

Ground Investigation

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Geotechnical & Environmental Consultants

Ground Investigation Report

At

**Eric Wall Nursery, Lake Lane, Barnham,
West Sussex PO22 0AF**

For

Epitair Limited

**Soils Limited
Newton House
Cross Road
Tadworth
Surrey KT20 5SR**

REPORT 14123/GIR

Ground Investigation Report

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Client: Epitair Limited

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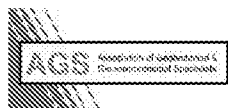
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	Name	Signature
Prepared by:	Nikos Sidiropoulos (ns@soils-limited.co.uk)	
Checked by:	R B Higginson	
	Nicholas Lambert	



Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

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Ground Investigation Report

At

Eric Wall Nursery, Lake Lane, Barnham, West Sussex PO22 0AF

For

Epitair Limited

Commission

An invitation and scope of works to tender for the investigation was received from Epitair Limited and the investigation was undertaken as outlined in Soils Limited subsequent quotation reference Q15088/REV 1.02 dated 6th February 2014.

This Phase II report must be read in conjunction with the Phase I Desk Study undertaken on the above site by Soils Limited (Report ref: 14123/DS, April 2014).

This Phase II report comprises the intrusive element of the investigation and incorporates the results, discussion and conclusions to the Intrusive Investigation.

The following sections make up the report made on the investigation and comprise:

Section 1 Introduction

- Objective of the Investigation;
- Location;
- Proposed Redevelopment;
- Limitations and Disclaimers.

Section 2 Site Works

- Proposed Works;
- Ground Conditions;
- Roots;
- Groundwater.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

- Standard Penetration Tests (S.P.T.);
- Quick Unconsolidated Undrained Triaxial Tests;
- Dynamic Probe Tests;
- Atterberg Limit Tests;
- Grading Analyses Tests;
- Laboratory California Bearing Ratio Tests;
- Sulphate and pH Tests.

Section 4 Foundation Design

- General;
- Foundation Scheme;
- Subsurface Concrete;
- Excavations.

Section 5 Revised Conceptual Site Model and Chemical Analysis of Soil Samples

- Site Characterisation and Revised Conceptual Site Model;
- Soil Sampling;
- Determination of Contaminants of Concern - Soil;
- Chemical Analysis of Groundwater Samples;
- Determination of Contaminants of Concern - Groundwater.

Section 6 Qualitative Risk Assessment

- Assessment Criteria;
- Representative Contamination Concentration - Soil;
- Groundwater Analyses;
- Representative Contamination Concentration - Groundwater;
- Tier 1 Quantitative Risk Assessment.

Section 7 Risk Assessment and Remediation Strategy

- Risk Evaluation/Estimation;
- Remedial Objective;
- Duty of Care;
- Excavated Material;
- Reuse of Excavated Material On-Site;
- Imported Material;
- Discovery Strategy.

Appendices

- Appendix A: A description of the fieldwork and the trial hole logs;
- Appendix B: The results of geotechnical laboratory tests carried out on soil samples obtained from the trial holes;
- Appendix C: The results of chemical laboratory analyses conducted on a number of soil and groundwater samples obtained from the trial holes;
- Appendix D: Soil Guideline Values and General Assessment Criteria;
- Appendix E: HazWasteOnline Waste Classification Tool Results.

The site works were performed in accordance with the methods given in BS 5930+A2:2010 (windowless sampler boreholes), BS EN ISO 22476-2:2005 (dynamic probing), BS 5930:1999 and BS 1377:1990 Part 9.

The geotechnical laboratory testing was performed by K4 Soils Laboratories in accordance with methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accreditation.

For the preparation of this report, the relevant BS code of practice were adopted for the laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892), which are pending.

The chemical analyses were undertaken by QTS Environmental Ltd in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sample borehole implies the specific technique used to produce a trial hole.

Section 1 Introduction

1.1 Objective of the Investigation

The overall objective was understood to be to supply the client with information regarding ground conditions, to assist them in preparing a scheme for redevelopment that was appropriate to the conditions present on the site and safe for end-users and for workers during the redevelopment phase.

This Phase II investigation was to be undertaken to provide parameters and assist for the design of foundations by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the trial holes.

Soil and groundwater samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users, groundwater and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Phase I Desk Study undertaken for the site by Soils Limited (Report ref: 14123/DS, April 2014) and/or the Revised Conceptual Site Model presented in Section 5.1 of this Phase II report.

Furthermore, two soil samples were taken for chemical laboratory testing (WAC) to enable recommendations for the classification of soil material for off-site disposal to an appropriate landfill, as agreed with the client.

Monitoring wells were installed in two of the cable percussion borehole (BH2 and BH4) and one of the window sampler boreholes (WS11) to allow groundwater sampling/testing and groundwater level monitoring on six occasions, following instructions by the client.

1.2 Location

The site was located in Barnham, West Sussex, PO22 0AF. The site had an O.S. National Grid Reference, at the approximate centre of the site, and area of, SU 965 045 and 7.55 Ha respectively.

1.3 Proposed Redevelopment

At the time of writing this report the proposed redevelopment of the site was understood to comprise the demolition of the existing greenhouses and associated buildings, and the construction of 107No. low rise residential units, with car parking areas. Communal and private soft landscaping was noted as part of the proposed redevelopment.

1.4 Limitations and Disclaimers

This Ground Investigation Report relates to the site located at St. Leonards C of E Primary School, 42 Mitcham Lane, London, SW16 6NP and was prepared for the sole benefit of Epitair Limited (The "Client") and was prepared solely for the brief described in Section 1.1 of this report.

Soils Limited disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

The conclusions and recommendations relate to land at Eric Wall Nursery, Lake Lane, Barnham, West Sussex PO22 0AF.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation prior to the casting of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior or following the site survey.

Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as *"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused"*.

The investigation and report do not address, define or make recommendations in

respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets remains with Soils Limited. License is for the sole use of the client and may not be assigned, transferred or given to a third party.

Section 2 Site Works

2.1 Proposed Works

The works to be undertaken on the site comprised the following items.

- The drilling of a number of windowless sampler boreholes at locations selected by Soils Limited;
- The driving of a number of dynamic probe holes, using a 'Super Heavy' Dynamic Probe (DPSH-B) adjacent to the boreholes, prior to their construction;
- The drilling of four cable percussion boreholes at locations selected by Soils Limited;
- Hand excavation of trial pits, at locations selected by Soils Limited, to recover soil samples solely for chemical laboratory testing;
- The installation of wells in the borehole(s) to allow groundwater sampling/testing and groundwater level monitoring on six occasions, following instructions by the client;
- Logging, sampling and *in-situ* testing as appropriate to the ground conditions encountered in the trial holes.

2.2 Ground Conditions

Between the 25th and 27th February 2014, four cable percussion boreholes (BH1-BH4) were drilled to a depth of 10.0 metres below ground level (bgl) in BH4 and 15.0 metres bgl in BH1-BH3, at locations selected by Soils Limited, where access could be gained and no live services were present.

Between the 26th and 28th February 2014, twelve windowless sampler boreholes (WS1-WS12) were drilled on site, at locations selected by Soils Limited, where access could be gained and no live services were present, to depths ranging between 3.65 metres below ground level (bgl) in WS3 and ~4.1 metres bgl in the remaining trial holes.

Dynamic probes were driven adjacent to the proposed borehole locations (DP1-DP12), prior to their construction, using a 'Super Heavy' Dynamic Probe (DPSH-B), at locations selected by Soils Limited, where access could be gained and no live services were present, to depths ranging between 7.0 metres in DP6 and DP11 and 8.0 metres bgl in the remaining DP's.

On the 26th February 2014, nine trial pits (TPA-TPI) were hand dug at shallow depth (0.60 metre bgl) at locations selected by Soils Limited, where access could be gained and no live services were present.

Monitoring wells were installed in two of the cable percussion borehole (BH2 and BH4) and one of the window sampler boreholes (WS11) to allow groundwater sampling/testing and long-term groundwater level monitoring on six occasions, following instructions by the client.

The approximate location of the trial holes are presented on Figure 2.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the trial hole logs and quoted in this report were measured from ground level directly adjacent to the individual trial hole.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots, or has been identified as part of the *in-situ* weathering profile, it has been described as Topsoil both on the logs and within this report. Where the soil has, in general, been found to have the same composition as the 'Topsoil' but also incorporated a minor constituent, e.g. less than an estimated 5%, of possibly non-naturally occurring material, or is of uncertain origin, the soil has been described as Topsoil/Made Ground both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion the succession of conditions encountered in the trial holes in descending order can be summarised as follows below:

**Topsoil/Made Ground
Head
River Terrace Deposits
London Clay Formation**

2.2.1 Topsoil/Made Ground

Topsoil was found from surface in each of the trial holes that comprised light brown to dark brown sandy clay with fine to medium gravel and roots to a depth of 0.05 metre in WS11 and 0.50 metre bgl in WS2-WS5.

Made Ground was only found in WS1 and WS6 and comprised dark grey brown clayey silt with fine to medium gravel, glass fragments and roots to depths ranging between 0.40 metre bgl in WS1 and 0.50 metre bgl in WS6.

2.2.2 Head

Soils described on the logs as Head were found in each of the trial holes directly beneath the Topsoil/Made Ground and comprised orange brown silty sandy to very sandy CLAY with occasional fine to medium subangular to angular gravel and occasional rootlets.

The soils of the Head were proved to depths ranging between 1.70 metres bgl in BH2/WS6 and 2.80 metres bgl in WS1/WS5 and for the full depth of TPA-TPI to 0.60 metre bgl.

2.2.3 River Terrace Deposits

The soils of the River Terrace Deposits were encountered in each of the boreholes, directly beneath the soils of the Head and comprised light brown

and orange brown clayey to very clayey fine to medium SAND with occasional fine to medium subangular to angular gravel and bands of SAND AND GRAVEL at depth.

The soils of the River Terrace Deposits were only proved in the cable percussion boreholes BH1-BH4 to depths ranging between 4.60 metres bgl in BH2 and 6.30 metres bgl in BH4.

2.2.4 London Clay Formation

The soils of the London Clay Formation were only encountered in the cable percussion boreholes BH1-BH4, directly beneath the soils of the River Terrace Deposits and comprised grey to dark grey fissured CLAY for their full depth to a maximum of 15.0 metres bgl in BH1-BH3.

2.3 Roots

Records of the depth of roots observed during the drilling of the boreholes and the hand excavation of the trial pits are given in Table 2.1.

Table 2.1 Root Records	
Trial hole	Root Depth (m bgl)
WS1	Live roots observed to 2.00
WS2	Live roots observed to 2.60
WS3	Live roots observed to 0.50
WS4	Live roots observed to 0.50
WS5	Live roots observed to 2.00
WS6	Live roots observed to 1.70
WS7	Live roots observed to 2.60
WS8	Live roots observed to 2.40
WS9	Live roots observed to 0.40
WS10	Live roots observed to 2.50
WS11	Live roots observed to 1.50
WS12	Live roots observed to 1.80
BH1	No roots observed
BH2	No roots observed
BH3	No roots observed
BH4	No roots observed
TPA	Live roots observed to 0.40
TPB	Live roots observed to 0.30
TPC	Live roots observed to 0.30
TPD	Live roots observed to 0.30
TPE	Live roots observed to +0.50
TPF	Live roots observed to 0.40
TPG	Live roots observed to 0.30
TPH	Live roots observed to 0.30
TPI	Live roots observed to +0.50

The description of roots was based solely on visual observation and is not definitive.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low, thus a direct observation such as from within

a trial pit is necessary to gain a better indication of the maximum root depth.

Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

As discussed in the Phase I Desk Study, undertaken on the above site by Soils Limited (Report ref: 14123/DS, April 2014), hedgerows were noted transecting the south-west of site in an east-west direct and mature trees were noted along boundary of site to north and west.

2.4 Groundwater

Groundwater equilibrium conditions may only be conclusively established by means of a series of measurements made in a standpipe, or piezometer installed in the ground after completion of site works.

Monitoring wells were installed in two of the cable percussion borehole (BH2 and BH4) and one of the window sampler boreholes (WS11) to allow long-term groundwater level monitoring on six occasions, following instructions by the client.

Groundwater was not encountered during the excavation of the trial pits; however their depth was limited to 0.60 metre bgl as they were excavated solely for contamination sampling/testing purposes.

Groundwater was encountered during the drilling of the boreholes and during the long-term monitoring undertaken to date, as presented in Table 2.2.

Changes in groundwater level do occur for a number of reasons including seasonal effects and variations in drainage.

Groundwater was encountered from surface during the drilling of the boreholes as the site was noted to be waterlogged. The extremely heavy rainfall in late January 2014 and February 2014 may well result in significantly higher groundwater levels than normally anticipated.

The site investigation was undertaken in February 2014 and the groundwater monitoring (to date) were conducted in March 2014, when groundwater levels should typically be rising to their annual maximum elevation (i.e. highest in March).

Any groundwater or surface water ingress **must** be prevented from entering foundation trenches. The possible effect of groundwater on the proposed redevelopment and the foundations will be discussed later in the report.

Table 2.2
Groundwater Records (to date)

Trial hole	Groundwater Depth (m bgl)	Comment
WS1	Strike at 2.00	Reading taken on 26-28.02.14
WS2	Standing at 1.45	Reading taken on 26-28.02.14
WS3	Standing at 1.40	Reading taken on 26-28.02.14
WS4	Groundwater from surface	Reading taken on 26-28.02.14
WS5	Strike at 1.60	Reading taken on 26-28.02.14
WS6	Standing at 1.00	Reading taken on 26-28.02.14
WS7	Standing at 1.10	Reading taken on 26-28.02.14
WS8	Standing at 1.60	Reading taken on 26-28.02.14
WS9	Standing at 0.45	Reading taken on 26-28.02.14
WS10	Standing at 2.05	Reading taken on 26-28.02.14
WS11	Groundwater from surface	Reading taken on 26-28.02.14
	Standing at 1.32	Reading taken from monitoring well on 19.03.14
	Standing at 1.28	Reading taken from monitoring well on 28.03.14
WS12	Groundwater from surface	Reading taken on 26-28.02.14
BH1	Standing at 1.00	Reading taken on 25-27.02.14
BH2	No groundwater observed	Reading taken on 25-27.02.14
	Standing at 1.15	Reading taken from monitoring well on 19.03.14
	Standing at 0.99	Reading taken from monitoring well on 28.03.14
BH3	No groundwater observed	Reading taken on 25-27.02.14
BH4	Seepage at 0.70	Reading taken on 25-27.02.14
	Standing at 0.87	Reading taken from monitoring well on 19.03.14
	Standing at 0.99	Reading taken from monitoring well on 28.03.14
TPA	No groundwater observed	Reading taken on 26.02.14
TPB	No groundwater observed	Reading taken on 26.02.14
TPC	No groundwater observed	Reading taken on 26.02.14
TPD	No groundwater observed	Reading taken on 26.02.14
TPE	No groundwater observed	Reading taken on 26.02.14
TPF	No groundwater observed	Reading taken on 26.02.14
TPG	No groundwater observed	Reading taken on 26.02.14
TPH	No groundwater observed	Reading taken on 26.02.14
TPI	No groundwater observed	Reading taken on 26.02.14

Section 3

Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Standard Penetration Tests (S.P.T.)

Standard Penetration Tests (S.P.T.) were undertaken during the drilling of the cable percussion boreholes in the granular soils of the River Terrace Deposits and the cohesive soils of the London Clay Formation.

The equivalent undrained cohesion of the cohesive soils of the London Clay Formation was based on the SPT "N" blow counts. The cohesive soils of the London Clay Formation were classified on the basis of the relationship given in Table 3.1.

Table 3.1 Undrained Cohesion Classification	
Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

(Ref: EN ISO 14688-2:2004 Clause 5.3.)

The undrained cohesion of the soils of the London Clay Formation was based on the relationship suggested by Stroud (1974) (ref: *Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.*).

The *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing, NA 3.7 SPT test, BS EN 1997-2:2007, Annex F* states "Relative density descriptions on borehole records should also be based on uncorrected SPT N values, unless significantly disturbed, using the density classification in BS 5930:1999+A1, Table 13.

The granular soils of the River Terrace Deposits were therefore classified on the basis of the relationship given in Table 3.2.

Table 3.2 Granular Soil Classification	
Classification	S.P.T. "N" blow count (blows/300mm)
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	Greater than 50

(Ref: *The Standard Penetration Test (SPT): Methods and Use, CIRIA Report 143, 1995*)

An interpretation of the S.P.T. "N" blow counts is given in Table 3.3.

Table 3.3 Interpretation Of S.P.T. "N" Blow Counts				
Strata	"N" blow Range (uncorrected)	Soil Type		Borehole
		Cohesive	Granular	
River Terrace Deposits Formation	5-50	-	Loose to dense	BH1-BH4
London Clay Formation	15-50/65mm	Medium to very high	-	

(The Standard Penetration Tests were conducted in accordance with B.S. 1377:Part 9:1990 Test 3.3.)

The test results are presented on the borehole logs, Appendix A.

3.2 Quick Unconsolidated Undrained Triaxial Tests

QUU Triaxial Tests were made on undisturbed cohesive soil samples of the Head (2) and the London Clay Formation (7) and a summary of the results is presented in Table 3.4.

Table 3.4 QUU Triaxial Test Results Summary			
Lithology	Moisture Content Range (%)	Undrained Cohesion Range (kN/m ²)	Soil Strength Range
Head	18-23	48-54	Medium
London Clay Formation	24-27	67-146	Medium to high

(The QUU Triaxial Tests were made in accordance with B.S. 1377:Part 7:1990 Test 9.0)

The test results are presented in Appendix B.

3.3 Dynamic Probe Tests

Dynamic probes were driven adjacent to the proposed borehole locations (DP1-DP12), prior to their construction, using a 'Super Heavy' Dynamic Probe (DPSH-B), at locations selected by Soils Limited, where access could be gained and no live services were present, to depths ranging between 7.0 metres in DP6 and DP11 and 8.0 metres bgl in the remaining DP's.

Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 63.5kg (DPSH) hammer onto the top of the rods through a set height, thus ensuring a consistent energy input. The number of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published that permit engineering parameters to be generated.

The equivalent undrained cohesion of the soils of the inferred London Clay Formation was based on the equivalent SPT "N" blow counts, derived from the dynamic probe tests, using in-house computer software (Geostru).

The cohesive soils of the inferred London Clay Formation were classified on the basis of the relationship given in Table 3.1.

The inferred undrained cohesion of the cohesive soils of the inferred London Clay Formation was based on the relationship suggested by Stroud (1974) (*ref: Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.*).

The *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing, NA 3.7 SPT test, BS EN 1997-2:2007, Annex F* states "Relative density descriptions on borehole records should also be based on uncorrected SPT N values, unless significantly disturbed, using the density classification in BS 5930:1999+A1, Table 13.

The granular soils of the River Terrace Deposits were therefore classified on the basis of the relationship given in Table 3.2.

The test results are presented in Appendix A.

(The Dynamic Probe 'Super Heavy' (DPSH-B) Tests were conducted in accordance with BS EN ISO 22476-2:2005).

3.4 Atterberg Limit Tests

A summary of the results of Atterberg Limit Tests made on cohesive samples of the Head (5) and a granular sample of the River Terrace Deposits is given in Table 3.5.

Table 3.5 Atterberg Limit Tests Results Summary						
Stratum	Moisture Content Range (%)	Passing 425µm Sieve Range (%)	Modified PI Range (%)	Soil Class Range	Volume Change Potential Range	
					BRE	NHBC
Head	16-26	70-100	6-18	CL-CI	Low	None to low
River Terrace Deposits	24	-	-	Non Plastic	None	None

NB: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results) Soil Classification based on British Soil Classification System. The most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.

(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Tests 4 and 5).

The test results are given in Appendix B.

3.5 Grading Analysis Tests

A summary of the results of Grading Analyses Test undertaken on granular samples (4) of the River Terrace Deposits is given in Table 3.6.

Table 3.6 Grading Analyses Test Results Summary			
Soil Description	Volume Change Potential Range		Passing 63µm Sieve Range (%)
	BRE	NHBC	
Slightly gravelly very clayey fine SAND (1 sample)	Yes	No	23
Clayey silty fine SAND (3 samples)	No	No	6-10

NB: Volume Change Potential refers to BRE Digest 240 (based on Grading test results). Shrinkability refers to NHBC Standards Chapter 4.2 (based on Grading test results). Volume Change Potential – BRE 240 states that a soil has a volume change potential when the clay fraction exceeds 15%. Only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve. NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than 35% and the Plasticity Index is greater than 10%.

(The Grading Analyses Tests were made in accordance with B.S.1377: Part 2:1990 Test 8).

The test results are given in Appendix B.

3.6 Laboratory California Bearing Ratio Tests

Laboratory CBR Tests were made on soil samples (2) taken from the Head and the results are presented in Table 3.7:

Table 3.7 Laboratory CBR Test Results		
Trial Hole/Depth (m bgl)	Moisture Content (%)	CBR (%)
BH1/0.50	26	0.80
BH3/0.50	25	1.6

The test results are given in Appendix B.

(The Laboratory California Bearing Ratio Tests were made in accordance with B.S.1377: Part 4:1990 Test 7).

3.7 Sulphate and pH Tests

The significance of the Sulphate and pH Test results are discussed within Section 4.3. The test results are given in the contamination results presented in Appendix C.

(The Sulphate and pH Tests were conducted in accordance with BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground').

Section 4 Foundation Design

4.1 General

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented below and overpage.

4.1.1 Topsoil or Made Ground

The terms *Fill* and *Made Ground* are used to describe material, which has been placed by man either for a particular purpose e.g. to form an embankment, or to dispose of unwanted material. For the former use, the Fill and/or Made Ground may well have been selected for the purpose and placed and compacted in a controlled manner. With the latter, great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter, as well as potentially methanogenic organic material.

The BSI Code of Practice for Foundations, BS 8004:1986, Clause 2.2.2.3.5 Made Ground and Fill, includes the caveat that *'all made ground should be treated as suspect, because of the likelihood of extreme variability'*.

A result of the inherent variability, particularly of uncontrolled Fill and/or Made Ground, is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Fill and/or Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Topsoil was found from surface in each of the trial holes that comprised light brown to dark brown sandy clay with fine to medium gravel and roots to a depth of 0.05 metre in WS11 and 0.50 metre bgl in WS2-WS5.

Made Ground was only found in WS1 and WS6 and comprised dark grey brown clayey silt with fine to medium gravel, glass fragments and roots to depths ranging between 0.40 metre bgl in WS1 and 0.50 metre bgl in WS6.

Made Ground might be present to similar or greater depths elsewhere on the site including service trenches, infilled ground, basements and the like.

4.1.2 Head

Soils described on the logs as Head were found in each of the trial holes directly beneath the Topsoil/Made Ground and comprised orange brown silty sandy to very sandy CLAY with occasional fine to medium subangular to angular gravel and occasional rootlets.

The soils of the Head were proved to depths ranging between 1.70 metres bgl in BH2/WS6 and 2.80 metres bgl in WS1/WS5 and for the full depth of TPA-TPI to 0.60 metre bgl.

The results of the Atterberg Limit testing indicated that the cohesive soils of the Head fell into the BRE Digest 240 and the NHBC Standards Chapter

4.2 ***low and none to low volume change potential*** classification respectively.

The **undrained strength** of the **cohesive soils** of the Head was classified in accordance with the BS 5930:1999+A2: and based on data derived from the:

1. DP blows interpretation as *very low and occasionally extremely low becoming medium and occasionally high with depth;*
2. QUU results interpretation as *medium*.

The **consistency** of the soils of Head was indicated to be *very soft to firm* in accordance with the BS 5930:1999+A2:2010, based on the field description of disturbed soil samples as presented on the borehole logs.

The soils of the Head are normally consolidated recent deposits (in geological terms) and would generally possess low bearing and high settlement characteristics and **should not** be considered suitable as a bearing stratum for the proposed redevelopment.

4.1.3 River Terrace Deposits

The soils of the River Terrace Deposits were encountered in each of the boreholes, directly beneath the soils of the Head and comprised light brown and orange brown clayey to very clayey fine to medium SAND with occasional fine to medium subangular to angular gravel and bands of SAND AND GRAVEL at depth.

The soils of the River Terrace Deposits were only proved in the cable percussion boreholes BH1-BH4 to depths ranging between 4.60 metres bgl in BH2 and 6.30 metres bgl in BH4.

The results of the Grading Analysis testing indicated that three out of four granular soils of the River Terrace Deposits fell into the BRE Digest 240 and the NHBC Standards Chapter 4.2 ***no volume change potential classification*** with the remaining sample noted to fall into the BRE Digest 240 ***no volume change potential*** and the and the NHBC Standards Chapter 4.2 ***volume change potential classification***.

The **relative density** of the soils of the River Terrace Deposits was classified in accordance with the BS 5930:1999+A2:2010 and based on the:

1. SPT blows interpretation as *loose to dense;*
2. DP blows interpretation as *loose and occasionally very loose to dense becoming very dense with depth.*

The soils of the River Terrace Deposits are normally consolidated soils and as such the granular soils generally have moderate to high bearing and moderate to low settlement characteristics.

4.1.4 London Clay Formation

The soils of the London Clay Formation were only encountered in the cable percussion boreholes BH1-BH4, directly beneath the soils of the River Terrace Deposits and comprised grey to dark grey fissured CLAY for their full depth to a maximum of 15.0 metres bgl in BH1-BH3.

The **consistency** of the soils of the London Clay Formation was indicated to be *stiff* in accordance with the BS 5930:1999+A2:2010, based on the field description of disturbed soil samples as presented on the borehole logs.

The **undrained strength** of the **cohesive soils** of the London Clay Formation was classified in accordance with the BS 5930:1999+A2: and based on data derived from the:

1. SPT blows interpretation as *medium to very high*;
2. DP blows interpretation as *low to medium becoming high and very high with depth*;
3. QUU results interpretation as *medium to high*.

The soils of the London Clay Formation are overconsolidated soils and as such generally have moderate to high bearing and moderate to low settlement characteristics and could be considered suitable for the proposed redevelopment using piled foundations.

4.2 Foundation Scheme

At the time of writing this report the proposed redevelopment of the site was understood to comprise the demolition of the existing greenhouses and associated buildings, and the construction of 107No. low rise residential units, with car parking areas. Communal and private soft landscaping was noted as part of the proposed redevelopment.

4.2.1 Guidance on Shrinkable Soils

The Building Research Establishment (BRE) Digests 240, 241 and 242 provide guidance on 'best practice' for the design and construction of foundations on shrinkable soils.

The BRE Digest 241 states: "*An increasingly common, potentially damaging situation is where trees or hedges have been cut down prior to building. The subsequent long-term swelling of the zone of clay desiccated by the roots, as moisture slowly returns to the ground, can be substantial. The rate at which the ground recovers is very difficult to predict and if there is any doubt that recovery is complete then bored pile foundations with suspended beams and floors should be used*".

The BRE Digest 240 sets out best practise in respect of the design of foundations taken into shrinkable soils. In predominantly clayey soils, moisture content recovery can take in excess of 20 years to complete.

The BRE Digest 240 suggests that *"Two courses of action are open:*

- *Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.*
- *Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage."*

The design of foundations suitable to withstand movements is presented in BRE Digest 241 "Low-rise buildings on shrinkable clay soils: Part 2".

The BRE Digest 240 sets out best practise in respect of the design of foundations taken into shrinkable soils and advises that a piled foundation must be used if there is any doubt regarding completion of soil moisture content following any tree removal. In predominantly clayey soils, moisture content recovery can take in excess of 20 years to complete.

The stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building.

It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

4.2.2 Conclusions and Recommendations

The foundation design must be suitable for the conditions present at the site.

Foundations **must not** be constructed within any Made Ground or Head due to the likely variability and potential for large load induced settlements **both total and differential**.

Foundations **must not** be placed within any live root penetrated or desiccated **cohesive soils**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth in order to bypass these unsuitable soils.

It was considered that the adoption of conventional strip or pad foundation could be proved problematic given the reasons presented below and overpage:

- the relatively high groundwater table recorded (water found from surface in places) during the investigation and the long-term groundwater monitoring undertaken to date;
- the generally poor engineering properties of the soils of the Head as

reflected in the relatively low DP blow counts recorded and their marked variation in terms of thickness that was noted to an excessive depth of 2.80 metres bgl in WS1/WS5;

- the presence of live roots that in places exceeded 2.5m bgl (2.6m bgl encountered in WS7/WS2);

Therefore, a piled foundation scheme should be adopted, with the foundations taken through any Made Ground, Head, below any live root zone and disturbed or desiccated soil, below the granular soils of the River Terrace Deposits and **into the underlying cohesive soils of the London Clay Formation such that sufficient bearing capacity was achieved.**

Consideration could possibly be given to deep strip/pad foundations; however this would require:

- long-term groundwater monitoring in order to establish whether groundwater levels are significantly lower in the summer months;
- additional works in the form of WS/DP on a plot-by-plot basis.

In the Table 4.1, preliminary load capacities calculated for varying diameters and lengths of vertically loaded piles into the cohesive soils of the London Clay Formation. These values have been calculated for the ground conditions found in BH1-BH4 and the results of the QUU tests and should be used for preliminary design purposes only as the actual working load is dependent on the type of pile and the method of installation.

The pile working loads incorporate a factor of safety of 3 on the ultimate skin bearing value and 3 on the ultimate end bearing value.

The values given incorporate an end bearing value (N_c) of 9 and a skin friction coefficient (α) of 0.45 in the cohesive soils of the London Clay Formation.

The calculations were based on both the undrained cohesion inferred from the SPT 'N' blow count values and the results of the Quick Unconsolidated Undrained Triaxial Tests in the cohesive soils of the London Clay Formation.

The upper five metres of the shaft of the pile have been ignored in the preliminary pile design given.

To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

The preliminary pile working loads given in the table below applies to individual piles.

Where pile groups are to be used the pile working load of the individual piles would be about 0.8 of that given in Table 4.1.

Temporary casing will be required where the upper portion of the pile passes through the Made Ground, Head, River Terrace Deposits, particularly below the groundwater table, to prevent necking of the green concrete.

Table 4.1 Preliminary Indicative Pile Working Loads (Single Pile Vertically Loaded) For Piles taken into the cohesive soils of the London Clay Formation			
Depth (m BGL)	Pile Diameter (m)		
	0.30	0.45	0.60
7.0	20	50	80
	20	40	50
	40	90	130
9.0	30	60	100
	50	90	110
	80	150	210
11.0	30	70	120
	90	150	190
	120	220	310
13.0	40	80	140
	130	220	280
	170	300	420
15.0	40	90	170
	180	300	380
	220	390	550
Note: End Working Load (kN) 170 Skin Working Load (kN) 380 Total Pile Working Load (kN) 550			

The construction of a piled foundation is a specialist job, and the advice of a reputable contractor, familiar with the type of ground and groundwater conditions encountered on this site, should be sought prior to finalising the foundation design, as the actual pile working load will depend on the particular type of pile and method of installation.

The bearing values may be limited by the maximum permissible stress allowable on a concrete pile.

Guidance on the design of a working platform for piling rigs can be provided by Soils Limited in accordance with the BRE "Working platform for tracked plant, 2004" documentation.

Possible lateral movements due to the high volume change potential cohesive soils of the London Clay Formation must be taken into account. Tensile reinforcement of the piles must be adopted in order to accommodate possible heave/swelling in accordance with the BRE 250.

4.3 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts fell into Class DS-3 of the

BRE Special Digest 1, 2005, '*Concrete in Aggressive Ground*'. Table C2 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) site classification of AC-3. For the classification given, the "mobile" case was adopted, as groundwater was recorded during the investigation and the groundwater monitoring. The pH of the soil was recorded to range between 6.7 and 7.8.

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, '*Concrete in Aggressive Ground*' taking into account the pH of the soils.

4.4 Excavations

Shallow excavations (<1.0m) in the Made Ground, or the Head are likely to be marginally stable at best.

Long, deep excavations are likely to become unstable as are those excavated through significant thickness of the Made Ground, Head, River Terrace Deposits, or those taken below the groundwater table, if encountered.

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

Section 5

Revised Conceptual Site Model and Chemical Analysis of Soil Samples

5.1 Site Characterisation and Revised Conceptual Site Model

The Phase II intrusive investigation established the existence of Made Ground that was only found in WS1 and WS6 and comprised dark grey brown clayey silt with fine to medium gravel, glass fragments and roots to depths ranging between 0.40 metre bgl in WS1 and 0.50 metre bgl in WS6.

Therefore, the Conceptual Site Model presented in the Phase I Desk Study undertaken on the above site by Soils Limited (Report ref: 14123/DS, April 2014) **did require revision** and is presented overpage in Table 5.1.

5.1.1 Soil

Soil samples were taken from the logged arisings recovered from the trial holes and placed in individual clean sampling containers to determine whether the soils had been impacted in order to assess the likelihood of human health being affected.

5.1.2 Groundwater

As discussed in the Phase I Desk Study, the Environment Agency Groundwater Vulnerability Maps showed a geological class of **Secondary A Aquifer** with soils of variable leaching potential, associated with the River Terrace Deposits.

Examination of the Environment Agency records showed no GSPZ within a 1000m radius.

Given the presence of groundwater, as established during the site investigation and the groundwater monitoring period, groundwater was considered as a sensitive receptor potentially being impacted by on-site sources thus groundwater sampling and chemical laboratory testing was undertaken, to assess the likelihood of groundwater being impacted, as discussed in detail in Section 5.4 of this report.

Table 5.1
Revised Conceptual Site Model

Risk Rating	Source	Pathway	Receptor
ON and OFF-SITE <i>Low to medium Risk</i>	ON SITE: Plastic oil tank, Boiler house and gas tanks, Herbicides and Pesticide; Made Ground found to underlie areas of the site	- Ingestion of soil - Dermal contact - Inhalation of dust (indoor and outdoor); - Inhalation of vapours (indoor and outdoor)	Human Health Future users of the site Visitors to the site Construction workers on site Service and maintenance workers Site neighbours and wider public
	OFF SITE: Railway Line and Nursery: Herbicides and Pesticide	- Location of service supply pipes in contaminated soils - Direct contact of concrete to high-sulphate soils	Building Materials Future Potable Water Supply Construction materials
	• Heavy Metals and Semi-Metals including: Arsenic, Cadmium, Chromium, Lead, Copper, Zinc, Beryllium, Vanadium etc. • Poly-cyclic Aromatic Hydrocarbons – Benzo (a) Pyrene, Fluorene, Dibenzo (a,h) Anthracene etc. • TPH-EPH • Pyrethroids • Organochlorine Pesticides • Others- Asbestos	- Via anthropogenic pathways (services trenches) - Migration downwards via natural granular soils	Groundwater/ Controlled Water

5.2 Soil Sampling

A non-targeted sampling strategy is appropriate when there is:

- No adequate information available regarding the likely locations of contamination;
- No sensitive areas where there is a need for a high degree of confidence.

A targeted sampling strategy is appropriate when there is:

- Adequate information available regarding the likely locations of contamination;
- Sensitive areas where there is a need for a high degree of confidence.

A non-targeted sampling strategy was generally adopted with sampling locations given by the client and restricted to where access could be gained and no services were identified. However, TPJ, TPK, TPL were hand excavated near existing above ground gas oil tanks as discussed in the Phase I Desk Study undertaken on the above site by Soils Limited (Report ref: 14123/DS, April 2014).

The soil sampling depths reflected both receptor and exposure scenarios of concern for groundwater and human health receptor, this being end users, groundwater, ground workers and future maintenance workers and are presented in Table 5.2.

Table 5.2 Sample Depth And Potential Receptors	
Sample Depth (m bgl)	Potential Pathways and Receptors
0.20m-0.50m	Direct ingestion, dermal contact and dust inhalation. Protection of site operatives, end users and maintenance workers.

5.3 Determination of Contaminants of Concern - Soil

The driver for the determination of the analysis suite was the information obtained from Conceptual Site Model presented in the Phase I Desk Study undertaken on the above site by Soils Limited (Report ref: 14123/DS, April 2014) and the Phase II intrusive investigation, as incorporated within the Revised Conceptual Site Model framework presented in Section 5.1. and is presented in Table 5.3:

Table 5.3
Determination Of Contaminants of Concern – Soil Samples

Determinant	Locations/Depths (m bgl)												
	BWS /0.2	TPF/ 0.5	TPH/ 0.5	TPG/ 0.5	TPD/ 0.5	TPC/ 0.5	TPB /0.5	TPA /0.5	WS1 /0.2	TPK /0.3	TPJ/ 0.3	TPL/ 0.3	BH4/ 0.2
Asbestos Screening	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
Total phenols	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
Total Cyanide	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
Organic Matter	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
pH	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
metals	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
metalloids	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
PAHs	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
TPH-EPH	✓									✓	✓	✓	X
Pyrethroids			✓		✓		✓						✓
Organochlorine Pesticides		✓		✓		✓		✓					

Notes: **metals:** Cd, Cr, Pb, Hg, Ni, Se, CN, S, Cu, Zn, Bo, V, **metalloids:** As, **organics:** USEPA 16 speciated PAH with assessment on benzo(a)pyrene, naphthalene, fluorene, dibenzo(a,h)anthracene. **TPH-EPH:** C₁₀-C₄₀ **Pyrethroids:** Including Cyfluthrin, Cyhalothrin, Cypermethrin, Deltamethrin, Fenvalarate, Permethrin, Resmethrin, Tetramethrin **Organochlorine Pesticides:** Including DDD, HCH, DDT

Asbestos screening aims at identifying fibres or fibrous material, which are indicative of the presence of asbestos. Should fibres or fibrous material be detected the sample is characterised as "suspected" and is subsequently submitted for further analysis for confirmation and speciation if required.

5.4 Chemical Analysis of Groundwater Samples

Groundwater was considered as a sensitive receptor being impacted by on-site sources thus groundwater sampling and chemical laboratory testing was undertaken, to assess the likelihood of groundwater being impacted.

Three groundwater samples were recovered from the wells installed in BH2, BH4 and WS11 and were placed in sample containers appropriate for the analytical suite and placed in a cool box for despatch to the chemical testing laboratory for analysis.

There was no free product recorded on the surface of the groundwater during well developing or during the groundwater monitoring period (measured using a product meter).

5.6 Determination of Contaminants of Concern - Groundwater

The driver for the determination of the analysis suite was as agreed with the client, the information obtained from the Phase I Desk Study undertaken on the above site by Soils Limited (Report ref: 13847/DS, December 2013), as incorporated within the Revised Conceptual Site Model framework presented in Table 5.4.

Table 5.4 Determination of Contaminants of Concern Groundwater Samples	
Determinand	Sampling Locations BH2, BH4 and WS11
Total phenols	✓
Total Cyanide	✓
Organic Matter	✓
pH	✓
metals	✓
metalloids	✓
organics	✓
TPH-EPH	✓
Pyrethroids	✓
Organochlorine Pesticides	✓

Notes: **metals:** Cd, Cr, Pb, Hg, Ni, Se, CN, S, Cu, Zn, Bo, V, **metalloids:** As, **organics:** USEPA 16 speciated PAH with assessment on benzo(a)pyrene, naphthalene, fluorene, dibenzo(a,h)anthracene. **TPH-EPH:** C₁₀-C₄₀ **Pyrethroids:** Including Cyfluthrin, Cyhalothrin, Cypermethrin, Deltamethrin, Fenvalarate, Permethrin, Resmethrin, Tetramethrin **Organochlorine Pesticides:** Including DDD, HCH, DDT

Section 6 Qualitative Risk Assessment

6.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix D.

6.2 Representative Contamination Concentration – Soil

At the time of writing this report the proposed redevelopment of the site was understood to comprise the demolition of the existing greenhouses and associated buildings, and the construction of 107 No. low rise residential units, with car parking areas. Communal and private soft landscaping was noted as part of the proposed redevelopment.

The results of the comparison of the representative contaminants concentration for human health receptor to the Soil Guideline Values (SGV), General Assessment Criteria (GAC) and SSV (Atkins AtRisk SSV Guideline) are presented in the Table 6.1 and are assessed against the **"Residential"** land-use scenario as this was considered a conservative land-use scenario given the type of the proposed redevelopment:

Table 6.1 Soil Guideline Values And General Acceptance Criteria Results		
Substance	Sample locations where SSV, SGV or GAC adopted exceeded for the "Residential" land-use scenario	
Arsenic		None
Cadmium		None
Chromium		None
Lead		None
Mercury (inorganic)		None
Nickel		None
Selenium		None
Benzo(a)pyrene		None
Copper		None
Zinc		None
Vanadium		None
Boron(water soluble)		None
Fluorene		None
Naphthalene		None
TPH-EPH		None
Pyrethroids		None
Organochlorine Pesticides		None
Asbestos screening *		None suspected

Note: * Asbestos screening was done by the sample preparers in sample reception. They were trained to look for fibrous material though cannot actually determine whether it was asbestos. If they saw fibres, they report fibres as 'Suspected'. The sample would then have to go to the laboratory for confirmation and speciation. If they do not see fibres, they report fibres as 'Not Suspected'.

6.2.1 Use of EPH as a Screening Tool

EPH analysis for total petroleum hydrocarbons gives a total for both aromatic and aliphatic fractions over the C₁₀-C₄₀ (diesel to oils and greases) carbon chain length. It is used as a cost effective risk assessment screening tool for diesel and higher end petroleum hydrocarbons. The EPH total is assessed using LQM CIEH

EC>10-12 range for aromatic fraction as this is the most sensitive value as presented on Table 6.2.

If exceeded then an additional stage of risk assessment using TPH CWG with aliphatic aromatic split may be considered. If not exceeded then the assessor has confidence that there was no risk.

Table 6.2 LQM-CIEH GAC - Aromatic		
Chain	SOM (%)	Concentration (mg/kg)
EC >10-12	1.0	69
	2.5	160
	6.0	346

To assess the potential toxicity to the human health receptor from the concentrations of organic compounds tested for such as naphthalene, fluorene, dibenzo(a,h)anthracene.

Soil Organic Matter (SOM) tests were undertaken on the samples submitted for chemical testing, which revealed SOM values ranging between 0.8% and 3.3%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate GAC.

6.3 Groundwater Analyses

Three groundwater samples were recovered from the wells installed in BH2, BH4 and WS11 and were placed in sample containers appropriate for the analytical suite and placed in a cool box for despatch to the chemical testing laboratory for analysis.

For Tier 1 risk assessment the results were compared against Environmental Quality Standards (EQS's) taken as UK Drinking Water Standards (DWS), EA Standard for Protection of Aquatic Life - Freshwater (SPAL) and World Health Organisation Guidelines for Drinking Water Quality, 1984 (WHO).

The UK Drinking Water Standards are the most appropriate published standards applicable to UK control of potable water sources.

6.4 Representative Contamination Concentration - Groundwater

The results of the chemical laboratory testing undertaken on three groundwater samples from BH2, BH4 and WS11 are presented in Table 6.3.

Table 6.3 Tabulated Result For Groundwater Samples (BH2, BH4 and WS11)				
Determinant	Units	EQS Source	EQS Concentration	Sample location where EQS level adopted was exceeded
Arsenic	µg/l	DWS	10	None
Cadmium	µg/l	DWS	5	None
Chromium	µg/l	DWS	250 (FW)	None
Copper	µg/l	DWS	2000	None
Nickel	µg/l	DWS	200 (FW)	None
Lead	µg/l	DWS	250	None
Mercury	µg/l	DWS	1	None
Selenium	µg/l	DWS	10	None
Zinc	µg/l	DWS	5000	None
Boron	µg/l	DWS	2000	None
Sulphate	mg/l	SPAL	400	None
Sulphide	µg/l	SPAL	0.25	None
Benzo (a) pyrene	µg/l	FW	0.01	None
Polycyclic Aromatic Hydrocarbon * ⁽¹⁾	µg/l	DWS	0.1	None
Extractable Petroleum Hydrocarbons	µg/l	DWS	10	None
Pyrethroids	-	-	-	Below the instrument detection limit
Organochlorine Pesticides				
Notes	DWS = UK Drinking Water Standards SPAL = EA Standard for Protection of Aquatic Life (Freshwater) FW=Freshwater standard EQS=Environmental Quality Standards (1)* Sum of fluoranthene, benzo 3.4 fluoranthene (<i>benzo (b) flouranthene</i>), benzo 11.12 fluoranthene (<i>benzo (k) flouranthene</i>), benzo 3.4 pyrene (<i>benzo (a) pyrene</i>) and indeno (1,2,3-cd) pyrene			

6.5 Tier 1 Quantitative Risk Assessment

Soil: Tier 1 Quantitative risk assessment established that **there was no risk to the human health receptors** of construction workers, future maintenance workers or end users as none of the determinants was noted to be in excess of their relevant DEFRA LQM CIEH SGV, SSV or GAC in the soil samples tested, as shown on Table 6.1.

Groundwater: Tier 1 Quantitative risk assessment established that **there was no risk to the groundwater receptor** as there were no concentrations of determinants in excess of their relevant Environmental Quality Standards (EQS) in the results of the groundwater samples (BH2, BH4 and WS11) tested, as shown on Table 6.3.

The results of the contamination testing are presented in Appendix C.

Section 7

Risk Assessment and Remediation Strategy

7.1 Risk Evaluation/Estimation

The objective of the remediation for the site is to ensure that the site clean-up, if required, removes any unacceptable risk to the identified receptors. This is best achieved using a risk based approach that considers the circumstances of the site, such as its location and intended use of the site, engineering considerations and the need to ensure suitable amenities for any development.

In essence the remedial objective should be to sever any source-pathway-target pollutant linkages that have been established for the site. Once this has been achieved, by whatever means, there can theoretically be no risk.

The following methodology has been developed from the "*Guide to Risk Assessment and Risk Management for Environmental Protection*" (DoE, 1995) and *Draft Statutory Guidance on Contaminated Land* (DoE, 1996).

The method presented is an updated and modified version of an in-house procedure used by the Enviros Aspinwall and represents one possible methodology for presenting and estimating the results of risk estimation.

This method is presented in tabular form overpage and involves the classification of the:

- Magnitude of the potential **consequence** (severity) of risk occurring (Table 7.1).
- Magnitude of the **probability** (likelihood) of the risk occurring (Table 7.2).

Table 7.1 Classification Of Consequence	
Classification	Definition
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIA. Short term risk of pollution (note: Water Recourses Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).
Medium	Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water recourse (note: Water Recourses Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).
Mild	Pollution of non-sensitive water recourses. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the <i>Draft Circular on Contaminated Land</i> , DETR, 2000).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc).

Table 7.2 Classification Of Probability	
Classification	Definition
High likelihood	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 receptors of harm or pollution.
Likely	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 likelihood	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 short term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the long term.

Once the consequence and probability have been classified, these can then be compared to produce a risk category, ranging from "very high risk" to very low risk" as shown in Table 7.3 using a simple matrix adapted from the DETR "Contaminated land risk assessment: A guide to good practice, 2001, CIRIA C552).

Table 7.3 Comparison Of Consequence Against Probability				
Probability	Consequence			
	Severe	Medium	Mild	Minor
High likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
Likely	High risk	Moderate risk	Moderate/low risk	Low risk
Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
Unlikely	Moderate risk	Low risk	Very low risk	Negligible risk

The following qualitative outcome definitions have been adopted to provide an idea of the risk severity and rank as well as the actions corresponding with this classification as given in Table 7.4.

Table 7.4 Description Of The Classified Risks And Likely Action Required	
Classification	Description/action required
Very high risk	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 remediation is likely to be required.
High risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Remediation may be necessary in the short term and are likely over the longer term.
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either 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. Some remedial works may be required in the longer term.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm if realised would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Soil chemical laboratory results: Tier 1 Quantitative risk assessment established that **there was no risk** to the human health receptors of construction workers, future maintenance workers or end users as **none** of the determinants was noted to be in excess of their relevant DEFRA LQM CIEH SGV, SSV or GAC in the soil samples tested, as shown on Table 6.1

Item 1.a.a in Table 7.5 was therefore dismissed.

With regards to Item 1.b.b1, specific reference should be made to Section 4.3 in order to provide guidance on the assessment of ground in respect of aggressiveness to concrete and on the specification of concrete to resist chemical attack (sulphates, sulphides, acids).

With regards to Item 1.b.b2 and particularly the selection of suitable pipeline materials to comply with the current regulations and to prevent water supply pipelines failing prematurely, specific reference must be made to the relevant water company guidance.

Groundwater chemical laboratory results: Tier 1 Quantitative risk assessment established that **there was no risk to the groundwater receptor** as there were no concentrations of determinants in excess of their relevant Environmental Quality Standards (EQS) in the results of the groundwater samples (BH2, BH4 and WS11) tested, as shown on Table 6.3.

Item 1.c.c on Table 7.5 was therefore dismissed.

Based on the intrusive investigation and the chemical laboratory testing, the Revised Conceptual Site Model presented in Section 5.1 has been re-examined and is presented in Table 7.5.

Table 7.5 Re-Examined Conceptual Site Model					
Source	Pathway	Receptor	Consequence of risk	Probability of risk	Risk Estimation
1. ON SITE: Plastic oil tank, Boiler house and gas tanks, Herbicides and Pesticide; Made Ground found to underlie areas of the site	a. Dermal contact, dust inhalation, ingestion	a. Human Health (End users, site operatives)	Not required		
	b. Direct contact	b1. Building materials	Concrete aggressiveness - Reference to Section 4.3		
		b2. Services	Water pipelines – Reference to Section 7.1		
OFF SITE: Railway Line and Nursery: Herbicides and Pesticide	c. Migration/Leaching	c. Groundwater	Not required		

7.2 Remedial Objective

This report is not a design document. The purpose of this section is to describe a framework for the treatment of contamination that can be developed by the designers

of the development to give the most practical and cost effective treatment for the proposed scheme.

According to the way in which the design of the project is conceived it may be possible to develop alternative strategies to those discussed. For example, the treatment systems described in this report are based upon the assumptions that finished ground levels for the development will be the same as those that currently exist. Increases in ground level could result in less onerous requirements to remove soil from the site.

The advice and recommendations presented are made on the basis of the chemical analyses results obtained to date.

Tier 1 Quantitative risk assessment established the risk to the **human health receptors** of end users, construction workers or future maintenance workers, and the **groundwater** receptor are presented in Table 7.6.

Table 7.6 Tier 1 Quantitative Risk Assessment	
Receptor	Risk
Human Health	None
Groundwater	None

Stripped soil must be stockpiled and samples taken and analysed to confirm that they are suitable for re-use on the site.

Any imported Topsoil used on this site shall be as defined in the British Standard BS3882:2007 Specification for topsoil.

In addition the topsoil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, either prior to placing or after placing, to ensure that the human receptor cannot come into contact with any compounds that could be detrimental to human health.

Any imported Topsoil used on this site including the proposed flower beds shall be as defined in the British Standard BS3882:2007 Specification for topsoil.

In addition the topsoil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, either prior to placing or after placing, to ensure that the human receptor cannot come into contact with any compounds that could be detrimental to human health.

Furthermore, in order to minimise the leaching potential of possible contaminants, the time period during redevelopment that the site will be open and exposed to rainfall (time period between removal of existing ground slab and construction of proposed basement slab) **must** be kept to a minimum.

In respect to the groundworkers and site operatives, it is understood that in order to minimise the effect of dust inhalation and dermal contact as exposure pathways, a

good standard of personal hygiene must be adopted, as discussed in detail in Section 7.3.

7.3 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust were generated as a result of construction activities. The site should be securely fenced at all times to prevent unauthorised access.

Washing facilities should be provided and eating restricted to mess huts.

7.4 Excavated Material

Excavated material must be classified with the Environment Agency for disposal at an appropriately licensed disposal facility. The requirements of Duty of Care and Health and Safety Guidance must be complied with.

Both Producers and Waste Management companies must ensure compliance with the new Waste Acceptance Criteria (WAC) prior to landfill in Hazardous, stable non-reactive cells and inert sites. These regulations govern the operation of landfill in England and Wales. Basic characterisation is the responsibility of the waste producer and compliance checking is generally the responsibility of the landfill operator. Therefore landfill operators will be unlikely to accept waste that does not meet the Waste Acceptance Criteria for their class of site. There is an obligation to 'treat' all soils destined for landfill, including non-hazardous waste. This treatment must now be documented and presented to the landfill operator or waste may be refused entry. Note that all liquids are banned from landfill.

For the purposes of legal compliance, 'treatment' must comprise three things (the 'three-point test') presented below:

1. It must be a physical, thermal, chemical or biological process.
2. It must change the characteristics of the waste.
3. It must do so in order to:
 - (a) reduce its volume, or
 - (b) reduce its hazardous nature, or
 - (c) facilitate its handling, or enhance its recovery.

7.4.1 Risk Based Hazard Assessment of Waste

Software such as the HazWasteOnline produced **Hazardous Waste Classification Tool**, enables soils 'total' chemical testing data to be used to identify the classification of waste soils in accordance with Environment Agency guidance. The HazWasteOnline Hazardous Waste Classification Tool was designed primarily for the classification of soil wastes as identified by the European Waste Catalogue (EWC) Chapter 17 - Construction and demolition wastes (including contaminated soils).

The classification of waste as either **hazardous or non-hazardous** must be conducted in accordance with the 2003 Environment Agency publication Interpretation of the Definition and Classification of Hazardous Waste (Technical Guidance WM2). This establishes the regulatory framework and allows classification of wastes based on their various risk phrases. Additional guidance provided by the 2007 Environment Agency publication How To Find Out if Waste Oil and Wastes that Contain Oil are Hazardous (HWR08) provides further clarification on the classification methodology for hydrocarbon contamination.

As part of the **Hazardous Waste Classification** process, contaminant compounds are selected based on historical and contemporary land-use. The inclusion of such data on the input form enables the correct waste classification to be determined. For example, in cases of land associated with former gasworks, the classification of coal-tar contaminated soils can be partially determined using total PAH concentrations as opposed to TPH concentrations as coal-tar may be deemed a "substance".

Hazardous (HWR08) provides further clarification on the classification methodology for hydrocarbon contamination.

The analysis results of the chemical laboratory testing undertaken as part of report, prepared by QTS Environmental Ltd were used for the **Hazardous Waste Classification** process.

Full results of the laboratory analysis (WAC) and hazardous waste classification tool are given in Appendix C and E respectively and the output is summarised overpage.

Waste Acceptance Criteria Testing

Where a risk based hazard assessment shows that the waste is not inert then Waste Acceptance Criteria Testing (WAC 2-stage leachate testing) is required to decide whether contaminated soil either:

- a) Meets WAC limits for hazardous landfill – so is acceptably insoluble/non-degradable and can be disposed therein,
- or
- b) Fails hazardous WAC – is so mobile, or degradable that it would breach the operator's Permit, so cannot even go to hazardous landfill without treatment.

For the purposes of this report and as agreed with the client, two samples of the Head (BH2/0.5m and BH4/1.2m) was submitted by Soils Limited for a two-stage leachate WAC test and the results compared to the threshold limits as summarised on the relevant laboratory test certificates.

The indicative waste classification of the samples of Head tested is presented in Table 7.7.

Table 7.7 Indicative Waste Classification							
Location	Depth (m.bgl)	Soil Type	EWC 2002 Catalogue Entry Code	Description Of EWC 2002	Hazardous ¹	Waste Classification ²	WAC Test
BH2	0.5	Red loamy clay	17-05-04	Soil and stones other than those mentioned in 17 05 03	No	Inert	Yes
BH4	1.2	Red clay	17-05-04	Soil and stones other than those mentioned in 17 05 03	No	Inert	Yes

Notes: ¹ Determined using dry soils analysis data and Hazwaste Online Waste Tool. ² Determined using Waste Acceptance Criteria analysis data.

7.4.3 Conclusion

Waste to be disposed off-site has been characterised in accordance with the Waste Acceptance Criteria 3-part risk assessment and based on the results could be classified as ***Inert***.

It must be mentioned that the WAC results provide an indication for off-site disposal at the suitable landfill however the responsibility regarding the acceptance of waste at a landfill site lies entirely with landfill operator.

Where naturally occurring soils need to be disposed off-site then these soils can be classified as 'listed' inert waste.

7.5 Reuse of Excavated Material On-Site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental Permitting Regulations 2007 (EPR). Environmental Permit Exemptions (EPE) are for the re-use of non-hazardous or inert waste only; hazardous waste cannot be re-used under a permit exemption. EPE apply only to imported inert waste materials; inert material arising on site and recovered on site is not classified as waste and does not require an exemption. It is possible that materials arising on-site will be classified as inert and would not need an exemption.

Environmental Permit Exemptions are only allowed for certain activities, placing controls on the quantities that can be stored and re-used. The re-use of waste shall be within areas and levels defined in planning applications and permissions for the development. An EPE requires a site specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site. Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

Should it be necessary to import materials from another site where materials are excavated and which is not material from a quarry or produced under a WRAP protocol, then an EPE would be necessary for the imported material whether the work was managed under the CoP or the EPR.

7.6 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

7.7 Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation. For instance, there may have been underground storage tanks (UST's) not identified during the Desk Study and/or Ground Investigation for which there is no historical or contemporary evidence. Such occurrences may be discovered during the demolition and construction phases for the redevelopment of the site.

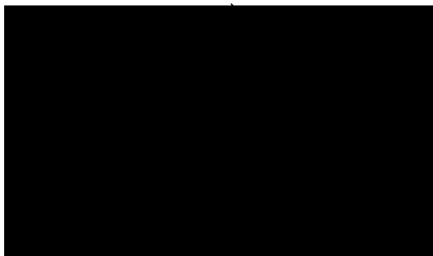
If such incidents occur then a Geo-environmental Engineer from Soils Limited must be advised and subject to a site visit(s), and if required additional sampling and testing, further remedial measures may be required.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination, this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then works should be suspended in the area of the site and the Local Authority be informed.

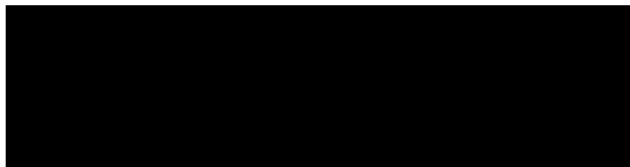
The following figures and appendices complete this report:

Figure 1	Site Location Plan
Figure 2	Trial Hole Locations
Appendix A	Field Work
Appendix B	Geotechnical Laboratory Analysis
Appendix C	Chemical Laboratory Analysis
Appendix D	Soil Guideline Values and General Assessment Criteria
Appendix E	HazWasteOnline Waste Classification Tool Results

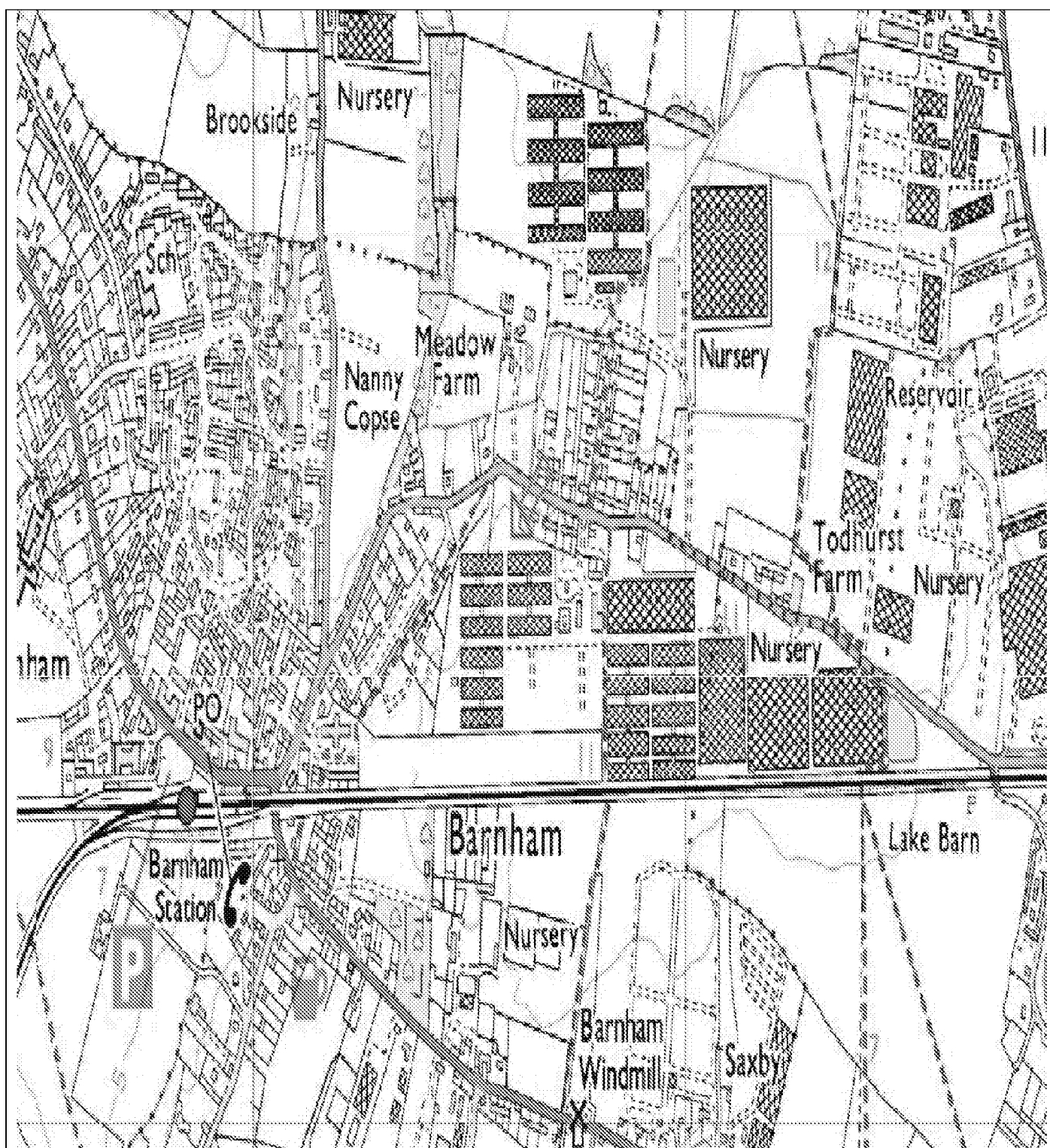


Nikos Sidiropoulos BSc, MSc.

Geotechnical Engineer



Eur Ing. R. B. Higginson B.Sc., PG. Dip., C.Eng., MICE., FGS.
Geotechnical Advisor



Project:

Eric Wall Nursery, Lake Lane, Barnham, West Sussex PO22 0AF

Client

Epitair Limited

Date:

April 2014

Ref:

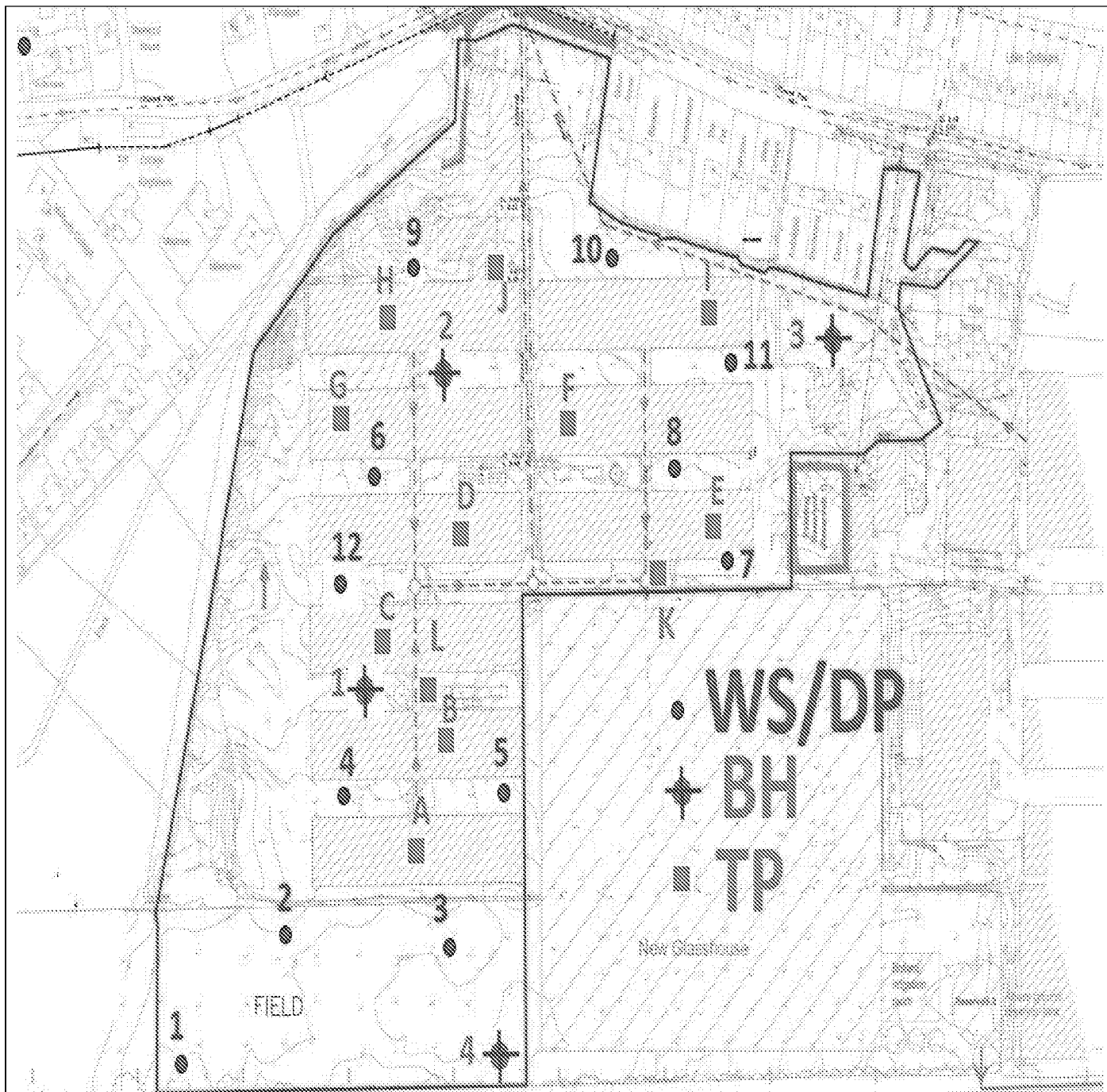
J14123

Site Location Map

Fig No. 1

soils
LIMITED

Geotechnical & Environmental
Consultants



Project: Eric Wall Nursery, Lake Lane, Barnham, West Sussex PO22 0AF		Fig No. 2  Geotechnical & Environmental Consultants
Client Epitair Limited	Date: April 2014	
Trial Hole Locations Plan	Ref: J14123	

Appendix A
Field Work

Soils Ltd (Greece)							Borehole No BH 1	
							Sheet 1 of 2	
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type Cable
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50
Client: Epitair Limited						Dates: 26/02/2014		Logged By

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	▽	0.20	D		0.10		Dark brown sandy clay with occasional gravel TOPSOIL	1	
		0.50-0.70	B				HEAD Orange brown silty sandy CLAY with fine to medium gravel		
		1.20-1.70	B		1.80			RTD Orange brown fine to medium SAND with occasional fine to medium gravel	2
		2.00	SPT	N=17 (1,2/ 3,4,5,5)					
		2.00-2.45	D						
		3.00	SPT	N=40 (2,2/ 5,9,12,14)	3				
		3.00-3.45	D						
		3.10-3.55	D						
		4.00	SPT	N=42 (4,5/ 7,9,11,15)	4.20			RTD SAND and GRAVEL	4
		4.00-4.45	D						
		4.20-4.60	B						
		5.00	CPT	N=15 (5,8/ 5,3,3,4)	5.70			LCF Grey to dark grey fissured CLAY	5
		5.00-5.50	B						
		6.00	D					6	
		6.50-6.80	U						
		7.00	D		7				
7.50	D								
8.00	SPT	N=21 (3,4/ 4,5,5,7)	8						
8.00-8.45	D								
9.00	D		9						
9.50-9.95	U	50							
9.95	D								
		Type	Results						

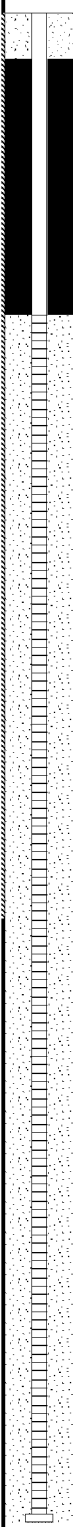
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Remarks: 1 Hour day work hand digging inspection pit to 1.20m bgl. No roots observed. Groundwater encountered at 1.0m bgl	
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Soils Ltd (Greece)							Borehole No BH 1	
							Sheet 2 of 2	
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type Cable
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50
Client: Epitair Limited						Dates: 26/02/2014		Logged By

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50	D				LCF Grey to dark grey fissured CLAY		
		11.00	SPT	N=25					11
		11.00-11.45	D	(3,3/ 5,5,6,9)					
		12.00	D						12
		12.50-12.90	U	50					
		12.90	D						13
		13.50	D						
		14.00	SPT	N=37					14
		14.00-14.45	D	(3,5/ 16,7,7,7)					
		15.00	D		15.00				15
								End of Borehole at 15.00 m	
									16
									17
									18
									19

Remarks: 1 Hour day work hand digging inspection pit to 1.20m bgl. No roots observed. Groundwater encountered at 1.0m bgl	
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Soils Ltd (Greece)							Borehole No BH 2 Sheet 1 of 2	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: -		Hole Type Cable	
Location: Eric Wall Nursery, Lake Lane, Barnham					Level: -		Scale 1:50	
Client: Epitair Limited					Dates: 25/02/2014		Logged By	
Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.25	D		0.20			TOPSOIL Dark brown sandy clay with gravel
		0.50	B					HEAD Firm orange brown silty sandy CLAY with fine to medium angular gravel.
		1.00	D					
		1.20-1.65	U	30				
		1.65	D		1.70			
		2.10	SPT	N=5				RTD Yellow brown silty clayey fine SAND
		2.10	D	(2,3/ 2,1,1,1)				
		3.10	SPT	N=38				
		3.10	D	(2,4/ 7,9,10,12)				
		4.00	SPT	N=50				
		4.00	D	(4,6/ 8,13,14,15)				
		4.60-4.90	D		4.60			LCF Stiff grey silty CLAY with occasional gravel.
		5.00	SPT	N=15				
		5.00	D	(18,6/ 3,3,4,5)	5.10			LCF Stiff grey silty fissured CLAY
		6.00	D					
		6.50-6.90	U	45				
		6.90-7.10	B					
		7.50	D					
		8.00	SPT	N=30				
	8.00	D	(3,3/ 6,7,8,9)					
	9.00	D						
	9.50-9.95	U	70					
	9.95	D						
		Type	Results					

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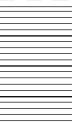
Remarks: 1 Hour day work hand digging inspection pit to 1.20m bgl. No roots or groundwater encountered.



Soils Ltd (Greece)							Borehole No BH 3 Sheet 1 of 2	
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type Cable
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50
Client: Epitair Limited						Dates: 25/02/2014		Logged By
Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D		0.10			TOPSOIL Dark brown sandy clay
		0.50-0.70	B					HEAD Orange brown silty sandy CLAY
		1.20-1.55	U	20	1.10			HEAD Orange brown silty sandy CLAY with fragments of fine to medium subangular gravel
		1.55	D					
		2.00	SPT	N=7 (4,3/	1.90			RTD Orange brown very clayey fine SAND with fragments of fine to medium subangular to angular gravel
		2.00-2.50	B	2,1,1,3)				
		3.00	SPT	N=8 (3,2/				
		3.00-3.45	D	2,2,2,2)				
		4.00	SPT	N=37 (5,7/	4.30			RTD SAND and GRAVEL
		4.00-4.45	D	8,8,8,13)				
		5.00	CPT	N=12 (7,8/				
		5.00-5.50	B	5,3,2,2)				
		6.00	D		5.70			LCF Grey to dark grey fissured CLAY
		6.50-6.95	U	40				
		6.95	D					
7.50	D							
8.00	SPT	N=21 (3,3/						
8.00-8.45	D	4,5,6,6)						
9.00	D							
9.50-9.95	U	45						
9.95	D							
		Type	Results					

Continued next sheet

Remarks: 1 Hour day work hand digging inspection pit to 1.20m bgl. No roots or groundwater observed.

Soils Ltd (Greece)							Borehole No BH 3 Sheet 2 of 2				
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type Cable			
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50			
Client: Epitair Limited						Dates: 25/02/2014		Logged By			
Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		10.50	D					LCF Grey to dark grey fissured CLAY			
		11.00	SPT	N=26 (3,4/ 5,5,7,9)						11	
		11.00-11.45	D								
		12.00	D							12	
		12.50-12.95	U	50							
		12.95	D							13	
		13.50	D								
		14.00	SPT	50 (5,7/ 8,42 for 70mm)	14.20					14	
		14.00-14.25	D							LCF Band of CLAYSTONE	
		15.00	D		15.00						
								End of Borehole at 15.00 m	16		
									17		
									18		
									19		
Remarks: 1 Hour day work hand digging inspection pit to 1.20m bgl. No roots or groundwater observed.											
											

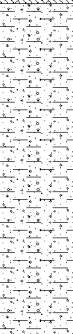
Soils Ltd (Greece)							Borehole No BH 4 Sheet 1 of 1		
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type Cable	
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50	
Client: Epitair Limited						Dates: 27/02/2014		Logged By	
Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D		0.10		TOPSOIL Dark sandy clay with gravel		
					0.40				HEAD Brown silty clayey SAND
		0.50-0.70	D						HEAD Brown silty sandy CLAY
		1.20-1.70	B		1.80		RTD Brown fine SAND		
		2.00	SPT	N=5 (2,1/ 1,1,2,1)					
		2.00-2.45	D						
		3.00	SPT	N=18 (1,2/ 2,3,5,8)					
		4.00	CPT	N=32 (4,5/ 7,7,8,10)	3.90		RTD SAND and GRAVEL		
		4.00-4.50	B						
		5.00	CPT	N=41 (5,7/ 9,10,11,11)					
		5.00-5.50	B						
		6.00	D		6.30		LCF Grey to dark grey fissured CLAY		
		6.50-6.95	U	35					
		6.95	D						
		7.50	D						
		8.00	SPT	N=15 (2,2/ 3,3,4,5)	9.00		LCF Grey silty SAND		
8.00-8.45	D								
9.00	D								
9.50	SPT	50 (8,9/ 12,12,14,12 for 65mm)							
		9.50-9.90	D						
		Type	Results	End of Borehole at 10.00 m					
Remarks: 1 Hour day work hand digging inspection pit to 1.20m bgl. 1 Hour day work winch rig and equipment out of field. No roots observed. Groundwater seepage at 0.70m bgl.									

Soils Ltd (Greece)							Borehole No WS 1	
							Sheet 1 of 1	
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type WS
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50
Client: Epitair Limited						Dates: 26/02/2014		Logged By GB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.20	D & J		0.40			Turf over fine to medium soft to very soft dark grey brown clayey SILT with fine to medium gravel, glass fragments and occasional fine rootlets. MADE GROUND			
		0.30	D & J								
		0.50	D & J								
		0.80	D		2.80			HEAD Soft light orange brown slightly sandy CLAY with occasional fine roots.			
		1.00	D								
		1.50	D								
		2.00	D								
		2.50	D								
				3.00	D		4.10				RTD Fine to medium dark yellow brown SAND with fine to medium gravel.
				3.50	D						
		4.00	D								
End of Borehole at 4.10 m											

Remarks: Roots observed to 2.00m bgl. Groundwater strike at 1.5m bgl.

Soils Ltd (Greece)							Borehole No WS 3	
							Sheet 1 of 1	
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type WS
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50
Client: Epitair Limited						Dates: 26/02/2014		Logged By GB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.20	D		0.50			Turf over fine to medium dark grey soft to very soft brown very clayey SILT with occasional roots and fine to medium gravel. TOPSOIL		
		0.40	D							
		0.60	D							
		0.80	D							
		1.00	D							
		1.50	D		2.70			HEAD Soft becoming very soft with depth light orange brown slightly sandy CLAY with rare fine to medium subangular gravel becoming more sandy with depth.	1	
		2.00	D							
		2.50	D							
		3.00	D							
		3.50	D							
4.00	D		4.10			RTD Fine to medium dense dark yellow orange brown SAND with fine to medium gravel	3			
									4	
									5	
									6	
									7	
									8	
									9	
End of Borehole at 4.10 m										

Remarks: Roots observed to 0.50m bgl. Groundwater standing at 1.4m bgl.								

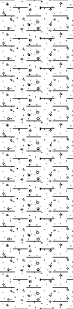
ARUN DISTRICT COUNCIL BN/19/16/PL

Soils Ltd (Greece)						Borehole No WS 9	
Project Name Eric Wall Nursery						Project No. 14123	
Location: Eric Wall Nursery, Lake Lane, Barnham						Co-ords: -	
Client: Epitair Limited						Level: -	
Dates: 26/02/2014						Scale 1:50	
Logged By GB							

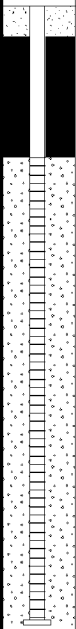
Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D & J		0.40			Turf over fine to medium soft dark grey orange mottled very clayey SILT with occasional rootlets, fine to medium gravel and rare glass fragments. MADE GROUND	1
		0.40	D & J						
		0.60	D & J						
		0.80	D						
		1.00	D		1.80			HEAD Soft becoming very soft light grey orange mottled brown slightly sandy CLAY with fine to medium angular gravel.	2
		1.50	D						
		2.00	D						
		2.50	D						
		3.00	D						
		3.50	D						
3.90	D		3.90				End of Borehole at 3.90 m	4	
								5	
								6	
								7	
								8	
								9	

Remarks: Roots observed to 0.40m bgl. Groundwater standing at 0.45m bgl.	
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Soils Ltd (Greece)						Borehole No WS 10	
Project Name Eric Wall Nursery						Project No. 14123	
Location: Eric Wall Nursery, Lake Lane, Barnham						Co-ords: -	
Client: Epitair Limited						Level: -	
Dates: 26/02/2014						Scale 1:50	
Logged By GB							

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D & J		0.40			Turf over fine to medium soft light grey brown very clayey SILT with occasional rootlets and fine to medium angular gravel. TOPSOIL	
		0.40	D & J						
		0.60	D & J						
		0.80	D						
		1.00	D						
		1.50	D		2.50		HEAD Soft becoming soft to firm light orange grey brown sandy CLAY with occasional angular gravel and fine roots.	1	
		2.00	D						2
		2.50	D						
		3.00	D						3
		3.50	D						
4.00	D		4.10			RTD Fine yellow grey clayey SAND.	4		
End of Borehole at 4.10 m							5		
								6	
								7	
								8	
								9	

Remarks: Roots observed to 2.50m bgl. Standing at 2.05m bgl	
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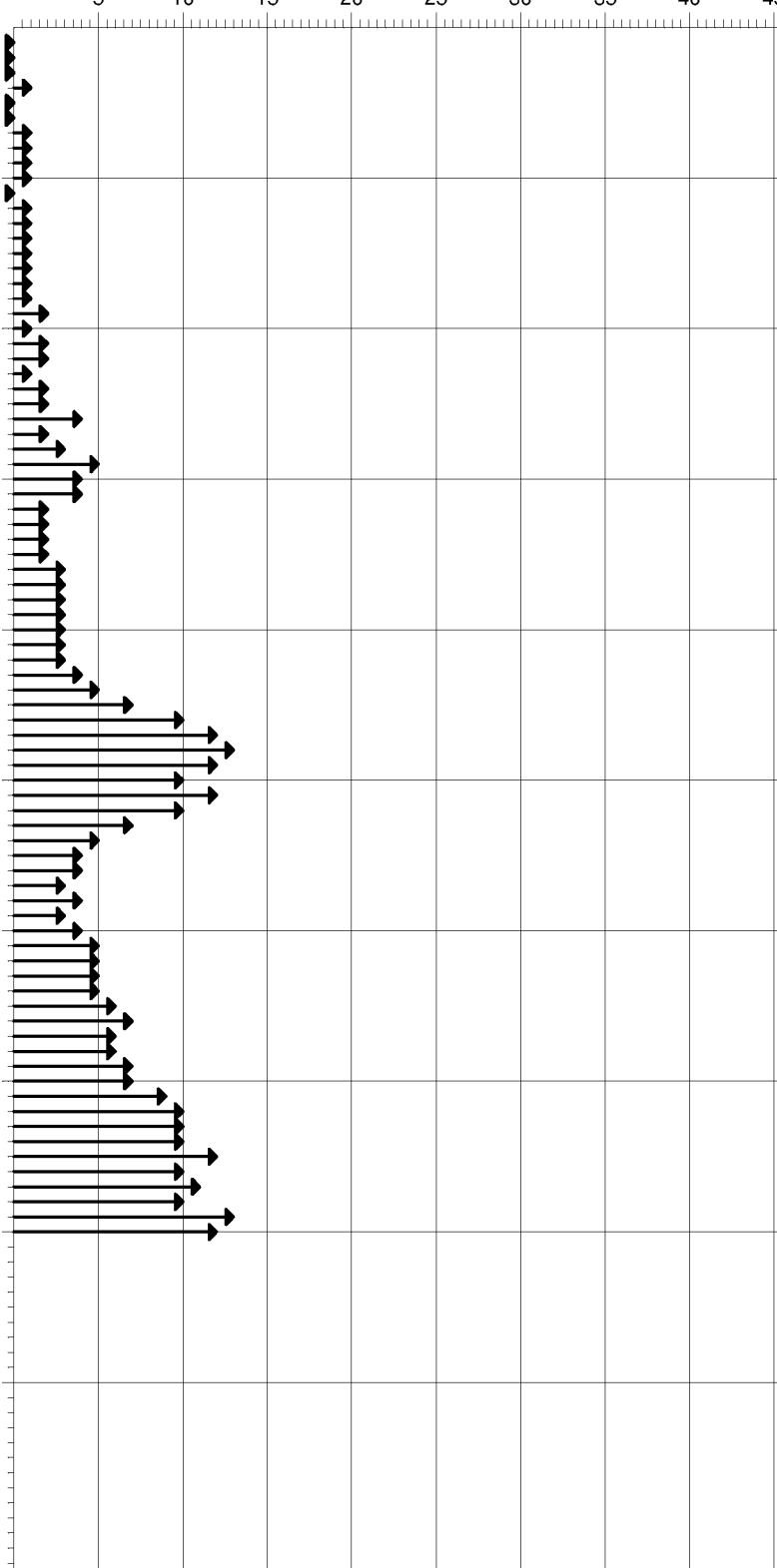
Soils Ltd (Greece)							Borehole No WS 11 Sheet 1 of 1		
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type WS	
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50	
Client: Epitair Limited						Dates: 26/02/2014		Logged By GB	
Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D		0.05			Dark brown fine sandy SILT. TOPSOIL	
		0.50	B					HEAD Soft to firm orange brown fine sandy silty CLAY with occasional fine roots and occasional ferruginous staining.	
		0.70	D						
		1.20	D						1
		1.60	D		1.50			HEAD Firm orange brown fine sandy CLAY with fine to medium sub-rounded to sub-angular gravel.	
		2.10	D		2.00			RTD Orange brown silty fine to medium SAND.	2
		2.60	D						
		3.10	D						3
		3.60	D						
		4.10	D		4.10				4
								End of Borehole at 4.10 m	
									5
								6	
								7	
								8	
								9	
Remarks: Roots observed to 1.50m bgl. Groundwater found from surface. Well installed									

Soils Ltd (Greece)							Borehole No WS 12	
							Sheet 1 of 1	
Project Name Eric Wall Nursery				Project No. 14123		Co-ords: -		Hole Type WS
Location: Eric Wall Nursery, Lake Lane, Barnham						Level: -		Scale 1:50
Client: Epitair Limited						Dates: 26/02/2014		Logged By GB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D		0.40			Soft to firm brown grey brown and orange brown mottled silty fine sandy CLAY with fine roots. TOPSOIL	1
		0.50	B					HEAD Orange brown and brown ferruginous stained fine sandy silty CLAY with occasional fine roots and occasional ferruginous staining.	
		1.00	D		1.80				2
		1.50	D						
		1.90	D						
		2.40	D		4.10			RTD Orange brown silty fine to medium SAND becoming grey brown from 2.75m bgl	3
		2.90	D						
		3.40	D						
		3.90	D						
							End of Borehole at 4.10 m	4	
								5	
								6	
								7	
								8	
								9	

Remarks: Roots observed to 1.80m bgl. Groundwater found from surface.								

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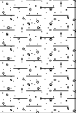
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(Nm)		0	1	1	2	1	5	10	15	20	25	30	35	40	45	10	20	30	40	1	0	1	1	2	1														0	1	1	0	1														0	1	1	1	0														1	1	3	7	8														1	9	9	7	6	6													2	5	4	3	3	3														3	2	2	1	1														3	2	4	5	9														12	14	20	15	16														20	19	21	19	19														3	16	11	6	4	4														5	4	4	5	4														5	5	6	5	6														6	7	7	6	6														9	8	9	8	7														4	8	8	9	8	8																																																																																						5																																																																																											6																																																																																											7																																																																																											8																																																																																											9																																																																																											<table><tr><td>Fall Height</td><td>750</td><td>Cone Diameter</td><td>50</td><td rowspan="3">Logger GJ</td></tr><tr><td>Hammer Wt</td><td>63.50</td><td>Final Depth</td><td>7.900</td></tr><tr><td>Probe Type</td><td>DPSH</td><td>Log Scale</td><td>1:50</td></tr></table>			Fall Height	750	Cone Diameter	50	Logger GJ	Hammer Wt	63.50	Final Depth	7.900	Probe Type	DPSH	Log Scale	1:50
Depth (m)	Readings Blows/100mm				Diagram (N100 Values)										Torque (Nm)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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Soils Ltd (Greece)						Trialpit No TP A Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: -		Scale 1:25
Client: Epitair Limited					Depth 0.60m		Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.25			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint	
						Trialpit Complete at 0.60 m	
						1	
						2	
						3	
						4	
Remarks: Roots observed to 0.40m bgl							
Groundwater: Dry							



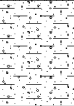
Soils Ltd (Greece)					Trialpit No TP B Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -	
Location: Eric Wall Nursery, Lake Lane, Barnham			Dimensions: -			
Client: Epitair Limited			Depth 0.60m			
Date 26/02/2014			Scale 1:25			
Logged By CF						
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.50	J		0.25			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint
						Trialpit Complete at 0.60 m
						1
						2
						3
						4
Remarks: Roots observed to 0.30m bgl						
Groundwater: Dry						

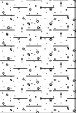


Soils Ltd (Greece)						Trialpit No TP C Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: -		Scale 1:25
Client: Epitair Limited					Depth 0.60m		Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.20			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint	
						Trialpit Complete at 0.60 m	
						1	
						2	
						3	
						4	
Remarks: Roots observed to 0.30m bgl							
Groundwater: Dry							



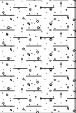
PlotBASE 3.1 (B04 426-48) Standard Trialpit Log v2 dated 27th Nov 03

Soils Ltd (Greece)						Trialpit No TP D Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: - Depth 0.60m		Scale 1:25
Client: Epitair Limited							Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.25			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60		HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint		
						Trialpit Complete at 0.60 m	
						1	
						2	
						3	
						4	
Remarks: Roots observed to 0.30m bgl							
Groundwater: Dry							

Soils Ltd (Greece)						Trialpit No T P E Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: -		Scale 1:25
Client: Epitair Limited					Depth 0.60m		Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.20			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint	
						Trialpit Complete at 0.60 m	
						1	
						2	
						3	
						4	
Remarks: Roots observed to 0.50m bgl							
Groundwater: Dry							

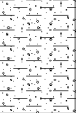


PlotBASE 3.1 (B04 426-48) Standard Trialpit Log v2 dated 27th Nov 03

Soils Ltd (Greece)						Trialpit No TP F Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: -		Scale 1:25
Client: Epitair Limited					Depth 0.60m		Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.20			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint	
						Trialpit Complete at 0.60 m	
						1	
						2	
						3	
						4	
Remarks: Roots observed to 0.40m bgl							
Groundwater: Dry							

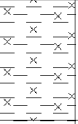


PlotBASE 3.1 (B) 426-48 Standard Trialpit Log v2 dated 27th Nov 03

Soils Ltd (Greece)						Trialpit No TP G Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: -		Scale 1:25
Client: Epitair Limited					Depth 0.60m		Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.20			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint	
						Trialpit Complete at 0.60 m	
1 2 3 4							
Remarks: Roots observed to 0.30m bgl							
Groundwater: Dry							



PlotBASE 3.1 (B) 426-48 Standard Trialpit Log v2 dated 27th Nov 03

Soils Ltd (Greece)						Trialpit No TP H Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: -		Scale 1:25
Client: Epitair Limited					Depth 0.60m		Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.20			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint	
						Trialpit Complete at 0.60 m	
						1	
						2	
						3	
						4	
Remarks: Roots observed to 0.30m bgl							
Groundwater: Dry							



Soils Ltd (Greece)						Trialpit No TP I Sheet 1 of 1	
Project Name Eric Wall Nursery			Project No. 14123		Co-ords: - Level: -		Date 26/02/2014
Location: Eric Wall Nursery, Lake Lane, Barnham					Dimensions: -		Scale 1:25
Client: Epitair Limited					Depth 0.60m		Logged By CF
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.50	J		0.20			Light brown sandy clayey fine to medium sub-angular to sub-rounded flint GRAVEL. Sand is fine to coarse. TOPSOIL	
			0.60			HEAD Light orange brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded made up of flint	
						Trialpit Complete at 0.60 m	
						1	
						2	
						3	
						4	
Remarks: Roots observed to 0.50m bgl							
Groundwater: Dry							



PlotBASE 3.1 (B04 426-48) Standard Trialpit Log v2 dated 27th Nov 03

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Appendix B

Geotechnical Laboratory Analysis

Client : Soils Ltd					Our Job/report no: 16324			Samples Rec : 14/03/2014		Testing Started: 31/03/2014		
Project name: Barnham					Project No: J14123			Project Started: 14/03/2014		Date reported: 04/04/2014		
BH / TP No	Sample no / ref	Sample depth (m)	Description	Moisture content (%)	Bulk Density (Mg/m3)	Dry density (Mg/m3)	Cell Pressure (kPa)	Strain at failure (%)	Max Deviator Stress (kPa)	Mode of failure	Shear Strength (kPa)	Phi (deg)
BH1	U	6.50	High strength fissured dark grey CLAY	25	2.06	1.66	130	5.1	242	Brittle	121	NA
BH1	U	9.50	High strength fissured dark grey CLAY	26	2.05	1.63	190	5.6	174	Brittle	87	NA
BH1	U	12.50	High strength fissured dark grey CLAY	27	2.04	1.61	250	7.1	291	Brittle	146	NA
BH2	U	1.20	Medium strength brown slightly sandy slightly gravelly CLAY with occasional black flecks (gravel is fine and sub-angular)	23	2.09	1.70	24	18	108	Plastic	54	NA
BH2	U	9.50	High strength fissured dark grey CLAY	24	2.05	1.66	190	5.1	267	Brittle	134	NA
BH3	U	1.20	Medium strength brown slightly sandy slightly gravelly CLAY (gravel is fm and sub-angular)	18	2.09	1.76	24	18	96	Plastic	48	NA
BH3	U	9.50	High strength fissured dark grey CLAY	26	2.07	1.65	190	6.6	269	Brittle	135	NA
BH3	U	12.50	High strength fissured dark grey CLAY	25	2.07	1.65	250	4.5	220	Brittle	110	NA
BH4	U	6.50	Medium strength fissured dark grey CLAY	27	2.02	1.60	130	6.6	135	Brittle	67	NA

Summary of Undrained Triaxial Compression Testing

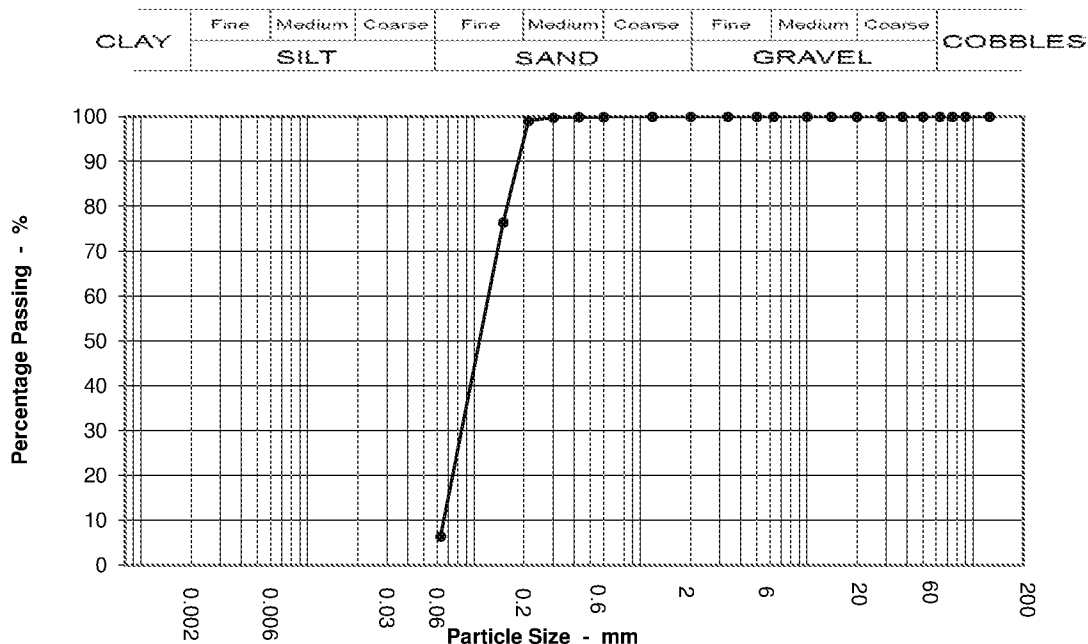
Checked and
approved

BS 1377 : Part 7 : Clause 8 : 1990

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford WD18 9RU

2519

K4 SOILS 	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	16324
		Project No:	J14123
Location	Barnham	Borehole / Trial Pit No:	WS10
		Depth	2.50 m
Visual Soil Description	Brown clayey silty fine SAND	Sample Type/No	D -



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	76		
0.063	6		

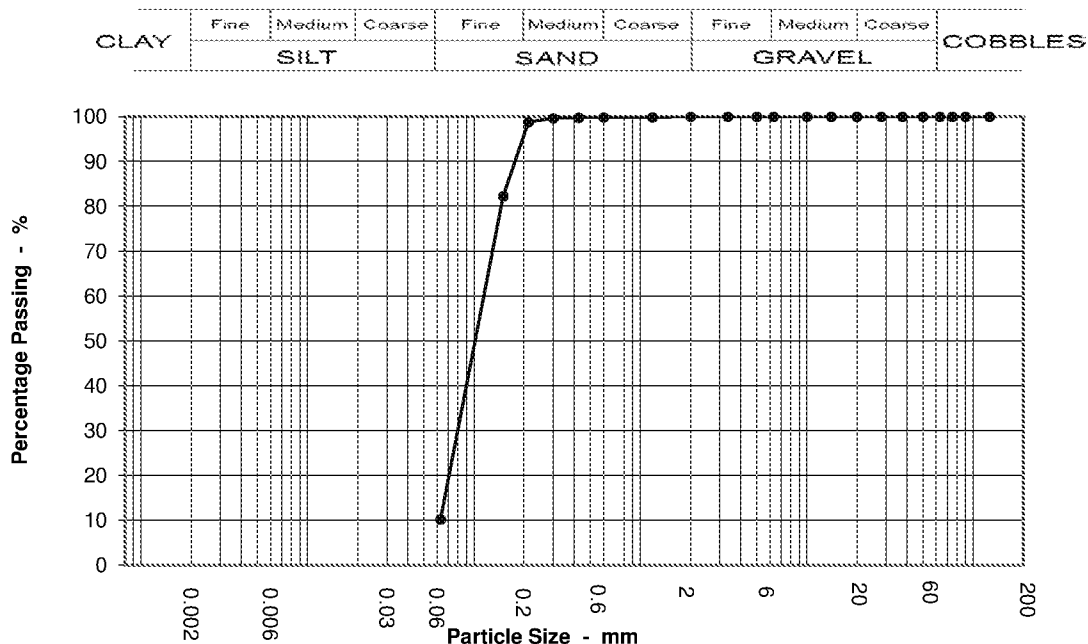
Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	93.6
Silt & Clay	6.4

Grading Analysis	
D100	125.0
D60	0.1
D10	0.1
Uniformity Coefficient	2

K4 SOILS LABORATORY	Approved Signatories:	Checked and Approved	
Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU. E-mail: k4soils@aol.com	K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)	Initials: kp	
	Test results relate only to the sample numbers shown above	Date: 04/04/2014	
All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9			
			2519

K4 SOILS 	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	16324
		Project No:	J14123
Location	Barnham	Borehole / Trial Pit No:	WS9
		Depth	2.00 m
Visual Soil Description	Brown clayey silty fine SAND	Sample Type/No	D -



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	82		
0.063	10		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A
Suitable Amount Of Sample Received	Yes

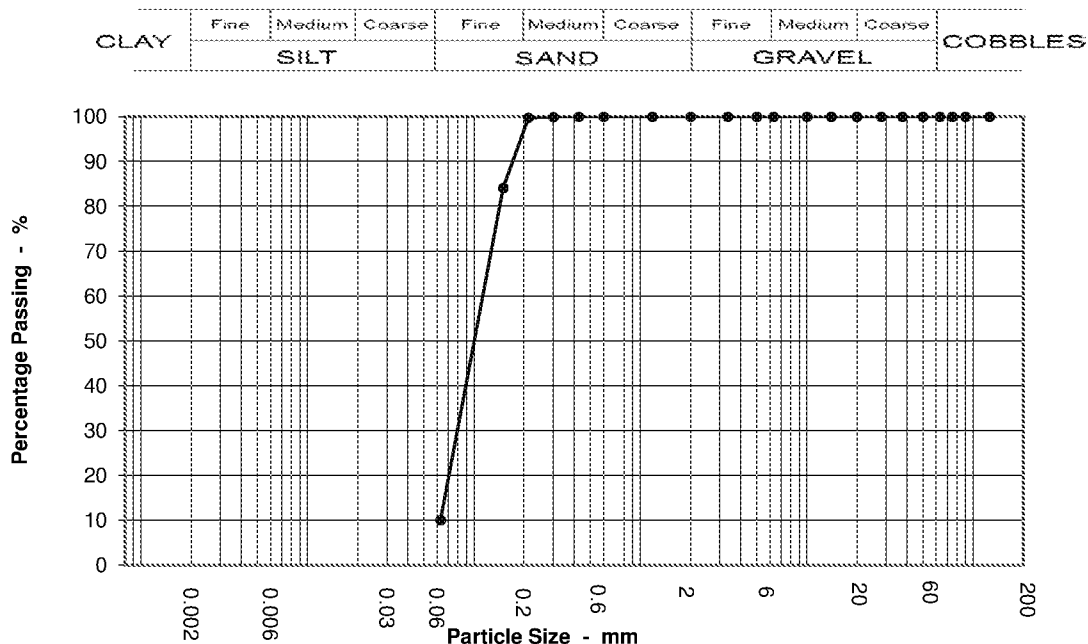
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	89.9
Silt & Clay	10.1

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

K4 SOILS LABORATORY	Approved Signatories:	Checked and Approved	
Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU. E-mail: k4soils@aol.com	K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)	Initials: kp	
	Test results relate only to the sample numbers shown above	Date: 04/04/2014	
All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9			

All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9

K4 SOILS 	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	16324
		Project No:	J14123
Location	Barnham	Borehole / Trial Pit No:	WS6
		Depth	2.00 m
Visual Soil Description	Brown clayey silty fine SAND	Sample Type/No	D -



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	84		
0.063	10		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A
Suitable Amount Of Sample Received	Yes

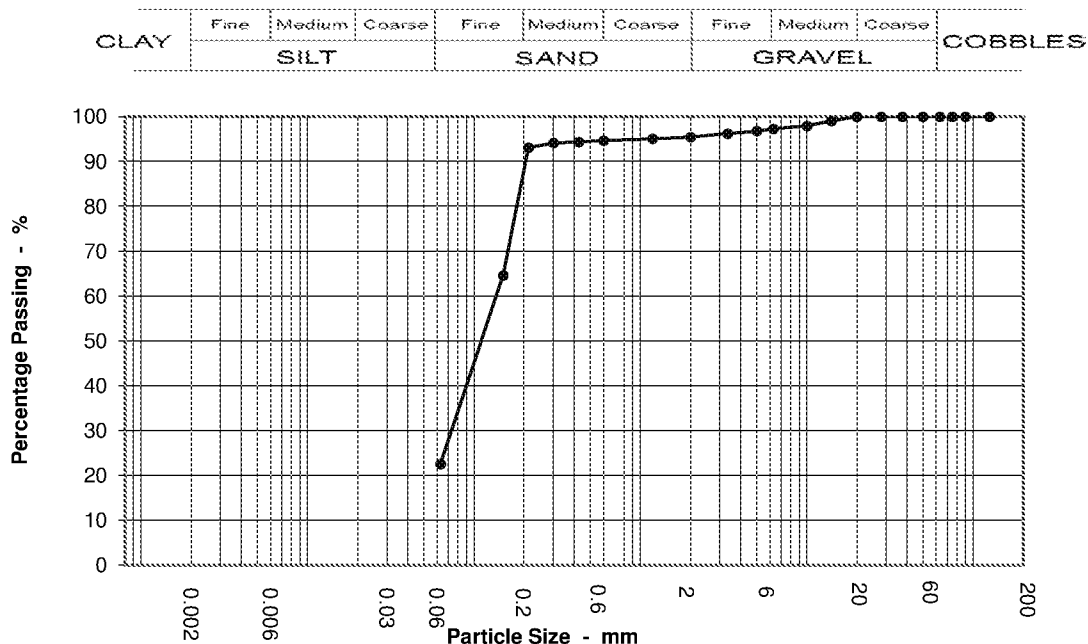
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	90.0
Silt & Clay	10.0

Grading Analysis	
D100	125.0
D60	0.1
D10	0.1
Uniformity Coefficient	2

K4 SOILS LABORATORY	Approved Signatories:	Checked and Approved	
Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU. E-mail: k4soils@aol.com	K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)	Initials: kp	
	Test results relate only to the sample numbers shown above	Date: 04/04/2014	
All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9			
			2519

All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9

K4 SOILS 	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	16324
		Project No:	J14123
Location	Barnham	Borehole / Trial Pit No:	BH3
		Depth	2.00 m
Visual Soil Description	Brown slightly gravelly very clayey fine SAND (gravel is fm and sub-angular to angular)	Sample Type/No	B -



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	98		
6.3	97		
5	97		
3.35	96		
2	95		
1.18	95		
0.6	95		
0.425	94		
0.3	94		
0.212	93		
0.15	65		
0.063	23		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	4.6
Sand	72.9
Silt & Clay	22.5

Grading Analysis	
D100	125.0
D60	0.1
D10	
Uniformity Coefficient	N/A

K4 SOILS LABORATORY	Approved Signatories:	Checked and Approved	
Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU. E-mail: k4soils@aol.com	K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)	Initials: kp	
	Test results relate only to the sample numbers shown above	Date: 04/04/2014	
All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9			

All samples connected with this report, incl any on 'hold' will be disposed off according to company policy. A copy of this policy is available on request. Sheet 3/3 MSF-11/R9



Report of California Bearing Ratio Test

BS 1377 : Part 4 : 1990:Clause 7.4

Project name: Barnham

Samples Received: 14/03/2014

Project Started: 14/03/2014

Client: Soils Ltd

Testing started: 31/03/2014

Project no: J14123

Our job /report no: 16324

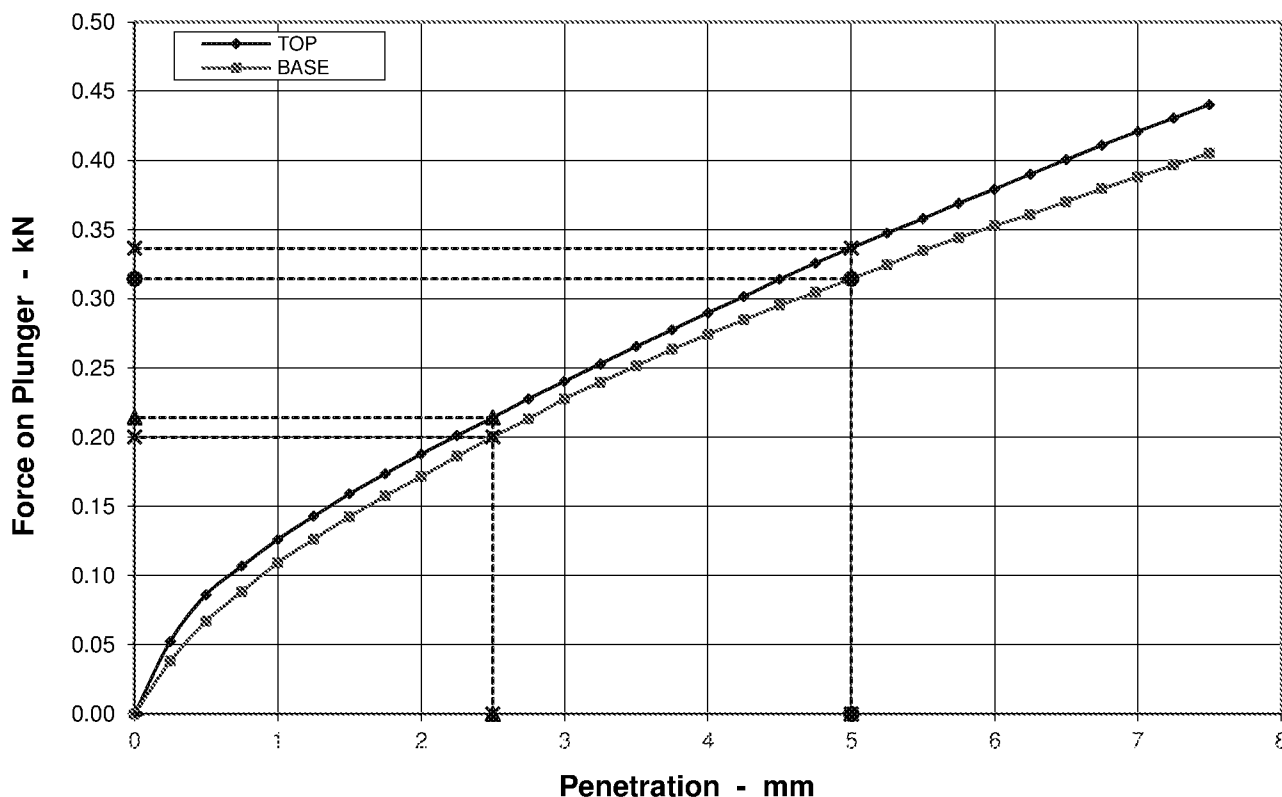
Date reported: 04/04/2014

BH / TP no: BH3

Sample no: B

Depth (m): 0.50 - 0.70

Soil Description: Brown sandy CLAY



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days N/A
	Amount of Swell	mm N/A

Sample Conditions		
Natural Moisture Content	%	25
Moisture Content - TOP	%	25
Moisture Content - BASE	%	25
Bulk Density	Mg/m ³	1.96
Dry Density	Mg/m ³	1.57

Test Conditions		
Sample Retained on 20 mm sieve	%	0.0
Sample Retained on 37.5 mm sieve	%	0.0
Seating Load - TOP	N	10
Seating Load - BASE	N	10
Surcharge	kg	4.4

Penetration mm	CBR Values %	
	TOP	BASE
2.5	1.6	1.5
5	1.7	1.6
Accepted CBR	1.7	1.6

K4 SOILS LABORATORY

Unit 8, Olds Close, Watford, Herts, WD18 9RU.

Tel:01923711288 Fax:01923711311.

E-mail: k4soils@aol.com

Approved Signatories:

K.Phaure(Tech.Mgr)

J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved

Initials: kp

Date: 04/04/2014



2519



Report of California Bearing Ratio Test

BS 1377 : Part 4 : 1990:Clause 7.4

Project name: Barnham

Samples Received: 14/03/2014

Project Started: 14/03/2014

Client: Soils Ltd

Testing started: 31/03/2014

Project no: J14123

Our job /report no: 16324

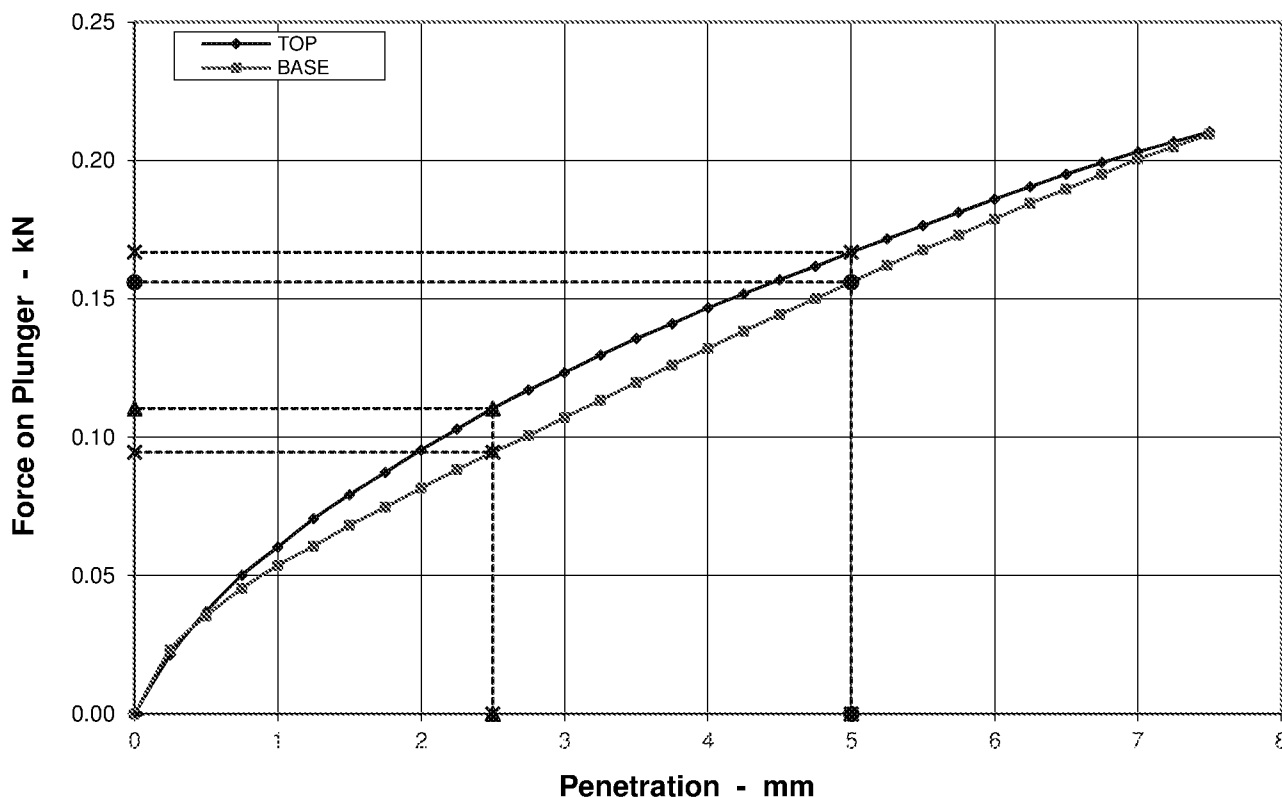
Date reported: 04/04/2014

BH / TP no: BH1

Sample no: B

Depth (m): 0.50 - 0.70

Soil Description: Brown slightly gravelly sandy CLAY (gravel is fm and sub-angular to sub-rounded)



Preparation	Method of Compaction	
	Rammer compaction with specified effort	
	Hammer type	2.5kg Rammer
	Soaking Period	days N/A
	Amount of Swell	mm N/A

Sample Conditions		
Natural Moisture Content	%	27
Moisture Content - TOP	%	26
Moisture Content - BASE	%	27
Bulk Density	Mg/m ³	2.03
Dry Density	Mg/m ³	1.60

Test Conditions		
Sample Retained on 20 mm sieve	%	0.0
Sample Retained on 37.5 mm sieve	%	0.0
Seating Load - TOP	N	10
Seating Load - BASE	N	10
Surcharge	kg	4.4

Penetration mm	CBR Values %	
	TOP	BASE
2.5	0.84	0.72
5	0.83	0.78
Accepted CBR	0.84	0.78

K4 SOILS LABORATORY

Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311.
E-mail: k4soils@aol.com

Approved Signatories: K.Phaure(Tech.Mgr)
J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved

Initials: kp

Date: 04/04/2014

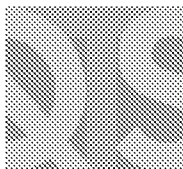


2519

All samples connected with this report, and any on 'hold' will be disposed off according to Company Policy. A copy of this policy is available on request.

MSF-11/R16 Sheet 2/2

Project Name: Barnham						Samples Received: 14/03/2014		K4 SOILS 	
						Project Started: 14/03/2014			
Client: Soils Ltd						Testing Started: 04/03/2014			
Project No: J14123				Our job/report no: 16324		Date Reported: 07/04/2014			
Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
WS3	D	2.50	Brown gravelly very sandy CLAY /clayey SAND (gravel is fine and sub-angular)	16	23	14	9	70	CL
WS2	D	2.50	Brown slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular to angular)	26	34	19	15	96	CI
WS5	D	2.50	Light brown and grey brown very silty CLAY with traces of fine rootlets and rare fine gravel	24	33	18	15	99	CL
WS7	D	2.50	Greenish brown and orangey brown SAND	24	-	-	-	-	Non Plastic
WS8	D	2.00	Light brown and grey silty CLAY with occasional scattered carbonaceous stains and rare fine gravel	21	37	20	17	99	CI
WS12	D	1.50	Brown and greyish brown slightly fine sandy very silty CLAY with traces of fine rootlets and scattered carbonaceous stains	24	38	20	18	100	CI
 Summary of Test Results BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method. BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index. BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.									Checked and Approved Initials: K.P Date: 07/04/2014
Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr) All samples connected with this report ,incl any on 'hold' will be stored and disposed off according to Company policy.Acopny of this policy is available on request.									



Nikos Sidiropoulos
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN



QTS Environmental Report No: 14-20247

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Sample Receipt Date: 17/03/2014

Sample Scheduled Date: 17/03/2014

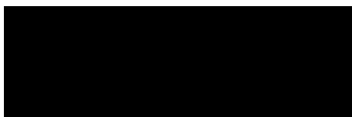
Report Issue Number: 1

Reporting Date: 21/03/2014

Authorised by:

Russell Jarvis
Director

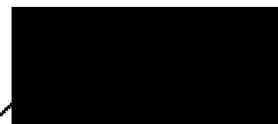
On behalf of QTS Environmental Ltd



Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



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



Soil Analysis Certificate						
QTS Environmental Report No: 14-20247	Date Sampled	25/02/14	25/02/14	25/02/14	25/02/14	25/02/14
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Barnham	TP / BH No	WS1	WS11	BH1	BH3	WS9
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	2.50	3.10	15.00	7.50	3.00
Reporting Date: 21/03/2014	QTSE Sample No	97409	97410	97411	97412	97413

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.5	6.7	7.8	7.8	7.6
Total Sulphate as SO ₄	mg/kg	< 200	NONE	250	< 200	1845	1560	288
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.02	< 0.01	0.30	0.37	0.03
Total Sulphur	mg/kg	< 200	NONE	< 200	< 200	2530	1553	< 200
Ammonium as NH ₄	mg/kg	< 0.5	NONE	< 0.5	10.6	15.4	17.3	12.8
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	14	8	30	30	49
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	< 3	< 3	5	4	102
W/S Magnesium	g/l	< 0.0001	NONE	0.0138	0.0056	0.0814	0.0813	0.0133

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

Analysis carried out on the dried sample is corrected for the stone content

Subcontracted analysis ⁽⁵⁾

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



Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 14-20247

Soils Ltd

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Reporting Date: 21/03/2014

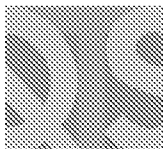
QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
\$ 97409	WS1	None Supplied	2.50	16.6	Light brown clay
\$ 97410	WS11	None Supplied	3.10	16.5	Light brown sand
\$ 97411	BH1	None Supplied	15.00	18.6	Light grey clay
\$ 97412	BH3	None Supplied	7.50	20.1	Light grey clay with crystalline material
\$ 97413	WS9	None Supplied	3.00	17.5	Light brown sand

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}

\$ samples exceeded recommended holding times



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



Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 14-20247

Soils Ltd

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Reporting Date: 21/03/2014

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	Determination of acetone/hexane extractable hydrocarbons by GC-FID	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 @ 450°C	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 SO ₄) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO ₄) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO ₄) - 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	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried

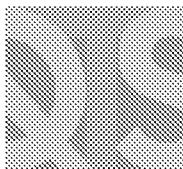
AR As Received

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Appendix C

Chemical Laboratory Analysis



Nikos Sidiropoulos
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN



QTS Environmental Report No: 14-20379

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Sample Receipt Date: 20/03/2014

Sample Scheduled Date: 20/03/2014

Report Issue Number: 1

Reporting Date: 26/03/2014

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd



Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



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



Soil Analysis Certificate

QTS Environmental Report No: 14-20379	Date Sampled	25/02/14	25/02/14	25/02/14	25/02/14	25/02/14
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Barnham	TP / BH No	TPF	TPH	TPG	TPD	TPC
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.50	0.50	0.50	0.50
Reporting Date: 26/03/2014	QTSE Sample No	97968	97969	97970	97971	97972

Determinand	Unit	RL	Accreditation					
Asbestos Screen ⁽⁵⁾	N/a	N/a	ISO 17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.9	7.8	7.2	6.8	7.1
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.08	0.05	0.08	0.08	0.12
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Organic Matter	%	< 0.1	NONE	1	0.8	1	0.9	0.9
Total Organic Carbon (TOC)	%	< 0.1	NONE	0.6	0.5	0.6	0.5	0.5
Arsenic (As)	mg/kg	< 2	MCERTS	7	10	8	5	8
Beryllium (Be)	mg/kg	< 0.5	NONE	0.5	0.6	< 0.5	< 0.5	0.5
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	1.1
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	26	25	27	22	35
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	18	12	15	9	19
Lead (Pb)	mg/kg	< 3	MCERTS	13	15	15	10	13
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	17	20	16	12	17
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	36	39	39	31	48
Zinc (Zn)	mg/kg	< 3	MCERTS	77	42	52	46	65
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
EPH (C10 - C40)	mg/kg	< 6	MCERTS					

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

Analysis carried out on the dried sample is corrected for the stone content

Subcontracted analysis ⁽⁵⁾

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Maidstone
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Soil Analysis Certificate

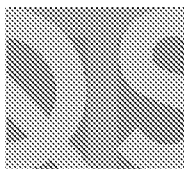
QTS Environmental Report No: 14-20379	Date Sampled	25/02/14	25/02/14	25/02/14	25/02/14	25/02/14
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Barnham	TP / BH No	TPB	TPA	TPK	TPJ	TPL
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.50	0.30	0.30	0.30
Reporting Date: 26/03/2014	QTSE Sample No	97973	97974	97976	97977	97978

Determinand	Unit	RL	Accreditation					
Asbestos Screen ⁽⁵⁾	N/a	N/a	ISO 17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	7.1	7.1			
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.11	0.12			
Sulphide	mg/kg	< 5	NONE	< 5	< 5			
Organic Matter	%	< 0.1	NONE	0.9	0.8			
Total Organic Carbon (TOC)	%	< 0.1	NONE	0.5	0.4			
Arsenic (As)	mg/kg	< 2	MCERTS	8	9			
Beryllium (Be)	mg/kg	< 0.5	NONE	0.6	0.6			
W/S Boron	mg/kg	< 1	NONE	< 1	< 1			
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5			
Chromium (Cr)	mg/kg	< 2	MCERTS	38	36			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	18	18			
Lead (Pb)	mg/kg	< 3	MCERTS	14	13			
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	19	19			
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			
Vanadium (V)	mg/kg	< 2	NONE	52	49			
Zinc (Zn)	mg/kg	< 3	MCERTS	66	58			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2			
EPH (C10 - C40)	mg/kg	< 6	MCERTS			< 6	< 6	< 6

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

Analysis carried out on the dried sample is corrected for the stone content

Subcontracted analysis ⁽⁵⁾



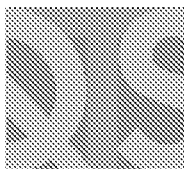
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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 14-20379	Date Sampled	25/02/14	25/02/14	25/02/14	25/02/14	25/02/14
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Barnham	TP / BH No	TPF	TPH	TPG	TPD	TPC
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.50	0.50	0.50	0.50
Reporting Date: 26/03/2014	QTSE Sample No	97968	97969	97970	97971	97972

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	< 0.1	< 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	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 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	< 0.1	< 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 dried at less than 30°C



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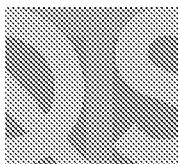


Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 14-20379	Date Sampled	25/02/14	25/02/14			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Barnham	TP / BH No	TPB	TPA			
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.50	0.50			
Reporting Date: 26/03/2014	QTSE Sample No	97973	97974			

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

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



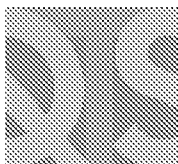
QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN

Soil Analysis Certificate - Organochlorine Pesticides

QTS Environmental Report No: 14-20379	Date Sampled	25/02/14	25/02/14	25/02/14	25/02/14
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Barnham	TP / BH No	TPF	TPG	TPC	TPA
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.50	0.50	0.50
Reporting Date: 26/03/2014	QTSE Sample No	97968	97970	97972	97974

Determinand	Unit	RL	Accreditation					
Aldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
alpha-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
beta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
cis-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
delta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dieldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Endosulfan A	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Endosulfan B	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Endrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
gamma-HCH (Lindane)	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Heptachlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Heptachlor epoxide	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Hexachlorobenzene (HCB)	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Isodrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Methoxychlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
o,p' - DDD	mg/kg	< 0.02	NONE	0.03	< 0.02	< 0.02	< 0.02	< 0.02
o,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
o,p' - DDT	mg/kg	< 0.02	NONE	0.06	< 0.02	< 0.02	< 0.02	< 0.02
p,p' - DDD	mg/kg	< 0.02	NONE	0.02	< 0.02	< 0.02	< 0.02	< 0.02
p,p' - DDE	mg/kg	< 0.02	NONE	0.06	< 0.02	< 0.02	< 0.02	< 0.02
p,p' - DDT	mg/kg	< 0.02	NONE	0.03	< 0.02	< 0.02	< 0.02	< 0.02
trans-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Trifluralin	mg/kg	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

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



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Soil Analysis Certificate - Pyrethroids						
QTS Environmental Report No: 14-20379	Date Sampled	25/02/14	25/02/14	25/02/14		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Barnham	TP / BH No	TPH	TPD	TPB		
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.50	0.50	0.50		
Reporting Date: 26/03/2014	QTSE Sample No	97969	97971	97973		

Determinand	Unit	RL	Accreditation				
Cyfluthrin ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	
Cyhalothrin ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	
Cypermethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	
Deltamethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	
Fenvalerate ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	
Permethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	
Resmethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	
Tetramethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	

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

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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 14-20379

Soils Ltd

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Reporting Date: 26/03/2014

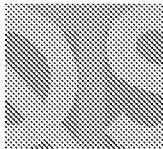
QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
\$ 97968	TPF	None Supplied	0.50	17.8	Light brown clay
\$ 97969	TPH	None Supplied	0.50	17.1	Light brown clay
\$ 97970	TPG	None Supplied	0.50	17.7	Light brown clay
\$ 97971	TPD	None Supplied	0.50	15.6	Light brown clay
\$ 97972	TPC	None Supplied	0.50	15.1	Light brown clay
\$ 97973	TPB	None Supplied	0.50	17.9	Light brown clay
\$ 97974	TPA	None Supplied	0.50	17.3	Light brown clay
\$ 97976	TPK	None Supplied	0.30	17.9	Light brown clay
\$ 97977	TPJ	None Supplied	0.30	17.3	Light brown clay
\$ 97978	TPL	None Supplied	0.30	18.1	Light brown clay

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}

\$ samples exceeded recommended holding times



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Lenham Heath
Maidstone
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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 14-20379

Soils Ltd

Site Reference: Barnham

Project / Job Ref: 114123

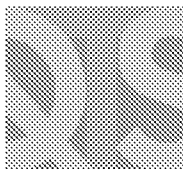
Order No: None Supplied

Reporting Date: 26/03/2014

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	Determination of acetone/hexane extractable hydrocarbons by GC-FID	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 @ 450°C	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 SO ₄) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO ₄) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO ₄) - 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	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried

AR As Received



Nikos Sidiropoulos
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent



QTS Environmental Report No: 14-20394

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Sample Receipt Date: 21/03/2014

Sample Scheduled Date: 21/03/2014

Report Issue Number: 1

Reporting Date: 27/03/2014

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd



Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



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



Soil Analysis Certificate						
QTS Environmental Report No: 14-20394		Date Sampled	25/02/14	25/02/14	25/02/14	
Soils Ltd		Time Sampled	None Supplied	None Supplied	None Supplied	
Site Reference: Barnham		TP / BH No	WS7	WS1	BH4	
Project / Job Ref: J14123		Additional Refs	None Supplied	None Supplied	None Supplied	
Order No: None Supplied		Depth (m)	0.20	0.20	0.20	
Reporting Date: 27/03/2014		QTSE Sample No	98048	98049	98050	

Determinand	Unit	RL	Accreditation				
Asbestos Screen ⁽⁵⁾	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	8.0	7.1	6.9	
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.02	0.01	< 0.01	
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	
Organic Matter	%	< 0.1	NONE	2.5	3.3	2.6	
Total Organic Carbon (TOC)	%	< 0.1	NONE	1.4	1.9	1.5	
Arsenic (As)	mg/kg	< 2	MCERTS	2	5	2	
Beryllium (Be)	mg/kg	< 0.5	NONE	< 0.5	< 0.5	< 0.5	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5	
Chromium (Cr)	mg/kg	< 2	MCERTS	7	11	9	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	4	7	5	
Lead (Pb)	mg/kg	< 3	MCERTS	13	24	12	
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	4	7	5	
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	
Vanadium (V)	mg/kg	< 2	NONE	3	2	7	
Zinc (Zn)	mg/kg	< 3	MCERTS	24	32	21	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	
EPH (C10 - C40)	mg/kg	< 6	MCERTS	< 6			

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

Analysis carried out on the dried sample is corrected for the stone content

Subcontracted analysis ⁽⁵⁾

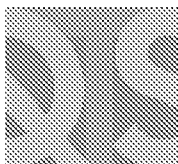


Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 14-20394	Date Sampled	25/02/14	25/02/14	25/02/14	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	
Site Reference: Barnham	TP / BH No	WS7	WS1	BH4	
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.20	0.20	0.20	
Reporting Date: 27/03/2014	OTSE Sample No	98048	98049	98050	

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	0.38	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.59	< 0.1		
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.47	< 0.1		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.24	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.25	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.27	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.12	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.20	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	2.5	< 1.6		

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



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

Tel: 01622 850440

Soil Analysis Certificate - Pyrethroids						
QTS Environmental Report No: 14-20394		Date Sampled	25/02/14			
Soils Ltd		Time Sampled	None Supplied			
Site Reference: Barnham		TP / BH No	BH4			
Project / Job Ref: J14123		Additional Refs	None Supplied			
Order No: None Supplied		Depth (m)	0.20			
Reporting Date: 27/03/2014		QTSE Sample No	98050			

Determinand	Unit	RL	Accreditation				
Cyfluthrin ^(S)	mg/kg	< 0.1	NONE	< 0.1			
Cyhalothrin ^(S)	mg/kg	< 0.1	NONE	< 0.1			
Cypermethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1			
Deltamethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1			
Fenvalerate ^(S)	mg/kg	< 0.1	NONE	< 0.1			
Permethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1			
Resmethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1			
Tetramethrin ^(S)	mg/kg	< 0.1	NONE	< 0.1			

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

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Unit 1, Rose Lane Industrial Estate
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Maidstone
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Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 14-20394

Soils Ltd

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Reporting Date: 27/03/2014

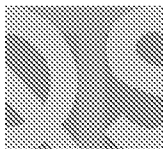
QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
\$ 98048	WS7	None Supplied	0.20	17.3	Light brown sandy clay
\$ 98049	WS1	None Supplied	0.20	17.8	Brown sandy clay with rubble and vegetation
&\$ 98050	BH4	None Supplied	0.20	17.6	Brown sandy clay

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

Insufficient Sample ^{1/5}

& samples received in inappropriate containers for hydrocarbon analysis

\$ samples exceeded recommended holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 14-20394

Soils Ltd

Site Reference: Barnham

Project / Job Ref: J14123

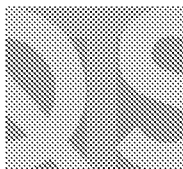
Order No: None Supplied

Reporting Date: 27/03/2014

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	Determination of acetone/hexane extractable hydrocarbons by GC-FID	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 @ 450°C	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	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried

AR As Received



Nikos Sidiropoulos
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent



QTS Environmental Report No: 14-20396

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Sample Receipt Date: 21/03/2014

Sample Scheduled Date: 21/03/2014

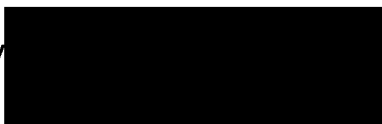
Report Issue Number: 1

Reporting Date: 27/03/2014

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd

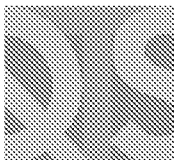


Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd





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



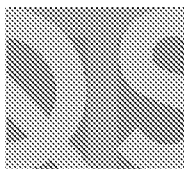
Soil Analysis Certificate						
QTS Environmental Report No: 14-20396		Date Sampled	25/02/14	25/02/14		
Soils Ltd		Time Sampled	None Supplied	None Supplied		
Site Reference: Barnham		TP / BH No	BH2	BH4		
Project / Job Ref: J14123		Additional Refs	None Supplied	None Supplied		
Order No: None Supplied		Depth (m)	0.50	1.20		
Reporting Date: 27/03/2014		QTSE Sample No	98054	98055		

Determinand	Unit	RL	Accreditation				
Asbestos Screen ⁽⁵⁾	N/a	N/a	ISO 17025	Not Detected	Not Detected		
pH	pH Units	N/a	MCERTS	7.1	7.1		
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2		
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.01	< 0.01		
Sulphide	mg/kg	< 5	NONE	< 5	< 5		
Organic Matter	%	< 0.1	NONE	0.4	0.3		
Total Organic Carbon (TOC)	%	< 0.1	NONE	0.2	0.2		
Arsenic (As)	mg/kg	< 2	MCERTS	< 2	3		
Beryllium (Be)	mg/kg	< 0.5	NONE	< 0.5	< 0.5		
W/S Boron	mg/kg	< 1	NONE	< 1	< 1		
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5		
Chromium (Cr)	mg/kg	< 2	MCERTS	7	11		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	5	4		
Lead (Pb)	mg/kg	< 3	MCERTS	20	5		
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	5	11		
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3		
Vanadium (V)	mg/kg	< 2	NONE	3	< 2		
Zinc (Zn)	mg/kg	< 3	MCERTS	13	16		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2		

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

Analysis carried out on the dried sample is corrected for the stone content

Subcontracted analysis ⁽⁵⁾



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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN

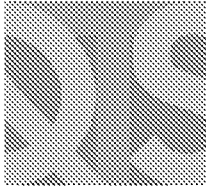


Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 14-20396	Date Sampled	25/02/14	25/02/14			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Barnham	TP / BH No	BH2	BH4			
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.50	1.20			
Reporting Date: 27/03/2014	QTSE Sample No	98054	98055			

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

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



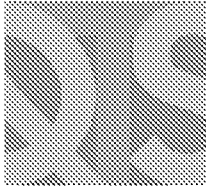
QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Waste Acceptance Criteria Analytical Certificate

QTS Environmental Report No: 14-20396		Date Sampled	25/02/14		<table border="1"> <tr> <th colspan="3">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th>Inert Waste Landfill</th> <th>Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th>Hazardous Waste Landfill</th> </tr> <tr> <td>3%</td> <td>5%</td> <td>6%</td> </tr> <tr> <td>--</td> <td>--</td> <td>10%</td> </tr> <tr> <td>6</td> <td>--</td> <td>--</td> </tr> <tr> <td>1</td> <td>--</td> <td>--</td> </tr> <tr> <td>500</td> <td>--</td> <td>--</td> </tr> <tr> <td>100</td> <td>--</td> <td>--</td> </tr> <tr> <td>--</td> <td>>6</td> <td>--</td> </tr> <tr> <td>--</td> <td>To be evaluated</td> <td>To be evaluated</td> </tr> </table>			Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																					
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																			
3%	5%	6%																																			
--	--	10%																																			
6	--	--																																			
1	--	--																																			
500	--	--																																			
100	--	--																																			
--	>6	--																																			
--	To be evaluated	To be evaluated																																			
Soils Ltd	Time Sampled	None Supplied																																			
Site Reference: Barnham	TP / BH No	BH2																																			
Project / Job Ref: J14123	Additional Refs	None Supplied																																			
Order No: None Supplied	Depth (m)	0.50																																			
Reporting Date: 27/03/2014	QTSE Sample No	98054																																			
Determinand	Unit	MDL																																			
TOC	%	< 0.1	0.2																																		
Loss on Ignition	%	< 0.01	2.60																																		
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																		
Sum of PCBs	mg/kg	< 0.7	< 0.7																																		
Mineral Oil	mg/kg	< 6	9																																		
Total PAH ^{MU}	mg/kg	< 1.7	< 1.7																																		
pH ^{MU}	pH Units	N/a	7.1																																		
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																		
Eluate Analysis		2:1	8:1		Cumulative	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																															
		mg/l	mg/l		10:1																																
		mg/kg	mg/kg		mg/kg																																
Arsenic		< 0.01	< 0.01		< 0.2	0.5	2	25																													
Barium		< 0.02	< 0.02		< 0.1	20	100	300																													
Cadmium		< 0.0005	< 0.0005		< 0.02	0.04	1	5																													
Chromium		< 0.005	< 0.005		< 0.2	0.5	10	70																													
Copper		< 0.01	< 0.01		< 0.5	2	50	100																													
Mercury		< 0.005	< 0.005		< 0.01	0.01	0.2	2																													
Molybdenum		< 0.001	< 0.001		< 0.1	0.5	10	30																													
Nickel		< 0.007	< 0.007		< 0.2	0.4	10	40																													
Lead		< 0.005	< 0.005		< 0.2	0.5	10	50																													
Antimony		< 0.005	< 0.005		< 0.06	0.06	0.7	5																													
Selenium		< 0.005	< 0.005		< 0.1	0.1	0.5	7																													
Zinc		< 0.005	< 0.005		< 0.2	4	50	200																													
Chloride ^U		4	< 1		< 12	800	15000	25000																													
Fluoride ^U		< 0.5	< 0.5		< 1	10	150	500																													
Sulphate ^U		3	2		< 20	1000	20000	50000																													
TDS		26	17		174	4000	60000	100000																													
Phenol Index		< 0.01	< 0.01		< 0.5	1	-	-																													
DOC		7.7	3.1		33.5	500	800	1000																													
Leach Test Information																																					
Sample Mass (kg)		0.22																																			
Dry Matter (%)		80.3																																			
Moisture (%)		24.6																																			
Stage 1																																					
Volume Eluate L2 (litres)		0.31																																			
Filtered Eluate VE1 (litres)		0.08																																			

Results are expressed on a dry weight basis, after correction for moisture content where applicable
 Stated limits are for guidance only and QTS Environmental cannot be held responsible for any discrepancies with current legislation
 M Denotes MCERTS accredited test
 U Denotes ISO17025 accredited test



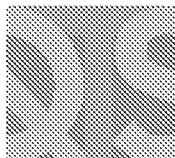
QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Waste Acceptance Criteria Analytical Certificate

QTS Environmental Report No: 14-20396		Date Sampled	25/02/14		<table border="1"> <tr> <th colspan="3">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th>Inert Waste Landfill</th> <th>Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th>Hazardous Waste Landfill</th> </tr> <tr> <td>3%</td> <td>5%</td> <td>6%</td> </tr> <tr> <td>--</td> <td>--</td> <td>10%</td> </tr> <tr> <td>6</td> <td>--</td> <td>--</td> </tr> <tr> <td>1</td> <td>--</td> <td>--</td> </tr> <tr> <td>500</td> <td>--</td> <td>--</td> </tr> <tr> <td>100</td> <td>--</td> <td>--</td> </tr> <tr> <td>--</td> <td>>6</td> <td>--</td> </tr> <tr> <td>--</td> <td>To be evaluated</td> <td>To be evaluated</td> </tr> </table>			Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
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100	--	--																																			
--	>6	--																																			
--	To be evaluated	To be evaluated																																			
Soils Ltd	Time Sampled	None Supplied																																			
Site Reference: Barnham	TP / BH No	BH4																																			
Project / Job Ref: J14123	Additional Refs	None Supplied																																			
Order No: None Supplied	Depth (m)	1.20																																			
Reporting Date: 27/03/2014	QTSE Sample No	98055																																			
Determinand	Unit	MDL																																			
TOC	%	< 0.1	0.2																																		
Loss on Ignition	%	< 0.01	2.50																																		
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																		
Sum of PCBs	mg/kg	< 0.7	< 0.7																																		
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Moisture (%)		26.6																																			
Stage 1																																					
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Filtered Eluate VE1 (litres)		0.18																																			

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 U Denotes ISO17025 accredited test



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



Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 14-20396	
Soils Ltd	
Site Reference: Barnham	
Project / Job Ref: J14123	
Order No: None Supplied	
Reporting Date: 27/03/2014	

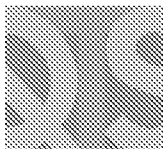
QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
&\$ 98054	BH2	None Supplied	0.50	18.4	Red loamy clay
&\$ 98055	BH4	None Supplied	1.20	21.6	Red clay

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

Insufficient Sample ^{1/5}

& samples received in inappropriate containers for hydrocarbon analysis

\$ samples exceeded recommended holding times



QTS Environmental Ltd
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Lenham Heath
Maidstone
Kent ME17 2JN



4480

Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 14-20396

Soils Ltd

Site Reference: Barnham

Project / Job Ref: 114123

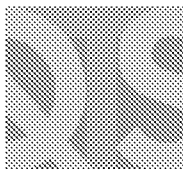
Order No: None Supplied

Reporting Date: 27/03/2014

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	Determination of acetone/hexane extractable hydrocarbons by GC-FID	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 @ 450°C	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 SO ₄) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO ₄) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO ₄) - 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	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried

AR As Received



Nikos Sidiropoulos
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 3JN



QTS Environmental Report No: 14-20314

Site Reference: Barnham

Project / Job Ref: J14123

Order No: None Supplied

Sample Receipt Date: 18/03/2014

Sample Scheduled Date: 18/03/2014

Report Issue Number: 1

Reporting Date: 24/03/2014

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd

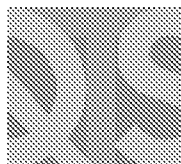


Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd





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



Water Analysis Certificate

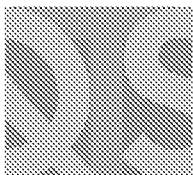
QTS Environmental Report No: 14-20314	Date Sampled	25/02/14	25/02/14	25/02/14		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Barnham	TP / BH No	BH2	BH4	WS11		
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 24/03/2014	QTSE Sample No	97604	97605	97606		

Determinand	Unit	RL	Accreditation			
pH	pH Units	N/a	ISO17025	7.2	7.4	6.9
Total Cyanide	ug/l	< 5	NONE	< 5	< 5	< 5
Sulphate as SO ₄	mg/l	< 1	ISO17025	187	18	6
Sulphide	mg/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1
Total Organic Carbon (TOC)	mg/l	< 0.1	NONE	4.4	3.6	7.1
Arsenic (dissolved)	ug/l	< 10	NONE	< 10	< 10	< 10
Beryllium (dissolved)	ug/l	< 1	NONE	< 1	< 1	< 1
Boron (dissolved)	ug/l	< 50	NONE	377	132	76
Cadmium (dissolved)	ug/l	< 0.5	NONE	< 0.5	< 0.5	< 0.5
Chromium (dissolved)	ug/l	< 5	NONE	9	< 5	< 5
Chromium (hexavalent)	ug/l	< 5	NONE	< 5	< 5	< 5
Copper (dissolved)	ug/l	< 10	NONE	< 10	< 10	< 10
Lead (dissolved)	ug/l	< 5	NONE	< 5	< 5	< 5
Mercury (dissolved)	ug/l	< 0.05	NONE	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	ug/l	< 7	NONE	< 7	< 7	< 7
Selenium (dissolved)	ug/l	< 5	NONE	< 5	< 5	< 5
Vanadium (dissolved)	ug/l	< 5	NONE	< 5	< 5	< 5
Zinc (dissolved)	ug/l	< 5	NONE	9	< 5	< 5
Total Phenols	ug/l	< 0.5	NONE	< 0.5	< 0.5	< 0.5
EPH (C10 - C40)	ug/l	< 10	NONE	< 10	< 10	< 10

Subcontracted analysis ⁽⁵⁾

Insufficient sample ^{1/5}

Unsuitable Sample ^{1/5}

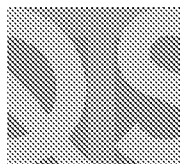


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Lenham Heath
Maidstone
Kent ME17 2JN

Water Analysis Certificate - Speciated PAH

QTS Environmental Report No: 14-2	Date Sampled	25/02/14	25/02/14	25/02/14		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Barnham	TP / BH No	BH2	BH4	WS11		
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 24/03/2014	QTSE Sample No	97604	97605	97606		

Determinand	Unit	RL	Accreditation					
Naphthalene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Acenaphthylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Acenaphthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Fluorene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Phenanthrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(a)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Chrysene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(b)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(k)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(a)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Dibenz(a,h)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(ghi)perylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Total EPA-16 PAHs	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		

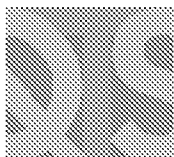


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Maidstone
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Water Analysis Certificate - Organochlorine Pesticides

QTS Environmental Report No: 14-20314	Date Sampled	25/02/14	25/02/14	25/02/14		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Barnham	TP / BH No	BH2	BH4	WS11		
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 24/03/2014	QTSE Sample No	97604	97605	97606		

Determinand	Unit	RL	Accreditation					
Aldrin	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
alpha-HCH	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
beta-HCH	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
cis-chlordane	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
delta-HCH	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Dieldrin	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Endosulfan A	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Endosulfan B	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Endrin	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
gamma-HCH (Lindane)	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Heptachlor	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Heptachlor epoxide	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Hexachlorobenzene (HCB)	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Isodrin	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Methoxychlor	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
o,p' - DDD	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
o,p' - DDE	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
o,p' - DDT	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
p,p' - DDD	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
p,p' - DDE	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
p,p' - DDT	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
trans-chlordane	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		
Trifluralin	ug/l	< 0.02	NONE	< 0.02	< 0.02	< 0.02		



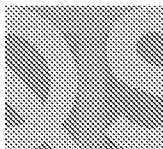
QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN

Water Analysis Certificate - Pyrethroids

QTS Environmental Report No: 14-20314	Date Sampled	25/02/14	25/02/14	25/02/14		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Barnham	TP / BH No	BH2	BH4	WS11		
Project / Job Ref: J14123	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 24/03/2014	QTSE Sample No	97604	97605	97606		

Determinand	Unit	RL	Accreditation					
Cyfluthrin ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Cyhalothrin ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Cypermethrin ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Deltamethrin ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Fenvalerate ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Permethrin ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Resmethrin ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Tetramethrin ⁽⁵⁾	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		

Subcontracted analysis ⁽⁵⁾



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone



4480

Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 14-20314

Soils Ltd

Site Reference: Barnham

Project / Job Ref: 114123

Order No: None Supplied

Reporting Date: 24/03/2014

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	EPH TEXAS	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID	E104
Water	F	TPH LQM	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E101

Key

F Filtered

UF Unfiltered

Appendix D

Soil Guideline Values and General Assessment Criteria

Appendix D

Soil Guideline Values and General Assessment Criteria

C1 Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'.

C1.1 Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

- 1) EA Science Report SC050021/SR2: *Human health toxicological assessment of contaminants in soil.*
- 2) EA Science Report SC050021/SR3: *Updated technical background to the CLEA model.*
- 3) EA CLEA Bulletin (2009).
- 4) CLEA software version 1.04 (2009)
- 5) Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

- *do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.*
- *do not cover risks to the environment, such as groundwater, ecosystems or buildings.*
- *do not provide a definitive test for telling when human health risks are significant.*
- *are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.*

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

C1.2 Land-use Scenarios

The CLEA model uses a range of standard land-use scenarios to develop conceptual exposure models as follows:

1 Residential

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur.

2) Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

3) Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

C1.3 Soil Guideline Values

The EA are publishing a series of SGV reports for a selection of common contaminants relevant to the assessment of land contamination.

SGV's are generic assessment criteria based on CLEA standard land-uses and can be used to simplify the assessment of human health risks from long-term exposure to chemical contamination in soil. They do not cover short-term exposure (i.e. construction and maintenance workers), acute exposure or other risks such as fire, suffocation or explosion, as might arise from an accumulation of gases such as methane and carbon dioxide, or either odour or aesthetic issues.

SGV's represent 'trigger values', indicators that soil concentrations above the SGV level may pose a possibility of *significant harm* to human health. The converse, where soil concentrations are less than the SGV, is that the long-term human health risks are considered to be tolerable or minimal.

C1.4 Generic Assessment Criteria

If an SGV is not available for a substance identified in the soil then the range of Generic Assessment Criteria published from a collaborative research by Land Quality Management Limited (LQM) and the Chartered Institute of Environmental Health will be used. For derivation of these Generic Assessment Criteria reference must be made to:

Nathanial, P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A., Ogden, R., Scott, D. *The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition)*. **Land Quality Press**. 2009.

In the case of Lead, the AtRisk Soil SSV have been used.

C1.5 Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of an SGV/GAC is not appropriate, for instance when the intended land-use is at variance with the CLEA standard land-uses, then a DQRA may be undertaken to develop site specific values for relevant soil contaminants.

- | | |
|---|--|
| ⇒ | Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation. |
| ⇒ | Developing more accurate parameters using site data. |

C1.6 Ongoing development of CLEA based guidance

The EA is involved in a programme of publishing SGV's and related toxicity data (the TOX reports). As at July 2009 ten SGV's and matching TOX reports had been published.

Soil Assessment Criteria (SAC's) may be derived using toxicity data from the updated TOX reports, where these are published, or from the original TOX reports. SGV reports also take account of recent updates for plant uptake and other factors.

- | | |
|---|---|
| ⇒ | GAC's developed by CLEA guidance and given in this report will need to be assessed against updated TOX reports and SGV's when these are published. |
| ⇒ | SGV reports may give values that differ from the GAC's used in this report. |
| ⇒ | These variations may materially alter the remediation requirement for the site, requiring either an increase or decrease in the extent, type and cost of remediation. |

C1.7 Phytotoxicity

CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

- ICRCL 70/90: *Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing.*

C1.8 Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

The DEFRA discussion paper Assessing risks from land contamination – a proportionate approach ('the way forward') (CLAN06/2006) aimed to increase understanding of the role that statistics can play in quantifying the uncertainty attached to the estimates of the mean concentration of contaminants in soil. In direct response CLAIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CLAIRE/CIEH 2008). A software implementation of the statistical techniques given in the report was published by ESI International (2008).

Treatment of Hot-Spots

- ⇒ A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.
- ⇒ Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

C2 Soil Guideline Values and General Acceptance Criteria

Soil Guideline Values and General Acceptance Criteria used in the preparation of this report is tabulated in the following pages:

DEFRA CLEA 1.04 Soil Guideline Values (as at July 2009) (Sandy Loam, pH 7, SOM 6%)

Contaminant	Residential (mg/kg DW)	Allotments (mg/kg DW)	Commercial (mg/kg DW)
Inorganic			
Arsenic	32	43	640
Cadmium	10	1.8	230
Mercury			
- Elemental	1.0	26	26
- Inorganic	170	80	3600
- Methyl	11	8	410
Nickel	130	230	1800
Selenium	350	120	13000
Organic			
May not be protective if SOM <6%			
Phenol	420	280	3200 (38,000*)
Benzene	0.33	0.07	95
Toluene	610	120	4400
Ethylbenzene	350	90	2800
Xylenes			
- o-xylene	250	160	2600
- m-xylene	240	180	3500
- p-xylene	230	160	3200
Dioxins			
Sum of PCDDs, PCDFs and dioxin-like PCB's.	8	8	240

* Based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health affects following long term exposure provided for illustration only)

Atkins AtRisk SSV Guideline Values For Lead (mg/kg)

Contaminant	Residential With Plant Uptake	Residential Without Plant Uptake	Commercial & Industrial	Open spaces
Lead 1% SOM sand soil	276	383	6490	1590
Lead 6% SOM sandy loam soil	342	383	6490	1590

LQM CIEH General Assessment Criteria (2nd edition) (mg/kg)

Contaminant	Residential	Allotment	Commercial
Metals			
Beryllium	51	55	420
Boron	291	45	192000
Chromium (III)	3000	34600	30400
Chromium (VI)	4.3	2.1	35
Copper	2330	524	71700
Vanadium	140	150	4250
Zinc	3750	618	665000

LQM CIEH General Assessment Criteria

General Assessment Criteria For Polycyclic Aromatic Hydrocarbons (PAH's) (mg/kg)

Determinants		Residential	Allotments	Commercial
Acenaphthene	1.0% SOM	210	34	85,000 (57) ^{sol}
	2.5% SOM	480	85	98,000 (141) ^{sol}
	6.0% SOM	100	200	100,000
Acenaphthylene	1.0% SOM	170	28	84,000 (86) ^{sol}
	2.5% SOM	400	69	97,000 (212) ^{sol}
	6.0% SOM	850	160	100,000
Anthracene	1.0% SOM	2,300	380	530,000
	2.5% SOM	4,900	950	540,000
	6.0% SOM	9,200	2200	540,000
Benzo(a)anthracene	1.0% SOM	3.1	2.5	90
	2.5% SOM	4.7	5.5	95
	6.0% SOM	5.9	10	97
Benzo(a)pyrene	1.0% SOM	0.83	0.6	14
	2.5% SOM	0.94	1.2	14
	6.0% SOM	1.0	2.1	14
Benzo(b)fluoranthene	1.0% SOM	5.6	3.5	100
	2.5% SOM	6.5	7.4	100
	6.0% SOM	7.0	13	100
Benzo(ghi)perylene	1.0% SOM	44	70	650
	2.5% SOM	46	120	660
	6.0% SOM	47	160	660
Benzo(k)fluoranthene	1.0% SOM	8.5	6.8	140
	2.5% SOM	9.6	14	140
	6.0% SOM	10	23	140
Chrysene	1.0% SOM	6.0	2.6	140
	2.5% SOM	8.0	5.8	140
	6.0% SOM	9.3	12	140
Dibenzo(ah)anthracene	1.0% SOM	0.76	0.76	13
	2.5% SOM	0.86	1.5	13
	6.0% SOM	0.90	2.3	13
Fluoranthene	1.0% SOM	260	52	23,000
	2.5% SOM	460	130	23,000
	6.0% SOM	670	290	23,000
Flourene	1.0% SOM	160	27	64,000 (31) ^{sol}
	2.5% SOM	380	67	69,000
	6.0% SOM	780	160	71,000
Indeno(123-cd)pyrene	1.0% SOM	3.2	1.8	60
	2.5% SOM	3.9	3.8	61
	6.0% SOM	4.2	7.1	62
Napthalene	1.0% SOM	1.5	4.1	200 (76) ^{sol}
	2.5% SOM	3.7	9.9	480 (183) ^{sol}
	6.0% SOM	8.7	23	1100 (432) ^{sol}
Phenanthrene	1.0% SOM	92	16	22,000
	2.5% SOM	200	38	22,000
	6.0% SOM	380	90	23,000
Pyrene	1.0% SOM	560	110	54,000
	2.5% SOM	1,000	270	54,000
	6.0% SOM	1,600	620	54,000

^{vap} – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

^{sol} – GAC presented exceeds the soil saturation limit, which is presented in brackets.

General Assessment Criteria For TPH (mg/kg)

Determinants		Residential	Allotments	Commercial
<i>Aliphatic</i>				
EC 5-6	1.0% SOM	30	740	3,400 (304) ^{sol}
	2.5% SOM	55	1,700	6,200 (558) ^{sol}
	6.0% SOM	110	3,900	13,000 (1150) ^{sol}
EC >6-8	1.0% SOM	73	2,300	8,300 (144) ^{sol}
	2.5% SOM	160	5,600	18,000 (322) ^{sol}
	6.0% SOM	370	13,000	42,000 (736) ^{sol}
EC >8-10	1.0% SOM	19	320	2,100 (78) ^{sol}
	2.5% SOM	46	770	5,100 (118) ^{vap}
	6.0% SOM	110	1,700	12,000 (451) ^{vap}
EC >10-12	1.0% SOM	93 (48) ^{vap}	2,200	10,000 (48) ^{sol}
	2.5% SOM	230 (118) ^{vap}	4,400	24,000 (118) ^{vap}
	6.0% SOM	540 (283) ^{vap}	7,300	49,000 (283) ^{vap}
EC >12-16	1.0% SOM	740 (24) ^{sol}	11,000	61,000 (24) ^{sol}
	2.5% SOM	1,700 (59) ^{sol}	13,000	83,000 (59) ^{sol}
	6.0% SOM	3,000 (142) ^{sol}	13,000	91,000 (142) ^{sol}
EC >16-35	1.0% SOM	45,000 (8.48) ^{sol}	260,000	1,600,000
	2.5% SOM	64,000 (21) ^{sol}	270,000	1,800,000
	6.0% SOM	76,000	270,000	1,800,000
EC >35-44	1.0% SOM	45,000 (8.48) ^{sol}	260,000	1,600,000
	2.5% SOM	64,000 (21) ^{sol}	270,000	1,800,000
	6.0% SOM	76,000	270,000	1,800,000
<i>Aromatic</i>				
EC 5-7	1.0% SOM	65	13	28,000 (1220) ^{sol}
	2.5% SOM	130	27	49,000 (2260) ^{sol}
	6.0% SOM	280	57	90,000 (4710) ^{sol}
EC >7-8	1.0% SOM	120	22	59,000 (869) ^{vap}
	2.5% SOM	270	51	110,000 (1920) ^{sol}
	6.0% SOM	611	120	190,000 (4360) ^{vap}
EC >8-10	1.0% SOM	27	8.6	3,700 (613) ^{vap}
	2.5% SOM	65	21	8,600 (1500) ^{vap}
	6.0% SOM	151	51	18,000 (3580) ^{vap}
EC >10-12	1.0% SOM	69	13	17,000 (364) ^{sol}
	2.5% SOM	160	31	29,000 (899) ^{sol}
	6.0% SOM	346	74	34,500 (2150) ^{sol}
EC >12-16	1.0% SOM	140	23	36,000 (169) ^{sol}
	2.5% SOM	480	57	37,000
	6.0% SOM	770	130	37,800
EC >16-21	1.0% SOM	250	46	28,000
	2.5% SOM	480	110	28,000
	6.0% SOM	770	260	28,000
EC >21-35	1.0% SOM	890	370	28,000
	2.5% SOM	1,100	820	28,000
	6.0% SOM	1,230	1,600	28,000
EC >35-44	1.0% SOM	890	370	28,000
	2.5% SOM	1,100	820	28,000
	6.0% SOM	1,230	1,600	28,000
<i>Aromatic & Aliphatic</i>				
EC >44 - 70	1.0% SOM	1200	1200	28,000
	2.5% SOM	1300	2100	28,000
	5.0% SOM	1300	3000	28,000

Note: a) SOM = Soil Organic Matter Content (%) b) LQM CIEH GAC not set for Allotment land-use

ICRCL 70/90 Restoration of metalliferous mining areas (mg/kg)

Phytotoxicity (Harmful to Plants) Threshold Trigger Values	
Copper	250
Zinc	1000

Notes: Many cultivars and specifically grasses have a high tolerance and there will be no ill-effect at the threshold trigger values given for neutral or near neutral pH. Site observation of plant vitality may give additional guidance.

LQM CIEH General Assessment Criteria

Volatile and Semi-Volatile Organic Compounds (mg/kg)

Contaminant	Residential	Allotment	Commercial
<i>Chloroalkanes & alkenes</i>			
1,2 Dichloroethane			
1.0% SOM	0.0054	0.0046	0.71
2.5% SOM	0.0080	0.0083	1.00
6.0% SOM	0.014	0.016	1.80
1,1,2,2 Tetrachloroethane			
1.0% SOM	1.4	0.41	290
2.5% SOM	2.9	0.89	580
6.0% SOM	6.3	2.0	1200
1,1,1,2 Tetrachloroethane			
1.0% SOM	0.90	0.79	120
2.5% SOM	2.1	1.9	260
6.0% SOM	4.8	4.4	590
Tetrachloroethene			
1.0% SOM	0.94	1.6	130
2.5% SOM	2.1	3.7	290
6.0% SOM	4.8	8.7	660
1,1,1 Trichloroethane			
1.0% SOM	6.2	48	700
2.5% SOM	13	110	1400
6.0% SOM	28	240	3100
Tetrachloromethene			
1.0% SOM	0.018	0.16	3.0
2.5% SOM	0.039	0.37	6.6
6.0% SOM	0.089	0.85	15
Trichloroethene			
1.0% SOM	0.11	0.43	12
2.5% SOM	0.22	0.95	25
6.0% SOM	0.49	2.2	55
Trichloromethane			
1.0% SOM	0.75	0.36	110
2.5% SOM	1.3	0.70	190
6.0% SOM	2.7	1.5	370
Vinyl Chloride			
1.0% SOM	0.00047	0.00055	0.063
2.5% SOM	0.00064	0.0010	0.081
6.0% SOM	0.00099	0.0018	0.12

Contaminant	Residential	Allotment	Commercial
<i>Explosives</i>			
2,4,6 Trinitrotoluene			
1.0% SOM	1.6	0.24	1000
2.5% SOM	3.7	0.58	1000
6.0% SOM	8.0	1.4	1100
RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)			
1.0% SOM	3.5	0.52	6400
2.5% SOM	7.4	1.1	6400
6.0% SOM	16	2.5	6400
HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)			
1.0% SOM	5.7	0.86	110,000
2.5% SOM	13	1.9	110,000
6.0% SOM	26	3.9	110,000
Atrazine			
1.0% SOM	0.24	0.037	870
2.5% SOM	0.56	0.085	880
6.0% SOM	1.3	0.20	880
<i>Pesticides</i>			
Aldrin			
1.0% SOM	1.7	1.3	54
2.5% SOM	2.0	2.6	54
6.0% SOM	2.1	4.0	54
Dieldrin			
1.0% SOM	0.69	0.13	90
2.5% SOM	1.4	0.32	91
6.0% SOM	2.2	0.73	92
Dichlorvos			
1.0% SOM	0.29	0.044	942
2.5% SOM	0.6	0.091	972
6.0% SOM	1.3	0.2	983
Alpha - Endosulfan			
1.0% SOM	2.9	0.47	2310 (0.003) ^{vap}
2.5% SOM	7.0	1.2	2990 (0.007) ^{vap}
6.0% SOM	16	2.7	3390
Beta - Endosulfan			
1.0% SOM	2.8	0.44	2580 (0.00007) ^{vap}
2.5% SOM	6.6	1.1	3160 (0.0002) ^{vap}
6.0% SOM	15	2.6	3480
Alpha -Hexachlorocyclohexanes			
1.0% SOM	19	3.0	14000
2.5% SOM	46	7.4	14600
6.0% SOM	100	18	14900
Beta -Hexachlorocyclohexanes			
1.0% SOM	1.7	0.26	1120
2.5% SOM	3.9	0.64	1130
6.0% SOM	8.5	1.5	1130
Gamma -Hexachlorocyclohexanes			
1.0% SOM	0.58	0.089	532
2.5% SOM	1.4	0.22	546
6.0% SOM	3.0	0.52	552

<i>Chlorobenzenes</i>			
Chlorobenzene			
1.0% SOM	0.33	5.9	59
2.5% SOM	0.73	14	32
6.0% SOM	59	130	310
1,2-Dichlorobenzene			
1.0% SOM	16	94	2100 (571) ^{sol}
2.5% SOM	39	230	5100 (1370) ^{sol}
6.0% SOM	91	540	12000 (3240) ^{sol}
1,3-Dichlorobenzene			
1.0% SOM	0.29	0.25	32
2.5% SOM	0.70	0.61	77
6.0% SOM	1.7	1.5	180
1,4-Dichlorobenzene			
1.0% SOM	30	15	4500 (224) ^{vap}
2.5% SOM	72	37	10000 (540) ^{vap}
6.0% SOM	167	88	22000 (1280) ^{vap}
1,2,3,-Trichlorobenzene			
1.0% SOM	1.0	4.7	110
2.5% SOM	2.6	12	270
6.0% SOM	6.1	28	620
1,2,4,-Trichlorobenzene			
1.0% SOM	1.8	31	230
2.5% SOM	4.5	75	560
6.0% SOM	11	180	1300
1,3,5,-Trichlorobenzene			
1.0% SOM	0.23	4.7	24
2.5% SOM	0.57	12	57.8
6.0% SOM	1.3	28	140
1,2,3,4,-Tetrachlorobenzene			
1.0% SOM	12	4.4	1800 (122) ^{vap}
2.5% SOM	4.5	75	3200 (304) ^{vap}
6.0% SOM	11	180	4500 (728) ^{vap}
1,2,3,5,- Tetrachlobenzene			
1.0% SOM	0.49	0.38	52 (39.4) ^{vap}
2.5% SOM	1.2	0.94	120 (98.1) ^{vap}
6.0% SOM	2.8	2.2	250 (235) ^{vap}
1,2,4, 5,- Tetrachlobenzene			
1.0% SOM	0.30	0.064	44 (19.7) ^{sol}
2.5% SOM	0.68	0.16	73 (49.1) ^{sol}
6.0% SOM	1.4	0.37	97
Pentachlorobenzene			
1.0% SOM	5.2	1.2	650 (43.0) ^{sol}
2.5% SOM	10	3.1	770 (107) ^{sol}
6.0% SOM	17	7.1	830
Hexachlorobenzene			
1.0% SOM	0.59 (0.20) ^{vap}	0.18	48 (0.20) ^{vap}
2.5% SOM	1.0 (0.50) ^{vap}	0.42	53
6.0% SOM	1.4	0.92	55
<i>Phenols & Chlorophenols</i>			
Chlorophenols (4 Congeners)			
1.0% SOM	0.87	0.13	3500
2.5% SOM	2.0	0.30	4000
6.0% SOM	4.4	0.70	4200
Pentachlorophenols			
1.0% SOM	0.55	0.084	1200
2.5% SOM	1.3	0.21	0.49
6.0% SOM	1200	1300	1400

<i>Others</i>			
Carbon Disulphide			
1.0% SOM	0.10	4.8	12
2.5% SOM	0.20	10	23
6.0% SOM	0.44	23	50
Hexachloro-1,3-Butadiene			
1.0% SOM	0.21	0.25	32
2.5% SOM	0.51	0.61	69
6.0% SOM	1.2	1.4	120

^{vap} – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

^{sol} – GAC presented exceeds the soil saturation limit, which is presented in brackets.

Appendix E
HazWasteOnline Waste Classification Tool Results

Job name

Barnham

Waste stream

Soils Suite 2 March 2014

Comments**Report**

Created by: Wilkinson, Luke

Created date: 14/04/2014 14:48

Job summary

#	Sample name	Depth	Classification result	Hazardous properties
1	BH2/0.50		Non Hazardous	
2	BH4/1.20		Non Hazardous	

Classification

 ☉ **Non Hazardous Waste**
 Classified as **17 05 04**
 in the European Waste Catalogue 2002

Classified by

Name:
Wilkinson, Luke
 Date:
14/04/2014 14:48
 Telephone:
01737 814221

Company:
Soils Ltd
Newton House
Cross Road
KT20 5SR

Sample details

Sample Name:

BH2/0.50

Site:

Project:

EWC 2002 code:

Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)

Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Sample Depth:

0 m

Dry Weight Moisture Content:

0%

Comments:

Hazard properties

None identified

Additional: Additional Risk Phrases "This is an additional risk phrase and such a risk phrases alone will not cause a waste to be hazardous."

Risk phrases hit:

R33 "Danger of cumulative effects"

Because of determinand:

Lead chromate: (compound conc.:0.00312%)

Determinands (Dry Weight Moisture Content: 0%)

pH: (Whole concentration entered as: 7.1 pH or 7.1 pH)

Cyanides (with the exception of complex cyanides): (Whole concentration entered as: <2 mg/kg or <0.0002%)

IGNORED Because: "<LOD"

Arsenic trioxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<2.641 mg/kg or <0.000264%)

IGNORED Because: "<LOD"

beryllium oxide: (Cation conc. entered: <0.5 mg/kg, converted to compound conc.:<1.388 mg/kg or <0.000139%)

IGNORED Because: "<LOD"

Boron tribromide/trichloride/trifluoride (combined risk phrases): (Cation conc. entered: <1 mg/kg, converted to

compound conc.:<13.43 mg/kg or <0.00134%) IGNORED Because: "<LOD"

Cadmium sulphide: (Cation conc. entered: <0.5 mg/kg, converted to compound conc.:<0.643 mg/kg or <0.0000643%,

"Note 1" conc.: <0.00005%) IGNORED Because: "<LOD"

Chromium(III) oxide: (Cation conc. entered: 7 mg/kg, converted to compound conc.:10.231 mg/kg or 0.00102%)

Chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.: <3.846 mg/kg or <0.000365%) IGNORED Because: "<LOD"

Copper (I) oxide: (Cation conc. entered: 5 mg/kg, converted to compound conc.: 5.629 mg/kg or 0.000563%)

Lead chromate: (Cation conc. entered: 20 mg/kg, converted to compound conc.: 31.196 mg/kg or 0.00312%, "Note 1" conc.: 0.002%)

Mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.: <1.353 mg/kg or <0.000135%) IGNORED Because: "<LOD"

Nickel dihydroxide: (Cation conc. entered: 5 mg/kg, converted to compound conc.: 7.897 mg/kg or 0.00079%)

Selenium compounds (with the exception of cadmium sulposelenide and sodium selenite): (Cation conc. entered: <3 mg/kg, converted to compound conc.: <4.5 mg/kg or <0.00045%) IGNORED Because: "<LOD"

vanadium(IV) oxide hydrogen phosphate hemihydrate, lithium, zinc, molybdenum, iron and chlorine-doped: (Whole concentration entered as: 3 mg/kg or 0.0003%)

Zinc chromate: (Cation conc. entered: 13 mg/kg, converted to compound conc.: 36.064 mg/kg or 0.00361%)

Phenol: (Whole concentration entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"

Naphthalene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Acenaphthylene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Acenaphthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Fluorene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Phenanthrene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Anthracene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Fluoranthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Pyrene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Benzo[a]anthracene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Chrysene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Benzo[b]fluoranthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Benzo[k]fluoranthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Benzo[a]pyrene; benzo[def]chrysene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Indeno[123-cd]pyrene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Dibenz[a,h]anthracene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

Benzo[ghi]perylene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

User Defined and non CLP Substances

pH

Comments: Appendix C, C4.5

Data source: WM2 - Interpretation of the definition and classification of hazardous waste (Second Edition, version 2.2), Environment Agency

Data source date: 30/05/2008

Classification: pH; pH

Boron tribromide/trichloride/trifluoride (combined risk phrases)

Comments: Combines the risk phrases and the average of the conversion factors for Boron tribromide, Boron trichloride and Boron trifluoride

Data source: N/A

Data source date: 10/01/2011

Classification: T+; R26/28, C; R34, C; R35, R14

Chromium(III) oxide (CAS Number: 1308-38-9)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

[http://clp-](http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=33806&HarmOnly=no?fc=true&lang=en)

[inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=33806&HarmOnly=no?fc=true&lang=en](http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=33806&HarmOnly=no?fc=true&lang=en)

Data source date: 26/11/2012

Classification: R20, R22, R36, R37, R38, R42, R43, R60, R61, R50/53

Acenaphthylene (CAS Number: 208-96-8)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=59285&HarmOnly=no>
Data source date: 16/07/2012
Classification: R22, R26, R27, R36, R37, R38

Acenaphthene (CAS Number: 83-32-9)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=133563&HarmOnly=no>
Data source date: 16/07/2012
Classification: N; R50/53, N; R51/53, R36, R37, R38

Fluorene (CAS Number: 86-73-7)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=81845&HarmOnly=no>
Data source date: 16/07/2012
Classification: N; R50/53, R53

Phenanthrene (CAS Number: 85-01-8)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=109754&HarmOnly=no>
Data source date: 16/07/2012
Classification: N; R50/53, R22, R36, R37, R38, R40, R43

Anthracene (CAS Number: 120-12-7)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=101102&HarmOnly=no>
Data source date: 08/03/2013
Classification: N; R50/53, R36, R37, R38, R43

Fluoranthene (CAS Number: 206-44-0)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=56375&HarmOnly=no>
Data source date: 16/07/2012
Classification: N; R50/53, R20, R22, R36

Pyrene (CAS Number: 129-00-0)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=87484&HarmOnly=no>
Data source date: 16/07/2012
Classification: N; R50/53, R23

Indeno[123-cd]pyrene (CAS Number: 193-39-5)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=128806&HarmOnly=no>
Data source date: 08/03/2013
Classification: R40

Benzo[ghi]perylene (CAS Number: 191-24-2)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=15793&HarmOnly=no>

Data source date: 16/07/2012

Classification: N; R50/53

Notes utilised in assessment

Additional Risk Phrase Comments

from section: Table 2.2 in the document: "WM2 - Hazardous Waste Technical Guidance"

"This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous."

Note used on:

Test: "Additional on R33" for determinand: "Lead chromate"

C14.3: Step 4

from section: C14.3 in the document: "WM2 - Hazardous Waste Technical Guidance"

"Identify whether any individual ecotoxic substance is present below a cut-off value shown in Table C14.1"

Note used on:

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Chromium(III) oxide"

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Copper (I) oxide"

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Lead chromate"

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Nickel dihydroxide"

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Zinc chromate"

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "vanadium(IV) oxide hydrogen phosphate hemihydrate, lithium, zinc, molybdenum, iron and chlorine-doped"

Note 1

from section: 1.1.3.2, Annex VI in the document: "CLP Regulations"

"The concentration stated or, in the absence of such concentrations, the generic concentrations of this Regulation (Table 3.1) or the generic concentrations of Directive 1999/45/EC (Table 3.2), are the percentages by weight of the metallic element calculated with reference to the total weight of the mixture."

Note used on:

Test: "H7 on R45" for determinand: "Lead chromate"

Test: "H10 on R60, R61" for determinand: "Lead chromate"

Test: "H10 on R62, R63" for determinand: "Lead chromate"

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Lead chromate"

Substance notes

Note 1

from section: 1.1.3.2, Annex VI in the document: "CLP Regulations"

"The concentration stated or, in the absence of such concentrations, the generic concentrations of this Regulation (Table 3.1) or the generic concentrations of Directive 1999/45/EC (Table 3.2), are the percentages by weight of the metallic element calculated with reference to the total weight of the mixture."

Note used on:

determinand: "Lead chromate"

Note A

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"

"Without prejudice to Article 17(2), the name of the substance must appear on the label in the form of one of the designations given in Part 3. In Part 3, use is sometimes made of a general description such as '... compounds' or '... salts'. In this case, the supplier is required to state on the label the correct name, due account being taken of section 1.1.1.4."

Note used on:

determinand: "Zinc chromate"

Note E (Table 3.2)

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"

"Substances with specific effects on human health (see Chapter 4 of Annex VI to Directive 67/548/EEC) that are classified as carcinogenic, mutagenic and/or toxic for reproduction in categories 1 or 2 are ascribed Note E if they are also classified as very toxic (T+), toxic (T) or harmful (Xn). For these substances, the risk phrases R20, R21, R22, R23, R24, R25, R26, R27, R28, R39, R68 (harmful), R48 and R65 and all combinations of these risk phrases shall be preceded by the word 'Also'."

Note used on:

determinand: "Nickel dihydroxide"

determinand: "Zinc chromate"

Version

Classification utilises the following:

WM2 - Hazardous Waste Technical Guidance, 3rd Edition, August 2013

CLP Regulations - Regulation (EC) No 1272/2008 of the European Parliament and of the Council: 16 December 2008

1st ATP - 1st Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 26 September 2009; binding date 1 Dec 2010

2nd ATP - 2nd Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 30

March 2011; binding date 1 Dec 2012 in respect of substances and 1 June 2015 in respect of mixtures

3rd ATP - 3rd Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 31 July 2012; binding date 1 Dec 2013

4th ATP - 4th Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 20 June 2013; binding date 1 Jun 2015

5th ATP - 5th Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 13 August 2013; binding date 13 Aug 2013

HazWasteOnline Engine: WM2 version 3 (Aug 2013)

HazWasteOnline Engine Version: 1.0.2429.5257 (14 Apr 2014)

HazWasteOnline Database: 1.0.2428.5256 (06 Apr 2014)

Classification

 ☉ **Non Hazardous Waste**
 Classified as **17 05 04**
 in the European Waste Catalogue 2002

Classified by

Name:
Wilkinson, Luke
 Date:
14/04/2014 14:48
 Telephone:
01737 814221

Company:
Soils Ltd
Newton House
Cross Road
KT20 5SR

Sample details

Sample Name:

BH4/1.20

Site:

Project:

EWC 2002 code:

Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)

Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Sample Depth:

0 m

Dry Weight Moisture Content:

0%

Comments:

Hazard properties

None identified

Additional: Additional Risk Phrases "This is an additional risk phrase and such a risk phrases alone will not cause a waste to be hazardous."

Risk phrases hit:

R33 "Danger of cumulative effects"

Because of determinand:

Lead chromate: (compound conc.:0.00078%)

Determinands (Dry Weight Moisture Content: 0%)

pH: (Whole concentration entered as: 7.1 pH or 7.1 pH)

Cyanides (with the exception of complex cyanides): (Whole concentration entered as: <2 mg/kg or <0.0002%)

IGNORED Because: "<LOD"

Arsenic trioxide: (Cation conc. entered: 3 mg/kg, converted to compound conc.:3.961 mg/kg or 0.000396%)

beryllium oxide: (Cation conc. entered: <0.5 mg/kg, converted to compound conc.:<1.388 mg/kg or <0.000139%)

IGNORED Because: "<LOD"

Boron tribromide/trichloride/trifluoride (combined risk phrases): (Cation conc. entered: <1 mg/kg, converted to compound conc.:<13.43 mg/kg or <0.00134%) IGNORED Because: "<LOD"

Cadmium sulphide: (Cation conc. entered: <0.5 mg/kg, converted to compound conc.:<0.643 mg/kg or <0.0000643%, "Note 1" conc.: <0.00005%) IGNORED Because: "<LOD"

Chromium(III) oxide: (Cation conc. entered: 11 mg/kg, converted to compound conc.:16.077 mg/kg or 0.00161%)

Chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<3.846 mg/kg or <0.000385%)

IGNORED Because: "<LOD"

Copper (I) oxide: (Cation conc. entered: 4 mg/kg, converted to compound conc.:4.504 mg/kg or 0.00045%)
Lead chromate: (Cation conc. entered: 5 mg/kg, converted to compound conc.:7.799 mg/kg or 0.00078%, "Note 1" conc.: 0.0005%)
Mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.:<1.353 mg/kg or <0.000135%) IGNORED Because: "<LOD"
Nickel dihydroxide: (Cation conc. entered: 11 mg/kg, converted to compound conc.:17.374 mg/kg or 0.00174%)
Selenium compounds (with the exception of cadmium sulphoselenide and sodium selenite): (Cation conc. entered: <3 mg/kg, converted to compound conc.:<4.5 mg/kg or <0.00045%) IGNORED Because: "<LOD"
vanadium(IV) oxide hydrogen phosphate hemihydrate, lithium, zinc, molybdenum, iron and chlorine-doped: (Whole concentration entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
Zinc chromate: (Cation conc. entered: 16 mg/kg, converted to compound conc.:44.386 mg/kg or 0.00444%)
Phenol: (Whole concentration entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
Naphthalene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Acenaphthylene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Acenaphthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Fluorene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Phenanthrene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Anthracene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Fluoranthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Pyrene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Benzo[a]anthracene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Chrysene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Benzo[b]fluoranthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Benzo[k]fluoranthene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Benzo[a]pyrene; benzo[def]chrysene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Indeno[123-cd]pyrene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Dibenz[a,h]anthracene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
Benzo[ghi]perylene: (Whole concentration entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"

User Defined and non CLP Substances

pH

Comments: Appendix C, C4.5
Data source: WM2 - Interpretation of the definition and classification of hazardous waste (Second Edition, version2.2), Environment Agency
Data source date: 30/05/2008
Classification: pH; pH

Boron tribromide/trichloride/trifluoride (combined risk phrases)

Comments: Combines the risk phrases and the average of the conversion factors for Boron tribromide, Boron trichloride and Boron trifluoride
Data source: N/A
Data source date: 10/01/2011
Classification: T+; R26/28, C; R34, C; R35, R14

Chromium(III) oxide (CAS Number: 1308-38-9)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=33806&HarmOnly=no?fc=true&lang=en>
Data source date: 26/11/2012
Classification: R20, R22, R36, R37, R38, R42, R43, R60, R61, R50/53

Acenaphthylene (CAS Number: 208-96-8)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=59285&HarmOnly=no>

Data source date: 16/07/2012

Classification: R22, R26, R27, R36, R37, R38

Acenaphthene (CAS Number: 83-32-9)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=133563&HarmOnly=no>

Data source date: 16/07/2012

Classification: N; R50/53, N; R51/53, R36, R37, R38

Fluorene (CAS Number: 86-73-7)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=81845&HarmOnly=no>

Data source date: 16/07/2012

Classification: N; R50/53, R53

Phenanthrene (CAS Number: 85-01-8)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=109754&HarmOnly=no>

Data source date: 16/07/2012

Classification: N; R50/53, R22, R36, R37, R38, R40, R43

Anthracene (CAS Number: 120-12-7)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=101102&HarmOnly=no>

Data source date: 08/03/2013

Classification: N; R50/53, R36, R37, R38, R43

Fluoranthene (CAS Number: 206-44-0)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=56375&HarmOnly=no>

Data source date: 16/07/2012

Classification: N; R50/53, R20, R22, R36

Pyrene (CAS Number: 129-00-0)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=87484&HarmOnly=no>

Data source date: 16/07/2012

Classification: N; R50/53, R23

Indeno[123-cd]pyrene (CAS Number: 193-39-5)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory

Data source:

<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=128806&HarmOnly=no>

Data source date: 08/03/2013

Classification: R40

Benzo[ghi]perylene (CAS Number: 191-24-2)

Comments: Risk phrase data taken from European Chemicals Agency's Classification & Labelling Inventory
Data source:
<http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=15793&HarmOnly=no>
Data source date: 16/07/2012
Classification: N; R50/53

Notes utilised in assessment

Additional Risk Phrase Comments

from section: Table 2.2 in the document: "WM2 - Hazardous Waste Technical Guidance"
"This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous."

Note used on:

Test: "Additional on R33" for determinand: "Lead chromate"

C14.3: Step 4

from section: C14.3 in the document: "WM2 - Hazardous Waste Technical Guidance"
"Identify whether any individual ecotoxic substance is present below a cut-off value shown in Table C14.1"

Note used on:

Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Arsenic trioxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Chromium(III) oxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Copper (I) oxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Lead chromate"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Nickel dihydroxide"
Test: "H14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "Zinc chromate"

Substance notes

Note 1

from section: 1.1.3.2, Annex VI in the document: "CLP Regulations"
"The concentration stated or, in the absence of such concentrations, the generic concentrations of this Regulation (Table 3.1) or the generic concentrations of Directive 1999/45/EC (Table 3.2), are the percentages by weight of the metallic element calculated with reference to the total weight of the mixture."

Note used on:

determinand: "Lead chromate"

Note A

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"
"Without prejudice to Article 17(2), the name of the substance must appear on the label in the form of one of the designations given in Part 3. In Part 3, use is sometimes made of a general description such as '... compounds' or '... salts'. In this case, the supplier is required to state on the label the correct name, due account being taken of section 1.1.1.4."

Note used on:

determinand: "Zinc chromate"

Note E (Table 3.2)

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"
"Substances with specific effects on human health (see Chapter 4 of Annex VI to Directive 67/548/EEC) that are classified as carcinogenic, mutagenic and/or toxic for reproduction in categories 1 or 2 are ascribed Note E if they are also classified as very toxic (T+), toxic (T) or harmful (Xn). For these substances, the risk phrases R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R113, R114, R115, R116, R117, R118, R119, R120, R121, R122, R123, R124, R125, R126, R127, R128, R129, R130, R131, R132, R133, R134, R135, R136, R137, R138, R139, R140, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, R174, R175, R176, R177, R178, R179, R180, R181, R182, R183, R184, R185, R186, R187, R188, R189, R190, R191, R192, 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determinand: "Zinc chromate"

Version

Classification utilises the following:

WM2 - Hazardous Waste Technical Guidance, 3rd Edition, August 2013
CLP Regulations - Regulation (EC) No 1272/2008 of the European Parliament and of the Council: 16 December 2008
1st ATP - 1st Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 26 September 2009; binding date 1 Dec 2010
2nd ATP - 2nd Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 30 March 2011; binding date 1 Dec 2012 in respect of substances and 1 June 2015 in respect of mixtures
3rd ATP - 3rd Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 31 July 2012; binding date 1 Dec 2013
4th ATP - 4th Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 20 June 2013; binding date 1 Jun 2015
5th ATP - 5th Adaptation to Technical Progress for European Regulation 1272/2008: Date entered into force 13 August 2013; binding date 13 Aug 2013

HazWasteOnline Engine: WM2 version 3 (Aug 2013)

HazWasteOnline Engine Version: 1.0.2429.5257 (14 Apr 2014)

HazWasteOnline Database: 1.0.2428.5256 (06 Apr 2014)