwater travels as the groundwater is inferred to be moving in a western direction.

The use of 50m as the compliance point builds in substantial conservatism in the assessment.

1.2.7 Sensitivity Analysis

As the model is dependent on a number of assumptions it was considered prudent to run a sensitivity analysis to test whether altering the input values for key parameters would have an effect on the values derived.

A sensitivity analysis was performed during the development of the target values which involved varying one input parameter at a time between reasonable minimum and maximum values and evaluating the effect this had on the target concentrations.

Distance to the compliance point, hydraulic conductivity, hydraulic gradient, degradation rates and time variant have been indicated as values of high sensitivity. However, the value set for distance to

compliance point is in line with current EA guidelines and degradation rates are taken from approved literature sources.

Hydraulic conductivity showed variation across the literature values consulted and across site derived values, however to ensure a site specific assessment was undertaken the site derived value was selected.

Values pertaining to the plume length and thickness are identified as low sensitivity values.

Hydraulic gradient was subject to a sensitivity analysis, using the possible ranges in hydraulic gradient. The mean was selected as the most representative for the Site, maintain a level of conservatism.

Table 5: Sensitivity Analysis

Contaminant	Min Hydraulic gradient 0.0032	Max hydraulic gradient 0.014	Mean hydraulic gradient 0.0069	Median hydraulic gradient 0.0051
Aromatic >C5-C6 (Benzene)	1.85E+19	1.80E+7	8.06E+11	2.92E+14
Xylene	1.02E+30	3.91E+12	2.24E+19	1.15E+23

1.2.8 Groundwater RTM Results

The results of the RTM model are included in 6.

Table 6: RTM model results

Contaminant	Initial Concentration (mg/l)	Target Concentration (mg/l)	RTV at Compliance Point (mg/l)	Groundwater Exceedances
Fluoranthene	2.8x10 ⁻⁴	6.3x10 ⁻⁶	3.18x10 ⁷	None
Benzo(b)fluoranthene	1x10 ⁻⁵	1.7x10 ⁻⁷	5.78x10 ³	None
Benzo(k)fluoranthene	1x10 ⁻⁵	1.7x10 ⁻⁷	1.38x10 ⁻²	None
Aromatic >C05-C06 (Benzene)	1x10 ⁻⁵	0.01	8.06x10 ¹¹	None
Aromatic >C08-C10 (Xylenes)	1x10 ⁻⁵	0.03	2.24x10 ¹⁹	None
Aromatic >C10-C12	1x10 ⁻³	0.09*	1.99x10 ²⁷	None
Aromatic >C12-C16	1x10 ⁻³	0.09*	2.19x10 ¹¹	None
Aromatic >EC16-EC21 (anthracene)	1x10 ⁻⁵	1.0x10 ⁻⁴	2.43x10 ⁸	None
Aromatic >EC16-EC21	0.01	0.09*	1.20x10 ⁴	None

Aromatic >EC21- EC35 (benzo[a]pyrene)	1×10^{-5}	1.7×10^{-7}	4.49×10^4	None
Aromatic >EC21- EC35	0.01	0.09*	1.20×10^4	None
Aliphatic >C5-C6	1×10^{-3}	15*	9.19×10^3	None
Aliphatic >C12-C16	1.3	0.3 *	1.84×10^2	None
Aliphatic >C16-C21	38	0.3 *	1.84×10^2	None
Aliphatic >C21-C35	120	0.3 *	1.84×10^2	None
Aliphatic >C35-C44	0.37	0.3 *	1.84×10^2	None
* World Health Organization (WHO) guide values for TPHCWG fractions in drinking water				

II. Parameter Calculations – Cannon Factory

Infiltration			
Average mm/year	Cannon Factory		
	0.05	0.05	m/day
631.9348	31.59674	1.579837	4.33E-06

	exceeding Tier 1	Target value	Source	concentration (mg/l)		Hydrocarbon CoPC indicators	High mobility?
				Socotec	Waterman		
waterman (2023)	Anthracene	0.0001	EQS				N
	Fluoranthene	0.0000063	EQS	0.00002			Y
	Benzo(a)pyrene	0.00000017	EQS				N
	Benzo (b)fluorant	0.00000017	EQS				N
	Benzo (k)fluorant	0.00000017	EQS				N
	Aliphatic >C5-C	15000	WHO				Y
	Aliphatic >C12-C	300	WHO				N - very low mobility
	Aliphatic >C16-C	-	WHO				N - very low mobility
	Aliphatic >C21-C	-	WHO				N - very low mobility
	Aliphatic >C35-C	-	WHO				N - very low mobility
	Aromatic >EC10	0.09	WHO				Y
	Aromatic >EC12	0.09	WHO				Y
	Aromatic >EC16	0.09	WHO			Anthracene	N - low mobility
Socotec (2019)	m & p Xylene	0.03	EQS				Y
	Arom >C05-C06	0.01	EQS			Benzene	Y
	Arom >C08-C10	0.03	EQS			Xylenes	Y
	Arom >C21 - C3	0.09	WHO			benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene	

BH01
BH02

	Borehole ID	Sample depth (m)	Strata	TOC (% w/w)	Fraction (%)
Socotec	BH2	2.5		0.57	0.0057
	BH2	3.5		0.096	0.00096
Waterman	WWS01				
	WWS02	2.8	SAND		0.022
		3.5	SAND		0.001
		4.5	SAND		0.001
	WWS03				
	WWS10	2.2	SAND		0.021
		3.8	SAND		0.013
	WWS11	3	GRAVEL		0.036
	WTP01				
	WTP02	2.5	SAND		0.001
	WTP03	2.5	GRAVEL		0.014
	WTP10				
	WTP11				
				Average	0.011566
				Median	0.00935

				02/05/2023	16/05/2023
Borehole ID	mAOD	Water Strike (mbgl)	depth London Clay is encountered	Depth to water (mbgl)	Depth to water (mbgl)
BH01	8.86	no strike recorded	5.4	2.67	2.32
BH02	8.75	no strike recorded	6.7	2.43	2.41
PH3		R			
PH3A		R			
PH3B		R			
PH3C		3			
WWS01	9.01	Dry			
WWS02	9.05	2.8		2.64	2.62
WWS03	9.04	3		2.8	dry
WWS10	-	3		2.55	
WWS11	9.05	3		dry	2.87
PH1	-	no strike recorded			
PH2	-	R			
PH3	-	no strike recorded			
PH4	-	R			
PH5	-	no strike recorded			
PH6	-	R			
		Average water strike	2.95		
		Average depth to londfon clay	6.05		
		thickness	3.1		

Hydraulic Gradient Calculations - Cannon Factory				
Borehole ID	Borehole ID	Head (dh)	distance (m) (dl)	dh/dl
WWS11	BH01	WWS11 - dry during the first round		
WWS10	BH01	0.31	53.47	0.0057976
WWS10	BH02	0.18	12.65	0.0142292
WWS02	BH01	0.22	49.87	0.004411
BH02	BH01	0.13	40.4	0.003218

Average	0.006914
Standard deviation	0.004989
Median	0.005105

E	N	Borehole ID	Groundwater Depths				
			mAOD	02/05/2023		16/05/2023	
				mbgl	mAOD	mbgl	mAOD
534424.67	189757.1	BH01	8.86	2.67	6.19	2.32	6.54
534464.6	189758.5	BH02	8.75	2.43	6.32	2.41	6.34
534472.41	189746	WWS02	9.05	2.64	6.41	2.62	6.43
534454.49	189773.9	WWS03	9.04	2.8	6.24	dry	-
534476.25	189778.6	WWS11	9.05	dry	-	2.87	6.18
534477	189761	WWS10	9.05*	2.55	6.5		

*assumed level as the borehole positioned inside the building, therefore assumed to be at the same level as WWS

0.26245109 0.000262451
2.00E+04

III. Remedial Target Worksheets – Cannon Factory



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	22-May-23	Version:	1
Contaminant	Aromatic >C10-C12		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C10-C12	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	2.80E-04	mg/l laboratory data
Half life for degradation of contaminant in water	t _{1/2}	2.04E+02	days Howard et al 1991
Calculated decay rate	λ	3.40E-03	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m assumed plume width
Plume thickness at source	Sy	3.10E+00	m assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³ EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d Site specific value
Distance to compliance point	x	5.00E+01	m EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days time variant options only
Parameters values determined from options			
Partition coefficient	Kd	3.01E+01	l/kg see options
Longitudinal dispersivity	ax	5.00E+00	m see options
Transverse dispersivity	az	5.00E-01	m see options
Vertical dispersivity	ay	5.00E-02	m see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	1.79E+02	fraction
Decay rate used	λ	1.90E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	1.95E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.27E-32	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	2.21E+28	

Remedial Targets

Remedial Target	1.99E+27	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.27E-32	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

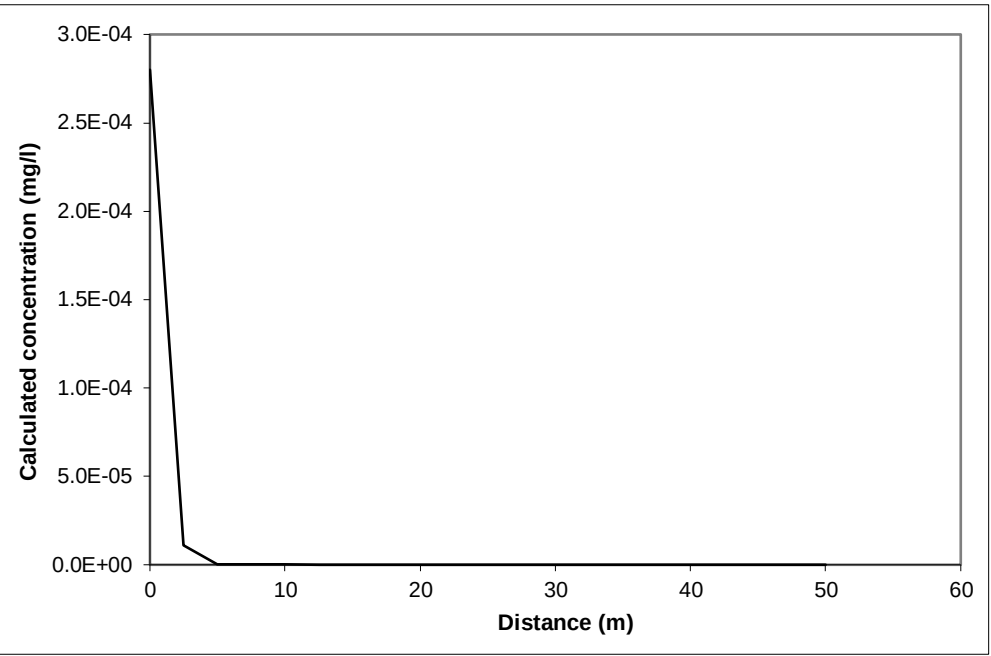
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.20E-02	fraction
Organic carbon partition coefficient	Koc	2.51E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{OC,n}		l/kg
Sorption coefficient for ionised species	K _{OC,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.01E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed				



Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0	2.8E-04
2.5	1.09E-05
5.0	4.21E-07
7.5	1.63E-08
10.0	6.31E-10
12.5	2.44E-11
15.0	9.38E-13
17.5	3.60E-14
20.0	1.38E-15
22.5	5.27E-17
25.0	2.01E-18
27.5	7.67E-20
30.0	2.92E-21
32.5	1.11E-22
35.0	4.22E-24
37.5	1.60E-25
40.0	6.09E-27
42.5	2.31E-28
45.0	8.78E-30
47.5	3.33E-31
50.0	1.27E-32

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	22-May-23	Version:	1
Contaminant	Aromatic >C12-C16		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C12-C16	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	1.00E-05	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	9.20E+02	days	Laboratory data
Calculated decay rate	λ	7.53E-04	days ⁻¹	Howard et al 1991
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	3.10E+00	m	assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	6.01E+01	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	3.56E+02	fraction
Decay rate used	λ	2.12E-06	d ⁻¹
Rate of contaminant flow due to retardation	u	9.80E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	4.11E-18	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	2.43E+12	

Remedial Targets

Remedial Target	2.19E+11	mg/l	For comparison with measured groundwater concentration.
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Ogata Banks

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	4.11E-18	mg/l
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

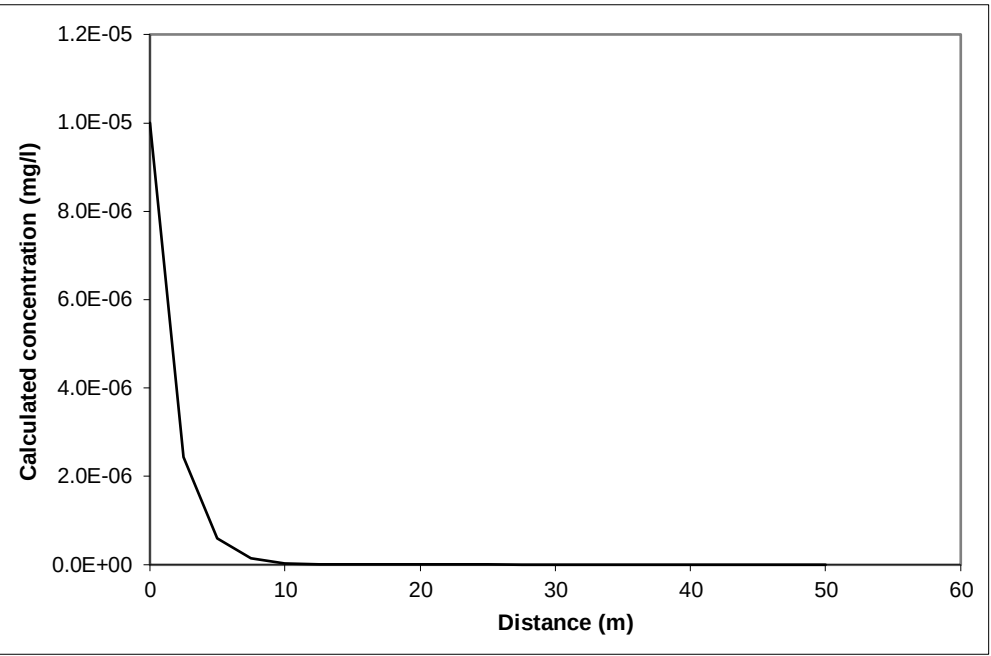
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.20E-02 fraction
Organic carbon partition coefficient	Koc	5.01E+03 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{OC,n}	l/kg
Sorption coefficient for ionised species	K _{OC,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	6.01E+01 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	Enter value	Calc value Xu & Eckstein	m
Transverse dispersivity	az	0.00E+00	5.00E+00	2.98E+00 m
Vertical dispersivity	ay	0.00E+00	5.00E-01	2.98E-01 m
		0.00E+00	5.00E-02	2.98E-02
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed				



Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	1.0E-05
2.5	2.43E-06
5.0	5.93E-07
7.5	1.44E-07
10.0	3.50E-08
12.5	8.50E-09
15.0	2.05E-09
17.5	4.95E-10
20.0	1.19E-10
22.5	2.86E-11
25.0	6.86E-12
27.5	1.64E-12
30.0	3.92E-13
32.5	9.36E-14
35.0	2.24E-14
37.5	5.33E-15
40.0	1.27E-15
42.5	3.03E-16
45.0	7.23E-17
47.5	1.72E-17
50.0	4.11E-18

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	22-May-23	Version:	1
Contaminant	Aromatic >EC16-EC21 (anthracene)		
Target Concentration (C_T)	0.0001	mg/l	Origin of C_T: EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >EC16-EC21 (anthracene)	from Level 1
Target Concentration	C _T	1.00E-04	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	1.00E-05	mg/l
Half life for degradation of contaminant in water	t _{1/2}	9.20E+02	days
Calculated decay rate	λ	7.53E-04	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m
Plume thickness at source	Sy	3.10E+00	m
Saturated aquifer thickness	da	3.10E+00	m
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	6.90E-03	fraction
Hydraulic conductivity of aquifer	K	1.01E-02	m/d
Distance to compliance point	x	5.00E+01	m
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days
Parameters values determined from options			
Partition coefficient	Kd	6.74E+01	l/kg
Longitudinal dispersivity	ax	5.00E+00	m
Transverse dispersivity	az	5.00E-01	m
Vertical dispersivity	ay	5.00E-02	m

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	3.99E+02	fraction
Decay rate used	λ	1.89E-06	d ⁻¹
Rate of contaminant flow due to retardation	u	8.74E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	4.11E-18	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	2.43E+12	

Remedial Targets

Remedial Target	2.43E+08	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	4.11E-18	mg/l
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

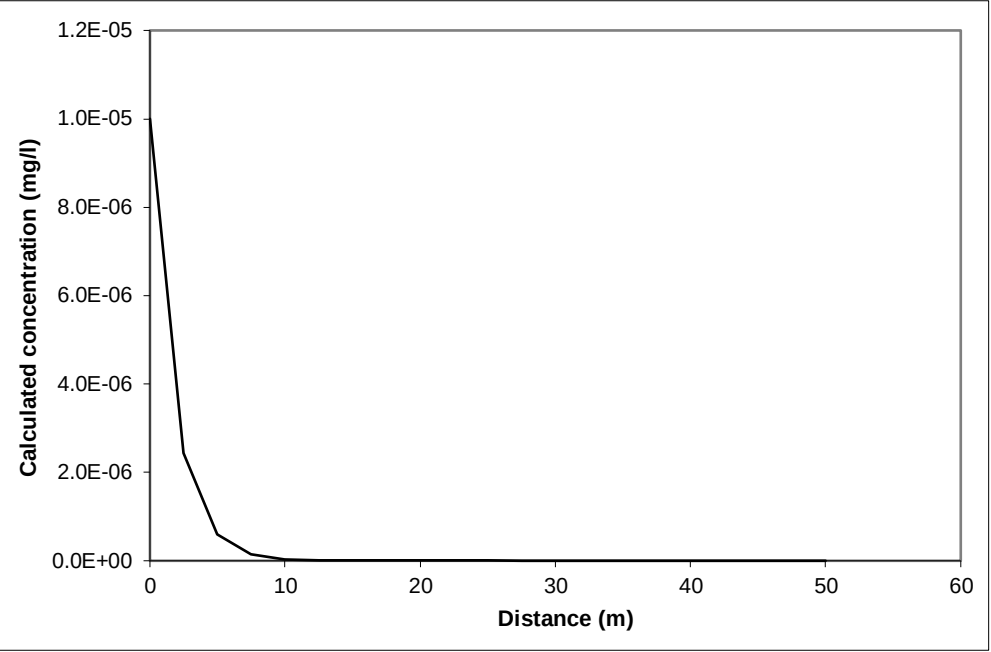
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.20E-02	fraction
Organic carbon partition coefficient	Koc	5.62E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		l/kg
Sorption coefficient for ionised species	K _{oc,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	6.74E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02	
Note values of dispersivity must be > 0					
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x					
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed					



Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	1.0E-05
2.5	2.43E-06
5.0	5.93E-07
7.5	1.44E-07
10.0	3.50E-08
12.5	8.50E-09
15.0	2.05E-09
17.5	4.95E-10
20.0	1.19E-10
22.5	2.86E-11
25.0	6.86E-12
27.5	1.64E-12
30.0	3.92E-13
32.5	9.36E-14
35.0	2.24E-14
37.5	5.33E-15
40.0	1.27E-15
42.5	3.03E-16
45.0	7.23E-17
47.5	1.72E-17
50.0	4.11E-18

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	22-May-23	Version:	1
Contaminant	Aromatic >EC21-EC35 (benzo[a]pyrene)		
Target Concentration (C_T)	0.00000017	mg/l	Origin of C_T: EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >EC21-EC35 (benz)	from Level 1
Target Concentration	C _T	1.70E-07	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	1.00E-05	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.06E+03	days	laboratory data
Calculated decay rate	λ	6.54E-04	days ⁻¹	Howard et al 1991
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	3.10E+00	m	assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	1.55E+03	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	9.13E+03	fraction
Decay rate used	λ	7.16E-08	d ⁻¹
Rate of contaminant flow due to retardation	u	3.81E-08	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	3.79E-17	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	2.64E+11	

Remedial Targets

Remedial Target	4.49E+04	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	3.79E-17	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

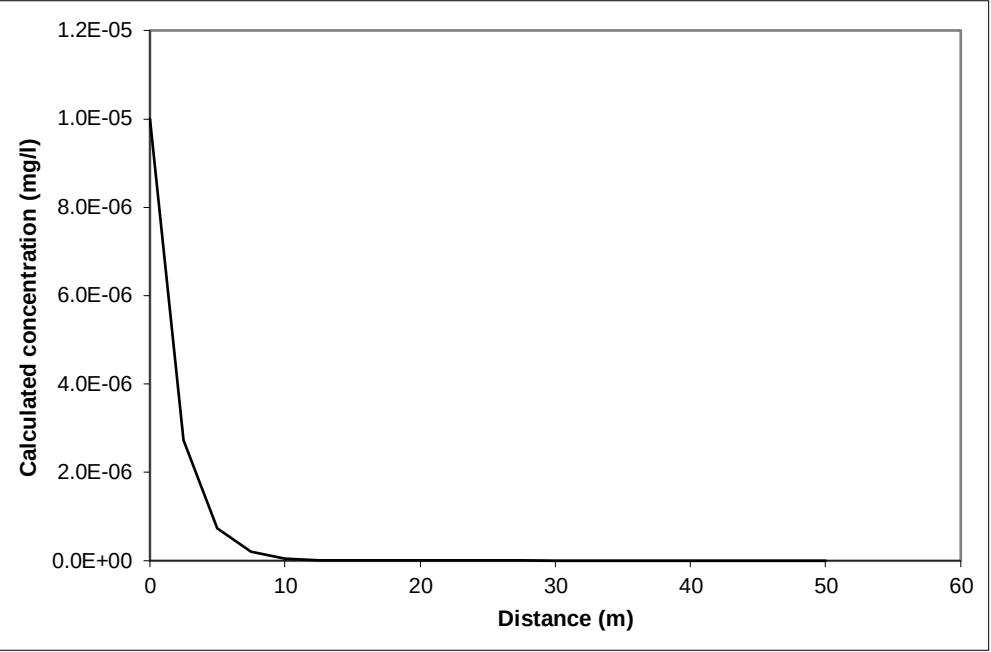
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.20E-02 fraction
Organic carbon partition coefficient	Koc	1.29E+05 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	1.55E+03 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	Enter value	Calc value Xu & Eckstein	m
Transverse dispersivity	az	0.00E+00	5.00E+00	2.98E+00 m
Vertical dispersivity	ay	0.00E+00	5.00E-01	2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02 m
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed				



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0 1.0E-05

2.5 2.72E-06

5.0 7.40E-07

7.5 2.01E-07

10.0 5.46E-08

12.5 1.48E-08

15.0 4.00E-09

17.5 1.08E-09

20.0 2.90E-10

22.5 7.77E-11

25.0 2.08E-11

27.5 5.56E-12

30.0 1.49E-12

32.5 3.97E-13

35.0 1.06E-13

37.5 2.82E-14

40.0 7.52E-15

42.5 2.00E-15

45.0 5.34E-16

47.5 1.42E-16

50.0 3.79E-17



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	22-May-23	Version:	1
Contaminant	Aliphatic >C5-C6		
Target Concentration (C_T)	15	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aliphatic >C5-C6	from Level 1
Target Concentration	C _T	1.50E+01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	1.00E-03	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	laboratory data
Calculated decay rate	λ	6.93E-05	days ⁻¹	Howard et al 1991
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	3.10E+00	m	assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	9.53E-01	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	6.62E+00	fraction
Decay rate used	λ	1.05E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	5.26E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.63E-06	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	6.13E+02	

Remedial Targets

Remedial Target	9.19E+03	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.63E-06	mg/l
		1.0E+100	days
			Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc

Organic carbon partition coefficient Koc

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{OC,n}

Sorption coefficient for ionised species K_{OC,i}

pH value pH

acid dissociation constant pKa

Fraction of organic carbon in aquifer foc

Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd

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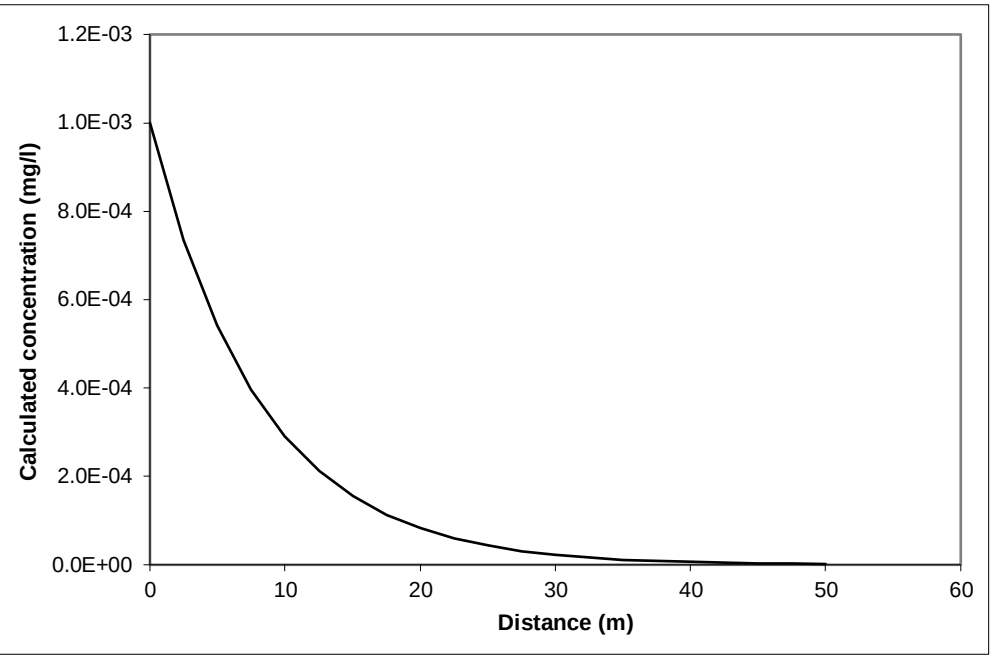
Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0 1.0E-03

2.5 7.35E-04

5.0 5.40E-04

7.5 3.97E-04

10.0 2.91E-04

12.5 2.13E-04

15.0 1.56E-04

17.5 1.13E-04

20.0 8.24E-05

22.5 5.97E-05

25.0 4.32E-05

27.5 3.12E-05

30.0 2.25E-05

32.5 1.62E-05

35.0 1.17E-05

37.5 8.44E-06

40.0 6.08E-06

42.5 4.37E-06

45.0 3.15E-06

47.5 2.27E-06

50.0 1.63E-06



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite	Version:	1
Date:	22-May-23		
Contaminant	Aliphatic >C12-C16		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

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The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aliphatic >C12-C16	from Level 1
Target Concentration	C _T	3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	1.30E+00	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	Howard et al 1991
Calculated decay rate	λ	6.93E-05	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	3.10E+00	m	assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	6.01E+04	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	3.55E+05	fraction
Decay rate used	λ	1.95E-10	d ⁻¹
Rate of contaminant flow due to retardation	u	9.82E-10	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	2.12E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	6.13E+02	

Remedial Targets

Remedial Target	1.84E+02	mg/l	For comparison with measured groundwater concentration.
-----------------	----------	------	---

Ogata Banks

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	2.12E-03	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

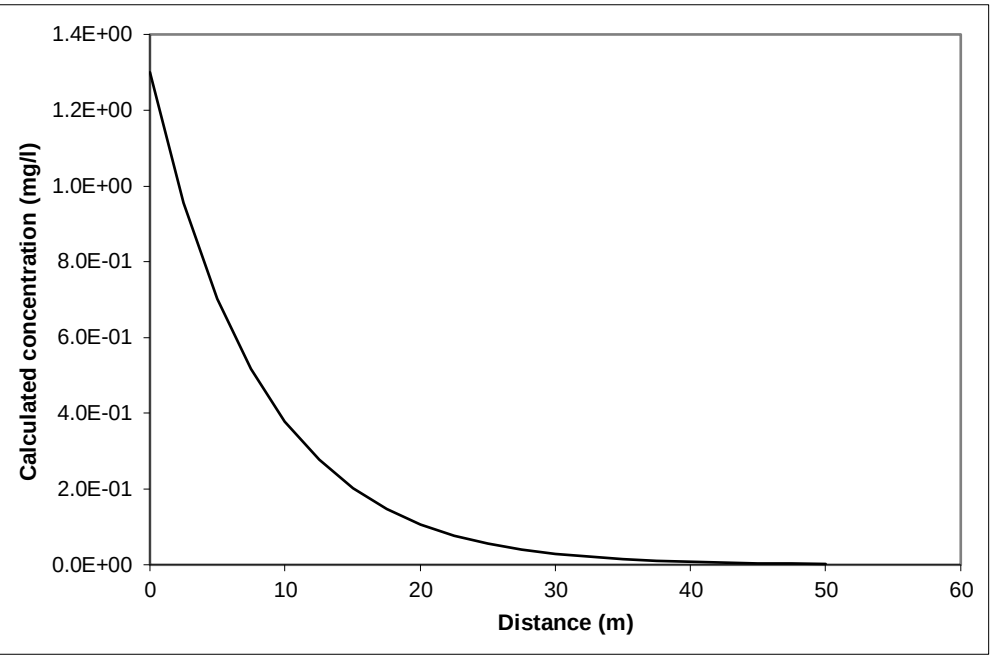
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.20E-02 fraction
Organic carbon partition coefficient	Koc	5.01E+06 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{OC,n}	l/kg
Sorption coefficient for ionised species	K _{OC,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	6.01E+04 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	Enter value 0.00E+00	Calc value Xu & Eckstein 5.00E+00	2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed				



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	1.3E+00
2.5	9.56E-01
5.0	7.02E-01
7.5	5.16E-01
10.0	3.79E-01
12.5	2.77E-01
15.0	2.02E-01
17.5	1.47E-01
20.0	1.07E-01
22.5	7.76E-02
25.0	5.62E-02
27.5	4.06E-02
30.0	2.93E-02
32.5	2.11E-02
35.0	1.52E-02
37.5	1.10E-02
40.0	7.90E-03
42.5	5.69E-03
45.0	4.09E-03
47.5	2.95E-03
50.0	2.12E-03



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	22-May-23	Version:	1
Contaminant	Aliphatic >C16-C21		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aliphatic >C16-C21	from Level 1
Target Concentration	C _T	3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	3.80E+01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	laboratory data
Calculated decay rate	λ	6.93E-05	days ⁻¹	Howard et al 1991
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	3.10E+00	m	assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	7.57E+06	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	4.47E+07	fraction
Decay rate used	λ	1.55E-12	d ⁻¹
Rate of contaminant flow due to retardation	u	7.80E-12	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	6.20E-02	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	6.13E+02	

Remedial Targets

Remedial Target	1.84E+02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	6.20E-02	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

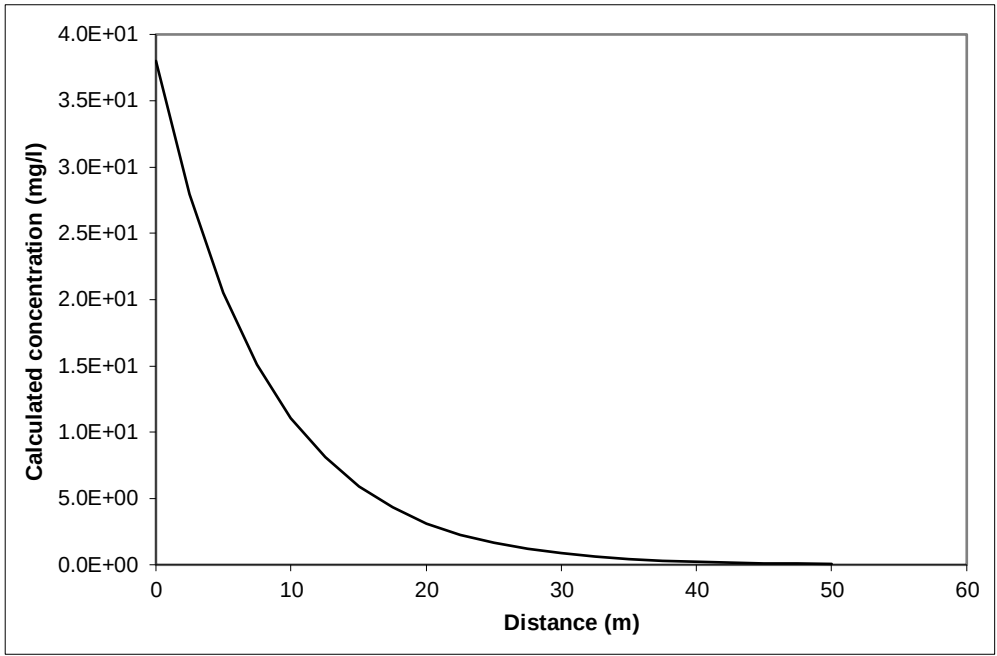
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.20E-02 fraction
Organic carbon partition coefficient	Koc	6.31E+08 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{OC,n}	l/kg
Sorption coefficient for ionised species	K _{OC,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	7.57E+06 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02	
Note values of dispersivity must be > 0					
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x					
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed					



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0	3.8E+01
2.5	2.79E+01
5.0	2.05E+01
7.5	1.51E+01
10.0	1.11E+01
12.5	8.11E+00
15.0	5.92E+00
17.5	4.31E+00
20.0	3.13E+00
22.5	2.27E+00
25.0	1.64E+00
27.5	1.19E+00
30.0	8.56E-01
32.5	6.17E-01
35.0	4.45E-01
37.5	3.21E-01
40.0	2.31E-01
42.5	1.66E-01
45.0	1.20E-01
47.5	8.62E-02
50.0	6.20E-02



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	24-May-23	Version:	1
Contaminant	Aromatic >EC16-EC21		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >EC16-EC21	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	1.00E-05	mg/l
Half life for degradation of contaminant in water	t _{1/2}	4.00E+03	days
Calculated decay rate	λ	1.73E-04	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m
Plume thickness at source	Sy	3.10E+00	m
Saturated aquifer thickness	da	3.10E+00	m
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	6.90E-03	fraction
Hydraulic conductivity of aquifer	K	1.01E-02	m/d
Distance to compliance point	x	5.00E+01	m
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days
Parameters values determined from options			
Partition coefficient	Kd	1.90E+02	l/kg
Longitudinal dispersivity	ax	5.00E+00	m
Transverse dispersivity	az	5.00E-01	m
Vertical dispersivity	ay	5.00E-02	m

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	1.12E+03	fraction
Decay rate used	λ	1.55E-07	d ⁻¹
Rate of contaminant flow due to retardation	u	3.11E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	7.47E-11	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	1.34E+05	

Remedial Targets

Remedial Target	1.20E+04	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	7.47E-11	mg/l
		1.0E+100	days
			Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc

Organic carbon partition coefficient Koc

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{OC,n}

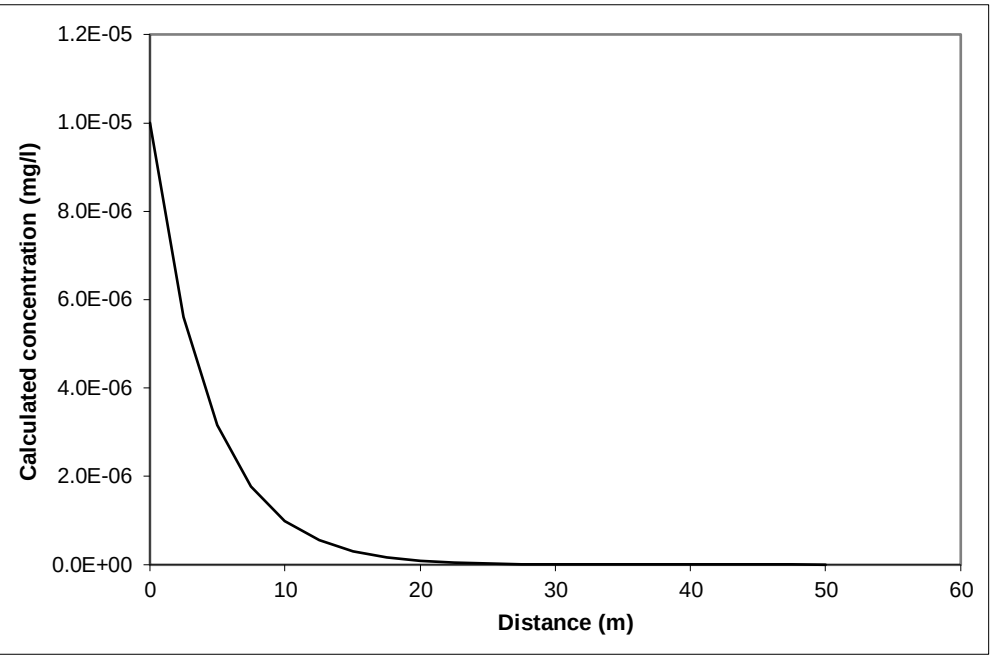
Sorption coefficient for ionised species K_{OC,i}

pH value pH

acid dissociation constant pKa

Fraction of organic carbon in aquifer foc

Soil water partition coefficient Kd



Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0 1.0E-05

2.5 5.62E-06

5.0 3.15E-06

7.5 1.77E-06

10.0 9.92E-07

12.5 5.55E-07

15.0 3.09E-07

17.5 1.72E-07

20.0 9.55E-08

22.5 5.29E-08

25.0 2.92E-08

27.5 1.61E-08

30.0 8.90E-09

32.5 4.90E-09

35.0 2.70E-09

37.5 1.48E-09

40.0 8.17E-10

42.5 4.49E-10

45.0 2.47E-10

47.5 1.36E-10

50.0 7.47E-11

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed: Cannon Factory, London

Completed by: Ugne Ankenaitė

Date: #####

Version: 1



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	24-May-23	Version:	1
Contaminant	Aromatic >EC21-EC35		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >EC21-EC35	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	1.00E-02	mg/l laboratory data
Half life for degradation of contaminant in water	t _{1/2}	4.00E+03	days Howard et al 1991
Calculated decay rate	λ	1.73E-04	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m assumed plume width
Plume thickness at source	Sy	3.10E+00	m assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³ EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d Site specific value
Distance to compliance point	x	5.00E+01	m EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days time variant options only
Parameters values determined from options			
Partition coefficient	Kd	1.51E+03	l/kg see options
Longitudinal dispersivity	ax	5.00E+00	m see options
Transverse dispersivity	az	5.00E-01	m see options
Vertical dispersivity	ay	5.00E-02	m see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	8.92E+03	fraction
Decay rate used	λ	1.94E-08	d ⁻¹
Rate of contaminant flow due to retardation	u	3.91E-08	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	7.47E-08	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	1.34E+05	

Remedial Targets

Remedial Target	1.20E+04	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	7.47E-08	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

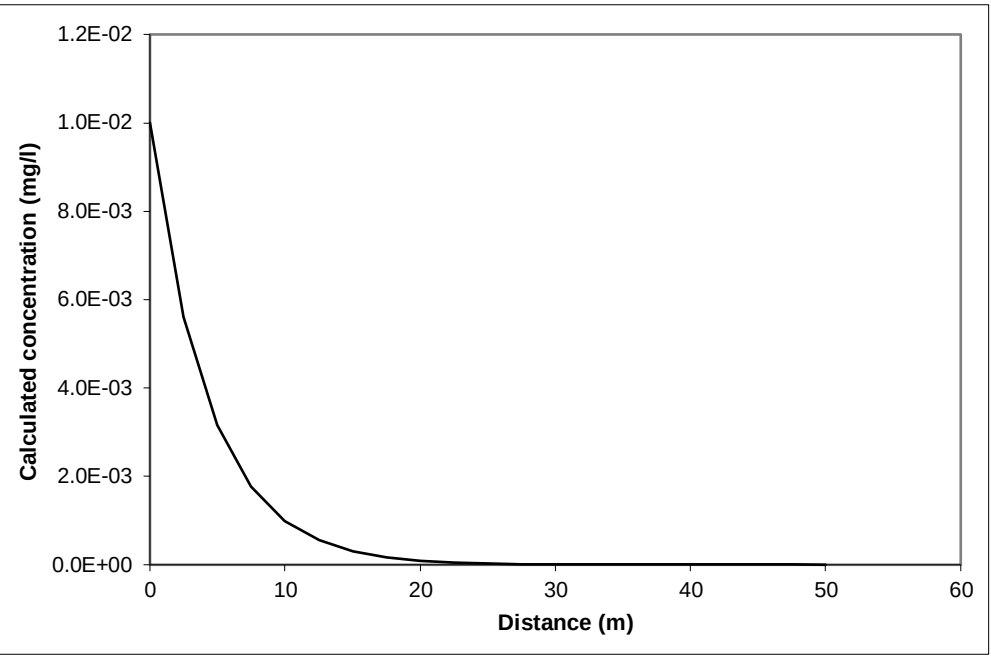
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.20E-02	fraction
Organic carbon partition coefficient	Koc	1.26E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{OC,n}		l/kg
Sorption coefficient for ionised species	K _{OC,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.51E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed				



Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

Distance	Concentration
	mg/l
0	1.0E-02
2.5	5.62E-03
5.0	3.15E-03
7.5	1.77E-03
10.0	9.92E-04
12.5	5.55E-04
15.0	3.09E-04
17.5	1.72E-04
20.0	9.55E-05
22.5	5.29E-05
25.0	2.92E-05
27.5	1.61E-05
30.0	8.90E-06
32.5	4.90E-06
35.0	2.70E-06
37.5	1.48E-06
40.0	8.17E-07
42.5	4.49E-07
45.0	2.47E-07
47.5	1.36E-07
50.0	7.47E-08

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	22-May-23	Version:	1
Contaminant	Aliphatic >C21-C35		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aliphatic >C21-C35	from Level 1
Target Concentration	C _T	3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	1.20E+02	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	Howard et al 1991
Calculated decay rate	λ	6.93E-05	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	3.10E+00	m	assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	7.57E+06	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	4.47E+07	fraction
Decay rate used	λ	1.55E-12	d ⁻¹
Rate of contaminant flow due to retardation	u	7.80E-12	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.96E-01	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	6.13E+02	

Remedial Targets

Remedial Target	1.84E+02	mg/l	For comparison with measured groundwater concentration.
-----------------	----------	------	---

Ogata Banks

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.96E-01	mg/l
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

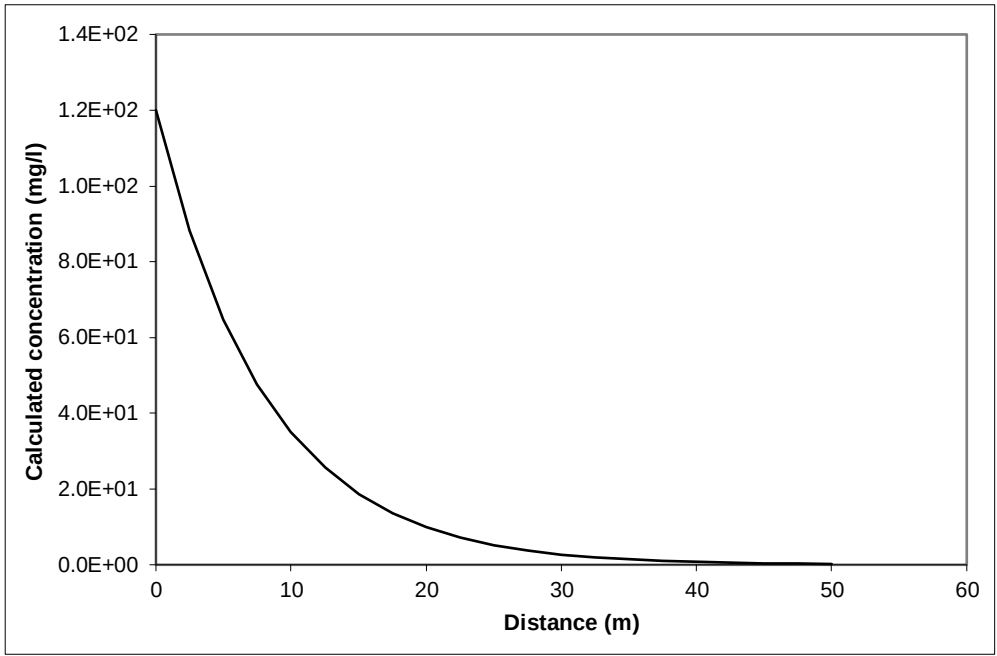
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.20E-02 fraction
Organic carbon partition coefficient	Koc	6.31E+08 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	7.57E+06 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02	
Note values of dispersivity must be > 0					
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x					
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed					



Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance	Concentration
	mg/l
0	1.2E+02
2.5	8.82E+01
5.0	6.48E+01
7.5	4.76E+01
10.0	3.50E+01
12.5	2.56E+01
15.0	1.87E+01
17.5	1.36E+01
20.0	9.88E+00
22.5	7.16E+00
25.0	5.18E+00
27.5	3.75E+00
30.0	2.70E+00
32.5	1.95E+00
35.0	1.41E+00
37.5	1.01E+00
40.0	7.29E-01
42.5	5.25E-01
45.0	3.78E-01
47.5	2.72E-01
50.0	1.96E-01

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Cannon Factory, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Cannon Factory, London		
Site Address:	Cannon Factory, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	24-May-23	Version:	1
Contaminant	Aliphatic >C35-C44		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aliphatic >C35-C44	from Level 1
Target Concentration	C _T	3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	3.70E-01	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	Howard et al 1991
Calculated decay rate	λ	6.93E-05	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	3.10E+00	m	assumed plume thickness
Saturated aquifer thickness	da	3.10E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	6.90E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.01E-02	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	7.57E+06	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	3.48E-04	m/d
Retardation factor	Rf	4.47E+07	fraction
Decay rate used	λ	1.55E-12	d ⁻¹
Rate of contaminant flow due to retardation	u	7.80E-12	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	6.04E-04	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	6.13E+02	

Remedial Targets

Remedial Target	1.84E+02	mg/l	For comparison with measured groundwater concentration.
-----------------	----------	------	---

Ogata Banks

Distance to compliance point 50 m

Concentration of contaminant at compliance point after C_{ED}/C₀ 6.04E-04 mg/l Ogata Banks
1.0E+100 days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc 1.20E-02 fraction

Organic carbon partition coefficient Koc 6.31E+08 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{OC,n} l/kg

Sorption coefficient for ionised species K_{OC,i} l/kg

pH value pH

acid dissociation constant pKa

Fraction of organic carbon in aquifer foc fraction

Soil water partition coefficient Kd 7.57E+06 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity

ax 0.00E+00 5.00E+00 2.98E+00 m

Transverse dispersivity

az 0.00E+00 5.00E-01 2.98E-01 m

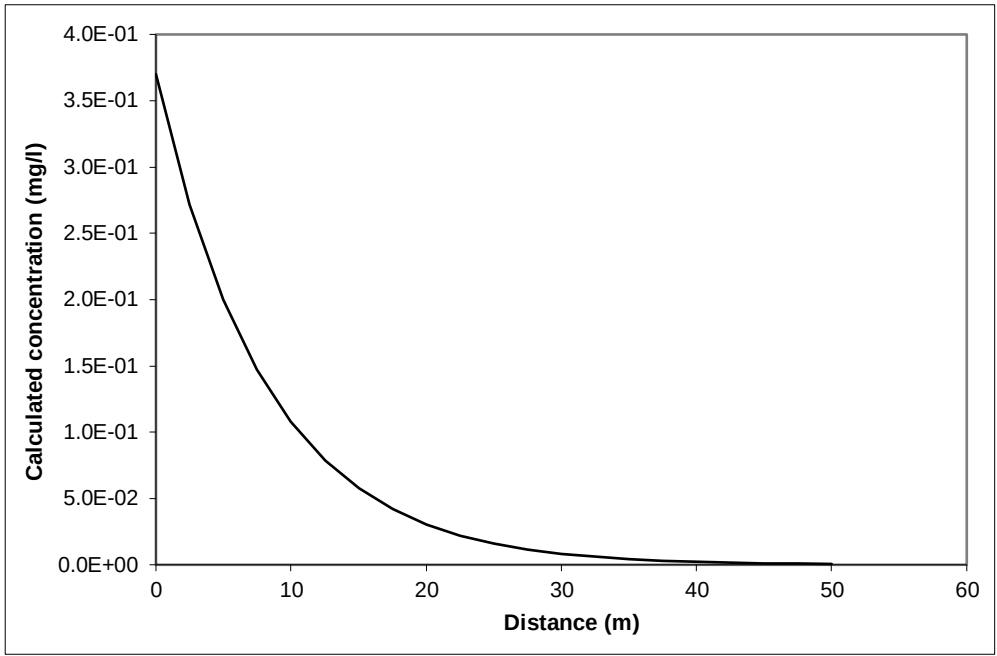
Vertical dispersivity

ay 0.00E+00 5.00E-02 2.98E-02

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{2.414}; az = ax/10, ay = ax/100 are assumed



Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0 3.7E-01

2.5 2.72E-01

5.0 2.00E-01

7.5 1.47E-01

10.0 1.08E-01

12.5 7.89E-02

15.0 5.76E-02

17.5 4.20E-02

20.0 3.05E-02

22.5 2.21E-02

25.0 1.60E-02

27.5 1.15E-02

30.0 8.34E-03

32.5 6.01E-03

35.0 4.33E-03

37.5 3.12E-03

40.0 2.25E-03

42.5 1.62E-03

45.0 1.17E-03

47.5 8.39E-04

50.0 6.04E-04

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed: Cannon Factory, London

Completed by: Ugne Ankenaitė

Date: #####

Version: 1

IV. Derivation of Site Specific Remediation Target Values – Ashley House

1. Derivation of Site Specific Remediation Target Values – Ashley House

Elevated concentrations of hydrocarbons were recorded in the groundwater at the Site, together with observations of hydrocarbons in the soils in the areas surrounding the tanks/former tanks. The soil sources will be addressed as part of the remediation and redevelopment. However, to confirm the concentrations recorded in the groundwater at the Site pose a low risk to the surrounding controlled waters environment, the following risk assessment has been completed. The following section outlines the methodology used together with justification of the input parameters.

1.1 Remedial Targets Methodology

Assessment of the potential risk to controlled water receptors from the identified contaminants of concern has been progressed using the EA Remedial Targets Methodology (RTM). The EA RTM model is a one-dimensional fate and transport single porosity model, which assess contaminant and groundwater migration in the intergranular flow pathway. Contaminants are present in the groundwater, the Level 3 groundwater assessment has therefore been used to model contaminant fate and transport on-site.

Conservatism

The RTM model is a deterministic model which attempts to replicate ground conditions from Site specific and literature information in order to conclude the possible risks to receptors, and generate criteria at which an impact at the receptor are absent. Due to the complexities of ground conditions and contaminant fate and transport in the environment any model is inevitably a very simplified assessment which may not consider various factors and is likely to provide an overly conservative assessment even with Site specific values. Examples of conservatism built into the model and the outputs are included below;

- The RTM Model assumes below ground obstructions are absent and a linear groundwater and contaminant flow path comprising a homogenous material is present between the source and receptor. However, the aquifer is not located within a heterogeneous material and several below ground obstructions are present in the local area including basements, likely to be distorting groundwater flow. Groundwater and contaminant flow are likely to be less than modelled with increased attenuation of contaminants along the flow path expected.
- An assumption has been made on the plume extending through the whole groundwater body, no allowance has been made for vertical contaminant concentration in the groundwater body. Utilisation of a plume through the entire groundwater body retains conservatism within the model.
- The RTM assessment models the soil transport pathway through predicting the proportion of a contaminant that will enter the dissolved phase within the soil. The dissolved component is then assumed as mixing with and becoming diluted by the underlying groundwater. The dilution is calculated from the ratio of infiltrating rainwater and groundwater flux. The RTM model does not however account for any potential attenuation as the leaching contaminant percolates through the vadose zone.
- The initial concentrations used are set at the maximum recorded groundwater concentrations, the maximum groundwater concentrations are assumed to originate from the closest monitoring well to the Site boundary. The use of the maximum concentration also assumes that concentration is present across the entire Site whereas in reality the maximum concentration is limited in its extent.
- No application of vertical transport retardation in the unsaturated zone including volatilisation of contaminants.

1.2 Physical and Chemical Input Parameters

Table 1 presents the physical and chemical input parameters and associated references used within the RTM worksheets.

Table 1: Controlled Waters Risk Assessment Input Parameters

Parameter	Value	Unit	Information Source
Level 1			
Water Filled Porosity	0.24	Fraction	The water bearing strata at the site is generally described as comprising very gravelly sand to very sandy gravel representing the Kempton Park Gravel Member. A Particle Size Distribution (PSD) test undertaken by Socotec indicated the gravel fraction to range from 63% to 93%. The standard default values for a sandy soil as specified in EA Science Report SCO50021/SR3 are used.
Air Filled Porosity	0.30	Fraction	The water bearing strata at the site is generally described as comprising very gravelly sand to very sandy gravel representing the Kempton Park Gravel Member. A Particle Size Distribution (PSD) test undertaken by Socotec indicated the gravel fraction to range from 63% to 93%. The standard default values for a sandy soil as specified in EA Science Report SCO50021/SR3 are used.
Bulk Density of Soil Zone Material	1.18	g/cm ³	The water bearing strata at the site is generally described as comprising very gravelly sand to very sandy gravel representing the Kempton Park Gravel Member. A Particle Size Distribution (PSD) test undertaken by Socotec indicated the gravel fraction to range from 63% to 93%. The standard default values for a sandy soil as specified in EA Science Report SCO50021/SR3 are used.
Fraction of Organic Carbon in the Soil	0.0021	Fraction	An average value has been selected based on the TOC values recorded within the Sand and Gravel site soils, refer to Appendix E sub-section V.
Level 2			
Infiltration	1.29x10 ⁻⁵	m/day	Based on a total annual rainfall between 2000 and 2022 of 631.9mm/year (Annual Rainfall for Heathrow). Based on the proposed landscaping parameters drawing (ref: 449-102 Rev 02 included in Appendix A) 85% of the site is proposed to be hardstanding, therefore a 15% of the rainfall is assumed to fall on permeable ground. Of the 15% falling on permeable ground the effective rainfall is calculated as 5% of annual rainfall entering the groundwater.
Length of contaminant source in direction of groundwater flow	60.68	m	Elevated concentrations of heavy chained hydrocarbons were recorded only in water sample from WWS06, marginally elevated concentrations of lighter chain hydrocarbons were recorded in a water sample from BH04 (located close to the UST), with no elevated concentrations recorded at the south-eastern, southern and north-western boundaries of the site.

Parameter	Value	Unit	Information Source
			The distance between exploratory hole locations is approximately 60.68m therefore this is taken as a dimension of the hotspot. This is considered to be an overestimation of a potential hotspot, however, to provide a conservative assessment, this value has been adopted.
Saturated aquifer thickness	2.84	m	Thickness of the Secondary A aquifer, comprising the Kempton Park Gravels, is taken from the borehole observations as the depth of strike to the low permeability layer.
Hydraulic gradient of water table	0.0026	-	Calculated as an average hydraulic gradient from on-site groundwater levels from the first monitoring round considered to be most representative of groundwater levels across the monitoring period. Refer to Appendix E sub-section V for calculations.
Hydraulic conductivity of aquifer in which dilution occurs	0.114	m/d	Representative of the Secondary A Aquifer, comprising the Kempton Park Gravels. Based on site specific Falling Head Tests. Refer to Appendix E sub-section V for calculations.
Width of contaminant perpendicular to groundwater flow	25	m	No specific hotspots of contamination were recorded at the Site, however, the distance between exploratory hole locations is approximately 25m therefore this is taken as a dimension of the hotspot.
Level 3 – soil			
Distance to compliance point	50m	m	The default 50 metres compliance point is used in the model for Hazardous Substances.
Bulk Density	1.18	g/cm ²	The Kempton Park Gravels at the site are heterogeneous but are generally described as sand and gravel. The standard default values for a sand as specified in EA Science Report SCO50021/SR3 are used.
Fraction of Organic Carbon in the Aquifer	0.0018	fraction	A median value has been selected based on the TOC values recorded within the superficial site soils (Kempton Park Gravels), refer to Appendix E sub-section V .
Level 3 – Groundwater			
Effective Porosity	0.2	%	Adjusted value given Domenico et al identify a total porosity for sand/gravel between 24% and 53%.
Bulk Density of Aquifer	1.18	g/m ²	The Kempton Park Gravels at the site are heterogeneous but are generally described as sand and gravel. The standard default values for a sand as specified in EA Science Report SCO50021/SR3 are used.
Plume thickness	2.84	m	Entire width of saturated aquifer.
Dispersivity	1 dimension User defined	-	Dispersivity in one direction has been used simulating a source at the top of the groundwater body. Xu and Eckstein has been used with the vertical dispersion altered to a low number to ensure the plume thickness does not exceed the physical limits of the aquifer. This is as advised in the 2006 EA RTM User Manual.

Parameter	Value	Unit	Information Source
	0.03 (Arom >C05-C06 (Benzene))		
	1.35 (Arom >C08-C10 (xylenes))		
	0.12 (Arom >C10-C12)		
	0.02 (Arom >C12-C16)		
	0.02 (Arom >C16-C21(anthracene))		
	0.00035 (Arom >C21-C35 (benzo[a]pyrene))		
	0.13 (Ali >C5-C6)		
	0.078 (Ali >C12 – C16)		
	0.56 (Ali >C16-C21)		
	3.1 (Ali >C21-C35)		
	0.23 (Ali >C35-C44)		

1.2.1 Hydraulic Gradient

Groundwater monitoring on a Site wide basis has been undertaken by Waterman on two occasions on 3rd and 16th of May 2023, within which groundwater levels have generally remained consistent between monitoring rounds. The groundwater levels recorded are presented in **Appendix E sub-section V**, with the first round of groundwater level readings used to calculate the hydraulic gradient.

The hydraulic gradient of the site was calculated based on groundwater levels recorded in the Kempton Park Gravels. Known distances between boreholes and changes in piezometric surface were calculated to derive hydraulic gradients. Analysis of the range of values indicates a small variation across the site.

The range in values was calculated between 0.00115 and 0.00451, which is considered to be indicative of the heterogeneous nature of the Kempton Park Gravels, comprising varying sand and gravel content. To decide on a representative value to be used within this risk assessment, basic statistics were calculated including the mean and median value. The mean was derived as 0.0026, with a standard deviation of 0.0015, alternatively the median was calculated, which was 0.00205. To provide a representative value, 0.0026 has been used within this risk assessment. **Appendix E sub-section V** presents the derived input parameters used in the Controlled Waters Risk Assessment.

The inferred groundwater direction plan (Figure Ref WIE16248-100_GIS_GQRA_7A, Appendix A) indicates the movement of groundwater is generally to the west.

1.2.2 Hydraulic Conductivity

One falling head test was undertaken as part of the Waterman Ground Investigation in 2023. The falling head test was completed in the Kempton Park Gravel (shallow groundwater body) and the results summarised in Table 2.

Table 2: Hydraulic conductivity test results

Borehole ID	Depth of falling head test (m bgl)	Strata	Hydraulic Conductivity (k) m/s
WWS04	2.5-3.5	Made Ground to 1.3mbgl (variable Made Ground consisting of coarse gravel and fine to coarse sand). Silt to 2.1mbgl (soft brown clayey sandy Silt. Sand is fine to medium.) Kempton Park Gravel to 3.5mbgl (brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to coarse.)	1.32×10^{-06}

Two falling head tests were also completed on the adjacent Cannon Factory. Although this is a different site, it is underlain by the Kempton Park Member, and is located approximately 85m to the northeast of the Ashley House Site. The results of the falling head tests for Cannon Factory are summarised in Table 3 below.

Table 3: Hydraulic conductivity test results (Cannon Factory)

Borehole ID	Depth of falling head test (m bgl)	Strata	Hydraulic Conductivity (k) m/s
WWS03	2.0-3.0	Made Ground to 1.0mbgl (reinforced concrete underlain by granular Mad Ground). Clay to 1.8mbgl (soft orange brown very sandy gravelly Clay. Gravel is angular to subrounded fine to coarse of flint and quartzite.) Kempton Park Gravel to 3.0mbgl (orange, brown clayey gravelly fine to medium SAND. Gravel is angular to subrounded fine to coarse of flint and quartzite.)	1.8×10^{-07}
WWS11	2.5-3.5	Made Ground to 1.3mbgl (reinforced concrete underlain by granular Mad Ground). Silt to 2.3mbgl (Soft orange brown sandy gravelly fine to medium SILT.) Kempton Park Gravel to 3.5mbgl (Brown sandy angular to subrounded fine to coarse GRAVEL of flint and quartzite. Sand is fine to medium)	5.32×10^{-08}

The variability of the values between 1.32×10^{-06} and 5.32×10^{-08} m/s indicates a variable permeability within the Kempton Park Gravel.

The relevance of this value measured can be compared to literature values.

Domenico and Schwartz 1990 provide literature values for gravel between 3×10^{-4} and 3×10^{-2} m/s and for coarse sand between 9×10^{-7} and 6×10^{-3} m/s.

Freeze and Cherry, 1979, provides literature values for gravel between 1×10^{-3} and 1.0 m/s, with a sandy gravel given as between 1×10^{-3} m/s and 1×10^{-2} m/s. The Kempton Park Gravels are generally described as between gravelly sand and a sandy gravel, which would indicate 1×10^{-2} m/s and 1×10^{-3} m/s, might be relevant literature values.

Falling head tests were not previously undertaken for the Site as part of the 2015 RSK and 2019 Socotec ground investigations.

Measured hydraulic conductivity from the ground investigation works indicates the site derived values are much lower than those expected from the literature values. This could be due the compact nature of the

strata and variable sand and gravel content. To ensure the assessment remains site specific the site derived hydraulic conductivity will be applied.

It is therefore considered that the hydraulic conductivity recorded on the Site is representative and will be applied.

1.2.3 Saturated Aquifer Thickness

Two rounds of groundwater monitoring have been completed following the completion of ground investigations. The results of the groundwater monitoring of the shallow aquifer have been tabulated and included in **Appendix E sub-section V**.

The saturated aquifer thickness of 2.84m is utilised in the assessment. The value is extrapolated from the recorded groundwater strikes and depth of low permeability London Clay as an average thickness.

1.2.4 Infiltration

Hard Cover and Soft landscaping

Soft landscaping is proposed as part of the development, bordering western and most of the northern Site boundaries. It is estimated that soft landscaping will cover approximately 15% of the proposed development. As a result the ground cover will remain open and the volume of infiltration through these areas will be much higher than the surrounding Development areas.

Based on this type of land-use and ground conditions across the site (sand and clay matrix in Made Ground, sandy gravelly superficial deposits), the effective infiltration, i.e. the percentage of rainfall that reaches the water table following losses from surface run-off, root zone recharge and plant uptake, should be calculated. This calculation is complex, however it is generally estimated that effective precipitation (i.e. that available to plants etc) is approximately half of total rainfall. Taking into account additional losses to run-off it is estimated that 5.0% of precipitation will end up as deep percolation to the underlying groundwater. It should also be noted that this is likely to be far less in the dry summer months as the ground surface is harder and the soils are drier, leading to a greater loss to surface run off and plant uptake. However, in the winter this is likely to be higher due to saturated soils and softer ground surface.

1.2.5 Contaminant Values

As discussed in the report text, indicative concentrations of key contaminants were tested for as part of the laboratory testing and the ground conditions were considered to be favourable to degradation.

Degradation in the dissolved phase only will be run for the contaminants of concern given the absence of sorption being a primary attenuation factor for them.

Half life values and partition coefficients for the contaminants of concern are included in Table below;

Table 4: Contaminant Values

Contaminant	Half life (days)	Koc (l/kg)	Henry's Law Constant (dimensionless)	Target Concentration mg/l (Source)
Aromatic >C05-C06 (Benzene)	750	68	0.116	0.01 (EQS)
Aromatic >C08-C10 (xylenes)	360	1590	0.112	0.03 (EQS)
Aromatic >EC10-EC12	204	2510	7.22×10^{-2}	0.09 (WHO DWS)

Aromatic >EC12-EC16	920	5010	1.26×10^{-2}	0.09 (WHO DWS)
Aromatic >EC16-EC21 (anthracene)	920	5.62×10^3	1.81×10^{-4}	0.0001 mg/l (EQS)
Aromatic >EC16-EC21	4000	1.58×10^4	6.95×10^{-4}	0.09 (WHO DWS)
Aromatic >EC21-EC35 (benzo[a]pyrene)	1060	1.29×10^5	1.76×10^{-6}	0.00000017 (EQS)
Aromatic >EC21-EC35	4000	1.26×10^5	2.48×10^{-5}	0.09 (WHO DWS)
Aliphatic >C5-C6	10000	794	21	15 (WHO DWS)
Aliphatic >C12-C16	10000	5.01×10^6	171	0.3 (WHO DWS)
Aliphatic >C16-C21	10000	6.31×10^8	1.07×10^3	0.3 (WHO DWS)
Aliphatic >C21-C35*	10000	6.31×10^8	1.07×10^3	0.3 (WHO DWS)
Aliphatic >C35-C44*	10000	6.31×10^8	1.07×10^3	0.3 (WHO DWS)

* There are no contaminant values derived for Aliphatic C21-C35 and C35-C44 bands due to their low mobility, however, for the conservative approach we have applied values for lighter chain Aliphatic band (C16-C21) to derive the RTV.

1.2.6 Distance to Compliance Point

The contaminants of concern are hazardous groundwater contaminants, a default compliance point of 50m will be used in the assessment, consistent with EA guidance.

It should be noted that the key surface water receptor at the Site is the Pymmes Brook, measured as a direct distance from the nearest point along the site boundary to be 360m east of the Site from the eastern site boundary.

Groundwater is currently inferred to the west away from the Pymmes Brook therefore the distance the groundwater will travel to the surface water receptor is likely to be in excess of 360m and the set compliance point of 50m.

The use of 50m as the compliance point builds in substantial conservatism in the assessment.

1.2.7 Sensitivity Analysis

As the model is dependent on a number of assumptions it was considered prudent to run a sensitivity analysis to test whether altering the input values for key parameters would have an effect on the values derived.

A sensitivity analysis was performed during the development of the target values which involved varying one input parameter at a time between reasonable minimum and maximum values and evaluating the effect this had on the target concentrations.

Distance to the compliance point, hydraulic conductivity, hydraulic gradient, degradation rates and time variant have been indicated as values of high sensitivity. However, the value set for distance to compliance point is in line with current EA guidelines and degradation rates are taken from approved literature sources.

Hydraulic conductivity showed variation across the literature values consulted and across site derived values, however to ensure a site specific assessment was undertaken the site derived value was selected.

Values pertaining to the plume length and thickness are identified as low sensitivity values.

Hydraulic gradient was subject to a sensitivity analysis, using the possible ranges in hydraulic gradient. The mean was selected as the most representative for the Site, maintain a level of conservatism.

Table 5: Sensitivity Analysis

Contaminant	Min Hydraulic gradient	Max hydraulic gradient	Mean hydraulic gradient	Median hydraulic gradient
	0.00115	0.00451	0.0026	0.00205
Aromatic >C10-C12	1.36E+19	1.96E+8	6.05E+11	4.16E+13
Aromatic >EC16-EC21	2.30E+2	1.75	7.66	1.74E+1

1.2.8 Groundwater RTM Results

The results of the RTM model are included in 6.

Table 6: RTM model results

Contaminant	Initial Concentration (mg/l)	EQS (mg/l)	RTV at Compliance Point (mg/l)	Groundwater Exceedances
Aromatic >C5-C6 (Benzene)	0.03	0.01	8.57x10 ³	None
Aromatic >C8-C10 (Xylenes)	1.35	0.03	5.25x10 ⁷	None
Aromatic >C10-C12	0.12	0.09*	6.05x10 ¹¹	None
Aromatic >C12-C16	0.02	0.09*	1.49x10 ⁴	None
Aromatic >EC16-EC21 (anthracene)	2.3x10 ⁻⁴	1.0x10 ⁻⁴	16.6	None
Aromatic >EC16-EC21	0.02	0.09*	7.66	None
Aromatic >EC21-EC35 (benzo[a]pyrene)	3.5x10 ⁻⁴	1.7x10 ⁻⁷	9.99x10 ⁻³	None
Aromatic >EC21-EC35	0.01	0.09*	7.66	None
Aliphatic >C5-C6	0.13	15*	1.44x10 ²	None
Aliphatic >C12-C16	0.048	0.3*	2.89	None
Aliphatic >C16-C21	0.56	0.3*	2.89	None
Aliphatic >C21-C35	3.1	0.3*	2.89	1 (WWS106)
Aliphatic >C35-C44	0.23	0.3*	2.89	None

* World Health Organization (WHO) guide values for TPHCWG fractions in drinking water

V. Parameter Calculations – Ashley House

Infiltration			
Average mm/year	Ashley House		
	0.15	0.05	m/day
631.934783	94.79022	4.739511	1.3E-05

	Contam exceeding Tier 1	Target value	Source	Initial Contaminant concentration (mg/l)		Hydrocarbon CoPC indicators	High mobility?
				Socotec	Waterman		
waterman (2023)	Anthracene	0.0001	EQS	0.00017	0.00023		N
	Fluoranthene	0.0000063	EQS	0.00002	0.00111		Y
	Benzo(a)pyrene	0.00000017	EQS	< 0.01	0.00035		N
	Benzo (b)fluoranthene	0.00000017	EQS	< 0.02	0.00051		N
	Benzo (k)fluoranthene	0.00000017	EQS	< 0.03	0.0002		N
	Aliphatic >C5-C6	15000	WHO	0.251	0.13		Y
	Aliphatic >C12-C16	300	WHO	0.078	0.048		N - very low mobility
	Aliphatic >C16-C21	-	WHO		0.56		N - very low mobility
	Aliphatic >C21-C35	-	WHO		3.1		N - very low mobility
	Aliphatic >C35-C44	-	WHO		0.23		N - very low mobility
	Aromatic >EC10-EC12	0.09	WHO	0.59	0.12		Y
	Aromatic >EC12-EC16	0.09	WHO		0.02		Y
	Aromatic >EC16-EC21	0.09	WHO		0.02	Anthracene	N - low mobility
Socotec (2019)	m & p Xylene	0.03	EQS	0.16	0.0082		Y
	Arom >C05-C06 (Benzene)	0.01	EQS	0.03	0.0089	Benzene	Y
	Arom >C08-C10 (xylenes)	0.03	EQS	1.35	0.0082	Xylenes	Y
	Arom >C21 - C35	0.09	WHO	0.168		benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene	

	Borehole ID	Sample depth (m)	Strata	TOC (% w/w)	Fraction (%)
Waterman 2023	WTP04	2.60	Kempton Park Gravel	N/A	0.005
	WWS04	2.20		N/A	< 0.0010
	WWS06	3.5		N/A	< 0.0010
	WWS07	2.10		N/A	< 0.0010
	WWS07	2.60		N/A	< 0.0010
	WWS09	3.00		N/A	0.002
Socotec 2019	PH1A	2.3		0.18	0.0018
	BH3	2.3		0.12	0.00121
RSK 2015	WS103	4		<0.03	0.0003

Average fraction	0.0021
Median	0.0018

				02/05/2023	16/05/2023	
Borehole ID	mAOD	Water Strike (mbgl)	depth London Clay is encountered	Depth to water (mbgl)	Depth to water (mbgl)	
BH03	8.95	no strike recorded	5.3	-		
BH04	9.02	no strike recorded	5.75	2.59		
PH1A		3				
PH2		3				
WWS04		3.4		dry		
WWS05	9.3	R				
WWS06	8.92	2.5		2.56	2.53	
WWS07	9.14	2.8		dry		
WWS08	9.11	2.5		-	2.51	
WWS09	8.94	2.9				
WS101	9.16	2.4		2.78		
WS102		R				
WS103		2.9				
WS104		2.75		-		
WS105		DRY				
WS106		R				
WS107		2.25				
WS108		DRY				
WS109		2.6		2.6		
WS110		R				
BH101		4.9	6.8	2.53		
BH102		5	6.4	2.53		
BH103		4.8	5.8	2.52		
				Average water strike	3.18	
				Average depth to londfon clay	6.01	
				thickness	2.83	

Hydraulic Gradient Calculations - Ashley House

Borehole ID	Borehole ID	Head (dh)	distance (m) (dl)	dh/dl
BH04	WWS06	0.07	60.68	0.00115
WS109	WWS06	0.26	68.17	0.00381
BH101	WS101	0.17	37.71	0.00451
WS109	BH102	0.11	73.78	0.00149
BH103	WS101	0.17	82.79	0.00205

Max	0.00451	Average	0.00260
min	0.00115	Median	0.00205

0.001478

E	N	Borehole ID	Groundwater Depths				
				02/05/2023		16/05/2023	
			mAOD	mbgl	mAOD	mbgl	mAOD
534292.6	189667	BH03	8.95	-	-	-	-
534352.7	189649.2	BH04	9.02	2.59	6.43	-	-
534354.4	189678.2	WWS04	9.25	dry		-	-
534291.6	189665.8	WWS06	8.92	2.56	6.36	2.53	6.39
534348.3	189660.8	WWS07	9.14	dry	-	dry	-
534356.9	189643.6	WWS08	9.11	-	-	2.51	6.6
534277.9	189642	WS101	9.16	2.78	6.38	-	-
534355.1	189661.2	WS109	9.22	2.6	6.62	-	-
534311.6	189629.4	BH101	9.08	2.53	6.55	-	-
534298.9	189699.3	BH102	9.04	2.53	6.51	-	-
534362.3	189625.8	BH103	9.07	2.52	6.55	-	-

VI. Remedial Target Worksheets – Ashley House



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	19-May-23	Version:	1
Contaminant	Aromatic >C10-C12		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C10-C12	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	1.20E-01	mg/l laboratory data
Half life for degradation of contaminant in water	t _{1/2}	2.04E+02	days Howard et al 1991
Calculated decay rate	λ	3.40E-03	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m assumed plume width
Plume thickness at source	Sy	2.83E+00	m assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³ EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d Site specific value
Distance to compliance point	x	5.00E+01	m EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days time variant options only
Parameters values determined from options			
Partition coefficient	Kd	5.27E+00	l/kg see options
Longitudinal dispersivity	ax	5.00E+00	m see options
Transverse dispersivity	az	5.00E-01	m see options
Vertical dispersivity	ay	5.00E-02	m see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	3.21E+01	fraction
Decay rate used	λ	1.06E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	4.62E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.79E-14	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	6.72E+12	

Remedial Targets

Remedial Target	6.05E+11	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point 50 m

Concentration of contaminant at compliance point after C_{ED}/C₀ 1.79E-14 mg/l Ogata Banks
1.0E+100 days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

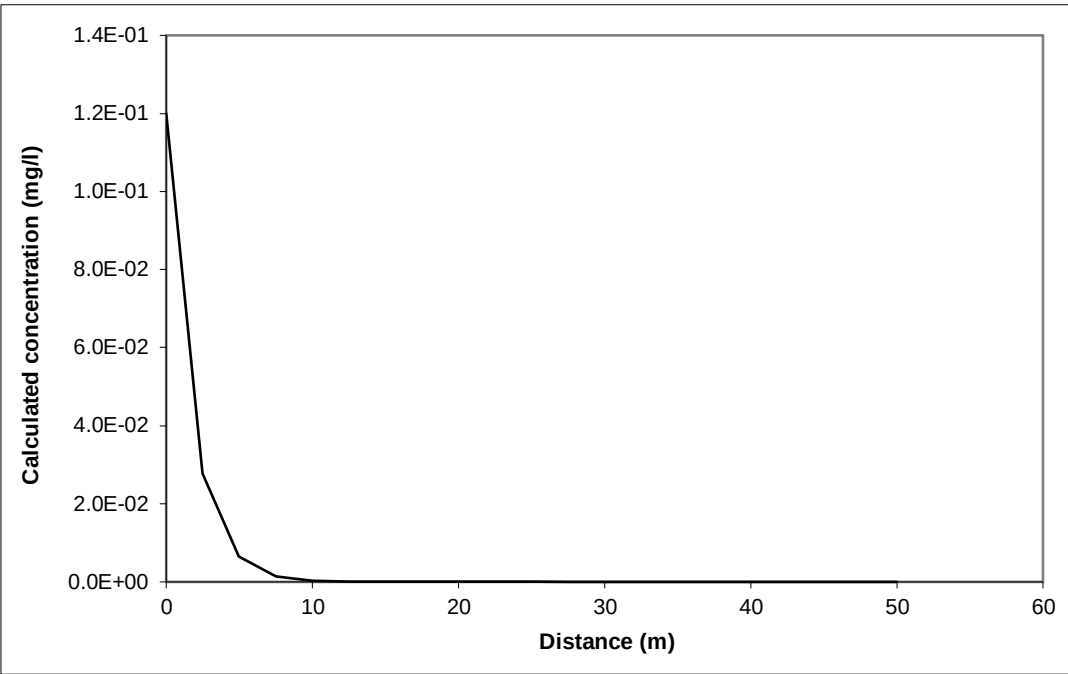
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	2.10E-03	fraction
Organic carbon partition coefficient	Koc	2.51E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		l/kg
Sorption coefficient for ionised species	K _{oc,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.27E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

	Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	5.00E+00 2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01 2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02 2.98E-02
Note values of dispersivity must be > 0			
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x			
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed			



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l	
0	1.2E-01
2.5	2.78E-02
5.0	6.46E-03
7.5	1.50E-03
10.0	3.46E-04
12.5	7.96E-05
15.0	1.83E-05
17.5	4.18E-06
20.0	9.54E-07
22.5	2.17E-07
25.0	4.95E-08
27.5	1.12E-08
30.0	2.55E-09
32.5	5.79E-10
35.0	1.31E-10
37.5	2.98E-11
40.0	6.75E-12
42.5	1.53E-12
45.0	3.47E-13
47.5	7.87E-14
50.0	1.79E-14



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	18-May-23	Version:	1
Contaminant	Aromatic >C12-C16		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C12-C16	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
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Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	2.00E-02	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	9.20E+02	days	laboratory data
Calculated decay rate	λ	7.53E-04	days ⁻¹	Howard et al 1991
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	2.84E+00	m	assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	9.02E+00	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	5.42E+01	fraction
Decay rate used	λ	1.39E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	2.73E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.21E-07	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	1.66E+05	

Remedial Targets

Remedial Target	1.49E+04	mg/l	For comparison with measured groundwater concentration.
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Ogata Banks

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.21E-07	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

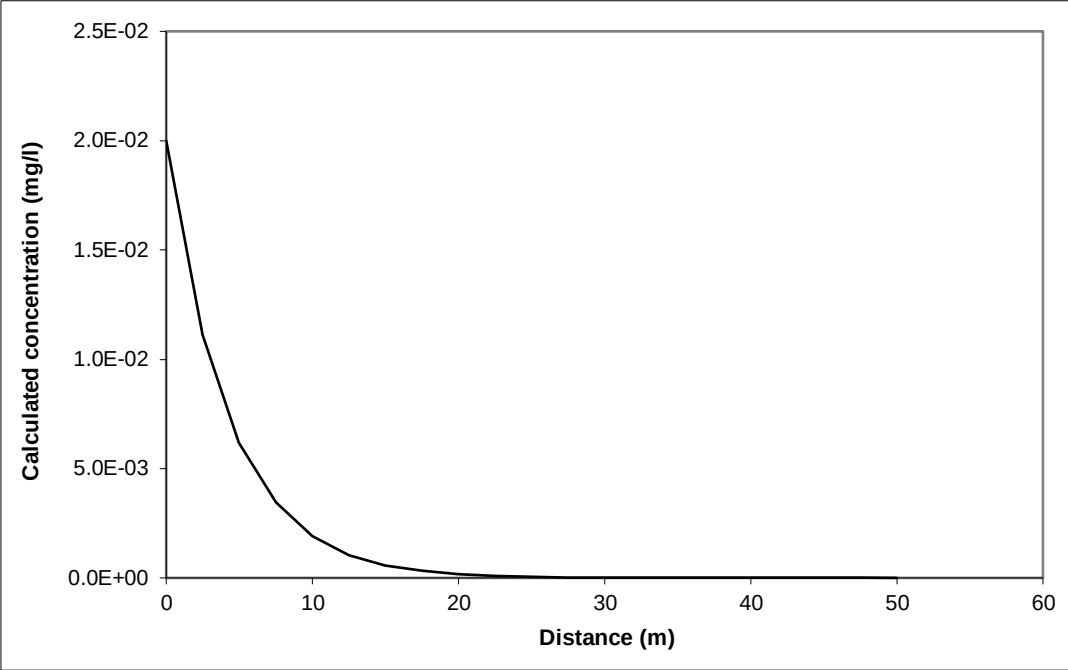
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.80E-03 fraction
Organic carbon partition coefficient	Koc	5.01E+03 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	9.02E+00 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	Enter value 0.00E+00	Calc value 5.00E+00	Xu & Eckstein 2.98E+00	m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02	
Note values of dispersivity must be > 0					
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x					
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed					



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	2.0E-02
2.5	1.11E-02
5.0	6.20E-03
7.5	3.45E-03
10.0	1.91E-03
12.5	1.06E-03
15.0	5.83E-04
17.5	3.21E-04
20.0	1.76E-04
22.5	9.61E-05
25.0	5.25E-05
27.5	2.87E-05
30.0	1.56E-05
32.5	8.51E-06
35.0	4.64E-06
37.5	2.52E-06
40.0	1.37E-06
42.5	7.48E-07
45.0	4.07E-07
47.5	2.22E-07
50.0	1.21E-07



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	19-May-23	Version:	1
Contaminant	Aromatic >C16-C21 (Anthracene)		
Target Concentration (C_T)	0.0001	mg/l	Origin of C_T: EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C16-C21 (Anthracene)	from Level 1
Target Concentration	C _T	1.00E-04	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	2.30E-04	mg/l laboratory data
Half life for degradation of contaminant in water	t _{1/2}	9.20E+02	days Howard et al 1991
Calculated decay rate	λ	7.53E-04	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m assumed plume width
Plume thickness at source	Sy	2.84E+00	m assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³ EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d Site specific value
Distance to compliance point	x	5.00E+01	m EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days time variant options only
Parameters values determined from options			
Partition coefficient	Kd	1.01E+01	l/kg see options
Longitudinal dispersivity	ax	5.00E+00	m see options
Transverse dispersivity	az	5.00E-01	m see options
Vertical dispersivity	ay	5.00E-02	m see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	6.07E+01	fraction
Decay rate used	λ	1.24E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	2.44E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.39E-09	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	1.66E+05	

Remedial Targets

Remedial Target	1.66E+01	mg/l	For comparison with measured groundwater concentration.
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Ogata Banks

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.39E-09	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc 1.80E-03 fraction

Organic carbon partition coefficient Koc 5.62E+03 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{OC,n} l/kg

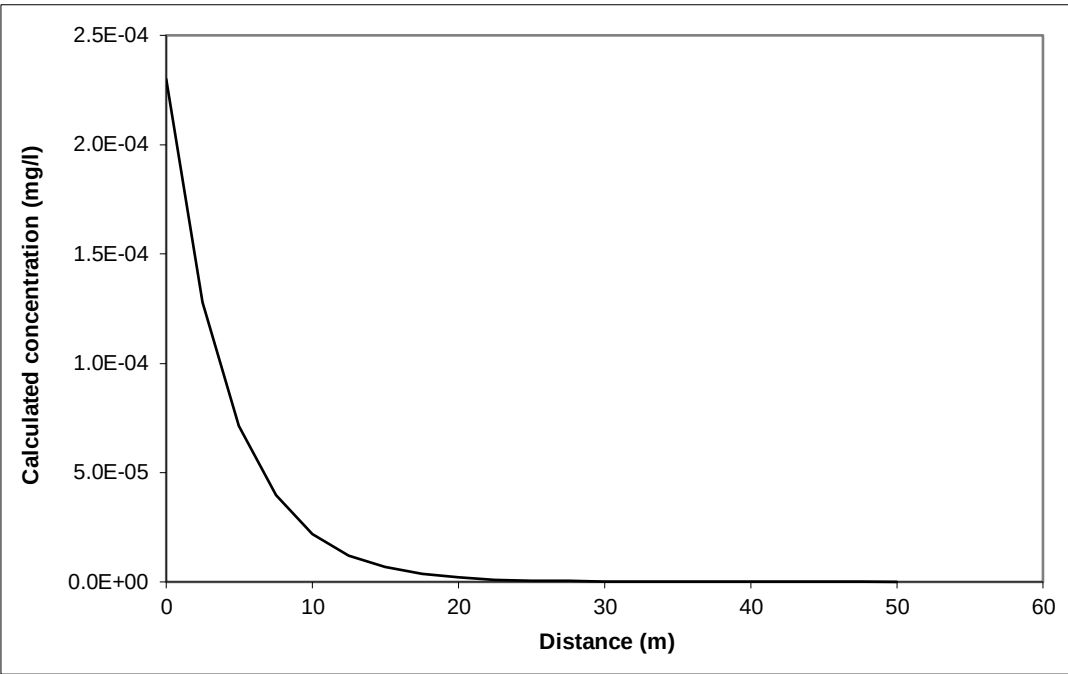
Sorption coefficient for ionised species K_{OC,i} l/kg

pH value pH

acid dissociation constant pKa

Fraction of organic carbon in aquifer foc fraction

Soil water partition coefficient Kd 1.01E+01 l/kg



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0 2.3E-04

2.5 1.28E-04

5.0 7.13E-05

7.5 3.97E-05

10.0 2.20E-05

12.5 1.22E-05

15.0 6.71E-06

17.5 3.69E-06

20.0 2.02E-06

22.5 1.11E-06

25.0 6.04E-07

27.5 3.30E-07

30.0 1.80E-07

32.5 9.79E-08

35.0 5.33E-08

37.5 2.90E-08

40.0 1.58E-08

42.5 8.60E-09

45.0 4.68E-09

47.5 2.55E-09

50.0 1.39E-09



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	19-May-23	Version:	1
Contaminant	Aromatic >C21-C35 (benzo(a)pyrene)		
Target Concentration (C_T)	0.00000017	mg/l	Origin of C_T: EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C21-C35 (benzo(a)	from Level 1
Target Concentration	C _T	1.70E-07	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	3.50E-04	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.06E+03	days	Howard et al 1991
Calculated decay rate	λ	6.54E-04	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	2.84E+00	m	assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.32E+02	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	1.37E+03	fraction
Decay rate used	λ	4.77E-07	d ⁻¹
Rate of contaminant flow due to retardation	u	1.08E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	5.96E-09	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	5.87E+04	

Remedial Targets

Remedial Target	9.99E-03	mg/l	For comparison with measured groundwater concentration.
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Ogata Banks

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	5.96E-09	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc 1.80E-03 fraction

Organic carbon partition coefficient Koc 1.29E+05 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{OC,n} l/kg

Sorption coefficient for ionised species K_{OC,i} l/kg

pH value pH

acid dissociation constant pKa

Fraction of organic carbon in aquifer foc

Soil water partition coefficient Kd 2.32E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity

ax 0.00E+00 5.00E+00 2.98E+00 m

Transverse dispersivity

az 0.00E+00 5.00E-01 2.98E-01 m

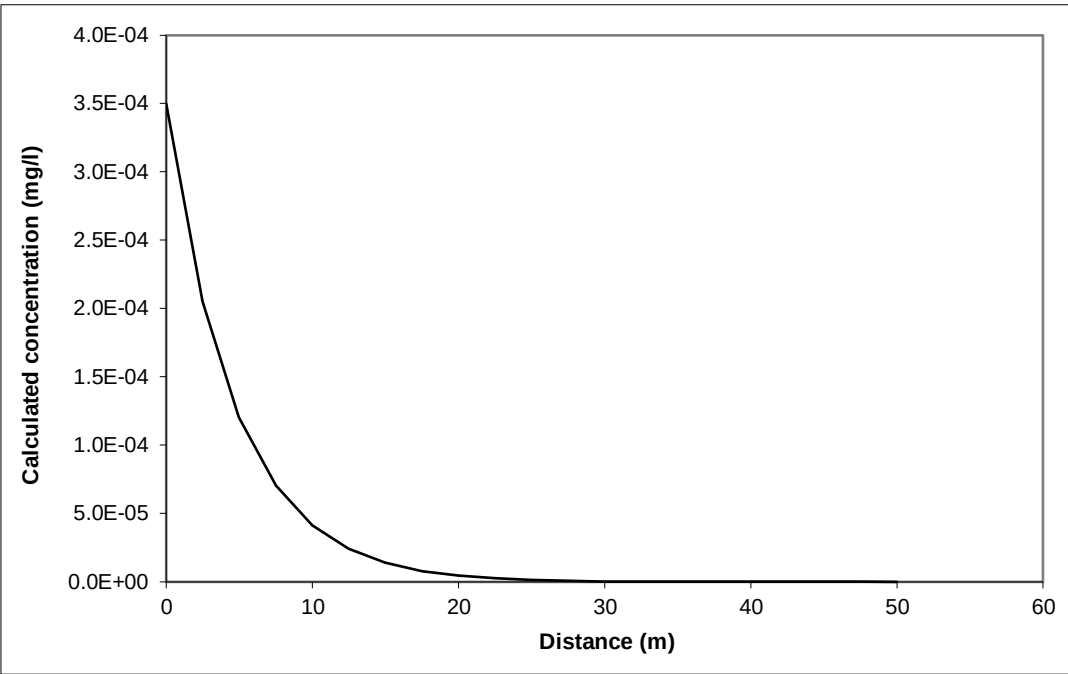
Vertical dispersivity

ay 0.00E+00 5.00E-02 2.98E-02

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{2.414}; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

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By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	3.5E-04
2.5	2.05E-04
5.0	1.20E-04
7.5	7.05E-05
10.0	4.12E-05
12.5	2.40E-05
15.0	1.39E-05
17.5	8.06E-06
20.0	4.66E-06
22.5	2.68E-06
25.0	1.54E-06
27.5	8.87E-07
30.0	5.09E-07
32.5	2.92E-07
35.0	1.68E-07
37.5	9.61E-08
40.0	5.51E-08
42.5	3.16E-08
45.0	1.81E-08
47.5	1.04E-08
50.0	5.96E-09



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	18-May-23	Version:	1
Contaminant	Aliphatic >C5-C6		
Target Concentration (C_T)	15	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aliphatic >C5-C6	from Level 1
Target Concentration	C _T	1.50E+01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	1.30E-01	mg/l laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days Howard et al 1991
Calculated decay rate	λ	6.93E-05	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m assumed plume width
Plume thickness at source	Sy	2.84E+00	m assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³ EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d Site specific value
Distance to compliance point	x	5.00E+01	m EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days time variant options only
Parameters values determined from options			
Partition coefficient	Kd	1.43E+00	l/kg see options
Longitudinal dispersivity	ax	5.00E+00	m see options
Transverse dispersivity	az	5.00E-01	m see options
Vertical dispersivity	ay	5.00E-02	m see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	9.43E+00	fraction
Decay rate used	λ	7.35E-06	d ⁻¹
Rate of contaminant flow due to retardation	u	1.57E-04	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.35E-02	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	9.63E+00	

Remedial Targets

Remedial Target	1.44E+02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.35E-02	mg/l Ogata Banks
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

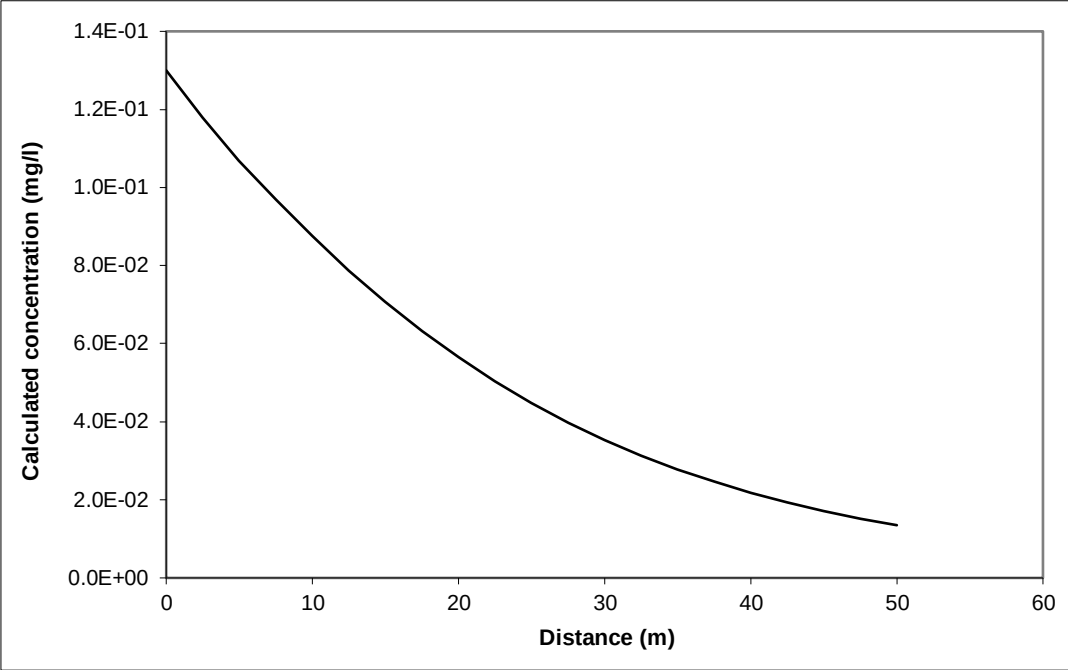
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.80E-03	fraction
Organic carbon partition coefficient	Koc	7.94E+02	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		l/kg
Sorption coefficient for ionised species	K _{oc,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.43E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

	Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	5.00E+00 2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01 2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02 2.98E-02
Note values of dispersivity must be > 0			
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x			
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed			



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

Distance	Concentration
	mg/l
0	1.3E-01
2.5	1.18E-01
5.0	1.07E-01
7.5	9.68E-02
10.0	8.75E-02
12.5	7.88E-02
15.0	7.07E-02
17.5	6.33E-02
20.0	5.65E-02
22.5	5.03E-02
25.0	4.48E-02
27.5	3.98E-02
30.0	3.53E-02
32.5	3.13E-02
35.0	2.78E-02
37.5	2.46E-02
40.0	2.19E-02
42.5	1.94E-02
45.0	1.72E-02
47.5	1.52E-02
50.0	1.35E-02



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	18-May-23	Version:	1
Contaminant	Aliphatic >C12-C16		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Aliphatic >C12-C16	from Level 1
Target Concentration	C _T 3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
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Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Source of parameter value			
Initial contaminant concentration in groundwater at plume core	C ₀	4.80E-02	mg/l
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days
Calculated decay rate	λ	6.93E-05	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m
Plume thickness at source	Sy	2.84E+00	m
Saturated aquifer thickness	da	2.84E+00	m
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	2.60E-03	fraction
Hydraulic conductivity of aquifer	K	1.14E-01	m/d
Distance to compliance point	x	5.00E+01	m
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m
Time since pollutant entered groundwater	t	1.00E+100	days
Parameters values determined from options			
Partition coefficient	Kd	9.02E+03	l/kg
Longitudinal dispersivity	ax	5.00E+00	m
Transverse dispersivity	az	5.00E-01	m
Vertical dispersivity	ay	5.00E-02	m

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	5.32E+04	fraction
Decay rate used	λ	1.30E-09	d ⁻¹
Rate of contaminant flow due to retardation	u	2.79E-08	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	4.99E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	9.63E+00	

Remedial Targets

Remedial Target	2.89E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀ 4.99E-03	mg/l	Ogata Banks
	1.0E+100	days	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

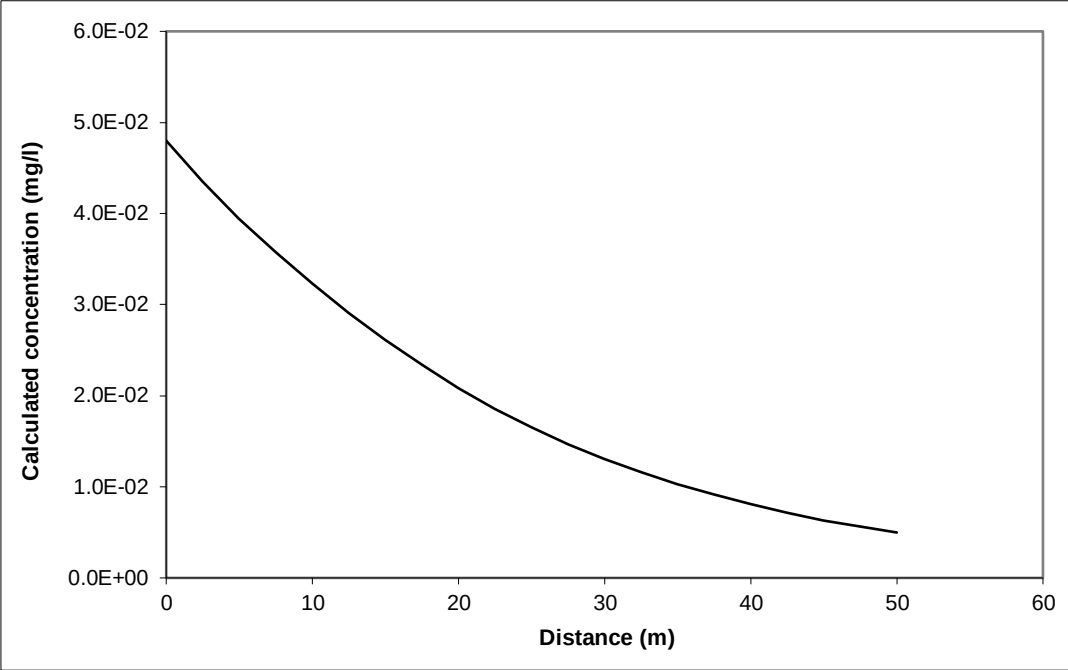
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.80E-03	fraction
Organic carbon partition coefficient	Koc	5.01E+06	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		l/kg
Sorption coefficient for ionised species	K _{oc,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.02E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02	
Note values of dispersivity must be > 0					
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x					
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed					



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	4.8E-02
2.5	4.35E-02
5.0	3.95E-02
7.5	3.58E-02
10.0	3.23E-02
12.5	2.91E-02
15.0	2.61E-02
17.5	2.34E-02
20.0	2.09E-02
22.5	1.86E-02
25.0	1.65E-02
27.5	1.47E-02
30.0	1.30E-02
32.5	1.16E-02
35.0	1.03E-02
37.5	9.10E-03
40.0	8.07E-03
42.5	7.15E-03
45.0	6.34E-03
47.5	5.62E-03
50.0	4.99E-03



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	19-May-23	Version:	1
Contaminant	Aliphatic >C16-C21		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Aliphatic >C16-C21	from Level 1
Target Concentration	C _T 3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	5.60E-01	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	Howard et al 1991
Calculated decay rate	λ	6.93E-05	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	2.84E+00	m	assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	1.14E+06	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	6.70E+06	fraction
Decay rate used	λ	1.03E-11	d ⁻¹
Rate of contaminant flow due to retardation	u	2.21E-10	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	5.82E-02	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	9.63E+00	

Remedial Targets

Remedial Target	2.89E+00	mg/l	For comparison with measured groundwater concentration.
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Ogata Banks

Distance to compliance point	50	m
Concentration of contaminant at compliance point after	C _{ED} /C ₀ 5.82E-02	mg/l
	1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

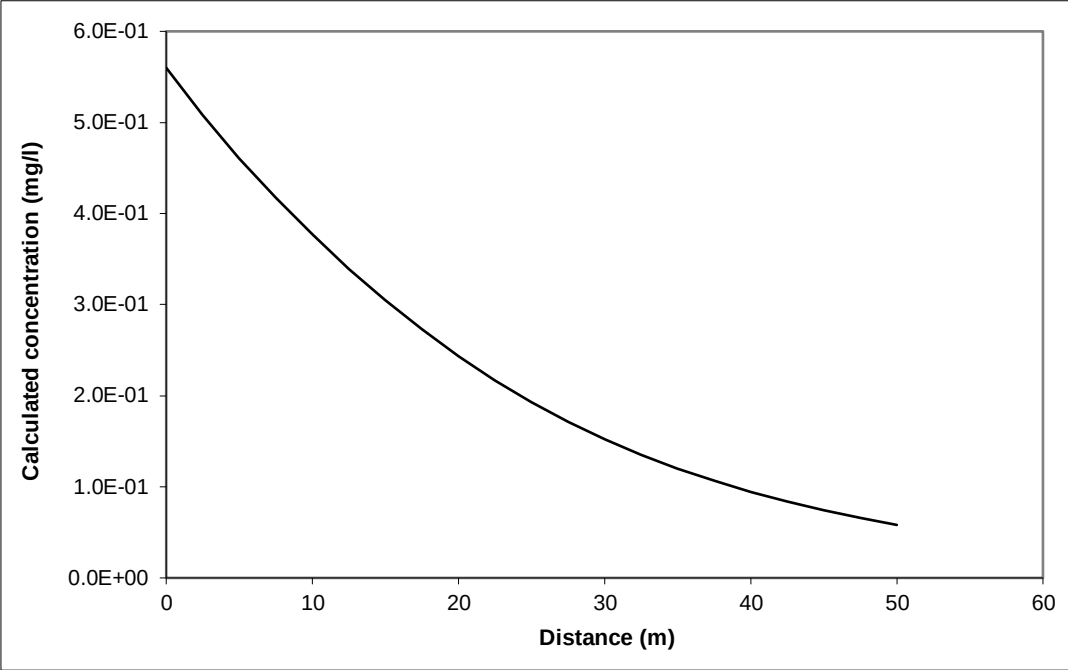
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.80E-03 fraction
Organic carbon partition coefficient	Koc	6.31E+08 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	1.14E+06 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00	m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01	m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02	
Note values of dispersivity must be > 0					
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x					
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed					



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

mg/l

0	5.6E-01
2.5	5.08E-01
5.0	4.60E-01
7.5	4.17E-01
10.0	3.77E-01
12.5	3.39E-01
15.0	3.05E-01
17.5	2.73E-01
20.0	2.43E-01
22.5	2.17E-01
25.0	1.93E-01
27.5	1.71E-01
30.0	1.52E-01
32.5	1.35E-01
35.0	1.20E-01
37.5	1.06E-01
40.0	9.41E-02
42.5	8.34E-02
45.0	7.40E-02
47.5	6.56E-02
50.0	5.82E-02



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	24-May-23	Version:	1
Contaminant	Aliphatic >C21-C35		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

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It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Aliphatic >C21-C35	from Level 1
Target Concentration	C _T 3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	3.10E+00	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	Howard et al 1991
Calculated decay rate	λ	6.93E-05	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	2.84E+00	m	assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	1.14E+06	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	6.70E+06	fraction
Decay rate used	λ	1.03E-11	d ⁻¹
Rate of contaminant flow due to retardation	u	2.21E-10	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	3.22E-01	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	9.63E+00	

Remedial Targets

Remedial Target	2.89E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	3.22E-01	mg/l
		1.0E+100	days
			Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

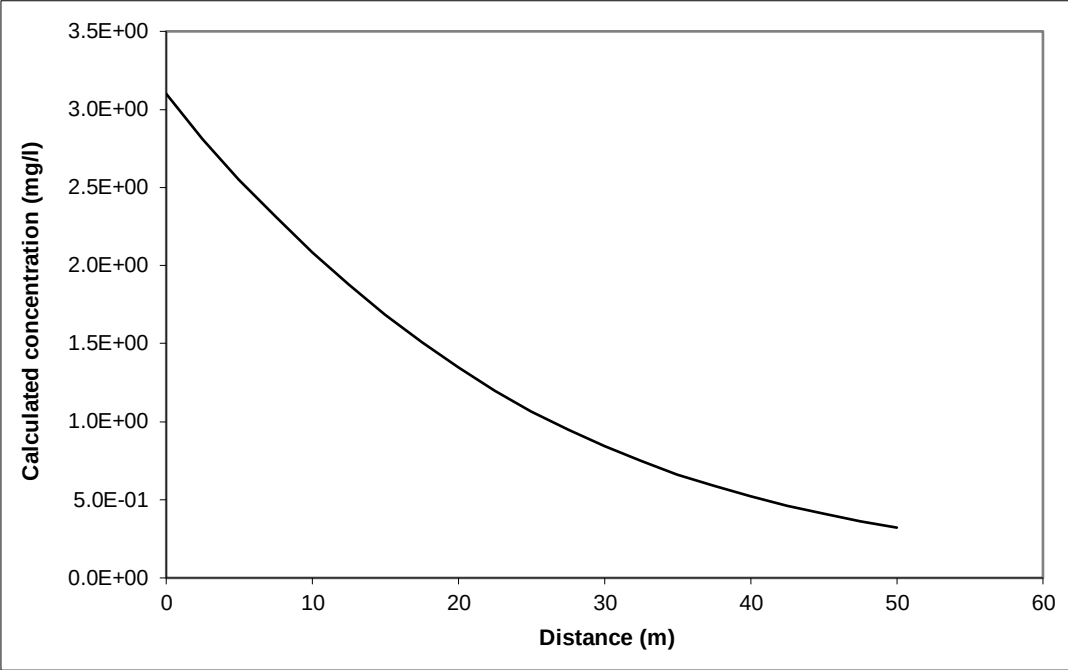
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.80E-03 fraction
		6.31E+08 l/kg
Organic carbon partition coefficient	Koc	l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	1.14E+06 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

	Enter value	Calc value	Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	5.00E+00	2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed				



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	3.1E+00
2.5	2.81E+00
5.0	2.55E+00
7.5	2.31E+00
10.0	2.09E+00
12.5	1.88E+00
15.0	1.69E+00
17.5	1.51E+00
20.0	1.35E+00
22.5	1.20E+00
25.0	1.07E+00
27.5	9.49E-01
30.0	8.42E-01
32.5	7.47E-01
35.0	6.63E-01
37.5	5.88E-01
40.0	5.21E-01
42.5	4.62E-01
45.0	4.10E-01
47.5	3.63E-01
50.0	3.22E-01



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	24-May-23	Version:	1
Contaminant	Aliphatic >C21-C35		
Target Concentration (C_T)	0.3	mg/l	Origin of C_T: WHO DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Aliphatic >C21-C35	from Level 1
Target Concentration	C _T 3.00E-01	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
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Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	2.30E-01	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	1.00E+04	days	Howard et al 1991
Calculated decay rate	λ	6.93E-05	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	2.84E+00	m	assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				

Partition coefficient	Kd	1.14E+06	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	6.70E+06	fraction
Decay rate used	λ	1.03E-11	d ⁻¹
Rate of contaminant flow due to retardation	u	2.21E-10	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	2.39E-02	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	9.63E+00	

Remedial Targets

Remedial Target	2.89E+00	mg/l	For comparison with measured groundwater concentration.
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Ogata Banks

Distance to compliance point	50	m
Concentration of contaminant at compliance point after	C _{ED} /C ₀ 2.39E-02	mg/l
	1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.80E-03 fraction
		6.31E+08 l/kg
Organic carbon partition coefficient	Koc	l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	1.14E+06 l/kg

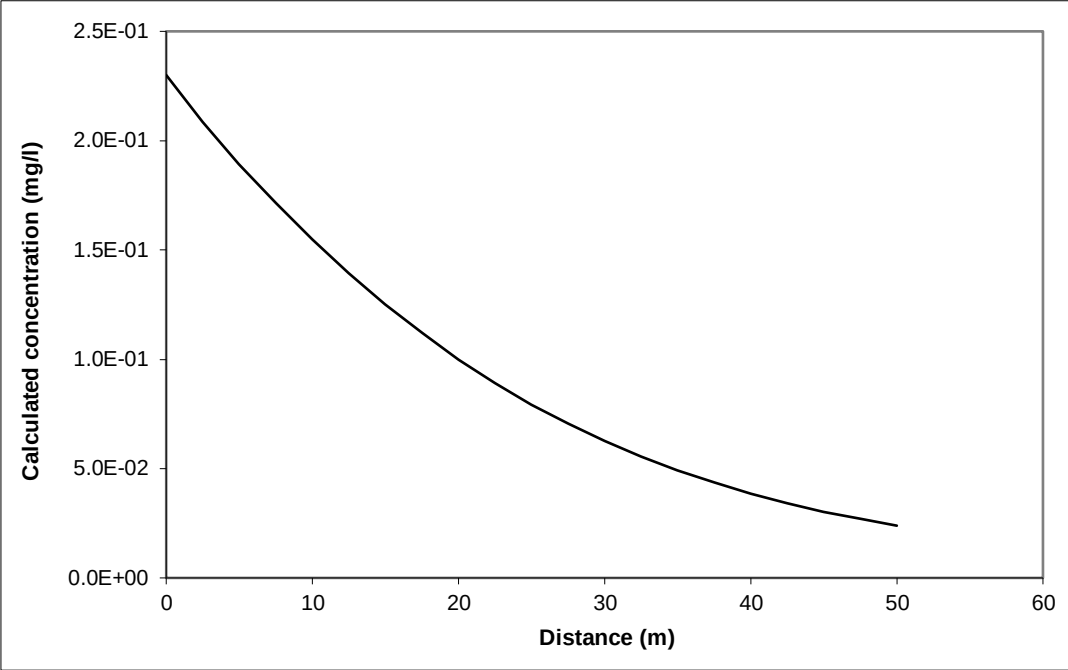
Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	Enter value 0.00E+00	Calc value Xu & Eckstein 5.00E+00	2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{0.414}; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	2.3E-01
2.5	2.09E-01
5.0	1.89E-01
7.5	1.71E-01
10.0	1.55E-01
12.5	1.39E-01
15.0	1.25E-01
17.5	1.12E-01
20.0	1.00E-01
22.5	8.91E-02
25.0	7.92E-02
27.5	7.04E-02
30.0	6.25E-02
32.5	5.55E-02
35.0	4.92E-02
37.5	4.36E-02
40.0	3.87E-02
42.5	3.43E-02
45.0	3.04E-02
47.5	2.69E-02
50.0	2.39E-02



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	24-May-23	Version:	1
Contaminant	Aromatic >C16-C21		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C16-C21	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	2.00E-02	mg/l	laboratory data
Half life for degradation of contaminant in water	t _{1/2}	4.00E+03	days	Howard et al 1991
Calculated decay rate	λ	1.73E-04	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	2.84E+00	m	assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.84E+01	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	1.69E+02	fraction
Decay rate used	λ	1.03E-06	d ⁻¹
Rate of contaminant flow due to retardation	u	8.78E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	2.35E-04	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	8.52E+01	

Remedial Targets

Remedial Target	7.66E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			

Distance to compliance point 50 m

Concentration of contaminant at compliance point after C_{ED}/C₀ 2.35E-04 mg/l Ogata Banks
1.0E+100 days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

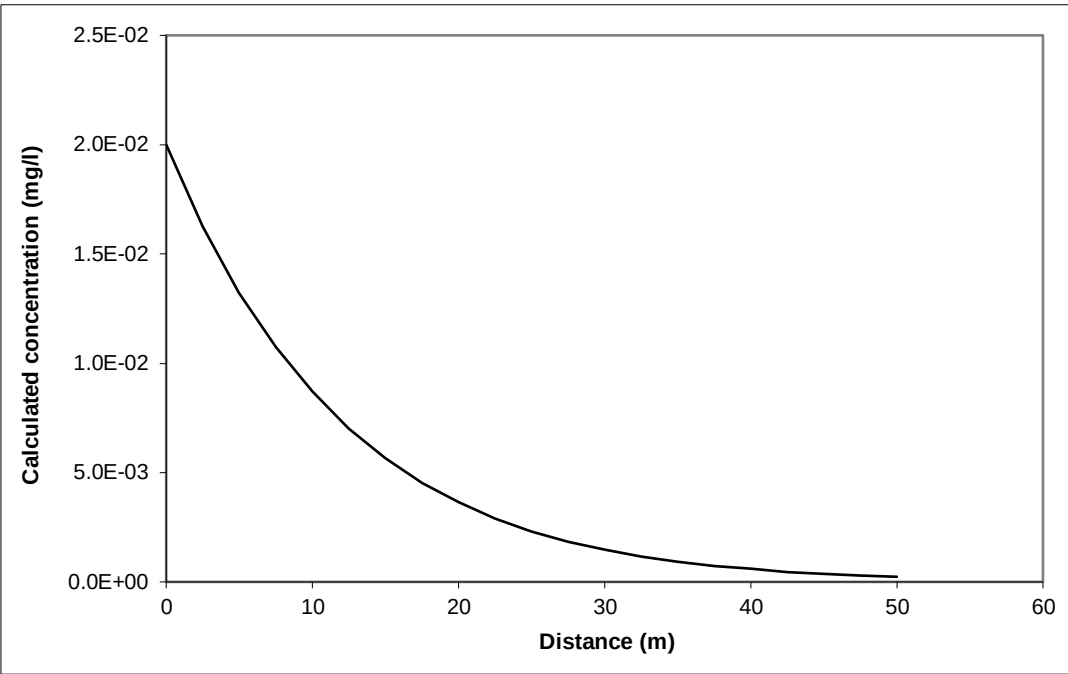
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	1.80E-03 fraction
Organic carbon partition coefficient	Koc	1.58E+04 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	2.84E+01 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Longitudinal dispersivity	ax	Enter value 0.00E+00	Calc value Xu & Eckstein 5.00E+00	2.98E+00 m
Transverse dispersivity	az	0.00E+00	5.00E-01	2.98E-01 m
Vertical dispersivity	ay	0.00E+00	5.00E-02	2.98E-02 m
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{2.414} ; az = ax/10, ay = ax/100 are assumed				



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	2.0E-02
2.5	1.63E-02
5.0	1.32E-02
7.5	1.07E-02
10.0	8.71E-03
12.5	7.03E-03
15.0	5.66E-03
17.5	4.54E-03
20.0	3.63E-03
22.5	2.90E-03
25.0	2.32E-03
27.5	1.85E-03
30.0	1.47E-03
32.5	1.17E-03
35.0	9.30E-04
37.5	7.39E-04
40.0	5.88E-04
42.5	4.67E-04
45.0	3.71E-04
47.5	2.95E-04
50.0	2.35E-04



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

<u>Details to be completed for each assessment</u>			
Site Name:	Ashley House, London		
Site Address:	Ashley House, Ashley Road, London, N17 9LZ, London		
Completed by:	Ugne Ankenaite		
Date:	24-May-23	Version:	1
Contaminant	Aromatic >C21-C35		
Target Concentration (C_T)	0.09	mg/l	Origin of C_T: WHO DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

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Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Aromatic >C21-C35	from Level 1
Target Concentration	C _T	9.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks

Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	1.00E-02	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	4.00E+03	days	laboratory data
Calculated decay rate	λ	1.73E-04	days ⁻¹	Howard et al 1991
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.50E+01	m	assumed plume width
Plume thickness at source	Sy	2.84E+00	m	assumed plume thickness
Saturated aquifer thickness	da	2.84E+00	m	measured from site data
Bulk density of aquifer materials	ρ	1.18E+00	g/cm ³	EA Science Report SCO50021/SR3
Effective porosity of aquifer	n	2.00E-01	fraction	EA Science Report SCO50021/SR3
Hydraulic gradient	i	2.60E-03	fraction	Site specific Value
Hydraulic conductivity of aquifer	K	1.14E-01	m/d	Site specific value
Distance to compliance point	x	5.00E+01	m	EA (2020) LCRM
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.27E+02	l/kg	see options
Longitudinal dispersivity	ax	5.00E+00	m	see options
Transverse dispersivity	az	5.00E-01	m	see options
Vertical dispersivity	ay	5.00E-02	m	see options

Dispersed plume thickness exceeds aquifer thickness! Reduce vertical dispersivity

Calculated Parameters Variable

Groundwater flow velocity	v	1.48E-03	m/d
Retardation factor	Rf	1.34E+03	fraction
Decay rate used	λ	1.29E-07	d ⁻¹
Rate of contaminant flow due to retardation	u	1.11E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.17E-04	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	8.52E+01	

Remedial Targets

Remedial Target	7.66E+00	mg/l	For comparison with measured groundwater concentration.
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Ogata Banks

Distance to compliance point	50	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.17E-04	mg/l
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc

Organic carbon partition coefficient Koc

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{OC,n}

Sorption coefficient for ionised species K_{OC,i}

pH value pH

acid dissociation constant pKa

Fraction of organic carbon in aquifer foc

Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd

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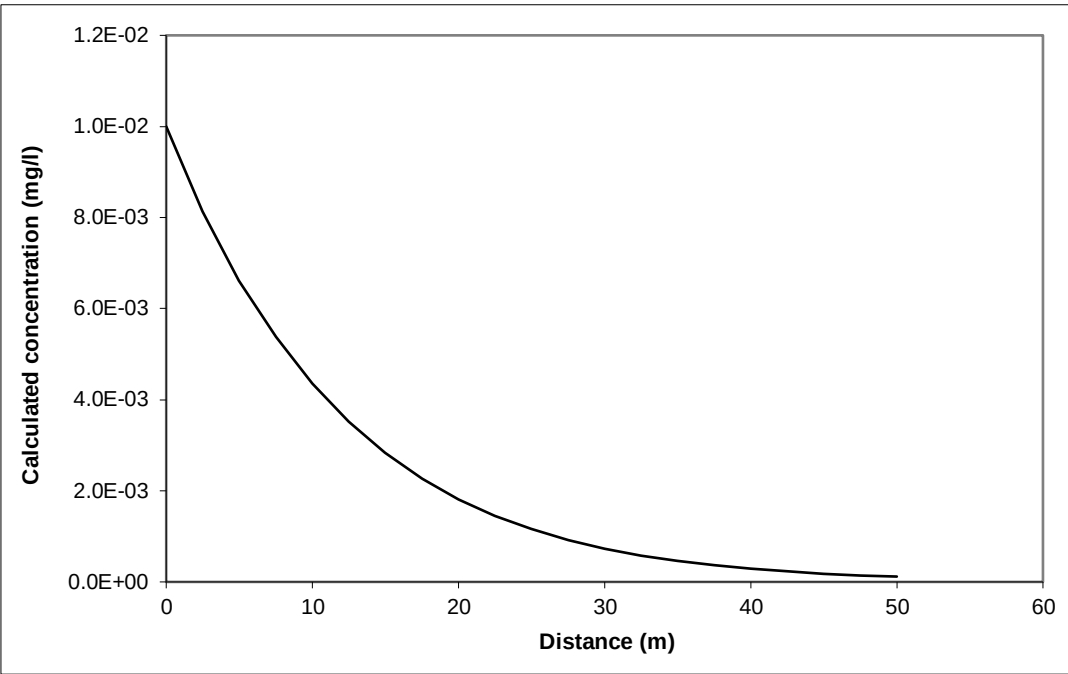
Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd

Soil water partition coefficient Kd



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared

with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Ashley House, London
Completed by:	Ugne Ankenaitė
Date:	#####
Version:	1

Detailed Ground Gas Assessment

Introduction

Calford Seaden on behalf of Notting Hill Genesis (client) instructed Waterman Infrastructure & Environment Limited (Waterman) to prepare a Detailed Ground Gas Risk Assessment for the Ashley House & Cannon Factory, Ashley Road South, Tottenham Hale, London (Site).

Previous ground investigations have identified the ground gas regime on the Ashley House as being Characteristic Situation 2 (CS2) in which ground gas protection measures are required in built structures. The purpose of this assessment is to undertake a critical review of the ground gas regime on the Ashley House site based on a detailed examination of the Site's environmental setting, ground conditions, surrounding land uses, and previous ground investigation results.

The report will conclude with an assessment of the Site's ground gas regime consistent with the approach detailed in CIRIA C665, and where required determination of the ground gas protection measures required to mitigate the risk to human health receptors.

The ground gas regime on the Cannon Factory has been identified as Characteristic Situation 1 (CS1) in which ground gas protection measures would not be required.

Proposed Development

Proposed buildings on the Ashley House site will comprise;

- A four storey building (Building 2) comprising 15 residential units above commercial units on the ground floor.
- A four to seven storey building (Building 2A) comprising residential units at ground floor alongside commercial units, and residential units on the floors above the ground floor.

Basements are not proposed.

A significant cut and fill is not proposed with finished levels generally remaining as existing.

Soft and hard landscaping will surround the buildings. Private soft landscaping is not proposed.

History

Historically the Ashley House site was a farm between 1850 – 1898 prior to becoming occupied by a multiple factories in 1913 (braid and bootlace factory, woollen factory and a pencil factory). In 1936 the Ashley House site was occupied by a printing ink and varnish factory which included various tanks chimneys and a water cooling tower. From 1972 to present the Site has remained as it currently exists.

Previous Site uses in which extensive fill would have likely occurred have not been identified.

Site Surroundings

Land uses historically in the surrounding area include recreational grounds, school, residential buildings, and works.

Landfills historical or current are absent in the surrounding area, with the closest landfill (historical/current) located 500m north east (Tottenham Marshes 1955 – 1962 – inert and industrial waste).

Ground Conditions

Geology generally encountered on-site is included in Table B1.

Table B1: Site Geology

Stratum	Thickness (m)	Description
Made Ground	0.59 – 2.0	Sub-base underlain by a sandy gravelly clay with fragments of brick, concrete
Enfield Silt Member	1.10 – 1.27	Orangish/yellowish brown slightly sandy gravelly CLAY
Kempton Park Gravel Member	1.14 – 3.50	Orangish brown very gravelly SAND to very sandy GRAVEL.
London Clay Formation	15.0	Grey and dark brown CLAY

Thin granular Made Ground deposits is present on-site consistent with the Site's history in which multiple phases of redevelopment or land raising has not occurred. The Site retains the current layout as observed in the 1972 historical maps when the Site was first developed. The Made Ground on-site is therefore associated with the construction of the existing development and is a minimum of 50 years old. Given the age of the Made Ground all readily degradable material would have degraded.

Ground Gas Regime

As identified in the CL:AIRE 2012 RB17 guidance document and CIRIA C665 ground gases only pose a risk to developments when the following can be satisfied, which is in line with source – pathway – receptor model followed by CLR11.

- An accumulation of a **large volume** of gas in the ground in or near the buildings (source).
- A pathway that allows gas to migrate through and/or out of the ground into a building or other structure sufficiently quickly to allow it to build up inside the building (pathway).
- A confined space within the building or structure where gas can build up to unacceptable levels (receptor).

In order for a risk from ground gases a source – pathway – receptor linkage needs to be present. This requires a sufficient quantity of gas to pose a hazard and one or more pathways by which it may cause significant harm to people. Crucially it is the quantity/volume of gas present within the soil/Made Ground matrix which should be considered a risk and not the gas concentration present in the ground (or monitoring well) which is commonly mistaken as posing a risk to future Site users.

Within this report the source – pathway – receptor linkage will be tested through a detailed site specific review of the Site's environmental setting, ground investigation results and the built structure present on-site. The report will conclude with an assessment into what the Site's ground gas regime is and whether ground gas protection measures consistent with BS8485 2017+2019 are required.

Ground Gas Source

A review of the Site's environmental setting identifies an absence of significant ground gas generating sources. Landfills identified as being representative of a significant ground gas generating source are absent on-site and in the surrounding area, and the Site is not in a coal mining area. Made Ground on-site is a relatively thin deposit (0.59 – 2.0m thick) and generally inert, with fragments of brick and concrete making up the anthropogenic fragments. A qualitative assessment of the Made Ground records it as being unlikely to represent a significant ground gas generating source.

As identified in the 2019 Geoff Card, James Lucas, and Steve Wilson, Technical Paper: Risk and Reliability in Gas Protection Design – 20 years on: Part 1, and the 2018 Ambisense and Environmental Protection Group, Using Ternary Plots for Interpretation of Ground Gas Monitoring Results river terrace gravels (Kempton Park Gravel Member, Enfield Silt Member) may contain small quantities of organic matter, which may degrade locally when exposed to oxygen generated during installation of boreholes. However, the rate of gas generation in these circumstances and the volume produced is extremely small and would not represent a risk to structures. The Kempton Park Gravel Formation or Enfield Silt Member would therefore not represent a significant ground gas generating source.

Off-site ground gas sources should only be considered a risk where a significant ground gas generating source is present. A review of historical maps identifies historical land uses similar to those present on-site or residential uses. The surrounding land uses are therefore likely to have a similar Made Ground composition and unlikely to represent a significant ground gas generating source.

Preferential pathways from an off-site significant ground gas generating source have not been identified.

The proposed Development will incorporate the following elements;

- Stripping of the existing hardstanding and sub-base;
- Excavation of the foundation pads and strip footings

The above actions completed as part of the proposed Developments construction will remove a portion of the Made Ground, decreasing the quantum of Made Ground on-site post development completion. The Site's level will be increased using crushed concrete and would therefore not represent a significant ground gas generating source. New ground gas sources will therefore not be introduced onto Site.

Six ground gas monitoring rounds have been completed on the Ashley House site, 4No as part of the 2019 Socotec ground investigation and 2No. as part of the 2015 RSK ground investigation. The ground gas monitoring results from the 6No monitoring rounds are included in Table B2.

Table B2: Ground gas monitoring results – RSK 2015

Borehole	Round 1			Round 2		
	Flow (l/hr)	Carbon Dioxide (%)	Methane (%)	Flow (l/hr)	Carbon Dioxide (%)	Methane (%)
BH101	0.2	1.7	<0.1	<0.1	0.3	<0.1
BH102	NM	NM	NM	0.1	0.3	<0.1
BH103A	NM	NM	NM	0.1	0.1	<0.1
WS101	0.4	2.1	16.3	<0.1	1.0	3.7
WS104	-0.5	3.6	<0.1	0.1	2.1	<0.1
WS107	-0.4	2.5	<0.1	<0.1	2.4	<0.1
WS108	0.3	0.1	<0.1	-0.1	0.3	<0.1
WS109	0.2	2.7	<0.1	<0.1	0.8	<0.1

Table B3: Ground gas monitoring results – Socotec 2019

Round	BH3			BH4		
	Flow (l/hr)	Carbon Dioxide (%)	Methane (%)	Flow (l/hr)	Carbon Dioxide (%)	Methane (%)
07/04/2019	<0.1	<0.1	<0.1	<0.1	0.7	<0.1
21/04/2019	<0.1	2.3	<0.1	<0.1	1.2	<0.1
24/04/2019	<0.1	2.7	<0.1	<0.1	0.2	<0.1
22/05/2019	<0.1	5.2	<0.1	<0.1	1.9	<0.1

The ground gas monitoring results are consistent with the absence of a significant ground gas source on-site or in the surrounding area. Methane concentrations and the gas flow rate are very low and commonly below the equipment's detection limit, and carbon dioxide is consistent with concentrations from the river terrace gravels (Enfield Silt Member and Kempton Park Gravel Member) in which concentrations up to 21% are not uncommon (EPG 2018 Ternary Plot Guidance, and CIEH 2009, Local Authority Guide to Ground Gas).

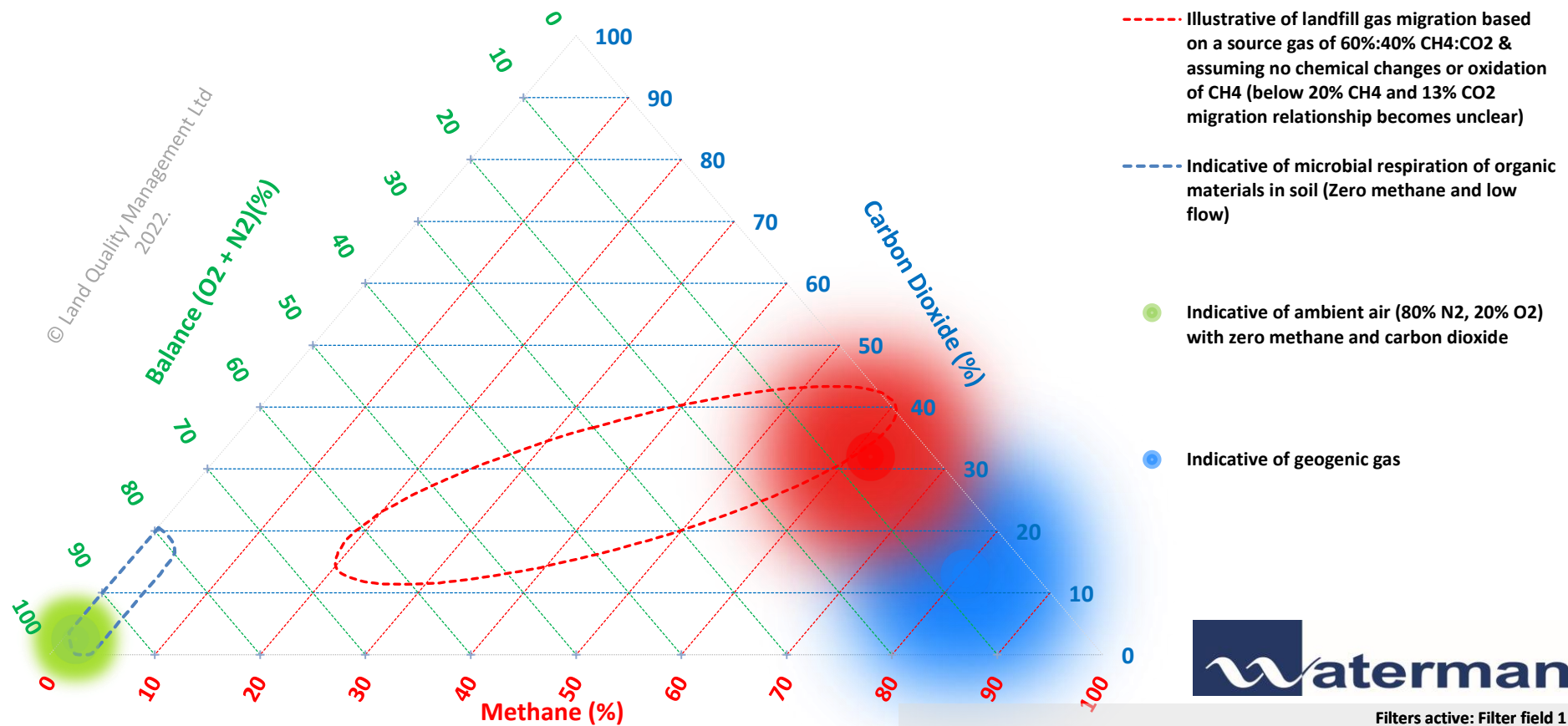
In the Kempton Park Gravel Formation and Made Ground in which low concentrations of readily degradable organic matter is present the carbon dioxide is generated through microbial/geochemical processes at very slow rates such they would not be emitted at the ground surface in sufficient quantities to pose a risk to built structures/future Site users. The installation of a monitoring well also temporarily exaggerates the microbial action through introducing oxygen into the sub-surface immediately surrounding the well, allowing enhanced degradation of the small volumes of organic material present in the Made Ground for a short time period. The presence of very low flow rates further confirms the above process in which carbon dioxide is being generated and emitted at very low rates.

Methane above the limit of detection was recorded solely in WS101. During the first monitoring round methane decreased from 18.7% at the start of the monitoring to 16.3% after 3 minutes. During the second monitoring round a decrease in methane from 20.9% to 3.7% after 10 minutes. The decrease in methane concentrations over the monitoring periods identifies a methane source with a small reservoir of readily degradable material rather than a large methane source as would be present at a landfill for example which would have large reservoir of readily degradable material. A review of the exploratory hole log for WS101 records Made Ground to 1.8m comprising 0.2m of concrete, 0.4m of sub-base, 1.2m of black silty sandy gravelly clay, underlain by the Kempton Park Gravel Member to base of exploratory hole. Between 1.2mbgl and 1.8mbgl black oil is identified in the sandy pockets and is the likely cause behind the high methane concentrations.

Petroleum hydrocarbons degrade and produce methane at very slow rates such hazardous rates of surface emissions are unlikely in the long term, the volume of methane produced is low but sufficient to cause high concentrations in the monitoring well. The absence of high flow rates in WS101 and on-site is further evidence the methane is being produced at a very slow rate. The high methane to low carbon dioxide ratio is consistent with the degradation of methane rather than interference with the meter. The gas from hydrocarbon degradation can become trapped below impermeable layers over time and if below the water table the pockets can become pressurised. There is no significant risk in the long term (because the volumes of gas are typically small). However they can present a short term health and safety hazard during construction if they are penetrated. Typically where a pocket is punctured, the gas pressure will dissipate over a few days. Given the above, the methane recorded in WS101 is unrepresentative of the ground gas regime on-site and is not evidence of a long term of high surface emissions risk, and will not be considered further.

The ground gas results from the monitoring completed have been included in a ternary plot (Figure B1) to further characterise the ground gas source and identify whether a significant ground gas risk is present/absent. The Ternary Plot identifies ground gas consistent with the microbial respiration of organic materials in soil, in which a low flow and low volume of ground gas is present.

Figure B1: Ternary Plot Ground Gas Results



Source Conclusion

A review of the Site's environmental Site setting identifies an absence of a significant ground gas source as being present on-site or off-site in the surrounding area. Made Ground is largely inert with a low organic matter content and has a maximum thickness of 2.0m. Landfills which would be a significant ground gas generating source are absent on-site or in the surrounding area, and the Site is not located in a coal mining area.

Pathway

For a risk to a human health receptor from ground gas risk there must be sufficient flow from the ground gas in the sub-surface environment into an enclosed space. The permeability of soil should therefore be considered when determining the potential for ground gas to reach the surface and migrate into a building. The empirical Gas Screening Values (GSV) included in the BS8485:2015+A1:2019 developed by correlations considered by Peckson (1985) did not account for permeability leading to the GSV used being highly conservative due to the absence of permeability which could have significant attenuation factor on ground gas migration.

Made Ground on-site has been recorded as comprising a predominately cohesive deposit with varying proportions of sand/gravel, in addition to anthropogenic material inclusions. The Made Ground would have a permeability in the region of $2.2 \times 10^{-5} \text{ m/s}$ (Environment Agency, SR3 2009), which would restrict the vertical migration of ground gases and would be resistant to pressure driven flows as caused by atmospheric pressure drops.

The proposed Development will incorporate a 250mm thick cast in-situ ground bearing reinforced floor slab with minimal penetrations. The ground floor slab will be tanked with a waterproof membrane with a minimum 200 gauge thickness. The cast in-situ ground bearing floor slab and membrane would restrict ground gas ingress and provide effective restriction of ground gas migration through it.

Receptor

The Development is residential led with buildings up to seven storeys, commercial is predominately located at ground floor with limited residential in Building 2A at ground floor. In areas of commercial use relatively high levels of ventilation will be present limiting the potential for ground gases to accumulate and the risk posed by ground gases to future human health receptors.

Conclusions

A review of the Site's environmental setting, which has been confirmed through completion of ground gas monitoring has not identified significant ground gas generating sources as being present on-site or in the surrounding area.

A review of the possible pathways and receptors identifies a 250mm thick cast in-situ ground bearing floor slab which would restrict the vertical migration of residual ground gas into the building, and a built structure which would inherently restrict the migration of ground gases into the proposed Development.

Following the detailed review of the Site's ground gas regime in-line with the recent guidance the Source – Pathway – Receptor linkage for the Site is broken primarily through removal of a ground gas source. The requirement for ground gas protection measures including ground gas membranes in the proposed Development would not be required.

Recommendations

- Ground gas protection measures would not be required in the completed developments;
- During construction works a watching brief should be maintained during excavations. Should Made Ground which would not be removed be encountered as part of the development construction which differs substantially from that identified in previous ground investigations either in appearance or thickness, works should cease and the environment consultant notified. The environmental consultant should assess the Made Ground encountered and its ground gas generation potential and determine whether there is a requirement for ground gas protection measures. The assessment of the Made Grounds ground gas generation potential, and determination of the requirement for ground gas protection measures should be agreed with the regulatory authority.

Appendix G Risk Rating Matrix

Table G.1: Risk rating for contaminated land qualitative risk assessment

Level of Severity	Likelihood		
	Most Likely	Reasonably Foreseeable	Unlikely
Acute harm or severe chronic harm. Direct pollution of sensitive water receptors or serious pollution of other water bodies.	High	High	Low
Harm from long-term exposure. Slight pollution of sensitive receptors or pollution of other water bodies.	Medium	Medium	Low
No significant harm in either short or long term. No pollution of water that is likely to affect sensitive receptors. No more than slight pollution of other water bodies.	Low	Low	Low

Appendix H Environmental Receptors

The Contaminated Land Statutory Guidance has a four category system that considers harm to human health, controlled waters, flora and fauna, property, livestock and crops. The Categories are broadly defined as follows:

- 1 Contaminated Land – similar to land where it is known that significant harm has been caused or significant harm is being caused
- 2 Contaminated Land – no significant harm being caused but there is a significant possibility for significant harm to be caused in the future
- 3 Not Contaminated Land – there may be harm being caused but no significant possibility for significant harm to be caused in the future
- 4 Not Contaminated Land – no contaminant linkage, normal levels of contaminants and no significant harm being caused and no significant possibility for significant harm to be caused in the future.

Table H.1: Significant pollution to controlled waters

Pollution of controlled waters

Under Section 78A(9) of Part 2A the term “pollution of controlled waters means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term “controlled waters” in relation to England has the same meaning as in Part 3 of the Water Resources Act 1991, except that “ground waters” does not include water contained in underground strata but above the saturation zones. (Paragraph 4.36)

Given that the Part 2A regime seeks to identify and deal with significant pollution (rather than lesser levels of pollution), the local authority should seek to focus on pollution which: (i) may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems; (ii) which may result in damage to material property; or (iii) which may impair or interfere with amenities and other legitimate uses of the environment. (Paragraph 4.37)

Significant pollution of controlled waters

Paragraph 4.38 states that “The following types of pollution should be considered to constitute significant pollution of controlled waters:

- (a) Pollution equivalent to “environmental damage” to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009, but which cannot be dealt with under those Regulations.
- (b) Inputs resulting in deterioration of the quality of water abstracted, or intended to be used in the future, for human consumption such that additional treatment would be required to enable that use.
- (c) A breach of a statutory surface water Environment Quality Standard, either directly or via a groundwater pathway.
- (d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants (as defined in Article 2(3) of the Groundwater Daughter Directive (2006/118/EC)5”.

Paragraph 4.39 states that “In some circumstances, the local authority may consider that the following types of pollution may constitute significant pollution: (a) significant concentrations⁶ of hazardous substances or non-hazardous pollutants in groundwater; or (b) significant concentrations of priority hazardous substances, priority substances or other specific polluting substances in surface water; at an appropriate, risk based compliance point. The local authority should only conclude that pollution is significant if it considers that treating the land as contaminated land would be in accordance with the

broad objectives of the regime as described in Section 1 (of the Contaminated Land Statutory Guidance). This would normally mean that the authority should conclude that less serious forms of pollution are not significant. In such cases the authority should consult the Environment Agency”.

The following types of circumstance should not be considered to be contaminated land on water pollution grounds:

- (a) The fact that substances are merely entering water and none of the conditions for considering that significant pollution is being caused set out in paragraphs 4.38 and 4.39 above are being met.
- (b) The fact that land is causing a discharge that is not discernible at a location immediately downstream or down-gradient of the land (when compared to upstream or up-gradient concentrations).
- (c) Substances entering water in compliance with a discharge authorised under the Environmental Permitting Regulations.

Significant pollution of controlled waters is being caused

In deciding whether significant pollution of controlled waters is being caused, the local authority should consider that this test is only met where it is satisfied that the substances in question are continuing to enter controlled waters; or that they have already entered the waters and are likely to do so again in such a manner that past and likely future entry in effect constitutes ongoing pollution. For these purposes, the local authority should:

- (a) Regard substances as having entered controlled waters where they are dissolved or suspended in those waters, or (if they are immiscible with water) they have direct contact with those waters on or beneath the surface of the water.
- (b) Take the term “continuing to enter” to mean any measurable entry of the substance(s) into controlled waters additional to any which has already occurred.
- (c) Take the term “likely to do so again” to mean more likely than not to occur again.

Land should not be determined as contaminated land on grounds that significant pollution of controlled waters is being caused where: (a) the relevant substance(s) are already present in controlled waters; (b) entry into controlled waters of the substance(s) from land has ceased; and (c) it is not likely that further entry will take place.

Significant Possibility of Significant Pollution of Controlled Waters

In deciding whether or not a significant possibility of significant pollution of controlled waters exists, the local authority should first understand the possibility of significant pollution of controlled waters posed by the land, and the levels of certainty/uncertainty attached to that understanding, before it goes on to decide whether or not that possibility is significant. The term “possibility of significant pollution of controlled waters” means the estimated likelihood that significant pollution of controlled waters might occur. In assessing the possibility of significant pollution of controlled waters from land, the local authority should act in accordance with the advice on risk assessment in Section 3 and the guidance in this sub-section.

In deciding whether the possibility of significant pollution of controlled waters is significant the local authority should bear in mind that Part 2A makes the decision a positive legal test. In other words, for particular land to meet the test the authority needs reasonably to believe that there is a significant possibility of such pollution, rather than to demonstrate that there is not.

Before making its decision on whether a given possibility of significant pollution of controlled waters is significant, the local authority should consider:

- (a) The estimated likelihood that the potential significant pollution of controlled waters would become manifest; the strength of evidence underlying the estimate; and the level of uncertainty underlying the estimate.

- (b) The estimated impact of the potential significant pollution if it did occur. This should include consideration of whether the pollution would be likely to cause a breach of European water legislation, or make a major contribution to such a breach.
- (c) The estimated timescale over which the significant pollution might become manifest.
- (d) The authority's initial estimate of whether remediation is feasible, and if so what it would involve and the extent to which it might provide a solution to the problem; how long it would take; what benefit it would be likely to bring; and whether the benefits would outweigh the costs and any impacts on local society or the environment from taking action

Reproduced from DEFRA (2012) Contaminated Land Statutory Guidance pursuant to section 78YA of the Environmental Protection Act 1990 as amended by Section 57 of the Environment Act 1995.

Table H.2: Significant harm to human health, ecological systems and property

Relevant types of receptor	Significant harm	Significant possibility of significant harm
Human beings	The following health effects should always be considered to constitute significant harm to human health: death; life threatening diseases (eg cancers); other diseases likely to have serious impacts on health; serious injury; birth defects; and impairment of reproductive functions. Other health effects may be considered by the local authority to constitute significant harm. For example, a wide range of conditions may or may not constitute significant harm (alone or in combination) including: physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts. In deciding whether or not a particular form of harm is significant harm, the local authority should consider the seriousness of the harm in question: including the impact on the health, and quality of life, of any person suffering the harm; and the scale of the harm. The authority should only conclude that harm is significant if it considers that treating the land as contaminated land would be in accordance with the broad objectives of the regime as described in Section 1 of the Contaminated Land Statutory Guidance.	The risk posed by one or more relevant contaminant linkage(s) relating to the land comprises: (a) The estimated likelihood that significant harm might occur to an identified receptor, taking account of the current use of the land in question. (b) The estimated impact if the significant harm did occur – i.e. the nature of the harm, the seriousness of the harm to any person who might suffer it, and (where relevant) the extent of the harm in terms of how many people might suffer it. In estimating the likelihood that a specific form of significant harm might occur the local authority should, among other things, consider: (a) The estimated probability that the significant harm might occur: (i) if the land continues to be used as it is currently being used; and (ii) where relevant, if the land were to be used in a different way (or ways) in the future having regard to the guidance on "current use" in Section 3 of the Contaminated Land Statutory Guidance. (b) The strength of evidence underlying the risk estimate. It should also consider the key assumptions on which the estimate of likelihood is based, and the level of uncertainty underlying the estimate.

Relevant types of receptor	Significant harm	Significant possibility of significant harm
Any ecological system, or living organism forming part of such a system, within a location which is: • a site of special scientific interest (under section 28 of the Wildlife and Countryside Act (WCA) 1981 (as amended) and Part 4 of the Natural Environment and Rural Communities Act 2006 (as amended)); • a national nature reserve (under Section 35 of the WCA 1981 (as amended)); • a marine nature reserve (under Section 36 of the WCA 1981 (as amended)); • an area of special protection for birds (under Section 3 of the WCA 1981 (as amended)); • a "European site" within the meaning of regulation 8 of the Conservation of Habitats and Species Regulations 2010 (as amended); • any habitat or site afforded policy protection under Section 15 of The National Planning Policy Framework (NPPF) on conserving and enhancing the natural environment (i.e. possible Special Areas of Conservation, potential Special Protection Areas and listed or proposed Ramsar sites); or • any nature reserve established under Section 21 of the National Parks and Access to the Countryside Act 1949.	The following types of harm should be considered to be significant harm: • harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or • harm which significantly affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location. In the case of European sites, harm should also be considered to be significant harm if it endangers the favourable conservation status of natural habitats at such locations or species typically found there. In deciding what constitutes such harm, the local authority should have regard to the advice of Natural England and to the requirements of the Conservation of Habitats and Species Regulations 2010 (as amended).	Conditions would exist for considering that a significant possibility of significant harm exists to a relevant ecological receptor where the local authority considers that: • significant harm of that description is more likely than not to result from the contaminant linkage in question; or • there is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration. Any assessment made for these purposes should take into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.
Property in the form of: • crops, including timber • produce grown domestically, or on allotments, for consumption • livestock • other owned or domesticated animals; • wild animals which are the subject of shooting or fishing rights.	For crops, a substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage. The local authority should regard a substantial loss in value as occurring only when a substantial proportion of the animals or crops are dead or otherwise no longer fit for their intended purpose. Food should be regarded as being no longer fit for purpose when it fails to comply with the provisions of the Food Safety Act 1990. Where a	Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question, taking into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.

Relevant types of receptor	Significant harm	Significant possibility of significant harm
	diminution in yield or loss in value is caused by a contaminant linkage, a 20% diminution or loss should be regarded as a benchmark for what constitutes a substantial diminution or loss. In the Guidance states that this description of significant harm is referred to as an "animal or crop effect".	
Property in the form of buildings. For this purpose 'building' means any structure or erection and any part of a building, including any part below ground level, but does not include plant or machinery comprised in a building, or buried services such as sewers, water pipes or electricity cables.	Structural failure, substantial damage or substantial interference with any right of occupation. The local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended. In the case of a scheduled Ancient Monument, substantial damage should be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled. The Guidance states that this description of significant harm is referred to as a 'building effect'.	Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question during the expected economic life of the building (or in the case of a scheduled Ancient Monument the foreseeable future), taking into account relevant information for that type of contaminant linkage.

Reproduced from DEFRA (2012) Contaminated Land Statutory Guidance pursuant to section 78YA of the Environmental Protection Act 1990 as amended by Section 57 of the Environment Act 1995.

Appendix I Generic Assessment Criteria

Human Health Generic Assessment Criteria

Background

In order to be able to make inference on whether the results obtained during the site investigation (e.g. chemical concentrations in soils, waters and gas) point to the presence of a potential hazard to human health, it is necessary to distinguish between the results, reflecting background and/or insignificantly elevated levels of contamination (i.e. with negligible potential to cause harm or pollution) and the results with significantly elevated concentrations (i.e. with significant potential to cause harm or pollution).

The approach to risk assessment with respect to risks to human health from contaminated land in the UK is set out in the publication Model Procedures for the Management of Land Contamination (CLR11) Environment Agency (2004).

This sets out a tiered approach:

- Preliminary Risk Assessment (e.g. establishing potential contaminant linkages);
- Generic Quantitative Risk Assessment (GQRA) (e.g. comparison of site contaminant concentrations against generic standards and compliance criteria e.g. Soil Guideline Values (SGV) or other Generic Assessment Criteria including an assessment of risk using the source pathway target model); and
- Detailed Quantitative Risk Assessment (DQRA) (e.g. the comparison of contaminant concentrations against site specific assessment criteria).

Preliminary Risk Assessment

This typically encompasses a desk based generation of a conceptual model to establish the potential contaminant linkages associated with the site and any proposed development. Works would typically involve:

- Evaluation of the potential sources of contamination on the site and in the locality and from both a current and historical perspective
- Statutory Consultation;
- Evaluation of a sites geology, hydrology and hydrogeology;
- Site inspection;
- Additional pertinent information as necessary on a site by site basis.

Where works indicate the presence of a potential contaminant linkage further evaluation and potentially site investigation works are necessary to determine the significance of the linkage.

Generic Quantitative Risk Assessment (GQRA)

In August 2008 the Environment Agency (EA) and Department of Environment Food and Rural Affairs (DEFRA) announced the withdrawal of the Contaminated Land Reports CLR7 – 10, CLEA UK (beta) and existing SGV reports as they no-longer fully reflected the revised approach to human health risk assessment.

New partial guidance (in particular Science Reports SR2, SR3 and SR7) and new risk assessment tools (CLEA model version v1.04, v1.05 and currently v1.06) were published in 2009 and these allow environmental practitioners to derive generic and site specific Soil Assessment Criteria (GAC and SAC).

Soil Guideline Values (SGVs)

The EA and DEFRA updated the TOX reports and Soil Guideline Values (SGVs) to reflect the guidance documents published in 2009. SGVs for arsenic, cadmium, nickel, mercury, selenium, BTEX compounds

(benzene, toluene, ethylbenzene and xylenes), dioxins, furans and dioxin like PCBs and phenol have been made available.

Since publishing the revised SGVs the CLEA model was updated to version v1.06. The Environment Agency has however confirmed that v1.05 has only a “minor effect on assessment criteria calculated using the CLEA software 1.04” and consequently the GACs derived are considered to remain valid. Environment Agency SGVs generated using v1.04 have also not been updated. Software version v1.06 is identical to v1.05 with some password protection enhancements that in no way affect the GAC values generated.

Owing to the scientific advances since 2009 and in particular toxicological research outputs, less significance is now placed on the SGVs in the hierarchy outlined below.

Category 4 Screening Levels (C4SLs)

Category 4 Screening Levels were generated by Contaminated Land: Applications in Real Environments (CL:AIRE) on behalf of DEFRA and made available to the public in April 2014. Category 4 Screening Levels were derived in response to policy changes outlined in the recently revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A). Part 2A was originally introduced to ensure that the risks from land contamination to human health, property and the environment are managed appropriately, with the revised SG being designed to address concerns regarding its real-world application. The revised SG presents a new four category system for classifying land under Part 2A, ranging from Category 4, where the level of risk posed is acceptably low, to Category 1, where the level of risk is clearly unacceptable.

The document SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (March 2014) states that:

The Impact Assessment that accompanied the revised Part 2A Statutory Guidance identified a potential role for new ‘Category 4 Screening Levels’ in providing a simple test for deciding when land is suitable for use and definitely not contaminated land. It was envisaged that these new screening levels would allow ‘low-risk’ land to be dismissed from the need for further risk assessment more quickly and easily and allow regulators to focus efforts on the highest-risk land. The C4SLs were proposed to be more pragmatic (whilst still strongly precautionary) compared to existing generic screening levels. It is anticipated that, where they exist, C4SLs will be used as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the currently or previously available SGVs.

Suitable For Use Screening Levels (S4USLs)

In January 2015, Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have published updated screening criteria that were derived in line with UK guidance on risk assessment (SR2 and SR3). The resultant screening criteria reflect the industries greater knowledge of the relevant toxicology and further consideration of exposure scenarios as set out in SP1010.

Waterman’s Generic Assessment Criteria (GACs)

Waterman have used the following hierarchy for the generic assessment of soils to evaluate Human Health.

- Published Category 4 Screening Values (C4SLs) derived by CL:AIRE on behalf of DEFRA; or in their absence;
- Suitable 4 Use Screening Levels (S4USLs) derived by LQM/CIEH; or in their absence;
- Published Soil Guideline Values (SGVs);
- GAC prepared in accordance with the CLEA v1.04 / v1.06 model by authoritative bodies (e.g. Contaminated Land Applications in Real Environments (CL:AIRE) 2009; and
- Waterman in-house GAC prepared in accordance with the CLEA V1.06 model and associated documents.

Tabulated values of the GACs used are presented overleaf. The references of the sources quoted in the table are:-

- Environment Agency, 2009. CLEA Software, version 1.06;
- DEFRA, Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Contaminated Land Report 11;
- DEFRA, 2014, SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document and appendices;
- LQM / CIEH, 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment;
- Environment Agency, 2009. Human health toxicological assessment of contaminants in soil. Report SC050021/SR2;
- Environment Agency, 2009. Updated technical background to the CLEA model. Report SC050021/SR3;
- Environment Agency, 2008. Compilation of chemical data for priority organic pollutants for derivation of Soil Guideline Values. Report SC050021/SR7; and
- EIC / CL:AIRE, 2010. Soil generic assessment criteria for human health risk assessment.

Detailed Quantitative Risk Assessment (DQRA)

Detailed Quantitative Risk Assessments are undertaken on a site specific basis and full details of the alterations to the CLEA model and generic land use scenarios will be described within the specific reports.

Benzo(a)pyrene Surrogate Marker (SM) Approach

The DEFRA Category 4 Screening Level for B(a)P is based on the surrogate marker approach. In order to utilise the GAC or others based on this approach, the sample assessed must exhibit certain properties that comply with underlying assumptions.

SP1010, Appendix E states:

“The SM approach estimates the toxicity of a mixture of PAHs in an environmental matrix by using toxicity data for a PAH mixture for which the composition is known. Exposure to the SM is assumed to represent exposure to all PAHs in that matrix therefore the toxicity of the SM represents the toxicity of the mixture. In most cases, BaP is chosen as the SM due to its ubiquitous nature and the vast amount of data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food (EFSA 2008). However, RIVM considered that ‘it would not be suitable to use BaP as a SM for carcinogenic risk assessment of PAH mixtures in soil due to the wide variety in composition of PAH mixtures in Dutch land contamination sites’, although little data was provided in the report to support this statement (RIVM 2001). Similarly, the Canadian Council of Ministers of the Environment (CCME) also stated that contaminated soil is likely to contain a diverse range of carcinogenic and non-carcinogenic PAH of varying potency (CCME, 2008).

The SM approach relies on a number of assumptions (HPA 2010).

- *The SM (BaP) must be present in all soil samples.*
- *The profile of the different PAH relative to BaP should be similar in all samples.*
- *The PAH profile in the soil samples should be similar to that used in the pivotal toxicity study on which HBGV was based i.e. the Culp study.*

[sic] To assess the PAH profile in the test soil sample [complies with the assumptions above], the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene,

benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated to ensure it is similar to the test material used in the Culp study (HPA 2010). To be considered sufficiently similar, the ratio relative to BaP should fit within the upper and lower limits (representing an order of magnitude above and below the mean ratio to BaP of test material used in the Culp study). In such cases BaP is considered an adequate SM and the LLTC for BaP may be used in the risk assessment.

If the site falls outside the order of magnitude limits, it may be appropriate to considering a LLTC for groups of surrogate markers, such as groups of 2, 4 or 8 PAHs, as used by EFSA for the evaluation of PAHs in food (EFSA 2008). Expert judgement should be sought in such situations where there is uncertainty as to whether BaP is sufficiently representative (HPA 2010)."

The ratios of the seven genotoxic PAHs relative to B(a)P can be calculated 'by hand' or using LQM's PAH profiling tool.

Generic Quantitative Risk Assessment Criteria

Table I1: Residential and Allotment end-uses.

Proposed End Use	units	Residential without plant uptake			Source
Soil Organic Matter Content	%	1	2.5	6	
Arsenic	mg/kg	40	40	40	DEFRA C4SLs
Antimony	mg/kg	550	550	550	CL:AIRE 2009
Barium	mg/kg	1300	1300	1300	CL:AIRE 2009
Beryllium	mg/kg	1.7	1.7	1.7	LQM S4ULs 2015
Boron (Water Soluble)	mg/kg	11000	11000	11000	LQM S4ULs 2015
Cadmium	mg/kg	150	150	150	DEFRA C4SLs
Chromium (Total)	mg/kg	910	910	910	LQM S4ULs 2015
Chromium (VI)	mg/kg	21	21	21	DEFRA C4SLs
Copper	mg/kg	7100	7100	7100	LQM S4ULs 2015
Lead	mg/kg	310	310	310	DEFRA C4SLs
Mercury	mg/kg	1.2	1.2	1.2	LQM S4ULs 2015
Molybdenum	mg/kg	670	670	670	CL:AIRE 2009
Nickel	mg/kg	180	180	180	LQM S4ULs 2015
Selenium	mg/kg	430	430	430	LQM S4ULs 2015
Vanadium*	mg/kg	1200	1200	1200	LQM S4ULs 2015
Zinc	mg/kg	40000	40000	40000	LQM S4ULs 2015
Aliphatic EC5 - EC6	mg/kg	42	78	160	LQM S4ULs 2015
Aliphatic EC6 - EC8	mg/kg	100	230	530	LQM S4ULs 2015
Aliphatic EC8-EC10	mg/kg	27	65	150	LQM S4ULs 2015

Proposed End Use	units	Residential without plant uptake			Source
Soil Organic Matter Content	%	1	2.5	6	
Aliphatic EC10-EC12	mg/kg	130	330	770	LQM S4ULs 2015
Aliphatic EC12-EC16	mg/kg	1100	2400	4400	LQM S4ULs 2015
Aliphatic EC16-EC35	mg/kg	65000	92000	110000	LQM S4ULs 2015
Aliphatic EC35-EC44	mg/kg	65000	92000	110000	LQM S4ULs 2015
Aromatic C5-C7	mg/kg	370	690	1400	LQM S4ULs 2015
Aromatic C7-C8	mg/kg	860	1800	3900	LQM S4ULs 2015
Aromatic C8-C10	mg/kg	47	110	270	LQM S4ULs 2015
Aromatic C10-C12	mg/kg	250	590	1200	LQM S4ULs 2015
Aromatic C12-C16	mg/kg	1800	2300	2500	LQM S4ULs 2015
Aromatic C16-C21	mg/kg	1900	1900	1900	LQM S4ULs 2015
Aromatic C21-C35	mg/kg	1900	1900	1900	LQM S4ULs 2015
Aromatic C35-C44	mg/kg	1900	1900	1900	LQM S4ULs 2015
Benzene	mg/kg	0.38	0.7	1.4	LQM S4ULs 2015
Toluene	mg/kg	880	1900	3900	LQM S4ULs 2015
Ethyl Benzene	mg/kg	83	190	440	LQM S4ULs 2015
Xylene - o	mg/kg	88	210	480	LQM S4ULs 2015
Xylene - m	mg/kg	82	190	450	LQM S4ULs 2015
Xylene - p	mg/kg	79	180	430	LQM S4ULs 2015
MTBE (Methyl tert-butyl ether)	mg/kg				CL:AIRE 2009
Naphthalene	mg/kg	2.3	5.6	13	LQM S4ULs 2015

Proposed End Use	units	Residential without plant uptake			Source
Soil Organic Matter Content	%	1	2.5	6	
Acenaphthylene	mg/kg	2900	4600	6000	LQM S4ULs 2015
Acenaphthene	mg/kg	3000	4700	6000	LQM S4ULs 2015
Fluorene	mg/kg	2800	3800	4500	LQM S4ULs 2015
Phenanthrene	mg/kg	1300	1500	1500	LQM S4ULs 2015
Anthracene	mg/kg	31000	35000	37000	LQM S4ULs 2015
Fluoranthene	mg/kg	1500	1600	1600	LQM S4ULs 2015
Pyrene	mg/kg	3700	3800	3800	LQM S4ULs 2015
Benzo(a)anthracene	mg/kg	11	14	15	LQM S4ULs 2015
Chrysene	mg/kg	30	31	32	LQM S4ULs 2015
Benzo(b)fluoranthene	mg/kg	3.9	4	4	LQM S4ULs 2015
Benzo(k)fluoranthene	mg/kg	110	110	110	LQM S4ULs 2015
Benzo(a)pyrene	mg/kg	3.2	3.2	3.2	LQM S4ULs 2015
Indeno(1,2,3-cd)pyrene	mg/kg	45	46	46	LQM S4ULs 2015
Di-benzo(a.h.)anthracene	mg/kg	0.31	0.32	0.32	LQM S4ULs 2015
Benzo(g.h.i.) Perylene	mg/kg	360	360	360	LQM S4ULs 2015
Phenol	mg/kg	750	1300	2300	LQM S4ULs 2015
Pentachlorophenol (PCP)	mg/kg	27	29	31	LQM S4ULs 2015
1,1,2,2 Tetrachloroethane	mg/kg	3.9	8	17	LQM S4ULs 2015
1,1,1,2 Tetrachloroethane	mg/kg	1.5	3.5	8.2	LQM S4ULs 2015
1,1,1 Trichloroethane	mg/kg	9	18	40	LQM S4ULs 2015

Proposed End Use	units	Residential without plant uptake			Source
Soil Organic Matter Content	%	1	2.5	6	
Trichloroethene	mg/kg	0.017	0.036	0.08	LQM S4ULs 2015
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	LQM S4ULs 2015
1,2- Dichloroethane	mg/kg	0.0092	0.013	0.023	LQM S4ULs 2015
Chloroethene (Vinyl chloride)	mg/kg	0.00077	0.001	0.0015	LQM S4ULs 2015
Trichloroethene	mg/kg	0.017	0.036	0.08	LQM S4ULs 2015
Tetrachloroethene	mg/kg	0.18	0.4	0.92	LQM S4ULs 2015
Trichloromethane (Chloroform)	mg/kg	1.2	2.1	4.2	LQM S4ULs 2015
Sum of PCDDs, PCDFs and dioxins like PCBs	ug/kg				CLEA SGVs 2009
Isopropylbenzene	mg/kg	12	28	67	CL:AIRE 2009
Propylbenzene	mg/kg	40	97	230	CL:AIRE 2009
Styrene	mg/kg	35	78	170	CL:AIRE 2009
Bromobenzene	mg/kg	0.91	2.1	4.9	CL:AIRE 2009
1,1,2 Trichloroethane	mg/kg	0.88	1.8	3.9	CL:AIRE 2009
1,1-Dichloroethane	mg/kg	2.5	4.1	7.7	CL:AIRE 2009
1,1-Dichloroethene	mg/kg	0.23	0.41	0.82	CL:AIRE 2009
1,2,4-Trimethylbenzene	mg/kg	0.41	0.99	2.3	CL:AIRE 2009
1,2-Dichloropropane	mg/kg	0.024	0.042	0.085	CL:AIRE 2009
2-Chloronaphthalene	mg/kg	3.8	9.3	22	CL:AIRE 2009

Proposed End Use	units	Residential without plant uptake			Source
Soil Organic Matter Content	%	1	2.5	6	
Bromodichloromethane	mg/kg	0.019	0.034	0.07	CL:AIRE 2009
Bromoform	mg/kg	5.2	11	23	CL:AIRE 2009
Chloroethane	mg/kg	8.4	11	18	CL:AIRE 2009
Chloromethane	mg/kg	0.0085	0.0099	0.013	CL:AIRE 2009
Cis 1,2 Dichloroethene	mg/kg	0.12	0.2	0.39	CL:AIRE 2009
Dichloromethane	mg/kg	2.1	2.8	4.5	CL:AIRE 2009
Hexachloroethane	mg/kg	0.22	0.54	1.3	CL:AIRE 2009
Trans 1,2 Dichloroethene	mg/kg	0.19	0.35	0.71	CL:AIRE 2009
Bis (2-ethylhexyl) phthalate	mg/kg	2700	2800	2800	CL:AIRE 2009
Butyl benzyl phthalate	mg/kg	42000	44000	44000	CL:AIRE 2009
Diethyl Phthalate	mg/kg	1800	3500	6300	CL:AIRE 2009
Di-n-butyl phthalate	mg/kg	450	450	450	CL:AIRE 2009
Di-n-octyl phthalate	mg/kg	3400	3400	3400	CL:AIRE 2009
Biphenyl	mg/kg	220	500	980	CL:AIRE 2009
2,4-Dinitrotoluene	mg/kg	170	170	170	CL:AIRE 2009
2,6-Dinitrotoluene	mg/kg	78	84	87	CL:AIRE 2009
Tributyl tin oxide	mg/kg	1.4	3.1	0.24	CL:AIRE 2009

Soil Contamination – Risk of Harm to Property

Structures and Underground Services

Buried Concrete

BRE Special Digest 1 (2005), 3rd Edition, entitled *Concrete in aggressive ground*, provides guidance on the specification for concrete for installation in natural ground and in brownfield locations. The procedures given for the ground assessment and concrete specification cover the fairly common occurrences of sulfates, sulfides and acids, and the more rarely occurring aggressive carbon dioxide found in some ground and surface waters, which affects concrete foundations and sub-structures. It gives procedures for specification of concrete and applies to both buildings and civil engineering construction.

Water Supply Pipes

Guidance is provided in the UK Water Industry Research (UKWIR) report entitled “*Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites*” Report Ref. No. 10/WM/03/21, 2010.

Guidance is provided in the November 2010 Q&A Update and the Questions and Answers Sheet dated 4 May 2011 included at the back of the UKWIR report. Item 3 has been reproduced here:

Table 12 UKWIR guidance

Item	Question	Answer
3	Following the flow chart in Figure 1.1, would it be acceptable to not undertake a site investigation and specify the use of barrier pipes (these seem to be suitable for all conditions)? Would it be acceptable to adopt the blanket approach of always using barrier pipes at Brownfield sites, negating the need for a desk study or intrusive investigation?	The UKWIR project steering group decided that barrier pipes would provide sufficient protection for the supply of drinking water in all Brownfield site conditions. It is therefore reasonable to expect that water companies will accept the use of barrier pipe in all situations as a blanket approach

Controlled Waters Generic Assessment Criteria

The Screening Values adopted by Waterman for ground and surface water quality have been selected on the basis of the water quality standards that apply at the controlled water receptor considered to be at potential risk of harm.

Surface Waters

The Water Framework Directive (WFD) (2000/60/EC) was originally introduced in 2000, however a raft of Daughter Directives were introduced to address the objectives the WFD originally set out. Over time the WFD and its Daughter Directives have gradually replaced number of the existing Directives including the Dangerous Substances Directive (DSD) and Surface Water Directive (SWD).

The WFD identifies 'Priority' and 'Priority Hazardous Substances', to which Environmental Quality Standards (EQS) have been determined. The WFD EQS do not provide a full complement of applicable values to adopt. In the absence of an EQS, values under the replaced Surface Water Directive have been used as a guide.

Groundwater

The EU Drinking Water Directive (DWD) (98/83/EC) lays out the standards for drinking water EU wide. The UK have followed the EU regulations and translated the Directive into the Water Supply (Water Quality) Regulations England 2000. The UK Drinking Water Standards are the most relevant criteria to use for the assessment of risks to water destined for potable sources.

The WFD, to date, have not set threshold values for groundwater on a river basin basis.

TPH and PAHs

A suitable risk based assessment criteria for risks from TPH in both surface waters and groundwater are not available in the UK. The WHO have produced a health based risk assessment for drinking waters with regard to TPH “Petroleum Products in Drinking Waters, Background document for development of WHO Guidelines for Drinking-water Quality. Ref. WHO/SDE/WSH/05.08/123”.

A complete list of assessment criteria for PAHs is absent from the UK (benzo(a)pyrene is available). However, the risk from PAHs should be considered. The theory presented in the WHO document “Petroleum Products in Drinking Waters, Background document for development of WHO Guidelines for Drinking-water Quality. Ref. WHO/SDE/WSH/05.08/123” has been applied to provide indicative screening values for PAHs with regard to drinking water. Published TDI and ID effects have been amended for the UK standard body weight and behaviour to derive a UK guideline for DWS of PAHs (70kg body weight and 2l of water consumed per day).

The derived TPH and PAH screening values are used as an indication of the risks from TPH and PAHs to human health through drinking water only.

The standards for the substances tested for in this investigation are provided below.

Table I4 Water Quality Standards

	Concentration (µg/l)
Determinand	Surface Water - EQS Freshwater (DEFRA Directions 2015)
Metals	
Arsenic	50
Cadmium	0.25*
Copper	46.80 (bioavailable)
Chromium (total)	4.7
Chromium (VI)	3.4
Chromium (III)	4.7
Iron	1000
Lead	11.80 (partial bioavailable)
Manganese	123 (bioavailable)
Mercury	0.07
Nickel	24.14 (bioavailable)
Zinc	41.82 (bioavailable)
Non-Metals	
BTEX	
Benzene	10
Toluene	74
Xylene (p+m)	30
Petroleum Hydrocarbons	

Aromatic EC6-EC7 (Benzene)	10
Aromatic EC7-EC8 (Toluene)	74
Polycyclic Aromatic Hydrocarbons	
Anthracene	0.1
Benzo(a)pyrene	0.00017
Benzo(b)fluoranthene	0.00017
Benzo(g,h,i.) Perylene	0.00017
Benzo(k)fluoranthene	0.00017
Fluoranthene	0.0063
Indeno(1,2,3-cd)pyrene	0.00017
Naphthalene	2
Volatile Organic Compounds	
1,2-Dichloroethane	10

Bioavailability based Environmental Quality Standards

Under the Water Framework Directive, originally introduced in 2000, and transposed into the UK regulatory framework via the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015, we are now required take account of the bioavailability when assessing the toxicity of heavy metal contamination in the freshwater environment.

What is Bioavailability and Why Account for it?

It is widely accepted that the total concentration of certain metals in freshwater often has limited relevance to potential environmental risk, but it is the 'bioavailable' fraction that is likely to result in toxic effects to aquatic organisms. Effectively, it's the bioavailability of a metal which reflects the actual metal concentration that the organism will be exposed to, and thus is the relevant concentration that we are interested in when assessing risk.

EQS developed under previous legislation (including the Dangerous Substances Directive (76/464/EEC)) were expressed as total concentration relative to hardness bandings to reflect the indications that toxicity to aquatic life was influenced by water hardness. Scientific knowledge and understanding on the impact of metals has since developed, and metal bioavailability in aquatic systems is now understood to be influenced by several site-specific physio-chemical factors including the pH, calcium content and the level of dissolved organic carbon (DOC) present within the water body under consideration.

Taking bioavailability into account as part of the risk assessment process is now considered best practice and will enable more accurate estimation of metal toxicity and the risks posed to the freshwater environment.

How to Account for Metal Bioavailability

The increased understanding of the impact of certain metals on the aquatic environment has enabled EQSs to be published by the UK Secretary of State for a number of metals based on their bioavailable concentration. These are referred to as EQSbioavailable and are listed in the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

It is very difficult to measure the bioavailable concentration of a metal directly. We therefore have to rely on models to predict the bioavailable concentration from dissolved concentrations. In the UK, a simple predictive tool has been developed that can take account of water quality parameters such as pH, and calcium to determine the amount of bioavailable metal present in the freshwater environment.

The tool is called the Metal Bioavailability Assessment Tool (M-BAT) and is acceptable for use under the UK regulatory framework.

Use of Background Concentrations for the Assessment of Zinc.

Metals occur naturally in the aquatic environment due to weathering of surface geology, and under the EQS Directive (2008/105/EEC) background concentrations for metals can be considered when assessing compliance against the respective EQS.

The situation for Zinc is now slightly different, and consideration of background concentration is now an explicit part of the zinc EQS released under the WFD and needs to be taken into account as part of the initial compliance assessment.

Using this approach, a local background concentration should be subtracted from the monitoring data before the bioavailability estimate is performed using M-BAT. Under the WFD, catchment specific background values have been defined for England and Wales to be used in conjunction with the EQSbioavailable. The background values are listed within the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 Schedule 3, Part 2, Table 2, and also reproduced in Appendix A of the M-BAT user guide available [here](#).

Lead

Lead is not included in the M-BAT tool (referred to above) as it is not a full bioavailable EQS. The EQS for lead is an EU standard under WFD. It takes into account the influence of DOC on the toxicity of lead but, unlike the full bioavailable standards for zinc, copper, manganese and nickel which are included in M-BAT, it only considers the influence of DOC, and does not require the consideration of calcium or pH.

Ground Gas and Volatile Organic Compounds Generic Assessment Criteria

Ground Gas

Current UK guidance has been produced by CIRIA, the British Standards Institution (BSI) and CL:AIRE. The following relevant documents have been prepared to date:

- CIRIA C665 – Assessing the risks posed by hazardous ground gases to buildings, 2007;
 - Aims to consolidate good practice in investigation, facilitate the collection of relevant data, instigate appropriate monitoring programmes, all in a risk based approach to gas contaminated land.
- BS 8576 – Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs), 2013;
 - Provides guidance on the monitoring and sampling of ground gases, including methane, carbon dioxide, oxygen, and VOCs. Guidance is not provided on the risk evaluation and characterisation of site's, the selection and design of protective measures, verification of protective measures, sampling of atmospheric gases, and the monitoring and sampling of radon.
- CIRIA C735 – Good practice on the testing and verification of protection systems for buildings against hazardous ground gases, 2014; and
 - Sets out the good practice guidance for the designer, installer, verifier, and regulator on the verification and integrity testing of gas protection systems.
- BS 8485 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, 2015.
 - Provides guidance on the appropriate ground gas parameters that can be used to identify a range of possible design solutions for protection against methane and carbon dioxide on a development.
- CL:AIRE - Technical Bulletin (TB 17), August 2018
 - The bulletin provides guidance on assessing ground gas monitoring data to ensure that sufficient data has been collected to cover critical variations in barometric pressure

Both the CIRIA and BSI publications have been prepared to be generally consistent with CLR11, *Model Procedures for the management of land contamination*, (Defra and the Environment Agency, 2004a) and follow a step by step approach summarised below:

1. Desk Study and Site Walkover.
2. Development of a Preliminary Conceptual Model and Risk Assessment.
3. Site Investigation (If deemed necessary from stage 2).
4. Risk Assessment and Site Characterisation.
5. Recommendation and Mitigation.

Where the preliminary conceptual model has deemed further investigation necessary to characterise the ground gas regime, an appropriate site investigation and monitoring regime should be designed and undertaken. In-depth guidance to assist in the design of the investigation is provided within C665 and BS 8576, which describes intrusive investigation techniques and provides guidance on selecting the number and location of monitoring wells based on the site specific conceptual model.

Waterman has generally followed the approach recommended in CIRIA C665, BS 8576, and BS 8485 with respect to characterising a site and determining the levels of gas protection methods required. Where deviations from the methodology detailed within above guidance occurs, the reasoning behind the deviation and implication of the analysis of the results has been included within the report.

Risk Assessment

In accordance with C665, to assess the ground gas regime at a site, the ground gas monitoring data should be assessed by determining the Gas Screening Value (GSV) (l/hr). BS 8485 details further guidance on which GSV can be adopted based on a number of modifiers.

$$\text{GSV} = (\text{Measured Maximum CO}_2 \text{ or CH}_4 \text{ Gas Concentration (\%)} / 100) \times \text{Maximum Measured Gas Flow Rate from boreholes (l/hr)}.$$

Both C665 and BS 8485 dictate where the gas flow has been measured as less than the detection limit of the instrument used (typically <0.1l/hr), the limit of detection of the instrumented should be used as the gas flow rate.

As per the guidance given in BS 8485 where a negative flow has been recorded, and there is an absence of a positive flow, a qualitative assessment has been undertaken into whether under different temporal conditions, a similar positive flow could occur. When the cause for negative flow is reasonably understood, it has been possible to rule out a corresponding credible positive flow and discount the negative flow.

The Gas Screening Value is used to classify the site, subject to the proposed end use of the site.

The Modified Wilson and Card classification system is used to attribute a Characteristic Situation (CS) value to the site/zone depending upon the calculated GSV. When attributing a CS, additional factors including the maximum recorded gas concentration and the maximum recorded gas flow rate should also be taken into account and may result in an increase in the CS value. Table I.2 below, outlines the CS values associated GSV's and additional factors which must be taken into account.

Table I5 Modified Wilson and Card Classification

Characteristic Situation (CIRIA 149)	Risk Classification	Gas screening value (CH ₄ CO ₂) l/hr	Additional Factors	Typical source of generation
1	Very low risk	<0.07	Typically methane ≤1% and / or carbon dioxide ≤5%. Otherwise consider increase to CS 2.	Natural soils with low organic content 'Typical' made ground
2	Low risk	<0.7	Borehole air flow rate not to exceed 70 l/hr. Otherwise consider increase to CS 3.	Natural soil, high peat/organic content. 'Typical' made ground
3	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
4	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking – susceptible to flooding, completed landfill (WMP 26B criteria)
5	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	Very High risk	>70		Recent landfill site

Notes:

- 1) Gas screening value: litres of gas / hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (l/hr)
- 2) Source of gas and generation potential/performance must be identified.
- 3) If there is no detectable flow use the limit of detection of the instrument.

Following determination of the site's CS, the requirements and scope of gas protection measures can be prescribed based on the guidance given in BS 8485:2015.

BS 8485 details the required ground gas protection measures for a development using a points-based system, whereby a certain number of points must be accumulated through the installation of various protection measures to mitigate the risk to structures or buildings from the accumulation of methane or carbon dioxide. The number of points assigned will be dependent on the building type and the CS.

Table I6 Building types are separated into four distinct scenarios.

Kj,f Modifier	Building Type			
	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial / public, possible multiple	Commercial / public	Commercial / industrial
Control (change of use, structural alterations, ventilation)	None	Some but not all	Full	Full
Room sizes	Small	Small / medium	Small to large	Large industrial / retail park style

Further details on the description of the building types, along with examples are included in BS 8485.

Following identification of the appropriate Building Type and CS, the minimum gas protection score can be determined through the use of the following table.

Table I7 Gas Protection Score

Characteristic Situation	Minimum Gas Protection Score			
	Type A	Type B	Type C	Type D
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5 ^A	5.5 ^A	4.5	3.5
5	N/A ^B	6 ^A	5.5	4.5
6	N/A ^B	N/A ^B	N/A ^B	6

^AResidential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system e.g. in Institutional and / or fully serviced contractual situations.

^BThe gas hazard is too high for this empirical method to be used to define the gas protection measures.

Post determination of the minimum gas protection score, a combination of two or more of the following three types of protection measures should be used to achieve the score:

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present;
- Ventilation measures; and
- Gas resistant measures.

Through combining at least two ground gas protection measures, the lack of redundancy in the use of a single protection measure approach is negated. The ground gas protection measures should work independently and collaboratively.

The tables below detail the specific ground gas protection measures and their associated scores.

Structural Barrier

Table I8

Floor and substructure design	Score ^A
Precast suspended segmental subfloor (l.e. beam and block)	0
Cast in-situ ground bearing floor slab (with only nominal mesh reinforcement)	0.5
Cast in-situ monolithic ground bearing raft or reinforced cast in-situ suspended floor slab with minimal penetrations	1 or 1.5 ^B
Basement floor and slab conforming to BS 8102:2009, Grade 2 waterproofing ^C	2
Basement floor and walls conforming to BS 1802:2009, Grade 3 waterproofing ^C	2.5

^AThe scores are conditional on breaches of floor slabs, etc., being effectively sealed.

^BTo achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast.

^CThe score is conditional on the waterproofing not being based on the use of a geosynthetic clay liner waterproofing product.

Ventilation Measures

Table I9

Protection element / system	Score	Comments
Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.	0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measure systems. If the layer has a low permeability and / or is not terminated in a venting trench or similar, then the score is zero.
Passive sub floor dispersal layer: Very good performance: Good performance: Media used to provide the dispersal layer are;	2.5 1.5	The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing, and type and thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS 8485 2015. Passive ventilation should be designed to meet at least good performance, see in Annex B of BS 8485 2015.
• Clear void; • Polystyrene void former blanket; • Geocomposite void former blanket • No-fines gravel layer with gas drains; • No-fines gravel layer.		
Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may compromise a clear void or be formed of geocomposite or polystyrene void formers.	1.5 to 2.5	This system relies on continues serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system including pumps and vents. Active ventilation should always be designed to meet at least good performance as described in in Annex B of BS 8485 2015.
Active positive pressurization by the creation of a blanket of external fresh air beneath the floor slabs by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.	1.5 to 2.5	This system relies on continues serviceability of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient coverage of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least good performance.
Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park).	4	Assumes that the car fumes is vented to deal with exhaust fumes designed to <i>Buildings Regulations 2000, Approved Document F</i> .

It should be noted that for Type A Buildings active ventilation systems are inappropriate.

Membrane

Table I10

Protection element / system	Score	Comments
Gas resistant membrane meeting all of the following criteria; Sufficiently impervious both in the sheet material A and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and / or carbon dioxide through the membrane; Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; Sufficiently strong B to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc.); and to withstand in-service stresses (e.g settlement if placed below a floor slab); Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and Verified in accordance with CIRIA C735.	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. If a membrane is installed that does not meet the all the criteria in column 1 then the score is zero..

A gas protection score should only be assigned to a membrane which is formed of a material with suitably low gas permeability and which has been installed so it completely seals the foundation (including effective seals around all penetrations) and does not sustain damage from in-service stresses.

Volatile Organic Compounds (VOCs)

The Building Regulations 2000 Approved Document C (2004 Edition) also refers to volatile organic carbons (VOCs). These are primarily assessed by examination of the VOC content of site soils. Further guidance on VOCs is provided in *"The VOCs Handbook; Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination"*, CIRIA Report C682, 2009.

For former landfill sites the risk from a wider range of trace gases are considered on a site specific basis when appropriate.

VOCs in groundwater

Under the Environmental Protect Act 1990, Building Regulations Approved Document C 2004 and the National Planning Policy Framework there is a requirement to ensure that Volatile Organic Compounds (VOC) are considered on a risk assessment basis.

VOCs are organic compounds that are volatile under normal atmospheric conditions. However, they may be found in the solid, liquid, and the dissolved phase as well as in the gaseous phase. VOCs are typically found in the following contaminants:

- Petroleum (non-halogenated) hydrocarbons (e.g. benzene, toluene, and butylbenzenes);
- Halogenated hydrocarbons (e.g. chlorinated ethenes and ethanes (dry cleaning fluids or degreasers) or chlorofluorocarbons (freons)); and
- Organic compounds containing nitrogen, sulphur, and oxygen (e.g. tetrahydrofuran).

The likely sources of the above contaminants include:

- Spills, leaks, and discharges from industries;
- Landfills;
- Buildings, furnishings, and common household products;
- Vehicle emissions;
- Marshland; and
- Uncontrolled waste disposal.

The risk to receptors from VOC occur from inhalation (acute and chronic), and a flammable / explosive risk when present at high concentrations in confined spaces.

Current UK guidance for VOCs are limited in comparison to ground gas, and is primarily given in the *“The VOCs Handbook; Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination”*, CIRIA Report C682, 2009.

Additional guidance was published in 2017 by the Society of Brownfield Risk Assessments (SoBRA) *‘Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile contaminants in Groundwater’*, February 2017. The 2017 SoBRA document provided a set of Generic Assessment Criteria (GAC) to allow the risk to a residential/commercial premise to be assessed quantitatively using the contamination concentrations recorded in the groundwater. The GAC were generated using the CLEA model, with each GAC being the theoretical concentration in groundwater/perched water beneath a property that is modelled as resulting in estimated average daily exposure (ADE) to the critical receptor that is equal to the Health Criteria Value (HCV).

The GAC were designed to incorporate several precautionary assumptions, these conservatisms include;

- The assumption that the impacted groundwater/perched water is directly beneath the building, when it may instead be offset from the receptor;
- The assumption that there is an infinite source term, when in fact the source may be finite;
- The assumption that there is no biodegradation between the source term and the receptor;
- The assumption that the groundwater source is at a depth of 0.65m bgl;
- The use of sand soil type for both the saturated and unsaturated zone.
- The omission of a capillary zone between the saturated and unsaturated zone.

These GAC are detailed in the Tables below.

Table I11 Petroleum Hydrocarbons

Chemical	CAS	GACgw vap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
1,2,4-Trimethylbenzene	95-63-6	24	2,200	559,000
Benzene 3	71-43-2	210	20,000	1,780,000
Ethylbenzene 3	100-41-4	10,000	960,000 (sol)	180,000
Isopropylbenzene	98-82-8	850	86,000 (sol)	56,000
Propylbenzene	103-65-1	2,700	240,000 (sol)	54,100
Styrene	100-42-5	8,800	810,000 (sol)	290,000
Toluene 3	108-88-3	230,000	21,000,000 (sol)	590,000
TPH Aliphatic EC5-EC6 3		1,900	190,000 (sol)	35,900
TPH Aliphatic >EC6-EC8 3		1,500	150,000 (sol)	5,370
TPH Aliphatic >EC8-EC10 3		57	5,700 (sol)	427
TPH Aliphatic >EC10-EC12 3		37	3,600 (sol)	34
TPH Aromatic >EC5-EC7 2,3		210,000	20,000,000 (sol)	1,780,000
TPH Aromatic >EC7-EC8 3		220,000	21,000,000 (sol)	590,000
TPH Aromatic >EC8-EC10 3		1,900	190,000 (sol)	64,600
TPH Aromatic >EC10-EC 12 3		6,800	660,000 (sol)	24,500
TPH Aromatic >EC12-EC16 3		39,000	3,700,000 (sol)	5,750
meta-Xylene 3,5	108-38-3	9,500	940,000 (sol)	200,000
ortho-Xylene 3,5	95-47-6	12,000	1,100,000 (sol)	173,000
para-Xylene 3,5	106-42-3	9,900	980,000 (sol)	200,000

Table I12 Polycyclic Aromatic Hydrocarbons

Chemical	CAS	GAC gw vap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
Acenaphthene	83-32-9	170,000 (sol)	15,000,000 (sol)	4,110
Acenaphthylene	208-96-8	220,000 (sol)	20,000,000 (sol)	7,950
Fluorene	86-73-7	210,000 (sol)	18,000,000 (sol)	1,860
Naphthalene	91-20-3	220	23,000 (sol)	19,000

Table I13 Pesticides

Chemical	CAS	GACgw vap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
Aldrin	309-00-2	47 (sol)	3,700 (sol)	20
alpha-Endosulfan	959-98-8	7,400 (sol)	590,000 (sol)	530
beta-Endosulfan	33213-65-9	7,500 (sol)	600,000 (sol)	280

Table I14 Halogenated Organics

Chemical	CAS	GAC _{gw} vp (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
1,1,1,2-Tetrachloroethane	79-34-5	240	22,000	1,110,000
1,1,1-Trichloroethane	71-55-6	3,000	290,000	1,300,000
1,1,2,2-Tetrachloroethane	79-35-4	1,600	150,000	2,930,000
1,1,2-Trichloroethane	79-00-5	520	49,000	4,491,000
1,1-Dichloroethane	75-34-3	2,700	260,000	3,666,000
1,1-Dichloroethene	75-35-4	160	16,000	3,100,000
1,2,3,4-Tetrachlorobenzene	634-66-2	240	31,000 (sol)	7,800
1,2,3,5-Tetrachlorobenzene	634-90-2	7.0	600	3,500
1,2,3-Trichlorobenzene	87-61-7	35	3,100	21,000
1,2,4,5-Tetrachlorobenzene	95-94-3	8.1	700 (sol)	600
1,2,4-Trichlorobenzene	120-82-1	68	7,200	41,400
1,2-Dichlorobenzene	95-50-1	2,000	220,000 (sol)	133,000
1,2-Dichloroethane	107-06-2	8.9	850	8,680,000
1,2-Dichloropropane	78-87-5	22	2,600	2,050,000
1,3,5-Trichlorobenzene	108-70-3	7.4	660	6,000
1,3-Dichlorobenzene	541-73-1	31	2,800	103,000
1,4-Dichlorobenzene	106-46-7	5,000	460,000 (sol)	51,200
Bromobenzene	108-86-1	220	20,000	388,040
Bromodichloromethane	75-27-4	17	1,600	3,000,000
Bromoform (Tribromomethane)	75-25-2	3,100	400,000	3,000,000
Chlorobenzene	108-90-7	98	15,000	387,000
Chloroethane	75-00-3	10,000	1,000,000	5,742,000
Chloroethene (Vinyl Chloride)	75-01-4	0.62	63	2,760,000
Chloromethane	74-87-3	14	1,400	5,350,000
cis-1,2-Dichloroethene	156-59-2	130	13,000	7,550,000
Dichloromethane	75-09-2	3,300	370,000	20,080,000
Hexachlorobenzene	118-74-1	16 (sol)	1,400 (sol)	10
Hexachlorobutadiene	87-68-3	1.7	230	4,800
Hexachloroethane	67-72-1	8.5	740	49,900
Pentachlorobenzene	608-93-5	140	12,000 (sol)	500
Tetrachloroethene	127-18-4	34	4,600	225,000
Tetrachloromethane (Carbon Tetrachloride)	56-23-5	5.3	770	846,000
trans-1,2-Dichloroethene	156-60-5	160	16,000	5,250,000
Trichloroethene	79-01-6	5.7	530	1,370,000
Trichloromethane (Chloroform)	67-66-3	790	85,000	8,950,000

Table I15 Others (Organic and Inorganic)

Chemical	CAS	GAC _{gw} vap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
2-Chloronaphthalene	91-58-7	160	14,000 (sol)	11,700
Biphenyl (Limonene)	92-52-4	15,000 (sol)	1,300,000 (sol)	4,060
Carbon disulphide	75-15-0	56	5,600	2,100,000
Mercury, elemental	7439-97-6	1.1	95 (sol)	56
Methyl tertiary butyl ether (MTBE)	1634-04-4	83,000	7,800,000	48,000,000

The risks to receptors from vapours will be assessed through assessment of the volatile contaminant concentrations recorded in groundwater samples against the SoBRA derived GAC. Where an exceedance is recorded, a qualitative assessment will be made, given the conservative approach of the SoBRA derived GAC as to whether a significant vapour regime is present on-site and possible risk to receptors exists. The vapour concentration recorded during headspace analysis of soils, SVOC / VOC contaminant concentration within soil samples, and the vapour concentration within installed boreholes will also be considered qualitatively during this assessment.

Where a significant vapour regime is present and a risk to receptors exists, further assessment will be required, this may include, vapour sampling, further intrusive investigations, or a Detailed Quantitative Risk Assessment (DQRA). Dependent on the results of the further assessment, remedial measures will be required to mitigate the risk to receptors.

Appendix J Limitations and Constraints

The assessment was undertaken in accordance with the scope agreed between Waterman and Notting Hill Genesis, and with Waterman's standard Terms of Appointment.

The benefit of this report is made to Notting Hill Genesis.

The information contained in this report is based on the findings of third party reports, observations made on site, exploratory hole records, laboratory test results, and groundwater monitoring.

The ground conditions reported relate only to the point of excavation and do not necessarily guarantee a continuation of the ground conditions throughout the non-inspected area of the site. Whilst such exploratory holes would usually provide a reasonable indication as to the general ground conditions, these cannot be determined with complete certainty.

Waterman has endeavoured to assess all information provided to them during this investigation, but makes no guarantees or warranties as to the accuracy or completeness of this information.

The scope of this site investigation includes an assessment of the presence of asbestos containing materials in the ground at the site but not within buildings or structures or below ground structures (basements, buried service ducts and the like).

The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

Our vision

“Engineering a better environment for people and the planet”

Our mission

“To solve complex problems for the benefit of clients, communities and the climate”

Our values

People orientated

Individually and collectively, people are our business.
We strive to create environments for everyone to flourish and thrive.

Flexible

Pragmatic by nature and dedicated to getting the job done to the highest possible standard.

Professional

Operating at pace with integrity to deliver technical and robust solutions.

Environmentally aware

We understand our responsibility to the environment, it shapes our decision making and informs our practice.

Innovative

Our forensic questioning provides the ability to deliver appropriate innovations at every stage on every project.

Relationship focused

We value individuality and the benefits of working collaboratively to achieve positive outcomes for all.

