



Main Investigation Report

at

Land at Tars Farm, Church Lane, Barnham, West Sussex PO22 0DB

for

Wilson Designer Homes Ltd

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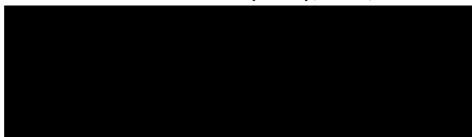
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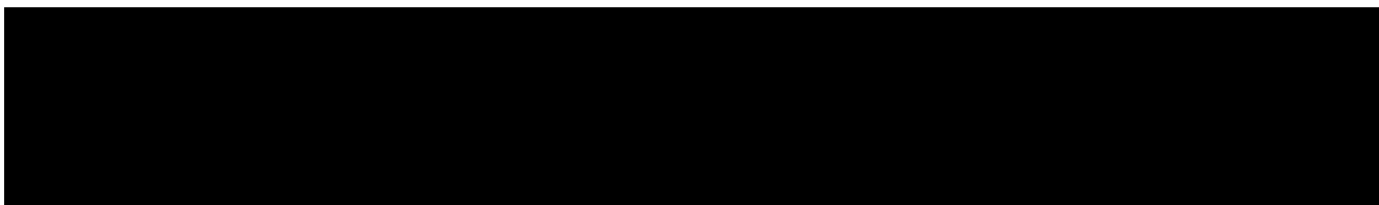
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Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations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



Commission

Soils Limited was commissioned by Wilson Designer Homes Ltd Ltd to undertake an intrusive ground investigation and produce a Main Investigation Report on land at Tars Farm, Church Lane, Barnham, West Sussex PO22 0DB. The scope of the investigation was outlined in the Soils Limited quotation reference Q20689/Rev2.00, dated 12th November 2018.

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

This Main Investigation Report must be read in conjunction with the Preliminary Investigation Report undertaken on the above site by Soils Limited, Report ref: 17324/DS, dated January 2019.

Standards

The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011 for WS/DP
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design
- BS EN ISO 14688-1:2002+A1:2013 - Geotechnical investigation and testing - Identification and description
- BS EN ISO 14688-2:2004+A1:2013 - Geotechnical investigation and testing - Principles for a classification
- BS 10175:2011+A1:2013 - Investigation of potentially contaminated sites

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 I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by Wilson Designer Homes Ltd Ltd to undertake an intrusive ground investigation and produce a Main Investigation Report 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.

Soil samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Preliminary Investigation Report undertaken for the site by Soils Limited (Report ref: 17324/PIR, dated January 2019) and/or the Revised Conceptual Site Model presented in Appendix C.1.

I.2 Location

The site was located at Land at Tars Farm, Church Lane, Barnham, West Sussex PO22 0DB and had an approximate O.S Land Ranger Grid Reference of SU 959 041.

The site location plan is given in Figure 1.

I.3 Site Description

At the time of the investigation, November 2018, the site comprised open grass land associated to Tars Farm House. The site sloped down to the west. No large trees were present on site however the southern boundary was marked by a mature hedgerow.

An aerial photograph has been included in Figure 2.

I.4 Proposed Development

The proposed development comprised construction of four detached residential houses with associated garages. The development was to include soft landscaping in the form of private residential gardens and communal planting, as well as hard landscaping in the form of access roads and driveways.

In compiling this report, reliance was placed on the drawing referred to as “scheme plan” (no drawing reference, undated) supplied to Soils Limited by the client. Any change or

deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

1.5 Anticipated Geology

The 1:50,000 BGS map showed the site to be located upon the bedrock London Clay Formation, with the potential for overlying superficial deposits of Raised Beach Deposits.

1.5.1 Raised Beach Deposits

Raised Beach Deposits consist of shingle, sand, silt and clay. Beach deposits may be in the form of dunes, sheets or banks, now above the level of the present shoreline as a result of earth movement or a general fall in sea level.

1.5.2 London Clay Formation

The London Clay Formation in the Hampshire/West Sussex region comprises silty and sandy clay, clayey and sandy silt, silty sand; sporadic claystones and thin beds of flint pebbles. The formation includes the Bognor Sand, Whitecliff Sand, Durley Sand, Portsmouth Sand and Nursling Sand Members. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay, and precautions against sulphate attack to concrete are sometimes required.

The lowest part of the London Clay Formation rests on the Reading Formation (Lambeth Group).

1.6 Limitations and Disclaimers

This Main Investigation Report relates to the site located on land at Tars Farm, Church Lane, Barnham, West Sussex PO22 0DB and was prepared for the sole benefit of Wilson Designer 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 Contract of Business and taking into account the resources devoted to us by agreement with the Client.

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

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

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

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

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

The 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 (Q20689/Rev2.00, dated 12th November 2018), was to comprise the following items:

- 1 day windowless sampler boreholes and dynamic probes;
- Installation of 3No. 5m deep groundwater monitoring wells;
- 1 day machine excavated trial pits;
- 1 day infiltration tests to BRE DG 365:2016;
- 1 day TRL – DCP probes;
- Geotechnical laboratory testing;
- Contamination laboratory testing.

2.1.1 Actual Project Works

The actual project works were undertaken on 15th November 2018 and 23rd November 2018, and comprised:

- 5No. windowless sampler boreholes (WS1 – WS5);
- 3No. groundwater monitoring wells;
- 5No. dynamic probes, super heavy (DP1 – DP5);
- 4No. machine excavated trial pits (TPSA1 – TPSA3);
- Infiltration testing to the principles of BRE DG 365:2016;
- 7No. TRL-DCP probes;
- Geotechnical laboratory testing;
- Contamination laboratory testing.

Three windowless sampler boreholes (WS1 – WS3) were backfilled with gravel and bentonite following the installation of groundwater monitoring wells. The remaining windowless sampler holes were backfilled with gravel upon completion.

The four machine excavated trial pits were backfilled with arisings and mounded over to allow for future settlement upon completion.

All trial hole locations have been presented in Figure 3.

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 15th November 2018, five windowless sampler boreholes (WS1 – WS5) were drilled

to depths ranging between 2.00m and 5.00m below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the client.

Five dynamic probes (DP1 – DP5) were driven prior and adjacent to their corresponding windowless sampler borehole to depths ranging between 5.00m and 7.00m bgl.

Three standpipes were installed within window sampler borehole locations WS1 – WS3 to allow for continued monitoring of both groundwater and soil gas.

On 23rd November 2018, four trial pits (TPSA1, TPSA1a, TPSA2 & TPSA3) were machine excavated to depths ranging between 1.00m and 1.50m bgl at locations selected by Soils Limited using a development plan provided by the client and targeted following the findings of the previous windowless sampler boreholes completed on the 15th November 2018. Infiltration testing was undertaken within each trial pit in accordance with the principles of BRE DG 365:2016.

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 signal generator (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)	Probe Hole	Depth (m bgl)
WS1 ^w	5.00	DPI	7.00
WS2 ^w	5.00	DP2	6.00
WS3 ^w	4.60	DP3	6.00
WS4	2.00	DP4	5.00
WS5	2.00	DP5	5.00
TPSA1	1.50		
TPSA1a	1.00		
TPSA2	1.00		
TPSA3	1.00		

Note: w - well installation

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 as:

Made Ground/Topsoil (MG/TS) London Clay Formation (LCF)

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

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
TS	Anthropocene	0.00	0.20 – 1.00	0.40	Greyish brown slightly sandy slightly gravelly SILT with frequent roots/rootlets.
LCF	Eocene	0.20 – 0.65	>7.00 ¹	Not proven ²	Greyish brown mottled brown slightly sandy silty CLAY.

Note: ¹ Final depth of trial hole. ² Base of strata not encountered. 0.00 denotes ground level.

2.3 Ground Conditions Encountered in Trial Holes

The ground conditions encountered in trial holes have been described below in descending order. The engineering logs are presented in Appendix A.1.

2.3.1 Topsoil/Made Ground

Soils described as Topsoil/Made Ground were encountered in all nine trial holes from ground level to depths ranging between 0.20m and 1.00m bgl.

The Topsoil/Made Ground comprised greyish brown slightly sandy slightly gravelly SILT with frequent roots/rootlets. Gravel was angular to sub-rounded clasts of flint and rare fine brick.

The depth of Topsoil has been included in Table 2.3.

Table 2.3 Final Depth of Topsoil

Trial Hole	Depth (m bgl)
WS1	0.65
WS2	0.55
WS3	1.00
WS4	0.50
WS5	0.55

Trial Hole	Depth (m bgl)
TPSA1	0.20
TPSA1a	0.20
TPSA2	0.25
TPSA3	0.25

2.3.2 London Clay Formation

Soils described as the London Clay Formation were encountered in each of the nine trial hole locations from immediately underlying the Topsoil/Made Ground and were inferred to the base of the investigation, 7.00m bgl within DP1.

The London Clay Formation was typically described as soft to firm greyish brown sandy CLAY becoming firm greyish brown with depth.

The depth of London Clay Formation has been included in Table 2.4.

Table 2.4 Final Depth of London Clay Formation

Trial Hole	Depth (m bgl)
WS/DPI	5.00 ¹ /7.00 ¹
WS/DP2	5.00 ¹ /6.00 ¹
WS/DP3	5.00 ¹ /6.00 ¹
WS/DP4	5.00 ¹ /5.00 ¹
WS/DP5	5.00 ¹ /5.00 ¹
TPSA1	1.50 ¹
TPSA1a	1.00 ¹
TPSA2	1.00 ¹
TPSA3	1.00 ¹

Note: ¹ Final depth of trial hole.

2.4 Roots

Roots/rootlets were encountered in each of the nine trial holes to depths ranging between 0.60 and 2.40m bgl. The depths of root/rootlet penetration have been included in Table 2.5.

Table 2.5 Depth of Root/Rootlet Penetration

Trial Hole	Depth (m bgl)
WS1	2.40
WS2	1.30
WS3	1.00
WS4	2.00 ¹
WS5	2.00 ¹
TPSA1	0.90
TPSA1a	0.80
TPSA2	0.60
TPSA3	0.60

Trial Hole	Depth (m bgl)
------------	---------------

Note: ¹ Final depth of trial hole

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. No mature trees were present onsite, there was a hedgerow to the west of the site with the remaining vegetation limited to grass.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

2.5 Groundwater

Groundwater was encountered within five out of the nine trial holes at between 1.40 and 3.90m bgl.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in November (2018), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September, with the highest elevations (shallowest) typically occurring around March.

Table 2.6 shows the details of the groundwater strikes during the intrusive investigation.

Table 2.6 Groundwater strikes

Trial Hole	Depth to Water (m bgl)	Notes
WS1	3.90	Rising to 2.50m bgl after 20mins
WS2	3.90	Rising to 2.50m bgl after 20mins
WS3	2.50	No rise observed
WS4	2.00	No rise observed
WS5	-	No groundwater encountered
TPSA1	1.45	Rising to 1.40m bgl
TPSA1a	-	No groundwater encountered
TPSA2	-	No groundwater encountered
TPSA3	-	No groundwater encountered

Note:

Details of the completed groundwater monitoring are presented in Table 2.7.

Table 2.7 Groundwater Monitoring Results

Date	WS1		WS2		WS3	
	Depth to water (m bgl)	Base of hole (m bgl)	Depth to water (m bgl)	Base of hole (m bgl)	Depth to water (m bgl)	Base of hole (m bgl)
23/11/2018	1.21	4.67	0.98	5.10	1.52	5.06
03/12/2018	1.18	5.08	0.47	4.14	0.80	4.67
12/12/2018	1.20	5.08	0.49	5.10	0.85	4.64
02/01/2019	0.95	5.05	0.12	5.08	0.75	4.62
06/02/2019	0.70	5.04	0.34	5.04	1.58	4.58
25/02/2019	1.03	5.05	0.18	5.04	1.30	4.60
13/03/2019	0.68	5.05	0.14	5.05	0.68	4.60

Note: Red = shallowest reading on the given date.

A total of seven groundwater monitoring visits were carried out between November 2018 and March 2019 with the shallowest groundwater consistently being located within WS2. The shallowest groundwater reading was 0.12m bgl, recorded within WS2 on the 2nd January 2019.

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 ranging between 5.00 and 7.00m bgl. The results were converted to equivalent SPT “N60” values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix B.1, Table B.1.1 to Table B.1.3.

The SPT “N60” values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig efficiency, borehole depth, overburden factors etc. Further correction of the ‘N’ values should therefore not be necessary. Raw field data is archived within the Soils Limited project file and can be provided on request.

The London Clay Formation recorded equivalent SPT “N60” values between <4 and 18 within cohesive beds. The cohesive beds were classified as low to high, typically low to medium strength with inferred undrained cohesive strengths of between 20 and 90kPa.

A full interpretation of the DPSH tests are outlined in Appendix B.2, Table B.2.1.

3.2 Dynamic Cone Penetrometer Tests

The Transport Research Laboratory (TRL), Dynamic Cone Penetrometer (DCP) was undertaken at twelve locations (DCP1 – DCP7.2). The results were interpreted based on the classification outlined in Appendix B.1.

The results from DCP testing indicated CBR values of between 4% and 294% for the soils encountered in the top 1.00m bgl. The high CBR values encountered were anticipated to be large gravel clasts struck during the test.

The DCP results are presented in Appendix B.3.

3.3 Infiltration Tests

Infiltration testing was undertaken in TPSA1a, TPSA2 and TPSA3 within the soils of the London Clay Formation 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.

None of the tests were compliant with BRE365 however an extrapolated infiltration rate was calculated within TPSA1a.

Infiltration rates were calculated and the results outlined in Table 3.1.

Table 3.1 Infiltration Rates

Trial Hole	Test No.	Test depth (m bgl)	Infiltration Rate (m/s)
TPSA1a	I	1.00	2.947×10^{-6}
TPSA2	I	1.00	Negligible infiltration
TPSA3	I	1.00	Negligible infiltration
Notes:			

3.4 Atterberg Limit Tests

Atterberg Limit tests were performed on four samples from the London Clay Formation. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The London Clay Formation was classified as medium to high volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

A full interpretation of the Atterberg Limit tests are outlined in Table B.2.2, Appendix B.2 and the laboratory report in Appendix B.3.

3.5 Sulphate and pH Tests

Two samples were taken from the London Clay Formation for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

The tests recorded water soluble sulphate <10mg/l with pH values of 6.6 to 9.8.

The significance of the sulphate and pH test results are discussed in Section 4.4 and the laboratory report in Appendix B.3.

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/Made Ground were encountered in all nine trial holes from ground level to depths ranging between 0.20m and 1.00m bgl. The Topsoil/Made Ground comprised greyish brown slightly sandy slightly gravelly SILT with frequent roots/rootlets. Gravel was angular to sub-rounded clasts of flint and rare fine brick.

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 London Clay Formation

Soils described as the London Clay Formation were encountered in each of the nine trial hole locations from immediately underlying the Topsoil and were present to the base of the investigation, 7.00m bgl within DP1. The London Clay Formation was typically described as soft to firm greyish brown sandy CLAY becoming firm greyish brown with depth.

The London Clay Formation recorded equivalent SPT "N60" values between <4 and 18 within cohesive beds. The cohesive beds were classified as low to high, typically low to medium strength with inferred undrained cohesive strengths of between 20 and 90kPa.

The London Clay Formation was classified as medium to high volume change

potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

The London Clay Formation is over consolidated and when not weathered can be expected to display moderate to high bearing capacities and moderate settlement. When weathered the London Clay Formation typically exhibits low to moderate bearing capacities and moderate to high bearing capacities. The soils of the London Clay Formation are expected to provide a suitable bearing stratum providing that adequate bearing and settlement characteristics can be proven.

4.1.3 Roots

Roots/rootlets were encountered in each of the nine trial holes to depths ranging between 0.60 and 2.40m bgl. 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. No mature trees were present onsite, vegetation comprised a hedgerow along the western boundary and grass across the site. It is possible that the maximum depth of root penetration is greater than that recorded in the trial pits and windowless sampler borehole.

4.1.4 Groundwater

Groundwater was encountered within five out of the nine trial holes between 3.90 and 1.40m bgl. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in November (2018), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September.

A total of seven groundwater monitoring visits were carried out between November 2018 and March 2019 with the shallowest groundwater consistently being located within WS2. The shallowest groundwater reading was 0.12m bgl, recorded within WS2 on the 2nd January 2019.

4.2 Foundation Scheme General

The proposed development comprised construction of four detached residential houses with associated garages. The development was to include soft landscaping in the form of private residential gardens and communal planting, as well as hard landscaping in the form of access roads and driveways.

In compiling this report, reliance was placed on the drawing referred to as “scheme plan” (no drawing reference, undated) supplied to Soils Limited by the client. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

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 showed that the London Clay Formation had **medium to high volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

High volume change potential should therefore be adopted where foundations pass through the London Clay Formation.

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 Foundation Scheme

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/rootlets were encountered in each of the nine trial holes to depths ranging between 0.60 and 2.40m bgl. If roots are encountered during the construction phase

foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. 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.

Considering the type of development, and dependant on the loads required, a shallow foundation solution was considered feasible however the following considerations may dictate that a piled foundation solution is the preferred choice;

- Relatively soft soils to 2.50m bgl resulting in low allowable bearing capacities
- Very high groundwater (0.12m bgl within WS2 on 2nd January 2019) dictating that even during a summer construction dewatering of trenches is likely to be required
- Relatively deep maximum root penetration dictating that foundation bases are likely to require inspection for roots and that foundations may have to be taken deeper to pass through the root penetrated soils
- High CBR values along access road would limit the requirement of a pilling mat to the site itself

4.3.1 Shallow Foundations into the London Clay Formation

Commercial software Table 4.1 shows the calculated bearing values and anticipated settlement characteristics. A soft layer of soil at the top of the weathered London Clay Formation was present to approximately 2.50m bgl across the site below which strength and settlement characteristics improved with depth. Foundation calculations were based on DP1 which was considered to be the worst case. Allowable bearing capacities were presented from 1.20m bgl, which was the average depth of root/rootlet penetration.

Table 4.1 Allowable Bearing Capacities within the London Clay Formation

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.20	5.00 x 0.75	65	<25
2.00		65	<25
2.50		75	<25
3.00		120	<25

Note:

The use of reinforced trench fill foundations would simplify construction and 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.

The anticipated settlement includes both elastic settlement and long-term drained settlement (in the case of cohesive soils).

Anticipated settlements may be taken as proportional to the bearing capacity adopted (for the same configuration of foundation), therefore if the bearing value is halved the anticipated settlement will halve.

All loose material 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 result in increased settlements.

Close attention should be paid to the presence of roots, which were found to be between 0.60 and 2.40m bgl, should roots be encountered foundations must be extended a minimum of 300mm below the deepest root.

Groundwater was encountered shallower than the likely founding depth, therefore foundation trenches are likely to require dewatering even if a summer construction is adopted.

4.3.2 Ground Floor Slab

NHBC Standards 2018, Chapter 5.2, Suspended Ground Floors, states:

- *“Ground floors should be constructed as suspended floors where the depth of fill exceeds 600mm”.*
- *“Suspended slabs should be adopted where the foundation depth dictated by the NHBC Standards 2018, Chapter 4.2, Appendix 4.2-C would exceed 1.5m bgl.”*

Given the relatively limited thickness of Topsoil (0.30m-0.90m bgl) ground bearing slabs could be adopted for the proposed redevelopment.

4.4 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 6.6 and 9.8. The classification given was determined using the mobile groundwater case, in the view of groundwater being encountered. The laboratory results are presented in Appendix B.3.

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.

4.5 Excavations

Shallow excavations in the Topsoil and London Clay Formation are likely to be marginally stable in the short term at best.

Deep excavations taken into the London Clay Formation are unlikely to be stable in the short term. 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.

4.6 Pavements

The Transport Research Laboratory (TRL), Dynamic Cone Penetrometer (DCP) was undertaken at twelve locations (DCP1 – DCP7.2). The results from DCP testing indicated CBR values of between 4% and 294% for the soils encountered in the top 1.00m bgl. The high CBR values encountered were anticipated to be large gravel clasts struck during the test.

When removing 400mm of either Made Ground or Topsoil the worst case CBR value was 4% which was considered suitable for design purposes for the majority of the road layout. CBR tests carried out through the existing access road where significantly higher suggesting that the existing road is likely to be suitable for use during construction.

CBR values are highly variable due to changes in moisture content and ground conditions, **in-situ testing must be undertaken** immediately prior to the installation of pavements/roads. Any soft spots at formation level should be dug out and replaced with a suitably compacted granular fill. Prior to construction the formation level should be proof rolled. The soils of the London Clay Formation would not be frost susceptible as plasticity indexes were >20%.

4.7 Soakaways

The BRE 365 test results allowed the extrapolation of an indicative soakage rate of 2.947×10^{-6} m/s at 1.00m bgl. Groundwater was encountered at a shallow depth of 1.40m bgl and therefore winter groundwater monitoring was ongoing at the time of reporting (January 2019) out to identify the highest groundwater elevation. Traditional soakaways should not typically be constructed with less than 1m between the base of the soakaway and the highest groundwater elevation.

Based on this it is considered unlikely that soakaways will be a viable option for surface water disposal and alternative means should be explored.

Section 5 Determination of Chemical Analysis

5.1 Site Characterisation and Revised Conceptual Site Model

The Preliminary Investigation Report undertaken by Soils Limited (report ref: 17324/PIR dated April 2016) identified a very low to moderate risk of ground contamination and from previous usage of the site and offsite sources.

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.

The CSM identified potential sources and a non-targeted sampling pattern was adopted as appropriate to these sources. Table 5.1 outlines the sampling undertaken.

Table 5.1 Sampling Strategy

Sample	Strategy	Proposed Use
TP/SA1a:0.10	Non-targeted – Topsoil	Private garden
TP/SA1:0.30	Non-targeted – London Clay Formation	Private garden
TP/SA2:0.10	Non-targeted – Topsoil	Shared driveway
TP/SA2:0.30	Non-targeted – London Clay Formation	Shared driveway
TP/SA3:0.50	Non-targeted – London Clay Formation	Private garden

Note:

5.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Preliminary Investigation Report and Main Investigation Report intrusive investigation. Table 5.2 outlines the specification for each sample tested.

Table 5.2 Chemical Analysis Specification

Substance	Locations: Depths (m bgl)				
	TP/SA1a:0.10	TP/SA1:0.30	TP/SA2:0.10	TP/SA2:0.30	TP/SA3:0.50
Asbestos Screen	✓	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓	✓
Total Cyanide	✓	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓	✓

Substance	Locations: Depths (m bgl)				
	TP/SA1:0.10	TP/SA1:0.30	TP/SA2:0.10	TP/SA2:0.30	TP/SA3:0.50
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, VOC/SVOC **Asbestos screening** was undertaken in accordance with HSG 248.

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 C.3.

6.2 Representative Contamination Criteria - Soil

The proposed development comprised construction of four detached residential houses with associated garages. The development was to include soft landscaping in the form of private residential gardens and communal planting, as well as hard landscaping in the form of access roads and driveways.

In compiling this report, reliance was placed on the drawing referred to as “scheme plan” (no drawing reference, undated) supplied to Soils Limited by the client. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

The chemical laboratory results were compared against the representative contaminants concentration for human health receptor to Soil Guideline Values (SGV), Category 4 Screening Levels (C4SL's) or Suitable 4 Use Level (S4UL).

Table 6.1 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix C.2.

Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the 'Residential with plant uptake' land-use scenario
None	N/A

The guideline values are assessed against the “Residential with plant uptake” land-use scenario, which was considered the most appropriate land-use scenario, given the type of the proposed redevelopment.

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 1.2% and 3.1%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate guideline value for organic determinants.

In summary, none of the samples tested showed concentrations in excess of the relevant C4SL for a residential land-use scenario.

None of the other substances tested recorded concentrations above the residential end-use screening values.

6.2.1 Asbestos

Asbestos Containing Material (ACM) was not detected within any of the five samples.

Whilst asbestos containing material was not identified in any of the five samples tested it is possible that asbestos is present in other areas of the site, particularly in the vicinity of the cement bound asbestos corrugated sheeting. 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

Groundwater sampling and testing was outside of the scope of this investigation, however as no soil samples showed contaminants above their relevant screening value it is considered that there is no apparent risk to the groundwater receptor.

6.4 Tier 1 Quantitative Risk Assessment

Quantitative risk assessments are undertaken for the soil, groundwater and soil gas. The CSM has been updated to take account of the assessments below and presented in Appendix C.1. The full laboratory chemical report is presented in Appendix C.2.

6.4.1 Soils

None of the samples tested showed concentrations in excess of the relevant C4SL for a residential land-use scenario. 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.

6.4.2 Groundwater

The Groundwater Risk Assessment established that **there was no risk** to the groundwater receptor.

6.4.3 Soil Gas

The Preliminary Investigation Report identified no risk of soil gas onsite. No additional sources of soil gas were identified during the site investigation therefore the Tier 1 Quantitative risk assessment established that there was no risk from soil gas.

6.5 Remedial Objective

The Tier 1 Quantitative risk assessment identified no risk to the human health receptor and therefore no remedial objective, remediation method statement, remedial works or validation was required.

6.6 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.

6.7 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered and competent advice should always be sought.

The amount, type and nature of the material to be removed will in part determine the amount and type of analysis that may be required to comply with current waste guidance, and thereby allow a competent person to suitably classify the material. Often this data is uncertain or unavailable, especially in the early stages of a project, and therefore further investigation, testing and analysis may be required as additional information regarding the development becomes available.

Wastes must be classified and defined by their solid characteristics to comply with current waste guidance. Existing information and analysis derived for environmental purposes may therefore be suitable for use in this context. Waste Acceptance Criteria (WAC) report the leachability of materials and therefore cannot be used to classify, characterise or define wastes. The only purpose of a WAC analysis is to determine the suitability of a given material for acceptance at one of the three different types of available licenced landfills (inert, stable non-reactive hazardous or hazardous).

Other options are available that may lead to significant savings against disposal to landfill and expert advice should always be sought from a competent person to advise on their relative costs or benefits and advise on any additional analysis, sampling or investigation that may be required to reduce remaining uncertainties and comply with current guidance. Further consideration of results using HazWasteOnline™ can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed.

6.8 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.

6.9 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.

6.10 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.

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Appendix A.1 Engineers Logs

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Appendix B.2 Interpretation

Appendix B.3 Geotechnical In-Situ and Laboratory Results

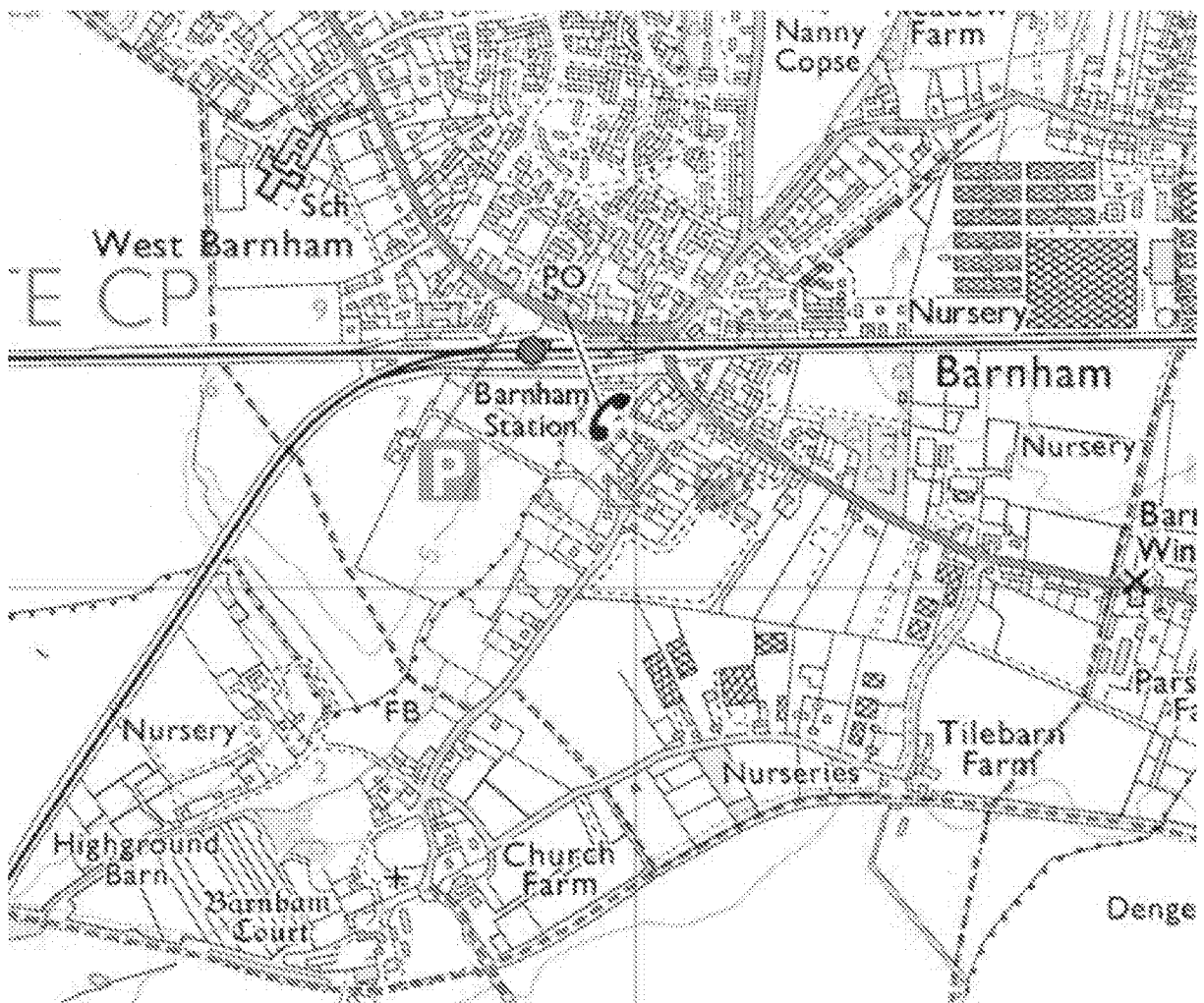
Appendix C Chemical Laboratory Testing

Appendix C.1 Conceptual Site Model

Appendix C.2 Chemical Laboratory Results

Appendix C.3 General Assessment Criteria

Appendix D Information Provided by the Client

**Figure 1 – Site Location Map**

Job Number
17324

Project
Land at Tars Farm, Church Lane, Barnham, West
Sussex PO22 0DB

Client
Wilson Designer Homes Ltd

Date
January 2019

Figure 2 – Aerial Photograph



Project

Land at Tars Farm, Church Lane,
Barnham, West Sussex PO22 0DB

Client

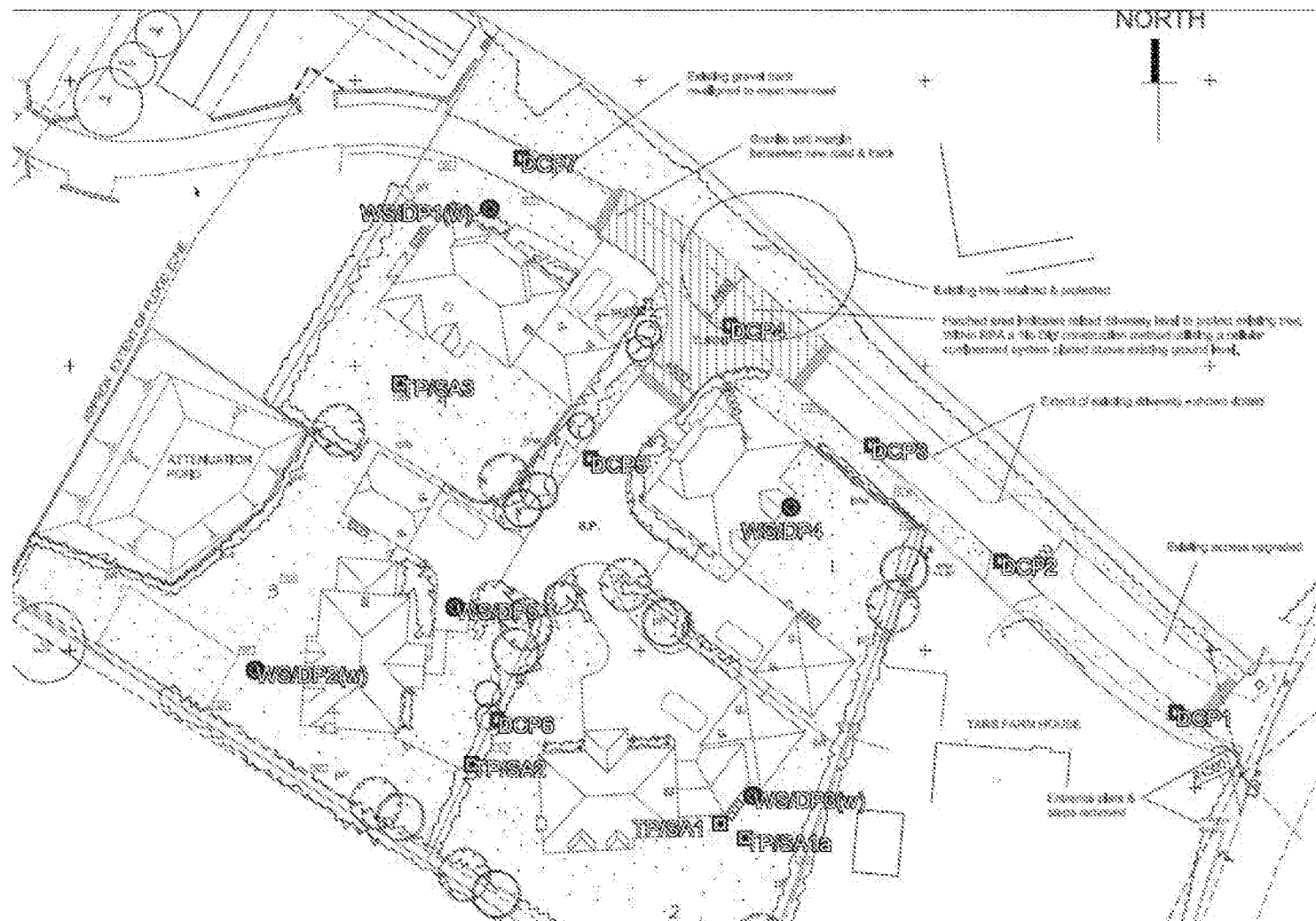
Wilson Designer Homes Ltd

Date

January 2019

Job Number

17324

Figure 3 – Trial Hole Plan**Project**

Land at Tars Farm, Church Lane,
Barnham, West Sussex PO22 0DB

Client

Wilson Designer Homes Ltd

Date

January 2019

Job Number

17324

Appendix A Field Work

Appendix A.1 Engineers Logs

		Soils Limited 		Trial Pit Log		Trial Pit No. TPSA1a Sheet 1 of 1	
Project Name: Land at Tars Farm			Project No.: 17324		Method:		Hole Type TP
Location: Church Lane, Barnham, West Sussex, PO22 0DB					Plant:		
Client: Paul Voller			Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 23/11/2018			Level:		Co-ords:		Logged By CB
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J D		0.20			Dark brown clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium angular quartz. TOPSOIL.
							Soft to firm yellowish brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, sub angular quartz. LONDON CLAY FORMATION
	0.60	J D		0.80			Light yellowish orange slightly clayey SAND. Sand is fine to coarse. LONDON CLAY FORMATION
	0.90	J D					
	1.00	B		1.00			End of Pit at 1.000m
1 2 3 4 5							
General Remarks:							Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:							

		Soils Limited 		Trial Pit Log		Trial Pit No. TPSA2 Sheet 1 of 1	
Project Name: Land at Tars Farm			Project No.: 17324		Method:		Hole Type TP
Location: Church Lane, Barnham, West Sussex, PO22 0DB					Plant:		
Client: Paul Voller			Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 23/11/2018			Level:		Co-ords:		Logged By CB
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J D					Dark brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium sub rounded quartz. LONDON CLAY FORMATION
	0.30	J D		0.25			Soft light orangish brown very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub rounded quartz. LONDON CLAY FORMATION
				0.40			Soft to firm light brown slightly mottled grey slightly sandy CLAY. Sand is fine to coarse. Occasional pockets of orange fine to coarse sand. LONDON CLAY FORMATION
	0.80	J D					
	1.00	B		1.00			End of Pit at 1.000m
							1
							2
							3
							4
							5
General Remarks:							Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:							

		Soils Limited 			Trial Pit Log		Trial Pit No. TPSA3 Sheet 1 of 1	
Project Name: Land at Tars Farm				Project No.: 17324		Method:		Hole Type TP
Location: Church Lane, Barnham, West Sussex, PO22 0DB				Plant:		Support:		
Client: Paul Voller				Trial Pit Length: m		Trial Pit Width: m		Scale 1:25
Dates: 23/11/2018				Level:		Co-ords:		Logged By CB
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J D					Light brown slightly clayey SAND. Sand is fine to coarse. TOPSOIL	
				0.25				
	0.50	J D					Brown clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse sub rounded quartz. LONDON CLAY FORMATION	
				0.80				
	0.90	J D					Firm light yellowish brown very sandy slight gravelly CLAY. Sand is fine to coarse. LONDON CLAY FORMATION	
	1.00	B		1.00			End of Pit at 1.000m	
1 2 3 4 5								
General Remarks:								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:								



Soils Limited

Borehole Log

Borehole No.

WS1

Sheet 1 of 1

Project Name: Land at Tars Farm

Project No.: 17324

Co-ords:

Hole Type
WS

Location: Church Lane, Barnham, West Sussex, PO22 0DB

Level:

Scale
1:50

Client: Paul Voller

Dates: 15/11/2018

Logged By
D

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D+J		0.45				
		0.50	D+J		0.65				
		0.90	D+J						1
		1.40	D		1.30				
		1.90	D		2.00				2
		2.20	D						
		2.70	D		2.90				3
		3.10	D						
		3.60	D						4
		4.20 - 4.40	D						
		4.60	D						
					5.00			End of Borehole at 5.00m	5
									6
									7
									8
									9
									10

General Remarks:

Groundwater Remarks:

Borehole Type

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

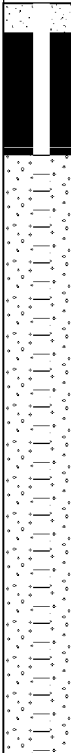
Sample Types

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

In-Situ Testing

SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Project Name: Land at Tars Farm	Project No.: 17324	Co-ords:	Hole Type WS
Location: Church Lane, Barnham, West Sussex, PO22 0DB		Level:	Scale 1:50
Client: Paul Voller		Dates: 15/11/2018	Logged By D

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.30	D+J		0.55		Very soft, dark brown to brown, slightly sandy, slightly silty, CLAY. Sand is fine. Frequent rootlets throughout. Occasional angular, to sub rounded, fine to coarse flint gravel. LONDON CLAY FORMATION	1			
		0.60	D+J				Soft to firm, greyish brown mottled, brown, slightly sandy, slightly silty, CLAY. Sand is fine. Rare rootlets. Rare angular to sub angular, fine to coarse flint gravel. LONDON CLAY FORMATION				
		0.90	D+J				Rootlets to 1.0 m.				
		1.10	D		1.00			Firm to stiff, brown and greyish brown mottled, slightly sandy, slightly silty CLAY. Sand is fine, and in fine pockets and lenses. Rare rootlets. LONDON CLAY FORMATION	2		
		1.60	D		2.60			Fine sandy lenses at 1.3, and 1.6 m. Occasional red oxide staining in flat partings. Rootlets not found below 1.3 m.			
		2.10	D								
		2.70	D				Stiff grey, slightly sandy, very silty CLAY/clayey SILT. Sand is fine, and in grey lenses. Sub-rounded coarse gravel sized pyrite nodule at 3.7 m. Becomes clayey silt below ~ 4.5 m. LONDON CLAY FORMATION	3			
		3.20	D				5.00			Fine grey sandy lenses at 3.1, 3.5, 3.7, 3.9, 4.4. Becomes siltier with depth.	
		3.70	D								
		4.20	D		5.00				4		
		4.70	D								
								6			
								7			
								8			
								9			
								10			

General Remarks:	Borehole Type CP: Cable Percussive WS: Windowless Sampler RC: Rotary Cored In-Situ Testing SPT: Split spoon - Standard Penetration Test CPT: Cone - Standard Penetration Test	Sample Types D: Disturbed B: Bulk J: Jar W: Water U: Undisturbed
Groundwater Remarks:		



Soils Limited

Northdown Green Road, Totton, Hants, PO19 9SD

Borehole Log

Borehole No.

WS3

Sheet 1 of 1

Project Name: Land at Tars Farm

Project No.: 17324

Co-ords:

Hole Type
WS

Location: Church Lane, Barnham, West Sussex, PO22 0DB

Level:

Scale
1:50

Client: Paul Voller

Dates: 15/11/2018

Logged By
D

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D+J		1.00		Soft, greyish brown, to brown with depth, slightly sandy SILT. Frequent rootlets, becoming occasional with depth. Rare, angular to sub-rounded, fine to coarse, flint gravel. TOPSOIL. Rootlets frequent from 0 - 0.5 m, occasional from 0.5 m to base of strata.		
		0.60	D+J						
		0.90	D+J						
		1.20	D		1.53			Very soft, brown, slightly gravelly, sandy SILT. Gravel is angular to rounded, fine to coarse flint. Odour of organic, rotting matter (putrid). Band of sandy, silty fine flint gravel (5 cm) at base of strata, underlain by a coarse sand lens at 1.5 m (~ 1 cm).	1
		1.60	D		1.80			Firm, greyish brown mottled, brown, slightly sandy, slightly silty, CLAY. Sand is fine. Occasional red oxide staining in partings.	2
		1.90	D		2.00			Firm, brownish grey, slightly sandy, very silty CLAY. Sand is fine, and in rare lenses, and partings. Occasional oxide staining in partings.	
		2.20	D				Stiff grey, slightly sandy, very clayey SILT. Sand is fine, and in grey lenses. Frequent, fine gravel sized calcareous fossilised shells. Sub-rounded coarse gravel sized pyrite nodule at 4.0 m.		
		2.60	D					Fine grey sandy lenses at 2.8, and 2 m. Calcareous shells feature from 2.4 m, to base of strata.	3
		3.20	D						
		3.60	D						
		4.00	D						4
		4.50	D						5
					5.00			End of Borehole at 4.60m	

General Remarks:

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

Project Name: Land a s:

Hole Type
WS

Location: Church Lane, Barnham, West Sussex, PO22 0DB

Level:

Scale
1:50

Client: Paul Voller

Dates: 15/11/2018

Logged By
D

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D					Soft to firm, brown, sandy SILT. Sand is fine - medium. Rare, angular to sub-rounded, fine to medium flint gravel. Frequent rootlets at surface. Rootlets to base of strata. Becoming soft to firm at 1. m.	
		0.60	D		0.50			Soft to firm, orangish brown, slightly clayey, sandy SILT. Occasional rootlets. Occasional rounded, fine gravel sized ferruginous fragments, and pockets. Rare angular to rounded, fine to medium flint gravel. LONDON CLAY FORMATION Rootlets rare at base of strata.	1
		0.90	D		0.83			Firm, yellowish brown and greyish brown mottled, slightly sandy, slightly silty CLAY. Sand is fine, and in pockets and lenses. Occasional roots and rootlets. LONDON CLAY FORMATION Fine sandy lenses at 0.85 1.3, 1.4, 1.5, 1.8, 1.95 m. Woody roots 1 - 2 mm diameter to 1.4 m depth.	
		1.20	D						
		1.60	D						
		1.90	D		2.00				
								End of Borehole at 2.00m	2
									3
									4
									5
									6
									7
									8
									9
									10

General Remarks:

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

Project Name: Land at Tars Farm

Project No.: 17324

Co-ords:

Hole Type

WS

Location: Church Lane, Barnham, West Sussex, PO22 0DB

Level:

Scale

1:50

Client: Paul Voller

Dates: 15/11/2018

Logged By

D

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	D		0.55			Soft to firm, brown, sandy SILT. Sand is fine - medium. Occasional, angular to rounded, fine to medium flint gravel. Rare, fine angular brick gravel. Frequent rootlets. MADE GROUND. Rootlets to base of strata. Becoming very clayey at base as grades into subsequent strata. N.B. no sample in WS from 0 - 0.35 m. Rootlets to base of strata. Roots - 1 mm thick above 1.5 m. Iron stone found at 1.5 m.	1
		0.60	D						
		0.90	D						
		1.20	D						
		1.50	D						
		1.90	D		2.00			Firm, yellowish brown and greyish brown mottled, slightly sandy, slightly silty CLAY. Sand is fine, and in pockets and lenses. Occasional rootlets. Rare sub-rounded, medium gravel sized ironstone fragments. LONDON CLAY FORMATION	2

End of Borehole at 2.00m

General Remarks:

Groundwater Remarks:

Borehole Type

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

In-Situ Testing

SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Sample Types

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

Soakaway Calculations

Soakaway Test No.	TPSA1a
Contract:	Tars Farm
Contract No.	17324

Field Test

Trial Pit Log (include details of groundwater):

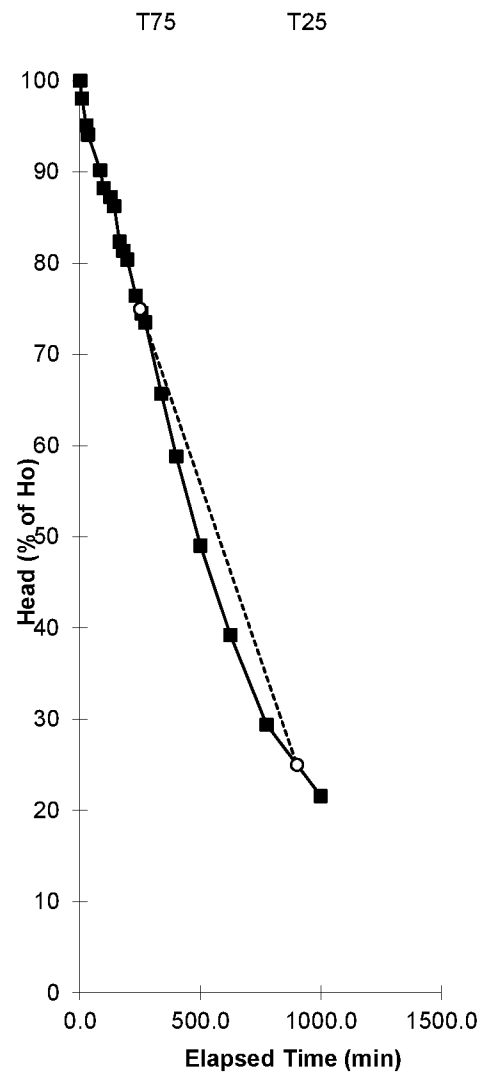
See trial Pit record

Depth of Pit	1.00 m
Width of Pit	0.60 m
Length of Pit	1.40 m
Depth of Pit Sealed	0.51 m
sp30	1.86 m2
yp73-25	0.2142 m3
t73-25	651.4 min
water used	0.4284 m3
i	2.947E-06 m/sec.

Field Data

Depth to Water	Elapsed Time	Head of Water	Head of Water
(m)	(min)	(% of Ho)	(m)
0.49	0	100	0.51
0.49	1.0	100	0.51
0.49	2.1	100	0.51
0.50	9.0	98	0.50
0.515	26.8	95	0.49
0.52	33.0	94	0.48
0.54	84.8	90	0.46
0.55	98.7	88	0.45
0.555	126.9	87	0.45
0.56	141.8	86	0.44
0.58	164.6	82	0.42
0.59	180.6	81	0.42
0.59	196.7	80	0.41
0.61	232.4	76	0.39
0.62	256.1	75	0.38
0.63	271.6	74	0.38
0.665	339.0	66	0.34
0.70	400.0	59	0.30
0.75	500.0	49	0.25
0.80	625.0	39	0.20
0.85	775.0	29	0.15
0.89	1000.0	22	0.11

T75	250.168	75
T25	901.563	25
T75-25	651.395	Derived from Best Fit



Comments

Extrapolated past 339mins

SOILS LIMITED

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

Soakaway Calculations

Seakaway Test No.	TPSA2
Contract:	Tars Farm
Contract No.	17324

Field Test

Trial Pit Log (include details of groundwater):

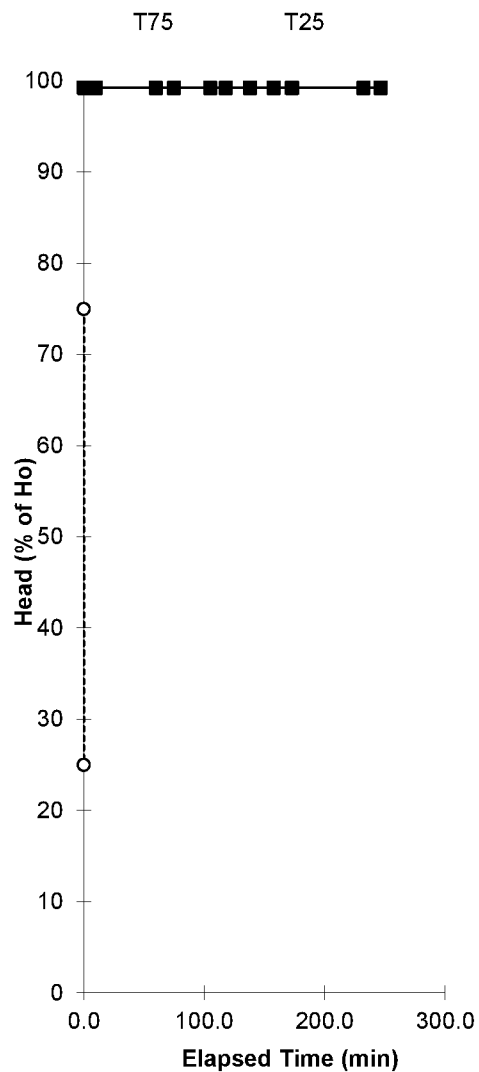
See trial Pit record

Depth of Pit	1.00 m
Width of Pit	0.60 m
Length of Pit	1.40 m
Depth of Pit Soaked	0.65 m
ap50	2.14 m ²
Vp75-25	0.273 m ³
t75-25	0.0 min
water used	0.5460 m ³
f	#DIV/0! m/sec.

Field Data

Depth to Water	Elapsed Time	Head of Water	Head of Water
(m)	(min)	(% of H ₀)	(m)
0.35	0	100	0.65
0.36	0.3	99	0.65
0.355	1.3	99	0.65
0.36	9.9	99	0.65
0.355	59.8	99	0.65
0.36	75.0	99	0.65
0.355	105.2	99	0.65
0.36	118.1	99	0.65
0.355	138.2	99	0.65
0.36	157.9	99	0.65
0.355	173.0	99	0.65
0.36	232.3	99	0.65
0.355	246.5	99	0.65

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



Comments

Negligible Infiltration

SOILS LIMITED

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

Soakaway Calculations

Soakaway Test No.	TPSA3
Contract:	Tars Farm
Contract No.	17324

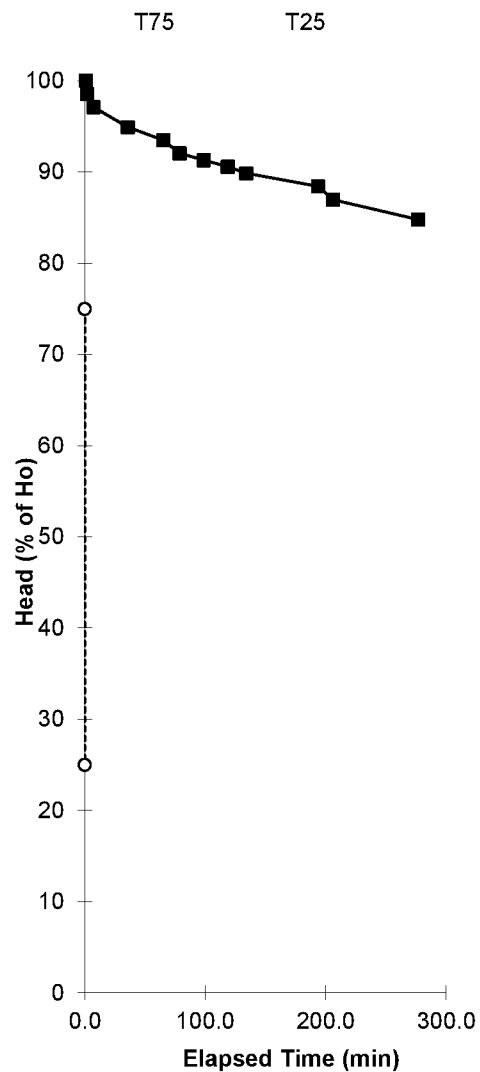
Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	1.00 m
Width of Pit	0.60 m
Length of Pit	1.40 m
Depth of Pit Soaked	0.69 m
ap50	2.22 m2
Vp75-25	0.2898 m3
tp75-25	0.0 min
water used	0.5796 m3
f	#DIV/0! m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.31	0	100	0.69
0.31	0.9	100	0.69
0.32	1.8	99	0.68
0.33	7.4	97	0.67
0.345	35.7	95	0.66
0.36	65.4	93	0.65
0.365	78.7	92	0.64
0.37	98.9	91	0.63
0.375	118.7	91	0.63
0.38	134.0	90	0.62
0.39	193.6	88	0.61
0.40	206.3	87	0.60
0.415	276.7	85	0.59



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

Comments

Negligible Infiltration

SOILS LIMITED

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

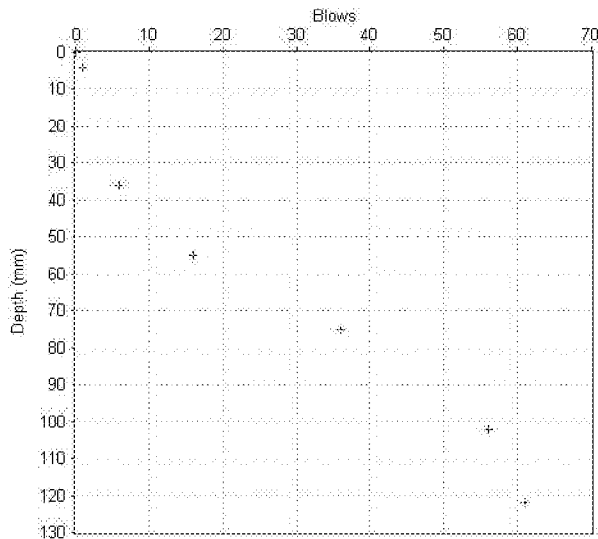
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

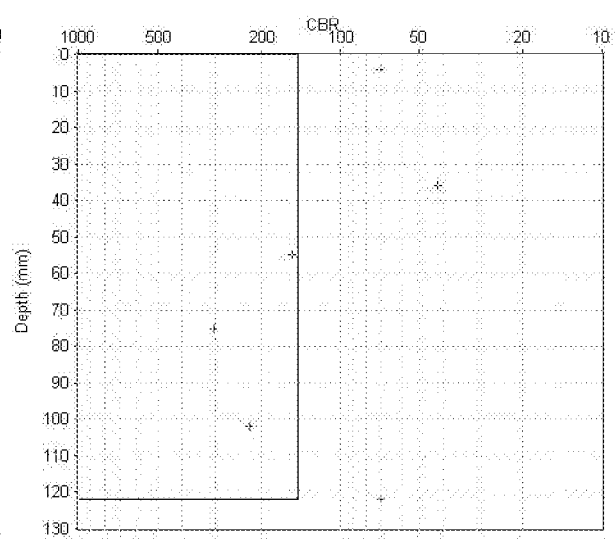
Chainage (km): 1.000
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 42
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 1.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	2.00	145	122	122	Base	0.14	0.69	0.69	0.69

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.69	0.69	0.69
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.69	0.69	0.69

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

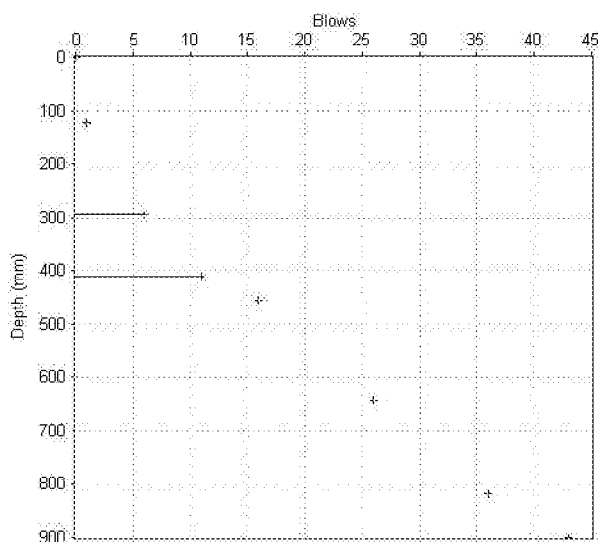
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

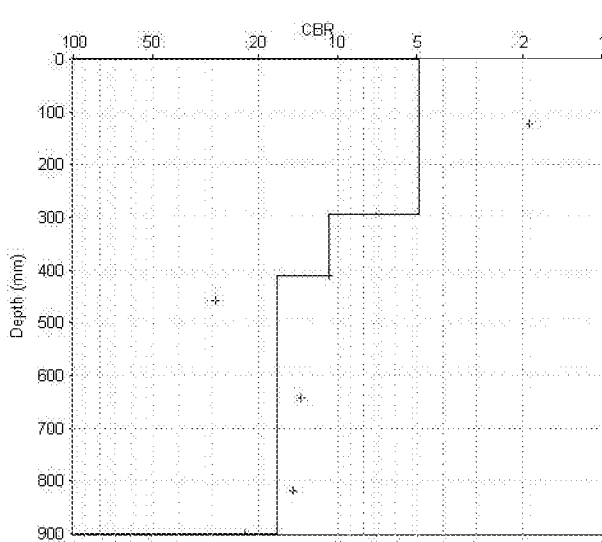
Chainage (km): 1.100
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 55
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 1.100



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	49.00	5	294	294	Base	0.01	0.16	0.16	0.16
2	23.40	11	117	411	Base	0.03	0.13	0.13	0.13
3	15.25	17	488	899	Base	0.04	0.84	0.84	0.84

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	1.14	1.14	1.14
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	1.14	1.14	1.14

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

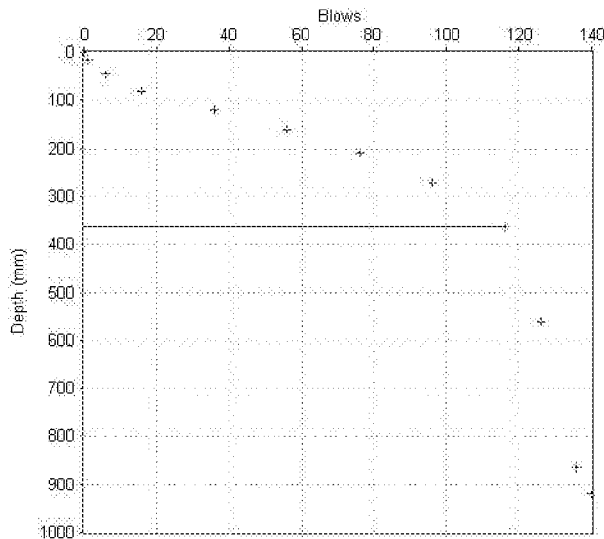
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

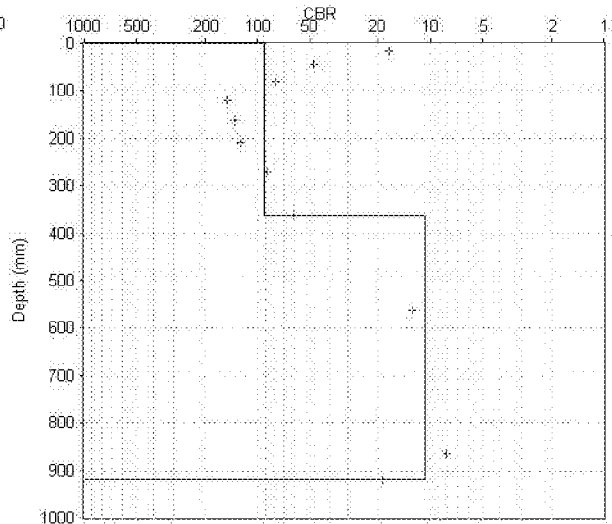
Chainage (km): 2.000
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 30
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 2.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	3.12	91	362	362	Base	0.14	1.93	1.93	1.93
2	23.25	11	558	920	Base	0.03	0.65	0.65	0.65

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	2.57	2.57	2.57
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	2.57	2.57	2.57

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

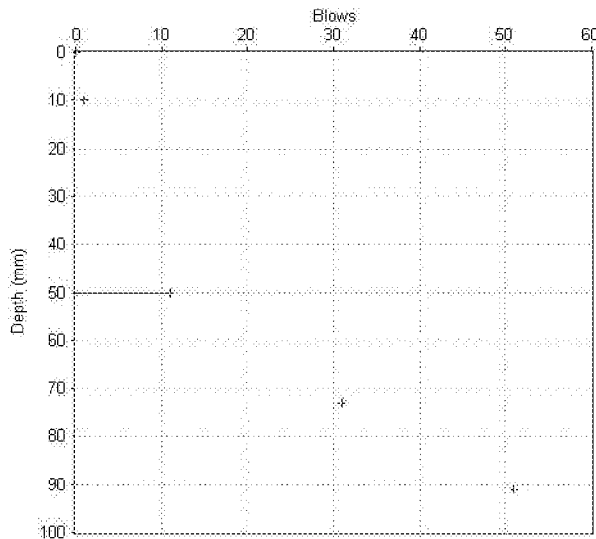
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

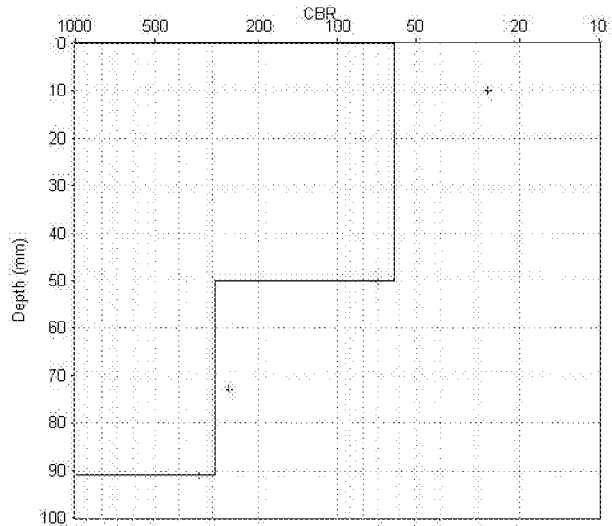
Chainage (km): 3.000
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 32
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 3.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	4.55	61	50	50	Base	0.11	0.23	0.23	0.23
2	1.03	294	41	91	Base	0.14	0.23	0.23	0.23

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.46	0.46	0.46
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.46	0.46	0.46

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

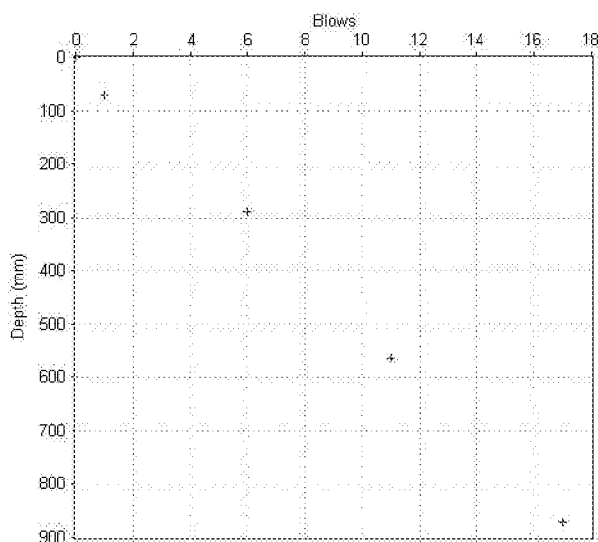
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

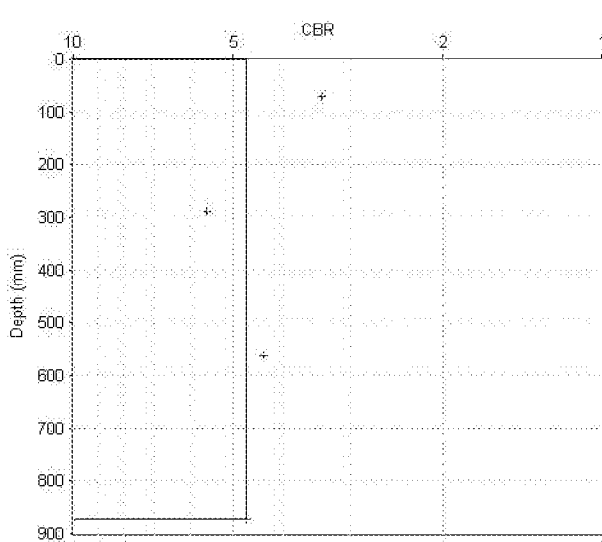
Chainage (km): 3.100
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 79
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 3.100



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	51.24	5	871	871	Base	0.01	0.46	0.46	0.46

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.46	0.46	0.46
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.46	0.46	0.46

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

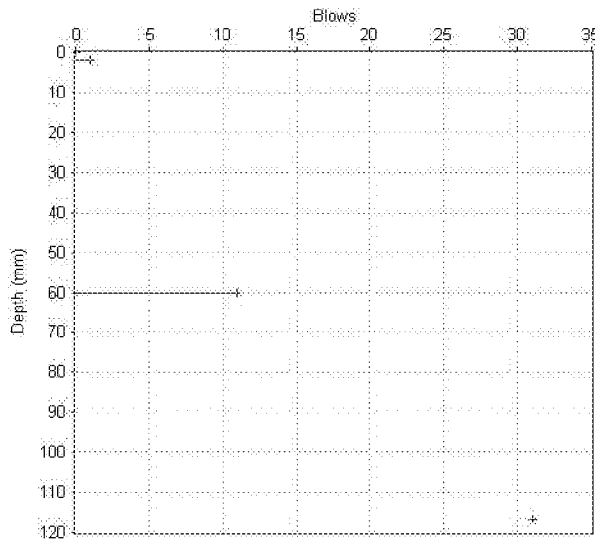
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

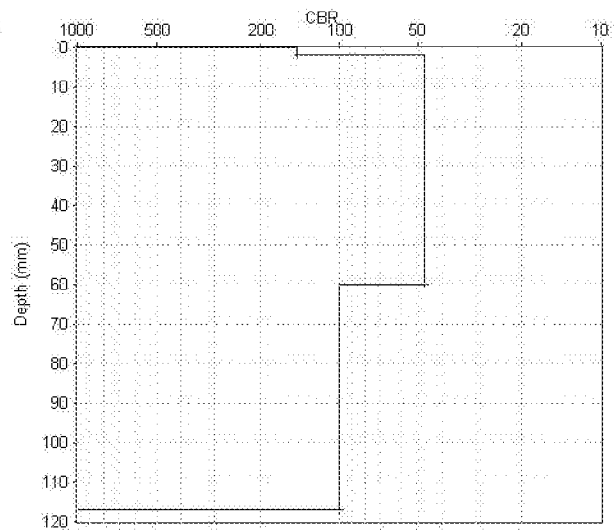
Chainage (km): 4.000
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 45
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 4.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	2.00	145	2	2	Base	0.14	0.01	0.01	0.01
2	5.80	47	58	60	Base	0.10	0.22	0.22	0.22
3	2.85	100	57	117	Base	0.14	0.31	0.31	0.31

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.55	0.55	0.55
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.55	0.55	0.55

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

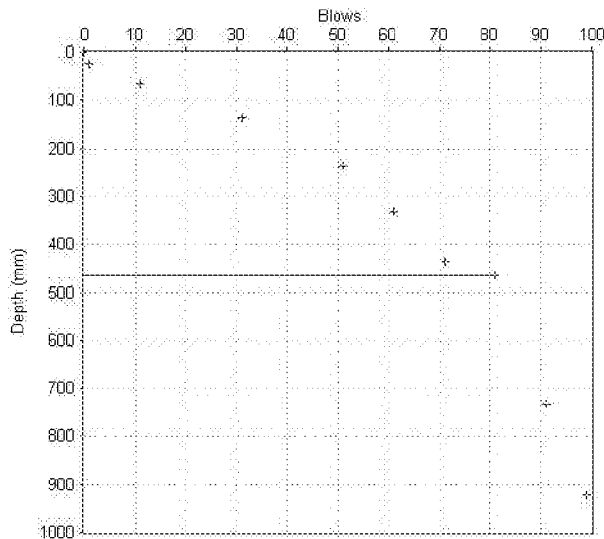
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

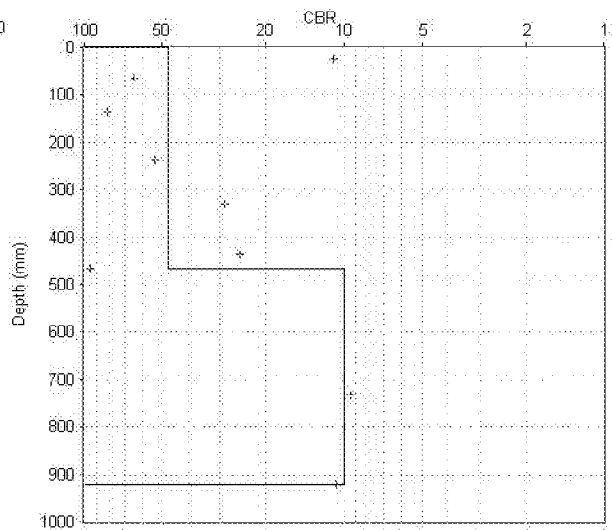
Chainage (km): 4.100
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 26
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 4.100



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	5.75	48	466	466	Base	0.10	1.81	1.81	1.81
2	25.28	10	455	921	Base	0.03	0.48	0.48	0.48

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	2.29	2.29	2.29
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	2.29	2.29	2.29

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

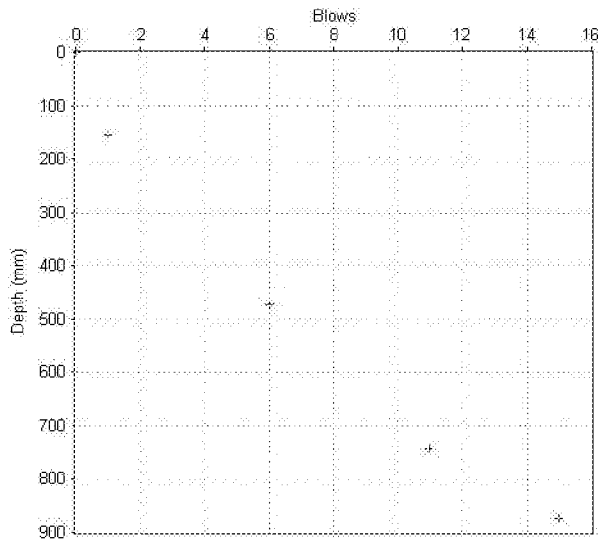
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

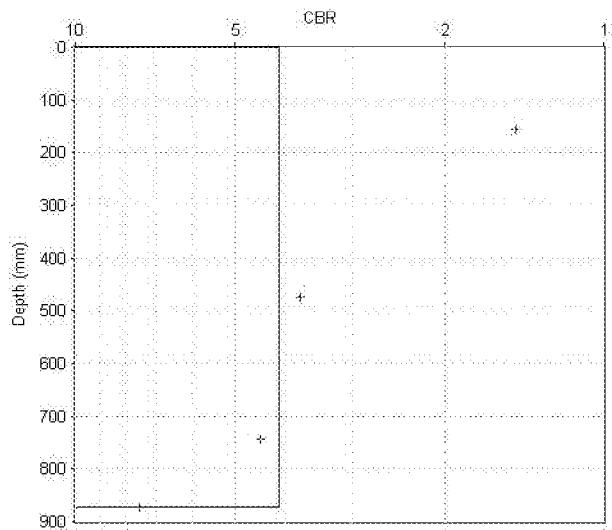
Chainage (km): 5.000
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 55
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 5.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	58.20	4	873	873	Base	0.01	0.40	0.40	0.40

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.40	0.40	0.40
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.40	0.40	0.40

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

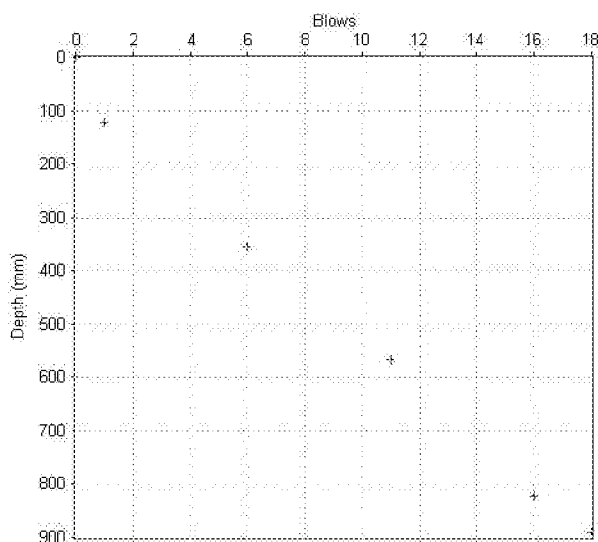
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

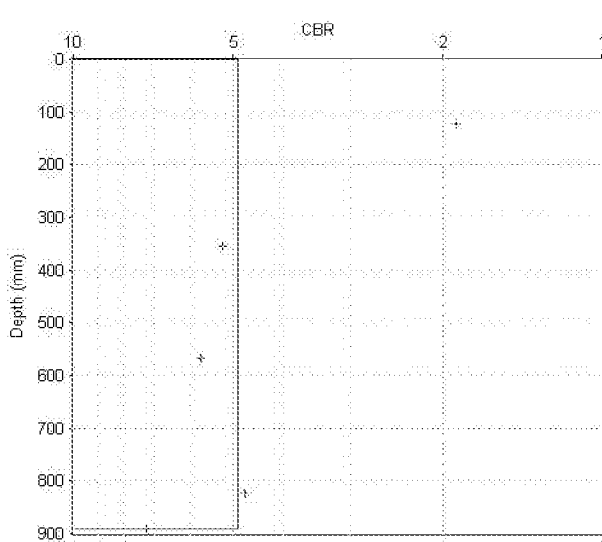
Chainage (km): 6.000
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 63
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 6.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	49.44	5	890	890	Base	0.01	0.48	0.48	0.48

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.48	0.48	0.48
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.48	0.48	0.48

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

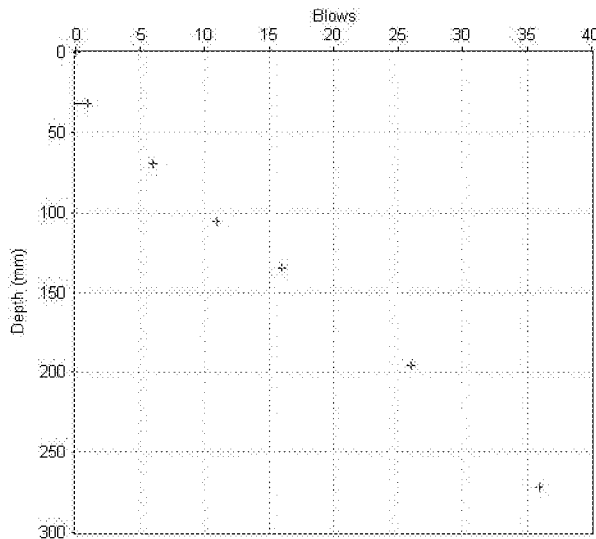
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

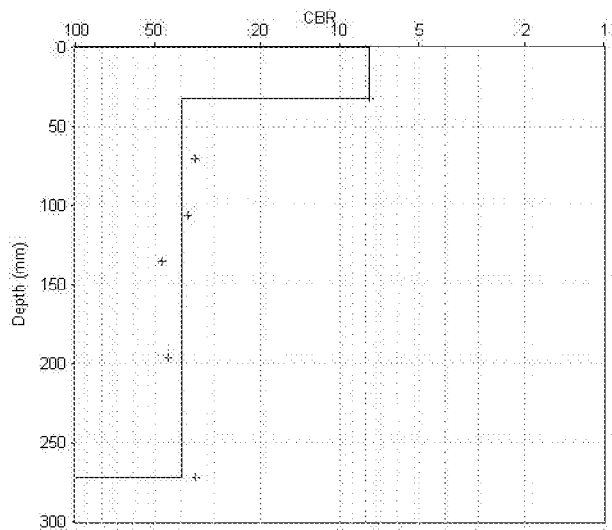
Chainage (km): 7.000
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 22
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 7.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	32.00	8	32	32	Base	0.02	0.03	0.03	0.03
2	6.86	39	240	272	Base	0.09	0.82	0.82	0.82

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.85	0.85	0.85
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.85	0.85	0.85

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

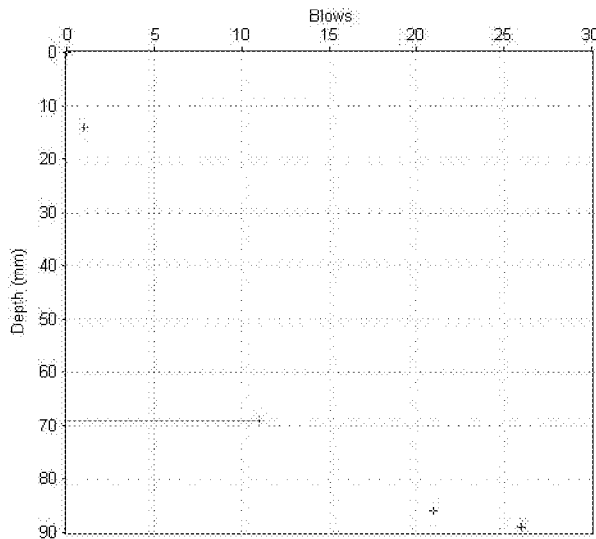
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

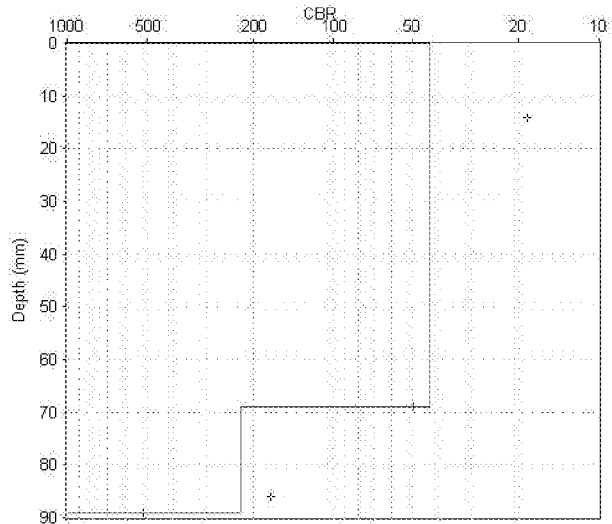
Chainage (km): 7.100
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 25
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 7.100



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	6.27	43	69	69	Base	0.09	0.25	0.25	0.25
2	1.33	223	20	89	Base	0.14	0.11	0.11	0.11

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.37	0.37	0.37
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.37	0.37	0.37

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

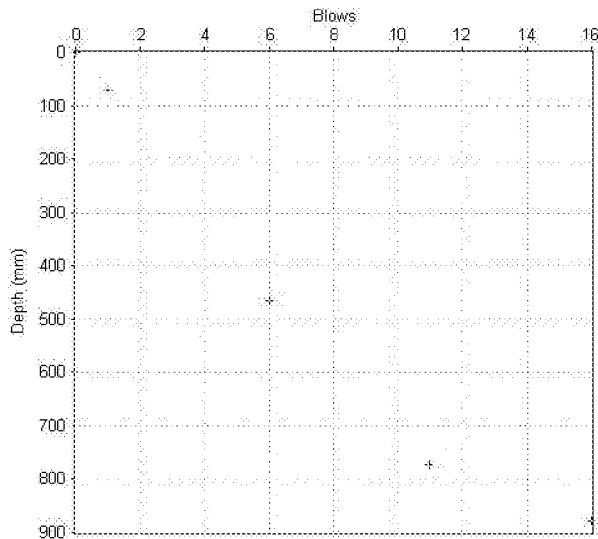
DCP Layer Strength Analysis Report

Project Name: 17324 DCP logs

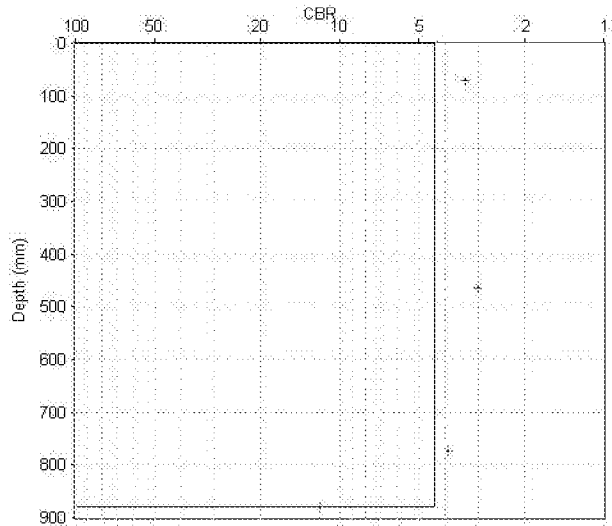
Chainage (km): 7.200
 Direction:
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 74
 Test Date: 09/01/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 7.200



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	55.00	4	880	880	Base	0.01	0.43	0.43	0.43

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.43	0.43	0.43
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.43	0.43	0.43

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Classification based on SPT “N” values:

The inferred undrained strength of the cohesive soils was based on the SPT “N” blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table B.1.1. (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 B.1.1 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

Note: (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

The relative density of granular soils was classified based of the relationship given in Table B.1.2.

The *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing*, NA 3.7 SPT test, BS EN 1997-2:2007, Annex F states “Relative density descriptions on borehole records should also be based on uncorrected SPT N values, unless significantly disturbed, using the density classification in BS 5930:2015, Table 7.

Table B.1.2 SPT “N” Blow Count Granular Classification

Classification	SPT “N” blow count (blows/300mm)
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	Greater than 50

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

Chalk samples recovered are disturbed by the sampling process. Therefore, it is difficult to assess an accurate chalk grade for in accordance with CIRIA C574 ‘Engineering in

Chalk'. 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 chalk grade 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), as outlined in Table B.1.3.

Table B.1.3 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)

Note:

Classification of DCP results to CBR:

The DCP consists of a cone fixed to the bottom of a 575mm vertical rod. An 8kg weight is repeatedly lifted and dropped onto an anvil at the mid-height of the rod to deliver a 'blow'. A vertical scale alongside the rod is used to measure the depth of penetration of the cone. These measurements are then converted to CBR values using the following equation derived from the DTP Interim Advice Note 73/06 – Design Guidance for Road Pavement Foundations:

Appendix B.2 Interpretation

Table B.2.1 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength
DPI	LCF 0.50 – 1.30 Sandy CLAY	4 – 7	Low ($C_u = 20 - 35\text{kPa}$)
	LCF 1.30 – 2.90 Sandy CLAY	<4	Very low ($C_u = <20\text{kPa}$)
	LCF 2.90 – 4.40 Sandy CLAY	7 – 11	Low to medium ($C_u = 35 - 55\text{kPa}$)
	LCF 4.40 – 7.00 Sandy CLAY	11 – 15	Medium ($C_u = 55 - 75\text{kPa}$)
DP2	LCF 0.70 – 2.10 Sandy CLAY	4	Low ($C_u = 20\text{kPa}$)
	LCF 2.10 – 2.80 Sandy CLAY	4 – 7	Low ($C_u = 20 - 35\text{kPa}$)
	LCF 2.80 – 6.00 Sandy CLAY	7 – 11	Low to medium ($C_u = 35 - 55\text{kPa}$)
DP3	LCF 1.20 – 1.60 Sandy CLAY	11 – 18	Medium to high ($C_u = 55 - 90\text{kPa}$)
	LCF 1.60 – 2.70 Sandy CLAY	4 – 7	Low ($C_u = 20 - 35\text{kPa}$)
	LCF 2.70 – 4.40 Sandy CLAY	7	Low ($C_u = 35\text{kPa}$)
	LCF 4.40 – 6.00 Sandy CLAY	11	Medium ($C_u = 55\text{kPa}$)
DP4	LCF 0.50 – 2.70 Sandy CLAY	4 – 7	Low ($C_u = 20 - 35\text{kPa}$)
	LCF 2.70 – 5.00 Sandy CLAY	7 – 11	Low to medium ($C_u = 35 - 55\text{kPa}$)
DP5	LCF 0.60 – 2.10 Sandy CLAY	4	Low ($C_u = 20\text{kPa}$)
	LCF 2.10 – 2.80 Sandy CLAY	4 – 7	Low ($C_u = 20 - 35\text{kPa}$)

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength
	LCF 2.80 – 5.00 Sandy CLAY	7 – 15	Low to medium ($C_u = 35 - 75\text{kPa}$)

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

Table B.2.2 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
LCF	22 – 32	33 – 39	87 – 100	33 – 45	CH	Medium to high	Medium to 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 most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.

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

Appendix B.3 Geotechnical In-Situ and Laboratory Results



Soils Limited

Probe Log

Probe No.

DP1

Sheet 1 of 1

Project Name:	Land at Tars Farm	Project No.	17324	Co-ords:		Hole Type	DP
Location:	Church Lane, Barnham, West Sussex, PO22 0DB	Level:	m AOD			Scale	1:50
Client:	Paul Voller	Dates:	15/11/2018			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	1				30
2	2				
3	2				
4	2				
5	2				
6	2				
7	2				
8	2				
9	2				
10	2				
11	2				
12	2				
13	2				
14	2				
15	2				
16	2				
17	2				
18	2				
19	2				
20	2				
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291	2				
292	2				
293	2				
294	2				
295	2				
296	2				
297	2				
298	2				
299	2				
300	2				
301	2				
302	2				
303	2				



Soils Limited

Probe Log

Probe No.

DP2

Sheet 1 of 1

Project Name:	Land at Tars Farm	Project No.	17324	Co-ords:		Hole Type	DP
Location:	Church Lane, Barnham, West Sussex, PO22 0DB	Level:	m AOD			Scale	1:50
Client:	Paul Voller	Dates:	15/11/2018			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0.1	1				20
0.2	1				
0.3	1				
0.4	1				20
0.5	2				
0.6	2				
0.7	2				40
0.8	2				
0.9	2				
1.0	2				40
1.1	2				
1.2	2				
1.3	2				30
1.4	3				
1.5	3				
1.6	3				60
1.7	3				
1.8	3				
1.9	3				
2.0	3				
2.1	3				
2.2	3				
2.3	3				
2.4	3				
2.5	3				
2.6	3				
2.7	3				
2.8	3				
2.9	3				
3.0	3				
3.1	3				
3.2	3				
3.3	3				
3.4	3				
3.5	3				
3.6	3				
3.7	3				
3.8	3				
3.9	3				
4.0	3				
4.1	3				
4.2	3				
4.3	3				
4.4	3				
4.5	3				
4.6	3				
4.7	3				
4.8	3				
4.9	3				
5.0	3				
5.1	3				
5.2	3				
5.3	3				
5.4	3				
5.5	3				
5.6	3				
5.7	3				
5.8	3				
5.9	3				
6.0	3				
6.1	4				
6.2	4				
6.3	4				
6.4	4				
6.5	4				
6.6	4				
6.7	4				
6.8	4				
6.9	4				
7.0	4				
7.1	4				
7.2	4				
7.3	4				
7.4	4				
7.5	4				
7.6	4				
7.7	4				
7.8	4				
7.9	4				
8.0	4				
8.1	4				
8.2	4				
8.3	4				
8.4	4				
8.5	4				
8.6	4				
8.7	4				
8.8	4				
8.9	4				
9.0	4				
9.1	4				
9.2	4				
9.3	4				
9.4	4				
9.5	4				
9.6	4				
9.7	4				
9.8	4				
9.9	4				
10.0	4				
Remarks	Fall Height mm		Cone Base Diameter mm		
	Hammer Weight kg		Final Depth 6m		
	Probe Type		Energy Ratio (Er) %		



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Probe Log

Probe No.

DP3

Sheet 1 of 1

Project Name: Land at Tars Farm

Project No.
17324

Co-ords:

Hole Type
DP

Location: Church Lane, Barnham, West Sussex, PO22 0DB

Level: m AOD

Scale
1:50

Client: Paul Voller

Dates: 15/11/2018

Logged By

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
1					10
2					30
3					40
4					50
5					45
6					60
7					
8					
9					
10					

Remarks

Fall Height mm
 Hammer Weight kg
 Probe Type

Cone Base Diameter mm
 Final Depth 6m
 Energy Ratio (Er) %





Soils Limited

Probe Log

Probe No.

DP4

Sheet 1 of 1

Project Name:	Land at Tars Farm	Project No.	17324	Co-ords:		Hole Type	DP
Location:	Church Lane, Barnham, West Sussex, PO22 0DB	Level:	m AOD			Scale	1:50
Client:	Paul Voller	Dates:	15/11/2018			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	1				30
2	2				30
3	2				60
4	2				60
5	2				70
6	2				
7	2				
8	2				
9	2				
10	2				
Remarks		Fall Height	mm	Cone Base Diameter	mm
		Hammer Weight	kg	Final Depth	5m
		Probe Type		Energy Ratio (Er)	%





Soils Limited

Probe Log

Probe No.

DP5

Sheet 1 of 1

Project Name:	Land at Tars Farm	Project No.	17324	Co-ords:		Hole Type	DP
Location:	Church Lane, Barnham, West Sussex, PO22 0DB	Level:	m AOD			Scale	1:50
Client:	Paul Voller	Dates:	15/11/2018			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	1				30
2	1				25
3	2				60
4	3				65
5	4				70
6					
7					
8					
9					
10					
Remarks		Fall Height	mm	Cone Base Diameter	mm
		Hammer Weight	kg	Final Depth	5m
		Probe Type		Energy Ratio (Er)	%





Laboratory Report



Contract Number: 41963

Client Ref:

Report Date: **10-12-2018**

Client PO: **17324**

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

Contract Title: **Tars Farm**
For the attention of: **Tom Rees-Blanchard**

Date Received: **04-12-2018**
Date Commenced: **04-12-2018**
Date Completed: **10-12-2018**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	6
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	6
Disposal of samples for job	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

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Accounts Assistant)
Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

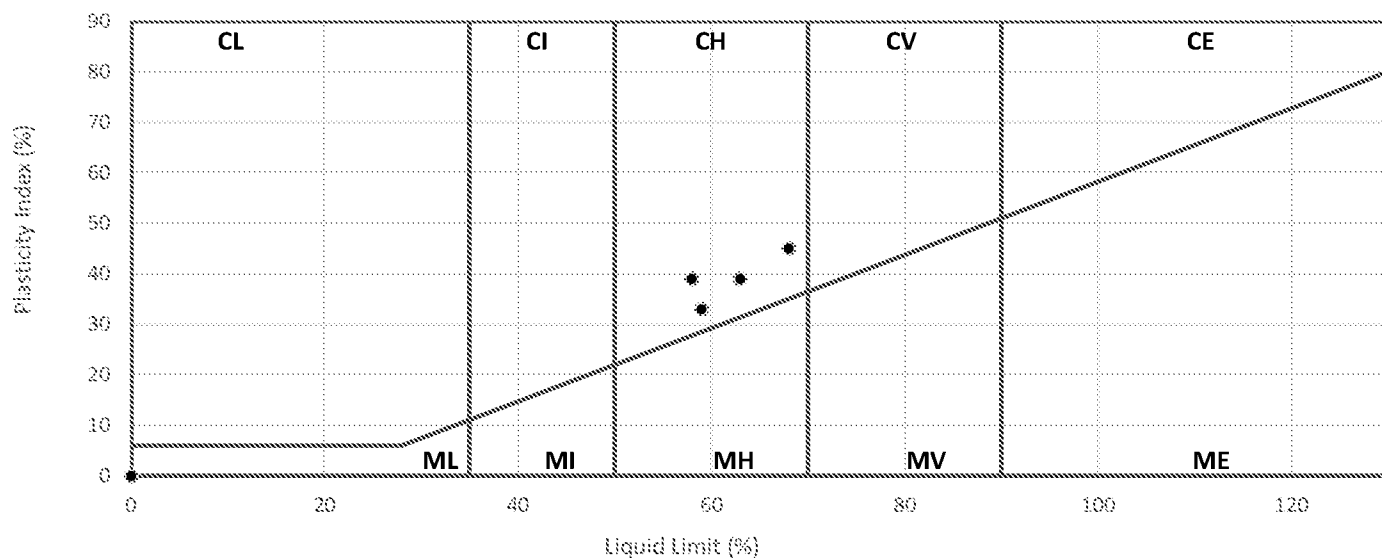
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)

Contract Number	41963	
Site Name	Tars Farm	

[illegible]

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

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION



Operators	Checked	09/12/2018	Emma Sharp	
DB	Approved	10/12/2018	Paul Evans	





Tom Rees-Blanchard
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 21N



DETS Report No: 18-85833

Site Reference: Tars Farm

Project / Job Ref: 17324

Order No: 17324

Sample Receipt Date: 28/11/2018

Sample Scheduled Date: 28/11/2018

Report Issue Number: 1

Reporting Date: 04/12/2018

Authorised by:



Russell Jarvis
Associate Director of Client Services

Authorised by:



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



Soil Analysis Certificate						
DETS Report No: 18-85833	Date Sampled	23/11/18	23/11/18	23/11/18	23/11/18	23/11/18
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Tars Farm	TP / BH No	TP/SA1a	TP/SA1	TP/SA2	TP/SA2	TP/SA3
Project / Job Ref: 17324	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 17324	Depth (m)	0.10	0.30	0.10	0.30	0.50
Reporting Date: 04/12/2018	DETS Sample No	375236	375237	375238	375239	375240

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	5.8	5.4	5.7	6.3	7.9
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	26	< 10	11	12	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.03	< 0.01	0.01	0.01	< 0.01
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Organic Matter	%	< 0.1	MCERTS	3.1	2.1	3.1	1.4	1.2
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.8	1.2	1.8	0.8	0.7
Antimony (Sb)	mg/kg	< 1	NONE	1.1	< 1	< 1	< 1	< 1
Arsenic (As)	mg/kg	< 2	MCERTS	9	10	10	11	8
Beryllium (Be)	mg/kg	< 0.5	NONE	0.5	0.5	0.6	0.7	0.6
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	14	14	15	17	15
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	13	11	10	7	6
Lead (Pb)	mg/kg	< 3	MCERTS	49	38	31	12	14
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	9	9	10	12	9
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	29	29	30	34	30
Zinc (Zn)	mg/kg	< 3	MCERTS	70	54	69	34	30
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

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



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Maidstone
Kent ME17 2JN

TEL: 01622 670440



Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 18-85833	Date Sampled	23/11/18	23/11/18	23/11/18	23/11/18	23/11/18
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Tars Farm	TP / BH No	TP/SA1a	TP/SA1	TP/SA2	TP/SA2	TP/SA3
Project / Job Ref: 17324	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 17324	Depth (m)	0.10	0.30	0.10	0.30	0.50
Reporting Date: 04/12/2018	DETS Sample No	375236	375237	375238	375239	375240

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.20	< 0.1	0.38	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	0.35	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	0.23	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	0.23	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	0.32	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.12	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	0.19	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.15	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.15	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	2.1	< 1.6	< 1.6

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



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Soil Analysis Certificate - TPH LQM Banded

DETS Report No: 18-85833	Date Sampled	23/11/18				
Soils Ltd	Time Sampled	None Supplied				
Site Reference: Tars Farm	TP / BH No	TP/SA2				
Project / Job Ref: 17324	Additional Refs	None Supplied				
Order No: 17324	Depth (m)	0.10				
Reporting Date: 04/12/2018	DETS Sample No	375238				

Determinand	Unit	RL	Accreditation				
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01			
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C16 - C35	mg/kg	< 10	MCERTS	< 10			
Aliphatic >C35 - C44	mg/kg	< 10	NONE	< 10			
Aliphatic (C5 - C44)	mg/kg	< 30	NONE	< 30			
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01			
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2			
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3			
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10			
Aromatic >C35 - C44	mg/kg	< 10	NONE	< 10			
Aromatic (>C5 - C44)	mg/kg	< 30	NONE	< 30			
Total >C5 - C44	mg/kg	< 60	NONE	< 60			

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



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 18-85833	Date Sampled	23/11/18				
Soils Ltd	Time Sampled	None Supplied				
Site Reference: Tars Farm	TP / BH No	TP/SA2				
Project / Job Ref: 17324	Additional Refs	None Supplied				
Order No: 17324	Depth (m)	0.10				
Reporting Date: 04/12/2018	DETS Sample No	375238				

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

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



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 18-85833	
Soils Ltd	
Site Reference: Tars Farm	
Project / Job Ref: 17324	
Order No: 17324	
Reporting Date: 04/12/2018	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
375236	TP/SA1a	None Supplied	0.10	15.5	Brown sandy clay with stones and vegetation
375237	TP/SA1	None Supplied	0.30	14.1	Brown sandy clay with vegetation
375238	TP/SA2	None Supplied	0.10	19	Brown sandy clay with vegetation
375239	TP/SA2	None Supplied	0.30	13.2	Brown sandy clay with vegetation
375240	TP/SA3	None Supplied	0.50	14	Brown sandy clay

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information				
DETS Report No: 18-85833				
Soils Ltd				
Site Reference: Tars Farm				
Project / Job Ref: 17324				
Order No: 17324				
Reporting Date: 04/12/2018				

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 Testing

Appendix C.1 Conceptual Site Model

Table C.I.I CSM Revised Pre Testing

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Dismantled barn on site Asbestos	Asbestos	Inhalation of dust	Site Workers/Site Maintenance	Medium	Likely	Moderate	As broken asbestos sheeting is present, this increases the likelihood of fibres which could become airborne. Gas, water, service and environmental risks considered low to negligible, no sources identified.	Phase II Ground Investigation to confirm the ground conditions present are as suggested. To include suitable chemical testing for a generic suite prior to undertaking a generic quantitative risk assessment. Consultation should be sought with a certified Asbestos contractor in order to produce a suitable remediation strategy if Asbestos is confirmed as being present in or on adjacent soils
			End Users	Medium	Likely	Moderate		
			Off-site Users	Medium	Unlikely	Low		
	-	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Migration via surface runoff	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
			Deep Aquifer	-	-	-		
		Migration in solution via groundwater	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
			Deep Aquifer	-	-	-		
	-	Direct contact with construction material	Buried structures	-	-	-		
			Buried Services	-	-	-		
			Off-site Users	-	-	-		
		Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
Above ground oil tank (unbundled) PAHs	-	Inhalation of dust	Site Workers/Site Maintenance	-	-	-	Potential for small-scale localised contamination.	Phase II Ground Investigation to confirm the ground conditions present are as suggested. To include suitable chemical testing for a generic suite prior to undertaking a generic quantitative risk assessment.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	PAHs	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Medium	Unlikely	Low		
			End Users	Medium	Unlikely	Low		
			Off-site Users	Minor	Unlikely	Low		
	PAHs	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Minor	Unlikely	Very low		
			End Users	Minor	Low	Very low		
			Off-site Users	-	-	-		
	PAHs	Migration via surface runoff	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
			Deep Aquifer	-	-	-		
			Off-site Users	-	-	-		
	PAHs	Direct contact with construction material	Buried structures	-	-	-		
			Buried Services	Minor	Low	Very low		
			Off-site Users	-	-	-		
	PAHs	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		
London Clay Formation Bedrock Sulphates	-	Inhalation of dust	End Users	-	-	-	The London Clay Formation is a pyrite-bearing stratum and as such has the potential to contain sulphates which can attack and damage concrete.	Phase II Ground Investigation to confirm the ground conditions present are as suggested. To include chemical testing to determine the sulphate concentration present within soils, and therefore determine the Aggressive Chemical Environment for Concrete in line with BRE Special Digest 1:2005 concrete in aggressive ground.
			Off-site Users	-	-	-		
			Off-site Users	-	-	-		
	-	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Migration via surface runoff	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
			Deep Aquifer	-	-	-		
			Off-site Users	-	-	-		
	Sulphates	Direct contact with construction material	Buried structures	Mild	Unlikely	Low		
			Buried Services	-	-	-		
			Off-site Users	-	-	-		
	-	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
			Building and confined spaces	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		

Table C.1.2 CSM Revised Post Testing

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Dismantled barn on site Asbestos	Asbestos	Inhalation of dust	Site Workers/Site Maintenance	-	-	-	No asbestos identified in any of the samples tested or within any of the soils described during detailed engineer logging.	No further work required.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Migration via surface runoff	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
		Migration in solution via groundwater	Deep Aquifer	-	-	-		
			Off-site Users	-	-	-		
		Direct contact with construction material	Buried structures	-	-	-		
			Buried Services	-	-	-		
	-	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
Above ground oil tank (unbunded) PAHs	-	Inhalation of dust	Site Workers/Site Maintenance	-	-	-	No contaminant present on site.	No further work required.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	PAHs	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	PAHs	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	PAHs	Migration via surface runoff	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
		Migration in solution via groundwater	Deep Aquifer	-	-	-		
			Off-site Users	-	-	-		
		Direct contact with construction material	Buried structures	-	-	-		
			Buried Services	-	-	-		
	PAHs	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		
London Clay Formation Bedrock Sulphates	-	Inhalation of dust	End Users	-	-	-	The London Clay Formation is a pyrite-bearing stratum and as such has the potential to contain sulphates which can attack and damage concrete.	Design concrete in line with Section 4.4.
			Off-site Users	-	-	-		
			Off-site Users	-	-	-		
	-	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	-	Migration via surface runoff	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
		Migration in solution via groundwater	Deep Aquifer	-	-	-		
			Off-site Users	-	-	-		
	Sulphates	Direct contact with construction material	Buried structures	Mild	Unlikely	Very low		
			Buried Services	-	-	-		
	-	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		

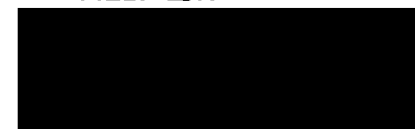
Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from Preliminary Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		

Appendix C.2 Chemical Laboratory Results



Tom Rees-Blanchard
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

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



DETS Report No: 18-85833

Site Reference: Tars Farm

Project / Job Ref: 17324

Order No: 17324

Sample Receipt Date: 28/11/2018

Sample Scheduled Date: 28/11/2018

Report Issue Number: 1

Reporting Date: 04/12/2018

Authorised by:



Russell Jarvis
Associate Director of Client Services

Authorised by:



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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
DETS Report No: 18-85833	Date Sampled	23/11/18	23/11/18	23/11/18	23/11/18	23/11/18
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Tars Farm	TP / BH No	TP/SA1a	TP/SA1	TP/SA2	TP/SA2	TP/SA3
Project / Job Ref: 17324	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 17324	Depth (m)	0.10	0.30	0.10	0.30	0.50
Reporting Date: 04/12/2018	DETS Sample No	375236	375237	375238	375239	375240

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	5.8	5.4	5.7	6.3	7.9
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	26	< 10	11	12	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.03	< 0.01	0.01	0.01	< 0.01
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Organic Matter	%	< 0.1	MCERTS	3.1	2.1	3.1	1.4	1.2
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.8	1.2	1.8	0.8	0.7
Antimony (Sb)	mg/kg	< 1	NONE	1.1	< 1	< 1	< 1	< 1
Arsenic (As)	mg/kg	< 2	MCERTS	9	10	10	11	8
Beryllium (Be)	mg/kg	< 0.5	NONE	0.5	0.5	0.6	0.7	0.6
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	14	14	15	17	15
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	13	11	10	7	6
Lead (Pb)	mg/kg	< 3	MCERTS	49	38	31	12	14
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	9	9	10	12	9
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	29	29	30	34	30
Zinc (Zn)	mg/kg	< 3	MCERTS	70	54	69	34	30
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

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



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 18-85833	Date Sampled	23/11/18	23/11/18	23/11/18	23/11/18	23/11/18
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Tars Farm	TP / BH No	TP/SA1a	TP/SA1	TP/SA2	TP/SA2	TP/SA3
Project / Job Ref: 17324	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 17324	Depth (m)	0.10	0.30	0.10	0.30	0.50
Reporting Date: 04/12/2018	DETS Sample No	375236	375237	375238	375239	375240

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.20	< 0.1	0.38	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	0.35	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	0.23	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	0.23	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	0.32	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.12	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	0.19	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.15	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.15	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	2.1	< 1.6	< 1.6

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



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Soil Analysis Certificate - TPH LQM Banded

DETS Report No: 18-85833	Date Sampled	23/11/18				
Soils Ltd	Time Sampled	None Supplied				
Site Reference: Tars Farm	TP / BH No	TP/SA2				
Project / Job Ref: 17324	Additional Refs	None Supplied				
Order No: 17324	Depth (m)	0.10				
Reporting Date: 04/12/2018	DETS Sample No	375238				

Determinand	Unit	RL	Accreditation				
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01			
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3			
Aliphatic >C16 - C35	mg/kg	< 10	MCERTS	< 10			
Aliphatic >C35 - C44	mg/kg	< 10	NONE	< 10			
Aliphatic (C5 - C44)	mg/kg	< 30	NONE	< 30			
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01			
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05			
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2			
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2			
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2			
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3			
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10			
Aromatic >C35 - C44	mg/kg	< 10	NONE	< 10			
Aromatic (>C5 - C44)	mg/kg	< 30	NONE	< 30			
Total >C5 - C44	mg/kg	< 60	NONE	< 60			

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



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 18-85833	Date Sampled	23/11/18				
Soils Ltd	Time Sampled	None Supplied				
Site Reference: Tars Farm	TP / BH No	TP/SA2				
Project / Job Ref: 17324	Additional Refs	None Supplied				
Order No: 17324	Depth (m)	0.10				
Reporting Date: 04/12/2018	DETS Sample No	375238				

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

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



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 18-85833	
Soils Ltd	
Site Reference: Tars Farm	
Project / Job Ref: 17324	
Order No: 17324	
Reporting Date: 04/12/2018	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
375236	TP/SA1a	None Supplied	0.10	15.5	Brown sandy clay with stones and vegetation
375237	TP/SA1	None Supplied	0.30	14.1	Brown sandy clay with vegetation
375238	TP/SA2	None Supplied	0.10	19	Brown sandy clay with vegetation
375239	TP/SA2	None Supplied	0.30	13.2	Brown sandy clay with vegetation
375240	TP/SA3	None Supplied	0.50	14	Brown sandy clay

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information				
DETS Report No: 18-85833				
Soils Ltd				
Site Reference: Tars Farm				
Project / Job Ref: 17324				
Order No: 17324				
Reporting Date: 04/12/2018				

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.3 General Assessment Criteria

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date	
			Allotments						Commercial			Residential						Park						
			With home-grown produce			Without home-grown produce			1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6				
Type	Contaminants	Species	Year	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			
Metals	Antimony		2010						550						7500				EIC/AGS/ CLAIRE	EIC/AGS/ CLAIRE	2010			
	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		
				VI	2014			21			21			170			49		22	250	C4SL	DEFRA	2014	
				VI	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			130			180			53			980			230	800	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			90			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 >C3 - 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 >C3 - 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	

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Media	Authority	Date	
			With			Without			Allotments			Commercial			Residential			Park						
			home-grown produce	home-grown produce	home-grown produce																			
Type	Contaminants	Species	Year	SOM	1.0	2.5	5	1	2.5	5	1	2.5	5	1	2.5	5	1	2.5	5	1	2.5	5		
	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
	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 (PAHs) (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(g,h)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	54000	54000	7400	7400	7400	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 (chloroethene)		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-tetranitro- 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
Chlorobenzenes	Gamma -Hexachlorocyclohexanes		2015	0.06	0.14	0.33	2.9	3.3	3.5															

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Media	Authority	Date	
			Allotments						Commercial			Residential						Park						
			With home-grown produce			Without home-grown produce																		
Type	Contaminants	Species	Year	SGM	1.0	2.5	5	1	2.5	5	1	2.5	5	1	2.5	5	1	2.5	5	1	2.5	5		
Phenols & Chlorophenols	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,- Tetrachlorobenzene		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,- Tetrachlorobenzene		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
	Pentachlorobenzene		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		2012				420			420			280			3200						SGV	DEFRA	2012
			2015	120	200	380	440	690	1200	23	42	83	440	690	1300	440	690	1300	440	690	1300	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 <i>et al</i> , 2015)
For Generic Risk Assessment, the values in Bold have priority	
Table reviewed February 2018	

Appendix D Information Provided by the Client

NORTH

SCHEDULE OF UNITS - 4 Total

LEGEND :

----- DIGITAL / ORDNANCE SURVEY APPLICATION SITE BOUNDARY

[Hatched Box] INDICATES INDIVIDUAL BIN STORE FOR 3 BINS IN EACH PRIVATE GARDEN

NOTE : ALL GARAGES TO MEASURE A MINIMUM OF 6.0m INTERNALLY. CYCLE STORAGE TO REAR OF EACH GARAGE.

c/b INDICATES 1.8m HIGH CLOSEBOARDED FENCE

p/f INDICATES 900mm HIGH POST & RAIL RAIL FENCE

b/w INDICATES 1.8m HIGH FACING BRICK GARDEN WALL

g. INDICATES GARAGE

△ INDICATES GATE ACCESS TO REAR GARDEN

B.P. INDICATES BLOCK PAVED ROAD FINISH

[Hatched Box] GRANITE SETTS RIVULE STRIP

[Dotted Box] EXISTING 600mm SPOT LEVELS

Hatched area indicates raised driveway level to protect existing tree. Within RPA a 'No Dig' construction method utilising a cellular confinement system placed above existing ground level.

Existing tree retained & protected

Granite sett margin between new road & track

Existing gravel track re-aligned to meet new road

Extent of existing driveway - shown dotted

Existing access upgraded

TARS FARM HOUSE

Entrance piers & steps removed

ATTENUATION POND

APPROX. EXTENT OF FLOOD ZONE

B.P.

TURNING

4

3

2

0m 5.0m 10m
1:250 scale @ A2

CROSLEY DESIGN
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client

MR P VOLLER

project

RESIDENTIAL DEVELOPMENT
LAND AT TARS FARM
CHURCH LANE, BARNHAM
WEST SUSSEX PO22 0DB

drawing

SITE PLAN

scale date job no. dng no. rev.

1:250 @A2 NOV. 18 1816 2.20 -

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Appendix D Information Provided by the Client