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Phase 2 Intrusive Site Investigation

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CONTENTS

1. Introduction

The following document is a Phase 2 Intrusive Site Investigation carried out by Oakshire Environmental, and includes details of the site, sampling methodology, ground conditions, an evaluation of risk and an assessment of further investigations.

1.1 Project Overview

The client's proposed project involves the erection of a residential dwelling, , private garden and parking at Old Orchard Lodge Cottage, Park Lane, Harefield, Uxbridge, UB9 6HJ. Following the identification of potential contaminant linkages at the site, an intrusive site investigation has been recommended. Oakshire Environmental have carried out a Phase 2 Intrusive Site
Investigation, as described below.

1.2 Purpose of Investigation

The objectives of the Phase 2 Intrusive Site Investigation were to:

- Establish the context and setting of development at the site.
- Identify and assess the nature and extent of contamination risk at the site.
- Determine the requirement for further investigations, remediation or mitigation measures.

1.3 Scope of Work

- Brief introductory information will be noted to provide context to the report and will include an Introduction, Project Overview, Scope of Work and Limitations.
- Assess the site and previous investigations, to establish the context and setting of development.
- In order to identify the nature and extent of contamination, 5 x samples will be taken down to a maximum depth of ~1.5m and analysed for Metals (As,Be,Cd,Co,Cu,Fe,Hg,Pb,Ni,Mn,Se,V,Zn), Chromium (III & VI), Cyanide, Phenols, PAHs, BTEX & MTBE, TPH CWG (Aliphatic/ Aromatic), pH, Asbestos (Qualitative) and Organic Matter in a UKAS accredited laboratory.
- Ground conditions encountered at the site, including identification of groundwater and made ground, will be noted and used to inform recommendations and conclusions.
- Results of laboratory testing will be assessed with reference to suitable screening values, including LQM/CIEH Suitable 4 Use Levels (S4ULs), CL:AIRE Category 4 Screening Levels (C4SLs) and Generic Assessment Criteria (GAC).
- This information will be used to update the Conceptual Site Model, produced as part of previous investigations to categorise the severity of consequence and probability of identified contaminant linkages, and conduct an evaluation of contamination risk to determine the requirement for further investigations, remediation or mitigation measures.
- Supporting appendix to include photographs, maps and plans of the site.

1.4 Limitations

Quantum Intelligent Trading Ltd is previously and hereafter referred to as “Oakshire Environmental” or “the company”. Oakshire Environmental has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. This report is only valid when used in its entirety and any information or advice contained within the report should not be relied upon until considered in the context of the whole report. Oakshire Environmental disclaims any responsibility to the client and others in respect of any matters outside the scope of this work. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate. This report has been prepared solely for the benefit of the client and any other party using or placing reliance upon any information contained in this report does so at their own risk. Oakshire Environmental accepts no responsibility or liability for the contents of this report being used for any purpose or project for which it was not commissioned. Oakshire Environmental accepts no liability whatsoever for any loss or damage arising from the interpretation or use of the information contained within this report. Furthermore, Oakshire Environmental does not accept any liability for the consequences of any legislative changes or the release of subsequent guidance documentation and following delivery of the report has no obligation to advise the client or any other party of such changes or their repercussions.

This report excludes consideration of potential hazards arising from any activities at the site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities. Oakshire Environmental does not warrant or guarantee that the site is free of hazardous or potentially hazardous materials or conditions. It should be noted that this report has been produced for environmental purposes only.

Oakshire Environmental cannot be held responsible for incorrect analysis of samples as the laboratory analysis presented in this report was carried out by Chemtech Environmental Ltd. The information and conclusions provided in this report are limited to, and representative of, the samples taken and cannot be extended to apply to the whole site, in addition, Oakshire Environmental cannot guarantee the accuracy of analysis for samples not taken at the source by the company or those which deviate due to exceedance of holding time or inappropriate sampling practises. The findings and/or recommendations of this report do not take into account any conditions that may be present but have hitherto not been encountered and as such further investigation and/or a reconsideration of the findings of this report should be undertaken if such conditions are subsequently encountered or an alternative development plan or land use is subsequently proposed.

2. Site

The following section provides a description of the site and location, proposed project and previous investigations, utilising information obtained from the client and publicly available sources.

2.1 Site Description and Location

The site is located in Harefield, Uxbridge, approximately 500m south-west of Harefield Hospital. The site is currently a vacant plot of land, following the recent demolition of the former residential property and is bordered by an access road to the north and west, agricultural land to the east and a public house and associated land to the south.

National Grid Reference: TQ 04640 90449

2.2 Proposed Development

The client's proposed project involves the erection of a residential dwelling, private garden and parking. For the purposes of the contamination risk assessment, the proposed development land use is classified as Residential with consumption of Homegrown Produce.

2.3 Previous Investigations

A Phase 1 Desk Study Report was carried out by ST Consult in February 2022. This assessment considered there to be a low risk to human health, due to potential Made Ground and asbestos from the previous development and demolition. The assessment recommended that a Phase 2 Intrusive Site Investigation should be undertaken, including sampling and testing of any Made Ground, topsoil and underlying natural soils, particularly within proposed areas of soft landscaping.

Based on the findings of previous investigations, sampling of soil at the site has been carried out, which has been tested for a comprehensive suite of contaminants including Metals (As,Be,Cd,Co,Cu,Fe,Hg, Pb,Ni,Mn,Se,V,Zn), Chromium (III & VI), pH, Cyanide, Phenols, Organic Matter, Polycyclic Aromatic Hydrocarbons (PAH), BTEX, Total Petroleum Hydrocarbons (TPH) and Asbestos (Qualitative).

3. Methodology

3.1 Sampling Work

Trial pits were dug at the locations shown on plans in the appendix, with ground conditions noted during the sampling process to inform recommendations and conclusions.

Soil samples were collected and placed into sealed sample containers. Samples collected for VOC analysis were filled as much as possible to minimise air spaces, as volatile compounds can be lost into these spaces. Sampling equipment was wiped clean between sample locations to minimise cross contamination.

3.2 Sampling Strategy

Five samples was considered to be a sufficient sample size, based on the size of the site, proposed use areas and the levels of contamination expected. Locations were chosen to focus on the proposed soft landscaping and buildings areas, while providing coverage of the whole site.

A range of sample depths were chosen to allow identification of variability through the soil profile. Soil in proposed soft landscaping areas at the site were sampled as this will represent the soil that is most likely to impact future site users through inhalation, ingestion and dermal contact pathways. The sample taken from beneath the proposed dwelling was collected to determine the risk to future site users and the proposed dwelling from the ingress of vapours and ground gases and to assess the extent of any made ground at the site.

3.3 Health & Safety

When collecting soil samples on a potentially contaminated site it must be assumed that the soil is contaminated in order to protect the health of the assessor. Protective rubber gloves were worn at all times as well as substantial footwear. Equipment was washed thoroughly before and after use and kept in a container when transported to avoid the spread of any possible contamination. Sample containers were packed with biodegradable fill for protection and placed in a sealed plastic container for transportation to the laboratory.

4. Ground Conditions

Ground conditions identified at the site during sampling work can be characterised as sandy CLAY with stones, gravel and demolition rubble, overlying stiff CLAY down to a depth of at least 1.5m.

5. Evaluation of Results

5.1 Screening Values

Results of laboratory testing of soil samples were analysed by comparing them to industry standard screening levels used for risk assessments. Screening levels used include the DEFRA Category 4 Screening Levels (C4SLs) based on Low Level of Toxicological Risk and the LQM/CIEH S4ULs for Human Health Risk Assessment. These levels cover multiple Soil Organic Matter (SOM) contents (1%, 2% and 6%) and assume a pH of 8. The 'residential with plant uptake' screening values were used to assess results. This land use considers direct soil and indoor dust ingestion and inhalation, skin contact with soils and dust, inhalation of vapours and ingestion of homegrown produce as exposure pathways. These levels take a conservative approach to assessing potential risk and concentrations below these screening values can be considered to represent 'uncontaminated conditions' which pose 'LOW' risk to human health based on the proposed land use.

It is important to note that exceedance of a relevant screening value does not necessarily constitute evidence of either a 'significant possibility of significant harm' or the need for remediation under the UK's planning regimes. Rather such exceedance should usually trigger a further detailed quantitative risk assessment, where site-specific parameters are used to derive site-specific assessment criteria. Common sense tells us, and a robust risk evaluation reveals, that a gross exceedance is a good indicator that an unacceptable risk is present.

5.2 Summary of Results

- Metal concentrations were all below the residential screening values
- pH was alkaline in samples S01 and S02 and acidic in samples S03, S04 and S05
- Cyanide (free) and Phenols (total) concentrations were all below the laboratory limit of detection suggesting they may not be present at all
- Total Organic Carbon values were very low in all samples
    - Soils with low organic matter content may allow the leaching of hydrocarbons through the soil as organic contaminants adsorb to organic matter particles
- PAH concentrations were below the laboratory limit of detection in samples S01 – S04 and below the residential screening values in sample S05
- BTEX concentrations were all below the laboratory limit of detection
- VPH concentrations were all below the laboratory limit of detection
- EPH concentrations were all below the residential screening values and many fractions were below the laboratory limit of detection
- No asbestos was detected in any of the samples

5.3 Risk Assessment Methodology

The potential level of risk posed by a particular source is determined by assessing the potential severity of the impact of the contaminant linkage on the receptor, if it is assumed to be present, and the probability of the contaminant linkage being present.

Severities are categorised from Minor to Severe and probabilities are categorised from Unlikely to High Likelihood to give a potential level of risk output.

Table 1: Risk Matrix

Probability	**Severity of Consequence**			
	Severe	Medium	Mild	Minor
High Likelihood	Very High Risk	High Risk	Moderate Risk	Low / Moderate Risk
Likely	High Risk	Moderate Risk	Low / Moderate Risk	Low Risk
Low Likelihood	Moderate Risk	Low / Moderate Risk	Low Risk	Very Low Risk
Unlikely	Low / Moderate Risk	Low Risk	Very Low Risk	Very Low Risk

Very High Risk

There is a high probability that severe harm could arise to a designated receptor from an identified source; or there is evidence that severe harm to a designated receptor is currently happening.

High Risk

Harm is likely to arise to a designated receptor from an identified source.

Moderate Risk

It is possible that harm could arise to a designated receptor from an identified source. It is relatively unlikely that any such harm would be severe or if any harm were to occur it is more likely that the harm would be relatively mild.

Low Risk

It is possible that harm could arise to a designated receptor from an identified source, however, it is likely that this harm, if realised, would normally be mild.

Very Low Risk

There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

5.4 Conceptual Site Model

The information in this section has been compiled to produce an initial conceptual site model outlining the potential sources, pathways and receptors to consider at the site. The level of risk was categorised by considering the severity and probability, as outlined in the previous section.

Table 2: Conceptual site model

Sources	Pathways	Receptors	Severity	Probability	Potential Level of Risk	
Made Ground from previous development and demolition	Direct ingestion Dermal contact Particulate inhalation Plant uptake	Site workers Future occupants	**Medium**	**Unlikely**	**Low**	Contaminant concentrations in soil across the site were all below the residential screening values suggesting a low risk to human health.
	Run-off Leaching	Secondary A aquifer	**Mild**	**Unlikely**	**Very Low**	The low concentrations of contaminants identified in shallow and deeper soil, along with the stiff clay soil encountered at the site, suggests that leaching of contaminants through soil to underlying groundwater is unlikely.
	Direct contact	Services Structures	**Mild**	**Unlikely**	**Very Low**	Hydrocarbon concentrations were very low in all samples suggesting a negligible risk to water supply pipes and building foundations.
Asbestos within fabric of former building	Particulate inhalation	Site workers Future occupants	**Medium**	**Unlikely**	**Low**	No asbestos was detected in any samples and no potential asbestos containing materials were identified during sampling work suggesting a negligible risk from the inhalation of asbestos fibres.

5. Conclusions

5.1 Risk Evaluation

The conceptual site model has identified the following contaminant linkages present at the site and the following conclusions have been drawn:

- There is a **low risk** to site workers and future occupants from direct ingestion, dermal contact, particulate inhalation, and plant uptake from Made Ground from previous development and demolition.
- There is a **very low risk** to the Secondary A aquifer from the run-off and leaching of contaminants through soil from Made Ground from previous development and demolition.
- There is a **very low risk** to services and structures from direct contact with contaminants in Made Ground from previous development and demolition.
- There is a **low risk** to site workers and future occupants from particulate inhalation of asbestos within fabric of former building.

5.2 Further Investigation

Based on laboratory testing of soil samples from the site and the updated conceptual site model, the risk to site workers and future occupiers is considered to be low while the risk to the Secondary A aquifer and services and structures is considered to be very low. Further investigation or remediation is, therefore, not considered necessary. It is important to note that this conclusion is based on the proposed development plan.

If visible or olfactory evidence of contamination is identified during excavations at the site, work should cease in order to allow further investigation to be carried out. In addition, to ensure regulatory compliance, Waste Classification & Waste Acceptance Criteria (WAC) testing of excavated material from the site may be required prior to off-site disposal.

6. References

Environment Agency *Land contamination: risk management*. [online] Available at: <gov.uk/guidance/land-contamination-how-to-manage-the-risks>.

Southern Testing, 2022. *Phase 1 Desk Study Report*.

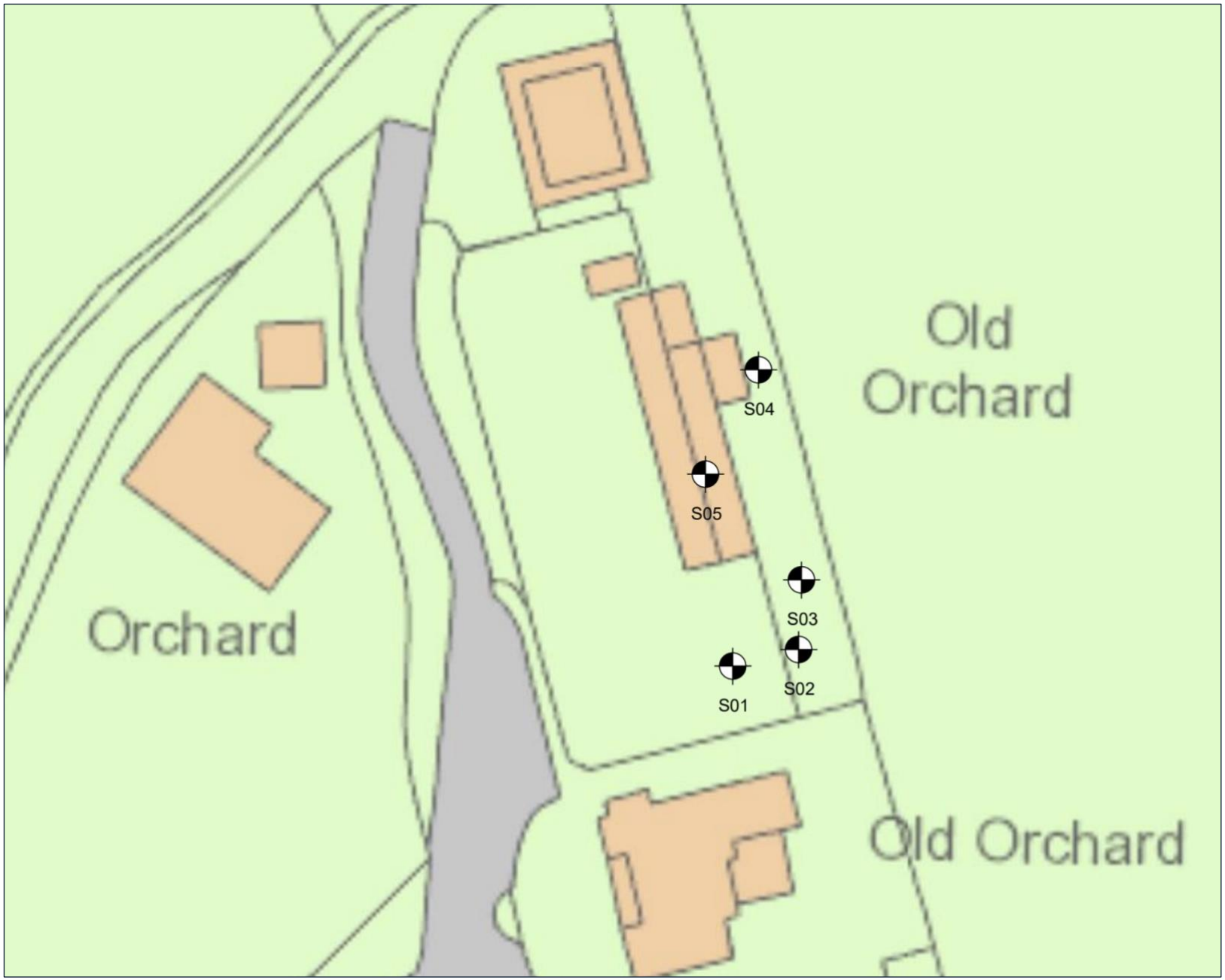
DEFRA, 2014. *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*. London: Department for the Environmental and Rural Affairs

Nathanail, C.P.; McCaffrey,C.; Gillett, A.G.; Ogden, R.C. & Nathanail, J.F., 2015. *The LQM/CIEH S4ULs for Human Health Risk Assessment*. Nottingham: Land Quality Press

USEPA, 2022. *Regional Screening Levels (RSLs).* [online] Available at: <epa.gov/risk/regional-screening-levels-rsls>.

Oakshire Environmental Available at: <oakshireenvironmental.co.uk>.

Appendix - Site Maps & Plans	
Description	
Site location plan	
Sources	
Contains OS data © Crown copyright and database rights	
Key	
	Site boundary
▲	North



Appendix - Site Maps & Plans	
Description	
Site plan showing sample locations	
Sources	
Contains OS data © Crown copyright and database rights	
Key	
⊕	Sample location
▲	North

Appendix - Site Photos
Description
Phot of the site facing south
Sources
Dragos-Adrian Antoci

Appendix - Site Photos
Description
Photo of the site facing north
Sources
Dragos-Adrian Antoci

Appendix - Site Photos
Description
Photo of the site facing east
Sources
Dragos-Adrian Antoci

Appendix - Site Photos
Description
Photo showing sample location S01
Sources
Dragos-Adrian Antoci

Appendix - Site Photos
Description
Photo showing sample location S02
Sources
Dragos-Adrian Antoci

Appendix - Site Photos
Description
Photo showing sample location S03
Sources
Dragos-Adrian Antoci

Appendix - Site Photos
Description
Photo showing sample location S04
Sources
Dragos-Adrian Antoci

Appendix - Site Photos
Description
Photo showing sample location S05
Sources
Dragos-Adrian Antoci

Lab number			113479-1	113479-2	113479-3	113479-4	113479-5
Sample id			S01	S02	S03	S04	S05
Depth (m)			0.30	0.30	0.30	0.40	1.50
Date sampled			07/09/2022	07/09/2022	07/09/2022	07/09/2022	07/09/2022
Test	**Method**	**Units**					
Arsenic (total)	CE127 M	mg/kg As	15.89	19.09	18.77	12.76	16.41
Beryllium (total)	CE127 U	mg/kg Be	<1	<1	1.64	<1	<1
Cadmium (total)	CE127 M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium (total)	CE127 M	mg/kg Cr	153.21	92.59	81.00	76.82	76.13
Chromium (III)	CE208	mg/kg CrIII	153.00	93.00	81.00	77.00	76.00
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1
Cobalt (total)	CE127 M	mg/kg Co	9.82	12.24	11.90	11.45	11.10
Copper (total)	CE127 M	mg/kg Cu	18.79	26.78	34.62	31.29	33.08
Iron (total)	CE127	mg/kg Fe	31722	27993	52777	32137	39079
Lead (total)	CE127 M	mg/kg Pb	14.19	20.45	20.02	19.95	27.57
Manganese (total)	CE127	mg/kg Mn	153.20	96.42	99.44	87.26	126.12
Mercury (total)	CE127 M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 M	mg/kg Ni	36.81	35.72	43.93	30.33	28.64
Selenium (total)	CE127 M	mg/kg Se	1.02	2.48	2.58	2.49	2.13
Vanadium (total)	CE127 M	mg/kg V	69.01	123.71	131.01	111.89	87.82
Zinc (total)	CE127 M	mg/kg Zn	44.96	66.59	95.21	80.57	85.11
pH	CE004 M	units	9.3	8.2	6.5	4.4	6.4
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	0.31	0.31	0.26	0.29	0.50
PAH							
Naphthalene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02

Fluorene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.10
Anthracene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	0.02
Fluoranthene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.28
Pyrene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.24
Benzo(a)anthracene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	0.14
Chrysene	CE087 M	mg/kg	<0.03	<0.03	<0.03	<0.03	0.14
Benzo(b)fluoranthene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.19
Benzo(k)fluoranthene	CE087 M	mg/kg	<0.03	<0.03	<0.03	<0.03	0.06
Benzo(a)pyrene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	0.11
Indeno(123cd)pyrene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.10
Dibenz(ah)anthracene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(ghi)perylene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.08
PAH (total of USEPA 16)	CE087	mg/kg	<0.34	<0.34	<0.34	<0.34	1.47
BTEX & TPH							
Benzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<1	<1	<1	<1	<1
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	1.59	<1	<1	<1	<1
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	2.24	<1	1.14	<1	1.13
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	17.08	5.31	3.92	3.56	2.37

EPH Aromatic (>EC35-EC44)	CE250	mg/kg	5.06	1.36	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	<6	<6	<6	<6
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	<6	<6	<6	<6
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	<15	<15	<15	<15
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	<10	<10	<10	<10
Subcontracted analysis							
Asbestos (qualitative)	$	-	NAD	NAD	NAD	NAD	NAD