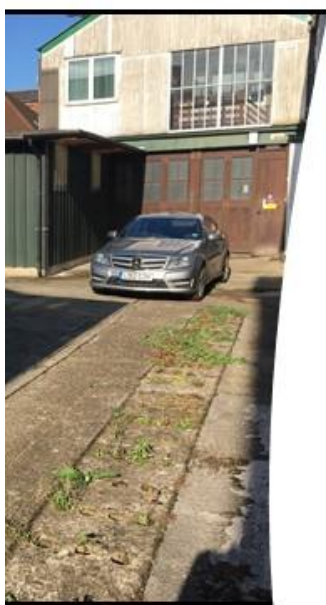




EARTH ENVIRONMENTAL
& GEOTECHNICAL

Geoenvironmental Investigation

Prospect Street

Reading

Report Ref: R0271/19

October 2019

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**GEOENVIRONMENTAL
INVESTIGATION**

PROSPECT STREET,

READING,

BERKSHIRE,

Report Ref: R02271/19

October 2019

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Written by:

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1.0 INTRODUCTION

1.1 Background

A Geo-Environmental Site Investigation has been commissioned by Hive Structure Ltd (the client) to examine ground conditions, retrieve soil samples for chemical testing and facilitate the monitoring of ground gasses and vapours for a proposed new residential development along Prospect Street, Reading (herein referred to as the assessment site).

1.2 Terms of Reference

Earth Environmental and Geotechnical (Southern) Ltd (EEGSL) was commissioned by the Client to undertake a Geo-Environmental Investigation of the site in accordance with the proposal Ref: R0271 dated 17th of September 2019.

The objectives of this investigation are as follows:

- *Undertake ground investigation works to enable shallow soil sample collection and the installation of gas monitoring wells;*
- *Undertake three weekly gas and vapour monitoring visits;*
- *Compile an interpretive report, including a Tier 1 (semi-quantitative) soils risk assessment and a Ground Gas Risk Assessment in accordance with relevant guidelines.*

1.3 Limitations of the Study

The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information, improved practices or changes in legislation may require a reinterpretation of the report in whole or in part. EEGSL reserve the right to amend either conclusions or recommendations in light of any further information that may become available. This report is provided for the sole use by the client and is confidential to them.

Recommendations within this report are also based on exploratory records and examination of samples and, where applicable, laboratory tests. No liability can be accepted for conditions not revealed by the excavations, particularly at intervening locations. Whilst every effort is made to ensure accuracy of data supplied, all opinions expressed as to the spatial distribution of strata between sampling locations is for guidance only and no responsibility is accepted as to its accuracy.

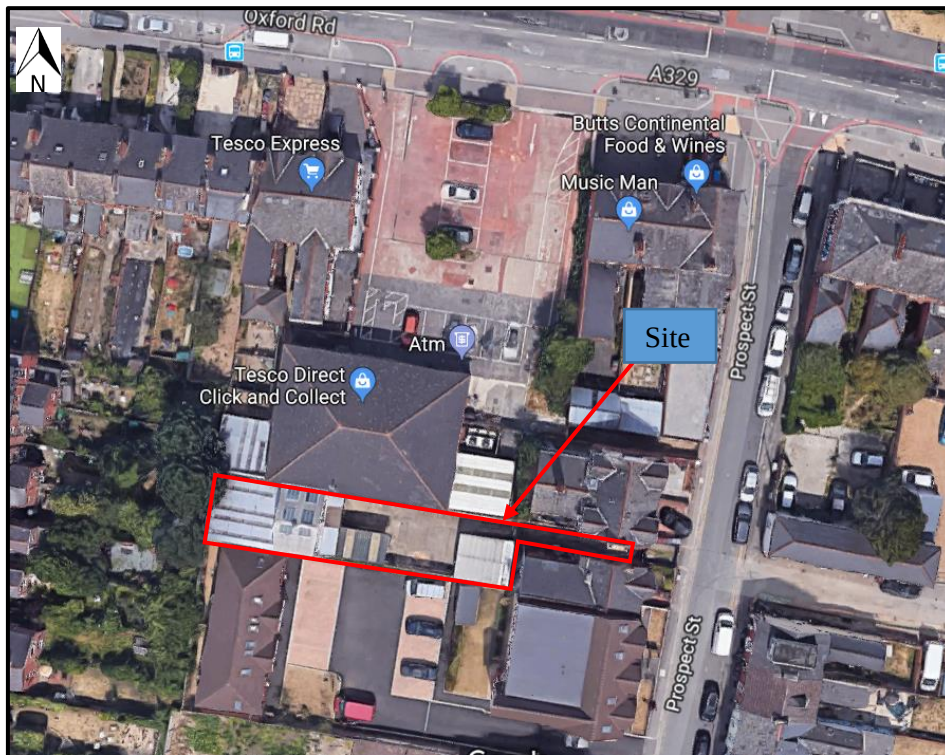
2.0 SITE LOCATION & DESCRIPTION

2.1 Site Location & Description

The site is currently occupied by a part two-story building (previously used for light industrial activities), an open sided single-story covered storage area, and an internal concrete courtyard. Access to the site is made via a drive which runs down the side of No.8 Prospect Street. The site itself is located within the central western area of Reading and is centred on National Grid Reference 470510, 173372.

The site location is shown in Figure 1.

Figure 1: Aerial Photograph Showing Site Location



2.2 Proposed Development

It is understood that the current use of the premises is Light industrial (Class B1(c)) and will be converted to 5 residential dwellings (Class C3). To enable this conversion, it is understood that the structure of the current building will be retained but the internal layout will be altered to accommodate for the new residential use.

A proposed site layout plan is provided within Figure 2 below.

Figure 2: Proposed Site Layout Plan



3.0 PHASE I DESK STUDY SUMMARY

3.1 General

A Phase I Desk Study for the assessment site was undertaken by EEGSL in September 2019 (EEGSL Report Ref: R0260/19). As part of the desk study all reasonable contamination sources, pathways and receptors were considered and the following Conceptual Site Model (CSM) and Preliminary Risk Assessment (PRA) were compiled.

The CSM/PRA is based on a proposed residential end use.

Table 1: Preliminary Conceptual Model

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Contamination of the ground beneath the site due to its current use as a builder's yard	Dermal contact, ingestion and inhalation of soils dust	Current Site users	Low likelihood	Moderate	Low to Moderate Risk	Considering the site has historically been used as a builders' yard, there is a potential for contamination to be present within the shallow soils due to the former use and storage of hazardous materials (oils, solvents, fuels, potential asbestos containing materials, paints and other hazardous construction materials). In addition, there is the potential for made ground to be present due to the sites redevelopment. However, considering the sites current industrial use, and given that the site is currently covered in a layer of concrete hardstanding, the risk to current site users from direct contact is considered LOW . This is primarily due to the concrete hardstanding providing a physical barrier between any contamination present within the shallow soils and the current site uses.
		Adjacent Site users	Unlikely	Moderate	Low Risk	Due to the current buildings and hardstanding across much of the site, there is very limited potential for migration of contamination present within the shallow soils towards neighbouring land uses. The current risk to adjacent site users is therefore considered LOW .
		Future Site users	Low likelihood	Moderate	Low to Moderate Risk	Given that the proposed residential development will use the current building structure and there are no areas of proposed soft landscaping, the risk to future sites users is also deemed low in this instance. It should be noted that asbestos materials have been identified within the structure of building currently on site, and hence a full asbestos survey should be undertaken, and any remedial actions taken prior to the site being occupied by the new users.

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
		Construction Workers	Low Likelihood	Moderate	Low Risk	Assuming appropriate health and safety measures are adopted (in line with CDM and other relevant health and safety guidance) a LOW risk to construction workers is anticipated during the redevelopment of the site. Once again it should be noted that asbestos materials have been identified within the current structure of building on site.
	Vertical or horizontal migration of contamination via leaching into the underlying shallow groundwater	Controlled Waters	Low Likelihood	Moderate	Low to Moderate Risk	Considering the site has historically seen some use as a builders yard, there is a potential for contamination to be present within the shallow soils beneath site, which could impact the underlying ground water (via infiltration and leaching). However, the sources of contamination are expected to be limited in volume and the potential for leaching is greatly reduced by the current covering of hardstanding. Considering the above, the risk to controlled waters from contamination present on site is considered LOW in this instance.
Contamination of the ground beneath the site due to the historical Garage located immediately to the north of the assessment site	Vertical or horizontal migration of contamination via leaching into the underlying shallow groundwater	Current Site users	Low likelihood	Moderate	Low to Moderate Risk	Hydrocarbon contamination within shallow groundwater has been identified associated with the former garage and fuel station neighbouring site to the north. Given the high leaching potential and granular nature of the underlying geology it is possible that contaminated groundwater may have migrated towards the assessment site. However, given the current hardstanding present at the assessment site, it is considered unlikely that this contamination, if present, could impact the current site users. The risk to current site users is therefore considered LOW in this instance.
		Future Site users	Low likelihood	Moderate	Low to Moderate Risk	The potential for contamination to migrate towards the assessment site from adjoining sources is considered moderate in this instance. However, once again given that the proposed development will maintain the current hardstanding the risk of future site users being exposed to contamination present within shallow soils beneath site is deemed unlikely. The risk to future site users is therefore also considered LOW . (It should be noted that new water pipes may require protecting due to the potential contamination being present)
	Vertical or horizontal migration of ground gas	Current Site users	Low likelihood	Moderate to High	Moderate Risk	A potential ground gas and vapour migration risk has been identified associated with the former use of the neighbouring site. Taking into account the works undertaken by Delta-Simons in 2013 and 2014, and the current understanding that no remediation works

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
						have been completed, it is assumed that this risk may still be present. Therefore, it is considered that a MODERATE risk exists for the site's current users. The main risk being accumulation of gases beneath the buildings causing asphyxiation or the potential for explosive gases to be present.
		Future Site users	Low likelihood	Moderate to High	Moderate Risk	Taking into account the information currently available, it is considered that a MODERATE risk is present to future site users due to the potential migration of ground gas and vapours.

3.2.1 Preliminary Contamination conclusions and recommendations

The conclusions of the Desk Study highlighted potential pollution linkages associated with the former use of the site as a builder's yard, and the potential for hydrocarbon contamination and ground gas migration from the adjoining former fuel station and garage.

Preliminary contaminants of concern included; inorganic contaminants (chiefly asbestos and heavy metals), hydrocarbons (both volatile and non-volatile) and the potential for ground gas.

Given the above conclusions, ground investigation works were proposed to help understand further the potential risk present at the assessment site and how these may impact on its proposed redevelopment. A summary of the ground investigation works undertaken and an assessment of the chemical laboratory results and gas risk assessment is provided within the following sections of this report.

4.0 SITE INVESTIGATION

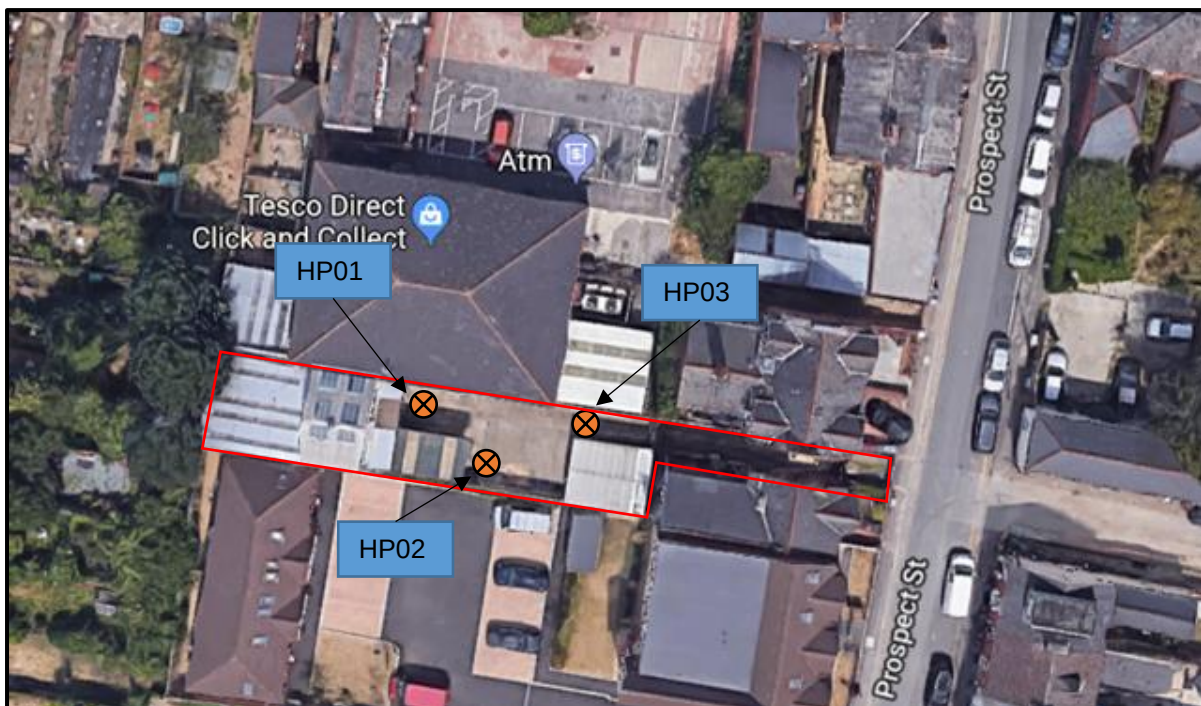
4.1 Exploratory Fieldwork

The fieldwork was carried out by EEGSL on 25th September 2019 and comprised:

- Three hand pits (designated HP01-HP03 inclusive) were excavated to a maximum depth of 1.5mbgl. Full hand pit logs are presented within Appendix 1.
- Installation of two 19mm diameter gas and ground water monitoring standpipes.
- Three weekly rounds of gas and groundwater level monitoring. Full results of the monitoring undertaken are presented within Appendix 2.
- Chemical testing of soils representative of the conditions uncovered at the assessment site by fully accredited chemical laboratory.

All fieldwork was carried out generally in accordance with BS 5930:2015 Code of Practice for Site Investigations, Eurocode 7, unless otherwise stated. The exploratory hole locations were determined on site by EEGSL and are shown approximately on the Exploratory Hole Location Plan below.

Figure 3: Exploratory Hole Location Plan



Each exploratory location was scanned using a Cable Avoidance Tool (CAT) in order to locate unrecorded underground services, and the exploratory locations were repositioned if necessary. On completion, all samples recovered from the site were taken to a specialist laboratory for testing.

All site investigation work was supervised full time by a representative of EEGSL. The logging of soils and rocks has been carried out in accordance with BS5930⁽²⁰¹⁵⁾ except where superseded by the soil and rock description methodology in BS EN14688-1⁽²⁰⁰²⁾, BS EN 14688-2⁽²⁰⁰⁴⁾ and BS EN 14689-1⁽²⁰⁰³⁾.

A summary of exploratory holes undertaken during the investigation is presented in Table 2, below.

Table 2: Summary of Exploratory Holes Undertaken

Hole	Type*	Depth (m)	Date Started	Date Finished	Backfill Details**
HP01	HP	1.50	25/09/2019	25/09/2019	SP
HP02	HP	1.25	25/09/2019	25/09/2019	SP
HP03	HP	1.00	25/09/2019	25/09/2019	A
* HP= Hand Pit. ** A= Arisings, SP = Standpipe					

5.0 GROUND CONDITIONS ENCOUNTERED

5.1 Soil Profile Encountered

The sequence of strata encountered beneath the site was:

- Made Ground
- Taplow Gravel Member

The depths of the various materials encountered in each of the exploratory holes are summarised in the following table.

Table 3: Summary of Ground Conditions Encountered

Hole	Depth to Stratum (m)			GROUND-WATER
	MADE GROUND		Taplow Gravel Member	
	Concrete	Gravelly sandy CLAY with brick and concrete	Gravelly sandy CLAY	
HP01	GL-0.05	0.05-0.20	0.20-1.50	-
HP02	GL-0.15	0.15-0.25	0.25-1.25	-
HP03	GL-0.05	0.05-0.25	0.25-1.0	-

5.2 Observable Indications of Contamination

During the investigation no visual or olfactory evidence of contamination was noted.

5.3 Obstructions

During the excavation of HP3 a gas supply pipe to the property was uncovered at a depth of 0.35mbgl. With onsite assistance of the gas supply company, the location was progress immediately adjacent to the service.

5.4 Groundwater

Groundwater was absent from all locations during excavation.

5.5 Ground Gas Monitoring

Three rounds of ground gas monitoring were undertaken between 1th October and 8th October 2019. Detailed results from each round are provided within Appendix 4. During the three monitoring rounds the atmospheric pressure ranged between 993mb and 1001mb.

During the monitoring visits the following ranges of gas concentrations were identified; Carbon Dioxide (CO₂) levels ranging from 0.0% to 1.2% by volume. The monitoring of Methane, Carbon Monoxide and Hydrogen sulphide was also undertaken, however concentrations above the detection limit of the gas analyser were not recorded during all three rounds. Borehole pressure was recorded ranging from -0.15Pa to -0.48Pa, however no gas flows were identified across all three monitoring rounds.

The monitoring of VOCs was also undertaken using a Photoionisation Detector (PID), however, an absence of VOCs was proven on all three rounds of monitoring.

Note: The concentrations of mobile, liquid and gaseous materials are likely to vary over time. The results obtained may therefore be representative of the conditions only at the time of sampling.

6.0 SOIL CONTAMINATION RISK ASSESSMENT

6.1 Tier I Human Health Soil Risk Assessment – Future Site Users

As part of the contamination assessment, the chemical results obtained by EEGSL have been screened against accepted compliance criteria, namely:

- Defra C4SL Health Criteria Values (March 2014), where available; and
- Tier 1 assessment values - based on LQM/CIEH Sutable 4 Use Levels⁽²⁰¹⁵⁾ (S4ULs).

As a preliminary screening assessment, all results have been compared to residential end use criteria for areas of soft landscaping and commercial/industrial end use criteria for areas of hardstanding/hard cover development.

The comparison of results is summarised in the following tables:

Table 4: Soil Results Comparison with Defra C4SL HCV/LLTC Values

Determinand	C4SL (mg/kg)*			Min. (mg/kg)	Max. (mg/kg)	No. of Samples with Exceedances
	Residential with home grown produce (1)	Residential without home grown produce (2)	Commercial (3)			
Arsenic	37	40	640	9	11	0
Benzo(a)pyrene	5.0	5.3	76	<0.1	<0.1	0
Cadmium	26	149	410	<0.2	<0.2	0
Chromium VI	21	21	9.1	<2	<2	0
Lead	200	310	2300	30	124	0
*Minimal risk Health Criteria Values						

The comparison within Table 4 has shown no elevated levels in excess of the C4SLs for residential end use.

The following contaminants were not assessed with respect to risks posed to Human Health as they are not generally considered to represent a significant risk to Human Health (CLR 8); sulphate and sulphide.

For contaminants not covered by the Defra C4SLs, reference is made to the Sutable for Use Levels (S4ULs) derived by The Land Quality Management Ltd & Chartered Institute of Environmental Health⁽²⁰¹⁵⁾ and summarised in Table 5 overleaf. The S4ULs are based on 1% Soil Organic Matter (SOM).

Table 5: Soil Results Comparison with LQM/CIEH S4UL

Determinant	Suitable 4 Use Levels (mg/kg)*			Min. (mg/kg)	Max. (mg/kg)	No of Exceedences
	Residential		Commercial (3)			
	with homegrown produce (1)	without homegrown produce (2)				
Metals						
Beryllium	1.7	1.7	12	0.6	0.6	0
Boron	290	11000	240000	<1	<1	0
Chromium	910	910	8600	14	17	0
Copper	2400	7100	68000	12	27	0
Mercury	1.2	1.2	58	<1	<1	0
Nickel	180	180	980	12	15	0
Selenium	250	430	12000	<3	<3	0
Vanadium	410	1200	9000	28	31	0
Zinc	3700	4000	730000	38	54	0
Polycyclic Aromatic Hydrocarbons						
Naphthalene	2.3	2.3	190	<0.1	<0.1	0
Acenaphthylene	170	2900	83000	<0.1	<0.1	0
Acenaphthene	210	3000	84000	<0.1	<0.1	0
Fluorene	170	2800	63000	<0.1	<0.1	0
Phenanthrene	95	1300	22000	<0.1	<0.1	0
Anthracene	2400	31000	520000	<0.1	<0.1	0
Fluoranthene	280	1500	23000	<0.1	0.14	0
Pyrene	620	3700	54000	<0.1	0.12	0
Benz(a)anthracene	7.2	11	170	<0.1	<0.1	0
Chrysene	15	30	350	<0.1	<0.1	0
Benzo(b)fluoranthene	2.6	3.9	44	<0.1	<0.1	0
Benzo(k)fluoranthene	77	110	1200	<0.1	<0.1	0
Indeno(1,2,3-cd)pyrene	27	45	500	<0.1	<0.1	0
Dibenz(a,h)anthracene	0.24	0.31	3.5	<0.1	<0.1	0
Benzo(ghi)perylene	320	360	3900	<0.1	<0.1	0
Speciated TPH						
Aliphatic >C5 - C6	42	42	3200	<0.01	<0.01	0
Aliphatic >C6 – C8	100	100	7800	<0.05	<0.05	0
Aliphatic >C8 – C10	27	27	2000	<2	<2	0
Aliphatic >C10 – C12	130	130	9700	<2	<2	0
Aliphatic >C12 – C16	1100	1100	59000	<3	<3	0
Aliphatic >C16 – C35	65000	65000	1600000	<3	<10	0
Aromatic >C5 – C7	70	370	26000	<0.01	<0.01	0
Aromatic >C7 – C8	130	860	56000	<0.05	<0.05	0
Aromatic >C8 – C10	34	47	3500	<2	<2	0
Aromatic >C10 – C12	74	250	16000	<2	<2	0
Aromatic >C12 – C16	140	1800	36000	<2	<2	0
Aromatic >C16 – C21	260	1900	28000	<3	<3	0
Aromatic >C21 – C35	1100	1900	28000	<10	<10	0
BTEX						
Benzene	0.087	0.38	27	<2	<2	0
Toluene	130	880	56000	<5	<5	0
Ethylbenzene	47	83	5700	<2	<2	0
m & p-xylene	60	88	6600	<2	<2	0
o-Xylene	59	82	6200	<2	<2	0
MTBE	56	79	5900	<5	<5	0

The comparison within Table 5 has shown very low concentrations of contamination, with no exceedances above screening criteria for residential end use.

6.2 Asbestos

Asbestos was not encountered in any of the samples analysed as part of this investigation.

6.3 Protection of underground services

The three samples screened have shown a general absence of contamination within the shallow soils beneath site, therefore it is considered unlikely that new services would require special protection measures.

7.0 GROUND GAS CONTAMINATION RISK ASSESSMENT

A preliminary gas risk assessment has been completed for the assessment site based on monitoring data collected from the two installations constructed as part of the recent ground investigation works. The two installations have slotted sections screened within the shallow Taplow Gravel Deposits present beneath the assessment site.

Results obtained during three monitoring visits between 1st October and 9th October 2019 indicated Oxygen (O₂) levels ranging from 16.6% to 18.9% by volume, Carbon Dioxide (CO₂) levels ranging from 0.0% to 1.2% by volume, Methane (CH₄) levels at 0.0% by volume, Carbon Monoxide (CO) levels at 0.0ppm and Hydrogen Sulphide levels at 0ppm. The atmospheric pressure ranged from 993mb to 1001mb across the three monitoring rounds.

Borehole flow rates were recorded during all three rounds, however in all instances no results above the limit of detection were recorded.

The monitoring of VOCs was also undertaken using a Photoionisation Detector (PID) during each monitoring round. However, during all three rounds an absence of VOCs was proven.

The potential risk associated with ground gases (whether from natural or man-made sources) is dependent on the concentration of gas and its flow rate to the surface. These factors are assessed by the monitoring of borehole installations over varying atmospheric conditions. The variable nature of gas generation and the effect of barometric pressure on gas flow, means that the volume of gas potentially reaching the ground surface can vary over time.

For the assessment of sites, in terms of the potential for ground gas to present a hazard, the risk-based methodology detailed in the CIRIA C665⁽²⁰⁰⁷⁾ is used. This is a risk-based approach that is designed to allow the quick and easy design of gas protection for development by comparing the measured gas emission rates to Characteristic Situations, based on risk-based Gas Screening Values (GSVs). The GSVs equate to the borehole gas volume flow rate as defined by Wilson and Card ⁽¹⁹⁹⁹⁾ and are calculated as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.

GSVs for carbon dioxide and methane have not been calculated as part of this assessment due to the absence of gas flows being recorded and the low levels of gas identified. Carbon dioxide and methane concentrations were recorded below the Characteristic Situation 1 GSV threshold of 5% and 1% respectively.

Given the above information, a Very Low gas risk / Characteristic Situation (1), is considered appropriate for the assessment site.

Taking the above into account, it is suggested that no special mitigation measures are required with regards to potential ground gas contamination.

8.0 REVIEW OF CONCEPTUAL SITE MODEL

The following section reviews the preliminary conceptual model (Table 1) based on the findings of the intrusive investigation.

Table 6 below provides a Revised Conceptual Model which supersedes the preliminary conceptual model in Table 1.

The Conceptual Model is based on a proposed residential end use.

Table 6: Revised Conceptual Model

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Contamination of the ground beneath the site due to its current use as a builder's yard	Dermal contact, ingestion and inhalation of soils dust	Current Site users	Unlikely	Moderate	Low Risk	Due to the lack of exceedances identified within the soil samples taken from site, and considering the site is currently unoccupied, the risk to current site users is considered LOW .
		Adjacent Site users	Unlikely	Moderate	Low Risk	Due to the lack of exceedances identified within the soil samples taken from site the risk to adjacent site users is considered LOW .
		Future Site users	Unlikely	Moderate	Low Risk	Due to the lack of exceedances identified within the soil samples taken from site the risk to future site users is also considered LOW . It should be noted that asbestos materials have been identified within the structure of the building currently on site, and hence a full asbestos survey should be undertaken, and any remedial actions taken prior to the site being occupied by the new users.
		Construction Workers	Unlikely	Moderate	Low Risk	Assuming appropriate health and safety measures are adopted (in line with CDM and other relevant health and safety guidance) a LOW risk to construction workers is anticipated during the redevelopment of the site.
	Vertical or horizontal migration of contamination via leaching into the underlying shallow groundwater	Controlled Waters	Unlikely	Moderate	Low Risk	A lack of shallow groundwater was recorded within the recent ground investigation alongside a lack of contamination present within the shallow soils. Taking this information into account, the risk to controlled waters from contamination present on site is considered LOW in this instance.
Contamination of the ground beneath the site due to the historical	Vertical or horizontal migration of contamination via leaching	Current Site users	Unlikely	Moderate	Low Risk	A lack of shallow groundwater was recorded within the recent ground investigation alongside a lack of contamination present within the shallow soils beneath site. Taking this information

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Garage located immediately to the north of the assessment site	into the underlying shallow groundwater					into account, the risk to current site users from migrating contamination within shallow groundwater is considered LOW .
		Future Site users	Unlikely	Moderate	Low Risk	A lack of shallow groundwater was recorded within the recent ground investigation alongside a lack of contamination present within the shallow soils beneath site. Taking this information into account, the risk to future site users from migrating contamination within shallow groundwater is considered LOW .
	Vertical or horizontal migration of ground gas	Current Site users	Unlikely	Moderate to High	Low Risk	A preliminary ground gas risk assessment has been completed for the assessment site using ground gas monitoring data collected over three separate visits and at two locations across the site. This information has shown a lack of elevated ground gas and vapour concentrations. It is therefore considered that the risk to current site users from migrating ground gas and vapours is LOW .
		Future Site users	Unlikely	Moderate to High	Low Risk	A preliminary ground gas risk assessment has been completed for the assessment site using ground gas monitoring data collected over three separate visits and at two locations across the site. This information has shown a lack of elevated ground gas and vapour concentrations. It is therefore considered that the risk to future site users from migrating ground gas and vapours is LOW .

9.0 CONCLUSIONS AND RECOMMENDATIONS

The following section provides a summary of the conclusions and recommendations based on the findings of the contamination testing and gas monitoring undertaken.

9.1 Soil Contamination

Based on available soil contamination results and the screening exercise completed in Section 6 of this report, it is considered that there is no significant risk to current or future site users from contaminant present within the shallow soils beneath the assessment site.

9.2 Ground Gas

As discussed within Section 7 of this report, a preliminary ground gas risk assessment has been completed based on three rounds of gas data collected from two installations at the assessment site. The two installations were screened within the shallow granular Taplow Gravel Deposits. The results of this monitoring identified a lack of elevated levels of both ground gas and hydrocarbon vapours.

As part of the ground gas risk assessment, the assessment site was designated as a Characteristic Situation 1, e.g. Very Low Risk. It is therefore considered that the assessment site is not at risk from migrating ground gasses, and the installation of specialist ground gas mitigation measures will not be required as part of the proposed redevelopment.

9.3 Groundwater

A lack of shallow groundwater was identified during the recent ground investigation. In addition, a lack of significant contaminant of the shallow soils was also recorded. Taking this into account, it is recommended that no further investigation works are required with regards to the assessment of shallow groundwater.

9.4 Site Personnel

As with all construction sites, personnel working on the site during the construction period should be encouraged to maintain a high standard of personal hygiene and on-site washing facilities should be available.

9.5 Other Matters

Due diligence is required during the construction period, and should any further evidence of contamination be found, appropriate investigation and / or action should be taken. The significance of any contamination not discovered by this investigation is outside the scope of this report.

9.6 Further works

No further works are considered necessary in this instance, and it is considered that sufficient information has now been uncovered to discharge the conditions relating to contaminated land associated with this proposed redevelopment.

APPENDIX 1
EXPLORATORY HOLE LOGS

Percussion Drilling Log

Project Name: prospect Street		Client: Hive Structure Ltd		Date: 25/09/2019	
Location: Reading		Contractor:		Co-ords: E465315.39 N173737.73	
Project No. : R0271		Crew Name:		Drilling Equipment:	
Borehole Number HP01	Hole Type WS	Level	Logged By	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05			CONCRETE	
					0.20			Soft brown slightly gravelly sandy CLAY. Gravel is medium to coarse angular with brick and concrete (MADE GROUND)	
								Soft brown slightly gravelly sandy CLAY. Gravel is fine to medium angular to sub-angular of flint and chert. (TAPLOW GRAVEL DEPOSITS)	
					1.50			End of Borehole at 1.500m	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks										 EARTH ENVIRONMENTAL & GEOTECHNICAL	
---------	--	--	--	--	--	--	--	--	--	---	--

Percussion Drilling Log

Project Name: prospect Street		Client: Hive Structure Ltd		Date: 25/09/2019	
Location: Reading		Contractor:			
Project No. : R0271		Crew Name:		Drilling Equipment:	
Borehole Number HP02	Hole Type WS	Level	Logged By	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15			CONCRETE	
					0.25			Soft brown slightly gravelly sandy CLAY. Gravel is medium to coarse angular with brick and concrete (MADE GROUND)	
								Soft brown slightly gravelly sandy CLAY. Gravel is fine to medium angular to sub-angular of flint and chert (TAPLOW GRAVEL DEPOSITS)	
					1.25			End of Borehole at 1.250m	
									1
									2
									3
									4
									5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Percussion Drilling Log

Project Name: prospect Street		Client: Hive Structure Ltd		Date: 25/09/2019	
Location: Reading		Contractor:			
Project No. : R0271		Crew Name:		Drilling Equipment:	
Borehole Number HP02	Hole Type WS	Level	Logged By	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15			CONCRETE	
					0.25			Soft brown slightly gravelly sandy CLAY. Gravel is medium to coarse angular with brick and concrete (MADE GROUND)	
								Soft brown slightly gravelly sandy CLAY. Gravel is fine to medium angular to sub-angular of flint and chert (TAPLOW GRAVEL DEPOSITS)	
					1.25			End of Borehole at 1.250m	
									1
									2
									3
									4
									5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

APPENDIX 2
GAS/GROUNDWATER MONITORING RESULTS

Gas Monitoring Record

Project Number:	R0271
Project Name:	Prospect Street, Reading
Date:	01/10/2019
Logger	LC + RL

Weather:	Sunny with paches of rain
----------	---------------------------

*mbgl - Meters below Ground Level

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	HP01	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	DRY	1.2	Tap Closed
Flow Rate (l/hr)	0	CO2 (%)	0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
Atmospheric Pressure (mbar)	993	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Borehole Pressure (Pa)	-0.15	O2 (%)	18.6	18.4	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18			
Time	11:45	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	HP02	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	DRY	1.13	Tap Closed
Flow Rate (l/hr)	0	CO2 (%)	0	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7			
Atmospheric Pressure (mbar)	994	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Borehole Pressure (Pa)	-0.24	O2 (%)	18.5	18.2	17.7	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.5	17.6	17.6	17.6	17.6	17.5	17.5	17.6			
Time	11:15	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

Gas Monitoring Record

Project Number:	R0271
Project Name:	Prospect Street, Reading
Date:	04/10/2019
Logger	LC

Weather:	Cloudy with patches of rain
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*mbgl - Meters below Ground Level

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	HP01	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	DRY	1.2	Tap Closed
Flow Rate (l/hr)	0	CO2 (%)	0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3			
Atmospheric Pressure (mbar)	1001	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Borehole Pressure (Pa)	-0.2	O2 (%)	18.9	18.6	18.4	18.4	18.4	18.4	18.4	18.4	18.3	18.3	18.3	18.4	18.4	18.4	18.3	18.3	18.4	18.4			
Time	11:45	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	HP02	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	DRY	1.13	Tap Closed
Flow Rate (l/hr)	0	CO2 (%)	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Atmospheric Pressure (mbar)	1001	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Borehole Pressure (Pa)	-0.24	O2 (%)	18.8	18.7	17.8	17.6	17.6	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5			
Time	11:30	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

Gas Monitoring Record

Project Number:	R0271
Project Name:	Prospect Street, Reading
Date:	09/10/2019
Logger	LC

Weather:	Dry and clear
----------	---------------

*mbgl - Meters below Ground Level

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	HP01	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	DRY	1.2	Tap Closed
Flow Rate (l/hr)	0	CO2 (%)	0	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
Atmospheric Pressure (mbar)	1001	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Borehole Pressure (Pa)	-0.45	O2 (%)	17.7	17.6	17.4	17.3	17.3	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	7.3			
Time	08:15	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	HP02	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	DRY	1.13	Tap Closed, flow reading flashed ERROR whilst logging
Flow Rate (l/hr)	0	CO2 (%)	0	0.7	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2			
Atmospheric Pressure (mbar)	1001	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Borehole Pressure (Pa)	-0.48	O2 (%)	17.8	17.8	17.3	16.9	16.8	16.7	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6			
Time	08:00	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

APPENDIX 3

LABORATORY TEST RESULTS



John Grace
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Kingsbury House
Kingsbury Square
Melksham
Wiltshire
SN12 6HL

DETS Ltd
Unit 1
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Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 19-14019

Site Reference: Prospect Street Reading

Project / Job Ref: R0271

Order No: None Supplied

Sample Receipt Date: 30/09/2019

Sample Scheduled Date: 30/09/2019

Report Issue Number: 1

Reporting Date: 08/10/2019

Authorised by:

A handwritten signature in black ink, appearing to read "Dave Ashworth".

Dave Ashworth
Technical Manager

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



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Soil Analysis Certificate						
DETS Report No: 19-14019	Date Sampled	25/09/19	25/09/19	25/09/19		
Earth Environmental & Geotechnical (Southern Ltd)	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Prospect Street Reading	TP / BH No	HP1	HP2	HP3		
Project / Job Ref: R0271	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.50 - 1.00	0.50 - 1.00	0.50 - 1.00		
Reporting Date: 08/10/2019	DETS Sample No	438503	438504	438505		

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	8.2	8.0	7.9	
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	
Complex Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	
Total Sulphate as SO ₄	mg/kg	< 200	NONE	< 200	< 200	< 200	
Total Sulphate as SO ₄	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	15	28	< 10	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.03	< 0.01	
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	
Organic Matter	%	< 0.1	MCERTS	0.6	0.8	1.2	
Arsenic (As)	mg/kg	< 2	MCERTS	9	10	11	
Barium (Ba)	mg/kg	< 5	NONE	41	44	63	
Beryllium (Be)	mg/kg	< 0.5	NONE	0.6	0.6	0.6	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS	14	15	17	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	12	11	27	
Lead (Pb)	mg/kg	< 3	MCERTS	30	21	124	
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	12	12	15	
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	
Vanadium (V)	mg/kg	< 2	NONE	28	29	31	
Zinc (Zn)	mg/kg	< 3	MCERTS	41	38	54	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-14019	Date Sampled	25/09/19	25/09/19	25/09/19		
Earth Environmental & Geotechnical (Southern)	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Prospect Street Reading	TP / BH No	HP1	HP2	HP3		
Project / Job Ref: R0271	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.50 - 1.00	0.50 - 1.00	0.50 - 1.00		
Reporting Date: 08/10/2019	DETS Sample No	438503	438504	438505		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.14		
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.12		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 19-14019	Date Sampled	25/09/19	25/09/19	25/09/19		
Earth Environmental & Geotechnical (Southern)	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Prospect Street Reading	TP / BH No	HP1	HP2	HP3		
Project / Job Ref: R0271	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.50 - 1.00	0.50 - 1.00	0.50 - 1.00		
Reporting Date: 08/10/2019	DETS Sample No	438503	438504	438505		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10		
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10		
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21		
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-14019	Date Sampled	25/09/19	25/09/19	25/09/19		
Earth Environmental & Geotechnical (Southern)	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Prospect Street Reading	TP / BH No	HP1	HP2	HP3		
Project / Job Ref: R0271	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.50 - 1.00	0.50 - 1.00	0.50 - 1.00		
Reporting Date: 08/10/2019	DETS Sample No	438503	438504	438505		

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5		
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 19-14019

Earth Environmental & Geotechnical (Southern Ltd)

Site Reference: Prospect Street Reading

Project / Job Ref: R0271

Order No: None Supplied

Reporting Date: 08/10/2019

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
438503	HP1	None Supplied	0.50 - 1.00	12	Brown sandy clay with stones
438504	HP2	None Supplied	0.50 - 1.00	10.1	Brown sandy clay
438505	HP3	None Supplied	0.50 - 1.00	13.1	Brown sandy clay with stones

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 19-14019

Earth Environmental & Geotechnical (Southern Ltd)

Site Reference: Prospect Street Reading

Project / Job Ref: R0271

Order No: None Supplied

Reporting Date: 08/10/2019

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 dphenylcarbazine followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

APPENDIX 4

REPORT LIMITATIONS

REPORT LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget and staff resources allocated to the project.

Other than that, expressly contained in the above paragraph, Earth Environmental & Geotechnical Ltd provides no other representation or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Earth Environmental & Geotechnical Ltd.

If a third party relies on this report, it does so wholly at its own and sole risk and Earth Environmental & Geotechnical Ltd disclaims any liability to such parties.

It is Earth Environmental & Geotechnical Ltd understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was an important factor in determining the scope and level of the services. Should the purpose for which the report is used, or the proposed use of the site change, this report will no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without Earth Environmental & Geotechnical Ltd review and advice shall be at the client's sole and own risk.

The report was written in 2019 and should be read in light of any subsequent changes in legislation, statutory requirements and industry best practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. The passage 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 contained in this report should not be relied upon in the future without the written advice of Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

The observations and conclusions described in this report are based solely upon the services that were provided pursuant to the agreement between the client and Earth Environmental & Geotechnical Ltd. Earth Environmental & Geotechnical Ltd has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report.

Earth Environmental & Geotechnical Ltd is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, Earth Environmental & Geotechnical Ltd did not seek to evaluate the presence on or off the site of electromagnetic fields, lead paint, radon gas or other radioactive materials.

The services are based upon Earth Environmental & Geotechnical Ltd observations of existing physical conditions at the site gained from a walkover survey of the site together with Earth

Environmental & Geotechnical Ltd 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 whilst Earth Environmental & Geotechnical Ltd have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified.

No responsibility can be accepted for errors within third party items presented in this report. Further Earth Environmental & Geotechnical Ltd was not authorised and did not attempt 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. Earth Environmental & Geotechnical Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to Earth Environmental & Geotechnical Ltd and including the doing of any independent investigation of the information provided to Earth Environmental & Geotechnical Ltd save as otherwise provided in the terms of the contract between the client and Earth Environmental & Geotechnical Ltd.

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 can also be variable and as investigation excavations 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. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and Earth Environmental & Geotechnical Ltd] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.