55 Riverside Road
Shoreham-by-Sea
West Sussex

Ground Contamination
Risk Assessment
and Remediation Strategy
and Verification Plan

ASHDOWN SITE INVESTIGATION LIMITED

Report No. R16-11505

July 2016

Report prepared for the benefit of:

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ADUR & WORTHING
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The risk assessment presented in this report follows 'source-pathway-receptor' techniques for the determination of whether a site is contaminated. This is standard practice in the UK, being intrinsic to Part 2A of the Environmental Protection Act 1990 as amended.

The report considers the proposed end users as the most sensitive human health receptors. If significant risks to construction workers are identified by the preliminary assessment attention is drawn to this, although it is noted that no assessment of risk from acute exposure has been undertaken in this connection.

This report is not intended to be either an ecological, archaeological or flood risk assessment. An appropriate specialist should be consulted about any concerns that may arise in this regard.

EXECUTIVE SUMMARY

The following presents a summary of the main findings of the quantitative ground contamination risk assessment. It is emphasised that no reliance should be placed on any individual point until the whole of the report has been read as other sections of the report may put into context the information contained herein.

It is proposed to extend the existing residential property at 55 Riverside Road, Shoreham-by-Sea, West Sussex. The proposal comprises the replacement of an existing conservatory and lean-to at the rear of the property with a two-storey extension and balcony, the replacement of an existing garage to the side with a single-storey extension and the construction of a porch to the front.

Reference to geological datasets indicates that the site is expected to be underlain by Storm Beach Deposits overlying the White Chalk Subgroup. Information from the local authority suggests that pulverised fuel ash (PFA) may have been placed beneath the site.

The Storm Beach Deposits and the White Chalk Subgroup are classified as Secondary A and Principal Aquifers respectively. The site does not lie within an Environment Agency Source Protection Zone with regard to the protection of the quality of groundwater that is abstracted for potable supply.

The preliminary contamination risk assessment identified potential complete pollutant linkages with regard to both proposed end users of the site and controlled waters beneath the site.

The ground investigation has identified the presence of asbestos materials and concentrations of lead considered to pose an unacceptable risk to human health within the made ground soils.

Remedial measures, comprising the provision of 300mm suitable cover material above a geotextile and geo-grid, will be required within all proposed areas of soft cover.

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1. INTRODUCTION

It is proposed to extend the existing residential property at 55 Riverside Road, Shoreham-by-Sea, West Sussex. The proposal comprises the replacement of an existing conservatory and lean-to at the rear of the property with a two-storey extension and balcony, the replacement of an existing garage to the side with a single-storey extension and the construction of a porch to the front.

Ashdown Site Investigation Limited was commissioned to carry out a quantitative ground contamination risk assessment of the site by Mr Julian Mills of Liam Russell Architects, 24 Windlesham Road, Brighton, BN1 3AG.

The scope of the commission and the terms and conditions under which the work was undertaken are set out within the offer letter Q16-4936 dated 9th June 2016. The instruction to proceed was received on behalf of the client, Mr Lawrence Pearce, in an email dated 10th June 2016.

The objectives of the works were to:

a) Test for the presence of potentially significant contamination in the ground; and
b) Develop a quantitative conceptual model of the site identifying potentially significant pollutant linkages relating to end users of the development, to controlled waters or off-site sensitive receptors;
c) Provide an options appraisal of remedial works to address any complete pollutant linkages; and
d) Provide a remediation strategy and verification plan for the development proposals.

This report should be read in conjunction with the preliminary ground contamination risk assessment report prepared by Ashdown Site Investigation Ltd, reference R16-11477/ds, dated June 2016.

2. SITE CONTEXT

2.1 Site Description

The site comprises an approximately rectangular shaped plot of land located at 55 Riverside Road, Shoreham-by-Sea, West Sussex, and is centred on the approximate Ordnance Survey national grid reference TQ 2209 0485. A site location plan and borehole location plan are presented as Figure 1 and Figure 2, respectively.

The site is bounded by the River Adur to the north, residential properties to the east and west and Riverside Road to the south.

At the time of the intrusive site works, the site was occupied by a single storey residential property located approximately centrally on the site, with an attached garage to the east of the property. A conservatory and an area of block paving were located against the northern elevation of the property, with an area of decking to the north of the conservatory.

2.2 Geological Data Review

2.2.1 Expected Geology

The stratigraphic succession that may be expected to underlie the site is presented in the following table.

Table 1. Expected Geological Strata

Type	Stratum
Superficial Deposits	Storm Beach Deposits
Bedrock Deposits	White Chalk Subgroup – Tarrant Chalk Member

2.2.2 Storm Beach Deposits

Storm Beach Deposits typically comprise well rounded to sub-angular fine to coarse gravel and cobbles of flint with small fractions of sand. The deposits may be expected to be well sorted, but will be laterally and vertically variable.

The site itself is part of a shingle spit which is bounded by the River Adur to the north and the sea to the south. Extensive works have been undertaken involving the construction and repair of groynes and recharging of the shingle beaches to stabilise and combat erosion of the spit.

2.2.3 White Chalk Subgroup

The White Chalk Subgroup comprises a weak, white chalk locally with flint bands together with scattered nodular flints. It may be expected to have a deeply convoluted upper surface as a result of solution weathering. The presence of natural cavities in the chalk is very rare and solution features, if present, can be expected to be infilled locally with more recent deposits.

The infill material may be significantly weaker than the surrounding chalk. Solution features can comprise pipes extending to several metres deep into the chalk or conical depressions and basin shaped structures.

Historically, chalk deposits were often mined locally. Most commonly historical mines characteristically comprise a narrow shaft with a number of chambers radiating from the base. These structures are colloquially known as "deneholes", "chalk-wells" or "chalkangles". The depth of the features reflects the depth to the underlying chalk bedrock. The shaft width was commonly in the order of 2m to 3m, widening out into galleries at depth. The chalk was extracted for soil improvement and was usually applied directly to fields though sometimes the chalk was processed, typically by burning in kilns where the chalk was used to produce quicklime (calcium oxide). Once they had reached their limits the mines were commonly capped. Various capping techniques were used; examples include the use of upturned trees or brick arching. Records pertaining to the distribution of these localised mines are incomplete, usually being limited to features marked as shafts or the occurrence of circular depressions on historic Ordnance Survey maps. In the field they are most likely to be visible as shallow depressions, if at all.

Site inspection and inspection of historical maps extending back in time to 1874 does not reveal the presence of any significant features at the site. Given the fact that the site is part of a shingle spit and within the immediate vicinity of the sea and the River Adur, it is considered highly unlikely that the site would have been subjected to mining for chalk.

2.3 Radon Gas

The site is reported to be within an area where between 1% and 3% of properties are above the action level requiring radon gas protection measures to be installed in new buildings. However, no radon protective measures are reported by the BGS to be necessary in the construction of new dwellings. It is recommended that discussions with building control should be undertaken to determine if they have any specific requirements in this connection.

2.4 Hydrogeology

2.4.1 Aquifer Classification

The Environment Agency designates aquifers in accordance with the Water Framework Directive. These designations reflect not only the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

The Storm Beach Deposits and the White Chalk Subgroup expected beneath the site are classified as a Secondary A Aquifer and a Principal Aquifer respectively. Secondary A Aquifers are characterised by permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Principal Aquifers comprise deposits that have high intergranular and/or fracture permeability, usually providing a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

2.4.2 Groundwater Source Protection Zones and Abstraction Licences

No groundwater abstraction licences are indicated within 2km of the site.

The site does not lie within an Environment Agency Source Protection Zone with regard to the protection of the quality of groundwater that is abstracted for potable supply.

2.5 Hydrology

2.5.1 Surface Water Features

The nearest recorded significant surface water feature is the River Adur, immediately to the north of the site.

There is no Environment Agency information on river quality within 250m of the site.

2.5.2 Surface Water Abstraction Licences

No surface water abstraction licences are indicated within 2km of the site.

3. GROUND INVESTIGATION

3.1 Introduction

The ground investigation comprised the excavation of a series of hand augered boreholes. The fieldwork was carried out on 20th June 2016. The exploratory hole locations are shown on Figure 2.

Descriptions of the strata encountered and comments on groundwater conditions are shown in the exploratory hole records given in Appendix A, together with notes to assist in their interpretation.

3.2 Exploratory Holes

3.2.1 Hand Auger Boreholes

Eleven boreholes (designated HA1 to HA11) were bored to depths of between 0.4m and 0.7m below ground level. The hand auger enables disturbed soil samples to be taken using a cutting tool twisted into the soil by hand. Where use of the hand auger was not possible due to ground conditions, hand tools were employed to excavate shallow pits enabling sample collection.

3.3 Sampling

Disturbed samples of soil were taken at the depths shown in the exploratory hole records and were collected in plastic tubs or amber jars fitted with gas tight lids.

On collection the amber jars were stored in cool boxes with cooling blocks to maintain temperatures below 4°C until transferred to refrigerators upon return to the office and subsequently forwarded to the external accredited chemical testing laboratory.

3.4 Laboratory Testing

Laboratory testing was scheduled by Ashdown Site Investigation Ltd. Results from the laboratory tests are provided in Appendix B.

Chemical testing of selected samples was undertaken by a laboratory with recognised (UKAS and MCERTS) accreditation for quality control.

4. GROUND CONDITIONS

4.1 Stratigraphy

4.1.1 Surface Covering

Each of the exploratory holes was excavated through a shallow cover of topsoil some 50mm to 100mm in thickness.

4.1.2 Made Ground

Made ground, generally comprising slightly sandy, slightly gravelly to very gravelly clay was recorded to the full depth of each exploratory hole. The gravel fraction comprised variable quantities of flint, chalk, brick, glass, charcoal-like and clinker-like material.

A discrete sample of suspected asbestos containing material was recorded within HA7 at a depth of 0.4m below ground.

4.2 Stability

Each of the exploratory holes was recorded to be stable during the course of excavation.

4.3 Groundwater Conditions

Ground water was not encountered within any of the exploratory holes during the course of the intrusive works.

5. QUANTITATIVE CONTAMINATION ASSESSMENT

5.1 Introduction

The preliminary contamination risk assessment identified potential pollutant linkages relating to the fact that the site comprises reclaimed land and that it was historically used as part of a shipyard.

Due to the presence of these potential pollutant linkages, an intrusive investigation was deemed to be required to allow a quantitative contamination assessment as to whether the underlying soils posed an unacceptable risk to human health.

5.2 Preliminary Conceptual Model

The conceptual model originally presented within the preliminary contamination risk assessment report (ref: R16-11477) for the proposed development is included in the following table.

Table 2. Preliminary Conceptual Model

Potential Sources Identified	Potential Contaminants	Receptor	Potential Pathways	Potential Pathway Present?	Probability	Consequence	Overall Assessment of Risk	Complete Pollutant Linkage Present?
Use of the site as part of a shipyard	Heavy metals PAH compounds PCBs Cyanide Petroleum Hydrocarbons VOC	Human Health (End Users)	a) Dermal contact with soil and dust (indoor & outdoor). b) Ingestion of soil and indoor dust. c) Consumption of homegrown produce and attached soil. d) Inhalation of soil dust (indoor and outdoor). e) Contamination of incoming services. f) Inhalation of soil vapours. g) Inhalation of soil gases/Risk of explosion.	Yes Yes Yes Yes Yes No No	Low Low Low Low Very Low n/a n/a	Severe Severe Severe Severe Severe n/a n/a	Moderate Moderate Moderate Moderate Low/ Moderate n/a Low/ Moderate	Yes Yes Yes Yes No No Yes
Made Ground beneath the site from reclamation and redevelopment works, potentially containing PFA	Heavy Metals PAH Compounds Asbestos	Groundwater	h) Migration to groundwater. a) Dermal contact with soil and dust (indoor & outdoor). b) Ingestion of soil and indoor dust. c) Consumption of homegrown produce and attached soil. d) Inhalation of soil dust (indoor and outdoor). e) Contamination of incoming services. f) Inhalation of soil vapours. g) Inhalation of soil gases/Risk of explosion. h) Migration to groundwater.	Yes Yes Yes Yes No No No Yes	Low Moderate Moderate Moderate Very Low n/a n/a Very Low	Moderate Moderate Moderate Moderate n/a n/a n/a Very Minor	Low/ Moderate Moderate Moderate Moderate n/a n/a n/a Negligible	Yes Yes Yes Yes No No No No

5.3 Assessment Strategy

The potential sources identified have the potential to have caused contamination anywhere on the site. Such contaminated materials, if present, would represent a risk where they are present within soft landscaped areas where direct contact with the soils and generation of soil derived dusts may occur. If volatile contaminants are recorded to be present, these may also pose a risk via the inhalation of soil vapours, or via the incoming services.

To determine whether such contaminants were present within the made ground, a non-targeted spread of sampling positions across accessible soft covered parts of the site was undertaken, with representative samples of the underlying soils tested for the contaminants identified within the conceptual model.

5.4 Analysis of Contamination Test Results

Statistical analysis of the concentrations of heavy metals and polycyclic aromatic hydrocarbon (PAH) compounds within the ten samples of the shallow made ground soils (samples were tested from depths of up to 0.6m below ground level) has been undertaken in line with guidance set out in 'Comparing Soil Contamination Data with a Critical Concentration' report, published by the CIEH/ CL:AIRE (May 2008).

The CIEH/CL:AIRE guidance provides a framework for assessing measured contaminant concentrations on a site against user defined critical concentrations – or indicators of risk.

Under a planning scenario, the null hypothesis tested is that the true population mean is greater than a "critical concentration". The critical concentration used within this assessment is the relevant screening value for the proposed end use.

The null hypothesis can be rejected if it can be shown (with a sufficient degree of confidence) that the true population mean lies below the critical concentration. The confidence level recommended within the guidance is 95% i.e. the statistical evidence must show that there is 95% likelihood that the true population mean lies below the critical concentration. In this instance the site is considered suitable for the proposed use.

Where there is insufficient evidence to reject the null hypothesis, further risk assessment and/or remediation may be necessary.

Guidance on comparing soil contamination data with a critical concentration is provided in Appendix C along with the summary sheets from the statistical analysis.

For the purposes of this assessment the "critical concentration" used are soil screening values (SSVs) comprising the 'Suitable For Use Levels' (S4ULs) calculated as a joint project between LQM and CIEH and published in 'The LQM/CIEH Suitable 4 Use Levels, 2015'. In lieu of an S4UL screening value for lead, the Category 4 Screening Level (C4SL) was used, as published within SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report, published by DEFRA, 2014.

For petroleum hydrocarbons, statistical analysis has not been undertaken. The results of the testing have been compared directly with calculated S4ULs.

In view of the proposed development the assessment has been made against SSVs calculated using the generic "Residential" land use as defined within Science Report SC050021/SR3,

January 2009, with the amendments discussed in the LQM/CIEH report. The critical receptor for this land use is considered to be a young female child resident on site from birth to age 6. Exposure routes that are considered include the potential for direct ingestion of the soil, the outdoor and indoor ingestion of dust, the potential inhalation of dust and vapours, ingestion of site grown vegetables and ingestion of soil attached to vegetables.

For the assessment of risk to controlled waters a qualitative assessment has been undertaken based upon the concentrations of contaminants recorded within the soil samples and the information obtained about the sensitivity of the underlying strata or nearby surface water receptors.

5.5 Heavy Metals

The following table summarises the soil screening values, maximum, minimum and mean concentrations and the 95th percentile upper confidence limits for the heavy metals tested for.

Table 3. Summary of Test Results and Statistical Analysis for Heavy Metals

Contaminant	SSV (mg/kg)	No. of Samples	Minimum Concentration (mg/kg)	Maximum concentration (mg/kg)	Limit of Detection (mg/kg)	Mean Concentration (mg/kg)	95% Upper Confidence Limit (mg/kg)	No of exceedances	Can H_o be rejected
Arsenic	37	10	6	17	<2	11	13.2	0	Yes
Cadmium	11	10	<LOD	0.3	<0.2	0.15	0.3	0	Yes
Chromium	910	10	12	28	<2	20.2	23.1	0	Yes
Copper	2400	10	14	54	<4	28.9	36.6	0	Yes
Lead	200	10	48	411	<3	150.8	**319.7**	**3**	**No**
Mercury	40	10	<LOD	0	<1	0.5	0.5	0	Yes
Nickel	180	10	7	35	<3	17.4	21.7	0	Yes
Selenium	250	10	<LOD	0	<3	1.5	1.5	0	Yes
Zinc	3700	10	65	286	<3	135.1	243.7	0	Yes
Hexavalent Chromium	6	10	<LOD	0	<2	1	1	0	Yes
Water Soluble Boron	290	10	<LOD	0	<1	0.5	0.5	0	Yes

The statistical analysis undertaken indicates that the 95th percentile concentration of lead exceeds the SSV. On this basis, the concentrations of lead within the made ground soils are considered to pose an unacceptable risk to future end users of the site where these soils remain within any proposed areas of soft landscaping.

The concentrations recorded are not considered to be sufficiently elevated so as to pose an unacceptable risk to controlled waters.

5.6 Asbestos

Five samples of the made ground were screened for the presence of asbestos. As noted in Section 4.1.2 a piece of suspected asbestos containing material was also identified within borehole HA7 at 0.4m depth. This was also screened for the presence of asbestos. With the

exception of this piece of discrete material, no other suspected asbestos containing materials were identified within the borehole arisings.

Small bundles of amosite fibres were identified within the made ground sample from HA8. The discrete sample of suspected asbestos containing material from within HA7 was confirmed as tile containing chysotile asbestos.

Given the identification of fibrous asbestos materials in one out of five samples screened along with the presence of encapsulated asbestos material, there is the potential for asbestos materials to be present elsewhere within the made ground soils recorded across the site. A detailed assessment of the risk from asbestos was beyond the scope of this investigation, but as the land beneath and in the vicinity of the site is known to have been raised using material derived from an industrial source, an unacceptable risk from asbestos should be considered to be present at this stage.

An asbestos survey of existing structures and infrastructure (as defined under Section 5(a) of the Control of Asbestos Regulations 2012) was beyond the scope of this investigation. The potential for asbestos containing materials to be present within the fabric of buildings or infrastructure located on the site cannot be dismissed by reference to the soil test results contained within this report. It is recommended that relevant asbestos registers be inspected prior to commencing any demolition works at the site. Where asbestos is identified to be present within buildings or infrastructure, these materials should be appropriately removed by licensed contractors and asbestos materials disposed of in accordance with legal requirements prior to demolition to avoid further contamination of soils at the site.

5.7 Cyanide

Four samples of the made ground were tested for total concentrations of cyanide. None of the samples recorded concentrations above the detection limit for the test.

There is not considered to be a significant risk to the proposed end users of the site or controlled waters beneath the site from cyanide contamination.

5.8 Organic Contaminants

5.8.1 Polycyclic Aromatic Hydrocarbon (PAH) Compounds

The following table summarises the soil screening values, maximum, minimum and mean concentrations and the 95th percentile upper confidence limits for the PAH compounds tested for.

Table 4. Summary of Test Results and Statistical Analysis for PAH Compounds

Contaminant	SSV (mg/kg)	No. of Samples	Minimum Concentration (mg/kg)	Maximum concentration (mg/kg)	Limit of Detection (mg/kg)	Mean Concentration (mg/kg)	95% Upper Confidence Limit (mg/kg)	No of exceedances	Can H_o be rejected
Naphthalene	2.3	10	<LOD	0	<0.1	0.05	0.05	0	Yes
Acenaphthylene	170	10	<LOD	0.26	<0.1	0.07	0.16	0	Yes
Acenaphthene	210	10	<LOD	0	<0.1	0.05	0.05	0	Yes
Fluorene	170	10	<LOD	0	<0.1	0.05	0.05	0	Yes
Phenanthrene	95	10	<LOD	0.75	<0.1	0.17	0.47	0	Yes
Anthracene	2400	10	<LOD	0.12	<0.1	0.06	0.09	0	Yes
Fluoranthene	280	10	<LOD	1.89	<0.1	0.40	1.15	0	Yes
Pyrene	620	10	<LOD	1.99	<0.1	0.43	1.23	0	Yes
Benz(a)anthracene	7.2	10	<LOD	0.88	<0.1	0.18	0.53	0	Yes
Chrysene	15	10	<LOD	1.02	<0.1	0.23	0.65	0	Yes
Benzo(b)fluoranthene	2.6	10	<LOD	0.91	<0.1	0.27	0.70	0	Yes
Benzo(k)fluoranthene	77	10	<LOD	0.36	<0.1	0.11	0.26	0	Yes
Benzo(a)pyrene	2.2	10	<LOD	0.68	<0.1	0.21	0.56	0	Yes
Indeno(123-cd)pyrene	27	10	<LOD	0.5	<0.1	0.15	0.39	0	Yes
Dibenz(ah)anthracene	0.24	10	<LOD	0	<0.1	0.05	0.05	0	Yes
Benzo(ghi)perylene	320	10	<LOD	0.55	<0.1	0.15	0.40	0	Yes

None of the samples tested contained concentrations of PAH compounds above their respective SSVs.

5.8.2 Petroleum Hydrocarbons and BTEX compounds

Six samples of made ground were tested for total concentrations of petroleum hydrocarbons with the results speciated by aromatic and aliphatic equivalent carbon weight fractions. These samples were also tested for concentrations of BTEX compounds.

The following tables list the screening values for petroleum hydrocarbon equivalent carbon weight fractions and BTEX compounds calculated for 1% organic content.

Table 5. Soil Screening Values for petroleum hydrocarbon equivalent carbon weight fractions

Petroleum Hydrocarbon Fraction	SSV (mg/kg)	Petroleum Hydrocarbon Fraction	SSV (mg/kg)
Aliphatic EC 5-6	42	Aromatic EC 5-7	70
Aliphatic EC >6-8	100	Aromatic EC >7-8	130
Aliphatic EC >8-10	27	Aromatic EC >8-10	34
Aliphatic EC >10-12	130	Aromatic EC >10-12	74
Aliphatic EC >12-16	1100	Aromatic EC >12-16	140
Aliphatic EC >16-35	65000	Aromatic EC >16-21	260
Aliphatic EC >35-44	65000	Aromatic EC >21-35	1100
		Aromatic EC >35-44	1100

Table 6. Soil Screening Values for BTEX Compounds (shown as mg/kg and µg/kg)

BTEX Compound	SSV (mg/kg)	SSV (µg/kg)
Benzene	0.087	87
Toluene	130	130,000
Ethylbenzene	47	47,000
p-Xylene[1]	56	56,000

[1] Xylene has three structural isomers, the SSV presented is for *p*-Xylene, which has the most conservative SSV.

None of the samples tested recorded petroleum hydrocarbons above the limit of detection of the test.

Five of the samples recorded detectable concentrations of toluene of between 7µg/kg and 18µg/kg. The sample from HA10 at 0.4m depth, which recorded the highest concentration of toluene, also recorded a concentration of *p*- and *m*-xylene of 3µg/kg.

The concentrations of BTEX compounds recorded are significantly below the soil screening values and therefore the concentrations recorded are not considered to pose an unacceptable risk to end users via direct contact or dust inhalation. The concentrations recorded are not considered to represent a risk via the inhalation of vapours, and are not sufficiently high as to warrant the use of protective water pipe.

The concentrations recorded are not considered to pose a significant risk to controlled waters beneath the site.

5.8.3 Volatile Organic Compounds (VOC)

Four of the samples that had been tested for concentrations of petroleum hydrocarbons were also screened for a range of volatile organic compounds. With the exception of the low concentrations of toluene and xylene discussed above, none of the samples recorded any detectable concentrations of VOC to be present.

As discussed in the previous section there is not considered to be a significant risk to proposed end users of the site or controlled waters beneath the site from VOC contamination.

5.8.4 Polychlorinated Biphenyl (PCB) Compounds

Four samples of the made ground were tested to determine their total concentration of PCB compounds.

None of the samples tested recorded PCB compounds above the limit of detection of the test.

There is not considered to be a significant risk to end users or controlled waters beneath the site from PCB contamination.

5.9 Quantitative Contamination Risk Assessment

A quantitative risk assessment of a site should consider any sources of contamination identified, the receptors that may be present in view of the development proposals and the contaminant pathways by which these may be linked. A complete pollutant linkage is only deemed to exist where all three are present and a site is considered suitable for use where no complete pollutant linkages are identified.

Where a complete pollutant linkage is considered to be present, an assessment of the level of risk associated with the pollutant linkage should be carried out in line with guidance published within "Contaminated Land Risk Assessment: A guide to good practice" published by CIRIA (C552, 2001).

The quantitative risk assessment for the site considers the sources of contamination identified, the receptors that may be present in view of the development proposals and the contaminant pathways by which these may be linked.

A complete pollutant linkage is only deemed to exist where all three are present and a site is considered suitable for use where no complete pollutant linkages are identified.

Where a complete pollutant linkage is considered to be present, an assessment of the level of risk associated with the pollutant linkage has been carried out in line with guidance published within "Contaminated Land Risk Assessment: A guide to good practice" published by CIRIA (C552, 2001).

The level of risk is determined using the risk matrix presented in the following table. Classifications of probability, consequence and risk are presented in Appendix D.

Table 7. Risk Assessment Matrix

		Probability			
		Very Low	**Low**	**Moderate**	**High**
Consequence	**Very Minor**	Negligible	Very Low	Low	Low/Moderate
	Minor	Very Low	Low	Low/Moderate	Moderate
	Moderate	Low	Low/Moderate	Moderate	High
	Severe	Low/Moderate	Moderate	High	Very High

The assessment of risk has been undertaken on the basis that the proposed development for the site will comprise extensions to the existing residential buildings along with the continued presence of soft landscaping with the remainder of the garden area where contact with soil and soil derived dust may occur and where the growing of fruit and vegetables may also take place. A copy of the proposed development layout is presented as Figure 3.

5.9.1 Quantitative Conceptual Model

The quantitative conceptual model for the proposed development is presented in the following table.

Table 8. Quantitative Conceptual Model

Source Identified	Contaminants	Receptor	Potential Pathways	Potential Pathway Present?	Probability	Consequence	Overall Assessment of Risk	Complete Pollutant Linkage Present?
Made Ground soils across the site.	Lead Asbestos	Human Health (End Users)	a) Dermal contact with soil and dust (indoor & outdoor). b) Ingestion of soil and indoor dust. c) Consumption of homegrown produce and attached soil. d) Inhalation of soil dust (indoor and outdoor). e) Contamination of incoming services. f) Inhalation of soil vapours. g) Inhalation of soil gases/Risk of explosion.	Yes Yes Yes Yes No No No	Moderate Moderate Moderate Moderate n/a n/a n/a	Moderate Moderate Moderate Moderate n/a n/a n/a	Moderate Moderate Moderate Moderate The identified contaminants are not considered to pose a risk via these pathways. n/a	Yes Yes Yes Yes No No No
	None Identified	Groundwater	h) Migration to groundwater.	No	n/a	n/a	n/a	No

6. REMEDIATION STRATEGY

CLR11 - Model Procedures for the Management of Contaminated Land recommends that remedial action proposed for the site should be justified. Remedial action has been justified due to the significant pollutant linkages identified within the contamination risk assessment report. Also as discussed in CLR11, the remediation options have been developed to meet the technical objectives for the development with the major drivers behind the recommendations being:

- To achieve successful remediation within a particular timescale and budget;
- Familiarity with the methodology by the developer/ground worker;
- Confidence that the remediation can be carried out by good technical practices; and
- Likely success of the style of remediation.

The remediation strategy has been produced based on the conclusions of the quantitative risk assessment.

6.1 Options Appraisal

The driver for remediation at the site is the presence of made ground soils containing asbestos materials and concentrations of lead and that are considered to pose a moderate risk to human health where they remain within proposed garden or soft landscaping areas where direct contact with the soils and the generation of soil derived dust may occur. There are no in situ or ex situ remediation techniques available to reduce the concentrations of lead within the made ground soils to below that of the published screening values, or which could guarantee removal of all asbestos containing materials within the matrix of the made ground soils.

The method chosen for remediation must be achievable by the groundworker, using techniques that they are familiar with. It is therefore considered that the remediation proposals could either comprise the complete removal of the contaminant source (the made ground soils), or the provision of a suitable cover system to sever the contaminant pathways in areas where the end users may reasonably be expected to be exposed to the soils or soil derived dust.

Due to the depth of made ground present, the complete removal of all such material would be prohibitively expensive and would be considered to represent an unsustainable approach to remediation. As such, the provision of a cover system is considered to the most appropriate method of remediation.

6.2 Proposed Treatment of Existing Contamination

6.2.1 Protection of Human Health

Following consultation with the local authority the following works are recommended to address the potential risks identified to the health of end users of the site. Details of how these works will be verified are provided in section 7 of this report.

It is proposed that all existing areas of soft landscaping will be covered with a 100mm reinforced concrete slab topped with paving.

In the event that any areas of soft landscaping are to be retained, at least 300mm of clean cover soil should be placed above a geotextile and geogrid.

Elsewhere on the site the presence of building cover, roadways and permanent access ways comprising hard cover will also act to sever the contaminant pathways and thereby reduce the risk to end users to an acceptable level.

6.2.2 Protection of Controlled Waters

The risk assessment did not identify any significant risk to controlled waters and therefroe no specific remedial measures are considered to be required in this regard.

6.2.3 Protection of Services

Although no specific risk via services has been identified by the risk assessment, in the event that any new service runs are to be installed it is recommended that these are over excavated and backfilled with virgin shingle to avoid future workers from being exposed to the made ground.

If new service runs are provided, all service providers' requirements must be fully adhered to in order to reduce the risk to end users and services to an acceptable level.

Details of any measures required by service providers and confirmation of their implementation should be included within the verification report.

6.2.4 Protection of Construction Workers

As a minimum and in accordance with industry best practice, all ground-workers should be issued with the appropriate PPE and should be instructed in safe working methods, particularly in view of the potential for asbestos to be encountered within the made ground soils. Site clearance should be undertaken by a suitably experienced contractor and appropriate working procedures and PPE should be employed to ensure the health and safety of the site operatives.

As a precautionary measure instructions should be given in the recognition of potentially hazardous materials, including oily and odorous soil and water and discoloured or fibrous substances. Any oil-like substances contacting the skin must be washed off immediately using an appropriate cleanser. Operatives should be warned to avoid contact between hands and mouth before washing. The consumption of food and smoking must be confined to designated clean areas. Suitable welfare (washing) facilities should be provided. These precautions should be taken in addition to anything highlighted by a site specific risk assessment which should be undertaken by any contractor prior to commencing work.

Particular attention should be paid to minimising dust arising from soils and appropriate precautions in this regard should include damping down of soils when in dry conditions.

All site personnel should be appropriately briefed on what actions to take in the event that evidence of significant contamination is identified or suspected.

6.3 Watching Brief on Development Works

If, during the course of the site clearance and development works, any materials not previously identified by the investigation that are suspected of being 'contaminants' are encountered, then the following procedure should apply:

a) All works in that area should cease and the site manager informed.
b) Advice should be sought from suitably qualified and experienced personnel as to whether any further site inspection, sampling, testing and/or assessment is deemed necessary.
c) If required, the conclusions of any assessment and any proposed remedial works (if required) should be agreed by the local authority.
d) If necessary, full details of any remedial works should be included in the verification report for the site.

Suspected 'contamination' may take the following form, though it is noted that this list is not exhaustive and site operatives should ask if they are at all unsure of any findings:

- Soil or water looks oily and/or has an oily odour
- Soil or water has a solvent type of odour
- Significant quantities of man-made materials within fill such as paint cans, car parts, glass fragments, where not previously recorded to be present
- Suspected asbestos containing materials (insulating boards, cement, loose fibres etc.)
- Significant volumes of clinker like or ashy material, where not previously recorded to be present
- Sand bags, and or/ subsurface concrete structures
- Animal carcasses or evidence of animal burial pits

7. VERIFICATION PLAN

A checklist summarising the requirements of the verification report is presented within Appendix E.

7.1 Inspection of Stripped Formations and Placement of Geotextile Marker and Geo-Grid

For all areas where remediation works are required, the stripped formation will be inspected prior to placement of either the concrete slab or the cover soils, to enable validation that only required excavations are sufficiently deep to enable placement of the specified thickness of cover soils and to document the placement of the geotextile and geo-grid in areas of proposed soft land-scaping. A photographic record of all stripped formations will be maintained for inclusion in the verification report.

If for any reason inspections are not undertaken for any given area where remediation works were specified, retrospective validation may comprise excavation of trial pits by hand on a grid basis to confirm that the specified works have been undertaken. In such exceptional circumstances these works may be undertaken in conjunction with the works detailed in Section 7.2 below.

7.2 Cover System Depth

Within any retained soft landscaping, the final depth of cover material placed should be confirmed by use of tape measurements made from finished or proposed surface level to the base of the cover soils.

Photographic evidence of the depth of cover soils present will be included in the verification report.

7.3 Cover System Materials

Any imported material from a potentially contaminated (e.g. industrial) site should be rejected. It is recommended that chemical testing results are obtained and supplied for comment prior to accepting the soils on site.

Once imported cover materials have been brought to site they should be stockpiled and protected from cross contamination with any other materials already on site. They will then be inspected, sampled and tested by Ashdown Site Investigation Ltd.

Should made ground remain at the formation level, the depth of cover material placed in the garden areas should be confirmed by tape measurements made within excavations through the cover soils. In the event that all made ground soils have been removed from site, then the depth of cover soils will not be measured.

All materials used to form the cover system must comply with current CLEA guidance for soils suitable for use within private gardens. The table below summarises the screening values against which any imported soils will be assessed.

These screening values comprise the 'Suitable For Use Levels' (S4ULs) calculated as a joint project between LQM and CIEH and published in 'The LQM/CIEH Suitable 4 Use Levels, 2015'. In lieu of an S4UL screening value for lead, the Category 4 Screening Level (C4SL) is used, as published within SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report, published by DEFRA, 2014.

For any material placed within a private garden area, the screening values used comprise those calculated using the generic "Residential" land use as defined within Science Report SC050021/SR3, January 2009, with the amendments discussed in the LQM/CIEH report

All materials should be free from any visual or olfactory evidence of petroleum hydrocarbon contamination and should contain no significant quantity of putrescible material (incl. wood or paper). The materials must be free from any asbestos containing materials. In addition to testing for the contaminants listed in the table below, screening of soil samples for the presence of asbestos fibres and petroleum hydrocarbons will be carried out.

Crushed material used beneath paving or decking within private gardens should be confirmed to be free from asbestos. If virgin quarried materials e.g. crushed limestone or granite, are used then testing will not be required. If recycled aggregates are used, representative samples must be tested to confirm the absence of any asbestos materials.

In addition to the above, all topsoil and subsoil materials used within the cover system should be free from propagules of aggressive weeds, fragments of glass, bricks, concrete, wire or

other potentially hazardous foreign matter and bulk vegetative growth, in order to ensure negligible risk of subsequent weed problems (introduced in the soil) or traumatic injury.

Table 9. Calculated soil screening values for imported soils

Contaminant	Screening Value (mg/kg)	Contaminant	Screening Value (mg/kg)
Arsenic	37	Fluorene	170
Cadmium	11	Phenanthrene	95
Chromium	910	Anthracene	2400
Copper	2400	Fluoranthene	280
Lead	200	Pyrene	620
Mercury	40	Benz(a)anthracene	7.2
Nickel	180	Chrysene	15
Selenium	250	Benzo(b)fluoranthene	2.6
Zinc	3700	Benzo(k)fluoranthene	77
Hexavalent Chromium	6	Benzo(a)pyrene	2.2
Water Soluble Boron	290	Indeno(123-cd)pyrene	27
Naphthalene	2.3	Dibenz(ah)anthracene	0.24
Acenaphthylene	170	Benzo(ghi)perylene	320
Acenaphthene	210		

It is noted that the SSV are only protective of long term risk to human health and do not necessarily represent suitable concentrations for planting or landscaping. If necessary, a horticulturalist should be consulted in this regard.

In the event that any individual samples of imported material records concentrations of contaminants above the screening values listed above, the method of assessment will be as follows:

- Additional testing (which may include retests of the original sample) will be undertaken to determine if this this is representative of a widespread issue, or may be attributed to a smaller part of the site, or batch of imported soils.
- Depending on the results of the additional testing, statistical analysis of the results may be carried out to determine whether the soil mass as a whole may be considered to contain elevated concentrations of contamination or not.
- If necessary, liaison with the regulators will be undertaken to agree whether or not the materials are to be considered suitable to remain.

Where testing and analysis identify a significant failure and the procedures above procedure do not provide sufficient evidence that the imported materials are suitable to remain, then the imported soils will be removed and replaced with other suitable soils.

8. POST REMEDIATION RISK ASSESSMENT

The remedial works set out in this report are considered to remove or sever the identified pollutant linkages. A post remediation conceptual model is presented in the following table.

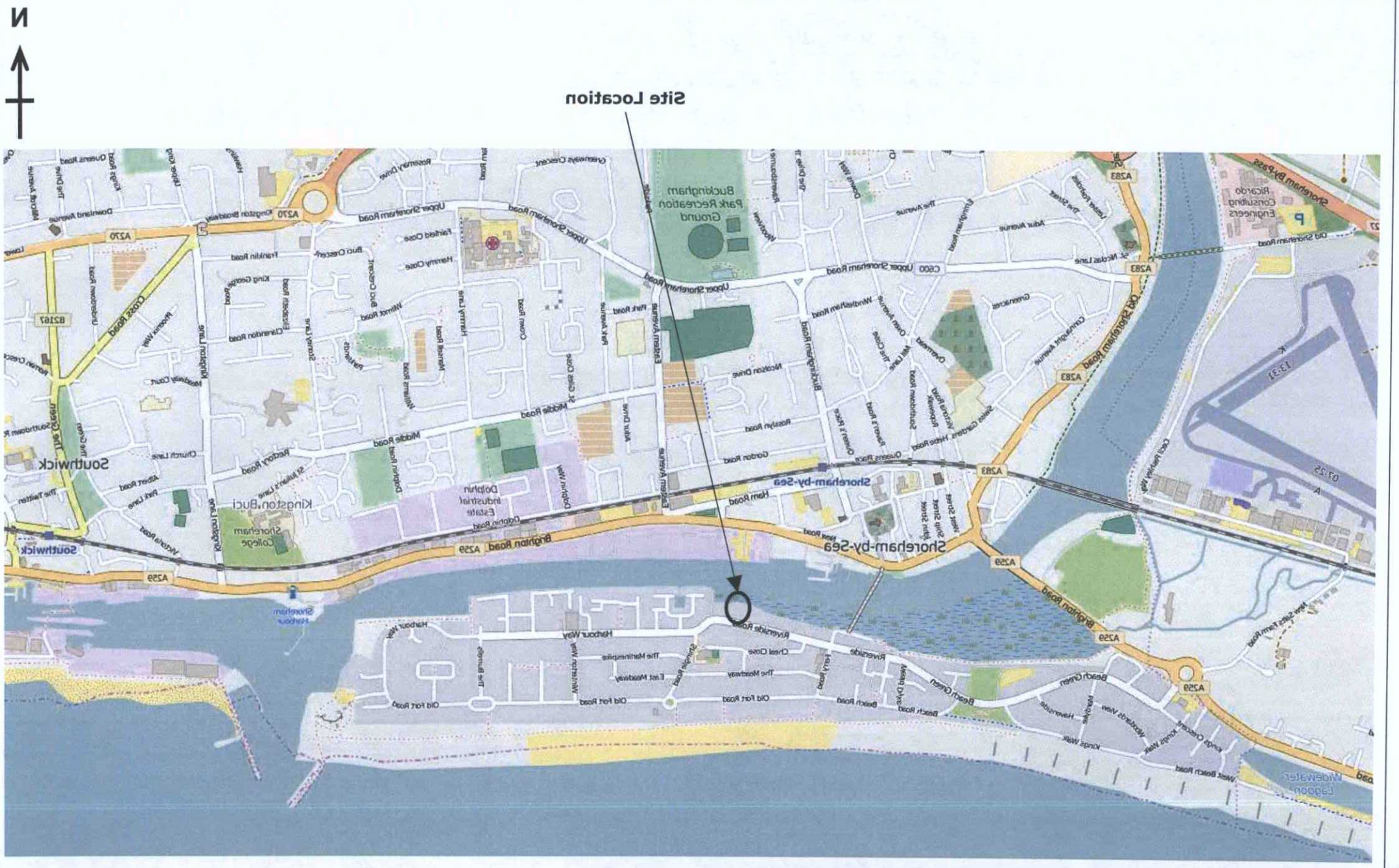
Table 10. Post Remediation Conceptual Model for End Users – Potential Pollutant Linkages and Assessment of Risk

Contaminant Source	Remedial Measures	Potential Pathway(s)	Assessment of Risk to Human Health
Made Ground Soils	Provision of 100mm reinforced concrete slab or 300mm of soils above a geotextile and geogrid within all soft landscaped areas.	Pathways severed by remedial measures	No significant pollutant linkages identified.

Ashdown Site Investigation Ltd.
July 2016

FIGURES

Figure 1 Site Location Plan
Figure 2 Borehole Location Plan
Figure 3 Proposed Development Layout



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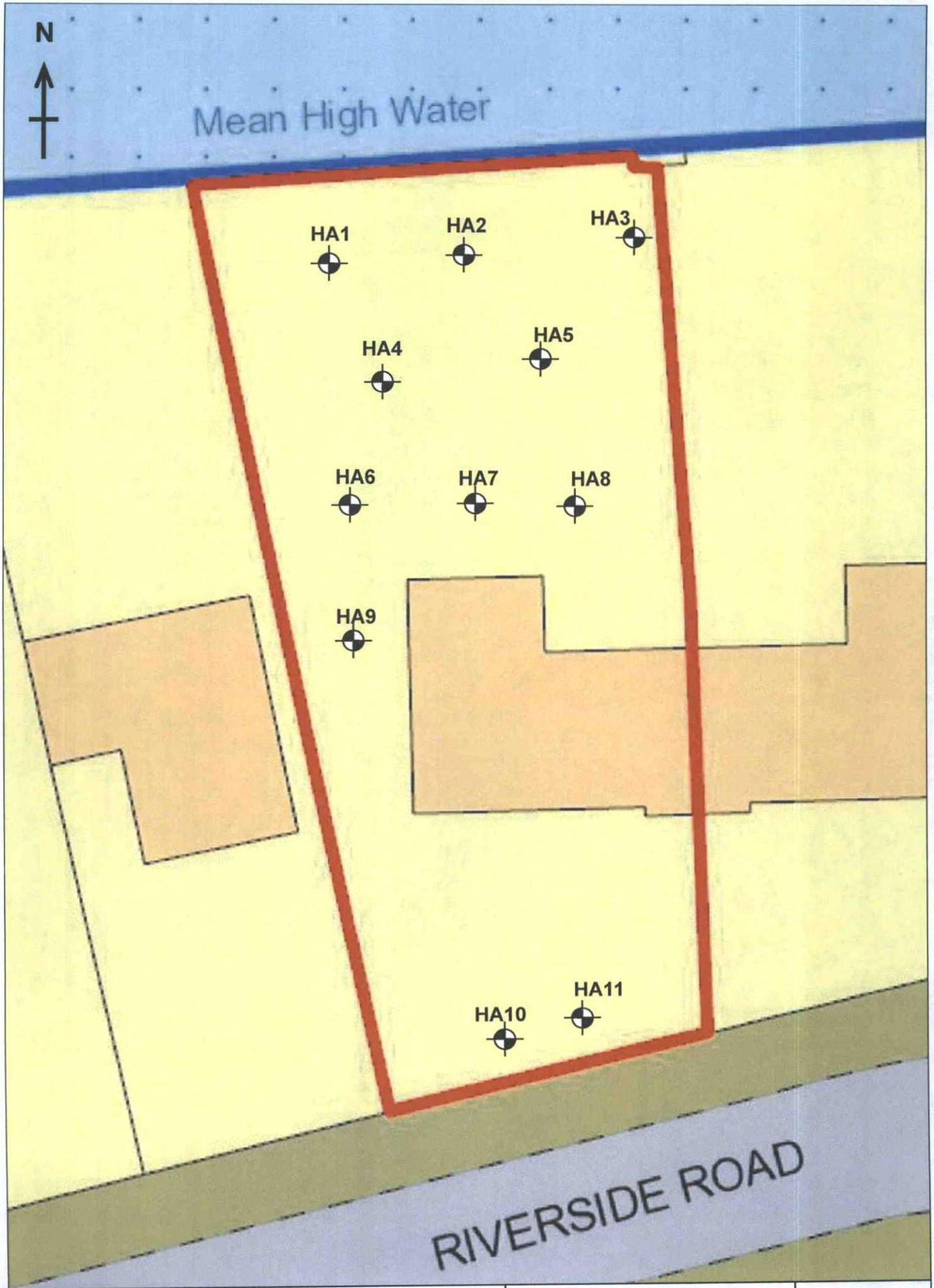
ASHDOWN SITE INVESTIGATION L·I·M·I·T·E·D	Site: 55 Riverside Road, Shoreham-by-Sea, West Sussex	Site Location Plan. Not To Scale	Figure 1 R16-11505



ASHDOWN SITE INVESTIGATION LIMITED	Site: 55 Riverside Road, Shoreham-by-Sea, West Sussex	Borehole Location Plan Not To Scale	Figure 2 R16-11505

Figure 3
2021-RS

Proposed Development Layout.
Not To Scale

Site: 55 Riverside Road, Storrington-by-Sea, West Sussex

ASHDOWN SITE INVESTIGATION
D.E.T.I.M.I.

APPENDIX A

Exploratory Hole Notes
Exploratory Hole Records

NOTES FOR THE INTERPRETATION OF EXPLORATORY HOLE RECORDS

1 Symbols and abbreviations

Samples

U 'Undisturbed' Sample: - also known as 'U100' or 'U4' - 100mm diameter by 450mm long. The number of blows to drive in the sampling tube is shown after the test index letter in the SPT column.
Uo Sample not obtained.
U* Full penetration of sample not obtained.
Pi Piston Sample: 'Undisturbed' sample 100mm diameter by 600mm long.
D Disturbed Sample.
R Root Sample.
B Bulk Disturbed Sample.
W Water Sample.
J Jar Sample (sample taken in amber glass jar fitted with gas tight lid)
T Tub Sample
Vi Vial Sample

In situ Testing

S Standard penetration test (SPT): In the borehole record the depth of the test is that at the start of the normal 450mm penetration. The number of blows per 75mm penetration is recorded, with the initial 150mm for seating blows being recorded followed by the blows recorded for the remaining 300mm of the test. The total blows to achieve the standard penetration of 300mm, discounting the seating blows, is noted as the N value on the log. Where the full penetration of the test cannot be achieved (a refusal) the number of blows achieved and the penetration achieved will be reported.

C Standard Penetration Test (SPT) conducted usually in coarse grained soils or weak rocks using the same procedure as for the SPT but with a 50mm diameter, 60° apex solid cone fitted in place of the sampler. Variations in test results are indicated by the same symbols as for the SPT (above).

V Shear Vane Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.

H Hand penetrometer Test: Undrained shear strength (cohesion) (kN/m^2) shown within the Vane/Pen Test and N Value column.

P Perth Penetrometer Test: See "In Situ Testing Notes" for full description. Number of blows for 300mm penetration shown under Vane/Pen Test and N Value column. In sand the number of blows is approximately equivalent to the SPT "N" value.

Excavation Method

CP Cable Percussion Borehole
WLS Dynamic Sampler Borehole using windowless sampler tubes
WS Dynamic Sampler Borehole using window sampler tubes
TP Trial Pit excavated using mechanic excavator
HDP Trial Pit excavated using hand tools

2 Soil Description

Description and classification of soils has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of soil, Part 1 Identification and description (BS EN ISO 14688-1:2002+A1:2013) and Part 2 Principles of classification (BS EN 14688-2:2004+A1:2013) as well as the BS5930:2015 code of Practice for Ground Investigations.

Fine Grained Soils

The consistency of fine grained soils given in the report is based on visual inspection of the samples and the strength is based on results of in situ and/or laboratory undrained shear strength tests when carried out.

The consistency is determined on the following basis:

Consistency	**Manual Test**
Very Soft	Soil exudes between fingers when squeezed in hand
Soft	Soils can be moulded by light finger pressure
Firm	Cannot be moulded by finger but rolled to 3mm threads without breaking/crumbling
Stiff	Crumbles/breaks when rolled to 3mm thick threads but can be moulded into a lump again
Very Stiff	Cannot be moulded and crumbles under pressure, can be indented by thumbnail

The terms used for the designation of the undrained shear strength are as follows:

Undrained Shear Strength	
Extremely to Very Low	<20 kPa
Low	20-40 kPa
Medium	40-75 kPa
High	75-150 kPa
Very High	150-300 kPa
Extremely high	300-600 kPa

Note: The undrained shear strength of the soils is measured either by laboratory testing or in the field using hand shear vane.

It is recognised that any coarse grained soil that has in excess of approximately 35% fine grained soil (clay and silt) can often be expected to behave as a fine grained soil despite the dominance of coarse grained material within the soil mass. To reflect this, it is the soil type that dominates the behaviour of the soil mass that appears on the exploratory hole records.

Coarse Grained Soils

The relative densities of coarse grained soils (sand and gravel) given in the report are based on field estimations and the results of the Standard Penetration Test (SPT) and equivalent correlation from other testing. The classification in terms of "N" Values is as follows:

SPT 'N' Value	**Relative Density**
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Greater than 50	Very Dense

3 Rock Description

Description and classification of rocks has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of rock, Part 1 Identification and classification (BS EN ISO 14689-1:2003) as well as the BS5930:2015 code of Practice for Ground Investigations.

The description of rock mass includes the type of rock, structure, discontinuities and weathering.

The unconfined compressive strength of rock material is determined on the following basis:

Term	Field Identification	Unconfined Compressive Strength (MPa)
Extremely Weak	Indented by thumbnail	Less than 1
Very Weak	Crumbles under firm blows with point of geological hammer, peeled by pocket knife	1 to 5
Weak	Peeled by pocket knife with difficulty, shallow indentations made by firm blow with geological hammer	5 to 25
Medium Strong	Cannot be peeled or scraped with knife, can be fractured with single firm blow of geological hammer	25 to 50
Strong	Requires more than one blow of geological hammer to fracture	50 to 100
Very Strong	Requires may blows of geological hammer to fracture it	100 to 250
Extremely Strong	Can only be chipped with geological hammer	Greater and 250

The terms describing discontinuity and bedding spacing are as follows:

Bedding Thickness	
Very Thick	>2000mm
Thick	2000-600mm
Medium	600-200mm
Thin	200-60mm
Very Thin	60-20mm
Thickly Laminated	20-6mm
Thinly Laminated	<6mm

Discontinuity Spacing	
Very Wide	>2000mm
Wide	2000-600mm
Medium	600-200mm
Close	200-60mm
Very Close	60-20mm
Extremely Close	<20mm

Chalk

Chalk description is based on BS EN ISO 14688, BS EN ISO 14689 and BS5930. The classification of chalk generally follows the guidance offered by the Construction Industry Research and Information Association (CIRIA) C574, 'Engineering in Chalk'. This is based on assessment of chalk density, discontinuity and aperture spacing, and the proportion of intact chalk to silt of chalk. See additional chalk classification notes.

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Site Name: 55 Riverside Road, Shoreham-by-Sea, West Sussex.

Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA1**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.20				0.10	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint.
	D	0.50				0.50	End of borehole at 0.50m
	J T	0.50					

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA2**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	JT	0.20				0.05	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint. with bituminous-like material at 0.20m depth.
	D	0.50				0.50	End of borehole at 0.50m
	JT	0.50					

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11505

Start Date: 20/06/2016
End Date: 20/06/2016

Borehole Number: **HA3**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.20				0.10	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint.
	D	0.50					
	J T	0.50				0.60	End of borehole at 0.60m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA4**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.20				0.10	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint.
	D	0.50				0.50	End of borehole at 0.50m
	J T	0.50					

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA5**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.20				0.10	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint.
	D	0.50				0.50	End of borehole at 0.50m
	J T	0.50					

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA6**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.20				0.10	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint.
	J T	0.50				0.50	End of borehole at 0.50m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA7**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.20				0.10	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint.
	D	0.40					with a sample of suspected asbestos containing material at 0.40m depth.
	J T	0.50				0.50	End of borehole at 0.50m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA8**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
						0.10	MADE GROUND: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium chalk, brick and flint.
	J T	0.30					
	D	0.50				0.50	
	J T	0.50					End of borehole at 0.50m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

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Site Name: 55 Riverside Road, Shoreham-by-Sea, West Sussex.

Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA9**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.20				0.10	MADE GROUND: Brown slightly sandy very gravelly clay. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse flint, chalk and brick.
	J T	0.60					
						0.70	End of borehole at 0.70m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

ASHDOWN SITE INVESTIGATION
L•I•M•I•T•E•D
E-mail: contact@ashdownsi.co.uk
Web: www.ashdownsi.co.uk
Tel: 01273 483119

Site Name: 55 Riverside Road, Shoreham-by-Sea, West Sussex.

Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA10**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.40				0.10	MADE GROUND: Brown gravelly sandy clay. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse flint, chalk and traces of brick, glass, ash-like, charcoal-like and clinker-like material.
						0.50	End of borehole at 0.50m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

ASHDOWN SITE INVESTIGATION
L•I•M•I•T•E•D
E-mail: contact@ashdownsi.co.uk
Web: www.ashdownsi.co.uk
Tel: 01273 483119

Site Name: 55 Riverside Road, Shoreham-by-Sea, West Sussex.

Job Number: R16-11505

Start Date: 20/06/2016

End Date: 20/06/2016

Borehole Number: **HA11**

Standpipe	Samples and In Situ Testing: Sample/ Test Type	Depth From (m)	Depth To (m)	Test Result	Legend	Depth	Stratum Description
						0.00	Topsoil.
	J T	0.30				0.10	MADE GROUND: Brown gravelly sandy clay. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse flint, chalk, traces of glass, brick, ash-like, charcoal-like and clinker-like material.
						0.40	End of borehole at 0.40m

Remarks

Groundwater: Borehole dry on completion.

Stability: Borehole stable on completion.

Notes: n/a

Excavation Method: HA

Borehole Diameter: Various

Made By: SA

ASHDOWN SITE INVESTIGATION L·I·M·I·T·E·D

APPENDIX B

Contamination Test Results

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

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Soil Analysis Certificate						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16	20/06/16	20/06/16	20/06/16	20/06/16
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA6	HA7	HA8	HA9	HA10
Project / Job Ref: R16-11505	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: P16-3725	Depth (m)	0.50	0.50	0.30	0.60	0.40
Reporting Date: 28/06/2016	QTSE Sample No	213234	213235	213236	213237	213238

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Detected		
Asbestos Matrix (S)	Material Type	N/a	NONE			Small bundles		
Asbestos Type (S)	PLM Result	N/a	ISO17025			Amosite		
pH	pH Units	N/a	MCERTS	7.8	8.1	7.8	8.0	7.9
Total Cyanide	mg/kg	< 2	NONE		< 2			< 2
Organic Matter	%	< 0.1	MCERTS	4.4	2.8	5	3.3	2.4
Arsenic (As)	mg/kg	< 2	MCERTS	17	10	17	14	6
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3	< 0.2	0.3	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	28	17	28	20	12
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	49	33	54	25	14
Lead (Pb)	mg/kg	< 3	MCERTS	311	203	411	76	57
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	35	15	23	16	7
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	248	166	286	70	65

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis (S)

QTS Environmental Ltd
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Rose Lane
Lenham Heath
Maidstone
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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16	20/06/16	20/06/16	20/06/16	20/06/16
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA1	HA2	HA3	HA4	HA5
Project / Job Ref: R16-11505	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: P16-3725	Depth (m)	0.20	0.50	0.50	0.20	0.20
Reporting Date: 28/06/2016	QTSE Sample No	213229	213230	213231	213232	213233

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	0.25	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.36	0.32	0.29	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.31	0.28	0.36	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.13	0.17	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	0.16	0.13	0.16	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.13	0.13	0.22	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.15	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 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

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16	20/06/16	20/06/16	20/06/16	20/06/16
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA6	HA7	HA8	HA9	HA10
Project / Job Ref: R16-11505	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: P16-3725	Depth (m)	0.50	0.50	0.30	0.60	0.40
Reporting Date: 28/06/2016	QTSE Sample No	213234	213235	213236	213237	213238

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.26	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	0.16	0.23	< 0.1	0.75
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.12
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.34	0.49	0.13	1.89
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.36	0.70	0.12	1.99
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.14	0.26	< 0.1	0.88
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.23	0.42	< 0.1	1.02
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.35	0.76	< 0.1	0.91
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.12	0.26	< 0.1	0.36
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.25	0.68	< 0.1	0.68
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.17	0.50	< 0.1	0.44
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	0.21	0.55	< 0.1	0.39
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	2.3	5.1	< 1.6	9.4

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							
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16	20/06/16	20/06/16	20/06/16	20/06/16
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA1	HA2	HA4	HA7	HA8
Project / Job Ref: R16-11505	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: P16-3725	Depth (m)	0.20	0.50	0.20	0.50	0.30
Reporting Date: 28/06/2016	QTSE Sample No	213229	213230	213232	213235	213236

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

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

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
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Lenham Heath
Maidstone
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Tel : 01622 850410

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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16				
Ashdown Site Investigations Ltd	Time Sampled	None Supplied				
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA10				
Project / Job Ref: R16-11505	Additional Refs	None Supplied				
Order No: P16-3725	Depth (m)	0.40				
Reporting Date: 28/06/2016	QTSE Sample No	213238				

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10				
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21				
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2				
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	7				
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	23				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	30				
Total >C5 - C35	mg/kg	< 42	NONE	< 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							
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16	20/06/16	20/06/16	20/06/16	20/06/16
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA1	HA2	HA4	HA7	HA8
Project / Job Ref: R16-11505	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: P16-3725	Depth (m)	0.20	0.50	0.20	0.50	0.30
Reporting Date: 28/06/2016	QTSE Sample No	213229	213230	213232	213235	213236

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	7	11	< 5	12	9
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 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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Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16				
Ashdown Site Investigations Ltd	Time Sampled	None Supplied				
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA10				
Project / Job Ref: R16-11505	Additional Refs	None Supplied				
Order No: P16-3725	Depth (m)	0.40				
Reporting Date: 28/06/2016	QTSE Sample No	213238				

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2				
Toluene	ug/kg	< 5	MCERTS	18				
Ethylbenzene	ug/kg	< 2	MCERTS	< 2				
p & m-xylene	ug/kg	< 2	MCERTS	3				
o-xylene	ug/kg	< 2	MCERTS	< 2				
MTBE	ug/kg	< 5	MCERTS	< 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 - Volatile Organic Compounds (VOC)						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16	20/06/16	20/06/16	20/06/16	
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA2	HA4	HA8	HA10	
Project / Job Ref: R16-11505	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: P16-3725	Depth (m)	0.50	0.20	0.30	0.40	
Reporting Date: 28/06/2016	QTSE Sample No	213230	213232	213236	213238	

Determinand	Unit	RL	Accreditation					
Dichlorodifluoromethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Vinyl Chloride	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Chloromethane	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Chloroethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Bromomethane	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Trichlorofluoromethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,1-Dichloroethene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
trans-1,2-Dichloroethene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,1-Dichloroethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
cis-1,2-Dichloroethene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
2,2-Dichloropropane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Chloroform	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Bromochloromethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,1,1-Trichloroethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,1-Dichloropropene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Carbon Tetrachloride	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,2-Dichloroethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
1,2-Dichloropropane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Trichloroethene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Bromodichloromethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Dibromomethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
TAME	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
cis-1,3-Dichloropropene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Toluene	ug/kg	< 5	MCERTS	11	< 5	9	18	
trans-1,3-Dichloropropene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,1,2-Trichloroethane	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
1,3-Dichloropropane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Tetrachloroethene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Dibromochloromethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,2-Dibromoethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Chlorobenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,1,1,2-Tetrachloroethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Ethyl Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
m,p-Xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	3	
o-Xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Styrene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Bromoform	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Isopropylbenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,1,2,2-Tetrachloroethane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,2,3-Trichloropropane	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
n-Propylbenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Bromobenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
2-Chlorotoluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,3,5-Trimethylbenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
4-Chlorotoluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
tert-Butylbenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,2,4-Trimethylbenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
sec-Butylbenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
p-Isopropyltoluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,3-Dichlorobenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,4-Dichlorobenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
n-Butylbenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,2-Dichlorobenzene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
1,2-Dibromo-3-chloropropane	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Hexachlorobutadiene	ug/kg	< 5	MCERTS	< 5	< 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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Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - PCB (7 Congeners)						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16	20/06/16	20/06/16	20/06/16	
Ashdown Site Investigations Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA1	HA4	HA7	HA10	
Project / Job Ref: R16-11505	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: P16-3725	Depth (m)	0.20	0.20	0.50	0.40	
Reporting Date: 28/06/2016	QTSE Sample No	213229	213232	213235	213238	

Determinand	Unit	RL	Accreditation					
PCB Congener 28	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	
PCB Congener 52	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	
PCB Congener 101	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	
PCB Congener 118	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	
PCB Congener 138	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	
PCB Congener 153	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	
PCB Congener 180	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	
Total PCB (7 Congeners)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	

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

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Bulk Analysis Certificate						
QTS Environmental Report No: 16-45769	Date Sampled	20/06/16				
Ashdown Site Investigations Ltd	Time Sampled	None Supplied				
Site Reference: 55 Riverside Road, Shoreham-by-Sea	TP / BH No	HA7				
Project / Job Ref: R16-11505	Additional Refs	None Supplied				
Order No: P16-3725	Depth (m)	0.40				
Reporting Date: 28/06/2016	QTSE Sample No	213239				

Determinand	Unit	RL	Accreditation					
Asbestos Type	PLM Result	N/a	ISO17025	Chrysotile				
Sample Matrix	Material Type	N/a	NONE	Tile				

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification) that is in accordance with the Health and Safety Executive HSG 248 Appendix 2.

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

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

Asbestos Analyst: Rosie Head

RL: Reporting Limit

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-45769	
Ashdown Site Investigations Ltd	
Site Reference: 55 Riverside Road, Shoreham-by-Sea	
Project / Job Ref: R16-11505	
Order No: P16-3725	
Reporting Date: 28/06/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
213229	HA1	None Supplied	0.20	22.5	Brown clay with vegetation
213230	HA2	None Supplied	0.50	17	Brown clay
213231	HA3	None Supplied	0.50	16	Brown clay with brick
213232	HA4	None Supplied	0.20	19.7	Brown clay with vegetation
213233	HA5	None Supplied	0.20	18.5	Brown clay with brick
213234	HA6	None Supplied	0.50	18.4	Brown clay with vegetation
213235	HA7	None Supplied	0.50	15.8	Brown clay with glass and vegetation
213236	HA8	None Supplied	0.30	22.1	Brown clay with brick
213237	HA9	None Supplied	0.60	19.8	Brown clay
213238	HA10	None Supplied	0.40	7	Brown clay with stones and vegetation

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 16-45769
Ashdown Site Investigations Ltd
Site Reference: 55 Riverside Road, Shoreham-by-Sea
Project / Job Ref: R16-11505
Order No: P16-3725
Reporting Date: 28/06/2016

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 diphenylcarbazide 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 C

Guidance on Comparing Soil Contamination Data with a Critical Concentration Statistical Analysis Summary Sheets

ASHDOWN SITE INVESTIGATION LIMITED

Notes on the "Guidance on Comparing Soil Contamination Data with a Critical Concentration" (CIEH & CL: AIRE, May 2008)

The Chartered Institute of Environmental Health & CL:AIRE, have published updated guidance on the statistical assessment of contaminated land data, "*Guidance on Comparing Soil Contamination Data with a Critical Concentration" (May 2008).* This is an update to previous guidance published within Contaminated Land Report CLR7 (Defra, 2002).

The CIEH/CL:AIRE guidance forms part of a package of proposed improved UK guidance highlighted in the Defra discussion paper, "*Assessing risks from land contamination –a proportionate approach. Soil guideline values: The Way Forward (CLAN 06/2006)". This discussion paper discussed* the role and use of SGVs for managing the risks associated with soil contamination.

The guidance states that its overall aim is to "increase understanding amongst stakeholders of the role that statistics can play in quantifying the uncertainty attached to estimates of the mean concentration of contaminants in soil, thereby creating a more informed basis for regulatory decision-making".

The initial question, on which the guidance is based, is whether the Site under consideration is to be assessed under the Planning System or under Part 2A of the Environmental Protection Act 1990. The key questions asked when considering contaminant concentrations vary depending on the scenario under consideration. The key questions will generally be:

- **Planning Scenario** – "can we confidently say that the level of contamination on this land is low relative to some appropriate measure of risk?" or "that the level of contamination is lower than the critical concentration" (alternative hypothesis).

- **Part 2A Scenario** – "can we confidently say that the level of contamination on this land is high relative to some appropriate measure of risk?" or "that the level of contamination is higher than the critical concentration" (alternative hypothesis).

Within the guidance, to 'answer' the relevant question above, a null hypothesis has been outlined for each scenario, which, if rejected with a high degree of confidence, means that the alternative hypothesis can be accepted. The null hypothesis for a planning scenario is that the soils contain levels of contamination above the critical concentration (i.e. the soils are assumed to be unsuitable for use until proven otherwise). Under the Part 2A scenario, the null hypothesis is that the soils contain levels of contamination below the critical concentration (i.e. the land is assumed not to fall within Part 2A legislation until proved otherwise).

For the planning scenario the null hypothesis may be rejected if it is considered that the 95th percentile of the normally distributed population as a whole lies below the critical concentration i.e. there is a 95% probability that your true population mean lies below the critical concentration. A lower probability of the true mean lying below the critical concentration may be used, but deviation from the standard 95% requires justification.

For the Part 2A scenario the null hypothesis may be rejected if it can be shown that the lower 95th percentile lies above the critical concentration. If the lower 95th percentile lies below the critical concentration but the true population mean lies above the critical concentration further assessment should be undertaken before the Site can be classified under Part 2A.

Guidance on the treatment of outliers (results that are not representative of a sample population), is also provided in the report. The guidance confirms that outliers should only be excluded from the dataset where they are either demonstrably the result of an error that can be identified and explained, or clearly indicate that more than one soil population exists within the dataset.

Where an individual result is recognised as a 'statistical outlier' or 'contamination hot-spot' within the data set (and where the critical concentration for that contaminant is exceeded), remediation work and or further investigation may be required.

esi

soil & groundwater

Client/client ref	
Project ref	P16-1750S
Site ref	SS Riverside Road, Shoreham-by-Sea
Data description	Made ground soils
Contaminant(s)	Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Copper, Zinc, Selenium, Boron.
Test scenario	planning: is true mean lower than critical concentration (μ < cc)?
Date	6 July 2016
User details	PM

Statistics calculator (version 1)

Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

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Climate plant rail. Project rail. Pump 1505 Site rail. Soil Riverside Road. Shoreline-by-Bee. Data description. Made ground acids. Contaminant(s). Arsenic. Cadmium. Chromium. Lead. Mercury. Nickel. Copper. Zinc. Selenium. Boron. Hexavalent Chromium (mg/kg)

Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Zinc (mg/kg)	Water Soluble Boron (mg/kg)	Hexavalent Chromium (mg/kg)
37	11	910	2400	200	40	180	250	3700	290	6
SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	CaSL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce	SNUL Readsheltal with Homegrown Produce
10	10	10	10	10	10	10	10	10	10	10
11	0.15	20.2	28.9	150.8	0.5	17.4	1.5	153.1	0.5	1
3.800589475	0.08489369	5.028805941	13.22823396	122.4869884	0	7.417702464	0	78.78726933	0	0
0	7	0	0	0	10	0	10	0	10	10
Half detection limit: Yes	Half detection limit: No	Half detection limit: No	Half detection limit: No	Half detection limit: No	Half detection limit: No	Half detection limit: Yes	Half detection limit: No	Half detection limit: No	Half detection limit: No	Half detection limit: No
Auto: One-sample f	Normal	Normal	Non-normal	Auto: Oneplyfav	Single value	Auto: One-sample f	Auto: Oneplyfav	Non-normal	Single value	Auto: Oneplyfav
Auto: One-sample f	Non-normal	Normal	Normal	Auto: Oneplyfav	Single value	Normal	Auto: Oneplyfav	Non-normal	Single value	Auto: Oneplyfav

Pharmacy: Is true mean lower than critical concentration (μ < C0)?						85%	Use Normal distribution to test for outliers			
-21.83330765	-403.7330811	-589.8538473	-588.8193057	-1.270106239	N/A	-69.37493112	N/A	-743.0840815	N/A	N/A
19.20937276	0.2671418	23.11710443	36.60882181	319.6509044	0.5	21.69842546	1.5	243.7007252	1	0.5
100%	100%	100%	100%	82%	100%	100%	100%	100%	100%	100%
evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
μ < C0	μ < C0	μ < C0	μ < C0	μ >= C0	μ < C0	μ < C0	μ < C0	μ < C0	μ < C0	μ < C0
Evidence level										
Reason										

esi

soil & groundwater

Client/client ref	
Project ref	55 Riverside Road, Shoreham-by-Sea
Site ref	R16-1505
Data description	Made ground soils

Contaminant(s)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(123-cd)pyrene, Dibenz(ah)anthracene, Benzo(ghi)perylene.
Test scenario	Planning: is true mean lower than critical concentration (μ < Cc)?
Date	6 July 2016
User details	PM

Statistics calculator (version 1)

Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CLAIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

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Client/client ref: Project ref: 65 Riverside Road; Site ref: R16-11505

Data description: Made ground soils

Contaminant(s): Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene

Critical concentration, C:	Naphthalene (mg/kg)	Acenaphthylene (mg/kg)	Acenaphthene (mg/kg)	Fluorene (mg/kg)	Phenanthrene (mg/kg)	Anthracene (mg/kg)	Fluoranthene (mg/kg)	Pyrene (mg/kg)
Notes	2.3	170	210	170	95	2400	280	620
	Shall Residential With Homegrown Produce (1% SOM)	Shall Residential With Homegrown Produce (1% SOM)	Shall Residential With Homegrown Produce (1% SOM)	Shall Residential With Homegrown Produce (1% SOM)	Shall Residential With Homegrown Produce (1% SOM)	Shall Residential With Homegrown Produce (1% SOM)	Shall Residential With Homegrown Produce (1% SOM)	Shall Residential With Homegrown Produce (1% SOM)
Sample size, n	10	10	10	10	10	10	10	10
Sample mean, $\bar{x}$	0.05	0.071	0.05	0.05	0.169	0.0527	0.397	0.427
Standard deviation, s	7.37425E-18	0.00940783	7.37425E-18	7.37425E-18	0.213831469	0.0227 1398	0.9482931 85	0.5852229 45
Number of non-detects	10	9	10	10	9	9	3	3
Set non-detect values to:	No	Yes	No	No	Yes	Yes	Yes	Yes
Outliers?	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal
Distribution	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev
Statistical approach	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev	Auto: Checkydev
Planning: is true mean lower than critical concentration (μ < C)?	◀	Evidence level required:	95%	Use Normal distribution?				
Test location:		-1.37E+19	-3.36E+19	-1.36E+19	-4.27E+19	-3.43E+19	-1.61E+19	-3.34E+19
Upper confidence limit on true mean:		0.05	0.05	0.05	0.05	0.08752529	1.150809252	1.223927899
Evidence level		100%	100%	100%	100%	100%	100%	100%
Basic decision on: Result		evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
		μ < C	μ < C	μ < C	μ < C	μ < C	μ < C	μ < C

Client/client ref: Project ref: 55 Riverside Road; Site ref: R16-1505

Data description: Made ground soils

Contaminant(s): Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene

	Critical concentration, C:	7.2	5	5.6	11	2.2	27	0.24	0.23
	Notes	SAUL Residential with Homegrown Produce (1% SOM)	SAUL Residential with Homegrown Produce (1% SOM)	SAUL Residential with Homegrown Produce (1% SOM)	SAUL Residential with Homegrown Produce (1% SOM)	SAUL Residential with Homegrown Produce (1% SOM)	SAUL Residential with Homegrown Produce (1% SOM)	SAUL Residential with Homegrown Produce (1% SOM)	SAUL Residential with Homegrown Produce (1% SOM)
	Sample size, n	10	10	10	10	10	10	10	10
	Sample mean, $\bar{x}$	0.183	0.232	0.27	0.109	0.206	0.146	0.05	0.15
	Standard deviation, s	0.2549529	0.2999185	0.3147137	0.1109979	0.2582935	0.1738529	7.37E-18	0.1798765
	Number of non-detects	5	4	4	7	6	7	10	7
	Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
	Outliers?	Yes	Yes	No	Yes	No	No	No	Yes
	Distribution	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal
	Statistical approach	Auto: Check/dev	Auto: Check/dev	Auto: Check/dev	Auto: Check/dev	Auto: Check/dev	Auto: Check/dev	Auto: Check/dev	Auto: Check/dev

Test for outliers ▼

Test statistic:	-87.03947259	-153.7108858	-23.41219264	-3.7196.48729E	-24.41246237	-494.1800037	-8.21945737	-5823.04973
Upper confidence limit (or the one-sided confidence limit)	0.5324728571	0.0954290913	0.7038022571	0.2516859014	0.5502039308	0.3871751784	0.05	0.3979482565
Evidence level	100%	100%	100%	100%	100%	100%	100%	100%
Basis: decision on:	Result	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
		μ <> c	μ <> c	μ < c	μ <> c	μ < c	μ <> c	μ > c

APPENDIX D

Classification of Probability, Consequence and Risk

Probability of risk being realised	
Classification	Definition
High	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Moderate	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Very Low	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Consequence of risk being realised		
Classification	Category	Definition
Severe	Human Health	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA.
	Controlled Waters	Short term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource.
	Property	Catastrophic damage to buildings/property.
	Ecological Systems	A short term risk to a particular ecosystem or organisation forming part of such ecosystem.
Moderate	Human Health	Chronic damage to Human Health.
	Controlled Waters	Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution).
	Ecological System	A significant change in a particular ecosystem or organism forming part of such ecosystem.
Minor	Controlled Waters	Pollution of non-sensitive water resources.
	Property	Significant damage to crops, buildings, structures and services.
	Ecological Systems	Damage to sensitive buildings/structures/services or the environment.
Very Minor	Human Health	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc).
	Property	Easily repairable effects of damage to buildings, structures and services.
	Project	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve.

Risk classification definitions	
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the long term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, 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. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but there is a low likelihood of this hazard occurring and if realised, harm would at worst normally be mild.
Very Low	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.

APPENDIX E

Checklist for Verification Report(s)

Item	Tick (4)
Documentation (Including Photographs) of Stripped Formation	
Documentation (Including Photographs) of Placed Geotextile and Geogrid	
Documentation (Including Photographs) Confirming Depth of Cover Soils	
Laboratory Test Data for Imported Materials	