soils LIMITED

Phase II Ground Investigation Report

at
The Dairy, Roads Hill,
Cathrington, Hampshire PO8 0TG

for
Peter Ernest Homes Ltd

Reference: 14814/GIR
June 2015

Control Document

Project
The Dairy, Roads Hill, Cathrington, Hampshire PO8 0TG

Document Type
Phase II Ground Investigation Report

Document Reference
14814

Document Status
Final

Date
June 2015

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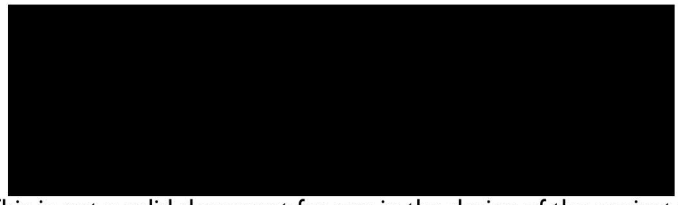

This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

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.

Commission

Soils Limited was commissioned by Peter Ernest Homes Ltd to undertake a Phase II Ground Investigation on land at The Dairy, Roads Hill, Cathrington, Hampshire PO8 0TG. The scope of the investigation was outlined in the Soils Limited quotation reference Q15981 dated 8th December 2014.

This document comprises the Phase II Ground Investigation Report and incorporates the results, discussion and conclusions to this intrusive works.

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: 14814, dated April 2015.

Standards

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

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

The chemical analyses were undertaken by QTS Environmental Limited 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.

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Section 1 Introduction

1.1 Objective of Investigation

Soils Limited was commissioned by Peter Ernest Homes Ltd to undertake a Phase II Ground Investigation to supply the client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed residential development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the trial holes.

In addition, soil samples were recovered for chemical laboratory testing to enable recommendations for any possible remediation due to the presence of contaminants that may pose a risk to the proposed end-user.

1.2 Location

The site was located at The Dairy, Roads Hill, Cathrington, Hampshire PO8 0TG and had an approximate O.S Land Ranger Grid Reference of SU 693 141.

The site location plan is given in Figure 1.

1.3 Site Description

At the time of reporting the site comprised open land with two single storey buildings, a number of shipping containers and caravans. The site covering was predominately broken tarmac and gravel with occasional grassed areas. Mature trees lined site boundaries with a scattering of weeds and shrubs of various species onsite. The site had a site slope down towards the north east, the wider topography was sloping down towards the west.

An aerial photograph has been included in Figure 2.

1.4 Proposed Development

The proposed development comprised a variety of one and two storey terraced and detached houses. The development comprised soft landscaping such as private and communal gardens. Hard landscaping would comprise access roads and driveway.
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In compiling this report reliance was placed on drawing number 14A_009 002 D, Dated Feb 2015 and was prepared by The Martin Ralph Group. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and

remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

The proposed development layout as provided by the client is included within Appendix F.

1.5 Anticipated Geology

The 1:50,000 BGS map showed the site to be situated on the bedrock of the Tarrant Chalk Member with the superficial Clay-with-Flints Formation overlying.

1.5.1 Clay-with-Flints

The deposits comprise for the most part brown sandy clays with a varying proportion of flints. The deposits are generally confined to the Chalk areas where they cap the high ground. The material is derived from the weathering of the flints out of the chalk, and the addition of clay from Eocene outliers.

It varies according to source rock type and climate and processes may include mechanical weathering by frost wedges to break rock apart; chemical weathering to decompose some minerals; and dissolution of carbonates.

1.5.2 Tarrant Chalk Member

The Tarrant Chalk Member typically comprised soft white chalk with relatively widely spaced but large flint seams. The lower boundary is conformable. Well-developed marls commonly occur for several metres above the Castle Hill Marls, up to and including the Pepper Box Marls, which are now taken as the base.

1.6 Limitations and Disclaimers

This Phase II Ground Investigation Report relates to the site located at The Dairy, Roads Hill, Cathrington, Hampshire PO8 0TG and was prepared for the sole benefit of Peter Ernest Homes Ltd (The “Client”). The report was prepared solely for the brief described in Section 1.1 of this report.

Soils Limited disclaims 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 Contact 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 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 on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, 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, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. 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 Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q15981 dated 8th December 2014.), was therefore to comprise the following items:

- Machine excavated trial pits
- Infiltration testing
- Windowless sampler borehole and dynamic probes
- Geotechnical laboratory analysis
- Chemical laboratory analysis

2.1.1 Project Works

The project site works were undertaken on 22nd April 2015 and comprised:

- 5No. Windowless sampler borehole (WS1 – WS5)
- 5No. Dynamic probes (DP1 – DP5)
- 3No. Machine excavated trial holes (TPA – TPC)
- 5No. Infiltration tests
- Geotechnical laboratory testing
- Contamination laboratory testing

Following completion of site works, soil cores were logged and sub sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

2.2 Ground Conditions

On 22nd April 2015 five windowless sampler boreholes (WS1 – WS5) were drilled, using an Archway Competitor Drilling Rig (Super Heavy), to depths of 5.00m bgl at location selected by Soils Limited using a development plan provided by the client. Five dynamic probes (DP1 – DP5), super heavy, were driven prior and adjacent to their corresponding windowless sampler borehole location to depths of 6.00m bgl.

Three trial holes were machine excavated, using a JCB 3CX, to depths 3.00m bgl (TPC) and 3.40m bgl (TPA) at locations selected by Soils Limited. Infiltration tests were conducted in each trial hole. Testing comprised pumping water from a 10,000L water tanker into unlined trial holes and recording the drop in water over time.

The maximum depths of trial holes have been included in Table 2.1.

All trial holes were scanned with a Cable Avoidance Tool (C.A.T.) and GENNY prior to excavation to ensure the health and safety of the operatives.

Table 2.1 Final Depth of Trial Holes

Trial Hole	Depth (m bgl)
WS1	5.00
WS2	5.00
WS3	5.00
WS4	5.00
WS5	5.00
DP1	6.00
DP2	6.00
DP3	6.00
DP4	6.00
DP5	6.00
TPA	3.00
TPB	3.20
TPC	3.40

The approximate trial hole locations are shown on Figure 3.

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.

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 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:

Made Ground/Topsoil (MG/TS)
Clay-with-Flints (CWF)
Tarrant Chalk Member (TCM)

The ground conditions encountered in the trial holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Age	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
TS	Recent	G.L.	0.35 – 0.50	0.40	Off white brown sub rounded to sun angular fine to coarse chalk and flint GRAVEL.
MG	Recent	G.L. – 0.35	0.20 – 1.00	0.50	Soft brown slightly sandy slightly clayey SILT. Gravel is fine to coarse sub rounded to sub angular brick, concrete and flint.
CWF	Quaternary	0.20 – 1.00	0.60 – 4.00[1]	2.00	Soft becoming stiff dark brown slightly sandy gravelly silty CLAY. Gravel is fine to medium sub angular to sub rounded flints and fragments of chalk.
TCM	Cretaceous	1.50 – 2.40	4.00[1]	Not proven[2]	CHALK recovered as fine to coarse intact chalk fragments with occasional flints.

Note: [1] Final depth of trial hole
[2] Base of strata not encountered

2.3 Ground Conditions Encountered in Trial Holes

The ground conditions encountered in trial holes have been described below in descending order.

2.3.1 Topsoil

Soils described as Topsoil were encountered in two trial holes (TPA & TPC) from ground level to depths ranging between 0.35m bgl and 0.50m bgl. The Topsoil typically comprised off white brown sub rounded to sub angular fine to coarse chalk and flint gravel.

The depth of Topsoil has been included in Table 2.3.

Table 2.3 Final Depth of Topsoil

Trial Hole	Depth (m bgl)
TPA	0.50
TPC	0.30

2.3.2 Made Ground

Soils described as Made Ground were encountered in all trial holes from ground level and in two locations (TPA & TPC) directly below the Topsoil at depths ranging between 0.35m bgl and 0.50m bgl. The Made Ground persisted to depths that ranged between 0.20m bgl and 1.00m bgl. The Made Ground typically comprised

soft brown slightly sandy slightly clayey silt. Gravel was fine to coarse sub rounded to sub angular brick, concrete and flint.

The depth of Made Ground has been included in Table 2.4.

Table 2.4 Final Depth of Made Ground

Trial Hole	Depth (m bgl)
WS/DP1	0.50
WS/DP2	0.40
WS/DP3	0.60
WS/DP4	0.20
WS/DP5	0.80
TPA	1.00
TPB	0.20
TPC	0.60

2.3.3 Clay-with-Flints

Soils described as the Clay-with-Flints were encountered in all trial holes from ranging between 0.20m bgl and 1.00m bgl. The Clay-with-Flints persisted to the full depth of investigation within three trial holes (WS4, WS5 and TPA) and to depths ranging between 1.50m bgl and 2.40m bgl in the remaining five. The Clay-with-Flints typically comprised soft becoming stiff dark brown slightly sandy gravelly silty clay. Gravel was fine to medium sub angular to sub rounded flints and fragments of chalk.

The Clay-with-Flints was encountered to the full depth of investigation in the south western corner of the site.

The depth of the Clay-with-Flints has been included in Table 2.5.

Table 2.5 Final Depth of Clay-with-Flints

Trial Hole	Depth (m bgl)
WS/DP1	1.50
WS/DP2	2.10
WS/DP3	2.40
WS/DP4	4.00[1]
WS/DP5	4.00[1]
TPA	3.40[1]
TPB	3.00
TPC	1.90

Note: [1] Final depth of trial hole

2.3.4 Tarrant Chalk Member

Soils described as the Tarrant Chalk Member were encountered in five trial holes at depths ranging between 1.50m bgl and 2.40m bgl. The Tarrant Chalk Member

persisted to the full depth of investigation when encountered. The Tarrant Chalk Member typically comprised chalk recovered as fine to coarse intact chalk fragments with occasional flints.

2.4 Roots

Roots were only observed in window sample boreholes at depths ranging between 0.10m bgl (WS5) and 1.70m bgl (WS2). The depths of root penetration have been included in Table 2.6.

Table 2.6 Depth of Root Penetration

Trial Hole	Depth (m bgl)
WS/DP 1	1.40
WS/DP 2	1.70
WS/DP 3	0.80
WS/DP 4	0.90
WS/DP 5	0.10
TPA	No roots observed
TPB	No roots observed
TPC	No roots observed

Roots may be found to greater depth 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.

2.5 Groundwater

Groundwater was not encountered during the intrusive investigation and was expected to be at depth within the Tarrant Chalk Member. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in April 2015 when groundwater levels should be reducing from their annual maximum (highest) elevation, which typically occurs around March.

Section 3 Discussion of Geotechnical In – Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at five locations (DP1 to DP5) adjacent and prior to the drilling of their respective windowless sampler boreholes to depths of 6.00m bgl.

Dynamic 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 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, based on dynamic energy, which permit engineering parameters to be generated.

The dynamic probe results were converted to equivalent SPT “N” values based on dynamic energy using in-house computer software (Geostru).

The inferred undrained strength of the cohesive soils was based on the equivalent SPT “N” blow counts, derived from 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.).

Table 3.1 SPT "N" Blow Count Cohesive 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.)

It is difficult to assess an accurate chalk grade for the Tarrant Chalk Member in accordance with CIRIA C574 ‘Engineering in Chalk’ as the chalk samples recovered are disturbed by the windowless sampling drilling process.

In the absence of a standardised correlation between SPT N values and chalk grade for the most recent chalk classification (CIRIA C574) a broad indication of the in-situ grade of the Tarrant Chalk Member can be assessed using a paper by T.R.M. Wakeling from a site in Mundford, Norfolk which compares SPT N values to the old Spink & Norbury chalk classification. From the Spink & Norbury classification it is possible to infer a basic CIRIA Grade (structureless or structured). Table 3.2 provides this broad comparison.

Table 3.2 Interpretation of SPT N Blow Counts in Chalk

SPT N Value Range	Spink & Norbury Grade	Inferred CIRIA Grade
<8	VI	Structureless (Dm)
8 – 15	V	Structureless (Dc)
15 – 20	IV	Structured chalk (C5 – A1)
20 - 25	III	Structured chalk (C5 – A1)
25 - 35	II	Structured chalk (C5 – A1)
>35	I	Structured chalk (C5 – A1)

Table 3.3 provides an interpretation of the equivalent SPT N blow counts for the soils encountered in the windowless sampler boreholes and those inferred from the dynamic probe counts.

Table 3.3 Interpretation of Dynamic Probe Blow Counts (DPSH)

DP	Strata (m bgl)	Equivalent SPT N Blow Counts	Cohesive Strength / Approximate CIRIA Chalk Grade
DP1	**CW F** Gravelly clay 0.50 – 1.50	3 – 14	Very low to medium (C_u = 15kPa – 70kPa)
	TCM Chalk 1.50 – 4.00	3 – 17	Very low to high (C_u = 15kPa – 85kPa)
	TCM[1] Chalk 4.00 – 6.00	12 – 26	Structureless (Dc) becoming structured chalk
DP2	**CW F** Gravelly clay 0.40 – 2.10	3 – 14	Very low to medium (C_u = 15kPa – 70kPa)
	TCM Chalk 2.10 – 4.00	3 – 17	Very low to high (C_u = 15kPa – 85kPa)
	TCM[1] Chalk 4.00 – 6.00	12 - >50	Structureless (Dc) becoming structured chalk
DP3	**CW F** Gravelly clay 0.60 – 2.40	3 – 17	Very low to high (C_u = 15kPa – 85kPa)
	TCM Chalk 2.40 – 4.00	3 – 14	Very low to medium (C_u = 15kPa – 70kPa)
	TCM[1] Chalk 4.00 – 6.00	6 - 17	Structureless (Dm) becoming structured chalk
DP4	**CW F** Gravelly clay 0.20 – 4.00	3 – 17	Very low to high (C_u = 15kPa – 85kPa)
	CW F[1] Gravelly clay 4.00 – 6.00	6 - 14	Low to medium (C_u = 30kPa – 70kPa)

DP	Strata (m bgl)	Equivalent SPT N Blow Counts	Cohesive Strength / Approximate CIRIA Chalk Grade
DP5	**CW F** Gravelly clay 0.80 – 4.50	6 – 12	Low to medium (C_u = 30kPa – 60kPa)
	TCM[1] Chalk 4.50 – 6.00	6 - 26	Structureless (Dm) becoming structured chalk

Note: [1] Ground conditions inferred past the base of windowless sampler boreholes.

The results from dynamic probing inferred that the cohesive soils of the Clay-with-Flints were of a **very low to high strength,** typically medium. Undrained cohesions of between **15kPa and 85kPa** were inferred from the correlations explained in Table 3.1. No correlation between strength and depth within the Clay-with-Flints could be established.

The results from dynamic probing inferred that the Tarrant Chalk Member ranged between **structureless (Dm) to structured (C5 – A1)**, typically structureless (Dc) chalk, which was inferred from the correlations explained in Table 3.2. The Tarrant Chalk Member improved in grade with depth.

The test results have be presented in Appendix A.

3.2 Atterberg Limit Tests

Atterberg limits tests were performed on four samples obtained from the Clay-with-Flints (WS1:1.30m bgl, WS2:1.90m bgl, WS4:2.40m bgl and WS5: 1.20m bgl), a summary of the results has been presented in Table 3.4.

Table 3.4 Atterberg Limit Test Interpretation

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
CWF	34 - 54	20 - 46	85 - 87	43 - 49	CH - CE	High	High

Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
Soils Classification based on British Soil Classification System

(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)

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 results from Atterberg Limits Tests confirmed that the soils of the Clay-with-Flints had **high volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

3.3 Saturation Moisture Content Test

Determination of saturated moisture content test was performed on one sample recovered from the Tarrant Chalk Member, the results have been presented in Table 3.5.

Table 3.5 Saturated Moisture Content Test Interpretation

Location	Depth (m bgl)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)	Moisture Content (%)	Saturation Moisture Content (%)	Density Classification (CIRIA)
W S1	2.10	1.74	1.33	31	38	Low density

(The Determination of Saturation Moisture Content of Chalk Tests were made in accordance with BS1377:Part 2:1990 Clauses 3.3).

The result from the saturated moisture content tests indicated the soils of the Tarrant Chalk Member were of a **low density**, as defined by CIRIA Publication, Engineering in Chalk, C574, 2002.

3.4 California Bearing Ratio (CBR) Test

One near surface samples from the Clay-with-Flints at a depth of 0.50m bgl was tested in the laboratory in order to provide an indication of likely California Bearing Ratio (CBR).

The results are summarised in Table 3.6.

Table 3.6 Saturated Moisture Content Test Interpretation

Sample	Laboratory Description	Moisture Content	CBR Value (Top)
TPB	Brown fine to coarse gravelly silty CLAY	28	4%

(Laboratory CBR Tests were performed in accordance with BS1377: Part 4: 1990: Clause 7.4)

The laboratory tests indicated a **CBR value 4%** for the variable soils of the Clay-with-Flints at the moisture contents tested.

The full test results are given in Appendix B.

3.5 Sulphate and pH Tests

Threes samples were taken for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, ‘Concrete in Aggressive Ground’.

The significance of the sulphate and pH Test results are discussed in Section 4.4 in this report, the results have been presented in Table 3.7.

Table 3.7 Sulphate and pH Tests

Trial Hole	Depth (m bgl)	pH	Sulphate (2:1) (mg/l)
WS1	0.80	7.9	130
WS4	1.20	7.6	50
WS5	2.40	7.5	120

(The Sulphate and pH Tests were undertaken in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground')

The test results are given in Appendix B.

3.6 Infiltration Tests (BRE Digest: 365)

Infiltration tests were performed at three locations (TPA, TPB and TPC) during the investigation to provide guidance on the suitability of the ground for the adoption of a surface water drainage system. The test strata comprised the Clay-with-Flints and the Tarrant Chalk Member. Tests were conducted in accordance with the principles of BRE Digest 365 Soakaway design: 1991.

BRE 365 that states for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test is completed once 75% of the water present has drained away, in order to determine whether or not the underlying ground conditions may be suitable for surface water drainage. It was not possible to complete three tests in each trial hole due to time constrictions on site and a limited water supply.

The test comprised piping water via a 10,000L tanker into the open trial hole, the drop in water level over time was then recorded to give an indication of soakage potential.

The results of Infiltration tests have been included in Table 3.8.

Table 3.8 Infiltration Test Results

Trial Hole/Test	Test No.	Test Stratum	Test Depth (m bgl)	Infiltration Rate (m/sec)
TPA	1	CWF	3.40	N/A
TPB[1]	1	CWF/TCM	3.80	1.162×10^{-5}
TPC	1	TCM	3.00	1.578×10^{-4}
	2	TCM	2.83	1.789×10^{-4}
	3	TCM	2.75	1.625×10^{-4}

Note: [1] Data extrapolated from 180mins to 250mins to provided indicative infiltration rate

A discussion of the results of the indicative infiltration tests is provided in Section 4.8.

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. Soil descriptions are based on analysis of disturbed samples taken from the trial holes.

4.1.1 Made Ground and Topsoil

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 Topsoil should be treated as suspect, because of the likelihood of extreme variability'*.

Soils described as Topsoil were encountered in two trial holes (TPA & TPC) from ground level to depths ranging between 0.35m bgl and 0.50m bgl. The Topsoil typically comprised off white brown sub rounded to sub angular fine to coarse chalk and flint gravel.

Soils described as Made Ground were encountered in all trial holes from ground level and in two locations (TPA & TPC) directly below the Topsoil at depths ranging between 0.35m bgl and 0.50m bgl. The Made Ground persisted to depths that ranged between 0.20m bgl and 1.00m bgl. The Made Ground typically comprised soft brown slightly sandy slightly clayey silt. Gravel was fine to coarse sub rounded to sub angular brick, concrete and flint.

A result of the inherent variability, particularly of uncontrolled Topsoil, 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 Topsoil and/or Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

4.1.2 Clay-with-Flints

Soils described as the Clay-with-Flints were encountered in all trial holes at depths ranging between 0.20m bgl and 1.00m bgl. The Clay-with-Flints persisted to the full depth of investigation within three trial holes (WS4, WS5 and TPA) and to depths ranging between 1.50m bgl and 2.40m bgl in the remaining five. The Clay-with-Flints typically comprised soft becoming stiff dark brown slightly sandy gravelly silty

clay. Gravel was fine to medium sub angular to sub rounded flints and fragments of chalk.

The Clay-with-Flints was encountered to the full depth of investigation in the south western corner of the site.

The results from dynamic probing inferred that the cohesive soils of the Clay-with-Flints were of a **very low to high strength,** typically medium. Undrained cohesions of between **15kPa and 85kPa** were inferred from the correlations explained in Table 3.1. No correlation between strength and depth within the Clay-with-Flints could be established.

The results from Atterberg Limits Tests confirmed that the soils of the Clay-with-Flints had **high volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

The laboratory tests indicated a **CBR value 4%** for the variable soils of the Clay-with-Flints at the moisture contents tested.

The Clay-with-Flints is normally consolidated and would therefore possess moderate bearing capacities with moderate settlement characteristics. The Clay-with-Flints can be considered as a suitable bearing stratum for the proposed development provided suitable thickness is encountered and targetable.

4.1.3 Tarrant Chalk Member

Soils described as the Tarrant Chalk Member were encountered in five trial holes at depths ranging between 1.50m bgl and 2.40m bgl. The Tarrant Chalk Member persisted to the full depth of investigation when encountered. The Tarrant Chalk Member typically comprised chalk recovered as fine to coarse intact chalk fragments with occasional flints.

The results from dynamic probing inferred that the Tarrant Chalk Member ranged between **structureless (Dm) to structured (C5 – A1)**, typically structureless (Dc) chalk, which was inferred from the correlations explained in Table 3.2. The Tarrant Chalk Member improved in strength with depth.

The result from the saturated moisture content tests indicated the soils of the Tarrant Chalk Member were of a **low density**, as defined by CIRIA Publication, Engineering in Chalk, C574, 2002.

Chalk is a weak rock that, if not weathered, possesses moderate to high bearing potential with low settlement characteristics. The Tarrant Chalk Member would be a suitable bearing stratum however the depth that the chalk was encountered in some locations may mean that the chalk cannot be adopted as a bearing stratum for all parts of the proposed development unless piled foundations are adopted.

4.1.4 Roots

Roots were only observed in window sample boreholes at depths ranging between 0.10m bgl (WS5) and 1.70m bgl (WS2). Roots may be found to greater depth 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.

4.1.5 Groundwater

Groundwater was not encountered during the intrusive investigation and was expected to be at depth within the Tarrant Chalk Member. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in April 2015 when groundwater levels should be reducing from their annual maximum (highest) elevation, which typically occurs around March.

4.2 Foundation Scheme

The proposed development comprised a variety of one and two storey terraced and detached houses. The development comprised soft landscaping such as private and communal gardens. Hard landscaping comprised access roads and driveway.

In compiling this report reliance was placed on drawing number 14A_009 002 D, Dated Feb 2015 and was prepared by The Martin Ralph Group. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

The proposed development layout as provided by the client is included within Appendix F.

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 results from Atterberg Limits Tests confirmed that the soils of the Clay-with-Flints had **high volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

High volume change potential must therefore be adopted where foundations are constructed within or pass through the soils of the Clay-with-Flints.

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 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.

The BRE Digest 240 suggests: *"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".

4.3 Conclusions and Recommendations

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

Roots were only observed in window sample boreholes at depths ranging between 0.10m bgl (WS5) and 1.70m bgl (WS2). If roots are encountered during the construction phase 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. Excavations must be checked by a suitable person prior to concrete being poured.

Although the Tarrant Chalk Member would be the most suitable bearing stratum for the proposed development the chalk was not encountered in some areas of the site. The site must therefore be zoned into founding stratum, either the Clay-with-Flints or Tarrant Chalk Member. The estimated zoned site plan has been included in Figure 4.

Considering the type of development a shallow foundation solution was considered the most suitable.

4.3.1 Zone 1

As the Tarrant Chalk Member was encountered at depths ranging between 1.50m bgl (WS1) and 2.10m bgl (WS2) the chalk was considered the most suitable bearing stratum in Zone 1.

Based on a 5.00 by 0.75m strip foundation bearing onto the Tarrant Chalk Member and using in-house software an allowable bearing value of 150kPa was achievable. Settlement should not exceed 20mm. The Chalk properties used in the design were obtained from both laboratory test results and The bearing capacity given is proportional to the settlement should higher bearing capacities be required greater settlements must be tolerated.

4.3.2 Zone 2

The Clay-with-Flints persisted to depths of between 1.90m bgl and 2.40m bgl in Zone 2 and can therefore be considered as a suitable bearing stratum. The Tarrant Chalk Member was directly below the Clay-with-Flints and can also be considered as a suitable bearing stratum.

Based on a 5.00 by 0.75m strip foundation bearing onto the Clay-with-Flints and using in-house software an allowable bearing value of 110kPa was achievable. Settlements should not exceed 25mm. The bearing capacity was limited by the settlements, greater bearing capacity's would result in intolerable settlements (>25mm).

The Tarrant Chalk Member was comparable to that found in Zone 2, which was determined from in-situ testing, and therefore a bearing capacity of 150kPa was achievable. Settlements should not exceed 20mm.

4.3.3 Zone 3

The Tarrant Chalk Member could not be targeted as a founding stratum as it was encountered at depths of >3.00m bgl.

Based on a 5.00 by 0.75m strip foundation bearing onto the Clay-with-Flints and using in-house software an allowable bearing value of 110kPa was achievable. Settlements should not exceed 25mm. The bearing capacity was limited by the settlements, greater bearing capacity's would result in intolerable settlements (>25mm).

4.3.4 General

The use of reinforced trench fill foundations should be used to reduce the possibility of differential settlement affecting the foundations.

For the allowable bearing value given above, settlements should not exceed the presented values, provided that excavation bases are carefully bottomed out and blinded, or concreted as soon after excavation as possible and kept dry. Foundations must not be constructed over former structures and other hard spots. The foundations design must be suitable for the conditions present at the site.

All loose material, loose blocks of chalk and soft spots must be removed from the base of the excavations, these excavations then being either concreted or blinded as soon after excavation as possible. Failure to do so could results in increased

settlements. Foundations must not be cast over foundations of former structures

and/or other hard spots.

Please note; the Tarrant Chalk Member will be frost susceptible and appropriate protection / cover should be given to exposed ground during winter construction.

A suspended ground floor, such as block and beam, should be incorporated due to the high volume change potential associated with the Clay-with-Flints Formation.

Any surface water ingress must be prevented from entering foundation trenches.

4.4 Groundwater

Groundwater was not encountered during the intrusive investigation and was expected to be at depth within the Tarrant Chalk Member. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in April 2015 when groundwater levels should be reducing from their annual maximum (highest) elevation, which typically occurs around March.

4.5 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts fell into Class **DS-1** of the BRE Special Digest 1 2005, *'Concrete in Aggressive Ground'.* Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-1**. The pH of the soils tested ranged between 7.5 and 7.9.

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 any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

4.6 Excavations

Shallow excavations in the Made Ground/Topsoil and Clay-with-Flints are likely to be marginally stable at best.

Deeper excavations taken into Tarrant Chalk Member are likely to be stable in the short term, depending on the thickness of overlying Clay-with-Flints. 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 or battered back to a safe angle of repose before excavations are entered by personnel.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary.

4.7 Pavements

Pavement structures in the form of access roads and car parking were proposed as part of the development. The laboratory tests indicated a ***CBR value of 4% for*** the cohesive soils of the Clay-with-Flints at the moisture content tested.

Preliminary pavement design should use a **CBR value of 4%**. CBR tests are highly moisture sensitive and therefore in-situ tests must be performed immediately prior to the construction of the pavements to confirm the design CBR value. Where summer construction is proposed it is possible that greater CBR values could be achieved which could reduce the thickness of the required pavement structure.

Any soils containing chalk fragments (e.g. Clay-with-Flints) or if the sub-base were to be constructed close to the Chalk must be regarded as frost susceptible and the sub-base thickness designed accordingly.

Although the chalk would be likely to have a higher CBR value than the Clay-with-flints, the pavement thickness would be limited by its frost susceptibility.

4.8 Surface Water Drainage

Five infiltration tests were performed within three trial pits (TPA to TPC), within the soils of the Clay-with-Flints and Tarrant Chalk Member, following the principles of BRE Digest 365 Soakaway design: 1991. BRE 365 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test can only be ended once 75% of the water present has drained away.

The water for each test was piped into the trial holes using a 100mm diameter hose from a 10,000ltr water bowser to provide suitably rapid discharge. The drop in water level over time was then recorded to give an indication of soakage potential. The rate of infiltration was measured from the side of the trial hole at ground level.

When testing only the Tarrant Chalk Member in one trial hole (TPC) three infiltration tests were achieved where 75% of the water infiltrated. Infiltration rates of between 1.625×10^{-4}m/s and 1.578×10^{-4}m/s where calculated.

In the two trial holes (TPA and TPB) where the Clay-with-Flints and Tarrant Chalk Member were tested, slightly slower infiltration was observed and in one trial hole (TPA) infiltration was insufficient to calculate an infiltration rate.

The BRE Digest 365 suggests that the lowest infiltration rate is adopted for design therefore a design rate of **1.625×10^{-4}m/s** is considered suitable for the adoption of natural soakaway system within the Tarrant Chalk Member.

In respect to the control of drainage CIRIA C574, Engineering in Chalk; 2002 states;

*“Concentrated ingress of water into the chalk can initiate new dissolution features, particularly in **low-density chalk,** and destabilise the loose backfill of existing ones. For this reason, any soakaways should be sited well away from foundations for structures, roads or railways, as indicated below:*

in areas where dissolution features are known to be prevalent, soakaways should be avoided if at all possible but, if unavoidable, should be sited at least 20m away from any foundations; where the chalk is of low density, or its density is not known, soakaways should be sited at least 10m away from any foundations; where the chalk is of medium density (or higher), the closest part of the soakaway should be at least 5m away from any foundations.

For drainage systems, flexible jointed pipes should be used wherever possible; particular care should be taken for the avoidance of leaks in both water supply and drainage pipework.

As the Chalk is a vitally important aquifer, the Environment Agency and local authority must be consulted when planning soakaway installations where chalk lies below the site even where it is mantled with surficial deposits.”

As the Chalk is a vitally important aquifer, the Environment Agency and local authority must be consulted when planning soakaway installations where chalk lies below the site even where it is mantled with surficial deposits.”

Section 5 Chemical Analysis of Soil Samples

5.1 Site Characterisation and Revised Conceptual Site Model

The Phase I Desk Study undertaken by Soils Limited (report ref: 14814/DS dated April 2015) identified a low to medium risk of ground contamination from the following onsite sources, which have been presented in Table 5.1.

Table 5.1 Sources of Contamination

Environs	Risk
MK Motors	Medium
Tipped waste (rusted metals, metals, plastics, glass, wood, rubble, empty paint cans Creosote containers)	Medium
Oil drums (plastic and metals)	Medium
Kinches Farm (dairy)	Low
Manure heap	Low

No offsite sources of contamination were identified within the Phase I Desk Study. The Phase II Ground Investigation did identify another potential source of contamination in the form of Made Ground, and therefore the Conceptual Site Model required revision.

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 targeted and non-targeted sampling strategy was adopted with sampling locations and sampling depths chosen to reflect both receptor and exposure scenarios of concern for the human health receptor (this being groundworkers and future maintenance workers), current and future buildings.

The sampling strategy has been included in Table 5.2.

Table 5.2 Sampling Strategy

Sample	Strategy	Proposed Use
TPA:0.25	Targeted – Beneath tipped waste	Rear garden of plot 7
TPC:0.50	Targeted – Adjacent to containers	Rear garden of plot 2
WS2:0.30	Targeted – Adjacent to workshop	Front garden of plot 9
WS3:0.40	Targeted – Adjacent to workshop	Rear garden of plot 2
WS4:0.40	Targeted – Adjacent to car storage area	Rear garden of plot 5
WS2:0.80	Non Targeted – Natural soils	Front garden of plot 9
WS3:2.50	Leachate Analysis for groundwater	N/A

5.3 Determination of Contaminants of Concern

The driver for the determination of the analysis suite was the information obtained from the Phase I Desk Study and Phase II intrusive investigation.

Table 5.3 Determination of Contaminants of Concern

Substance	Locations:Depths (m bgl)						
	TPA: 0.25[S]	TPC: 0.50[S]	WS2: 0.30[S]	WS3: 0.40[S]	WS4: 0.40[S]	WS2: 0.80[S]	WS3: 2.50[L]
Asbestos Screen	✓	✓	✓	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓	✓	✓	✓
Total Cyanide	✓	✓	✓	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓	✓	✓	✓
pH	✓	✓	✓	✓	✓	✓	✓
Metals	✓	✓	✓	✓	✓	✓	✓
Metalloids	✓	✓	✓	✓	✓	✓	✓
Organics	✓	✓	✓	✓	✓	✓	✓
PAHs	✓	✓	✓	✓	✓	✓	✓
TPH-CWG			✓	✓		✓	✓
BTEX			✓	✓		✓	✓

Notes: **metals**: Cd, Cr, Pb, Hg, Ni, Se, CN, S, Cu, Zn, Bo, V. **metalloids**: As. **organics**: USEPA 16 speciated PAH, TPH-CWG (speciated TPH), BTEX. **Asbestos screening** was undertaken in accordance with HSG 248. [S]= Soil sample. [W] = Water sample. [L] = Leachate.

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 E.

6.2 Representative Contamination Criteria - Soil

The proposed development comprised a variety of one and two storey terraced and detached houses. The development comprised soft landscaping such as private and communal gardens. Hard landscaping would comprise access roads and driveway.

In compiling this report reliance was placed on drawing number 14A_009 002 D, Dated Feb 2015 and was prepared by The Martin Ralph Group. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

The results of the comparison of the representative contaminants concentration for human health receptor to the Soil Guideline Values (SGV), Category 4 Screening Levels (C4SL's) Atkins ATRISKsoil SSV Guideline Values for Lead and General Assessment Criteria (GAC) are presented in Table 6.1.

The SGV and GAC are assessed against the "Residential" land-use scenario, which was considered the most appropriate land-use scenario, given the type of the proposed redevelopment.

The assessment for lead was undertaken based on the Category 4 Screening Value (C4SL) for the "Residential" land-use scenario.

Table 6.1 Summary of Chemical Analysis of Soils Samples

Substance	Sample location where SGV, SSV or GAC adopted were exceeded for the 'Residential' land-use scenario
Arsenic	None
Beryllium	None
w/s Boron	None
Cadmium	None
Chromium	None
Copper	None
Lead	None
Mercury (inorganic)	None
Nickel	None
Selenium	None
Vanadium	None
Zinc	None
Total Cyanide	None

Substance	Sample location where SGV, SSV or GAC adopted were exceeded for the 'Residential' land-use scenario
PAHs	None
TPH-CWG (speciated)	None
BTEX	None
Asbestos Screen*	None

Note: * Asbestos screening was carried out in accordance with HSG 248.

To assess the potential toxicity to the human health receptor from the concentrations of organic compounds tested for, Soil Organic Matter (SOM) tests were undertaken on the samples submitted for chemical testing, which revealed SOM values of between 0.8 % and 6.7%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate GAC for organic determinants.

In summary, none of the samples tested showed concentrations in excess of the relevant screening criteria for a residential land-use scenario.

Note on Asbestos; as asbestos containing material was not identified onsite but may present in other areas of the site. If encountered, care must be taken to ensure any such material is separated and disposed of in an appropriate manner to a licensed waste facility.

6.3 Risk to Groundwater

In the absence of groundwater, leachate testing was performed on a sample recovered from the Tarrant Chalk Member to assess the potential impact from overlying soils. The results of the leachate testing are presented in Table 6.2.

Table 6.2 Summary of Chemical Analysis for Groundwater and Leachate Samples

Substance	Units	EQS Source	EQS Concentration	Sample where EQS Level was exceeded
Arsenic	µg/l	SPAL	50	None
Benzene	µg/l	DWS	1	None
Boron	µg/l	DWS	1000	None
Cadmium	µg/l	SPAL/DWS	5	None
Chromium	µg/l	DWS	50	None
Copper	µg/l	DWS	2000	None
Nickel	µg/l	DWS	20	None
Lead	µg/l	DWS	10	None
Mercury	µg/l	DWS	1	None
Selenium	µg/l	DWS	10	None
Vanadium	µg/l	DWS	250000	None
Zinc	µg/l	DWS	5000	None
Sulphate	mg/l	SPAL	400	None
Sulphide	µg/l	SPAL	0.25	None
Toluene	µg/l	WHO	700	None
Ethylbenzene	µg/l	WHO	300	None
Xylenes	µg/l	WHO	50	None

Substance	Units	EQS Source	EQS Concentration	Sample where EQS Level was exceeded
MTBE	µg/l	WHO	15	None
Benzo (a) pyrene	µg/l	DWS/FW	0.01	None

Note: **DWS** = UK Drinking Water Standards.
SPAL = EA Standard for Protection of Aquatic Life (Freshwater).
FW = Freshwater standard.
EQS = Environmental Quality Standards.
WHO = World Health Organisation
[1] The specified compounds are benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene and indeno[1,2,3-c,d]pyrene.

In summary, none of the determinants tested recorded concentrations above the groundwater screening values.

6.4 Tier 1 Quantitative Risk Assessment

The Tier 1 Quantitative risk assessment therefore established that there was **no risk to the human health receptors** of construction workers or future end-users.

Groundwater: The Groundwater 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) through leachate analysis.

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

6.5 Remedial Objective

The Tier 1 Quantitative risk assessment therefore established that there was **no risk to the human health receptors** and therefore no remediation was required.

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

In addition any imported 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.

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.

6.6 Soil-Gas Risk

The Phase I Desk Study did not identify any potential sources of soil gas within 250m of the site it was therefore considered unlikely that a potential soil gas risk was present.

6.7 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 is 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.

6.8 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'):

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.

WAC testing or risk-based assessment was not undertaken at this stage but may be necessary depending upon whether material is required to be taken off-site.

6.9 Re-use 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.

6.10 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.

6.11 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Care should be taken during excavation works especially to investigate any soils, which appear by eye (e.g. such as fibrous materials, large amounts of ash and unusual discolouration), odour (e.g. fuel, oil and chemical type odours or unusual odours such as sweet odours or fishy odours) or wellbeing (e.g. light headedness and/or nausea, burning of nasal passages and blistering or reddening of skin due to contact with soil) to be contaminated or of unusual and/or different character to standard soils or those analysed.

In the event of any discovery of potentially contaminated soils or materials, this discovery should be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must be recorded and the Local Authority, and a competent and appropriate third party Engineer/Environmental consultant notified immediately. An approval from the Local authority must be sought prior to implementing any proposed mitigation action.

The discovery strategy must remain on site at all times and must demonstrate a clear allocation of responsibility for reporting and dealing with contamination. A copy of the strategy must be placed on the health and safety notice board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

List of Figures

List of Appendices

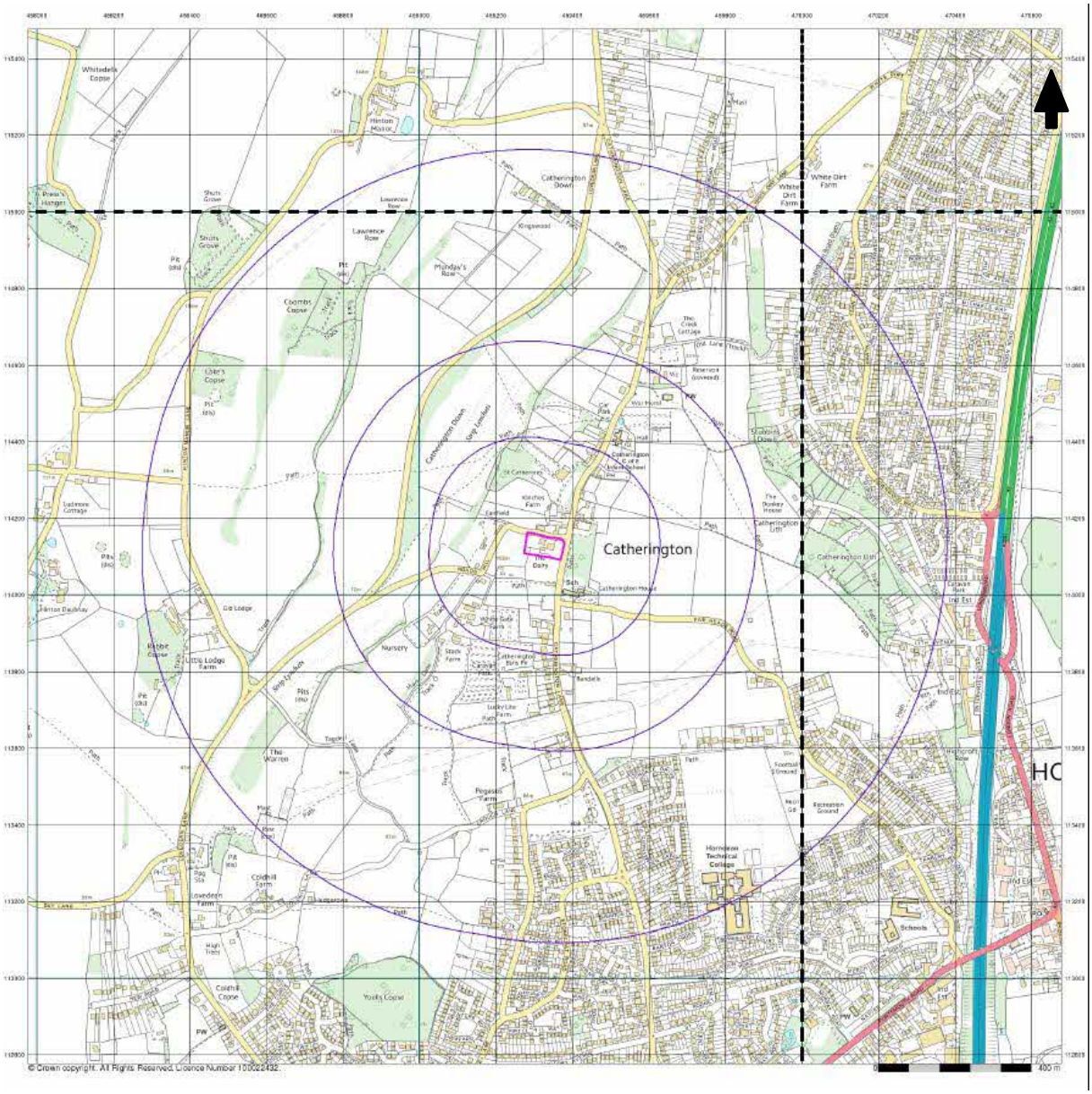

Figure number	Title
1	Site Location Map
Project	**Date**
The Dairy, Cathrington	June 2015
Client	**Job Number**
Peter Ernest Homes Ltd	14814

Figure number
2

Project
The Dairy, Cathrington

Client
Peter Ernest Homes Ltd

Title
Aerial Photograph

Date
June 2015

Job Number
14814

Figure number
3

Project
The Dairy, Cathrington

Client
Peter Ernest Homes Ltd

Title
Trial Hole Location Map

Date
June 2015

Job Number
14814

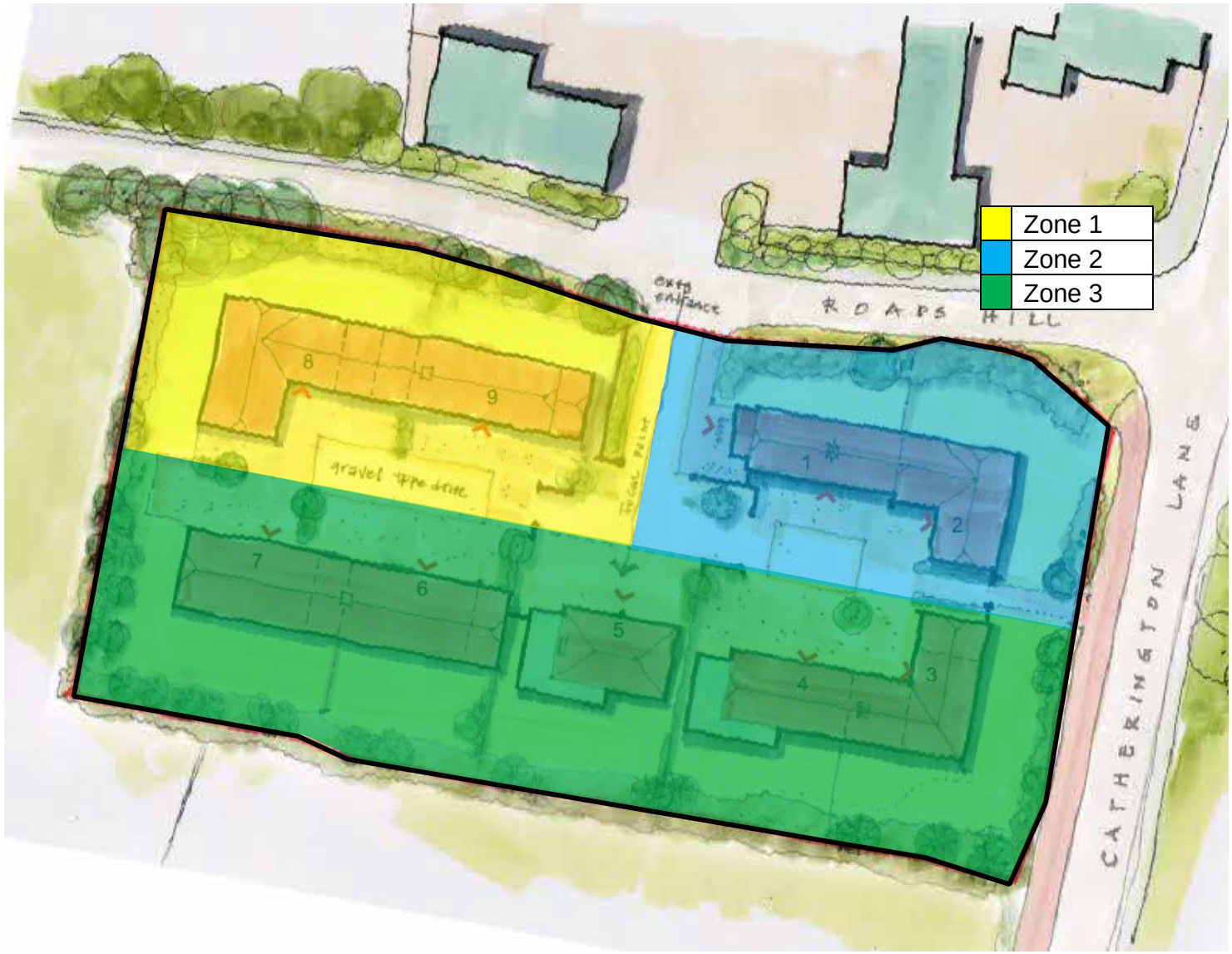

Figure number
4

Project
The Dairy, Cathrington

Client
Peter Ernest Homes Ltd

Title
Foundation Zones

Date
June 2015

Job Number
14814

Appendix A Field Work

Soils Limited
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Tel: 01737 814221 Email: admin@soilslimited.co.uk

Borehole Log

Borehole No. WS1
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No.: 14814	Co-ords:	Hole Type WS
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: Peter Ernest Homes Ltd		Dates: 22/04/2015	Logged By JH

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.08 0.20 0.40	D&J D&J D&J		0.50			Soft orangey brown very slightly sandy gravelly silty CLAY. Sand is medium. Gravel is fine to medium sub-angular to sub-rounded flint, brick and tarmac. Rare ash and rootlets. MADE GROUND
		0.80	D&J					Firm orangey brown slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is medium. Gravel is fine to coarse sub-angular flint and intact chalk fragments. CLAY-WITH-FLINTS
		1.30	D		1.50			
		1.80	D					Off white mottled brown structureless CHALK recoverd as fine to medium intact chalk fragments in a soft slightly sandy clayey matrix. Sand is medium to coarse. TARRANT CHALK MEMBER
		2.20	D					
		2.80	D					
		3.20	D					
		3.80	D					
					4.00			End of Borehole at 4.00m

1 2 3 4 5 6 7 8 9 10

General Remarks:
Rootlets observed to 1.40m bgl. No groundwater encountered.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon -Standard Penetration Test
CPT: Cone -Standard Penetration Test

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Borehole Log

Borehole No. WS2
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No.: 14814	Co-ords:	Hole Type WS
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: Peter Ernest Homes Ltd		Dates: 22/04/2015	Logged By JH

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	J		0.10			Black slighlty silty slightly sandy fine to coarse sub-angular flint and tarmac GRAVEL. Sand is medium to coarse. Rare shoots. MADE GROUND.
		0.20	D&J		0.20			
		0.30	D&J		0.40			Brown slghlty silty slightly sandy fine to medium sub-rounded flint,brick and tarmac GRAVEL with occasional carbonised material. Rare rootlets.MADE GROUND
		0.80	D&J					Soft orangey brown very slightly sandy gravelly silty CLAY. Sand is medium. Gravel is fine to medium sub-angular to sub-rounded flint, brick and tarmac. Rare ash and rootlets. MADE GREOUND
		1.30	D					Firm orangey brown slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is medium. Gravel is fine to coarse sub-angular flint. CLAY-WITH-FLINTS
		1.90	D					
		2.20	D		2.10			Off white mottled brown structureless CHALK recovered as fine to medium intact chalk fragments in a firm slightly sandy clayey matrix. TARRANT CHALK MEMBER
		2.80	D					
		3.20	D					
		3.80	D					
					4.00			End of Borehole at 4.00m

1 2 3 4 5 6 7 8 9 10

General Remarks:
Rootlets observed to 1.7m bgl. No groundwater encountered.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon -Standard Penetration Test
CPT: Cone -Standard Penetration Test

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	Borehole Log	Borehole No. WS3 Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No.: 14814	Co-ords:	Hole Type WS
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: Peter Ernest Homes Ltd		Dates: 22/04/2015	Logged By JH

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.01	D		0.05			TARMAC
		0.10	D&J		0.20			Soft orangey brown mottled black slightly sandy slightly silty gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub-angular brick, flint and tarmac. MADE GROUND
		0.40	D&J		0.60			Soft dark grey slightly sandy slightly silty gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub-angular brick and flint. Rare rootlets and carbonised materials. MADE GROUND
		0.80	D&J					Firm orangey brown slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is medium. Gravel is fine to coarse sub-angular flint. CLAY-WITH-FLINTS
		1.20	D					
		1.70	D					
		2.50	D		2.40			Off white mottled brown structureless CHALK recovered as fine to medium intact chalk fragments in a firm slightly sandy clayey matrix. TARRANT CHALK MEMBER
		2.90	D					
		3.20	D					
		3.80	D					
					4.00			End of Borehole at 4.00m

1 2 3 4 5 6 7 8 9 10

General Remarks:

Rootlets observed to 0.80m bgl. No groundwater encountered.

Groundwater Remarks:

Borehole Type	Sample Types
CP: Cable Percussive	D: Disturbed
WS: Windowless Sampler	B: Bulk
RC: Rotary Cored	J: Jar
	W: Water
	U: Undisturbed

In-Situ Testing

SPT: Split spoon -Standard Penetration Test

CPT: Cone -Standard Penetration Test

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Borehole Log

Borehole No. WS4
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No.: 14814	Co-ords:	Hole Type WS
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: Peter Ernest Homes Ltd		Dates: 22/04/2015	Logged By JH

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.10	D&J		0.20			Dark brown slightly sandy gravelly SILT. Sand is fine to medium. Gravel is fine to medium sub-angular to sub-rounded flint, brick and intact chalk fragments. Rare fine plastic sheeting. Abundance of roots and rootlets. MADE GROUND
		0.40	D&J		0.50			Soft to firm dark brown slightly sandy gravelly silty CLAY. Sand is fine to medium. Gravel is fine to medium sub-angular to sub-rounded flint and intact chalk fragments. CLAY-WITH-FLINTS
		0.80	D&J		1.00			Stiff orangey brown slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is medium. Gravel is fine to coarse sub-angular flint. CLAY-WITH-FLINTS
		1.20	D					Stiff orangey brown mottled black slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is medium. Gravel is fine to coarse sub-angular flint. CLAY-WITH-FLINTS
		1.70	D					
		2.40	D					
		3.20	D					
					4.00			End of Borehole at 4.00m

General Remarks:
Rootlets observed to 0.90m bgl. No groundwater encountered.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon -Standard Penetration Test
CPT: Cone -Standard Penetration Test

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Borehole Log

Borehole No. WS5
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No.: 14814	Co-ords:	Hole Type WS
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: Peter Ernest Homes Ltd		Dates: 22/04/2015	Logged By JH

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D&J					
		0.40	D&J					Soft dark grey slightly sandy slightly silty gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub-angular brick, concrete and flint. Rare rootlets and carbonised materials. MADE GROUND
		0.60	D&J		0.60			Soft dark grey slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is fine to coarse. Gravel is fine to medium sub-angular brick, flint. Rare rootlets. MADE GROUND
					0.80			Stiff orangey brown slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is medium. Gravel is fine to coarse sub-angular flint. CLAY-WITH-FLINTS
		1.20	D					
		1.80	D					
		2.40	D					
		2.80	D		2.70			Stiff dark orangey brown mottled black slightly sandy slightly silty gravelly CLAY with occasional iron staining. Sand is medium. Gravel is fine to coarse sub-angular flint. CLAY-WITH-FLINTS
		3.80	D					
					4.00			End of Borehole at 4.00m

General Remarks:
Rootlets observed to 0.10m bgl. No groundwater encountered.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon -Standard Penetration Test
CPT: Cone -Standard Penetration Test

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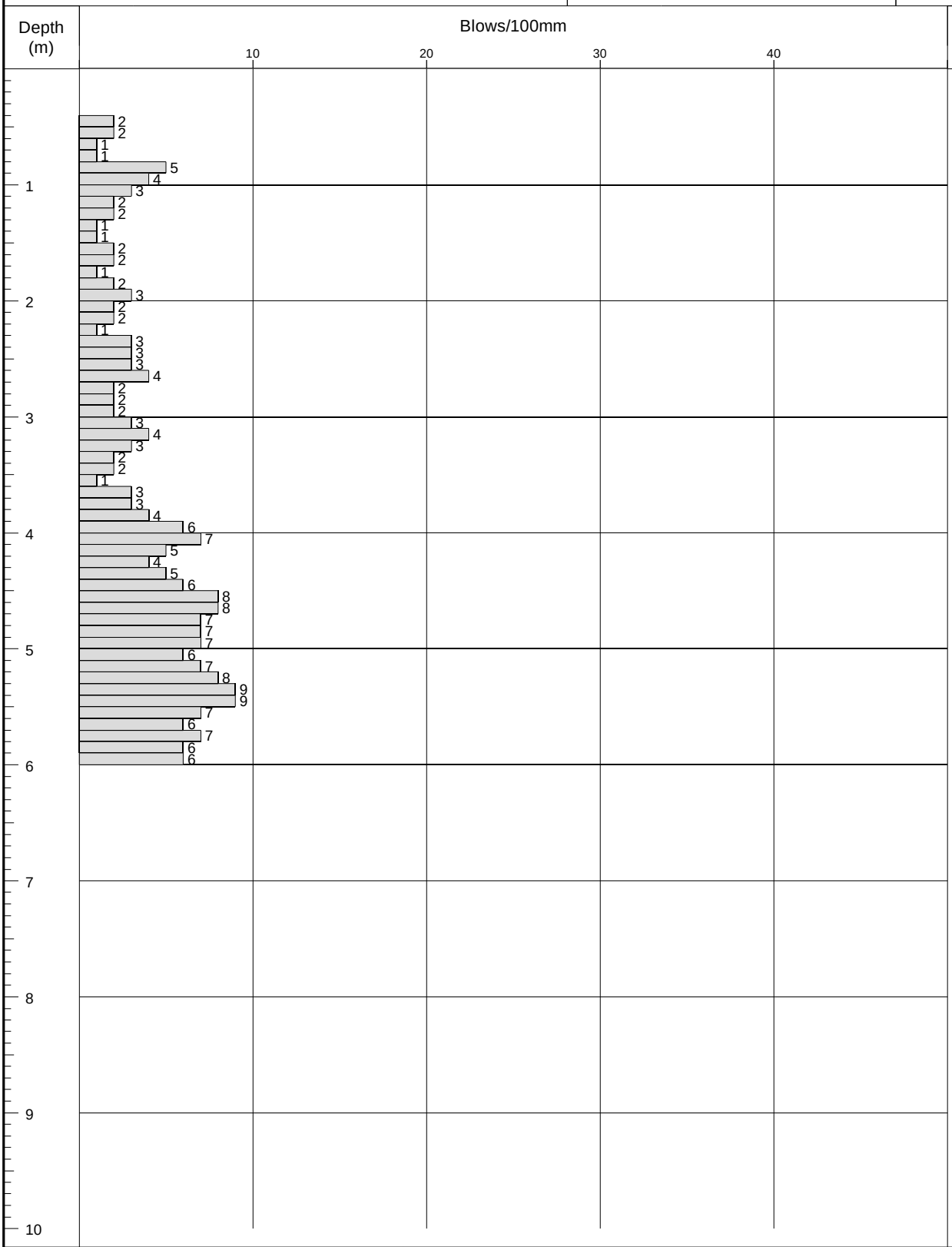
Probe Log

Borehole No.
DP1
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No. 14814	Co-ords: -	Hole Type DP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: PETER ERNEST HOMES LTD		Dates: 22/04/2015 -22/04/2015	Logged By



Remarks	Fall Height	Cone Base Diameter	
	Hammer Wt	Final Depth	5.90
	Probe Type	Log Scale	1:50

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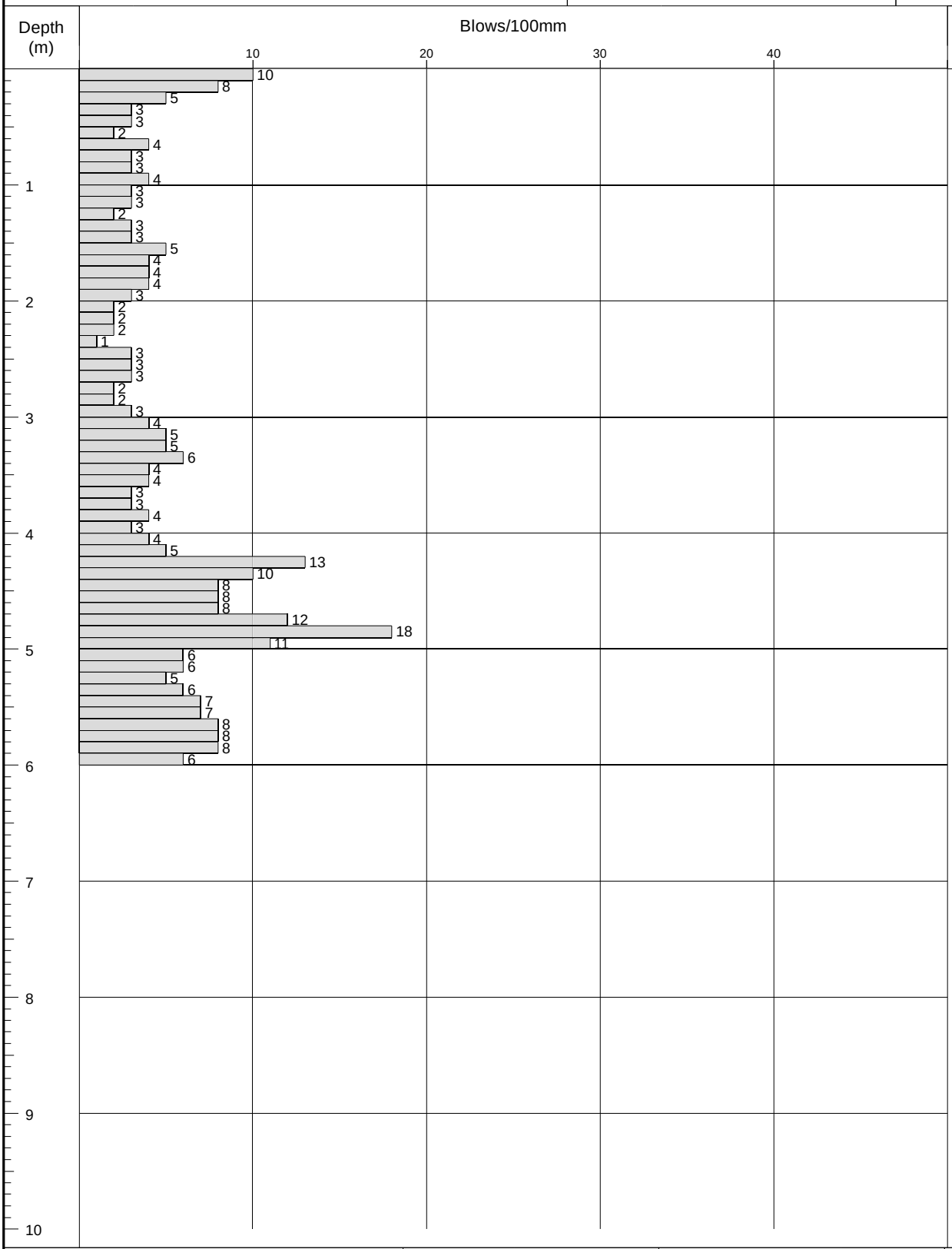
Probe Log

Borehole No.
DP2
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No. 14814	Co-ords: -	Hole Type DP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: PETER ERNEST HOMES LTD		Dates: 22/04/2015 -22/04/2015	Logged By



Remarks	Fall Height	Cone Base Diameter	
	Hammer Wt	Final Depth	5.90
	Probe Type	Log Scale	1:50

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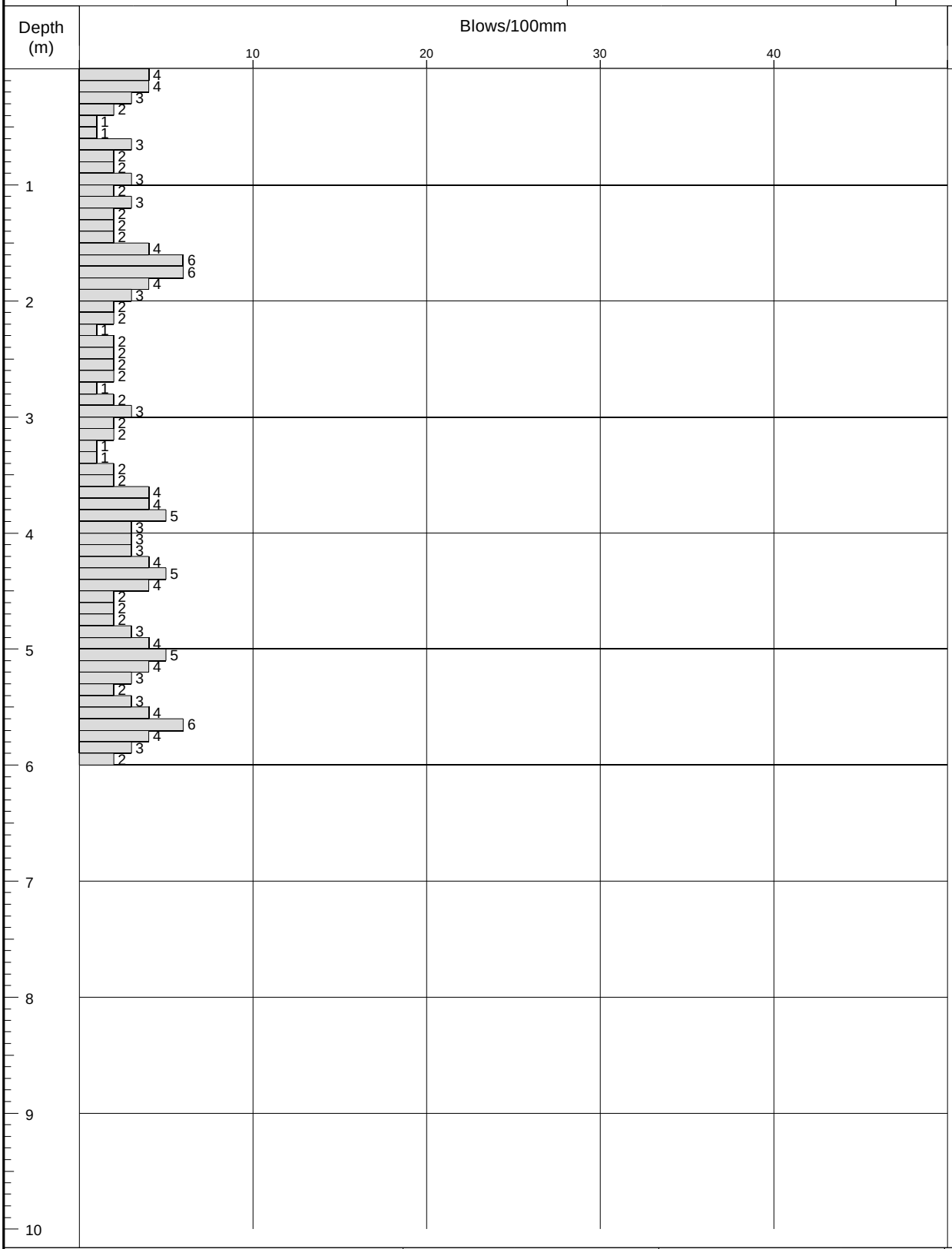
Probe Log

Borehole No.
DP3
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No. 14814	Co-ords: -	Hole Type DP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: PETER ERNEST HOMES LTD		Dates: 22/04/2015 -22/04/2015	Logged By



Remarks	Fall Height	Cone Base Diameter	
	Hammer Wt	Final Depth	5.90
	Probe Type	Log Scale	1:50

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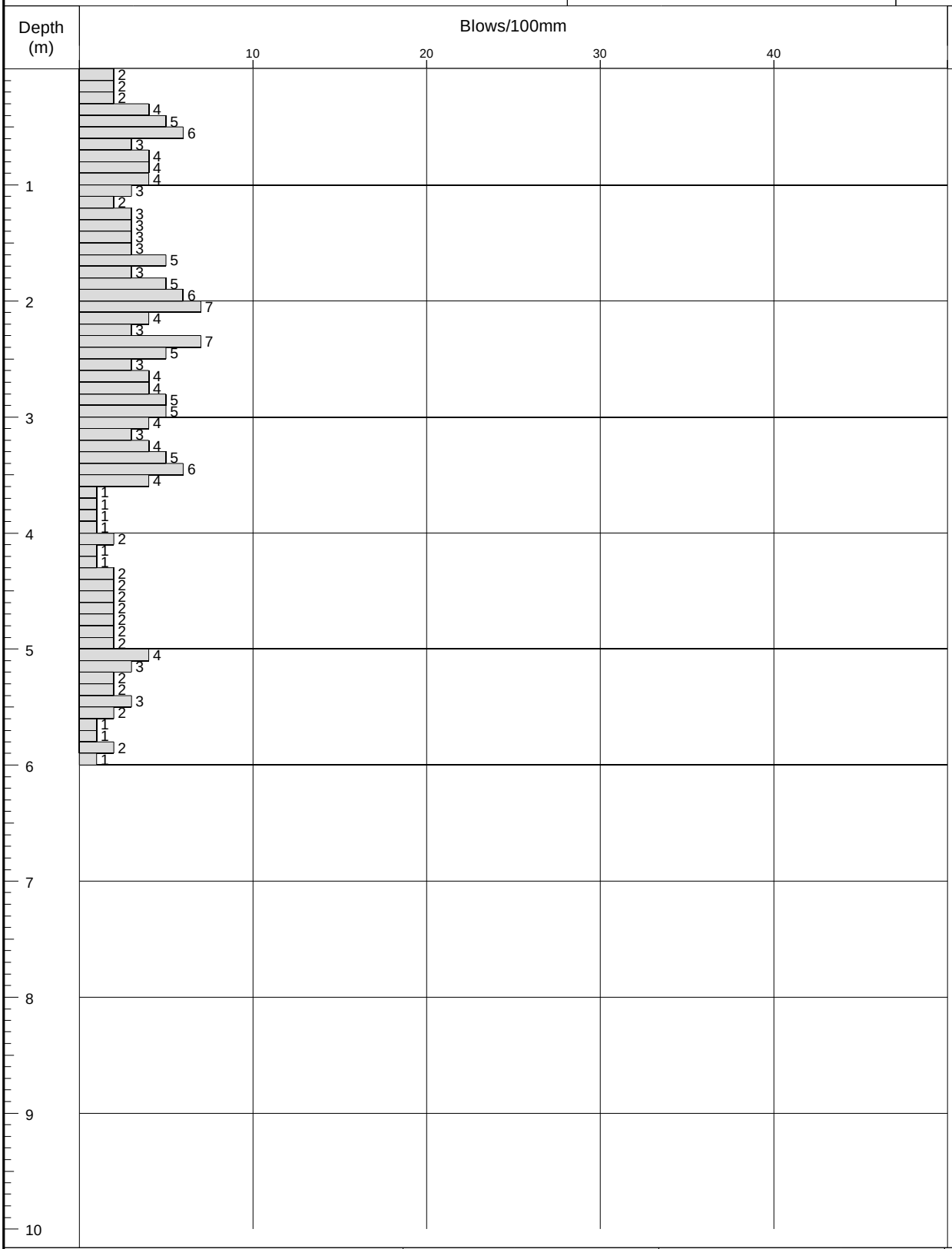
Probe Log

Borehole No.
DP4
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No. 14814	Co-ords: -	Hole Type DP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: PETER ERNEST HOMES LTD		Dates: 22/04/2015 -22/04/2015	Logged By



Remarks	Fall Height	Cone Base Diameter	
	Hammer Wt	Final Depth	5.90
	Probe Type	Log Scale	1:50

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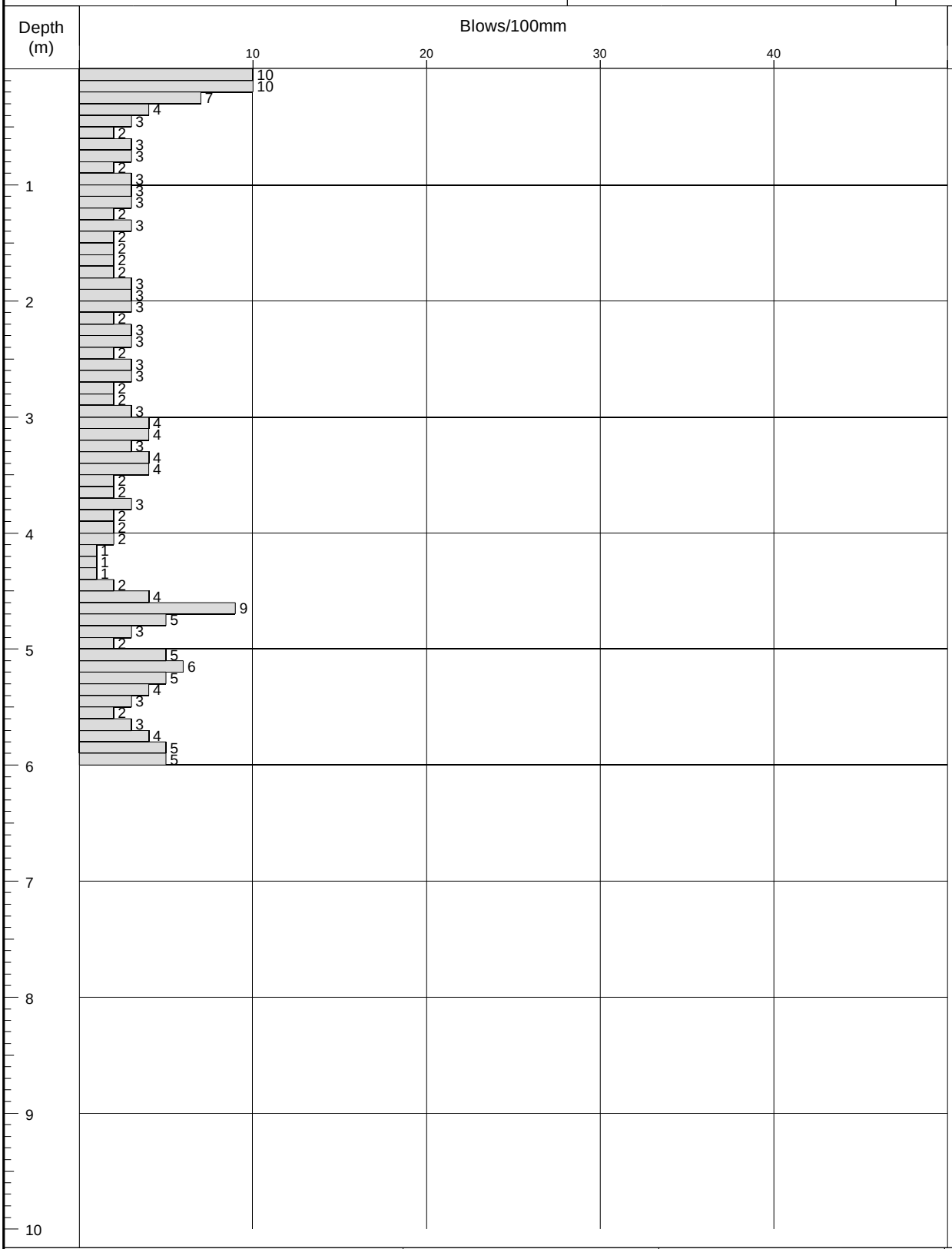
Probe Log

Borehole No.
DP5
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No. 14814	Co-ords: -	Hole Type DP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Level:	Scale 1:50
Client: PETER ERNEST HOMES LTD		Dates: 22/04/2015 -22/04/2015	Logged By



Remarks	Fall Height	Cone Base Diameter	
	Hammer Wt	Final Depth	5.90
	Probe Type	Log Scale	1:50

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Trial Pit Log

Trial Pit No. TPA
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No.: 14814	Method:	Hole Type TP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Plant:	
		Support:	Scale 1:25
Client: Peter Ernest Homes Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 22/04/2015	Level:	Co-ords:	Logged By JO

Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
Depth	Type	Results				
0.25	D					Off white sub-rounded to sub-angular fine to coarse CHALK fragments with frequent fine to coarse flint. TOPSOIL
0.50	B		0.50			Soft brown slightly sandy slightly clayey SILT with frequent fine to coarse sub-rounded to sub-angular brick, concrete, flint and mixed gravels. (MADE GROUND)
0.75	D					
1.00	D		1.00			Soft orange brown slightly silty gravelly sandy CLAY. Gravel was fine to coarse angular flints. CLAY-WITH-FLINTS
1.50	D					
2.00	D					
2.50	D					
3.00	D					
3.20	D					
			3.40			End of Pit at 3.40m

1
2
3
4
5

General Remarks:
No roots observed. No groundwater encountered.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Project Name: The Dairy, Roads Hill,	Project No.: 14814	Method:	Hole Type TP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Plant:	
		Support:	Scale 1:25
Client: Peter Ernest Homes Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 22/04/2015	Level:	Co-ords:	Logged By JO

Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
Depth	Type	Results				
						Soft brown slightly sandy slightly clayey SILT with frequent fine to coarse sub-rounded to sub-angular brick, concrete, flint and mixed gravels. MADE GROUND
0.25	D		0.20			Soft orange brown slightly silty gravelly sandy CLAY. Gravel is fine to coarse flints. CLAY-WITH-FLINTS
0.50	B					
0.75	D					
1.00	D					
1.50	D					
2.00	D					
2.50	D					
3.00	D		3.00			CHALK recovered as fine to coarse intact chalk fragments with occasional flints. TARRANT CHALK MEMBER
3.20	D		3.20			End of Pit at 3.20m

1
2
3
4
5

General Remarks:

No roots observed. No groundwater encountered.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No. TPC
Sheet 1 of 1

Project Name: The Dairy, Roads Hill,	Project No.: 14814	Method:	Hole Type TP
Location: Cathrington, Waterlooville, Hampshire, PO8 0TG		Plant:	
		Support:	Scale 1:25
Client: Peter Ernest Homes Ltd	Trial Pit Length: m	Trial Pit Width: m	
Dates: 22/04/2015	Level:	Co-ords:	Logged By JO

Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
Depth	Type	Results				
0.25	D		0.35			Gravel over off white sub-rounded to sub-angular fine to coarse CHALK fragments with frequent fine to coarse flint. TOPSOIL
0.50	B		0.60			Soft brown slightly sandy slightly clayey SILT with frequent fine to coarse sub-rounded to sub-angular brick, concrete, flint and mixed gravels. MADE GROUND
0.75	D					Soft orange brown slightly silty gravelly sandy CLAY. Gravel is fine to coarse flints. CLAY-WITH-FLINTS
1.00	D					
1.50	D					
2.00	D		1.90			CHALK recovered as fine to coarse intact chalk fragments with occasional flints. TARRANT CHALK MEMBER
2.50	D					
3.00	D		3.00			End of Pit at 3.00m

1 2 3 4 5

General Remarks:
No roots observed. No groundwater encountered.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soakaway Calculations

Soakaway Test No.	TPA(S1)
Contract:	The Dairy, Roads Hill
Contract No.	14814

Field Test

Trial Pit Log (include details of groundwater):

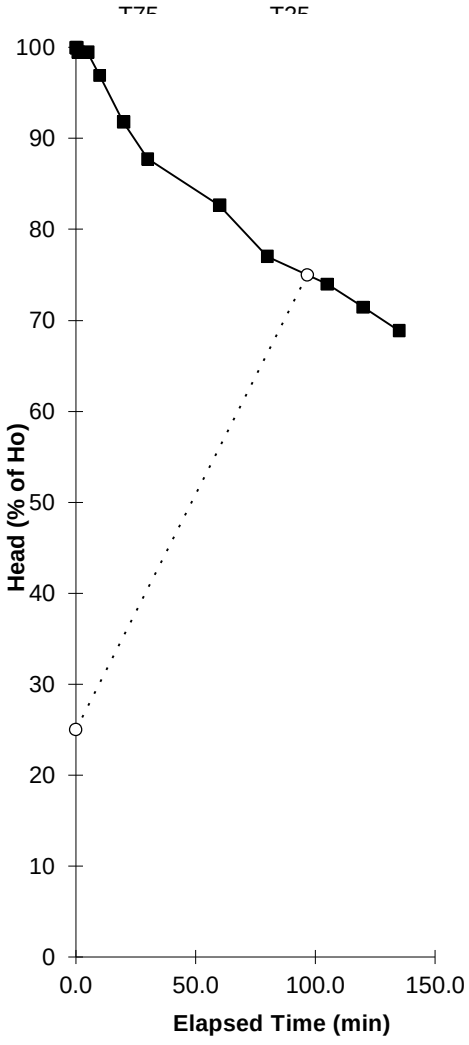
See trial Pit record

Depth of Pit	3.40	m
Width of Pit	0.50	m
Length of Pit	1.80	m
Depth of Pit Soaked	1.90	m
ap50	5.27	m2
Vp75-25		m3
t75-25		min
water used		m3
f	N/A	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.5	0		
1.44	0.1	100	1.96
1.44	0.2	100	1.96
1.44	0.4	100	1.96
1.45	1.0	99	1.95
1.45	5.0	99	1.95
1.50	10.0	97	1.90
1.60	20.0	92	1.80
1.68	30.0	88	1.72
1.78	60.0	83	1.62
1.89	80.0	77	1.51
1.95	105.0	74	1.45
2.00	120.0	71	1.40
2.05	135.0	69	1.35

T75	96.667	75
T25	0.000	25
T75-25	-96.667	Derived from Best Fit



Comments

Insufficent infiltration recorded over the test period, and infiltration was not obtainable as 75% of the water had not drained away.

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Soakaway Calculations

Soakaway Test No.	TPB (S1)
Contract:	The Dairy, Roads Hill
Contract No.	14814

Field Test

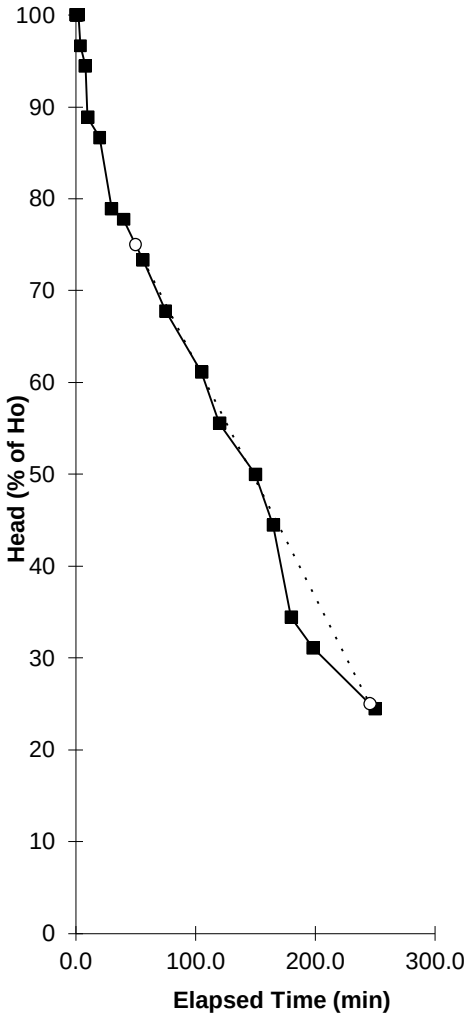
Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	3.80	m
Width of Pit	0.50	m
Length of Pit	1.80	m
Depth of Pit Soaked	0.90	m
ap50	2.97	m2
Vp75-25	0.405	m3
t75-25	195.7	min
water used	0.8100	m3
f	1.162E-05	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
2.9	0		
2.90	0.1	100	0.90
2.90	0.2	100	0.90
2.90	0.4	100	0.90
2.90	1.0	100	0.90
2.90	2.0	100	0.90
2.93	4.0	97	0.87
2.95	8.0	94	0.85
3.00	10.0	89	0.80
3.02	20.0	87	0.78
3.09	30.0	79	0.71
3.10	40.0	78	0.70
3.14	56.0	73	0.66
3.19	75.0	68	0.61
3.25	105.0	61	0.55
3.30	120.0	56	0.50
3.35	150.0	50	0.45
3.40	165.0	44	0.40
3.49	180.0	34	0.31
3.52	198.0	31	0.28
3.58	250.0	24	0.22



T75	50.000	75
T25	245.667	25
T75-25	195.667	Derived from Best Fit

Comments

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Surrey, KT20 5SR

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Soakaway Calculations

Soakaway Test No.	TPC (S1)
Contract:	The Dairy, Roads Hill
Contract No.	14814

Field Test

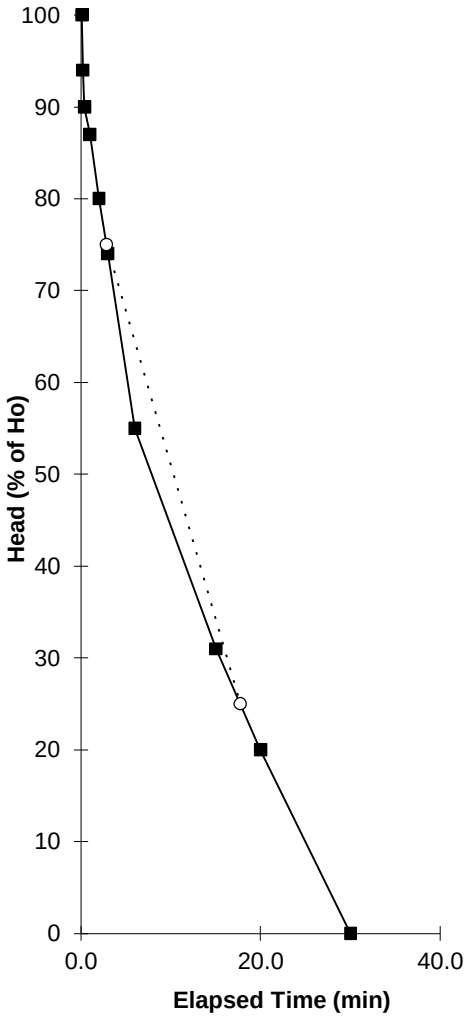
Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	3.00	m
Width of Pit	0.50	m
Length of Pit	1.57	m
Depth of Pit Soaked	1.10	m
ap50	3.062	m2
Vp75-25	0.43175	m3
t75-25	14.9	min
water used	0.8635	m3
f	1.578E-04	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.9	0		
2.00	0.1	100	1.00
2.06	0.2	94	0.94
2.10	0.4	90	0.90
2.13	1.0	87	0.87
2.20	2.0	80	0.80
2.26	3.0	74	0.74
2.45	6.0	55	0.55
2.69	15.0	31	0.31
2.80	20.0	20	0.20
3.00	30.0	0	0.00



T75	2.833	75
T25	17.727	25
T75-25	14.894	Derived from Best Fit

Comments

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Soakaway Calculations

Soakaway Test No.	TPC (S2)
Contract:	The Dairy, Roads Hill
Contract No.	14814

Field Test

Trial Pit Log (include details of groundwater):

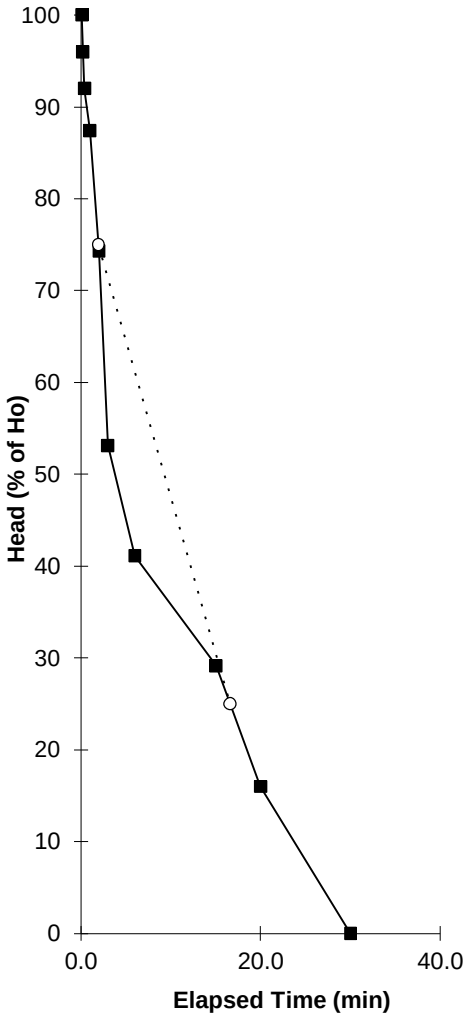
See trial Pit record

Depth of Pit	2.83	m
Width of Pit	0.50	m
Length of Pit	1.57	m
Depth of Pit Soaked	1.83	m

ap50	4.5731	m2
Vp75-25	0.718275	m3
t75-25	14.6	min
water used	1.4366	m3
f	1.789E-04	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1	0		
1.08	0.1	100	1.75
1.15	0.2	96	1.68
1.22	0.4	92	1.61
1.30	1.0	87	1.53
1.53	2.0	74	1.30
1.90	3.0	53	0.93
2.11	6.0	41	0.72
2.32	15.0	29	0.51
2.55	20.0	16	0.28
2.83	30.0	0	0.00



T75	1.946	75
T25	16.576	25
T75-25	14.630	Derived from Best Fit

Comments

SOILS LIMITED

Newton House, Cross Road, Tadworth
Surrey, KT20 5SR

Telephone: 01737 814 221
Facsimile: 01737 812 557

Soakaway Calculations

Soakaway Test No.	TPC (S3)
Contract:	The Dairy, Roads Hill
Contract No.	14814

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

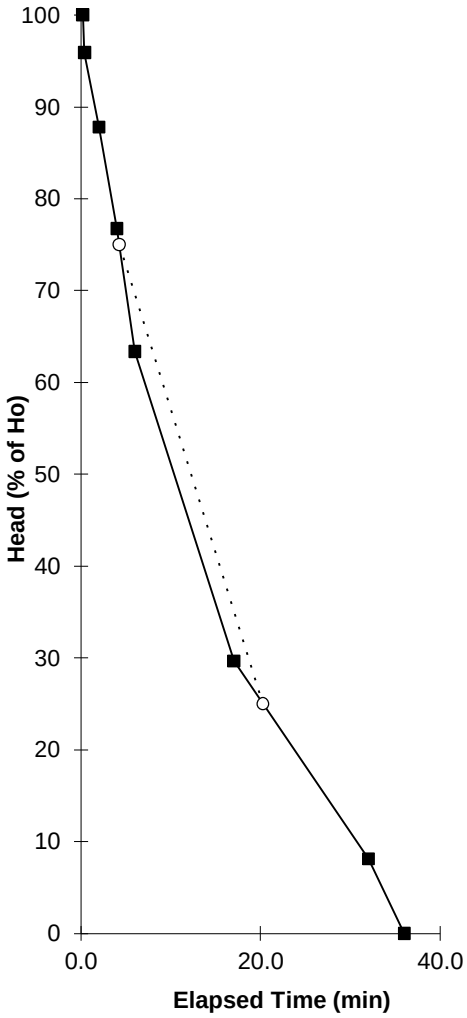
Depth of Pit	2.75	m
Width of Pit	0.50	m
Length of Pit	1.57	m
Depth of Pit Soaked	1.75	m

ap50	4.4075	m2
Vp75-25	0.686875	m3
t75-25	16.0	min
water used	1.3738	m3
f	1.625E-04	m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1	0		
1.03	0.2	100	1.72
1.10	0.4	96	1.65
1.24	2.0	88	1.51
1.43	4.0	77	1.32
1.66	6.0	63	1.09
2.24	17.0	30	0.51
2.61	32.0	8	0.14
2.75	36.0	0	0.00

T75	4.261	75
T25	20.243	25
T75-25	15.982	Derived from Best Fit



Comments

SOILS LIMITED
Newton House, Cross Road, Tadworth
Surrey, KT20 5SR

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Facsimile: 01737 812 557

Appendix B Geotechnical Laboratory Results

Laboratory Report

GEO Site & Testing Services Ltd

Contract Number: 26931

Client's Reference: **14814**

Report Date: **19-05-2015**

Client **Soils Limited**
Thomas Telford House
Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

Contract Title: **The Dairy, Roads Hill**

For the attention of: **Rob West**

Date Received: **14-05-2015**

Date Commenced: **14-05-2015**

Date Completed: **19-05-2015**

Test Description	Qty
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	4
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	4
CBR: Remoulded Specimen 1377 : 1990 Part 4 : 7 - * UKAS	1
(SMC) Saturated Moisture Content 1377 : 1990 Part 2 : 3.3 & 7.3 - @ Non Accredited Test	1
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Williams (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

Client ref: 14814

Location: The Dairy, Roads Hill

Contract Number: 26931-

Hole Number	Sample Number	Type	Depth (m)	Description of Sample*
WS1			1.30	Brown gravelly fine to medium clayey SILT.
WS2			1.90	Brown gravelly fine to medium silty CLAY.
WS4			2.40	Brown gravelly fine to medium silty CLAY.
WS5			1.20	Brown gravelly fine to medium silty CLAY.

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory

GSTL
GEO SITE & TESTING SERVICES LTD

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: 19.5.15

UKAS TESTING
2788

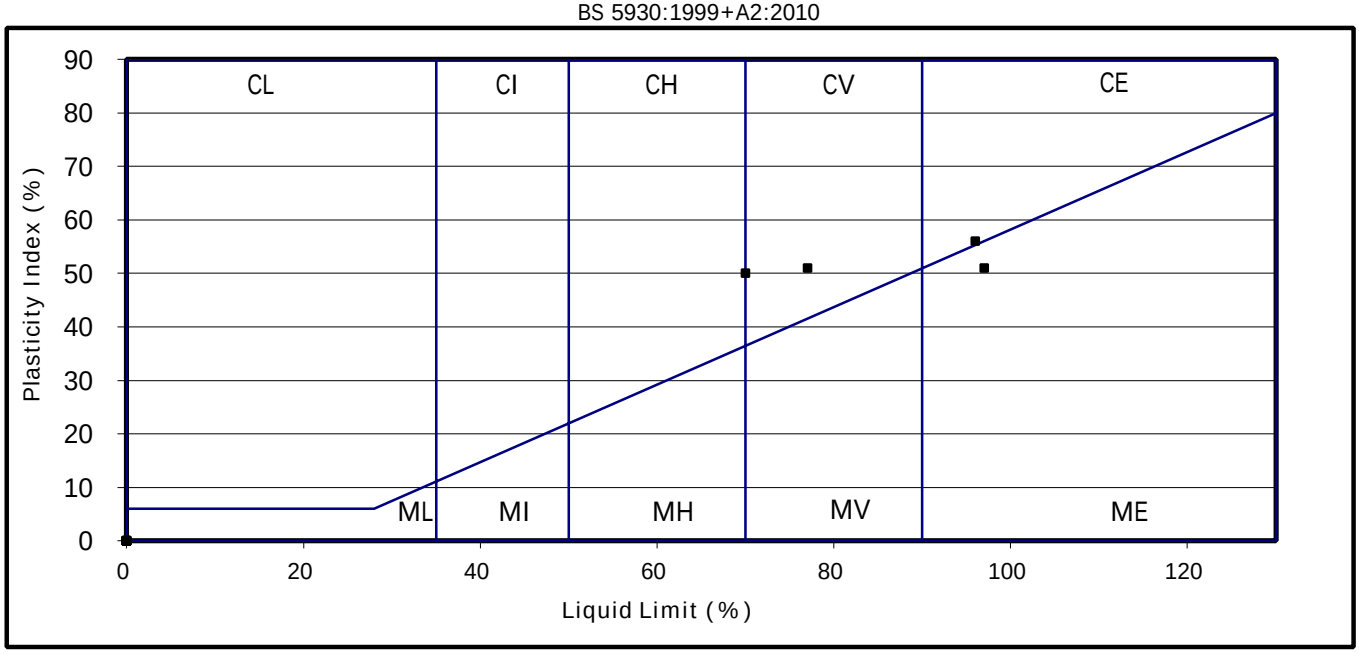
Test Report: Method of the Determination of the plastic limit and plasticity index
BS 1377 : Part 2 : 1990 Method 5

Client ref: 14814
Location: The Dairy, Roads Hill
Contract Number: 26931-

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
WS1		1.30	54	97	46	51	85	ME Extremely High Plasticity
WS2		1.90	34	70	20	50	85	CH/V High/HighPlasticity
WS4		2.40	39	96	40	56	87	CE Extremely High Plasticity
WS5		1.20	35	77	26	51	86	CV Very High Plasticity

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.
BS 5930:1999+A2:2010



GSTL
GEO SITE & TESTING SERVICES LTD

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: 19.5.15

UKAS TESTING 2788

Test Report: Method for Saturation Moisture Content of Chalk

BS 1377 : Part 2 : 1990 Section 3.3

Client Ref: 14814

Location : The Dairy, Roads Hill

Contract Number: 26931-

Borehole Number	Sample Number	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Saturation Moisture Content % Clause 8.	Remarks
WS1		2.10	31	1.74	1.33	38	

GSTL GEO Site & Testing Services Limited

Emma Sharp - Office Manager

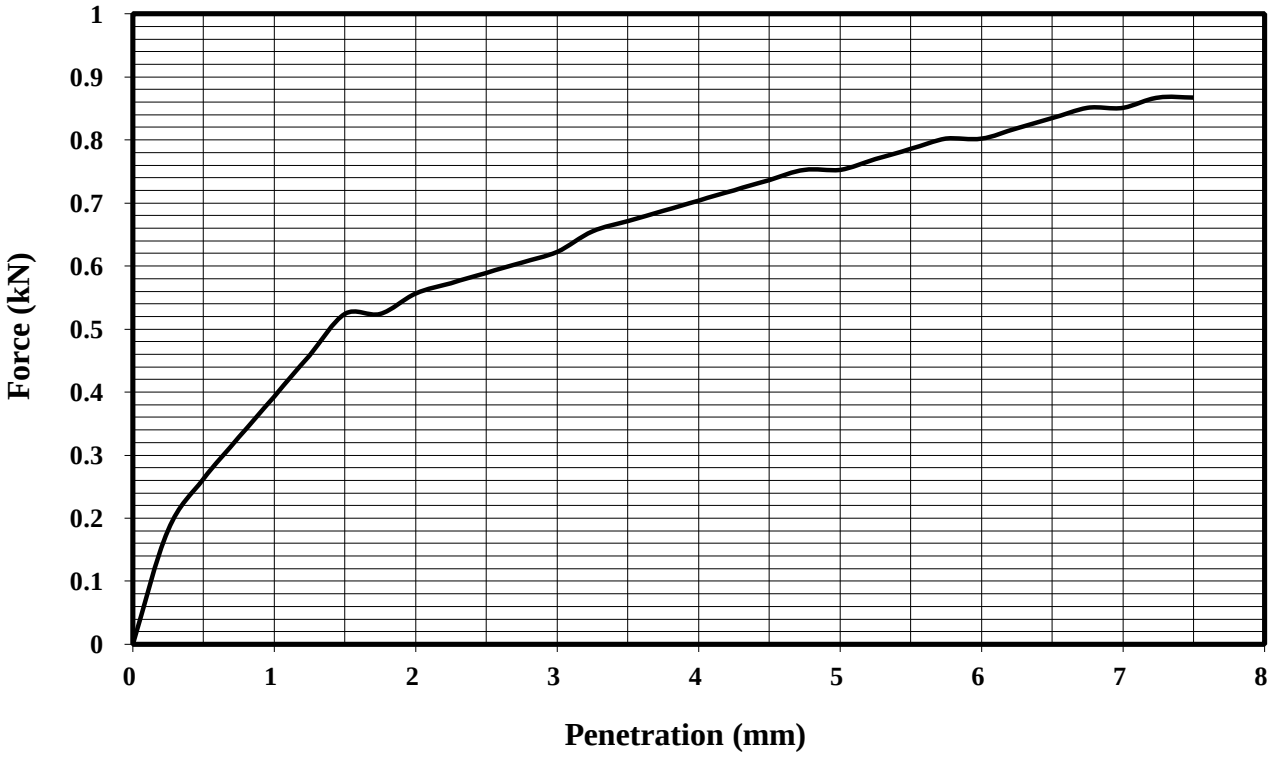
Checked By 18/5/15 Date

Ben Sharp - Contracts Manager

Approved By 18/5/15 Date

Test Report: Determination of the California Bearing Ratio
BS 1377: Part 4: 1990 Clause 7

Client ref:	14814
Location:	The Dairy, Roads Hill
Contract Number:	26931-
Sample Type:	B
Hole Number:	TPB
Sample Number:	N/A
Depth (m):	0.50 - N/A
Description:	Bronw fine to coarse gravelly silty CLAY.



Initial Sample Conditions		Test Conditions		Method of Compaction:	
				2.5kg Rammer	
Moisture Content:	28	Surcharge Kg:	2.0	Final Moisture Content %	
Bulk Density Mg/m3:	1.96	Soaking Time (hrs):		Sample Top	28
Dry Density Mg/m3:	1.53	Swelling mm:		Sample Bottom	28
C.B.R. Value %	Sample Top	4.46			
Percentage retained on 20mm BS test sieve:		18	Remarks:		

Checked By:
Emma Sharp (Office Manager)

Approved By:
Paul Evans (Quality Manager

GSTL
GEO Site & Testing Services Limited

Date Approved: 19.5.15

UKAS TESTING
2788

Rob West
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 15-31309

Site Reference:	The Dairy, Roads Hill, Cathrington
Project / Job Ref:	14814
Order No:	None Supplied
Sample Receipt Date:	11/05/2015
Sample Scheduled Date:	11/05/2015
Report Issue Number:	1
Reporting Date:	14/05/2015

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
Tel : 01622 850410

Soil Analysis Certificate							
QTS Environmental Report No: 15-31309	Date Sampled	07/05/15	07/05/15	07/05/15		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS1	WS4	WS5		
Project / Job Ref: 14814	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.80	1.20	2.40		
Reporting Date: 14/05/2015	QTSE Sample No	147945	147946	147947		

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.9	7.6	7.5		
Total Sulphate as SO_4	mg/kg	< 200	NONE	256	< 200	208		
W/S Sulphate as SO4 (2:1)	g/l	< 0.01	MCERTS	0.13	0.05	0.12		
Total Sulphur	mg/kg	< 200	NONE	< 200	< 200	< 200		
Ammonium as NH_4	mg/kg	< 0.5	NONE	8	5.9	7		
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	20	17	22		
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	37	12	5		
W/S Magnesium	g/l	< 0.0001	NONE	0.0041	0.0024	0.0067		

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

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

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 15-31309	
Soils Ltd	
Site Reference: The Dairy, Roads Hill, Cathrington	
Project / Job Ref: 14814	
Order No: None Supplied	
Reporting Date: 14/05/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
147945	WS1	None Supplied	0.80	16.2	Light brown clay with stones
147946	WS4	None Supplied	1.20	20.5	Light brown clay with stones
147947	WS5	None Supplied	2.40	15.2	Light brown clay with stones

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

Insufficient Sample I/S

Unsuitable Sample U/S

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

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-31309
Soils Ltd
Site Reference: The Dairy, Roads Hill, Cathrington
Project / Job Ref: 14814
Order No: None Supplied
Reporting Date: 14/05/2015

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

D Dried
AR As Received

Appendix C Chemical Laboratory Analysis

Rob West
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 15-31110

Site Reference:	The Dairy
Project / Job Ref:	14814
Order No:	None Supplied
Sample Receipt Date:	05/05/2015
Sample Scheduled Date:	05/05/2015
Report Issue Number:	1
Reporting Date:	07/05/2015

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
Tel : 01622 850410

Soil Analysis Certificate							
QTS Environmental Report No: 15-31110	Date Sampled	22/04/15	22/04/15				
Soils Ltd	Time Sampled	None Supplied	None Supplied				
Site Reference: The Dairy	TP / BH No	TPA	TPC				
Project / Job Ref: 14814	Additional Refs	None Supplied	None Supplied				
Order No: None Supplied	Depth (m)	0.25	0.50				
Reporting Date: 07/05/2015	QTSE Sample No	147123	147124				

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	7.8	7.7			
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2			
W/S Sulphate as SO4 (2:1)	g/l	< 0.01	MCERTS	0.04	0.03			
Sulphide	mg/kg	< 5	NONE	< 5	< 5			
Organic Matter	%	< 0.1	MCERTS	2.1	1.4			
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.2	0.8			
Arsenic (As)	mg/kg	< 2	MCERTS	5	6			
Beryllium (Be)	mg/kg	< 0.5	NONE	< 0.5	0.9			
W/S Boron	mg/kg	< 1	NONE	1.2	1.4			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.8	0.7			
Chromium (Cr)	mg/kg	< 2	MCERTS	20	18			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	36	16			
Lead (Pb)	mg/kg	< 3	MCERTS	153	39			
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	13	18			
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			
Vanadium (V)	mg/kg	< 2	NONE	20	31			
Zinc (Zn)	mg/kg	< 3	MCERTS	213	66			
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^{O}C

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

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

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

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

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

Asbestos Analyst: Graham Revell

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis $^{(S)}$

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

Soil Analysis Certificate - Speciated PAHs							
QTS Environmental Report No: 15-31110	Date Sampled	22/04/15	22/04/15			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: The Dairy	TP / BH No	TPA	TPC			
Project / Job Ref: 14814	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.25	0.50			
Reporting Date: 07/05/2015	QTSE Sample No	147123	147124			

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	0.15	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	0.43	< 0.1			
Pyrene	mg/kg	< 0.1	MCERTS	0.43	< 0.1			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.24	< 0.1			
Chrysene	mg/kg	< 0.1	MCERTS	0.27	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.38	< 0.1			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.13	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.31	< 0.1			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.20	< 0.1			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.22	< 0.1			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	2.8	< 1.6			

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

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

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 15-31110	
Soils Ltd	
Site Reference: The Dairy	
Project / Job Ref: 14814	
Order No: None Supplied	
Reporting Date: 07/05/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 147123	TPA	None Supplied	0.25	7.6	Brown clayey sand with rubble
$ 147124	TPC	None Supplied	0.50	17	Brown gravelly clay with stones and brick

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

Insufficient Sample I/S

Unsuitable Sample U/S

$ samples exceeded recommended holding times

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

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-31110
Soils Ltd
Site Reference: The Dairy
Project / Job Ref: 14814
Order No: None Supplied
Reporting Date: 07/05/2015

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

D Dried
AR As Received

Rob West
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

QTS Environmental Ltd
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t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 15-31289

Site Reference:	The Dairy, Roads Hill, Cathrington
Project / Job Ref:	14814
Order No:	None Supplied
Sample Receipt Date:	11/05/2015
Sample Scheduled Date:	11/05/2015
Report Issue Number:	1
Reporting Date:	15/05/2015

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

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Soil Analysis Certificate							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15	08/05/15	08/05/15	08/05/15	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS2	WS3	WS4	WS2	
Project / Job Ref: 14814	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.30	0.40	0.10	0.80	
Reporting Date: 15/05/2015	QTSE Sample No	147886	147887	147888	147889	

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	8.9	7.8	7.6	7.6	
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
W/S Sulphate as SO4 (2:1)	g/l	< 0.01	MCERTS	0.04	0.03	0.02	0.03	
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	
Organic Matter	%	< 0.1	MCERTS	2.3	4	6.7	0.8	
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.3	2.3	3.9	0.5	
Arsenic (As)	mg/kg	< 2	MCERTS	7	9	5	10	
Beryllium (Be)	mg/kg	< 0.5	NONE	1.1	0.9	0.5	2.4	
W/S Boron	mg/kg	< 1	NONE	1.9	2.9	2.1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	1.1	1.1	1.8	0.8	
Chromium (Cr)	mg/kg	< 2	MCERTS	30	27	26	40	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	20	22	50	14	
Lead (Pb)	mg/kg	< 3	MCERTS	38	81	116	19	
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	27	24	20	38	
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	
Vanadium (V)	mg/kg	< 2	NONE	54	49	34	78	
Zinc (Zn)	mg/kg	< 3	MCERTS	87	147	416	75	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

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

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

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

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

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

Asbestos Analyst: Wioletta Goral

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis $^{(S)}$

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Soil Analysis Certificate - Speciated PAHs							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15	08/05/15	08/05/15	08/05/15	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS2	WS3	WS4	WS2	
Project / Job Ref: 14814	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.30	0.40	0.10	0.80	
Reporting Date: 15/05/2015	QTSE Sample No	147886	147887	147888	147889	

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	0.33	< 0.1	0.53	< 0.1	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	0.80	0.13	1.06	< 0.1	
Pyrene	mg/kg	< 0.1	MCERTS	0.67	< 0.1	0.90	< 0.1	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.36	< 0.1	0.45	< 0.1	
Chrysene	mg/kg	< 0.1	MCERTS	0.33	< 0.1	0.55	< 0.1	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.47	< 0.1	0.72	< 0.1	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.17	< 0.1	0.24	< 0.1	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.38	< 0.1	0.50	< 0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.26	< 0.1	0.43	< 0.1	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.24	< 0.1	0.39	< 0.1	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	4	< 1.6	5.8	< 1.6	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

QTS Environmental Ltd
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Soil Analysis Certificate - TPH CWG Banded							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15	08/05/15	08/05/15		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS2	WS3	WS2		
Project / Job Ref: 14814	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.30	0.40	0.80		
Reporting Date: 15/05/2015	QTSE Sample No	147886	147887	147889		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	140	< 10	43		
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	140	< 21	43		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	34	< 10	< 10		
Aromatic (C5 - C35)	mg/kg	< 21	NONE	34	< 21	< 21		
Total >C5 - C35	mg/kg	< 42	NONE	174	< 42	43		

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

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Soil Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15	08/05/15	08/05/15		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS2	WS3	WS2		
Project / Job Ref: 14814	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.30	0.40	0.80		
Reporting Date: 15/05/2015	QTSE Sample No	147886	147887	147889		

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

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C

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Leachate Analysis Certificate							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15					
Soils Ltd	Time Sampled	None Supplied					
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS3					
Project / Job Ref: 14814	Additional Refs	None Supplied					
Order No: None Supplied	Depth (m)	2.50					
Reporting Date: 15/05/2015	QTSE Sample No	147890					

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	ISO17025	7.1				
Total Cyanide	ug/l	< 5	NONE	< 5				
Sulphate as SO_4	mg/l	< 1	ISO17025	< 1				
Sulphide	mg/l	< 0.1	NONE	< 0.1				
Total Organic Carbon (TOC)	mg/l	< 0.1	NONE	2.3				
Arsenic	ug/l	< 5	ISO17025	< 5				
Beryllium	ug/l	< 3	ISO17025	< 3				
Boron	ug/l	< 5	ISO17025	17				
Cadmium	ug/l	< 0.4	ISO17025	< 0.4				
Chromium	ug/l	< 5	ISO17025	< 5				
Chromium (hexavalent)	ug/l	< 5	NONE	< 5				
Copper	ug/l	< 5	ISO17025	< 5				
Lead	ug/l	< 5	ISO17025	< 5				
Mercury	ug/l	< 0.05	ISO17025	< 0.05				
Nickel	ug/l	< 5	ISO17025	< 5				
Selenium	ug/l	< 5	ISO17025	< 5				
Vanadium	ug/l	< 5	ISO17025	< 5				
Zinc	ug/l	< 2	ISO17025	7				
Total Phenols	ug/l	< 0.5	NONE	< 0.5				

Subcontracted analysis (S)

QTS Environmental Ltd
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Leachate Analysis Certificate - Speciated PAH							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15					
Soils Ltd	Time Sampled	None Supplied					
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS3					
Project / Job Ref: 14814	Additional Refs	None Supplied					
Order No: None Supplied	Depth (m)	2.50					
Reporting Date: 15/05/2015	QTSE Sample No	147890					

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

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Leachate Analysis Certificate - TPH CWG Banded							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15					
Soils Ltd	Time Sampled	None Supplied					
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS3					
Project / Job Ref: 14814	Additional Refs	None Supplied					
Order No: None Supplied	Depth (m)	2.50					
Reporting Date: 15/05/2015	QTSE Sample No	147890					

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	ug/l	< 10	NONE	< 10				
Aliphatic >C6 - C8	ug/l	< 10	NONE	< 10				
Aliphatic >C8 - C10	ug/l	< 10	NONE	< 10				
Aliphatic >C10 - C12	ug/l	< 10	NONE	< 10				
Aliphatic >C12 - C16	ug/l	< 10	NONE	< 10				
Aliphatic >C16 - C21	ug/l	< 10	NONE	< 10				
Aliphatic >C21 - C34	ug/l	< 10	NONE	< 10				
Aliphatic (C5 - C34)	ug/l	< 70	NONE	< 70				
Aromatic >C5 - C7	ug/l	< 10	NONE	< 10				
Aromatic >C7 - C8	ug/l	< 10	NONE	< 10				
Aromatic >C8 - C10	ug/l	< 10	NONE	< 10				
Aromatic >C10 - C12	ug/l	< 10	NONE	< 10				
Aromatic >C12 - C16	ug/l	< 10	NONE	< 10				
Aromatic >C16 - C21	ug/l	< 10	NONE	< 10				
Aromatic >C21 - C35	ug/l	< 10	NONE	< 10				
Aromatic (C5 - C35)	ug/l	< 70	NONE	< 70				
Total >C5 - C35	ug/l	< 140	NONE	< 140				

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UKAS TESTING
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Leachate Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 15-31289	Date Sampled	08/05/15					
Soils Ltd	Time Sampled	None Supplied					
Site Reference: The Dairy, Roads Hill, Cathrington	TP / BH No	WS3					
Project / Job Ref: 14814	Additional Refs	None Supplied					
Order No: None Supplied	Depth (m)	2.50					
Reporting Date: 15/05/2015	QTSE Sample No	147890					

Determinand	Unit	RL	Accreditation					
Benzene	ug/l	< 1	ISO17025	< 1				
Toluene	ug/l	< 5	ISO17025	< 5				
Ethylbenzene	ug/l	< 5	ISO17025	< 5				
p & m-xylene	ug/l	< 10	ISO17025	< 10				
o-xylene	ug/l	< 5	ISO17025	< 5				
MTBE	ug/l	< 10	ISO17025	< 10				

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 15-31289	
Soils Ltd	
Site Reference: The Dairy, Roads Hill, Cathrington	
Project / Job Ref: 14814	
Order No: None Supplied	
Reporting Date: 15/05/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
147886	WS2	None Supplied	0.30	19.3	Brown clay with stones
147887	WS3	None Supplied	0.40	26.8	Grey sandy clay with stones
147888	WS4	None Supplied	0.10	18.8	Brown sandy loam with chalk
147889	WS2	None Supplied	0.80	19.3	Orange clay with stones

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

Insufficient Sample I/S

Unsuitable Sample U/S

QTS Environmental Ltd
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Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-31289
Soils Ltd
Site Reference: The Dairy, Roads Hill, Cathrington
Project / Job Ref: 14814
Order No: None Supplied
Reporting Date: 15/05/2015

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

D Dried
AR As Received

QTS Environmental Ltd
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Rose Lane
Lenham Heath
Maidstone
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UKAS TESTING
4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-31289
Soils Ltd
Site Reference: The Dairy, Roads Hill, Cathrington
Project / Job Ref: 14814
Order No: None Supplied
Reporting Date: 15/05/2015

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 co	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 GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detect	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 GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	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	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 (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

Appendix D Conceptual Site Model

Linkage No	Contaminants Identified	Pathway	Receptor	Risk Assessment Methodology	Site specific settings	Risk Classification:	Action Required
1	None	e.g. Uptake (root and stomata), ingestion, inhalation and dermal absorption by animal)	Ecological features (i.e. Flora and Fauna)	Presence of SSSI, Museum, Natural reserves and others within 0- 250m to the site. Use EA Science Report	No surface water feature with 250m of site.	None	None
2	None	e.g. Chemical attack	Building structures/services	Soil testing & use BRE 2005 for risk assessment. Water UK (2014) for pipes. Use Anglian Water trigger for services risk assessment	Proposed foundations and services pipes to be used.	None	None
3	None	e.g. Inhalation	Human health Site residents	Use CLEA for human risk assessment	Residential development	None	None
		ingestion and dermal contact	Human Health Workers	Assessment not within the scope of this Desk study (responsibility of building contractor). Ground workers should follow regulations on health and safety during development (HSE, 1991)	Workers and the general public should follow regulation on health and safety during development (HSE, 1991)	None	Follow HSE procedures
4	None	e.g. Leaching (direct precipitation, overland flow and through flow)	Shallow groundwater	Assess distance from watercourse and direction of flow – Consider use of R&D 20 publication and EA remediation target for risk assessment	Surface water at risk	None	None
5	None	e.g. Leaching (direct precipitation, overland flow, through and groundwater flow)	Deep groundwater	Undertake groundwater or leachate testing depending on site specific ground conditions. – Consider use of R&D 20 publication and EA remediation target for risk assessment if contamination is identified.	Contaminants unable to leach through unproductive Clay-with-Flints Formation . Although the site was situated on a principal aquifer with a GSPZ 1.	None	None
6	None	e.g. Through fissures, shafts, high permeability strata and inhalation by human	Human and Building Structures	Current or former Landfill sites within 0-250m to the site. Assess nature/age/size of site for Risk Assessment. Use CIRIA 149 & 665 to assess need for gas protection measures where necessary following ground gas testing	No historical landfills noted within 250m of site.	None	None

Appendix E General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

1.1 Introduction

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC).

GAC are conservative values adopted to ensure that they are applicable to the majority of possible contaminated site. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC derived by a third party or the Environment Agency/ DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC to ensure that they are used appropriately. Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific values for relevant soil contaminants based on the site specific conditions.

1.2 General Assessment Criteria

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

1.2.1 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:
• EA Science Report SC050021/SR2: Human health toxicological assessment of c in soil.
• EA Science Report SC050021/SR3: Updated technical background to the CLEA model.
• EA CLEA Bulletin (2009).
• CLEA software version 1.04 (2009)
• Toxicological reports and SGV technical notes.

The CLEA guidance and tools:
1. do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.
2. do not cover risks to the environment, such as groundwater, ecosystems or buildings.
3. do not provide a definitive test for telling when human health risks are significant.
4. 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.

1.3 Soil Guideline Values (2009)

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 that the SGV, is that the long-term human health risks are considered to be tolerable or minimal.

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.

1.4 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.

1.5 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*.

1.6 Other 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 (CIEH) are used for example. In the case of Lead, Category 4 screening levels (C4SLs) have replaced the AtRisk Soil SSV.

1.6.1 CL: AIRE Category 4 screening levels (C4SLs) (2014)

A new statutory DEFRA guidance recently (i.e. August 2014) published some GACs with a more pragmatic (but still strongly precautionary) approach in their derivation called the Category 4 screening levels (C4SLs). These values provide a higher simple test for deciding that land is suitable for use and definitely not

contaminated land. They are intended as generic screening values, (ii) they describe a level of risk that whilst above 'minimal' is still 'low' and (iii) they provide a 'higher simple test' for deciding that land is suitable for use and definitely not contaminated. These values were derived for four generic land uses: residential, commercial, allotments, and public open space.

1.6.2 LQM/CIEH Suitable 4 Use Level (S4UL) (2015)

The new S4UL's ((Nathanail *et al*, 2015), was developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants. The S4ULs were:

- based on Health Criteria Values, updated to reflect changes since 2009
- derived for the standard CLEA land uses and the two public open space scenarios developed by Defra SP1010
- developed for ca 85 substances (those previously covered by the LQM/CIEH GAC and the SGV substances);
- Compliant with SR2 and the long standing principle of 'suitable for use' and reflecting changes to exposure parameters produced by Defra SP1010.

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 (3nd edition)*. **Land Quality Press**. 2015.

1.7 Standard Land-use Scenarios

The standard land-use scenarios used to develop conceptual exposure models are presented in the following sections:

1.7.1 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 home-grown 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.

1.7.2 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.

1.7.3 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).

1.7.4 Public Open Space within Residential Area

The generic scenario refers to any grassed area 0.05 ha and that is close to Housing.

- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil
- Predominantly used by children for playing and may be used for activities such as a football kick about
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply
- older children as the critical receptor on basis that they will use site most frequently (Age class 4-9)
- ingestion rate 75 $mg.day^{-1}$

1.7.5 *Public Open Space Park*

This generic scenario refers to any public park that is more than 0.5ha in area:

- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)

- Female child age classes 1-6
- Soil ingestion rate of 50 mg.day^{-1}
- Occupancy period outdoors = 2 hours.day^{-1}
- Exposure frequency of 170 days.year -1 for age classes 2-18 and 85
- days.year^{-1} for age class 1
- Outdoor exposure pathways only (no tracking back).

1.8 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 the CLEA standard land-uses, then a DQRA may be undertaking 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.

1.9 Current Criteria

Table 1 presents the current Generic Assessment Criteria and reference should be made to the original publications if needed.

1.10 Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) and CL: AIRE Category 4 screening levels (C4SLs) (2014) 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.

Land Use				Residential With or Without Plan Uptake						Allotments			Commercial			Public Open Space (POS)								
				With home-grown produce			Without home-grown produce									Residential			Park					
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants	Species	Year																					
Metals	Arsenic		2014			37			40			49			640			79			168	C4SL	DEFRA	2014
			2015			37			40			40			640			79			170	S4UL	LQM/CIEH	2015
	Beryllium		2015			1.7			1.7			35			12			2.2			63	S4UL	LQM/CIEH	2015
	Boron		2015			290			11000			45			240000			21000			46000	S4UL	LQM/CIEH	2015
	Cadmium		2015			11			85			1.9			190			120			532	S4UL	LQM/CIEH	2015
			2014			26			149			4.9			410			220			880	C4SL	DEFRA	2014
	Chromium	*III*	2015			910			910			18000			8600			1500			33000	S4UL	LQM/CIEH	2015
		IV	2014			21			21			170			49			23			250	C4SL	DEFRA	2014
		IV	2015			6			6			1.8			33			7.7			220	S4UL	LQM/CIEH	2015
	Copper		2015			2400			7100			520			68000			12000			44000	S4UL	LQM/CIEH	2015
	Lead					200			310			80			2330			630			1300	C4SL	DEFRA	2014
	Mercury	Elemental	2012			1.0			1.0			26			26							SGV	DEFRA	2012
			2015			1.2			1.2			21			*58*			16			*30*	S4UL	LQM/CIEH	2015
		Inorganic	2012			170			170			80			36000							SGV	DEFRA	2012
			2015			40			56			19			1100			120			240	S4UL	LQM/CIEH	2015
		Methyl	2012			11			11			8			410							SGV	DEFRA	2012
			2015			11			15			6			320			40			68	S4UL	LQM/CIEH	2015
	Nickel		2012			130			130			230			1800							SGV	DEFRA	2012
			2015			180			180			230			980			230			3400	S4UL	LQM/CIEH	2015
	Selenium		2012			350			350			120			13000							SGV	DEFRA	2012
			2015			250			430			88			12000			1100			1800	S4UL	LQM/CIEH	2015
	Vanadium		2015			410			1200			91			9000			2000			5000	S4UL	LQM/CIEH	2015
	Zinc		2015			3700			40000			620			730000			81000			170000	S4UL	LQM/CIEH	2015
BTEX & MTBE	Benzene		2012			0.33			0.33			0.07			95							SGV	DEFRA	2012
			2014			0.87			3.3			0.18			98			140			230	C4SL	DEFRA	2014
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	S4UL	LQM/CIEH	2015
	Toluene		2012			610			610			120			4400							SGV	DEFRA	2012
			2015	130	290	660	*880*	1900	3900	22	51	120	*65000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*	S4UL	LQM/CIEH	2015
	Ethylbenzene		2012			350			350			90			2800							SGV	DEFRA	2012
			2015	47	110	260	83	190	440	16	39	91	*4700*	*13000*	*27000*	24000	24000	25000	*17000*	*22000*	*27000*	S4UL	LQM/CIEH	2015
	Xylenes	o-xylene	2012			250			250			160			2600							SGV	DEFRA	2012
			2015	60	140	330	88	210	480	28	67	160	*6600*	*15000*	*33000*	41000	42000	43000	*17000*	*24000*	*33000*	S4UL	LQM/CIEH	2015
		m-xylene	2012			240			240			180			3500							SGV	DEFRA	2012
			2015	59	140	320	82	190	450	31	74	170	*6200*	*14000*	*31000*	41000	42000	43000	*17000*	*24000*	*32000*	S4UL	LQM/CIEH	2015
		p-xylene	2012			230			230			160			3200							SGV	DEFRA	2012
			2015	56	130	310	79	180	310	29	69	160	*5900*	*14000*	*30000*	41000	42000	43000	*17000*	*23000*	*31000*	S4UL	LQM/CIEH	2015
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	*3200*	*5900*	*12000*	*570000*	590000	600000	*95000*	*130000*	*180000*	S4UL	LQM/CIEH	2015
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	*7800*	*17000*	*40000*	600000	610000	620000	*150000*	*220000*	*320000*	S4UL	LQM/CIEH	2015
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	*2000*	*4800*	*11000*	13000	13000	13000	*14000*	*18000*	*21000*	S4UL	LQM/CIEH	2015
	Aliphatic >C10 - C12		2015	*130*	*330*	*760*	*130*	*330*	*770*	2200	4400	7300	*9700*	*23000*	*47000*	13000	13000	13000	*21000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
	Aliphatic >C12 - C16		2015	*1100*	*2400*	*4300*	*1100*	*2400*	*4400*	11000	13000	13000	*59000*	*82000*	*90000*	13000	13000	13000	*25000*	*25000*	*26000*	S4UL	LQM/CIEH	2015
	Aliphatic >C16 - C35		2015	*65000*	*92000*	*110000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aliphatic >C35 - C44		2015	*65000*	*92000*	*140000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	*26000*	*46000*	*86000*	56000	56000	56000	*76000*	*84000*	*92000*	S4UL	LQM/CIEH	2015
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	*56000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*	S4UL	LQM/CIEH	2015
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	*3500*	*8100*	*17000*	5000	5000	5000	*7200*	*8500*	*9300*	S4UL	LQM/CIEH	2015
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	*16000*	*28000*	*34000*	5000	5000	5000	*9200*	*9700*	*10000*	S4UL	LQM/CIEH	2015
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	*36000*	*37000*	*38000*	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015
	Aromatic >C21 - C35		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aromatic >C34 - C44		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015

Land Use			Residential With or Without Plan Uptake						Allotments			Commercial			Public Open Space (POS)								
			With home-grown produce			Without home-grown produce									Residential			Park					
		SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants Species	Year																					
	Aliphatic + Aromatic >C44 - C70		1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAH's) (mg/kg)	Acenaphthene	2015	210	510	1100	*3000*	*4700*	*6000*	34	85	200	*84000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene	2015	170	420	920	*2900*	*4600*	*6000*	28	69	160	*83000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene	2015	2400	5400	11000	*31000*	*35000*	*37000*	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene	2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene	2014			5			5.3			5.7			76			10			21	C4SL	DEFRA	2014
		2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene	2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene	2015	320	340	250	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	S4UL	LQM/CIEH	2015
	Benzo(k)fluoranthene	2015	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	S4UL	LQM/CIEH	2015
	Chrysene	2015	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	S4UL	LQM/CIEH	2015
	Dibenz(a,h)anthracene	2015	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015
	Fluoranthene	2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene	2015	170	400	860	*2800*	*3800*	*4500*	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene	2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene	2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	*190*	*460*	*1100*	4900	4900	4900	*1200*	*1900*	*3000*	S4UL	LQM/CIEH	2015
	Phenanthrene	2015	95	220	440	*1300*	*1500*	*1500*	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene	2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54	54000	7400	7400	4700	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)	2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane	2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane	2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	*140000*	*57000*	*76000*	*100000*	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane	2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane	2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene	2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	*810*	*1100*	1500	S4UL	LQM/CIEH	2015
	Tetrachloromethane (Carbon Tetrachloride)	2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene	2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
	Trichloromethane	2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
	Vinyl Chloride (cloroethene)	2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
Explosives	2,4,6 Trinitrotoluene	2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	*23000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
Pesticides	Aldrin	2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
	Dieldrin	2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine	2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos	2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan	2015	7.4	18	41	*160*	*280*	*410*	1.2	2.9	6.8	*5600*	*7400*	*8400*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan	2015	7	17	39	*190*	*320*	*440*	1.1	2.7	6.4	*6300*	*7800*	*8700*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes	2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes	2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
	Gamma -Hexachlorocyclohexanes	2015	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015
Chlorobenzenes	Chlorobenzene	2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	*1300*	*2000*	*2900*	S4UL	LQM/CIEH	2015
	1,2-Dichlorobenzene	2015	23	55	130	24	57	130	94	230	540	*2000*	*4800*	*11000*	90000	95000	98000	*24000*	*36000*	*51000*	S4UL	LQM/CIEH	2015
	1,3-Dichlorobenzene	2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015
	1,4-Dichlorobenzene	2015	61	150	350	61	150	350	15	37	88	*4400*	*10000*	*25000*	17000	17000	1700	*36000*	*36000*	*36000*	S4UL	LQM/CIEH	2015
	1,2,3,-Trichlorobenzene	2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	*770*	*1100*	*1600*	S4UL	LQM/CIEH	2015
	1,2,4,-Trichlorobenzene	2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	*1700*	*2600*	*4000*	S4UL	LQM/CIEH	2015
	1,3,5,-Trichlorobenzene	2015	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	*380*	*580*	*860*	S4UL	LQM/CIEH	2015
	1,2,3,4,-Tetrachlorobenzene	2015	15	36	78	24	56	120	4.4	11	26	1700	3080	4400	830	830	830	*1500*	*1600*	*1600*	S4UL	LQM/CIEH	2015
	1,2,3,5,- Tetrachlobenzene	2015	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	*49*	*120*	*240*	78	79	79	*110*	*120*	*130*	S4UL	LQM/CIEH	2015
	1,2,4, 5,- Tetrachlobenzene	2015	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	*42*	*72*	*96*	13	13	13	25	26	26	S4UL	LQM/CIEH	2015

Land Use			Residential With or Without Plan Uptake						Allotments			Commercial			Public Open Space (POS)								
			With home-grown produce			Without home-grown produce									Residential			Park					
		SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	Name	Authority	Date
Type	Contaminants Species	Year																					
	Pentachlrobenzene	2015	5.8	12	22	19	30	38	1.2	3.1	7	*640*	*770*	*830*	100	100	100	190	190	190	S4UL	LQM/CIEH	2015
	Hexachlorobenzene	2015	*1.8*	*3.3*	4.9	*4.1*	*5.7*	*6.7*	0.47	1.1	2.5	*110*	120	120	16	16	16	30	30	30	S4UL	LQM/CIEH	2015
Phenols & Chlorophenols	Phenols	2012			420			420			280			*3200*							SGV	DEFRA	2012
		2015	280	550	1100	750	1300	2300	66	140	280	*760*	*1500*	*3200*	*760*	*1500*	*3200*	*760*	*1500*	*3200*	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)	2015	0.87	2	4.5	94	150	210	0.13	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	S4UL	LQM/CIEH	2015
	Pentachlorophenols	2015	0.22	0.52	1.2	*27*	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	S4UL	LQM/CIEH	2015
Others	Carbon Disulphide	2015	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	S4UL	LQM/CIEH	2015
	Hexachloro-1,3-Butadiene	2015	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	S4UL	LQM/CIEH	2015
	Sum of PCDDs, PCDFs and dioxin-like PCB's.	2012			8			8			8			240							SGV	DEFRA	2012

NOTE

Priority	Guideline (mg kg^{-1})
1	Site Specific Assessment Criteria (SSAC) (Soils Limited)
2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014)
3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)
4	2015: Suitable 4 Use Level (S4UL) (Nathanail *et al*, 2015)
	For Generic Risk Assessment, the values in Bold have priority

Appendix F Information Provided by the Client

1:500

INDICATIVE ACCOMMODATION

1	2 bed flat
2,3,5	2 bed cottages (A)
4,6	3 bed cottages (A)
7-9	4 bed houses
10-12	3 bed houses
13	4 bed house

Site boundary - 0.5ha
13 units @ 26 dph.
Indicaitive only (OS Plan)

Bins and bikes located in a single storey enclosure.
Approximately 35 parking spaces can be provided in addition to garages.

Access to site and units

NOTES:

No discussions have been had with Planning Authorities. Drawing is based on ProMap / OS Plan. For illustrative purpose only

AMENDMENTS		DATE
A	CONCEPT LAYOUT CHANGED	06.11.14

CLIENT
PETER ERNEST HOMES LTD

PROJECT
RESIDENTIAL DEVELOPMENT
THE DAIRY,
CATHERINGTON
HANTS

DRAWING TITLE
INDICATIVE LAYOUT
.

DATE
24.02.2014

SCALE
1:500 @ A3

DRAWING No.
14A_009 002

REVISION
A

THE MARTIN RALPH GROUP
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SITE AS PROPOSED

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